APRIL 1987 £1·10

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Practical Wireless

The Radio Magazine

FREE INSIDE ~ DATACARD

UK ONLY **70cm Repeaters** WORTH 50p

Build The PW 'Itchen' LCR Bridge

New Series- Test Methods & Equipment

PLUS

Simple Discriminating Continuity Tester

Reg Ward & Co. Ltd.

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Yaesu

FT1	HF Transceiver	**P.O.A.**	(—)
FT980	HF Transceiver	**1750.00**	(—)
SP980	Speaker	**110.00**	(2.50)
FT767		**1550.00**	(—)
FEX767(2)	2m Module (767)	**169.00**	(2.50)
FEX767(70)	70cm Module (767)	**215.00**	(2.50)
FEX767(6)	6m Module (767)	**169.00**	(2.50)
SP102	Speaker	**75.00**	(2.00)
SFT290	MkII New Super 290	**429.00**	(—)
FT290	2m M/Mode Port/Transceiver	**379.00**	(—)
FT290	With Mutek front end fitted	**409.00**	(—)
MMB11	Mobile Bracket	**37.50**	(1.50)
NC11	Charger	**10.50**	(1.50)
CSC1	Carrying Case	**6.50**	(1.50)
YHA15	2m Helical	**7.50**	(1.50)
YHA44D	70cm ½wave	**12.50**	(1.50)
YM49	Speaker Mike	**22.00**	(1.50)
MMB15	Mobile Bracket	**14.55**	(1.50)
FT23	2m Mini H/H	**249.00**	(2.50)
FT27	70cm Mini H/H	**£269.00**	(2.50)
FNB9	Spare Battery Pack (23/73)	**23.00**	(1.50)
FNB10	Spare Battery Pack (23/73)	**25.00**	(1.50)
FNB11	Spare Battery Pack (23/73)	**42.00**	(1.50)
NC.18C	Charger (23/73)	**10.50**	(1.50)
NC.28	Charger (23/73)	**11.00**	(1.50)
NC.29	Base Charger (23/73)	**49.00**	(2.50)
PA6	Car Adap/Charger (23/73)	**14.50**	(1.50)
MH12A2B	Speaker Mic	**22.00**	(1.50)
FT727	2m/70cm H/H	**425.00**	(3.00)
FNB3	Spare Battery Pack	**40.00**	(1.50)
FNB4	Spare Battery Pack	**45.00**	(1.50)
FNB5	Empty Cell Case	**9.00**	(1.50)
FT209R	NEW 2m H/Held/C/W FNB3	**299.00**	(—)
FT709R	70cm H/Held	**319.00**	(—)
FT270R	2m 25W F.M.	**399.00**	(—)
FT270RH	2m 45W F.M.	**469.00**	(—)
FT2700R	2m/70cm/25W/25W	**499.00**	(—)
FRG9600	60-905MHz Scanning RX	**525.00**	(—)
MMB10	Mobile Bracket	**10.00**	(1.50)
NC9C	Charger	**10.35**	(1.50)
PA3	Car Adaptor/Charger	**20.50**	(1.50)
FNB2	Spare Battery Pack	**25.00**	(1.50)
YM24A	Speaker Mike	**27.00**	(1.50)
FT726R	2m Base Station	**999.00**	(—)
430/726	70cm Module for above	**349.00**	(3.00)
FRG8800	HF Receiver	**639.00**	(—)
FRV8800	Convertor 118-175 for above	**100.00**	(2.00)
FRT7700RX	A.T.U.	**59.00**	(2.00)
MH1B8	Hand 600 8pin mic	**20.00**	(1.50)
MD1B8	Desk 600 8pin mic	**79.00**	(1.50)
MF1A3B	Boom mobile mic	**25.00**	(1.50)
YH77	Lightweight phones	**19.50**	(1.50)
YH55	Padded phones	**19.95**	(1.50)
YH1	L/weight Mobile H/set-Boom mic	**19.00**	(1.50)
SB1	PTT Switch Box 208/708	**21.00**	(1.50)
SB2	PTT Switch Box 290/790	**18.00**	(1.50)
SB10	PTT Switch Box 270/2700	**21.00**	(1.50)
FF501DX	Low Pass Filter	**37.50**	(1.50)
NEW			
FT767GX	HF TXCR	**1550.00**	(—)
FT727	2M/70CM H/H	**425.00**	(—)
FL7000	HF Linear	**1600.00**	(—)

Linear Amps

TOKYO HI POWER			
HL 160V	2m, 10W in, 160W out	**244.52**	(2.50)
HL 82V	2m, 10W in, 85W out	**144.50**	(2.50)
HL 110V	2m, 10W in, 110W out	**249.00**	(2.50)
HL 35V	2m, 3W in, 30W out	**76.00**	(2.50)
HL 30	2m, 3W in, 30W out	**54.00**	(2.50)
HL 20U	70cms, 3W in, 20W out	**122.50**	(2.50)
MICROWAVE MODULES			
MML144/30-LS	inc preamp (1/3 w i/p)	**98.90**	(2.50)
MML144/50-S	inc preamp, switchable	**106.95**	(2.50)
ML144/100-S	inc preamp (10w i/p)	**149.95**	(3.00)
MML144/100-HS	inc preamp (25w i/p)	**159.95**	(3.00)
MML144/100-LS	inc preamp (1/3w i/p)	**169.95**	(3.00)
MML144/200S	inc preamp (3/10/25 i/p)	**369.84**	(3.00)
MML432/30L	inc preamp (1/3w i/p)	**169.05**	(2.50)
MML432/50	inc preamp (10w i/p)	**149.50**	(2.50)
MML432/100	linear (10w i/p)	**334.65**	(3.00)
B.N.O.S.			
LPM 144-1-100	2m, 1W in, 100W out, preamp	**235.00**	(3.00)
LPM 144-3-100	2m, 3W in, 100W out, preamp	**235.00**	(3.00)
LPM 144-10-100	2m, 10W in, 100W out, preamp	**205.00**	(3.00)
LPM 144-25-180	2m, 25W in, 180W out, preamp	**305.00**	(3.00)
LPM 144-3-180	2m, 3W in, 180W out, preamp	**355.00**	(3.00)
LPM 144-10-180	2m, 10W in, 180W out, preamp	**355.00**	(3.00)
LP 144-3-50	2MN 50W out, preamp	**145.00**	(3.00)
LP 144-10-50	2M 10W in, preamp	**145.00**	(3.00)
LPM 432-1-50	70cm, 1W in, 50W out, preamp	**255.00**	(3.00)
LPM 432-3-50	70cm, 3W in, 50W out, preamp	**255.00**	(3.00)
LPM 432-10-50	70cm, 10W in, 50W out, preamp	**215.00**	(3.00)
LPM 432-10-100	70cm, 10W in, 100W out, preamp	**395.00**	(3.00)
LPM 432-3-100	70cm, 3W in, 100W out, preamp	**395.00**	(3.00)

SWR/PWR Meters

HANSEN			
FS50VP	50-150MHz 20/200 Interval PEP/SWR	**106.70**	(2.50)
FS300V	50-150MHz 20/200 PWR/SWR	**53.50**	(2.50)
FS300H	1.8-60MHz 20/200/10W	**53.50**	(2.50)
FS210	1.8-150MHz 20/200 Auto SWR	**63.50**	(2.50)
W720	140-430MHz 20/200W	**41.50**	(2.50)
WELZ			
SP10X	1.8-150MHz PWR/SWR	**39.95**	(2.50)
SP122	1.8-60MHz PWR/SWR/PEP	**79.95**	(2.50)
SP220	1.8-200MHz PWR/SWR/PEP	**67.95**	(2.50)
SP225	1.8-200MHz PWR/SWR/PEP	**119.95**	(2.50)
SP420	140-525MHz PWR/SWR/PEP	**74.95**	(2.50)
SP425	140-525MHz PWR/SWR/PEP	**119.95**	(2.50)
SP825	1.8-200-430-800-1240MHz	**179.00**	(2.50)
TOYO			
T430	144/432 120 W	**52.50**	(2.50)
T435	144/432 200 W	**58.00**	(2.50)

Scanning Receivers

SMC8400	VHF/UHF Scanner	**249.00**	(3.00)
SX200	VHF/UHF Scanner	**325.00**	(3.00)
SX400	VHF/UHF Continuous Coverage	**645.00**	(3.00)
AOR2002	VHF/UHF Continuous Coverage	**487.30**	(3.00)
HX2000	H/H Scanner	**269.00**	(3.00)

Icom Products

IC751A	HF Transceiver	**1465.00**	(—)
IC745	HF Transceiver	**P.O.A.**	(—)
IC735	New HF Transceiver	**949.00**	(—)
AT100	100W ATU (751/745)	**365.00**	(3.50)
AT150	150W ATA (735)	**315.00**	(3.50)
PS55	Ext PSU (735)	**185.00**	(3.00)
IC505	50MHz multi-mode portable	**459.00**	(—)
IC290D	2m 25w M/Mode	**542.00**	(—)
IC28E	25W FM	**325.00**	(—)
IC28H	2m 45W FM	**399.00**	(3.00)
IC Micro	2E New Mini H/H	**259.00**	(3.00)
IC2E	2m The Original H/H	**225.00**	(3.00)
IC02E	2m H/H	**299.00**	(3.00)
IC275E	New 2m 25 Base Stn	**1029.00**	(—)
IC4E	70cm H/H	**285.00**	(3.00)
IC04E	70cm H/H	**299.00**	(3.00)
IC48E	70cm 25W FM Mobile	**449.00**	(3.00)
IC490	70cm 10W M/Mode	**617.00**	(—)
IC3200	2m/70 Dual Band FM Mobile	**556.00**	(—)
IC12E	23cm H/H	**428.00**	(3.00)
ICR71	Gen Cov RX	**825.00**	(—)
IC7000	VHF/UHF Scanner	**957.00**	(—)
AH7000	25-1300MHz Discone	**82.00**	(2.50)
SP3	Ext Speaker	**61.00**	(2.00)
CK70	DC Cable (R70/R71)	**7.00**	(1.50)
EX257	FM Board (R70/R71)	**41.00**	(1.50)
GC5	World Clock	**43.00**	(2.00)
HAND HELD ACCESSORIES			
AQ2	Waterproof Bag all Icom H/H	**14.38**	(1.50)
BC35	Desk Charger	**70.15**	(2.00)
BP3	Battery Pack 8.4V (2/4E/02/04E)	**29.90**	(1.50)
BP4	Empty Battery Case (2/4E/02/04E)	**9.20**	(1.50)
BP5	Battery Pack 10.8V	**60.95**	(2.00)
BP7	Battery Pack 13.2V (02/04E only)	**74.75**	(2.00)
BP8	Battery Pack 8.4V	**71.30**	(2.00)
CP1	12v Charge Lead BP3/7/8	**6.90**	(1.50)
DC1	DC/DC converter operate from 12v	**17.25**	(1.50)
FA2	2m Helical BNC	**9.20**	(1.50)
FA3	70cm Flexible ¼Ω Antenna (BNC)	**9.20**	(1.50)
HM9	Speaker/Mic	**21.85**	(2.00)
HS10	Head set Boom Mike	**20.70**	(1.50)
HS10SA	Vox Unit HS10 (02/04E only)	**25.30**	(1.50)
HS10SB	PTT SW Box HS10	**20.70**	(1.50)
LC1	Leatherette Case 2E/4E+BP5	**6.90**	(1.50)
LC3	Leatherette Case 2E/4E+BP3	**6.90**	(1.50)
LC11	Leatherette Case 02E/04E+BP3	**9.20**	(1.50)
LC14	Leatherette Case 02E/04E+BP5/7/8	**9.20**	(1.50)
SS1	Shoulder Strap	**10.35**	(1.50)
OTHER ACCESSORIES			
SM6	600ohm 8P Base Mic	**46.00**	(2.00)
SM8	1.3K/600Ω 8P Base Mic	**82.00**	(2.00)
SM10	Comp/Graphic Mike	**116.00**	(2.50)

Oscar Antennas

2QW	2m ¼ wave element	**3.15**	(1.50)
2NE	2m ⅝ wave element	**8.94**	(2.00)
2VF	2m ½ wave element	**16.13**	(2.00)
78F	2m ⅞ wave element	**21.15**	(2.00)
88F	2m ⅝ wave element	**24.10**	(2.00)
258	70cm 2 × ⅝ wave element	**29.37**	(2.00)
358	70cm 3 × ⅝ wave element	**33.73**	(2.00)
70N2M	2m & 70cm Dual band element	**24.95**	(2.00)
70N2DX	2m & 70cm Dual band element	**37.35**	(2.00)
HS770	2m & 70cm Duplexer	**24.95**	(2.00)
GCCA	Gutter clamp 4m cable	**14.25**	(1.50)
SOCA	4m Cable	**6.00**	(1.50)
TMCAS	TRVHK Mount + 6m cable	**12.75**	(1.50)
SOMM	Mag. Mount	**12.75**	(1.50)
SOWM	Adjustable Wing Mount	**6.00**	(1.50)
VHFL	Discone 65-520MHz	**22.50**	(2.50)
GP144W	2m 2 × ⅝ Colinear	**42.00**	(3.00)
GP432	70cm 3 × ⅝ Colinear	**47.50**	(3.00)
70H2V	2m & 70cm Dual Band Colinear	**47.00**	(3.00)

Datong Products

PC1	Gen. Cov. Con.	**137.40**	(2.00)
VLF	Very low frequency conv.	**34.90**	(2.00)
FL2	Multi-mode audio filter	**89.70**	(2.00)
FL3	Audio filter for receivers	**129.00**	(2.00)
ASP/B	r.f. speech clipper for Trio	**82.80**	(2.00)
ASP/A	r.f. speech clipper for Yaesu	**82.80**	(2.00)
ASP	As above with 8 pin conn	**89.70**	(2.00)
D75	Manual RF speech clipper	**56.35**	(2.00)
D70	Morse Tutor	**56.35**	(2.00)
MK	Keyboard morse sender	**137.40**	(2.00)
RFA	RF switched pre-amp	**36.00**	(2.00)
AD270-MPU	Active dipole with mains p.s.u.	**51.75**	(2.00)
AD370-MPU	Active dipole with mains p.s.u.	**69.00**	(2.00)
MPU	Mains power unit	**6.90**	(2.00)
DC144/28	2m converter	**39.67**	(2.00)
PTS1	Tone squelch unit	**46.00**	(2.00)
ANF	Automatic notch filter	**67.85**	(2.00)
SRB2	Auto Woodpecker blanker	**86.25**	(2.00)

CW/RTTY Equipment

Tono 550	Reader	**329.00**	(3.00)
ICS/AEA			
PK64	Complete Packet/Amtor terminal	**239.00**	(3.00)
PX232	Packet/RTTY Terminal	**269.00**	(3.00)
BENCHER			
BY1	Squeeze Key, Black base	**67.42**	(2.50)
BY2	Squeeze Key, Chrome base	**76.97**	(2.50)
HI-MOUND MORSE KEYS			
HK703	Up down keyer	**38.35**	(2.00)
HK704	Up down keyer	**26.35**	(2.00)
HK706	Up down keyer	**21.80**	(2.00)
HK707	Up down keyer	**20.15**	(2.00)
HK710	Up down keyer	**39.95**	(2.50)
HK802	Up down solid brass	**109.00**	(2.50)
HK803	Up down solid brass	**104.50**	(2.50)
HK808	Up down keyer	**39.95**	(2.50)
MK703	Twin paddle keyer metal base	**34.50**	(2.00)
MK705	Twin paddle keyer marble base	**32.78**	(2.00)
MK706		**30.48**	(2.00)
KENPRO			
KP100	Squeeze CMOS 230/13.8v	**109.25**	(3.00)
KP200	Memory 4096 Multi Channel	**234.55**	(3.00)

Trio

TS940S	9 Band TX General Cov RX	**1995.00**	(—)
AT940	Auto/ATU	**258.23**	(2.50)
SP940	Ext Speaker	**92.32**	(2.50)
TS930S	9 Band TX General Cov RX	**1750.00**	(—)
AT930	Auto/ATU	**192.75**	(2.50)
SP930	Ext Speaker	**90.94**	(2.50)
TS440	**NEW** 9 Band TX General Cov RX	**1195.00**	(—)
AT440	Auto/ATU	**152.73**	(2.50)
PS50	H/Duty PSU	**234.63**	(2.50)
TS830S	160-10m Transceiver 9 Bands	**1095.00**	(—)
AT230	All Band ATU/Power Meter	**185.90**	(2.50)
SP230	External Speaker Unit	**70.12**	(—)
TS530SP	160m-10m Transceiver	**895.00**	(—)
TS430S	160m-10m Transceiver	**995.00**	(—)
PS430	Matching Power Supply	**183.26**	(3.50)
SP430	Matching Speaker	**43.00**	(2.50)
MB430	Mobile Mounting Bracket	**16.66**	(2.50)
FM430	FM Board for TS430	**50.68**	(2.50)
SM220	Station Monitor	**362.37**	(3.50)
BS5	Band Scope Unit (520/530)	**72.05**	(2.00)
BS8	Band Scope Unit (830/940)	**81.22**	(2.00)
TL922	10/160 2K Linear	**1495.00**	(7.00)
TM201A	2M 25W Mobile FM	**358.00**	(3.00)
TM401A	70cm 12W Mobile FM	**392.82**	(3.00)
TH21	2M Mini H/H	**228.00**	(2.50)
TH41	70cm Mini H/H	**268.00**	(2.50)
TR751	2M 25W M/M Mobile	**649.00**	(—)
TS711	2M 25W Base Stn	**991.29**	(—)
TS811	70cm 25W Base Stn	**1085.00**	(—)
R2000	Gen Coverage HF/RX	**637.26**	(—)
VC10	118-174MHz Converter (R2000)	**170.76**	(2.00)
R5000	**NEW** General Coverage HF/RX	**895.00**	(—)
VC20	118-174MHz Converter (R5000)	**176.32**	(2.00)
HAND HELD ACCESSORIES			
BT2	Empty Battery Case TH21/41	**12.50**	(1.50)
DC21	DC Power Supply TH21/41	**26.38**	(1.50)
EB2	Ext. Battery Case TH21/41	**17.85**	(1.50)
HMC1	Headset with Vox TH21/41	**34.71**	(1.50)
PB21	Nicad Pack TH21/41	**25.68**	(1.50)
BC6	Desk Charger TH21/41	**106.21**	(2.00)
SC8	Soft Case TH21/41	**12.50**	(1.50)
SMC30	Speaker/Mic TH21/4/2600	**29.85**	(1.50)
ACCESSORIES			
MC50	4P Desk Mic	**48.59**	(2.50)
MC60A	8P Desk Mic	**93.02**	(2.50)
MC80	Electric Desk Mic	**56.93**	(2.50)
MC85	Desk Mic Audio Level Comp	**107.55**	(2.50)
MC42	8P Fist Mic	**22.22**	(1.50)
MC35	4P Fist Mic	**22.91**	(1.50)
MC55	Mobile Mic (6br 8p)	**55.53**	(2.50)
LF30	HF Low Pass Filter	**34.02**	(2.00)
KX3	Receiver ATU (Mizuho)	**67.28**	(2.50)
HS6	Lightweight H/phones	**25.68**	(2.00)
HS5	Deluxe H/phones	**39.57**	(2.00)
SW100A	SWR/Power Meter 1.8-150MHz	**52.76**	(2.00)
SW100B	SWR/Power Meter 140-450MHz	**52.76**	(2.00)
SW200A	SWR/Power Meter 1.8-150MHz	**113.85**	(2.50)
SW200B	SWR/Power Meter 140-450MHz	**113.85**	(2.50)
SW2000	SWR/Power Meter 1.8-54MHz 2K	**123.57**	(2.50)
SWT1	2m ATU	**40.26**	(2.00)

Power Supplies

DRAE			BNOS		
4 amp	**43.40**	(2.50)	6 amp	**75.00**	(3.00)
6 amp	**63.00**	(3.00)	12 amp	**125.00**	(3.50)
12 amp	**86.50**	(3.50)	25 amp	**185.00**	(4.50)
24 amp	**125.00**	(4.50)	40 amp	**385.00**	(4.50)

Aerial Rotators

KR250	Light Duty	**78.00**	(3.00)
AR200XL	Light Weight	**59.95**	(3.00)
AR40	5 core Medium Duty	**125.00**	(2.50)
KR400	Med/H Duty	**139.00**	(3.00)
KR500	6 core Elevation	**149.00**	(3.00)
KR400RC	6 core Medium Duty	**169.00**	(3.00)
KR600RC	8 core Heavy Duty	**219.00**	(3.00)
T2X	8 core Very Heavy Duty	**499.00**	(—)
KR5400	Elevation/Azimuth	**279.00**	(3.00)
KR5600	Elevation/Azimuth	**369.00**	(3.50)
KR800SDX	Heavy Duty	**325.00**	(3.50)
KR1000SDX	Heavy Duty	**368.00**	(4.00)

Switches

SMCS 2U	2N 50239	**18.95**	(2.00)
SMCS 2N	2 way 'n' Skts	**23.50**	(2.00)
Welz	2 way SO239	**29.95**	(2.00)
Welz	2 way 'n' Skts	**49.00**	(2.00)
Drae	3 way SO239	**15.40**	(2.00)
Drae	3 way 'n' Skts	**19.90**	(2.00)
Kenpro KP21N2 way Switch		**27.00**	(2.00)

Miscellaneous

DRAE	Wavemeter	**27.50**	(2.00)
T30	30W Dummy load	**8.50**	(2.00)
T100	100W Dummy load	**38.00**	(2.00)
T200	200W Dummy load	**56.00**	(2.00)
CT20A	20W Dummy Load PL259	**15.95**	(2.00)
CT20N	20W Dummy Load N. Plugs	**22.95**	(2.00)
CT530	100W Dummy Load (500WHmin)	**79.00**	(2.50)
DRAE	2m Pre-set A.T.U.	**14.50**	(2.00)
TOKYO HI-POWER			
HC200	10-80 HF Tuner	**115.00**	(2.50)
HC400	10-160 HF Tuner	**199.00**	(3.50)
CAP CO. AERIAL TUNERS			
SPC300D	1kW PEP	**225.00**	(6.00)
SPC3000D	3kW PEP	**325.00**	(6.00)
1-1	Balun	**16.75**	(1.50)
1-4	Balun	**16.75**	(1.50)

AERIALS BY:- JAYBEAM – MINIBEAM – HYGAIN – G. WHIP – MET – TONNA

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Practical Wireless
The Radio Magazine

APRIL 1987 VOL. 63 NO. 4 ISSUE 961

THIS MONTH

NEXT MONTH

Mods for the AR-2001

Versatile Signal Tracer

"I Have a Message For You"—The Case for Third Party Traffic

The Icom IC-28E 2m Mobile Rig Reviewed

and

Another *PW* Special Offer: Black Star 600MHz Frequency Counter

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★FREE WITH THIS ISSUE★
70cm Repeater Datacard

Regular Features

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In London,
the address, 223/225 Field End Road, Eastcote, Middlesex,
telephone 01-429 3256.

In Bournemouth,
the shop manager is Colin, G3XAS,
the address, 27 Gillam Road, Northbourne, Bournemouth,
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Although not a shop, there is on the South Coast a source of good advice and equipment, John, G3JYG. His address is Abbotsley, 14 Grovelands Road, Hailsham, East Sussex. An evening or weekend call will you put in touch with him. His telephone number 0323 848077.

Lowe Electronic Shops are open from 9.00 am to 5.30 pm, Tuesday to Friday and from 9.00 am to 5.00 pm on Saturday. Shop lunch hours vary and are timed to suit local needs. For exact details please telephone the shop manager.

AR2002 receiver

Frequency range of the AR2002 is from 25 to 550 and from 800 to 1300 MHz. Modes of operation are wide band FM, narrow band FM and AM. The receiver has 20 memories, memory scan and a search mode which checks frequencies between user designated limits.

The receiver has a push button keypad for easy frequency entry and operation.

A front panel knob allows the listener to quickly step up or down in either 5, 12.5 or 25 kHz steps from the frequency initially chosen.

The AR2002 has a front panel LED bar "S" meter.

There is a front panel 3.5 mm jack socket for headphone use.

A socket for the optional RS232 interface (RC PACK) is provided on the rear panel. The RC PACK consists of an 8 bit CPU with its own ROM and RAM and with your own computer acting as a dumb terminal many additional operating facilities become available. Of course, if you want to write your own programs using the RC PACK as an interface then "the sky's the limit".

AR2002 Receiver . . . £487.30 inc VAT, carriage £7.00

from TRIO, a **new** short wave receiver, the **R5000**.

The R5000 is a new general coverage receiver. It offers the dedicated short wave listener and radio amateur a receiver that will match the performance of the best transceivers available today.

The R5000's frequency range is continuous from 100 kHz to 30 MHz and its modes of operation are USB, LSB, CW, AM, FM and FSK. An optional VHF converter (VC20) extends the frequency range to include 108 to 174 MHz.

The R5000 uses 2SK 125 junction-type FETs in the high sensitivity direct balanced first mixer resulting in outstanding two signal characteristics and a substantially improved noise floor level.

Operating from either 12 V DC or 240 V AC the receiver can be used both in the home or whilst out in car, caravan or boat.

The receiver has two rates of tuning for each mode selected by a front panel switch. The frequency increments for SSB/CW/FSK are 10 Hz and 100 Hz, for AM 100 Hz and 1kHz and for FM 2.5 kHz and 5 kHz.

Both low (50 ohms) and high (500 ohms) aerial connections are provided on the rear panel of the R5000. The required aerial can be selected by means of a front panel switch. Information on which aerial to be used with a stored frequency can also be held in memory.

The R5000 has 100 memory channels which store frequency, mode and which of the two aerial connections has been selected. Information is easily transferred from one VFO to the other, from memory to VFO and in order to quickly access your favourite station, from VFO to any of the memories. Both memory scan and frequency scan (between frequencies in memories 8 and 9) are included in the receiver. Halt on an occupied channel whilst scanning can either be timed or until the signal drops. The entire one hundred memories can also be quickly scrolled to check the data held and to find the location of an empty channel.

To enhance reception, IF shift and a tunable notch filter are part of the R5000 receiver. Filter selection according to mode is automatic when the front panel selectivity switch is set to AUTO. This automatic selection can, of course, be overridden. Additionally the introduction of optional SSB and CW filters (YK88SN for SSB and either YK88C or YK88CN for CW) will improve the already excellent signal to noise ratio and selectivity. The optional YK88A-1 AM filter will improve the shape factor and enhance reception even further.

The R5000 general coverage receiver also has keyboard frequency entry, dual mode noise blanker, two 24 hour clocks with timer, option VS1 voice synthesizer and CW tone mode indication for the blind operator, a large 100 mm diameter top mounted speaker, switchable AGC (fast or slow), RF attenuation (10, 20 or 30 dB steps) and a F.LOCK switch which protects against frequency shift if the VFO knob is accidentally moved.

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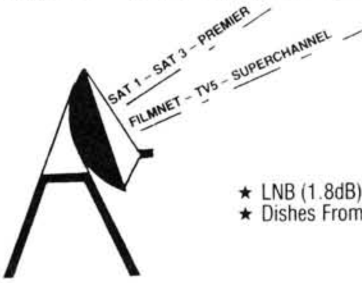

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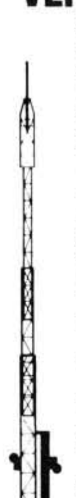

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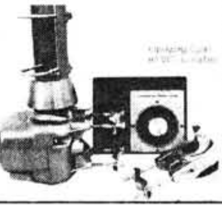

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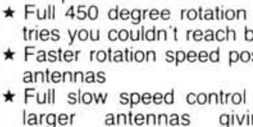

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SC-1	S.H Station Consol PSU (4 amp)	£49.00
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FTV107 2/70	S.H 2 Mtrs and 70cm 10 watt	£359.00
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HAL ST-5000	A.S RTTY TU (St 5 type)	£95.00
ICS AMT 1	S.H AMTOR/RTTY TU C. W BBC S.WARE	£165.00
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Yaesu Shirt	New 'T' shirt 'Yaesu'	£2.50
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SP4	N.O RF Speech Processor	£39.00
UDM 211	N.O Base Mic Tect	£24.95
YD844	N.O Base Mic 'Yaesu'	£25.00
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VHFL	S.H Discone ANT	£15.00
Various Morse Keys, shop soiled, approx 25% off		POA

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S.H Secondhand 3 month warranty
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Yaesu	FRG8800	**639.00**	(—)
Yaesu	FRV8800 V.H.F. Converter	**100.00**	(2.00)

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Trio	TS440S	**1195.00**	(—)
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Trio	TS830S	**1095.00**	(—)
Trio	TS530SP	**895.00**	(—)
Yaesu	FT980	**1750.00**	(—)
Yaesu	FT757GX	**969.00**	(—)
Yaesu	FT767GX	**1550.00**	(—)
Icom	IC735	**949.00**	(—)

V.H.F. SCANNING RECEIVERS			
Icom	ICR7000	**957.00**	(—)
Yaesu	FRG9600	**525.00**	(—)
A.O.R.	AR2002	**487.30**	(—)
Signal	R532 "Airband"	**224.00**	(—)

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Revcone	Discone Antenna 30-500MHz	**31.50**	(2.00)
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Trio	TR751E 25w multimode	**649.00**	(—)
Trio	TS711E base station	**991.00**	(—)
Yaesu	FT290II Portable multimode	**429.00**	(—)
Yaesu	FT203R +FNB3 Handheld	**255.00**	(—)
Yaesu	FT209RH +FNB3 Handheld	**309.00**	(—)
Yaesu	FT270RH 45w F.M. mobile	**469.00**	(—)
Yaesu	FT726R base station (70cm optional)	**999.00**	(—)
Icom	IC2E Handheld	**225.00**	(—)
Icom	IC02E Handheld	**299.00**	(—)
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Trio	TS811E base station	**1095.00**	(—)
Yaesu	FT703R +FNB3 Handheld	**289.00**	(—)
Yaesu	FT709R +FNB3 Handheld	**319.00**	(—)
Yaesu	70cm module for FT726R	**349.00**	(—)
Icom	IC4E Handheld	**285.00**	(—)
Icom	IC04E Handheld	**299.00**	(—)
Icom	IC471E base station	**927.00**	(—)

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A.K.D.	V.H.F. wavemeter	**24.95**	(1.50)
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Trio	LF30A low pass filter 30MHz 1kW	**34.00**	(2.00)
Adonis	AM303G desk mic with pre-amp	**53.00**	(2.00)
Adonis	AM503G desk mic with compression	**69.00**	(2.00)
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Welz	CH20A 900MHz SO239 skts.	**29.95**	(1.50)
SA 450N	2way diecast 500MHz N skts.	**23.75**	(1.00)
SA 450	as above but SO239 skts.	**17.50**	(1.00)
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UR76	50 ohm coax dia. 5mm	per metre	**0.30**	(0.10)
UR70	70 ohm coax	per metre	**0.35**	(0.10)
UR95	50 ohm coax dia. 2.3mm	per metre	**0.40**	(0.10)
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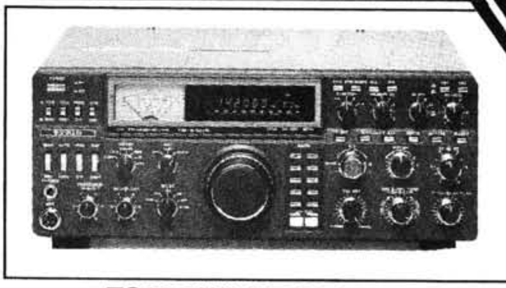

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Access

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A Power Supply?

The Power Supply. It's probably the most important bit of gear in the shack. It's the base that everything else is built on top of. As that base, obviously, any inadequacies in the power supply will be seen as a degradation in the performance of anything that's connected to it.

For example, a noisy power supply can cause both a horrible buzz on the transmitted audio and a reduced receiver sensitivity. Another example is when you connect a linear amplifier to a power supply that is just not man enough for the job – the power supply output voltage drops at peak transmit so you have less output power and a non-linear amplifier (more TVI).

Most radios are supplied without an integral power supply, the resultant savings in weight, bulk and cost make the radio more versatile and affordable. To use that radio at home you need a power supply of some sort and most radio amateurs cut corners when choosing this "accessory".

Don't think of it as an accessory. If you cut corners all of that expensive radio performance can be lost. You may even blow up your nice new radio. How many Hams can tell the story of the £500 radio that went up in a puff of smoke when they connected a twenty quid power supply to it. The repair bills can be horrendous (£14 an hour plus parts).

When choosing a power supply, check the specs. Just like you would if it were a radio or a linear. Protection, ripple, mains input voltage, shutdown, continuous versus peak. If you get confused by the terminology ask a friend – or better yet read the revues.

When you see what's available then you'll probably be looking at one of three types (20 to 30 Amps is the most popular):

The BNOS 12/25A has a continuous output rating of 25 Amps (at 13.8V) yet can be used intermittently at thirty amps. In addition to this beefy output, it has a whole host of protection features.

Daiwa Power Supplies are imported from Japan. Their comparable model has a continuous output of only 20 Amps yet a rating of 30 Amps peak. As with all imported equipment check that the transformer is really rated for 240V not 220V, it makes a big difference when you look at Power Supplies.

BNOS's domestic competitor is Drae. Their top of range model – the unmetered 24A – has a maximum output of 24 Amps and a continuous rating of 18 Amps and, for some reason, a non-standard output voltage of 13.5 Volts.

As you can see from the table, the 12/25A is a comprehensively protected Power Supply Unit that is specifically designed for the radio amateur. **When you look at Power Supplies, don't compromise quality -- buy BNOS.**

BNOS 12/25A SPECIFICATIONS

Input Requirements	240V AC 50 Hz (±10%)
Output Voltage	13.8V DC
Maximum Output Current	30 Amperes (@ current shutdown)
Continuous Current Rating	25 Amperes
Regulation	0.1% for 10% change in input
Ripple	<20mV at max output (2mV typical)
Protection Features	Overvoltage, 100% Foldback Current, Radio Frequency Interference, Back EMF
Weight	9 Kilos
Dimensions	H 190mm × W 165mm × D 330mm

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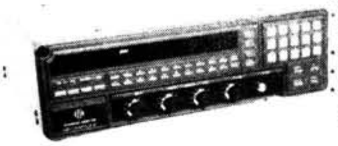

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- Computer control options
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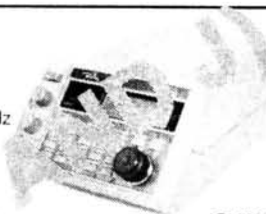

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- AM & NFM & WFM on all bands
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- 20 memories
- Compact size
- 12v dc operation
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- Channel activity counter
- 70 memories
- 12v dc & 240v ac

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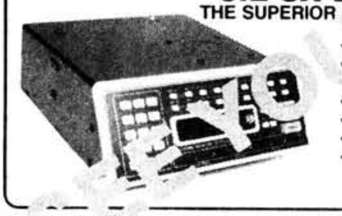

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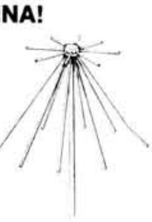

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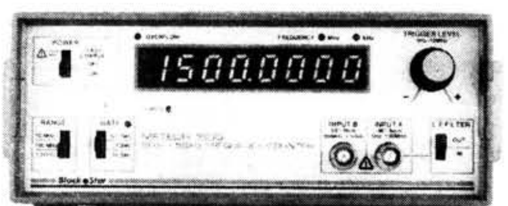

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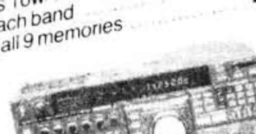
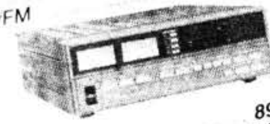
ICOM 3200E 2m/70cm 25w each band	556.00
ICOM IC 47E 25w FM very small 9 memories	495.00



HF EQUIPMENT

YAESU FT 767 1.8MHz-430MHz. All mode gen cov rcvr	POA
YAESU FT ONE gen cov tvcr	POA
YAESU FT 980 gen cov tcvr inc AM/FM	1750.00
YAESU FT 757GX gen cov tcvr inc AM/FM/Keyer	949.00
ICOM IC 751A gen cov tcvr inc AM/FM/Keyer	1465.00
ICOM IC 745 gen cov tcvr	925.00
ICOM 735 gen cov tcvr inc AM/FM	929.00



HF LINEAR AMPLIFIERS

YAESU FL 2100Z 160m to 10m	899.00
YAESU FL 7000 solid state integral PSU and ATU	1590.00
TOKYO HL 1K 1Kw amplifier	POA
TOKYO HL 1KGX new 1K linear	POA
TOKYO HL 2K new 2K linear	POA
TOKYO HL 3K 3Kw new linear	POA
ICOM IC 2KL/LPS	1646.00

Plus the latest Ameritron range from the U.S. – see next page

HANDHELD TRANSCEIVERS

FT 727 VHF UHF Hand held	425.00
YAESU FT 203R with FBA 5 battery case	225.00
YAESU FT 203R with FNB 3 nicad 2.7w	255.00
YAESU FT 203R with FNB 4 nicad 3.7w out	259.00
YAESU FT 209R with FBA 5 battery case 1.8w	269.00
YAESU FT 209R with FNB 3 nicad 2.7w	299.00
YAESU FT 209R with FNB 4 nicad 3.7w	305.00
YAESU FT 209RH with FBA 5 battery case	275.00
YAESU FT 209TH with FNB 3 nicad 3.7w	309.00
YAESU FT 209RH with FNB 4 nicad 5w	315.00
ICOM IC 2E synthesised 1.5w 2m	225.00
ICOM IC 02E keypad entry lcd display	289.00
ICOM IC 4E synthesised 1.5w 70cm	275.00
ICOM IC 04E keypad entry lcd display 70cms	289.00

FT 703R and FT 709R available same output spec as FT 203/209.

RECEIVERS

YAESU FRG 8800 gen cov 150Khz-30Mhz large display, keyboard entry free tuning	609.00
ICOM IC R71 100 Hz to 30Mhz passband tuning/notch filter, variable tuning rate	789.00
YAESU FRV 8800 converter module 118-179 for FRG 8800 range extension	100.00
AOR 2002 UHF/VHF 25Mhz-550Mhz and 800 Mhz-1300Mhz. STAR BUY.	465.00
YAESU FRG 9600 UHF/VHF. Scanning receiver all mode 100 mem. Now up to 950Mhz	499.00
ICOM R700 Scanning tcvr 25-2000 Mhz 99 memories all mode	919.00
FDK ATC 720 airband rcvr handheld 720 channels	189.00
FDK RX 40 141-180 Mhz handheld rcvr	159.00
JIL SX 400 UHF VHF recvr inc PSU	598.00

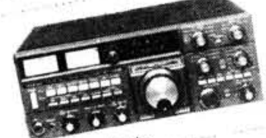
RTTY/CW

TONO 5000E CW RTTY ASCII and AMTOR c/w 5" high res monitor	POA

Range of 50 Mhz equipment both YAESU and ICOM in stock.

