

Amateur RADIO

For all two-way radio enthusiasts

**Early Beginnings:
Amateur Radio Before 1940**



**Saving Space:
The Micro-Mod System**

**The Panasonic RF-B600L
General-Coverage Receiver Reviewed**

SCANNER CORNER

CHALLENGER BJ200 Mk 2 HF/VHF scanning receiver. Our most popular scanner! 26-520 MHz (with some gaps) - 16 memory channels, search scan, priority and delay - covers civil and most military bands complete with free Raycom air band antenna.
£189.00 plus £10.00 post/packing

SONY AIR-7 AIR/PMR/VHF/AM scanner. 150 KHz - 2.2 MHz, 88-108 MHz, 108-136 MHz and 144-174 MHz. A quality sensitive hand scanner with good sound, 10 memories per band, priority and delay functions.
£249.00 plus £10.00 post/packing

SONY PRO-80 AIR/PMR/VHF/AM scanner. The executive version of the AIR-7. More features, functions and more coverage.
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BEARCAT BC55 XLT starter scanner. 29-54 MHz, 136-174 MHz and 406-512 MHz. 10 memories. An ideal first unit.
£99.99 plus £10.00 post/packing

BEARCAT BC100 XLT pro scanner, as the BC200 XLT (see above) but without 950 MHz. This is real value at **£179.99 plus £10.00 post/packing**

MOBILE

ICOM 3210E DUAL BAND MOBILE, 144/430 MHz, simple to use but sounds good on the air and packed with too many features to list. We both use one so it has to be good.
£499.00 plus £10.00 post/packing

ICOM 3200E 144/430 MHz DUAL BAND MOBILE package. 25W on both bands, 10 memories and built in duplexer, this rig was selling at over £500 not long ago! A real bargain, and with a free dual band antenna.
£399.00 plus £10.00 post/packing
RAYCOM modded version for boom mics with tone on front panel at
£419.00 plus £10.00 post/packing

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FULL RANGE OF ICOM, YAesu, BEARCAT, MFJ, BUTTERNUT, CUSHCRAFT, AEA, NAVICO, TONNA, TEN TEC, WELZ IN STOCK. MOST PRODUCTS YOU SEE IN THIS MAG ARE AVAILABLE AT RAYCOM. PLUS OUR SPECIAL PACKAGE DEALS. CALL US NOW FOR DETAILS OR SEND LARGE SAE!

NAVICO AMR1000/S 144 MHz mobile transceiver. A highly intelligent and well thought out rig, it mounts just about anywhere and features auto tone burst, proper repeater channelling. Excellent results on our Marconi tester. Well worth a look at. Prices from **£247.25 plus £10.00 post/packing**

HF/VHF/UHF RX/TRX

ICOM ICR7000 V/UHF The ultimate in receivers, all mode 25-1300 MHz (2 GHz) with free Royal 1300 discone **£925.00 plus £10.00 post/packing**

ICOM ICR71 SW Receiver covers all short wave bands. For the serious listener, with free short wave antenna **£825.00 plus £10.00 post/packing**

YAesu FT747GX All band/mode transceiver with RAYCOM Mk 2 mod for better RX performance. 120W TX, general coverage RX and free 20 amp regulated PSU. A great TRX package **£725.00 plus £10.00 post/packing**

YAesu FRG9600 with the famous Raycom modifications. Supplied with free Royal 1300 discone and free mains psu. We really make them perform. Why not let us mod your 9600? **Mark 2, 60-950 MHz + tweaked RX! £545.00 plus £10.00 post/packing**
Mark 5, 100 KHz-950MHz plus 'N' connector plus active front end
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Your 9600 modded to Mark 2
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Your 9600 modded to Mark 5
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(2-3 week turnaround subject to parts)

TEN-TEC PARAGON. A fine transceiver from one of the worlds best. A world-class rig you must come in and try out. 100w all mode, general coverage receiver. Computer I/F and voice module optional.
£1898.00 plus £10.00 post/packing

We stock much more than we can possibly list here. Please call us if you don't see what you want or if you would like a detailed price list of our products.

EASTER MADNESS!

FOR ONE MONTH ONLY!

Bearcat BC200XLT

THE BEST HANDHELD VHF/UHF SCANNER.

£199.99

Save £50 on current MRP!
 Bearcat 100XLT as above
 less 950 MHz only **£179.99**
 PLUS £10.00 post/packing
 This offer cannot be repeated!

COVERS 29 TO 956MHz (with some gaps). Covers all popular VHF/UHF PMR, Amateur, Air Band, Marine, Cellular and many other interesting frequencies. *200 Memory Channels. Complete with helical, detachable Ni-Cad pack and charger. Green keyboard/display nightlight. Super fast scan and search mode. Free where-to-listen guide and backed by Raycom scanner expertise and service.*

RAYCOM NEWS BOX

Lots happening at Raycom! We are now stockists of the HRS range of Cushcraft and Butternut antennas, MFJ accessories and Packet terminals. See the TEN-TEC Paragon HF TRX and have a go. It's a beauty! - We are now stocking AEA PK-232 Packet terminals and software - *RAYCOM goes digital!* - We are now carrying NAVICO VHF mobiles. A nicely designed rig from the marine radio specialists, worth a look. - New Yaesu handhelds in stock, little beauties and best designed HT we have seen for a while. Look for a RAYCOM special mod for this one. - ICOM 725's now in stock, this will be a winner with the same type of DDS synth system as the IC781. *Don't buy an HF rig without looking at it.* - We always look around for good scanners. Watch this space! 50-950 MHz plus Pan Display! - New ICOM mobiles and HT's on the horizon. - Re-organisation in our service and shipping departments to improve service turnaround. - If you need anything to do with radio please call us, if we haven't got it we can probably get it! - We have thousands of items too numerous to list here. - We are always looking for used kit and will give you a good part exchange on new equipment. - We are SONY dealers and carry a wide range of their quality receivers and scanners. - *Don't forget we are now open again Thursdays, and late Friday until 7 pm.* - ICOM 3200 with tone button mod now available for headset use at £419 plus carriage. Raynet modded 3210 available - call.

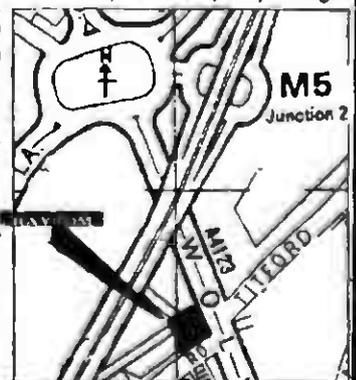
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10-3CD	3-ele 10m	£115.04
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AV4	4-band	£104.58
Ranger	VHF	£42.95
Ranger	UHF	£42.73
HF6V	5-band	£159.00
SC3000	Scanner	£63.99
70N2DX	Mobile dual	£37.00
G5RV	Full size	£16.95
G5RV	Half size	£14.95
R1300	Discone	£59.50

STOP PRESS! TCL Professional dipole kits. Complete with all fittings and guys. 1-30 MHz coverage.

TCLDSB Single band £69.95
 TCLDDB Dual band £99.95

This is only part of our stock of HF, VHF, UHF and mobile antennas. We also carry a wide range of accessories for antennas. Call for info or drop in for free advice! And of course, there's always our famous ROYAL 1300 discone (Improved spec. over ICOM AH7000 Diamond D109) still at **£59.50 plus £5.00 post/packing.**



ORDERING INFORMATION

ALL PRODUCTS SHOWN ARE NORMAL STOCK ITEMS. PHONE BEFORE 4 P.M. FOR NEXT DAY DELIVERY. MAIL ORDER PLEASE INCLUDE CARRIAGE AND PHONE NUMBER. ITEMS OVER £750 CARRIAGE FREE. PLEASE ALLOW TIME FOR PERSONAL CHEQUES TO CLEAR. MANY OTHER ITEMS IN STOCK. PLEASE CALL FOR MORE INFORMATION AND FOR EXTRA SPECIAL DEALS.

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AC127	0.20	BC107A	0.11	BD131	0.42	BD534	0.45	BF272	0.26	BFY90	0.77	GEX542	9.50	R2108B	1.45	TIP146	2.75	2SC496	0.80
AC128	0.28	BC107B	0.11	BD132	0.42	BD535	0.45	BF273	0.18	BLY48	1.75	MJ3000	1.98	R2322	0.58	TIP161	2.95	2SC784	0.75
AC128K	0.32	BC108	0.10	BD133	0.50	BD575	0.95	BF335	0.35	BR100	0.45	MJE340	0.40	R323	0.66	TIP2955	0.80	2SC785	0.75
AC141	0.28	BC108B	0.12	BD135	0.30	BD587	0.95	BF336	0.34	BR101	0.49	MJE520	0.75	R2540	2.48	TIP3055	0.55	2SC789	0.55
AC141K	0.34	BC109	0.10	BD136	0.30	BD588	0.95	BF337	0.29	BR103	0.55	MJE520	0.48	RCA16029	0.85	TV106/2	1.50	2SC9310	0.95
AC142K	0.45	BC109B	0.12	BD137	0.32	BD698	1.50	BF338	0.32	BR303	0.95	MJE2955	0.95	RCA16039	0.85	TV106	1.50	2SC937	1.95
AC176	0.22	BC114A	0.09	BD138	0.30	BD701	1.25	BF355	0.37	BR4443	1.15	MPSA13	0.29	RCA16181	0.85	TV106/2	1.50	2SC1034	4.50
AC176K	0.31	BC115	0.55	BD139	0.32	BD702	1.25	BF362	0.38	BRY39	0.45	MPSA92	0.30	RCA16334	0.90	ZRF0112	16.50	2SC1096	0.80
AC187	0.25	BC116A	0.50	BD140	0.30	BD707	0.90	BF363	0.65	BSW64	0.95	MRF237	4.95	RCA16335	0.85	2N1100	6.50	2SC1106	2.50
AC187K	0.28	BC117	0.19	BD144	1.10	BDK32	1.50	BF371	0.25	BSX60	1.25	MRF450A	15.95	RCA16572	0.85	2N1308	1.35	2SC1124	0.95
AC188	0.25	BC119	0.24	BD150C	0.29	BDK53B	1.65	BF394	0.19	BT100A/02	0.85	MRF453	17.50	S20600	0.95	2N1711	0.30	2SC1162	0.95
AC188K	0.37	BC125	0.25	BD159	0.65	BF115	0.35	BF422	0.32	BT106	1.49	MRF454	26.50	SK65F	1.45	2N2219	0.28	2SC1172	2.20
AC1917	1.15	BC140	0.31	BD160	1.50	BF119	0.65	BF423	0.25	BT116	1.20	MRF455	17.50	T6021V	0.45	2N2626	0.55	2SC1173	1.15
AD142	2.50	BC141	0.25	BD166	0.65	BF127	0.39	BF457	0.32	BT119	3.15	MRF475	2.95	T6027V	0.45	2N2905	0.40	2SC1306	1.75
AD149	1.50	BC142	0.21	BD179	0.72	BF154	0.20	BF458	0.36	BT120	1.65	MRF477	14.95	T6029V	0.45	2N2905	0.40	2SC1364	0.50
AD161	0.50	BC143	0.24	BD182	0.70	BF158	0.22	BF467	0.68	BU108	1.69	MRF479	5.50	T6036V	0.55	2N3054	0.59	2SC1413A	2.50
AD162	0.50	BC147B	0.12	BD198	0.50	BF160	0.20	BF493	0.35	BU124	1.25	OC23	9.50	T9011V	0.75	2N3702	0.12	2SC1628	0.75
AD176	0.50	BC148A	0.09	BD203	0.50	BF177	0.38	BF499	0.25	BU125	1.25	OC25	1.50	T9015V	2.15	2N3703	0.12	2SC1678	1.50
AF114	1.50	BC149	0.09	BD204	0.76	BF178	0.26	BF500	0.23	BU126	1.60	OC26	1.50	T9034V	2.15	2N3704	0.12	2SC1945	3.75
AF115	2.50	BC153	0.30	BD222	0.40	BF179	0.34	BF501	0.23	BU204	1.55	OC28	1.50	T9038V	3.95	2N3705	0.20	2SC1953	0.95
AF116	2.50	BC157	0.12	BD223	0.59	BF180	0.29	BF502	0.25	BU205	1.30	OC29	4.50	THY15/80	2.25	2N3706	0.12	2SC1957	0.80
AF117	2.50	BC159	0.09	BD225	0.48	BF181	0.29	BF503	0.25	BU208	0.95	OC32	5.50	THY15/85	2.25	2N3708	0.12	2SC1969	2.95
AF118	3.50	BC161	0.55	BD232	0.35	BF182	0.29	BF504	0.25	BU208A	1.15	OC42	1.50	TIP29	0.40	2N3733	9.50	2SC1985	1.50
AF121	0.60	BC170B	0.15	BD233	0.35	BF183	0.29	BF505	0.25	BU208B	1.35	OC44	1.25	TIP29C	0.42	2N3737	2.75	2SC1988	1.15
AF124	0.65	BC171	0.09	BD236	0.49	BF184	0.35	BF506	0.25	BU209	1.20	OC45	1.00	TIP30C	0.45	2N3792	1.35	2SC2029	1.95
AF125	0.65	BC172B	0.10	BD237	0.40	BF185	0.28	BF507	0.25	BU209A	1.50	OC70	1.00	TIP31C	0.55	2N4280	3.50	2SC2078	1.45
AF126	0.45	BC173B	0.10	BD242	0.65	BF195	0.11	BF508	0.25	BU210	1.24	OC71	0.75	TIP32C	0.42	2N4427	1.95	2SC2091	0.85
AF127	0.65	BC174	0.09	BD246	0.75	BF197	0.11	BF509	0.25	BU408	1.50	OC72	2.50	TIP33C	0.95	2N4444	1.15	2SC2098	2.95
AF139	0.40	BC177	0.15	BD276	0.32	BF198	0.16	BF510	0.25	BU426A	0.75	OC75	1.50	TIP34B	0.95	2N5294	0.42	2SC2166	1.95
AF150	0.60	BC178	0.15	BD379	0.45	BF199	0.14	BF511	0.25	BU500	2.25	OC81	1.00	TIP41A	0.45	2N5296	0.48	2SC2314	0.80
AF178	1.95	BC182	0.10	BD410	0.65	BF200	0.40	BF512	0.25	BU508A	1.95	OC84	1.50	TIP41C	0.45	2N5298	0.60	2SC2371	0.36
AF239	0.42	BC182B	0.10	BD434	0.65	BF240	0.20	BF513	0.25	BU508B	1.90	OC139	12.50	TIP42C	0.47	2N5485	0.45	2SC2910	0.95
AS27	0.85	BC183	0.10	BD436	0.60	BF241	0.15	BF514	0.25	BU508C	1.95	OC171	4.50	TIP47	0.65	2N5496	0.95	2SK19	0.55
AS77	1.50	BC183L	0.09	BD437	0.60	BF245	0.30	BF515	0.25	BU508D	1.90	OC200	4.50	TIP48	0.65	2N5641	16.50	2SK33	0.55
				BD438	0.75	BF256L	0.35	BF516	0.25	BU508E	1.95	OC201	5.50	TIP50	0.65	2N5643	16.50	3SK88	0.95
				BD510	0.95	BF257	0.28	BF518	1.35	BU508F	1.95	OC205	10.00	TIP20	0.60	2SA439	0.95		

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AN214Q	2.50	BA521	1.50	LA4400	3.50	MC1327	1.70	SL1310	1.80	STK463	11.50	TA7630	2.50	TBA570	1.00	TDA1010	2.15	TDA2600	6.50	UPC1191V	1.50
AN236	1.95	CA1352E	1.75	LA4420	3.50	MC1327Q	0.95	SL1327	1.10	STK465	7.95	TA7631	2.50	TBA651R	2.50	TDA1015	2.25	TDA2610	2.50	UPC1250C	2.95
AN239	2.50	CA3086	0.46	LA4422	3.50	MC1352P	1.00	SL1327Q	1.10	STK0029	7.95	TA7632	2.50	TBA673	1.95	TDA1035	2.50	TDA2611A	1.95	UPC1253C	2.45
AN240P	2.80	CA3123E	1.95	LA4430	2.50	MC1357	2.35	SN7421	0.85	STK0029	7.95	TA7633	2.50	TBA750	1.95	TDA1037	1.95	TDA2614	3.50	UPC1260	2.95
AN247	2.50	CA3136E	2.50	LA4461	3.95	MC1358	1.58	SN7421	0.85	TA7061AP	1.50	TA7634	2.50	TBA750Q	2.65	TDA1044	2.15	TDA2655	4.50	UPC1265C	3.95
AN260	2.95	CA3140S	2.50	LA4470	3.25	MC1496	1.75	SN76110N	0.85	TA7073	2.45	TA7635	2.50	TBA800	0.89	TDA1170	1.95	TDA2658	2.75	UPC1308S	1.95
AN262	1.95	CA3140T	1.15	LA4472	3.50	MC1723	2.50	SN76115N	1.25	TA7073	3.50	TA7636	2.50	TBA800A	1.65	TDA1180	2.15	TDA2690	2.45	UPD2114C	2.50
AN264	2.50	CA3140S	2.50	LA4472	3.50	MC3357	2.75	SN76131N	1.30	TA7078P	1.50	TA7637	2.50	TBA810P	1.65	TDA12700	3.95	TDA2691	2.55	555	0.35
AN271	3.50	ET16016	2.50	LA4472	3.50	MC3401L	2.50	SN76226M	2.95	TA7120P	1.45	TA7638	2.50	TBA820M	0.75	TDA1327	1.70	TDA3510	3.50	556	0.60
AN303	2.95	HA1137W	1.95	LA4472	3.50	MC14106P	2.95	SN76227N	1.05	TA7129P	2.50	TA7639	2.50	TBA820M	1.45	TDA2002	0.75	TDA3560	3.95	723	0.50
AN303	2.95	HA1136W	1.50	LA4472	3.50	MC14518CP	7.50	SN76228N	2.95	TA7130P	1.50	TA7640	2.50	TBA820M	1.45	TDA2003	1.95	TDA4050	2.95	741	0.35
AN313	2.95	HA1322	2.95	LA4472	3.50	ML2318	1.75	SN76228N	2.95	TA7137P	1.00	TA7641	2.50	TBA820M	1.45	TDA2010	1.95	TDA4600	2.50	747	0.50
AN315	2.95	HA1339A	2.95	LA4472	3.50	ML2328	2.95	SN76650N	1.15	TA7146P	1.50	TA7642	2.50	TBA820M	1.45	TDA2015	2.95	TDA4600	2.50	748	0.35
AN316	3.95	HA1366W	2.75	LA4472	3.50	ML2329	2.95	SN76650N	1.15	TA7146P	1.50	TA7643	2.50	TBA820M	1.45	TDA2020	2.95	TDA4600	2.50	748	0.35
AN331	3.95	HA1406	1.95	LA4472	3.50	MSM5807	8.75	SN76650N	1.15	TA7146P	1.50	TA7644	2.50	TBA820M	1.45	TDA2020	2.95	TDA4600	2.50	748	0.35
AN342	2.95	HA1551	2.95	LA4472	3.50	SAA500A	3.50	SN76650N	1.15	TA7146P	1.50	TA7645	2.50	TBA820M	1.45	TDA2020	2.95	TDA4600	2.50	748	0.35
AN362L	2.50	LA1201	0.95	LA4472	3.50	SAA1025	7.25	SN76650N	1.15	TA7146P	1.50	TA7646	2.50	TBA820M	1.45	TDA2020	2.95	TDA4600	2.50	748	0.35
AN612	2.15	LA1230	1.95	LA4472	3.50	SAA1251	4.95	SN76650N	1.15	TA7146P	1.50	TA7647	2.50	TBA820M	1.45	TDA2020	2.95	TDA4600	2.50	748	0.35
AN6362	3.95	LA3201	0.95	LA4472	3.50	SAA501D	5.35	SN76650N	1.15	TA7146P											

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A2087	11.50	EAC91	2.50	EF184	0.85
A2134	14.95	EAF42	1.20	EF731	4.50
A2293	6.50	EB34	1.50	EF732	4.50
A2426	33.50	EB41	3.95	EF800	11.00
A2599	37.50	EB91	0.85	EF804S	15.00
A2792	27.50	EBCC3	2.50	EF805S	25.00
A2900	11.50	EBCA1	1.95	EF806S	25.00
A3283	24.00	EBCE1	1.50	EFB12	0.65
A3343	35.95	EBCE9	1.95	EFL200	1.50
AC/SP3A	4.95	EBCE9	1.95	EPF60	3.50
AC/SP2PEN	8.50	EBF80	0.95	EPH90	0.72
AC122	59.75	EBFB3	0.95	EK90	1.50
AH221	39.00	EBF89	0.95	EL32	0.95
AH238	39.00	EBF93	0.95	EL33	5.00
AL60	6.00	EBL1	4.50	EL34	3.25
ANI	14.00	EBL21	4.50	EL34 MULLARD	6.50
ARP12	2.50	EC52	0.75	EL34	6.50
ARP34	1.25	EC70	1.75	EL34	6.50
ARP35	2.00	EC81	7.95	EL34	6.50
AZ11	4.50	EC86	1.95	EL36	2.50
BS894	250.00	EC88	1.95	EL36	2.50
BT58	55.00	EC90	1.95	MULLARD	3.95
BT117	25.00	EC91	5.50	EL38	9.00
BT113	35.00	EC93	1.50	EL41	3.50
CIK	27.50	EC95	7.00	EL42	2.00
C3M	17.95	EC97	1.10	EL71	4.50
C1134	32.00	EC8010	12.00	EL71	4.50
C1149/1	195.00	EC8012	3.50	EL83	7.50
C1150/1	135.00	EC8013	3.50	EL84	0.95
C1534	32.00	EC8015	3.50	EL84	0.95
CCA	3.50	EC81	1.50	MULLARD	4.50
CD24	6.50	EC81 SPECIAL		EL84	
CK1006	3.50	QUALITY	2.25	SIEMENS	2.50
CK5676	6.50	EC82	0.85	EL85	4.50
CV NOS PRICES		EC82		EL86	1.75
ON REQUEST		PHILIPS	1.95	EL90	1.75
D3A	27.50	EC83	0.95	EL91	6.00
D63	1.20			EL95	1.75
DA41	22.50			EL152	15.00
DA42	17.50			EL360	6.75
DA90	4.50			EL500	1.95
DAF91	0.95			EL504	1.95
DAF96	0.95			EL506	5.95
DC70	1.75			EL509	5.25
DC90	3.50			EL509 MULLARD	7.50
DCX-4-5000				EL519	6.95
DET16	28.50			EL802	3.65
DET18	28.50			EL821	6.95
DET20	2.50			EL822	12.95
DET22	35.00			EL820	22.50
DET23	35.00			EM34	12.50
DET24	27.50			EM83	1.65
DET25	22.00			EM84	1.65
DET29	32.00			EM85	3.95
DF91	1.50			EM87	2.50
DF92	1.50			EN32	15.00
DF96	1.25			EN91	2.25
DF97	1.25			EN92	4.50
DG10A	8.50			EV51	0.80
DH63	1.50			EV70	7.50
DH77	0.90			EV81	2.15
DK91	1.20			EV82	1.15
DK92	1.50			EV83	1.50
DL35	2.50			EV84	5.95
DL63	1.00			EV86/87	0.65
DL70	2.50			EV88	0.95
DL73	2.50			EV91	1.50
DL91	3.95			EV9500A	5.95
DL92	1.50			EV802	0.70
DL93	1.50			EZ35	1.00
DL510	13.50			EZ40	3.50
DL516	10.00			EZ41	3.50
DM70	5.25			EZ80	0.75
DM160	6.50			EZ81	0.75
DOD-006	79.50			EZ90	1.50
DY51	1.50			F44-800	4.50
DY86/87	0.85			G55/1	1.50
DY802	0.85			G180/2M	6.95
E55L	49.50			G240/2D	9.00
EB0CC	19.50			G1C108	17.50
EB0CF	12.50			G1C108	17.50
EB0F	18.50			G1C104B	17.50
EB0L	29.50			G1C104E	17.50
EB1CC	5.50			G1C124B	17.50
EB1L	12.50			G086W	6.00
EB2CC	4.50			GDT120M	5.00
EB3CC	5.50			G4	6.00
EB6C	9.50			GRI10G	4.00
EB8CC	7.95			GSI0K	16.50
EB8CC	3.50			GSI0H	12.00
EB8CC-01	6.95			GSI2D	12.00
EB8CC	6.95			GTIC	14.00
MULLARD	4.95			GU20	35.00
E90CC	7.95			GUX1	13.50
E90F	7.95			GUX13	24.00
E91H	3.95			GUX150SS	14.50
E92CC	3.95			GYS01	1.50
E99F	6.95			GYS02	1.50
E130L	18.50			GZ32	2.50
E180CC	10.50			GZ33	3.95
E180F	6.50			GZ34	2.50
E182CC	9.00			GZ34	2.50
E186F	8.50			GZ37	4.50
E188CC	7.50			GZ37	4.50
E235L	12.50			HBC90	1.95
E280F	19.50			HL41	3.50
E283CC	12.00			HL90	3.50
E288CC	17.50			KT8C	7.00
EB10F	25.00			KT33C	5.00
E114B	1.00			KT36	2.95
EA50	1.00			KT44	5.95
EA52	55.00			KT45	5.95
EA76	1.95			KT61	5.00

KT63	2.00	PY88	0.65	V241C/K	195.00
KT66 USA	11.95	PYS00A	1.95	V453	12.00
KT66 GEC	25.00	PY800	0.85	VLS631	10.95
KT66 TEONEX	5.00	PY801	0.85	VP48	9.50
		Q83-300	72.00	VP41	4.95
		KT177 GEC	11.95	VR101	2.50
		KT81	7.00	VR105/30	2.50
		KT88 USA	12.95	VR150/30	2.50
		KT88		VU39	2.50
		Selectron	15.00	W1	4.50
		KTW61	2.50	W67	4.50
		KTW62	2.50	W77	5.00
		KTW63	2.00	W81M	4.50
		KT263	2.50	W739	1.50
		L87-20	95.00	X24	4.50
		MS08	6.95	X41	4.50
		M50B	195.00	X66/X65	4.50
		M5143	155.00	X76M	1.95
		M5199	295.00	XC24	1.50
		M8079	6.00	XC25	0.50
		M8082	7.50	XFW47	1.50
		M8083	3.25	XFW50	1.50
		M8091	7.50	XG1-2500	75.00
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		M8100	5.00	XRI/3200A	
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		M8137	7.00	Y65	6.95
		M8161	6.50	YD1100	75.00
		M8162	5.50	YJ1060	265.00
		M8163	4.50	YLI020	42.50
		M8190	5.50	YLI060	195.00
		M8195	6.50	YLI070	195.00
		M8196	5.50	YLI1071	195.00
		M8204	5.50	YLI1290	6.50
		M8223	4.50	YLI290	12.00
		M8224	2.90	Z77	6.20
		M8225	3.00	Z300T	6.00
		ME1400	3.50	Z302C	12.00
		ME1401	29.50	Z359	9.00
		ME1402	29.50	Z520M	4.00
		MHLD6	4.00	Z700U	9.50
		MP25	195.00	Z759	19.85
		MS48	5.50	Z803U	12.95
		MU14	3.50	ZA1000	28.50
		N37	12.50	ZA1001	1.50
		N78	9.85	ZA1002	1.50
		OA2	1.50	ZM1001	6.00
		OA2ZWA	2.50	ZM1005	8.00
		OA3	2.50	ZM1020	6.00
		OB2	1.50	ZM1021	8.00
		OB2ZWA	2.50	ZM1023	7.95
		OC3	2.50	ZM1041	14.00
		OD3	2.50	ZM1082	9.00
		OM4	2.50	ZM1084	10.00
		OM5B	3.00	ZM1175	6.50
		OM6	1.75	ZM1177	9.00
		ORP43	2.50	ZM1202	55.00
		ORP50	3.95	ZM1263	4.00
		P61	2.50	IA3	4.50
		P41	2.50	IAE4	3.50
		PABC80	0.75	IAX2	3.50
		PC88	0.75	IB22	10.00
		PC97	1.10	IB27	55.00
		PC900	1.25	IB3GT	1.95
		PC984	0.40	IB3SA	45.00
		PC985	0.55	IB63A	75.00
		PC986	0.70	IK3	2.50
		PC987	0.70	INSGT	2.50
		PC988	0.70	IP28	25.00
		PC989	0.70	IR5	1.50
		PC990	0.70	IS5	1.50
		PC991	0.70	IT4	1.50
		PC992	0.70	IU4	1.75
		PC993	0.70	IU5	1.50
		PC994	0.70	IUX25	2.50
		PC995	0.70	IA3	4.50
		PC996	0.70	IA4	4.50
		PC997	0.70	IA5	4.50
		PC998	0.70	IA6	4.50
		PC999	0.70	IA7	4.50
		PC1000	0.70	IA8	4.50
		PC1001	0.70	IA9	4.50
		PC1002	0.70	IA10	4.50
		PC1003	0.70	IA11	4.50
		PC1004	0.70	IA12	4.50
		PC1005	0.70	IA13	4.50
		PC1006	0.70	IA14	4.50
		PC1007	0.70	IA15	4.50
		PC1008	0.70	IA16	4.50
		PC1009	0.70	IA17	4.50
		PC1010	0.70	IA18	4.50
		PC1011	0.70	IA19	4.50
		PC1012	0.70	IA20	4.50
		PC1013	0.70	IA21	4.50
		PC1014	0.70	IA22	4.50
		PC1015	0.70	IA23	4.50
		PC1016	0.70	IA24	4.50
		PC1017	0.70	IA25	4.50
		PC1018	0.70	IA26	4.50
		PC1019	0.70	IA27	4.50
		PC1020	0.70	IA28	4.50
		PC1021	0.70	IA29	4.50
		PC1022	0.70	IA30	4.50
		PC1023	0.70	IA31	4.50
		PC1024	0.70	IA32	4.50
		PC1025	0.70	IA33	4.50
		PC1026	0.70	IA34	4.50
		PC1027	0.70	IA35	4.50
		PC1028	0.70	IA36	4.50
		PC1029	0.70	IA37	4.50
		PC1030	0.70	IA38	4.50
		PC1031	0.70	IA39	4.50
		PC1032	0.70	IA40	4.50
		PC1033	0.70	IA41	4.50
		PC1034	0.70	IA42	4.50
		PC1035	0.70	IA43	4.50
		PC1036	0.70	IA44	4.50
		PC1037	0.70	IA45	4.50
		PC1038	0.70	IA46	4.50
		PC1039	0.70	IA47	4.50
		PC1040	0.70	IA48	4.50
		PC1041	0.70	IA49	4.50
		PC1042	0.70	IA50	4.50

STRAIGHT &

LEVEL

TRIPLE dc POWER SUPPLY

The TS3023S is a laboratory-quality triple output power supply. Two outputs each provide 0 to 2A at 0 to 30V and can be switched to independent tracking; the third output provides up to 4A at 4 to 6V for logic circuits. All outputs have remote sensing.

