AUGUST 1986 £1.30

Amateur RADIO

For all two-way radio enthusiasts

CW: The outdated mode?

Balanced to unbalanced transformers

Fixed voltage PSUs

On test: Icom ICR7000 VHF/UHF general coverage Rx

AmRad 10GHz system

R. WITHERS COMMUNICATIONS LTD

Manufacturers, importers and suppliers of world famous communications products
584 HAGLEY ROAD WEST OLDBURY, WARLEY, BIRMINGHAM B68 0BS
021-421 8201/2/3. CELLNET 0860 323056. PRESTEL BMX 21421 8216
Amateur Radio. Business Radio. Radio Telephones. Sales. Service Accessories.

ICOM YAESU

THE TECHNICALLY ORIENTATED RADIO COMMUNICATIONS SPECIALISTS.

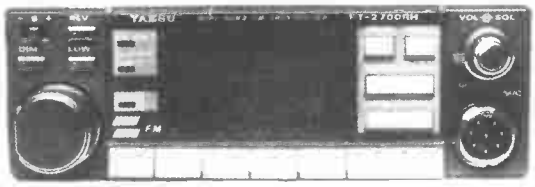
R.W.C. "PRICE BUSTERS"
x x x x ARE HERE x x x x

FT 2700RH 2M & 70CM. 25 WATT DUAL BAND TRANSCEIVER

FULL DUPLEX BASE STATION PACKAGING COMPRISING OF.

FT2700RH	£499
RAYCOM 12amp BASE PSU	£49
HOXIN 70N2V DUAL BAND BASE ANTENNA	£39
HOXIN HS770 DUPLEXER UNIT	£19.95
10 METERS OF H100 LOW LOSS CO-AX	£8.50
2 × PL259S: 1 × N plug connector	£3.50

NORMAL PRICE £619.45



FULL DUPLEX MOBILE PACKAGE COMPRISING OF

FT 2700RH	£499
HOXIN 70N2M DUAL BAND MOBILE ANTENNA	£20.95
HOXIN HS770 DUPLEXER	£19.95
SUN SO239 GUTTER MOUNT	£9.95
MOBILE LOUD SPEAKERS	£12.50
1 × N PLUG CONNECTOR	£2.00

NORMAL PRICE £563.90

OUR COMPLETE PACKAGE CASH PRICE. JUST £499 + £10 p&p
only 25 available

OUR COMPLETE PACKAGE CASH PRICE. JUST £469 + £10 p&p
only 20 available

PRICE BUSTERS...PRICE BUSTERS...PRICE BUSTERS

FT 270RH 2M. 45WATT FM. TRANSCEIVER

COMPLETE BASE STATION PACKAGE COMPRISING OF.

FT270RH	£399
RAYCOM 12amp BASE PSU	£49
SUN TRIPLE 5/8 BASE ANTENNA	£39
10 METERS OF H100 LOW LOSS COAX	£8.50
2 × PL259s:	£1.50

NORMAL PRICE £497.00

COMPLETE MOBILE STATION PACKAGE COMPRISING OF

FT270RH	£399
SUN 7/8 MOBILE ANTENNA	£14.50
SUN GUTTER MOUNT	£9.50
MOBILE LOUDSPEAKER	£12.50

NORMAL PRICE £435.50

OUR COMPLETE PACKAGE CASH PRICE. JUST £399 + £15 p&p
only 25 available

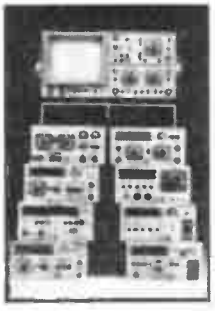
OUR COMPLETE PACKAGE CASH PRICE. JUST £379 + £10 p&p
only 20 available

THIS TREMENDOUS "PRICE BUSTERS" OFFER IS ONLY AVAILABLE BECAUSE OF OUR BULK BUYING POWER. PLEASE NOTE WE CAN ONLY OFFER THESE PRICES WHILST PRESENT STOCKS LAST, THIS OFFER IS THEREFORE SUBJECT TO AVAILABILITY. WE ADVISE YOU TO PLACE YOUR ORDER NOW. USUAL FINANCE FACILITIES APPLY. APPLY NOW FOR YOUR RWC CHARGE CARD.

Tel: 021 421 8201 (24hr answerphone)
Telex: 334303 G TXAGWM

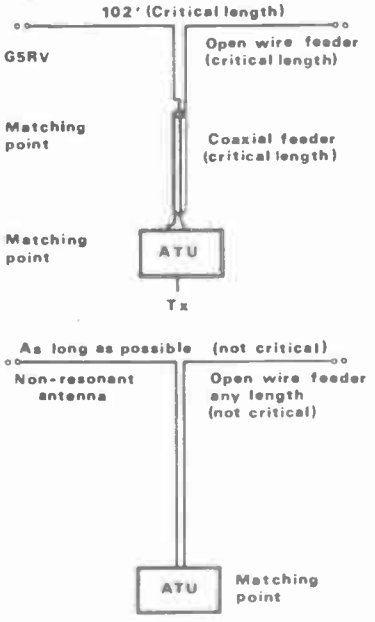
Access VISA AMERICAN EXPRESS RWC Credit card Fast Mail Order

Amateur RADIO



Editor:
Anita Ley
Assistant Editor:
Jane Berry
Advertisement Manager:
Marian Vidler
Subscriptions:
01-760 0409
Accounts:
Clare Brinkman
Publisher:
Peter Williams
On sale: Last Thursday of the month preceding cover date
Next issue: Cover date September 1986 on sale 23 August 1986
Published by:
Amateur Radio Magazines,
Sovereign House,
Brentwood, Essex
CM14 4SE, England
(0277) 219876
Printed: In England
ISSN: 0264-2557
News Trade Sales by:
Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS.
01-247 8233

Front cover: Icom ICR7000 (p23) Photo by Jay Moss-Powell G6XIB



SERVICES

P.M. COMPONENTS LTD

PHONE 0474 60521 3 LINES

SELECTRON HOUSE
SPRINGHEAD ENTERPRISE PARK, SPRINGHEAD ROAD
GRAVESEND, KENT DA11 8HD

VISA

TELEX 966371 TOS PM

A SELECTION FROM OUR STOCK OF BRANDED VALVES

A1714	24.50
A1998	11.50
A2087	11.50
A2134	14.95
A2293	6.50
A2426	29.50
A2599	37.50
A2792	27.50
A2900	11.50
A3042	24.00
A3283	24.00
AC/THI	4.00
ACT22	59.75
AC/S2 PEN	8.50
AH221	39.00
AH238	39.00
AL60	8.00
AN1	14.00
ARP12	0.70
ARP34	1.25
ARP35	2.00
AZ11	4.50
BL63	2.00
BS450	67.00
BS810	55.00
BS814	55.00
CIK	19.00
C3JA	39.50
C6A	9.00
C1112G	70.00
C1108	65.00
C1134	32.00
C1148A	115.00
C1150/1	135.00
C1534	32.00
CCA	2.50
CC3L	0.90
CL33	2.00
CV Nos Prices on request	
D3a	29.50
D63	1.20
DA41	22.50
DA42	17.50
DA90	4.50
DA100	125.00
DAF91	0.45
DAF91	0.70
DAF96	1.00
DC70	1.75
DC90	1.20
DCX4-1000	12.00
DCX4-5000	25.00
DET16	28.50
DET18	28.50
DET23	35.00
DET24	39.00
DET25	22.00
DF91	0.70
DF92	0.60
DF96	0.65
DF97	1.00
DH63	1.20
DH77	0.90
DH79	0.65
DH149	2.00
DK91	0.90
DK92	1.20
DL35	2.50
DL63	1.00
DL70	2.50
DL73	2.50
DL91	1.50
DL92	0.95
DL93	1.10
DL94	2.50
DL96	2.50
DLS10	13.50
DLS16	10.00
DM70	1.95
DM160	2.75
DY51	1.50
DY86/87	0.65
DY802	0.72
E80CF	11.00
E80F	18.50
E81CC	3.15
E81L	12.00
E82CC	3.50
E83CC	3.50
E83F	8.50
E86C	9.50
E88C	7.95
E88CC	3.50
E88CC Siemens Special	5.95
E90CC	7.95
E90F	7.95
E91H	4.50
E92CC	3.95
E99F	6.99
E130L	25.00
E180CC	9.50
E182CC	9.00
E180F	6.50
E186F	6.50
E188CC	7.50
E280F	19.50
E283CC	10.00
E288CC	13.50
E55L	42.00
E810F	26.00
E1148	1.00
E1524	6.95
EA50	1.00
EA76	1.95
EA79	1.95
EAA91	0.60
EABC80	0.70
EAC91	2.50
EAF42	1.20
EAF801	2.00
EB34	1.50
EB41	3.95
EB91	0.65
EBC33	2.50
EBC41	1.95
EBC81	1.50
EBC90	0.90

EBC91	0.90
EB91	0.50
EBF80	0.65
EBF83	0.65
EBF85	0.95
EBF89	0.70
EBF93	0.95
EBL1	2.50
EBL21	2.00
EC52	0.75
EC70	1.75
EC80	9.50
EC81	7.95
EC86	1.00
EC88	1.00
EC90	1.10
EC91	5.50
EC92	1.95
EC93	1.50
EC95	7.00
EC97	1.10
EC157	439.50
EC8010	12.00
ECC32	3.50
ECC33	3.50
ECC35	3.50
ECC81	1.15
ECC81 Special quality	1.95
ECC82	0.65
ECC82 Mullard	1.50
ECC82 Philips	1.95
ECC83 Siemans	2.50
ECC83	
ECC83 Philips	1.95
ECC83 Siemans	2.50
ECC83 Tungsram	1.50
ECC84	0.50
ECC85	0.75
ECC86	2.75
ECC88	0.95
ECC91	2.00
ECC180	0.72
ECC189	1.95
ECC801S	3.50
ECC803S	4.95
ECC804	0.60
ECC2000	12.00
ECF80	1.15
ECF82	1.15
ECF86	2.25
ECF200	1.85
ECF202	1.85
ECF801	0.85
ECF805	2.50
ECF806	10.25
ECH3	2.50
ECH4	3.00
ECH35	3.50
ECH42	1.00
ECH81	0.65
ECH83	0.78
ECH84	0.69
ECH2000	1.50
ECL80	0.60
ECL82	0.65
ECL81	0.55
ECL83	2.50
ECL84	0.74
ECL85	0.69
ECL86	0.80
ECL805	0.69
EF22	2.50
EF37A	2.00
EF39	1.10
EF40	4.50
EF41	3.50
EF42	3.50
EF50	2.50
EF55	4.95
EF70	1.20
EF71	1.50
EF72	1.20
EF73	1.00
EF80	0.55
EF83	3.95
EF85	0.50
EF86	2.25
EF86 Mullard	4.50
EF89	1.50
EF91	1.95
EF92	2.15
EF93	0.95
EF94	0.95
EF95	1.50
EF97	0.90
EF98	0.90
EF183	0.65
EF184	0.65
EF730	1.80
EF731	3.50
EF732	3.50
EF800	11.00
EF805S	13.50
EF812	0.65
EFL200	1.80
EH90	0.72
EK90	9.95
EL32	0.95
EL33	4.00
EL34	2.25
EL34 Mullard/Phillips	4.50
EL36	1.95
EL37	9.00
EL38	4.75
EL41	3.50
EL42	2.00
EL81	6.95
EL82	0.58
EL83	6.95
EL84	0.75
EL85	4.50
EL86	0.85
EL90	2.15
EL91	6.00

EL 95	1.75
EL 153	12.15
EL 183E	3.50
EL183P	3.50
EL500	1.40
EL504	1.40
EL509	5.25
EL519	6.95
EL802	3.65
EL821	8.50
EL822	12.95
EM1	9.00
EM4	9.00
EM80	0.70
EM81	0.70
EM84	1.65
EM85	3.95
EM87	2.50
EN32	16.50
EN91	1.50
EN92	4.50
ESU150	14.95
ESU872	25.00
EY51	0.80
EY81	2.35
EY83	1.50
EY84	5.95
EY86/87	0.50
EY88	0.55
EY91	5.50
EY500A	1.50
EY802	0.70
EZ35	0.75
EZ40	2.75
EZ41	2.15
EZ80	0.75
EZ81	0.75
EZ90	1.50
F6064	2.95
FW4/800	2.95
G55/1K	9.00
G180/2M	6.95
G232 Mullard	3.95
G240/2D	9.00
GC10B	17.50
GC10D	17.50
GC10/4B	17.50
GC10/4E	17.50
GC12/4B	17.50
GD86W	6.00
GDT120M	5.00
GN4	6.00
GN10	15.00
GR10G	4.00
GS10C	16.50
GS10H	12.00
GS12D	12.00
GT1C	14.00
GT1C S/S	13.00
GTE175M	8.00
GTR150W	1.00
GU20	35.00
GXU1	13.50
GXU3	24.00
GXU50SS	14.50
GY501	1.20
GY802	1.00
GZ30	1.00
GZ31	1.00
GZ32	1.00
GZ33	4.50
GZ34	2.15
GZ37	4.50
HAA91	1.00
HABC80	0.90
HBC90	0.75
HBC91	0.80
HF93	0.75
HF94	1.50
HK90	1.06
HL2K	4.95
HL23DD	4.00
HL90	0.70
HL92	1.50
H133/DD	3.50
HR2	4.00
HY90	1.00
HVR2	3.00
K3118	86.00
KR6/3	45.00
KT8C	7.00
KT33C	3.50
KT36	2.00
KT44	4.00
KT45	4.00
KT61	4.00
KT63	2.00
KT66/CV1075 special yellow ssss pot	19.50
KT66 USA	9.95
KT77 Gold Lion	10.95
KT81	7.00
KT88 USA	10.95
KT88 Gold Lion	18.95
KTW61	2.50
KTW62	2.50
KTW63	2.00
KTZ63	2.50
L102/2K	6.95
L120/2K	12.00
LB7-20	95.00
LS9B	6.95
M502A	60.00
M537A	80.00
M5143	155.00
M8079	6.00
M8082	7.50
M8083	3.25
M8091	7.50
M8096	3.00
M8098	5.50
M8099	5.00
M8100	5.50
M8136	7.00
M8137	7.95
M8161	6.50
M8162	5.50

M8163	5.50
M8190	4.50
M8195	6.50
M8196	5.50
M8204	5.50
M8223	4.50
M8224	2.00
M8225	3.50
ME1401	29.50
ME1402	29.50
ME1501	14.00
MH4	3.50
MHLD6	4.00
ML4	4.50
MS4B	5.50
MU14	3.50
N37	12.50
N78	9.85
OA2	0.85
OA2WA	2.50
OA3	2.50
OB2	0.85
OB2WA	2.50
OC2	2.50
OC3	1.50
OD3	1.70
OM4	1.00
OM5B	3.00
OM6	1.75
ORP43	2.50
ORP50	3.95
P61	2.50
P41	2.50
PABC80	0.50
PC86	0.75
PC88	0.75
PC92	3.50
PC97	1.10
PC800	1.10
PC900	1.25
PCC84	0.40
PCC85	0.54
PCC88	0.70
PCC89	0.70
PCC189	0.70
PCC805	0.70
PCC806	0.80
PCE82	0.80
PCF80	0.65
PCF82	0.50
PCF84	0.65
PCF86	1.20
PCF87	0.40
PCF200	1.80
PCF201	1.80
PCF800	0.40
PCF801	1.35
PCF802	0.60
PCF805	1.25
PCF806	1.00
PCF808	1.25
PCH200	1.50
PCL82	0.85
PCL83	2.50
PCL84	0.75
PCL85	0.80
PCL86	0.85
PCL800	0.80
PCL805	0.90
PD500	3.50
PD510	3.65
PEN25	2.00
PEN40DD	2.50
PEN45	3.00
PEN45DD	3.00
PEN46	2.00
PEO5-25	39.50
PEO5-40N	42.50
PFL200	0.95
PL21	2.50
PL36	0.95
PL38	1.50
PL81	0.72
PL81A	0.72
PL82	0.60
PL83	0.52
PL84	0.78
PL88	1.00
PL95	1.75
PL302	1.00
PL345	12.50
PL500	0.95
PL500	1.10
PL504	1.15
PL508	1.75
PL509	4.85
PL519	4.95
PL802T	3.50
PL820	2.95
PL5557	29.50
PL5727	2.50
PY32	0.60
PY33	0.50
PY81	0.70
PY82	0.70
PY83	0.70
PY88	0.66
PY500A	1.95
PY800	0.79
PY801	0.79
QB3-300	54.95
QB5-1750	139.50
QBL5-3500	495.00
QEO3-10	4.95
QE08-200	£145.00
QF40	65.00
QP25	1.00
QQEO2/5	19.50
QQEO3-12	7.95
QQEO3-20	35.00
QQEO6/40	45.00
QQVO2-6	19.50
QQVO3-10 Mullard	15.00
QQV03-10	5.50

QQVO3-20A	25.00
QQVO3-20B	32.00
QQVO6-40A	27.50
QQVO7-50	63.50
QQZO3-20	42.50
QS75/20	1.50
QS75/40	3.00
QS92/1D	5.00
QS95/10	4.85
QS108/45	4.00
QS150/15	6.95
QS150/30	1.15
QS150/45	7.00
QS1200	3.95
QS1202	3.95
QS1203	4.15
QS1205	3.95
QS1206	3.95
QS1206	1.05
QS1207	0.90
QS1208	0.90
QS1209	3.15
QS1210	1.50
QS1211	1.50
QS1212	3.20
QS1213	5.00
QS1215	2.10
QS1218	5.00
QU37	9.50
QU37	11.50
QVO3-12	4.95
QVO5-25	1.75
QVO6-20	29.50
QV2-250C	45.00
QVO8-100	145.00
QY3-125	65.00
QY4-250	70.00
QY4-400	76.00
R10	4.00
R16	12.00
R17	1.50
R18	2.50
R19	2.50
R20	1.20
R1169	55.00
RG1-125	4.95
RG1-240A	14.50
RG3-250A	3.50
RG3-1250A	35.00
RK2K25	62.50
RK-20A	12.00
RL16	1.50
RPL16	12.00
RPY13	2.50
RPY43	2.50
RPY82	2.50
RR3-250	15.00
RR3-1250	35.00
RS613	45.00
RS685	54.95
RS688	52.15
S6F17	5.95
S6F33	29.95
S11E12	38.00
S30/2K	12.00
S104/1K	10.00
S109/1K	15.00
S130	5.95
S130/P	5.95
SC1/800	6.00
SC1/1100	6.00
SC1/1200	5.00
SC1/1300	6.00
SC1/2000	9.00
SD6000M	45.00
SP4B	4.95
SP41	5.00
SP42	3.00
SS501	35.00
ST11	1.50
STV280/40	11.95
STV280/80	19.95
SU42	4.95
TB2 5/300	85.00
TB2-300	45.00
TB3/2000	395.00
TBL-2-300	275.00
TBL2-500	395.00
TD03 10E	40.00
TD1-100A	25.00
TD3-12	4.00
TP25	1.50
TSP4	7.00
TT11	1.50
TT21	45.00
TT22	45.00
TT100	57.00
TTR-31MR	65.00
TY2-125A	85.00
TY4-400	85.00
TY8-600W	365.00
TYS2/250	375.00
U18-20	2.75
U19	11.95
U24	2.00
U25	0.90
U25	0.90
U37	9.00
U41	6.95

U50	2.00
U82	3.00
U191	0.70
U192	1.00
U193	0.65
U251	1.00
U801	0.75
UABC80	0.65
UAF42	1.00
UBF80	0.60
UBC41	2.95
UBC81	1.50
UBF89	0.60
UBL21	1.75
UC92	1.20
UCC84	0.70
UCC85	0.60
UCF80	1.00
UCH21	1.20
UCH41	2.50
UCH42	2.50
UCH81	0.65
UCL82	1.75
UCL83	2.50
UF85	1.20
UF41	1.15
UF42	1.15
UF80	0.80
UF89	2.50
UL44	3.50
UL84	0.85
UU5	3.50
UU7	8.00
UU8	9.00
UY41	3.50
UY85	0.70
V235A/1K	250.00
V240C/2K	225.00
V241C/1K	195.00
V246A/2K	315.00
V339	3.50
VLS631	10.95
VP133	2.00
VR75/30	3.00
VR101	2.00
VR105/30	1.50
VR150/30	1.15
VT52	2.50
VU29	4.50
VU39	1.50
W77	5.00
W729	1.00
W739	1.50
X24	1.00
X66/X65	4.95
X76M	1.95
XC24	1.50
XC25	0.50
XFW47	1.50
XFW50	1.50
XG5-500	22.50
XL1-5V	1.50
XL628FT	7.50
XNP12	2.50
XR1-1600A	49.50
XR1-3200A	79.50
XR1-6400A	99.50
Y65	6.95
Y503	25.00
Y602	12.00
Y4070	130.00
YD1100	75.00
YJ1060	265.00
YL1000	9.50
YL1020	29.00
YL1030	59.50
YL1060	95.00
YL1070	195.00
YL1071	195.00
YL1290	59.50
Z77	1.20
Z303C	9.00
Z359	9.00
Z505S	15.00
Z520M	4.00
Z521M	8.00
Z700U	3.00
Z749	0.50
Z759	19.95
Z800U	3.00
Z803U	16.95
Z900T	9.50
ZA1000	12.50
ZA1001	1.50
ZA1002	1.50
ZC1040	8.00
ZM1005	8.00
ZM1020	8.95
ZM1021	8.00
ZM1023	7.95
ZM1041	14.00
ZM1082	9.00
ZM1084	10.00
ZM1177	9.00
ZM1202	55.00
ZM1263	4.00
ZM1612	3.00
1A3	4.50
1AC6	1.20
1B3GT	1.95
1B22	10.00
1B27	55.00
1B35A	29.50
1C5GT	2.50
1FD1	2.50
1G3GT	2.50
1K3GT	2.50
1N1	4.50
1N2	4.50
1P28	25.00
1N5GT	2.50
1P28	25.00
1S2	0.55
1S5	0.70
1T4	0.70
1U5	1.00
1X2B	1.40
1Z2	8.95
2AS15A	11.50
2B22	69.50

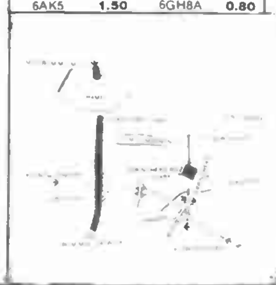
2C39A	29.50
2C39BA	29.50
2C40	37.00
2C42	29.50
2C51	0.75
2CY5	1.50
2B7	1.50
2D21	1.50
2D21W	2.50
2E22GY	45.00
2E26	7.95
2J42	93.00
2K25	27.50
2K25 Ray	75.00
2K26	95.00
2K29	250.00
2K56	250.00
3A108A	9.00
3A/107B	12.00
3A/109B	11.00
3A/110B	12.00
3A/141K	11.50
3A/147J	7.50
3A/167M	10.00
3A2	3.95
3A3A	3.95
3A4	1.10
3AL5	0.95
3AT2	3.35
3AU6	0.65
3B2	3.00
3B4	7.00
3B7	4.50
3B24	10.00
3B26	24.00
3B28	12.00
3BZ6	1.50
3C4	2.50
3C45	24.00
3CB6	1.50
3CN3A	2.50
3CS6	0.95
3CY5	1.50
3CX3	2.80
3D6	4.50
3D21A	29.50
3E22	49.50
3EH7	1.95
3EJ7	1.95
3W4GT	2.50
4B32	35.00
4B551B	115.00
4BQ7A	1.75
4BZ6	1.95
4-65A	59.00
4-125A	72.80
4-250A	79.50
4-400A	87.50
4C27	25.00
4C28	25.00
4CB6	1.95
4CX250B	49.00
4CX25OB EIMAC	£59.50
4CX250BM	75.00
4CX250K EIMAC	95.00
4CX350A	95.00
4CX350F	79.50
4CX1500B	398.50
4GS7	2.25
4GV7	2.25
4JC6A	2.95
4J52	75.00
4KT6	1.50
4X150A	35.00
5A/102D	9.50
5A152M	9.00
5A163K	10.00
5A170K	6.25
5A-206K	10.00
5A-180M	9.00
4AM8	4.15
5AM8	2.15
5AN8	1.20
5AR4	2.00
5AU4	1.50
5B 110M	10.00
5B-254M	14.50
5B-255M	19.50
5B255M	19.50
5B/256M	9.00
5B-257M	9.00
5B-258M	14.50
5C22	125.00
5R4GB	3.50
5R4GY	3.50
5T4	5.95
5U4G	2.95
5U4GB	3.50
5V4G	1.25
5Y3GT	1.95
5Z4GT	0.85
6/30L2	0.70
6A/203K	9.00
6A7	4.95
6A8G	1.50
6AC7	2.00
6AF4A	2.50
6AG5	1.50
6AG7	1.95
6AH6	2.50
6AJ4	2.00
6AJ7	2.00
6AK5	1.50

6AK6	2.50
6AL5	0.60
6AM4	3.25
6AM5	6.00
6AM6	1.50
6AN5	2.65
6AN8A	2.65
6AQ5	2.15
6AQ8	0.85
6AR5	5.95
6AR8	3.95
6AS5	1.50
6AS6	2.50
6AS7G	4.50
6AT6	0.75
6AT8	1.75
6AU4	2.00
6AU6	0.95
6AV6	0.75
6AW8A	2.50
6AZ8	5.95
6B7	2.80
6B8G	1.50
6BA6	0.95
6BA7	4.50
6BA8A	3.50
6BC8	1.00
6BE6	0.72
6BG6G	3.00
6BH6	1.95
6BH8	1.50
6BJ6	1.20
6BK4	4.00
6BK7A	1.95
6BL8	1.15
6BM8	0.58
6BN4	1.65
6BN6	1.65
6BN7	4.50
6BN8	3.95
6BQ5	0.75
6BQ7A	0.72
6BL7GTA	3.95
6BL8	1.15
6BR5	0.70
6BR7	4.95
6BR8	2.15
6BR8A	2.15
6BS7	5.50
6BW4	1.50
6BW6	5.35
6BW7	1.50
6BW8	4.00
6BX6	0.48
6BX7GT	3.50
6BZ6	2.50
6BZ7	2.95
6C4	1.10
6C5	1.95
6C6	2.50
6C8G	1.50
6C11	2.50
6C18	2.50
6CA4	4.95
6CA7	3.50
6CB5	3.95
6CB6	1.95
6CD6GA	4.50
6CF6	1.50
6CG7	2.25
6CH6	6.95
6CL3	3.95
6CL6	3.25
6CL8A	2.00
6CM5	1.60
6CM7	2.95
6CS6	0.75
6CS7	0.95
6CW4	6.50
6CY5	1.00
6CY7	2.95
6D6	2.50
6DC6	2.95
6DJ8	0.95
6DK6	1.15
6DQ5	6.95
6DQ6B	2.50
6DW4	2.15
6EA4	4.95
6EA7	2.50
6EA8	2.50
6EB8	1.75
6EM5	2.80
6EM7	2.50
6EU7	£1.95
6EU8	1.75
6EV7	2.95
6EW7	4.50
6EW6	1.80
6F1	2.00
6F5	4.95
6F7	5.50
6F6G	2.00
6F12	1.50
6F13	3.00
6F14	1.00
6F17	2.75
6F21	2.50
6F23	0.60
6F24	1.25
6F25	1.25
6F28	1.25
6F32	1.25
6F33	17.00
6FH8	12.50
6G6G	5.50
6GH8A	0.80

6GK5	1.50
6GK6	1.95
6GM6	0.95
6GS7	2.15
6GV7	2.80
6GW8	0.80
6H1	9.50
6H3N	1.10
6H6	1.95
6H6GT	1.95
6HB7	0.95
6HF5	5.50
6HF8	2.50
6HS6	4.95
6HS8	1.95
6HZ6	2.65
6J4	2.15
6J4WA	3.15
6J5	2.50
6J6	2.05
6JB6A	3.95
6JE6C	5.50
6JM6	3.95
6JS6C	4.95
6JU8	2.50
6J7	2.50
6K7G	2.00
6K8Y/G	3.00
6KD6	5.95
6KM8	2.50
6KT8	2.95
6KZ8	1.95
6L1	2.50
6L19	3.95
6L6GC	2.95
6L6GC (GE)	4.95
6L6GT	1.95
6LD20	1.15
6LF6	7.50
6LJ8	2.50
6LQ6	5.50
6L15	3.15
6MJ6	4.95
6N7	2.50
6N7GT	2.50
6P15	1.50
6P25	4.00
6P26	4.00
6P28	2.00
6Q7	1.75
6Q7GT	1.20
6R7G	3.15
6S4A	1.50
6SA7GT	1.35
6SC7	1.50
6SG7	2.50
6SH7	1.35
6SJ7GT	1.35
6SK7	1.35
6SK7GT	1.35
6SL7GT	0.85
6SN7GT	1.35
6SQ7	1.35
6SS7	1.95
6U4GT	1.75
6U8	1.15
6U8A	1.50
6V6GT	1.50
6X2N	1.00
6X4	1.50
6X5GT	1.00
6X5GTY	1.00
6X8A	2.25
7A6	4.50
7A7	2.00
7AD7	1.75
7AU7	1.50
7B6	3.50
7B7	2.50
7C6	2.50
7E7	2.50
7J7	5.50
7V7	4.15
7Y4	2.50
8B10	2.50
8BQ5	1.95
8D8	2.50
8EQ7	1.95
8298A	8.50
85A8	1.50
10D2	1.25
10DE7	2.50
10F1	0.75
10GK6	1.95
10P14	2.50
10P18	0.70
10LD12	0.65
11E3	55.00
12A6	3.95
12AD6	1.50
12AG8	1.50
12AL5	1.00
12AT6	0.95
12AT7	1.15
12AT7WA	2.50
12AU6	1.95
12AU7	0.65
12AV6	1.95
12AX4GT	1.00
12AX7	0.65
12AX7WA	2.50
12AY7	3.95
12AZ7A	1.95
12B4A	4.50
12BA6	1.50
12BE6	1.95

12BH7A	2.50
12BL6	1.75
12BY7A	2.75
12CA5	1.95
12CX6	1.20
12DQ6B	3.50
12DW4A	3.50
12DW7	2.50
12E1	17.95
12E14	35.00
12GN7	4.50
12HG7A	4.50
12J7GT	3.50
12K5	1.95
12K7GT	1.50
12K8	1.95
12SA7GT	1.95
12SG7	4.75
12SH7	1.95
12SK7	1.95
12SJ7	1.50
12SN7GT	1.85
12SQ7GT	1.95
12SR7	2.50
13D3	3.20
13D7	3.20
13D7	2.50
13D9	3.20
13DR7	2.95
13EI	145.00
13EM7	3.50
14S7	1.95
7BR3	3.95
17EW8	0.95
17DW4	2.50
17DW4A	2.95
17JZ8	4.50
18D3	6.00
19AQ5	3.50
19AU4GT	2.50
19G3	17.00
19H5	33.50
19Q6	9.00
20A2	10.50
30D1	0.70
20LF6	3.50
20L1	0.95
20P1	0.55
20P3	0.60
20P4	1.95
20P5	1.15
21JZ6	3.15
21LU8	2.50
24B1	39.50
24B9	39.50
25L6GT	1.75
25BQ6	1.75
29C1	19.50
29KO6	6.50
30C17	0.40
30C18	1.48
30F5	0.95
30FL1	1.00
30FL2	1.35
30FL12	0.95
30FL13	1.10
30FL14	1.25
30L1	0.45
30L15	0.80
30L17	0.80
30P4MR	1.00
30P12	1.00
30P18	0.50
30P19	1.00
30PL1	2.50
30PL13	0.80
30PL14	1.75
31JS6A	5.50
33A/158M	19.60
35A5	4.80
35L8GT	2.00
35W4	0.70
35Z3	1.85
38HE7	4.50
40KD6	5.80
42	6.95
47	6.00
50A5	1.50
50C5	0.95
50CD6G	1.15
50EH5	1.80
52KU	2.00
53CG	15.00
60B5	1.00
60JY6	2.96
61SPT	4.50
75B1	3.50
75C1	2.50
83	8.80
83AI	9.00
84	3.00
85A1	6.50
85A2	1.50
90AV	10.00
92AG	19.50
92AV	12.50
95A1	6.50
108C1	1.50
150B2	6.95
150C2	1.50
150C4	2.15
185T	1.50
274A	15.00
307	5.00
328A	15.00
388A	17.50

404A	10.95
425A5	8.00
431U	4.80
572B	65.00
5636	1.50
6146A	7.50
6158	3.20
6386	14.50
6883B	9.95
6973	5.95
705A	6.00
706A	8.00
715C	45.00
725A	276.00
7527	89.50
7703	395.00
803	14.95
805	39.00
807	1.95
810	85.00
811A	15.00
813	23.50
829B	14.50
832A	14.50
833A	95.00
866A	4.50
872A	25.00
873	60.00
884	5.50
927	15.00
930	9.95
931A	17.50
954	1.00
958A	1.00
1299A	0.80
1619	2.50
1625	3.00
1626	3.00
1927	25.00
2050	3.95
2050W	4.50
3545	4.00
4313C	4.00
4328D	9.00
5642	9.50
5651	2.50
5654	1.95
5663	1.95
5670	3.25
5672	4.50
5687	4.50
5692	3.50
5696	3.50
5704	3.50
5718	6.15
5725	2.50
5726	1.50
5727	1.95
5749	2.50
5750	1.85
5751	2.95
5763	4.95
5814A	3.25
5829WA	6.50
5840	3.50
5842	11.00
5847	10.95
5879	8.50
5886	13.95
5894	39.50
5899	4.50
5963	2.00
5965	2.25
6005	1.85
6012	16.00
6021	3.65
6057	2.50
6058	3.95
6060	2.25
6062	4.50
6063	2.00
6064	2.95
6067	1.95
6072	4.20
6080	7.95
6132	10.00
6146B	9.50
6688	6.50
6887	9.50
6080	7.95
6080WA	9.50
6096	5.50
6132	10.00
6136	2.50
6146B	9.95
6157	2.80
6201	6.45
6211	2.50
6267	2.25
6350	3.50
6688	6.50
6870	11.50
6887	9.80
6873	4.50
7189	3.50
7199	6.15
7239	17.50
7247	2.95
7360	13.50
7527	85.00
7586	15.00
6591A	4.95
7868	3.95



Open Mon-Thurs 9.00am-5.30pm
Fri, 9.00am-5.00pm
• 24 HOUR ANSWERPHONE SERVICE •
ACCESS & BARCLAYCARD PHONE ORDERS WELCOME

UK ORDERS P&P £1.00
PLEASE ADD 15% VAT
Export order welcome carriage at cost
Please send your enquiries for special quotations for large quantity

CALLERS WELCOME

SECONDHAND EQUIPMENT GUIDE

by Hugh Allison G3XSE

Well, I mistakenly thought I'd bought my bargain of the year at the British Amateur Television Club (BATC) Convention at Crick. As usual this smallish 'do' (small by comparison with most other rallies) was producing numerous bargains, such as house brick size black and white non-working TV cameras, with lens, at a fiver a go, all of which turned out to be easy repairs. In addition, a bloke arrived with a very tasty JVC colour camera with zoom lens, built-in mic, electronic viewfinder (which can be used for recording and playback), sound monitor and all 12 volt powered to boot. The owner set it up and I stood watching with interest as he demonstrated it. How much, enquired your scribe, more in hope than interest. When he said forty quid I paid up pronto and disappeared with it double quick before he came to his senses!

Why, you may ask, didn't I think this was *the* bargain – didn't it work? No, it worked a treat, it's just that at the Cambridge rally cum boot sale a fortnight later I bought what *must* rate as the bargain of the year. A Commodore Pet computer, with 32K expansion fitted, for £2.

Avoiding computers

I have gone out of my way to avoid computing as a hobby, mainly because I saw it as a great way of wasting even more time, but for two quid it would have been criminal to leave it behind, besides which, many years ago, I had played and enjoyed an excellent draughts game on this machine and had a copy of the game still kicking about.

Obviously, for two quid, it wasn't working, but after a couple of false starts two brilliant colleagues sussed that a 74LS157 was only throwing its outputs up and down a volt or so rather than the more usual five volts, normal operation being restored after replacement. I have it on good authority, as an aside, that the power supply rectifiers in Pets are very often dry jointed and are a good starting point for all repairs to these machines. Setting this bargain aside, the Cambridge 'do' this year was far better than last year's, mainly because of the car boot sale area.

Talking of computers, Sinclair ZX81s seem to be selling for eight quid boxed with power supply and handbook, less if something is missing, and about twelve quid for one with memory expansion (16K) or, absolute top whack, fifteen with printer and a load of games as well.

I received a pleasant, unexpected letter from the Tiverton Radio Club (re their mid-Devon rally), in which they detailed some of the items they sold on their bring-and-buy. Although I travel to most rallies, a clash of venues or an appointment the day before or the day after can sometimes preclude my going to some of the more distant gatherings, so their letter was most welcome (if any other rally organisers would care to send along lists I'd be grateful).

One item of note was a Yaesu FTDX560 which sold for £125. I have noticed a downward trend in the price of these over the past few years. For example, about five years ago these were going in the high two hundreds, and the £125 seems to fit in well with the prices of the last two I have seen change hands at £135 each. They are great rigs, dead reliable and supply moderate access when working on them. However, they have a slight tendency to drift, of the order of a couple of kHz in the first hour (about half as bad as most of the 400 series rigs, although I cannot truthfully explain why). Don't let this comment put you off one though, the drift is just noticeable rather than annoying.

An old one may well have thrashed its PA valves into extinction, so budget for another twenty quid just in case. If you can, see one work into a dummy load wattmeter before purchase. Power in does not necessarily equal power out! To sum up, I would rather have a secondhand FTDX560 than an equally priced KW2000.

Repairing multimeter movements

A few months ago I made a few comments about repairing AVOs, particularly out of balance movements which are often brought on by the weight falling off the 'back' of the pointer. A reader wrote in to say that his AVO was indeed severely out of balance, yet the weight (normally just a few turns of wire) was still present and correct. To recap, balance is required to stop the pointer reading differently between standing up and laying down.

In this reader's case I was able to assist since he had admitted overloading it before the balance problem occurred. His overload had caused him to have to re-zero the movement, and what he had failed to realise was that pointer, pivot and balance weight should all be in a straight line. His overload had bent the pointer and simply re-zeroing was causing the out of balance trouble. I understand that half an hour's careful work re-straightening the pointer, using a ruler as a straight edge reference, cured the trouble. I'd suggest a wooden ruler by the way. Metal ones have a tendency to jump into the movement at unexpected moments.

Luckless owners

Continuing with AVOs, other letters have referred to the luckless owners having problems with the movement sticking at some point in its travel. I can sympathise with this one. Although dead reliable, in fact exceedingly reliable, all meter movements are delicate mechanisms and AVOs are no exception. Common causes of sticking are bits of metal swarf down the meter movement.

It's not hard to get the movement out of an AVO, which involves two screws and two wires, and I'd recommend this be done rather than attempt to work on the beast in its case. A good strong light behind you is also fairly essential. Now look down the movement between the poles of the magnet. If there is anything in there it has got to come out. I have found that pushing out swarf is often a quick way to disaster, as it will turn over and jam in, but leading it out works quite well. This technique involves slipping a thin screwdriver blade, pin or other suitable metallic object down to the swarf. The swarf will then follow the blade out as it is withdrawn until it sits on the edge of the magnet, where it can be removed with plastic tweezers.

Jammin'

Other causes of jamming movements are distorted backplates and pointers, both fairly obvious. One that did catch me out was a slightly bent zero adjusting arm which fouled on the pointer as it came past. On the subject of spares, buying an AVO as a spare for yours can be fraught with pitfalls. Check that it is absolutely the same, as there are often detail differences between apparently identical units.

The number of screws around the outside, and their positions, can be a clue. A quick look at the battery compartment may reveal a discrepancy, and if you can open it up check the battery 'fingers' between compartment and contacts. Many a plan of mine to build a good 'un out of two duff 'uns has been thwarted by differences such as those above.

One final point on multimeters, don't ever think about cleaning the meter face on a Selectest (the 'GEC AVO') with

STRAIGHT & LEVEL

VELLY INTERLESTING

As one of the only amateur radio outlets in the UK currently selling Sony products, Waters & Stanton Electronics recently received a visit from one of the Japanese staff at Sony UK to discuss the company's communications range.