VHF MOBILE TRANSCEIVERS

YAESU FT 290R mob/port 2m all mode c/w nicads, chgr. case. Mk II	POA
YAESU FT 290R as above with Mutek	POA
YAESU FT 270R 25w FM	379.00
YAESU FT 270RH 45w FM with fan	445.00
YAESU FT 2700RH 2m/70cms 25w each band full duplex	399.00
ICOM IC 290D 25w all mode	515.00
ICOM IC 27E 25w FM 9 mem	379.00
ICOM IC 27H 45w FM 9 mem	419.00
FDK M750XX 2m all mode 20w	449.00
FDK M725X 2m FM 25w	279.00



VHF BASE STATIONS

YAESU FT 726R/2M all 726 options available	949.00
ICOM 271E multi mode 25w 32 mem	799.00
ICOM IC 271E/H multi mode 100w	979.00

UHF BASE STATIONS

YAESU FT 726 70cms multimode — all 726 options	949.00
ICOM 471 E 25w multimode 70cms	889.00
ICOM 471 H high power multimode (75w) — 70cms	1099.00
ICOM 1271 E multimode 1240-1300 Mhz	1099.00

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WRITE ON . . . *the page where you have your say*

STAR £10 LETTER

Public Service

Sir: Having just come through one of the coldest periods when many villages have been cut off from the rest of the country by deep snow, the thought has occurred as to whether amateurs really are providing a complete and proper service to the public.

What if a villager comes to an amateur in an isolated village and asks for a message that he is safe and well, to be passed to his family elsewhere, because the phones are not working and the mail can't get through? At present he has to be politely told although the amateur may be sitting in front of over £1000 worth of sophisticated communications equipment, he cannot pass a simple message to give relief to the villager and his family because of licence restrictions.

None of the other major English speaking nations i.e. Canada, USA and Australia have these restrictions and, at a moments notice in any case of need or disaster, individual amateurs can swing into action and provide a much needed service of message handling for the public, via what are known as Third Party Traffic Networks.

In addition to the provision of much needed timely relief, public traffic handling is one of the best methods of introducing the public to amateur radio and so showing that we are a service and not just an expensive hobby.

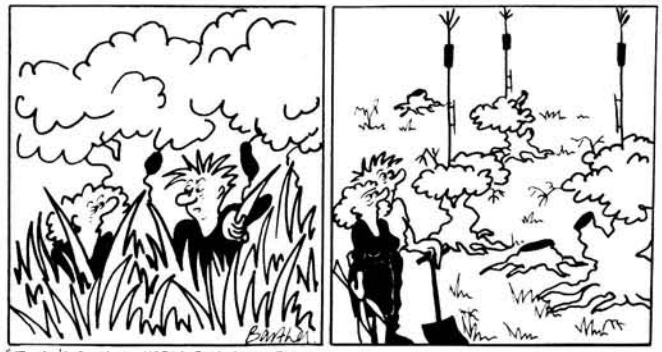
There is no doubt that a demonstration of satellite communication to the public can generate a lot of interest, but a member of the public who has just had a message confirming that his family is safe will have a much greater appreciation, and more important, understanding of what amateur radio is all about.

Special event callsigns have been described as a form of third party but are of no use for emergency traffic as most disasters do not give 28 days notice of when they are going to happen.

With increasing general pressure on spectrum, in future there will be a greater need for amateurs to justify the occupation of their bands. A full and strong tradition of public service would fill this need and provide a much improved public understanding of amateur radio.

Mike J. R. Wade G8OGO
Rye, E Sussex

LAUGH WITH BARTHES



"THERE'S SO MUCH NEEDS DIGGING IN THE GARDEN" — "YOU'RE RIGHT DEAR".

PW COMMENT

The New PW

AS ANNOUNCED LAST MONTH, we shall be making some changes to *Practical Wireless*, commencing with the May issue. Some of our special features for DX listening and viewing enthusiasts will be transferring to the new *Short Wave Magazine*, and some of *SWM*'s regular columns aimed at readers (whether licensed or not) whose specific interest is amateur radio will be crossing over into *PW*.

The most sweeping changes in *PW* will be in *On the Air*. Reports of happenings on the h.f. amateur bands will be compiled by Paul Essery G3KFE, while those on v.h.f. and above will be the province of Norman Fitch G3FPK. The present *Amateur Bands* column written by John Fell G0API will disappear, though John will not be severing his connection with the magazine.

Ron Ham's column on RTTY will continue more or less unchanged in *PW*, but his present *VHF Bands* feature will be largely reorganised. The broadcast Band II DX reports will transfer to *SWM*, and the remainder of the feature, which is staying in *PW*, will deal with propagation reports from h.f. to u.h.f., including beacons, amateur, CB and broadcast bands, plus solar and barometric observations. Ron's TV column will be transferred more or less unchanged into *SWM*.

Amateur satellite happenings will continue to be reported in *PW* by Pat Gowen G3IOR, but his news of other satellites and space events will cross into *SWM*. Brian Oddy's comprehensive coverage of stations heard on the long, medium and short wave broadcast bands will also be moving into *SWM*, but a brand new feature in *PW* will give a brief round-up of the most important happenings on the broadcast bands.

Short Wave Magazine's counterpart of *On the Air* will be called *Seen and Heard*. As already mentioned, it will include contributions by Brian Oddy, Pat Gowen and Ron Ham, but there will some new columns, too. These include *Amateur Bands Round-up* by Justin Cooper, and a data communications column called *Decode*, covering RTTY, AMTOR, packet, FAX, etc, compiled by Mike Richards G4WNC.

Among other features to be found in the new *SWM* will be reviews and regular buyers' guides to receivers and scanners, news of broadcasting stations and studios, and a "Starting Out" series for newcomers to short wave listening. And there will be occasional simple constructional articles on antennas and receiver accessories, too. There are other ideas "in the pipeline", but more about those when they're fully developed.

And what other changes shall we be making to *Practical Wireless*? Well, in response to recent pleas from our readers, more constructional features are planned, plus more articles on repairs, renovation and fault-finding. Again, we have a few more ideas up our sleeves, but these are still being finalised at the moment.

As I said last month, these changes are bound to upset some readers, who would prefer things to remain as they were. We hope that you will find one or other of the two "new" magazines to your liking (or better still, both, but we appreciate very well that for many readers, money is pretty tight).

Subscribers to *PW* who would prefer to transfer the remainder of their current subscription to *SWM* can do so, and will receive the same number of issues, at no extra charge, despite the higher rate for that title. Subscribers to *SWM* who would rather transfer their subscription to *PW* can also do so, but for them the **money value** of the unexpired portion of the subscription will be credited, to allow for the higher rate at which they paid, and their subscription extended accordingly. For readers wishing to subscribe to both titles, a special rate for UK subscriptions of £27.00 will be offered, giving a 10 per cent discount on the normal rates (£13.00 for *PW*, £17.00 for *SWM*). For overseas readers, where the surface mail rates are £15.00 and £17.00 respectively, the special combined rate will be £29.00.

Geoff Arnold G3GSR

Listening In

Sir: I feel I must support Mr Thomson (*PW* Feb '87) in his call for *Practical Wireless* to cover more than just Amateur Radio.

I for one would like to see some magazine deal with utility stations, though I realise that the listening to these stations is a rather grey legal area. Having said that, the multitude of weather stations provide interesting clues to propagation conditions and are no more illegal to listen to than WWV.

Listeners are obviously interested in these stations as the sale of scanners and frequency lists for both h.f. and v.h.f./u.h.f. proves, so perhaps they might deserve some space.

Matthew Probert
Basingstoke

Sir: It's not very often that I decide to put pen to paper, but after reading M. Thompson's letter (*PW* Feb '87) I felt that I must write and chip in my two penn'orth. I would like to say how much I endorse the said gentleman's comments regarding the lack of material in your magazine printed for the benefit of the Short Wave Listener.

I am a keen s.w.l. and, although I listen to the amateur bands, I have no wish to become a radio amateur.

I am fairly confident in saying that there are many more s.w.l.s in the four countries within the British Isles than radio amateurs. Whilst not wishing to incur the wrath of the amateur fraternity, I am raising this point because thousands of these unheard radio enthusiasts must surely buy *PW*, if only for the excellent "On the Air" feature.

What I am really suggesting is that you include a regular feature on the hobby of short wave listening, incorporating articles on antenna construction, how to get started, receiver alignment, hints and tips, the list is endless. Maybe even a *PW* Short Wave Listening Club?

L Smart
Trelewis, Wales

Your wish is our command.—Ed.

Send your letter to the Editorial Offices in Poole, the address is on our Contents page. Writer of the Star Letter each month will receive a voucher worth £10, to spend on items from our PCB or Book Services, or on *PW* back numbers, binders, reprints or computer program cassettes. And there's a £5 voucher for every other letter published.

Letters must be original, and not duplicated to other magazines. We reserve the right to edit or shorten any letter. Brief letters may be filed via our Prestel Mailbox number 202671191. The views expressed in letters are not necessarily those of *Practical Wireless*.

Looking Back

Sir: I was delighted that you published G4NJPs response to my letter in your December issue as it amply illustrates the apathetic "live and let live" attitude of a number of RSGB members.

I received an enormous number of supportive letters from individual members, secretaries of affiliated clubs and even area representatives. None of these, I am happy to report, criticised the voluntary committees but rather the HQ organisation. Because one qualifies as a "volunteer" does not automatically mean that you are a qualified administrator.

The RSGB, I am told, represents only about 43 per cent of licensed amateurs. Let's improve on this.

The December AGM brought out the feelings I expressed about proxy votes and pressure from the attendees compelled the Council to abstain from exercising this undemocratic practice.

Had I insisted, in my business, that employees of less than five years' standing had no voice in management decisions I would have long since been bankrupt.

Vic J. Copley-May G3AAG
Petersfield

Sir: Full marks for your feature "Trials of a New Licensee". Also full marks to G1SGB for his doggedness in getting started against such odds and the factual way in which he gives his sad but useful information.

What a contrast to 40 ▶

OUR SERVICES

QUERIES

We will always try to help readers having difficulties with a *Practical Wireless* project, but please observe the following simple rules:

1. We cannot give advice on modifications to our designs, nor on commercial radio, TV or electronic equipment.
2. We cannot deal with technical queries over the telephone.
3. All letters asking for advice **must** be accompanied by a stamped, self-addressed envelope (or envelope plus International Reply Coupons for overseas readers).
4. Write to the **Editor, "Practical Wireless", Enefco House, The Quay, Poole, Dorset BH15 1PP,** giving a clear description of your problem.
5. Only one project per letter, please.

COMPONENTS, KITS AND PCB'S

Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the article. **Kits** for most of our more recent projects are available from **CPL Electronics,** 8 Southdean Close, Hemlington, Middlesbrough, Cleveland TS8 9HE, telephone Middlesbrough (0642) 591157. The **printed circuit boards** are available from our **PCB SERVICE** (see page 1 of this issue).

CONSTRUCTION RATING

Each constructional project is given a rating, to guide readers as to its complexity:

Beginner
A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently.

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

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

BACK NUMBERS AND BINDERS

Limited stocks of most issues of *PW* for the past 18 years (plus a few from earlier years) are available at £1.25 each, including post and packing to addresses at home and overseas (by surface mail).

Binders, each taking one volume of *PW*, are available price £5.50 to UK addresses, £5.75 overseas, including post and packing. Please state the year and volume number for which the binder is required. Prices include VAT where appropriate.

CLUB NEWS

If you want news of radio club activities, please send a stamped, self-addressed envelope to **Club News, "Practical Wireless", Enefco House, The Quay, Poole, Dorset BH15 1PP,** stating the area of the country you're interested in.

ORDERING

Orders for p.c.b.s, back numbers and binders, *PW* computer program cassettes and items from our Book Service, should be sent to **Post Sales Department, "Practical Wireless", Enefco House, The Quay, Poole, Dorset BH15 1PP,** with details of your credit card or a cheque or postal order payable to Practical Wireless. Cheques with overseas orders **must** be drawn on a London Clearing Bank.

Credit card orders (Access, Mastercard, Eurocard or Visa) are also welcome by telephone to Poole (0202) 678558. An answering machine will accept your order out of office hours.

SUBSCRIPTIONS

Subscriptions are available at £13 per annum to UK addresses and £15 overseas, from **"Practical Wireless" Subscription Department, Competition House, Farndon Road, Market Harborough, Leicestershire LE16 9NR. Tel: (0858) 34567.** Airmail rates for overseas subscriptions can be quoted on request.

years ago when the newcomer was welcomed, helped and treated fairly by all concerned—even by the RSGB, when members were more important than their subscriptions. The cavalier treatment of G1SGB is not reserved for newcomers. It echoes, in close detail, a recent "hassle" of mine, when a "short deadline" member's ad achieved copy three months after payment.

I am struck by the irony (*PW*, same issue) of the wet letter by one G4NJP, who first tries to disparage the considered arguments of G3AAG in a snide and ill-mannered way and then exhorts the RSGB to "carry on the good work". I wonder what G1SGB makes of that? Then he mentions "democracy". Would the RSGB publish this letter?

J. Leonard G3CUN
Birmingham B36

Novice

Sir: How relieved I was to see that there was a response to my "star" letter in the September issue. I was beginning to think nobody had noticed it!

My reaction after reading Mr Davies's letter was of laughter. No doubt he will be phoning the National Tiddleywinks Association, the Luton Girls Choir and Alcoholics Anonymous for their views next.

Really Mr Davies, your logic is lamentable! CB operators and s.w.l.ers may well be considered novices, but certainly not Novice Amateurs. Novice Amateurs **are** Amateurs, they pass exams, they are permitted to own and operate Yaesus etc., and they are issued with official callsigns such as VK4VOK. So your 500 phone calls were not only a waste of money, they were also a waste of time.

Prior to 1976, our system was exactly the same as yours! By putting two more steps in the ladder we not only encourage more beginners to have a go, we also made it easier for those halfway up to reach the top. The new system is an unqualified success. Had it not been a success, it would have been scrapped.

Another myth I would like to dispel, is the belief held by some of you that our Novice Amateurs are only capable of 5 w.p.m. Morse. Some of them can operate at over 30 w.p.m. The requirement for a Novice licence is a **minimum** of 5 w.p.m. Because our "B" licence amateurs can get Novice privileges on h.f. by passing 5 w.p.m. Morse, it provides them with an intermediate step to the "A" class licence. You don't have to be a genius to see why we will never revert to your system, surely?

Please permit me to end this letter with an extract from a letter written by Richard Rhodes KH6IO of San Antonio, Texas to *CQ Amateur Radio*, Dec '85 issue:

"I strongly support the proposed expansion of (American) Novice privileges (to include phone). During the peak of the last sunspot cycle, I sat on the island paradise of Kauai, Hawaii and operated h.f. for 8–12 hours a day. Some of my nicest sideband QSOs were with Australian and Japanese Novices. Most of them were more gentlemanly and polished than many of the "lids" who thought 30 years in ham radio had turned them into radio royalty . . ."

Tony Taylor VK4FOX
Innisfail, Queensland

Sir: Here's some cheer to publish re the RSGB. When I sent my full subscription in December 1986 to RSGB I asked for a form to apply for reduced subscriptions the following year as I was 65 in November '86. Imagine my surprise (and joy!) when my cheque was returned and I was asked to send the **reduced** subscription this year.

Don Owen G0ESR
Stourbridge

A Trusty Steed

Sir: The true moral of Mr Clark's experiences (letter, *PW* February 1987) is obvious: stick to the mechanical craftsmanship of the trusty HRO rather than waste time, effort and money on the string and pulley system of a cheap Japanese receiver! I certainly know which one will survive beyond AD2000!

Michael O'Beirne G8MOB
Esher, Surrey

You Can't Please Them All?

Sir: Reference *PW* September '86, 50MHz Converter. Why choose a converter with 144MHz output when, as usual, most s.w.l.s use a 28–30MHz receiver as an i.f. strip. To use this unit, I would have to have in my possession a 144MHz rig or receiver, both very costly when you are unemployed. A 28–30MHz output would be less noisy and easier to use (i.e. FRG-7).

R. G. Williams
Borehamwood, Herts

Time Signals

Sir: I was interested to read Old Timer's piece on 1920s Time Signal's in the Feb '87 issue. May I comment on one or two points.

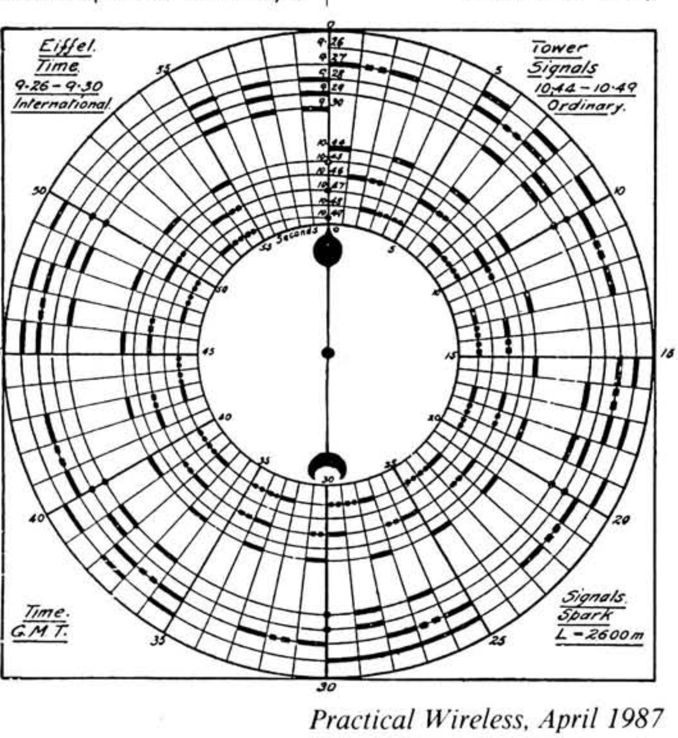
The English radio buff at the beginning of the 1920s was not limited to listening to time signals only. The Co-optimists and the Roosters were indeed some years away but there were the regular "Hague Concerts" transmitted on 261kHz from station PCGG in Holland.

I believe there were more time signals from the Eiffel Tower than indicated in the article. By the early 1920s there were seven groups of time signals transmitted during the day, starting with a 9.26–9.30a.m. period and finishing with the 10.44–10.46 group. The groups were not all coded in the same way, some being in "International" code ending with a dash during the 60th second; and some being in what was termed "Ordinary" code with dots marking the minutes as described in the article. The accompanying contemporary diagram shows the code.

Regarding time signals for East Germany, Nauen (Y3S) has for many years been transmitting time signals on 452kHz. Does Old Timer mean that Radio Berlin International has announced that they are once more coming up on long wave to suit his splendid 1918-style crystal set?

Finally, the "Tempus" crystal set of the early 1920s was not the first to be commerically produced for reception of Eiffel Tower and other time signals. The "Horophone" was manufactured for this purpose from 1913 by the Synchronome Co. of London. The Eiffel Tower time signal service had started three years earlier in 1913.

Patrick Leggatt
Farnham, Surrey



NEWS . . . *compiled by G4LFM*

BARTG Awards

There are three awards awarded by BARTG that you can try for.

Quarter Century Award. This is for having worked or heard amateur radio stations in at least 25 different countries.

Century Award. This is for having worked or heard the required number of amateur stations on the v.h.f., u.h.f. and s.h.f. bands.

Members Award. This is for having worked or heard at least 25 different BARTG members on any band.

You can always get leaflets on any of these awards for an s.a.e. to the Awards Manager, ***Ted Double G8CDW, 89 Linden Gardens, Enfield, Middlesex, England EN1 4DX.***

Youngest YL?

Recently we reported a young lady taking her Morse test, nothing unusual you say. Well not normally, but this young lady was 10 years old at the time! So I thought I'd like to hear more.

Sarah J. Rutt is now eleven years old, but started studying the RAE in July 1985. Her story is best in her own words.

"I studied for about nine months, doing half an hour on my own and one hour or twenty minutes with Dad every day. I like the mathematical side of it, some of which was easy and some difficult. The regulations I didn't understand, didn't like and found extremely difficult.

. . . I took the exam on May 16. I was excited but nervous. I discovered that I had got some wrong in the first half from Dad during the break. It made me even more nervous.

. . . I waited for the results for three months. Then just as we were about to go on holiday a large envelope . . . came through the door . . . 'This is to certify . . . has passed the RAE with the following:

Distinction

Distinction'

. . . I had started studying for the Morse test as soon as I had taken the RAE . . . I studied for three or four months in all.

. . . I took the Morse test on August 20 . . . After sending and receiving lots of bits and pieces I got my ARC (No. 3644) a few days before Dad went to Israel, which meant that I only had a few days to use the radio.

. . . I got in a muddle using the radio at first. Most of the time I ran out of things to say."

Sarah took the QRQ run at the HF Convention too! Now she is building a 7MHz band receiver from a kit.

At least we know that with youngsters like Sarah there will be another generation of radio amateurs to take our places. So if you hear a young person on the air don't assume they're all pirates, being sworn at when you're only young isn't fair. Without new blood into the hobby it will grow stale, old and die.

Sarah, the magazine wishes you all the best with both amateur radio and any other challenges you decide to take on.

DXpedition

From Saturday March 21 to Saturday April 4, a party of three operators will activate the Universal Locator Squares of IO41, 42, 43, and 44 consecutively, each for a period of three days.

The station will operate on the 144MHz band using 144·244 u.s.b. whenever possible with a 70-element array and the maximum permitted p.e.p.

For further information and/or schedule arrangements contact: ***Craig G6GRK QTHR or Leeds 638919***. Please enclose an s.a.e. with written enquiries.

BAEC

The latest newsletter from the British Amateur Electronics Club has landed on my desk recently. It contains plenty of interesting reading, there's an article on Opto-electronics, part 8 of a series on computers, plenty of readers' letters as well as for sale and news, views and reminders.

Annual subscription is £7, and if you would like more details then write to: ***Hon. Secretary, J. G. Margetts, 53 High Oaks Close, Locks Heath, Southampton SO3 6SX***.

Silver Jubilee

On April 27 the Loughton & District ARS are celebrating their 25th anniversary. Although over the years they have lost a few members, some have moved away and others, sadly, "now operating the big transceiver in the sky", they have gained new faces and are always looking for more.

They actually featured in *Practical Wireless* back in 1966, and Jack Atkinson G3OPA (then the club secretary) who was in the photograph then is still with the club today.

We wish the club all the best for the next 25 years when we look forward to mentioning their Golden Jubilee.

Bristol FMTV Group

The Bristol FMTV Group is now well and truly established with over 30 paid-up members, the group's first project is therefore assured a good chance of success.

The first project being undertaken by the group is a 23cm FMTV repeater for Bristol. So far they have:

A full technical submission approved by the RSGB repeater management group that has been passed on to the DTI for the issue of a licence.

They have applied for GB3ZZ, a frequency of operation of 1·249GHz input, 1·3185GHz output, f.m. operation, and 25 watts horizontally polarised.

The repeater will be capable of full colour high definition pictures with intercarrier sound over most of the Bristol areas as well as South Wales, Bath and the Cotswolds.

So far site tests have had good pictures received from Bath, Forest of Dean and South Wales.

Their AGM will be on March 24 so if you are interested in finding out more contact ***Roger G4ZQF, QTHR***.

Morsum Magnificant

If you don't get enough time to read novels but do like a book or magazines you can read snippets from, the Morsum Magnificant might appeal to you.

It is a quarterly magazine to provide international in-depth coverage of all aspects of Morse telegraphy, all for a £6 annual subscription.

The latest issue is full of interesting short articles, some about people and their collections of Morse keys, historical items of mile-stones in the story of Morse, personal reminiscences and anecdotes. All enjoyable reading.

For subscription to Morsum Magnificant, send your cheques payable to Morsum Magnificant to ***Tony Smith G4FAI, 1 Tash Place, London N11 1PA***.

Remote Imaging Group

This group are the ones to contact for lots of gen on getting into weather satellite watching. If you already watch these satellites then that is an even better reason for joining their ranks. Their newsletter (called *RIG*) is packed full of articles, with data for finding the satellites to projects for decoding etc.

For more details contact: ***Des Watson G3YXO, Norton, Gote Lane, Ringmer, Nr Lewes, East Sussex BN8 5HX.***

Radio Netherlands

On Monday April 20, Radio Netherlands are planning a documentary looking at 40 years with Radio Netherlands, including some of the famous personalities they have spoken with over 4 decades of broadcasting

NEWS . . . *compiled by G4LFM*

BRARS

In 1964 a small number of dedicated Railway Radio Amateurs formed an International Organisation called FIRAC—Federation Internationale des Radio Amateur Cheminots.

Since its inception the organisation has grown to over 2500 members of which British Rail ARS is a small cog.

This year BRARS is celebrating 21 years since its inception in 1966, and during the year the Society is arranging several radio stations from railway sites, using either GB calls or the club callsign G4LMR.

The first planned event is May 8–10 at Ravenglass using the callsign G4LMR.

Other events during the year that they hope to be involved in are the 150th Anniversary of Crewe Railway Workshops, Didcot Steam Weekends and a special event station from one of London Transport's Tube Stations.

For more details of BRARS contact: ***Geoff Sims G4GNQ, 85 Surrey Street, Glossop, Derbys SK13 9AJ.***

SMC Phone Home?

South Midlands Communications have changed their telephone numbers. The new numbers are:
Tel: 0703 255111
FAX: 0703 263507
TLX: 477351 SMCOMM G

Can You Help?

Mr C. Edwards recently purchased a Grundig Satellit 1000, but there was no instruction booklet with the set. He would also like to listen to amateur radio using this set, but needs an s.s.b. adaptor unit. If you can help please contact: ***C. Edwards, 3 Link Avenue, Bedlington, Northumberland.***

Mr McTernan has a Siemens Phonosuper K53 table top radiogram, which is working, but only just! He would like a copy of the wiring diagrams to enable him to get the set working properly. If you can help contact: ***Mr P. McTernan, 13 Eastern Avenue, Pinner, Middx HA5 1NW.***

Mr Kirk has "a most beautiful reel-to-reel video recorder" which he wants to use with his SSTV gear. He needs a circuit, can anyone help? It was made by Internation Video Corporation of California, Model IVC801PSM, it also has a plate marked The Marconi Company recorder video 1430–99–537–4294 identity VA–49–0009–3.

If you can help contact ***Mr N. Kirk G3IDK, 54 Allendale Road, Rotherham, Yorks S65 3BY.***

Mid Lanark Open Day

The Mid Lanark ARS is holding its Open Day on June 14. They are hoping to run satellite operation, RTTY demos. h.f. working, DXing and QRO. That's in addition to the usual junk stand and car boot sale. They do say that as usual trade stands will be there too.

More details from the club sec: ***David Williams GM1SSA. Tel: Holytown 732403.***

Special Event Station

GB2RCK: The Rotary Club of Kirkwall are holding a Hobbies Exhibition in the Town Hall, Kirkwall, Orkney on March 14/15.

The exhibition will be open from 10am–4.30pm and again from 7–9pm on the Saturday, and 2–5pm on Sunday.

More details from ***Bill BM3IBU, QTHR.***

Rally Dates

3 May: The 4th Anglo-Scottish Rally will be held in Kelso's Tait Hall from 11am to 5pm.

There will be the usual talk-in on S22, traders' stands, club stands, hot and cold snacks, bar, raffles and Morse Tests, to mention but a few things.

Entrance is £1, but juniors and accompanying YLs and XYLs are most welcome and admitted free. For more information contact ***Andre Saunders GM3VLB on 0573 24664*** any evening.

11 May: The annual Drayton Manor Mobile Rally will be held at Drayton Manor Park and Zoo, Fazeley, near Tamworth.

The Park is on the A4091, 1m south of the A5/A4091 junction at Fazeley. Talk-in will be on both 144 and 430MHz using the callsign G3MAR/A.

21 June: The Denby Dale & District ARS will be holding their annual rally at Shelley High School. That's 8km south-east of Huddersfield.

Doors open at 11am (10.30 for the disabled). There is free parking, usual trade and club stands, lucky draw, bring and buy, children's entertainments, bar and the usual good food.

For more details contact ***G3DSY, QTHR or Tel: 0484 602905.***

19 July: The fifth McMichael Rally is being held at the Haymill Centre, Burnham, near Slough. Doors open at 10.30am (10.15 for the disabled).

A large number of national and local traders are expected and a car boot sale has been arranged for those with only a few items to sell. Other attractions will be many demonstrations, including a mini fairground, radio controlled models and a CAMRA beer tent.

Amateur TV will be in operation as will a special h.f. station GB4MR, all contacts will receive a special QSL card.

5 April: Pontefract & District ARS are holding a components fair for radio and electronic enthusiasts in the Carleton Community Centre, Carleton, nr Pontefract. Doors open from 11am to 4.30pm and admission is free.

Attractions are: trade stands, licensed bar, refreshments, bookstand and much more. For more details contact ***C. A. Mills. Tel: 0977 43101.***

5 April: The Cambridgeshire Repeater Group are holding their 5th Junk Sale Extravaganza at Pye Telecom Canteen, St. Andrew's Road, Chesterton, Cambridge. Doors open at 10.30am for an all day event.

Trade stands will be there as well as the "monster" junk sale auction. More details from ***G8KMS, QTHR. Tel: 022 023 3362.***

24 May: The 11th East Suffolk Wireless Revival is being held at the Civil Service Sportsground, Straight Road, Bucklesham, Ipswich.

Attractions are: traders, car boot sale, antenna testing range, childrens' play areas and model flying display to name but a few. Entrance and car parking costs £1. More details from ***Jack Toothill G4IFF. Tel: 0473 464047.***

GB3SE

In early November 1986, GB3SE was granted a licence by the DTI. On November 21 at 2100 it was switched on into full repeater/beacon use in Stoke-on-Trent.

GB3SE can be found on 1·297075GHz, whilst it's receiver input frequency is on 1·291075GHz. When not in use the transmitter stays on the air for beacon purposes and identification is by frequency shift keying at a rate of one callsign every 35 seconds, each eighth callsign is transmitted using m.c.w.

Repeater use is obtained by the usual method of transmitting a 1·750kHz toneburst. To acknowledge the fact that GB3SE has switched from beacon to repeater use, a letter "T" in Morse code is transmitted, alternatively a letter "H" or "L" if the carrier frequency on the input is more than plus or minus 5kHz from the nominal input frequency, this is then followed by the repeater callsign in m.c.w. For an indication as to when the repeater mode has finished, a tone of 1 second duration and 400Hz audio frequency is transmitted, the carrier will of course continue to radiate and the next identification callsign will be sent using f.s.k.

At the moment GB3SE is running 6 watts e.r.p., the antennas in use are two Alford slots (horizontal polarisation omni-directional). During the first 24 hours of use, a total of 12 different callsigns were monitored.

More information can be obtained from: ***G8DZJ, QTHR.***

144MHz Colinear Antenna

Ant Products have sent me a copy of the first issue of the *Tiger Antenna Newsletter* which, as well as interesting articles and news items, has details of their latest Tiger colinear antenna for 144MHz operation.

It is claimed to have a gain of 7dB from the three half-wave configuration and that with a correctly matched and decoupled coaxial feeder no unwanted radiation occurs from the outer braid of the feeder. This ensures that all the r.f. energy is radiated by the antenna.

The matching and electrical connections are housed inside a polythene insulator which is moulded into a completely machined alloy body carrying a weather-proof SO239 socket.

An alloy ring is fitted to the lower part of the antenna and is secured by means of a 6mm grub screw. The ring supports five stainless steel spokes forming a quarter-wave choke and effectively insulating the lower part of the tubing used to mount the complete antenna. The position of this ring can be adjusted to tip the v.s.w.r. curve to either end of the band. A stainless steel Jubilee clip is used to secure the socket assembly into the lower half of the mast, providing good electrical and mechanical integrity for this part of the antenna.

The antenna will easily handle the maximum legal power and should be mounted as high as possible and in the clear.

For further details and a copy of the Newsletter contact ***Ant Products, All Saints Industrial Estate, Baghill Lane, Pontefract, West Yorkshire. Tel: (0977) 785274.***

FRG-9600 Mods

After months of development R. Withers Communications have released details of their latest h.f. mods for the Yaesu FRG-9600. The mods give coverage from 100kHz to 950MHz, improved S meter and a typical receiver sensitivity of better than 2μV p.d. at h.f. At frequencies of 60 to 950MHz the sensitivity improves to better than 1μV (12dB SINAD).

RWC fit a high performance h.f. front end made for them by AKD. This is fitted internally with switching circuits and a small toggle switch on the rear apron to enable band changing with the display reading actual frequency (100kHz to 60MHz).

The standard SO239 connector is replaced by an "N" type for coverage from 60 to 950MHz and an SO239 fitted for h.f. coverage.

The fitting of an "N" type connector means that it is now possible to use a wide-band discone antenna such as the Icom AH7000 which is fitted with low-loss cable and "N" type connectors as standard. A dipole or long wire antenna can be used for the h.f. coverage.

New FRG-9600s are available from RWC in two versions. Option 1 is an FRG-9600 Mk2 series 2 with 60 to 950MHz "N" type connector for £519.00 plus £5.00 carriage. Your standard FRG-9600 can be modified by RWC for £40.00 inc. VAT and return insured carriage.

Option 2 is an FRG-9600 Mk3 with internal switchable h.f.mods (100kHz to 950MHz), actual frequency readout, "N" type connector for 60 to 950MHz and SO239 for h.f. This costs £625.00 plus £5.00 carriage. Modifying your own set will cost you £129.00 inc. VAT and return carriage. In this case the 950MHz extended coverage will be fitted at the same time. If you already have the Mk2 then fitting the new h.f. mod will set you back £99.00 inc. return carriage.

All mods are fully guaranteed for twelve months from purchase or modification providing RWC's seals are unbroken.

Further details are available from ***R. Withers Communications Ltd., 584 Hagley Road West, Oldbury, Warley, Birmingham B68 0BS. Tel: 021-421 8201.***

Mobile Microphone

With the new *Highway Code* recommendations effectively banning hand-held microphones in cars, some form of vehicle mounted microphone is essential.

For some months Waters & Stanton have been experimenting with various types of mics in an effort to find one suitable for mobile use and which neither obstructed the driver's vision or was attached to his body. The result is the Adonis FX-8.

This unit is capable of being mounted away from the operator, on the dash board or sun visor for instance. The highly directional microphone unit is fitted with back-to-back electret capsules and comes with all the hardware for fitting onto the dash or sun visor. Unlike normal noise cancelling mics, the output of each capsule is fed into separate amplifiers that are driven back-to-back and only the difference signal—the operator's voice—is fed to the transceiver. Ambient noise is virtually eliminated. A gearstick mounted control box with UP/DOWN buttons completes the system and has a level control to match the mic to the rig. The only extra required is a suitable mic plug for the rig.

Tests carried out in an old and noisy Range Rover with the mic at least a metre away from the operator showed very good results, with extremely low background noise and an audio quality similar to a conventional fist mic.

The Adonis FX-8 costs £69.95 inc. VAT from ***Waters & Stanton Electronics, 18–20 Main Road, Hockley, Essex SS5 4QS. Tel: (0702) 206835.***

1296MHz ATV Antenna

If you are into 1296MHz ATV and want to help the construction of GB3ZZ, Bristol's proposed 1296MHz f.m. TV repeater, this antenna is just the job for you.

Manufactured exclusively for the Bristol FMTV Group, this 18-element Yagi provides a compact and inexpensive "starter" or portable antenna for ATV enthusiasts.

The antenna is supplied assembled, needing only one screw to fix the rear reflector element.

According to the details sent to me by the Group the gain is about 10dB with an s.w.r. of 1·5 across the band. Length is 920mm and it weighs in at 300g. The clamp supplied fits masts up to 55mm diameter and a waterproof terminal box is fitted.

At a cost of £12.50 collected or £14.75 posted to a UK address, all proceeds after manufacturing costs have been deducted, will go to Group funds. Group members can have a 20 per cent discount.

Orders to ***Bristol FMTV Group, 15 Witney Close, Saltford, Bristol BS18 3DX.***

Kit Cat

Greenweld have just sent me a copy of their latest catalogue. This is a single source for an extensive range of electronic kits covering all abilities and interests.

Amplifiers, pre-amps, transmitters, power supplies and other interesting projects are included together with a range of interfaces for popular computers. Also listed are kits utilising plug-in breadboards.

For your free copy contact ***Greenweld Electronics Ltd., 443 Millbrook Road, Southampton SO1 0HX. Tel: (0703) 772501.***

RWC PRESENT A WORLD FIRST!
YAESU FRG9600/RWC MK3/HF-UHF 100KHz-950MHz.

We now offer the NEW FRG9600's in two versions:

Option [1]: FRG9600 Mk2 series 2 60-950MHz 'N' Connector. @ £519.00 Plus £5.00 carriage, or we will modify a standard unit for £40.00 inc. VAT (Inc £5.00) return insured carriage.

Option [2]: FRG9600 Mk3 100KHz-950MHz HF switchable, actual frequency readout, (no external units) 'N' connector for V-UHF and SO239 fitted for HF @ £625.00 Plus £5.00 carriage, or we will modify an existing unit for £129.50 inc return carriage, which will have the 950MHz extended coverage fitted at the same time. *(existing MK2 owners can have the New HF mod fitted for £99.00 inc. return carriage).

All modifications are Fully Guaranteed for twelve months from date of purchase/modification providing our modifications seals are unbroken.

***OPTIONS:** We are able to supply RWC modified Video units (PAL, 6MHz I.F.) @ £27.50 (fitted free during modification) and PA4 AC-DC Power units plus CAT interface units, Etc.