Both 0 to 30V 2A outputs have 0.5in 3.5 digit liquid crystal displays which simultaneously display output voltage and output current. With the output switch *off*, the display can be used to preset the output voltage and current limit prior to connection of the load. The power supply operates in constant current or constant voltage modes with automatic crossover. A display annunciator indicates constant current mode. Coarse and fine controls permit the output voltage to be set within 5mV, and the current limit control is logarithmic to give good resolution at low-current settings. Load and line regulation are better than 0.01% with ripple and noise typically better than 1mV. The two supplies can be switched to be independent or tracking.

The 4-6V 4A output has a single 0.5in 3.5 digit liquid crystal display which displays either output voltage with the output switch *off* or output current with the output switch *on*. A display annunciator indicates current limit. The output voltage is set by a calibrated control. Over-voltage protection is provided.

All outputs are protected against forward or reverse voltages. The power supply has a steel case, rubber feet and integral mains lead.

The TS3023S sells at £385.00. For further information, contact the Sales Office, Thandar Electronics Ltd, 2 Glebe Road, Huntingdon, Cambridgeshire PE18 7DX. Tel: (0480) 412451.

SPEEDPLATE PENCIL

Gunson Ltd have just introduced a Speedplate pencil which removes accumulated dirt and grime from virtually any material. It

restores metal to its original brightness and gives an oxydisation-free surface, perfect for electrical contact or jointing.

The pencil uses a tip made up from a bunch of glass fibre strands. It is in a propelling case so that only a small piece of the 300mm refill is exposed. It is accurate and able to reach difficult places.

The Speedplate pencil is available from the car and accessory counters of many high street shops. It costs £3.34 including VAT. A pack of ten refills costs £2.99.

If you have any difficulty obtaining the product, contact Gunson Ltd, Pudding Mill Lane, London E15 2PJ. Tel: 01-555 7421.

BASE MICROPHONES

The new XL30 and CM40 Electret base microphones are available from Nevada. They have been developed using an Electret element with a tailored audio response to bring out the best in modern amateur transceivers.

When used with Kenwood equipment they may be powered directly from the microphone socket of the transceiver. For other brands a PP3 may be fitted as an internal power source.

Specifications are: output level – adjustable from 0V to 1.4V; frequency response – 1-200-3000Hz; output impedance – 1K ohm; gain – 40dB; switching – isolated PTT switch; power – 9V PP3 battery or 9-15V dc from transceiver.

The XL30 is a basic amplified microphone and retails at £46.50. The CM40 uses an audio processor with volume and tone controls and retails at £55.75.

For further information, contact Nevada, 189 London Road, North End, Portsmouth, Hants PO2 9AE. Tel: (0705) 660036.

END-FED LF AERIALS

The end-fed 'Zepp' aerial derived its name from the fact that it was originally designed

for use on the Zeppelin airship. In essence it comprised an end-fed half-wave dipole. Such an aerial was very convenient; it had no untidy feeders hanging from the centre, and as a consequence was light in weight, easily erected and fairly inconspicuous. Its disadvantage was the need for an open wire feeder and an ATU.

Sagant have just produced the modern-day version of such an antenna. Each one covers a single band and incorporates the missing ATU in an encapsulation at the feed end. Thus, 50 ohm cable can be connected directly to the feed point at one end, and the opposite end can be attached to any convenient support. There is no hanging feeder from the centre. An additional bonus is the RF filtering provided by the matching circuit.

Two models are available, one for 40m and the other for 80m. Dimensions are similar to a full-size dipole. The aerials come complete with a special PVC covered multi-strand copper wire, matching unit fitted SO239 socket, insulators, support cord, weather sealing tape and tuning instructions. The aerial element is pre-tuned and fully assembled.

For further information and prices, contact Waters & Stanton Electronics, 18-20 Main Road, Hockley, Essex SS5 4QS. Tel: (0702) 206835/204965.

HMS PLYMOUTH GROUP

Members of the Royal Naval Amateur Radio Society living in the Devon and Cornwall area, have formed an HMS Plymouth Group to be responsible for amateur radio operations from Falklands' veteran HMS Plymouth based at her namesake city.

The ship will be open to the public from 29 March 1989, until October. There will be a charge for admission.

The intention of the radio amateur group is to provide, as far as possible, a replica room ('W/T Office') and at the same time carry on with radio

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

contacts which will be seen and heard by visitors. Frequencies in use will be the usual HF and VHF bands, and QSL cards will be sent to all contacts via the bureau. The callsign has yet to be allocated but it is hoped to reissue the old Devonport signal letters GUZ and the ship would then use GB3GUZ.

Members of the RNARS, both at home and abroad, are invited to join the Group at an annual subscription of £2.00, to be sent to the Hon Treasurer, Chris Harper, 24 Cunningham Road, Tamerton Foliot, Plymouth PL5 4PS. Other financial offers would be gratefully accepted and put towards the provision of additional equipment.

The Secretary of the Group is Mrs 'Bobby' Harper, wife of the Treasurer.

HMS Plymouth, the last of the Type-12 frigates, is now 'in retirement' and was heading for a watery grave as a missile target. Since then, the Warship Preservation Trust and a team of volunteers have worked miracles to open the ship for public display.

A warm welcome is extended to all visitors and in particular to those with an interest in amateur radio.

CW NOVICE AWARD

Many amateurs have been encouraged to use the CW operating mode by the prospect of gaining an award for their earliest efforts on the key.

The CW Novice Award is administered by the G-QRP Club on behalf of the European CW Association and the World QRP Federation.

To qualify, the applicant must work fifty different stations using the CW mode during the first twelve months of holding an amateur licence.

For a Class A award, maximum power to be used when making the fifty contacts is 3W RF output for contacts made up to 31 December 1988, and 5W RF output for contacts made from 1 January 1989. For a Class B award, any licensed power is allowed.

Applications are accepted from all over the world and must consist of a log extract giving details of the fifty contacts made. This must be certified as true by the applicant and one other licensed amateur.

Applicants from outside the UK must enclose three IRCs with their application. UK applicants must enclose three first class stamps.

Applications should be sent to A D Taylor G8PG, 37 Pickerill Road, Greasby, Merseyside L49 3ND.

CENTENARY AWARD

In the year in which Birmingham celebrates the centenary of it becoming a city, MARS is offering a Centenary Award.

This will take the form of a specially designed certificate and will be awarded to any person who works 100 stations within the city boundary (not to be confused with postcodes), simplex only, in any mode except packet and on any band; plus a G1 or G3 MAR (HQ station) and two special event stations from within the city walls. No Raynet or talk-in stations may be included.

The certificate can be endorsed for any special circumstances requested by the applicant, eg, QRP, and is available to SWLs.

The award will run for the whole of 1989. Closing date for claims is 1 April 1990.

To claim your certificate, send an SAE in the first place, to Paul O'Connor G1ZCY, 100 Coldbath Road, Billesley, Birmingham B13 0AH, who will send you an application and log forms. When these are completed and verified return them to Paul with £2.00 (£1.50 for MARS members).

SPECIAL EVENT STATION

During 1989 the Bedford and District Amateur Radio Club plans to commemorate the outbreak of the Second World War by operating several special event stations using callsigns GB2WW and GB4BOB.

The locations will include a number of former Royal Air Force and United States Army Air Force stations in and around the Bedford area.

Further details can be obtained from the Special Events Secretary, Richard G1ZOJ, or the Special Events Manager, Ray G0EYM, at 30 Cotswold Close, Putnoe, Bedford MK41 9LR. Tel: (0234) 244506.

NEW SECRETARY

The Bridgend & District Amateur Radio Club has appointed a new secretary. He is Mr D E George GW1OUP, 24 Ty Fry Close, Brynmenyn, Bridgend, Mid-Glamorgan CF32 8YB. Tel: (0656) 723508.

BARTG NEWS

The British Amateur Radio Teledata Group now has a volunteer to handle queries about computers in datacomms. He is Arthur Bard G1XKZ, 9 Linden Road, Oak Park, Cullompton, Devon EX15 1TE.

Arthur will tackle any questions about the use of micros for amateur radio datacomms. This service isn't limited to BARTG members, but their questions naturally take precedence. This service is *only* available by letter.

BATC RALLY

The British Amateur Television Club is holding this year's convention/rally in the Founders Suite at the Coventry Crest Hotel on 30 April.

Doors open at 10am. Admission is free to BATC members on production of a ticket from CQTV, and 50p to non-members.

There will be a wide range of stalls, traders and demonstrations covering all aspects of both amateur TV and satellite TV equipment. Technical lectures will take place in the afternoon.

The venue is located on the A46, 500 yards south of Junction 2 of the M6. Ample parking is available.

Trade enquiries should be addressed to G8CJS or G8OZP, both QTHR.

ANGLO-SCOTTISH RALLY

The Kelso Amateur Radio Society is hosting the sixth Anglo-Scottish Rally in the Tait Hall, Kelso, on Sunday 30 April from 11.00am to 5.00pm. Admission is £1.00.

There will be the usual stalls, talk-in on S22, Morse tests (booked through the RSGB), raffles and refreshments.

For further information, contact Bruce Cavers GM4UIB, QTHR, tel: Kelso 24654.

We are happy to include details of new products, clubs, rallies, special events, awards, etc, in **Straight & Level**. Please send your news to the editorial address on page 3 of this issue.

ALINCO DUAL BANDER

- ★ 2m/70cm
- ★ 25 Watts output
- ★ Full duplex operation
- ★ 21 Memories
- ★ 2 Call channels
- ★ Priority channel
- ★ Dual VFO's
- ★ 12.5 & 25kHz steps
- ★ Memory Scan
- ★ Programme Scan
- ★ Memory Skip

£449 inc vat

ALD-24E



This transceiver could transform your operating habits! It contains completely separate 2m and 70cms transceivers, permitting full duplex operation. To the un-initiated, this means you can transmit on 2m whilst receiving on 70cms, or vice versa. The built-in duplexer means a single antenna socket with a full 25 watts output on both bands. Measuring only 5.5"x2"x6.5" it is the ideal mobile rig. Its comprehensive memory and scanning facilities provide rapid access to both

simplex and repeater channels on 2m & 70cms. Using the dual VFO's you can instantly switch between 2m & 70cm and the single knob tuning provides simple and quick frequency selection. The large LCD readout incorporates an S-meter and is back lighted. If you are looking for a completely self contained 2m & 70cm station, then look no further. At this price it has to be a bargain. For further details of this amazing transceiver, send today for the full colour brochure.

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The Panasonic RF-B600L (DR B600)

General-Coverage Communications Receiver

by Ken Michaelson G3RDG

The Panasonic RF-B600L is classed as a portable receiver and weighs 4.6kg (10.14lb) without batteries, which is a reasonable weight to carry. It is equipped with a handle on the right-hand side of the case for this purpose. It covers four frequency ranges, one of which is the FM section of the spectrum. The specifications of the rig are in the table.

The case is finished in grey with a silver-coloured rim round the edge. The top displays a Mercator projection of the earth's surface with the world's principal cities and time zones superimposed on it. To the left of this are two tables giving the short wave allocation of the broadcast and amateur bands, the figures being given in both metres and megahertz. This is a real help when using the receiver.

Front panel

The front panel has the loudspeaker on the left, protected by a wire mesh. To the right of this are three vertical controls. At the top is the 'AM ANL' (automatic noise limiter) push on/off switch. This is used if car ignition noise becomes intrusive when you are receiving AM broadcasts. Below this is another push on/off switch controlling the bandwidth (push in for narrow). Below this is a three-position rotary switch labelled 'AM/USB/LSB'. The LSB/USB positions are also used for CW reception. At the bottom of this column of controls is the headphone jack fitted with a 6.3mm socket. Inserting a jack plug into this socket disconnects the internal speaker.

Along the bottom of the panel, in line with the headphone jack, are four rotary controls and two push on/off switches. From left to right they are 'Volume', 'Bass', 'Treble', 'AM RF Gain', 'Lock' and 'Tuning Speed'. The functions of the first four are obvious, but the addition of a tuning lock means that if you tune in a station and then press the tuning lock switch, the tuning cannot be affected by an accidental movement of the main tuning knob. Incidentally, the 'Lock' switch displays a red light when it is in the 'on' position. The last switch offers the facility of varying the tuning rate and operates in different steps for different modes. For FM you have a choice of 100kHz or 50kHz steps, for LW and MW the rates are either 10kHz or 1kHz and for the short wave band either 1kHz or 100Hz. The tuning knob is on the right of the set and has a very smooth feel to it.

The four rotary knobs along the bottom of the panel and the tuning knob all have rubber rings over the operating surfaces which, in my opinion, makes them easy and pleasant to handle. There is also a finger detent on the front of the tuning knob, another handy feature. At the top right of the receiver is the main on/off switch, and alongside this is a red LED indicator light which is illuminated when the set is operating.

The centre panel on the front of the rig projects slightly and is finished in silver. The top third of this area is taken up by the S meter (which doubles as a battery level indicator) and the digital frequency display. The latter gives a clear reading

of the frequency and shows additional information on either side of it. On the right MHz or kHz are displayed, and on the left either memory or channel number. The bottom two-thirds of the panel are taken up by microswitches. The right-hand side provides 'Direct Access Tuning' and is in the form of a keypad from '0' to '9', to the right of which are 'Memory', 'Direct' and 'Enter' buttons, and below them, three keys for use with the 'SW Zone Auto Tuning' ('Up', 'Down' and 'Stop'). The keys '1' to '9' are used for the nine memory channels and the '0' for the direct entry of frequency.

The left-hand side of the panel has four horizon microswitches controlling the reception ranges, each of which has a red LED which is illuminated when the particular range is in use. To the left of these are six switches arranged in two lines of three, one above the other. The top line has a switch to change from S meter readings to battery condition, and two other switches which control the illumination of the S meter and the digital display. This is in order to economise on battery consumption. Below these are three more switches encompassing 'SW Zone Auto Tuning'. When receiving short wave broadcasts, these, in conjunction with the three keys on the right of the panel, are used to tune up or down in 5kHz increments within a ± 150 kHz zone around a selected centre frequency. When in the manual position you can move the frequency in 5kHz steps by pressing one of the keys on the right, either 'Up' or 'Down', without using

THE PANASONIC RF-B600L RECEIVER

the tuning knob. When in the 'Scan' position pressing either the 'Up' or 'Down' key will make the receiver scan for a signal within the selection zone, remaining on a station for about three seconds before moving on to the next. The set can be instructed to stay on any desired signal by pressing the 'Stop' key. In 'Seek' position the receiver will automatically scan over the selected range and stop at the first readable signal, stopping the auto tuning function. To cease the operation before receiving any signal, the user has only to press the 'Stop' key.

Rear panel

The rear panel of the RF-B600L has a number of alternate connections for external antennas, in addition to two built-in antennas. There is a telescopic one, intended for either the FM or SW band, which can be adjusted for angle as well as length, and there is also a ferrite core antenna inside the set which provides excellent reception for the MW and LW bands, provided that the signal strength is reasonably good. A normal SO239 chassis mounting socket is provided for connection to a low impedance coaxial cable from an external antenna. Below this is a control that switches between the SW built-in antenna and an external one, and also alters the impedance from low to high if required, to suit the antenna in use. When set to the external position, the telescopic antenna is disconnected. In the same area are three terminals giving either low or high impedance connections for various types of antenna which do not use a coax feeder.

On the other side of the panel is a dc input jack (13.2V dc) to allow operation from a car battery. Below this is the normal ac input socket. Towards the centre there is a bank of three further facilities, all with 3.5mm sockets: the external earphone/speaker socket (8 ohms impedance only), the recording output jack and the stand-by jack. The output level of the recording output jack is fixed regardless of the position of the unit's volume control. The stand-by jack allows the receiver to be used as part of an amateur transmitting station; when the jack plug is connected to ground the receiver is muted. In my case, the connection was made to the 'T/R' control terminal on the IC-751.

The spaces for the batteries are on the underside of the rig. Three type 'AA' cells are required for memory back-up and eight type 'D' cells for radio power when the receiver is used portable.

Performance

In the most important frequency range for long distance reception, 1.6110-29.9999MHz, the receiver acts as a double superheterodyne with a respectable sensitivity of 1.2 μ V and a selectivity in the narrow position of \pm 1.5kHz. These figures are borne out in use. I should point out that the narrow position of the 'Band Width' switch only applies to the

Specifications of the Panasonic RF-B600L

FM

Frequency range: 87.5-108MHz
Receiver type: Single superheterodyne
IF: 10.7MHz
Sensitivity: 2.5V/75 ohms (S/N 26dB)
Image interference ratio: 30dB (at 98MHz)

LW

Frequency range: 150-420kHz
Receiver type: Single superheterodyne
IF: 450kHz
Sensitivity: S/N 6dB, 70 μ V/m
S/N 26dB, 600 μ V/m (at 280kHz)
Selectivity: Wide: \pm 3.5kHz (-6dB)
 \pm 7kHz (-60dB)
Narrow: \pm 1.5kHz (-6dB)
 \pm 4kHz (-60dB)
Image interference ratio: 35dB (at 280kHz)

MW

Frequency range: 520-1610kHz
Receiver type: Single superheterodyne
IF: 450kHz
Sensitivity: S/N 6dB, 35 μ V/m
S/N 26dB, 400 μ V (at 1000kHz)
Selectivity: Wide: \pm 3.5kHz (-6dB)
 \pm 7kHz (-60dB)
Narrow: \pm 1.5kHz (-6dB)
 \pm 4kHz (-60dB)
Image interference ratio: 40dB (at 1000kHz)

SW

Frequency range: 1.6110-29.9999MHz
Receiver type: Double superheterodyne with PLL synthesiser
IF: 1st: 39.9-40MHz
2nd: 450kHz
Sensitivity: (400Hz, 30% modulation 50mW)
S/N 6dB: 1.2 μ V (50 ohms) (at 6MHz)
S/N 26dB: 10 μ V (50 ohms) (at 6MHz)
Selectivity: Wide: \pm 3.5kHz (-6dB)
 \pm 7kHz (-60dB)
Narrow: \pm 1.5kHz (-6dB)
 \pm 4kHz (-60dB)
Image interference ratio: 50dB (at 6MHz)
Speaker: 9cm PM dynamic speaker
Semi-conductors: IC 15
FET 9
Transistors 96
Output power: 2.0W (RMS max)
1.6W (MPO)
Power source: ac: 110-250V, 50/60Hz (transformer tapping)
Power consumption: 12W
Battery: 12V (eight 'D' size cells for radio)
4.5V (three 'AA' size cells for memory back-up)
Dimensions: 376mm (w) \times 122mm (h) \times 291mm (d)

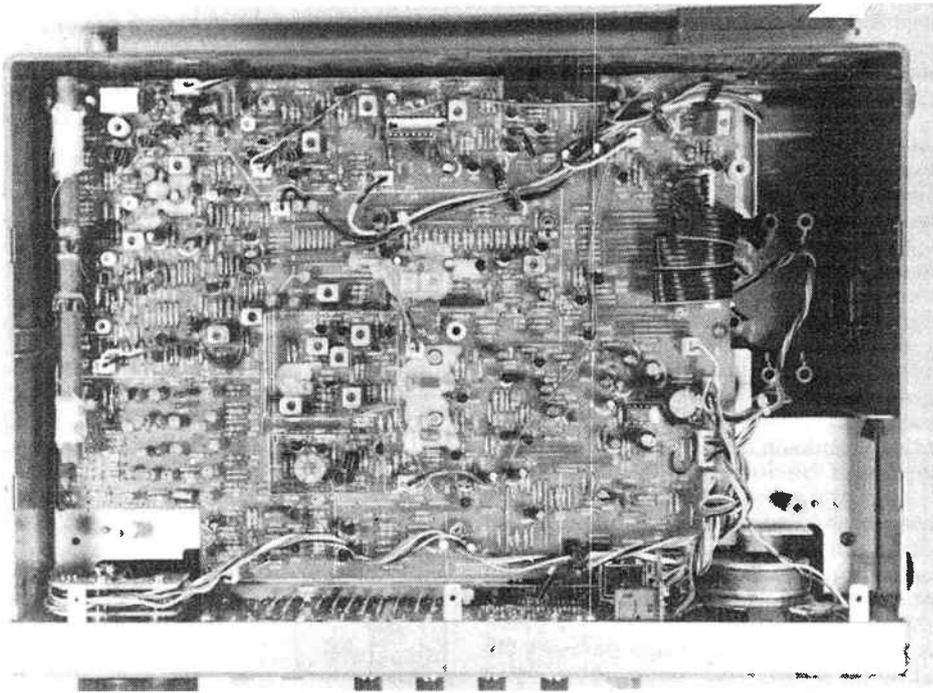
reception of AM stations. This is fine for short wave listeners who make a practice of logging long distance broadcasts, but when the receiver is used to copy SSB signals in the amateur bands, I do not consider the selectivity of \pm 3.5kHz at -6dB to be sufficient. I spent a considerable time listening on the 14MHz band and to be honest, although I was able to resolve the majority of stronger SSB signals, when I endeavoured to read a weak station close to one of the more powerful Italians, it couldn't be done.

Using the receiver for the purpose for which I imagine it must have been designed, and setting my frequency reading to one of the short wave

commercial broadcast bands, I got excellent results. With the available added selectivity in AM, a large number of stations was copied. Although I used my external dipole for some of the frequencies, most of the time it wasn't necessary, owing to the sensitivity of the receiver when copying the commercial broadcasts. In passing, Panasonic should be complimented on the smoothness of the main tuning knob, which made it a pleasure to operate the set. I consider that to listen to the commercials, it is not necessary to erect an outdoor antenna. The ferrite core one inside the set, provided excellent reception for LW and MW in my QTH.

THE PANASONIC RF-B600L RECEIVER

Interior view of the receiver



When listening to the SW band, the operator has to extend the telescopic antenna, keeping it vertical. The best results on the FM band were achieved with the telescopic antenna fully extended in the first place, and then the length and angle altered for optimum reception.

Excellent rig

The RF-B600L (otherwise known as the DR B600) is, as far as I know, the most reasonably priced communications receiver, at £499.00 including VAT and Securicor delivery. I found it an excellent rig, the only grouse I have being the selectivity in the sideband modes. It is well-finished and comes with a fully descriptive Owner's Manual.

My thanks to Waters and Stanton Electronics, 18/20 Main Road, Hockley, Essex SS5 4QS, tel: (0702) 206835, for the loan of the receiver for this review.

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AN EXPERIMENTAL DF ANTENNA

by Steven Goodier G4KUB and John Goodier G4KUC

Last summer a number of 'fox hunts' were organised by our local radio club. For those of you who don't know what a radio fox hunt is, then let us explain.

The idea of the hunt is to locate as quickly as possible one or several hidden transmitting stations. Usually, the hidden station transmits at a prearranged schedule, eg, thirty seconds every five minutes or one minute every ten minutes. It is then up to the 'hunters' to take bearings on the signal and, with the help of an Ordnance Survey map and a bit of luck, find the 'fox'.

After attending a few local fox hunts, a friend showed us a circuit diagram containing a couple of transistors, some capacitors and a few resistors. At the top of the diagram there were two diodes, three RF chokes and two dipoles. Apparently, the circuit was part of a DF antenna which had been used on a previous fox hunt.

The antenna

The idea for this simple antenna first appeared in an early edition of **RATEC Magazine**, and is based around two half-wave dipoles placed in the same plane on one boom. At a frequency of 144MHz, the dipoles are placed approximately 1m apart. The two aerials will never receive a given signal in the same phase until the signal is at right angles to the boom. The theory of how the aerial works is shown in **Fig 1**.

The output from the two dipoles is coupled into the antenna socket of the rig, but before this is done an audio tone is superimposed on to the received signal. When the rig is switched on and the aerial is connected up you will hear a high-pitched whistle, along with the received station. The whistle will vary in volume when you turn the aerial, and the tone will reduce considerably when the boom is at right angles to the transmitting station. When this 'null' is reached, you can take the bearing of the transmitting station.

The circuit

The circuit diagram for the electronics used in the DF antenna is shown in **Fig 2**. The circuit is based around the two transistors TR1 and TR2, which form a multivibrator. The frequency at which the circuit oscillates is determined by the two capacitors C4 and C5; with the values chosen, this frequency will be about 1kHz. The two half-wave dipoles are coupled into the circuit via C1 and C9 and the signals are passed on to the switching diodes D1 and D2, with the resulting output appearing at the Rx socket via C10.

R1 and R6 take the output from the oscillator and couple it to the input from each dipole, thus superimposing the

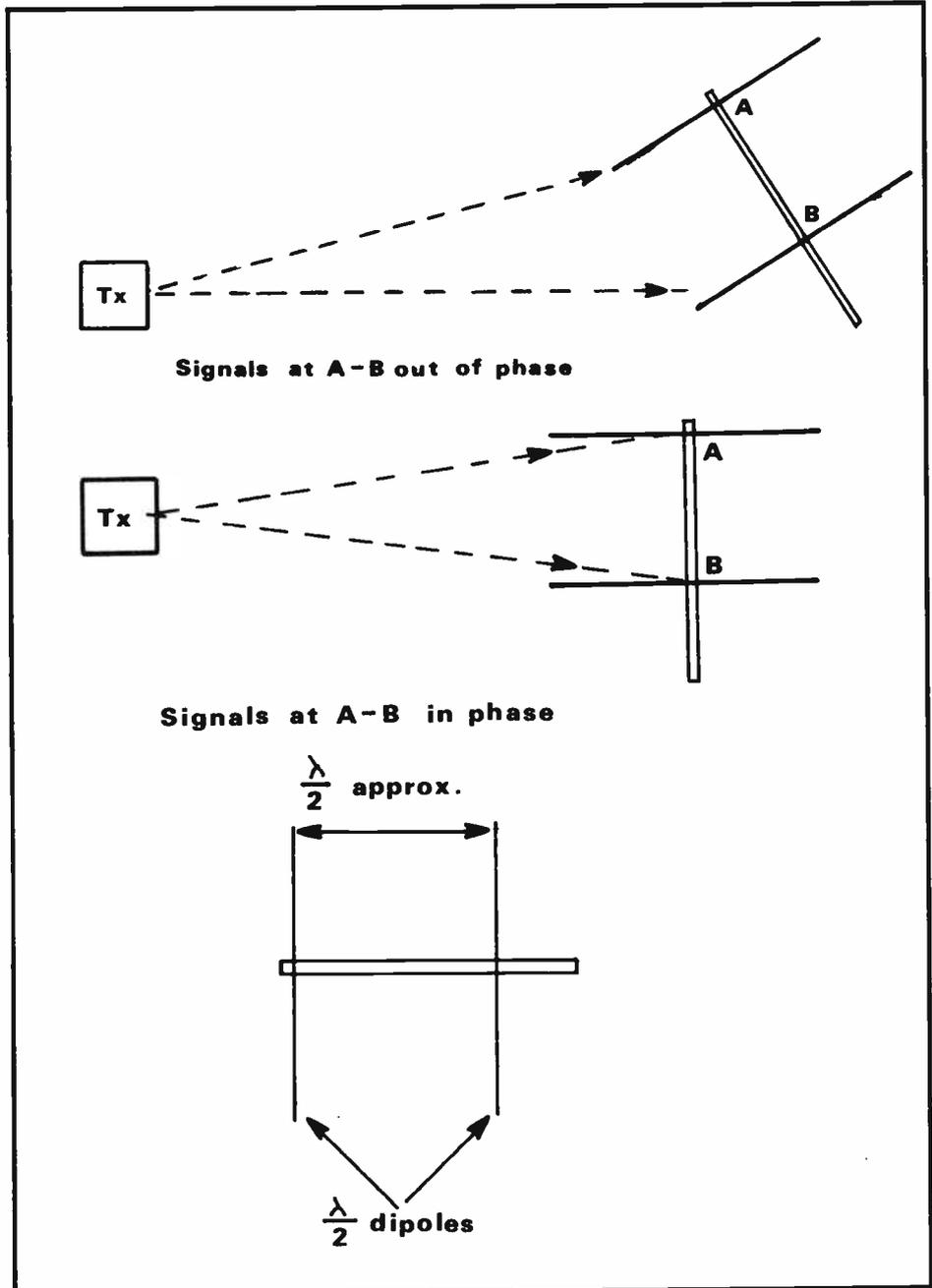


Fig 1: The theory behind the aerial. The two dipoles are a half-wave apart and about a half-wave in length

tone on the received signal. A 'hold' switch SW2 disables the oscillator, so that normal sound can be heard from the receiver without the 1kHz whistle. The circuit is powered from a 9V battery and has a supply voltage of about 5 to 15V.

Construction

The construction of the antenna is very simple when carried out in a number of stages and there should be few problems. There are four parts to the aerial: the PBC layout for the electronics, the boom, the elements, and the final wiring.

The antenna is contained in a die-cast box, and the interconnections should be well-screened and as short as possible. The variable-resistor can be of any value from 100 to 500 ohms. A switch has been included to switch out the attenuator and provide a through-path.

At this point you may want to change antennas; a shielded loop or a small two element beam such as the HB9CV is ideal. When the signal is rock-crushing, increase the attenuation until the S meter drops or, if your receiver is not fitted with an S meter, until the back-

AN EXPERIMENTAL DF ANTENNA

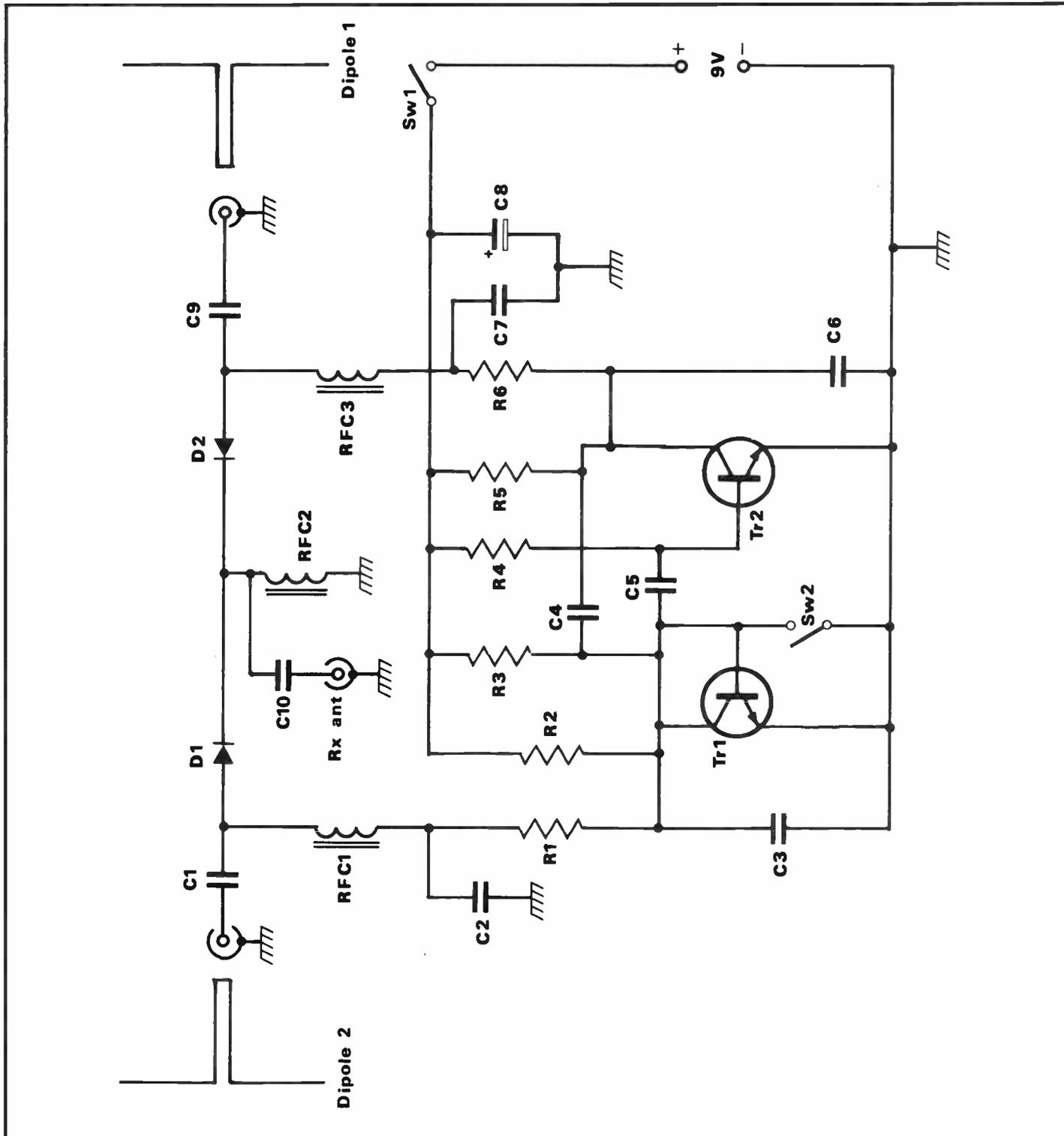


Fig 2: The circuit diagram for the DF aerial. RFC1, RFC2 and RFC3 are home-made

ground noise increases. Then it is just a matter of turning the antenna around until the signal strength is increased.