The problems with the absence of air band on the ICF2001D were pointed out and arrangements made to change UK orders to the alternative model with air band included.

The company sells this receiver for £329 and also stocks accessories, including the active antenna AN-1 which retails at £49.

Also available is the Sony Air-7 hand-held monitor. Its frequency coverage makes it suitable for air band, public service or marine band monitoring, plus normal domestic use. It is priced at £249.

For more details on this equipment contact: *Waters & Stanton Electronics, 12 North Street, Hornchurch, Essex RM11 1QX. Tel: (04024) 44765.*

A new illustrated brochure, *Sony Short Wave – Radios and Accessories*, is now available.

Included is detailed information on the company's range of radio receivers, such as the ICF2001D, a relative newcomer, the ICF7600D, the ICF7600A and the WA8000 multiband radio and stereo cassette recorder.

There is also a list of radio stations world-wide.

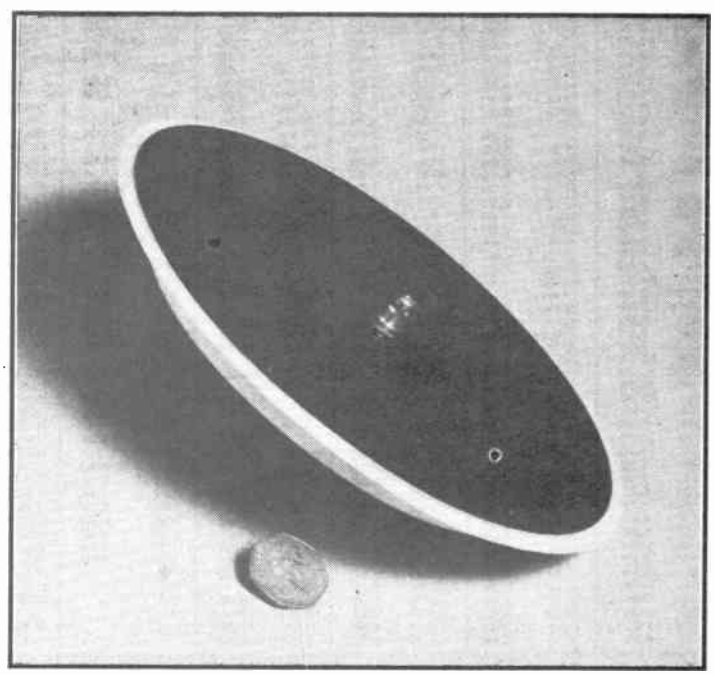
To obtain a copy of the brochure contact: *Sony (UK) Ltd, Sony House, South Street, Staines, Middlesex TW18 4PF. Tel: (0784) 61688.*

LOW PROFILE ANTENNAS

Antenna Products Limited have introduced a range of low profile antennas covering 190-225MHz and 800-950MHz.

Both antenna types have been designed to meet the specific requirements of public transport, railways and truck and lorry applications. The height of the antenna has been kept to a minimum by using a micro-strip technique, the LP200 being just 25mm tall and the LP900 (for cellular radio) 20mm high.

Because they use a magnetic field radiator the antennas are less affected by the presence of close metal



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

objects, eg ventilators on the roof of the vehicle. In addition both types are ground plane independent, which makes them ideal for mounting on fibreglass cabs.

More information is available from: *Antenna Products Ltd, Unit 48, Edison Road, Rabans Lane Industrial Estate, Aylesbury, Bucks HP19 3TE. Tel: (0296) 34455.*

COAXIAL SWITCHES

A new ultra-reliable miniature microwave switch series for frequencies from dc to 24GHz, the Wavecom SP3T-6T, is now available from Anglia Microwaves Ltd in Essex.

With lifetime figures of the same order as Wavecom's larger proven switch series, the new miniature devices have a 1.375 inch diameter, making them some 22% smaller.

They are therefore ideal for use in cases where size and weight are important design constraints.

1,000,000 reliable switching cycles are guaranteed per switch position, without intermittent contacts, without increasing RF contact resistance to more than 15 milliohms, and with less than 0.1dB increase in insertion loss.

Four models are available, the SP3T with three switch positions, the SP4T with four, the SP5T with five and the SP6T with six. Maximum VSWR is 1.5:1 and insertion loss specification is less than 0.5dB. Insulation is quoted at 60dB or greater.

Options include the provision of indicator circuitry and digital logic control inputs for use in computer-controlled systems.

For more information contact: *Anglia Microwaves Ltd, Radford Business Centre, Radford Way, Billericay, Essex CM12 0BZ. Tel: (02774) 58955.*

STAY TUNED

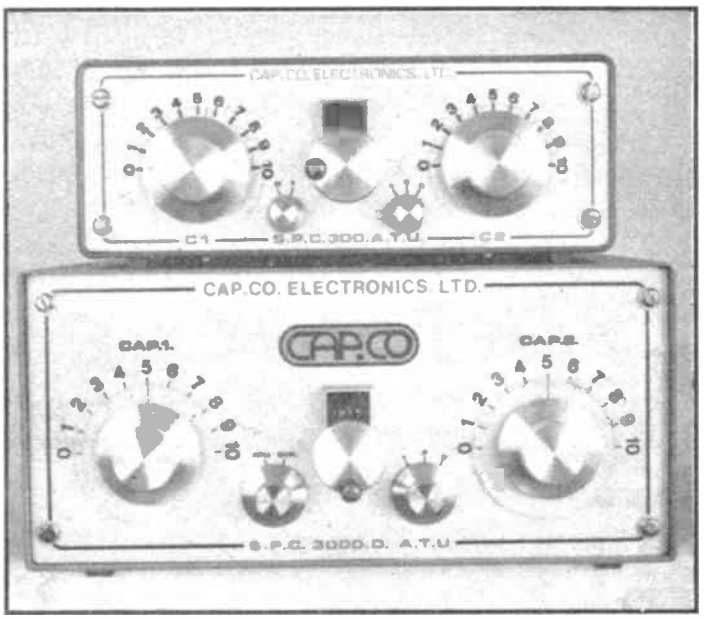
New from Cap Co Electronics Ltd are two new ATUs, the SPC-300D and the SPC-3000D.

Both units feature a safety device, offering a degree of protection from static discharges if an aerial should be struck when connected as usual.

By having electro-mechanical switching via relays and control switches, when the supply is switched off all antennas which are coupled to the ATU are automatically grounded. This obviates the need to decouple all the aerials when there are signs of lightning.

The company feels that with our eratic weather conditions this feature is a real bonus.

The units also have provisions for connecting three aerials, a 'direct' and 'through' position and incorporate a kW balun for balanced or unbalanced operation.



For further information contact: *Cap Co Electronics Ltd, 63 Hallcroft, Birch Green, Skelmersdale, Lancs WN8 6QB.*

BACK PACKING

Yaesu's new 'back pack' HF field portable transceivers are now available from Amcomm/ARE.

The FT70F and FT70G models weigh 5.8kg each and include a Nicad pack. They are designed to provide reliable, convenient, medium range communications under rugged field conditions, for marine, amateur, commercial, industrial and military uses.

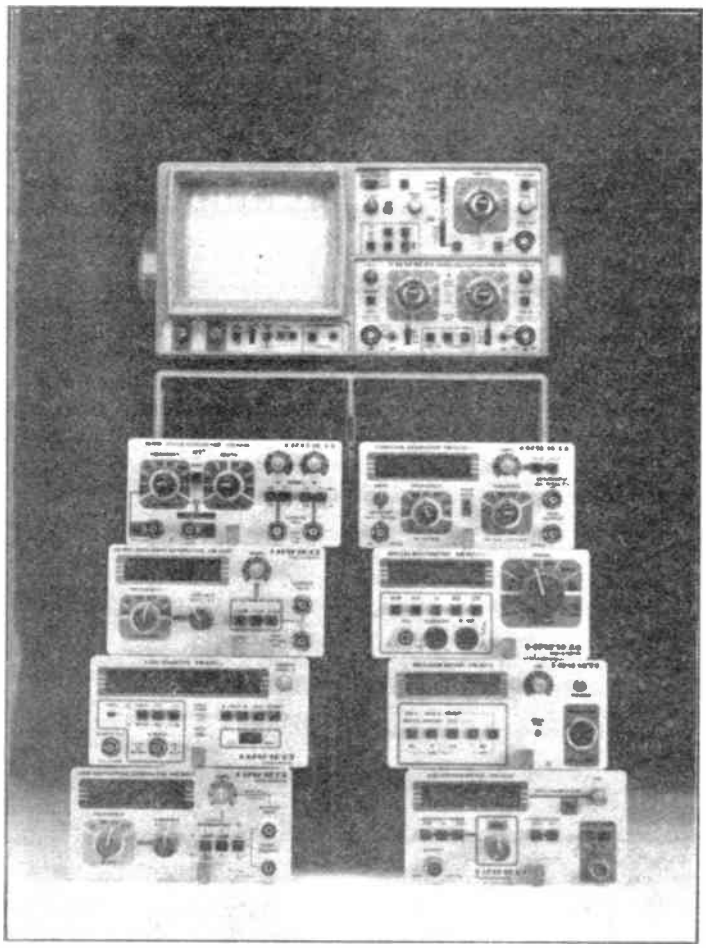
The frequency synthesized, all solid-state circuitry operates with a 10 watt (5W on AM) multimode transmitter ranging between 2 and 230MHz, and will receive down to 500kHz.

The unit is built with a die-cast, anodised aluminium front panel with combined battery pack, making it fairly weatherproof.

Flexible operation is assured by SSB, semi break-in CW and AM modes, high/low power selection and all-mode receiver squelch.

For further details contact: *Amcomm/ARE, 373 Uxbridge Road, Acton, London W3 9RN. Tel: 01-992 5765/6/7.*

STRAIGHT & LEVEL



MODULAR TEST SYSTEM

Hameg Limited, noted for their range of low cost, high performance oscilloscopes, have now entered the general test and measurement market with the introduction of the HM8000 modular test system.

The heart of the HM8000 series is the HM8001 mainframe, built to match the Hameg range of flat line oscilloscopes, and it can therefore be stacked above or below, singly or in multiples.

The HM8001 holds up to two modules of the series side by side and has eight independent floating voltages to supply power to the modules.

There are nine modules presently available for use in the HM8001 mainframe:

a 4.5-digit digital multimeter with true rms capability.
a 200m-20k, 4 point measurement milliohm meter.
a 1GHz counter with period measurement.
a distortion meter with auto frequency nulling.
a 0.1Hz to 1MHz function generator.
a 20Hz to 20MHz sine wave generator.
a 2Hz to 20MHz pulse generator with variable width and period.
a 5Hz to 50kHz sine wave generator, distortion <0.01%.
a triple power supply, 2 off 1.3V-20V, 0.4A + 5V, 0.5A.

Full specifications of the range of modules plus the mainframe are included in an attractive catalogue which is available upon request.

New modules will be added at regular intervals to further enhance the system.

The HM8001 mainframe costs £121.00 plus VAT, and the modules vary in price from £134.00 to £243.00 plus VAT and have a two year warranty.

The HM8000 series is available ex-stock from Paxton Instruments of Letchworth, Herts and other selected Hameg distributors.

More details are available from: *Hameg Oscilloscopes Ltd, 74-78 Collingdon Street, Luton, Bedfordshire LU1 1RX Tel: (0582) 413174.*

OSCILLOSCOPE TROLLEY

A fully adjustable trolley designed to accept most modern oscilloscopes and the full Crotech range is now available from Electronic & Computer Workshop Ltd.

The trolley, model 304, manufactured by Crotech Instruments Ltd, features a table size of 42 × 30cm approximately and can be tilted over a wide range of angles for comfortable operation and viewing. The large rubber load-carrying feet absorb most vibration experienced during movement and two strong jockey wheels make it easy to place the 'scope wherever it is needed.

Other features include a strong retaining rail at the back of the table to hold the instrument even at the highest tile angle and an auxiliary shelf to carry other equipment.

The model 304 trolley is offered at a price of £123.05, including post/packaging and VAT.

For further information please contact: *Electronic & Computer Workshop Ltd, 171 Broomfield Road, Chelmsford, Essex CM1 1RY. Tel: (0245) 262149.*

DUMMY LOAD

Nevada Communications, the manufacturing division of Telecomms which deals in high quality 934MHz personal radio and cellular test equipment, has introduced a dummy load into its Professional series.

This British-made unit is intended for 934MHz/cellular applications, but should find many uses in other areas. It covers 0-3000MHz with a power handling capacity of 15W and costs £29.95 including VAT.

For further details contact: *Telecomms, 189 London Road, North End, Portsmouth, Hants. Tel: (0705) 698113*

POCKET DMM

A new pocket size digital multimeter from AB European Marketing is supplied in a plastic wallet complete with attached test probes and operating instructions.

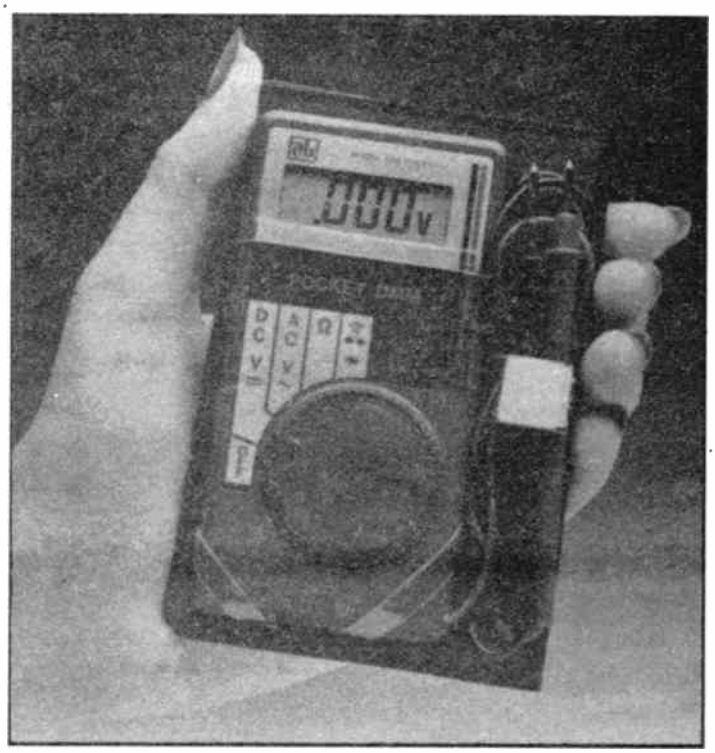
It weighs less than 80g including the two long-life LR44 button cells with which it is supplied, and measures 108 × 54 × 8mm.

The meter has a large 3½-digit display and a rotary mode selector for ac/dc voltage ranges, resistance and continuity and diode testing. It is fully autoranging in all modes.

Warning indicators show the user when the batteries are running low and which measurement mode the meter is in. An audible tone indicates a low resistance path in the continuity test mode.

The digital multimeter retails for £24.60 excluding VAT, postage and packing.

More information can be obtained by contacting: *AB European Marketing, Forest Farm Ind Estate, Whitchurch, Cardiff CF4 7YS. Tel: (0222) 618336.*



STRAIGHT & LEVEL

TOUGH METERS

Kaise distributor Eagle International has announced two new drop-proof multimeters, designed to withstand a drop of 1 metre.

The SK 300 is a 20,000 opv meter with comprehensive measuring ranges, and has an integral bench stand for convenience. As well as having a drop-proof body and movement, the SK 300 is protected by fuse/diode and has a carrying case

The SK 322 is very similar to the 300 but has extra features: 12 amp ranges on dc and ac, and a continuity test function with a buzzer. As with all Kaise equipment, these products are backed by Eagle's 2 year guarantee.

For more information contact: *Eagle International, Unit 5, Royal London Estate, 29/35 North Acton Road, London NW10 6PE. Tel: (01) 965 3222.*

MEMORY MODE DMM

Mercer Electronics has introduced the model 9370 digital multimeter. It offers autoranging or manual selection of voltage and resistance ranges, and measures up to 1000V dc (5 ranges), 750V ac (4 ranges), 10A ac and dc (2 ranges), or 2 megohms (5 high power and 4 low power ranges).

The memory mode provides up to 99 counts of zero offset. Also included is an audible continuity indication. Basic V dc accuracy is 0.5%. Low and high energy fusing are provided.

The unit is housed in a 5.9 × 2.95 × 1.34 inch high-impact case and weighs ¾lb. A 9V battery, colour-coded test leads with screw-on alligator clips and an operator's manual are also furnished. It costs $59.

Details are available from: *Mercer Electronics, 859 Dundee Avenue, Elgin, Illinois 60120, USA. Tel: (312) 697 2265.*

BENCHTOP MULTIMETER

The Fluke 37 benchtop multimeter from Electronic Brokers features the combined analogue/digital display pioneered in the Fluke 70 series along with the accuracy and input overload protection found in the Fluke 20 series.

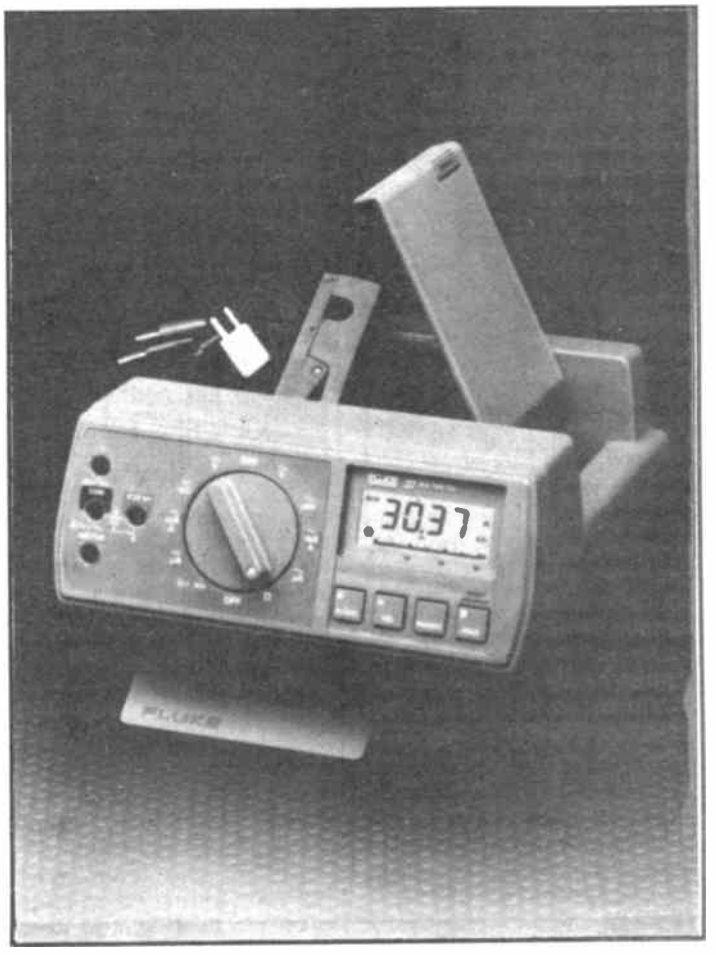
Features include an innovative case style which has been specially designed for ease of use and functionalism, either on the bench or in the field. The front panel has a 15° slope for optimum visibility and switch access, whilst a large compartment at the rear of the case enables storage of test leads and small accessories inside the meter. A built-in carrying handle allows easy portability.

The Fluke 37 is claimed to meet or exceed the specifications of any 3½-digit bench digital multimeter currently available, having a basic dc accuracy of 0.1% and a wide bandwidth ac response. Exceptional shielding against electromagnetic interference is provided by unique internal design and construction techniques.

The instrument offers many features which have never before been available on a bench meter, including min/max and relative recording modes, Fluke's 'touch hold' capability, and a combined analogue/digital display with a 3200 count resolution. Autoranging with manual range selection and a continuity/diode test beeper are also included.

Operation is from either an internal 9V battery with a typical life of 1000 hours, or from line power using an optional Fluke battery eliminator.

For more details contact: *Electronic Brokers Limited, 140-146 Camden Street, London NW1 9PB. Tel: (01) 267 7070.*



SIGNAL GENERATOR

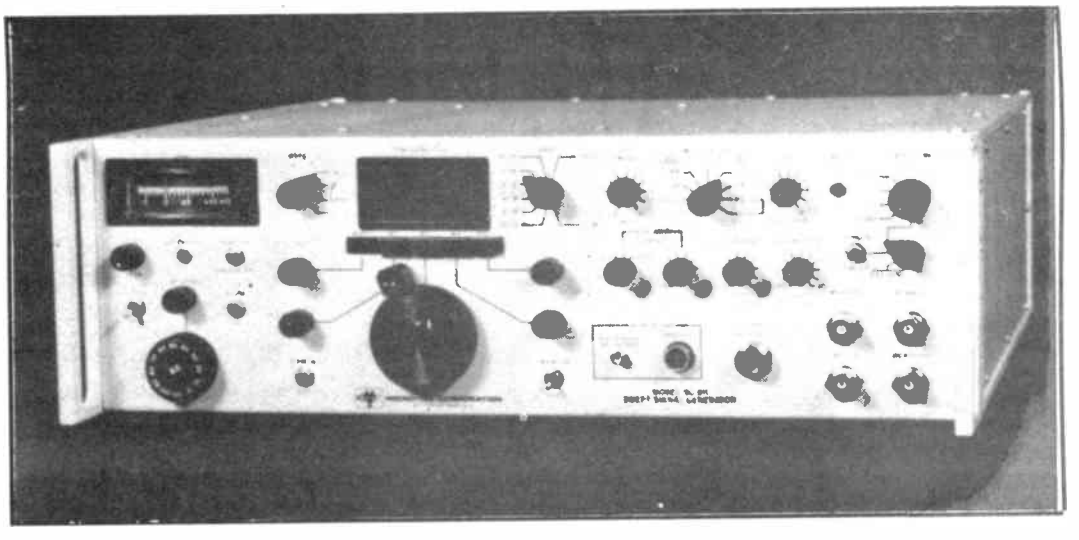
The new NATO-approved Micro-Tel SG811B microwave signal generator is designed for receiver, ECM and EW test procedures in laboratory, field and production environments.

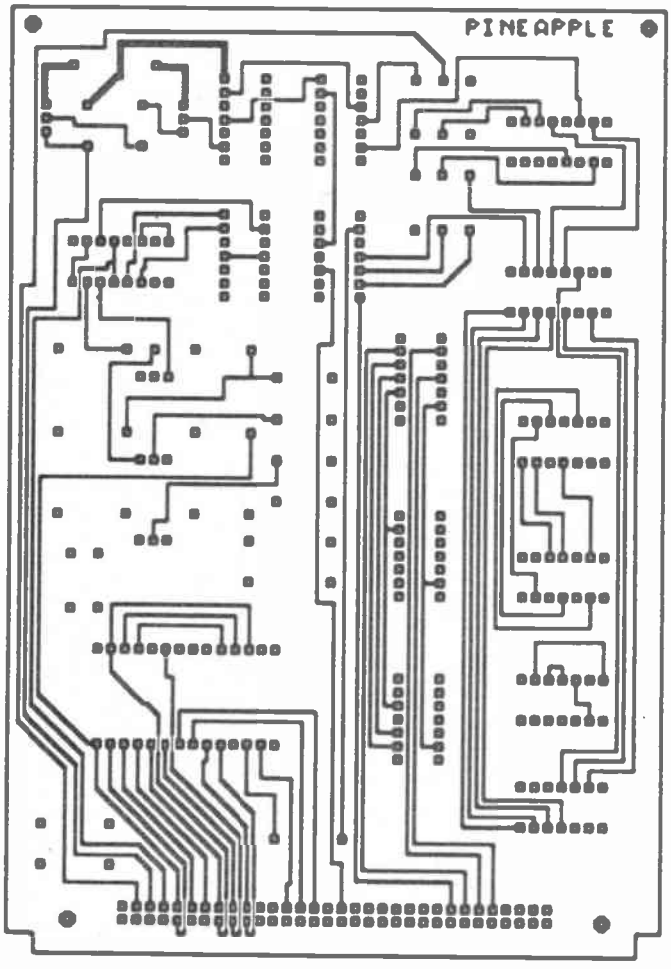
It covers the frequency range 10MHz to 18GHz, which can be increased to 40GHz with an optional extender.

Unique features are claimed to include a built-in switchable attenuator covering 1-110dB, with vernier control range of −5 to +10dB, and a tracking filter which reduces the harmonic output to below −60dBc. An integral pulse generator with an on-off ratio greater than 70dB, an adjustable delay between 0.05 and 200 milliseconds and rise and fall times of less than 20 nanoseconds, offers similar operator benefits.

Other user aids are full IEEE control; a removable RF assembly for remote operation up to 200ft to eliminate transmission line loss; and optional full synthesis control (100Hz steps).

For more details contact: *Tony Chapman Electronics Ltd, Electron House, Hemnall Street, Epping, Essex CM16 4LS. Tel: (0378) 78231/2.*





BREAKING THE MOULD

A new range of AR electronics equipment from Acoustic Research was launched at the Consumer Electronics Show in Chicago, USA.

The range comprises three frequency synthesis receivers, one CD player, an audiophile pre and power amplifier (with dynamic power circuitry), a frequency synthesis tuner and two integrated amplifiers.

All except the 40 watt receiver are controllable using a remote infra-red hand-set and VCR or Laser Vision sound signals can be routed through all models, while many also provide high-quality video and audio dubbing between VCRs.

Styled by leading American design house Gregory Fostella Associates, the new range presents a bold, uncluttered individual appearance.

The range has also been designed to cope with the extra demands made by digital compact disc, and in several models discrete electronics are used in preference to integrated circuits in order to achieve the lowest possible noise and highest possible sound quality from all sources.

All models except the X-04 receiver can be operated remotely by means of an infra-red hand-set.

The new range of electronics is the result of considerable investment by AR and will become available in the UK during October 1986.

For further information contact: *Teledyne Acoustic Research, High Street, Houghton Regis, Dunstable, Bedfordshire LU5 5QJ. Tel: (0582) 867777.*

SWEET FRUITS

Pineapple Software's 'Diagram' drawing program for the BBC micro has been available for about a year now, and with sales having passed all expectations the company has now released two new related products.

The first is a utilities disc for Diagram. Produced by one of Pineapple's customers, it offers half a dozen useful facilities, including the addition of a border around any part of the diagram, screen numbering to assist in locating a given position in a large diagram, shifting diagrams etc. It costs £10 + VAT.

Pineapple offer a free updating service for customers purchasing Diagram, and one such major update is imminent. Versions are also now available for the Master series and ADFS systems (with a Winchester drive it is possible to produce diagrams covering no less than 3800 mode 0 screens, with fast scrolling over the diagram area).

The other new product is called 'PCB'. Since many customers were using Diagram for PCB design, Pineapple have produced a dedicated program for this purpose. It is supplied on 16K EPROM for any 32K BBC micro, and will produce high quality artwork for the direct production of PCBs.

The program offers extensive component layout and track drawing facilities (with tracks in different colours for double-sided boards), and all files can be stored on disc for future use.

To use PCB, a system must include a medium resolution colour monitor and an Epson FX compatible printer with the quadruple density graphics command ESC "Z" available.

A future addition to PCB will be an auto-routing add-on which will allow intelligent auto-routing of tracks on both sides of a double-sided board. This will be supplied at a reduced cost to anyone already using the program.

For further informaton contact: *Pineapple Software, 39 Brownlea Gardens, Seven Kings, Ilford, Essex IG3 9NL. Tel: (01) 599 1476.*

TVRO Rx KIT

The Comex Systems TVRO receiver kit takes the risk out of awkward RF construction, and is described as a 'must' for the satellite and TV amateur alike.

The kit comprises a motherboard and components for mounting the RF and IF modules; the video, control and sound IF circuits; the two modules, one a tunable converter covering 950-1450MHz and the second an IF processor and wideband FM quadrature detector. The board is silkscreen printed and is simple to construct.

Comex Systems is also able to supply much of the add-on equipment, such as dishes, wideband pre-amps, F-type plugs (at least one is required for the board), scalar horns, Mitsubushi heterodyne converters and FM TV transmission equipment.

Two further add-on kits will be available very shortly, a tuning display and a tunable sound IF (making the receiver stereo).

More information is available from: *Comex Systems Ltd, Comet House, Unit 4, Bath Lane, Leicester LE3 5BF. Tel: (0533) 25084.*

FEEL THE PULSE

New from Electronic Brokers is the Thandar TG series of high specification function and pulse generators.

The TG101 function generator has a frequency range of 0.02Hz to 200Hz in five overlapping decade ranges, with an accuracy of better than ±8%. Offering sine, square and triangle waveforms, the TG101 has a variable dc offset and a 10Vpp output into a variable 600Ω load. Other features include a TTL output and an external sweep mode.

The TG102 function generator has a 0.2Hz to 2MHz frequency range in six overlapping decade ranges, with an accuracy of better than ±5%.

The external sweep mode offers a 10kΩ input impedance and a linearity of better than 1%. With sine, triangle and square wave operating modes, the generator has a 20Vpp output into a variable 50Ω load and is capable of driving up to twenty standard TTL loads.

The TG105 is a pulse generator with a 5Hz to 5MHz operating range in six overlapping decade ranges and jitter of less than 0.1%. A choice of operating modes is offered, including free-run, gated, triggered, square wave and complement. Available outputs include variable 50Ω with a typical rise/fall time of 10 nanoseconds, TTL, external trigger and manual single shot or gate.

The TG series has a range of optional accessories including carrying case, service manual and bench instrument rack.

More information is available from: *Electronic Brokers Limited, 140-146 Camden Street, London NW1 9PB. Tel: 01-267 7070.*

CLUB NEWS

Amateur Morse test

The DTI has announced that a pass in the Radio Amateur Morse Test will from now on be regarded as valid for life. Previously, where a break of over 12 months had occurred in licensed operation, or where a licence had not been obtained within 12 months of having passed a Morse test, a further test was required. This change of policy will bring into line the currency of the Morse test with that of the Radio Amateur Examination, where a pass is already valid for life.

Atlantic Challenger event

Members of the Wimbledon and District Radio Society participated in a special event station (GB2AC) to mark the successful speed record attempt by Richard Branson's Virgin Atlantic Challenger II.

The members who took part in the exercise were G1SHV, G4SBK, G4XLM and G8NCT.

The society has recently changed its meeting place. In future all club meetings will be held at St Andrew's Church Hall, Herbert Road, Wimbledon SW19. Information is available from T W Mansfield G3ESH on 01-942 1418.

College quest

The London Electronics College, which celebrates its 80th anniversary this year, intends to mark the event by setting out on an international quest to find its oldest former student.

The college, formerly known as the British School of Telegraphy founded in 1906, trained early marine radio officers using the original Marconi wireless telegraph, some 300 of its students being at sea in 1912. Harold Bride, wireless operator on the SS Titanic at the time of the tragic iceberg disaster, and Thomas Cottam on the SS Carpathia, the first ship to acknowledge the radio distress messages which saved so many lives, were both trained at the college.

Nowadays, the college specialises in professional electronics technician education, having ceased radio officer training in 1980. The nautical connection was maintained to the end as the college was amongst the sponsors of the Trans-Globe Polar Expedition, led by Sir Ranulph T-W Fiennes under the patronage of the Prince of Wales, during 1979-82. Lady Virginia Fiennes, the expedition radio operator trained at the college during one of the last marine courses.

Since its foundation the college reckons it must have trained some 5,000 students, many of whom will still be scattered over the remote parts of the world, both on land and at sea. In honour of the college's 80th birthday, a general signal 'QSO' is being sent out to all former students asking them to get in touch again. It's just possible that some of those original 1906 Marconi wireless telegraph operators will respond to the call. Present-day staff and students look forward to welcoming such visitors on a tour of inspection – just to see how much electronics has changed in the era of microcomputers and new technology.

Worked All Midlands

The Wythall Radio Club will be supporting the Worked All Midlands Clubs Award during the forthcoming months. The club callsign, G4WAC, will be active throughout this period every Tuesday night from 8pm onwards.

Tuesday night is the regular club night and visitors are most welcome. An RAE course is held every week from 7.30 to 9.00pm.

The venue is the Wythall Community Centre, Silver Street, Wythall, South Birmingham. Contact Terry G1MEE on (0546) 824705 for further details.

Field Day

The Thames Valley ARTS combined old technology with new for its 1986 National Field Day entry.

Working from the comfort of a caravan sited on G3OCP's farm, operators G3JIP and G3BPM matched their solid-state Drake TR7 to a 264ft centre fed dipole with a bank of five home-built antenna tuners switched for fast band changing and precise matching on all contest frequencies.

Details of other events can be obtained from: *V E Brand G3JNB, Hightrees, Blackdown Avenue, Pyrford, Woking, Surrey GU22 9QG.*

En vacances

Members of the Stourbridge and District ARS should note that there are no meetings in August.

The club will meet as per normal in September, however, on the first and third Mondays of the month, at the Robin Woods Centre, School Street, off Enville Street, Stourbridge, West Midlands. Meetings begin at 8.00pm.

IRTS Yearbook

We have just received the 1986/87 edition of the *Irish Radio Transmitters Society's Handbook*.

As usual a useful editorial is included, as well as club reports, information on international prefixes, the 14MHz Band Plan, a news service, and call listings.

If you are interested in joining the society, application forms are available from PO Box 462, Dublin 9.

Communications display

'Communication Across the Commonwealth' is the theme of an exhibition by the Communications and Electronics Museum at the Edinburgh College of Art during July and August 1986.

Coinciding with the Commonwealth Arts Festival and the Edinburgh Festival, the exhibition will evoke memories of commercial broadcasting techniques and services of the 1930s.

The museum was formed by bringing together the collections of two enthusiasts, Dr G Winbolt and Mr D Byrne. With support from the Portsmouth City Museum and commercial sponsors, the museum is being established to preserve historical equipment which is currently being stored in Portsmouth and catalogued and restored by an MSC Community Programme Scheme.

Mr Byrne, one of the founders of the Communications and Electronics Museum

CLUB NEWS

Hamfest '86

The Flight Refuelling ARS has organised this year's Hamfest in conjunction with the Bournmouth RAIBC. It will be held on Sunday 10 August at the Flight Refuelling Sports and Social Club Ground, Merley, Wimborne, Dorset.

This event has now become established as one of the largest on the south coast, and this year's special attraction will be a flying display of radio controlled helicopters. Other attractions will include radio stations on HF and VHF, a demonstration of satellite TV and 934MHz CB.

Saner members of the family might like to visit the craft fair or have a go on the bouncing castle.

Junk junkies will no doubt flock round the bring-and-buy stall and there will also be on-site Morse testing. This should be booked in advance through the RSGB.

There will be two special event stations on the site, one being a low power station, GB2LP, and the other the club station, GB2FRH.

For further information on this event, contact: *Ashley Hulme G0CDY, 71 Victoria Gardens, Ferndown, Wimborne, Dorset BH22 9JQ.*

Going, going, gone!

On 16 September the Rugby Amateur Transmitting Society is holding an auction of radio goodies.

To keep all you hungry hams happy there will also be a barbeque to provide sustenance, as well as trade and club stands.

The doors open at 7.30pm and admission is free. The venue is the Cricket Pavilion, 'B' Building Entrance, BTI Radio Station, A5 Trunk Road, Hillmorton, Rugby, Warwickshire CV23 0AS.

For more information contact Kevin Marriot G8TWH on (0788) 77986.

Bring-and-buy

The Verulam ARC meets at the RAF Association Headquarters, New Kent Road, off Marlborough Road, St Albans, on the second and fourth Tuesdays of the month.

The events planned for August are an activity evening on 12 August and a bring-and-buy sale on the 26th, both at 7.30 for 8.00pm.

Information is available from: *Gerry Wimpenny G4OBH, 30 Faircross Way. St Albans. Tel: (0727) 52003.*

Open day

On 9 August Birmingham based Eddystone Radio Ltd is holding an open day at its factory for members of staff and their families. A feature of the event will be an amateur radio station operating on the HF, VHF, UHF and microwave bands using the company callsign G6SL.

Sale of car boots?

The Dunstable Downs Radio Club has organised, for the third successive year, the National Amateur Radio Car Boot Sale on 21 September at the Shuttleworth Collection, Old Warden Aerodrome, Nr Biggleswade, Beds.

If your XYL or OM has been giving you ear-ache about the overflowing junk box, then this could be the opportunity you need to get rid of some of your old gear (and possibly purchase somebody else's!).

There will be over 100 stalls, as well as an aircraft and motor museum. The doors open at 10am and admission is 50p.

More details are available from: *Phil Morris G6EES, 10 Seamons Close, Dunstable, Beds LU6 3EQ. Tel: (0582) 607623.*

Anglesey special

The Holyhead and District Amateur Radio Society is planning to run a two-day special event station at the Anglesey Show on 12 and 13 August. The show will be held at Mona, Near Gwalchmai, Anglesey.

The society meets on alternate Sundays at the Foresters Arms, Kingsland Road, Holyhead at 7.30pm. Information is available from: Mrs B Anziani, 12 Beach Close, Morawelon, Holyhead, Gwynedd.

Domesday anniversary

To celebrate the 900th anniversary of the Domesday Book, the Gloucester Amateur Radio Society will be using the special event callsign GB9DB during September.

The station will commence transmission on 6 September at 1200GMT on HF and VHF. This will coincide with the opening of the Gloucester Local History Festival on the same site. QSL cards will be available from the RSGB and incoming cards should be sent either to the RSGB at Lambda House or to G4AYM.

More details can be obtained from: *Nicholas Negus G6AWT, 12 Laura Close, Longlevens, Gloucester GL2 9JH. Tel:(0452) 504515.*

TV triumph

The Borehamwood and Elstree ARS is planning to set up a special event station in association with the BBC to mark the 50th anniversary of high definition TV transmission.

The BBC started the first high definition television service on 2 November 1936 at Alexandra Palace in North London. The first programmes were viewed by probably no more than 2,000 people, a figure which had grown to 50,000 by the start of the war in 1939. In just half a century it has become the most powerful means of communication in the world.

The society will be operating SSB, CW and possibly RTTY on 2, 10, 15, 20, 40 and 80 metres, subject to propagation conditions. A special QSL card has been designed and it is hoped that many international contacts will be made.

The transmissions will begin on 20 September at 1200GMT and will continue until the following day at the same time.

Further details are available from: *Ivor Rosenberg G4XEW, 11 Parkside Drive, Edgware, Middlesex HA8 8JU.*

Quick and painless

The Southgate ARC's events for the next month or so will include an Open Evening on 14 August, and a lecture from Steve Wight on 11 September entitled 'The Quick and Painless Way to Learn CW'.

That sounds unlikely, but if you want to learn the dreaded code why not give it a try? The meetings are held at the Holy Trinity Church Hall, Green Lanes, Winchmore Hill, London N21. All meetings commence at 7.45pm.

More information can be obtained from: *Dave Elson G4YLL, 200 Churchgate Road, Cheshunt, Herts EN8 9EL.*

Morse course

The Milton Keynes & District Amateur Radio Society is holding Morse classes in two grades: the first for novices up to 12wpm and the second an advanced QSO type course to achieve speeds of up to 20wpm.

Both courses are tutored by officially appointed RSGB Morse examiners and run for 20 weeks. A charge of 60p per week (ie, £12.00) is payable in advance.

The venue is 'The Meeting Place', Hodge Lea Lane, North Milton Keynes, Bucks. Enrolment details are available from Alan G0AXF on (0908) 78804 or Stuart G1GOF on (0908) 767904.

Radio exam

Readers in the Bristol area may be interested in a course to prepare candidates for the City & Guilds Radio Amateurs' Exam in May 1987.

The venue will be Twyford House, High Street, Shirehampton, Bristol BS11 0DE, beginning on 1 October. Enrolment is by post and any enquiries should be directed to Mrs A Mitchell on (0272) 822400.

BCT RAE

The Brighton College of Technology is running an RAE course for the May exam commencing in September.

Enrolment is on 8 and 9 September between 4.00 and 8.00pm.

Further details are available from: *Mr R A Bravery G3SKI, Brighton College of Technology, Pelham Street, Brighton BN1 4FA. Tel: (0273) 685971.*

Absolute beginners

An RAE course is scheduled to begin on 16 September at Paddington College.

This course, however, is described as 'different' from most.

Not only does it cover the syllabus for the City & Guilds RAE, it also makes use of the college facilities to allow students to carry out practical experiments in the electronic theory covered.

The aim is to provide an elementary grounding in electronics as well as an amateur radio licence.