OTHER PRODUCTS

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ALINCO ALM-203E	£269.00
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ALINCO EDC1	£29.00
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CAPCO B/1-1	£15.50
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DATONG ANF	£67.85
DATONG D70	£56.35
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HOXIN HS-78F	£21.15
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JAYBEAM 8XY-2M	£43.00
JAYBEAM LR1-2M	£35.70
JAYBEAM LW10-2M	£28.23
JAYBEAM MBM48	£42.45
JAYBEAM PBM14-2M	£68.50
JAYBEAM Q4-2M	£35.50
JAYBEAM TB1MK3	£99.00
JAYBEAM TB2MK3	£199.00
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SUN-ANT KG208SE10	£14.50
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Model shown is 1308M 13.8V 6a metered.
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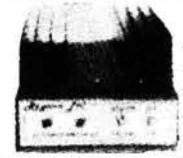
All units use Mitsubishi or Toshiba power modules.



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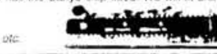
This is a complete modification board designed to fit all CB radios that incorporate modification board designed to fit all CB radios that have the SANYO LC7137 series of sythesizer chip, the unit comprises of a small pcb with six microchips and fits almost all current legal (CB27/81) radios, the unit is supplied with full fitting instuctions and can be fitted easily by most enthusiasts, with the current upsurge in interest in this band demand has been high as this means that over 90% of current CB radios can now be used on 10mtr amateur band.
PRICE £22.50 × £1.00 Post and packing (built & tested).
Works excellent in Cybernet, Binatone Lowe TX40G etc. Check if your radio has the Sanyo chip fitted. We will fit unit for you **£40.00** inclusive P & P.
* *Only suitable for experienced constructors.*
KIT OF PARTS AVAILABLE £17.50 × £1 P & P.
**Only available from RWC see R&EW March 1985 for full circuit description etc.*



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If you are a Bona-Fide Radio/Electronics Dealer Contact Martin, Andy or Ray NOW!

Ask your local dealer or call us direct

Kit Construction– It's Easy

If you have just passed the RAE and are looking for a cheap way of getting on 144MHz, Elaine Richards G4LFM looks at the Spectrum Communications answer for you.

Spectrum Communications FTX-201 & FM-1000

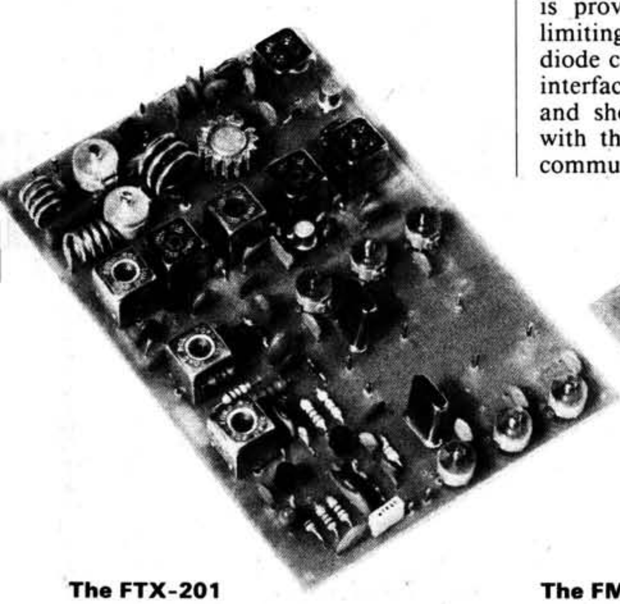
The two kits reviewed here are the FTX-201 Foundation transmitter and the FM-1000 Frequency Modulator from Spectrum Communications. As the name implies the Foundation transmitter has been designed as a simple no frills, low-cost unit with an r.f. output of up to 0·5W. Simplicity is assured by using a crystal oscillator followed by 5 stages of r.f. amplification. The techniques used are all fairly standard and hence easy to set-up and fault, if necessary.

Construction

The review kit was a pre-production prototype and the p.c.b. layout and components list weren't quite a typical Spectrum Communications kit. By the time you buy a kit all should be OK on the production versions.

The components supplied were of good quality and adequate for the task. All inductors were supplied ready wound and were a mixture of Japanese and Spectrum's own manufacture. The p.c.b. was good quality single sided glass fibre and all holes were of the correct size and spacing.

Construction time for an experienced constructor is about 3 hours. The supplied instructions were adequate for an inexperienced constructor but the beginner may need some help.



The FTX-201

Foundation FTX-201 Circuit Description

The crystal oscillator is conventional Colpitts circuit using a parallel mode crystal operating at its fundamental frequency (12–12·1667MHz).

Frequency (phase actually) modulation is achieved by closely coupling the modulator transistor to the oscillator to create a Waikato modulator. Provision has been made on the p.c.b. for switching up to 6 different crystals.

The 12MHz output is applied to a common emitter doubler to 24MHz. The residual 12MHz is filtered out by a second 24MHz tuned circuit. Next stage is a common base tripler to72MHz the output of which is again filtered to attenuate any remaining 12 and 24MHz components. The final frequency changing stage is a common base doubler to 144MHz with a double tuned output to reduce out of band signals.

The final two stages are tuned common emitter amplifiers producing 200mW and 800mW respectively in the tested kit. In line with good r.f. practice the final r.f. output is passed via a two-stage low-pass filter to reduce harmonic output to better than 50dB below the carrier.

FM-1000 Modulator Circuit Description

This unit is a simple microphone amplifier and speech processor. Gain is provided by a 741 op-amp and limiting is achieved with a simple diode clipping circuit. The modulator interfaces directly with the FTX-201 and should be capable of operation with the majority of low impedance communication microphones.

The FM-1000

General

The basic FTX-201 kit contains no microphone amplifier or antenna switching but these items are available separately from Spectrum. The Kit comes supplied with an S20 crystal but others are easily obtained as standard 12MHz parallel resonance units are required. To calculate the required crystal frequency simply divide the final 145MHz frequency by 12.

Uses

With a matching receiver and power amplifier this unit would be ideal for the mobile operator who only needs one or two repeater channels and doesn't need the expense of a synthesised rig. Another potential use for such a combination would be as a dedicated Packet Radio rig again with perhaps one or two channels. All in all a good simple design which, if constructed carefully, would be ideal for the practically minded newcomer.

Setting-up

The supplied setting-up instructions for the FTX-201 were very detailed and very cleverly avoided using any test equipment that would not normally be available in the shack. The only items required are a d.c. voltmeter, d.c. ammeter (up to about 200mA), s.w.r./power meter and a dummy load. Each stage is peaked up in turn and then finally trimmed for maximum output. The setting-up instructions included typical measurement values for each stage of alignment which is a great help in the event of a problem. The output power on the review sample was 800mW throughout the 144MHz band.

On the Air

When driven with a low impedance communications microphone and the FM-1000 mic amplifier and clipper the modulation level and quality was very good. The only problem on the original set-up was a tendency to instability which was due to poor layout on the author's part! It is very important to ensure that the mic amplifier and mic leads are well screened to prevent any r.f. getting back into the system. ***PW***

The Vin-Plonk Special

The Vin-Plonk Special is a simple 14MHz band transmit/receive antenna based on the principle of "electrovineology". As this word does not appear in 1987 dictionaries, it can be defined as "the science of using wine bottles as indoor and portable mini-tower transmit/receive erections" says Richard Q. Maris G2BZQ.

It is a matter of fact; good, bad or indifferent—depending on your point of view—that if you have £X00 then you can go out and buy a "super duper commercial h.f. antenna" and erect it in your garden. For a further £X000 a black box h.f. transceiver can be attached to the antenna; and if you "press the key" or "switch on the mic" then you will work the world. This goes on for a year or two. You have done the lot! Bearing in mind that amateur radio is a hobby, then what can you do next? How about a bit of experimentation with antennas?

The *ARRL Antenna Book* states that a h.f. TX can be used to load up just about anything, as an antenna, such as bedsprings, gutters, downpipes, tin roofs, metal flagpoles, TV antennas, wire reinforced plastics clothes line, wire fences and even a tree trunk (if you have one). Unfortunately they then rather smartly proceed to the next chapter—without giving very many actual details as to how this act should be performed!

The Vin-Plonk is a **fun project**! It works! It uses:

- 1½ litre wine bottle (empty)
- coffee jar
- biscuit tin lid
- wire
- piece of wood
- length of coaxial feeder
- junk box variable capacitor with knob.

Some (many?) readers will say "the man is crazy—he must be joking!"

Believe it, or not, it resonates excellently as an indoor 14MHz band RX antenna, and it can also be loaded with the transmitter. The QSO, which proved the latter point was with a DJ on 14MHz c.w., during the middle of one morning. The distance? Well, 800/950km! Maybe not a DX antenna, but it does prove that just about anything can be "TX loaded" with a bit of ingenuity. Incidentally, for some time the author has had his beady eye on a large metal-framed window 4m × 1.5m.

The circuit is shown in Fig. 1a. It consists of L1 wound around the bottle, L2 is the loading/matching coil around the coffee jar with a 150pF air-spaced receiver type variable capacitor of unknown parentage, it could easily be 100pF. At the top is a "top hat", which is a biscuit tin lid.

Construction is shown in Fig. 1b. a 180mm diameter biscuit tin lid is glued to the blunt end of the wine bottle, the "instant" type glue is best. Onto the bottle body, as shown, is wound 11m of 1 × 0·6 pvc covered wire, but no doubt any thin pvc covered wire or flex would do. The wine bottle "body" is 100m diameter. Solder the top end of L1 to the top hat.

The bottle is then glued to a 60mm coffee jar, as shown. This is a tricky job as the glue sets instantly so that you don't get a second chance. The prototype looks a bit like the Leaning Tower of Pisa, as the glue set while still doing the vertical alignment of the bottle and coffee jar!

Inductor L2 is 3½ turns of 20 s.w.g. tinned copper wire, spaced about 6mm between turns, with the wire anchored in place with glue.

The base of the unit is a piece of 25mm thick wood. The coffee jar/bottle contraption is glued to one end of

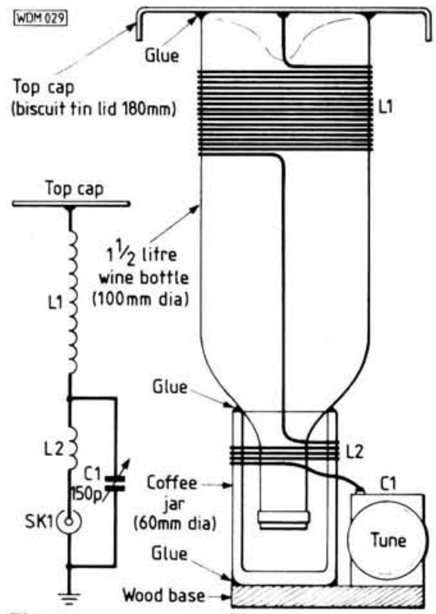


Fig. 1a **Fig. 1b**

the base. The 150pF capacitor is mounted down the other end on a small bracket. Though the coaxial socket is shown, in the circuit, the author dispensed with this and went straight into a length of coaxial feedline, which was cleated to the base board.

Tuning? If you have a transceiver, then resonate C1 for maximum signal on receive, and it does not have to be adjusted on transmit. At least, that's what happened to the author.

A few simple connections, with bits of wire and a soldering iron and you have the Vin-Plonk Special! And the thing didn't cost anything—it was all lying around somewhere in the house or garage. **PW**

Constructional

The PW "Blandford" Receive Converter PART 2

In this, the final part, Ray Howgego BSc G4DTC describes the construction

Construction and Layout

Before construction is undertaken, some thought should be given to the final layout and enclosure of the separate modules. The oscillator module, and possibly the u.h.f. tuner will be mounted in diecast or heavy gauge tinplate boxes, the tuner being rigidly bolted to the mainframe. The mixer module and TV rejection filter need not be additionally screened, but on no account should they be placed within the oscillator box. The three v.h.f. amplifiers may be constructed on a single sheet of plain copper-clad board, or as three separate modules, and are best bolted directly to the external enclosure via the variable capacitor shafts which then protrude through the front panel. Sufficient space should be allowed for the intended reduction drive of the main tuning control and for its calibrated scale, which will need to have a diameter of at least 200mm if it is to be marked with any accuracy. It might be significant to mention here that some u.h.f. tuners, notably the Mullard type, require rotation through slightly more than 180°. The front panel will also need to take the gain control R13 and the amplifier selector switch S1. If the mains power supply is to be enclosed within the finished unit, the transformer is best mounted as remotely as possible from the u.h.f. TV tuner to prevent induced 50Hz currents and possible transformer vibration which can produce an f.m. ripple on all received signals.

To facilitate adjustment of the oscillator module the r.f. "sniffer" shown in Fig. 2.1 is recommended and may be quickly soldered up on a small tagstrip or piece of Veroboard. The meter may be any sensitive analogue movement of about 200µA f.s.d., or a multimeter on its most sensitive voltage range. The loop at the end of the twisted flex should be held coaxially with the inductance in the circuit under test and preferably not so close as to detune it. Readings of about 100µA or a few tenths of a volt will generally be registered.

Oscillator Construction

If you intend to make your own p.c.b., note that in order to stop short-circuits occurring between component legs and ground, all holes on the ground-plane side of the p.c.b. should, after etching, be lightly countersunk with a suitable twist drill. Holes taking inductors and trimmers need to be slightly enlarged.

Next construct a small rectangular enclosure measuring 85 × 18mm, with a depth of about 18mm, it may be preformed out of tinplate salvaged from a used soup can. The base of the enclosure should be soldered directly to the p.c.b. ground-plane. A hole will need to be drilled in the enclosure 9mm above the ground-plane to take the connection to L5 and another, on the opposite side, to accommodate the coaxial cable

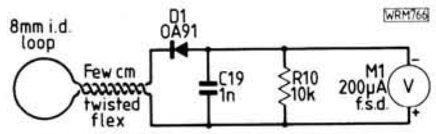
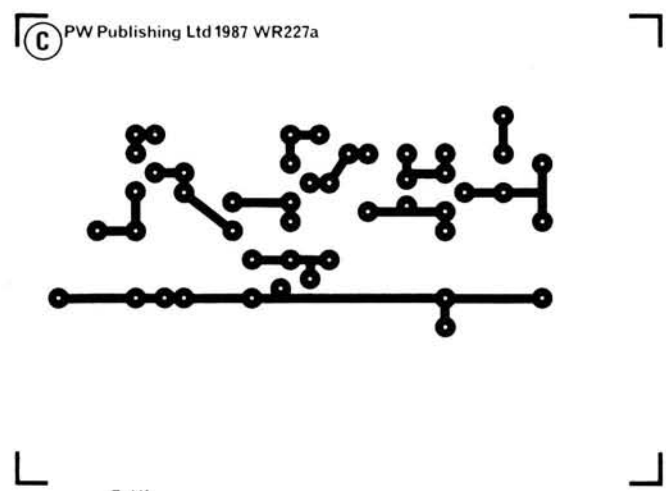
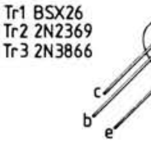


Fig. 2.1: Circuit diagram of r.f. alignment aid





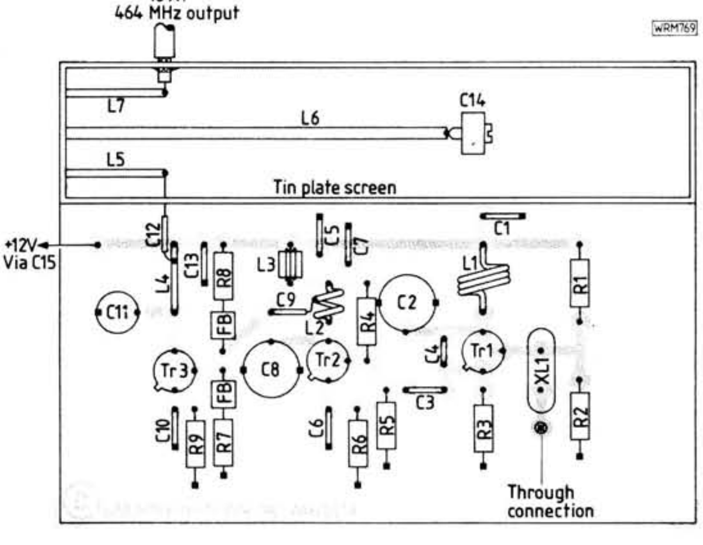


Fig. 2.2: Double-sided track pattern (shown full size) and component overlay of oscillator module

which connects to L7. A third hole is required at the far end to facilitate the insertion of a trimming tool for adjustment of C14.

While working in this area, the three short lengths of heavy gauge wire which form L5, L6 and L7 may be soldered into position, see Table 2 and Fig. 2.3 for full details. The trimmer C14 is soldered with its rotor plate to the ground-plane and is mounted vertically so that its stator plate tag supports the end of L6.

All other components may now be inserted as indicated in Fig. 2.2. Due to the rather high density of components, it is wiser to solder devices in order of decreasing size, trimmers first, then inductors, as smaller components might need to be routed around them. All components having a return to the "earthy" side of the circuit are soldered directly to the ground-plane with the shortest possible lead length. This applies, in particular, to all ceramic plate decoupling capacitors, which should be soldered right up against the capacitor body. These very small capacitors disintegrate rather easily under physical strain, particularly when hot, and their lead should be pre-formed before soldering. There is only one link between opposite sides of the board, that returning the crystal to the ground-plane. Don't forget the two ferrite beads on R8 and R7, also ensure that the rotor plate of the trimmer C11 is soldered to ground. Do not be too concerned about the exact dimensions of the inductors; the large tuning range of the trimmers will accommodate a wide margin of error.

Commissioning the Oscillator

Connect a stable 12 volt supply between the positive rail and the ground-plane and adjust the trimmers so that their plates are fully unmeshed.

TABLE 2: COIL WINDING DATA

Coil No	Turns	Wire s.w.g.	Coil Form Dia (mm)	Remarks
L1	3	22 e.c.w.	7	Close wound self supporting
L2	2	22 e.c.w.	4	Extend to 5mm tapped at $\frac{1}{2}$ turn
L3	3	26 e.c.w.	—	Wound on ferrite bead
L4	—	20 t.c.w.	—	5 x 9mm loop, see Fig. 2.3
L5	—	20 t.c.w.	—	13mm long height as L6, see Fig. 2.3
L6	—	16 t.c.w.	—	50mm long 9mm above ground plane supported by C14, see Fig. 2.3
L7	—	20 t.c.w.	—	13mm long height as L6, see Fig. 2.3
L8–10	3	24 e.c.w.	3	Spaced wire thickness
L11	—		—	6·8μH inductor 34–48689(2)
L12	—	— t.c.w.	—	See Table 1

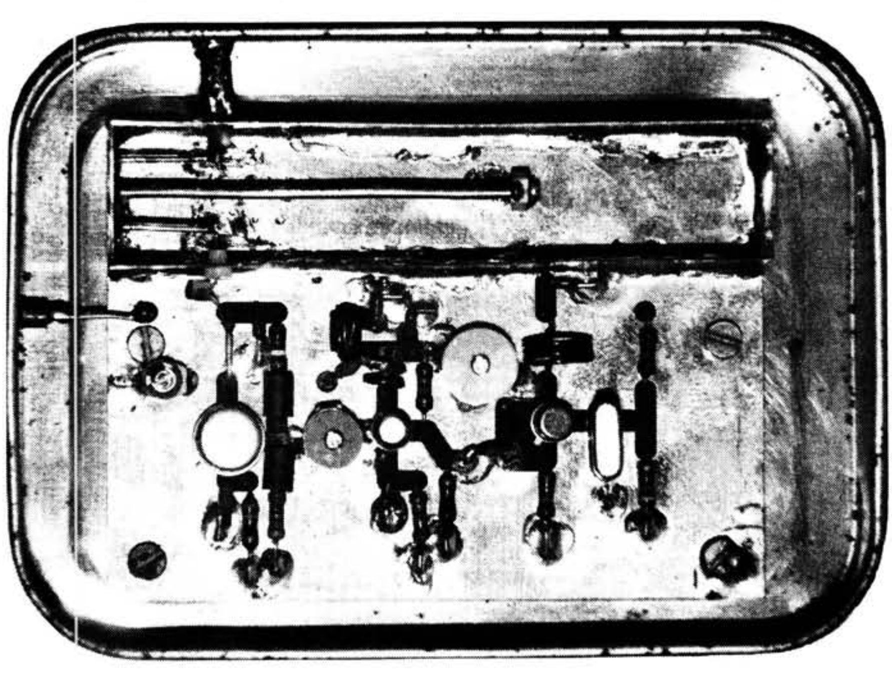
e.c.w. = enamelled copper wire, t.c.w. = tinned copper wire

Place the loop of the r.f. sniffer close to L1 and very slowly adjust trimmer C2 until, when its plates are about one third meshed, a sharp increase in meter deflection is observed. Move the loop as far as possible from L1 consistent with obtaining a usable meter reading and re-adjust C2 for maximum deflection. This highly critical tuning point coincides with fifth-overtone oscillation, a second, much broader, deflection will be observed when C2 is at nearly maximum capacitance; this is the third overtone and must be rejected. Switch the supply voltage on and off several times to ensure that the oscillator starts up each time; if not, de-tune C2 slightly until it does. If for some reason, fifth overtone operation cannot be excited, the components C3 and R1 may need to be selected on test, starting with the values stated and then deviating either side of this with the next preferred values.

Now introduce the loop of the sniffer to L2 and slowly increase the capacitance of C8. One or two weak resonance might be identified followed by a third which gives a substantial meter deflection, this coincides with 232MHz operation. It should not be possible to accidentally set this stage to 116MHz as it falls outside the tuning range of C8. Next move the sniffer loop close to L4, C11 being adjusted until a similarly large meter deflection is obtained. If two resonant peaks can be tuned with C11, the one corresponding to the higher capacitance setting should be accepted. Since this stage cannot be tuned to 232MHz, the correct frequency must have been selected. If the required resonance occurs when C11 is set at maximum or minimum capacitance, the dimensions of L4 should be decreased or increased respectively.

Next, solder the required length of coaxial cable to the coupling inductor L7, as indicated in Fig. 2.3, then place the sniffer loop inside the trough enclosure. Tune C14 for maximum meter deflection; this should require C14 to be set at about half maximum capacitance. With the loop still within the enclosure, all trimmers can then be adjusted slightly and peaked to give a maximum meter deflection. A voltmeter across R9 should show about 0·7V, indicating a d.c. input to Tr3 of around 120mW, and both transistors, Tr2 and Tr3, should run slightly warm to the touch.

The module may now be installed in its box. If a u.h.f. TV receiver is available, a very strong carrier should be observed just below channel 21 (464MHz), with the receiver lightly coupled to the oscillator module's output. Trimmers C8, C11 and C14 may be given a final tweak to produce maximum darkening of the raster, there should be no patterning on the raster. A carrier will also be observed at 696MHz (near channel 49) but should be comparatively weak, other 116MHz harmonics should be barely discernable.



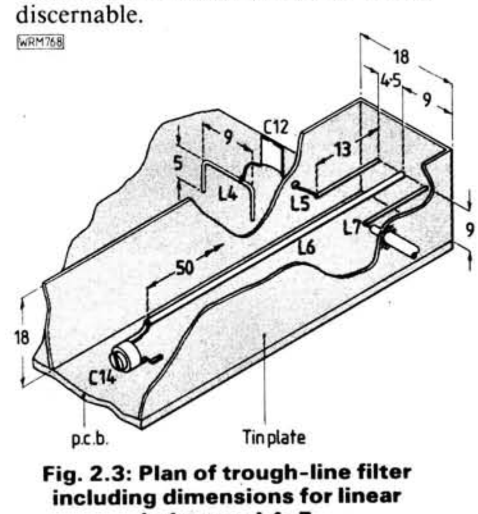


Fig. 2.3: Plan of trough-line filter including dimensions for linear inductors L4–7

TV Tuner

The u.h.f. TV tuner should be considered next. If a tuner is to be removed from a redundant receiver, a note of its connections should be made before removal. Details of the Mullard four-button type tuner are shown in Fig. 2.4. There are basically only six connections: antenna, i.f. output (both coaxial), two supply lines, and the a.g.c. connection discussed earlier. The tuner should be stripped of any switch mechanisms and its side cover removed for inspection. A coaxial lead is then connected from the i.f. output directly to the antenna socket of an h.f. receiver tuned to 29·5MHz, not forgetting the isolating capacitor C23 which prevents any d.c. potential at the i.f. output being grounded via the receiver. The a.g.c. connection will require a fixed d.c. bias for maximum gain, best derived from a potential divider network across the 12 volt supply rail. The network shown in Fig. 2.4 will deliver the 3 volts required to bias the r.f. amplifier, the overall gain of the converter is controlled from R13. Other types of tuner will require some experimentation in this area.

When a 12 volt supply is connected to the tuner, a higher noise level should emanate from the receiver and, by slowly tuning the unit, local TV signals should be heard. The small i.f. coil, normally set around 32MHz, should then be adjusted by moving its core into the coil former until a peak in the noise is heard. This is usually within the tuning range of the coil; if not, a small capacitor (a few picofarads) can be connected across the coil.

The 464MHz oscillator must now be fired up and the tuner checked to ensure that it will tune this frequency with its variable capacitor sections fully meshed. If this is not possible, the widest rotor plates in the oscillator compartment of the tuner should be carefully, and very slightly, bent inwards to increase the maximum capacitance. It is inadvisable to use the oscillator trimmer because increasing its capacitance will severely restrict the upper frequency limit. Any modification to the tuning capacitor should be reproduced as closely as possible in all other capacitor sections so that tracking is maintained. With the side cover replaced, the oscillator trimmer should be adjusted so that the tuner **just** tunes the 464MHz carrier at its lower frequency limit. Due to the slight change in intermediate frequency, the three remaining trimmers will need to be peaked for maximum noise, preferably near the upper frequency limit where system gain will be at its lowest. Tracking between circuits is usually excellent and no dead spots should be apparent when the unit is swept across the band. The matching between the tuner output and the receiver input might be improved, with the inclusion of capacitor Cx, typically 100–200pF, as shown in Fig. 2.4.

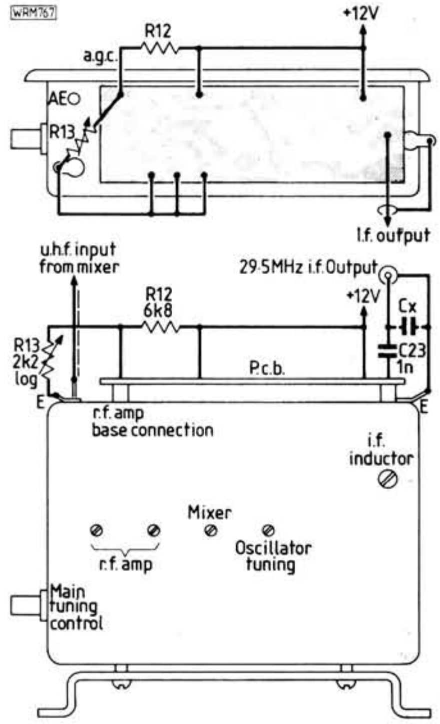


Fig. 2.4: External connections to u.h.f. TV tuner

Mixer and Filter Construction

The mixer module and TV rejection filter FL1 are constructed as separate units, their installation, whether within a box containing the tuner or as outboard units bolted to the mainframe, being left to the discretion of the constructor. The mixer itself requires some special attention. You will notice, referring to Fig. 2.5, that there are several unaccounted-for holes drilled around pins 2, 5, 6 and 7. Through these holes are threaded short lengths of wire, which are soldered on both sides of the p.c.b. They provide a non-inductive return to the upper side ground-plane. Any excess solder should be carefully filed down so that when the mixer is installed, it is not raised more than one millimetre or so above the surface of the p.c.b. Take care to insert the mixer correctly; pin 2 lies immediately below the letter M of "MCL". Alternatively, more recent devices may have pin 1 colour-coded. The metal case of the mixer should not

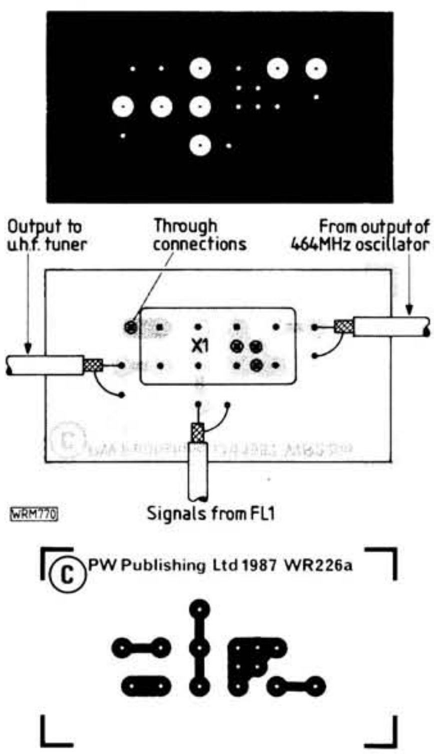


Fig. 2.5: Double-sided track pattern (shown full size) and component overlay of mixer module

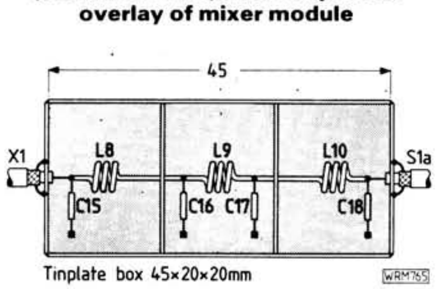
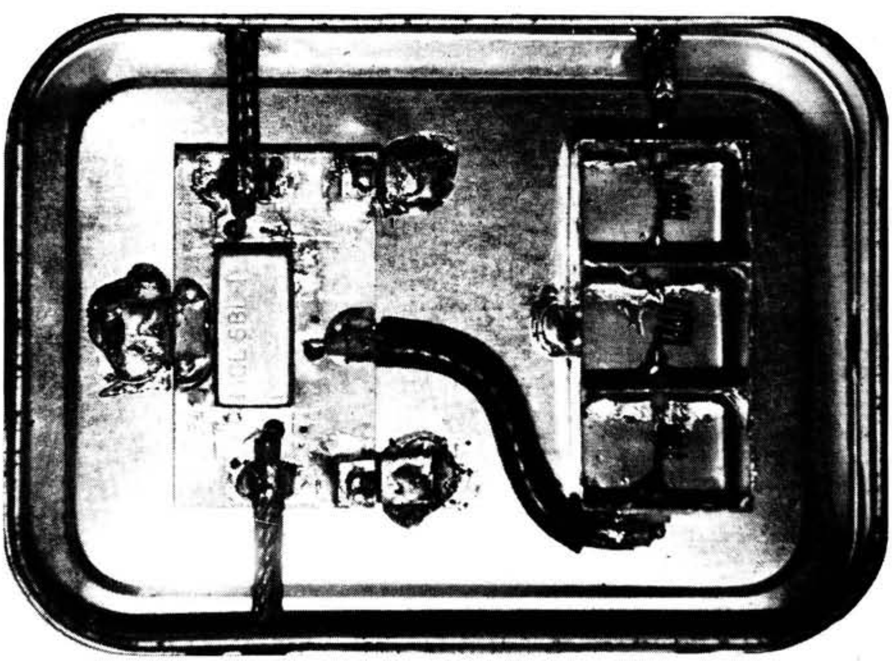


Fig. 2.6: Constructional details of FL1, 420MHz low pass filter



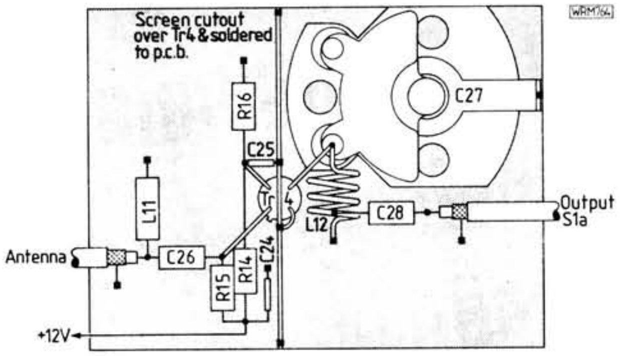
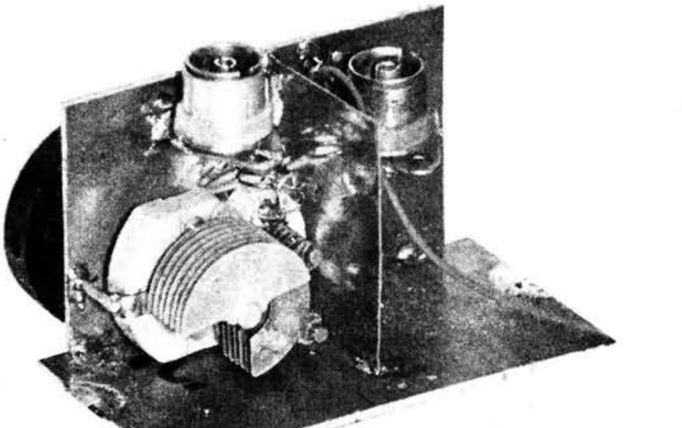


Fig. 2.7: Component layout of v.h.f. pre-amplifier, one of three (shown full size)



Capacitors C15, 18 are 6·8pF, and C16,17 are 15pF

make casual contact with the ground-plane and is best left floating. Coaxial cables from the tuner, filter and oscillator are connected as shown in Fig. 2.5, and should be stripped so as to reveal the barest minimum of unscreened lead.

The TV rejection filter FL1 is constructed in a 45 × 20 × 20mm tinplate box. It is divided internally into three sections by two tinplate bulkheads, each being drilled to take a connection from one filter section to another. All the seams of FL1 will need soldering along their entire length. The internal construction, shown in Fig. 2.6, is a job for nimble fingers and some thought should be given to the best plan of attack. The three coils, which should be identical, are wound separately and insulated where they pass through the internal screens. The holes in the screens should be as narrow as possible and capacitor leads kept short.

Pre-Amplifier Construction

There are three amplifiers to construct, and they can be built separately or together on a single board. All follow the same basic design shown in Fig. 2.7 and components that differ from one band to another are shown in Table 1.

A small tinplate screen with a cutout at its base just large enough to take the transistor body, is soldered across the ground-plane. All components are supported by their leads on one side of the board. The decoupling capacitor C25 must be soldered directly between the transistor base lead and the screen with virtually no lead length.

Variable air-spaced capacitors are expensive devices, and if other values are to hand it may be more cost-effective to design the amplifiers around them, even if it means constructing a fourth amplifier. Some experimenting with inductors will be needed to give a small overlap in band coverage: exact reproducibility cannot be guaranteed in such circuits. In the prototype, each amplifier was provided with its own antenna socket, but antenna switching could be incorporated if the constructor is willing to tolerate a small loss. The amplifier cannot be tested until the entire converter has been wired, the objective being then to ensure that at least one of the amplifiers will produce a noise peak at any frequency tuned. Any instability, although none was apparent in the prototype, can be cured by judicious placing of small supplementary screens around the inductors.

Power Supply

The Mullard tuner recommended for this project is reasonably tolerant of supply voltage changes, shifting by less than 20kHz/V, which is exceptionally good for a free-running oscillator at such high frequencies. A 7812 regulator provides more than adequate stabilisation and will accept an applied p.d. anywhere between 15V and 30V, allowing the use of any mains transformer having a loaded secondary output of between 11V and 22V r.m.s. If the regulator is bolted directly to the chassis, no further heatsinking will be necessary.

Testing and Calibration

A main tuning scale of 200mm diameter will allow graduation at 1MHz intervals and will be very nearly linear over the entire spectrum, each MHz occupying approximately ½ degree on the scale. A reduction drive of 400:1 or better, without backlash, is essential if signals are to be tuned directly on the converter itself. A cord drive, of the type common to most domestic receiver, is recommended, the drum being mounted on the TV tuner shaft, and can easily be arranged to provide a 40:1 reduction without allowing vibration from the front panel being passed through to the tuner. The cord itself may then be driven by a small epicyclic 10:1 reducer or a second cord drive. Precise details are left to the ingenuity of the constructor.

Although the constructor might eventually invest in a wide-band v.h.f. antenna, a simple horizontal dipole of 3 or 4 metres total length will bring in all of the more obvious signals from 10kHz to 400MHz. It will possess a number of resonances in the v.h.f. band and, while not being over-receptive to signals below 30MHz, is unlikely to cause unmanageable cross-modulation. The antenna should initially be connected to the low frequency antenna socket, that is, directly into the mixer without amplification. If each module has been tested after construc-

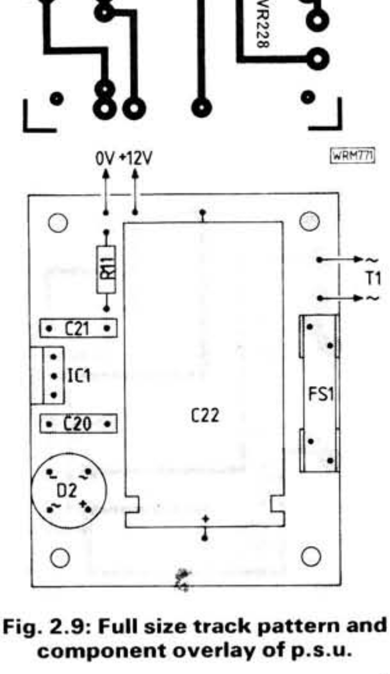


Fig. 2.9: Full size track pattern and component overlay of p.s.u.

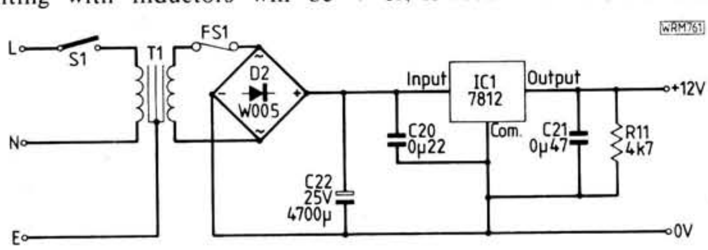


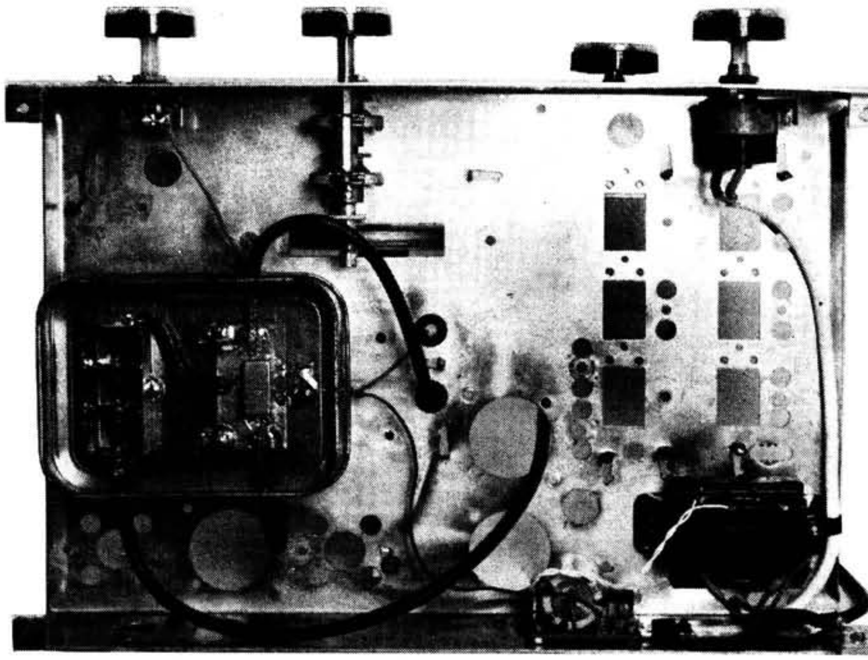
Fig. 2.8: Circuit diagram of p.s.u.

tion there is no reason why the completed unit should not work immediately.