The PCB

The most difficult problem facing the home constructor is designing the circuit layout for the electronic components. You could build the circuit layout on a piece of veroboard, but it is better to use a printed circuit board (see **Fig 3a** and **Fig 3b**).

Constructing the PCB is a lot faster when it is correct, ie, if there are no

tracks missing. The best way to make the PCB is to use a PCB pen.

Start making the PCB by mounting all of the resistors and capacitors, being careful to mount C8 the correct way round. Next, solder the two diodes D1 and D2 into place, again making sure that they are the correct way round. RFC1, RFC2 and RFC3 are home-made chokes, using three-to-four turns of 30swg enamelled copper wire on a ferrite bead. TR1 and TR2 can be almost any general-purpose npn silicon transistor, such as the BC108 or BC109. This device has a

small lug on one side of the 'can' which indicates the emitter lead; the middle lead is the base and the remaining lead is the collector. While fitting the device, make sure that the lug is near the bottom of the board.

When all the components are fitted, solder into place a number of soldering pins in order to attach the input/output connections, as well as the wiring for the supply voltage and hold switch. When you have completed the board, check for any mistakes, such as dry joints, etc.

To test the antenna you will need

AN EXPERIMENTAL DF ANTENNA

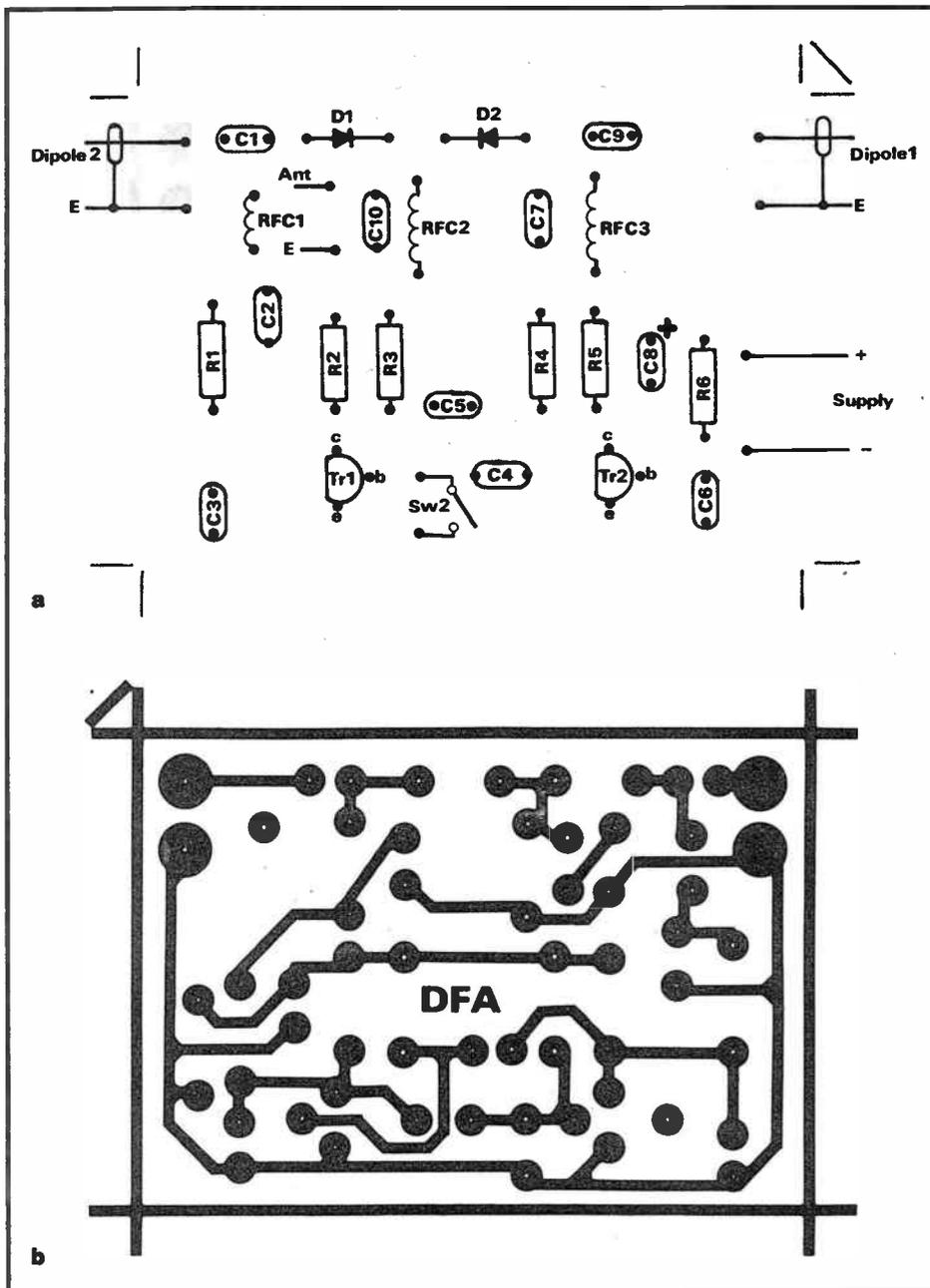


Fig 3a: The PCB overlay. The point marked 'ANT' is the output to the receiver's antenna socket.
Fig 3b: The PCB foil pattern. The size of the printed circuit board is 60 x 45mm approximately

either a crystal earpiece or a pair of Walkman-type headphones. First, connect a supply voltage to the board and then connect the headphones or earpiece to one of the dipole's inputs. You should hear a high-pitched whistle. Change to the other dipole's input and you should hear the whistle again (if you close the hold switch the whistle will stop). That completes the construction of the PCB board.

The boom

Fig 4 shows the layout of the antenna with the two element boxes and the main control box which is attached to the boom. The boom can be made from any suitable material, but in the prototype a 1in dowel was cut to a length of 1090mm and painted with enamel paint to make it waterproof. Two boxes are fixed to each

end of the boom (**Fig 5** shows a close up view of one end) each measuring 50mm x 50mm x 31mm, and are available from Verospeed, stock number 86-21580E.

In **Fig 5** there are two 4mm sockets fitted to the centre of the box to take the elements for the dipoles. Screw the boxes to the boom so that the sockets are 1010mm apart (see **Fig 4**). The next job is to temporarily fit the control box which contains the PCB, the on/off switch and the hold switch. Position the control box in the centre of the boom, but only mark and drill the fixing holes, as more work needs to be done before it is permanently fixed in place.

The elements

Four elements are needed, and are all made in the same way. Almost any type of metal rod is suitable for the elements,

but it is important to make sure that the diameter is no more than 3mm. **Fig 5** shows each element in more detail, as well as the rod which is attached to a 4mm plug. The only way to attach the rod to the plug is to solder it, so you will have to obtain some special solder (Maplin Electronics supply an aluminium solder that can also be used with brass, copper, nickel, stainless steel and tin-plate).

Start by cutting a length of rod about 50cm longer than necessary, making sure that one end is clean and clear of any grease, then solder it to the plug. After it has cooled, check the joint and, if satisfied, construct the other three elements. The best way to cut them is to plug them into the element boxes and cut an overall length of about 980mm, being careful to trim equal lengths from each end.

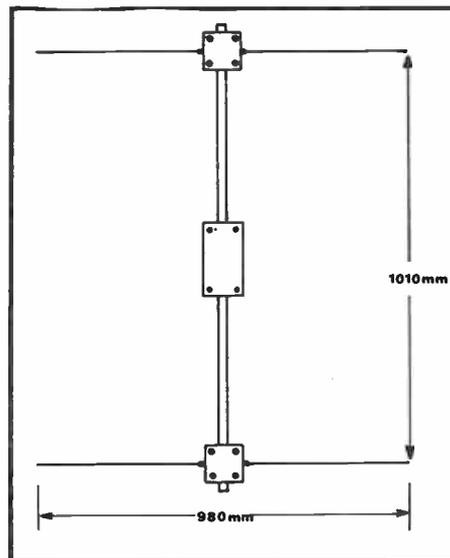
Final wiring

The first thing to do is mark and drill the control box. The size of the box is 121mm x 66mm x 40mm, and it is available from Verospeed, stock number 86-20102B.

Apart from the mounting holes, six more holes need to be drilled to carry cable to and from the dipoles, the on/off switch, the hold switch and the PCB mounting holes. The cable entry holes are located at both ends of the box, and the two holes for the switches are on one side. Finally, two holes are drilled into the base of the box to hold the PCB in place.

Before fitting the PCB into the box, solder all of the wiring to the solder pins (see **Fig 2** and **Fig 3**). Use miniature RG174 coaxial cable to run up to the dipoles, although 50 ohm cable will do if necessary. Next, fit the PCB into the box and attach the connections to the switches. After you have secured the box to the boom, pass the coaxial cable through the holes in each end of the box and attach the cable to the top of the boom with tie clips or insulating tape. When you reach the element box, pass the cable through a small hole at one end

Fig 4: The boom with the element and control boxes



AN EXPERIMENTAL DF ANTENNA

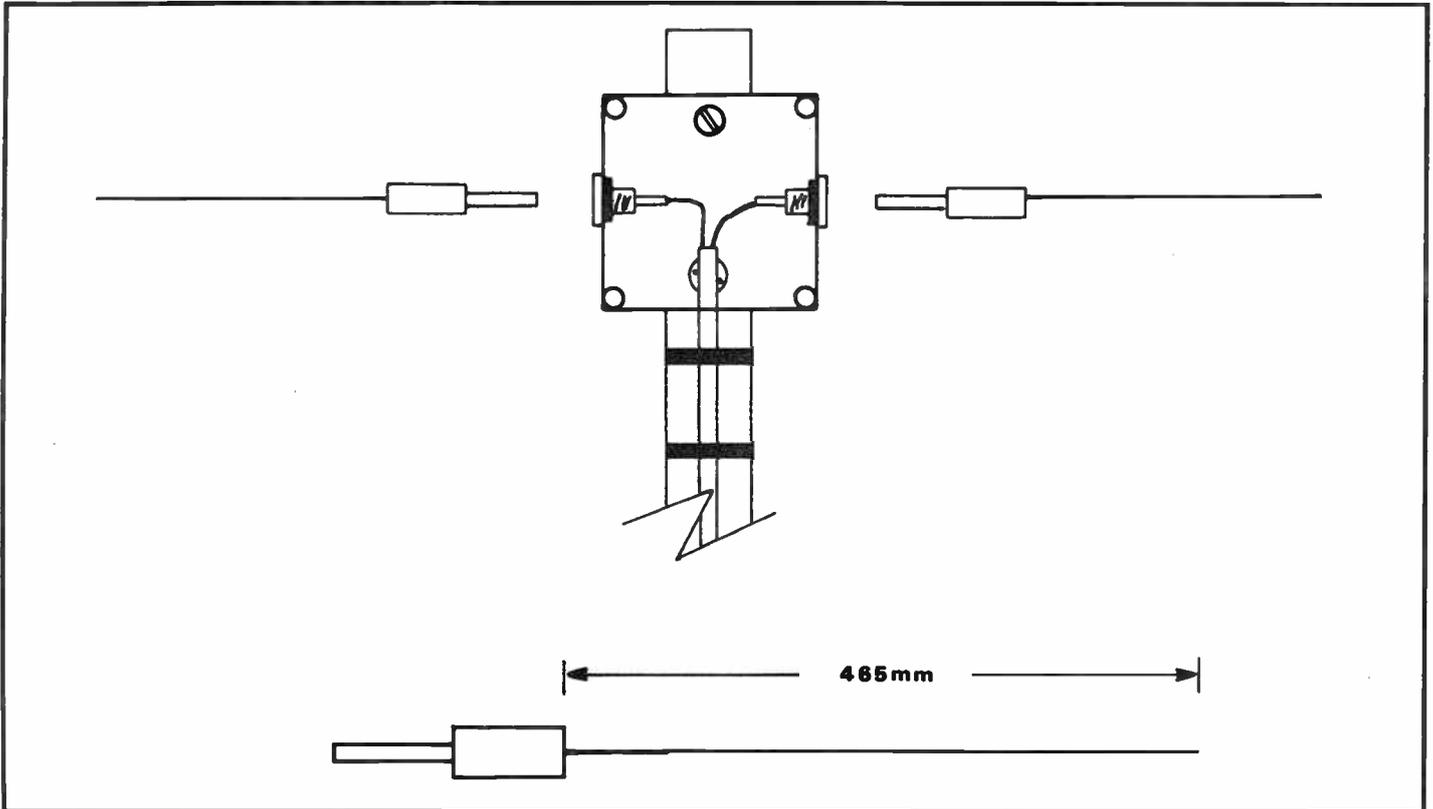


Fig 5: A close-up of one of the element boxes. The elements plug into the end boxes making the antenna portable

of the box and solder it as shown in **Fig 5**. You are now ready to test your antenna.

Testing

Plug in the elements which make up the dipoles and connect a power supply to the unit, (ie, the battery). Make sure that the hold switch is open and switch the antenna on. If all is well you will hear a whistle, along with any station received. The whistle will vary a little when the aerial is turned, and there will also be a null when the signal is at right angles to the boom. The whistle will stop when you close the hold switch. Your antenna should now be working.

It is much better to start with a known transmission such as the local repeater, for example, as most people know where it is located. If it is 'off the air', then use the transmission from a friend's station. The null is very sharp, so you will have to turn the beam very slowly. When the boom is at right angles to the transmission there will be a drop in the tone. In practice, you cannot tell from which direction the station is coming, but this isn't a disadvantage once you have taken a second bearing and seen where the two signals cross on the map.

General fox hunting

As with all fox hunting, it is usual to take one bearing and then move off at about 45° to 90°, and take another bearing. Where they cross on the map will place you within 1km of the fox. One problem you will encounter is that your receiver will become swamped by the transmission of the fox, so you will need to employ a 'signal attenuator' of the variable type shown in **Fig 6**.

ELECTRONIC COMPONENTS LIST

Resistors

R1, R6	10k
R2, R5	1k2
R3, R4	15k

Capacitors

C1, C2, C7, C9, C10	10nF
C3, C6	470pF ceramic disc
C4, C5	47nF
C8	47µF 16V (working minimum)

Semiconductors

TR1, TR2	BC108 or equivalent
D1, D2	1N4148 or 1N914

Miscellaneous

RFC1, RFC2 and RFC3
 3 ferrite beads
 30swg enamelled copper wire
 Printed circuit board and PCB pen
 Ferric chloride crystals
 2 × SPDT subminiature switches
 Solder pins, wire, etc

THE ANTENNA COMPONENTS LIST

Length of 1in dowel	
2 × die-cast boxes measuring 50mm × 50mm × 31mm	Verospeed 86-21580E
Die-cast box measuring 121mm × 66mm × 40mm	Verospeed 86-20102B
4 × 4mm sockets	Maplin HF73Q
4 × 4mm plugs	Maplin HF66W
4 × element rods	
Aluminium solder	Maplin FY71N
50 ohm screened cable, ie, RG174 miniature coaxial cable	
Nuts, bolts, screws, etc	

AN EXPERIMENTAL DF ANTENNA

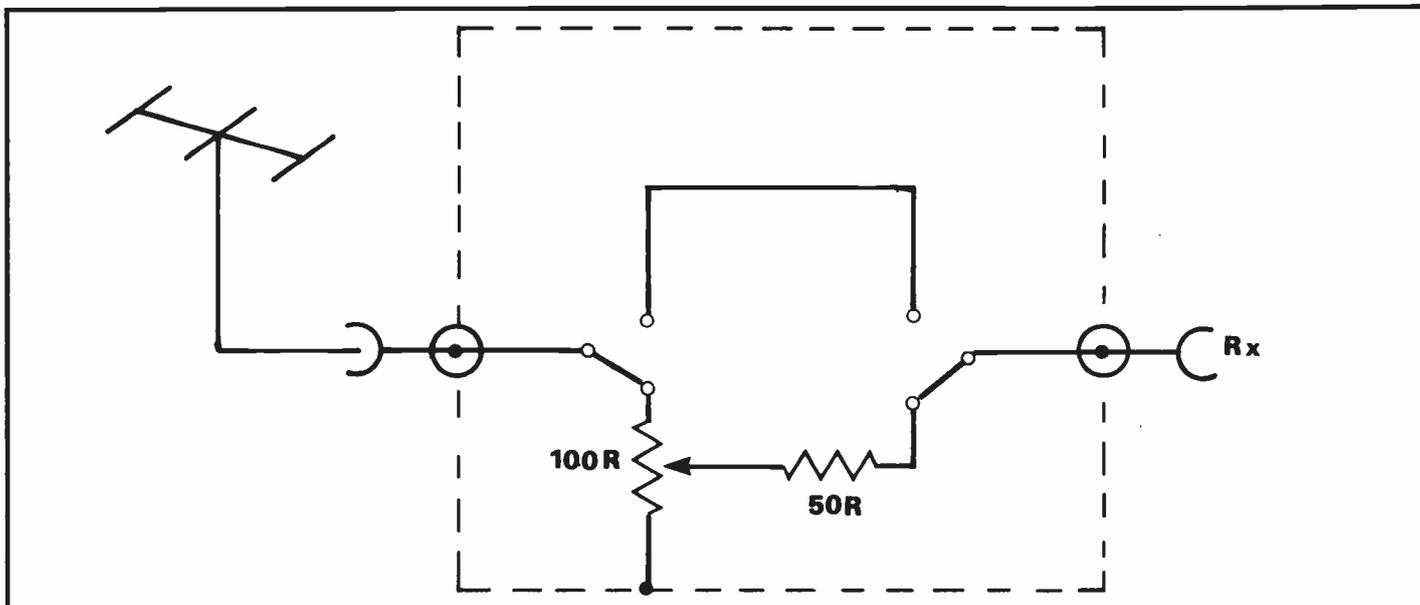


Fig 6: A variable attenuator. The unit fits between the antenna and the antenna socket of the receiver

Conclusion

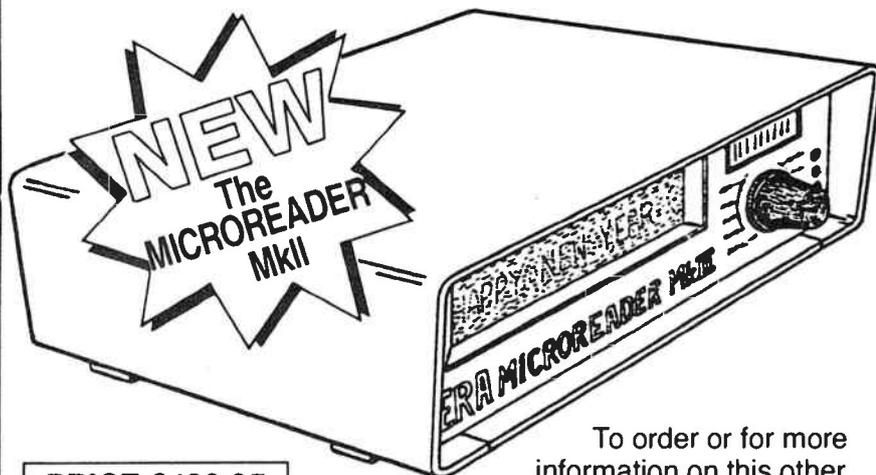
As far as we know, six DF antennas have been built to this design, and everyone has been happy with their performance. Since it is an experimental aerial, there is room for improvement to both its design and construction. Perhaps you would like to try a scaled-down

or scaled-up version to use on other bands such as 70cm or 50MHz?

If you are really interested in fox hunting then there is no substitute for first-hand experience, so keep your ears to the ground to find out when there is a fox hunt in your area, and then get out there and have a go.

By talking to other people involved in fox hunting, you will obtain all the information you need to know about map reading, plotting a bearing, types of antennas to use and, finally, going for the 'kill'. Better still, try and arrange a talk about the subject at your local radio society.

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The World of D | A | T | A

BY DON FIELD G3XTT

I want to start this month by looking at what equipment you need to get going with datacomms. You may be surprised to know that you almost certainly have much of the gear in your shack already, which will minimise the costs. Just what you will need will depend on your chosen mode(s) and band(s), but essentially you will end up with something like the set-up shown in **Fig 1**.

I shall say something about the computer and the radio at a future date, but in practice your choice will almost certainly be determined by what you already use in the shack. What you won't have is the TNC (Terminal Node Controller) which, as you can see, sits between the computer and the rig. The TNC is the heart of the system, so it's worth having at least a basic understanding of what goes on inside. This will help you when choosing which one to buy. Incidentally, I should mention at this stage that the TNC is essentially for packet operation, though many TNCs also support RTTY, AMTOR and other data modes. If you only wish to operate, say, RTTY, then you can get along with a specialist RTTY terminal unit, but I am assuming that for many of you packet radio will be the starting point.

The role of the TNC is to sit between your computer and the radio and to assemble the data you wish to send into packets for transmission, and to disassemble incoming packets. For example, each packet of data which is sent out will have callsigns, routing information, parity bits, etc, included. You will have input some of this data to the TNC at the beginning of the contact,

but it needs to be included in each outgoing packet.

The TNC also controls the transmission and reception of data across the packet network, re-sending packets where necessary (for example, where they have been corrupted by QRM), or asking the distant station for a retransmission.

Your computer talks to the TNC via an RS232 or TTL link. RS232 is the common standard for asynchronous data communication; the data passes along this link as a series of dc voltages representing ones and zeros. However, your transceiver doesn't want to be presented with an RS232 signal, so the TNC will usually include a modem (modulator/demodulator) to turn the output of the TNC into audio tones which can be fed into the microphone socket of the transceiver for transmission. The modem will also turn incoming audio back into suitable dc signals for the TNC to decode.

In theory, all the TNC operations could be carried out by the computer itself, but few home computers are fast enough to handle all the necessary operations in real time. The Cambridge packet system, developed for the BBC microcomputer, attempted to do this. However, it is not widely used nowadays, mainly because the BBC micro is not well-known outside the UK, and other, international, standards have been adopted by the packet radio fraternity. However, there is a move to KISS (Keep It Simple Stupid) mode for TNCs, where many of the TNC functions are bypassed and more of the clever stuff is done in the computer. This is useful

when playing with new protocols such as TCP/IP (don't worry about what this is for the moment).

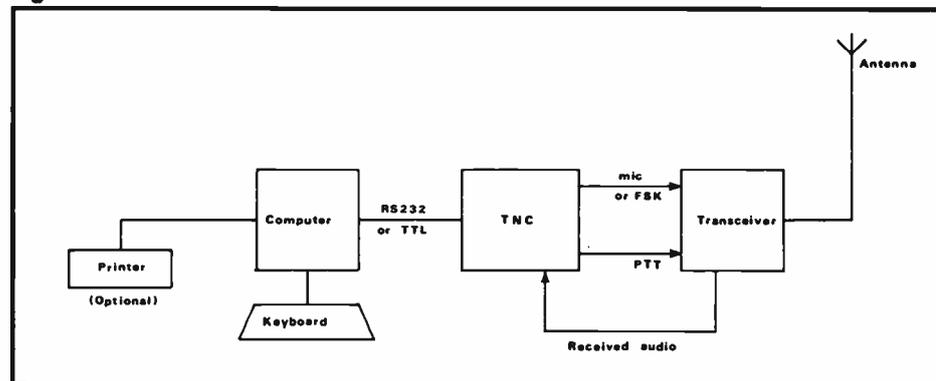
The first packet QSO took place in Canada on 31 May 1978 on the 220MHz band. It used a protocol developed by Doug Lockhart VE7APU for the Vancouver Amateur Digital Communications Group. The VADCG protocol was only ever intended for experimental purposes but was widely used in the USA and Canada, and TNCs were made available to support this protocol.

Other protocols have also been developed and much experimental work still goes on. However, for all practical purposes right now, if you want to get started on packet radio you want to choose a TNC that supports the AX25 protocol.

AX25 is an amateur adaptation of the commercial X25 protocols used for data transmission over public data networks. AX25 was pioneered by AMRAD (Amateur Radio Research and Development Corporation) and RATS (Radio Amateur Telecommunications Society). In 1982, with the launch of Oscar 10 imminent, it was important to select a standard from among the various packet radio protocols then in use by amateurs. The main contenders were VADCG, TAPR/DA (developed by the Tucson Amateur Packet Radio group) and AX25.

The Tucson group had been heavily involved in packet radio since the first ARRL Computer Networking Conference in October 1981, and had gained some early experience in making TNC kits. When AX25 was adopted as a standard, the TAPR group began to develop a suitable TNC. This became the TNC-1. TAPR quickly realised that demand was likely to outstrip their ability to supply and had the good sense to license manufacture of their TNC to third parties. Thus, AEA brought out their PKT-1 in 1984, this being identical to the TAPR TNC-1 in almost every respect. However, AEA's ability to advertise and promote their products in a big way soon led to a rapid increase in the number of stations in the USA equipped for AX25 packet operation. Heathkit and Kantronics also brought out TNC-1 clones, and eventually TAPR were able to stop manufacturing kits of their own and were able to get back to development work.

Fig 1: The amateur datacomms station



The TNC-2

Now we get to the crucial bit. The next product from the TAPR stable was the TNC-2. This was a totally new design, based on the Z80 processor chip (the TNC-1 had used a 6809). It was smaller than the TNC-1, ran on 12V and had a number of new features. As with the TNC-1, TAPR sold the manufacturing rights to the TNC-2 and a number of companies quickly got into production. When you buy a TNC today, it will almost certainly be based on the TNC-2. If not a direct 'clone', it will implement most, if not all, of the TNC-2 commands. For some purposes, such as NET/ROM support, you will need a very close clone, but otherwise your choice of which model to buy will be based on other factors. Some manufacturers produce a basic TNC-2 clone for a minimal price. Others prefer to add value by including other modes (such as RTTY and AMTOR), by incorporating both VHF and HF modems, and by distinguishing their products in various other ways.

I set out to compile a table of all the TNCs currently available, together with a summary of their features, price, etc. This started to get rather large, so I have provided some basic information this month and will add more detail next month. Bear in mind that prices, specifications and suppliers can change, so check before you buy. I am indebted to all the suppliers who helped me with product information, especially to Phil G6DLJ, of Siskin Electronics, who went out of his way to provide me with a wealth of detailed information. A couple of years ago TNCs were available only from a few specialist suppliers. Now all the mainstream 'black box' suppliers are jumping on the bandwagon.

All the TNCs in the table offer the full TNC-2 command set (over ninety-five commands in all) or, at least, all the commands you are likely to need in practice, and some offer additional commands. When you make your selection, bear the following in mind:

1 While much VHF operation takes place on fixed channels, a tuning unit is almost essential for HF operation. This should at least be of the dual-LED-type to indicate the upper and lower tone frequencies. A series of LEDs is to be preferred, while an oscilloscope is best of all. Some TNCs have a suitable output to connect to a 'scope.

2 Because standards for data transmission are changing so quickly, it is important to buy a TNC which can be updated as new firmware becomes available (the new software usually comes as a plug-in ROM chip). The reputable suppliers will often keep your name on file and notify you when this happens. For packet, the upgrades which you may require at some stage are KISS and level 3 networking software. At the moment, NET/ROM support is more relevant to groups wishing to set up a packet repeater. All the Pac-Comm and MFJ products support NET/ROM, and there is also a version of NET/ROM for the AEA PK88. As far as I am aware, the other current products from AEA and Kantronics do not support NET/ROM.

TNCs Currently Available

Model	Suppliers	Notes
Pac-Comm Tiny 2	S, A, PA, AC, IS	Replaces TNC-200
Pac-Comm Micropower 2	S, PA, A, AC, IS	As Tiny-2, but uses only 40mA (realtime clock and printer port available as options)
Pac-Comm TNC-220	S, A, PA, AC, IS	Modems can be switched under S/W control
Pac-Comm PC-120	S, A, PA, AC, IS	Not a stand-alone TNC but a plug-in card for IBM PC. PC-120 can operate on two channels simultaneously. TCP/IP drivers available
Pac-Comm DR200	S, A, PA, IS	Specialist stand-alone dual-port purpose-built digipeater/gateway
Kantronics KAM	S, A, L	Both ports may be active simultaneously. Personal BBS included. S/W selection of EU or US RTTY tones. Time and Day clock. Direct FSK output
Kantronics KPC-2	L, A, S	Includes KAM PBBS and KA-node
Kantronics KPC-4	L, A, S	As KPC-2 plus gateway, allowing simultaneous operation on two bands
AEA PK232	S, I, P, IS	SIAM, 'Host mode', outputs for direct FSK, 'scope and external modem
AEA PK88	I, P, S	Host mode, output for external modem. Replaces PK87
MFJ Multi-mode Data Controller	A	Output for Direct FSK
G0BSX	G4CLI	Kit - PCB, Documentation and Firmware only

Key to suppliers:

A AMDAT, Crofters, Harry Stoke Road, Stoke Gifford, Bristol BS12 6QH. Tel: (0272) 699352

AC Andrews Computer Services, 6 Ash Hill Close, Bushey, Herts WD2 1 BW. Tel: 01-950 9381

I ICS Electronics Ltd, PO Box 2, Arundel, West Sussex BN18 0NX. Tel: (0243) 65575

IS Instrument & Satellite Services, 175 Staffordstown Road, Randalstown, Co Antrim BT41 3LT. Tel: (08494) 73467

L Lowe Electronics, Chesterfield Road, Matlock, Derbyshire. Tel: (0629) 580800

P Photo-Acoustics Ltd, 58 High Street, Newport Pagnell, Bucks MK16 8AQ. Tel: (0908) 610625

PA Pack-Age, Braeside, Urquhart, By Crossford, Fife KY12 8QJ. Tel: 031-331 2755 (evenings)

S Siskin Electronics, PO Box 32, Hythe, Southampton SO4 6WQ. Tel: (0703) 849962

G4CLI Dave Lockwood, 3 Westfield Court, Horbury, Wakefield, West Yorkshire WF4 6EU. Tel: (0924) 275191.