The course is pitched at the absolute beginner and in previous years the college has achieved a 90% pass rate. Attendance is required twice a week for thirty weeks.

Further details are available from the college on 01-402 6221.

L·E·T·T·E·R·S

NO INTEGRITY

Thank you for publishing the letter from Nev Kirk G3JDK (*Letters*, June).

I recently had a problem with a household name in amateur equipment. Believing the company to be the sole importer of an American antenna which I wanted to buy, I wrote no less than four times during a twelve month period, on each occasion enclosing a self-addressed and franked envelope.

My next step was to appeal to the advertising manager of the magazine carrying the advertisement, suggesting that readers should be alerted to the treatment likely to be received from this particular advertiser.

The first reply was to indicate that it was 'a little premature to suppose that this company is no longer involved in the mail order business'. When I protested that I was really complaining about discourteous treatment, the advertising manager then suggested I try telephoning!

The magazine was *Radio Communications*– it is little wonder that the RSGB is currently appealing for increased membership.

K A Fillmore GI4IBD, Belfast

OSCILLOSCOPES

Having read the book review, *Oscilloscopes*, in July's issue, it struck me that there must be a fair number of newer enthusiasts who are not aware of some of the very useful and informative publications of the sixties and seventies, all well out of print. I would suggest to anyone with an interest in home-brewing and experimenting that a visit to the local library could be productive.

Authors of this period who wrote very useful books were Robert G Middleton, who had a very worth-while series published by Foulsham-Sams around 1964 (eg, *101 ways to use your oscilloscope*); Thomas M Adams, who wrote the excellent *Basic Electronics* series, also from Foulsham-Sams, 1963; Rufus P Turner, same period and publisher; George Zwick, author of *The Oscilloscope* published by Foulsham-Tab in 1974; and W E Miller, who wrote *The Cathode-Ray Oscilloscope*.

I hope this information has been of some use to anyone interested in the home-brew side of our hobby.

Mike Shepherd G8YZW, Essex

DEMOCRACY?

G3OUF replied well to what G6JNS had to say (*Letters*, July), but this still doesn't mean that the RSGB is perfect.

Everybody is complaining about how crowded 2m is, and changing to 12.5kHz (which many rigs are incapable of) is a pain. So why didn't the RSGB apply for another amateur band at 220-222MHz (?) when the DTI asked for applications for allocations?

Surely 17dBW of FM only on the band would relieve 2m and not cause much interference? Everyone wants to relieve the pressure on 2m except the RSGB, it seems.

'We lead Europe', the RSGB claimed after getting an allocation on 6m. If that's the case, why don't you (at the RSGB) get off your backsides and apply for another VHF allocation to take the pressure off 2m, or is the RSGB content with sitting on its laurels?

Also, what sort of democratic society plans to put forward proposals to change the vote needed to remove a chairman from 50% to 66%? Is rule of the minority democratic?

M Zatman G0CNO (a member)

WEIGHTED VOTING

Has gerrymandering replaced democracy in the RSGB?

I refer to the minutes of the December 1985 AGM as published in the May 1986 issue of *RadCom*.

The colossal number of proxy votes held by members of council begs the question as to whether the AGM is a total farce. The 1985 President alone had enough proxy votes to hold sway over any decision that the AGM may have made.

It is time that the AGM was turned over to a representative forum for discussing questions of today, and not for prolonging the ideas of yesterday.

The leadership of our hobby do themselves no credit in adopting these tactics of massive overkill to protect their position; they do so at the cost of moving the amateur service into the twenty-first century. I do not doubt that their motives are honest, it's just that I feel they are not listening to enough grass roots opinion concerning very basic principles.

The high road to Hades is paved with good intentions; good intentions are not enough.

Keith Killigrew G6DZH, Worcs

SUCCESS!

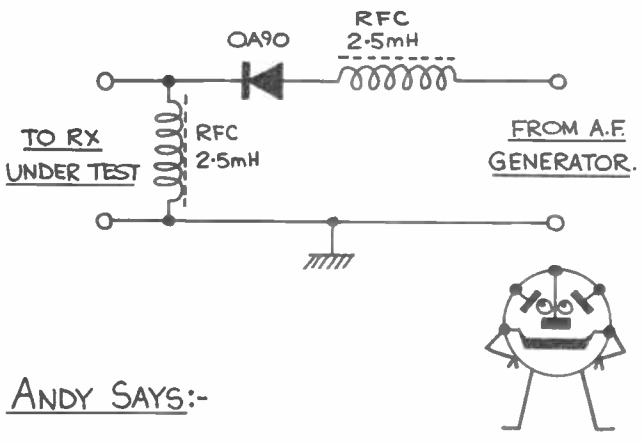
Many thanks for the success of my advert in the May number for a Realistic DX200. I arranged to send it to an amateur from Burgess Hill, near Brighton. It was a rush job; the client had to receive it before 26 May as he was going to Guyana in South America and wanted to take it with him.

I sent the set on the 23rd and received his letter and cash on the 24th, with a request to write to him in Guyana. I have sent him an airmail letter but as yet have received no reply. I hope all went well.

J W Heath, Staffs

We would like to point out that the views expressed in this column are not necessarily those of *Amateur Radio* magazine. The Editor reserves the right to shorten letters where necessary.

ANDY TIPPS by Deejay



ANDY SAYS:-

"HERE'S A USEFUL GADGET FOR TESTING RECEIVERS IF YOU DON'T HAVE ACCESS TO AN R.F. SIGNAL GENERATOR. JUST CONNECT THIS HARMONIC GENERATOR BETWEEN AN A.F. GENERATOR AND THE RECEIVER UNDER TEST. THE OA90 DIODE RECTIFIES THE AUDIO, PRODUCING HARMONICS THROUGH A GOOD PORTION OF THE RADIO SPECTRUM"

TWO FOR THE ROAD.

The very latest IC-28E 2m. FM mini-mobile from ICOM.

This new 2 metre band transceiver is just 140mm (W) x 50mm (H) x 133mm (D) and will fit nearly anywhere in your vehicle or shack. Power output is 25 watts or 5 watts low power and is supplied complete with an internal loudspeaker

The large front panel LCD readout is designed for wide angle viewing with an automatic dimmer circuit to control the back lighting of the display for day or night operation

The front layout is very simple, all the controls are easy to select making mobile operation safe The IC-28E contains 21 memory channels with duplex and memory skip functions. All memories and frequencies can be scanned by using the HM-15 microphone provided Also available is the IC-28H with the same features but with a 45 watt output power

Options include IC-PS45 13 8v 8A power supply, SP8 and SP10 external speakers, HS15 flexible mobile microphone and PTT switchbox

→» Rx Range 138-174 MHz.«←

IC-290D/490E Mobiles

These SSB CW FM transceivers are ideal for mobile or base station operation The IC-290D for 2 metres produces 25 watts/5 watts low power The IC-490E for 70 centimetres produces 10 watts/ 1 watt low power Both transceivers have a range of operating features, these include 5 memory channels, dual V F O 's and a priority channel to automatically check your most used frequency Squelch on FM and SSB to allow silent scanning whilst searching for signals, slow or fast AGC for SSB and CW and a noise blanker to suppress pulse type QRM. Sidetone is provided on CW

Memory and full or programmable band scan with internal switches to stop on busy or empty channels Programmable offsets are included for odd frequency splits

Options include IC-PS45 13 8v 8A power supply IC-BU1 memory back up battery unit, IC-SP8 and SP10 mobile speakers

British TELECOM Callmat

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Tha

ICOM

The ICOM Control System

If you have a BBC Micro (Model B) or Commodore 64 or 128 the ICOM control system can control up to four (or more) ICOM radios in the range IC-751 735 R71 R7000 271 471 and 1271 (and 745 with modification) The help menu shows the available functions

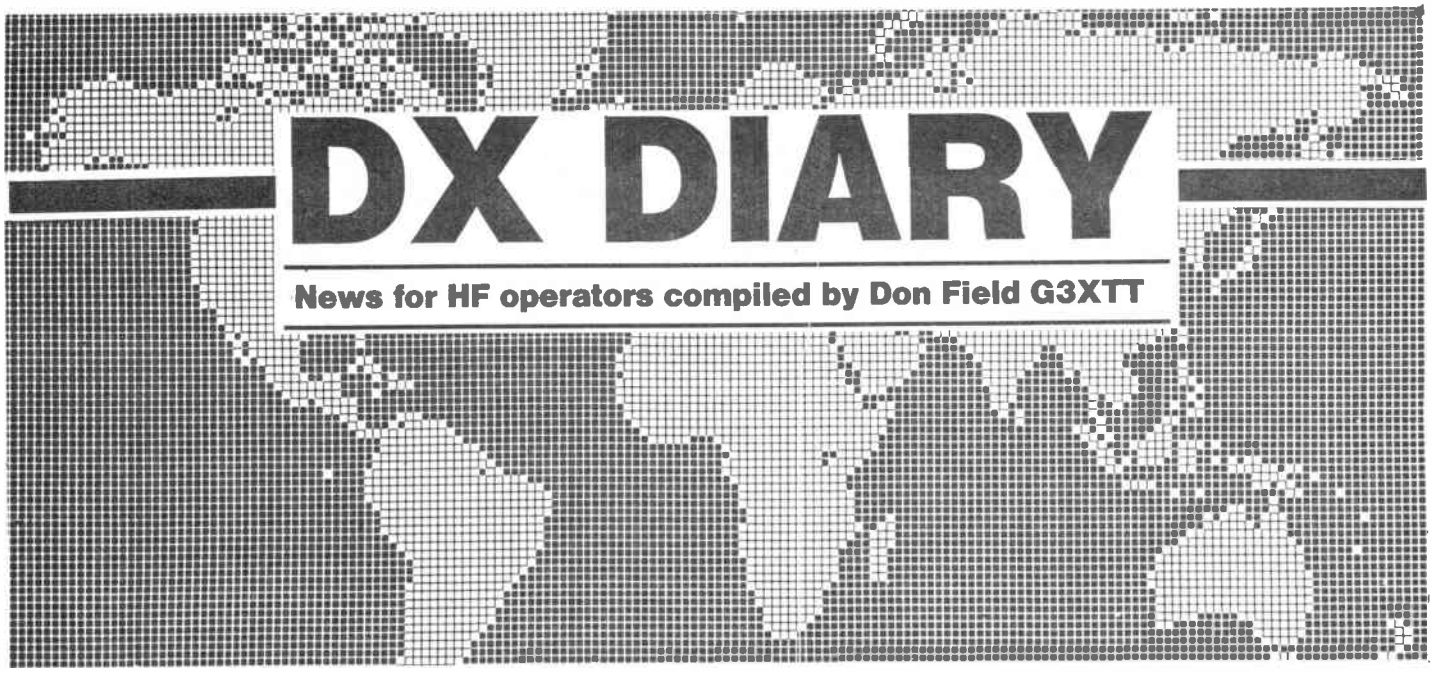
	H = HELP	↔	Frequency Steps
F0	Frequency	↑ V	Up/Down (arrows)
F1	Select Mode	M	Memory Channel
F2	Freq/Memory Scan	.	Memory Up/Down
F3	Mode Scan	/	VFO/Memory
F4	VFO → Memory	B	Bargraph Select
F5	Memory Write	"	Occupancy On/Off
F6	Memory Clear		Scan Stop Off/On
F7	Set 'SIG' Level	S	Change Set
F8	Memory File Read	DEL	Speech (If fitted)
F9	Memory File Write	Q	Quit

IC-735, The Compact HF Radio

The new ICOM IC-735 is ideal for mobile portable or base station operation. It has a general coverage receiver from 0.1MHz to 30MHz and transmits on all amateur bands from 160m to 10m. SSB, CW, AM and FM modes are included as standard. RTTY and Amtor are also possible. The IC-735 has a built-in receiver attenuator, pre-amp, noise blanker and RIT to enhance receiver performance. A 105dB dynamic range with pass band tuning and a sharp I.F. notch filter for superior reception. The twin VFO's and 12 memories can store mode and frequency. The HM12 scanning mic is supplied. Scanning functions include programme scan, memory scan and frequency scan.
The IC-735 is one of the first H.F. transceivers to use a liquid crystal display which is easily visible under difficult conditions. Controls that require rare adjustment are placed behind the front panel hatch cover but are immediately accessible. Computer remote control is possible via the RS-232 jack. Output power can be adjusted from 10 to 100 watts with 100% duty cycle. A new line of accessories are available, including the AT150 electronic automatic antenna tuner and the PS55 AC power supply. The IC-735 is also compatible with most of ICOM's existing line of HF accessories. See the IC-735 at your authorised ICOM dealer or contact Thanet Electronics Limited

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet Electronics

Sea Street, Herne Bay, Kent CT6 8LD
Tel: (0227) 363859
Dept. AR



DX DIARY

News for HF operators compiled by Don Field G3XTT

I write this piece while the 3COA expedition is active from Annobon Island. Unfortunately news of this one arrived too late for inclusion in the July *DX Diary*, but the group of Gabonese amateurs who put it on the air were due to be there for about 2 weeks so I hope you ran across them if you needed to. At the time of writing they have already been worked in the UK on all five of the principal HF bands, generating lots of interest because there has been no operation from this remote spot since January 1982.

Bad manners

Unfortunately, though, a rare expedition always brings out the worst manners. While I write this the rig is on in the background, tuned to the expedition frequency on 40 metres. Despite efforts by the expedition operators to pull specific calls out of the pile-up ('The station with Alpha Bravo in the call, please call again, etc), many European stations continue to call and call without any regard to requests for the pile-up to stand by.

It used to be said that it was the East European amateurs who misbehaved in this way, but I am hearing stations in Finland, Spain, France, Italy and, yes, the UK who are persistently calling out of turn.

It has, of course, been said that all is fair in love and war, but amateur radio should be neither. It is a sad reflection on at least some adherents of our hobby when people behave in this way. From my own experiences as a DXpedition operator I am convinced that European operators are much worse than our American cousins in their manners on the air, and I have yet to hear a Japanese amateur call out of turn.

The plus side

However, enough of this. Fortunately our hobby has its plus side as well, and DXing can be, and usually is, a thoroughly enjoyable experience. One of particular interest to appear on the bands during June was VR6NP from Henderson Island in the Pacific. This was Nick G4TAW, who is with the Sir Walter Raleigh expedition ship which I have mentioned from time to time in this column.

Another member of the group operated with the unusual callsign VR6HIJL. Both were worked in the UK on 20 metres, with openings both around midnight and again soon after dawn. They were also worked one morning on 40 metres.

Talking about islands, Bob Nash of Worked All Britain has written to me about the WAB Islands Award, of which I gave details in last December's column. This award has already attracted a lot of interest, particularly as a result of the valiant efforts by several WAB enthusiasts to activate the various islands.

Jim Johnston GI4MKC, with the help of a friendly, boat-owning neighbour, has activated many islands in Antrim, Down, and Strathclyde, while Nina and Randolph Webster, GM4RXW and GM3MOR, have activated numerous islands off the west coast of Scotland. So far, the leading scorer is John Brindle G0DVT, who has already worked over 70 islands.

If you are interested in this WAB award it is worth keeping an ear to the WAB net frequency on 80 metres (3760kHz). The Cambridge University Wireless Society has tentative plans to activate some of the Scottish islands during the summer vacation, and GW4OFQ was due to operate from St Tudwal's Island off the Welsh coast during the weekend of 25/26 July.

Islands galore

Looking farther afield at islands which count for the RSGB Islands on the Air Award, several operations are due in late July and during August. These include Ouessant Island by F2TO/P from 31 July to 27 August (check 7050-60kHz at 0900GMT and 14110-115kHz at 1830 and 2200GMT); Ile Planier by F5TV/P until 31 July (check 7080kHz at 1100GMT); Ile aux Chevaux by F6BNQ on 25/26 July; Ile de Batz by FD1HVQ from 8-16 August using the callsign FV6NDX; the Noirmoitier Group by F6HMV/P until 30 July; the Belle Islands by F6BNQ and F6FWW from 28-31 July; the Westman Islands by TF1PS during the last week of July; and Vikna Island by LA9PX from 15-17 August.

The predominance of French expeditions is because the French have their own islands award now so, as with the WAB award, there is lots of newly inspired enthusiasm.

Other DX

If it's country chasing which turns you on, the prospects for August are less rosy, but there are some interesting ones due to appear. Probably the best is HS0C, to be activated by Japan's UNICEF ham club from 27 July to 2 August. There is talk of them visiting Bangladesh and Nepal as well, but operation from the first of these at least is very unlikely.

The re-issuing of individual licences in Thailand still seems to be some way off, but the HS0A club station should continue to be active in the major contests. They showed up in the All Asia SSB Contest in June and are likely to be on in the CW leg which takes place over the weekend of 23/24 August. The SEAnet (South East Asia net) SSB contest takes place over 16/17 August, so they may also show up in that one.

Much nearer to home, GB6OC will be operational from the Birmingham Superprix sports event on 24/25 August, helping to publicise Birmingham's bid to host the 1992 Olympic Games. This station was also due to be operational on other sporting occasions over the summer period.

Mike Smedal, ex-A71AD, is currently active from Cyprus as 5B4TI. His A7 logs, which were confiscated when he left Qatar, have now been returned to him, so if you still need a QSL it is worth dropping Mike a line at PO Box 7121, Nicosia, Cyprus.

Activity from the British Sovereign Bases (ZC4) is still relatively low, partly because

licences are only issued to personnel who have been resident on the island for at least 6 months. Nevertheless ZC4CZ and one or two others are making a valiant effort to meet demand for what has now become quite a rare one.

I worked HG5A on 160 metres on 15 June. The operator, Peter HA5KDQ, told me that several HA stations now have 60 metre permits, with a 10 watt power limitation. I was also fortunate enough to work Z21EV on 160 the same night. Chris is frequently on the band from about 0130GMT, and at times his signal can be surprisingly loud. Unfortunately it is only on rare occasions that he can hear Europeans calling him due to high atmospheric noise level at his end.

Home again

Both 9U5JB and ZL8OY are now QRT, having left their respective countries. It could well be some time before either of these countries reappear on the bands.

DF8AN/3A was due to be operational from Monaco until 31 July on 80-10 metres, both CW and SSB. Another German, DF2UU, was due to be active from Malta as 9H3DX until 31 July.

Ross WB6GFJ, is on what seems to have become his annual trip to Tahiti, and will be operational as FO0FB until 11 August. In previous years he has been worked on 20 metres SSB in the mornings (check 14145 and 14180kHz in particular). He is hoping to activate Takaroa Island during this trip for the benefit of IOTA enthusiasts. The new prefixes for residents of Tahiti were due to come into effect on 1 July.

These are FO4 and FO5. Don't be surprised, though, if you continue to hear FO8 stations on the bands.

DX nets

It is relatively straightforward to track down a DXpedition station because they usually operate on the popular DXpedition frequencies and are active round the clock. Finding that one and only resident operator in a remote spot can, however, be like looking for a needle in a haystack. Some, though, like to check into the various DX nets which run on a regular basis. Working DX this way is frowned upon by many DXers, but if you are new to the DXing game it can be an easy way of getting your toes wet.

The idea is to call in at the beginning of the net to the Master of Ceremonies (he will often take call-ins country by country, so wait until he asks for G stations). Once he has a list of who is on frequency he will give each one the opportunity to make at least one call to one of the DX stations in the net. This way you get the chance to call without having to fight it out with the 'big guns'.

DX nets have a bad reputation because sometimes the MC is inclined to 'help' the QSO along by passing across callsigns and reports. This obviously makes a mockery of the whole thing. Some of the long-established nets, though, are well run and are worth checking into from time to time. *Table 1* shows some of the best known nets as far as European DXers are concerned. There are many more specialised ones for IOTA chasers, US county chasers, WAB square hunters, Top Band enthusiasts, and so on.

As a final point, before calling in to a net it is always worth listening to it on a couple of occasions first, to see just how the MC likes to run things. This way you are least likely to upset anybody!

Some well-known DX nets

DK9KE net	1100GMT	12155kHz	Daily
'220' net	0500/0600GMT	14220kHz	Daily
Round Table	1700GMT	14175kHz	Daily
ZL2AAG	0700GMT	7085kHz	Sun-Thur
Rare Russian	0400GMT	7045kHz	Fri/Sat/Sun

Table 1

Standard frequency and time transmissions

WWV	Fort Collins, Colorado	2.5, 5, 10, 15, 20MHz
WWVH	Maui, Hawaii	2.5, 5, 10, 15, 20MHz
JJY	Tokyo, Japan	2.5, 5, 8, 10, 15MHz
CHU	Ottawa, Ontario	3.33, 7.335, 14.670MHz
VNG	Lyndhurst, Australia	5.425, 7.515, 12.005MHz
OLB5	Czechoslovakia	3.170MHz
VWC	Calcutta, India	12.744MHz
DAO	German Hydro Institute	2.775, 12.763MHz

Table 2

Time beacons

Many readers will be familiar with the standard time and frequency transmissions which originate from Rugby. There are others around the world which you might like to know about, if only because they give a rough idea of propagation at any given time. Several of them fall within the frequency coverage of an amateur bands only rig, though to hear all of them you will need a general coverage receiver of some sort. The list appears in *Table 2*.

Awards

Details this month of a couple of home-grown awards. Firstly, the Worked All GJ Award. This requires contacts with each of Jersey's twelve parishes (St Helier, St Peter, St Saviour, St Martin, St John, St Lawrence, St Mary, St Brelade, St Ouen, St Clement, Grouville and Trinity). Contacts with visiting stations or with portable or mobile stations do not count. One of the contacts must be with GJ3DVC, the club station. This is the one exception to the no-portable rule, in that GJ3DVC/P is also acceptable.

The application should take the form of a log extract signed by the applicant and countersigned by a club official. The log extract should contain callsign, operator's name, name of parish, time, frequency, mode and signal report. The award is also available to listeners. Applications, with 10 IRCs or equivalent (English postage stamps are not valid in Jersey) go to the Awards Manager, Jersey Amateur Radio Society, PO Box 338, Jersey, Channel Islands.

Secondly, the Stourbridge & District Amateur Radio Society issues the STARS Award. The aim is to obtain 8 points as follows: 2 points for contacts with the club calls G6OI and G6SRS, and special event call GB6OI, and one point for club members (G4CVK, G4IEB, G4XOM and G0AGH are the most active).

An active bunch

At least one of the club stations must be worked. The club will be active during the YO DX Contest on 2/3 August, the RSGB SSB Field Day on 6/7 September, the SAC SSB Contest on 27/28 September, the WA-Y2 Contest on 18/19 October and the OK-DX Contest on 9 November. Log details, certified by two licensed amateurs, should be sent to the awards manager, G6VAT, together with the £1.25 fee. There are no restrictions on band or mode, but all contacts must have been made since 1 August 1984.

Contests

So, finally, to contests for August. A major one is the DARC European CW Contest on 9/10 August, a 48-hour event in which European stations work non-Europeans. The rules are complex because they allow additional points for passing log data to stations worked. I should be able to help with a photocopy of the rules if you are keen to put in an entry. Even if you don't propose taking it seriously, though, this is a good opportunity to work some interesting CW DX.

I have already made reference to the SEAnet Contest on 16/17 August and the All Asia CW Contest on 23/24 August. Both of these are 48-hour events, although UK stations will find long periods during which they have no propagation to the relevant parts of the world.

Apart from the above, there are several smaller events in the timetable. These include the New Mexico and New Jersey QSO Parties on 16/18 August, the YO-DX Contest on 2/3 August and the LZ DX Contest on 6 September.

All of which means there is plenty of opportunity to keep busy. I was interested to read just recently in the Canadian *Long-Skip* magazine a profile of HA5DW. Lajos is 29 years old and has been licensed since 1969. In 1984 alone he made 50,000 QSOs! I wonder how many *Amateur Radio* readers make even a tenth of that number in a year?

Do drop me a line with news of your activity. My address, once again, is 105 Shiplake Bottom, Peppard Common, Henley on Thames RG9 5HJ.

BALANCED FEEDERS AND BALUNS

RESONANT OR NON-RESONANT ANTENNAS

by V J Copley-May G3AAG

Before examining baluns (balance to unbalance transformers) in any great depth, it might be a good idea to explain why these simple devices are necessary at all.

The majority of today's black box antenna tuning units are based upon the simple T circuit described by Dave Maxwell W2DU (see *Figure 1*). Over the years, however, there have been a number of variations of this circuit (see *Figures 2a* and *2b*). Broadly speaking, these variations have claimed improved antenna matching and, more particularly, better harmonic suppression.

The circuit of *Figure 2a* dates back to 1961 and was described by Lew McCoy W1ICP, who called it the 'Ultimate Transmatch'. Transmatch is an abbreviation for transmitter matching device. The circuit of *Figure 2b*, developed by Doug DeMaw W1FB, was called the SPC transmatch (Series Parallel Capacitor). Doug's design rightly claimed a substantial increase in harmonic attenuation.

The arguments for and against the three circuits have raged over the years, many of the protagonists supporting their claims with sophisticated laboratory experiments.

Pen to paper

As recently as February 1986 (CQ) Lew MacCoy put pen to paper and admitted that his circuit did not require the dual capacitor at the input, as had been pointed out by Dave Maxwell. Lew said, 'I consider the argument for improved harmonic attenuation to be ridiculous for a very simple reason. The FCC long ago passed a rule that all transmitters must have 40dB harmonic attenuation of all harmonics in the final amplifier stage. That is the case today, so harmonic attenuation arguments so far as transmatches are concerned are ridiculous'.

Had I been discussing transmatches some thirty or forty years ago, when the majority of transmitters were home-brewed, I would have taken quite a different line and talked about link coupling and Faraday screens, etc. Today, I am in the same situation as the majority of HF operators. I use a black box, and nothing would induce me to poke around the inside.

Satisfaction

I am satisfied, and it has been amply proven in practice, that the manufacturers have dealt with harmonic suppression in the transceiver. As a matter of course all black box manufacturers quote spurious signals as better than −40dB. When reviewing the TS930 and TS940 in *Radio Communication* in May 1986, Peter Hart G3SJX quoted measurements of at least −48dB (at best −59dB) for harmonic suppression. Generally speaking, it is the fundamental which causes TVI or trouble with VCRs, and not harmonics.

Many newly licensed class A operators have fallen upon the G5RV as a simple solution to their antenna problems and, indeed, many old-timers fall back on it as a standby. Far be it for me to criticise Louis Varney's design, which in its day was a simple answer to the all-band antenna problem.

Many newcomers, however, are unaware that this antenna in its original form was nothing more than a 102 foot top-fed with open wire feeder of critical length. Louis Varney was able to show that on all the bands then in use such a design provided an acceptable match.

Of course, we have since been allocated additional bands upon which the original design will not work. A later version of the G5RV included a section of coaxial cable added on for use with transmitters or ATUs which did not have balanced outputs. This coaxial addition was again of critical length.

The snag, if there is one, is that the antenna and feed lines were frequency critical and there was nothing you could do by adding an ATU between the transceiver and the coaxial feeder to correct a mismatch where the ribbon feeder met the co-ax. The only thing you could be reasonably sure of was that it was possible to tune out the mismatch at the bottom of the co-ax so, at least, the transceiver was looking into a non-reactive load of 50 ohms.

If you were to use the G5RV at frequencies for which it was not critically cut (its resonant frequencies) then there would be mismatches and the feeder would radiate. The radiation pattern would be upset. These mismatches would be particularly evident on 10m and 80m where the bandwidths are wide.

Whether the G5RV is a good all-band antenna will depend upon a number of factors concerned with height, slope, frequencies, etc. With a number of installations where it proves necessary to droop the ends it is almost impossible to acquire the good matching properties which Louis Varney showed were achievable. I've mentioned adding an ATU to overcome these problems, and it would indeed do just that so far as the transceiver is concerned, but this still leaves the feeders with mismatches.

Why a resonant antenna?

Figures 3a and *3b* show two centre-fed long wire antennas fed by ATUs. What is immediately apparent is that the 'system', as shown in *Figure 3a*, has a number of constraints. Firstly, the length of the

Fig 1

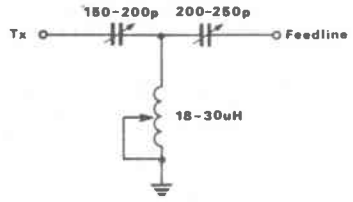


Fig 2a

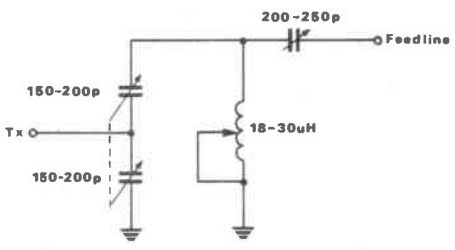
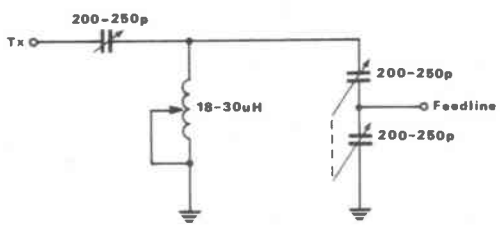


Fig 2b



flat top is critical and may not fit into your back yard. The length of the ribbon as well as the co-ax is also critical and may be inconvenient. We also have a matching point at the junction of the ribbon and co-ax and there may or may not be a good match at this point depending upon the sighting of the flat top, the slope and the transmission frequency.

Mismatch

Remember that the electrical length of the flat top will not be 102 feet. Its electrical length is influenced by a number of factors: height, closeness of buildings and other antennas, slope, wire diameter, etc. If you are at the wrong end of the 80 metre band for which your G5RV is resonant, your SWR (Standing Wave Ratio) could be as high as 8:1 and the ATU has to adjust for this mismatch.

That's all very well, but you may now have 68 feet or so of co-ax on which you have an SWR of 8:1 and it's unbalanced. This means you are going to have a power loss which is logarithmically proportional to length. Let's assume you are using RG58/U. The loss on 80m will be less than 1dB which really does not matter, but a similar SWR on 10m will give you a loss of around 2.5dB and that is serious. But worst of all, and this applies to both 10m and 80m, the co-ax and ribbon are unbalanced and will radiate power which should be going out of the flat top. Furthermore, the radiation pattern of the flat top will be spoilt.

No matching problems

Now look at the system depicted in *Figure 3b*. This system does not raise any of the matching problems or give trouble from feeder radiation. This is a non-resonant antenna. At least, of course, it must be resonant at some frequency and there is nothing to stop you making it resonant at a particular frequency so that you have a radiation pattern which puts a lobe on a bearing you particularly want.

There is no sensible argument in favour of a resonant antenna. The fact of the matter is that an antenna of this type does not have to be resonant to be an efficient radiator. The purist will say, 'Ah! But if it's not resonant then you will be upsetting the radiation pattern.' So what? How many of us have the choice to select the orientation of the flat top or even ensure that it is flat and at the correct height? The average suburban back garden runs one way or another and is seldom round. So, if we want to put up as much wire as possible so that we have an efficient radiator, it has to be orientated in a direction dictated by the topography, and not where we ourselves want to put lobes.

Remembering this, there can be very little to say in favour of a resonant antenna crammed awkwardly into a confined space. I must emphasise that we are talking of multiband wires.

The exception, perhaps, is if you are interested in getting a lobe pointing in a particular direction on one band. If this is so, why bother with an all-band antenna?

Forget it

My advice would be to forget the G5RV with its limitations and go for a non-resonant antenna fed with open wire line. Put up as much wire as possible, as high as possible, and do not droop the ends. Cut it at the exact centre and connect to any convenient length of open wire feeder, making sure that the feeder falls away from the centre at right angles to the top as far as possible, preferably by a quarter wave on the lowest band upon which you are likely to be seeking best performance.

Even without this stipulation it is going to work pretty well. You will not need to match the centre. The feeder is not going to radiate on any frequency you select since it is balanced. Currents on one leg are equal to the currents on the other leg at any position in the feeder, and thus cancel each other out.

Balance

We have now come full circle. It is important to remember that what you are looking at in *Figure 3b* is a non-resonant antenna operating in a system which is resonant overall. The only part of the system which radiates your signal is the flat top and that is what you want.

We have eliminated most of the problems which face a G5RV user with limited space but have also introduced a new one, the solution to which just couldn't be simpler. Assuming you have no desire to construct your own ATU with a balanced output (shame on you!) you will want to use your black box ATU, which does not have a balanced output. They seldom do.

Enter the balun, a simple device to construct, which will provide your black box with a balanced output. Should you wish to have this balun inside the box and cut the box about (with consequent warranty problems) you may have to resort to winding it on a ferrite rod or ring so that it is small enough to go in the box. You will then have to find a ferrite ring with sufficient permeability (around 40) and that's not easy.

Rings found at rallies are often manufacturers' surplus, and made to all sorts of specifications. You might find a nice fat one, only to discover that they are normally used at domestic supply frequencies and will be extremely lossy in HF applications. You are also going to get core saturation problems. Therefore, choose a balun which is virtually air cored.

The balun is a transformer even if it has a 1:1 ratio. As such it will transform one

Fig 3a

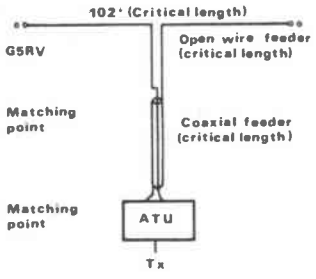


Fig 3b

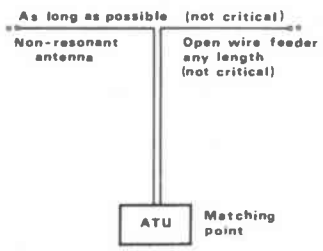


Fig 4 *4:1 balun*

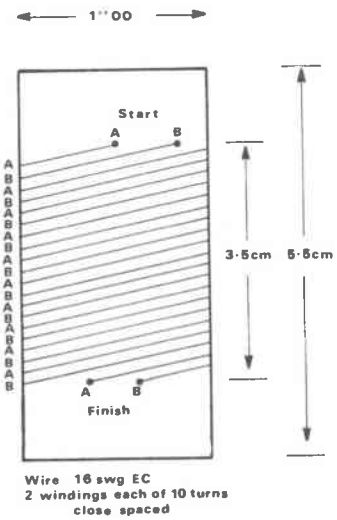
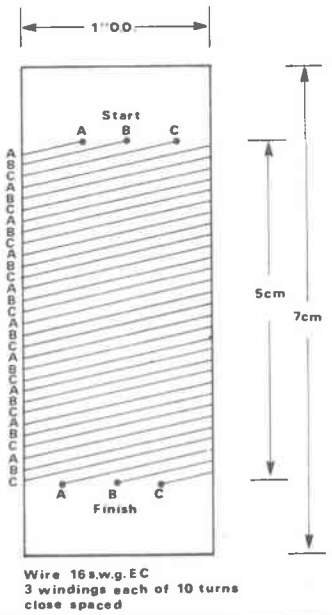


Fig 5 *1:1 balun*



impedance Z_i to another impedance Z_o, where $Z_i=Z_o$. It may be desirable to introduce some transformation ratio other than 1:1 in the balun to suit your ATU. I would recommend that you make up both described here and connect up whichever gives you the best results. This will depend upon your feeder length, but you don't really have to calculate anything. In most cases the 4:1 will be the most useful.

Here goes . . .

Figure 4 shows the construction of a 4:1 balun which will stay cool at 1kW PEP. *Figure 5* shows a similar balun designed for a ratio of 1:1 (note that this is more complicated). Nonetheless both can be made by anyone without any difficulty. I have a blind friend who has made several.

Take a length of 1in OD PVC water pipe (the white one) and cut off about 30 centimetres. Mark the centre. Drill three holes around the circumference about a quarter of an inch apart and either side of your centre line. These should be 5cm apart (2.5 each side of centre) for the 1:1 balun and 3.5cm apart for the 4:1 balun. The drilled holes should just allow you to pass 16swg enamelled copper wire through them.

Now take two or three lengths of the 16swg EC wire (two for a 4:1 and three for a 1:1). The lengths should be about four feet long; no more is necessary. Grip the ends of these wires close together in a vice and pull the free end with a pair of pliers, so that the wires are taut and haven't any kinks or bends.

Now insert the free ends in the holes on one side of the centre line of your 'former'. Holding each end of the former, wind the wires close spaced onto it, keeping them taut at all times.

You must wind on ten turns for each wire. If you are making a 4:1 balun you will now have 20 turns on the former, but if it is a 1:1 you will have 30 turns consisting of three separate windings. Gripping the free ends so that they do not uncoil, release the vice and feed the new free ends through the remaining holes in the former.

Bend the wires back into the former so that they do not slip. Now cut off the surplus tube so that the overall length of the former is about 7cm. Liberally apply PVC cement over the holes and allow to set. At this stage it is important to identify the individual coil wires and for this it is safer to use a continuity meter than to rely on the naked eye. Using sticky tape, label the wire ends A Start, A Finish, B Start, B Finish, etc.

Table 1 shows how you must connect the windings to complete your 1:1 or 4:1 balun.

With a short PL259 female to female coupler, connect your balun to the coaxial output of the ATU and the two free wires to your open wire feeder and you're away. Tune up and work DX. If you are fussy, box the balun in a metal enclosure, perhaps a biscuit tin, but make sure than no part of the coil is less than 1in from your coils.

	1:1 balun	4:1 balun
Wire ends	**Connect to:**	**Connect to:**
A Start	Outer of PL259 plug	Centre of PL259 plug *and* one side of balanced feeder
B Start	C Finish *and* one side of open wire feeder	A Finish *and* outer of PL259 plug
C Start	Centre of PL259 plug	None
A Finish	Other end of open wire feeder	Outer of PL259 plug
B Finish	Outer of PL259 plug	Other end of balanced feeder
C Finish	B Start	None

JUST PUBLISHED

3rd EDITION OF

U.K. LISTENERS CONFIDENTIAL FREQUENCY LIST

50% LARGER, SMARTLY BOUND with semi-stiff cover.

Completely revised:- Now includes lots more information on MILITARY, CIVIL, AIR, MARITIME, PRESS BULLETINS, RTTY etc.

£5.95 +p·p 75p

4 PUBLICATIONS YOU SHOULDN'T BE WITHOUT!

UK LISTENERS CONFIDENTIAL FREQUENCY LIST NEW EDITION

This publication has now sold well over 2500 copies since it was advertised only a few months ago. Now the recent updated version is selling even better. No self respecting listener should be without a copy. If you enjoy exploring the short wave bands then this publication will add to your enjoyment. It covers the hf spectrum from 2 to 30 mHz and gives details of transmissions outside the amateur bands. Specially designed for the UK and European listener it sets out in a very easy way a comprehensive list of hundreds of interesting transmissions that will keep you occupied for days on end! Only a fraction of the cost of other similar publications it contains details of Marine, Air, Military, Embassy, Press and News agencies. Many listings have time schedules included together with comprehensive RTTY details. It tells you the frequencies used by civil and military aircraft whilst flying the Atlantic, when and where to pick up the press bulletins, long distance marine traffic etc and much more. Send today for your copy of this worthwhile publication.

£5.95 p&p 75p

THE COMPLETE UHF-VHF FREQUENCY GUIDE 26-2000 mHz

Many listeners have asked for a guide to th wide VHF/UHF spectrum and to meet this request we have recently published this frequency manual. It covers the range 26 to 2000 mHz and has been specially prepared for the UK listener. Anybody who has used a scanning receiver will know that the wide frequency range involved means that it is difficult to know exactly where to listen. This guide takes all the guessing out of monitoring. It lists all the services throughout the spectrum together with both simplex and duplex frequency splits. If you've spent your hard earned money on a scanning receiver or are considering buying one you'll find that this publication contains a wealth of information that has previously remained un-published!

£4.95 p&p 40p

VHF-UHF AIRBAND FREQUENCY LIST

This frequency manual is without doubt the most comprehensive list of VHF/UHF aircraft listings available in the UK. Of vital importance to the airband enthusiast or indeed any keen VHF/UHF listener it sets out in a very easy to follow manner full details of a whole host of stations. Every known UK airfield quencies, etc. Included are Civil, RAF, USAF, MOD, Naval fields on both VHF and UHF bands. There are also air to air frequencies, the Red Arrows frequency, and much more. Send today for your copy and find out just how much you have been missing!

£3.95 p&p 40p

HF OCEANIC AIRBAND RADIO SUPPLEMENT NEW SECOND ADD.