If an accurate 1MHz squarewave oscillator is available, calibration points may be established right across the band compared with the internally generated carriers which appear at 116, 232 and 348MHz on the dial. In fact, the scale is sufficiently linear to allow reasonably accurate calibration by simply interpolating between these markers. Once the scale has been calibrated, the v.h.f. amplifiers may be switched in and their inductors adjusted, resulting in very much improved sensitivity and rejection of spurii.

For tuning above 30MHz the gain control R13 may be held near maximum, while below 30MHz it will require backing off until the mush between stations, caused by intense cross-modulation, becomes virtually inaudible. Also, if the tuner is to be used in conjunction with a transistorised receiver, it should be appreciated that this complaint might lie with the receiver itself and that some measure of post-converter attenuation could be beneficial.

There is considerable variation in the upper frequency limit of u.h.f. TV tuners and some might take in the 430MHz amateur band. This would necessitate the removal, or switched by-pass, of FL1 which would otherwise introduce appreciable attenuation. In addition, it is, of course, possible to switch the antenna direct to the TV tuner, while at the same time removing the supply voltage from the oscillator module, to introduce a second band tuning the spectrum from 464MHz to nearly 900MHz. A third band tuning 938MHz to 1300MHz, using subtractive mixing, might also be contemplated but would almost certainly require the more expensive SBL 1-X mixer and a large measure of selective pre-amplification.



Underside view of "Blandford" test rig showing reduction drives and mounting of screened enclosures

The possible use of Varicap tuned units has been largely ignored in the foregoing account, partly because those tested exhibited insufficient thermal and mechanical stability (this defect could be overcome in practice with the application of a.f.c.). However, voltage controlled tuning would be more convenient in that it would allow the tuning range to be split into any number of small segments, a single variable resistor being connected in series with an arrangement of switched preset resistors which would define the width of each segment. Further experimentation might be directed towards the application of (a.f.c.) automatic frequency control, a luxury rejected by the author on account of the intermittent nature of most v.h.f. signals, or towards a fully-fledged scanning receiver for about a tenth of the cost of its commerical counterparts. **PW**

ERRORS & UPDATES

Award Chasing on Satellites January '87

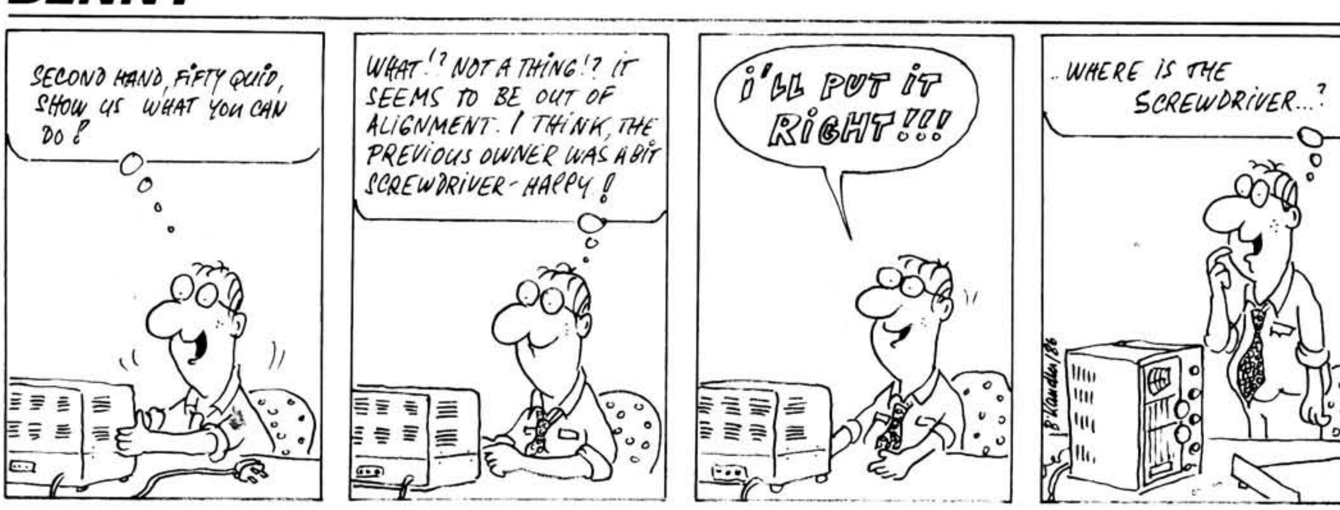
A typographical error crept into the first paragraph of the article. Line 7-8 stated ". . . the use of satellites is specifically prescribed . . .". It should have read ". . . the use of satellites is specifically proscribed . . .". We apologise for any embarrassment this has caused.

Transceiver Power Unit Sept 1980

also in Practical Power Supplies

We have now located a supplier of the 78HG 5 amp variable regulator i.c., Greenweld Electronic Components, 443 Millbrook Road, Southampton SO1 0HX. Tel: (0703) 77250.

BENNY



M. P. Clarke originally designed this continuity tester to help when ringing out long lengths of cable on radar sites. For the amateur it also has its uses.

Simple Discriminating Continuity Tester

What distinguishes this continuity tester from many others is its ability to discriminate between the normal resistance in a circuit or cable and the slightly higher resistance of a poor connection.

The circuit of the continuity tester is shown in Fig. 1, it comprises two distinct sections,
1: the oscillator and
2: the probe sensor

The oscillator section employs a conventional multivibrator circuit using Tr1 and Tr2 with a free-running frequency of about 1·5kHz. This output is directly coupled to a medium-impedance telephone earpiece which produces a suitably loud tone.

The probe sensor is required to control the tone output, which it does by switching the power supply on and off as required. Another feature of the probe sensor in this circuit is the ability to indicate the presence of any excess resistance in the circuit under test.

The sensor is very simple and is comprised of Tr3, D1 and R5. When the probes are shorted together, Tr3 is driven into saturation and the oscillator supply current (approximately 30mA) is split via two paths. The first path is D1 and the collector-emitter junction of Tr3, and the second path is the test probes, R5 and the base-emitter junction of Tr3.

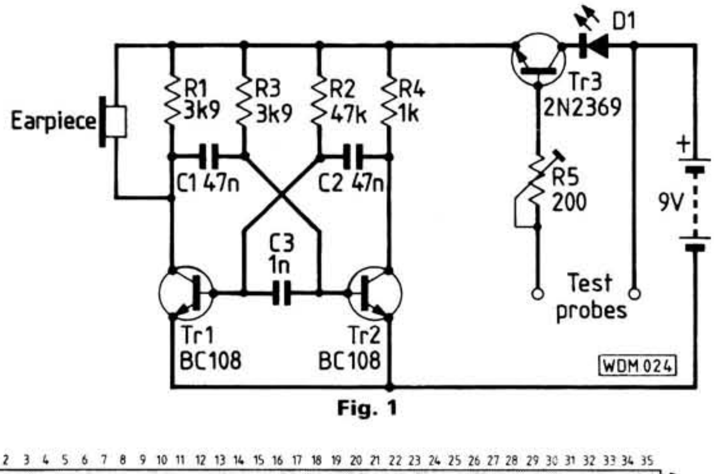
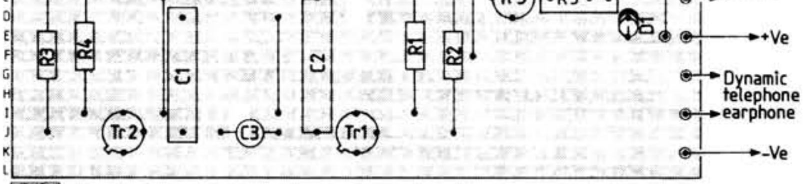


Fig. 1



Veroboard and component layout

If R5 is set to about 25Ω the current is equally divided between these two paths and the l.e.d. is illuminated. Any increase in the resistance of R5, or the circuit under test, will make the l.e.d. brighter and conversely any decreases will dim the l.e.d. If R5 is adjusted so that the l.e.d. is just extinguished with the probes connected to the circuit under test, the l.e.d. lighting will indicate the presence of excess resistance in the circuit.

One added bonus of this probe sensor is that it eliminates the need for an on/off switch. Providing the probes are kept apart the supply current, when the unit is not in use, is reduced to the leakage current through D1 which is minimal.

In Use

When checking equipment wiring or short cable runs it is sufficient to short the probes together and adjust R5 so that the l.e.d. just extinguishes. To check the wiring the probes are connected, one to each end of the circuit. If all is well with the circuit the tone will sound and the l.e.d. will remain extinguished. If the tone doesn't sound then the circuit is probably open, or very high resistance. If the tone sounds and the l.e.d. lights then there is some excess resistance which may be due to a poor connection.

When testing long cable runs it is obviously impractical to connect one probe to each end of the circuit. The technique here is to either loop pairs of wires at the distant end or to bunch all the wires at the distant end. If the "looping" system is employed, the probes are connected one to each leg of the looped pair. If the "bunching" system is used then one wire is nominated as the "master" and one probe is connected to this wire and the other probe is moved sequentially around the remaining wires.

To set R5 on long cable runs the probes are connected to the first circuit under test and R5 is adjusted until the l.e.d. just extinguishes. The indications given by the tone and l.e.d. are the same as for testing short cable runs, as described earlier.

One word of warning about this unit is the current applied to the circuit under test is between 15 and 30mA. So it should **not** be connected directly to semiconductor circuitry. ***PW***

SHOPPING LIST

Resistors

¼W 5% Carbon film

1kΩ	1	R4
3.9kΩ	2	R1,3
47kΩ	1	R2

Potentiometers

Cermet trimmer

200Ω	1	R5

Capacitors

Polycarbonate

47nF	2	C1,2

Sub-min Ceramic plate

1nF	1	C3

(1) Cricklewood Electronics Ltd. Tel: 01-450 0995.
(2) J&N Bull Electrical. Tel: 0273 734648.

Semiconductors

Diodes

red l.e.d.	1	D1

Transistors

BC108	2	Tr1,2
2N2369(1)	1	Tr3

Miscellaneous

Veroboard 30 holes × 6 tracks; 4T telephone earpiece(2); PP3 battery; Battery connector; pvc covered wire; Crocodile clips (2).

How Much? & How Difficult?
£5
Beginner

NEWS EXTRA

Engineering Details

Hooke & Toller Porcorum: A new relay station has been built 17km north-west of Dorchester. The channels are:
Ch. 40—BBC1 South West
Ch. 43—ITV TSW
Ch. 46—BBC2
Ch. 50—Channel 4
Viewers will need horizontal group B antennas.

Bristol: The v.h.f. f.m. Radio 4 service from the Bristol relay transmitting station (Ilchester Crescent) has changed to 93·7MHz. Also the v.h.f. f.m. service for Radio Bristol will change frequency:
Bath — 104·6MHz
Ilchester Cres — 94·9MHz

Chilfrome: A new relay station has been built 15km north-west of Dorchester. The channels are:
Ch. 39 — BBC1 West
Ch. 45 — ITV HTV West
Ch. 49 — BBC2
Ch. 52 — Channel 4
Viewers will need horizontal group B antennas.

Club Changes

The Armagh & Dungannon District ARC have moved their meeting place and evening. The new details are:
County Armagh Golf Club
Newry Road
Armagh City
2nd Wednesdays.

The Felixstowe & District club have moved. The new address is:
The Scout Hut
Bath Road
Felixstowe

Welwyn/Hatfield ARC have changed their main meeting venue: The new address is:
Lemsford Village Hall
Brocket Road
Lemsford

Reunion Dinner

Saturday May 2 is the date for the Cambridge University Wireless Society and Oxford University Radio Society Reunion Dinner for 1987.

This dinner is the main social event for the two societies and is intended to allow both past and present members to meet and talk in conjunction with a first class formal dinner.

It will be held in Selwyn College, Cambridge. The cost is £15 and some limited accommodation is available. Applications should be sent to ***Dr James Keeler G4EZN, Selwyn College***.

RAYNET News

During the wintery weather of January 13–17, conditions caused a number of RAYNET groups to be called out.

Leicestershire: Members operated their "snowdesk" travelling info service for the benefit of mobile radio amateurs and the community at large in collaboration with their CEPO. They worked for 40 hours over 3 days with over 3000 messages.

West Midlands: Groups were placed on a listening watch by their CEPO to gather road info for the Fire Service. They ran from Tuesday to Thursday.

Norfolk: RAYNET were called out by the Police and CEPO (for use with the Ambulance Service, Health Authority, Social Services and Highways Dept). They were involved with getting patients and consultants to hospitals, transporting urgent drugs, babies' milk, fuel and even a search for a missing person. Total activity exceeded 6000 RAYNET manhours.

Strathclyde: RAYNET was called out by their EPO to help the Social Services Dept. The Army were also involved and there developed a friendly rivalry between groups e.g. Jan 14 Army 23, RAYNET 22 jobs completed.

We all should say a big thank you to those mentioned here (and those unmentioned) for all their work and all the unsung heros who helped by keeping frequencies clear throughout the emergency. Amateur radio at its best.

Commonwealth Games Award Certificate

Any person who has not to date received their certificate is requested to contact the originators and organisers of the Award—The Lothian Radio Society, QTHR, who used the callsign GB8CG for the event.

PO Box 20 Motherwell, The Post Office box of the Mid-Lanark ARS was used for both stations taking part as a clearing house for mail for the Lothian Club.

Can We Help You?

Do you have any forthcoming rallies, special events or exciting news—tell us and we'll tell others.

Test Methods and Equipment Part 1

In this series, Ray Steele takes a look at all kinds of test measurements, standards of measurement and test equipment.

Metric Units

The French Academy of Science was instructed, in 1790, by the French Government to invent a new system of units.

Since all measurements are based on observations in one's environment, they chose their unit of length as one tenmillionth of the distance from the North Pole to the equator, along the latitude through Paris. This they called the metre and the decimal system was born. Decimal multiples and their symbols are shown in Table 1.1.

The unit of time was adopted without change from the existing units as 1/86 400 of the mean solar day. The unit of mass chosen was the gram which is 1cc of distilled water at 4°C and 760mm of Mercury (atmospheric pressure).

The above centimetre-gram-second (CGS) system was adopted by the British Association for the Advancement of Science since the metre-kilogram-second (MKS) system is unwieldy for laboratory use.

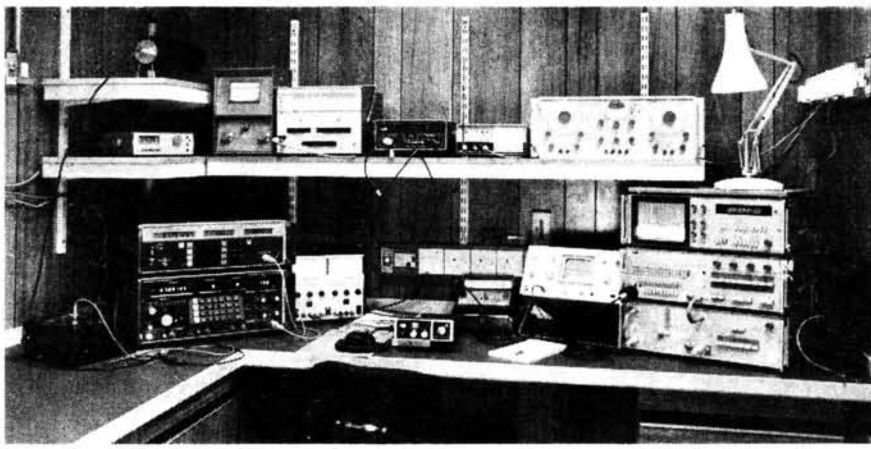
Giorgi, an Italian engineer, introduced the Ampere to the MKS system which was modified to the MKSA system in 1935.

The original MKS system was in use in France by 1795, five years after the French Government commissioned the French Academy. It was also adopted at the metre convention of 1875, by seventeen countries, 80 years after it was adopted by France. But the USA and Britain are only just starting to implement these on a scale outside the laboratory, even though there was an international agreement in 1960 accepting these as System International d'Unites (SI units).

Some common SI units and their symbols are shown in Table 1.2.

The Imperial system (foot-pound-second) is a legacy of the Roman occupation. The conversion between the two units is shown in Table 1.3. The biggest advantage of the metric system is that it goes up or down in steps of ten, making calculations easy. Some quantities have unique names honouring scientists: Watt, Joule, Coulomb, Newton, Hertz etc.

Units are either fundamental or derived. Length and mass are fundamental units but force has dimensions of kg m/s and is a derived unit since it contains more than one fundamental unit.



This is how the original PW lab looked

Standard of Measurement

Standards of measurement are maintained at four levels:

International standards
Primary standards
Secondary standards
Working standards

Working standards are used for calibrating laboratory instruments and secondary standards are calibrated by industrial laboratories using primary standards.

Primary standards are compared to provide an average figure. Primary standards are kept in national laboratories like the National Physical Laboratory (UK) and National Bureau of Standards (USA). The International standards are kept near Paris at the International Bureau of Weights and Measures and checked occasionally.

Table 1.1
Decimal Multiples

Tera	T	10^{12}
Giga	G	10^{9}
Mega	M	10^{6}
Kilo	k	10^{3}
Hecto	h	10^{2}
Deca	da	10
Deci	d	10^{-1}
Centi	c	10^{-2}
Milli	m	10^{-3}
Micro	µ	10^{-6}
Nano	n	10^{-9}
Pico	p	10^{-12}
Femto	f	10^{-15}
Atto	a	10^{-18}

Table 1.2
Some common SI units

Quantity	Symbol	Unit
Potential Difference	V	volt
Current	A	ampere
Resistance	Ω	ohm
Quantity of Electricity	C	coulomb
Power	W	watt
Frequency	Hz	hertz
Inductance	H	henry
Magnetic Flux	Wb	weber
Magnetic Flux Density	T	tesla
Capacitance	F	farad
Temperature	K	kelvin
Time	s	second
Mass	kg	kilogram
Length	m	metre
Force	N	newton
Work	J	joule
Velocity	m/s or m^{-s}	metre/second

Table 1.3
Metric to Imperial Conversion

	Metric	Imperial
Mass	kilogram	2·205 pounds
Length	metre	39·37 inches
Velocity	metre/second	3·2808 feet per second
Temperature	degrees centigrade	(9/5)C + 32° Fahrenheit
Work	joule	23·75 foot-poundals
Power	watt	0·00134 horse power
Force	newton	7·23 poundals

Voltage, Current and Resistance Standards

Voltage standards employ Weston cells of the saturated or unsaturated variety. A saturated cell employing cadmium sulphate as the electrolyte is shown in Fig. 1.1. The positive electrode is mercury and the negative electrode is an amalgam of cadmium consisting of 10 per cent cadmium.

At 20°C, the voltage is 1·0185V with an internal resistance of between 500 and 800Ω. Therefore the voltage drop across the internal resistance becomes important if the current increases above 100μA.

The voltage of the cell drops 40μV for each degree (Centigrade) rise in temperature and the cell is immersed in a bath of oil to keep the temperature constant.

The saturated cell reproduces the voltage fairly accurately and is used as a primary standard. The unsaturated cell is used as a secondary standard since it is rugged and stable at room temperatures.

A standard resistor is made from manganin, an alloy of high resistance so that only a small piece is necessary to represent one ohm. This source is kept in a glass jar with double walls so that the temperature and humidity are constant. The other feature of manganin is its low temperature coefficient i.e. its resistance changes in small amounts with changes in temperature.

The ampere was defined as the current which produced a force of 2×10^{-7} newton per metre in two parallel conductors one metre apart. The ampere was also defined as that current which would deposit 1·118mg of silver out of a silver nitrate solution in one second.

In 1948 the definition of the ampere was changed to that current producing the required force between two coils of defined size. This is easier to reproduce than either of the previous two definitions.

▲ **A typical digital multimeter and handbook**

What a digital multimeter looks like inside ▶

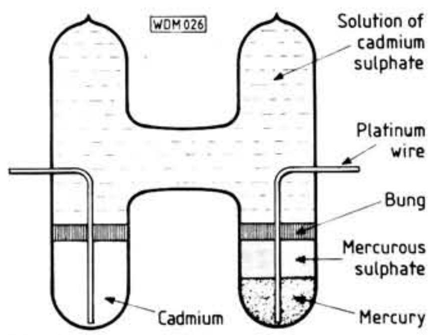


Fig. 1.1

Magnetic Flux, Inductors and Capacitors

One method of generating a standard magnetic flux is shown in Fig. 1.2. A hollow brass cylinder is wound with insulated copper wire. When a catch releases the cylinder, it drops into a soft iron container.

A permanent magnet is located in the centre of the container and the windings on the cylinder cut the field of the permanent magnet. This causes a current to be induced in the windings which is proportional to the field (flux). The cylinder drops at a constant rate under gravitational pull.

Standard inductors come in sizes from 100μH to 10μH and standard capacitors with solid dielectrics or air as a dielectric. Silver-mica is a stable solid dielectric and is used in the larger value capacitors.

Time and Frequency

If we can derive one, the other follows since one is the reciprocal of the other i.e.

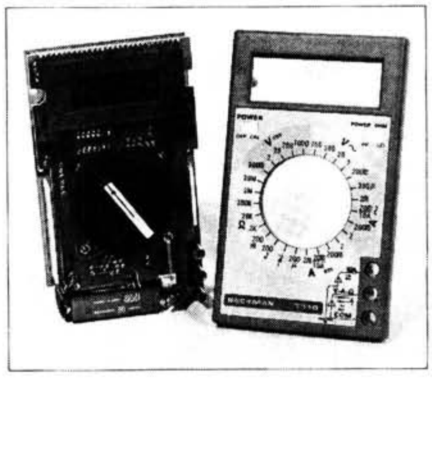
$t = 1/f$

When electrons fall from a higher to lower energy level, light is emitted in giving up this energy. The relationship is:

$hf = E_2 - E_1$

where: E_2 is the higher energy level
E_1 is the lower energy level
f is the frequency
h is Planck's constant

This relationship is explained in Fig. 1.3. Caesium emits a frequency of 8 192 631 770Hz and has been used in atomic clocks since 1955. This is much



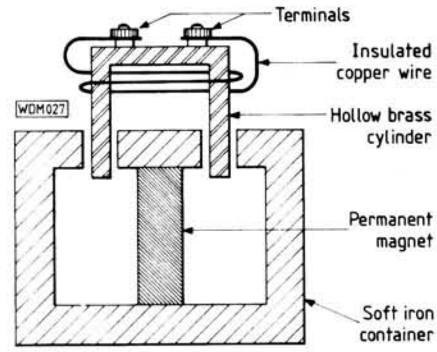


Fig. 1.2

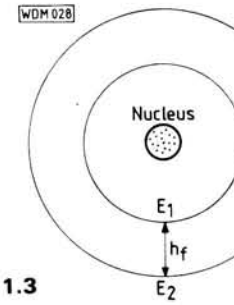


Fig. 1.3

more accurate than relying on the earth's rotation.

Standard Mass

The International Bureau of Weights and Measures near Paris keeps the International kilogram which is accurate to 1 part in 10^8. Laboratory standards are accurate to 1 part in 10^6 and working standards to 5 parts in 10^6. The term weight is not used since the weight of an object will vary with its distance from the earth.

Standard Length

Since 1960 this has been based on radiation from a krypton lamp. Before this the metre was defined as the distance between two marks on a platinum-iridium bar. This is accurate to 1 in 10^5 but the krypton lamp method is more accurate. The wavelength of the orange-red discharge is multiplied by 1 650 763·73 to arrive at one metre. Steel blocks with faces flat to within 0·25 to 0·5 in 10^{-6} metre are used as working standards.

Temperature and Luminous Intensity

The primary temperature standard is the platinium thermometer and temperature is measured in kelvin (absolute temperature).

Platinum solidifies at 2042 kelvin and a black body at this temperature is used as the standard of luminous intensity. A candela is one sixtieth of this intensity per square centimetre.

Tungsten lamps are used as secondary standards and by operating at the required temperature, the radiation is the same as that of the primary standard. This is in the visible region.

These are the standards and units in use at present. No doubt there will be improvements in the standards if not in the units.

PART 2 NEXT MONTH

COME ON DO
& MEET T

At this years RSGB exhibition you will be able to see and buy ICOM equipment direct from us, Thanet Electronics Ltd, sole ICOM importers in the U.K.

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

PW "Itchen" LCR Bridge

The d.c. Wheatstone bridge is historically the basic circuit for measuring resistance and comparing resistors accurately. This self contained LCR component bridge, which is based on the Wheatstone circuit, can measure resistance (10Ω–10MΩ), also capacitance (10pF–10μF) and inductance (100μH–1H). Usable indications can also be obtained for values up to a factor of ten above and below the ranges quoted. The bridge will find many uses in the service department and experimenter's workshop says J. Thornton Lawrence GW3JGA.

The d.c. Wheatstone bridge is a very simple and accurate arrangement for measuring resistance, the circuit of which is shown in Fig. 1a. It consists of a battery to drive current through the resistor bridge network and a centre zero meter or null detector to detect the balance condition. The unknown resistor to be measured, Rx, is connected in one arm of the bridge and the remaining three calibrated resistance arms of the bridge, Ra, Rb and Rs are adjusted in value to give zero indication on the meter. In this condition the value of Rx is given by:

$$Rx = Rs \times (Ra/Rb)$$

In Fig. 1b the same circuit has been redrawn to show graphically that if Ra and Rb are equal, balance or zero reading will be obtained when Rs = Rx.

In Fig. 1c the same circuit is shown with Ra and Rb replaced with a variable potentiometer control in which the ratio of Ra to Rb can be varied by rotating the control. If the control is fitted with a knob, scale and pointer then the scale can be calibrated directly in terms of Ra/Rb—this method is used in the *PW* "Itchen".

In theory the ratio Ra/Rb provided by the potentiometer is infinite, but in practice ratios of up to 10:1 are quite satisfactory, with indications of lesser accuracy up to 100:1. To cover a wider range of values of Rx the value of Rs (the range or standard resistor) can be switched in decade ranges—100, 1000, 10 000 etc. This allows the value of Rx to be measured directly by selecting an appropriate value of Rs, adjusting the potentiometer for null indication, reading the ratio indicated on the dial and multiplying this by the value of Rs. For example, with the unknown resistor connected, an attempt to find a null point would be made by rotating the potentiometer and, if necessary, switching the value of Rs to bring the null point within the 10:1 range on the potentiometer dial. If a null was obtained at a dial reading of 2·5 and Rs was set to 1000Ω then the value of Rx could be read off as:

$$2{\cdot}5\ (\text{dial}) \times 1000\ (\text{Rs}) = 2500\Omega$$

A feature of the Wheatstone bridge is that the measurement is not affected by the supply voltage. In practice, if the bridge volts are reduced then it may require a more sensitive null detector to locate the null point with the same certainty, but the resistance measurement would be unaffected.

AC Wheatstone Bridge

The d.c. version can be made to work on a.c. simply by replacing the battery with an a.c. voltage source, at say audio frequency, and the null detector by a headphone or a.c. millivoltmeter. In addition to being able to measure resistors the bridge will now be able to measure reactive components, capacitors and inductors. Because of the relative simplicity of the circuit the bridge is unable to isolate and measure separately the reactive and resistive parts of a complex impedance. However, for checking components and making the usual workshop measurements, this is unlikely to be a serious limitation.

Circuit Description

The circuit of the *PW* "Itchen" is shown in Fig. 2. It comprises a Wien bridge oscillator running at 1·6kHz, a Wheatstone bridge circuit with a

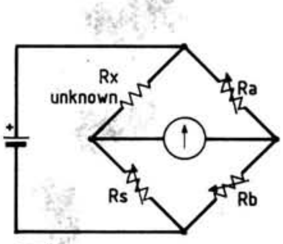


Fig. 1a: DC Wheatstone bridge

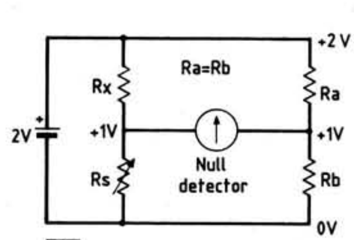


Fig. 1b: Wheatstone bridge redrawn to show balance

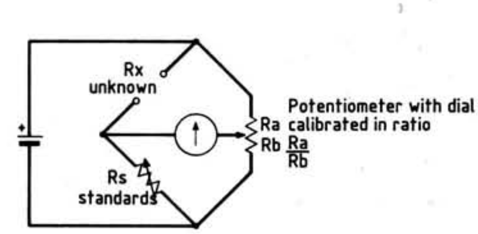
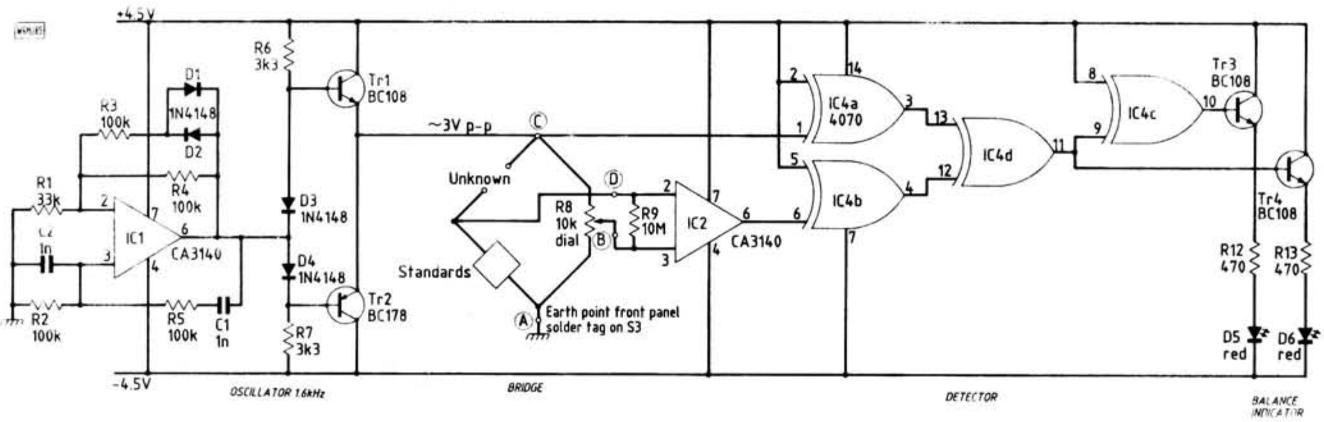


Fig. 1c: Wheatstone bridge with ratio dial and standard



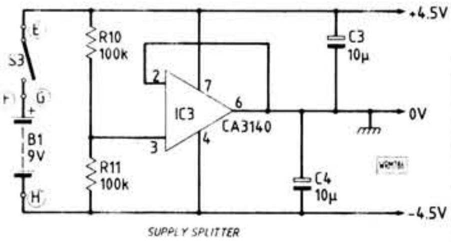


Fig. 2: LCR bridge circuit diagram

potentiometer and dial calibrated in ratio and a sensitive null detector incorporating a phase sensitive rectifier with l.e.d. balance indicator. Most a.c. bridge circuits require a special transformer either to drive the bridge or to feed the null detector. An alternative is to exploit the common mode rejection characteristic of an op-amp. The *PW* "Itchen" uses a CA 3140 f.e.t. op-amp for this purpose.

Oscillator

The 1·6kHz oscillator consists of an op-amp IC1 with positive feedback through a Wien bridge network R5, C1, R2, C2 which determines the frequency of oscillation. Amplitude stabilisation is provided by the negative feedback network R1, R4 and R3 and D1 and D2. The sine wave output is fed to a push-pull amplifier consisting of Tr1 and Tr2; this stage has a low output impedance and provides a 3V peak-to-peak signal to drive the Wheatstone bridge network.

Bridge Network

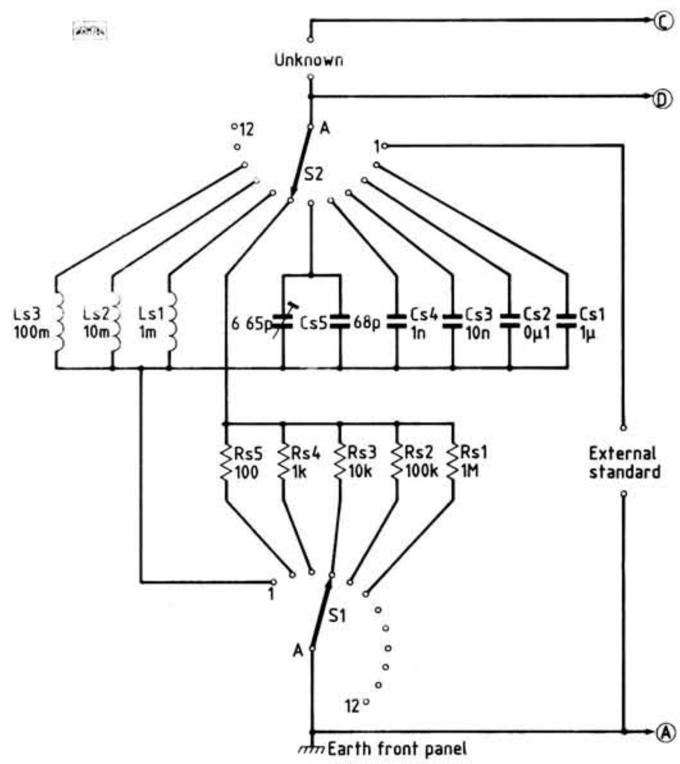
The bridge network is built on the front panel and comprises the ratio potentiometer and the "standards" (resistors Rs, inductors Ls, and capacitors Cs) which are switched into circuit by two rotary switches S1 and S2. These are shown in Fig. 3 and the scale is shown in Fig. 4. It will be noticed that there is a forward reading scale for R and L and a reciprocal scale for C. The scale is calibrated for the 10kΩ 1watt wire-wound potentiometer, RS Components type 173-237. If any other type of potentiometer is used, having differing degrees of rotation, then a different scale will be required and details for making this are given at the end of the article.

Ideally all the "standards" should have a tolerance of no greater than ± 1%. Unfortunately, not all the values required are available to as close a tolerance as this. However, the following components are readily available and were used successfully in the prototype.

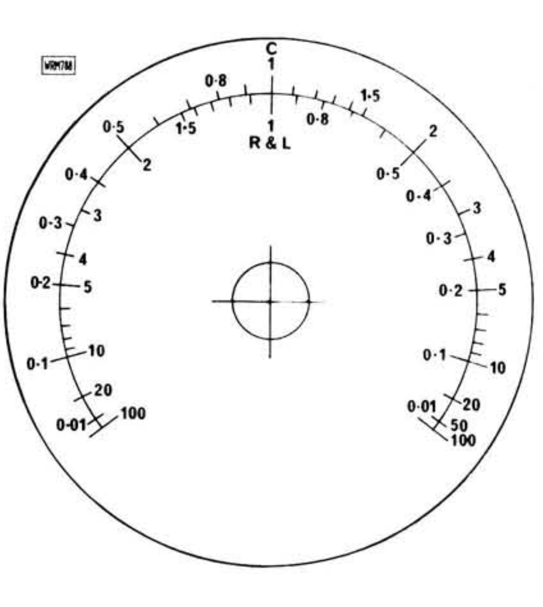
List of "Standards"

Rs1 1M0 0·25W metal film 1%
RS 149–228
Rs2 100k 0·25W metal film 1%
RS 148–972
Rs3 10k 0·25W metal film 1%
RS 148–736
Rs4 1k0 0·25W metal film 1%
RS 148–506
Rs5 100R 0·25W metal film 1%
RS 148–269
Cs1 1µ0 Polyester 10%
RS 115–152
Cs2 100n Polyester 20% 20%
RS 115–102
Cs3 10n Polystyrene 2·5%
RS 113–409
Cs4 1000p Silvered Mica 1%
RS 124–948
Cs5 68p Silvered Mica 1%
RS 124–752
in parallel with
5-65p Trimmer RS 125–660

Ls1 1mH Toko 181LY–102 5/10%
Ls2 10mH Toko 181LY–103 5/10%
Ls3 100mH Toko 181LY–104 5/10%



◀ **Fig. 3: Switched L,C&R standards**



▲ **Fig. 4: Front panel scale (full size) for LCR ratios**

The range switches are arranged so that one covers the resistance ranges and the other the capacitance and inductance ranges. An EXT (external) position is provided which allows an external standard to be connected to the EXT terminals. This is a useful feature as the bridge can be used to match components or to measure differences between two similar components connected to the UNKNOWN and EXT terminals respectively. Note that Cs5 consists of two components, a fixed capacitor with a trimmer connected in parallel. The trimmer is set during calibration to compensate for the few picofarads of unavoidable stray capacitance existing within the bridge and ensures that the low capacitance (100pF) range reads correctly.

Detector

The null detector consists of an op-amp IC2 whose excellent common mode rejection and high gain are used to isolate and amplify difference signals appearing between points (D) and (B) on the bridge network. The output from IC2 is compared with the oscillator signal in a phase-sensitive detector circuit using an exclusive OR gate IC4d. The output of this is fed to Tr4 and its associated l.e.d. and to IC4c connected as an inverter and so to Tr3 and its l.e.d. In use, the bridge is balanced when both l.e.d.s display the same brightness. The phase method of balance detection gives a sharper, clearer indication than that from the usual null detector.

Supply Splitter

The op-amps require both positive and negative supplies and to avoid the need for two separate batteries the incoming single 9 volt supply is "centre tapped" using IC3. The centre voltage is determined by R10 and R11 and IC3 is connected as a voltage follower to provide a 0 volt connection for the derived +4·5V and −4·5V lines.