3 If you want to operate on both HF and VHF it's nice to be able to leave both rigs permanently connected to the TNC, with changeover by way of a switch on the TNC. Some TNCs will also support simultaneous operation of the VHF and HF ports. Incidentally, even when TNCs boast an HF modem, the internal filters are generally optimised for VHF and are less than ideal for HF operation.

4 It is a great help to buy terminal software to run on your PC. Most of the TNCs can be driven by any of the popular terminal emulation packages such as Procomm, the shareware programme for IBM (and clones). However, with ninety-

five or more commands to remember, it's nice to have a specially-designed TNC driver software with menu selection of commands. Some of these packages are very powerful indeed, offering split-screen (so that the information you type is separated from that which you are receiving), 'host mode' (giving detailed TNC status information on-screen), sophisticated text-editing facilities, memories and much more. YAPP, another public domain program for the IBM and clones, was written especially for driving WA7MBL mailbox software and is particularly useful if you will be doing a lot of file transfers.

5 The standard VHF modem tones are 1200 and 2200Hz (the Bell 202 standard). On HF there is a variety of standards, but most European operators use 1460 and 1260Hz. There is no incompatibility between this standard and others which also use 200Hz separation (eg, the Bell 103 standard of 2025 and 2225Hz), but the indicated carrier frequency on your rig will be different. Hence the benefit of the up-and-coming method of specifying the operating frequency as the mid-frequency of the two tones, because this is constant whatever tones you are using. The standard for frequency shift on RTTY is 170Hz, but a packet modem with 200Hz shift is usually all right. There is another problem here since the US convention is that the lower of the two tones represents 'mark', whereas in the rest of the world the higher tone represents mark. No problem if you operate in USB and the US station in LSB (or vice versa) but, again, the indicated frequencies on your rigs will be very different; a point to be borne in mind when setting up skeds.

As well as the TNC-2 clones in the table, Grosvenor Software, 2 Beacon Close, Seaford, Sussex, tel: (0323) 893378, supply TNC software on disc or ROM cartridge for the Dragon and Tandy Color Computer. This comes with VHF/HF modem, while RTTY, SSTV, CW and AMTOR are available for an extra charge.

News

I have covered a lot of ground above,

but I hope you found it useful. Now to some news related to datacomm operation. The good news is that UHF networking on 70cm and 23cm is on the increase, which will take some of the load off 144.650MHz. Some of the 23cm links are experimenting with the G3RUH 9600 baud modem, which will speed up inter-mailbox forwarding enormously. We can expect similar high-speed links to evolve between NET/ROM modes, and in a year or two it may actually be possible to do what the early experimenters were able to do - have realtime QSOs on VHF from one end of the country to the other. Present levels of congestion make this impossible. Having said this, one undesirable practice is mailbox 'DXing', in other words, trying to access distant mailboxes either directly during a 'lift' or via digipeaters or NET/ROM. The idea of the mailbox network is that all bulletins, other than local ones, are carried on all mailboxes. So do stick to accessing only your local mailbox, which will help to minimise congestion.

The BARTG Spring VHF/UHF RTTY Contest takes place on 15-16 April, from 1800 on the Saturday until 1200 on the Sunday. Full rules, plus copies of log and cover sheets, are available from Peter Adams G6LZB.

Arthur Bard G1XKZ, of BARTG, is apparently willing to tackle any questions about the use of micros in amateur datacomms. This service is not limited to

BARTG members, but do send your questions only by letter and enclose an SAE.

On the HF front, the Region III IARU conference last year voted to allow packet operation between 14070 and 14112kHz, much to the consternation of many HF operators elsewhere in the world. The reason given was to include 14111kHz which is used for inter-BBS forwarding. The whole issue of packet bandplanning on HF remains a hot potato which I can't see being resolved for some years to come.

The Vietnam DXpedition in January was active on RTTY with the callsign 3W1A, giving many operators a rare new one. Y10VP also appeared from Baghdad on both RTTY and AMTOR. A Brazilian operation from St Peter and Paul Rocks, starting 2 or 3 May, will also place special emphasis on RTTY, with the callsign ZY0SY.

Finally, it appears that there has been a lot of malicious interference to the 4X1RU to N4QQ-1 BBS link on 15m. US restrictions on third-party traffic mean that BBS linking between the US and Europe is effectively a non-starter, so a lot of European traffic has to go via Israel, this being the nearest country with which the US has a third-party agreement.

That's it for this month. Feedback on what you would like to see here is welcome, either via the mail or via packet to G3XTT at GB7WOK.

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THE MICRO-MOD SYSTEM

by Glen Ross G8MWR

The amateur bands are becoming ever more crowded and finding a clear spot on the dial is increasingly difficult. Consequently several attempts have been made to persuade amateurs to make more use of space-saving techniques such as CW, but with little success. The difficulties are two-fold. First, not everyone likes the 'chore' of learning and using Morse; second, although CW will work easily in a 200Hz bandpass, very few modern rigs are supplied with suitable filters. It is, however, normal for manufacturers to use the 2.5kHz SSB filter for CW reception. This means that the CW transmission appears to take up the space that twelve properly filtered signals would use. It is therefore incorrectly assumed that this mode does not offer much in the way of saving space.

Zero bandwidth

Imagine the advantages of a system that used normal voice techniques and yet occupied what amounts to zero space. Such a system has recently been described in **Revista de la Sociedad de los Aficionados de Radio Emisoras de Santa Euforia del Gran Puerco** - no simple titles like **Amateur Radio** out there! The author is Hosa B Marvella, who holds the experimental callsign IM2GUD. Thanks are due to the journal for permission to republish some of the original material.

Sub-audio FM

Let us consider the normal NBFM system currently used on most VHF transceivers. The frequency response of the audio is tailored to its usual range of 300 to 3500Hz, the level is set to give the correct deviation and used to modulate the transmitter. At the receiver the audio signal is recovered, amplified, and fed to the loudspeaker. The bandwidth needed is typically around 25kHz to achieve this performance. The system being proposed uses a bandwidth which can be less than 10Hz but which, for practical purposes, is set to around 30Hz.

Reduction

This is achieved by reducing the deviation at the transmitter to a point where the carrier hardly shifts. This means that many more transmissions can be carried on the band and that all of the transmitted power is concentrated in a very narrow bandwidth instead of being dissipated in 25kHz. The improvements in transmitting efficiency and, consequently, the distances that can be worked, are enormous.

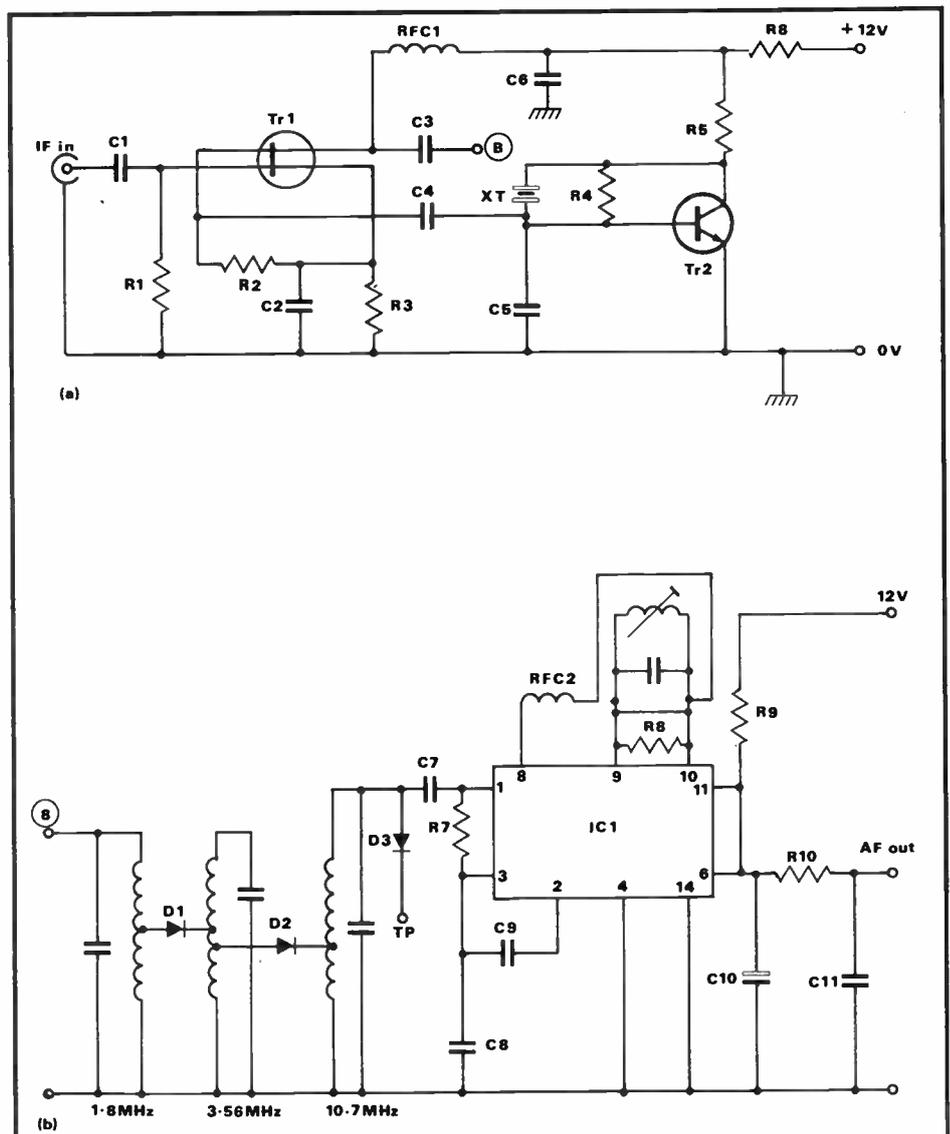


Fig 1 a and b

Parts List

C1	.01 disc	R1	100kΩ ¼W	TR1	3N201
C2	.01 disc	R2	180kΩ	TR2	BC108
C3	.01 disc	R3	1kΩ	D1,2,3	OA81
C4	47pF	R4	120kΩ	IC1	CA3089
C5	100pF	R5	4.7k		
C6	0.1 disc	R6	470Ω		
C7	.01 disc	R7	330Ω		
C8	.02 disc	R8	3.9kΩ		
C9	.02 disc	R9	39Ω		
C10	10µF16V	R10	10kΩ		
C11	.01 disc				

Parts list for Fig 1

THE MICRO-MOD SYSTEM

Recovery

So far everything has been easy, but recovering the audio is a different matter (see Fig 1). If the signal is processed as it stands, all you would hear is a sub-audible growl. Fortunately, the solution to this problem comes in the form of frequency multiplication. This is simply a method of changing frequency, but with the advantage of simultaneously multiplying the bandwidth of the signal. If you assume that the transmitted deviation is set to 30Hz, then you must multiply by a factor of twelve to recover the original audio bandwidth of around 3500Hz.

Method

For convenience the circuit in Fig 1, which shows how to recover the audio, is shown in two parts. In practice the two points marked 'B' are connected. The circuit is built on a small PCB which can be installed at some convenient point in the rig.

Different rigs use different intermediate frequencies (IF) in the receive section and the first requirement is to get this to a standard frequency so that the PCB will work with any input. A sample of the receiver's IF is connected to the input of the adapter unit which consists of a broadband circuit. TR1 is a dual-gate FET which functions as a mixer. The local oscillator voltage is generated by TR2 and drives gate 2 of the FET. The crystal frequency used in the oscillator will depend on the IF used in your rig. The crystal frequency is calculated as the receiver's IF $\pm 1.18\text{MHz}$. A crystal can be used above or below the IF because sideband inversion, which would be a disaster in an SSB environment, is of no consequence in this type of circuit.

Multiplication

The output from the mixer is developed across the RF choke in the drain circuitry and applied to the first tuned circuit at 1.18MHz.

The diode D1 is fed from a tap on the tuned circuit and placed to about 10% of the winding from the earthed end. The multiplier diode is terminated with a similarly tuned circuit and adjusted to twice the input frequency at 3.56MHz. A diode is an excellent generator of harmonics but, unfortunately, the available power falls rapidly when you try to remove the higher harmonics. By doubling in the first stage, a sufficient signal is gained to drive the next diode stage which is arranged to triple the frequency to 10.7MHz.

Demodulation

The signal is applied to pin 1 of a CA3089 in the same way as a normal FM signal, which in fact it now is.

(Translator's note: 'The .01 capacitor feeding pin 1 could be replaced with a small 10.7MHz ceramic filter. Using a filter of 2.5kHz bandwidth, for example, would substantially improve the signal-to-noise ratio. This could approach the point where an FM signal would have

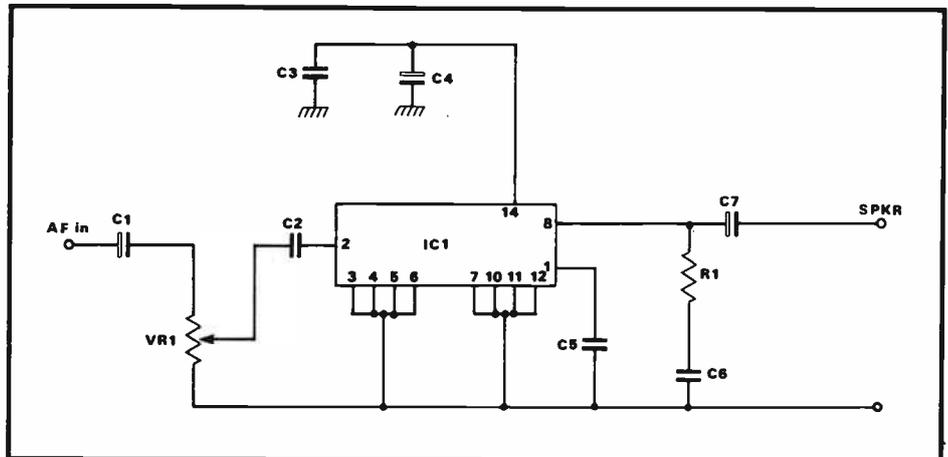


Fig 2

Parts List

C1	10 μ F 16V	IC1	LM380
C2	0.1 μ F	VR1	10k Ω log
C3	0.1 μ F	R1	3.3 Ω
C4	100 μ F 16V		
C5	0.1 μ F		
C6	0.1 μ F		
C7	100 μ F 16V		

Parts List for Fig 2

similar capabilities to those expected of a single sideband signal in a 2.5kHz bandwidth').

Signal amplification and limiting should be carried out first, followed by the final sections of the 3089 to demodulate the signal. The recovered audio output is available at pin 6 of the integrated circuit which must be filtered to remove any residual RF and to limit the audio response to that required. The signal is then connected to the rig's volume control using screened cable to avoid picking up hum from local ac mains fields.

External

The only problem with this system in its present form is that some people are reticent about altering the rig's components. Fortunately, the system can be built as an external add-on. This requires only two changes to the basic circuitry. Replace the input resistor R1 with a small audio frequency choke and use a crystal cut to exactly 1.18MHz.

The first stage now acts as an audio frequency up-converter, while the remaining circuitry operates as normal. A small audio amplifier and speaker should be fitted to the external box (the circuitry is shown in Fig 2). The audio system is based on an LM380 integrated circuit.

Set-up

Connect the 12V supply, which only has to provide about 200mA while driving the rig. It is important to use screened leads when you connect up the IF input next. There is no danger of shorting your rig because the capacitor C1 blocks any dc

which might appear on this input line. You now need a local operator to send you a signal with the usual level of tone modulation. This is achieved on a VHF or UHF rig by holding down the toneburst button. First, set up the multiplier circuitry. Disconnect the end of D1 from the 3.56MHz tuned circuit and connect a 100 micro amp meter from the end of the diode to earth. Tune the 1.18MHz circuit for the highest attainable reading. If the meter exceeds the full-scale reading, simply reduce the input level or use a higher-reading meter. After reconnecting the diode, disconnect D2 and repeat the procedure as before, this time tuning the 3.56MHz circuit. Finally, connect the meter to the test point, marked 'TP' on the circuit diagram, and adjust the 10.7MHz circuit. Carefully peak the preceding tuned circuits to get the highest reading possible on the meter. You may need to repeat this final procedure several times to accurately tune the multipliers. The only other adjustment necessary is to the discriminator coil on the 3089. Tune to a weak signal and carefully adjust the core to obtain the best signal-to-noise ratio. Remember, do *not* tune for loudest recovered audio.

Note

Further research has revealed an article by W8SBQ in the April 1963 edition of QST which details experiments in Micro-FM undertaken by his local Detroit club. Although their equipment was rudimentary, the results were encouraging. I feel that the pioneering work done by W8SBQ twenty-five years ago ought to be acknowledged.

SECOND-HAND

by HUGH ALLISON G3XSE

Sound the alarms! Stop press! A bargain! Yes, the find of the year: Redicom MX4100. Never heard of it? Neither had I till earlier this year, when nosing about the stalls at a rally, one caught my eye. The stallholder kindly let me open one up (a *real* amateur always carries a selection of screwdrivers at a rally), and I was mega-impressed with what I saw: very modern components, well laid out and all in a box only slightly bigger than a car radio. When asked what frequency it was on and what the crystal multiplication was, the stallholder uttered a helpful 'Dunno', but a fiver seemed very reasonable.

So what is it? A really nice 70cm FM box. Sensitive? My word yes, about a third of a microvolt for 15dB quieting, and bags of received audio available. The transmitter is also ace, well over 10W, and in fact all examples I've played with gave about 15W out.

There are some drawbacks of course. The mike socket is very weird, so try for the matching plug, if possible, when buying. The mike socket is also on the back of the rig, which can be inconvenient. Crystal control is a hang-up. The formula is $\times 12$ for transmit, ie, a 36MHz one is required. For receive, well, the first IF seems to be 21.418MHz, so we need $f_{reqd} + 21.418$ divided by nine, ie, about 50MHz.

Apart from the superb electrical performance and small size, one other nice point is that every pot on the boards is clearly marked – mic gain, dev, squelch, etc. Brilliant. This rig carries the Hugh Allison seal of approval, so remember the name, Redicom MX4100.

Ceramic filters (transfilters)

These things have been around now for some time, I encountered my first one twenty years ago in a 'Mohican' Heathkit receiver. They are used to shape the response of the IF.

In comes a ten-year-old home stereo system with built-in AM and FM tuner. The complaint was that the AM section didn't work; it had slowly faded away over a period of about a week. Stamped inside was a little label that said 'IF 455kHz', and '455' written on the ceramic filter tended to confirm it.

Audio stages were working, ditto the AM mixer/oscillator. The IF strip was looking suspect, though the strange thing was that it was 'dual' – ie, it doubled as a 10.7MHz strip on FM, and it was working on FM!

One clue was that the IF seemed to be 470kHz and very broad. On a hunch I 'shorted' the filter out with a 1000pF capacitor. Lots of gain and the set now worked. The filter had gone to 20dB of insertion loss whilst going walkies 15MHz higher.

Armed with this knowledge, repairing a CB set that was low gain and off frequency (though the synthesiser was spot-on) was easy. I'd hidden it at the back of the shelf a week before 'cos I couldn't repair it. So, beware drifting ceramic filters!

RF and power supplies

The normal bench 0 to 30V PSU had been 'borrowed' to recharge some Ni-Cads. No problem, there was another 0 to 12V 10A PSU under the bench. I swung it up, plugged it in and used it to repair a CB set with a duff display. There were no coloured lights in the bar graph-type S meter, so I fitted a spare chip and voilà, a perfect repair.

Being a conscientious sort of chap, I decided to check the transmit strip. I pressed the mike button and there was a brilliant flash, then the set went dead. The 'new' PSU had its voltmeter pointer embedded in the right-hand-end stop, though a gentle tap on the top restored it to the 12V position.

Whilst swearing and trying to work out what had happened, I noticed the needle do it again. Putting the avo across the PSU output showed it was going up to 20V. Then I noticed it was doing it in time to a colleague transmitting into a dummy load on an adjacent bench; the PSU was sensitive to RF energy in the vicinity. Is this the first recorded incidence of power supply unit interference?

A quick check with another CB set, powered from another PSU, showed that 1W into a dummy load a foot away would provoke it into giving 20V. A 0.1 μ F capacitor across the output terminals of the PSU effected a cure.

What about the 'repaired' CB set? The bulbs had all blown together with the new bar graph driver chip. Whoopee. Of course there wasn't another spare...

Reusing second-hand components

Very often at junk sales you see piles of ex-computer boards at very reasonable prices, often just 10p each. These can provide a wealth of useful components, particularly resistors, capacitors and potentiometers. These components are quite often what is termed 'computer grade'. Although an unspecific term, there is a good chance that these bits are high-quality, reliable components that, although used, still have plenty of life left in them. Also there is the possibility that the decent, professional engineer who designed the board, carefully chose components to work well within their ratings. Well, you never know.

Apart from obviously used boards there are two other boards worth looking for, both containing unused components. One is the 'components-inserted-but-never-soldered' type, often seen at

rallies. Here the leads are sometimes their original lengths, which may be handy. The other type, seen surprisingly often, is the 'it-sunk-in-the-solder-bath' board.

On a big-batch production job it is obviously not practical to have people hand-soldering every joint on to the board. What happens is that the components are inserted into the board (and leads cropped) by a machine. The boards run over some flux, then over the surface of a bath of molten solder. If there is too much solder in the bath it can run over the edges of the board and cover the top. These boards look horrible but it is worth remembering that only the bottom of the board has been fluxed, thus the solder may not have 'wet' the lead-outs on the top of the board. Apply a soldering iron around the top and very often the excess solder runs off with no problem at all. I've bought high-quality boards awash with excess solder for pennies each, and retrieved many modern, useful components. Don't be put off by appearances here.

Semiconductors, etc

You will notice that I've not mentioned active devices above, only passives. Transistors can be salvaged, and I've often suggested Pye Westminsters as good sources of RF devices for a quid or two.

Very often transistors are marked with in-house numbers on surplus boards, or sometimes 'R' numbers, for research purposes. You stand virtually no chance of finding out what these are, or of their nearest well-known number. Perhaps I'd better not tell the story here of how I once phoned up a large semiconductor manufacturer and the customer enquiry engineer said, 'If you care to hang on I'll go and look up my "R"s'!

The trick with unknown transistors is to guess at what they might have been doing. IF strips probably contain 'linear' RF receiving-type transistors, ditto front ends and most likely multiplier strips. Computer boards, if very old, probably contain switching transistors and the like. Power supplies contain high-current devices and maybe fixed voltage regulators.

ICs are often so cheap nowadays that the risk of using a salvaged one isn't worthwhile. However, a month or two ago I desperately needed a common or garden 4001 chip. I found a scrap board with one, but it was double-sided and the chip was soldered on both sides. The best solution here, when you want the chip but don't care about the board, is to cut the chip out with an inch or so of board around it (a 'nibbler' is an excellent tool for this), or drill a series of holes around the chip, then knock the

SECOND-HAND

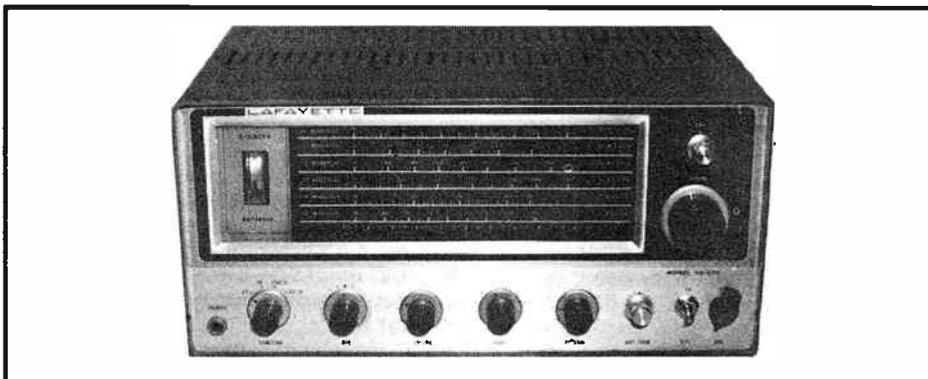
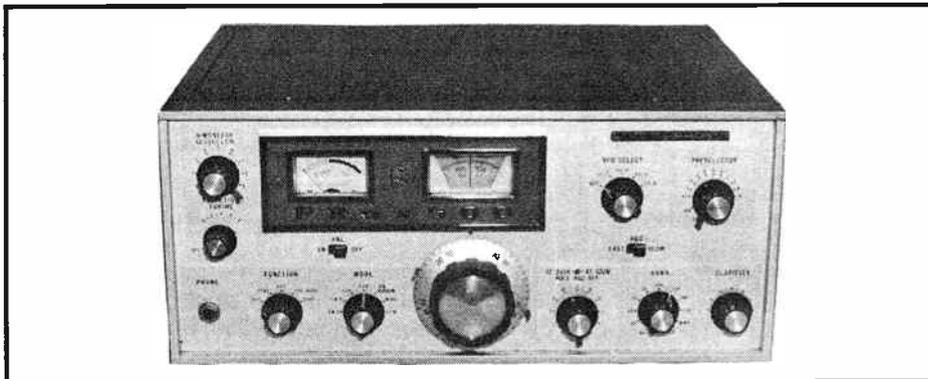
piece out. You can then unsolder each leg and cut away the board between it and the next leg as you go. When using a salvaged chip I try, if space permits, to employ it in a socket in the repaired equipment.

50MHz receivers

There is a growing interest in receiving 50MHz, reflected by queries in my postbag, and there are two major reasons for disappointment with receivers bought for this band. The first is that 50MHz *isn't there!* Think back ten or twenty years. Even the most optimistic of enthusiasts wouldn't have dared hope we would get the band back. Importers and manufacturers shared this feeling, so in sets made to sell world-wide, although 50MHz was emblazoned on the front panel, 70MHz was fitted in models intended for the British market. It's not mega-difficult to check for yourself. Very often 50MHz uses the 28 to 30MHz range as the second IF, so locate the internal 'converter' and admire the crystal frequency. If it's around 20MHz, then the thing will indeed receive 50MHz. If we have 40MHz in there, then beware, it's probably 70MHz. It isn't practical to say that all examples of Yaesucom XYZ receivers cover 70MHz when switched to 50MHz, 'cos some will have come in via, say, America, where they will have had 50MHz fitted. Watch out.

The other reason for disappointment is poor performance. When you look back at the kind of sensitivity people were getting twenty years ago and compare it with today's norm, you will see there have been massive advances made. Some of these sets are trying to work on 50MHz with valves, techniques and layouts not really suitable for VHF use. The end result is, quite frankly, dreadful. Far, far better to forget the built-in 50MHz converter/front end entirely and use the set to tune 28 to 30MHz as the second IF on a more modern converter.

Here are two quick reviews of receivers of each type; one with 70MHz fitted and the other with a poor 50MHz performance. I would like to emphasise that there are many others available. It's probably true to say that any ten-



Top: Sommerkamp FRDX500. **Bottom:** Lafayette HA600

twenty-year-old HF set that includes 50MHz is not going to compete *on that band* with any modern-day set.

Sommerkamp/Yaesu FRDX500

Wow, what an impressive looking bit of kit. A mate of mine nearly bought one once thinking it was a transceiver. Built like the proverbial and dead reliable. Mains powered and all valves built in, except the 50 (or 70) MHz and 2m converters. There is FM and provision for a narrower CW filter. There is a squelch, an S meter and slow and fast AGC. All 'old' bands are covered, 160 to 10m, plus CB (11m) and WWV, and it's very stable. Performance? Well, really excellent 160 to 21MHz, 10m suffers slightly – about 2µV for 10dB, and the 70 and 144MHz converters are not brilliant either, about 2µV for 15dB sig noise. All in all an excellent HF set. Consider the VHF stuff

as a not-too-handy free gift, be it 50 or 70MHz, and 144.

To work on, easy. Loads of room, logical layout and easy to replace components. Price, well, variable is the best I can say. Last year I saw one take all day to sell at £70.00 (Brighton) yet one was snapped up at £125.00 at Leeds. I'd say £100.00 is just too much.

Lafayette HA600

Bands: 80, 40, 20, 15 and 10m. It has 50MHz fitted, but forget it. 10µV for 10dB is the best I've seen out of one of these on that band, and I've seen much, much worse. There is a built-in S meter and a BFO. It's a cheap, moderately handy receiver, quite adequate as, say, a first 'amateur bands only' box. I've had great fun with one of these and a two-transistor transmitter on 80m. Price? £35.00 to £45.00 for a worker.

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News and comment from Glen Ross G8MWR

This month I have to report that I have received no less than three letters from the RSGB, two of which they know about and one which they certainly don't as it comes from our tame mole. The first one just contained some routine information, but the other two are most interesting.

The 2m band

When we published the 2m bandplan two months ago, I said that there were certain to be some claimants for airspace that I was not aware of, and sure enough one has turned up. This one comes from an unexpected source, no less than Don Field of our DX Diary column. This time he is wearing his RSGB HF Committee Publicity Officer hat and his letter concerns 144.525MHz. It appears that this frequency is used as a DX alerting net, the idea being that if someone spots a bit of choice DX on 20m or wherever, he grabs the 2m mike and announces it to the (local) world.

Background

The frequency involved is 144.525MHz, which is just above the SSB section of the band. Don says that this spot was first used in the Thames Valley area but that it is now spreading. He says that there is no official RSGB backing for this frequency

usage but mentions a recent article in **RadCom** by Angus G3OSS, which does, in fact, promote its use for this purpose. Don requests that we either leave the channel vacant for this usage, or at least QSY if someone wants to use it to alert other operators to DX possibilities.

Reasonable?

Now on the face of it this request seems reasonable, but there is no denying the fact that it further reduces the space available on the band for VHF operators. If this were the only option open to the HF people then there could be little argument, but this is not the case and there are other possibilities available to them. Consider 1.8MHz; this has similar daylight range to 2m and would serve the same purpose. The argument may go that to QSY to top band you would have to retune the rig, etc, and admittedly this could be a nuisance. Perhaps they could ask for a break on the local repeater, then we would all get to know what is going on. At least that option would give them far greater coverage than a local simplex channel.