Prepared in response to many requests for more information about the air traffic on the hf bands this little guide sets out to explain to the beginner how the hf band works in relation to air traffic. It contains full details of the world aircraft frequency bands in the range 2 to 23 mHz together with control frequencies and those commonly used for Oceanic control. Also included are many VOLMET frequencies, the Search and Rescue frequencies used by RAF helicopters and Nimrods, the Hf RT network, London Company frequencis, European control centres etc. An ideal companion for the hf airband listener. Send today for your copy.

£2.95 p&p 35p

WATERS & STANTON ELECTRONICS

18-20 MAIN ROAD, HOCKLEY, ESSEX – 12 NORTH STREET, HORNCHURCH, ESSEX.
MAIL ORDER TO: 18-20 MAIN ROAD, HOCKLEY, ESSEX TEL: (0702) 206835

VISA Access

ANGUS McKENZIE TESTS

ICOM ICR7000 VHF/UHF general coverage receiver

In the past, unless you were prepared to spend many thousands of pounds on an extremely expensive general coverage VHF receiver, you would have had to consider one of the scanning receivers costing a few hundred pounds if you wanted to tune across VHF frequencies.

Receivers such as the Eddystone 1990, costing several thousand, had relatively poor stability and the designs used fairly old techniques, including analogue tuning. Many of the cheaper scanning receivers could be classed as toys and, whilst the Yaesu FRG9600 is very good ergonomically, I pointed out in my review in the August issue that its RF performance left a lot to be desired.

The AR2001 was far better in terms of sensitivity and front-end performance, but its ergonomics were very poor, and last year we saw the introduction of the AR2002, which is quite a lot better, with the rather unpopular membrane touchpad changed to proper buttons and a click step tuning knob included.

Around last Christmas, AOR further improved the AR2002 circuitry by redesigning the PLL synthesizer, and more recent samples have therefore had far less birdies and the performance is slightly improved.

Eagerly anticipated

I first heard about the ICR7000 last summer and could hardly wait to get my hands on one, especially after I picked up a brochure about it in the US last September. After considerable delays, just a few samples have arrived in the UK, and I would like to thank Thanet very much for providing me with a review sample within two days of its arrival.

The receiver has a frequency coverage of 25 to 1000MHz, with an additional band covering 1025 to 2000MHz. The microwave band is activated by pressing a '1GHz' button on the front panel, this switching in a 1GHz input mixer to beat down the microwave coverage to that of the normal frequency coverage of the receiver. AM, wide FM, narrow FM and SSB modes are included and there are two modes of FM selection, one giving a choice from the front panel of 15 or 6kHz IF filters and the other position giving 150kHz or 15kHz filters, the FM selector switch for this being on the back panel.

Channelling

A channelling control on the front allows you to select the stepping rate of the main tuning knob, the choice being between 100Hz, 1kHz, 5kHz, 10kHz, 12.5kHz or 25kHz channelling. The tuning knob rotates very smoothly, with 50 channels per revolution, and its tension can be altered by accessing a preset screw underneath the front of the chassis in the usual Icom manner.

When you switch from a narrow spacing to a wider one, eg from 100Hz to 25kHz, the microprocessor notes the offset that you have dialled in and then channels from this offset. At first you might find this a little annoying, but there is, in fact, a lot of sense in it since many 25kHz separated channels are also offset from the MHz by 6.25 or 12.5kHz, the latter offset being used for 934MHz CB, for example.

There is a 4 × 4 push-button matrix on the front panel for directly accessing any required frequency very rapidly, and this pad includes a decimal point and zero to avoid confusion. This feature makes it very simple to operate, as you just have to dial in the MHz and 'enter' to get to the nearest MHz, or alternatively dial in a frequency with the decimal point followed only by the number of kHz points that you require.

Ninety-nine memories are available, and it is quite easy to put any frequency into any of the memories, and not just the one that the memory click step rotary is switched to at the time. The memory channel knob can be set for direct access by entering the memory required on the pushpad, followed by pushing the memory channel button instead of 'enter'.

There are 'write' and 'clear' buttons and a memory set button, the latter being used when you want to enter a frequency to a desired memory other than that shown on the memory channel rotary.

A priority channel can be selected at will. You simply have to set the required frequency and then enable priority checking by pressing the priority button. The rate at which it monitors the priority channel can be varied with the scan speed rotary control.

Programmable scan

Programmable scan is very simple to use, allowing you to set the lower and upper limits as required and then enable by pushing one button. The scan limits are retained in memory until they are changed, even if you use the receiver in the mean time for something else. You can also scan either all the memories (memories without info are always jumped over), or you can choose just the memories of a predetermined mode.

When you are scanning you can select the receiver to stop only on channels with modulation, which allows it to bypass unmodulated carriers. There is a rotary control to vary the scanning speed from very slow to comparatively fast. This is complemented by a four-position switch which allows scanning to proceed after carrier drop or five or fifteen

seconds after a carrier has been found, or finally to stop on a carrier permanently until you wish to start scanning again.

There is one final brilliant piece of microprocessor-controlled programming which concerns the programmable scan. 'Auto write', when selected, sets the receiver into the programmable scan mode and then proceeds to dump all the frequencies on which the receiver stops whilst scanning low to high between the chosen limits directly into memories 80 to 99. This is really amazing, for if you have an aircraft transmission receiving licence you can leave it to scan over the air band from, say, 118 to 128MHz. It will find all the frequencies for you, especially if you scan fairly slowly, and of course you need not be in attendance.

An optional speech frequency readout is available for this receiver (EX310) and this has obvious applications for use by the blind, but it also has one fantastic application which will be of interest to all potential purchasers. On the front panel there is a 3.5mm jack socket for delivering audio to an external tape recorder (constant gain, between 250mV and 800mV peak, dependant on mode selected).

Recorder connection

On the back is a recorder remote start/stop line, which starts the recorder as soon as the squelch opens (the squelch control is operative on all modes). If the optional speech readout is fitted and a special 'speech enable' switch on the back panel is depressed, a speech frequency readout is superimposed at the beginning of each period that the squelch opens, ie when the recorder starts. If the receiver is in the programmable scan mode, it will then provide you with a tape on which all the frequencies received are identified, in addition to the audio modulation being recorded. At any time, speech readout can be enabled by depressing a button on the front panel.

The S-meter, scaled normally, can, at the push of a switch, become a centre 0 FM tuning meter. This will be particularly useful for determining the precise offset of some channelling. To the left of the large tuning knob are four more buttons. The bottom one is called 'remote', and when this is depressed an optional infrared remote control unit (IC-RC12) can be used to operate the receiver in many of its functions.

Push-buttons on the remote control can vary volume up and down in steps, vary frequency in channels either up or down, and scan continuously if the buttons are held down. Modes can be selected and both memory and programme scan can be enabled. Priority monitoring can be enabled and any memory channel can be accessed immediately. The optional speech readout can also be enabled from the remote control.

At the bottom of the control is a 3 × 4 matrix, which duplicates the one on the main receiver's front panel for direct entry of frequency.

Easy remote control

I liked the remote control, which was very easy to use, and there is even an audio mute button on it. Another button to the left of the VFO switches in a 20dB antenna attenuator, a third one is to switch in a noise blanker, and a fourth dims the lights when depressed.

The digital frequency readout indicates in 100Hz increments and extremely comprehensive status functions are displayed, including memory status. Two 3.5mm jacks on the front panel are provided for headphone and tape recorder audio connections. On the back is a 3.5mm jack for an external speaker connection and a 3.5mm jack socket called 'remote', which carries a computer interface single wire serial bus.

Thanet will shortly be able to supply a UK made external computer interface to convert this to normal control interfacing with some popular computers. The first interface, already available from Thanet, is made by Jaytee Electronic Services, and interfaces the ICR7000 with an RS232 and either a floppy disc or a cassette tape programme supplied to work with the BBC B.

The JT603B comes complete with leads, programme and instructions in a box, but there are also other versions available for DIY installation, which are very much cheaper. The computer interfacing allows for almost unlimited memories and adds 100kHz and 1MHz stepping rates, operated by BBC B function buttons.

Other facilities

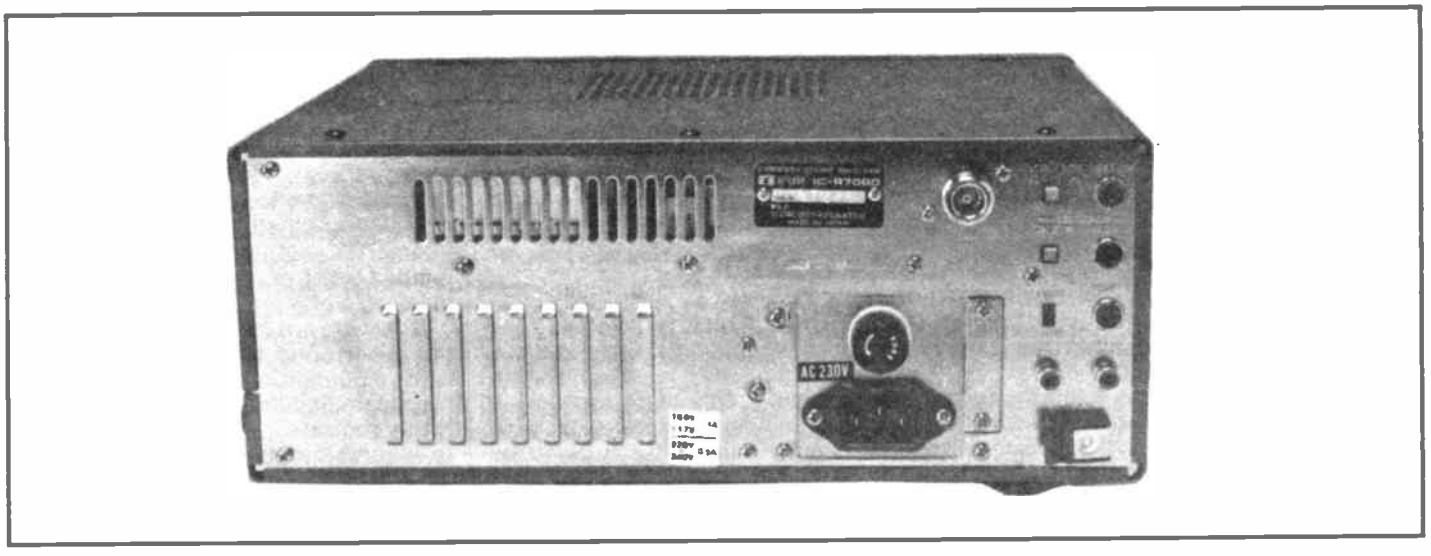
Many other facilities are included in the package, which will also be most useful. A switch selects USB or LSB, and this is on the back as it was an afterthought put on at the request of many of Icom's importers. There are two phono sockets also on the back, one being spare (you can connect what you like to it) and the other a 10.7MHz IF output with a 50 ohm source impedance. The level from this is approximately equal to the level of the input, but it decreases in gain referred to the input once AGC is beginning to bite in the earlier stages. Levels up to 100μV thus have unity gain, but a level of 1mV comes out around 10dB lower.

This IF output can be used to feed an external panoramic adaptor or spectrum analyser centred on 10.7MHz, the bandwidth being around 10MHz wide from about 8 to 18MHz on the first review sample. The second one, however, actually had more gain at 6MHz than it did at 10.7MHz, with a fairly rapid roll-off above 12.5MHz.

It seems probable that an IF trimmer needs fairly careful adjustment to optimise the bandwidth of the 10.7MHz IF output buffer. Note that frequencies higher than the tuned one are inverted so that they come out below the 10.7MHz centre, and vice versa.

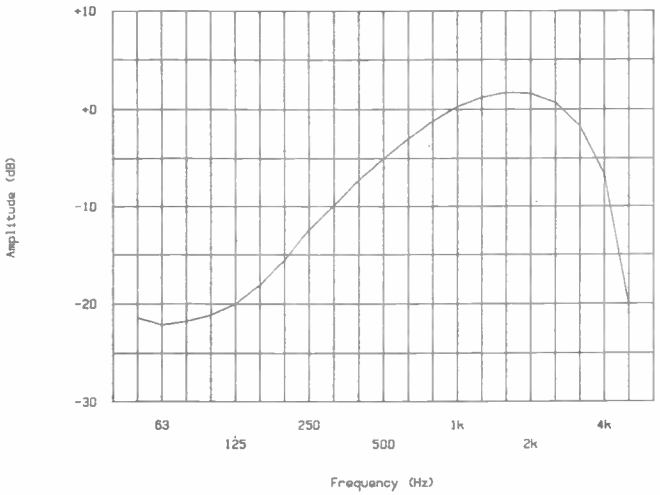
Also on the back panel is an IEC mains socket and fuse, together with a large earth clamp. The antenna connection is a 50 ohm N-type socket, a very sensible choice, as it will have lower losses than the dreaded SO239!

A computer interface board is fitted internally to drive the single wire serial bus, which allows the entire receiver to be operated under computer control,



making the combination an extremely powerful one.

The first IF is at 778.7MHz when the receiver is tuned from 25 to 512MHz. This IF changes to 266.7MHz for frequencies between 512 and 1000MHz. When the 1GHz button is pushed in, the appropriate IF is chosen as if the frequency was 1GHz lower. The second IF is 10.7MHz, whilst the third is 455kHz.



FM received audio response (750μS pre-emphasis)

Subjective tests

I must praise the facilities and ergonomics of this receiver very highly indeed, and Icom could hardly have bettered their front panel design. Directly accessing any frequency was so simple and tuning from the chosen frequency was delightfully smooth. Once you had selected the appropriate channelling, it was possible to tune manually across a very wide frequency band remarkably quickly, and I found that I could detect the presence of a carrier very easily by noting a passing blip.

I was surprised to find that I still heard this blip if a carrier was only a few dB above noise, so you could very quickly tell if a band was active. Similarly, the programmable scan was remarkable as it was quite fast as well.

I did find a slight snag when I programmed the receiver to auto-write Band II FM radio signals in the wideband FM position. It tended to stop on a strong FM station both 25kHz below it and on it, and I feel that Icom could have added a 100kHz channel position for Band II as well as television video and sound scanning and tuning. Looking at the characteristics of the 10.7MHz IF on my Marconi 2382 spectrum analyser, we noted that this output could be very useful with a TV converter, enabling you to tune in normal and amateur TV over the entire range of this receiver if you have the appropriate external converter and demodulator connected to a suitable VDU.

Audio quality

The audio quality on NBFM with the 15kHz filter was excellent, about as clear and clean as I have heard, and I noted that the 6kHz filter was extremely useful for winkling out very weak stations extremely close to much stronger ones, even if the latter were only 10kHz off channel. However, 144 and 432MHz FM amateur signals tended to be distorted on the 6kHz filter, as deviations are still on the high side for this filter. Perhaps one day, if 12.5kHz channelling becomes officially recognised, the 6kHz filter will come into its own on the VHF amateur bands. It separated 29.6MHz band FM very well, however.

The AM reproduced quality was excellent, and seemed a lot cleaner than that from the ICR71, but the AM bandwidth was rather wide. Wideband FM sounded a little odd and it was quite clear that the high frequency de-emphasis was strange, as there seemed to be a hole in the response. Higher up I noted an undue amount of sibilance, although the sound was quite clean from a communications point of view.

There was plenty of audio output power available, both from the internal speaker and to an external one. The audio gain control seemed to be a linear type, so I found myself adjusting it frequently between minimum and around nine o'clock. The squelch control allowed one to set the opening up threshold over extremely wide limits, and this is particularly useful if you wish to ignore all weaker stations.

Sensitivity problems

Although I was most impressed with the apparent sensitivity between 28MHz and around 934MHz, it seemed quite clear that on frequencies above 1025MHz the sensitivity was lacking. The sensitivity on 1296MHz just could not compare with that of the Icom IC1271 which I reviewed some months ago. However, I never noted any RFIM problems, which I consider amazing, but I did note an image problem on the 70cm band. Whilst I was monitoring 433.2MHz, some PMR on 454.6MHz came bursting through on top of a very weak FM mobile, the image thus being 21.4MHz high.

Strangely, I did not have any image problems at VHF frequencies unless I connected the receiver to one of my large beams, most of the tests being carried out with my two discones, a 934MHz CB antenna and a 29MHz 5/8 vertical whip.

I now have to come to the one area that is not satisfactory, the noise sidebands of the VHF local oscillator. Listening to SSB, I noted a marked gargle on speech and some hiss pumping coming up with modulation. The stability was extraordinarily good, but there was a slight 'auroral' tinge there all the time.

CW had the most extraordinary mush around it, certainly not bad enough to interfere with copy, but making the effects so much more obvious. A continuous carrier was also particularly mushy, and this led to the poor distortion measurement on SSB. On both FM and AM the signal-to-noise ratio was clearly disturbed by the local oscillator noise, for the background noise hash was not as low as it should have been, but in a communications sense it was not too disturbing.

In the circumstances I think it is fair to accept this noise modulation, for it is likely to be a few years before we will see frequency synthesizers that are both quiet and cheap enough to be incorporated into sets in this price range.

Laboratory tests

I first had a good look at sensitivities on the 2m band, and these were comparable with rigs such as the Trio 9130; quite adequate, although it might have been better. As can be seen from the table, the SSB, AM and FM sensitivities remained within quite a small range over the entire VHF band and well into UHF, but above 800MHz tailed off slightly to become just adequate at 990MHz.

At the LF end, the set was rather less sensitive than many HF transceivers are on 28MHz. As the RF input intercept point measurements were generally surprisingly good, although not as good as dedicated narrow band receivers, you might well find that you can use a broadband pre-amplifier in front of the set, for example one made by muTek and Datong, which will noticeably hot up the sensitivity.

I would advise an external pre-amp bypass switch, however, so that you can cut it out on bands where signals are extremely strong, eg Band II FM radio. You will certainly need a pre-amp to cover the 934MHz area, but don't buy one with too much gain as you may find that cellular radio signals will cause intermodulation in the pre-amplifier, as well as the rig.

Better than the competition

It was difficult to make close-in front-end intermodulation measurements because of the noisy synthesizer, but the worst figure that I was able to measure was better than much of the competition, and going just a little further out in the spacings of the interfering carriers, the IM performance became quite good. With spacings of several MHz, the performance was very good, and the incredible performance from carriers spaced at +50 and +100MHz was quite outstanding.

We had a look at the reciprocal mixing performance at 144.05MHz and it was a little better than we thought it would be, but it deteriorated rapidly for strong carriers within ±20kHz. A carrier offset by 5kHz would give a ratio of only 60dB, ie a steady carrier only 60dB above the basic noise level of the receiver would lift the noise up by 3dB.

Within the SSB passband, it was very obvious that the synthesizer noise was much worse. There is a problem here, for it is very difficult to design a synthesizer which can be tuned across a band very rapidly, whilst at the same time having a phase locked loop filter at a sufficiently low frequency to filter out much of the phase noise. The ideal situation would be for the synthesizer to have two separate filters, a broad one in use when you are tuning the set and a much narrower one coming into play when the set is not being tuned.

The SSB filter had a fairly wide bandwidth at the top but was reasonably steep, the measurements at −40 and −60dB being effected by the reciprocal mixing performance, for in the selectivity test the actual high frequency beat tone was clearly very well down, although the hiss was not. The three FM selectivities all measured outstandingly well, and this is the first time that I have had the opportunity of switching between very narrow at 6kHz and narrow at 15kHz.

ICR7000 Lab Results

Sensitivity
FM 12dB sinad with 16kHz filter

29.6MHz	−117dBm
50.2MHz	−119dBm
98MHz	−119dBm
144.2MHz	−118dBm
250MHz	−118dBm
432.2MHz	−119dBm
550MHz	−117dBm
750MHz	−117dBm
850MHz	−117dBm
934MHz	−117dBm
990MHz	−116.5dBm
1039MHz	−103dBm

SSB, 12dB sinad

28.55MHz	−118dBm
50.2MHz	−121dBm
144.2MHz	−119dBm
432.2MHz	−120dBm

AM for 10dB S/N

28.55MHz	−114dBm
98MHz	−117dBm
120MHz	−118dBm
433.4MHz	−117dBm

RFIM performance
Set tuned to 120MHz. Intercept points ref various spacings

100/200kHz	−20dBm
200/400kHz	−8.5dBm
500kHz/1MHz	−8.5dBm
5/10MHz	−5.5dBm
20/40MHz	+8dBm
50/100MHz	+26dBm

Reciprocal mixing performance
Carrier spacing/carrier level to Rx noise ratio

5kHz	60dB
10kHz	70dB
20kHz	77dB
50kHz	87dB
100kHz	93dB

S-meter readings, SSB at 144.05MHz

S1	−104dBm
S5	−87dBm
S9	−70dBm
S9+20	−50dBm
S9+40	−32dBm
S9+60	−13dBm

Selectivity SSB

−3dB	2.8kHz
−6dB	3kHz
−40dB	5.1kHz affected by RM
−60dB	5.2kHz affected by RM

Selectivity FM, wanted and unwanted channels modulated

	15kHz filter	6kHz filter
±12.5kHz	+8/+14dB	+24/+25dB
±25kHz	+60/+61dB	+61/+61dB

Selectivity AM

−6dB	14kHz
−40dB	23kHz
−60dB	29.5kHz

Audio distortion WFM

1kHz mod/75kHz deviation	4.5%
50kHz	1.9%

NBFM/16kHz filter

1kHz mod/5kHz deviation	5.6%
2.5kHz	1.6%

AM distortion 1kHz mod at −50dBm RF level

90%	1.6%	30%	1.6%

RF level at −23dBm gave similar readings
SSB product detector distortion from 1kHz carrier beat 10% (inc noise, see review)
Audio output power: 8 ohms 3.2W 4 ohms 5.2W
Tape record jack output typically 270 to 800mV, depending on mode
Typical frequency error −0.12kHz
AGC threshold approx 1μV
Dimensions (including projections): 303mm w × 127 h × 319 d, weight 8kg

Lower deviation

Most of the commercial NBFM transmissions employ much lower deviation than average radio amateurs and the 6kHz filter almost always sounded surprisingly good on commercial transmissions The average amateur signals, however, sounded rather less distorted with the 15kHz filter. The AM filter was surprisingly wide, although the skirts fell off moderately sharply. I did not ever notice AM selectivity problems, though, as most of the AM transmissions that were checked were at 25kHz spacings.

On FM, the S-meter had a range of 32dB from S1 to S9, and this is excellent. On SSB there was a 34dB range between S1 and S9, and the scale was well controlled right up to S9+600dB. S9 varied quite a lot over the frequency range of the receiver, and was rather less sensitive than we are used to on VHF. S-meter readings would be more normal, however, with an excellent log scaling, if you used an external pre-amp of around 15dB gain.

I did, in fact, look at two samples of ICR7000 for this review, and the first one gave S-meter readings which were much less sensitive than the second one.

The product detector produced an extraordinarily high distortion figure on a carrier set to give a 1kHz beat note, but we all had a good listen to the sound and came to the conclusion that nearly all of the reading was reciprocal mixing noise rather than harmonics. This again is due to phase and amplitude noise being present on the local oscillators.

AM distortion performance

The AM distortion performance was extraordinarily good and far superior to that of the Icom HF equivalent rig, the ICR71. FM distortion was average on NBFM, but somewhat high on wideband FM. We plotted frequency responses for FM and AM, and whilst NBFM proved to have a very steep roll-off below 400Hz, wideband FM and AM extended down to below 100Hz.

On all modes, we noticed an extraordinary suck-out at 4950Hz, which was very sharp, amounting to some 45dB rejection, and I have to assume that this was included to suck out a 5kHz synthesizer whistle. The wide FM response included this suck-out, which contributed to a very odd de-emphasis curve showing no real resemblance to 50μS! There is an internal preset which can adjust the depth of this steep notch

and on the second sample it was greatly reduced, with a clearly improved overall response, although wide FM de-emphasis was still quite badly out.

We checked for various image responses, and the main problem noted was a +21.4MHz image on UHF frequencies, especially around 433MHz, the image ratio being 63dB (3dB better than Icom's spec). When we checked the image response at 98MHz, however, it was far better and not likely to cause any problem. The first IFs did not seem to cause any image problems, measurements being around −80dB or better.

There was plenty of power output from the rig, the power into 4 ohms being higher than I have noted before on any Japanese communications receiver. The received frequency accuracy was quite extraordinarily good, only 120Hz out on the 144MHz band, so you should be able to find the station you want if you just enter the required frequency. Furthermore, I did not note any frequency drift over quite a long period.

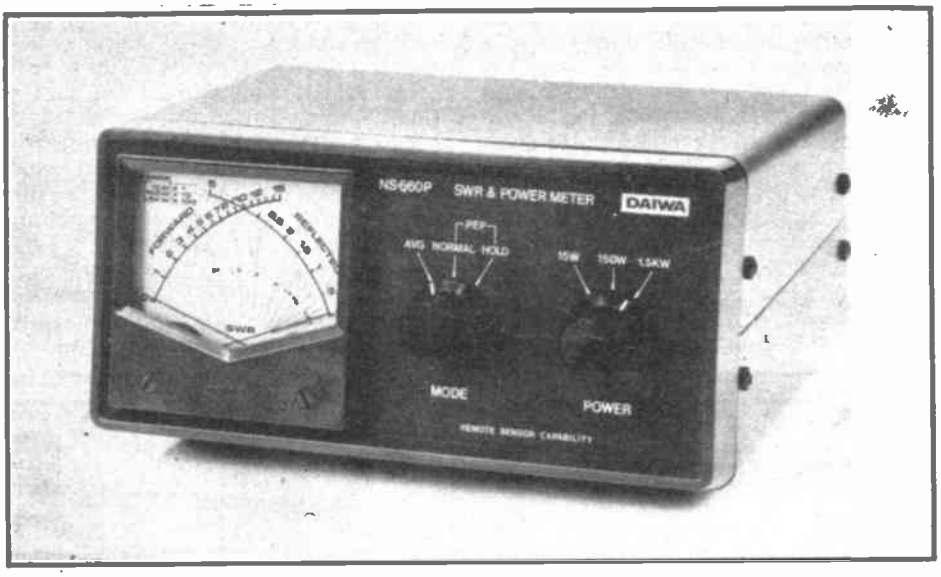
Conclusions

I am most impressed with this very remarkable receiver, despite my criticism of the noisy synthesizer. Very few users would be likely to require the SSB facility often, but I feel that despite the synthesizer Icom were right to provide the facility; it could be very useful for both amateur and professional users.

At first you might think that a price of around £900 is a lot to pay for a receiver, but after you have used it for a while and you try its extraordinary facilities you will realise that Icom have spent a lot of money developing all the circuitry, which fully justifies the price. I have no doubt that there will be a very healthy demand among professionals for this receiver, and radio amateurs and keen VHF short wave listeners should seriously investigate this model if they can justify the cost, for it is so far ahead of the competition.

A broadband pre-amp is not too expensive and you could easily make your own, and so my reservations on sensitivity are not so serious as the intercept point is quite good.

I therefore feel that I can warmly recommend the ICR7000, although it is not ideal for use as an independent receiver at the bottom end of its range. One of the most interesting products that I have reviewed in this magazine for a long time. Many thanks to Jeff Ginn for assisting with the measurements.



DIAWA NS660P

peak reading power/SWR meter

In 1983 I reviewed very many power and SWR meters in this magazine, and since then I have recommended an SSB Products Termaline VHF/UHF meter and an EME in-line power/SWR meter. I recently visited the Lowe Electronics shop in Eastcote and Andy Beckett showed me a new product from Daiwa, the NS660P, which looked most interesting. A fortnight later a review sample arrived from Matlock, and I have had just enough time to put it through its paces for this issue.

Dual needle movement

The meter employs the Daiwa standard dual needle movement, designed to allow one needle to read forward power whilst the other one reads reverse power. The intersection point of the two needles has a scaling below it to indicate the standing wave ratio.

When using the internal measurement head, the meter can be switched to read FSDs of 15, 150 and 1500W forward power, a three-position switch selecting the required range. A second three-position switch selects average power, normal peak power and PEP 'hold'. Unfortunately, reverse power, and thus SWR, can only be read on the average power switched position and thus you need a CW carrier to take an SWR reading.

In the normal PEP position, the meter indicates an approximate average peak power, whereas in the peak hold position it reads the true peak envelope power fairly accurately.

Input and output sockets are SO239s on the back and there is a special socket for interconnecting a remote sensing head, three of these being available as optional extras. The U66H covers the same frequency range as the meter's internal head, 1.8 to 150MHz. It is also fitted with SO239 sockets. The power ranges covered are 15W, 150W and 1.5kW. The head is supplied with a one metre cable.

The second optional head is the U66V, covering the frequency range 140 to 525MHz, and this can be ordered with either SO239s or N-types. This head is limited to a maximum throughput power of 300W CW, and gives ranges of 1.5W, 15W and 150W.

The third head is the U66S1, which covers the range 900 to 1300MHz, its maximum throughput power being rated at 60W CW with ranges of 1.5W, 15W and 60W on the 150W scale. It is fitted with N-type sockets. None of these heads arrived in time for the review, unfortunately.

On the back of the meter is a switch to select the internal head, which works with the SO239s, or the remote sensing head which can be up to 20 metres away from the meter, provided an optional extension cable is purchased. There is also a lamp switch which puts a dc voltage through to the lamps which illuminate the front panel meter. You can either power the meter from an external PP3 battery or from an external dc power supply with a voltage from 6V to 24V. The internal circuitry takes 7mA and is used for the PEP readings.

Laboratory tests

We interconnected the output of my Trio TS940S with the meter, then through a Bird type 4314 PEP meter to a Rohde & Schwarz 30dB attenuator load feeding my Marconi 2382 spectrum analyser. Accurate power measurements were taken with the carefully calibrated 2382 analyser, the Bird meter being used only as an approximate check; its own accuracy was not particularly good.

We checked the meter on continuous CW, with CW strings of dits and with normal speech on SSB. With continuous carrier set at around the 100W level the Daiwa 660P tended to over-read an average of 10%, except for 1.9 and 28.5MHz where it over-read around 5%.

When the Daiwa meter was set to the peak normal position, the power indica-

tions were marginally higher. When we checked the peak normal position with a continuous row of dits, the peak indications were surprisingly accurate. On the peak hold position, the meter tended to over-read around 10%, depending on the range.

We then did a series of checks comparing the Daiwa peak normal and hold positions with the Marconi analyser indications, also taking into account readings from the Bird PEP meter. I intentionally chose non-processed speech, driving the TS940S reasonably into ALC. The peak normal position tended to under-read PEP by an average of 3dB or so, thus indicating only around half of the true output PEPs. The peak hold position usually produced peaks which under-read by no more than 10%, which is thus quite accurate.

We checked that the meter would not indicate SWR on the PEP ranges, but we noticed that the reverse power needle did move very slightly in this position. When the meter was set to the average position, various SWRs across the LF and HF bands read quite accurately. It should be noted, however, that there are no graduations indicated between 5:1 and infinity:1, but I suggest that you should not have such bad readings in your system anyway!

We then set up the meter for testing on the 144MHz band, driving it from my Dressler D200S linear via the Bird PEP meter, with the same Rohde & Schwarz load feeding extra calibrated attenuation into the spectrum analyser. The through-loss was significantly below 0.1dB, which is excellent, and the meter did not introduce any measurable SWR. This must therefore be substantially better than 1.1:1, despite the SO239 sockets!

Continuous power checks were carried out at low and high power and at 144.2MHz readings were well within 5% accuracy, as far as we could tell. On peak normal, however, a string of CW dits, several per second, under-read by around 20%, whilst on peak hold the same dits under-read by only 5%.

SSB on the 144MHz band under-read appreciably on peak normal, but on peak hold readings tended to be not more than 10% down. We then decided to try a few tests sending only one dit per second, and both the Daiwa on the normal peak position and the Bird PEP meter under-read the true peak values by up to 4dB.

It was most fascinating to see that on the PEP hold position, the very short dits under-read by only 10%, showing that very fast transients are read more accurately on the Daiwa than on the Bird meter, which has only recently been overhauled.

Finally, we transmitted continuous two-tones of approximately equal amplitude, and noted that the Daiwa meter under-read the peak power on the hold position by around 10%, the normal peak position under-reading by nearly 25%.

Conclusions

This meter offers some useful facilities, and its performance on 144MHz is surprisingly good considering it uses SO239 sockets rather than N-types. 10% accuracy is more than adequate for the amateur, and I very much liked the Daiwa dual needle movement. There are a few meters available which will read SWR automatically on speech or CW, but this new Daiwa model does require a continuous carrier for reverse power and SWR measurements.

I was rather disappointed that the normal peak position under-read speech peaks very noticeably, but the peak hold position is excellent. It would be reasonable to assume that the remote sensing heads (price to be announced shortly) will give an equivalent performance, and thus allow much more flexibility in use.

At £99.50, the meter is reasonably priced, but it is a pity that the 432MHz and 1296MHz remote heads have very restricted power indication maxima. The power ranges are easy to read and use and the meter is well presented, although the initial instruction sheet supplied is rather vague.

Many thanks to Lowe Electronics for getting the meter to me at short notice, and to Jeff Ginn for assisting with the measurements.

SHORT WAVE LISTENER

TREVOR MORGAN GW4OXB

In this hobby the old saying that 'the more you put in, the more you get out' is often, but not always, true. Some of our readers put an awful lot of time into their listening and reap the dividends in logbooks full of interesting and exotic contacts while others, nonetheless keen, just don't seem to hook the big ones.

Even listening stations with superb set-ups and planned periods of listening often fail in attempts to fill the log with exotica. Conversely, some of the simplest stations seem to be able to pull in the DX when others are struggling. I think the term 'Sods' Law' just about sums it up nicely!

Not a 'super station'

F J Brown of Redcar is a case in point. His set-up consists of the Panasonic RF3100 fired up to a 15m end-fed wire via a homebrew antenna tuner; not, one would think, the idea of a 'super station'. Nevertheless, his attempts at reaching the Gold prefix award have resulted in him gaining a Bronze for eighty metres, Bronze and Silver for twenty metres and Bronze for fifteen metres! Frank has concentrated on SSB for these awards and certainly deserves congratulations; I fully expect Gold claims within a very short time!

Frank mentions that ten metres is showing signs of being on the upgrade, but also that forty doesn't yield much (get that CW sorted, Frank, and you'll find them!). Currently, Frank is awaiting the results of the RAE exams with baited breath!

Neil Rogers of Warminster was also in the hunt and put his Uniden CR2021 and 40ft end-fed wire to the test to get the thousand prefixes for the Gold award. Neil included such delights as A71, AL7, BV0, CS8, DU4, HC5, HH7, HZ1, LU8, PZ1, S79 and a host of US, Japanese and Russian stations amongst his superb list. Now on the hunt for the Lifeboat stations, Neil is finding the awards a good testing ground, not only for his techniques but also for his equipment, which has been running a high temperature for some time now!

Cyril F Hutchings of Wellington has been out of the radio scene for some years, but he has made his comeback with a vengeance and sent in a claim for Bronze. His entry consisted of 209 prefixes worked, including CR9, HV2, YB3 and YC3, plus a list of 43 stations heard. Cyril reckoned he was a bit too old in the tooth for award chasing, but rose to the challenge and got hooked. Well done Cyril.

Angela Sitton of Stevenage was next in the running with her single band claim for the Bronze on twenty metres. With AA4, BV2, CU5, HH2, KL7, VU2, XA5, YB0, YZ7, 4Z4 and a crop of Ws and Ks, Angela used her 66ft centre-fed to advantage.

I liked Angela's comment in her letter regarding listeners, in which she said: 'The serious SWL is a receiving amateur and is an asset to the amateur radio hobby'. Well said Angela.

Can't be outdone

Philip Begley of Huntingdon was not to be outdone, and his DX200 and 60ft end-fed got him into the lists with well over the required 500 prefixes for his Silver award. Some trouble down on the farm had a new generator feeding power where it shouldn't, giving Pip some headaches, but the receiver did its job when he eventually made the time. Well done Pip. This particular claim was 'lost' in the upheaval here earlier in the year and if you have not had a claim acknowledged, please let me know so that it can be dealt with.

A nice letter from the secretary of the White Rose ARS included the results of the 6th SWL LF contest, and it was pleasing to see our own Tony Blackburn in 6th place. The previous winner, Roelf Smit of Holland was in first place with 80,702 points in the phone section, while Britain's Don Piccirillo managed a respectable 18,230 points in the CW section. The next contest will be on 17/18 January 1987. Why not have a go?

It was nice to hear from our old friend, Chris Foreman, one of our first Gold award winners. Chris has been changing QTH to his home town of Gateshead but, despite the moving, managed to pass the RAE in December with two credits! Now a member of the G-QRP Club, he is busy getting his homebrew station ready for the Morse pass.

Makes a change

Meanwhile, down in the principality, Charlton Cole of Pontnewydd has been having a twiddle of the knobs to work some broadcast stuff for a change. He has had some nice cards and souvenirs from Ecuador, Switzerland, Australia, USA and Finland. Charlton, who as a point of interest celebrates his seventy-third birthday this year, is looking for a copy of the *International Callbook*, so if any kind soul could be helpful, please write to Charlton at 5 Tynewydd Court, Pontnewydd, Cwmbran NP44 1LJ.

Peter Wood of Crowborough has the Trio 9R59DE and wonders how the 'E' version differs from the 'S' version – anyone know? Peter has now put up a G5RV with good results but is concerned that the ends are bent around a bit.

Quite a few people seem to worry too much about this aerial's configuration. I have used one for years in all sorts of guises and, like many others (long before I was weaned), have found that as long as you get the centre up as high as possible there doesn't seem to be any problem. I have used it with the feeders running parallel to the aerial and only ten feet above the ground and have worked one chap who was using a quarter-sized version on eighty metres and putting out a belter of a signal! As another gentleman who was using a monstrous double-sized version said, whatever size the aerial is, always use the normal feeder length. G5RV himself apparently confirms this.

We have another AR88 supporter in A Hawkins of Runcorn, who uses his linked to a delta loop for 20 metres in horizontal mode indoors and a dipole for fifteen half in and half out of his QTH – rather unorthodox, but it works in a bad location.

Having only been into SWL for a couple of weeks, any help with his new hobby would be most welcome at 111B Parkers square, Southgate, Runcorn, Cheshire.

Dave Dowes of Rochester has also been on the broadcast bands and finds the 'Two Bobs' on the Radio Switzerland DX programme very interesting on Saturdays around 6165 at 1300.

Also worthy of mention, says Dave, are Radio Prague, from whom he has received his monitors' certificate, and Radio Berlin International on Mondays on 6155, 7185 or 9730.

Other interesting programmes logged recently include Taiwan at 2157 on 11855, Radio Canada International at 2300 on 11710, HCJB, Quito at 2100 on 17790, Kuwait on 11670 at 1800, Radio South Africa at 1259 on 21585 and UAE Dubai at 1330 on 17775.

Real old timer

Alan Dunsford of Exeter is using his Eddystone EC10 with an end-fed and has been into the radio scene for some forty odd years! He also has an ex-RAF V55R receiver that needs a new transformer and wonders if any of our readers can help. Alan bemoans the cost of QSL cards nowadays. Too true, Alan! Anyone with info on the V55R can contact him at 17 New North Road, Exeter, Devon.

As members of the International Listeners' Association will be aware, there is yet another award on the list. This time it's for the broadcast listeners among you.

The claims are required for 100 broadcast stations *verified*. Stations in your own country are *not* valid but there should be no real difficulty in getting the required number, and claims should be sent to the ILA, 1 Jersey Street, Hafod, Swansea SA1 2HF.

Single band claims are valid and stations like Radio Kiev, Radio Vilnius, etc all count separately even though they are in the same country, as they are autonomous republics within the USSR. Local radio stations in the USA also count separately towards the award. There is no fee for the award.

Pocket portable

This month's review was sparked off by the need to get hold of a receiver that was portable. Simple, one might think, except that as my mode of transport is the old bike it was essential that the receiver should fit into the pocket of my cycling jacket! Naturally, this requirement excluded all of the usual brands, as most receivers are made for home base use. However, one model attracted my attention and it is this receiver that I have been using for the past month or so.

The Sony ICF7600D is a very attractive little receiver, being only 7½ × 4¾ × 1¼ inches, presented in either a black or silver finish. I chose the silver.

Controls: The front panel is split into sections by recessing the controls in two tones of grey. Just less than 50% of the front panel is taken up by the speaker grill. To the upper right are the clock, frequency readout, the clock timer controls and the ON, OFF and 'sleep' keys. The tuning indicator LED is also in this section alongside the frequency read-out.