Construction

The construction is conveniently divided into two parts: (1) the front panel which carries the ratio potentiometer, and the range switches with their "standard" components, as shown by the photograph and (2) the printed circuit board containing the active circuits and components, as shown in Fig. 5. The front panel and the p.c.b. are the same size (173mm × 84mm) and drop into slots in the Vero 202-21039N case, as shown in the photograph.

The first stage is to mark out and drill the front panel as shown in Fig. 6. This is best done by covering the front of the panel with masking tape, marking the hole positions on the tape and centre punching through it on to the panel. The tape may then be removed before drilling. Lettering is done using press-on lettering (I used Letraset Sheet 208) as shown in the photograph. The scale shown in Fig. 4 is full size

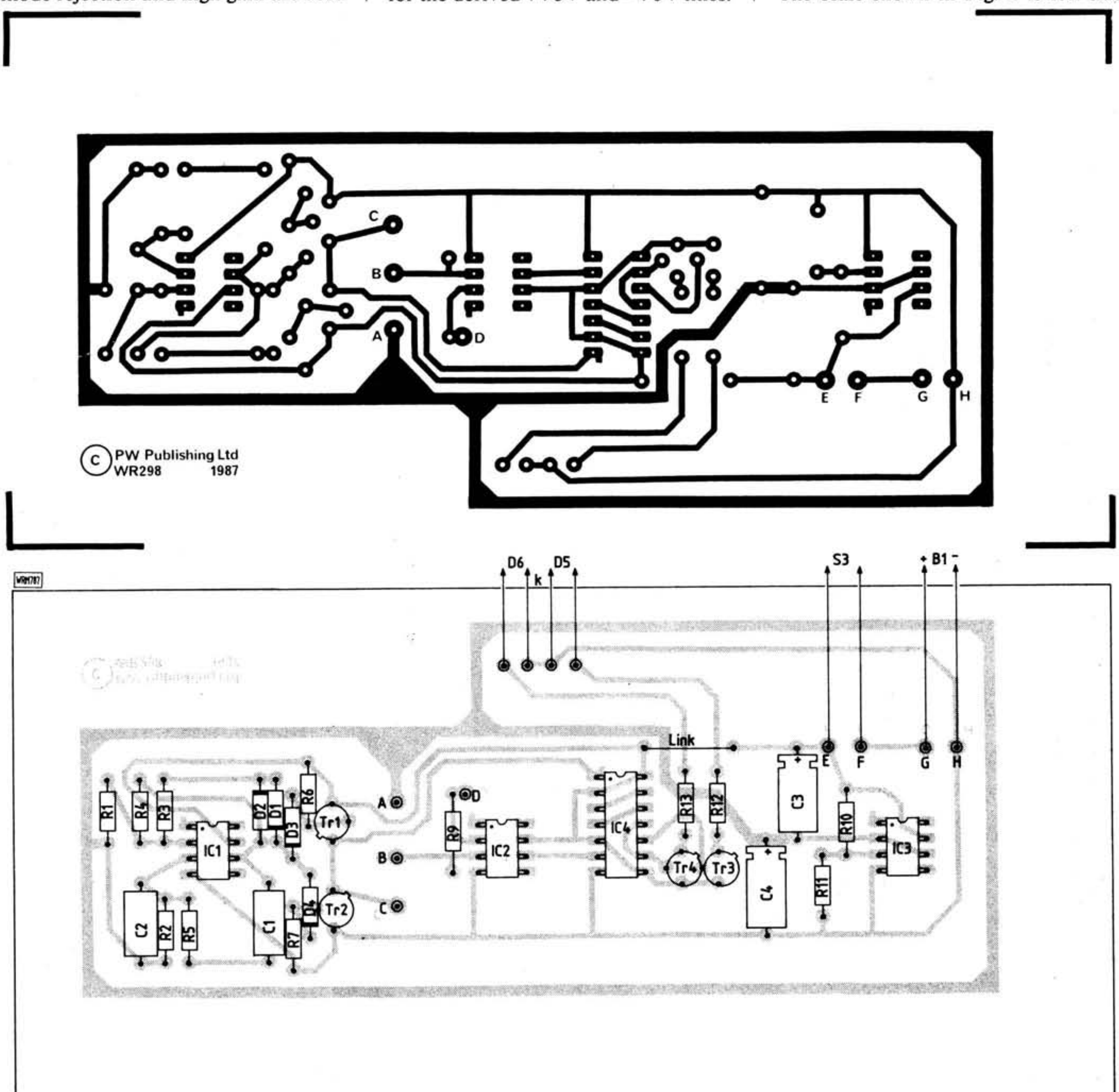


Fig. 5: Copper track pattern and component layout shown full-size

and may be photocopied, cut to size and fixed to the front panel using Cow Gum or Pritt Stick adhesive. Make sure that it is centred over the potentiometer hole and that the centre line is vertical.

Range Switches

The spindles of the rotary switches S1 and S2 should first be cut to length to suit the type of knob being used. The easiest way to wire each switch is to clamp it in a vice, by the spindle, keeping the tags uppermost. The switch can then be rotated to the most convenient position for soldering. It can be seen that the tags around the edge of the switch are numbered 1 to 12 and the tag near the centre is labelled "A".

Start by wiring S1 as this is the simplest. Cut the resistor leads (Rs1 to Rs5) to a length of 35mm. Bend one end of each resistor lead to hook through the appropriate switch tag and solder it in position. Repeat for all resistors. Cut a 75mm length of 20 s.w.g. tinned copper wire and bend it into a circle of diameter 22–23mm, overlap the ends and solder to form a ring. Carefully bend the end of each resistor lead over the ring, adjust and position the leads as necessary, then solder into position. This completes the assembly of S1.

The switches S1 and S2 have an adjustable rotation limit stop fitted so that the number of positions can be defined. To set the stop, remove the fixing nut and shakeproof washer completely and lift off the stop ring. Check the hole locations and, for S1, replace the stop ring with the leg in hole 6 (the 5th one going clockwise). For S2 use hole 10 (the 9th one going clockwise). The switch should be fitted to the front panel immediately, to avoid the stop ring accidentally slipping out and be-

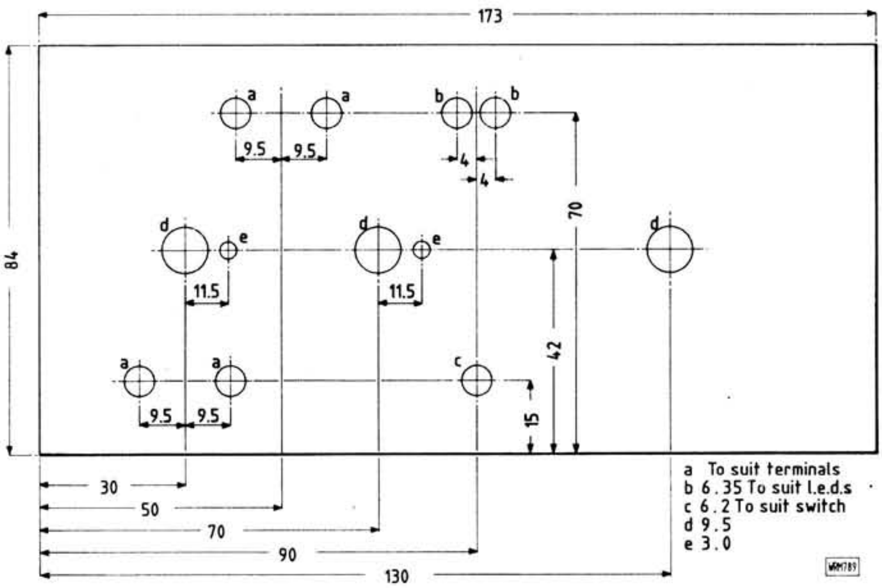
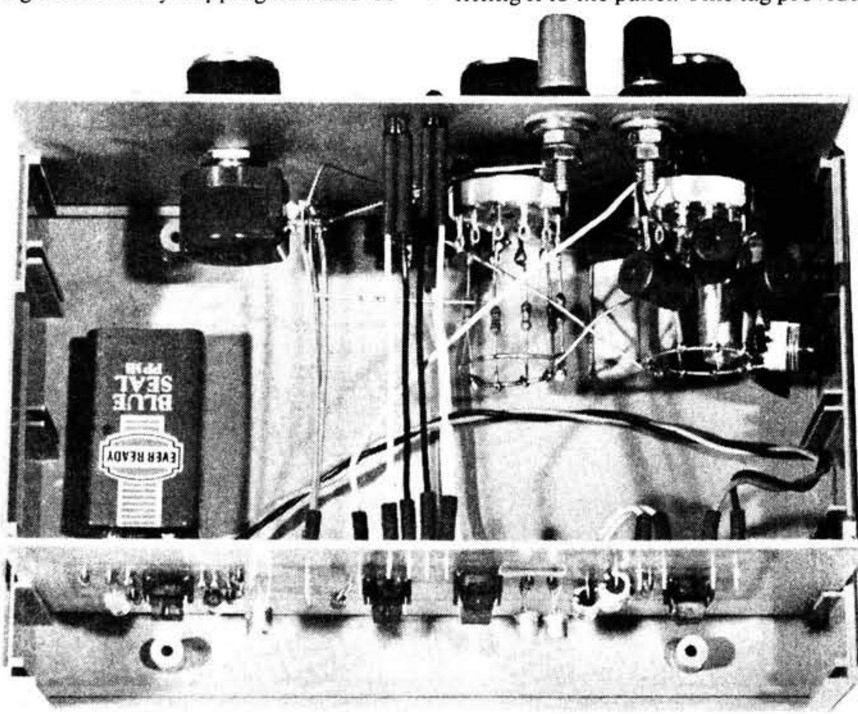


Fig. 6: Front panel drilling pattern

coming misplaced. It is important that the switch is correctly positioned with the locating peg immediately below the mounting hole before fitting the shakeproof washer and nut.

Repeat the above assembly procedure for S2. It will be necessary to solder mounting wires to each of the three inductors, these can then be mounted in the same way as the capacitors. Cut the leads to length and make another ring of wire to support the components as with S1. The trimmer capacitor may be soldered directly to the ring by its rotor tags and a lead taken from its stator tag to the switch, along with the 68pF capacitor, the parallel combination forming Cs5. Set the switch rotation stop to 10 and fit the switch to the front panel.

Next fit the UNKNOWN and EXT terminals, using insulated bushes. Take the on/off switch S3 and fit a large earth tag on the bush before fitting it to the panel. This tag provides the main earth connection for the front panel and should not be omitted. The remaining wiring is then completed using 20 s.w.g. tinned copper wire. To make a neat job it is helpful to pre-stretch the wire—just clamp the end of a 1 metre length in a vice and with a pair of pliers pull the other end until the wire just stretches and work-hardens to give a nice straight length ready for wiring.



Interior view showing range of switch wiring and layout

The Printed Circuit Board

The p.c.b. is loaded with components in the usual way and double-ended pins are inserted and soldered at the points where leads are taken to the front panel and battery. The front panel and p.c.b. are fitted in the case in the positions shown in the photograph and the connections between the p.c.b. and the panel are made using lengths of insulated wire, as straight and direct as possible. The l.e.d.s have their leads lengthened by soldering on pieces of insulated wire and are then mounted through the holes in the front panel, the leads cut to length and soldered to the pins on the p.c.b. The PP3 battery connector leads are connected to pins G and H as shown in Fig. 5.

Pointer Knob

Some improvisation may be needed here depending on the tools and materials you have to hand. The prototype instrument used an RS moulded knob, Style SK (RS 499-087), as this has a large flat flange on which to glue the pointer. The pointer is made from clear Perspex which may be obtained from a local sign manufacturer or cut from a sandwich box lid. The pointer is filed to shape and a cursor line scribed on the underside and filled with black drawing ink. A hole is drilled in the knob end, to clear the potentiometer spindle bush and the completed pointer is centred on the underside of the knob and fixed to the flange using Evostik impact adhesive.

Calibration

The calibration depends on the pointer knob being in the correct position on the potentiometer spindle. The easiest way to achieve this is to take two 1% 10kΩ resistors and connect one to the UNKNOWN terminals and the other to the EXT terminals. Switch S1 to L&C and S2 to EXT. Adjust the ratio potentiometer R8 for balance, loosen the pointer knob and re-tighten so that the pointer is on "1". Change over the two 10kΩ resistors and if necessary readjust the potentiometer for balance. If there is a slight difference then reset the pointer to a position midway between this position and "1". The knob setting is now complete.

To calibrate the 100pF range, switch S1 to L&C and S2 to 100pF. Connect a 100pF 1% (silvered mica) capacitor to the UNKNOWN terminals and set the ratio potentiometer to "1". Using an insulated trimming tool adjust the trimming capacitor (part of Cs5) for balance. This completes the calibration.

Using the *PW* "Itchen"

In normal use, the component to be tested is connected to the UNKNOWN terminals. It should be free of all other connections and the connecting leads kept as short as possible, particularly when measuring small values of capacitance. Set the Range switches to R or L&C as required (for R the L&C knob must be set to the "3 o'clock" position and for L&C the R knob to the "9 o'clock" position) and search for a balance point by rotating the ratio control over the whole of its range. If the balance is at one end, try changing the decade range to bring the balance point to within the 0·1 to 10 part of the scale. Note the scale reading at balance and multiply this by the range switch position to obtain the value of the component. If the component under test contains both reactive and resistive components, e.g. a very leaky capacitor, then, depending on the actual values, the balance of the bridge may become less sharp and there may also be some error in the reading.

The EXT terminals may be used by switching the L&C switch to EXT. In this position an external standard may be connected, the scale then indicates the ratio of the UNKNOWN to the external standards. It should be borne in mind that the oscillator, driving the bridge, has only a limited amount of power available and will become distorted should the external standard have a resistance or reactance of less than about 100Ω at 1·6kHz.

An additional use for the EXT facility is in matching components. Two components are connected to the EXT and UNKNOWN terminals and the difference can be read from the ratio scale. Differences of less than 0·5 per cent can easily be measured by this method.

Computer Generation of the Ratio Scale

The calibration of the ratio scale for the *PW* "Itchen" was calculated on a BBC B using the program given here.

```
100 REM WHEATSTONE BRIDGE
110 REM RATIO DIAL
CALIBRATOR
120 REM GW3JGA
130 RESTORE
140 INPUT "INPUT TOTAL
DEGREES "T
150 DATA
·01,·05,1,·15,·2,·25,·3,·4,·5,·6,·7,·8,·9
160 DATA
1·0,1·1,1·2,1·3,1·4,1·5,2,2·5,
3,4,5,6,7,8
170 DATA 9,10,15,20,50,100,-1
180 PRINT "RATIO", "DEGREES"
190 READ R
200 IF R=-1 THEN END
210 LET A=((T/(1+R))*R)-(T/2)
220 LET A=INT(A*10)/10
230 PRINT R,A
240 GOTO 190
```

Typical results:

INPUT TOTAL DEGREES ? 300

RATIO	DEGREES
1E-2	−147·1
5E−2	−135·8
0·1	−122·8
0·15	−110·9
0·2	−100·1
0·25	−90
0·3	−80·8
0·4	−64·3
0·5	−50
0·6	−37·5
0·7	−26·5
0·8	−16·7
0·9	−7·9
1	0
1·1	7·1
1·2	13·6
1·3	19·5
1·4	25
1·5	30
2	50
2·5	64·2
3	75
4	90
5	100
6	107·1
7	112·5
8	116·6
9	120
10	122·7
15	131·2
20	135·7
50	144·1
100	147

SHOPPING LIST

Resistors

0·25W 5% Carbon Film

470R	2	R12,13
3·3k	2	R6,7
33k	1	R1
100k	6	R2,3-5,10,11
10MΩ	1	R9

0·25W 1% Metal Film

100R	1	Rs5
1kΩ	1	Rs4
10k	1	Rs3
100k	1	Rs2
1MΩ	1	Rs1

1W Wire-wound Potentiometer

10k	1	R8 (RS 173-237)

Capacitors

Silvered Mica

68pF	1	Cs5 (part)
100pF	1	for calibration purposes
1nF	1	Cs4

Polystyrene 2·5%

10nF	1	Cs3

Polyester Film 5/10%

1nF	2	C1,2
100nF	1	Cs2 (5% preferred)
1μF	1	Cs1 (5% preferred)

Axial Electrolytic 16V

10μF	2	C3,4

Miniature Foil Trimmer

5·5-65pF	1	Cs5 (part) (RS 125-660)

Inductors

5/10% (5% preferred)

1mH	1	Ls1 Toko 181LY−102
10mH	1	Ls2 Toko 181LY−103
100mH	1	Ls3 Toko 181LY−104

Semiconductors

Diodes

Red l.e.d	2	D5,6
1N4148	4	D1-4

Transistors

BC108	8	Tr1,3,4
BC178	1	Tr2

Integrated Circuits

CA3140	3	IC1-3
4070	1	IC4

Miscellaneous

Cabinet Vero 202-21039N (Maplin Verobox 216 Order Code LQ09K) (1); p.c.b. (1); double ended pins (12); insulated 4mm terminals (4); knobs (3); battery connector (1); PP3 battery (1); 20 s.w.g. tinned copper wire; S1,2 1p 12w rotary (2); S3 s.p.s.t. min toggle (1).

Toko Inductors from Bonex Ltd., 102 Churchfield Road, Acton, London W3 6DH.

The method may be of use to constructors who wish to use an alternative type of wire-wound potentiometer having a different number of degrees of electrical rotation.

1. Determine the number of degrees of electrical rotation by mounting the potentiometer on a flat panel or piece of card and fitting it with a knob and pointer. Connect an ohmmeter between the slider connection and one end of the resistive track and determine the point at which the resistance is at zero—this is usually a few degrees before the mechanical limit of rotation. Mark this position on the panel. Repeat for the other end of the track and mark the panel again.

2. Using a protractor, measure the number of degrees of electrical rotation.

3. Load and run the program, enter the total number of degrees when requested.

4. The program prints a list of ratios from "0·01 to 1" through unity and up to "10 to 1" with their degree positions relative to the electrical centre of rotation.

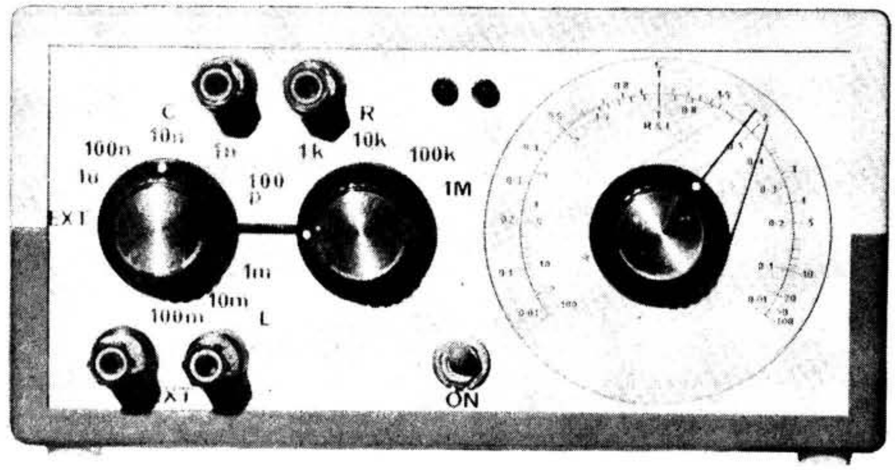
5. Now comes the tedious bit! Draw a circle on a sheet of paper the same size as the scale arc and, using a protractor, mark in all the ratio points working both ways from the top centre position. If you have access to a photocopier that can reduce originals, then it is easier to work to twice the required size and reduce it afterwards.

6. Place a sheet of drafting film over the drawing and draw, using black ink, the arc and ratio points. Label the tracing using press-on lettering and photocopy on to plain paper (reducing if necessary), cut out and mount the scale as described previously.

References

Electronic Measurements, Terman & Pettit, McGraw Hill. (a.c. Wheatstone Bridges), p.69.

A Capacitance and Resistance Bridge, J. T. Lawrence, *Practical Wireless*, Nov. 1970, p548.



Completed instrument showing front panel markings

How Much?
&
How Difficult?
£23
Intermediate

Antenna Radiation Patterns Computerised–3

by Dr. L. W. Brown G0FFD and F. C. Judd G2BCX.

The first two parts of this series have included about a dozen different radiation patterns produced by the computer and another selection will be featured in the fourth part. In this part we will deal with the "mathematical" formation of antenna radiation patterns and how the computer can be programmed to draw these patterns for us.

It does not require lengthy and difficult programs to get the computer to draw antenna radiation patterns. Indeed some of the programs consist of only a few entries as will be illustrated. It should be mentioned that the radiation pattern print-outs shown so far in these articles have been graphically enhanced so the programs for producing them were a little more complex.

To show how a computer can be used to draw antenna polar diagrams we take the familiar example of the radiation in the horizontal plane from a vertical dipole with a reflector spaced a quarter-wavelength away as shown in Fig. 3.1. A wave arriving at the reflector from the driven element will, because it has travelled a distance of $\lambda/4$, be 90 degrees out of phase with its incident radiation. Thus the re-radiation from the reflector is, in total, 90 + 180 = 270 degrees out of phase with that being radiated by the driven element.

At a large distance from the driven element and reflector (such that the signals from both can be regarded as parallel), the radiation from the reflector has travelled the extra distance d as shown in Fig. 3.1, and therefore suffers a further phase delay of a fraction of d/λ of one cycle, i.e. $360 \times d/\lambda$. From the geometry of Fig. 3.1, d evidently equals $\lambda/4 \times \cos(A)$. This further phase delay thus becomes:

$$360 \times d/\lambda = 90 \times \cos(A) \text{ degrees}$$

and the total phase difference at the distant point between the radiation from the driven element and its reflector is the above 270 degrees plus this further quantity i.e.

$$270 + 90\cos(A) \text{ degrees.}$$

The net effect at the distant receiving antenna is the algebraic sum of two radiations having this phase difference.

Reference to books on trigonometry will reveal that the sum of two signals of the same amplitude (E) and frequency, but with this phase difference, results in a net signal amplitude of

$$E \cos(\tfrac{1}{2}(270 + 90\cos(A)))$$

The polar diagram is the graphical plot of the variation of this quantity with the angle A.

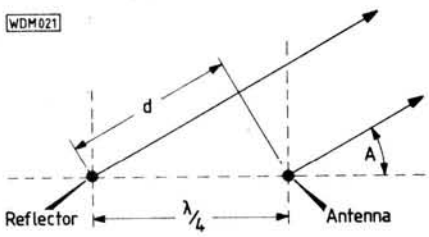


Fig. 3.1

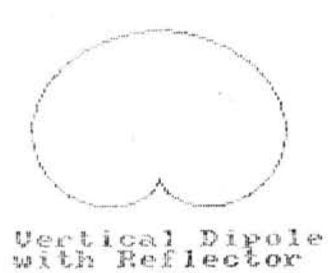


Fig. 3.2

The Computer Program

The listing below is a very simple program which causes the computer to plot a polar diagram resulting from the above in a matter of seconds. In fact it takes only a few moments to actually enter the listing.

```
10 CLS : DEG : ORIGIN 320,100
20 FOR A=0 TO 360
30 R=ABS(E*COS(135+45*COS(A)))
40 PLOT R*SIN(A), R*COS(A)
50 NEXT
```

Line 10 clears the screen, sets the computer to "degrees" and puts the polar diagram in a suitable position on the v.d.u. The "loop", Lines 20 to 50, then plots the polar pattern on the screen. The listing shown is for the Amstrad CPC464 BASIC, but with very little change can be readily adapted for BBC, Commodore and Sinclair users. The Amstrad screen is 640 pixels wide × 400 pixels deep, hence the numerical values given to the origin. So (E) in Line 30 should be given a numerical value to suit the size of the screen. A print-out from this program is shown in Fig. 3.2.

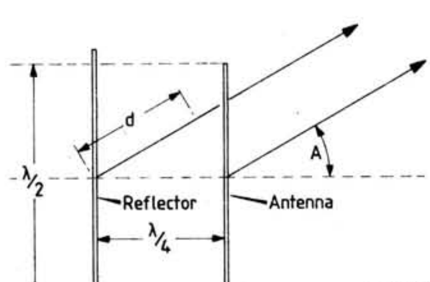


Fig. 3.3

By itself the vertical dipole in the above example radiates equally in all directions in the horizontal plane, i.e. it is omni-directional. If, instead of the vertical dipole and reflector we were using a horizontal dipole and reflector, as in Fig. 3.3, then the program for a polar diagram for this will need to be modified to take into account the fact that the dipole no longer radiates equally in all directions as it does when vertical. This is done by multiplying the polar diagram of the combination by the polar diagram of the dipole alone, the latter being the well known cosine (figure-of-eight) pattern. The listing for a horizontal dipole and reflector thus becomes;

```
10 CLS : DEG : ORIGIN 320,100
20 FOR A=0 TO 360
30 R=ABS(E*COS(A)*COS
   (135+45*COS(A)))
40 PLOT R*SIN(A), R*COS(A)
50 NEXT
```

in which (E) of the previous listing has been replaced by E*COS(A) to cater for the polar diagram of the dipole alone. It may be seen from the print-outs of the two programs (Figs. 3.2 and 3.4) that, as would be expected, the horizontal dipole and reflector give a narrower pattern in the horizontal plane than does the vertical arrangement but also has two small lobes at the rear.

INPUT Programs

Although graphically enhanced, all the polar diagrams shown in these articles stem from essentially simple programs similar to those shown above. We now introduce two simple programs which require an INPUT, a command allowing a specific parameter to be entered as a variable. Examples of this will be found in two programs, both of which are concerned with the vertical polar diagrams of horizontal and vertical antennas above a conducting ground.

In this instance the signal arrives at a distant point via two paths, direct and by reflection from the ground. The illustration for a horizontal antenna (Fig. 3.5) shows the two paths for an angle of elevation A. Whilst the ground reflected signal has travelled from AE to R(r), the direct signal has travelled from AE to Q(s). The reflected signal therefore travels an extra distance given by (r–s). From the geometry of Fig. 3.5, AE–O = O–I and I–P = 2H sin(A). Also AE–Q = P–R. Thus (r–s) = d in the illustration, i.e. the reflected wave travels an extra distance, d. It therefore suffers a phase lag of $360 \times d/\lambda$ degrees similar to the previous discussion. However, from the geometry of Fig. 3.5, $d = 2 \times H \times \sin(A)$ so the phase lag is:

$$360 \times 2 \times H \times \sin(A)/\lambda$$

In addition, there is a phase change of 180 degrees on reflection at the conducting ground. The total phase difference of the reflected wave thus becomes:

$$180 + 2 \times 360 \times H \times \sin(A)/\lambda$$

Again reference to books on trigonometry will show that the sum of two signals of the same frequency and

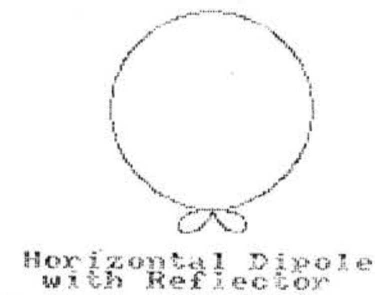


Fig. 3.4

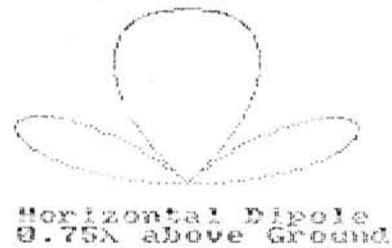


Fig. 3.6

amplitude (E) but differing in phase by this amount, results in a net signal of amplitude:

$$E \times \sin(2 \times 180 \times H \times \sin(SA))$$

and the polar diagram is the graphical plot of the quantity with angle (A). The listing becomes:

```
10 CLS : DEG : ORIGIN 320,100
20 INPUT "Height above Ground"; H
30 FOR A=0 TO 180
40 R=ABS(E*SIN(2*180*H*SIN(A)))
50 PLOT R*COS(A), R*SIN(A)
60 NEXT
```

in which the only new feature is Line 20 which invites the entry of the height of a dipole above ground and which may be entered as a whole number or fractions of a wavelength, e.g. 0.25, 0.5, 0.75, 1.0 etc. The INPUT command may vary with different computers, but very little alteration to the above listing should be necessary. A sample print-out from the program is shown as Fig. 3.6.

With a vertical dipole at a given height above ground we again need to multiply the above polar diagram by the polar diagram of the dipole less

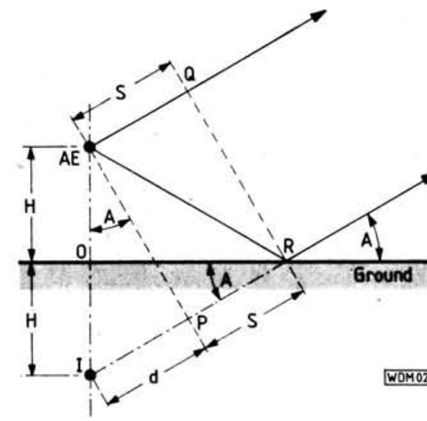


Fig. 3.5

Fig. 3.7

ground, i.e. by the usual cosine term and we then have the following listing for this antenna at a given height in wavelengths:

```
10 CLS : DEG : ORIGIN 320,100
20 INPUT "Height above Ground"; H
30 FOR A=0 TO 180
40 R=ABS(E*COS(A)*SIN
   (2*180*H*SIN(A)))
50 PLOT R*COS(A), R*SIN(A)
60 NEXT
```

in which (E) of the previous listing has been replaced by E*COS(A). All other remarks are the same. Remember (E) in each listing must be entered as a numeral, e.g. 100 (greater or smaller depending on the computer v.d.u.), and determines the magnitude of the displayed plot. A print-out from the above program listing is shown in Fig. 3.7. Note that annotations are not provided for in any of the above listings.

Part 4

Part 4 continues with further examples of antenna radiation patterns, including linear radiators (long wire antennas) and multiple element arrays.

CLUB NEWS

If you want news of radio club activities, please send an s.a.e. to our Poole office, stating the area of the country you're interested in. Club Secretaries, please keep the info coming to Elaine Richards G4LFM.

HF Band Antenna for Difficult Locations Part 3

In the final part of this series F. C. Judd G2BCX looks at discreet antennas and loops and suggests some further reading.

A reasonable proposition if you have a detached two-storey house or the same semi-detached house and are prevented by local restrictions from putting up masts is a wire "loop" all round the house as high as possible—part way round with a semi-detached house, of course. Close proximity to walls, behind which are bound to be electric light cables and water pipes, may have some detrimental effects but better a not-quite-so-good antenna than a very poor one, or none at all. The general idea is illustrated in Fig. 3.1a and 3.1b. To make the antenna as inconspicuous as possible, the wire need be only 18 or 20s.w.g. or equivalent. Good insulation on entry to the shack is essential especially if the antenna is to be operated harmonically and will, therefore, be voltage fed.

The same idea could well be applied to a bungalow, Fig.3.1c by placing the antenna support brackets upward instead of outward. For the benefit of the curious it could be described as a special lightning conductor, or a device to break up snow falling from the roof in winter!

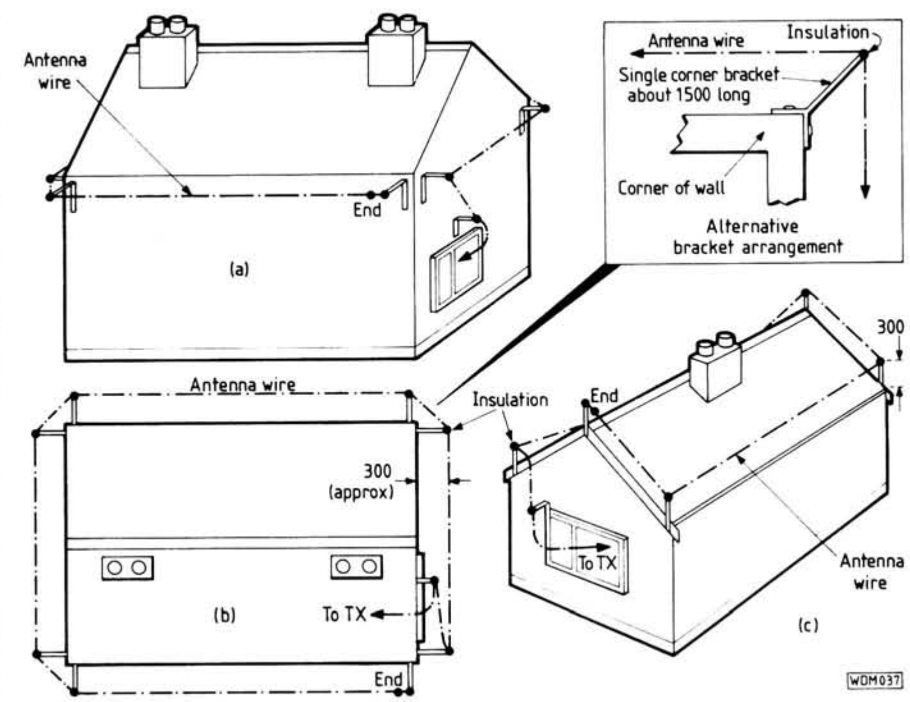


Fig. 3.1: How to loop an antenna around the house

A Discreet Antenna

This is just a simple practical idea that offers the possibility of a temporary arrangement that probably won't excite the neighbours or the local planning authorities. It would at least suffice until some permanent arrangement could be established. The "discreet antenna" may be about 40m long and consist of a very thin gauge wire strung between a tree, or a self-supporting mast and a high point on the house. End fed from a suitable a.t.u. it could be made to operate on a number of bands harmonically. This would mean voltage fed at high impedance for 3·5MHz and above, so good insulation will be necessary at the point of entry to the shack and at the far end. At 1·8MHz the antenna would be current fed and behave more or less as a quarter-wave tuned against ground, so once again a good earthing system is required. It would be advisable to tie some corks, or pieces of coloured plastics ribbon at intervals along the wire to prevent birds flying into it and suffering damage to themselves. This will, of course, make the neighbours aware that something is suspended across your garden but may keep them guessing for a while, at least until the planning authorities say "yea or ney" to a fully fledged antenna system.

Small Loop Antennas

These are intended for use on the higher frequencies, e.g. 21 and 28MHz, and could be accommodated in a fairly large loft.

A complete loop antenna is, in effect, a closed circuit using a single conductor of one or more turns looped so that its two ends meet. Loop antennas may take two different forms.

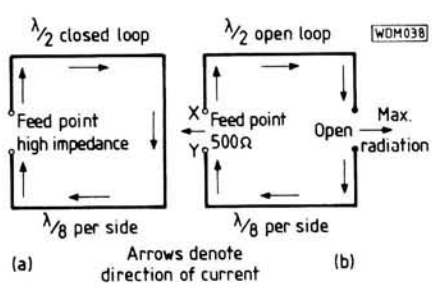


Fig. 3.2: A suitable loop for 21 or 28MHz

One where the total conductor length and maximum linear dimensions of a turn are small compared with the wavelength, and the other where these become comparable with the wavelength. Unfortunately such loops are large at the lower frequencies and are also directional. About the smallest practical loop, which is also the basis of the "quad" antenna, is a square with sides $\lambda/4$ long.

Loop antennas of this nature are more suited to 21 or 28MHz but could be accommodated in a loft. The smallest that might be considered has a total conductor length of $\lambda/2$ making each side $\lambda/8$ long. Unfortunately a completely closed loop of this size (Fig. 3.2a) has a very high impedance input but can be fed as a low impedance device providing it is open at the top as shown in Fig. 3.2b. The radiation resistance at a current anti-node, as at X–Y, which is also the impedance, is approximately 50 ohms. Maximum radiation is in either direction parallel to the plane of the loop as in Fig. 3.2c. The small size results in a loss of about 1dB with reference to a dipole when the field from such a loop is compared with maximum radiation from a dipole in either of its two directions.

One Wavelength Loops

Loops in which the conductor length is one wavelength—λ/4 per side if square—have characteristics that are different to those of half-wave loops. Three different loop systems are shown in Fig. 3.3 with (a) and (b) having a square format whilst (c) is triangular, an upturned delta, and with each side λ/3. The directional characteristics of these loops are opposite to those of a small loop, i.e. the radiation is maximum perpendicular to the plane of the loop. If the loops (a) and (b) are mounted vertically, with the feed point at the bottom, the radiation is horizontally polarised. If the loop is orientated so that the feed point is on one side then the radiation will be vertically polarised.

The total electrical length of a **one wavelength loop** is shorter than an equivalent straight wire for the same wavelength. For loops operating in the region of 28 to 30MHz, and where the ratio of the conductor length to wire diameter is large, the loop resonance will be:

Length (metres) = 306·3/f (MHz).

The radiation resistance of a resonant one wavelength is approximately 100 ohms so a matching device would be needed with a 50 ohm feed. Maximum radiation is broadside to the plane of the loop and about 2dB greater than that from a dipole.

The upturned delta loop Fig. 3.3c has a slightly lower feed impedance than the square loops but similar radiation characteristics. It can be combined with another to provide a two-band arrangement, e.g. for 21 and 28MHz. Radiation patterns (horizontal mode) for these loop antennas are shown in Fig. 3.4.

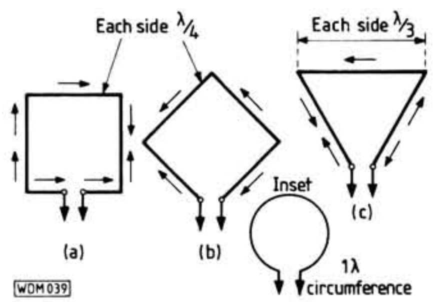


Fig. 3.3: Three different loop systems

Other Antennas for Restricted Space

In this part most emphasis has been placed on the "harmonic" type of antenna which lends itself to installation where space is limited because it can be made to operate on a number of h.f. bands. Multi-band verticals have been mentioned although planning permission may be needed to put one up in a garden. Loop antennas as in Fig. 3.2 and 3.3 that could be used indoors in a large loft space, offer possibilities for the highest h.f. bands only. However, there are many more that might be better suited to particular situations, far too many to include in this series. References to publications containing details of antennas for resticted spaces, as well as other relative information are listed below.