Further options

Another alternative would be to use a converted CB rig with a dedicated

frequency on 10m FM. This would be a very cheap option, probably costing under £30.00, and would also have the extra advantages of greater local range and of promoting extra activity on 10m. Yet another option would be to use a converted taxi-type mobile radio unit, which can be obtained for around £10.00, and use 4m as the news band. Heaven only knows it is used for little else at the present time. If they were to use that option they could at least rely on getting a clear spot whenever they wanted it. Under the present proposal they have to rely on someone's goodwill.

General use

The idea of a warning net is great, and the use of this frequency as a general-purpose DX net, carrying warnings of openings and DX on the VHF/UHF bands, as well as specific DX on the HF bands, would make the whole thing more palatable. Perhaps the RSGB HF and VHF committees might talk to each other about this idea? If, however, they are adamant about it being used purely as an HF DX spot, then surely there are better ways of implementing it than to further limit the free usage of an already overfull band. I have an awful suspicion that at the end of the day we will have to learn to live with yet another intrusion of the band.

Beaconry

Beacons are very useful devices for both setting up your gear and checking for enhanced propagation. Up until now the 13cm band has not been too well-endowed with beacons, but matters are improving. The latest unit to come on air is GB3OHM which is located near Birmingham. The beacon operates on 3.4569GHz and runs 1.5W to an Alford slot aerial. The beacon came on air at 1700GMT on 4 February. Reports on reception of the signal, so as to establish the coverage, etc, are welcome. All reports should be sent to Mathew Twyman G6KOA, who is QTHR in the callbook.

The Midlands area is already blessed with GB3CLE on 1.3GHz, located on the Clee Hills; GB3LES on 2.3GHz and GB3LEX which operates on 10GHz, both of which are located north of Leicester. All of these beacons give excellent coverage over a wide area. The new

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Birmingham 3.4GHz unit nearly completes the set, all we need now is one on 5.6GHz. In case you are wondering about 24GHz, that is already catered for by several 'private' beacons (which are now legal), any of which are available at the cost of a phone call to the operator.

Contest rules

There is a great divide in opinion as to how the microwave contests should be timed. On the bands above 3cm, the contests have traditionally been run for a few hours on Sundays. In some quarters it is felt that better exploitation of the band's possibilities would be achieved if the hours were extended. There is some validity in this proposition, as frequently the band starts to open up as the evening starts to cool down. This, of course, coincides with the end of the contest. The feeling is that the contest should be a twenty-four-hour affair as on the lower bands.

Problems

The RSGB Microwave Committee has decided to try the twenty-four-hour idea out for one contest and has decreed a starting time of 2000hrs GMT on the Saturday. It has been pointed out that not many operators would fancy setting up at that time at the beginning of April, simply because it will be dark. A more civilised time of 1400hrs has been put forward and this is being considered by the committee. Another problem is that most 10GHz operators look at the contests in a very light-hearted way; it is great to go out for a few hours on Sunday afternoon and play with the gear. How many of them will bother to put in a score when they know they are competing with the All Day Gang?

Wide v narrow

Another point that has received some attention is the possible separation of the mode scores. At the moment all contacts, whether wideband FM or SSB, are lumped together for scoring purposes. This, in theory, gives the SSB operator a great advantage because on an equal power basis the performance of SSB is 16dB better than WBFM. The idea is to have a separated results list so that the WBFM operator does not feel that he has no chance of a good placing in the results. The opposing view is made by G3OXL, who says that unless the results are in a single list, the FM operator is not put under any pressure to upgrade his system.

Two parts

G8KQW comes up with an excellent idea: a twenty-four-hour period for the serious SSB operator, with its own results, and a separate eight-hour contest for the WBFM boys. This would be run over the same weekend to enable cross-mode contacts to be made. This should keep everyone happy. He also suggests that the twenty-four-hour period should include an enforced eight-hour close-down from 2200hrs on Saturday until 0600hrs on Sunday morning. An added advantage of this is that it would enable groups to change site for the

70cm Bandplan	
Frequency	Usage
433-432	Not available within 100km of London
432	Low-end CW section
432-432.025	Moonbounce
432.05	CW calling freq
432.150	High-end CW section
432.150	Low-end SSB section
432.200	SSB calling freq
432.350	Microwave talk-back
432.500	High-end SSB section
432.500	Low-end all-mode
432.600	RTTY calling freq
432.600	FSK working
432.675	Packet working
432.700	Fax calling freq
432.800	High-end all-mode
432.800	Low-end beacons
432.810	GB3WHA
432.890	GB3SUT
432.910	GB3MLY
432.970	GB3CTC
432.980	GB3ANG
433.000	High-end beacons
433.000	Low-end FM
"	"
"	Repeater and FM simplex channels
"	"
"	"
433.300	RTTY repeaters
"	"
433.500	FM calling freq
433.550	Talk-in freq
433.600	RTTY and FSK
433.700	"
"	"
"	Raynet
"	"
"	"
434.600	High-end FM
434.600	"
"	"
"	Repeater inputs
"	"
435.000	"
435.000	"
"	"
"	ATV section plus satellites
"	"
440.000	"

Sunday period, which would mean even more sites being activated.

The surprising thing is that the RSGB Microwave Committee apparently wasn't able to foresee these objections nor come up with the KQW idea, which is based on the rules of existing contests. Incidentally, those of you who are seriously interested in the bands above 1GHz are recommended to subscribe to the RSGB's Microwave Newsletter. This is produced at roughly monthly intervals and is always full of interesting and useful information. The cost is low and details can be obtained from the RSGB at the usual address.

Bandplan

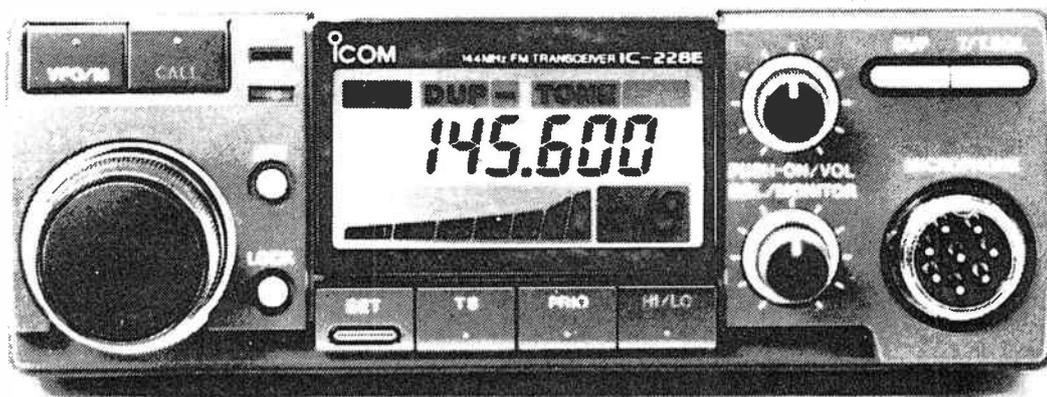
A 70cm bandplan was promised to you and, even if it is a month later than promised, you will find it listed in the accompanying table above. This information is as up-to-date as I can make it but, as in the case of the 2m bandplan, someone is sure to come along to claim their own spot.

Close-down

We are out of space again. What was in that third letter I told you about? Patience, my children, all will be revealed in next month's thrilling instalment!

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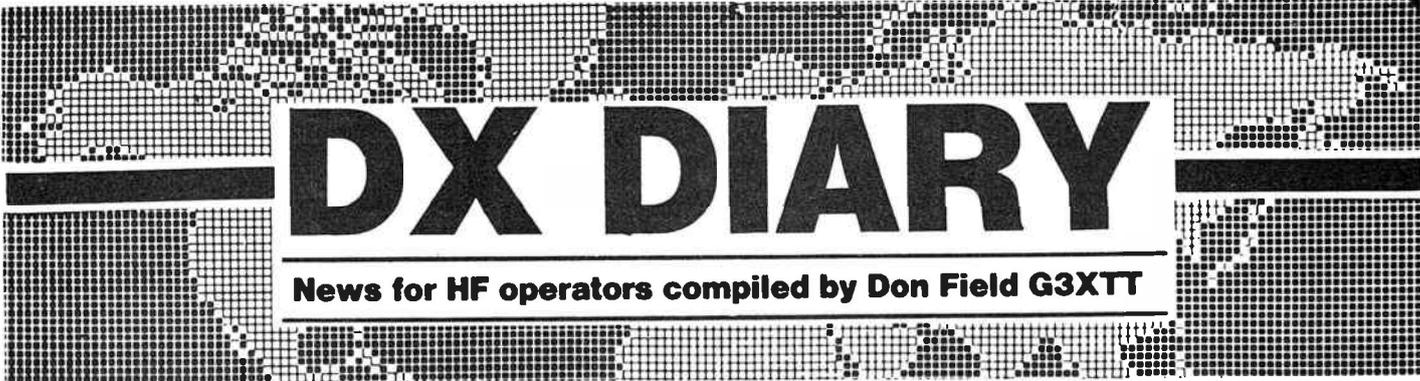
- Full crossband duplex.
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DX DIARY

News for HF operators compiled by Don Field G3XTT

There was plenty for the DX chaser to be pleased about during February. The Russian DXpedition to Vietnam came off as planned, using the callsign 3W0A on SSB and CW and 3W1A on RTTY. 4W0PA was regularly active on 20m on both CW and SSB, although his inexperience as an operator led to very low QSO rates. YI0VP was active from the club station in Baghdad to celebrate 'Victory and Peace'. There were a couple of successful German DXpeditions to the Pacific, putting both the Caroline Island groups on the air, plus KH8 (American Samoa). These are just the highlights. The Indians turned up from the Laccadive Islands towards the end of the month, and there was much else besides. The only disappointments were that the Russian operators in Vietnam failed to make it to Spratly, and HA5PP returned from Laos having been unable to get the expected licence.

Propagation

We are now getting a clearer idea of what sort of a sunspot peak we might be in for, and readers may well have seen some of the more fanciful stories in the press about how high-solar activity could lead to major failures in the national grid, causing electrical blackouts across the country. Certainly there has been a rapid increase in solar flux during the early months of this year, suggesting that this sunspot peak could be the second-best since records began. Over the past months, solar activity has been following cycle 19 (which peaked in November 1957) with remarkable consistency, which would suggest a high peak in about a year's time.

QSLs again

I had an interesting phone call from Jim GU0ELF, a regular reader of this column, concerning remarks I made in February about direct versus bureau QSLing, and in January about the demand for contacts with Jersey, Guernsey and the Isle of Man. Jim tells me that, despite there being about 125 licensed amateurs on Guernsey, most of them steer clear of the HF bands because of the pile-ups that always appear. As a result, those who do persevere tend to get swamped with QSL cards. Jim used to get about 1,000 a month via the bureau and found that he didn't have either the time or the funds to deal with them all. He now asks for direct QSLs and reckons that this means he only gets cards from those who really want one (as against

those ops who send out bureau cards for every contact as a matter of course). If no return postage is enclosed he is happy to return cards via the bureau, but at least by this method he has reduced the workload to manageable proportions. As he points out, there is nothing to stop even Russian amateurs mailing cards to him direct nowadays.

On a different note, Jim told me that quite frequently he gets cards arriving with extra dollar bills or IRCs for contacts which are very definitely not in his log. Clearly, there are some amateurs out there, hopefully a minority, who think they can buy a confirmation. This happened to me recently, with a Russian amateur offering me an R-100-0 certificate (for working Russian oblasts) in return for two GJ6UW QSLs (for which I am manager) for bands on which he needed Jersey confirmed!

Following Jim's phone call, I received a letter from Graham G4KLP on the same subject. Graham operates regularly as JY8CL and has also been QRV from ST and BV in recent years. Graham says that the time taken to handle incoming QSLs wouldn't be too bad if people were careful, but often he finds that they make mistakes with time or date on the card and he has to waste time searching through the log (not all QSL managers are as diligent in this respect as Graham, of course, and you can hardly blame them). Even so, Graham doesn't think the so-called 'honour' system for awards is satisfactory as there are definitely those who would cheat. To back up this statement, he gives several instances of QSLs which he has received for QSOs which did not and could not have taken place. Graham also mentions that a very high proportion of cards he receives are from SWLs, and that almost all of them are useless and time-wasting. However, he will always respond to SWLs who send direct with SAE and return postage.

80m DXCC

The ARRL has announced the top ten recipients of the new single-band 80m DXCC award. Not surprisingly John ON4UN heads the list with 326 all-time countries credited, followed by W4DR with 304. John is the only European in the top ten.

WARC bands

I see from DX News Sheet that Tom GW3AHN, who has made a speciality of the so-called WARC bands since they became available, now has 176 countries

worked on 24MHz and 128 on 18MHz. This makes my own scores of thirty-two and thirty-six look rather pathetic! However, it just shows what is possible. The scope should increase enormously later this year, when the current power, mode and antenna restrictions are lifted. There are strong rumours that this will happen in July. Activity on 18MHz received an unexpected boost when US amateurs were given access to the band on 1 February. No doubt this will serve to attract more DX stations, and I imagine the ARRL will soon start to allow 18MHz contacts to count towards the DXCC awards. W1JR achieved WAS (Worked All States) on 18MHz in just five days! This was the twelfth band on which Jim has managed WAS!

SM7PKK

Cass WA6AUD, writing in the US **CQ Magazine**, recently gave some interesting background on Mats SM7PKK, who has spent the Swedish winter operating from various islands in the Pacific. Mats, now twenty-one, took up amateur radio at seventeen years of age and, within a year, advanced through all grades of the Swedish licence. His favourite mode is CW, where he has been showing about 5kHz above the band-edges. By the time you read this he should be in the South Cook Islands. Not a bad way for a young man to spend the long winter months! Send QSLs to Mats Persson, Betsev 22, S-240-10 Dalby, Sweden, to be dealt with on his return.

DX news

When 4W0PA appeared on the bands at the end of January, few people took much notice. North Yemen has been off the air for many years, and pirate 4W callsigns have appeared during that period with monotonous regularity. However, this one turns out to be genuine, in much the same way that 5A0A took us all by surprise from Libya a few years ago. Hans 4W0PA is a doctor based in Yemen for two years with the Medical-Aid programme. He is not an experienced DXer but has been doing his best to cope with the inevitable pile-ups. John PA3CXC, who is handling his QSLs, is hoping to get permission to go out as a guest operator at some stage to put 4W0PA on the air in some of the major contests.

The frequencies to watch are 14010 and 14180kHz, though Hans will also seek permission to operate on the other bands, and word is that he may well

appear on 10 and 15m very soon. Let's just hope the paperwork is forthcoming to keep the ARRL happy!

If you see this column early enough, you might still be in time to catch DJ6SI and his XYL, who were due to sign TY9SI and TY9YL from 22 March until 3 April. One report also says that they will be accompanied by DJ6JC who will operate mainly on RTTY.

There were rumours that Ron ZL1AMO would visit the North Cook Islands around mid-March. This is quite a rare one, so let's hope the rumours were true.

C9MKT hopes to be active on the weekends of 7-9 April, 12-14 May and 9-11 June. Ken is also reported to be planning some activity from Swaziland and Tanzania during April or May. 3DA0BK, who is ex-ZS5MY, is also active from Swaziland and will be working hard for the various major awards.

The Natal DX Group is planning an operation from St Peter and Paul Rocks, to start around 2 or 3 May. The call signs will be ZY0SW on CW, ZY0SS on SSB and ZY0SY on RTTY. Check the usual DX frequencies, but bear in mind that they will usually be operating split-frequency.

There have been a number of reports that the operator at XU1SS has been arrested and the gear impounded. This does not bode well for future operation from Kampuchea, so I hope that you managed to catch this one while it was around.

How about this? The Long Island DX Bulletin reported recently that Ronald and Nancy Reagan plan to take their amateur licence exams and to set up a contest-style multi-op station at their retirement ranch in California!

I5DEX will be in Angola for six months from late March and has applied for a licence. This is a rare one nowadays, so let's hope he pulls it off.

The much-postponed Mexican operation from Revilla Gigedo looks set for ten days in early May, depending upon military co-operation to get them there. The call sign will be XF4T. The SSB frequencies are 3795, 7050, 14250, 21300 and 28500kHz. CW on 025.

IOTA

Island chasers should note that YJ8JS is due to operate from Banks Island off the New Hebrides from 9-12 May, probably using the call sign YJ1BK. He will then move to Torres Island for a 15-18 May operation, probably as YJ1TR. This project, which started out as a modest one-man holiday cum DXpedition, has apparently now become something of a *cause célèbre* in the Pacific, with various major companies offering sponsorship, and the possibility of some further operators joining Norman for the operation. Promises to be an interesting one! Incidentally, Islands on the Air manager, G3KMA, has recently updated the IOTA Directory, and has taken this opportunity to make some revisions to the rules. If you feel like getting involved in island chasing, then drop Roger a line at his callbook address. At the last count, the directories were £2.00 each. The IOTA net continues to meet at 1300GMT on 14260kHz on Saturdays and Sundays.

DX nets

OE2DYL has recently sent me details of the new 1989 edition of his publication 'DX Nets Around the World' List 8. This contains information about more than 100 active DX nets. The price is \$3.00 (US) or nine IRCs. For \$10.00 (thirty IRCs) he will send you all eight lists published to date (the theory behind this is that old nets may be reactivated as the sunspots increase). Order from Dieter Konrad, Bessarabierstr 39, 5020 Salzburg, Austria.

International Marconi Day

Once again there will be a number of special stations on the bands to celebrate International Marconi Day which, this year, falls on 12 April. The stations concerned are:

K1W/IMD near Cape Cod, the North American end of the first Europe to USA radio transmission.

VE1IMD at the site of the new Marconi museum in Nova Scotia.

VO1IMD at St John's, where the first transatlantic contact was made.

EI1IMD near where the first Irish experiments took place.

IY4FGM the official Marconi Club station.

G80IMD from the Isle of Wight, used by Marconi for many of his experiments.

GB4IMD from Marconi's original site at Poldhu Cove in Cornwall.

GB2IMD from Northern Ireland.

GB2MAR from the Marconi Club in Portsmouth.

All operations will be on SSB in the following bands: 3770-3780, 7070-7080, 14260-14280, 21360-21380, 28360-28380, 28760-28780kHz, plus FM on 29640kHz. An attractive certificate will be available from the Cornish Amateur Radio Club (PO Box 100, Truro TR1 1RX) for working (or hearing in the case of SWLs) at least six of the special stations. The charge is £2.00, and you need to send along details of the contacts made. Contacts made on Marconi Day may also be counted towards the Mary Rose Award and the Marconi Spectrum Award. Further details from G3FWE.

OH-DX-Ring

I was interested recently to receive a QSL card from OH0AM, which carried the following information:

'The OH-DX-Ring - OH2AM - was founded 7 August 1964. We like to think that the kids added a page to the history of DX then or created one of the Mysteries of Ages. Anyway, it marked an event when Finland ceased to be just a small, modest country tucked away in the far north of Europe. Finland decided to stand tall in DX - to assert itself in the game. Always!

'In 1986, having run the track more than once, the DX-Ring decided to take a new step by doubling its membership and invited another ten, qualified, true-blue DXers to join its ranks. The criteria were the same as those used more than twenty years earlier.

'Membership in OH2AM testifies to distinguished service in the DX vineyards and contests. It also involves a commitment to further the cause of Finnish Amateur Radio and to represent Finland with honour overseas.

'Today we are enjoying the Great Days of DX and Contesting. Advanced in numerous fields, Finland's contribution to amateur radio is well-known and appreciated throughout the world. Attuned to the finer things, OH2AM has been leading the way, with many firsts in amateur radio bearing the AM label.

'You'll be hearing about us time and again. Remember OH2AM - it stands for DX Magic. We believe in the Mystique of DX; we are Believers.'

And, indeed, who can disagree with them. From their contest activities, including the OH0W super-station, to their DXpeditions, which include helping to put some brand new countries like S0RASD and 4J1FS on the bands, the Finnish boys have become a legend over the past few years and an inspiration to us all.

Visalia

Should you just happen to be in the USA in late April, remember that the Visalia International DX Convention, the leading event of its kind, takes place in Visalia, California from 21-23 April. From past experience I can heartily recommend this one.

Contests

April is relatively quiet, with no major international contests. Locally, there is the SP-DX Contest, a CW event, on 1-2 April (starting at 1500GMT on the Saturday) and the Helvetia Contest on 29-30 April. The latter is both CW and SSB and runs for twenty-four hours from 1300GMT on the Saturday. Looking towards May, on 6-7th there is the Italian RTTY Contest, and the following weekend the Russian CQ-M Contest. More details on these and other May contests next month.

Awards

The Luxembourg Independency Award commemorates the independence of Luxembourg, gained by treaty in 1839. To obtain the award you need to score 150 points from contacts made with LX stations during 1989. Each contact scores ten points, and each station can only be counted once per band. To claim the award, send a certified list of contacts (with usual log details) to Réseau Luxembourgeois des Amateurs d'Ondes Courtes, Awards Manager, PO Box 1352, L-1013 Luxembourg, no later than 31 July 1990. There appears to be no charges for the award, but you are asked to provide a self-addressed, adhesive mailing label.

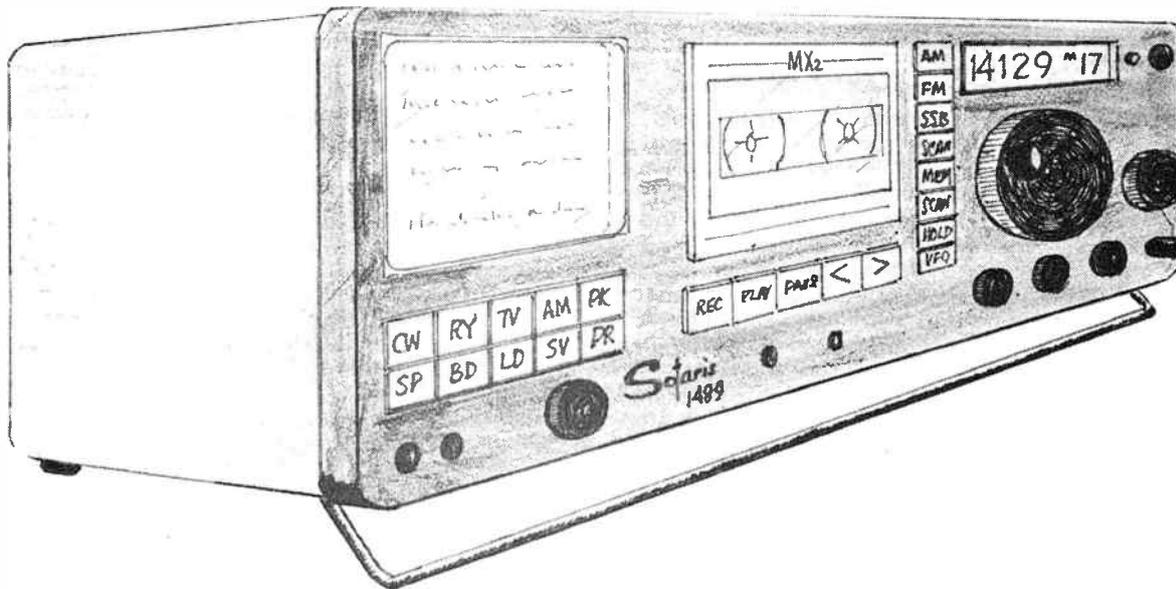
The Andorra 5 Bands Award is also for contacts made since 1 January 1989. Work five different C31 stations (other Andorra prefixes do not count), one per band, and send QSLs to URA, PO Box 150, Andorra la Vella, Andorra. Again, there appears to be no charge.

Stop press . . .

Martti OH2BH and seven other amateurs from Finland, Mexico, the USA and Japan, will operate as XF4L in a major effort from Revilla Gigedo from 11-19 April. They will look especially for Europe. The QSL route is to OH2BN.

SHORT WAVE LISTENER

TREVOR MORGAN GW4OXB



It is a pleasure to be able to review a really different receiver for the serious listener. It is expensive but it does cover most interests from amateur and broadcast monitoring to air and marine bands. In fact, it is the short wave listener's dream.

The Solaris 1489 receiver

The Solaris 1489 is not just a short wave receiver. It is the embodiment of all the features that many short wave enthusiasts consider to be essential in a listening station.

The receiver has a frequency range of 150kHz to 650MHz, catering for upper and lower sidebands, CW, AM and FM. Mode selection is made by front-panel mode keys which have LED indicators. The frequencies from 150kHz to 30MHz are tuned in 10Hz steps via the main tuning knob or by using the scan mode, and provision is made for 100Hz steps for fast tuning. Above 30MHz, tuning is in 12.5kHz steps. An RIT control allows tuning between these parameters.

The scanning system allows scanning in either direction at two speeds and provision is made for up to twenty memory

channels to be scanned independently of the main tuning. Each channel is held for three seconds and, if no signal is present, the scan moves to the next channel in the program. When a 'busy' channel is encountered, an indicator informs the operator, who can then switch in the scanned frequency. The scanning program can be set for any mode.

As an alternative to selected frequencies, the receiver can scan continuously between chosen points by programming the higher and lower frequencies.

The main tuning indicator is the standard seven-digit LED display. A separate two-digit display shows the channel scanning. As stated, the station caters for all modes and a fully screened built-in microprocessor deals with RTTY, SSTV, AMTOR and Morse systems. Control keys for these are set at the front of the unit. The display for these modes is on a 100mm x 70mm miniature flat television screen. On entering the system, the screen displays a menu from which the operator selects the mode required. Speed, frame

adjustments and baud rates are selected from the panel and are indicated on the screen.

There are sockets provided for input of signals from other sources and output to a standard video monitor. There is also a centronics parallel port for a standard printer for hard copy.

A cassette recorder is fitted which allows recording of signals from the main receiver so permanent records can be kept of stations received.

The antenna inputs are on the rear of the casing. There is provision for coax-fed aerials for HF and VHF/UHF and wire aerials for HF. The latter are fed to an in-built antenna tuner. There is also a fitted 160cm telescopic aerial for portable use.

In practice, the main receiver is extremely stable and operation is the same as for a normal general-coverage receiver. A flywheel-type drive makes fast tuning up and down the band simple but an adjustable 'drag' can be used. With the memory scanner in operation, an LED shows if a signal has been received and the operator selects the override, thus

switching in the second VFO. This can be done at any time and does not affect the main tuning.

Having the in-built computer is a real boon for the data mode fans. Select 'Data' switches on the on-board computer, and the screen displays a menu from which you choose the mode required. The necessary programs are in ROM, so no loading of programs is needed. The signals from the receiver are fed directly to the computer and shown on screen.

The usual adjustments for baud or frame rate, as well as CW speed, can be made but, as the television is preset, there are no brightness or contrast controls.

Although the picture is quite small, the image is sharp and clear. A single 'Print' command enables hard copy to be made with a suitable printer. Audio recordings can be made using the on-board cassette unit and replayed into the computer or transferred to another recorder via an extension socket on the back of the unit.

Provision is made for standard 8 ohm headphones and an extension loudspeaker,

but the built-in speaker is very good.

There is also a built-in 24-hour-mode digital clock which has six alarm settings. If 'Timer' mode is selected, the receiver will be switched on at a preset time and on a preset frequency (selected on the memory VFO).

Power consumption is about 2.5A with the computer in circuit, and the weight is about 4.5kg including the batteries. The batteries are rechargeable and will run a good eight hours per charge, even in data mode.

The price of the Solaris 1489 is around £650.00. Taking into account the all-mode capability and the excellent performance of the receiver, it is good value for money.

Dream-land

Traditionally, the April issue of many magazines contains an item that, despite its initial seriousness that leads the reader to believe its content, turns out to be a practical joke. To be quite honest, I was thinking in these terms when I started preparing my article this month. However, I decided to break with tradition a little. Instead of a practical joke, why not a dream?

Listeners, like all hobbyists, have dreams of things that could be if only the manufacturers had the vision. The Solaris 1489 is such a dream. It is composed of those technical features that listeners have said, 'If only it had...'

As such, it bears no relation to any station in production. Whether it could be produced is a matter of conjecture but it is nice to dream occasionally!

Back to reality

Coming down to earth, the winter season has meant that DX has been more difficult to

find, however, the bands have been better than expected. The peak of the current sunspot cycle is due around 1990. Nobody is sure of precisely when, but if things continue to improve over the next twelve months, the HF bands will be really humming.

Mike Turner of London has been filling his log with amateur stations, as he has found the broadcast side boring lately. Typical loggings are AA4TH from Stone Mountain, Atlanta, all the US states, 5B4TI, HZ1AB, J52US, 5V2UD, TF5BW, JF7TYA and a nice one in JY1 chatting to G0BBD from his aircraft.

Peter Rhein of Torrington came across a handy piece of information. Apparently, a batch of Sangean ATS 803A receivers has a fault in that there is a programming error in the organising software for IC402. This means that when you press the SW button 27, it calls up the twelve short wave bands sequentially, the error being that on 16, 19, 25 and 31m, the start frequency is wrongly programmed. Comet are selling these receivers at £79.95 which is a very good price indeed for a rig that many readers are finding as good as some receivers costing a lot more.

Jim Lawrence of Halstead has added a new receiver, the Trio RZ1 Scanner, to his equipment line-up, as well as a Yoko multi-standard TV receiver. The television gave some excellent pictures during the recent Sporadic E period and fifteen stations in ten countries were logged: USSR (two), Norway (five), Yugoslavia, Iceland, Sweden, Italy, Spain, German Democratic Republic, German Federal Republic and Czechoslovakia, and all these using a simple discone!

On the fax scene, Jim has

been adding to his news-transmission loggings with a nice new one from Buenos Aires on 20.736 – a frequency worth watching.

Darrell Jacobs of Mortimer is still in the awards' lists and this month claimed the Continental award for North America on 20m only. Darrell also queries an SU3 call heard on 40m at 1640hrs on 9 January. Is he genuine?

Philip Davies of Market Drayton sent in his usual excellent report (where do you find the time, Phil?). The 10m band has been superb, particularly during the ARRL 28MHz Contest. Ninety-four new US prefixes were logged with forty different states during the contest, including: K5TA, KF7B, KY0B, WX6M, NK7U, NT0V, WG7Z, N10E, K0DD, WE0A, KB0PR and WA0DYU and, just to keep the East Coast on the map, AD3V (Delaware).

The two best loggings during the contest were FP5HL on St Pierre et Miquelon and HK0HEU (who didn't give his QTH). The 15m band offered a couple of nice catches in VE8CB from Cambridge Bay, Victoria Island and A47RS from Muscat in Oman. There were some nice openings on 40m with OY5J (Faroes), GU3EJL (Alderney), TA4A (Aydin, Turkey), LW1 (Argentina) and T77 (San Marino). However, the best QSO logged on 40m has got to be T12KD working 9K2EC (Kuwait). GB0NIN was also logged on 40m from the oil rig **Ninian** in the North Sea.

Here is some information gleaned from the air on the situation in the USSR. Celebrating the 70th Anniversary of the Byelorussian State (oblasts in brackets): EW1LWN(005) Brest, op/QSL UC1LWN; EW2AB (188) Minsk, op/QSL UC2AB;

EW2WO(006) Vitebsk, op/QSL UC2WO; UC7E (188) Minsk, op/QSL UC1AWZ. Also Latvia and Lithuanian celebrations with: LY2ZO (038), op/QSL UP1BZO; LY2ZZ (038), op/QSL UP1BZZ; LY2WW (038), op/QSL UP1BWW and YL2VZ (037), op/QSL UQ2GM.