The lower section contains the main tuning control keys. These consist of scanner start/stop, manual scan up/down, band select, figures 1 to 0, AM and FM select and execute. The latter three are lettered in red with a 'hatching' and the legend 'direct tuning' below.

On the right-hand side panel are the volume control, a two position tone control, AM mode control giving normal, fine tune and SSB positions, and the fine tuning control.

The left-hand panel has the high/low sensitivity switch, antenna socket, tape recorder output, earphone socket and six volt supply socket (the power supply is included).

The top panel has a power supply lock, which prevents the ON button being pressed by accident while carrying the receiver, and the telescopic aerial which is 27 inches long when extended and can be used vertically while the receiver is laying flat on a table.

The back panel holds the time setting control button, the battery compartments and a printed 'Time Zone' map and band range table. Six MN1500 type batteries are required. Four of these are for powering the receiver while the other two are for computer back-up and clock.

The receiver caters for the 76 to 108MHz band on FM, 522 to 1611kHz on medium wave, 153 to 519kHz on long wave and 1615 to 29995MHz on short wave. Individual frequencies within the ranges can be entered by pressing the AM or FM mode keys, required frequency and execute. The scan tuning key operates as a start/stop for the autoscan and the receiver will scan frequencies in preset increments of 5kHz on short wave, 9kHz on medium wave, 3kHz on long wave or 0.1MHz on FM modes. The manual scan operates with the same spacing but can be scanned up or down the range.

Broadcast orientated

This receiver is obviously aimed at the broadcast listener as only these frequencies have been set into the memory bank for scanning purposes. For instance, if you key in 14000 and autoscan, the scanner runs through the amateur twenty metre band with no problems but goes on up into the 19 metre broadcast band and, on reaching 15595, returns to the start of that band, ie 15100! So, if you want to scan the amateur bands, you must really do it manually.

Incidentally, there is no mention of the amateur bands at all in the otherwise excellent instruction manual!

Also, for some obscure reason, the receiver covers 1615 to 3895kHz which are not on the band selector but are scanned as one 'block' instead of separate bands, and the bands 21900 to 26100 and 26105 to 29995 are scanned separately but are, again, not on the band select program. There are, obviously, only ten memorised bands and I wonder how much the cost would have been increased by adding the amateur bands and the missing ones mentioned.

There are ten memories available in which you can enter any required frequency in the range by simply selecting the frequency and pressing the memory number and the enter key. Unfortunately, you cannot scan the memories automatically but can recall each one by pressing the keys in the required order.

Finding the faint ones

Using the SSB/CW mode, it is quite often the case that the required station is transmitting on a frequency between the presets. In this case, the fine tuning control can be used to check between the range, which is especially useful for detecting those faint ones.

So, what is it like actually in use? To put it simply, delightful! The compactness and ease of handling were a pleasure and, using the telescopic aerial, Japan, Korea, Ecuador, South Africa, Canada and the whole of Europe were easily logged in the broadcast bands.

As for the amateur bands, SSB reception was very good with no trace of any drift at all and JAs, DU, Ks and Ws, PY and ZS were copied very well indeed. The CW ends of the bands revealed the same sort of sensitivity and DU, PY, 5N4, AP2, JA and most of the eastern states of America were logged in a short time.

Using the supplied wire aerial, signals were considerably better and a lot of good DX could have been worked if I'd had the time.

Being used to the 'no frills' Trio TS130 as my base transceiver, the memory and scanning facilities were used extensively. The memories were most useful as I was able to program in the QRP calling frequencies and nip back to them in turn for a quick listen, and also had room for the air traffic control frequencies to listen to Concord receiving her instructions.

The scanning was useful to run through a broadcast band to check on which signature tunes could be found on the hour. I can't say that I found any use for the scanning on the amateur bands but others may find it useful.

All in all, it's a very nice little receiver that lived up to expectations and is well worth the asking price of around £150. I would have liked to have the facility of scanning the memories and, as mentioned, have the amateur bands scanned or separately dealt with by the band selector. I have not yet tried the receiver on a 'real' aerial, but as it is purely intended for portable use in my case, it was more important to use it as such.

The instruction manual is adequate and the *Wave Handbook* which is included is excellent.

As regular readers know, *Amateur Radio* magazine has fully supported the founding of the International Listeners' Association and as a result the membership has grown steadily to eighty plus. Currently, membership is spread through nine countries with enquiries being received from many others, even across the Iron Curtain.

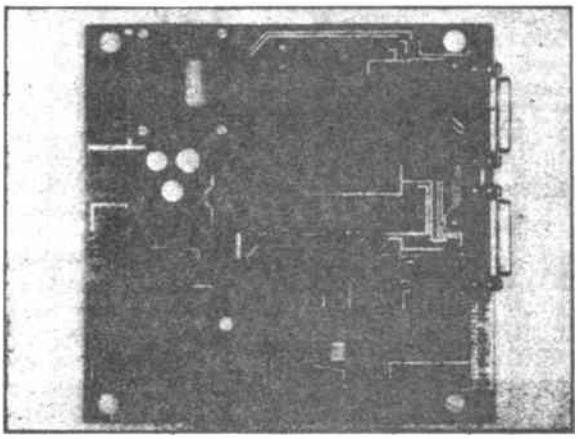
The association is open to all listeners, broadcast or amateur, free of charge and a quarterly newsletter is issued giving general information on all aspects of the hobby. A healthy correspondence group has sprung up and information regarding techniques and ideas is being exchanged between members. If you are interested, simply send your name and address and details of your shack to: ILA, 1 Jersey Street, Hafod, Swansea SA1 2HF.

A computerised listing of over 5,000 US and foreign QSL managers is available from W6GO. This list is most useful if you are trying to get QSL cards for one of the many awards available that require confirmation of contacts, as many stations operating from temporary locations use the managers as do quite a number of operators in the States.

The listings cost $2.00 (5 IRCs) from W6GO, PO Box 700, Rio Linda, Ca 95673.

Well, that's it for another month. I attended the Longleat Rally this month and will be reporting on this in the next issue. Also, I'll be looking at some of the kits available on the market. Until then, good listening.

The Archer Z80 SBC

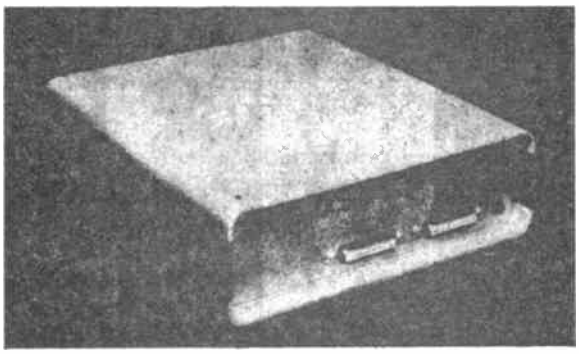


The **SDS ARCHER** – The Z80 based single board computer chosen by professionals and OEM users

* Top quality board with 4 parallel & 2 serial ports, counter-timers, power-fail interrupt, watchdog timer, EPROM & battery backed RAM.
* **OPTIONS:** on board power supply, smart case, ROMable BASIC, Debug Monitor, wide range of I/O & memory extension cards.

from **£185** + VAT

The Bowman 68000 SBC



The **SDS BOWMAN** – The 68000 based single board computer for advanced high speed applications

* Extended double Eurocard with 2 parallel & 2 serial ports, battery backed CMOS RAM, EPROM, 2 counter-timers, watchdog timer, powerfail interrupt, & an optional zero wait state half megabyte D-RAM.
* Extended width versions with on board power supply and case

from **£295** + VAT

Sherwood Data Systems Ltd

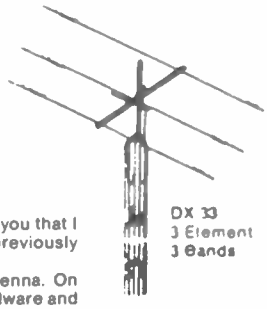
Sherwood House, The Avenue, Farnham Common, Slough SL2 3JX. Tel: 02814 5067

Penetrate the four corners of the earth with the

DX "PENETRATOR"

HERE'S THE SPECIFICATION...

★ 3 elements of each band ★ Broadband operation
★ heavy duty 2kW rated ★ Stainless steel hardware
★ Gain up to db8 ★ SWR less than 1.3:1



DX 33
3 Element
3 Bands

HERE'S WHAT THE CUSTOMERS SAY!

1 VK7NOW "I have recently installed a DX33 beam and I would like to advise you that I am extremely satisfied with it. It certainly outperforms the TH3JNR which I previously used ans also the VSWR is lower"

2 G3AAE "This letter is to tell you how pleased I am with the DX 33 antenna. On unpacking the DX 334 was immediately impressed with the quality of the hardware and in operation it is just as impressive. I have used it on all three bands and have been obtaining excellent reports from DX stations all over the world. I have conducted tests with other stations and these show the electrical figures included in the DX 33 specification are fully met in practice.
Congratulations on a very fine product"

NOW IN USE FROM VK7 to VE7!

PRICES (INC. CARR & VAT)

ANTENNAS

Cat No		Price
WESTERN ANTENNAS (Carriage paid)		
1075 DX-7/2	7MHz 2 ele Yagi Gamma matched 20 boom	£402.50
1076 DX-7/3	7MHz 2 ele Yagi Gamma matched 40 boom	£546.25
1077 DX-51	Rotary dipole for 28 24 21 18 & 14MHz	£126.50
1080 DX-6V	10 80m Multi and Vertical plus 30m	£115.00
1081 DX-31	Dipole 10 15 20m 2Kw p&p	£97.75
1082 DX-32	2 elements 10 15 20m 2kw p&p	£161.00
1083 DX-33	3 element 10 15 20m 2kw p&p	£224.25
1084 DX-34	4 element 10 15 20m 2kw p&p	£310.50
1085 DX-31/32	Conversion kit	£69.00
1086 DX-32/33	Conversion kit	£80.50
1087 DX-33/44	Conversion kit	£92.00
1089 DX-103	3 element 10m Yagi	£97.75
1090 DX-105	5 element 10m Yagi	143.75
1093 DX-4k	Converts DX 31/2/3/4 to 40m dipole	£103.50
1094 DX-27/1	Rotary dipole for 22mhZ CB	£23.00
1095 DX-27/3	3 ele B for 27MHz Gamma matched	£69.00
1096 DX 24/Q	2 ele quad 2 10 15 & 20m	£230.00
1097 DX 26/Q	2 ele quad 2 10 15 18 20m	£281.75
1099 DX-7/14-2/6	2 ele 40m. 6 ele on 20m. 50' boom	£806.00

ROTATORS . . . we only stock the best . . . EMOTO

WE ARE THE SOLE UK DISTRIBUTORS

EMOTO 195TSX for light HF and large VHF arrays	161.00
EMOTO 105PSX Pre-set controller	£56.20
EMOTO 502SAX for heavier HF beams plus VHF/UHF	£226.55
EMOTO 1102MXX The really big one for large HF monobanders	£327.75
EMOTO 1103MXX As 1102MXX but great tuning power	£333.50
EMOTO 1102MSAX Circular dial for 9MHz beams	£458.85
EMOTO 1103SAX Circular dial for 9MHz beams	£466.90
MB-300 Rotary bearing	£25.30
452 Coupler for 105TSX	£26.45
451 Flexible mount for 1102/3	£20.70
MB-303 Bearing	£17.25

S.A.E 220 x 110mm FOR ALL ENQUIRIES PLEASE

10011SSB POWER METER
GIVES STEADY READING ON SPEECH
PM-2000 A. 105-30 MHz-O-2Kw p&p.... **£77.62**
TVI FILTERS DJØAV Type
ES-1 kit comprised of 3 high pass 1 braid breaker, hi-fi loudspeaker, mains filter and RSGB Council member.
Thinks they're the 'bees knees'

MASTS AND TOWERS
WE BUILD TOWERS OVER 300FT HIGH!
SO WHEN YOU BUY YOUR LITTLE "HUNDRED FOOTER" YOU'LL KNOW YOU'RE BUYING WHERE EXPERIENCE COUNTS!

KENWOOD TRIO
THEY'RE BOTH THE SAME!
(BAR THE LABEL!)
SO WHAT DO *YOU* THINK OF A FIRM THAT SINKS TO THE DEPTHS OF PUBLISHING LIES SAYING "NO SPARES"?
LOOK
TS - 940 ..... **£18.75** WITH ATU

• **ACCESS** • **BARCLAYCARD** • **DINERS CLUB** • **H.P. ARRANGED** • **PART EXCHANGE**

Western Electronics (UK) Ltd
FAIRFIELD ESTATE, LOUTH, LINCS LN11 0JH
Tel: Louth (0507) 604955 Telex: 56121 WEST G
OPEN HOURS Mon-Fri 09.00-12.30. 13.30-17.00
Saturdays by appointment

FIXED VOLTAGE HIGH CURRENT POWER SUPPLIES

by Roger Alban GW3SPA

Having recently built a variable voltage, high current power supply for use on the test bench, I soon found the need for a fixed voltage high current supply to run the 10 metre multimode rig and linear amplifier. The specification for this power supply is quite different from the requirements for a variable voltage power supply. However, the general design procedures will be the same and reference to this can be found in my series, *Power Supplies*, published in *Radio and Electronics World* magazine from May 1985 to January 1986.

The specification

The general requirement was for a 10 amp, 13.8 volt supply that would be fully protected against short circuit of the output terminals and would also provide protection against over-voltage. It was intended that the circuit design should be kept as simple as possible by using integrated circuits where possible. It was also required that the power supply should be capable of supplying 10 amps continuously without overheating.

The heart of any power supply is the mains transformer, and the value of the secondary voltage will determine the design of the remaining circuitry. The transformer discovered at the recent Barry Radio Rally was a rather heavy beast measuring 143mm × 143mm × 191mm tall. More importantly, the secondary voltage was rated at 30 volts at 20 amps. The secondary consisted of two separate windings and the primary winding contained a large number of tap positions to cater for mains voltages above and below the normal 250 volt ac supply.

The transformer attracted very little attention from prospective buyers because of the apparent high rated secondary voltage. Without my pocket calculator, I kick-started the grey matter into life and mentally calculated the ideal secondary voltage for a 13.8 volt supply to be approximately 24 volts.

No wonder the transformer was not selling!

A flash of inspiration stopped me in my tracks. Could the secondary voltage be reduced by altering the primary tap position on the primary winding? I decided to take a gamble and offer the trader half the asking price to take the lump of metal off his hands! Not expecting a friendly reply, I was surprised when he agreed. Perhaps he had become tired of carting this piece of heavy junk around from one rally to the next! However, I soon discovered how heavy the transformer was when carrying it from the trade hall to the boot of the car parked outside.

Had I made an error of judgement? On arriving home I set about checking the calculations for the ideal secondary voltage.

Figure 1 shows the prototype ideal circuit. Here a number of assumptions have to be made. It is assumed that the minimum voltage drop across the voltage regulating IC will be in the order of 3 volts, and that a driver transistor Tr1 will be required to be used between the pass transistor Tr2 and the output of the voltage regulator. It is also assumed that load sharing resistors will be required as a number of pass transistors will be placed in parallel with Tr2.

The emitter collector voltage of all the transistors used is assumed to be 0.6 volts. For the sake of convenience it is assumed that 0.5 volts will be developed across each load sharing resistor under full load condition. If the regulated output voltage is to be 13.8 volts, then the minimum unregulated supply at the input to the voltage regulator must be 13.8+0.5+0.6+0.6+3.0 which equals 18.5 volts unregulated supply.

The calculation of the secondary terminal voltage must also take into account the type of rectifier circuit to be used. *Figure 2* shows the transformer connected to a bridge rectifier and reservoir capacitor.

The most popular rectifier configuration to be found today is the full wave bridge rectifier, which is manufactured with the four diodes encapsulated in a square block. The actual rating of the rectifier will depend upon not only the maximum current to be supplied by the power supply to the load but also on the value of reservoir capacitance to be used and the Peak Inverse Voltage (PIV) which is likely to be developed across each individual diode. Note that the bridge rectifier may also require to

Fig 1 *Voltage distribution to produce the ideal secondary voltage*

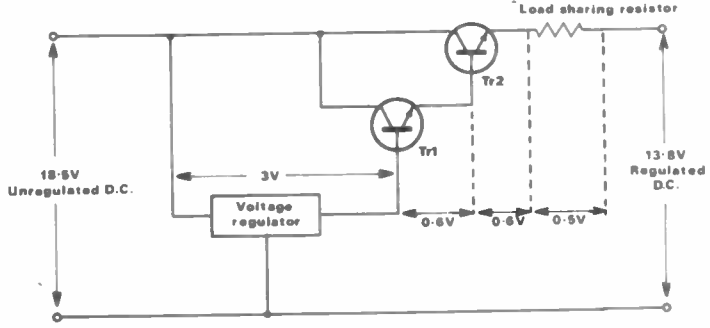
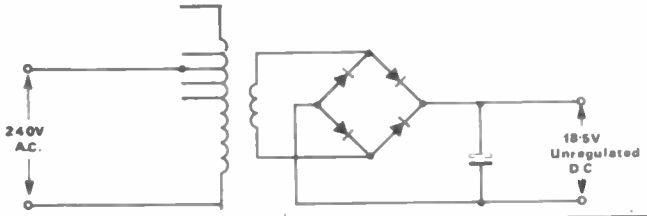


Fig 2 *Typical rectifier circuit*



be fixed to a heatsink to dissipate heat.

The typical voltage drop across the junction of the diode will be 1 volt. Therefore, for a bridge rectifier combination, 2 volts will be dropped across the bridge. If, for example, we are designing a 10 amp power supply, then the bridge rectifier will need to dissipate 20 watts of power. Therefore, some of the higher current rated encapsulated rectifiers will contain a metal base plate to assist with heat transfer when mounted directly onto a heatsink or bolted to the metal case of the power supply.

Individual diodes

If you happen to decide to use individual diodes, again some of the high power diodes will be stud mounted for fixing directly onto a heatsink.

I have always been a firm believer in under-rating the value of components used, which in turn will protect the power supply against being overloaded. In the case of the rectifier it would be wise to derate by a factor of 50 per cent for current handling capability.

Another important factor to consider is the voltage rating of the diode. The maximum voltage that is likely to appear across the junction of the diode will occur when the diode is not conducting. During this non-conducting period, twice the peak voltage comprising the voltage across the secondary winding plus the voltage across the reservoir capacitor will appear across the diode junction. Therefore, it is important to give consideration to this factor when purchasing your diodes. I purchased 30 amp, 100 volt potted bridge diode blocks from the local Barry Radio Rally for 50p each.

The size of the reservoir capacitance is also important to consider. Make the value of C too small and the level of unwanted output ripple under full load conditions will increase. However, if you make the value of C too large, then you are risking the possibility that you will destroy the rectifying diodes with the very high peak charging current required by the reservoir capacitors when the power supply is connected to the mains supply. In my article *Power Supplies* it was shown that a value of approximately 3,000μF/amp was satisfactory to provide a ripple free supply under full load conditions without destroying your bridge rectifier circuit.

Another important factor is the voltage rating of the capacitor. This must exceed the peak value of the secondary voltage of the transformer. Again, bargains are to be had at your local radio club rally. Two 15,000μF, 63 volt working computer grade reservoir capacitors were purchased for £1 each.

To arrive at the ideal secondary voltage of the transformer, a few more assumptions must be made. There will be an ac component of ripple across the reservoir capacitor. Let us assume that it will be on the high side of 3.5 volts peak to peak. Also, one can expect that the voltage regulation of the secondary voltage of the transformer will vary between no load and full load condition.

Again, let us allow for the secondary voltage to drop by 2.5 per cent on full load. We must also remember that the voltage on the secondary side of the transformer is sinusoidal and therefore we must convert the voltage to an rms value. Therefore, the ideal secondary voltage will be the value of the minimum unregulated supply (18.5 volts) plus the peak to peak value of the ripple current (3.5 volts) plus the voltage dropped across the bridge rectifier (2 volts), making a subtotal of 24 volts. Take into account the 2.5 per cent regulation which will yield 24 volts × 1.025, which equals 24.6 volts.

To convert this peak value of voltage to an rms value we need to divide 24.6 by $\sqrt{2}$, which will give an ideal secondary voltage of 17.39 volts. The hardest part of the exercise is to find a suitable mains transformer with a secondary voltage of this order capable of supplying the current at a reasonable price!

The transformer mentioned earlier and purchased at the local Barry Rally was rated at 30 volts, some 12.61 volts in excess of the minimum required value. This in turn will mean that if the maximum load current is to be 10 amps, then an additional 126 watts of wasted energy will be required to be dissipated to the surrounding air. However, this unwanted waste in energy can be further reduced by adjusting the tapped position on the primary side of the transformer. Hence we have a transformer that can be successfully used to build a 13.8 volt high current power supply.

High in-rush current

One snag that I overlooked when using high current transformers was the initial in-rush of current required on switch-on to create the back EMF. At first I could not understand why a 3 amp mains fuse in the 13 amp plug was blowing on each occasion the transformer was plugged into the mains. I thought that perhaps I had purchased a duff transformer.

It was only after inserting an ammeter into the primary side of the transformer that I realised the cause of the problem. It can be solved by using a higher value of mains fuse such as a 10 amp slow blow. I firmly believe that to provide the maximum electrical protection for the power supply a smaller fuse would be preferred.

The initial high start-up current can be substantially reduced by using a soft start circuit, as shown in *Figure 3*. A one hundred ohm resistor is placed in series with the primary winding to limit the initial peak 'in-rush' current to approximately 250 volts divided by 100 ohms, which equals 2.5 amps. In practice, the peak value of the current will be a lot less because we must take into account the resistance of the primary winding.

As the magnetic flux builds up inside the core of the transformer, it will cut the

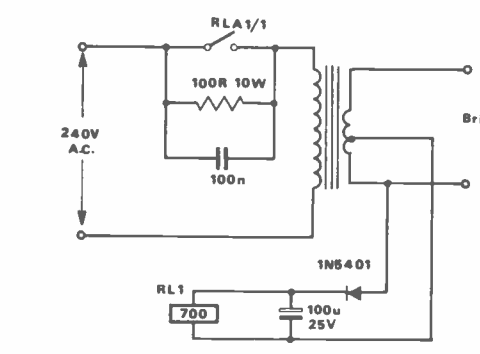


Fig 3 *Soft start circuit*

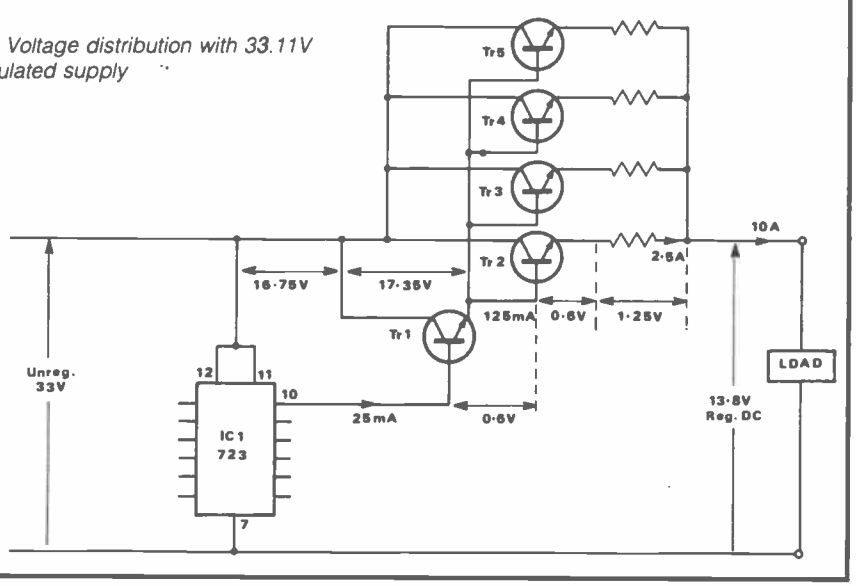


Fig 4 *Voltage distribution with 33.11V unregulated supply*

secondary winding and induce a secondary voltage. This secondary voltage continues to build up as the magnetic flux becomes established in the core of the transformer and the in-rush current will decrease. A point in time will be reached when the value of the secondary voltage is sufficient to energise the small relay placed across the secondary of the transformer and the relay contacts will close, shorting out the 100 ohm resistor in series with the primary winding to create the normal working conditions for the transformer. Using this technique a 3 amp mains fuse can be used to protect the power supply against electrical malfunction.

Voltage regulator

The next step in the design is to choose a suitable voltage regulator integrated circuit which best meets the specification for the power supply. Remember that it was my intention to provide current limiting.

It would make life simple if an integrated circuit could be found to provide not only the voltage regulation, but the current limiting as well. After an extensive search a device was finally chosen to perform this task.

The selected device was an L723, which is packaged in a conventional 14-pin DIL holder. It is capable of operating from a maximum voltage of 40 volts, well in excess of the unregulated voltage which is likely to arise from using the newly acquired transformer. However, the maximum output current is only 150mA, which will require additional current amplification by a buffer stage positioned between the output of the voltage regulator and the base of the pass transistors.

The IC contains its own reference voltage source, therefore the number of external components can be kept to a minimum. Another important feature is that the IC contains internal circuitry to provide current limiting. If, for example, voltage is sampled across one of the load sharing resistors as shown in *Figure 4*, which is connected to pins 2 and 3 of the IC, the device will provide current limiting.

According to the manufacturer's data sheet, the IC only needs to sample 0.65 volts to provide current limiting which commences at 1 amp. To provide current limiting which is to start at, say, 10 amps, a single resistor value of 0.65 ohms will be required. In practice the load current will be equally shared by a number of load sharing resistors, as more than one pass transistor will be used.

The point at which current limiting commences can be made to be variable by inserting a 1kohm linear potentiometer across one of the load sharing resistors from which the sample voltage is taken. The sample voltage required for voltage regulation can be taken from the centre wiper of a linear potentiometer forming part of a voltage dividing chain across the output terminals of the regulated voltage supply.

Heatsinking

The next stage of the design is to consider carefully the often forgotten problem of providing adequate heatsinking for the pass transistors. I am fond of using 2N3055 transistors in this part of the power supply circuitry because they are very robust and can be purchased for as little as 25p.

My intention is to use four of these transistors which will be attached to two 1.1°C/W heatsinks. The virtues of heatsinking were discussed at length in my earlier article, and the conclusion gained was that the use of two pass transistors attached to each heatsink improves the thermal conductivity.

As the newly acquired transformer produces a secondary rms voltage of 24 volts when primary overvoltage tap winding is used, the resulting unregulated voltage will be $24 \times \sqrt{2} \div 1.025$, which equals 33.11 volts. The voltage developed across each pass transistor will be 33.11−2−3.5−0.5−13.8 volts, which equals 13.31 volts. Therefore, the total power required to be absorbed by the four pass transistors on full load will be 13.31 volts × 10 amps, which equals 133.1 watts ÷ 4, which equals 33.275 watts per pass transistor.

The maximum heat capable of being dissipated by each 1.1°C/W heatsink with two 2M3055 pass transistors attached will be:

$$\text{Wattage} = \frac{\text{Temperature difference}}{\text{Total thermal resistance}}$$

$$\text{Wattage} = \frac{200°C - 25°C}{\frac{(1.5+0.5)+1.1}{2}} = 83.33W$$

The two pass transistors together will dissipate 33.275 watts × 2, which equals 66.55 watts. Therefore, the heatsink arrangement will operate satisfactorily in this particular circuit configuration.

Pass transistors

Each pass transistor will only carry a quarter of the full load current of 10 amps. The current gain of the 2N3055 transistor is quoted as being 20. Therefore, the base current of each pass transistor will be 2.5 amps ÷ 20, which equals 125mA.

If we now join together all the base connections and attach this to the output of the voltage regulator we will exceed the maximum output current for the L723 of 150mA. Therefore, a buffer transistor will be required between the output of the voltage regulator and the four base connections of the pass transistors. If we use another 2N3055 transistor as the buffer amplifier and connect its emitter to the four bases of the pass transistors, as shown in *Figure 4*, then the total emitter current will be 500mA. Assuming that the current gain is 20, the base current will be 600mA divided by 20 which will be 25mA, well within the maximum output capability of 150mA for the voltage regulator.

The 2N3055 buffer transistor can be a type TIP3055, which can be mounted directly to the inside of the power supply cabinet. One factor often overlooked is the power being dissipated by the many devices making up the power supply. Each pass transistor will dissipate 33.11−13.8−1.25 volts multiplied by 2.5 amps, which equals 45.15 watts, just outside the maximum heat capable of being dissipated by two transistors mounted on each heatsink.

By adjusting the primary tap of the mains transformer it is possible to decrease the unregulated voltage from 33.11 volts down to 30 volts, which reduces the heat dissipated by each pass transistor down to 37.375 watts; well within the maximum amount of heat that can be dissipated by the 1.1°C/W heatsinks with two transistors attached to each.

When using the L723 voltage regulator to provide current limiting it is necessary to develop 1.25 volts maximum across each load sharing resistor. Therefore, each resistor will be 1.25 volts divided by 2.5 amps which equals 0.5 ohms. Each resistor will need to dissipate 3.125 watts, making a total of 12.5 watts dissipated inside the cabinet of the power supply.

The driver transistor Tr1 will have developed a voltage between collector and emitter V_{ce} of 17.35 volts, and will draw an emitter current of 0.5 amps. The transistor will need to be capable of dissipating 8.675 watts. The TIP3055 transistor, which is packaged within a type TAB case, can be secured to the metal inside wall of the power supply case. The L723 voltage regulator will develop 16.75 volts between input and output and will draw a maximum current of 25mA. The regulator IC will therefore dissipate 420mW, well within the quoted maximum power dissipation of 660mW.

Current limiting

The L723 voltage regulator IC contains the facility to be able to provide current limiting by sensing a voltage whose magnitude is proportional to the load current. In the data sheet the manufacturer shows the relationship between the value of sensing voltage and value of limiting current by using the following equation:

$$R_{sc} = \frac{0.65}{I_{s/c}}$$

where R_{sc} is the value of the load sharing resistor in ohms, and $I_{s/c}$ is the value at which current limiting commences.

In the case of the circuit configuration shown in *Figure 4*, each load sharing resistor will be carrying a maximum current of 2.5 amps. For the power supply to be protected against excessive currents, which could occur if the output terminals were short circuited or a fault occurred in the load, it is desirable to commence current limiting at a value of 10 amps. This means that each load sharing resistor will not carry more than 2.5 amps.

If we are sensing the voltage dropped across one of the load sharing resistors,

Fig 5 *Current limiting using the L723 voltage regulator*

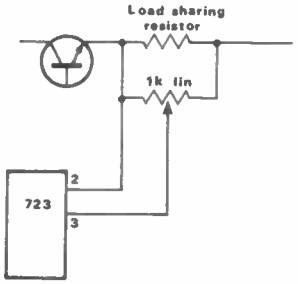
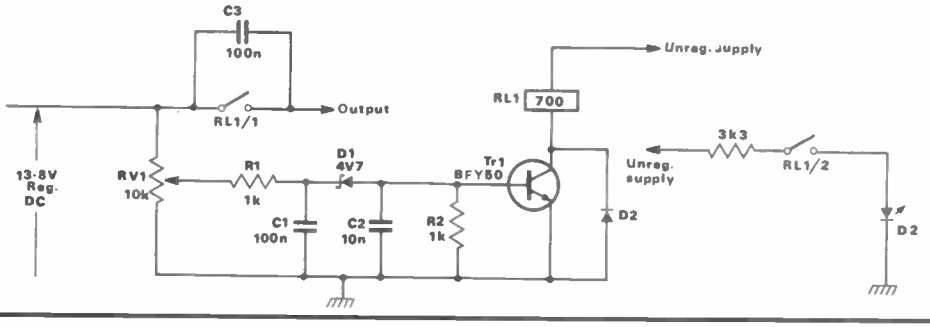


Fig 6 *Over-voltage protection circuit*



the value of this resistance will be:

$$R_{sc} = \frac{0.65}{I_{s/c}} = \frac{0.65}{2.5} = 0.26 \text{ ohms}$$

Figure 5 shows a means of being able to vary the value at which current limiting commences by inserting a potentiometer in parallel with the load sharing resistor and varying the slider to adjust the value of sensing voltage.

The value of the potentiometer should be such that it will not significantly affect the overall resistance value of the load sharing resistor and upset the current sharing between the four pass transistors. As a rule of thumb the value of the potentiometer should be a minimum of ten times the value of the load sharing resistor. The circuit configuration will provide variable current limiting which is adjustable from 5.2 amps upwards.

Over-voltage protection

One of the most important features needed in the design of the power supply is protection to safeguard the load from being damaged should the supply develop a fault and full unregulated voltage find its way onto the output terminals of the supply.

The conventional method is to use a thyristor in a crowbar circuit which will short circuit the output of the supply and protect the load if an over-voltage condition is sensed. The main disadvantage with this type of circuit is the fact that you will need a ready supply of spare fuses! This is the type of protection circuit normally found in professional power supplies.

However, there is an alternative method of providing protection against over-voltage without the inconvenience of blowing fuses. This alternative method uses a relay contact to remove the over-voltage from the output terminals of the power supply and was described in my earlier article.

Figure 6 shows the circuit I chose. A 10kohm potentiometer is placed across the regulated side of the supply and the wiper arm adjusted to select the desired tripping voltage. The resistor R1 limits the base current of Tr1 to a safe level. Resistor R2 clamps the base of Tr1 to ground. Capacitors C1 and C2 prevent any unwanted transients from causing nuisance tripping.

The Zener diode D1 has been included to limit the threshold at which tripping occurs, which will be approximately the value of the Zener diode plus the base emitter voltage of Tr1. In the example shown the minimum tripping voltage will be 4.7 volts plus 0.6 volts, which equals 5.3 volts. Diode D2 has been included to prevent the back EMF of the relay coil from damaging Tr1.

To ensure the fast operation of the relay, the supply for this is taken from the high voltage unregulated side of the supply. A front panel indication that the protection circuit has operated is provided by an LED diode connected to any spare contacts on the relay and connected via a 3.3kohm resistor to the unregulated side of the supply.

When this circuit was first proposed it raised quite a lot of discussion among readers. There are those who feel strongly that the conventional crowbar circuit is the only positive way of providing protection against over-voltage. It is argued that the relay operation would be too slow to protect the load and that the relay contacts on opening on full load would create a spark which would prolong the time the supply is available to the load after over-voltage has been detected.

Fig 7 *PSU circuit diagram*

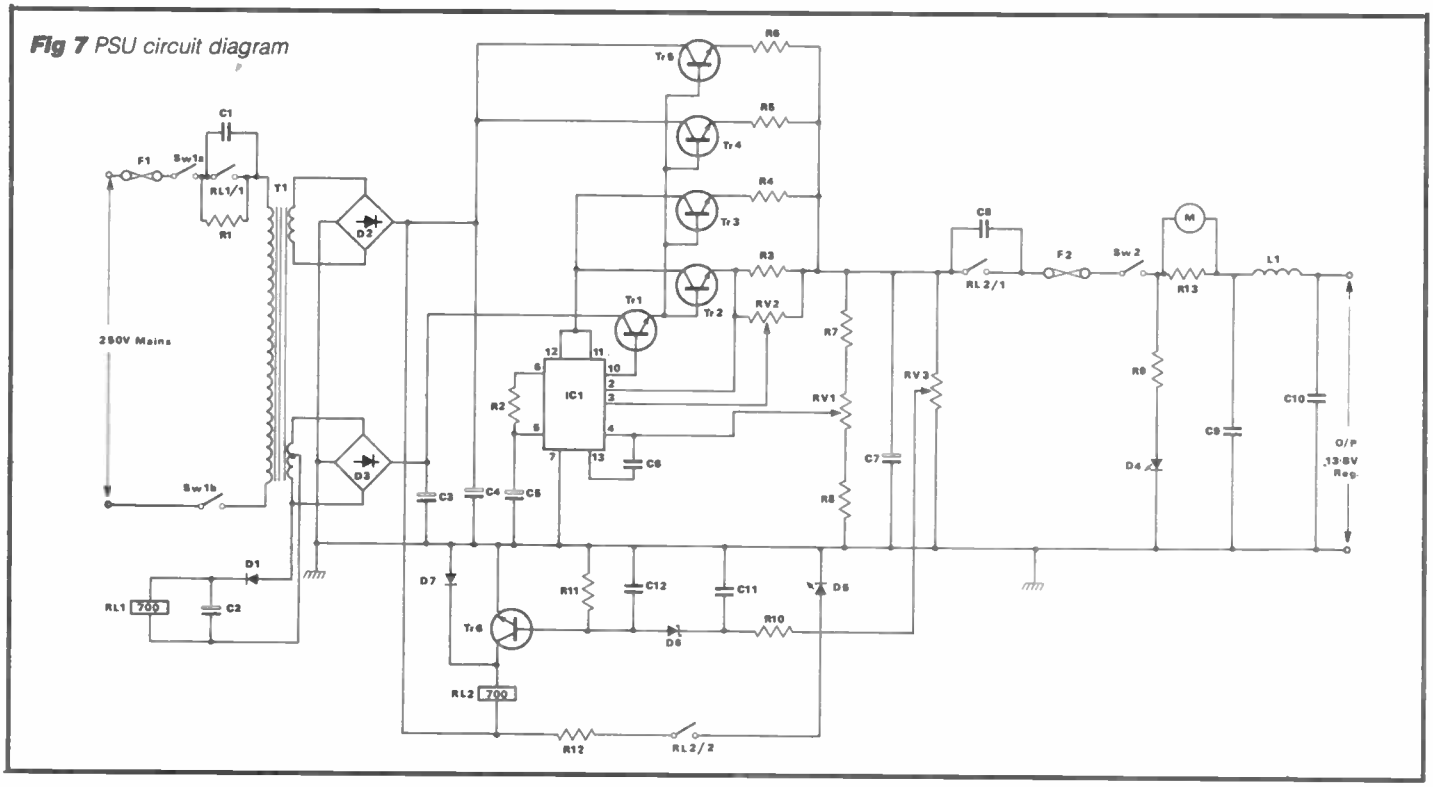
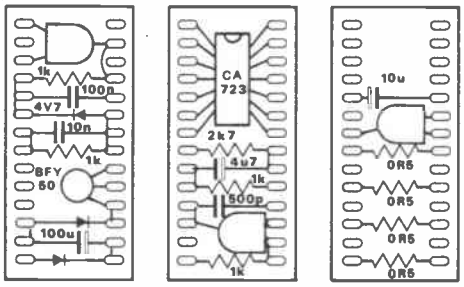


Fig 8 *Component layout on the three tag boards*



The only defence I can offer is that the circuit has been tested using an inexpensive CB set as the sacrificial load. With a crocodile lead the unregulated voltage was connected to the output terminals of the power supply, just in front of the relay contact RL1/1. The over-voltage protection circuit operated and the CB set survived, only to be used as the sacrificial load on a number of occasions afterwards to prove that the first attempt of survival was not a fluke.

The main advantage of this circuit is that the protection fuse does not blow when the over-voltage circuit operates. However, if you still feel that you would be happier using a crowbar circuit, please refer to the October 1985 edition of *Radio and Electronics World* magazine.

Problems with RF

One of the problems encountered using power supplies which are voltage regulated by means of an integrated circuit is the effect that stray RF has on the voltage regulation of the power supply. I experienced a problem when testing a 50 watt linear amplifier and was baffled to find that the output voltage would decrease from 13.8 volts down to 4 volts for no apparent reason when the transmitter was keyed.

The problem was traced to the voltage regulator chip being affected by stray RF. The solution was to insert a low pass filter close to the output terminals of the power supply to prevent any unwanted RF from finding its way into the guts of the power supply.

The full circuit diagram of the fixed voltage power supply is shown in *Figure 7*. Transformer T1 is the monster purchased on spec from the local radio rally. A sample of the secondary voltage is rectified by diode D1 and smoothed by C2 to operate relay RL1 to provide the soft start facility required on switch on. The full secondary voltage of T1 is rectified by D2 and D3 and smoothed by capacitors C3 and C4. The unregulated voltage of one secondary winding is fed to the voltage regulator IC, whilst the unregulated voltage from the other secondary winding is fed directly to the collectors of the pass transistors Tr4 and Tr5.

If you happen to find yourself with a transformer with only one secondary winding, then the circuit shown in *Figure 7* can be quite easily altered to suit. After the rectification and smoothing, the unregulated voltage should be fed to the input of the voltage regulator. The collectors of all four pass transistors should be connected together and joined to the unregulated side of the supply.