PW

Further Reading

1. Delta Beams for 10 & 15 Metres. GW2DDX, *PW*, March 81.
2. DX Dipole for Restricted Sites. G3XAA, *PW*, March 82.
3. Mini-X Beam for 10 Metres. GW2DDX, *PW*, March 82.
4. Antennas, Part 5. G2BCX, *PW*, 83. (General information. Harmonic Antennas.)
5. An ATU for Low Power. (1·8 to 30MHz). G4FAI. *PW*, April 83.
6. Aerial Tuner. G3OGR. *Out of Thin Air*, PW Publishing. (All h.f.Bands.)
7. Aerials for 160 Metres. G3WVR. *Out of Thin Air*. (Fair amount of space needed but interesting possibilities.)
8. *HF Antennas for All Locations.* G6XN. RSGB.
9. *ARRL Antenna Handbook.*

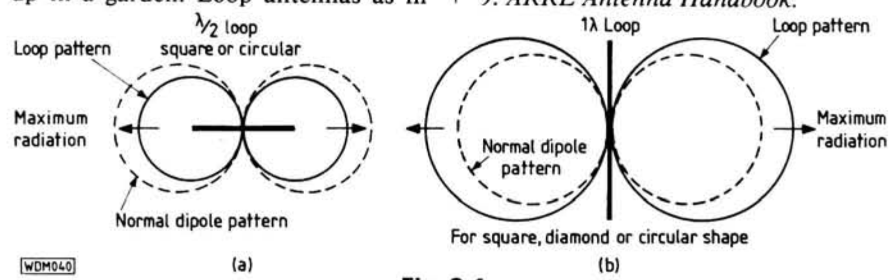


Fig. 3.4

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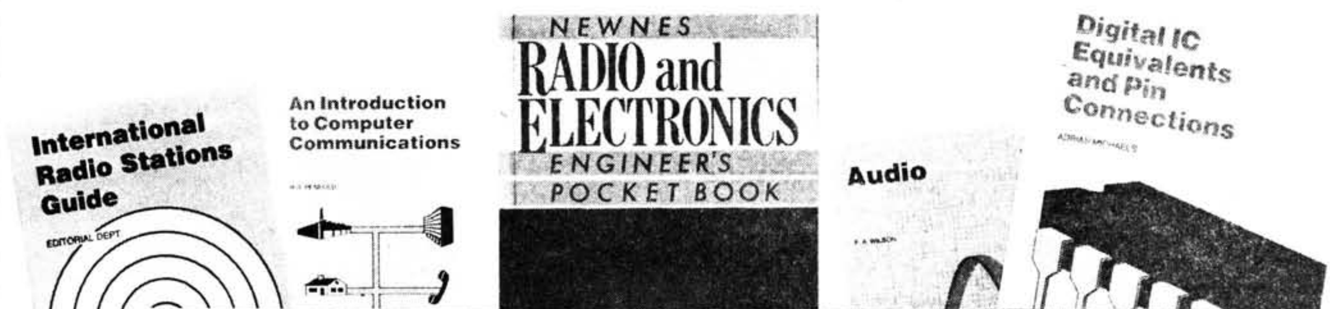

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PW REVIEW

In the first part of his review of the Lowe HF-125 communications receiver, Geoff Arnold G3GSR looked at the background to the design, and at the circuit techniques employed. This month, he describes the controls in more detail, and also reports on how the receiver performed on an antenna and on the bench in the PW *Test lab.*

Regular readers of my reviews will know that one thing which I always look for in a piece of radio equipment, particularly a receiver, is the ability to operate it in its basic form without having to read the handbook first. The HF-125 has been designed in such a way that this is perfectly possible.

Switch on, set the MODE switch according to the sort of station you want to listen to, turn the main tuning knob to give the required frequency on the l.c.d. readout (using the MHz UP/DOWN buttons as a band switch for large changes in frequency), set the VOLUME and TONE controls as desired. That's all there is to it! The MODE switch selects the optimum filter bandwidth automatically: c.w. and s.s.b. 2·5kHz; a.m. 7kHz; a.m.s. (synchronous a.m.) 4kHz; f.m. 12kHz. These are what a computer buff would call the default settings. You can select other filter bandwidths manually if you want to. The options are 2·5, 4, 7 or 10kHz on s.s.b. and a.m.; 400Hz or 2·5kHz on c.w. The button marked FILTER SELECT steps through the options at each push. If the MODE switch is moved to another position, the bandwidth returns to the default setting. On f.m., where the bandwidth is fixed, the FILTER SELECT button is used to switch the squelch circuit on and off.

Incidentally, in talking about the Detector option last month, a gremlin got at my w.p. keyboard. Synchronous a.m. and e.c.s.s. are **not** the same thing, as was implied there. In synchronous a.m., a carrier replacement oscillator in the receiver is phase-locked to the incoming carrier, and stays in lock for quite deep fades. In e.c.s.s., on the other hand, the normal carrier insertion oscillator provided for s.s.b. is used, and the operator has to adjust the receiver tuning to give exact zero-beat between the c.i.o. and the incoming carrier to achieve clear demodulation.

Using e.c.s.s. has the advantage that the receiver operates in the s.s.b. mode, and either sideband can be selected, for maximum freedom from interference. The accuracy achieved with manual tuning is satisfactory for speech reception, where the phasing between the carrier at the transmitter and at the receiver demodulator is not critical, and in fact frequency errors of up to around 100Hz are barely detectable unless you know the speaker at the distant transmitter. For the reception of music it's a different matter, as anyone who's ever tried to listen to music on an s.s.b. receiver will know. The phasing between the various harmonic and non-harmonic component parts of a musical sound must be preserved if it is not to sound entirely different. To maintain that phasing, the carrier oscillator input to the receiver demodulator must be in phase with the transmitter carrier oscillator. The phase-locked oscillator in the synchronous a.m. detector option for the HF-125 ensures that this happens.

Memories

To get back to the receiver controls, besides the FILER SELECT and MHz UP/DOWN buttons already mentioned, there is a button which switches a 20dB r.f. attenuator into circuit in the receiver front end, and a MEMORY SELECT button. The FILTER, ATTENUATOR and MEMORY SELECT buttons operate in a similar way, in that the first push converts the l.c.d. frequency readout into a status display for the button, and subsequent pushes cycle the particular function through its options. In each case the l.c.d. reverts to displaying tuned frequency if no buttons are pressed for three seconds.

The MEMORY SELECT button allows the operator to review the contents of the fifteen memories in the primary bank (in other words, what frequencies they are storing) whilst still listening to the frequency selected with the main tuning knob. One disadvantage of using a rotary switch, rather than push-buttons, for the MODE control is that the mode cannot be controlled electronically, and therefore the memories cannot store the mode along with the frequency. The rotary switch was chosen by the designers because it is cheaper, being self-indicating.

To retune the receiver to one of the memory channels, one simply presses the RECALL button whilst the appropriate memory contents are being displayed. The receiver can then be tuned manually away from that frequency without altering the memory contents. To replace the current memory contents by the new frequency being displayed, press the MHz UP and DOWN buttons simultaneously to give the STORE function. The receiver can be returned from a memory channel to the original manually tuned frequency by pressing the RESTORE button.

Four special operating functions are available on the HF-125 by pressing **and holding** the MEMORY SELECT button whilst pressing one of the other buttons. These functions are:

1. Select alternate memory bank (memories A.01 to A.15)—press MEMORY SELECT and FILTER SELECT.

2. Revert to standard memory bank (memories 01 to 15)—press MEMORY SELECT and RF ATTEN.

3. Front panel control lock (disables tuning control and functions)—press MEMORY SELECT and MHz DOWN.

4. Control unlock (reverses above operation)—press MEMORY SELECT and MHz UP.

The front panel can also be unlocked by changing mode.

The optional Technical Manual for the HF-125 details yet another set of functions for the front panel controls which provide a self-diagnostic test procedure, testing the m.p.u. system and its associated connections, providing alignment setting up signals, and testing the memories by filling them with alignment test frequencies. This feature means, according to the designers, that the initial alignment of the receiver can be completed in approximately three minutes, using a 50MHz frequency meter, a d.c. d.v.m., an h.f. signal generator and a SINAD meter.

The keypad option provides direct entry of tuned frequency in 1kHz steps, in addition to the standard tuning arrangements. The 12-button pad includes a * (star) key to cancel incorrect entries, and a # (hash) key to enter or action the selected frequency when it is below 3MHz. The receiver is retuned automatically when the last digit is pressed for frequencies above 3MHz.

Performance

The table of results of our laboratory tests shows that the pre-production model tested corresponded very closely with the manufacturer's specifications given in Part 1 of this review.

On-air testing of the receiver over all modes and bands gave generally very good results. The keyboard option for frequency entry is very useful, and is certainly something I would recommend. The automatic tuning rate adjustment for the main tuning knob I am less happy about.

To quote the User Manual: "The rate at which the receiver tunes when the tuning knob is rotated depends on the mode selected and on the speed of rotation of the knob . . . when the tuning knob is rotated rapidly the tuning rate increases. This allows a slow tuning rate for precise signal resolution coupled with the ability to reach the required frequency quickly. You may find at first that the receiver apparently 'jumps' in frequency when you are trying to tune a signal. This is because you have moved the tuning control quickly or in a jerky fashion and the receiver has increased its tuning rate. A smooth action will cure the problem . . .".

Well, I tried; believe me, I tried! The difficulty I found was that when searching a band, I would tune through a station, then stop and reverse towards the optimum point, whereupon the receiver tended to go to its high rate setting and shoot several kilohertz back past the wanted station. The tuning rate detector seems to be at its most sensitive when the direction of rotation of the tuning knob has just reversed. I very definitely feel that the detector needs to be made less sensitive, and I hope that the necessary change to the software can be made in the production models. It may then be necessary to fit a heavier flywheel tuning knob than at present used.

The synchronous a.m. detector option gives a noticeable improvement in the quality and consistency of audio output from broadcast station signals suffering some types of selective fading, but for others the benefit is less marked.

Spurious signals did not prove a problem. The User Manual lists six frequencies which are "slightly stronger" than the receiver background noise, of which only one falls within a broadcast band (21·587MHz) and one within an amateur band (28·800MHz). I found one more, on 29·695MHz.

The receiver case is coated with a heavy-duty epoxy paint finish, and the front panel is made from a scratch-resistant polycarbonate material, with the panel legends printed on the reverse of the polycarbonate so that they won't wear off in use. The case is fitted with a retractable tilt-bail foot, to raise the front panel level, but I found that this was rather too high for convenient use.

The quality of the audio output, though not "hi-fi", is certainly good enough to warrant the use of a reasonable quality 4Ω external loudspeaker for broadcast band listening.

When operating the HF-125 from a mains p.s.u., it is essential to have an earth connected to the receiver

★ OUR LAB TESTS

Sensitivity: (10dB s/n)

c.w./s.s.b.		a.m. (70% mod.)		f.m. (3kHz deviation)	
Freq. (MHz)	Input (μV)	Freq. (MHz)	Input (μV)	Freq. (MHz)	Input (μV)
0·5	0·25	1·0	0·72	29·5	0·2
1·9	0·22	2·5	0·59	for 12dB	
3·6	0·23	4·0	0·59	SINAD	
7·1	0·23	5·0	0·59		
10·1	0·22	6·1	0·59		
14·1	0·26	7·1	0·54		
18·1	0·26	9·5	0·77		
21·1	0·26	12·0	0·54		
24·1	0·26	13·7	0·60		
28·1	0·28	15·1	0·65		
		17·7	0·67		
		21·5	0·67		
		26·0	0·82		

S-Meter calibration: (At 14·2MHz u.s.b.)

Reading	Input required	
	dBm	μV
S1	—	
S2	−107	
S3	−102	
S4	−99	
S5	−95	
S6	−89	
S7	−83	
S8	−77	
S9	−72	55
S9+10	−62	
S9+30	−40	
S9+50	−18	

Audio output: 1·25W into 4Ω with 1·8% t.h.d.

Record output: 35–40mV

AGC threshold: 3μV (s.s.b./c.w.)

Dynamic range:

Signal separation from carrier (kHz)	Dynamic range (dB)
20/40	82
50/100	92

Frequency stability: Drift +55Hz in first 15 minutes; +25Hz in next hour at 14·2MHz

I.F. Rejection: >78dB

Image rejection: >89dB

Attenuator: 19dB at 14·2MHz

Selectivity:

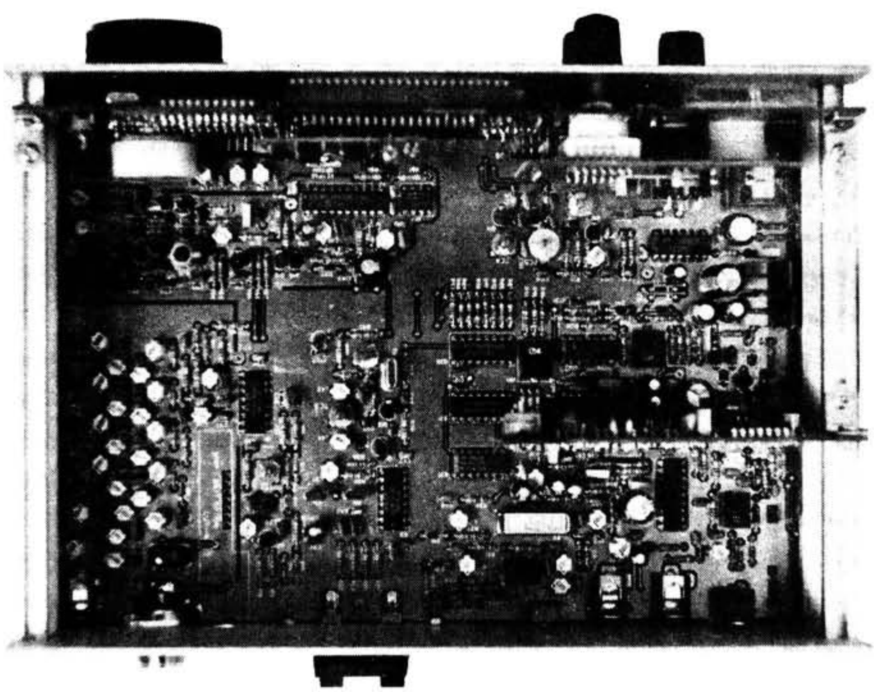
Filter (kHz)	Bandwidth (kHz)	
	−6dB	−60dB
2·5	2·8	3·7
4	6·0	9·5
7	8·2	12·2
10	11·4	36·6
400Hz (c.w.)	400Hz	—

Test equipment used:
Marconi Instruments 2017 and 2019 signal generators, TF2163S attenuator, 2435 frequency meter, TF2304 modulation/SINAD meter, TF893A power meter. Hatfield Instruments 3159 signal combiner.

GROUND terminal or the negative power supply rail. If this connection is omitted, the audio output suffers from a very strong "buzz" on all frequencies up to about 3MHz. It is understood that Lowe Electronics are modifying the design of the supplied mains adaptor to include an earth connection back to the third pin of the mains plug. In some situations, where the mains earth connection is noisy, it may be better to disconnect this third lead from the plug (taping it safely out of the way) and run a separate connection to a quieter earth point such as a buried rod or plate, if available.

The excellent User Manual comprises 24 pages in all, covering antenna and earth arrangements, power supplies, audio outputs, characteristics of the various signal modulation modes, controls and connections, operation, care of the receiver, optional units, a brief circuit description with block and circuit diagrams, and finally h.f. band plans for the amateur and broadcast bands. For anyone wanting more details of the HF-125, copies of the User Manual are available from Lowe Electronics, price £2.50, refundable against the purchase of a receiver.

A 41-page Technical Manual is also produced for the HF-125. This includes a full technical description of the receiver, semiconductor data, test and alignment procedures, parts list, p.c.b. layouts and circuit diagrams.



Prices

The HF-125 in its basic form, including the full complement of i.f. filters and an a.c. mains adaptor, is priced at £375.00. The Keypad Option K-125 (keypad and interface) is £59.50 including fitting. The Detector Option D-125 (f.m. and synchronous a.m.) is also £59.50. The Portable Option P-125 (NiCad pack, charger and active whip antenna) is £69.50.

Our thanks go to **Lowe Electronics Ltd., Chesterfield Road, Matlock, Derbyshire DE4 5LE, telephone 0629 2817** for the loan of the review receiver. ***PW***

PRODUCTS EXTRA

Computer Control for the Yaesu FRG-9600

We have just received news of a new product that brings computerised scanning within the reach of everyone. Called the Yaesu Controller, it consists of an eprom and a cable and it allows you to control all of the functions of the FRG-9600 from a BBC computer without using any sort of interface. The chip is inserted into one of the ROM sockets inside the BBC and the cable is plugged into the Analogue to Digital converter on the back of the computer and into the CAT socket on the scanner. Then, by simply typing *YAESU on the keyboard, the computer takes complete control and gives you all of the extra facilities that are usually only available when an expensive interface is used. We have not had time to fully evaluate this product but here are just some of the features that we think are noteworthy; 9 Priority channels, 255 active memory channels, memory storage on disc, step sizes infinitely variable between 0·1kHz and 99999kHz, on-screen S-meter, labelling of memories, Search and Store, direct access to spot frequencies by label or from the keyboard, new Osword calls, an attractive screen display with useful prompts and well thought-out menus.

The Yaesu Controller will also work with the FT-757GX and we believe that it will be compatible with the FT-767 and the FRG-8800.

We hope to be able to bring you a full review in the near future but until then, further details of this interesting new product, which retails at £40 plus £1 p+p, are available from Alan Hooker of ***Alan Hooker Electronics, 42 Nether Hall Road, Doncaster DN1 2PZ. (Tel: 0302 25690).***

OBITUARY
Eric Dowdeswell G4AR

Established readers of *Practical Wireless* will be saddened to hear of the death on February 2 of Eric Dowdeswell, who had been associated with *PW* for many years.

Eric, who confessed to being of "1918 vintage", was introduced to the mysteries of radio at an early age by his father, and had become a licensed radio amateur by 1939. This, plus his work on mechanical TV projection systems, led him into war service in army wireless workshops around the Middle East.

In Istanbul, he met and married a Greek girl, Christine, bringing her home when demob came in 1946. After working for a while on wideband amplifiers and oscilloscopes with Nagard, Eric became a Flight Radio Officer, and spent 14 years with Sudan Airways, based in Khartoum. There, as ST2AR, he gained over 200 certificates of achievement in working 273 countries on c.w. or s.s.b.

Returning to the UK in 1967, Eric became General Manager of the RSGB for a while, then joined the Editorial staff of *Practical Wireless*. When the magazine's offices were relocated to Poole in 1977, domestic reasons forced him to stay in London, and he became Technical Editor of *Electrical and Radio Trader*, an IPC Business Press publication, where he remained until his retirement in 1983. Eric's association with *PW* did not end when it left London, however, and he continued to write the *Amateur Bands* column each month, only giving up that task last autumn.

I shall remember Eric with great affection, for the kind way in which he initiated me into the mysteries of journalism when I joined *Practical Wireless* from industry in 1973, and for his meticulous attention to detail at all times. His former colleagues on the magazine join me in offering condolences to all his family. ***G3GSR***

ON THE AIR

AMATEUR BANDS

Reports to John Fell G0APL 14 Rectory Avenue, Corfe Mullen, Wimborne, Dorset BH21 3EZ

by John Fell G0APL

As I commence this month's report the much "media hyped" big freeze has given way to a period of relatively warm stable high pressure, which whilst producing plenty of thick fog has also resulted in some useful v.h.f./u.h.f. propagation affects.

For the v.h.f. and above minded amateur such "anomalous" propagation is vital to sustain contacts at distances in excess of "line of sight" limitations, created by the natural obstacle of the earth's curvature and resulting "bulge" block. A short review of the available propagation modes seems appropriate at this point so let's first consider unobstructed line-of-sight paths.

Radio waves, like light, travel in relatively straight lines so if the transmitting and receiving antenna heights are known the available workable distance can be calculated. The distance from each end of the link to the horizon is obtained from the formula:

$$D\ (km) = \sqrt{12{\cdot}75H}$$

where H is the antenna height in metres. Because of changes in air pressure, temperature and humidity along the path, the refractive index of the atmosphere can be modified leading to bending or refraction of the signal, allowing an extension to the true line of sight path. On average a figure for this extension amounts to a path length increase of 33 per cent or a modified refractive index figure of 1·33. The "practical" rule of thumb formula now becomes:

$$D\ (km) = \sqrt{17H.}$$

If you do the sums it will be clear that many contacts made exceed this figure by a very large amount and point to the existence of other extended range mechanisms. Signal strength decreases with distance and the loss or attenuation over a given path follows the so called "inverse square law"—each time you double the path length you attenuate the received signal by 6dB or four times. Path loss also varies with frequency—an unobstructed path of 16km would result in a signal attenuation of 90dB at 50MHz, 109dB at 432MHz or 137dB at 10GHz.

Tropospheric related signal enhancement can take place between high power/large antenna systems utilising *tropospheric scatter*, involving both stations focusing their signals onto a specific area in the troposphere, between 300–15 000m above sea level. Path losses are much greater than simple line-of-sight but by elevating high gain directional antennas and maintaining a low angle of radiation signals can be scattered from a common mid-path point by reflections off dust particles, clouds and refractive index variations that occur at these heights. The main drawback is the high effective radiated power requirements—e.m.e. stations or near equivalents.

Tropospheric bending is a mechanism that relates to weather conditions and allows much enhanced DX contacts, this time with even QRP stations. Normally air temperature decreases with increasing height but during abnormal conditions an abrupt increase in temperature at a particular height can occur causing a very large increase in refractive index. Slowly declining high pressure systems are ideal times to watch for this situation—if you have a really good elevated location this phenomena can also block the DX at such times if you happen to be above the active layer height!

Tropo ducting is a related form of propagation and together with *super refraction* occurs most frequently over sea paths. In this case two distinct temperature changes are present at different heights producing a duct effect which behaves in the same ultra low-loss manner as a waveguide. The duct height (distance between temperature change boundaries) determines the lowest frequency that may be propogated and frequently allows contacts over several thousand km well into the middle microwave regions. Super refractive ducting over the Mediterranean has pushed the world 10GHz DX record well beyond the 1000km mark with equipment that is now modest in e.r.p. terms for amateur stations.

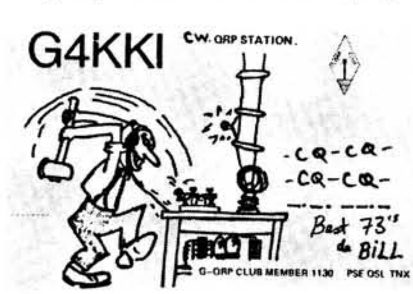
Other "natural" scatter modes include those caused by lightning and rain, the former can produce enhancement over 800km paths, due to localised ionisation near the strike, but please ensure your station is well away from this point. I would always recommend *total* disconnection of *all* station antenna feeds when there is the remotest possibility of lightning activity in the area. Rain scatter is usable with large cumulo-nimbus formations and allow extended contacts at 10GHz, where individual rain drops resemble significant portions of the wavelength in use. The recovered signals sound similar to the randomly scattered auroral signals at lower frequencies—weak and watery!

I have talked about F2, Sporadic-E, Transequatorial, meteor and auroral propagation effects in previous issues which really only leaves the more esoteric propagation enhancing agents such as man-made satellites, aircraft reflections and artificial auroras, with the principle exception of e.m.e. (earth moon earth). This is traditionally a technique that can only be utilised by above average equipped stations and to be fully exploited demands high power and highly directional/high gain antenna systems. Over the last 25 years several amateur stations worldwide have held contacts by back scattering radio signals from the Moon's surface. As this natural satellite is on average some 33 000km distance, with a surface resembling dusty concrete you can well imagine the requirements for extremely sensitive/low-noise receivers coupled to very narrow beamwidth antenna systems.

Multiple bays of Yagi antennas are common on 144 and 432MHz, with parabolic dishes dominating at 1·3GHz and above. Signals are randomly rotated in polarisation by the interactions with the earth's atmosphere, reducing the returned signals by anything up to the full cross-polarised amount of 30dB (1000 times)—not helpful when the signal is only a few dB above the background noise produced by the remnants of the "big bang" and other celestial r.f. noise sources.

Circular polarisation with ready control of sense (right or left hand) is now common on 1·3GHz and above, virtually illiminating the effects of polorisation shift. A 4m parabolic dish on 1·3GHz will have a gain of some 30dB over a dipole and can be readily built, fitted to a rotatable and elevatable mount and in conjunction with a reasonable GaAs-f.e.t.pre-amplifier will allow "backyard" e.m.e. receive capability.

A pair of 2C39 coaxial triode valves in a suitable cavity layout will produce some 150W of r.f. and will allow two-way contacts. If you really want to work DX above 50MHz e.m.e. is the *only* natural phenomena that will produce a WAC award for your shack wall—Have fun. I hope to contact some of you later on this year via the Moon, at least on 1·3GHz.



All equipment used at the QTH of Bill Stevenson G4KKI (RSARS 1596), including his QSL card, is homebrew

To the Band

Back to earth, but gently I hope, and several of you have taken the trouble to put pen to paper once again, plus some newcomers!

No top band offerings this month but judging by the reaction to a homebrew 1·8MHz project at my local amateur radio society there is certainly plenty of activity present and pending—a.m. is alive and kicking in 1987!

Bill Stevenson G4KKI, Swinton, Manchester sent in details of his "all homebrew" QRP 3·5MHz station which is based on the DSB80, Z match a.t.u. + accessories and loaded dipole antenna. Being ex-Royal Signals it's not surprising that the main activity involved c.w. contacts at the 2W level with amongst others GB2ALC, G6PJ, G3US, G3FBN, G4VDJ, GM3OXX/A, GM3MXN and G0AHW. Bill even makes his own QSL cards!

Angie Sitton BRS 88639 (but not for long) Stevenage has produced another detailed log, the result of countless hours of careful listening, an activity we could *all* profit from. First of all the really good news that the RAE results came eventually and hopefully by the time you are reading this several of you may well have worked Angie as a brand new G0—well done indeed! Logged on January 5 was K2MGR on c.w. at 2358. Newcomer s.w.l. **Leighton Smart**, Trelewis sent in details of loggings across the h.f. bands which include several 3·5MHz band contacts. Using a 25m long wire or his inverted V feeding a Grundig 1400SL RX, Leighton noted K1DQV/KP4 in QSO with LA6OJ at 2317 on Jan 9 together with NU4Q, W1OQQ, K9CAN and W1GNE—all s.s.b. The 11th produced N1CKU in QSO with GI4VKS with VE3RP working into DL on the 12th. To round things off VO1HN was heard working into G/EI on the 14th. Leighton is currently in the process of setting up a local s.w.l. club and has decided upon SWL 259 as his personal indentification. If you live in the Trelewis area why not make contact, the address is 33 Nantgwyn CF46 6DB.

The 7MHz produced a fair crop of DX for Angie Sitton with VK2LA, LU2DIO and HI1KHA (Dominican Republic) heard during late December on c.w. January 1 found HV3SJ, Vatican City, on s.s.b. (QSL via I0DUD) and K4FU on c.w. January 3 featured 8P6RE (Barbados), J87CD (St. Vincent QSL via Sue GW0ANT) and YX5D (Venezuela QSL Tony, Box 2289, Caracus). A final South American was HK3JZD, Columbia at 0042 on the 18th. Leighton Smart heard S79LJ at 2239 on the 10th, 4N7ZZ(?) at 2206 on the 12th, with JA5AQC deep in the noise, and UP2BAY at 2121 on the 13th. Leighton asks if s.s.b. is permitted on 10MHz and whilst he has logged stations using this mode, the band is designated for narrow band modes i.e. c.w. Stepping up to 14MHz, we once again find the bulk of the activity with 13 stations listed by Angie Sitton including HF6ABH and close neighbour VP8LP on January 1. ZS1RR, 5U7IL, 5A6XF and 7X2LS showed up on the 4th. Israeli special call 4Z7T was logged on the 11th with ZF6AD and Seychelles Islanders S79SHW and S79V on the 11th and 13th. Bill Stevenson had a solitary contact on 14MHz with YL of OH6LC. Leighton Smart also listened on 14MHz, with N7 CSJ/MM (Indian Ocean) observed at 1436 on 13 January. AA4AH, logged at 1236 on 15 January, provided a new US prefix and Leighton wonders if this was a special event station?

21MHz opened up for Angie Sitton with Brazilian special call ZX2U on 4 January, 9J2BO Zambia on the 11th together with ZS1JW. The 18th produced a very weak VU2SMN at 1124, SC0IH (QTH Rhodes) at 1246 and YC0MCA with YB0ZA at 1124 and 1133 respectively.

28MHz saw some decline from the levels of October/November but none the less produced some interesting traffic. Angie heard SV1VR at 1133 on 1 January. **Phil Dykes** G4XYX, Poole, completed several QSOs at the 10W p.e.p. (max) level in conjunction with his 2-element cubical quad. Amongst the total DJ17U was worked on 19 November EA2PZ on 25 November, HG4XX plus IU0UWS (Sardinia Special call) on 14 December.

SM5DYC exchanged on 27 December, UA6ADC on 4th, WD8IXE/J6L (St. Lucia) on 2nd and YU3HR on the 14th.

50MHz continues to provide activity and it is hoped that the DTI will soon clarify the further development of the band in the UK and allow general access to all licence categories. The UK 6m group has been actively promoting the band and has been instrumental in providing equipment for amateur activity in Malta. It is hoped to install a beacon and have stations active from the island during the coming months. Finland is also thought to be considering licencing amateur operations on 50MHz

From Now On . . .

This is the last "Amateur Bands" written by John Fell. We would like to thank him for his past efforts, and to thank all those who sent reports to him.

Future h.f. band reports should be sent to **Paul Essery G3KFE, c/o Practical Wireless, Enefco House, The Quay, Poole, Dorset BH15 1PP,** for inclusion in "On the HF Bands".

Reports of activity at v.h.f. and above should be sent to **Norman Fitch G3FPK, 40 Eskdale Gardens, Purley, Surrey CR2 1EZ.**

All reports should reach their destinations by March 27.

RTTY

Reports: as for VHF Bands, but please keep separate.

by Ron Ham BRS15744

Thanks to the help from members of the Gilwell Park Scout Amateur Radio Group, **Steve Beazley**, Chingford, has been able to add RTTY to his s.w.l. station. Steve has been active for about 9 years and currently uses a Trio R300, with a Datong converter for 144MHz, with a full size G5RV antenna for the h.f. bands, a long wire for 3·5MHz and a Slim Jim for the v.h.f. band. "During the past two months, I have logged over 70 RTTY stations on 144MHz, including F6 and PE1 on November 29," wrote Steve on January 18. He uses a Commodore 64 computer and Scarab software for RTTY and the 4 countries he copied on 3·5MHz and the 17 on 14MHz, between January 15 and 18 have been included, along with Len Fennelows and mine, in the list of RTTY prefixes logged throughout this period, Fig. 1.

The majority of amateur stations do send QSL cards to confirm contacts or in reply to a meaningful reception report and these cards are normally accepted as proof for the number of achievement certificates, which are offered by various organisations. RTTY enthusiasts wishing to know more about the availability of national and international awards, can look forward to the publication of a new book entitled, *RTTY AWARDS,* written by Ted Double G8CDW, the Awards Manager of the British Amateur Radio Teleprinter Group. Ted has listed the qualifications required to earn a certificate from radio societies in Belgium, France, Germany, Holland, Japan, Scandinavia, UK, USA and the USSR and has included the address of the organiser to contact. Enquiries about the price and delivery of this book should go to Peter Adams G6LZB, 464 Whippendell Rd., Watford, Herts WD1 7PT.

"There is always something interesting to be found on 14MHz," wrote **Len Fenelow G4ODH,** Wisbech. He logged RTTY signals from 47 countries, ranging over all continents on 14MHz during the month prior to January 18, and that included a new one 9X5 Rwanda. He also copied RTTY from 7 countries on 3·5MHz, 11 on 7MHz and 3 on 21MHz. Activity on 21MHz has been sparse to say the least. "The African QSO was interesting, it was in German between and emigrant Swiss and a fellow national in Berne," said Len.

Although I received RTTY from 25 countries, around 14·090MHz, during this period, the majority were European. The exceptions were Sri-Lanka copied at 1532 on January 17 and Guatemala, a new one for me on 21MHz at 1636 on the 25th. I was lucky to read this one because of QSB, however, I left my R2000 receiver

Fig. 1: The RTTY chart

Country (Prefix)	Frequency (MHz) 3·5	7	14	21	28
Australia (VK)			X		
Austria (OE)	X		X		
Balearic Is (EA6)			X		
Belgium (ON)	X				
Brazil (PY)			X		
Bulgaria (LZ)			X		
Canada (VE)			X		
Canary Is (EA8)			X		
Ceuta & Melilla (EA9)			X		
Cuba (CO2)			X		
Czechoslovakia (OK)		X	X		
Denmark (OZ)	X		X		
East Germany (Y2)	X	X	X		
England (G)	X	X	X		
Finland (OH)		X	X		
France (FE)	X	X	X		
Gozo & Comino (9H4)			X		
Greece (SV)			X	X	
Guatemala (TG)			X	X	
Guernsey (GU)		X			
Holland (PA)	X	X			
Hungary (HA)			X		
India (VU)			X		
Indonesia (YB)			X		
Israel (4X)			X		
Italy (I, IK, IT)		X	X	X	
Kenya (5Z)			X		
Lebanon (OD)			X		
Luxembourg (LX)			X		
Moldavia (UO)			X		
Morocco (CN8)			X		
Nigeria (5N)				X	
Northern Ireland (GI)			X		
Norway (LA)	X	X	X		
Oman (A4X)			X		
Poland (SP)	X	X	X		
Portugal (CT)			X		
Rhodes (SV5)			X		
Rumania (YO)			X		
Rwanda (9X5)			X		
San Marino (T7)			X		
Sardinia (IS)			X		
Scotland (GM)	X		X		
Sicily (IT9)		X	X		
South Africa (ZS)			X		
Spain (EA)		X	X		
Sri Lanka (4S)			X		
Sweden (SM)	X	X	X	X	
Switzerland (HB)		X	X		
Ukraine (UT)			X		
USA (W)			X	X	
USSR (UA, UB)			X		
Wales (GW)	X		X		
West Germany (DF, DJ, DL)	X	X	X		
Yugoslavia (YU)		X	X		

Country (Prefix)	Frequency (MHz) 3·5	7	14	21
Australia (VK)			X	
Austria (OE)			X	
Bulgaria (LZ)			X	
Canada (VE)			X	
England (G)			X	
Finland (OH)			X	
France (FE)			X	X
Hungary (HA)			X	
Italy (I, IK, IT)		X	X	
New Zealand (ZL)			X	
Norway (LA)			X	
Poland (SP)			X	
Portugal (CT)			X	
Scotland (GM)		X	X	
Sicily (IT9)			X	
Spain (EA)			X	
Sudan (ST)			X	
Sweden (SM)	X			
Switzerland (HB)		X	X	
Tanzania (5H3)				X
USA (W)			X	
West Germany (DF, DJ, DL)	X	X	X	

tuned to his frequency and when he returned to a Brazilian station his country and callsign, TV9VT, came during the upward peak of the fading.

At 0837 on December 30, I logged strong signals from SK6SA sending "MAILBOX LITHENBURG AMATEUR RADIO GROUP". Some text that amused me early on January 14 was, "THAT IS MY 'WEAPONS' HI HI," said an OH9 to an LX after describing his equipment.

"AMTOR traffic has been rather more frequent this time," said Len, whose consistency and patience rewarded him with the 22 prefixes listed in Fig. 2.

Fig. 2: The AMTOR chart

This column is remaining unchanged, so keep your reports coming to Ron— by March 27 this month.

SPACE & SATELLITES

Reports to: Pat Gowen G3IOR, 17 Heath Crescent, Hellesdon, Norwich, Norfolk NR6 6XD.

by Pat Gowen G3IOR

OSCAR-10

Despite all of the problems of failure to accept commands into the now almost completely depleted IHU memory, AMSAT-OSCAR-10 seems to have failed into the ideal mode. The transponder is now fixed in the high-power mode of Mode "B" (435MHz up, 145MHz down) and excellent two-way QSOs are being effected.

The beacon is on low power, but with a plain unmodulated carrier only, this giving no indication of the battery state, temperature, attitude, spin rate, or any other parameter. The spare battery pack is locked in, and should last for a considerable time. Unless the power supply is badly depleted, and a switch mode effected (there being no way to revert) by a high power station using the transponder during an eclipse period, there is no reason to believe other than that the satellite may continue to give good two way communication for a considerable period. To quote **Peter Guzelow DB2OS** "The last command I sent was the RESET command, so the IHU is stopped. The output ports are reset, which turns the transponder and beacon on. There is no danger that further memory errors will change this status. In other words, the IHU is out of operation . . . the transponders will be on for ever . . . if the battery holds".

As no means is left to turn the satellite to effect optimum earth pointing of the antennas, there will naturally be periods when severe spin modulation will disrupt the QSO quality. Already in late January it would appear from observational behaviour that precession (a "wobble") is beginning to occur, and this will additionally mean a gradual slowing of the spin rate.

The impossibility of commanding the magno-torquers to re-orientate the satellite to steer the solar panels to face the sun will additionally mean that there will be times when even if out of eclipse the satellite should not be used. At the time of writing, all users are urgently requested not to run more than 100W e.r.p. and not to use the transponder at all when the satellite is in shadow. All these periods will be advised on the AMSAT nets and by AMSAT observers via the satellite itself to update the bad sun angles and mean anomaly periods at which the eclipses begin and end.

Already the command team consisting of ZL1AOX, VK5AGR and DB2OS have calculated when these periods might be, and the following schedule is implored to maintain the life of the satellite.

PERIOD 1987	MA for use from/to	Reason
Jan/Feb	20–220	Avoids eclipses
Mar/Apr	DO NOT USE	Low to zero solar illumination
May/Jun	30–220	Avoids eclipses
Jul/Aug	40–220	Avoids eclipses
Sep/Oct	DO NOT USE	Low to zero solar illumination
Nov/Dec	Await further information nearer to the date.	

Jim Miller G3RUH, has kindly sent us in a fully detailed forecast which is produced as Fig. 1.

On the user side, an interesting report is sent to us by **Paul Thompson G6MEN**, of the Civil Service Amateur Radio Society. To celebrate the 25th anniversary of the launch of OSCAR-1, GB1CSR was activated on OSCAR-10 and the RS satellites, and worked over 200 stations. On RS-5 and 7 prefixes included EA1, EA6, YU, LA, DL, SM, ON, OZ, CT, F, PA, UA3, UA4, UB5, UA9, HB9, W1, and VE1. Using OSCAR-10 they worked I, OZ, ON, OE, DL, LU, W3, W9, ZS6, PT2, VK6, and the best of all V85GA in Brunei. Fuji-OSCAR-12 was monitored, but the system was not felt to give a good enough downlink to attempt QSOs as, in particular, an ear-splitting local thermostat was giving regular 2 minute bursts of S9 noise across the entire radio spectrum!