The Turkoman Republic has also been logged on 40m with RH8AZ(191) and RH8BG (180).

Phil's oblast score is now 145 with UZ4SWU being the latest in 091 (Volzhsk). Many thanks for the report, Phil.

New computer program

Some exciting news from Technical Software for those with BBC computers. A new program consisting of software and hardware interface has been produced, which enables BBC users to resolve fax, packet, SSTV, RTTY, Morse, AMTOR/SITOR, UoSAT and ASCII.

The program has full printer support including screen dump of SSTV pictures, filter, shift and speed adjustments in all modes, text store and full save facilities for fax and SSTV. The package supplied includes the interface, EPROM, all connecting leads and a demonstration cassette at an all-in price of £259.00. Considering the price of 'stand alone' decoders, this is very reasonable and gives the BBC computer a substantial upgrade for radio monitoring purposes. (Technical Software, Fron, Upper Llandwrog, Caernarfon LL54 7RF).

That's about it for this month, folks. Next month we'll have a look at what's happening in the world of broadcast monitoring. Meanwhile, have a good month of listening.

Any questions or reports to: 1 Jersey Street, Hafod, Swansea SA1 2HF.



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EVERYTHING BUT THE SQUEAK

by Ken Williams

There are three ways of tackling the problem of obtaining components for a constructional project. The first task is always to draw up a list of required components, after which the constructor must:

- Purchase his requirements in shops or by mail order.
- Attempt to find what he needs at rallies and club junk sales.
- Remove the required items from his personal component store (otherwise known as the junk box).

If the first method is chosen, it may prove quite expensive, even to the point where it would be cheaper to purchase a ready-built item for the same task.

If the second method is adopted, it may well prove to be quite long-winded, for there are only a limited number of rallies and club sales within a given area. This method may also prove expensive, particularly if transport costs and entrance fees are taken into account.

For the enthusiastic experimenter there remains only the final option, by which means construction can be pursued without incurring excessive expense.

Of course, new components will need to be purchased from time to time, but, with a deep junk box, you should find that you already have most hardware needed for the proposed project. Very often also, the design of the equipment can be adapted to use the components in stock.

Stocking a junk box

The art of developing a comprehensive, yet inexpensive, junk box is to recognise equipment which may contain useful components, yet is insufficiently attractive to the radio amateur population at large to provoke interest.

For an example, at a club sale the auctioneer may hold up an old AM Pye Ranger and ask for an opening bid. Nobody in his right mind would consider modifying the equipment for use on the air, so there is little interest and a bid of 10p or 20p will often secure.

When you get the equipment on to your bench, open up the case and see what you have purchased. Initial inspection will reveal three chassis bolted to a frame. Cut the interconnecting wires and unscrew the chassis-fixing screws.

The centre chassis is the power unit. Except for perhaps an odd resistor, nothing of much use will be found so this can be safely consigned to the dustbin. The remaining chassis are the transmitter and the receiver respectively. Depending on your philosophy towards valves, two courses of action could be followed.

If you favour valves, the transmitter could be used for experimenting with aerials without the danger of damaging

the main rig's output transistors with high VSWR, etc. The circuit is very similar to that of the much later Cambridge equipment and is capable of 4-5W output on 2m.

The receiver is insensitive by modern standards, but could perhaps be retuned to listen to a local aeromobile channel where signal strengths are high. Otherwise, the best policy is to reduce it to produce.

If you do not favour the use of valves, strip both chassis. Remove all the valves and put them in two plastic bags, the power valves in one and the remainder in the other. Put on one side for disposal at the next junk sale where they will probably fetch as much as you paid for the whole equipment!

Remove the aerial changeover relay from the transmitter chassis. This was manufactured by Magnetic Devices and is quite capable of handling 50W up to 500MHz. Now remove the crystal holders together with the ceramic switch wafer and associated trimming capacitors. Other components from this chassis include the airspaced aerial trimming capacitor, miniature HF chokes, some ceramic and silver mica capacitors and such resistors as can be removed leaving sufficiently long leads. Finally, remove the coils and screening cans and, if thermionic equipment is ever constructed, the valve-holders.

Much the same technique can be employed in stripping the receiver. Particularly useful is a number of ferrite cored ceramic VHF chokes in the heater circuits of the RF stages, the IF transformers on 10.7MHz and 465kHz, which can be used with either valves or FETs, and the 10.7MHz to 465kHz conversion crystal.

The control unit will disgorge a loudspeaker, another yaxley switch and a couple of indicator lamps.

Dispose of the stripped chassis in the dustbin and consider what you have obtained: a 50W aerial changeover relay; a number of trimmer capacitors; a dozen or so crystal holders; a two-pole six-way ceramic wafer switch; RF chokes for HF and VHF; IF transformers; sundry capacitors and resistors; a loudspeaker; another yaxley switch; some indicator lamps and a box full of nuts and bolts, all for a cost of 10p or 20p and half an hour's time. Against this may be set the resale value of the valves at the next junk sale.

Cleaning

There are few things more annoying when starting construction than having to spend time preparing components for use. So, after completing a chassis-stripping operation, it is well worthwhile spending a few minutes cleaning the

recovered items. Straighten the wires on resistors and capacitors; remove strands of wire, surplus solder and dirt or grease. Ceramic components can often benefit from a few minutes' scrub with a stiff brush under the tap.

Hard-wired chassis

This technique of 'component recovery' may be applied to almost any hard-wired chassis, the main consideration for retention being whether the components will be of future use or have resale value.

It is also wise to purchase valve equipment containing mains transformers whenever possible, for even if the construction of thermionic equipment is not contemplated, most of the older types intended for valve equipment have several substantial heater windings which can be used in series for low-voltage power units.

Do not neglect reusable chassis fittings. I well remember purchasing a chassis for 20p at a junk sale, from which I removed a pair of chrome handles. These were not of immediate use, so I cleaned them on a buffing wheel before returning them to the next sale. They were purchased for 50p - by the vendor of the original equipment!

Solid-state equipment

More care has to be taken when selecting solid-state equipment, for PCB construction means that far shorter lead lengths are employed. A transistor will be of little future use if the connections are less than an eighth of an inch long, whilst ICs which are soldered directly on to the board are likely to be damaged when you try to remove them.

Nevertheless, there are many other useful items which may be removed. These include: PCB mounting switches; potentiometers; plugs; sockets; capacitors and, from time to time, filters; oscillator units, etc.

When stripping components from old chassis or PCBs, there is always the danger that they will be damaged in the process, or were unserviceable even before removal. Therefore, it is always a good idea to check any components removed before storing away.

Obviously, any showing signs of overheating should be rejected immediately, likewise any with obvious defects, such as missing connections or cracked seals.

In general, resistors, provided that the leads are of adequate length, will be serviceable. A simple check with a multimeter will confirm this.

Capacitors present a greater problem. You will usually find that low-value ceramic and silver mica capacitors will be perfectly serviceable no matter what

their age. Modern types of mid-range (1-1000nF) will usually be reusable, but the older types using paper or wax insulation are very prone to leakage and are not really worth keeping.

High voltage electrolytic capacitors are suspect, especially those from older equipment. Unfortunately, at the present time these are difficult and expensive to obtain and it would be regrettable if serviceable items were discarded.

One method of testing is to charge the capacitor to its working voltage through a high-value resistor, disconnect and wait to see whether it retains its charge. If it doesn't, reject it immediately, but if after a few minutes a reasonable charge remains, it will probably be serviceable.

It is hardly worth keeping low-voltage electrolytics from thermionic equipment as modern PCBs use smaller and more efficient equivalents in abundance.

Providing that the lead lengths are adequate, transistors can usually be removed from PCBs without damage. A simple check with a multimeter will confirm that the junctions are unharmed.

As long as excessive heat has not been applied to crystal or mechanical filter units, they should be serviceable, and can be placed directly in store.

Constructors anticipating building valve equipment may be suspicious of any valves removed from surplus chassis. This fear is generally unfounded because, although some may be a little

low in emission, the vast majority will prove perfectly satisfactory for most purposes. In the past twenty years, I cannot remember more than one or two valves obtained at club sales which would not operate.

Valuable asset

The novelist, Neville Shute, once defined an engineer as a person who could do for ten bob what anybody could do for a pound. In meeting this criterion, a deep junk box is probably the constructor's most valuable asset. Without it he is reduced to endless searches through catalogues and rally stalls. With it he can concentrate on his main interest – constructing equipment.

The 1988 Annual General Meeting of the RSGB

by Martyn Bolt G4SUI

The 62nd Annual General Meeting of the Radio Society of Great Britain, which took place in December last year, was particularly significant, firstly, because 1988 was the 75th anniversary of the Society and secondly, because it was the first AGM to be held outside London. This will hopefully go some way in dispelling the 'London Wireless Club' tag which has so often been given to the Society.

The venue was the University of Manchester Institute of Science and Technology, which has excellent lecture theatre facilities. Situated in the centre of Manchester, the venue was easy to find; the talk-in by local radio amateurs being appreciated by everybody. There was adequate and, more importantly, free parking. The meeting was well attended with just under 250 people present. My membership renewal was around the time of the AGM and as I was unable to renew it before the meeting, I did not have voting rights, although I could still attend the meeting.

The turnout, whilst a significant increase on recent years was, in my opinion, disappointing. One often hears amateurs voicing their solutions to the problems of the Society and the apparent north/south divide, yet when presented with an opportunity to go on record with their thoughts they are noticeably absent. My advice to these amateurs is to 'put up or shut up'; anybody can knock a body of volunteers such as the council members, but it takes a good man or woman to get out of the armchair and do something about it.

There were several familiar faces at the meeting, and I was glad to see that people who had attended the old venue were also prepared to support the RSGB at its new one.

The seats at the front of the auditorium, which were reserved for council and committee members, had quite a few empty spaces when the meeting started and I feel sure that the official apologies received did not cover all those missing.

As the AGM presents the only real opportunity for RSGB members to have their queries answered by the heads of the relevant committees, it should be attended by all the council and I would like to see more than 1% of the membership turn out.

A welcome change from previous years was the prompt start to the meeting. The minutes of last year's AGM were not challenged this year.

The accounts again showed a deficit and quite a few of the older members expressed their dismay at this. Although the loss was less than last year, it would be nice to see the Society make at least a small profit next year. I was disappointed that several times during the AGM members were put off asking questions by the President repeatedly saying, 'Time is short, we must press on'. It was not until later that I realised that an hour had been taken off the meeting time to allow a small percentage of RSGB members to prepare for the Presidential Installation Dinner which was to take place later in the evening.

The names of those elected to serve on the council during 1989 were announced. I do not propose to reproduce the list here as those who are interested will have been able to read it in the January issue of **RadCom**. I was pleased to hear that all the members who had overseen the last council election had volunteered to do so again. I think these people deserve the thanks of all members for what could be an onerous task.

There was some debate on the reappointment of the auditors. Some members felt that money might be saved by appointing a new firm of accountants, and whilst I suspect that charges may be less away from the City, the time and money spent in acquainting a new firm with the specific needs of the Society might outweigh any savings. In the end it was agreed to reappoint. The 62nd Annual General Meeting of the RSGB was then concluded. In all, I think it had taken just over an hour.

After a break for tea and biscuits, we returned to the lecture theatre for the 'Open Meeting' which began with the presentation of awards for services to the Society, amateur radio, and contributions to **RadCom** during the year. Following this we were treated to a fifteen-minute video of the opening of the 75th National Convention earlier in 1988. In view of the apparent shortage of time, I considered this unnecessary as it had already been covered in detail in **RadCom** earlier in the year.

The President, Sir Richard Davies KCVO G2XM, then delivered the presidential address. This contained some very interesting points, including the announcement of sponsorship towards the preparation and presentation of promotional material, in the region of £150,000.

The open forum is the most interesting part of the annual meeting for me, as this is when amateurs can try to get answers to the questions that have been puzzling them all year. Once again, the 'old faithfuls' were raised: 'Why does my mate get **RadCom** before me?', 'What about the abuse of repeaters?', etc. I sometimes think that it would be beneficial if the RSGB printed a list of the most common questions and answers, to save time.

The next prefix for new car registrations is 'G' and the Society has approached the DVLC at Swansea to see if amateurs can have their callsign as a car registration number. One member present was in total opposition to this 'posing' as he called it. I see it merely as an extension of the recent craze of emblazoning the callsign on badges, hats and jumpers, etc.

The proposed new beginners' licence was also discussed. My feelings on this are that it will inevitably come about, so instead of burying our heads in the excuse, 'I did the RAE and so should everybody else', we should offer constructive ideas on introducing new recruits to the hobby. There are fewer new licensees every year, so if we are not careful the hobby will die of apathy in the not too distant future.

The meeting finished at 6pm with the draw for the 75th Anniversary lottery. The names of the prize-winners are published in the February 1989 issue of **RadCom**.

AMATEUR RADIO BEFORE 1940

by Ian Poole G3YWX

The origins of radio date back to a series of experiments by a German physicist named Heinrich Hertz in 1887 and 1888. Continuing the theoretical work of James Clerk Maxwell, Hertz demonstrated that electromagnetic waves actually existed. In fact, he managed to transmit a signal over a short distance by generating a spark in one circuit which generated a smaller spark in a receiving circuit. Unfortunately, Hertz died in 1894 at the age of thirty-seven. His death was a great loss to science and many people have since wondered what would have happened had he lived longer.

The genius of Marconi

After reading an article about Hertz written by Professor Reghi, the idea of 'wire less' communication caught the imagination of a young Italian named Guglielmo Marconi. Marconi first set about repeating Hertz's experiments and, at first, achieved similar distances of only a few yards. Then he added a coherer; an early device for detecting a radio spark. By trial and error he was soon able to achieve distances of over a mile and a half.

Despite his achievements, Marconi could not sell his ideas in his native Italy and so in 1896 he came to England. Here he met men like Campbell Swinton and Sir William Preece who shared his interest in wireless.

Popularising wireless

Initially the idea of wireless appeared to be little more than a conjuring trick to most people. Marconi played on this fact by regularly giving demonstrations to the public. Before long he succeeded in transmitting over a distance of nearly nine miles. Then, in 1898 he established communication across the English Channel.

In December 1901, after many setbacks, Marconi managed to send the letter 'S' in Morse code from Poldhu in Cornwall to St John's in Newfoundland. This triumph brought the new science of wireless to the attention of newspapers all over the world.

First licences

With the achievements and advances being made in wireless, more and more people were becoming interested in it. At this time there were no restrictions on its use. However, the British Government quickly realised that the use of wireless would have to be regulated, so in 1904 the Wireless Telegraphy Act was passed. This Bill required that each station should be licensed. Even so, the Government stated that it wanted only to regulate without placing any undue restrictions on amateur experiments.

By June 1906 as many as sixty-eight people had licences. Some were famous such as Dr J A Fleming of University College London, a former colleague of Marconi and the inventor of the diode valve.

The first licenses were not issued with callsigns. It was soon decided, however, that some means of identification was necessary. So in 1910 the first callsigns were introduced. These consisted solely of three letters and gave no indication of the country of origin. All new stations were given a callsign when the licence was issued, and existing stations were sent a letter informing them of their callsign, politely telling them how to use it.

Onset of war

With interest in experimental wireless rising rapidly, the onset of World War One brought everything to an abrupt halt. By early 1914 a total of 1,963 licences had been issued. Then on 1 August 1914, a telegram was sent to most stations instructing the owner to remove his aerial and dismantle the apparatus. As time progressed it was announced that all equipment had to be surrendered to the Post Office for the duration of the war. This was adhered to very strictly, as one poor soul discovered to his cost, when he was prosecuted for merely possessing a small transmitter.

There was no amateur activity during the war, but many enthusiasts found that their skills were eagerly sought for the war effort.

The war was also a time when great technological advances were made. Transmitters became more sophisticated and better receivers were needed. The major requirements were for better selectivity and greater sensitivity. In order to solve these problems, countless hours were spent developing new ideas.

On the side of the allies, men like Lucien Levy and Captain H J Round made great developments, which enabled Edwin Armstrong to develop the first superhet receiver. This tremendous breakthrough enabled far greater selectivity and gain to be achieved. This was because valves were prone to oscillate at radio frequencies if the gain was increased beyond comparatively small values. By converting the incoming signal to a fixed lower frequency, both gain and stability could be improved.

Back on the air

After the end of the war, the authorities were slow to allow experimental amateur activity to start again. It was not until the middle of 1920, after a great deal of lobbying by wireless societies, that licences were reissued.

This time the licence conditions were

different. Applicants had to satisfy the authorities on a greater number of requirements. Not only had they to outline a series of experimental tests they wished to conduct, but they also had to prove they were capable of using wireless transmitting equipment, and that they could send and receive Morse at 12wpm.

Callsigns were reissued with a different format which consisted of a number, usually '2', followed by two letters. Some of these callsigns became famous, particularly the one held by the British Broadcasting Company - 2LO.

Despite the restrictions imposed, many people took out these new licences and interest began to grow at an increasing rate.

Challenge of the Atlantic

America had been much less affected by the war than Europe. It had far more radio amateurs, many of whom were interested in making DX contacts. Some notable successes had been achieved as the distances covered gradually increased the number of contacts being made across the American continent.

Very soon people became interested in the possibility of a transatlantic contact. This was not as straightforward as it first appeared, since there was a number of difficulties. For example, American stations were allowed to use up to 1kW of power, whereas British stations were limited to a meagre 10W. Also as British stations were only just getting back on the air, their progress was hindered by their receivers which were less sophisticated than those in the USA.

Feeling that lack of experience and poor equipment were the causes of Great Britain's difficulties, the American Radio Relay League sent over an experienced operator named Paul Godley. He came to Great Britain with an Armstrong superhet to perform a series of tests. Initially, he set up his station in London, but found the level of electronic noise was too high. Accordingly, he moved to Ardrossan, a small town in Scotland. It was here, during 12 December 1921, that he heard 1BCG in Connecticut.

The next hurdle was to achieve a two-way contact. This was more difficult in view of the power available to British stations, and the level of interference from the enormous number of amateurs in the USA.

Nevertheless, a British station, SWS, was copied by eight Americans in December 1922. Yet, surprisingly, this did not produce a two-way contact. This honour went to the French station 8AB, operated by Leon Deloy, in 1923. The first transatlantic contact from the UK was

made between Jack Partridge 2KF in Merton and 1MO in Connecticut.

Once the challenge of the Atlantic had been conquered, this opened the way for contacts over even greater distances. As equipment gradually improved, so did the distances that could be achieved. Then in 1924 the first contact between Great Britain and New Zealand was made.

Prefixes

As contacts between different countries and continents became commonplace, it became obvious that it was necessary to devise an easy way of identifying a station's country of origin. At this time it was possible for a station in one country to contact a station abroad, using exactly the same callsign.

The problem was not as easy to solve as it might have been today, since there were no international regulatory bodies. As a result, various countries suggested and implemented different solutions. Accordingly, confusion reigned because there were at least two systems in operation.

The ARRL wanted to use a system where the 'de' or 'from' sent between the callsigns was replaced by a letter indicating the country each station transmitted from. For example, one might have heard 2AA GU 1AA, the 'G' indicating 2AA was in Great Britain, and the 'U' indicating that 1AA was in the USA.

An alternative system, similar to the

one used today, was devised and adopted in Europe. A callsign had a prefix of one or two letters, indicating the station's country of origin. In fact, many of the original prefixes have remained: G for Great Britain, F for France, EA for Spain, etc. Other prefixes have changed, such as KB for Germany, OU for Denmark and SA for Sweden.

Licence conditions

The licences that were issued around this time bore little resemblance to those we know today. Originally there were no internationally agreed amateur bands. Sometimes people had to obtain permission to operate on a certain 'wavelength', but occasionally they used it without prior consent.

As occupancy of the short wave bands rose and pressure on space started to become a problem, it was necessary to set aside certain bands purely for amateur use. This happened in 1927 when an international conference agreed on a set of bands to be used by radio amateurs and experimenters.

Experimenters in Great Britain found that their licences gave them access to most of the bands, but they were full of restrictions that were not placed on foreign amateurs. Being experimenters and not amateurs as such, they were not allowed to call CQ. Instead, they had to put out a 'test' call. Originally they could not operate within 25kHz of any band-edge, and aerials could be no more than 100ft in length. The most amusing

restriction was that 80m could not be used on weekdays between May and September before 1935!

The issuing of licences was somewhat haphazard by today's standards. Having satisfied the tests, the next step was to convince the Post Office that it was necessary to possess a transmitting licence to carry out a series of experiments. At the first attempt it was normal for an artificial aerial licence to be issued. This allowed transmitters to be built and tested, but only into a dummy load. These artificial aerial licences had a callsign consisting of the number 2 followed by three letters.

To obtain a full licence it was usual for at least two attempts to be made. Once a full licence was issued, a callsign consisted of the prefix 'G' followed by a number then two letters. Initially, the number was 2, but later some with a 5 were issued and then with the figures 3, 4, 6 and 8.

Another war

Amateur radio continued to develop until the start of World War Two. On 31 August 1939 it was announced that amateur activity was to cease and equipment was to be impounded.

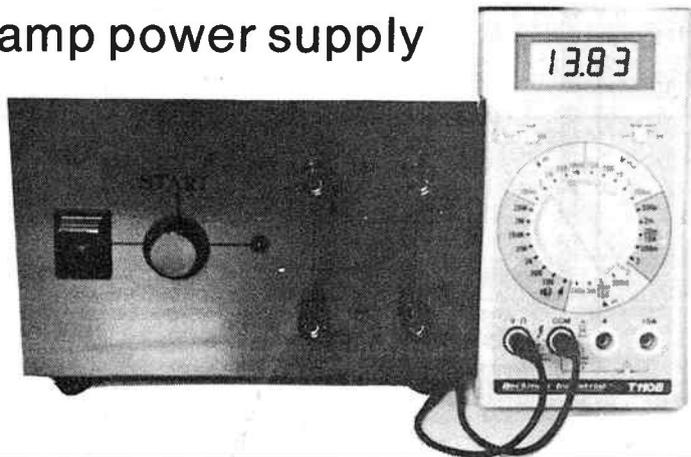
By 1939 amateur radio had progressed from spark transmission covering only a few feet, to AM and CW contacts worldwide. During those early years radio amateurs contributed a wealth of experience to lay the foundations of the technology we know today.

NEXT MONTH

Amateur RADIO

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■ Steven and John Goodier review the Beckman Industrial T110B 13.8V 20amp power supply



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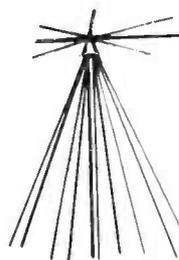
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PROJECT

BOOK

by Martin Williams

It is common knowledge that whenever there is a group of VHF operators, the conversation will invariably include the subject of aerials. A major problem with these discussions is that they are often based on misconception and half-truths, coupled with an unswerving trust in the accuracy of an SWR meter. Another problem is the near impossibility of making accurate measurements under amateur conditions. If things are difficult when you have a professional aerial test range, what chance do we have?

Claimed gain

Aerial makers claim various gain figures for their arrays. These figures are difficult to dispute because they often do not take account of the conditions under which the measurements were taken. I am not saying that we are being deliberately misinformed, but the figures are usually calculated at the most favourable frequency while using a particular mounting and feed arrangement.

Your choice

It is important to bear in mind that gain is not the only criterion when buying an aerial. You must also decide on things like the front-to-back ratio and the frequency bandwidth needed. For example, a beam which is ideal for 70cm DX would have a narrow frequency response of around 432.5MHz and a tight beamwidth. This would be useless when working amateur TV because you need at least 6MHz bandwidth at the top end of the band, say around 437MHz.

No gain

An aerial does not produce actual gain in the sense that it increases the transmitted power. The apparent gain is due to the aerial sending all of the power in one direction, unlike the average vertical which spreads it around. A convenient way to measure the gain of an aerial is to compare it with a 'standard' array, such as the long-established dipole aerial.

Isotropic radiator

The dipole aerial has a gain of around 2.14dB when compared to the classic, but non-existent, isotropic radiator. This is a device which would evenly illuminate the inside of a sphere with equal radiation at all points. The purpose of

referring to the isotropic is that the gain figures for the aerial rise dramatically. For instance, an aerial giving 4dB referenced to a dipole can be quoted at 6.14dB compared to an isotropic radiator. This sounds like a better buy, since it appears to the unwary to have 50% more gain!

How much?

There has been a lot of research on the maximum amount of gain which can be obtained from a given number of elements in a Yagi-type array. The NBS figures are best known, but important work has also been done by Krautz and Greenbaum, among others. These figures assume that the aerial has no sidelobes or resistive losses, therefore, the amount of gain appears to be higher than can be obtained in practice. The figures are calculated by measuring the 3dB points in the vertical and horizontal directions. These figures are then used

to derive the data which is shown in Table 1.

How many?

It is commonly believed that the gain can be increased by piling more elements on to the boom. In fact, provided that the element lengths have been optimised, as they should have been, the gain of an array depends more on the length of the boom rather than on the number of elements. Adding extra elements might increase the bandwidth but it will do little else. The maximum gain is achieved from a given boom length by using the number of elements shown in Table 2. These are the sort of figures you can expect from using normal home construction techniques, provided the elements' lengths and spacings are optimised. The figures in Table 2 apply to any band, since the boom measurements refer to the wavelength and are not absolute measurements.

GAIN VERSES NUMBER OF ELEMENTS

Elements	NBS(dBi)	Krautz(dBi)
3	9.25	10.95
5	11.3	12.15
6	12.35	13.20
12	14.40	15.13
15	15.55	16.55
17	16.35	16.90

Table 1

Table 2

GAIN VERSES BOOM LENGTH

Boom length (wavelength)	Number of elements	Gain(dBi)
0.2	2	5.0
0.3	3	7.5
0.6	4	8.5
0.8	5	9.5
1.1	6	10.5
1.5	7	11.0
1.75	8	12.0
2.1	9	12.5
2.5	10	13.0
3.20	12	14.5
4.00	14	15.5
4.80	16	16.5

50MHz

by Ken Ellis G5KW

Major DX openings

I would like to begin this month's column with a comment from one of my regular contributors, 'A fantastic month, my best since I started on 6m many years ago!'

The active part of the twenty-seven-day Carrington cycle continued to produce high solar flux numbers and excellent propagation conditions during February. The January peak of 291 on the 13th was followed on 12 February by a peak of 279 with DX openings to the central Americas and at the end of the month to Hong Kong, Japan and Africa, but as is usual during February, there were few openings to North America. This was probably due to polar absorption via the 'stratwarm exists alerts' sent out by WWV and other agencies.

Enhanced F2 propagation was in evidence on the north/south and other routes. There were also indications of African TEP to the Mediterranean and Europe; an early start to the spring equinox season. I have been asked to explain what the stratwarm exists alerts mean. Rick K1JRW gave me the following resumé on stratwarm exists and polar absorption. I hope that it will make the subject clearer.

'... Winter-time absorption results in weak signals lasting a few days. The cause is not simple, but basically it involves the arrival of particles into the polar regions during geomagnetic disturbances. These particles trigger a series of events, including the ionisation of nitric oxide and oxygen in the auroral zones 60 to 70° latitude, north and south. This causes absorption and electron depletion in these regions for about three days.

'Some two to four days later, the heat which builds up from this reaction causes winds in the stratosphere to blow the neutral nitrous oxide and heat to the west in the northern hemisphere and towards lower latitudes. This results in large absorption areas, 1,000 to 2,000km in diameter, spreading south and west from the polar regions and affecting mid-latitude east/west DX paths for the following five to six days. The absorption develops in two opposite areas of the globe. The regions in-between often experience lower than normal signal absorption. Consequently, the earth is divided into four alternating bands of above average and below average signal absorption. This pattern moves about 30° each day; the equivalent of two, one hour time zones'.

New countries worked by UK

Several UK operators now have over forty countries to their credit. TR8CA from Gabon, West Africa, running only 5W to a five element beam, is a much sought after DX signal, but there have been problems caused by a few irresponsible UK operators sending long replies and calling CQ on his frequency, despite his frequent protests. On one occasion he had three QSOs while a caller was sending his own callsign; obviously he was not conversant with DX procedure!

I do not like criticising Class B operators, but there are those who still have a lot to learn. Regrettably, some of the more experienced operators were not above criticism either. It is a pity that 50MHz users do not make more use of split frequency operation which is so successfully employed on the HF bands.

All-time first G/VS6

Another welcome station was VS6UP, Hong Kong, worked for an all-time first by Ted Collins G4UPS at 0900hrs on 25 February, and later by G3JVL, G4JCC, G3COJ and G3SED. During the same day, several Japanese stations broke through on 50.110 causing QRM to each other. I first heard JH41IUC shortly before 0900hrs but despite calling the station, I received no reply. Several others came through by 0911hrs, but only JA4MBM, a club station using high power and a multi-element beam antenna, and J54IFU were positively identified due to QRM. Operators in other parts of the country heard other Js, but there were no QSOs reported. Apparently, a few got through on the 26th as the Js spread out above the DX frequency. Many UK operators had QSOs with African stations and many new squares were contacted. PA3CCI contacted Hong Kong stations during the weekend.

VK6s heard in Europe

Eric F9LT, who unfortunately has not yet received his 6m permit, heard two VK6s and other DX but he was unable to reply. As I mentioned last month, WAC is just around the corner, so by the time you read this it may already have taken place.

SMIRK

The Six Metre International Radio 'Klub' was formed on 13 October 1973 by Ray Clark K5ZMS, Secretary/Treasurer; Tex Kennedy N5TX, President; Gene Barnes; Pat Dyer WA5IYX and others, to increase interest and activity on the 6m

band throughout the world.

At present, there are over 5,400 members in all fifty American states and eighty-eight other countries. Members include some of the most well-known HF, VHF and UHF operators in the world. Many members are also known for their links with various national and international organisations.

The accomplishments of the organisation include: special awards for working different countries; a 6m contest, held in June each year; a newsletter called 'The Six Shooter'; a QSL information list to help operators obtain QSL cards, and services providing information on technical issues and propagation.

Perhaps the most important contribution to the band by SMIRK's members is to obtain and then loan equipment to operators who want to work 6m. Members, such as G4UPS and G4JCC in Europe, have helped to provide equipment, and ZS6WB and others in Africa have been active in getting more African countries on 6m.

Application forms can be obtained from Ted Collins QTHR, on receipt of an SAE. The annual membership fee is US\$6.00.

UK Six Metre Group

The Six Metre Group was formed in 1982 by Steve G4JCC and Ken G5KW for amateurs who share a common interest in the 50-54MHz band. The aims of the group are: to encourage interest, provide assistance, and offer advice to other countries trying to obtain a 50MHz allocation for their amateurs; to maintain a fund to support 6m beacons, and to publish a newsletter which is sent to all members and 50MHz orientated amateurs overseas.