In my circuit the output from the voltage regulator is fed via a buffer transistor, Tr1, to the bases of the four pass transistors. Equal current sharing for each pass transistor is achieved by load sharing resistors which are placed in series with the emitter of each pass transistor. Across one of the load sharing resistors, R3, a sample voltage is taken via the preset potentiometer, VR2, to set the value for current limiting.

If each load sharing resistor is made to be 0.5 ohms, then the magnitude of the voltage developed across the load sharing resistor on full load will be 1.25 volts. This voltage will result in the threshold for current limiting commencing at 5.2 amps. Therefore, VR2 will provide an adjustable range for current limiting starting from 5.2 amps upwards. The load sharing resistors can be home-made by winding 605mm of 36swg wire onto an old fashioned type quarter watt solid carbon rod resistor.

Alternatives

Alternatively, the resistors can be purchased; the nearest preferred value being 0.47 ohms and the suggested wattage rating being about 7 watts.

The regulated voltage can be adjusted by varying VR1 which samples the regulated voltage and feeds the sample to pin 4, the inverting input of the voltage regulator IC. The value of voltage at which the over-voltage protection circuit will operate can be varied by adjusting preset VR3. When the over-voltage protection relay, RL2, is energised, the supply is removed from the output terminals by contacts RL2/1 opening, and a visual indication of the operation of this protection circuit is given by contacts RL2/2 closing and illuminating LED D5, located on the front panel. LED D4 also gives a visual front panel indication when regulated voltage appears on the output terminals of the power supply.

Unwanted RF is prevented from entering the power supply by a low pass filter comprising C9, L1, and C10. L1 is a 10mH choke, which is constructed by winding 40 turns of 20swg wire wound on a 23mm diameter toroidal core. An ammeter has also been included on the front panel to provide the user with an indication of the current being supplied. I used a 1mA FSD metre I found in the junk box.

A meter shunt was constructed out of 70mm of 0.6mm diameter wire. However, the meter can be calibrated by placing it in series with a known accurate ammeter, such as an AVO, and the shunt adjusted to obtain the same reading as shown on the known ammeter. The numbering on the scale plate of the ammeter can be altered by removing the existing numbering with white typist correcting fluid and renumbering using rub-on transfers.

Construction

As mentioned before, the heart of the power supply is the transformer used. Dependant upon its physical size is the size of the case you will use together with the positioning of all the major components. Due to the large physical size of the transformer used, I purchased a 254mm × 254mm × 178mm equipment case for £7.20 from Minffordel Engineering of Ffestiniog (tel: 076676 2572).

The various components were positioned as shown in *Photograph 1*. The large transformer was positioned on its side and bolted to the back and bottom of the case.

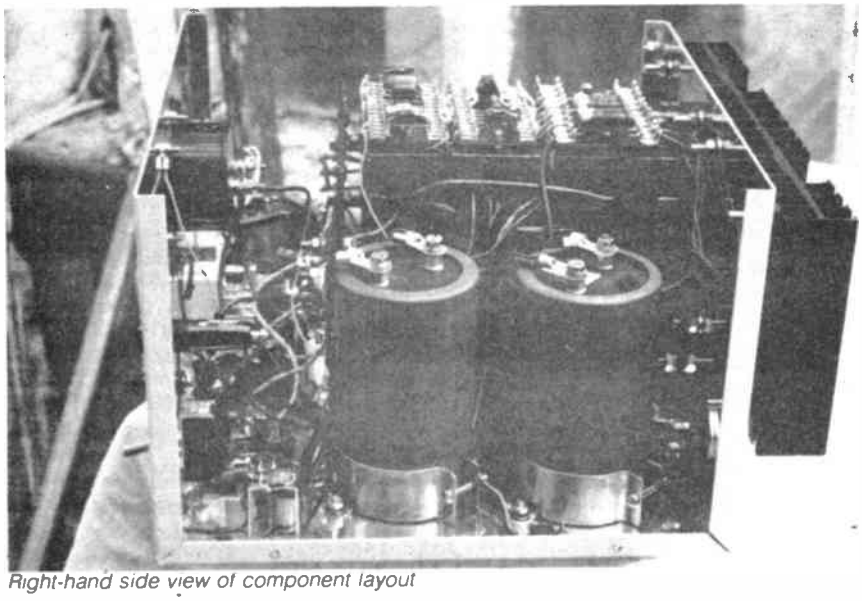
The next largest components are the two reservoir capacitors which are mounted alongside the transformer, leaving plenty of room behind the front panel to accept the components which are to be mounted on it. The two heatsinks are mounted on the back of the case and are slightly raised off the surface, using large nuts for spacers. This will assist with air circulation around the back of the heatsinks.

The two bridge rectifying square blocks were bolted directly on to the floor of the case just behind the front panel and directly in front of the transformer secondary terminals. The two relays were discovered in the junk box and bolted to the floor of the case. The electronic components were soldered onto three separate tag boards and then bolted with spacers to the metal frame of the transformer.

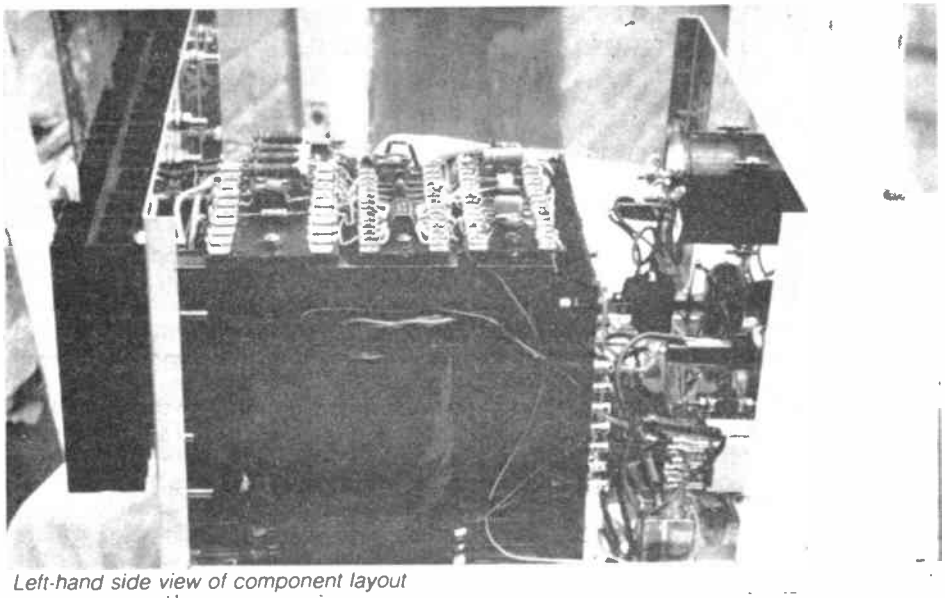
The electronics associated with the over-voltage protection circuit were attached to the tag board located nearest to the front panel. The middle tag board contains the components associated with the voltage regulator.

It will be noted from the photograph that the voltage regulator IC has been inserted into an IC holder. This not only assists with the method of construction but also safeguards the IC from being damaged when the components are being soldered together. It is wise to check all your wiring before inserting the IC into its holder. The tag board located nearest the heatsinks contains the four load sharing resistors and VR2.

The layout of the components on the 3 tag boards is shown in *Figure 8*. The components to be included in the layout of the front panel should be set out



Right-hand side view of component layout



Left-hand side view of component layout

COMPONENTS LIST

C1	0.1μF 300V dc working
C2	100μF 2V
C3	15000μF 63V
C4	15000μF 63V
C5	4.7μF 25V
C6	500pF
C7	10μF 20V
C8	0.1μF
C9	0.1μF
C10	0.01μF
C11	0.1μF
C12	0.01μF
D1	IN5401
D2	BA26933 or equivalent
D3	BA26933 or equivalent
D4	Standard 0.2in red LED
D5	Standard 0.2in red LED
D6	4.7V Zener 500mW
D7	IN4007
F1	3A slow blow
F2	10A
IC1	L723
L1	10mH choke, 40 turns of 20swg on 23mm diameter toroidal
R1	100 ohms 10W
R2	2k7 ¼W
R3	0.47 ohm 7W wire wound
R4	0.47 ohm 7W wire wound
R5	(as above)
R6	(as above)
R7	1k ¼W
R8	1k ¼W
R9	3k3 ¼W
R10	1k ¼W
R11	1k ¼W
R12	3k3 ¼W
RL1	700 ohms 2-way single pole
RL2	700 ohms 2-way double pole
S1	Double pole single throw
S2	Single pole single throw
Tr1	TIP3055
Tr2	2N3055
Tr3	2N3055
Tr4	2N3055
Tr5	2N3055
Tr6	BFY50
VR1	1k LIN
VR2	1k LIN
VR3	10k LIN

symmetrically to be pleasing to the eye, and the panel itself should be sprayed using a car touch-up aerosol. The lettering was achieved by using rub-on transfers, which can be protected by spraying the front panel with a can of lacquer aerosol.

The choke, L1, is mounted as close to the positive output terminal as can possibly be achieved to prevent unwanted RF from finding its way inside the cabinet. The TIP3055 buffer transistor, Tr1, is bolted to the floor of the cabinet using a mica washer. This way the cabinet acts as a heatsink for the transistor.

The photographs show the component layout from each side of the cabinet and will assist you with your own particular component layout ideas. The mains input socket is mounted on the back panel just below the heatsink. It should also be noted that the four pass transistors are mounted at an equal distance on the two heatsinks, and have been bolted side by side to assist with the even distribution of temperature over the whole surface area of the heatsinks.

Calibration

With a multimeter connected to the output terminals of the supply, adjust the voltage regulator preset, VR1, to obtain a reading of 15 volts. The over-voltage protection circuit can now be adjusted by rotating the slider of the preset VR3 until the over-voltage protection circuits operates. Next re-adjust VR1 to obtain a voltage reading of 13.8 volts.

The current protection adjustment preset, VR2, can be made with either a home-made load connected to the output terminals of the supply or a known piece of equipment which draws approximately 10 amps. A useful dummy load was described in the January 1986 edition of *Radio and Electronics World*. With the dummy load connected, VR2 should be adjusted to a point where current limiting commences at 10 amps.

Conclusions

The power supply has been in use at my shack, running the 10 metre rig and linear amplifier, for approximately six months without giving any trouble. The transformer used is capable of supplying a lot more current than is really required to operate the 10 metre equipment. Consequently the physical size and weight of the power supply is large. Perhaps with hindsight it might have been more practical to have purchased a smaller transformer like one of those nice compact light-weight toroidal transformers. Unfortunately, the cost is the only factor which prevents me from taking the matter further.

If you happen to see a chap with short arms and deep pockets wandering around one of the radio rallies, it could be me! However, the power supply described in this article was built at a fraction of the price you would have had to pay for one of those nice factory manufactured black boxes.

ARE YOU A BUDDING WRITER?

We are particularly keen to receive construction articles, so if you have designed and built a project which you think could be of interest to fellow radio amateurs we would be pleased to receive your contribution.

You do not need to be an expert writer to see your name in print. Accuracy in the design of your project is far more important. If you can put your ideas down on paper, typewritten if possible, and illustrate them with clear drawings and photographs where appropriate, the *Amateur Radio* editorial team will sort out the style, grammar, spelling, etc.

If you have an idea which you wish to discuss with the Editor before submitting in article form, she will be pleased to receive your call.

We will, of course, pay for all articles which are accepted for publication.

NEWSAGENT ORDER FORM

To (name of newsagent)

Amateur RADIO

Please order a copy of ***Amateur Radio*** for me every month

NAME.....

ADDRESS.....

.....

.....

Newstrade distributors: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS. (Tel: 01-247-8233)

THE GW4WDR RTTY PROGRAM

for the

BBC COMPUTER

A user review by
KEN MICHAELSON G3RDG

This was an interesting program to review, primarily because it has two unusual features, neither of which I had come across before. Firstly, it has nine pages of pre-stored text insertion available, and the introduction of the text can be treated in the manner of a word processor, ie allowing full insertion and deletion of characters and lines within the actual text page. But more of that later. The second feature available in the program is the means of controlling the frequency on a synthesized transceiver/receiver from the keyboard of the Beeb during the transmission or reception of RTTY.

In this case, the up and down cursor keys are used to alter the frequency, and each time one of them is pressed a relevant pin will become positive at the user port. With a simple transistor interface (the circuitry is given in the manual supplied), the receive and/or transmit frequency may be altered. The program uses the Teletext graphics of Mode 7, and is displayed in full colour using a 40 column display. This allows a standard colour TV to be used. A high resolution monitor is not required, although I used my monitor for the review getting an excellent picture.

Two menus

There are two menus in the program, menu 1 giving the following options: 1 – load text page; 2 – catalogue disc; 3 – save text page; and 4 – execute RTTY program, which takes you on to the next menu. The second menu gives the following facilities: 1 – edit text pages; 2 – QSO review (more of that later); 3 – set GMT clock; and 4 – set auto CR/LF.

To actually get into the RTTY screen it is necessary to press 'Escape'. It is not necessary to use all of the text pages, in fact one need not use them at all. In order to access the text pages for insertion when in memory 2, just press '1'. The screen will then clear and the question 'Page=?' will appear. On pressing '1' (or 2 or 3 or any number up to 9) the page in question will be shown if anything has been written into it previously. If not, then nothing will show and one can then write whatever is required. Any time a new line is wanted the Return key is pressed (this is shown on the screen as ':'). One can also edit whatever is displayed from the previous insertion.

There are six commands which can be used in conjunction with the text pages to give the 'word processor' type of editing mentioned above. All these are preceded by pressing the 'Control' key, and they are as follows: I – insert a blank line; D – delete a line; U – move text up to the cursor position; W – switch ON/OFF insert mode; O – recall old page before editing; and L – clear text screen. The cursor keys are used to move around.

Sit back and relax

Station particulars, name, QTH and things of that sort can be entered and recalled for transmission by typing '!1' or '!2' etc, into the type ahead buffer, (in this case the '!' is called the 'pling' and is used as a control key, not as an exclamation mark). So, when having a QSO one can press one or two keys and sit back and let the computer do the work. What a change from the days when I used to type my fingers to the bone on the old Model 7ER/P teleprinter!

The action of pressing '2' in menu 2 gives you a 'QSO review'. You are able to inspect any text which has been transmitted or received up to the limit of the 10K memory allowed for that purpose. It may be scrolled up and down by using the cursor keys and if, for any reason, hard copy is required and the printer had not been enabled during the actual QSO, then this can be done by positioning the text required roughly in the centre of the screen and pressing 'CTRL P'. This will cause the screen to be dumped to the printer. A clock is included as the third option of the menu and the setting of it is achieved by the third command of this menu. This clock is displayed in the top right hand corner of the screen continuously in all of the many program screens, and I would suggest that it is set to GMT rather than local time. Unfortunately, the clock did not function with my particular version of the program, due I understand, to some conflict with the ROMs in my Beeb, but GW4WRD is bringing out a revised version shortly.

This brings me to the last option in the menu; that of line length. The program display line length of outgoing and incoming messages is 40 characters per line split screen, as mentioned above. However, that has no relationship to the line length of the station the other end, who might be operating a mechanical teleprinter requiring 69 characters per line, or any type of computer which may require much less before the 'line feed/carriage return'. This problem is accommodated in the program by the facility to preset the line length before 'line feed/carriage return', anywhere from 10 characters to 99 characters. The default value is 64 characters.

While in the menu 2, typing '★' will pass the subsequent line to the operating system, so as to allow access to the various operating system commands, such as '★CAT', '★FX', '★MOTOR' etc. In this manner the text pages can be loaded or saved to/from disc or tape, according to which is being used. This is achieved by the following commands: '★SPAGE filename' – save text pages; and '★LPAGE filename' – load text pages. Apart from this use of a '★' command, the ten orange function keys may also be programmed to contain messages or to control program functions. A good example of this is that any function key of choice (0 to 9), may be programmed so that a 'CQ' call may be made and concluded merely by pressing one function key.

Transmit command

'★KEY0:[!R!R!C!C!C!G!P★' will, on pressing function key 0, command the Beeb to switch the rig to 'transmit', send 'letter shift' followed by two lines of 'RY', three lines of 'CQ de your callsign', the time in GMT, 'Please K K K' and then your callsign in CW (if the CW ident is enabled), finally switching the rig back to 'receive'. There are four baud speeds already in the program (45.45, 50, 75 and 110 set by pressing 'CTRL' and 'F0', 'F1', 'F2' and 'F3'), but the program will accommodate any baud speed from 16 to 999, so any other speed can be entered to a function key following the procedure above.

It is impossible, in this review, to cover all the facilities and variations available because the manual runs to sixteen pages, but noting a few more conveniences in the program would not go amiss. One is able to toggle the printer on/off

either in transmit mode or receive mode or both by pressing 'CTRL' and 'F7' for transmit and/or 'F8' for receive. The 'normal/reverse' facility, which is a very necessary operation at times, can be achieved by pressing 'CTRL' and 'F4' in a toggle fashion, as with the printer.

Blue bars

These facilities are displayed on the operating screen over three blue bars, top, middle and bottom. On the top bar are shown from the left, the mode Rx/Tx, then a most interesting aid: two small yellow oblongs, one above the other, showing 'mark' and 'space', and when the station is correctly in tune. These oblongs oscillate in sympathy with the incoming signal so that one is able to tune correctly even without the tuning indicators usually available on terminal units, and I felt that this was an excellent addition.

Next, the word 'searching' or 'locked' was displayed, really self-explanatory because as soon as a signal was tuned in correctly by the oblong bars, the word 'searching' changed to 'locked' and text was displayed. Following this either the letter 'L' or 'F' were displayed, which stood for 'letters' or 'figures' and which changed according to what was being transmitted.

If the text went into 'figure shift' during a transmission which was obviously letters, then the program could be 'forced' back to 'letter shift' by pressing ']'. The opposite effect could be achieved by pressing '['.

'Callsign capture'

There is also a facility for 'callsign capture', which saves the operator typing the far end's callsign every time the transmission is changed over. To do this I just had to press 'CTRL C' while the other chap's callsign was being sent, and if it was 'captured' a bleep sounded (in this program a very pleasant bell-like sound), and the callsign appeared in the yellow section of the central blue bar. The callsign could now be sent merely by pressing '!M', which recalled it from the memory. GW4WRD reckons that it will work for 95% of the time.

```
CQ CQ CQ CQ CQ CQ CQ DE G3RDG G3RDG G3RDG PLEASE KKKK

CQ CQ CQ CQ CQ CQ CQ DE G3RDG G3RDG G3RDG PLEASE KKKK

LS FFGGJ

G3RDG G3RDG DE YO4PX YO4PX
UR RST 589 589 589 589 589 589 QTH IS CONSTANTA
NAME IS FERY FERY FERY FERY FERY SO HOW COPY ????
BTU G3RDG G3RDG DE YO4PX YO4PX PSE KN KKK
YO4PX  YO4PX  DE  G3RDG  G3RDG...GOOD  EVENING  TO  YOU...I  COPY  NOW 579
579...NAME IS KEN KEN KEN AND QTH IS LONDON LONDON...RIG TRIO TS820S WITH
50 WATTS...WX RAIN WX RAIN...SO BTU FERY DE G3RDG
RYRYRYRYRYRY G3RDG G3RDG DE YO4PX Y4PX RGR RGR KEN
MNY TKS FOR REPORT WX IN CONSTANTA HAS BEEN FINE     SUNNY  AND  CLEAR TEMP
ABOUT 23 DEGREES CENTEGRADE CONSTANTA IS LOCATED ON THE BLACK SEA COAST
SO TKS FOR QSO  IF YOU NEED MY CARD  ADDRESS IS BOX 90 CONSTANTA BOX 90
CONSTANTA ROMANIA PSE  SASE ENCLOSED
BTU KEN HOPE YU STILL COPY   CNDX ARE UNSTABLE
G3RDG G3RDG DE YO4PX YO4PX PSE KKKKK
YO4PX YO4PX DE G3RDG G3RDG...OK FERY...NO I DO NOT NEED YOUR QSL CARD...
I DO NOT COLLECT THEM HI....THANKS FOR NICE QSO..GOOD DX AND 73 TO
YOU FROM LONDON...ALL THE BEST...BI BI
YO4PX DE G3RDG AR SK TIME 2139 UTC  GOOD NITE KEN CUAGN SOON
G3RDG DE YO4PX SKSKSKSK
```

Printout of a QSO in RTTY using this program

It worked every time for me, but perhaps I was lucky. To the left of the 'callsign capture' on the central bar the 'normal/reverse' information is shown. It is toggled by 'CTRL F4', and to the right the speed is displayed.

As I mentioned above, there are 4 pre-programmed speeds, and the default condition is 45.45 bauds. The bottom bar displays the printer status, transmit and receive, CW ident on/off and the shift, which can be changed to any one of the four preprogrammed speeds by pressing 'CTRL' and 'F0', 'F1', 'F2', or 'F3', as described above.

Special commands

There are 10 special commands, all preceded by '!' and since your own callsign is embedded in the program when you buy it, in order to quickly send a 'CQ' call all you do is to type '!C' and out it goes. To summarise, they are as follows: '!C' – CQ de callsign; '!T' – The Quick Brown Fox etc; '!R – RYRYRYRY' etc; '!QRZ' – QRZ de callsign; '!D' – DE callsign; '!S' – Callsign; '!P' – please KKK; '!G' – time GMT, '!M' – recall from memory (captured callsign); and finally '!page'. This allows a text page to be recalled, where 'page' is replaced with a number from 1 – 9. I put my station details in page 1, and sent them out by merely pressing '!1'. Too easy.

Conclusion

In conclusion, I must say that I found this program great fun to use, and having become familiar (more or less!) with the various commands, was able to use it with speed. Calling up all the preprogrammed texts was also an interesting exercise. I would recommend it. My only moan is that there really should be some form of insert to slide under the plastic strip above the function keys, to be used as a memory prompt. Until I got the general idea of it, I was frantically turning over the sixteen (!) pages of the instructions.

Where to get it

The GW4WRD RTTY program is available on tape for £12 and on disc for £14.50, VAT, postage and packing inclusive. The callsign must be stated when ordering or a dummy callsign will be used instead. The program can be obtained from HAMTEL, Rock Hill Llanarthne, Carmarthen, Dyfed SA32 8LJ.

An Rad 10GHz system

by Glen Ross G8MWR

Having obtained a dish and worked out the focal length and the expected gain using the information in last month's article, we now come to the next step which is deciding on the type of feed to be used. Let us look at the various methods that are available and the advantages and disadvantages of each type.

The horn feed

The idea frequently put forward by newcomers to these bands is that the simplest method of illuminating the dish would seem to be to just place the head in front of the dish on suitable supports. Alternatively, you could mount the head behind the dish and run a piece of waveguide to a small horn mounted at the focal point. This type of 'direct' feed is shown in *Figure 1*. There are, however, some problems to this approach.

The first is that one must place the effective 'point of origin' of the small horn assembly at the focal point of the dish, and it is not easy to determine with real accuracy where this origin is located. One usually has to resort to sliding the assembly around until the best results are obtained and then making up the permanent supports.

Because the unit may have to be mounted anything up to fifteen inches in front of the dish, you also end up with a bulky assembly to carry around. There is also a certain amount of 'aperture blocking' which will reduce the gain slightly, but this is not a major consideration.

Criteria

Much more important is the fact that you cannot just use any old horn (say a Solfan) in this application. The essential point is that the radiation from the horn should just cover the area of the dish. Obviously, any spillage will result in reduced gain and if the beam from the horn only illuminates part of the dish then you might just as well have saved yourself a lot of trouble and used a smaller dish in the first place.

The feed horn must therefore be designed for use with the particular dish or rather for a dish with a particular f/d (focal length divided by diameter) ratio. This is easily done from tables which are available in good books, but it can result in some surprising designs, frequently resulting in a feed horn which may have an expanding angle in one plane and a reducing one in the other.

If you decide to take this path, a feed for a focal plane dish (f/d=0.25) would need a 3dB beamwidth of 155°, whilst a suitable horn for a dish with an f/d ratio of 0.7 would require a beamwidth of 48°.

Indirect feeds

There are two main methods of indirect feed. The first, using a plane reflector, is shown in *Figure 2*. This is, in effect, the same as the direct feed but has the advantage that the head can be placed within the dish assembly. The sub-reflector should be about six inches or more in diameter for use at 10GHz, but should not be greater than one third of the diameter of the dish as the gain would then start to disappear rather rapidly.

The reflector is set so that it just intercepts the line from the edge of the dish to the focal point, the head being positioned at the same distance from the plate as the real focal point is, ie the distances marked 'A' are equal. The reflector may be a solid plate or may be made from mesh, provided that the size of the holes does not exceed a tenth of a wavelength (about 3mm at 10GHz).

Cassegrain feed

This is the second type of indirect feed and is shown in *Figure 3*. The planar reflector of the previous system is replaced by a shaped reflector in the form of a hyperboloid. This has the effect of making the focal length of the dish appear longer than the true focal length, which can make mounting the feed system a lot simpler mechanically. The same restrictions on the size of the sub-reflector apply as in the case of the planar system already described.

Penny feed

This type of feed, whilst not being the most efficient method of feeding a dish, is the one used by the vast majority of operators. This is due to its simplicity of construction and the fact that it enables a very robust mounting, with the head and other equipment situated behind the dish. Reference to *Figure 4* will make the constructional details clear.

It is often thought that this feed works by the RF travelling along the waveguide and then squirting out of the slots into the dish, in the same way as water behaves. This is not the case. The two slots are in fact resonant lengths and each acts as a half-wave dipole. The RF travelling up the waveguide feeds these two dipoles which then radiate the power into the dish.

The slots can be made by carefully filing away the metal until the required dimensions are reached. The depth of each slot is not critical and, due to the bandwidth of this type of design, the length can vary by a few per cent from the correct dimension without causing undue concern. This all adds up to kitchen table technology of the highest order.

Precautions

After the slots have been cut, the end of the waveguide should be squared up and all swarf removed before fitting the disc to the end of the guide. This should only be soldered to the smaller dimensioned side of the guide and it is essential to ensure that no solder gets into the guide.

One way of achieving this is to cover the parts where solder is not required with a coating of grease so that the solder cannot take to these areas. When the job is complete these areas can be washed with a solvent or detergent and the slots and the back of the disc can be cleaned with a small flat file; a nail-file does an excellent job.

A fair amount of heat is required for this work and a small butane blowlamp is probably the best way to do it. If an ordinary heavy iron is to be used, it will be found helpful to heat up the work on an electric hotplate (preferably while your wife is out).

Mounting

An easy way of mounting the assembly into the dish is to use an extra square flange, as shown in *Figure 5*. A small hole is first drilled through the centre mark on the dish and then the flange is mounted centrally on this hole. The rectangular cut-out can then be made with a square file, using the flange as a jig. When making arrangements to mount the dish onto a support do not forget that the one inch dimension of the waveguide must be vertical to obtain the normal polarisation.

Setting up

The feed can now be inserted through the dish and the end flange for connection to the head can be fitted. The waveguide should be allowed to protrude through the flange slightly while being soldered into place and, when the solder is set, this excess material should be carefully filed down to give a perfectly flat surface to mate up with the head.

The feed should be adjusted until the slots come at the focal point measured from the inside surface of the dish. The waveguide can then be soldered to the supporting flange.

An alternative method of fixing the guide to the backplate flange is to drill and tap the flange to take 2BA screws in each face and then use these to lock the feed once the correct position has been found. These screws should not be over-tightened or serious distortion of the waveguide may result.

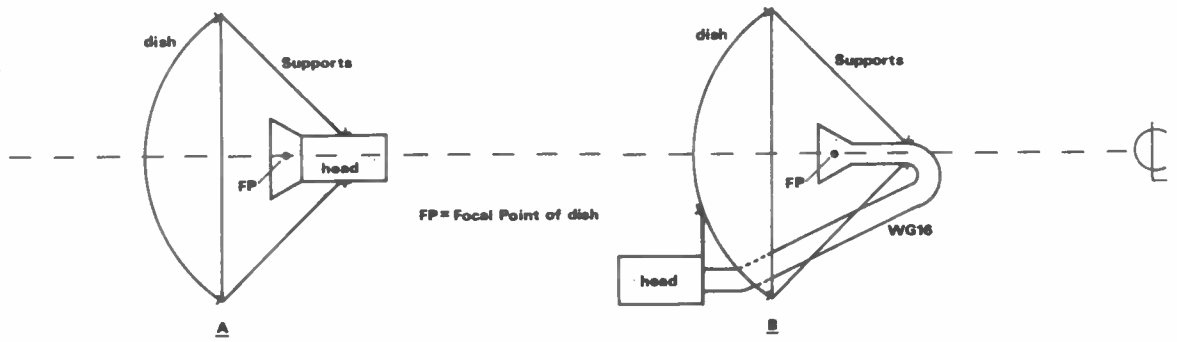


Fig 1 *Showing two methods of direct feed. In B the WG16 may be taken through a hole in the dish or may be routed outside it*

The accuracy of the feed positioning may be checked by pointing the dish towards the sun and checking to see that the bright circle of light comes at the slots at the end of the feed. This test cannot be done by firing at a lamp, as it is essential that the rays of light are exactly parallel.

The feed should be checked to ensure that it is central in the dish by measuring from each face of the waveguide to the edge of the dish. The dimensions taken from opposite sides of the guide should, of course, be equal. If they are not, a careful amount of pressure in the required direction should be applied. The feed being offset will not result in a serious loss of gain (unless the offset is considerable), but it will result in the dish 'squinting' and not firing in the direction you think it will.

On a short length of waveguide such as is used in these designs there is little loss due to VSWR, but some gilding of the lily can be obtained if a set of matching screws is mounted on the WG16, as shown in *Figure 6*. The screws used are 8BA, with either small springs in compression or a set of locknuts.

It will be found when adjusting these screws that only one, or perhaps two with different effectiveness, will be found to make any effect. In theory only one screw at the correct point is needed, but in practice this point is difficult to determine and so three screws are used in the sure knowledge that at least one of them is going to be in the right place.

Instead of soldering three separate screws to the waveguide, it may be more convenient to mount the whole matching assembly as a sub-unit on a small piece of brass and then to solder this to the WG16, although this would involve some careful positioning of the holes in the block and those in the waveguide.

Supplies

The parts are available from the Microwave Society, 81 Ringwood Highway, Coventry at the following prices: WG16 waveguide at £4.25 per foot length and the square flanges at £3.75 each; the penny feed disc at 75p (please allow a reasonable amount towards postage); and all the other parts are available as listed in the previous articles, except that there is a delay of 28 days in the supply of new orders for the heads.

Next month we put the whole system together.

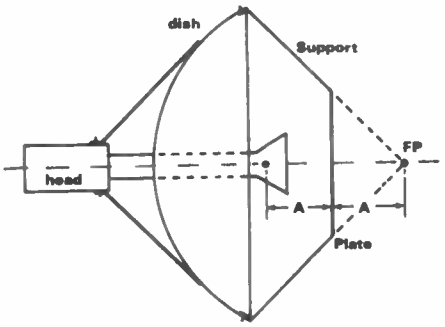


Fig 2 *Indirect feed using a plane reflector*

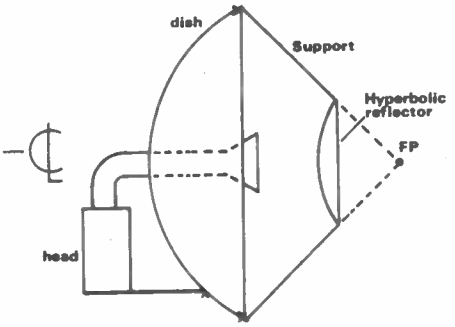


Fig 3 *Shows increased focal length using the Cassegrain system and also an alternative head mounting using a 90° WG16 bend*

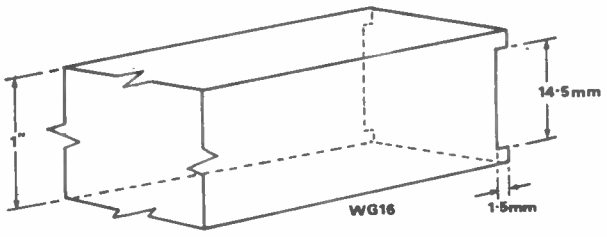


Fig 4 *Showing construction of feed system*

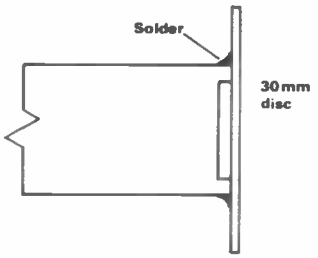


Fig 5 *Showing method of mounting penny feed nto dish*

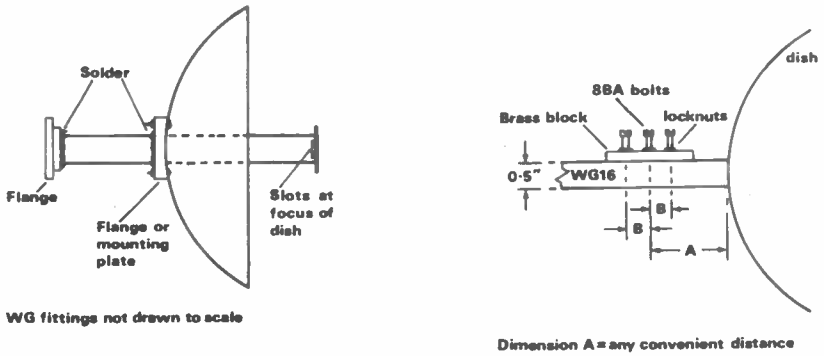


Fig 6 *Showing details of matching sections*

Britain's fastest selling sunglasses

Reactolite RAPIDE
THE WORLD'S FASTEST REACTORS

NOW £5 OFF!

Choice of 4 types – all at the amazingly low price of £7.95

Last year a staggering 4 out of 10 sunglass wearers chose Reactolite Rapides.

This year, as an extra bonus, we are offering the readers of this magazine the opportunity to buy direct – a massive saving of £5 on the normal retail price of £12.95.

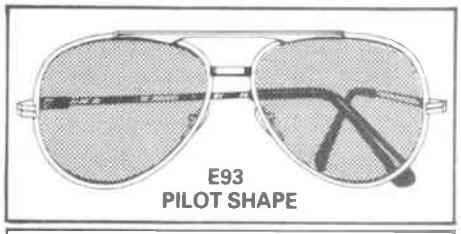
All 4 models have beautifully designed frames and genuine, optically ground, Reactolite Rapide lenses – the fastest reacting photochromic glass in the world!

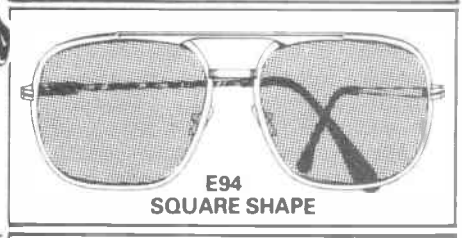
E93 Pilot Shape The 'cut-away' sporting look. Superbly designed and built incorporating *soft, flexible nose pads* for total comfort and *optical quality hinges* (illustrated). Frames available in 3 colours.

E94 Square Shape High quality specification as above but with a more classical shape.

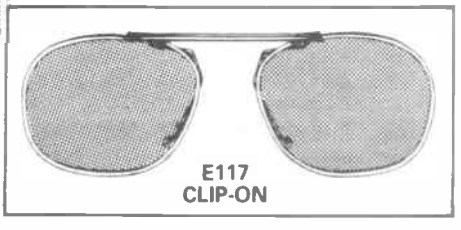
E80 Unisex Top of the fashion range with a beautifully sculptured 'tortoise shell' type plastic frame in brown and crystal.

E117 Clip-On Add Reactolite Rapide sun protection to prescription lenses. Designed to fit almost any spectacles.


E93
PILOT SHAPE


E94
SQUARE SHAPE


E80
UNISEX


E117
CLIP-ON

FREE!

Crushproof case with every pair ordered!

TO: ***Amateur Radio***

Sunglasses Offer, Sovereign House, Brentwood Essex CM14 4SE

Please send me the following pair(s) at £8.80 (this includes 85p for postage, packing and insurance per pair).

	NO REQUIRED
E93 in Gilt/Nickel/Black* frame	☐
E94 in Gilt/Nickel/Black* frame	☐
E80 in 'Tortoise Shell' frame	☐
E117 in Gilt frame	☐

*Please delete.

I enclose cheque/P.O. for £ made payable to: ***Amateur Radio***

Name

Address

Post Code

NO QUIBBLE MONEY BACK GUARANTEE!!

Allow up to 21 days for delivery.

0886

CW CW CW

The Outdated Mode?

by Ian Poole G3YWX

Is CW outdated, old fashioned and laboriously slow? This may seem so to some as there are a number of other methods of sending data which are far more sophisticated. But if all this is true, why do so many radio amateurs still use Morse to great advantage, rather than using all the other forms of transmission which are available? The answer lies in the fact that in spite of tremendous advances in technology, Morse still has many advantages to offer. The old saying that the simplest is best applies very much to Morse.

The simplicity of the equipment required for CW has attracted many people over the years. Nowadays, with the almost universal use of the complicated Japanese black boxes, many people have decided to have a go themselves and build some of their own equipment. As a CW transmitter is much simpler than a sideband one it takes a lot less time, test equipment and money to build, which makes it a far more attractive proposition for the would-be constructor. In fact, one of the off-shoots of this is the growing band of QRP enthusiasts who, in the main, build a lot of their equipment without spending a fortune or taking months to complete a project. A couple of transistors, a crystal and a handful of other components – and a key of course – are all that is required to build a simple VXO (variable crystal oscillator) type transmitter which is capable of running something in the region of one to five watts.

Other advantages

There are also other advantages to using CW. With many people complaining about the crowded band conditions, it is worth thinking about how small a bandwidth is needed for CW. As the actual rate at which the signal is keyed in is relatively slow, much narrower bandwidths can be used. In fact some communications receivers employ special CW filters which can be as narrow as 50Hz. While it is rarely necessary to use filters quite this narrow, it does show that it is possible to put far more CW signals into a given bandwidth than SSB, which needs about 3kHz, or FM which needs even more.

Not only does CW need less bandwidth, it can also be copied at much lower signal strengths. This is the reason why the majority of moon bounce contacts are made using CW and it is most unusual to be able to use SSB for this. It is found that Morse can actually be copied when it is only marginally above the noise level, and as it only requires a small bandwidth the noise level will be much lower as well. Sideband and FM require signal strengths well above the noise level for reasonable copy and, coupled with the extra noise from the wider bandwidth, this means that CW has an advantage of about fifteen to twenty decibels. Thus stations which have poor locations or only low power stand a far better chance of having contacts if they use CW. Of course, this is another reason why QRP enthusiasts tend to stick to Morse and not use SSB.

It can be seen that CW still has a lot going for it, in spite of the fact that it may seem outdated at first sight, and there are groups who are using CW more often – the growing number of QRP operators, Class B licencees, and those on the bottom end of 2 metres. So Morse can look forward to a long future of use on the amateur bands as a popular mode for communication.

Shorthand

One of the secrets of being able to keep up the speed at which information is sent in a Morse contact is the ability to use the abbreviations which are commonplace on the air. Over the years a whole range has been built up, and although they might seem quite daunting to the newcomer many of them are quite self-explanatory. Some just involve dropping the vowels out of a word like STN, which stands for station, or in other cases the spelling is altered to reduce the number of dots and dashes sent, such as SED instead of said. There are also a number of other abbreviations like 73 and 88 whose origins started back in the days of wire telegraphs and were handed down over the years and have now become incorporated into everyday use on the air.