"RS" Satellites

RS-1 is still being heard sending "55" and "5015" on 29·402MHz whilst in sunlight. The transponders are on from time to time on RS-5 and 7 to permit loading and battery charge status, but no official schedule for use is given this eclipse period. A new period of six weeks of full time operation will commence in the third week of March. At the time of writing, RS-9 and 10 are still awaited, the latest word from UA3CR indicating a further slight non-technical delay.

Fuji

FO-12 maintained its provisional schedule for about one week, and then reverted to a week's full time Mode "JA". It is understood that the new satellite has still to be officially handed over to the user community, and that experiments are still proceeding to load the digital software and to evaluate the charge/discharge cycle optimum ratio.

UoSATs

To provide the optimum coverage of space news and up-to-date Keplerian elements, Uo-9 will transmit a Keplerian data bulletin each alternate Friday through Sunday, whilst Uo-11 will provide a news bulletin each week. To experiment with the possibilities of magno-torquing and gravity gradient, Uo-11 will be de-spun and commanded to invert, that is to go "upside down". This will undoubtedly upset the signal, and may produce QSB. The TLM and WOD will indicate the satellite position. Normally, although the deviation is far greater, Uo-11 is some 3dB weaker than its older brother, as it is higher and hence the path loss is greater.

MIR

In addition to our news in "What goes up" we have word that a large scientific Astrophysics Laboratory package is being prepared to send up to MIR, to dock onto one of the ports in the same manner as the COSMOS satellite was united with SALYUT-7. Whether we shall have a new powerful h.f. beacon is yet to be known.

Views of ARSENE

In the February issue, we gave some details of the progress of the "ARSENE" AMSAT—F satellite and its control station, now being developed by CNES for a future *Ariane* launch. Thanks to **Bernard Decaunes HB9AYX**, we now have been sent some photographs that he took re-

1987 Date Mondays	Arg Peri AP	Sun's Position SAZ	SEL	Spacecraft Attitude ALON	ALAT	Best MA MINsq	Solar Illum. SA	ILL%	Eclipse Data MA in	MA out	Dur Mins	Recommended Use MA-MA
1987 Jan 5	174	72	2	154	15	75	7	99	220	240	54	
1987 Jan 12	176	78	4	154	14	73	15	97	224	242	50	
1987 Jan 19	178	84	6	153	14	72	22	93	227	244	45	Jan/Feb
1987 Jan 26	180	90	8	152	13	70	29	88	231	246	42	--------
1987 Feb 2	181	96	10	151	13	69	36	81	233	247	39	20 - 220
1987 Feb 9	183	102	11	150	12	68	43	73	236	249	36	
1987 Feb 16	185	109	12	150	12	66	50	64	238	250	34	
1987 Feb 23	187	115	13	149	12	65	57	54	240	251	32	
1987 Mar 2	189	121	13	148	11	64	64	44	241	252	31	
1987 Mar 9	191	128	14	147	11	63	71	33	243	253	30	
1987 Mar 16	193	134	13	146	10	61	78	21	244	254	29	Mar/Apr
1987 Mar 23	195	140	13	145	10	60	84	10	245	255	29	--------
1987 Mar 30	196	147	12	144	9	59	86	7	246	0	28	D O
1987 Apr 6	198	153	11	144	9	58	80	17	247	1	28	N O T
1987 Apr 13	200	159	10	143	8	57	74	28	248	2	28	U S E
1987 Apr 20	202	165	9	142	8	56	67	39	249	3	28	
1987 Apr 27	204	171	8	141	7	54	60	50	250	4	28	
1987 May 4	206	177	6	140	7	53	54	59	250	5	28	
1987 May 11	208	183	5	139	6	52	47	68	251	5	28	
1987 May 18	210	189	3	138	6	51	40	77	252	6	28	
1987 May 25	211	194	2	138	5	50	33	84	253	7	28	May/Jun
1987 Jun 1	213	200	1	137	5	49	27	89	253	8	29	--------
1987 Jun 8	215	206	-1	136	4	48	20	94	254	9	29	30 - 220
1987 Jun 15	217	212	-2	135	4	47	13	97	255	10	30	
1987 Jun 22	219	217	-3	134	3	46	7	99	0	11	30	
1987 Jun 29	221	223	-4	133	3	45	0	100	1	12	31	
1987 Jul 6	223	229	-4	132	2	44	-7	99	2	13	32	
1987 Jul 13	225	235	-5	131	2	44	-13	97	2	15	33	
1987 Jul 20	227	241	-5	131	1	43	-20	94	3	16	34	
1987 Jul 27	228	247	-5	130	1	42	-27	89	4	18	36	Jul/Aug
1987 Aug 3	230	252	-5	129	0	41	-33	83	6	19	37	--------
1987 Aug 10	232	258	-5	128	0	40	-40	76	7	21	39	40 - 220
1987 Aug 17	234	264	-4	127	-1	39	-47	68	8	23	42	
1987 Aug 24	236	270	-4	126	-1	39	-54	59	10	26	44	
1987 Aug 31	238	276	-3	125	-2	38	-60	50	12	29	47	
1987 Sep 7	240	282	-2	124	-2	37	-67	39	14	32	51	
1987 Sep 14	242	288	-1	124	-3	36	-74	28	16	36	54	
1987 Sep 21	243	294	0	123	-3	36	-80	17	19	40	59	Sep/Oct
1987 Sep 28	245	300	1	122	-4	35	-86	7	22	45	63	--------
1987 Oct 5	247	306	2	121	-4	34	-84	10	26	51	68	D O
1987 Oct 12	249	312	2	120	-5	34	-78	21	30	57	73	N O T
1987 Oct 19	251	318	3	119	-5	33	-71	32	36	64	77	U S E
1987 Oct 26	253	324	4	118	-6	32	-64	43	43	73	81	
1987 Nov 2	255	330	4	118	-6	32	-58	54	52	83	84	
1987 Nov 9	257	336	5	117	-7	31	-51	64	61	93	86	
1987 Nov 16	258	342	5	116	-7	31	-44	73	74	106	88	Nov/Dec
1987 Nov 23	260	349	5	115	-8	30	-36	80	86	119	90	--------
1987 Nov 30	262	355	5	114	-8	30	-29	87	100	134	93	Await
1987 Dec 7	264	1	4	113	-9	29	-22	93	114	149	96	further
1987 Dec 14	266	8	4	112	-9	29	-15	96	127	164	99	notice.
1987 Dec 21	268	14	3	112	-10	28	-8	99	141	178	101	
1987 Dec 28	270	20	2	111	-10	28	-1	100	153	190	99	

Fig. 1

cently on a visit to F8FV in Toulouse, which show the achievements to date.

A section of the control room at Tolouse "Sup Aero" Technical High School, with the terminal computer used as a simulator for the command coding and decoding between the ground control (called 'Stella') and the ARSENE satellite is shown in Fig. 2. The upright panel is a seven segment l.e.d. indicator for visual indication warning of channels, such as the U batteries, the Solar Panel current, the spin rate, etc. and with status points for the repeater, temperature, motor, battery, and the p.a.s. on 145MHz and 2·4GHz.

The pair of Intel consoles (microprocessors), the drawing desk, and the console of the forthcoming "Stella" ground control, which will house an Icom transceiver, and already contains a functional az-el antenna command control system is shown in Fig. 3.

A partial view of the ARSENE construction room, also at the Technical High School "Sup Aero" in Tolouse, with a central wrapped prototype section under investigation is shown in Fig. 4.

The photographs in Figs. 5, 6, and 7 are self obvious, as they have captions that are easily understandable in French or English.

A model of the ARSENE satellite itself, in the solar panels deployed configuration, but with prototype antennas is shown in Fig. 8.

The present project status has:

The pyrotechnical deployment of the solar cells functioning.

The specialist pneumatic attitude building control underway

The Apogee kick motor (called "MARS") already received from "SEP" (the Societe Europenne de Propulsion)

Numerous modules in the final stages, and even the p.c.b.s tested, with only the components to be mounted and soldered to the space-quality standard required.

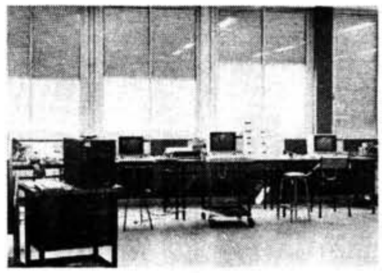


Fig. 2

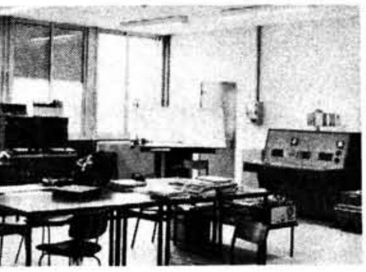


Fig. 3

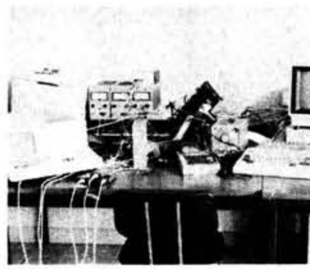


Fig. 4

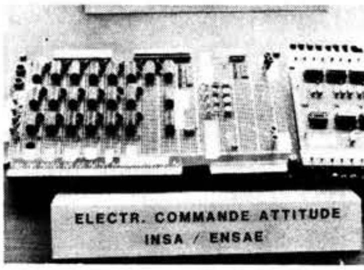


Fig. 5

Fig. 6

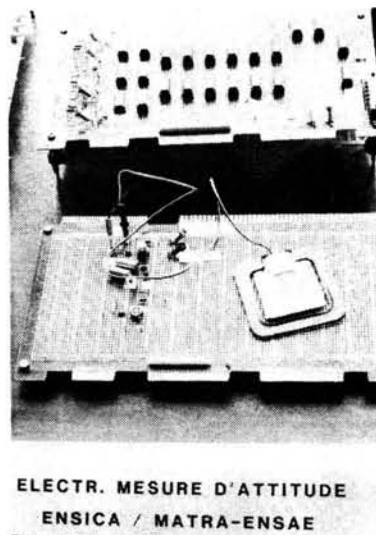


Fig. 7

Moonbounce in 1987

Moonbounce is normally a very "hit and miss" form of communications for the radio amateur, as the limitations of power and antennas imposed by the depth of one's pocket and the area of real estate available for large antennas mean that most QSO are very marginal at the best of times. EME stations speak of "good" and "bad" conditions, in the same manner that h.f. operators refer to the variables caused by the ionosphere, or v.h.f. terrestrial users speak of tropospheric changes affecting their activities.

At first sight, the e.m.e. path would not appear to change very much, apart from the 2dB enhancement of the returned signal created when the moon is at perigee, brought about by the inverse square law advantage when the moon is closer to earth. All e.m.e. operators know that this is not the only factor, as often the moon will be at optimum perigee, yet echoes are absent, and the reverse case, when the moon is at outmost apogee, yet good returns result.

Another factor affecting those with linear antennas is the Faraday rotation of the signal brought about by its dual passage through the ionosphere, when the received polarisation can be twisted through 90 degrees, giving severe attenuation unless the antenna can be matched to the incoming angle. This is invariably worse when the lunar angle is low, when the signal has to traverse a low angle of ionospheric incidence.

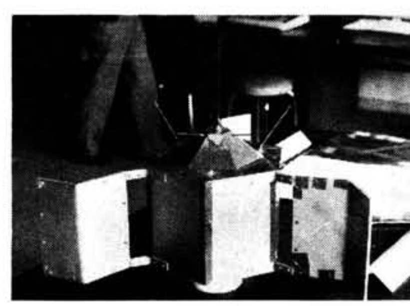


Fig. 8

An opportunity for investigating advantageous propagation will present itself this year, and has been pointed out to us by **John Branegan GM4IHJ**. John indicates that the orbit of the moon about earth is subject to cyclic variation every 18·6 years, and that 1987 features one of the cycle peaks. This cycle takes the moon 5 degrees above and below the mean line around earth every 27 days, as every 18·6 years there is a period when this 5 degree cycle adds to the 23·5 degree cycle of the earth around the sun, the arc that produces our winters and summers. When the two cycles add this year, the moon is said to have a very high declination at one part of its 27 day cycle and a very low declination

14 days later in the bottom half of this cycle.

This cycle peaks in September this year, and on 15/16 September 1987 the lunar declination will maximise at nearly 29 degrees, this meaning both high and more Northerly lunar positions, this giving short paths through the ionosphere, and hopefully excellent e.m.e. results. As a comparitor, allowing for an improving perigee, fourteen days later the cycle gives maximum negative declination. The moon will now be very low in the south, seen through a very thick oblique incidence ionosphere and atmosphere, which should give very poor results. Our Fig. 9 comes from GM4IHJ's "ALMANAC" program for the Spectrum, and shows the lunar data for the relative period in September. The columns read date, the time of transit (maximum elevation), the actual angle of elevation, the rise time, the set time, and the angular diameter of the moon. These are from the G3IOR QTH, and need adjustment for more distant locations.

EME ALMANAC DATA

Date	Trans	EL	Rise	Set	Ang
14/9	0503	64	2037	1418	14.9
15/9	0555	66	2125	1520	14.8
16/9	0648	66	2226	1606	14.7
17/9	0739	64	2337	1638	14.7
18/9	0828	62	....	1700	14.7
19/9	0914	58	0053	1716	14.8
20/9	0958	53	0209	1728	14.8
21/9	1040	48	0323	1737	14.9
22/9	1121	42	0438	1746	15
23/9	1202	36	0554	1755	15.2
24/9	1244	29	0710	1805	15.3
25/9	1329	23	0829	1815	15.4
26/9	1416	18	0954	1830	15.5
27/9	1508	13	1119	1851	15.7
28/9	1605	10	1245	1922	15.8
29/9	1705	9	1402	2010	16
30/9	1807	9	1501	2120	16.1
1/10	1908	12	1543	2246	16.2

Fig. 9

IARU moves

Region 2 of the International Amateur Radio Union has now backed Region 1 in recognising the damage being done to satellite communications by terrestrial users in the sub-bands allocated to space communications.

At their latest meeting, they considered that the majority of the interference is due to f.m. by the negligence or ignorance of the operators, as they are unaware of the presence of the weaker satellite uplink and downlink signals, and further might not have that mode to demodulate them. As the f.m. signals cover up to 10kHz, a major section of any satellite passband, they are asking member societies to remind the amateur radio operators in their country of the problems they are causing, and will take it upon themselves to inform more widely of those bands and frequencies which are allocated to satellites.

Despite similar measures taken in Hungary at the IARU Region 1 meeting, following papers given by G3IOR on behalf of AMSAT and RSGB at the April 1978 conference in Miskolc-Tapolca, the problem is unfortunately still extremely evident in Europe. Numerous mainland continental repeaters (thankfully not in the UK thanks to consideration and RSGB forethought) are still present in the 145·800–146·000 space sub-band with consequent problems to OSCAR-9 and 11 145·825MHz reception and decoding, and even more so to the relatively weak OSCAR-10 145·810MHz telemetry and higher transponder downlink band. Problems are presented in the form of wideband blocking in the FO-12 uplink passbands, evidenced as wide loud QRM on users' downlinks, and severely attenuating the entire passband to boot. Many nets, RAYNET groups and ordinary f.m. Simplex users also continue to use space allocated frequencies in the upper 200kHz of the 144MHz band, many of whom have been advised of the problems they are causing, but persist despite pleas for abatement.

The ten metre 29·310–29·510 downlink section that is used by the "RS" series of satellites is frequently blocked by 29MHz band f.m. stations having converted 27MHz CB rigs to the amateur band on a channelised basis, possibly not even knowing their actual frequency other than the illuminated channel number. At times of good "E" layer propagation, severe difficulty is experienced in reading the satellite telemetery and the transponded signals due to the presence of high power omni-directional radiation from simplex stations over wide areas. It is very difficult to communicate the problems being experienced to the causers, as few of these users are able to read c.w., or even s.s.b., having only the mode for which this section of the band is NOT intended. Even the 435MHz Mode "B" uplink and Mode "L" downlink sections are not immune from simplex f.m. problems, although the presence of amateur wide-band TV seems fairly compatible.

If you suffer problems from persistent users, first gently remind them of their obligations, and carefully explain the issue. Remind them of the licence clause regarding causing interference to other licensed stations. If this fails, then report them to your National Society, and if this too fails, then remember that (with the exception of 1269MHz) our small sections may be used as both uplink and downlink bands, and one might well be transmitting on the band whilst listening on quite another band, i.e. to the satellite itself for the downlink return. The next obvious step is best not recommended!

Keplerian Elements

Avid trackers will note that this month again we have given a listing of the latest Keplerian elements for all of the main satellites of interest. These elements, which originate from NASA have been sent in by **Birger Lindholm**, of Dalsbruck, Finland. This month we have included a set supplied by G3RUH for the sun, which whilst not exactly a satellite of earth as thought in ancient times, can still be followed in the same way. The sun, though a variable emitter is a valuable radio signal source for those who wish to check and improve their v.h.f. and u.h.f. receiver capability. By first pointing the antenna to the quiet sky, and then to ground, an increase of some 3dB will be seen on the good front-ended receiver, due to the ground temperature, regardless of antenna. Two dB is acceptable, but no noticeable difference will alert you to the need for receiver improvement. When we then point to the sun, it becomes antenna gain dependant, and the average good single Yagi will show some 2 to 4dB of sun noise above the quiet sky. If no increase is detectable, then your antenna and feeder needs some improvement, whilst if you can see better than 12dB when the sun is quiet, you have moonbounce capability with your array.

Equator Crossings

A number of readers have expressed their need for reference orbits, i.e. actual ascending equator crossing times and the longitude of that crossing, with which to use their trackers. As space is limited in our column, we do not normally have the room for both without cutting out a lot of important satellite information. It is, however, quite simple to find an equator crossing from the given Keplerian elements, by running them on a minute to minute time scale after midnight on a given day, and then noting the longitude in degrees west of the Greenwich meridian and the exact time at zero degrees latitude of the first ascending (South to North going) crossing of each satellite. Computers are now so cheap, and tracking programs using Keplerian data so readily available, that this method is strongly recommended for continued use.

Even so, all of this is purely academic for those who do NOT have a computer, as their need of equator crossings to use for "Oscarlators" or tables (such as we have published in past columns) is even greater. In deference to many of our readers' communicated wishes, we have this month included two sets. Fig. 10 is for when you get your copy, and Fig. 11 two weeks later, to keep you going until you receive your next issue in early March. They give you the data for the first ascending (Northbound) equator crossing of the day for each of the main satellites of interest and are computed from the "Eqxer" program, another one new from GM4IHJ for the Spectrum computer. The first column gives the satellite name. F12 is Fuji Oscar-12, RS-5 is Radio-Sport-5, RS-7 Radio-Sport-7, "Mir" the latest USSR space station, "Sal" is the older SALYUT-7 space station, RS1 the ageing but still operating first Radio-Sport satellite, UO1 is UoSAT-1 alias OSCAR-9, UO2 is UoSAT-2 alias OSCAR-11, whilst NO9 and N10 are NOAA-9 and NOAA-10 respectively. M13, M14 and M/1 are the METEOR 2/13, 2/14 and 3/1 satellites.

The second column gives the UTC (GMT) time of the first ascending equator crossing of the day selected, and the third column "Brg" the longitude in degrees West of Greenwich of the crossing. For following orbits, under "Next Orbit", column 4 gives the number of minutes that will elapse before the next equator crossing, which can be added to the given EQX time to give the next orbit of the day. Column 5 gives the number of degrees further west that the satellite will be on this next equator crossing, which can be added to the given bearing to give that following. (Subtract 360 if "Brg" + "inc" exceed 360 upon addition). A similar addition can be performed for the following day, where under "Next Day" if "+ min" is added to UTC EQX it will give the time of crossing the following day, and if "+ deg" is added to "Brg" the longitude of that next day crossing is supplied. If feedback shows these to be required on a regular basis, we will try to include monthly.

If a precise updated reference orbit is really essential, then merely come up on one of the many AMSAT nets and ask, and it will be readily supplied. If you need them quarterly, they will be sent with *OSCAR News* on request. Should you need them for a complete year, then "Project OSCAR" send an annual prediction book giving all crossings of FO-12, RS-5, RS-7, UO-9 and UO-11 for a $10 donation in USA, or $12 overseas, sent to the address given in this issue.

What goes up . . .

On Friday, 16 January, as planned, the USSR launched Progress-26 to carry supplies and equipment to the MIR space-

Satellite	OSCAR-9	OSCAR-10	OSCAR-11
Internat Design	81–100B	83–58B	84–21B
Object	12888	14129	14781
Epoch Year	1986	1986	1986
Epoch Day	319·19196703	312·44034196	315·59538399
Inclination	97·6545	26·9515	98·1309
RAAN	325·3871	51·0499	20·3554
Eccentricity	0·0000899	0·6033158	0·0014765
Arg of Perigee	294·1946	158·5947	62·5607
Mean Anomaly	65·9186	244·4550	297·7114
Mean Motion	15·28930712	2·05880591	14·62084842
Decay Rate	3·704e^{-5}	−4·1e^{-7}	1·85e^{-6}
Orbit Number	28403	2560	14390
Beacon Freq.	21·002	145·810	145·826
	145·825	436·055	435·025
	435·025		2·4015GHz
	2·401GHz		

Satellite	NOAA6	NOAA9	NOAA10
Internat Design	79–57A	84–123A	86–73A
Object	11416	15427	16969
Epoch Year	1986	1986	1986
Epoch Day	307·07480828	307·89222401	312·26547395
Inclination	98·5000	99·0189	98·7436
RAAN	318·1542	267·0251	339·8730
Eccentricity	0·0012787	0·0015717	0·0014554
Arg of Perigee	33·4085	115·9787	124·0419
Mean Anomaly	326·7897	244·3005	236·2147
Mean Motion	14·24959779	14·11457336	14·22474587
Decay Rate	1·1e^{-6}	1·62e^{-6}	−1·9e^{-7}
Orbit Number	38157	9753	733
Beacon Freq.	APT=137·5	APT=137·62	137·5
	DSB=136·77	DSB=137·77	

Satellite	RS1	RS5	RS7
Internat Design	78–100A	81–120C	81–120E
Object	11084	12999	13001
Epoch Year	1986	1986	1986
Epoch Day	304·03950743	311·19322740	310·21414812
Inclination	82·5441	82·9662	82·9654
RAAN	310·5547	28·9451	22·5374
Eccentricity	0·0013314	0·0011597	0·0022806
Arg of Perigee	98·8395	117·5884	32·0531
Mean Anomaly	261·4160	242·6426	328·1935
Mean Motion	11·96696353	12·05063605	12·08700109
Decay Rate	9·0e^{-8}	1·3e^{-07}	1·3e^{-7}
Orbit Number	35008	21509	21562
Beacon Freq.	29·401	29·330	29·340
		29·452	29·501

Satellite	METEOR 2/12	METEOR 2/13	METEOR 2/14
Internat Design	85–13A	85–119a	86–39A
Object	15516	16408	16735
Epoch Year	1986	1986	1986
Epoch Day	312·96537809	312·09477722	293·44694819
Inclination	82·5360	82·5328	82·5342
RAAN	341·1634	256·7874	297·9405
Eccentricity	0·0015074	0·0018002	0·0013632
Arg of Perigee	263·9382	89·2286	209·0294
Mean Anomaly	96·0057	271·0923	151·0110
Mean Motion	13·83923447	13·84006107	13·83742428
Decay Rate	5·2e^{-7}	1·17e^{-6}	1·17e^{-6}
Orbit Number	8948	4385	2020
Beacon Freq.		APT=137·3	

Satellite	METEOR 3–1	COSMOS 1602	COSMOS 1766
Internat Design	85–100A	84–105A	86–55A
Object	16191	15331	16881
Epoch Year	1986	1986	1986
Epoch Day	313·98670695	323·89922782	285·79422121
Inclination	82·5512	82·5355	82·5271
RAAN	187·6414	124·1435	220·1264
Eccentricity	0·0019689	0·0023774	0·0025534
Arg of Perigee	150·4031	259·5323	40·6070
Mean Anomaly	209·8008	100·3202	319·7043
Mean Motion	13·16945767	14·73570394	14·73430933
Decay Rate	5·0e^{-8}	6·64e^{-6}	8·9e^{-7}
Orbit Number	5033	15700	1118
Beacon Freq	APT=137·85	APT=137·4	APT=137·4

Satellite	FO12	SALJUT 7	MIR
Internat Design	86–61B	82–033A	86–17A
Object	16909	13138	16609
Epoch Year	1986	1986	1986
Epoch Day	315·42879698	316·86459818	316·92012796
Inclination	50·0124	51·6129	51·6126
RAAN	334·6864	216·5710	189·3350
Eccentricity	0·0011668	0·0001320	0·0024484
Arg of Perigee	91·7324	147·3568	84·2948
Mean Anomaly	268·4846	212·7591	276·0550
Mean Motion	12·44392645	15·30731678	15·77925873
Decay Rate	−2·5e^{-7}	8·02e^{-6}	1·1819e^{-4}
Orbit Number	1127	26284	4197
Beacon Freq.	435·797	19·955	121·750
	435·910	142·42	143·625

Satellite	The Sun
Epoch Year	1990
Epoch Day	1,000
Inclination	23·4406
RAAN	0·000
Eccentricity	0·0167133
Arg of Perigree	282·7685
Mean Anomaly	357·6205
Mean Motion	0·002737778522
Decay Rate	0·000
Epoch Rev	1989
Semi Major Axis	149597870km

Note: The sidereal time conversion figure for 1990 is 0·27610467

station. The vehicle successfully automatically docked on Sunday 18 January. A three man cosmonaut crew intended to follow in the new more powerful SOYUZ-TN-1 within the following week, but extremely bad weather at Tyuratum prevented the launch, which was to be expected during the window in late February. The crew will be going for a record breaking ten months stay in orbit, but, to our regret, no licensed radio amateurs are in the current crew. A Syrian cosmonaut will lift off to MIR in July, a French member soon, and two Bulgarian cosmonauts are now under training in Moscow for a MIR mission in 1988.

NASA have announced the five man crew for the next Shuttle mission, consisting of Fred Hauke (of Challenger 51-A), Richard Covey, John Lounge, George Nelson, and David Hilmers. Again, no current amateur licences figure in the team. The mission may be further delayed, as the composite replacement for the solid fuel booster sectioning neoprene seal rings that failed and resulted in the Challenger catastrophe have been found to be denatured by anti-oxidants in the rocket, this meaning a further period to find a suitable replacement for the section junctions.

Meanwhile, the trusty DELTA launch vehicles which successfully took the early OSCAR missions in orbit have been brought back with a new improved version called "MLV" (for Medium Launch Vehicle) which will be used for many of the waiting USAAF and commercial payloads.

The NAFDA launch agency of Japan will be placing "MOS" the Marine Observation Satellite into orbit in mid-February with the eighth and last No.1 launcher, which has had a zero failure rate, having launched a test satellite, two weather satellites, two communications satellites (including JAS-1) and a pair of direct broadcasting satellites since February 1981. This summer Japan will use the H-1 rocket to put the ETF-4 test satellite into orbit, and much later JAS-1B. JAS-1B is identical to JAS-1A, which is now in orbit as our latest amateur-radio satellite FUJI-OSCAR-12. It was built concurrently with JAS-1, and should be up and aloft by the end of 1989.

ESA has been contracted to fly ITAL-SAT in 1990 on the ARIANE-4. Due to the long delay caused by the third stage ignition failure problem, a back-log of 41 satellites are now waiting for ARIANE launches. Meanwhile, the USSR has formed GLAVKOSMOS, a commercial launch agency available for scientific packages from the International community, who may be very amenable to the free launch of satellites for the scientifically and educationally inclined amateur builders.

. . . must come down . . .

The "NUSAT-1" (Northern Utah SATellite) built by the students of Utah's Weber State College was intended as a Federal Aviation Administration test and radar calibration satellite, and as a technical building project. It was launched by the "GASCAN" (Get Away Special CANister) from the *Challenger* Shuttle mission in April 1985 into a 370km circular orbit, and was tracked by NORAD until it burned out at 1051UTC 16 December last year, when it re-entered off the Pacific coast of Chile. It had never worked as intended, but, as it was made of Aluminium, we can bet it would have provided some superb meteor scatter if so employed, as the high temperature oxidation ions produced from total upper atmosphere incineration would have provided an excellent medium. With modern home microcomputers, Meteor Scatter adherents have a good chance of predicting these events, and might do well to run extreme DX scheds over the likely period calculated.

Weber college are now busy building a further satellite of advanced technology, the frame of which is already finished, and the electronics half way to completion. AMSAT and the Richland Community College of Decatur, Illinois are working with the Ogden Utah group on a number of projects which are proposed for future "GASCAN" launches.

Project Oscar

To commemorate the 25 year anniversary of the launch of their first amateur-radio satellite OSCAR-1, Project Oscar had a big get together, lunch and celebraton on December 12, with most of the original pioneers present. They launched the "Bud Schultz (W6CG) Memorial Award" which will annually honour those Radio Amateurs who are nominated as making a significant long-term contribution to the Amateur Space Programme, and will take the form of a plaque and a rotating trophy. Signed nominating petitions, listing, the contributions of the nominee, should be sent to arrive not later than 1 March each year to Schultz Award, Project OSCAR Inc, P.O. Box 1136, Los Altos, CA 94023-1136, USA.

Project Oscar have created the "Oscar Archives" at the Foothill Electronics Museum, 12345 El Monte Road, Los Altos Hills, California. This will provide a secure location for the retention of the many important papers, documents and prototypes that give the history and development of amateur radio in space, to compliment the precious items on the history of amateur broadcasting and communications radio development generally.

ALLSATS EQX ON 15/3/87

SAT	UTC EQX	Brg W	Next +min	Orbit +inc	Next +min	Day +deg
F12	0048	229	115.7	29.2	64.3	20
RS5	0109	230	119.4	30	113.4	30
RS7	0012	223	119.1	29.9	108.7	29
Mir	0109	268	91.3	23.2	21.7	12
Sal	0031	191	94	23.8	65.2	22
RS1	0129	320	120.3	30.2	3.9	3
UO1	0040	93	94.1	23.5	66.9	17
UO2	0117	50	98.4	24.6	37.3	9
NO9	0000	313	102	25.5	90.3	23
N10	0129	89	101.2	25.3	78.2	20
M13	0108	33	104	26.1	16.6	6
M14	0137	122	104	26.1	16.9	6
M/1	0056	87	109.3	27.4	90.8	25

Fig. 10

AMSAT News

Patrick Hamptaux ON1KHP, writes to say that AMSAT-Belgium are moving ahead, and are now producing a regular member magazine. AMSAT-Chile has just been formed, now making a world total of 24 AMSAT affiliated organisations. AMSAT have resolved to hold a meeting in Spring this year to assist the co-ordination of all groups and the pooling of resources to form a collective International AMSAT organisation.

UoSAT Software

The University of Surrey team has now written some software that will display the raw and unprocessed real time telemetry and WOD for the BBC computer. This is now available from AMSAT-UK, with details for a s.a.s.e. to G3AAJ, AMSAT-UK, London E12 5EQ. Similar software written by N5AHD for CP/M computer systems is available from the AMSAT Software Exchange, P.O. Box 27, Washington DC, 20044, USA.

ALLSATS EQX ON 29/3/87

SAT	UTC EQX	Brg W	Next +min	Orbit +inc	Next +min	Day +deg
F12	0011	277	115.7	29.2	64.3	20
RS5	0153	262	119.4	30	113.4	30
RS7	0155	270	119.1	29.9	108.7	29
Mir	0126	358	91.3	23.2	21.7	12
Sal	0125	285	94	23.8	65.2	22
RS1	0033	328	120.3	30.2	3.9	3
UO1	0049	95	94.1	23.5	66.9	17
UO2	0021	35	98.4	24.6	37.3	9
NO9	0001	133	102	25.5	90.3	23
N10	0123	87	101.2	25.3	78.2	20
M13	0000	41	104	26.1	16.6	6
M14	0033	131	104	26.1	16.9	6
M/1	0026	103	109.3	27.4	90.8	25

Fig. 11

David Lane G4MUV, has written to tell us of a brand new Commodore-64 program that gives tracking of all the amateur radio satellites, plus MIR, Salyut-7, NOAA-8 and 9. It displays the satellite position on a high resolution map of earth at any selected time, automatically updates the real time position display, and tracks for 24 hours in preselected steps. It can display the satellite position by entering the MA value, print the options displayed without map, and list the output. Furthermore, it will cover both stations in a potential QSO, giving AZ and EL for both ends. It is called "SuperSat 64" and is available from Erich Eichmann, DK1TB, 4930 Detmold, Kiewningstr. 57, West Germany. Telephone: (W. Germany) 05231/27786 after 1900UTC.

From next month Pat Gowen's column will be splitting into two. Amateur Satellites will remain in *PW*, whilst the remainder (weather, etc.) will be moving to *SWM*.

VHF BANDS

Reports to: Ron Ham BRS15744, Faraday, Greyfriars, Storrington, West Sussex RH20 4HE.

by Ron Ham BRS15744

The magnetometers, used by **Karl Lewis,** Saltash, **Ron Livesey**, Glasgow and the NOAA laboratories in Boulder, were unsettled during the latter 10 days of December. Ron, the auroral co-ordinator for the British Astronomical Association, received reports of auroral glow from the weather ship *Cumulus*, at station Lima, for the night of December 21/22 and from Karl Cooper, in Kirkwall, for 23/24 and 25/26. Both Karl Lewis and Ron Livesey reported "stormy" magnetic conditions between the 21st and 24th and for the 23rd, Boulder said, "Minor storm mid-latitudes, major storm high latitudes," which ties up nicely with the aurorae. In Sevenoaks, Cmdr Henry **Hatfield,** using his spectrohelioscope to observe the sun, located 7 filaments and a few quiescent prominences (q.p.s) at midday on December 24, 6 filaments and a few q.p.s. at 1145 on the 26th, a single spot, 5 filaments and a few small q.p.s at 1145 on January 3, a small and faint plage, 4 filaments and a few q.p.s at 1130 on the 6th and 3 filaments and 2 very small prominences at 1133 on the 12th. Henry also recorded small bursts of solar radio noise, at 136MHz, on December 30 and January 1.

From Knutsford, **Dave Coggins,** who monitors the television channel R1 (49·75MHz), reports "Ghostly rapid QSB" at 2200 on December 22 and steady auroral type signals at 1928 on January 2.

Congrats to Colin Clements on becoming the director of the Radio Section of the London Solar Society and is co-ordinating his sections work in a regular column in their journal, *Solar News*. A picture of Colin's radio telescope, installed at his QTH in Lisburn, appeared in this column some time back. Readers interested in the work of the LSS and obtaining copies of *Solar News*, should send an s.a.e. for details, to Bert Chapman, "Brindles", Mill Lane, Hooe, Battle, E. Sussex TN33 9HT.

The 28MHz Band

"I was pleasantly surprised to work stations in HA, I, TA, 4X and 5B on January 1, which got me off to a great start for the new year," wrote **Dave Lingard G0CLH,** Northfield. He then worked into Sweden on the 7th and at 1730 on the 12th, while the German beacon DL0IGI was 599, he heard a couple of DLs, but despite a prolonged "CQ" he reaped nothing.

From Hanworth, **Don Hodgkinson G0EZL,** worked SM on December 27, EA on the 30th, LZ on January 1, DL and HG on the 5th and SM again on the 9th. "An Israeli station was coming through on the 18th, at the same time as the Cyprus beacon 5B4CY, but I did not manage a QSO," said Don. He worked into 66 countries on 28MHz during 1986 and has chalked up 5 countries between January 1 and 18.

For a few weeks **Bill Kelly** in Belfast found the 28MHz band generally poor and was surprised to hear a QSO, at 1045 on the 9th, between CB stations in North Carolina and Toronto on 27MHz. "Ever the unexpected is what keeps the radio hobby going," said Bill.

From Walsall, **Gordon Pheasant G4BPY** said, "We are still getting quite a lot of out-of-season Sporadic-E. Christmas Day was very good; I worked into Sweden at 1115 on 28MHz and received a little DXTV on Ch. E2 (48·25MHz) at 1130.

Dave Coggins noted "fluttery" signals on G stations on December 29, January 1 and 3. He copied stations from Turkey and the USSR on the 1st and Germany and Hungary on the 5th. Like most propagation addicts, Dave listens intently for weak and unusual signals in what could easily be written off as a dead band. "It is interesting to listen very carefully, especially with a beam, on 28MHz when the band is dead, because one can hear all sorts of squeaks, hetrodynes and "pings" of signals via meteor scatter," said Dave.

Fred Pallant G3RNM, Storrington, heard a TA2 on c.w. at 1121 on January 1.

Tony Usher G4HZW, Knutsford, is planning to make a daily call on 28MHz and would like to arrange skeds. He also points out that none of these unusual weak signals can be heard when the band is active.

Propagation Beacons

My thanks to **Chris van den Berg**, The Hague, Dave Coggins, **Len Fennelow G4ODH,** Wisbech, Don Hodgkinson, Henry Hatfield, Bill Kelly, **Ted Waring**, Bristol, Dave Lingard, **Ted Owen**, Maldon,

	DECEMBER 86						JANUARY 87																					
	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
DF0AAB									*	*	*	*							*							*		
DK0TEN		*			*		*	*	*	*	*	*	*		*			*	*	*	*					*		
DL0IGI	*	*			*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*
IY4M		*		*						*	*		*		*			*		*	*			*				
LA5TEN	*	*											*		*													
PY2AMI							*																					
VK2RSY						*																						
ZS6PW	*	*		*	*																					*		
3B8MS																							*	*				
5B4CY			*			*	*																	*				

Fig. 1

	DECEMBER 86													JANUARY 87																
	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CT3B			*			*	*	*	*	*				*		*	*													*
DH2B		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*						*	*						*
W6WX/B									*																					
ZS6DN/B											*			*			*	*		*	*	*	*	*			*	*	*	*
4U1UN/B		*				*	*	*	*		*		*	*	*		*	*		*			*	*			*	*		*
4X6TU/B			*			*	*	*	*			*		*		*	*						*	*	*					*

Fig. 2

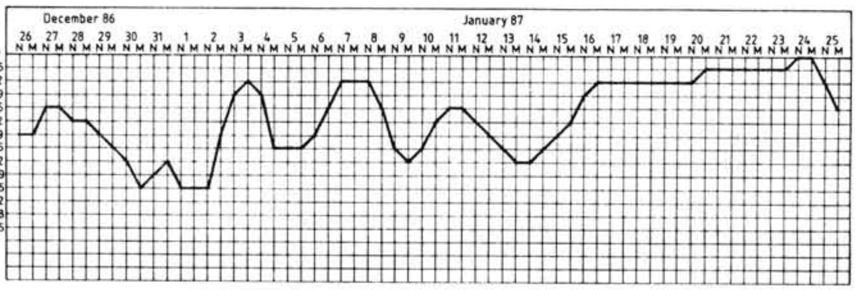


Fig. 3

Fig. 4

Fred Pallant, Gordon Pheasant and **John Willett G6TRR**, Stoke-on-Trent, for their 28MHz beacon logs. Using these I was able to compile Fig. 1.