Membership is open to all UK and overseas amateurs at an annual cost of £5.00. The 1989 AGM will be held at the RSGB VHF Convention, Sandown Park, on 16 April. If you are interested in becoming a member contact Alan Wright GW3LDH or Peter Turner G4IIL QTHR.

ZS news by Hal Lund ZS6WB

'Propagation on 6m continued to be poor in ZS during January with only occasional openings, most falling on weekdays with low or nil activity levels. The higher flux numbers had little effect on TEP and F2 propagation. On the 23rd, there was a brief opening from ZS6 to SV1 which was followed by an excellent TEP opening to the Mediterranean on 25 January, extending south to ZS4/5.

'Conditions improved on 4 February when a brief opening occurred to Cape Town with ZR1DS and ZR1MI/M; the first stations worked from Pretoria via the 50.200 repeater. SSB openings to Cape Town are frequently missed because of low ZS1 activity.

'ZS1IS will be on 6m from the South African coastal town of Walvis Bay, which is fifty miles from Windhoek and completely surrounded by Namibia. W3AZD of the ARRL DX department, advises that QSOs with Walvis Bay will not count for either South Africa or Namibia until Namibia gains independence from South Africa when it will count as a new country. Meanwhile, for ARRL and other awards, it is only a new grid square (JG77).

'A new African country on 6m is TU2MA who appeared for the first time on 11 February. TR8CA (who hopes to be joined soon by TR8BL) is also new on 6m running 5W to a five-element yagi.

'Watch 50.115 and 28.885 for 8Q7/JF1UMK and JF2MBF. JG2BR1 and JS2BLS DXpeditions are expected to visit Kruger National Park this year - Punda Maria in KG57; Letaba, KG56 and Satara, KG55.

'Other rare squares to watch for include ZS1IS-JG77, ZR1L-JG77, ZS3AT-JG86, ZR6KE-KF18, ZS2NR-KF37, ZS4NS-KG32 and ZR6CBK-KG53'.

From the mailbag

Geoff Brown GJ4ICD, from St Helier, Jersey, writes, 'UK stamps are not valid in Jersey'. Many UK stations are still sending them for the return of QSL cards. Since 1 June 1987 Geoff has worked 173 squares and forty-two countries two-way on 50MHz; the highest reported to date. Highlights for 1989 include two-way QSOs with: TI2HL, 23/1/89; ZD8MB, 1/2/89; T77C, 11/2/89; 9Y4VU, 14/2/89, and TU2MA, 16/2/89.

Geoff continues, 'On 24 January I switched off our beacon at 0215hrs and tuned over the band to find a QSO occurring on 50.115 between two or three JAs lasting for about eight minutes. Two of the stations were certainly JAs but the other station had, I think, an "8" in the callsign (signals were weak). St Helier does not have a 50MHz beam so I was unable to tell which path the signals were coming from'.

On 21 February Geoff had another all-time first working TR8CA Gabon, at 1311hrs, making six new firsts for GJ during February. Congratulations Geoff, on an outstanding performance.

Ray Cracknell G2AHU sent in this report.

'Costas SV1DH/SZ2DH, Athens, asks if his 30,650km QSO with JG2BR1 on 9 October 1988 at 2310hrs constitutes a new record on 6m? It has been the practice to put the limit as the antipodes (20,004km, or slightly more on some routes) since night-time paths, following the equatorial highs, sometimes occur at 50MHz. Costas is well-known for his in-depth knowledge of TEP and its successful operation over many years. He experienced early TEP openings during January to ZS3, 4, 5, 6, and by other modes worked FY7, F, T7, J5, CT and VE1. Costas reports that evening TEP is more reliable than afternoon TEP.

'JA1VCK Hatauo, Japan, reports that at the time of writing the first F2 openings of the year to KL7 and W6 had occurred (JA-W contacts are rare during January).

'VK3OT reports hearing the 9H1SIX beacon and OH signals around 1300hrs beaming long path. 9M2AQ is officially operational from the end of February, and A35EM will be activated by JA1OEM from mid-March. ZK3YY by 5W1GP is expected on 6m from mid-April.

'Despite all the American 50MHz beacons listed, none have been reported as heard in the UK or elsewhere. The reason is probably that most beacons do not have the ERP necessary to work long-distance DX. Nevertheless, a dedicated beacon such as GB3SIX which is beamed to the USA has been successful, and QRP beacons on omni-directional aerials are successfully used for Sporadic E and TEP between optimum zones'.

Ted Collins G4UPS, Devon, recently sent this report.

'FY5DG, French Guiana, is now active on 6m using a dipole and 3W, and will soon have a beam and more power. QSL via Box 450 Kourou, French Guiana.

'The Gonsett Sidewinder 6m rig which I sent to St Helena while I was at ZD8 has now been located and handed over to Julian ZD7CW. Unfortunately, it required a step-down transformer on arrival. However, SMIRK has decided to send an FT-620B and a three-element antenna to St Helena for Julian to use.

'From the Canary Islands, I overheard a W station report that DJ3OS/EA8 had his EA8 licence withdrawn for transmitting on 6m.

'The club station, T70A, San Marino, has been awarded a three-year 6m permit. Tony T77C and Julian T77J worked 6m on 6 January and had a QSO with Steve G4JCC at 1533hrs.

'Costas SV1DH, Greece, states that all QSOs with SV1DO and SV0FE between 19 April 1988 and 15 July are valid.

'The USA base station HZ1AB has been granted permission to operate on 6m and should be on the air soon, if not already.

'A five-element tonna antenna has arrived in the Falkland Islands, so Fred VP8PTG should now be operational.

'LA6XL will be going on his annual DXpedition to Iceland from 20 July to 7 August using an FT-726 and a five-element antenna.

'In Venezuela, Gerry DL3ZM/YV5 was very active on 6m during the last solar cycle but he is now back in YV5. His keyer on 50.044.5 has been heard by several Gs on 10 January but no QSOs were reported'.

Mike G3SED, Portsmouth, writes: 'This February, with its rising solar flux, has seen the early start of the TEP season on 6m. From the middle of the month we have had almost daily openings to central Africa, with South Africa coming in again from the 20th. At last, the band opened to the Far East from the 25th. 6m is beginning to sound like 10m!

'Stations worked: 11 January, 4X1IF, X-band; 19 January at 1319hrs, HC5K; 28 January, 1119hrs, T77C (they are only on at weekends - I was pleased to work San Marino for a new one and after thirty minutes of trying we caught a meteor burst and exchanged 509 reports); 1 February, 1700hrs, ZD8MB (after many months of hearing the beacon we exchanged 5-9 reports). From 1655 to 1730hrs I heard the J52 keyer peaking at S9. 25 February, 0910hrs VS6UP; 26 February, at 0950 I heard JA4MBM calling CQ. At 1010hrs, JA4MBM was my first JA QSO on 6m peaking at S9. Also at 1010hrs I heard the following: JA6TEW, JE3GUG, JI3OPA, JA6TEW, JA6IML. At 1120hrs, TR8CA - my thirty-eighth country on 6m. At 1145hrs I worked: ZS6WB, ZS4WS, ZS6BMS, ZS6SS and ZS6KE'.

That ends an exciting and historic month on 6m with the prospect of even better things to come as we near the peak of cycle 22. Until next time, good DX on 6m.

Please continue to send in your reports and comments to Ken Ellis G5KW, 19 Joyes Road, Folkestone, Kent CT19 6NX.

BITS TO BUILD

RF SIDETONE: AN UPDATE AND IMPROVEMENT

In the December 1988 issue of *Amateur Radio*, I described some simple sidetone circuits for monitoring the keying of a CW transmitter. The last of these circuits was an RF activated sidetone, produced in kit form by Kanga Products. Useful little thing; it simply sits on the shelf and emits a 'bleep' every time the

transmitter is keyed, and without any form of connection to the transmitter.

The PCB had a built-in audio amplifier to drive a loudspeaker, and the device chosen was the ULN2283. Sad to say, the supplies of this device appear to have dried up, consequently, this has forced Kanga Products to look for a replace-

ment. They have chosen the LM386.

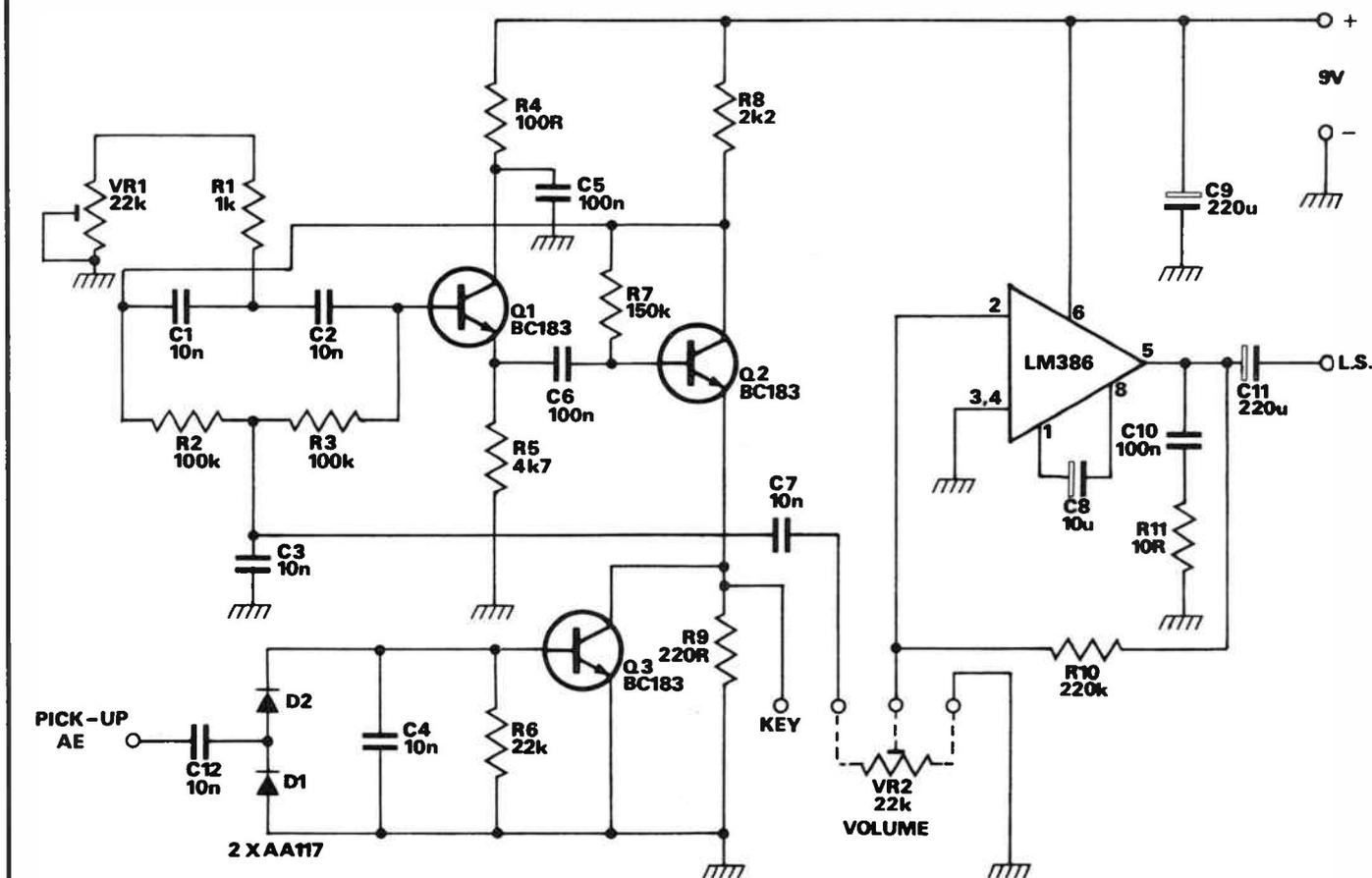
The audio amplifier

The need to redesign the board to accommodate the new device, set their minds to developing further improvements to its performance and versatility. As a result, they have improved the

TABLE OF VALUES

VR1	22k preset	C1, 2	
VR2	22k log pot	C3, 4, 7	
R1	1k	C12	10nF
R2, 3	100k	C5, 6	
R4	100R	C10	0.1 μ F
R5	4k7	C8	10 μ F 16V
R6	22k	C9, 11	220 μ F 16V
R7	150k	TR1, 2, 3	BC183
R8	2k2	IC1	LM386
R9	220R	D1, 2	AA119
R10	220k		
R11	10R		

Fig 1



BITS TO BUILD

quality of the oscillator and also enabled the board to function as an RF activated sidetone, Morse practice oscillator, AF signal generator and bench amplifier. Not a bad set of improvements, so let us look at the new circuit.

Fig 1 shows the circuit diagram. (A comparison with **Fig 4** in the December 1988 article shows that the oscillator circuit has been completely changed. The original used a multivibrator-type circuit, which, although effective, hardly produces the sweetest of sounds). The new circuit has a 'twin T' oscillator with the advantage of a near sine-wave. This gives a far more pleasant tone. The circuit also allows for a small degree of frequency adjustment.

The sidetone

The tone is variable from about 500Hz to 1500Hz. Most sidetones are set too high in frequency for listening comfort. The human ear is much happier listening at the 500Hz end of this range, rather than the usual 800 to 1000Hz in sidetone circuits. Being able to vary the pitch of the sidetone in use is not a bad idea either. It is also a good idea to make VR1 a front panel control, and to vary the pitch from time-to-time during long operating sessions.

This was routine in the days when separate transmitter and receiver stations monitored the transmitted signal on the receiver during transmission.

To use the unit as a stand-alone RF activated sidetone, a small pick-up wire is connected via C12 to diodes D1 and D2. The resultant dc potential turns on the

transistor TR3. This shorts out the 22k resistor R9, allowing the tone to be generated. A key can also be inserted at this point so that the unit can be used as a Morse practice oscillator.

The PCB layout

The audio signal is controlled by a front panel volume control (22k potentiometer), which will accept an input point so that the unit can be used as a test-bench audio amplifier. The LM386 will drive an 8Ω loudspeaker, and has a supply-voltage of 10V. The board is powered by a 9V battery. If a station power supply unit is used, it may be necessary to add a small 3 pin regulator such as the 78L8, since most station supplies are 12V.

Fig 2 shows the PCB layout as supplied by Kanga Products. **Fig 3** shows the interconnections between the PCB and the panel-mounted controls and terminations, as well as all of the possible applications for the board. On this diagram, an output socket for the tone and a tone amplitude control are shown, should the unit be required as an audio source.

The new circuit adds up to a versatile piece of equipment for the amateur radio shack. It is simple to build and works well.

The CW practice oscillator and RF sidetone kit is available from: Kanga Products, 3 Limes Road, Folkestone, Kent CT19 4AU. Tel: (0303) 76171. It is priced at £10.95.

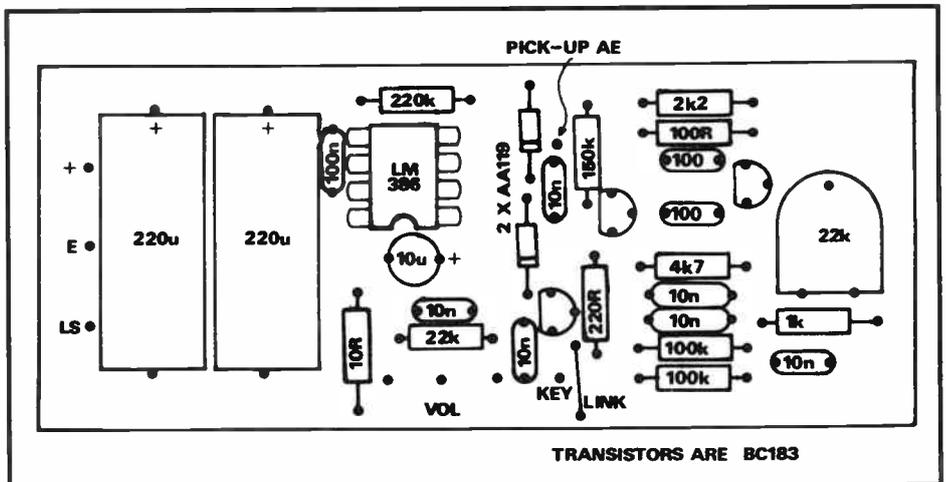
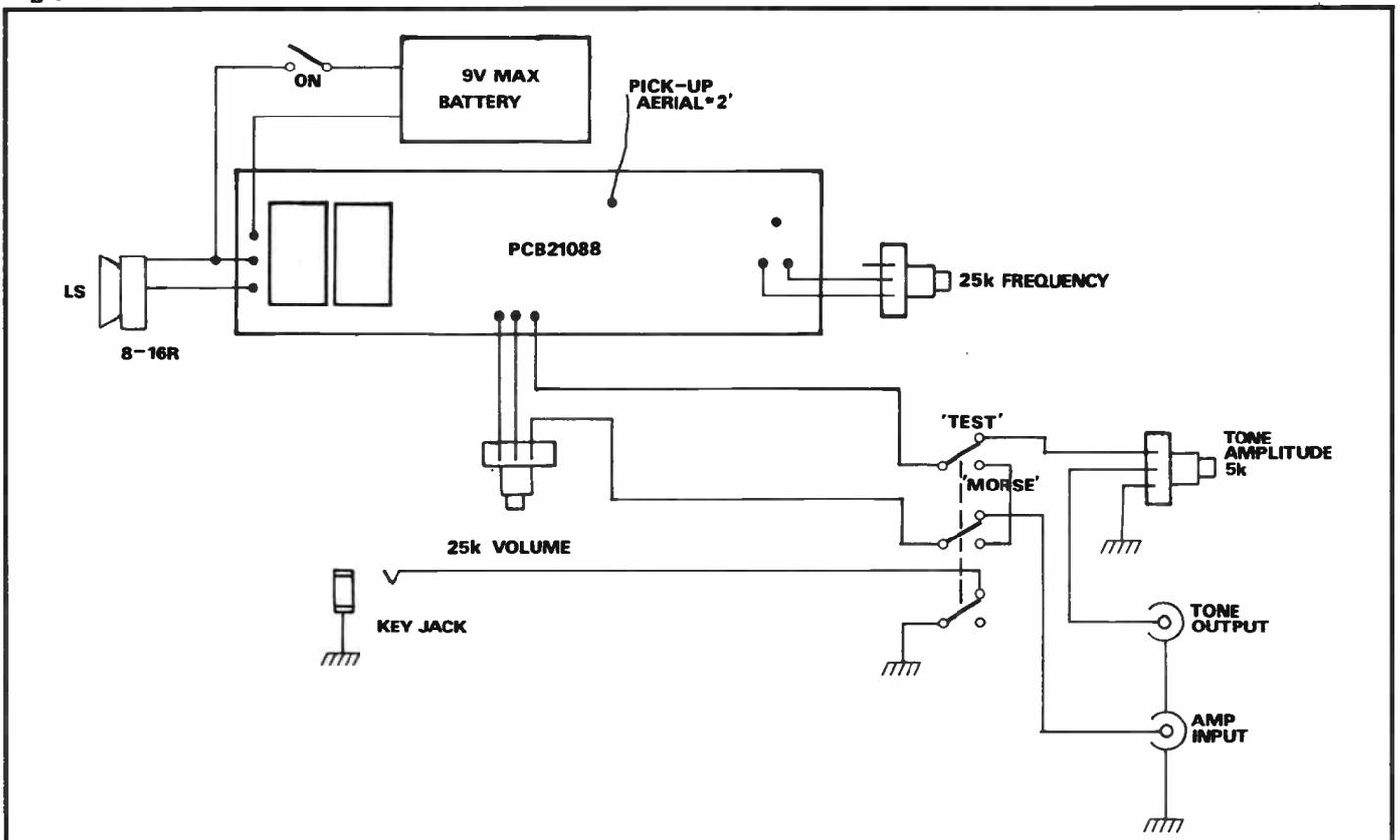


Fig 2

Fig 3



MODERN COMMUNICATIONS SATELLITES

by Angus Fairfax-Lucy

Satellites are now a part of our lives whether we realise it or not. A new era in commercial television is dawning because of them. So, what are they really?

These lumps of metal hurtling around the earth are roughly divided into two categories: radio/telecommunications and television satellites. The principles governing the use of satellites are not as complex as you might think.

Gravity

The first thing to consider is gravity. Imagine that someone has the misfortune to drive a car off the edge of a cliff. Obviously, it would not drop straight down but would travel forwards and downwards at the same time. The faster the car was travelling when it left the edge, the further it would travel before

landing. If you ignore the effects of air resistance for a moment, and imagine that the 'car' was travelling at 17,000mph, it would orbit the earth once before landing.

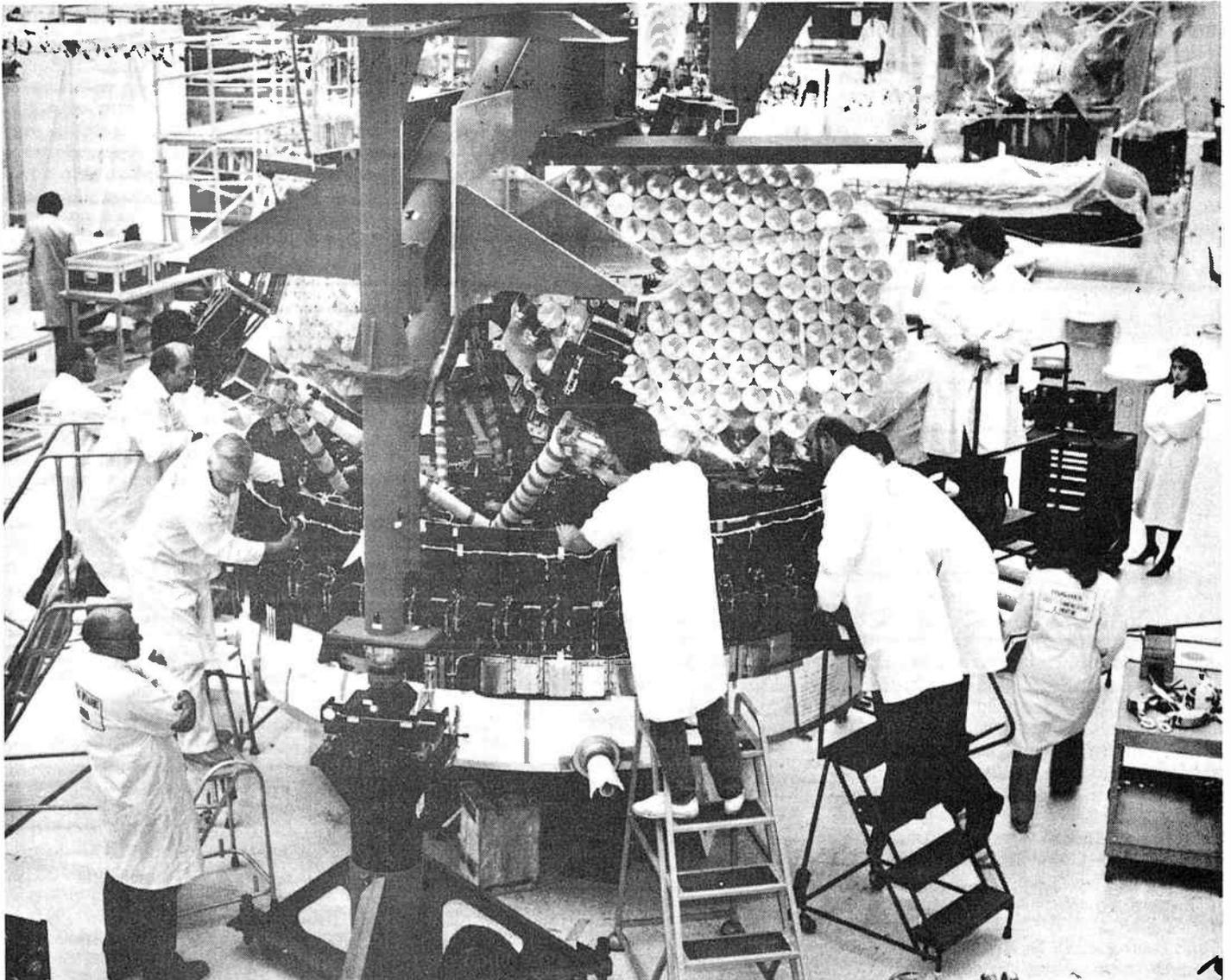
In reality, as the speed of sound (around 762mph) is approached, the air molecules pack together to form dense airwaves and, as the atmospheric pressure momentarily drops sharply, a sonic boom occurs, indicating that the 'sound barrier' has been broken. Friction is a problem, and that is why the US space shuttle is covered with special tiles to prevent the spacecraft from burning upon re-entry into the atmosphere.

Low orbit

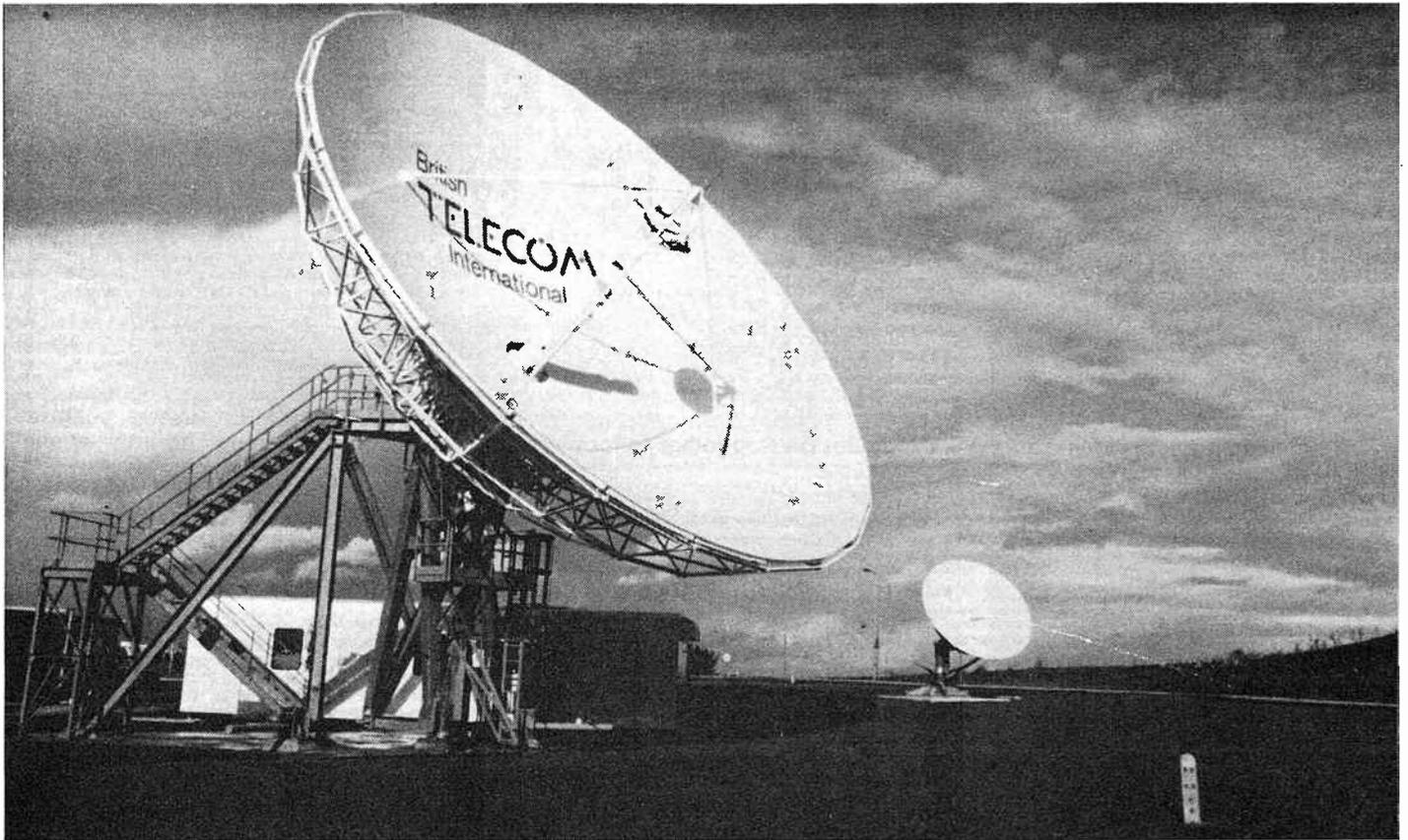
Satellites are normally first encountered between 150 and 400 miles high. At this 'low' orbit, air resistance is not a

problem – but gravity still is. All types of satellites at this altitude are only accessible during certain hours of the day and have to be tracked, ie, followed across the sky. This is not only highly inconvenient, but uneconomical for commercial satellite users, such as television companies and international telecommunications companies. The satellites they use are particularly expensive to operate, therefore it makes good sense to use them all the time, without having to continually keep track of them across the sky. These satellites are in what is called a geosynchronous orbit. This is a special 'high' orbit of about 22,000 miles high.

When a satellite is in orbit, there are two main things that affect its performance. The first is gravity and the second is centrifugal force. The latter tries to



Intelsat 6: the world's largest commercial communications satellite



The BTI Skyphone aerial provides in-flight communications for transatlantic air travellers

make something travel in a straight line; thus, although gravity is 'pulling' the satellite towards the earth, centrifugal force is trying to keep it in a straight line away from the earth. The balance between these two opposing forces is achieved by the speed of the satellite - too fast, and it would disappear in a straight line - too slow, and gravity becomes the dominant force, pulling the machine to its inevitable destruction upon entering the atmosphere. Obviously, the higher the orbit, the higher the speed needs to be.

Geosynchronous orbit

To obviate these problems, a satellite must also adopt a geosynchronous orbit. This allows the satellite to circle the earth in time with the earth's own rotation, thereby allowing the satellite to remain at the same (geostationary) point above the earth's surface.

There are currently two main delivery systems whereby a satellite can be placed into a high orbit. These are Ariane, the French and European rocket venture, and NASA, using the American space shuttle. These two systems use different methods of placing satellites into a high orbit.

The speed of the satellite, once in a low circular orbit, is increased from 17,000mph to 22,800mph. Then the satellite slows down and its orbit becomes elliptical (the furthest point reached from the earth is about 22,000 miles). Since the speed of a satellite in an elliptical orbit is initially only 3,000mph, then gravity, weak though it is at such a distance from earth, starts dragging it back. The speed of the satellite at its furthest point from earth is increased via

onboard motors to about 7,000mph, thus putting it into a high circular orbit. Both Ariane and the space shuttle release their satellites at low orbit.

Since the final path of all satellites follows the equator, American satellites have to use more fuel because their launching position is further from the equator than the European's launching site at Kourou, French Guiana. Unfortunately, once a satellite is in position, there are many adverse gravitational forces trying to change it.

Let us examine how satellites operate. A typical modern communications satellite contains many transponders, each

receiving a specific signal from earth, and broadcasting it back; just like a collection of repeaters in the sky, except that these transponders operate in the microwave bands, not V/UHF. The received signal is rebroadcast to earth on an RF power output of between 10 and 400W. Obviously, the stronger the signal from the satellite, the smaller its receiving dish needs to be on earth. Unfortunately, the power output of a satellite is limited by its capacity to dissipate the heat generated by the microwave transmitter. Microwaves are used, among other reasons, because of the relative size of the antenna required for the satellite. The frequencies normally used for satellite communications are between 800MHz and 30GHz.