In addition there is the Q code, which is used in both amateur and professional

Common abbreviations

ABT	about	NR	number
AGN	again	OM	old man
ANT	antenna	OP	operator
BCNU	be seeing you	OT	old time
CFM	confirm	PA	power amplifier
CLD	called	PSE	please
CONDX	conditions	RX	receiver
CUD	could	SA	say
CUL	see you later	SED	said
CUAGN	see you again	SIGS	signals
DE	from	SKED	schedule – a pre-arranged contact
DR	dear		
DX	long distance	SN	soon
ES	and	SRI	sorry
FB	fine business	STN	station
FER	for	SUM	some
FONE	phone or speech	TKS	
FREQ	frequency	or	thanks
GA	good afternoon	TNX	
GB	goodbye	TMW	tomorrow
GD	good day	TU	to you
GE	good evening	TX	transmitter
GLD	glad	UR	your
GM	good morning	VY	very
GN	good night	WID	with
GND	ground	WKD	worked
HI	laugh	WKG	working
HPE	hope	WL	will
HR	here	WUD	would
HRD	heard	WX	weather
HV	have	XYL	wife
HW	how	YL	young lady
MNI	many	73	best regards
ND	nothing doing	88	love and kisses

Amateur versions of some commonly used Q codes	
QRG	Exact frequency
QRM	Man-made interference
QRN	Static interference
QRO	High power
QRP	Low power
QRS	Send more slowly
QRT	Close station down
QRU	I have nothing more to say
QRX	Wait
QSB	Fading
QSL	Confirm receipt (hence 'QSL card' confirming a contact)
QSO	A contact
QSY	Change frequency
QTH	Location

fields. Essentially it consists of a series of three letter codes starting with the letter Q, each having specific meanings. The codes more commonly used by amateurs are given in *Table 2*, although the full list of codes is much longer and very comprehensive.

Finally, when giving reports of RST599 this is almost universally shortened to 5NN or S89 to S8N, etc. There is a full set of abbreviations for numbers where N (-.) is nine, D (-..) is eight, B (-...) is seven and so forth until T for zero is reached. N for nine and T for zero are the only ones in common use and although T is seldom used in reports, it is often used when other figures are transmitted, such as when mentioning transmitter powers or giving serial numbers in contests.

Protocol

This is one area which is a little open to interpretation. Different people tend to use the procedural abbreviations in slightly different ways, so no hard and fast rules can be set down. However, it does help to follow what the majority of people do to avoid too much confusion.

Basically, the more commonly used abbreviations include AR for end of message, K as an invitation to transmit, KN as an invitation for a particular station to transmit, and VA and CL to indicate the station is closing down and will not answer any further calls. Many of these abbreviations are used so frequently that they are run together; AR becomes .-.-. with no spaces between the letters and similarly VA becomes ...-.-

It is probably AR which causes the most confusion about exactly where it should be used. Being defined as end of message, some people place it after the callsigns have been sent and before the K, but probably most people send it just before the callsign as it is shown in the typical contact in *Table 3*.

At the end of the transmission either K or KN can be sent. While both of them are invitations for another station to transmit there is a difference between them. K on its own is an invitation for anyone to transmit and should be used at the end of a CQ call, for example. KN is an invitation for only a particular station to transmit and is used when a contact is in progress. In theory KN should not really be necessary, because when giving the callsigns out it should be obvious that a contact is in progress and no other stations should reply. Unfortunately there are some over enthusiastic operators around, especially on the HF bands, who do call in the middle of contacts if it is not made totally clear to them, and therefore the use of KN is a wise precaution.

Finally, at the end of the last transmission in a contact, VA is used instead of KN to indicate that a reply is not expected and that other stations may call. However, if the station is closing down it is worth sending CL instead of VA to prevent any other stations calling.

A typical contact in Morse

CQ CQ CQ DE G7AA G7AA G7AA CQ CQ CQ DE G7AA G7AA G7AA CQ CQ CQ DE G7AA G7AA G7AA AR PSE K

G7AA G7AA DE G9ZZ G9ZZ

G9ZZ G9ZZ DE G7AA G7AA GA OM ES TNX FER CALL = UR RST 5NN 5NN = NAME IS TED TED ES QTH LONDON LONDON = SO HW CPI? AR G9ZZ DE G7AA KN

G7AA DE G9ZZ GA TED ES TNX FER RPRT = UR RST 5NN 5NN = NAME IS DON DON ES QTH LEEDS LEEDS = SO HW CPI? AR G7AA DE G9ZZ KN

G9ZZ DE G7AA FB DON ES TNX FER RPRT = ERE RNG 100W TO DIPOLE ES TX DBLE CONV SHET = WX SUNNY ES TEMP ABT 20 C = SO BACK TU AR G9ZZ DE G7AA KN

G7AA DE G9ZZ OK TED UR RIG DOING FB JOB = 7X HBREW RNG TEN WATTS ES ANT GP = WELL QRU ERE SO SA 73 ES HPE CUAGN BEST DX AR G7AA DE G9ZZ KN

G9ZZ DE G7AA OK DON ES TKS FER NICE QSO BCNU ES BEST 73 TU ES URS GL ES GUD DX AR G9ZZ DE G7AA VA

TU

Contacts in CW

In just the same way that contacts – particularly on the DX bands – can have a standard form on phone, so they do on CW as well. It is probably worth giving an example of a 'rubber stamp' contact as it would be called as a starting place to show the way things happen in Morse. *Table 3* gives an example of one of these contacts which might occur on the DX bands.

Although it may look as if a lot of abbreviations are used which at first sight may not be easy to understand, they very soon become second nature. It is also very easy to see why they are used if you try to write everything out long hand! The only thing which may seem a little surprising is the use of = instead of a full stop. This has become standard and although there are Morse characters for punctuation, these are seldom used.

Apart from these obvious differences, contacts on CW are very much the same as on phone. Whether you want to chin-wag (or whatever the equivalent is for Morse), or just exchange reports, there is just as much scope with CW as there is on phone.

Learning Morse

Learning Morse seems to be a major stumbling block for many people. Some try, and despite repeated attempts never seem to be able to master it, while others listen to some of the contacts which take place on the HF bands and are put off by the speed at which the Morse is being sent. However, a great number of people are able to master the Morse code and this is borne out by the number of new Class A licences which are being issued.

When setting out to learn CW the first requirement is determination. It is surprising how many people start to learn it and then give up when they have reached about eight or ten words per minute. It helps if a set amount of time can be put aside each day for practice, with possibly a bit more at weekends or when time allows.

Having done this there are several methods which can be used when practising. It is obviously of great benefit if a local radio club runs a CW class. Then there are the RSGB slow Morse transmissions which are also very good. However, it may not always be possible to use either of these, and they will not be able to provide all the practice that is needed, so other methods have to be used.

One possibility is to buy one of the pre-recorded Morse courses which are available. In addition to this there are a number of electronic Morse tutors which can send various groupings of letters and numbers. Although both of these are very useful they both have their disadvantages. When using the pre-recorded tapes they have to be played several times and it is surprising how easy it is to learn what is coming next. The electronic Morse tutors do not suffer from this as

International Morse code

A	·–	N	–·
B	–···	O	–––
C	–·–·	P	·––·
D	–··	Q	––·–
E	·	R	·–·
F	··–·	S	···
G	––·	T	–
H	····	U	··–
I	··	V	···–
J	·–––	W	·––
K	–·–	X	–··–
L	·–··	Y	–·––
M	––	Z	––··
1	·––––	6	–····
2	··–––	7	––···
3	···––	8	–––··
4	····–	9	––––·
5	·····	0	–––––
Full stop	·–·–·–	Comma	––··––
?	··––··	=	–···–
Wait	·–···	Mistake	·····
Stroke (/)	–··–·		
Start of work (CT)	–·–·–	End of message (AR)	·–·–·
Invitation to transmit (K)	–·–	End of work (VA)	···–·–
Invitation for a particular station to transmit (KN)	–·––·		

they send random letters. However, they still do not send plain language. To overcome this it is worth trying to get several tapes of plain language made up, using them only as long as the contents are not remembered.

Another very valuable source of practice is to listen on the bands. Although there is plenty of Morse on the DX bands, this is generally quite fast and the contacts are usually of the 'rubber stamp' variety, when the next letter can often be guessed. However, some of the best practice occurs at weekends on 80 and 40 metres, where there is plenty of good Morse sent at a reasonable speed. This is far better practice because the contacts are usually not just the 'rubber stamp' sort but contain quite a bit of variety.

Keys and keyers

There are a variety of Morse keys and keyers available on the market today. Everybody must be familiar with the ordinary Morse key, or straight key as it is sometimes called, and everyone who has used Morse at any time is bound to have used one. As they essentially consist of a pair of contacts and a handle, the quality of the Morse which is sent is entirely dependent upon the operator. Therefore some people will send better Morse than others, and in fact every operator will send slightly differently. This means that each operator will have his own 'finger print' and it is often possible to recognise someone purely by listening to the style of the Morse which is being sent.

Straight keys are ideal for learning Morse and for sending it in many circumstances. However, when higher speeds are required, various mechanical or electronic aids can be used to make the sending easier, although many experienced operators can send very good Morse at surprisingly high speeds on a straight key.

Semi-automatic 'bug key'

One of these sending aids is the semi-automatic 'bug' key. This is a mechanical device which has what is called a paddle instead of the more usual handle. If the paddle is pressed towards the left it makes a sustained contact and this can be used to make the dashes. Then, if it is pressed to the right, a weighted lever vibrates to make and break a contact for the dots. The position of the weight on the lever can be varied to alter the speed of the dots and hence the speed of the Morse. Although many companies have made these bug keys the most famous must be the Vibroplex key.

The next stage includes the fully automatic electronic keyers, which are available either as complete units or just as paddles to connect into the electronics provided in a transceiver. These paddles can also form the basis for a home-brew keyer.

Fully automatic keyers fall into two categories. The first is a basic one that has a single paddle. This will produce dots when pressed to one side and dashes for the other. The second type is known as an iambic or squeeze keyer and has two paddles side by side. When one paddle is pressed it gives dots, and the other gives dashes. However, when they are both pressed or squeezed together dots and dashes are sent alternately. This can reduce the number of movements required to generate letters like C,Q and so forth where dots and dashes are mixed together, and so ease sending at speed.

Although these keyers make sending much easier, and also make the Morse which is generated easier to listen to because all the ratios of dots and dashes are correct, they are more difficult to use. Obviously the iambic keyer will be the most difficult, but with a certain amount of practice it soon becomes second nature and very much easier than using a straight key!

Conclusion

Morse is still used every day by many amateurs old and new as an effective way of communication. So it is worth spending some time to learn or brush up your Morse and listen at the CW end of the band. I'm sure it will be worth your while.

News and comment from Glen Ross G8MWR

The sub-heading for this feature says 'News and Comment', and I have certainly been getting plenty of the latter with regard to the RSGB and its attitude to the VHF end of the spectrum. There has also been some comment to the effect that I seem to be an RSGB basher; this is far from the truth, so let me put my own attitude to the society on the line. It is simply this: if you are in any way involved in the hobby of amateur radio then you should be a member of the national society; no ifs or buts or excuses, you should support it.

Why?

If it was not for the RSGB amateur radio as we know it would not exist! You probably came into the hobby via a Class B licence; who do you suppose got that facility for you?

You may not like the repeater system, but you must appreciate that it is a Godsend to anyone in a poor location. Do you ever make use of the network of beacons? How would you feel about having to pay for a separate licence for use on ATV, with, incidentally, a second callsign in the G6-plus three series.

Still not enough? Then how about a separate permit before you could work mobile and having to make out your log in full at the time of the contact. Can you imagine pulling into the side of the road, entering a CQ call in your log, getting a reply and at the end of the contact having to stop and enter in the details of time, etc in the same detail as in your normal home station log?

There's more

How would you, as a Class B operator, like to be restricted to 432MHz and above as we were for several years after the licence was first introduced? If you are a Class A ham, how would you like to still be restricted to 10 watts of CW for the first year's operating and then have to convince the powers that be that you have been a good boy/girl, worked hard at your hobby, and now deserve the facility to use phone? Would you really not want the new bands that have been obtained since the war, including 15 metres?

International

Who represented us at the international conventions where, instead of losing bands as everyone thought was a forgone conclusion, we came away with new bands and increased facilities? While we are on the international scene, how would you like the postal bills for your QSL cards if the bureau system did not exist, apart from the problem of trying to find out just where to send your cards? We all know Box 88 for Russian cards but do you know where to bulk post your cards for, say, Brazil?

Problems

If you want the facilities and representation then you must support the society. However, supporting does not mean that you have to expect perfection; show me any outfit that cannot be improved. Equally, you do yourself and the society no favours by hiding your head in the sand and pretending, with slavish disregard of the obvious, that there are no problems.

Any society is stronger if it listens to those who are unhappy about things and then tries to do something about them, even if this only amounts to showing that the person complaining has got hold of the wrong end of the stick, or that there are considerations to be taken into account which could not be made public knowledge.

Communication

For a society that is involved in the communication business it seems ill-equipped to keep the members informed as to what is going on. What is desperately needed is a good MRO (Membership Relations Officer). Such a person would insist that the society must at least be seen to be talking to its members first and to officialdom afterwards, even if this is in fact not the case.

If you have paid your money you expect, and should get, prompt attention. One of our readers recently contacted me to say that having written to the RSGB for advice on a minor technical problem he had at last got a reply . . . one year to the day of his original request.

A few years ago the DTI issued a new schedule without any discussion with the society. The release of Morse to the Class B man was made, in spite of the RSGB's cover-up date of May, in the Gazette notice about 50MHz operating on 20 December last year. The society has still given little prominence to the fact that you are now allowed to use the facility from any location and that you do not have to give your callsign in a voice mode.

Although sticking to the RSGB guidelines in this matter makes a lot of sense, it is not a legal requirement. There has been, as far as I can discover, no publicity at all from the society to inform members that crossband working VHF to HF by Class B operators has been legal for some considerable time.

The new RIS interference rules were drawn up with no reference to the RSGB, as they admit, and the society is now fighting a rear-guard action which is having the effect of injecting some common sense into the guidelines used by the department.

RSGB Morse tests

You will be well aware of the problems of getting a test since the RSGB took them over in April. Horrendous tales of Morse tests being conducted using an earpiece some fifteen feet from the applicant have come to light. Even now, although most of the more populated areas have testing facilities of some sort, we are still waiting for the promised coverage. You may say that in the time available they have not done a bad job, but do you know what time was available?

Time scale

Let us look in the July issue of *RadCom* under the reports of council meetings (one report being for a meeting held last October; how's that for keeping the members in touch?). One quote from the meeting held on 28 November was as follows: 'A letter received from the DTI dated 18 November . . . responsibility for Morse tests as from 1 April 1986'.

Let us now move on *two months* to the meeting on 18 January 1986 and quote: 'Proposed that council give authority to the President and the Presidential Advisory Group (no less!) to set up a vetting panel'.

You will notice that exactly two months after receiving the original letter, and knowing that unless things moved quickly there would be no Morse testing available from 1 April, there was no talk of actually recruiting any testing staff for the panel to vet. Even now, nine months after the original letter, we still have not got anything like the coverage that was promised.

On the line

So where do we stand? The RSGB is obviously not a perfect society operating in a perfect world, but its staff, and hundreds of volunteers, do the best they can to look after your interests. They may not always get it right and they can sometimes be accused of using the big cover-up to get out of problems. They are

certainly not very hot on keeping the membership informed as to what is going on and they are abysmally slow at replying to letters, etc, but who else do you go to for support?

There is no other society that even gets within shouting distance of achieving for us what it has done. You must support it, if for no other reason than you can only get changes made from inside the system. Standing on the sidelines and shouting abuse at the ref does not score any goals; you must be prepared to take a few knocks and play the game.

How funny!

At least a sense of humour remains within the hobby. The following was heard on the local repeater: 'The repeater receiver must be superb; you are really scratchy on the input but a great signal through the box'. This one on a simplex frequency: 'Sorry you are getting a noisy signal from me. Is it any better now that I have switched my noise blanker in?'

Certificates

A couple of our special category awards this month, both for operation on 24GHz. The first goes to Dave G0DJA for an initial contact of 15km using low power wideband FM. The second one goes to Ian G0EDT for the first reported 24GHz mobile to mobile contact. I suppose I qualify for one as well because I was on the other end.

The contact was made using 5 milliwatts of WBFM to 20dB horn aerials mounted on the dash of one car and on the rear parcel shelf in the other. If you have done something a little out of the ordinary please let us know; you could get a nice certificate for your trouble.

Odd bits

A release from the DTI now means that once you have taken your Morse test you have got it for life. In the past, if you let your Class A licence lapse for a few years you were required to retake the test.

RIS problems still raise their heads. In Stratford-on-Avon an official insisted on access to an amateur's premises, even though he was not prepared to show any form of authority to do so to the amateur's wife, the licencee being absent at the time. To show what could happen in this line, a Canadian amateur has been barred by a court from ever again transmitting from his home and in Germany an amateur has been given an enforced reduction from 750 watts to four because of problems with a VCR.

More bits

The use of the repeater system to carry news broadcasts was something which should have happened years ago. Now the DTI say they are prepared to allow broadcasts on days other than Sundays. If this can be made a general arrangement, it will enable the RSGB to get the latest news to members far more effectively.

In space

Oscar 10 has had a sticky time due to passing through the Van Allen radiation belt a few times. All amateurs are asked to refrain from using it until Amsat get the thing running again. Listen to the Amsat news broadcasts for info.

The latest news on the Japanese packet satellite JAS-1 is that it should be launched around 31 July.

Nearer home we are getting murmurings that some continental countries may already have introduced the new common licence, which means that you will not need to apply for a reciprocal licence if you intend to operate in these countries. More details on this one as soon as we find out exactly who has gone ahead with it.

Sign off

Thanks for your letters and phone calls. The address for correspondence is 81 Ringwood Highway, Coventry, or you could try the magic electronic mail and use Prestel 203616941.

anything. Not water, not a dry cloth, not solvents – don't clean 'em at all. Anyone want a Selectest with no calibration markings?

Starflite transmitter

Years ago, when I was just a lad, a friend of mine was lucky enough to be given an example of the Lafayette KT390, which is an all valve, crystal or external VFO controlled 90 watt CW or AM transmitter. Covering 80, 40, 20, 15 and 10, I well remember the good contacts we used to have on it, although we never aspired to a VFO. I think I liked it because it had a built-in power supply and looked like a real rig. The interesting bit, ie the transmit strip, is a 6CL6 oscillator, a 6CL6 driver and a 6146 PA; all rubbish still available today.

It thus came to pass that, at a recent rally, I couldn't resist a non-working but clean example being offered for a fiver. If contemplating one, by the way, don't be put off by markings on the back panel about 110V ac etc, as most are 'dual', ie they can be re-wired for 240V. However, please take care if the seller has an American accent!

The example I bought had a particularly boring fault: R4, a 33K resistor in the grid keying circuit was open circuit and was no trouble to repair. I like rigs where you can go in with big soldering irons!

Lots of fun, I had loads of contacts with a 3505kHz rock on all bands and an old Heathkit RA1 as the receiver. I get a lot of letters asking about really cheap HF rigs and the Starflite could be an alternative to bear in mind, given the limitations of CW and xtal control. For a worker expect to pay £15 to £25, dependant on condition, crystals fitted and your skill at haggling. I've noticed quite a few for sale at rallies this year after not seeing any for about ten years, so you might be lucky. Keep your eyes open.

FREE CLASSIFIED ADS

FREE CLASSIFIED ADS CAN WORK FOR YOU

We are pleased to be able to offer you the opportunity to sell your unwanted equipment advertise your 'wants'.

Simply complete the order form at the end of these ads. feel free to use an extra sheet of paper if there is not enough space. We will accept ads not on our order form.

Send to: ***Amateur Radio Classified Ads***, Sovereign House, Brentwood, Essex CM14 4SE.

DEADLINE AND CONDITIONS

Advertisements will be published in the first available issue on a first come first served basis. We reserve the right to edit or exclude any ad. Trade advertisements are not accepted.

FOR SALE

■ Icom IC2E 2m hand-held Tx/Rx, 2 watts, handbook, mains charger, £95. MPF1 single board Z80 microcomputer with 8255 and Z80 P10, 16 parallel input/output lines, Z80 CTC 4 independent counter timers, cassette interface, mains PSU and all manuals. Good for robotics and other control applications, £35. Two Tangerine 6502 systems, one with Tanex and Asimov word processor mounted in portable case with full 74 key keyboard, all leads, mains PSU and manuals, £30: second with Tanex + 48K memory board, RS232 interface, A-D converter board, Eprom programmer board (needs new ROM software), backplane in 19 inch rack mount, manuals and three rail PSU, £35. Oric Atmos micro with Author word processor and printer lead, £25. High precision Calcomp 565 drum plotter with pens, manual and transformer, £50. All original BBC micro software: BCPL ROM, utility disc and manual, £40. VU-CALC spreadsheet package, £9. Datascribe word processor and database ROM and utility disc, £20. Hulk knowledge engineering system, £7. Lisp on tape with Acornsoft, BBC manual, £12. Chemical structures on tape, £5. Superb Merlin macro assembler for Apple II+, with manual, £30. Leonardo, the 'ultimate graphics package' for Spectrum 48K, £6. Original Wordstar manual, £9. John Dawson. Tel: 01-387 5539, 08.30-18.30 most weekdays or (0295) 77269, weekends

■ The Morse Talker, Microwave Modules MMS1, £55. Two hour Morse tapes, eight lesson, £4. Tel: Farnborough, Kent 58825

■ Tokyo hy-power ATU, HC200, two months old, mint, 200W PEP, £65 + p&p. Tel: (0952) 57670

■ FRG7700, FRA7700, FRV7700, covers 118, 130, 140, 150, 70 – 80MHz, £300 ovno. Surplus to requirements. 'Snowy', 161 Coneygree Road, Stanground, P/boro, Cambs PE2 8LH. Tel: (0733) 42439 after 6pm

■ Icom IC240, hardly used, original packing, handbook, mobile bracket, unmodified but with 3 articles on increasing channels, £120. Yaesu FRG7 general coverage Rx, excellent condition, handbook, £120. George Tatler, 10 Marshway, Penwortham, Preston, Lancs PR1 9PL. Tel: (0772) 556301 (work), 749778 (home)

■ Two ZX81 computers, new, unused, £20 each. ZX81 16K RAM pack, £10, or £45 the lot. Boat radio, 0.2–4.2MHz with BFO, good for 80 and 160 metre listening, £50. ICF7600D, £95. Two metre receiver, £35. Metal detector, C-scope, £15. CB hand-held, 40 channel, 4 watts. Realistic, £60, plus microphone, £5. SX200N scanning receiver plus power supply and discone aerial, £170 plus post. Mike, 14 Doverfield Road, Brixton, London SW2 5NB. Tel: Jane, 01-769 6298

■ FT101ZDFM, FC902, fan, hardly used, G5RV, balun, £580, split, offers? 13 foot collinear 2m, clamps, cable, PL259, £55. Labgear UHF set-side 2-output pre-amp, £7. Mains Tx, 50V/4A, many taps, £4. 'Box' for ITT CVC8/9 conversion to teletext, £10. R/C transmitter, £6. Bags resistors (new), approx 800, 50p/£1. 4×2AH HP11 r/charge, hardly used, £4. 5×HP11, 1.2AH, £2.50. Philips cassette recorder, mike, £4. Many other bits cheap. Geoff. Tel: (0424) 446888 ext 136 (Hastings)

■ Drake TR7, DR7, AUX7, all filters fitted, general coverage 2×FA7 PS7 heavy duty FA7 ext, VFO speaker, RF proc 7077 7073, one of the best SW transceivers ever made, giveaway, £800 ono. Sony ICF2001D latest air/SW/FM scanner, portable, £220 ono. AOR2002, £350. Ferrograph 3 speed stereo reel-to-reel, £60. AKG mic etc joystick Commodore 64+4 computer, £70. (C16+64) games worth £80 ono, cass + joystick. Mrs Fordham, 31c Anerley Park, SE20, Penge

■ Reflector telescope, 3 inch, for sale or exchange for 3 inch refractor, or 70cm transceiver. Have xtals for VHF marine band, Tx 6MHz range, Rx 48/50MHz range, or as complete. 24V Marconi transceiver. Tx, requires attention. G8BSK, 290 Priory Road, St Denys, Southampton SO2 1LS

■ Sony ICF2001 receiver, push-button, digital tuning, LW/MW/SW/AM/CW, memory facility, general coverage, good condition, offers to Mr N Cameron, 16 St Mary's Cres, Westport, Co Mayo, Eire

■ Brand new radio harness to fit Burndept or similar type radio, £8.50 incl p+p. Pye PF1 vehicle adapter, £5, rare! Pye PF6 vehicle adapter, £25, this one also charges the battery. Wood and Douglas 10W 70cms PA, £35, good saving. Legal CB convert to 10m FM, £35. All plus postage, except harness. Tel: (0302) 835280

■ Tower–free standing, un-guyed, 58 foot, heavy duty galvanized steel westower, 3HD, framed base plate type, tilts over, winches up and down, fitted with safety winches. £725 ono. G6DPP. Tel: Loughborough (0509) 233318

■ Word-receiver, 0.30kHz FM 375–108MHz, quartz controlled, 16 preset memories, 2 speakers, alarm clock, SSB reception, £345, new and boxed. Superstar 360 FM transceiver, legal front panel, FM/AM/LSB/USB and more, £150, good as new, rig only. Hitachi stereo radio cassette recorder, portable, 4 wavebands, 16W, Dolby and record deck, £130, new and boxed. Tel: 01-207 2326

■ Harvard H407 27MHz FM tcvr base station model, one year old, used for only three hours, still with original box, £50 or swap for Datong or similar active antenna for short wave bands. Also have MMC28/144kHz converter, £10 or swap for 1985 *World Radio TV Handbook*. Terry Denyer, 26 Wemyss Place, Kyle of Lochalsh, Ross-shire IV40 8DE, Scotland. Tel: (0599) 4538 after 6pm and before 10pm, weekdays only

■ FDK750 2m multimode transceiver, 10 watts output, twin VFO up/down scan, vgc, £230. Tel: (0235) 815338

■ Superstar 360, £100. Expert PD8500 by Elbex home base (like a super Ham International jumbo), 80FM 80AM 160SSB, £100. Zetagi frequency counter C50, £25. Zetagi linear BV131, £60. UFO 1604 digital scanner, £25. ⅝ antenna, £15. Tel: Suffolk (0394) 460474

■ Surplus receivers etc, available to best offer but must collect. Marconi Atlanta type 2207C, covers 15kHz to 28MHz in 10 bands, good working order. Eddystone 770R, AM/FM, 19 to 165MHz, working but shows its age in its looks. Eddystone 730/4GC receiver, needs restringing of dial, otherwise OK and a good performer. Amstrad EX330 amp, plus EX303 tuner, 7070 tape deck and JVC JLA15 gram deck, all in stack. Sold as one item; note amp requires new output trannies. Alan Thompson, 16 Ena Avenue, Neath, West Glamorgan. Tel: 0 639 4040

■ Yaesu FR50B HF receiver, 80mtrs to 10mtrs, very good condition, suit beginner or experienced SWL. £70 including delivery. Paul Lock, 36 Parkengear Vean, Probus, Truro. Tel: (0726) 882812

■ JIL SX200N scanning monitor receiver, VHF low, VHF high, UHF, AM, FM, 32,000 frequencies, 16 memory channels, clock, 26MHz to 514MHz, £200. John, 12 Fiddlewood Road, St Faiths Road, Norwich, Norfolk MN6 6DW. Tel: (0603) 413284

■ Service manual for Trio TS430S, £9. W2AU 1:1 balun, £5. Terry G4OXD. Tel: (0462) 35248 after 6pm

■ FDK700EX 2mtr in vgc, 0-25W complete and boxed, £140. Pair of 19 ele tonnas for 70cm, £13.00 each. 13 ele tonna for 2mts, £15. Brand new Astatic Silver Eagle, £59. Armstrong 621 stereo amp, a quality British product, £60 no offers. Wanted: a cheap working rotator, and a 70cm linear. Ken G1GPC. Tel: Harlow (0279) 26647

■ Yaesu 225RD multi-mode 2m base station, muTek board, immaculate condition, £550. Yaesu 290R, no mods, never used mobile, 18 months old, £225. Tel: Chas, 01-764 6767

■ Closing shack, going mobile: FT101ZD MkIII, modified for 11 metres and 45 metres, mint condition, £200. Also PDL11 quad antenna for 11 metre band, £70. Cobra 148GTL-DX 11m Tx/Rx, £90 ono. Zetagi 11m mobile linear, 100W SSB, £50. Ham Int Jumbo 11m and CB band, £120. Would consider exchanging some of above equipment for Yaesu FT11 mobile, must be converted to 11m and 45m. Bob 163AT107. Tel: Cardiff (0222) 539670

■ muTek 10GHz (GD1F 107μB Gunn diode board, £42. Solfan in-line 10GHz Gunn unit, £12. Rank Xerox tele-copier, £20. Yaesu SP102 speaker, £40. Icom SP3 speaker, £42. Wraase SC1 SSTV/FAX unit (latest model), £700. Jaybeam D15/24, 23cms yagi, (new), £45. Wanted: Robot 1200C SSTV unit (latest model). Phone Paul G4XHF. Tel: (0293) 515201

■ FREE! Are you interested in medium wave and long wave radio? Yes! Then Medium Wave News is for you. This informative and up to date newsletter, published by the only UK club dedicated to MW and LW radio, contains all the latest news, views, reception tips and feature articles. For a free sample issue and full subscription details please send a large SAE to: Medium Wave Circle (Secretary), 69 Alderley Way, Cramlington, Northumberland NE23 9UQ

■ Trio 430S with FM, SSB and AM filters, matching PSU, speaker and auto ATU, £950. May split. TU21E spare battery charger, little used, £170. Reason for sale: purchase 940S. Broom Apollo 13 feet 6 inches speed/ski boat, 60hp, electric start Yamaha, only 6 months old, new QTH reason for sale, complete with trailer, etc, £3500 ono. Swap 940S and cash adj. G4AMZ not QTHR. Paul Leach, 1 Murray Close, Victoria Road, Macclesfield, Cheshire SK10 3QZ. Tel: (0625) 610852

■ Yaesu FT7B 50 watt HF mobile tcvr with YC7B digital read-out, mobile bracket, manual, £350. Pete Jenkins. Tel: (08926) 4489 daytime, work

■ Attractive semi-detached bungalow, East Cornwall, 750 foot asl, ex-DX, 2-bds, lounge, kitchen, bath/shower, hall, c/htng, d/glazed, garage, gardens 50 foot tower c/w TB3 tribander, 9ele tonna, KT600 rotator, permanent planning! All in excellent condition, early viewing rec'ended, £29,950 for quick sale. G4RLZ. Tel: Liskeard 62954 evenings

■ FT290R 2m all mode, nicads and charger, £225 ono. Call evenings after 6.30. Tel: Brighton 508713

■ Trio TS520S, good cond, recently serviced and fitted with new tubes. Sale includes two, as new 6146B/82&8A tubes, boxed, £360. Also DX200 comms Rx, vgc, £60, or part exchange with cash adj 520S only or 520S plus DX200 Rx for HF tcvr with digital readout and notch filter, etc. Will sell 520S and Rx together for £400. Angus G0CMV, Stratford Upon Avon. Tel: (0789) 840464

■ Icom 290E multimode, man, leads, bracket, checked by Thanet. Exchange for AOR2002 or SX400 or ICR70, or will exchange 290E and Sony R T reel stereo recorder, TG645 3h 3mot, Mike, 14 boxed tapes & others, splicer, in exchange for Icom R71. Abbey, 21 Moat Close, Bramley, Hants, Tel: B/Stoke 882 825

■ 934 Cybernet Delta One, Crest, pre-amp, 45ft co-ax, approx 4 months old, £380 complete. Ring after 5.30pm, Roger. Tel: (0223) 242646, Cambridge, Cambs

■ Sony 7600D PLL synthesized receiver, full continuous waveband coverage, FM, LW, MW, SW, power adaptor, instruction book, wave handbook, £110, boxed. Tel: (0228) 36958

■ Swap my Realistic DX300 general coverage receiver (0.015-30MHz) for Superstar 360 or Cobra 148 (with legal 40 chan) or might consider Ham International Jumbo. Must be in pristine condition. Tel: (021) 744 8322 (Martin)

■ Trio TS530S, CW filter, mint cond, £475. Buyer collect. Mr J Dufrane, 44 Hazelton Road, Marlbrook, Bromsgrove, Worc B61 0JE. Tel: (0527) 79505, G4MBW

FREE CLASSIFIED ADS

■ Yaesu FT207R handie, with pouch and 2 batts, YM-24A speaker mic, NC-2 charger. Sell or swap for 2m mobile. Cradley Heath. Tel: (0384) 64745

■ I have sorted out all new unwanted components and made a list. Please send SAE to Mr Lawrence, 7 Griffin Crescent, Littlehampton, Sussex, if interested

■ Portable mini VHS video recorder, colour (zoom) camera, dual charger, used ½hour only, £595 ono. Selmer Thunderbird twin-50 valve amplifier, 2x12in speakers, about 20 years old, £90 ono. Goodmans amplifier (same valves as Selmer) ex-lab, offers? Fender jazz bass, 1960s, vintage, £180 ono. Collectors item – Ecko valve radio, L/M/S, motorised tuning, offers? Quantity Philips G8 colour sets, 22in/26in and spares, space needed, good cabinets, any offers? Roger Emens, 4 Tanners Lane, Hathern, Loughborough, Leics (Junction 23, M1) Tel: (0509) 843214 evenings

■ Grundig Concert Boy 220, FM/LW/MW, SW5, 9 to 18MHz, battery and ac, mint cond, manual, £30. HC Bach, 52 Tudor Close, London NW3 4AG. Tel: (01) 794 9790

■ Panasonic HF Rx, 150kHz-30MHz, AM/SSB/CW/FM, BFO, wide and narrow filter, mains or battery, with 2mtr converter, £160. Receive ATU, boxed, hardly used, cost £62, £45 ono. Reftec 934MHz MK2, mobile Tx 8 watts output, boxed with mag mount, colinear, or £300 the lot. May part exchange new and boxed RT852 CB. All can be seen working. Contact M Hynes flat one, 3A High Street, Torrington North Devon EX38 8HN

■ 70cms amateur television transmitter/receiver, 10 watts output, colour or B&W, £60. Also 2 metre linear amplifier, 1.5 watts in, 30 watts out, suit IC2E etc, £30. Tel: Batley, W Yorks (0924) 470619, after 6pm

■ Are you interested in medium wave and long wave radio? Yes! Then *Medium Wave News* is for you. This informative and up to date newsletter, published by the only UK club dedicated to MW & LW radio, contains all the latest news, views, reception tips and feature articles. For a free sample issue and full subscription details please send a large. SAE to: Medium Wave Circle (Secretary), 69 Alderley Way, Cramlington, Northumberland NE23 9UQ

■ Video camera, Shibaden, fully gen, lockable to ext synch, c/w integral mains PSU and Lense (b/w), £70 ono Tel: (031 660) 5768

■ Hundreds of radio and TV valves (new and seconds) all guaranteed. Also service sheets and manuals. Send SAE for details. Mr FD Brown, 6 Ryan Close, Ferndown, Dorset BH22 9TP

■ Complete shack clearance! Unrepeatable bargains! 25 years accumulation of radio and electronics stock for sale because of complete change of hobby. Lowest possible prices! Everything from valves to computers; from components to complete working projects. Books, mag's, serv sheets, cir diag's. Rare, unusual, obsolete parts and components. Vero boards, PC boards new and used. PSUs transformers, transistors, ICs, speakers, sold irons. Spare parts for radio, hi fi, tape recs, examples: 350 valves, new and used, many types, mixed, all tested, all for £35. Own-built single keyboard, portable electronic organ. Built-in rhythm gen and amp, many features, perfect, as new, for less than I paid for the components, £110. Own-built rhythm generator, complete, vg wkg ord £35. B&O Beogram 1000 stereo record deck, Beomaster 900 stereo tuner/amp and B&O bookshelf speakers, excel cond and wkg ord, £125. Too many items to make a list, so please send your list of what you need with SAE or your phone no to Mr Z Edes, 23 Valencia Way, Andover, Hants SP10 1JG. Tel: Andover 58343 evenings and weekends

■ Drake TR7, AUX7, DR7, SP7, SP75, 7073, 7077, SP75, FA7, FA7 service manual, heavy duty full cycle PSU, transister PA, general coverage 0-30MHz NB7, decent filters, excellent American transceiver, £850. Sony ICF2001D, £225. Bargain AOR2002, £350. Bargain CBM 64&4, joystick, games, unwanted hence swap for 2mtr transceiver, any old rubbish considered, or £90 ono. 5 watts per channel stereo amp, £10. PSU inc, ideal Walkman amp. Demo's 31c Anerley Park, London SE20. Write

■ Electronic organ, JEN Allegro 361/S, two 44 key keyboards, 8 rhythms, 7 preset voices and synthy section, automatic accompaniment, Leslie, vibrato, reverb, two 30 watt RMS internal amplifiers, internally mounted 12 inch, 8 inch and 3 inch speakers. Walnut finish cabinet with lockable roll-top, bench seat. All as new, £450. Buyer to collect or arrange and pay for delivery. R Middleton, 49 Wolseley Road, Stafford ST16 3XW

■ Eddystone 770R receiver, 19 to 165MHz in six bands, £100. KW Vespa Tx, £30. RTTY V-type tuning indicator, £10. Tel: (0608) 811102

■ Reel to reel T/Rs, Grundig TK140, Philips, N4308 4 track, working vintage Bush radio DAC90A, not working, complete, offers. Edwards, 2 Beach Road, Burton Bradstock, Dorset DT6 4RF. Tel: (0308) 897 625

■ Heathkit RA-1, clean but needs alignment, has S meter mod to facia, £12. Heathkit Q-mult, £8. Heathkit S99 valve stereo amp (heavy!), £10. Will exchange for skywave forth ROM, with manual for ZX81. Tel: Mike, Stoke-on-Trent 262190, after 6pm please

■ Digital multi-meter, Philips 2521, £200. Glayzer, 27 Albert Road, Southport, Merseyside. Tel: (0704) 31153

■ Eddystone 1001, 550kHz – 30MHz, 10 xtal positions, good cond. Sell or exchange for signal gen or good quality dip meter, etc. C Reynolds, 12 Berry Road, Scalloway, Shetland. Tel: (0595) 88429

■ FDK750E 2mtr multi-mode, 1/10W, scan hand mic, plus 10 ele J/beam long yagi, £240. Trio 7930 2 mtr FM 5/25W mobile/base, scan hand mic, plus MC55 mobile safety boom mic, £250. May swap either for FRG7700 or similar, WHY? Tel: Bridgnorth 3790 (Shropshire)

■ Four Pye Amio VHF transceivers, good condition, £25 each. Robert, Coventry. Tel: (0203) 77186

■ Surplus receivers etc, available to best offer, but must collect. Marconi Atalanta type 2207C, covers 15kHz to 28MHz in 10 bands, good working order. Eddystone 770R, AM/FM, 19 to 165MHz, working but shows its age in its looks. Eddystone 730/4 GC receiver, needs restringing of dial, otherwise OK and a good performer. Amstrad EX330 amp, plus EX303 tuner, plus 7070 tape deck, plus JVC JL-A15 gram deck, all in stack. Sold as one item and note amp requires new output trannies. Alan Thompson, 16 Ena Avenue, Neath, West Glamorgan. Tel: (0639) 4040

■ Advance E2 signal generator, 100kHz–100MHz, £40. 625 line TV cross-hatch generator, £10. 405 line TV alignment generator (7–70 MHz wobulator), offers please. EHT probe to convert meter to read up to 30kV, £10. Can arrange delivery if required. Tony Howard, Bedford. Tel: (0234) 68559, work hours

■ Yaesu FT-one, all filters, FM, non-volatile memory, £900 ono. MDI mic, £40. MHI mic, £10. FTV107R transverter, and 2m & 70cms units, £300, (will split). FTV707R, frame only, £25. FF501DX low-pass filter, £18. TR10 7200G, £40. Tokyo HL45U, 45 watt, 70cms and preamp, £90. Toyot 435 SWR power, £30. Datong auto woodpecker blanker, £45. FL3 filter, £80. Welz SP10X, £13. SP380, £30. Scarab MPTU, £40. MBA TOR C-64 cartridge, £50. 500 watt 1GHz dummy load, £50. 70cms & 2m band-pass filters. 50 watt 2m linear & preamp. SEM tranzmatch & ezi-tune, 600MHz divide by 10 prescaler, used heliax. M Fincher, 27 Albert Street, Tring. Tel: 6752

■ MuTek GD1E, 107μB, 10GHz Gunn diode board, £46. Solfan 10GHz Gunn head unit, £12. Jaybeam D15/23, 23cms yagi, (new) £46, Rank Xerox 400, tele copier and paper, £26. Tokyo Hy-power 2m linear, HL82V, 10W in, 80W out, £110. FT290/790, CSC-1A case (new), £3.50. MET 432-17X crossed 70cms yagi (new), £36. Yaesu FP80A PSU (matches 480 or 780), and 36. Paul G4XHF Tel: (0293) 515201