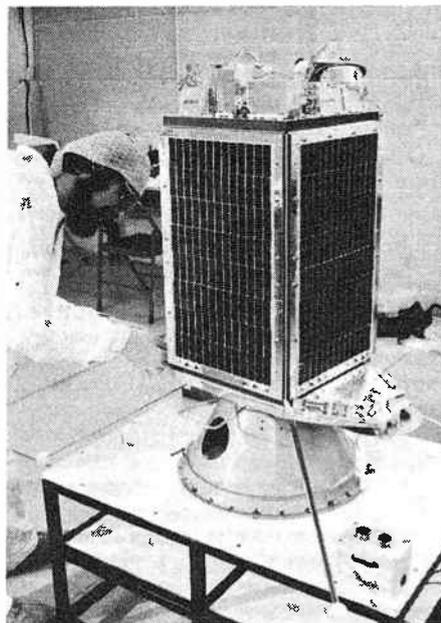
Satellites have a lifetime of many years, although this ultimately depends on how much fuel is carried on board.

Satellites in lower orbits do not last very long due to the stronger gravitational forces present at lower altitudes, which eventually pull the satellite back into the atmosphere and to its destruction.

Radio amateurs

Satellites used by radio amateurs are in low orbit and are becoming ever more sophisticated in terms of the increased use of packet and data traffic, as well as phone and CW traffic.

Since satellite TV in the home has become more commonplace and cheaper to use, increasing our knowledge of these new developments can only contribute towards the use of amateur radio and its participation in today's world of modern technological science.



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■ Dressler AR30 active antenna, £60.00. ERA, SSB audio filter, £60.00. Racal RA17L, fitted with rare seven-digit LED MHz and kHz digital read-out, £500.00. Tel: (0306) 712878

■ Packet radio TNC, radio port, supports VHF or HF packet operation, 300/1200 baud, 12V supply, fitted with personal mailbox system, boxed, £85.00. Tel: (0283) 37237

■ Heathkit SW717 general-coverage receiver, 0.55kHz to 30MHz, good condition, will swap for a Daiwa Search 9 VHF Rx or similar, must be in good condition, or sell for £40.00. Prefer buyer inspects/collects or pays postage, possibly swap for Colt 444 or computer for RTTY/CW. No ZX80/81's. Tel: (0302) 866256

■ Yaesu FRG7700 Rx, vgc, preamp, ATU with mods, all three major call books: world, USA and UK, £200.00 ono. Tel: (0634) 404096 buyer collects

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■ Sony PRO 80, as new, boxed, £250.00 ono. Tel: 01-228 4835

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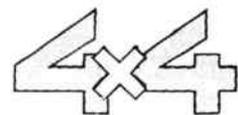
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<p>PAYMENT Above rates exclude VAT. All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by the publication date. Overseas payments by International Money Order or credit card.</p> <p>FOR FURTHER INFORMATION CONTACT Amateur Radio, Sovereign House, Brentwood, Essex CM14 4SE. (0271) 219876</p>	<p>Commission to approved advertising agencies is 10%.</p> <p>CONDITIONS 10% discount if advertising in both Amateur Radio and Radio & Electronics World. A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.</p>
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No. 1 LIST BAKERS DOZEN PACKS

All packs are £1 each, if you order 12 than you are entitled to another free. Please state which one you want. Note the figure on the extreme left of the pack ref number and the next figure is the quantity of items in the pack, finally a short description.

- BD02 5 13A spurs provide a fused outlet to a ring main where devices such as a clock must not be switched off.
- BD07 4 1a flex switches with neon on/off lights, saves leaving things switched on.
- BD09 2 BV 1A mains transformers upright mounting with fused clamp.
- BD11 1 8Wn speaker cabinet ideal for extensions, takes our speaker. Ref BD137.
- BD13 12 30 watt reed switches, it's surprising what you can make with these—burglar alarm, secret switches, relay, etc., etc.
- BD22 2 25 watt loudspeaker two unit crossovers.
- BD29 1 B.G.A.C. stereo unit is wonderful value.
- BD38 2 Nice constant current chargers adept to charge almost any nice battery.
- BD32 2 Humidity switches, as the air becomes damper the membrane stretches and operates a microswitch.
- BD42 5 13A rocker switch three tags so on/off, or change over with centre off.
- BD45 1 24hr time switch, an Electricity Board, automatically adjust for lengthening and shortening day, original cost £40 each.
- BD48 10 Neon valves, with series resistor, these make good night lights.
- BD56 1 Mini unselector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole.
- BD58 2 Flat solenoids—you could make your multi-tester read AC amps with this.
- BD57 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 motor with gearbox. Final speed 16 rpm, 2 watt rated.
- BD103A 1 BV 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 coat.
- 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.
- BD138 8 Microphone inserts—magnetic 400 ohm also act as speakers.
- BD148 4 Reed relay kits, you get 18 reed switches and 4 coil sets with notes on making c/o relays and other gadgets.
- BD148 8 Safety cover for 13A sockets—prevent those inquisitive little fingers getting nasty shocks.
- BD180 8 Neon indicators in panel mounting holders with lens.
- BD193 5 5 amp 3 pin flush mounting sockets make a low cost disco panel.
- BD196 1 in flex solderstat—keeps your soldering iron etc. always at the ready.
- BD198 1 Mains solenoid, very powerful, has tie 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 8in x 4in speakers, 4 ohm made from Radiomobile so very good quality.
- BD252 1 Pancostat, controls output of boiling ring from simmer up boil.
- BD254 50 Leads with push-on 4in tags—must for hook-up—means connections etc.
- BD263 2 Oblong push switches for bell or chimes, these can make up to 5 amps so could be foot switch if fitted into mattress.
- 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
- BD306 1 Tubular dynamic mic with optional table rest.

VERY POWERFUL 12 VOLT MOTORS—Yard HORSEPOWER. Made to drive the Sinclair C5 electric car but adaptable to power a go-kart, a mower, a rail car, model railway, etc. Brand new. Price £15.00 plus £2.00 postage. Our ref 15PB.

WHITE CEILING SWITCH 5 amp 2 way surface mounting with cord and tassle. Made by the famous Crabtree Company. Price £1 each. Our ref BD32A.

13A SWITCH SOCKETS Top quality made by Crabtree, fitted in metal box with outside so ideal for garage, workshop, cellar, etc. Price £2 each. Our ref 2P27.

POWERFUL IONISER

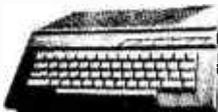
Generates approx. 10 times more IONS than the ET1 and similar circuits. Will refresh your home, office, workroom etc. Makes you feel better and work harder—a complete mains operated kit, cases included. £12.50+£2 P&P. Our ref 12P51.

ULTRA SONIC INTRUDER ALARM. Small, nicely cased, will detect movement in a room up to 10m x 10m. Ingenious construction makes it independent of the mains; cannot be switched off, even with its on-off switch, until you know the secret, has delayed action enabling you to switch it on and leave the room; it has an inbuilt piezo sander which is very penetrating and high pitched and would frighten away most intruders. Has internal switching and could be coupled to an outdoor alarm if required.

It is the basis of a very efficient burglar alarm, or has other uses. For instance: you could disconnect the internal sander and using the internal switches you would know when somebody arrives without that person being aware that you know. Similarly, this unit could be used to operate other equipment ultra-sonically. It is brand new, guaranteed OK, complete but less battery (PP3 alkaline type). Price is £20 plus £3 insured delivery. Our ref 20P11.

110 DECIBEL HORN. For use with the ultra-sonic intruder detector. Ideal for external positioning to attract the attention of neighbours should you have an intruder. This unit has its own mounting bracket and comes complete with good length of lead. Price £7. Our ref 7P9. Incidentally, this could also be used as a loudspeaker.

THREE CAMERAS All by famous makers, Kodak, etc. One dia and two different instant cameras. All in first class condition, believed to be in perfect working order, but not as untested. You can have them for £10 the three, including VAT, which must be a bargain—if only for the lenses, flash gear, etc. Our ref 10P35.



ATARI 800X COMPUTER At 64K this is most powerful and suitable for home and business. Brand new, complete with PSU, TV lead, owner's manual and six games. Can be yours for only £46 plus £3 insured delivery.

DATA RECORDERS ACORN for Acorn Electron, etc., reference number ALF03, with TV lead, manual and PSU. Brand new. Price £10 plus £1.50 post. Order ref 10P44.

ATARI XC12 for all their home computers. With leads and handbook. Brand new. Price £15 plus £2 post. Order ref 15P20.

JOYSTICK FOR ATARI OR COMMODORE for all Atari and Commodore 84 and Vic20. New. Price £5. Order ref 5P128.

EXTRA SPECIAL OFFER We will supply the Atari 800X, data recorder XC12, joystick and six games for £87.50 plus £4 insured delivery.

SUB-MINI TOGGLE SWITCH Body size 8mm x 4mm x 7mm SBDT with chrome dolly fitting nuts. 4 for £1. Order ref. BD64M.

SOUND TO LIGHT UNIT. Complete kit of parts for a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two-tone metal case and has controls for each channel, and a master on/off. The audio input and output are by Vee. sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitates ease of connecting lamps. Special price is £14.95 in kit form.

WALKMAN TYPE PERSONAL STEREO CASSETTE PLAYERS. These are not second hand but are slightly reject and may need some attention. All are complete with stereo headphones and are famous makes: Sanyo, Panasonic, Sony, etc. Stereo cassette type, no radio, £5 each. Our ref 5P132.

SPECIAL OFFER is ten of the cassette only version, our ref 5P132, for £40. This offer is our ref 40P3.

RE-CHARGEABLE NICKALS 'B' SIZE. These are bagged for easy joining together but tags, being apt welded, are easy to remove. Virtually unused, tested and guaranteed. £2.00 ref 2P141 or 6 wired together for £10.00 ref 10P43.

LASER TUBE

Made by Philips Electrical. New and unused. This is helium-neon and has a typical power rating of 1.6mW. It emits red polarised light and is completely safe provided you do not look directly into the beam when any damage could result. **DON'T MISS THIS SPECIAL BARGAIN!** Price £28.95 plus £3 insured delivery.

POWER SUPPLY FOR PHILIPS LASER available in kit form, Price £15 plus £2 postage.

PAPET AXIAL FAN—MANUFACTURERS REF NO. TYPHON.

This is mains operated, 15 watt rating and in a metal frame with metal blades so OK in high temperatures. Body size approx. 69mm square x 15mm thick. £5.00 each, plus £1.00 postage. Our ref 6P6.

VERY POWERFUL MAGNETS Although only less than 1" long and not much thicker than a pencil these are very difficult to pull apart. Could be used to operate embedded reed switches, etc. Price 50p each, 2 for £1.00. Ref BD64Z.



ORGAN MASTER is a three octave musical keyboard. It is beautifully made, has gold plated contacts and is complete with ribbon cable and edge connector. Brand new, only £12 plus £3 postage. Order ref. 12P5.

MUSIC FROM YOUR SPECTRUM 128 We offer the Organ Master three octave keyboard, complete with leads and the interface which plugs into your 128. You can then compose, play, record, store, etc., your own music. Price £19 plus £3 special packing and postage. Order ref. 18P1.

3BA DOUBLE POLE RELAY WITH 12V COIL complete with mounting brackets, made by the Japanese Darron Company. Price £2 each. Our ref. 2P173A.

HAND-HELD VIDEO LAMP. Mains operated and will enable you to take professional standard videos. Made by the famous Ferguson Company, this uses a 1000w halogen lamp in a fan cooled, hand-held and hand-switched metal housing. Comes complete with optional band-door assembly and camera bar. Obviously intended to retail at over £60, we offer these at £30 each plus £3 insured delivery. Our ref 30P3.

AN ALLADIN'S CAVE We have opened another shop in Hove, the address is number 12 Boundary Road which is between Hove and Portslade fairly close to the seafront. When you want to see before you buy and when you want to browse around the special bargains available, this is where you should make for as the Portland Road shop in future will be just mail order. You can of course collect from Portland Road but you should bring in an order complete with reference numbers so that the store can attend to it easily.

J & N BULL ELECTRICAL

Dept AR, 280 PORTLAND ROAD, HOVE
BRIGHTON, SUSSEX BN3 6AT

MAIL ORDER TERMS: Cash, PO or cheques with order. Orders under £20 add £1.50 service charge. Monthly account orders accepted from schools and public companies. Access and E-card orders accepted. Brighton (0273) 736848 or 283389

POPULAR ITEMS

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

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 REMAINING. 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-writing into any 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 1/16in thick. These are polished 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. 5 for £1. Our ref BD274A.

THE MONITOR made for ICL, uses Philips black and white tube. Brand new and complete but untested. £16.00 plus £3.00 post.

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

FREE POWER Can be yours if you use our solar cells—steroid made modules with new system bubble magnifier 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 10mA, Price £1. Our ref. BD831. Module B gives 400mA, Price £2. Our ref 2P98. Module D gives 700mA, Price £3. Our ref. 3P2.

SOLAR POWERED NI-CAD CHARGER 4 Ni-Cad batteries AA (HP7) charged in eight hours or two in only 4 hours. It is a complete, boxed ready to use unit. Price £8. Our ref. 8P3.

SWITCH AC LOADS WITH YOUR COMPUTER This is a easy and reliable if you use our solid state relay. This has no moving parts, has high input resistance and acts as a noise barrier and provides 4KV isolation between logic terminals. The turn-on voltage is not critical, anything between 3 and 30V, internal resistance is about 1K ohm. AC loads up to 10A can be switched. Price is £2 each. Ref. 2P185.

METAL PROJECT BOX ideal size for battery charger, power supply, etc.; sprayed grey, size 8in x 4 1/2in x 4 1/2in, ends are louvred for ventilation other sides are flat and un drilled. Price £2. Order ref 2P181.

800 SMOOTHING CAPACITOR. Sprague powerwytic 38,000uF at 50V. £3. Our ref. 3P61.

4-CORE FLEX CABLE. Cores separately insulated and grey PVC covered overall. Each copper core size 7/32mm. Ideal for long telephone runs or similar applications even at mains voltage 20 metres £2. Our ref 2P186 or 100 metres coil £8. Our ref. 8P18.

6-CORE FLEX CABLE. Description same as the 4-core above. Price 15 metres for £2. Our ref. 2P187 or 100 metres £9. Our ref. 9P1

TWIN GANG TUNING CAPACITOR. Each section is 0005pfd with trimmers and good lead 1/4in spindles. £1 each. Our ref. BD630.

13A PLUGS Pins slanted 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. **30W 4-30W** Mains transformers 2 1/2 amp 110V watt leading, tapped primary, 280-245 upright mounting £4. Order ref. 4P24.

BURGLAR ALARM BELL—1" gang OK for outside use if protected from rain. 12V battery operated. Price £3. Ref. 8P2.

VERY RELIABLE CAPACITOR 4.7u 400V not electrolytic so not polarised, potted in oil can, size 1 1/4x 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.

USEFUL MAINS TRANSFORMER Upright mounting, normal tapped primary, has two secondaries. One gives 20v at 1.5 amps if used alone, or the other gives 10v at 3 amps if used alone. Join the two in series for 30v at 1 amp. Price £2. Our ref 2P214.

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

SINGLE SCREENED FLEX 70C copper conductors, pvc insulated then with copper screen, finally outer insulation. In fact quite normal screened flex. 10m for £1. Our ref BD668. Ditto, but solid conductor. 10m for £1. Our ref BD688A.

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 Belgian company, very good quality. Price 4 for £1. Ref. BD597.

TELEPHONES. We have just received a consignment of desk telephones, rotary dial type, in good working order and in new condition. We offer these at £5 each plus £2 special packing and postage. This model would have the connecting lead with four tags for going into the old type junction box. Our ref 5P134. Or for £5 you can have the same telephones but with the new flat BT type plug fitted. Our ref 5P16.

3-CORE FLEX BARGAIN No. 1—Core size 3mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15m for £2. Ref. 2P186.

3-CORE FLEX BARGAIN No. 2—Core size 1.25mm so suitable for long extension leads carrying up to 13 amps, or short lead up to 25A. 10m for £2. Ref. 2P180.

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 numeric 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—this is 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 runs 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.

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 4 pin power lead and 34 pin computer lead. Price £40. Our ref 40P1.

THE 'ALADDIN'S' CAVE OF ELECTRONIC & COMPUTER EQUIPMENT

COLOUR MONITORS

16" Decca, 80 series budget range, colour monitors features include: PIL tube, attractive teak style case, guaranteed 80 column resolution, only seen on monitors costing 3 times our price, ready to connect to a host of computer or video outputs. Manufacturers fully tested surplus, sold in little or hardly used condition with 90 day full RTB guarantee. 1000's Sold to date.

DECCA 80 RGB - TTL + SYNC input for BBC type interface etc. DECCA 80 COMP 75 (1) composite video input with integral audio amp & speaker ideal for use with video recorder or TELEBOX ST or any other audio visual use.

Only £99.00 (E)

HIGH DEFINITION COLOUR

BRAND NEW CENTRONIC 14" monitors in attractive style moulded case featuring hi res Mitsubishi 0.42 dot pitch tube with 669 x 507 pixels, 28MHz bandwidth. Full 90 day guarantee.

Order as 1004-N2 for TTL + sync RGB for BBC etc £159.00 (E)
1003-N1 for IBM PC etc fully CGA equiv £189.00 (E)
1005-N2 RGB interface for QL 85 columns £169.00 (E)

20" & 22" AV Specials

Superbly made, UK manufacture, PIL tube, all solid state colour monitors, complete with composite video and sound inputs, attractive teak style case, ideal for a host of applications including Schools, Shops, Disco's, Clubs etc. Supplied in EXCELLENT little used condition with 90 day guarantee.

20" Monitor £165.00 (F) 22" Monitor £185.00 (F)

MONOCHROME

MOTOROLA M1000-100 5" CRT black & white compact chassis monitor measuring only cm 11.6h, 12w, 22d. Ideal for CCTV or computer applications. Accepts standard Composite video or individual H & V syncs. Operates from 12v DC at approx 0.8a. Some units may have minor screen marks, but still in very usable condition. Fully tested with 30 day guarantee & full data. **Only £29.00 (C)**

Fully cased as above, with attractive moulded, desk standing swivel and tilt case Dim. cm 12h, 14.5w, 26d. **£39.00 (C)**

JVC type 751-7 5" ultra compact black & white chassis monitor for 12v 0.7a DC operation Dim cm 11h, 14w, 18d. Simple DISS circuit data included to convert data and separate sync input to composite video input. Ideal portable equipment etc. Supplied with full data. **Brand New £65.00 (B)**

KGM 324 9" Green Screen, Little used fully cased, mains powered high res monitors with standard composite video input. Fully tested and in excellent condition. **£49.00 (E)**

20" Black & White monitors by AZTEK, COTRON & NATIONAL All solid state, fully cased monitors, ideal for all types of AV or CCTV applications. Units have standard composite video inputs with integral audio amp and speaker. Sold in good, used condition, fully tested with 90 day guarantee. **Only £85.00 (F)**

FLOPPY DRIVE SCOOP

Drives from Only £39.95

A MASSIVE purchase of standard 5.25" disk drives enables us to offer you prime product at all time super low prices. All units unless stated are removed from often BRAND NEW equipment, fully tested and shipped to you with a full 120 day guarantee. All units offered operate from +5 and +12 volts DC, are of standard size and accept the common standard 34 way interface connector.

TANDON TM100-2A IBM compatible 40 track FH double sided **Only £39.95 (B)**
TANDON TM101-4 FH 80 track double sided **Only £49.95 (B)**
JAPANESE Half Height double sided drives by Canon, Tec, Toshiba etc. Specify 40 or 80 track **Only £75.00 (B)**
TEAC FD55-F 40-80 track double sided Half Height **Brand New £115.00 (B)**

DISK DRIVE ACCESSORIES

34 Way interface cable and connector single £5.50, Dual £8.50 (A) 5.25" DC power cable £1.75. Fully cased PSU for 2 x 5.25" Drives £19.50 (A) Chassis PSU for 2 x 8" drives **£39.95 (B)**

8" DISK DRIVES

SUGART 800/801 single sided refurbished **£175.00 (E)**
SUGART 851 double sided refurbished **£260.00 (E)**
MITSUBISHI M2894-63 Double sided switchable Hard or Soft sector **£275.00 (E)**
SPECIAL OFFER Dual 8" drives with 2mb capacity in smart case with integral PSU **ONLY £499.00 (F)**

COMPUTER SYSTEMS

TATUNG PC2000. Big brother of the famous EINSTEIN, the TPC2000 professional 3 piece system comprises: Quality high res GREEN 12" monitor. Sculptured 92 key keyboard and plinth unit containing the Z80A CPU and all control electronics PLUS 2 Integral TEAC 5.25" 80 track double sided disk drives. Many other features include Dual 8" IBM format disk drive support, Serial and parallel outputs, full expansion port, 64k ram and ready to run software. Supplied complete with CPM, WORDSTAR, BASIC and accounts package. **BRAND NEW**
Full 90 day guarantee. **Only £299(E)**
Original price OVER £1400

EQUINOX (IMS) S100 system capable of running either TURBO or standard CPM. Unit features heavy duty box containing a powerful PSU, 12 slot S100 backplane, & dual 8" double sided disk drives. Two individual Z80 cpu boards with 192k of RAM allow the use of multi user software with upto 4 RS232 serial interfaces. Many other features include battery backed real time clock, all IC's socketed etc. Units in good condition and tested prior despatch, no documentation at present, hence price of only £245.00 (F)

S100 PCB's IMS A465 64k dynamic RAM. £55.00 (B) IMS A330 FDC controller £85.00 (B). IMS A862 CPU & I/O £65.00 (B)

SAE for full list of other S100 boards and accessories.

PRINTERS

Bulk purchase brings you incredible savings on a range of printers to suit all applications. Many other 'one off bargains' can be seen at our South London Shop

HAZELTINE ESPRINT Small desktop 100 cps print speed with both RS232 and CENTRONICS interfaces. Full pin addressable graphics and 6 user selectable type fonts. Up to 9.5" single sheet and tractor paper handling **Brand New Only £199.00 (E)**

CENTRONICS 150 series. A real workhorse for continuous use with tractor feed paper, either in the office, home or factory, desk standing, 150 cps 4 type fonts and choice of interfaces. Supplied BRAND NEW

Order as:
150-SN up to 9.5" paper handling **£185.00 (E)**
150-SW up to 14.5" paper handling **£225.00 (E)**
150-GR up to 14.5" paper plus full graphics **£245.00 (E)**
When ordering please specify RS232 or CENTRONICS interface.

Ultra Fast 240 cps NEWBURY DATA NDR 8840 High Speed Printers Only £449 !!

A special purchase from a now defunct Government Dept enables us to offer you this amazing British Made, quality printer at clearance prices. SAVING YOU OVER £1500 !! The NDR8840 features high speed 240 cps print speed with integral, fully adjustable paper tractor, giving exceptional fast paper handling for multi part forms etc. The unit features 10 selectable type fonts giving up to 226 printable characters on a single line. Many other features include Internal electronic vertical and horizontal tabs, self test, 9 needle head, Up to 15.5" paper, 15 million character ribbon cartridge life and standard RS232 serial interface. Sold in SUPERB tested condition with 90 day guarantee. **Only £449.00 (F)**

EPSON model 512 40 column 3.5" wide paper roll feed, high speed matrix (3 lines per second) printer mechanism for incorporation in point of sale terminals, ticket printers, data loggers etc. Unit features bi directional printhead and integral roll paper feed mech with tear bar. Requires DC volts and simple parallel external drive logic. Complete with data. RFE and tested **Only £49.95 (C)**

EPSON model 542 Same spec as above model, but designed to be used as a slip or flatbed printer. Ideal as label, card or ticket printer. Supplied fully cased in attractive, small, desk top metal housing. Complete with data. RFE and tested **Only £59.00 (D)**

PHILIPS P2000 Heavy duty 25 cps bi directional daisy wheel printer. Fully DIABLO, GIME, WORDSTAR compatible. Many features include fully loaded platter - up to 15" paper, host of available daisy wheels, single sheet paper handling, superb quality print. Supplied complete with user manual & 90 day guarantee plus FREE dust cover & daisy wheel. **BRAND NEW Only £225.00 (E)**

Most of the items in this Advert, plus a whole range of other electronic components and goodies can be seen or purchased at our

** South London Shop **

Located at 215 Whitehorse Lane, London SE25. The shop is on the main 68 bus route and only a few miles from the main A23 and South Circular roads. Open Monday to Saturday from 9 to 5.30, parking is unlimited and browsers are most welcome. Shop callers also save the cost of carriage.

MODEMS

Modems to suit all applications and budgets. Please contact our technical sales staff if you require more information or assistance.

SPECIAL PURCHASE V22 1200 baud MODEMS ONLY £149 !!

MASTER SYSTEMS type 2/12 microprocessor controlled V22 full duplex 1200 baud. This fully BT approved modem employs all the latest features for error free data comms at the staggering speed of 120 characters per second, saving you 75% of your BT phone bills and data connect time !! Add these facts to our give away price and you have a superb buy !! Ultra slim unit measures only 45 mm high with many integral features such as Auto answer, Full LED status indication, RS232 interface, Remote error diagnostics, SYNC or ASYNC use, SPEECH or DATA switching, Integral mains PSU, 2 wire connection to BT line etc. Supplied fully tested, EXCELLENT slightly used condition with data and full 120 day guarantee.

LIMITED QUANTITY Only £149 (D)

CONCORD V22 1200 baud as new £390.00 (E)
CONCORD V22 1200-2400 BIS £399.00 (E)
RIXON EX BT Modem 27 V22 1200 £225.00 (E)
DATEL 4800 / RACAL MPS 4800 EX BT modem for 4800 baud sync use. **£295.00 (E)**
DATEL 2412 2780/3780 4 wire modem unit EX BT fully tested. **£199.00 (E)**
MODEM 201-1 75-1200 BAUD for use with PRESTEL etc EX BT fully tested. **£49.00 (E)**
TRANSDATA 307A 300 baud acoustic coupler with RS232 I/O **Brand New £49.00 (E)**
RS232 DATA CABLES 16 ft long 25w D plug to 25 way D socket. Brand New **Only £9.95 (A)**
As above but 2 metres long **£4.99 (A)**
BT plug & cable for new type socket **£2.95 (A)**

RECHARGEABLE BATTERIES

Maintenance free, sealed long life LEAD ACID
A300 12v 3 Ah **£13.95 (A)**
A300 6v 3 Ah **£9.95 (A)**
A300 6-0-6 v 1.8 Ah **RFE £5.99 (A)**

NICKEL CADMIUM

Quality 12 v 4 Ah cell pack. Originally made for the TECHNOICOLOR video company, this unit contains 10 high quality GE nicad, D type cells, configured in a smart robust moulded case with DC output connector. Dim cm 19.5 x 4.5 x 12.5. Ideal portable equipment etc. **BRAND NEW £24.95 (B)**

12v 17 Ah Ultra rugged, all weather, virtually indestructible refillable NICAD stack by ALCAD. Unit features 10 x individual type XL1.5 cells in wooden crate. Supplied to the MOD and made to deliver exceptionally high output currents & withstand long periods of storage in discharged state. Dim cm 61 x 14 x 22. Complete with instructions. **£95.00 (E)**

EX EQUIPMENT NICAD cells by GE Removed from equipment and believed in good, but used condition. 'F' size 7Ah 6 for £8 (B) Also 'D' size 4Ah 4 for £5 (B)

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End of line purchase enables this brand new unit to be offered at an all time super low price. The NEC D2248 8" 80 Mb disk drive features full CPU control and industry standard SMD interface, Ultra high speed data transfer and access times leave the good old 5106 Inter. complete with instructions. **Only £399.00 (E)**

Dual drive, plug in 135 Mb sub system for IBM AT unit in case with PSU etc. **£1499.00 (F)**
Interface cards for upto 4 drives on IBM AT etc available **Brand new at £395.00**

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All power supplies operate from 220-240 v AC Many other types from 3v to 10kv in stock. Contact sales office for more details.

PLESSEY PL12/2 Fully enclosed 12v DC 2 amp PSU. Regulated and protected. Dim cm 13.5 x 11 x 11 **New £18.95 (B)**
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POWER ONE PHC 24v DC 2 amps Linear PSU fully regulated **New £19.95 (B)**

BOSHERT 13088 switch mode supply ideal disk drives or complete system. +5v 6a, +12 2.5a, -12 0.5a, -5v 0.5a. Dim cm 5.6 x 21 x 10.8 **New £29.95 (B)**

BOSHERT 13090 same as above spec but outputs of +5v 6a, +24v 1.5a, +12v 0.5a, -12v 0.5a **New £39.95 (B)**

GREENDALE 19AB0E 50 Watt switch mode outputs +5v 6a, +12v 1a, -12v 1a, +15v 1a, D, 11 x 20 x 5.5 **RFE Tested £24.95 (B)**

CONVER AC130-3001 High grade VDE spec compact 130 watt switch mode PSU. Outputs give +5v 15a, -5v 1a, + & -12v 6a. Dim 6.5 x 27 x 12.5 Current list price £190. Our price **New £59.95.00 (C)**

FARNELL G6/40A Compact 5v 40 amp switch mode fully enclosed **New £140.00 (C)**

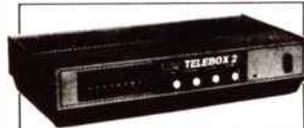
FARNELL G24 5S Compact 24v 5 amp switch mode fully enclosed **New £95.00 (C)**

Special Offer EXPERIMENTORS PSU ONLY £16.95 (C)

Made to the highest spec for BT this unit gives several fully protected DC outputs most suited to the Electronics Hobbyist. +5v 2a, + & -12v 1a, +24v 1a and +5v fully floating at 50ma. Ideal for school labs etc. Quantity discount available. Fully tested with data RFE = Removed From Equipment

The AMAZING TELEBOX Converts your monitor into a QUALITY COLOUR TELEVISION

Brand new high quality, fully cased, 7 channel UHF PAL TV tuner system. Unit simply connects to your TV aerial socket and video monitor turning same into a fabulous colour TV. Dont worry if your monitor does not have sound, the TELEBOX even has an integral audio amp for driving a speaker plus an auxiliary output for headphones or HI FI system etc. Many other features: LED Status Indicator, Smart moulded case, Mains powered, Built to BS safety specs. Many other uses for TV sound or video etc. Supplied BRAND NEW with full 1 year guarantee. Carriage code (B)



TV SOUND & VIDEO TUNER ONLY £29.95

TELEBOX ST for monitors with composite video input £39.95
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Colour when used with colour CRT. RGB version NOT suitable for IBM-C101E type colour monitors. DATA sheet on request. PAL, overseas versions CALL.

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Keep your hot parts COOL and RELIABLE! In our range of BRAND NEW cooling fans.

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19" Rack cabinets 100's in stock from £15.00