■ Trio TW4000A 2m/70cms transceiver. Sony ICF7600D receiver (black). Both as new, offers to GM4DHJ. Tel: (041 889) 9010 (Glasgow)

■ Slow scan TV transmit and receive program for the Sinclair Spectrum computer, hardware needed, £5. Paul Goodrum, 9 Ryston Close, Downham Market, Norfolk PE38 9BD. Tel: (0366) 388615

■ SX200N VHF/UHF scanner receiver, new condition, freq coverage 26-88, 108-180, 380-514, bargain £180. Terry. Tel: Hednesford (05438) 77995

■ Racal RA117E comm receiver, with RA63 SSB adpt in Racal steel case, £300. Plessey 1.5B adapt with matching ATU for Plessey PR155G receiver, £150. Two SSB adaptors for B40 receiver, one £30, one £50. B41 receiver, £40. G F Clarke, 8 Angus Close, Horsham, Sussex RH12 2EQ. Tel: (0403) 54848

■ Drake TR7, PS7 power supply, RV75 VFO, MS7 speaker, MN2700 2kW ATU, fitted balum, Drake desk mic, all filters fitted, AUX7 with three modules, NB board surge protector all in mint condition, £1,200. G4OOK QTHR. Tel: Stuart (0642) 211685

■ Line 22, 144MHz SSB pack, Eddystone 840C receiver, 383 scotch copier 3M. All work OK. Offers to: Bardsley, 110 Compstall Road, Romiley, Stockport SK6 4EH. Tel: (061 430) 2287

■ Yaesu FT225RD 2m multi-mode base station with muTek front-end. Excellent condition, £550. Yaesu FT290R multi-mode base portable, as new, £225. Datong D70 Morse tutor, £35. Tel: evenings, Chas, 01-764 6767

■ Sony 6700 receiver 1-6-30MHz 7m MW, USB/LSB/CW, cost £240, accept £100. Exchange for Lyentron 12 band receiver or Trio R600. B Collis, 5 Railway View, Macfin, Ballymoney, Co Antrim, N Ireland BT53 6QU

■ Video cameras, Vidicons, all types. 813s and bases, AVO light meter (collectors item). Exchange anything interesting. Brown, 45 Marlborough Avenue, Falmouth TR11 4HS

■ FT726R 2m, 70cm, HF Satellite units, narrow CW filter, boxed, manual, ex cond, £1,000 ono. Consider p/exch HF radio with cash adjustment. Tel: Mike, Epsom 42476

■ Sony 2001D, air, FM, SW 100-30MHz, air band 116-139MHz, FM 76-108MHz, 32 memory scan, PSU bought November, £300, offers. Commodore computer, ideal for children, 64K+4, joystick, ACE plus 11 other games, cost £110 in sale, offers. AOR2002 scanner, 25-550, 800-1300MHz, AM, NFM, WFM, 20 mems, PSU, £350. Take the lot away, £625. Ferrograph reel to reel, £50. Bargain, stereo three speed, spares. 31c Anerley Park, Penge SE20. Ask for Peter

■ Wraase SC1 SSTV/FAX Tx/Rx unit, latest model (as new), £695. Jaybeam D15/23 23cms Yagi, £45 (new). Case for FT790/290, £3.25 (new). Yaesu SP102 extension speaker, £41 (new). NEC 12 inch green screen monitor, £48 (as new). Solfan 10GHz head unit, £12. MuTek GD1F 107μB Tx/Rx, 10GHz board, £41. Paul G4XHF. Tel: (0293) 515201

■ Grundig Satellit model 2100, FM, LW, MW, 10 short waves, excellent condition, £150. Sony ICF7600D, FM, LW, SW synthesized receiver, as new, £100 including post & pack. Roberts Radio, model R800, MW, LW, FM, mains & batt, £35.00. Mr William Robbins. Tel: 01-855 2998

■ Icom 745 transceiver with Icom SM6 desk mike (list £950), £750. Drae 25A power pack (list £125), £80. Microwave 2m transverter (list £125), £80. Other items, complete station. All items little used, as new, boxed with handbooks, leads etc. 24 Humphries Close, St Cleer, Liskeard, Cornwall PL14 5DP. Tel: (0579) 42384

■ FT77 FM unit FMU77–6 months old, £20. Yamaur, 7 High Pleasance, Larkhall, Strathclyde ML9 2HJ. Tel: (0698) 887176

■ SWL station incorp Drake R7A receiver, mint condition, Tono 550 comm terminal. Heil sound ex speaker, Zenith 12 inch green display monitor, Datong outdoor active antenna, Sony AN1 active antenna, also headphones, power supplies, books etc. Offers around £1,400. Tel: George (0772) 704009 after 6pm

■ Valve list. Send me your price lists of any quantity of unused boxed valves and I will try and put you in touch with readers who send me a SAE stating their valve requirements. No charges. C T Brown, 8 The Elms, Horringer, Bury St Edmunds, Suffolk IP29 5SE

■ Two 8 inch Mitsubishi M2896-63 half-height disc drives, both boxed with technical manuals. £60 each or £100 for both (as new never been used). Tel: 01-471 0669 after 6pm, ask for Danny

■ Fantanox airband converter, £5. Harvard CB base station, £60. Two metre base receiver, xtalled £13, R2, R7, £25. Tandy portable CB, £60. ZX81 computer, plus 16K RAM pack, plus three games, £10. New ZX81 Plus, 16K RAM pack, £25. Black and white TV, £25. Sony ICF7600D portable communications receiver, £80. President CB rig, plus power mike £20. Portable scanning receiver, R2, R7, S20, £25. J Barton, 24 Pinfold Road, Streatham, London SW16. Tel: 01-769 6298 after 6pm

FREE CLASSIFIED ADS

■ Have Polaroid Polavision land player and Polavision instant movie land camera. Zoom lens, used twice, as new, swap for HF Rx or HF Tx, age not too important, must be in gwo, anything considered. Tel: 01-200 3825 NW London

■ Bremi linear, 26-30MHz, perfect, £45. Antenna 5/8 for 10/11m, high gain, £20. DNT 10m rig, perfect, £35. Max Bacon, Retreat, Wareside, Herts. Tel: (0920) 3564

■ Yaesu/Sommerkamp 9600 VHF/UHF receiver, SSB/FM/AM with HF converter, covers 0-905MHz without gaps. Includes ac adaptor and mobile mount, one week old, reluctant sale (going HF). Best sensible offer secures. Tel: 01-845 4008 (Ruislip)

■ Plessey Avionics PR155G high specification professional communications receiver. 0-30MHz continuous PLL tuning, complete with service and operating manual, absolutely mint condition, £450 ono. Tel: (04868) 7088 (Goldalming, Surrey)

■ Ham International Jumbo 27MHz home base. Rare opportunity to obtain this Rolls-Royce of base stations. Limited edition produced as fully legal UK 40 channel FM, 240V, with built in signal meter, SWR meter, anl, audio filter, ant switch, mic gain, RF gain, AF gain, Tx and mod lights, phones sockets. Complete with matching Ham International Big Puncher desk mic. Immaculate, £100. Tel: (0723) 862924

■ National HRO plug-in coil packs, 900kHz to 30MHz. Cover ranges 900kHz-2.05MHz/1.7MHz-4MHz/ 3.5MHz-7.3MHz/ 7.0MHz-14.4MHz/ 14MHz-30MHz, £20. Can have receiver, power supply and speaker for nothing (been modified to partly miniature valves). Would prefer swap for useful military radio, WHY. Tony Howard. Tel: (0234) 68559 (work hours, inc Sats)

■ Two TS180S HF transceivers, two PS30 20A PSUs, two AT230 tuning units, VFO180, SP180 with built-in filters. Also SM220 station monitor scope, MC50 station mic, microdot RTTY terminal (video module requires attention). All good condition. Reason for sale: changing hobby. Tel: (0788) 536626

■ Exchange complete camera processing outfits, including Olympus OM40 prog, OM30 cameras with flash, winder, lenses, filters, gadget bag etc, and colour darkroom with enlarger, p/tank, chemicals, paper, trays, plus lots more. All 2 months old in vgc, cost £820, will exchange for good HF trans, preferably with FM, but all very carefully considered, WHY? Or sell for £550. Tel: Chris. (02407) 5036

■ Trio R600, new October, original packing, as new condition, not used a lot, genuine reason for sale, £250. Tel: Deal (0304) 363687

■ Yaesu FT290R 2 mtr, no mods. Realistic PRO2003 home base scanner, covers 68-512MHz. CWR600 CW/RTTY reader. MM144/100S 2 mtr 100W linear. Saisho TCR5005 port/mains TV/stereo radio cassette. Total value £1,028 new, exchange for all band HF trans, ie FT102, IC740, IC720A, FT902DM, TS430, WHY, or sell £650. Will include Ferguson 3V32 stereo 2 speed VHS video, original price £649, for FT1, FT980, TS980, TS930S, or sell total for £1,000. Tel: Chris G1BFH. (02407) 5036

■ Spectrum 48K interface one, 2 microdrives, cartridges, ZX printer plus 6 rolls paper, datacorder, joystick and interface, Spelmate back-up interface, keyboard, every issue *Crashmicro, Micro Adventurer*, lots of software, books, adventure maps, game hints, in fact complete computer set-up (going back to model railways), £199. Dave, Bourne End. Tel: (06285) 24529 evenings

■ Amstrad CPC6128 colour monitor, built-in disc drive, 2 months old, boxed, sell for £300, or swap for Yaesu FRG8800. Tel: Hull 651498 after 1600 hours and ask for Paul

■ 19in rack cabinets to take 10½in racking. Cabinet 16in deep, £8. 140mm card frame to suit above, £2 each. Don. Tel: Hitchin 811591

■ Trio TR7200G 2 metre, FM only transceiver, £100 ono. Spectrum Plus keyboard and power supply, £60 ono. Plus 18 inch b/w TV, £20 ono. Dave Wells. Tel: Lancing 755898 after 8pm

■ Yaesu 225RD, immac cond, muTek FE-board, original packing, £325. Yaesu FL2100Z linear, new bands, mint, original packing, £270. Westower 3/S 45ft, two years old, £210. New QTH forces sale. Tel: (0932) 780917

■ 80ft radio telephone aerial complete with guys, cost £3,500 new, offers. Thorp Wardell Services Group, Barley Castle Lane, Appleton, Near Warrington. Tel: (0925) 61356

■ Realistic DX100 and DX200, all band communications receivers, complete with operations manuals, £120 ono. RO'(G) Shiels, 3 Mess, HMS Arrow, BFPO Ships. Tel: (021) 327 6678

■ CAPCo SPC300 ATU Rx/Tx, 400W 1kW PEP; 4-1 balun, 1kW PEP; 2 open wire spacer kits, £100. Tono 777 reader/sender, RTTY, Amtor, bit-inversion, CW etc, £200. Both boxed as new with manuals. Mr Ferry. Tel: 01-570 5603

■ Yaesu FR101S comm receiver, mint cond, no mods, with manual, £200. Realistic DX200 five band comm receiver, no mods, mint cond, with manual, £75. Buyers inspect and collect. G2AFN, QTHR. Tel: Leamington Spa (0926) 38926

■ Trio TS430S, virtually unused, hence £600, with original packing and manual. Icom tcvr IC701, 100W, solid-state, 10m to 160m (pre-WARC), complete with matching spkr/PSU IC701 PS and desk mic, SM2, no extras to buy, all original packing and manual, prefer buyer to inspect and collect or carriage extra. Would be interested in IC2001D with aircraft as p/ex. VR57 valve wanted. Tel: Hemel Hempstead (0442) 59970

■ Eddystone 770R receiver – 19 to 165MHz, in six bands, £100. KW Vespa Tx, £30. RTTY V-type tuning indicator, £10. Tel: (0608) 811102

■ Scanning receiver, Bearcat 210, coverage 32-50, 146-174, 416-512MHz, with service manual, boxed, mint, £115 ono. Realistic PRO2001 scanner, coverage 30-50, 144-174, 430-512MHz, service manual available, in good condition, £150 ono. Shogun sel call unit, new, £25. Tel: 01-582 8738

■ Yaesu FT209R trans hand-held, 10MHz coverage, good cond, boxed with speaker mike and charger, £190. Standard C7800 VHF trans, good cond, boxed, £140. G6EBN not QTHR. Tel: Waltham Cross (0992) 32114 after 7pm

■ Trio TM211E 2 metre FM transceiver, 9 months old, warranty, inst manual, boxed, 5W/25W incl dcs and dsc system used in shack, only £250. G1JUB not QTHR. Tel: Cuffley 872772

■ Realistic DX160 comm receiver, general coverage, 150kHz to 30MHz in five bands, excellent cond, good working order, ideal for beginner in short wave radio or as a standby rec. Buyer collects, £50 ovno. Tel: Goole 2235 ask for Andy

■ Leak throughline FM tuner (mono), 88-108MHz, ideal for conversion, £10. Tel: Bristol 776891 evenings or weekends

■ Ferrograph 4AN mono open reel tape recorder, speeds 3¾-7½, complete with manual, microphone and 20 assorted tapes. Gwo, bargain, £18. Tel: Bristol 776891 evenings or weekends

■ Sony ICF2001 FM/AM/SSB/CW Rx, 150kHz to 30MHz plus 76MHz to 108MHz FM, as new and boxed with manual, £89. Ken Ballance, 18 Rambleford Way, Parkside, Stafford ST16 1TW. Tel: Stafford (0785) 44964

■ 23cm filter, 3-pole type, 70cm ½-wave filter, wavemeter to cover 144MHz to 2500MHz, 10GHz wavemeter in kit form. Paul Sergent, 6 Gurney Close, Costessey, Norwich. Tel: (0603) 747782

■ FT707 transceiver, YM35 mic, 10A Coutant PSU, all vgc, £350. Trio JR500S Rx, £30. Datong code call, £10. Heathkit 'scope 10-18U, £20. Rod G3RTB. Tel: (0904) 641011, York

■ Sony ICF2001D, brand new, £300. John Atkinson, 39A The Drive, Adel, Leeds LS16 6BQ. Tel: (0532) 670476

■ Ham Jumbo HF Tx – main RF trann's and xtals removed due to visit from DTI, but can soon refit or sell in non-working cond. Only one mod: record jack on front panel for conn'tn to computer for CW decoding. Or will swap for SX200N scanner or any similar rig. Also loads of junk for home-brew fans. Phone for details. Pete, 27A Friarn Street, Bridgwater, Somerset TA6 3LH. Tel: (0278) 428 633

■ Four BSR/MacDonald turntables, all in varying states of disrepair (all serviceable), £10 each or £30 for 4. 100 watt disco PA (needs attention), £30 ono. 3 channel light controller (needs attention), £20 ono. Electric lead guitar (Strat copy) plus case (box), strap and lead, £80 ono. Marshall 12 watt lead guitar amplifier, as new and under guarantee, £70. Beyer Dynamic audio microphone (as used by the BBC, etc), £20 ono. All carriage arranged to anywhere. All items must be sold. Tony D Sheach, 8 Struan Road, Portree, Isle of Skye IU51 9EG. Tel: (0478) 2548, after 7pm

■ Grandstand P2004 2 watt 4 frequency FM/UR hand-set, won in a competition, extremely good condition and a very rare item (Serial No 000019). This set is believed to be one of very few in circulation (model never marketed). Uses FM/UR channels 2, 14, 21, 39. This rare item must be sold so highest offer accepted, circa £70+ ono. Carriage anywhere in UK or abroad. Tony D Sheach, 8 Struan Road, Portree, Isle of Skye IU51 9EG. Tel: (0478) 2548, after 7pm

■ Yaesu FT290R, immaculate, inc case, Nicads, charger, £250. Desk mic with compression, wired 290, £25. Tokyo Hy-power 30 watt linear, with GaAsFET pre-amp, £55. 6 amp PSU, £15. Save £15 buy the lot for £330. Halicrafters SX140 ham band Rx, £60. Realistic DX100L Rx, £30. Buyers to collect. Datong D70 Morse Tutor, £35. Mike G1HGD. Tel: Kenilworth (0926) 55158 evenings, 53964 day

■ Trio TH21E 2m hand-held, Trio UK spec, with Nicad, charger, flexiwhip aerial, strap and case. Excellent condition, £155 incl UK carriage. C Redwood, 45A Lulworth Avenue, Hamworthy, Poole, Dorset BH15 4DH

■ Kubota 3kW generator, now costs over £700. Run for only 30 hours, £495. G6JNS QTHR. Tel: (0905) 620041, 24 hours

■ First reasonable offer for following complete HF station: HW101 with PSU, immaculate cond, 220W PEP; Hanson PEP/Voc/SWR meter (new); VR3 vertical antenna (new); 20ft x 2in mast with 10ft ext; AR2000 rotator; 8 over 8 beam; co-ax and plugs and many station accessories included. Reason for sale: emigration. Callers or written offers welcomed, must sell by July 31 1986. Chris GM0CFK, 130 Main Street, Kinglassie, Fife

WANTED

■ Eddystone 888, 880 or 680. KW76, 77, 202, or Drake 2B. All letters answered. B Smith, Hirsts Cottage, Spa Lane, Lathom, Ormskirk, Lancs L40 6JG. Tel: (0695) 21128

■ 2m mobile, offering 2m Yaesu handie in exchange, plus cash if required. Cradley Heath. Tel: (0384) 64745

■ Copy of *Hobby Electronics*, May 1979. Just want to borrow and return. Mr Lawrence, 7 Griffin Crescent, Littlehampton, Sussex

■ Elecrolytic for Shirley TWA/15/15 amp power pack. 60-40-40μF, 450V m/wkg, 525V surge. Plessey CE8447. Prompt payment inc postage. Mr K Piggott, Foxgloves, Elim, Eglwyswrw, Crymych, Dyfed SA41 3TJ

■ B/W 405 line TV to convert up to 625 line for TV DX. Condition not important, but must be working. Dual standard B/W TV for TV DX acceptable. R Shaw, 37 Lawns Wood, Malinslee, Telford, Shropshire TF3 2HS

■ Portable valve radios, any early valve sets, Hacker transistorised receivers. Tel: Reading (0734) 883799

■ WS19 Mk1, also Mk111 with B set. R107 chassis spares. BC348D special case/cabinet, fixing screws and original PSU rotary generator. R1155 Jones plugs, also left/right indicator units and headgear, etc. Collection no problem. Tony Howard. Tel: (0234) 68559, (Bedford), work hours

■ SX200N scanner or Revco RS2000E scanner for ST5MC RTTY terminal unit. Pye Pockethone with charger, batter mike, 3 crystals and Sinclair 48K Spectrum with leads. Clive Powis, 28 Kingston Gardens, Chelmsley Wood, Bham B37 5HS. Tel: (021) 788 8447

■ Sony CRF330K SW communications receiver. Must be in excellent condition. Tel: (0206) 394336, Essex

■ Required: an out of date copy of *World Radio/TV Handbook*, year and price, please phone Holbeach 22649

■ Does anyone have a Yaesu FT902DM for sale, as I have been looking for one of these particular transceivers for some time, without success. I am prepared to pay a good price assuming the transceiver is in absolutely mint condition. If anyone is interested in selling, telephone my inlaws number below and leave a message. Genuine callers only please! Maurice Hughes, 128 Ravenswood Rise, Dedridge, Livingston, West Lothian, Scotland EH54 6PQ. Tel: Midcalder 880345

■ WW2 German radio radar equipment and accessories, parts, spares, valves, descriptions etc, WHY? AR77 receiver, WS65, WS66, WS11,

FREE CLASSIFIED ADS

R1084 grnd station receiver for museum purposes. Do not have to be in working condx. Will collect. OZ8RO, Rae Otterstad, Vejdammen 5, DK-2840, Holte, Denmark. Tel: (010) 452 801875

■ Sony CRF330K short wave receiver, must be in first class condition. Tel: (0206) 394336, Essex

■ SX200N scanner or Revco RS2000E scanner for ST5MC RTTY terminal unit. Pye Pocketphone with charger, battery, mike and 3 crystals, and Sinclair 48K Spectrum with leads. Clive Powis, 28 Kington Gardens, Chelmsley Wood, B'ham B37 5HS. Tel: (021) 788 8447

■ Help! I need a circuit diagram for a low pass filter with a cut-off frequency of 565MHz. I want to strongly attenuate signals above that frequency. If anyone can help will they please write to L Gorman, 128 Lyons St, Southampton, Hants SO2 0LZ. Postage refunded

■ Nato 2000 in perfect condition. Good price paid for a late model. Mini or 3 beam mini for 27 or 28MHz. Also Modulat or frequency charger, 119-136MHz, or any others for FRG7700. Tel: (0283) 221870

■ Urgently wanted: circuit diagram, also handbook for Hallicrafter receiver, No S85. Write or phone details. I B Eccles, 137 Apple Trees, Barhill, Cambridge. Tel: 81004

■ TV502 2 metre transverter and DG5 digital readout. Both to suit TS520S. Have Icom 260E 2 metre multi-mode to barter with. Also want 10 metre FM box. Contact G0DQW. Tel: (0743) 241194 (office hours)

■ HF linear, any type considered – commercial or homebrew, WHY? Tel: (0608) 811102

■ FRV7700 for FRG7700, must be in good condition. Any information on software for Spectrum computers or Amstrad computers regarding Rx/Tx, radio modes etc. Bernard, 99 Rothfarnham Road, Dublin 14, Ireland. Tel: 905768

■ Bound volumes of RSGB bulletin from 1950 to 1967. Can collect from Midlands or south of England. G6JNS QTHR. Tel: (0905) 620041, 24 hours

■ Service manual required for Pye UHF signal generator SG1U or any operating information, ie frequency range, crystal calculations. Also required HC6/U crystals, 12.027MHz 12.030MHz 12.037MHz. All postage, photocopying costs covered. F Eyles, 41 Bredon Grove, Poolbrook, Malvern, Worcs WR14 3JS. Tel: (06845) 62385

■ ATV Tx, low power type preferred and 70cm AM. Paul Sergent, 6 Gurney Close, Costessey, Norwich. Tel: (0603) 747782

■ Modulator and PSU No 4192 for STR18 installation. Also aerial tuning unit. Dynamotor for WS62. Service manual for BC639. D/F aerial and 'J' switch for T1154. Indicator 62 or 97 or 266, non-working model acceptable. Aerial tuning unit and L/spkr for TCS. Also connecting leads. J A Brown, 57 Mountbatten Road, Braintree, Essex CM7 6EY. Tel: (0376) 45023

■ PCR receivers with ac/PU, LW/MW/SW version. Please send full details of condition and realistic price required. Richard Marris, 35 Kingswood House, Farnham Road, Slough, Berks SL2 1DA

■ FRG seven, digital if possible. Will swap Sony 6700W 0.5–30MHz. Tel: Leicester 312874

■ Manual inc circuit diagram of Trio Kenwood QR666GC Rx, or circuit and parts list. Photocopies OK. Also copy or original of *Elektor Summer Circuits 1980*, single board signal generator using two terminal coils. G4LEG. Tel: (0293) 32825 after 6pm

■ YO901P multiscope, Yaesu, vgc, fair price paid. SP901P. Phone patch speaker, vgc. Colin G4YIQ, QTHR, 13 Newick Ave, Pallister Park Est, Middlesbrough TS3 8QJ. Tel: (0642) 244415

■ Circuit diagram and service manual for Trio TR7200G 2m crystal controlled set. Tom Lorimer, 443 Delgatie Court, Glenrothes, Fife, Scotland KY7 4RW. Tel: (0592) 771583

■ German military radio/radar, parts, descriptive literature, etc from WW2. Also agent sets. Will collect or pay freight. Does anyone have an AR77? Cash and/or hardware compensation offered. OZ8RO Rag Otterstad, Vejdammen 5, DK-2840 Holte, Denmark. Tel: 010-452-801875

■ Heathkit RA1 c/w instruction manual as per May edition this mag. For absolute beginner aged 50 who wants to see if he likes the hobby and cannot afford too much. Ahh! All letters answered, postage refunded. Terry Bullous, 43 Attfield Drive, Whetstone, Leicester LE8 3ND

■ Heathkit RG-1 all valve general coverage receiver with instruction handbook in good condition. Tel: (051) 931 1001

■ Information or data required for a Pye F460 UHF basestation and UHF starphone. G8BSK, 290 Priory Road, St Denys, Southampton SO2 1LS

■ Icom PS55 PSU. Mrs Fordham, 31c Anerley Park, SE20, Penge

■ Heathkit RG-1 or RA-1 Rx. Must be prepared to send to Eire. Will pay carriage. Good price paid. Mr N Cameron, 16 St Mary's Cres, Westport, Co Mayo, Eire

■ Do you have any Akai or JVC ¼ inch wide video tape on any size reel. Good price paid, new or used. Also want manual or circuit diagram of AKAI VTR model VT700 and circuit of International Video Corps reel to reel VTR, model 801P, previously owned by Marconi Ltd, London. Come on you Marconi lads! Nev Kirk G3JDK, 54 Allendale Rd, Rotherham, Yorks S65 3BY. Tel: Wickersley 541606 anytime

■ Details of any video tapes on ham radio and the RAE. Tel: (0288) 55179

■ Radation geiger counter with sound/metered portable with good ranges, low μC to high levels, with ins manuals. Also any radio software for TRS80, model 100 computer. Tel: 9 to 5, office hours (0475) 385526.

■ Ruled graticule glass for hartly 13A oscilloscope contact. Mr E Turner, 70 Cleaswell Hill, Guidepost, Northumberland NE62 5DY

■ Bird 43 thruline wattmeter inserts. Please ring giving power handling and freq available or similar compatible inserts. Mike Buckley, 12 Ranmore Ave, Croydon, Surrey, CR0 5QA. Tel: 01-654 2582

■ HF Rx or HF transceiver in gwo: R1000, FRG7, HW100 or sim, WHY. Swap for Polavision instant movie outfit, ie movie camera and zoom lens and land player (monitor), as new, anything considered, or offers. Tel: 01-200 3825 NW London

FREE CLASSIFIED AD FORM

Send to: Amateur Radio Classified Ads · Sovereign House · Brentwood · Essex CM14 4SE

Classification: (tick appropriate box) If you want to insert ads under more than one classification use separate sheets for second and subsequent ads

For Sale ..... ☐ Wanted ..... ☐

USE BLOCK CAPITALS (One word per box)

To avoid mistakes please write clearly and punctuate your ad

Name/Address Postcode/Telephone							

USE SEPARATE SHEET FOR MORE WORDS

Ensure that you have included your name and address, and/or telephone number

CONDITIONS: Ads will be published in the first available issue on a first come first served basis. We reserve the right to edit or exclude any ad. Trade advertisements are not accepted

Amateur RADIO SMALL ADS

ESR ELECTRONIC COMPONENTS

- **FULL RANGE OF COMPONENTS**
- MOTORS & SERVOS
- ROBOT ARMS & INTERFACES
- VELLEMAN ELECTRONIC KITS

Send for new catalogue **60p** *inc P&P*

13a Station Road, Cullercoats, North Shields, Tyne & Wear NE30 4PQ
091 251 4363

SP ELECTRONICS

48 Limby Road
Ruckhall, Nottingham
Tel: (0602) 640377
Open Monday-Saturday 8.30-5.30

USED AMATEUR EQUIPMENT?

I Buy, Sell & Exchange!
SELLING? I pay the BEST POSSIBLE PRICES for your Clean Used Equipment! BUYING? I have the BEST SELECTION of top Quality Used Equipment Available!
For the Deal You've been Looking for. Phone Dave, G4TNY ANYTIME ON HORNCHURCH (04024) 57722 or Send SAE

Electronic ATU for HF Receivers

Is your HF communications receiver plagued with interfering signals that should not be there? Is the only way to eliminate them by switching in the antenna attenuator, reducing the receivers overall sensitivity? Not any more – the compact HF3B electronic tuner eliminates this effect by giving at least 20dB rejection, and removing background hash that is so irritating on many modern receivers. The unique electronic circuitry runs for over 12 months on a PP3 battery.

Price: £28 including battery, all connectors and p&p

Evans Electronics,
11 Hill View, Bryn-y-Baal, Mold, Clwyd CH7 6SL

Voucher removed

Ian Fisher Communications of Stanhope

CB Works, Bondisle Way, Stanhope, Bishop Auckland Co Durham DL13 6TY

Main Distributors of 27Mhz C.B. radios and aerials also manufacturers of the new 27Mhz mobile electron coil whip. This is a powerful aerial designed for 10m and 11m mobile use.

PRICE £16.50 each
Guaranteed for five years.

Large stocks of coaxial cable, plugs, sockets and adaptors.
All available via mail order.

OPEN: MON-SAT 10.30am-6.00pm
RING FOR DETAILS
(0388) 528464

TRANSFORMERS

240/12v 1 amp £2, 240/12-0-12v 1 amp £3. 240/12v-0-12v 20amps £22. Diodes 400v stud 40amp £1.50 Valves 4-pin 4v 350v Rectifiers £2. Transistors MJ1000 £2.50, Signal meters 2in 100 Yamp £2. **Maiden Transformers, 134, London Road, Kingston on Thames 546 7534.** Access

Selectronic

The UK's leading suppliers of 934MHz personal radio equipment

203 High Street
Canvey Island, Essex
Tel: 0268 691481
(Open Mon-Sat 9-5.30)

Amateur radio equipment also in stock

RF DEVICES AT ROCK BOTTOM PRICES!

Nobody beats us!

Over 30,000 RF devices at low prices

REPLACEMENT RF TRANSISTORS

MRF454 HF/SSB 80W	£18.20
MFR450 HF/SSB 50W	£11.60
MRF238 VHF/FM 25W	£12.80
MRF475 HF/SSB 20W	£2.99
2SC1969 HF/SSB 18W	£2.50
2SC2043/1307 HF 16W	£2.00
2SC1947 VHF 3.5W	£7.60
2SC1946A VHF 32W	£14.30

REPLACEMENT RF POWER MODULES

M57704/SAU3 UHF 15W	£36.00
M57712/SAV7 VHF/FM 25W	£39.00
M57713/SAV8 VHF/SSB 15W	£39.00
M57716/SAU4 UHF/SSB 15W	£49.00
M57719 VHF/PMR 15W	£29.00
M57727 VHF/SSB 38W	£45.00
M57749/SAU11 934/FM 7W	£29.00

Send £1.00 p&p and SAE for full list
All prices inc. VAT
Many Ic's and other types in stock

RAYCOM LTD
DEPT AR 584 HAGLEY RD WEST
QUINTON BIRMINGHAM
B68 0BS
021 421 8201-3
(24hr answer phone)

TRF AND SUPERHETRODYNE MODULES
AM, SSB and CW.
Assembled, tested and guaranteed.
See for details.
R EAST
REGABY, ANDREAS, ISLE OF MAN
Tel: (0624) 88672. 24 hours

MAXI — Q

COILS AND CHOKES
PREVIOUSLY MADE BY
DENCO SAE PRICE LIST

8 BRUNEL UNITS, BRUNEL ROAD, GORSE LANE IND ESTATE, CLACTON, ESSEX CO15 4LU.
TEL: (0255) 424152

RTTY-AMTOR-SSTV

Printed Circuit Boards and Boxed Units available for following computers
BBC, Commodore, Apples, Amstrad etc.
CAT control programs available for YAESU, FT757 and FRG 8800

Mr J Melvin G3LIV
2 Salters Court, Gosforth, Newcastle,
Tyne & Wear NE3 5BM
Tel: 091 2843028

NEXT ISSUE ON SALE

Amateur RADIO

Thursday 28th August

ELECTRONIC COMPONENT SUPPLIES

Semiconductors, Capacitors, Resistors, Switches, Opto, Hi-Tech and much more. 7400 series from 10p, 74LS from 14p 4000 series from 10p, Linear from 12p 2716 £1.45 also Tools, Solder etc.

FREE CATALOGUE
with SAE from:

45 Copper Beach Gardens,
Ensbury Park, Bournemouth,
Dorset.
0202.421837/519898.

XXX

ADULT VIDEO CLUB
OUR GIRLS WILL GIVE YOU
THE INTIMATE DETAILS. NOW RING
0924 471811 (24 HRS)
OR WRITE: AVC, PO BOX 12,
BATLEY, W YORKSHIRE

MORSE CODE PREPARATION
Cassette A 1-12 wpm for amateur
Cassette B 12-25 wpm for professional examination preparation
Each cassette is type C90
Price of each cassette (including booklets) **£3.95.**
Morse key with separate battery (PP3) — driven solid-state oscillator and sound transducer produces clear tone for sending practice Price of key with electronic unit **£8.95.**
Price includes postage etc Europe only
MH ELECTRONICS (Dept AR)
12 Longshore Way Milton Portsmouth PO4 8LS

YAESU ST ONE
All factory mods and options complete with STV ONE 07R Transverter including 2m and Trio MC60 Base Mic. price £1000 or very near offer
(Can deliver)
TEL: 0386 830614

D.P. HOBBS (Norwich) Ltd
13 St Benedicts Street, Norwich Tel: 615786
Open Mon-Sat 9-5.30
Closed Thurs 1.00pm
Stockists of:
YAESU, FDK, ICOM, JAYBEAM
& Electronic Component Specialists

SERVICE MANUALS

For most Makes Models Age of electronic equipment
Amateur Radio Test equipment Audio Television, Video, Vintage Military etc Thousands Stocked SAE enquiries

MAURITRON TECHNICAL SERVICES
Dept AR, 8 Cherry Tree Road, Chinnor, Oxon OX9 4QY.

FOR SALE BY TENDER

A quantity of consumer I/cs & semiconductors. This offer is subject to highest bid for entire stock plus VAT = 15%, carriage at cost, closing date 28th August. All items new unused.
Please send your offer marked TENDER R1362 to address below in a sealed envelope.

Type	Quantity
25D73 complimentary audio o/p	900
2SA634 complimentary audio o/p	1000
2SA634 PNP	1000
2SO1008 NPN	1000
2SO1096 NPN PA	700
2SC1520 NPN H/V	400
2SC1674 NPN	600
2SC458 NPN	1000
2SC815 NPN	900
C59011 NPN	1200
2SD288 NPN AF O/F	400
2SD362 NPN A/F	1800
KA2101/CA3065 TV-IFI/C	1000

RAYCOM LTD
Dept AR, 584 Hagley Rd West
Quinton, Birmingham
B68 0BS
Tel: 021 421 8201-3
Telex: 334 303G TXAGWM

PNP Communications Communications Interface

for RTTY — Morse — AMTOR

Our popular range of communication modules is now available, fully boxed and tested under the model number.

CTU 20

The CTU20R is RTTY only & costs **£62.50** whilst the CTU20RM is for morse as well and costs **£75.25**
For shortwave listeners the MF2-DX gives the option of 170Hz, 425Hz or 850Hz shift reception and costs **£56.95**

Send a large (A4) SAE for full Cat
Please add VAT at the current rate.
Access & Barclaycard (VISA) welcome.

62 Lawes Avenue, Newhaven
East Sussex BN9 9SB
Tel: (0273) 514465

Telephone the advertising department on: 0277 219876 for details

ADVERTISERS INDEX

Amateur RADIO

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
61 x 90	⅛ page	£66.00	£62.00	£59.00	£53.00
128 x 90 or 61 x 186	¼ page	£115.00	£110.00	£105.00	£92.00
128 x 186 or 263 x 90	½ page	£225.00	£210.00	£200.00	£180.00
263 x 186	1 page	£430.00	£405.00	£385.00	£345.00
263 x 394	double page	£830.00	£780.00	£740.00	£660.00

COLOUR AD RATES

colour rates exclude cost of separations

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£550.00	£530.00	£470.00
263 x 394	double page	£1,130.00	£1,070.00	£1,010.00	£900.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof & small ad	mono artwork	on sale thurs
Sep 86	31 Jul 86	6 Aug 86	8 Aug 86	28 Aug 86
Oct 86	28 Aug 86	3 Sep 86	5 Sep 86	25 Sep 86
Nov 86	2 Oct 86	8 Oct 86	10 Oct 86	30 Oct 86
Dec 86	30 Oct 86	5 Nov 86	7 Nov 86	27 Nov 86

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.

An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.

Previous copy will automatically be repeated if no further copy is received.

A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.

Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

COPY
Except for County Guides copy may be changed monthly.

No additional charges for typesetting or illustrations (except for colour separations).

For illustrations just send photograph or artwork.

Colour Ad rates do not include the cost of separations. Printed – webb-offset.

Above rates exclude VAT.

PAYMENT
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.

FOR FURTHER INFORMATION CONTACT
Amateur Radio, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219876

Commission to approved advertising agencies is 10%.

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.

A.R.E. Communications Ltd.

38 BRIDGE STREET, EARLESTOWN
NEWTON-LE-WILLOWS
MERSEYSIDE. TEL: 09252 29881

FIRST AGAIN WITH THE NEW MODELS

Yaesu 767GX

HF plus 2m plus 70cm plus 50MHz
Built in auto ATU
Built in power supply
Keyboard entry
2 VFO's
10 memories
Auto frequency tracking
Cat interface

£BERNIE

DUAL BAND 144-432

YAESU FT727G

A dual band handheld transceiver 144-146 and 430-440. Up to 5 watts out oneach band. Built in VOX Cat interface

£BERNIE

C.T.E. INTERNATIONAL s.r.l.

MANUFACTURERS OF HIGH QUALITY ACCESSORIES IN EUROPE FOR OVER 15 YEARS

FOR THE AMATEUR RADIO AND C.B. ENTHUSIAST

Now in the U.K.

ACCESSORIES

AU10
High quality extension speaker especially designed to optimise reception on any transceiver

£7.98

POWER SUPPLIES

F57 £19.84

5–7 AMP 13.8 Volt stabilized supply

F1820 £99.98

20 AMP max 13.8V supply

F911 £49.00

10 AMP max. 13.8V supply

New CT1600
2 MTR FM Handheld Transceiver
A super sensitive h/held with full spec. PWR:–1.5.W/0.5W repeater shift thumbwheel CH. selection

£199.00

FD1350
Frequency counter 10hz – 1.3 Ghz
8 Digit accurate counter requires 13.8 V supply max input sig. 1.V P.P. impedance:– 50 OHM/50 PF

£129.00

ANTENNAS 26–30Mhz (Incl. 29 Mhz FM)

SALIUT 27
3/4 wave ultra-high gain base antenna. Adjustable 26–30mhz power max. 2 KW gain 6.5 dB. The ultimate base antenna for long distance work. Height. 9.1. mtrs

£49.72

MERCURY
This top class half wave leaves the cheap copies standing. High grade aluminium and a low loss coil enable it to cope with up to 1KW and provide over 3 dB's gain 26–30 Mhz

£27.82

SKYLAB
Europes most popular base antenna with 6dB gain and high efficiency. 26–30 Mhz

£24.00

COLUMBIA
Helically wound for ultra high efficiency. Will handle 600W. 3.2dB 1.4mtrs long Comes complete with mount. cable and plug ready for use.

£19.45

SHUTTLE
Fibreglass whip with exceptional Rx/Tx characteristics 600W. 1.2dB 1.67mtrs long Comes complete with mount. cable and plug ready for use.

£13.72

AMPLIFIERS

FOR USE BY LICENSED RADIO AMATEURS ONLY

B42
2 MTR mobile AMP. The latest edition to the CTE range the B42 offers high class performance at 144 Mhz
Power :–40 Watts
Supply :–13.8 Volts
Input PNR:– 0–10 Watts

£59.68

757
Mobile HF linear power 150W switchable class "C" or "AB" suitable for AM–FM– CW–SSB remote control facility

£99.98

737
Mobile HF linear power 50W max. input 10W suitable for AM–FM– SSB

£37.69

767
Mobile HF linear power 80W switchable class "C" or "AB" suitable for AM–FM– CW–SSB remote control facility

£43.00

DC9
Solid state mains powered. base station HF 150W amplifier switchable class "C" or "AB" suitable AM–FM–CW– SSB

£148.50

Send £1.00 for the complete C.T.E. catalogue and price list, and receive a £2.00 voucher for your first purchase redeemable from any authorised C.T.E. stockist or direct.

C.T.E. products are available from authorised stockists throughout the U.K. or direct from

U.K. Office and Distribution:—
Telecomms,
189 London Road, North End, Portsmouth, PO2 9AE.
Tel: (0705) 662145. Telex: 869107 TELCOM G.

TELECOMMS