"The 14MHz beacon chart, Fig. 2, shows how inconsistent the h.f. segment was between December 20 and January 18, with the NE/SW Finland and Madeira beacons being almost absent up to January 18 and the S/SE/NW aligned signals being fairly well in evidence for most of the time," wrote Len Fennwlow. He also logged signals from the v.h.f. beacons in Angus GB3ANG (144·975), Cornwall GB3CTC (144·915MHz) and Wrotham GB3VHF (144·925MHz) at widely varying strengths, each day from December 28 to January 17. He could just hear the Lerwick beacon GB3LER (144·965MHz) on the 28th and 17th.

Don Hodgkinson logged GB3CTC almost daily and GB3VHF every day throughout the month prior to January 20 and added the French beacon FX3THF (144·905MHz) on December 28 and January 6 and 20.

Tropospheric

The atmospheric pressure, measured at my QTH, began this period on December 26 reasonably high at 30·1in and ended, falling rapidly, on January 25 from 30·7, Fig. 3. In fact, Ted Owen's barometer and my barograph only fell below 30·0 on December 30, 31 and January 1 and for a short period on the 9th and 14th.

During a mild lift on January 18 and 19, Dave Lingard reported that most of the normally just audible repeaters were fading in and out and GB3PI was workable for a couple of hours on the 18th and GB3MP was about 5 points above normal.

Chris van den Berg, received signals through the 144MHz repeaters in Belgium ON0AN and ON0OV on most days between December 20 and January 20. While the pressure was very high on the 18th, 19th and 20th he added Danbury GB3DA R5, Dover GB3KS R1, Maidstone GB3KN R4 and Wymondham GB3NB R1 to the list.

934MHz CB

"I've only been working the band for 9 months," said **Jim Willett CL-24**, Grimsby (Fig. 4) on December 30. He tells me that around a dozen stations are using 934MHz in his locality. While working from his car, some 160m a.s.l. during a lift on December 20, he contacted stations in Alderney, Berry Head, Bath, Bristol, Chelmsford, Exeter, Falmouth, Gloucester, Ipswich, Maidstone, Oxford, Ramsgate, Southampton and West Malling. All using a Cybernet Delta 1 transceiver and a Nevada PE7M mag-mount antenna. The best DX was with marine/mobile stations in Alderney, about 480km and Berry Head at 290km.

"Although the band was very quiet on January 3, I managed to work 35 stations whilst some 500m a.s.l., 11km south of Buxton," wrote **Anthony Jones AJ-26 G1UU1**, from Walsall. His log includes 16 contacts ranging from 40 to 64km, 9 at 80km, 3 at 96km and his best DX was MC-96 in Corby at 110km.

"Boxing Day proved a good day out for all who took the trouble to go to the high points," wrote **John Raleigh DW 4** from Bedford.

On January 3, **Bill Ellis WE-614**, Houghton-Regis, worked into Sussex. On the 18th, **John** and **Ralph Rowlett GR-587**, Upper Caldecote, had QSOs with stations in Felixstowe, Ipswich and Sussex between them.

At midday on December 28, **John Levesley UK-627**, Bransgore, operating /M from the Purbeck hills—some 200m a.s.l.—, worked other mobiles at situated at Haytor, Medstead and Portsmouth at distances of between 70 and 120km. "A good example of flat conditions working," said John. During the evening of January 3, he found stations at 80km range about 3dB above normal and on the 19th, with a decaying high pressure system, he heard QSOs between stations in Chippenham, Jersey, Lyneham and Milton Keynes. John uses a Cybernet Delta-1 transceiver and a Nevada colinear antenna.

Ian WDC-622, Rotherham, tells me that while conditions were good, he had QSOs with stations in Durham, Norfolk and Surrey, which is good gen, but please Ian, I cannot reply to your letter unless you include your full name and QTH.

Band II

It is with deep regret that I have to report the death of **Dr. Harold Brodribb** of St. Leonards-on-Sea, who, for many years, was a regular contributor to this and the television sections of my columns. In recent years he made a special and detailed study of the entire French radio network and how the signals from many of these stations changed or became audible at his QTH, in relationship to the atmospheric pressure. We extend our sympathy to Harold's family and to his many friends.

My thanks to **Stewart Russell**, Forfar, for the gen that on January 22, Edinburgh's Radio Forth, is changing frequency from 96·8 to 97·3MHz. "It is hoped that the signal will be much better for stereo users like myself," said Stewart.

John Willett, Stoke-on-Trent, recently installed a new Band II antenna and can usually hear a Belgian and a French station between 98 and 99MHz. "These two transmissions are there every day, sometimes dropping into the noise or being knocked out by official transmitters, but otherwise they are good propagation indicators," said John. Early in January, he logged bursts of signals from stations in France and Yugoslavia via meteor scatter.

My thanks to **Francis Hearne**, Ilford for the information that BRMB Birmingham, changed frequency form 94·8MHz to 96·4MHz on January 21 and that Radio 210, Reading, has extended its coverage from January 1 to cover the Basingstoke area on 102·9MHz.

I received strong signals from several French stations, between 94 and 103MHz, at 0812 on January 9, 1255 on the 18th, 1830 on the 19th, 0900 on the 20th and 0925 on the 25th.

Tailpiece

And that is the end of *VHF Bands* in its present form and my thanks are due to you all for your past support. However, as from our next issue, I will be writing a new column devoted entirely to propagation and I will still look forward to receiving your letters, comments and reports about aurora, beacons, blackouts, meteor scatter, solar activity, Sporadic-E, sunspots and tropo-openings, in fact, anything that you think has upset the normal paths of radio signals. In future I will also be presenting a column, especially for the Band II enthusiasts, in our associate journal *Short Wave magazine*. See Amateur Bands for where you should send v.h.f. and h.f. band reports.

TELEVISION

Reports: as for VHF Bands, but please keep separate.

by Ron Ham BRS15744

On December 25, **Simon Hamer** (New Radnor), glimpsed several pictures in Band I but could only identify Germany's ARD on Ch. E2 (48·25MHz) and Sweden on Ch. E3 (55·25MHz). However, on January 5 he saw Russian news on Ch. R1 (49·75MHz), complete with their BPEMR logo.

During the peak of the Quadrantid meteor shower on January 3, I copied a multitude of small and some long persistence "pings" of synchronising pulses, via meteor trail reflection, from the various television transmitters that use Chs. E2 and R1. Although this was achieved by listening to these pulses on an ex-military R216 v.h.f. communications receiver, an adjacent television set, was tuned to the same channels to prove that the larger "pings" were strong enough to produce some very clear pictures for up to 10 seconds.

Simon Hamer identified strong meteor scatter signals, on the 3rd and 4th, on several spots in Band I from Austria, Czechoslovakia, Denmark, Italy, Poland, Spain, Sweden and the USSR by their test cards and/or programme captions.

At 1746 on the 3rd, **Dave Coggins** (Knutsford) logged "pings" on Ch. R1 and many 2–3 seconds bursts of pictures on Ch. E2 for most of that evening.

Highlights from the log sent by **Edwina and Tony Mancini** (Belper), for the period December 21 to January 19, include weather from Austria; ballet, ice-skating and the PRAHA logo from Czechoslovakia; "Fawlty Towers" with sub titles from Denmark; Lotto Toto and Wochenschay from Germany; regional test cards scribed Bagn, Bremanger and Melhus from Norway; current affairs, news and sport from Poland; a nature programme about mice, news and an 18th century type play from Spain; football from Sweden and news, with the HOBOCTN and RO/CCCP logos from the USSR.

Tropospheric

Conditions on Christmas Day allowed Simon Hamer to watch a carol service in Gaelic from Radio Telefis Eireann-1 and Noel Edmonds' Christmas show on RTE-2 on Chs. D, F and H and G, I and J, respectively in Band III.

"Around midday on January 3 the barometer showed a slight fall from a very high pressure of 1032mb, which prompted me to try the set," wrote **George Garden**, while on holiday in Laurencekirk. As he hoped, George found very good conditions on the u.h.f. band and, despite a big hill to the south of him, he received a weak, but steady monochrome signal from Craigkelly and a strong colour picture from Black Hill. "It is very rare to receive the Craigkelly transmitter from this location," said George.

"Not much to report this time, although there has been a lot of high pressure," wrote **Noel Smythe** (Caerphilly) on January 20. However, he found the French Canal Plus on Ch. 5 was up most of the time. He also saw RTBF, from Belgium, on the 10th and a very strong French station on Ch. 22 on the 18th.

I received Band III pictures from Belgium at 1830 on January 19 and from Belgium and Holland at 0900 on the 23rd.

SSTV

Having moved QTH, **Richard Thurlow G3WW** (March) has spent a fair bit of time re-installing his antennas and gear and routing and screening feeder cables to reduce the level of computer hash generated by some of his equipment. Early in December he copied SSTV signals from two Italian stations, on 14·230MHz, with his /M antenna placed horizontally on chairs in his new shack. On the 29th, using his 2DYM trapped dipole, he exchanged 24 seconds colour pictures, on 3·735MHz, with G3OQD in Kent. Richard is also active on 144MHz, with a rotatable 9-element Tonna. Tests have proved that he can work all stations in the Fenland SSTV net as far away as Norwich.

"The last week has been very active from the USA," wrote **Les Hobson G0CUI** (Rotherham) on January 17. He exchanged pictures with K9SLQ, W5ZR, WA2CBA and VE3PT on 14MHz and stations in Germany, Poland and Sweden on 3·5MHz. "VE3PT is now active again on SSTV after being QRT on this mode for a few years," said Les. He now has 2 or 3 QSOs each week with this Canadian station.

At 1255 on Christmas Day, Dave Coggins copied a "CQ" on 14·234MHz from YU2RL.

Photographs

Most readers record the highlights of their DXTV with a camera and, as usual, I

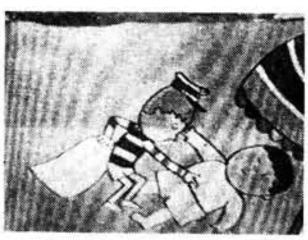


Fig. 1: Polish TV picture

Fig. 2: Spanish TV picture

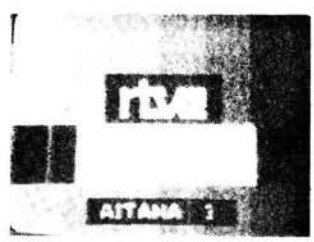


Fig. 3: Spanish regional news caption

Fig. 4: Soviet news picture

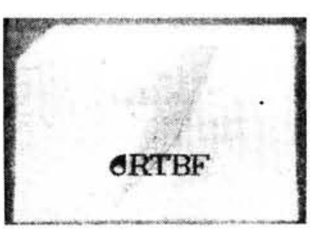


Fig. 5: Belgian TV logo

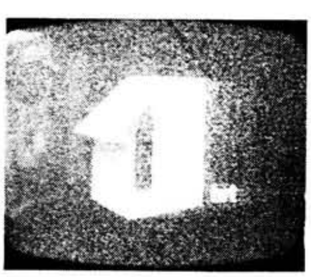


Fig. 6: Belgian TV logo

Fig. 7: Indian TV service

Fig. 8: Julandhar TV signal

Fig. 9: Rawalpindi TV signal

Fig. 10: Rawalpindi TV signal

Fig. 11: SSTV from Germany

Fig. 12: SSTV from Italy

have received a wide variety of pictures. These include cartoon programmes from Poland and Spain, Figs. 1 and 2, photographed by **Len Eastman** (Bristol), and a Spanish regional caption and an item from Soviet news, Figs. 3 and 4, by Noel Smythe and me, all received in Band I during the 1986 Sporadic-E season. Noel and I also copied logos from Belgium, Figs. 5 and 6, in Band III while the troposphere was open last October 4 and November 29, respectively.

During similar openings last year, **Major Rana Roy** (India), logged pictures from television services in India on Ch. 4, Fig. 7, Julandhar Ch. 9, Fig. 8 and Rawalpindi Ch. 8, Figs. 9 and 10.

SSTV signals from Germany, Fig. 11, and Italy, Fig. 12, were received by **Peter Lincoln** (Aldershot) and Richard Thurlow, respectively.

All Change

Thanks to the support of all my regular contributors and our readership in general, this television column was born and has grown up in *Practical Wireless* and now, as from next month, we are moving, your letters, pictures, text and scribe to *Short Wave Magazine* with the prime object of adding long distance television to this specialised journal for the broadcast bands enthusiast.

Reports and photographs for inclusion in *SWM* (May and June issues) should arrive with Ron by March 18 and April 23

MW BROADCAST BAND DX

Reports to: Brian Oddy G3FEX, Three Corners, Merryfield Way, Storrington, W. Sussex RH20 4NS

by Brian Oddy G3FEX

Due to the very considerable interest in listening, PW Publishing Ltd have purchased the *Shortwave Magazine (SWM)* and from the April issue they intend to transform it into an exciting new magazine devoted entirely to listeners and DXers. Some of the articles by contributors to "On The Air", including my "MW & SW Broadcast Band DX" series, are being transferred to the new publication and new contributors will also help to produce a magazine which will cover many bands and modes of reception.

A number of technical articles on subjects related to listening will appear in the new SWM including my "Newcomer SWL" series which will become a separate monthly feature to help those new to DXing. In view of this exciting news, you will no doubt want to be one of the first DXers to be mentioned in the new *SWM*, so please send along your l.m., m.w. and s.w. broadcast band reports to me to help make the new magazine the best ever for the listener!

Just to reassure you, with all these changes *PW* won't be abandoning the s.w.l. completely. There will be a number of new regular features covering the whole span of radio for the hobbyist.

DX Report

(Note: All frequencies in kHz: Time UTC=GMT)

Transatlantic DX: The conditions have been generally very good and some interesting new stations have been logged by DXers this time. The signals from some of the more frequently mentioned stations located in Canada, N and S. America and the Caribbean have been heard before midnight and this fact has encouraged a number of listeners to take part in Transatlantic DXing for the first time during recent weeks.

The signals from CJYQ on 930 in St. Johns, NF, which are used by many DXers as a pointer to band conditions, have been rather weaker than usual, although they have been coming in early—in fact **George Morley** logged them during a listening session one night in Redhill at 2230. Another DXer who found the CJYQ signals to be rather poor at 2330 was **Alan Curry** up in Stockton-on-Tees. Some idea of their signal after midnight can be ascertained from the report by **Jim Willett** of Grimsby who noted SIO 333 in his log at 0150 and by **Rab Freeman** who logged them as SINPO 34433 in Port Glasgow at 0310.

Writing from Cardiff, **Alan Jarvis** says that he has not been able to hear CJYQ once this winter although he has been hearing WINS 1010 and WHN 1050 in New York quite regularly. The "memory station" WMRE 1510 in Boston has been well received too and he picked up WCAU on 1210 in Philadelphia at 0044 for a new one, Alan has also been hearing WHDH 850 in Boston and WBAL 1090 from Baltimore. It is interesting to note that he has been hearing CFBC on 930 in St. John's, which is usually occupied by CJYQ! He also logged CFRB on 1010 in Toronto for the first time.

Many of the signals from the New York area have been reaching the UK well before midnight and one of the outstanding signals just now is WINS 1010. During one listening session Alan Jarvis logged them at 2230! Of course the conditions are not always good as Alan Curry discovered when he listened to a round-up of sports news via WINS at 0045, for reception was rather poor. **Roy Spencer** of Nuneaton also noted poor signals from WINS at 0459 one night and decided to take a look at the tropical bands instead!

Quite by accident, **David Edwardson** of Wallsend came across a broadcast in French on 1570kHz whilst he was tuning into various stations with his Trio R600 one night at 2300. To his amazement it proved to be CKLM in Montreal, Canada. He listened to their signal for nearly 45 minutes before deciding to look around the band to see what else he could find! It wasn't long before he logged his second station—the Caribbean Beacon, Anguilla on 1610 at 2359, which broadcasts Evangelical programmes and is often a good signal before midnight.

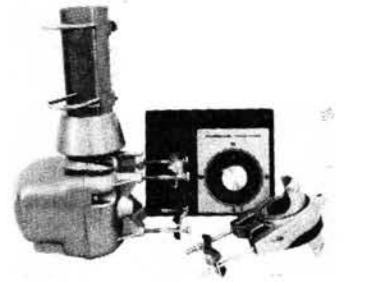
Loop antennas were mentioned in several of the reports—Alan Jarvis has been busy in Cardiff with the construction of his "Hula Loop" design (*PW*, October '86, page 64). He says he has sorted out the mechanics of supporting the thing so that it is stable, free standing and rotatable and hopes to have some results soon. **Alan Scholefield** of South Shields has an unusual hexagonal loop with a mean dimension of 1·3m nearing completion, so it will interesting to hear how well it performs. George Morley has also been testing out a loop antenna ahead of his Trio R2000 receiver. During one night between 2330 and 0150 he logged three stations in New York, namely WNBC 660, WNEW 1130 and WHN 1050, as well as WMRE 1510 in Boston. From Canada he heard CBM 940 in Montreal and CKLM 1570 in Lavel, PQ. During a subsequent night George heard several additional stations including WINS 1010 in New York and WCAU 1210 in Philadelphia and from Canada were CJYQ 930; CKCW 1220 in Moncton NB and CKLM 1570.

George has recently purchased a Sony ICF2001D and finds the ECSS mode of reception very good for DXing. Using the Sony between 2230 and 2359 with just its built-in ferrite antenna he logged three Canadian stations—CJYQ 930, CBM 940 and CKCW 1220; three from New York—WNBC 660, WINS 1010, WNEW 1130 and two from Boston—WBZ 1030 and WMRE 1510. Searching the band again the next morning at 0700 produced two stations from Canada—VOCM 590 in St. John's and CFRB 1010 in Toronto; also three stations from New York—WINS 1010, WBZ 1030 and WHN 1050.

Rab Freeman compiled his report during five nights of listening between 0130 and 0445. From the USA came two exciting commentaries on basketball games in the New York area, broadcast at 0210 by WNBC 660 and at 0235 by WNEW 1130; a "phone-in" programme at 0253 via WHDH 350; the news at 0300 from WCBS in New York on 880, a local weather report and a programme of "country" music followed by the station announcement of WHN 1050 at 0305. From Canada he picked up a programme of "morning music" from CKYQ on 610 in Grand Bank, NF at 0143; the news from Montreal at 0300 via CBM 940 and a weather report from St. John's, NF via CJYQ 930 at 0310.

Rab also logged VOCM 590 at 0205; WABC 770 in NY at 0247; WGY 810 Schenectady, NY at 0433; CHER 950 in Sydney, NS; WINS 1010; CJRP 1060 in Quebec, PQ; WCAU 1210; WMRE 1510; CKLM 1570 and on 1610 the Caribbean Beacon, Anguilla. He says that this list could have been extended by at least another 15 stations had he been able to establish positive identification.

Writing from Bristol, **Tim Shirley** says that he has been hearing a strong signal from Radio Globo in Rio de Janerio, on 1210 in Brazil as early as 2130 and has sent them another report and now awaits their QSL. Jim Willett also noted their signal in his log—he picked them up with his Yaesu FRG-7 receiver at 0130 with SIO 322. Some of the other stations noted were VOCM 590 at 0130; CIYQ 680 in Grandfalls, NF at 0200; WHIN 1010 Gallatin, TX at 0230; WBAL 1090 at 0250; WTOP 1500 in Washington at 0225 and the Carribbean Beacon, Anguilla 1610 at 0330. Jim managed to log five stations which have not been reported before in this series so they are subject to confirma-



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tion by QSL, namely KCLG 1210 in Washington, UT at 0030; WGAR 1220 in Cleveland, OH at 0200; WLAM 1470 in Lewiston, ME at 0345; WOKJ 1550 in Jackson, MS at 0400 and XEHI 1470 at 0315 from Mexico.

A short period of exceptionally good conditions can provide much excitement for many dedicated DXers—one of them, **Derek Taylor** of Preston, recently had the thrill of hearing the identification callsign KING of a low power station in Seattle, USA on 1090. Their signal gave comfortable listening without the need for headphones and their callsign was clearly received. Derek says, "if this is confirmed, it will probably be a once in a lifetime catch for me as I don't think conditions as good as that will be repeated for some time". Derek mentioned that he will be going up to Cape Wrath, N. Scotland in March with Barry Davies for a DXpedition. It was at Cape Wrath that the first ever logging from Alaska on medium wave took place in 1985, when John Faulkner heard KBRW in Barrow, Alaska on 680—his reception was subsequently confirmed.

Other DX: Using a Vega 206 receiver in Tunbridge Wells, **Darren Taplin** has been checking the SINPO ratings of some of the international broadcasts to Europe which reach him via the sky wave path at night—RBI Berlin, GDR 1359 rated 44433 from 1915; Radio Polonia, Warsaw 1503 was 44444 from 2230 and RSI Stockholm, Sweden 1179 was 44544 at 2300. Darren also logged the signals from two transmitters in Yugoslavia—Ljubljana 918 was 44433 at 2259 and Zargreb 1134 was 54544 at 2200.

A Vega 206 portable receiver was also used by **Geoff Blakey** to enjoy some DXing at two locations. While in Deal, Kent he logged many stations during three evenings including five in W. Germany —AFN Frankfurt 873, RIAS Berlin 873, AFN Stuttgart 1143, VOA via Munchen Ismaning 1197 and Mainflingen 1539; also Lushnje, Albania 1395; RTE-2 Athlone, S. Ireland 612 and Solvesburg, Sweden 1179. While DXing during the evening in Gosport he logged three stations in S. Ireland, namely RTE-1 Tullamore 567; RTE-2 Athlone 612 and Dublin 1278. Also noted were RNE-1 La Coruna, Spain 639; AFN Frankfurt 873; Radio-1 Milano, Italy 900 and BBC Ulster via Lisnagarvy, N. Ireland 1341.

Philip Rambaut has been conducting a survey of the l.w. and m.w. bands at noon in Macclesfield. A total of 16 long wave stations and 86 official medium wave stations were logged—38 of these were local radio stations! Some of the transmitters operating on the l.w. band use very high power and their signals cover considerable distances by day or night. Those logged were Donebach 153, W. Germany (500kW); Allouis 162, France (2000kW); Kaliningrad 171; USSR (1000kW); Oranienburg 177, E. Germany (750kW); Saarlouis 183, W. Germany (200kW); Motala 189, Sweden (300kW); BBC Droitwich 200 (400kW); DLF Munich 209, W. Germany (500kW); Roumoules 218, Monaco (1400kW); Konstantinow 227, Poland (2000kW); Junglinster 236, Luxembourg (2000kW); Kalundborg 245, Denmark (300kW); Tipaza 254, Algeria (1500kW); Burg 263, E. Germany (200kW); Topolna 272, Czechoslovakia (1500kW) and Minsk 281, USSR (500kW).

QSL from Radio Jersey sent in by Simon Hamer

Some of the more interesting m.w. signals which Philip noted stemmed from transmitters in several countries: Belgium —Wavre 540 and 621, Wolvertem 927 and 1512; Czechoslovakia—Praha 639 and 1287; Denmark—Kalundburg 1062; France—Rennes 711, Lille 1071, Nancy 1350; Germany—Bayreuth 549, Frankfurt 594, Muhlacker 576, Hamburg 972, Wolfsheim 1017, Burg 1044, Neumunster 1269, Heusweiler 1422, Mainflingen 1539; Holland—Lopic 675, Flevoland 747 and 1008; Isle of Man—Foxdale 1368; Luxembourg—Manach 1440; Monaco

DXers

1 Maurice Andries, Dendermonde Belgium
2 Geoff Blakey, Deal
3 Colin Diffell, Corsham
4 Rab Freeman, Port Glasgow
5 Michael Hill, Stockton-on-Tees
6 Alan Jarvis, Cardiff
7 Philip Rambaut, Macclesfield
8 Roy Spencer, Nuneaton

Freq (kHz)	Station	ILR BBC	1	2	3	4	5	6	7	8
603	Invicta Sound	I		D				D		D
630	R. Cornwall	B						D		
630	R. Bedfordshire	B		D	D			D	D	D
657	R. Clwyd	B				N	D	D	D	
657	R. Cornwall	B						D		
666	Devonair R.	I			D			D		
666	R. York	B				N			D	
729	BBC Essex	B		D						
756	R. Cumbria	B				D	D			
756	R. Shropshire	B			D			D	D	D
765	BBC Essex	B		D						
774	R. Kent	B		D						
774	R. Leeds	B					D		D	
774	Severn Sound	I			D			D	D	D
792	Chiltern R.	I		D					D	D
801	R. Devon	B			D	N		D	D	
828	2CR	I						D		
828	R. WM	B							D	D
828	R. Aire	I					D			
828	Chiltern Radio	I						D		D
837	R. Leicester	B			D			D	D	D
855	R. Devon	B						D		
855	R. Norfolk	B		D						D
855	R. Lancashire	B				N			D	
873	R. Norfolk	B		D					D	D
936	GWR	I			D			D	D	
954	Devonair R.	I						D		
954	R. Wyvern	I			D			N	D	D
990	R. Devon	B				N		D		
990	Beacon R.	I							D	D
999	R. Solent	B			D			D		
999	Red Rose R.	I				N	D		D	
999	R. Trent	I								D
1026	Downtown R.	I				N				
1026	R. Jersey	B		D				D		
1026	R. Cambridgeshire	B		D					D	D
1035	R. Sheffield	B					D		D	
1035	R. Kent	B		D				D		
1035	Northsound R.	I				N				
1035	West Sound	I				N		D		
1107	Moray Firth R.	I				N				
1107	R. Northampton	B			D					D
1116	R. Derby	B						D	D	D
1116	R. Guernsey	B			D			D		
1152	LBC	I		D		N				
1152	R. Clyde	I				N				
1152	Metro Radio	I					D			
1152	BRMB	I			D			D		D
1152	Picadilly R.	I							D	
1152	R. Broadland	I	D	D				N		

Freq (kHz)	Station	ILR BBC	1	2	3	4	5	6	7	8
1161	R. Sussex	B	D	D						
1161	R. Tay	I				N				
1161	Viking R.	I				N				
1161	GWR	I			D			D		
1161	R. Bedfordshire	B							D	D
1170	Swansea Sound	I						D		
1170	R. Orwell	I	D	N						
1170	Signal R.	I							D	D
1242	Invicta Sound	I	D	N				N		D
1251	Saxon Radio	I		D				D		
1260	GWR	I			D			D		
1260	Marcher Sound	I				N			D	
1260	Leicester Sound	I								D
1278	Pennine R.	I							D	
1305	Red Dragon	I			D			D		D
1323	R. Bristol	B			D	N		D	D	D
1323	Southern Sound	I				N				D
1332	Hereward R.	I						N	D	D
1359	Essex R.	I		D						
1359	Red Dragon	I			D	N		D		
1359	Mercia Sound	I				N			D	D
1431	Essex R.	I		D				N		
1449	R. Cambridgeshire	B							D	D
1458	R. London	B	D	D		N				
1458	R. WM	B								D
1458	R. Manchester	B				N			D	
1458	R. Newcastle	B				N	D			
1458	R. Devon	B						D		
1476	County Sound	I				N		N	D	D
1485	R. Merseyside	B				N			D	D
1485	R. Oxford	B						D		
1503	R. Stoke-on-Trent	B							D	
1521	R. Mercury	I		D		N				
1521	R. Nottingham	B							D	
1530	Pennine R.	I				N			D	
1530	BBC Essex	B		D		N				
1530	R. Wyvern	I						D		D
1548	Capital R.	I	D	D		N				D
1548	R. Bristol	B			D			D		D
1548	R. Forth	I				N				D
1548	R. City	I							D	
1557	Hereward R.	I				N		N	D	D
1557	Ocean Sound	I			D	N		D		
1584	R. Nottingham	B				N			D	
1584	R. Shropshire	B								D
1584	R. Tay	I				N				D
1602	R. Kent	B								D

Key: D—Day; N—Night

—Monte-Carlo 1467; Norway—Kvitsoy 1314; Poland—Wroclaw 1206; Sweden —Solvesborg 1179; UK—BBC Dumfries relay (2kW) 585, BBC Wallasey relay (0·5kW) 1107, BBC Llandrindod Wells relay (1kW) 1125; USSR—Kaliningrad 1143.

The broadcasts from Manx Radio, Isle of Man on 1368 may be received during daylight hours by those listeners who have a fairly clear path towards the island—especially if there is a large stretch of sea involved in the path, such as to Cornwall. For most of us it is not possible to hear their signals until darkness falls—reception then takes place via the skywave path to many areas. Some idea of their signal in Edinburgh during the evening can be ascertained from the SINPO 43334 which **Robert Taylor** noted in his log while listening to their football results at 1745. **Michael Hill** has also been getting good reception of their programmes in Stockton-on-Tees around 2330.

For those listeners who send along a detailed report to Manx Radio they have an attractive QSL card and some interesting literature about the history of their station. No doubt they will be very surprised to receive a report from Rab Freeman who picked up their signal in Portugal at night while on holiday in Armacao De Pera, Algarve! Rab found there was quite a lot of fading present on their signal at 1812 and the overall rating was only 2—he managed to hear their signal on three nights while there.

Rab also logged several other signals at night from the UK—the strongest of them was the BBC Lisnagarvey, N. Ireland transmitter on 1341. Although he could hear BBC Radio 1 on 1053 and 1089, BBC Radio 2 on 693 and 909, BBC Radio 3 on 1215 and BBC Radio 4 on 200, it was not possible to tell which transmitter was actually being heard. BBC Radio London on 1458 and ILR Capital Radio on 1548 were positively identified and both had an overall rating of 2/3. From S. Ireland, he logged RTE-1 on 567 and RTE-2 on 1278—taking your receiver with you on holiday can certainly prove to be very interesting!

The BBC Radio Scotland transmissions on 810 are being heard during daylight hours in Turku, Finland by **Kari Nieminen**, however it is not possible to say if the transmitter received in Burghead or Westerglen since they both operate on the same frequency. At 1400 the signal is SIO 323 but at dusk much fading takes place as the sky wave signal arrives. Kari also listens to Radio NRK Kvitsoy, Norway on 1314—he says their signal is SIO 544. The signals from BBC Radio Scotland on 810 are also reaching **Maurice Andries** in Dendermonde, Belgium during daylight with SINPO 23443. Some of the other signals which reach him during daylight originate from BBC transmitters in Orfordness 684 and 1296 and Lisnagarvey 1341. He can also hear BBC Radio 1 on 1053 and 1089 and Radio 2 on 693 and 909 which use numerous transmitters around the UK.

While tuning around the m.w. band in the evening, Tim Shirley picked up two stations in Greece—Athinai 729 at 1900 and Kerkyra 1008 at 2000. He has also been hearing Solt, Hungary 540 at 2030 and two stations in Roumania—Baia Mare 1404 at 1830 and Baneasa 1593 at 0024. Moving down to the l.w. band he logged Brasov, USSR on 153 at 1745. **John Nash** has been checking the l.w. band in Brighton to see if he could hear the International Service of Radio Finland on 254—this originates in Helsinki and is broadcast to Europe from a transmitter in Lahti. Reception proved to be impossible due to the very strong signal from Tipaza, Algeria on that frequency.

The 1000kW medium wave outlet of Radio Moscow's World Service in Kaunas, USSR on 1386 was noted in the report from Roy Spencer—they broadcast to Europe at 2200. Roy also logged TWR Monte-Carlo, Monaco on 1467 at 2245—their transmission to Europe commences at 2200 but it is seldom mentioned in reports. It is not often that the two Italian stations logged by Alan Jarvis are mentioned either, namely Rome on 846 and Milan on 900.

RNE-1 Madrid 585, Spain; Algiers 891, Algeria and Radio Las Palmas 1008, Canary Islands were received by **Alexander Little** in Glasgow between 2145 and 2230.

Local Radio DX

There have been even more stations logged this time—see chart.

My thanks to **Neil Oakley** of Whitstable, Kent for pointing out that the new BBC local radio station in Essex is called simply BBC Essex and not BBC Radio Essex. It seems that signals from the BBC Essex m.w. transmitters are being well received in many areas—can you hear them?

QSL Addresses

ILR Plymouth Sound, Earl's Acre, Alma Road, Plymouth, PL3 4HX.

ILR Piccadilly Radio, 127/131 The Piazza, Piccadilly Plaza, Manchester, M1 4AW.

ILR Radio Tay, P.O. Box 123, 6 North Isle Street, Dundee, DD1 9UF.

Deadlines for May and June *SWM* are March 18 and April 23

SW BROADCAST BANDS

Reports: as for Medium Wave DX, but please keep separate

by Brian Oddy G3FEX

For the Newcomer SWL

In order to avoid some of the r.f.i. problems, which were discussed last month, it is necessary to install any short wave antenna as far away as possible from the noisy electrical environment which exists in most houses. That way any direct pick up of interference by the antenna is avoided or reduced.

The tiny wanted signals from a remote antenna needs to be conveyed without picking up unwanted interference on the way. It's necessary to use an **r.f. transmission line** or **feeder** system. Non resonant transmission lines and the reasons for the use of both balanced and unbalanced feeders were discussed in *PW* Feb '87.

To ensure that the wanted signals reach the receiver with as little loss as possible it is important that an impedance match exists at all points along system. Although a good match can be obtained between a low impedance 72 balanced feeder and the centre of a halfwave or dipole antenna when operated on its fundamental resonant frequency (*PW* Feb '87), let us now consider what happens if one attempts to use a dipole on harmonically related frequencies. Note: the 2nd harmonic is twice the fundamental frequency, the 3rd harmonic is three times the fundamental frequency etc.—there is no 1st harmonic, since one times the fundamental is the fundamental!

The voltage, current and impedance distribution along antennas one, two or three halfwaves long was shown in *PW* Dec '86. This indicated that although the impedance at the centre of a single halfwave is low, the impedance at the centre of a wire two halfwaves long (a fullwave) is very high. It is also showed that the impedance at the centre of a three halfwave wire is low. In fact this pattern repeats itself as the number of halfwaves is increased and it is important to understand that the impedance is only low at the centre of a wire when there are an odd number of halfwaves present along it. This means our dipole can only be used effectively on the fundamental and odd harmonic frequencies, since there will be a total mismatch at all other frequencies.

Now consider some practical aspects of a dipole cut to resonate on a fundamental frequency on the 7MHz (41m) band with a third harmonic in the 21MHz (13m) band, where it resonates as a three halfwave centre-fed antenna. Perhaps most important for the s.w.l. is there will be a change in the directivity of the antenna, because the radiation patterns of a dipole and a three halfwave antenna are quite different (*PW* Dec '86). The maximum response to incoming signals will no longer be at right angles to the antenna but from four main directions at 45° to the wire.

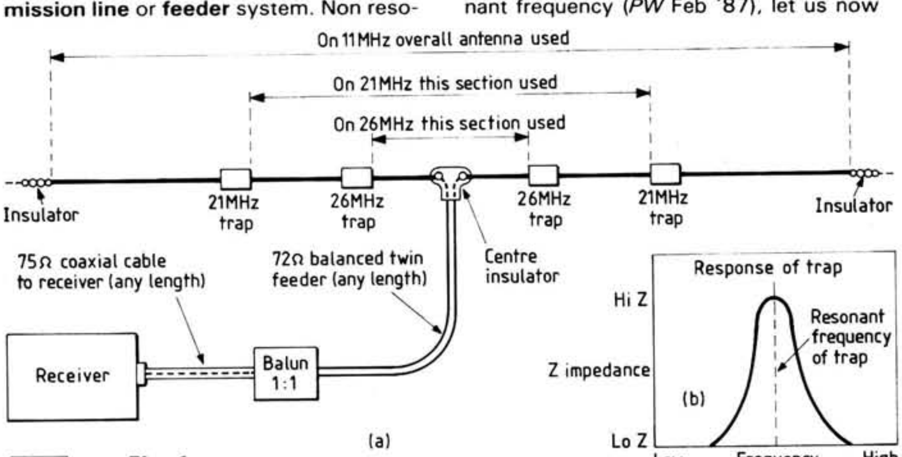

Fig. 1

Resonance in the 13m band will not be exactly three times the fundamental frequency. The formula for calculating the length of the dipole allowed for end effect and the amount required for three half-wave operation will be different (*PW* Dec. '86). Since the centre feed point impedance of a three halfwaves antenna is about 95 there will be a slight mismatch to the 72 balanced feeder (1·3:1), but for receiving purposes this can be ignored.

A single dipole antenna will prove to be of limited use to most s.w.l.s and while some locations may allow several dipoles to be erected, but unfortunately for most of us such a scheme must remain a figment of the imagination! Some method of adapting a simple dipole is therefore required.

One simple idea is to connect several dipoles in parallel across the feed point of an existing dipole, each new one added being resonant on another band. Supporting them can be quite a problem, they don't all have to run in the same general direction. Although such a system will work quite well, it can be very unsightly!

Another simple idea is to attach extension wires of suitable lengths between insulators at each end of an existing dipole. To change frequency, the antenna is lowered and "jumpers" are used so that the additional wires are brought into use, thus lowering the resonant frequency of the system.

Having to lower the antenna each time is inconvenient, and the "jumper" wires tend to corrode easily.

A system developed from this idea use parallel tuned switching circuits called trapes to automatically "jumper" into use the extension wires as the frequency of reception changes is called a trap dipole —see Fig. 1a. The response of a parallel tuned circuit is shown in Fig. 1b—note that the impedance is very high at resonance and low at all other frequencies. It is this property which allows the traps to act as insulators at their resonanct frequency and yet provide a connection to the outer extension wires at other frequencies.

The inductance of the coils which form the traps reduce the overall antenna length needed and this may help considerably where space is a problem. Suitable traps, complete kits of parts or ready made trap dipoles which cover all the s.w. broadcast bands are available commercially from advertisers in *PW*.

Conditions on 25 and 21MHz

(Note: Frequencies in MHz. Time in UTC = GMT)

Occasional openings may happen on the 25MHz (11m) band but broadcasters in this part of the world probably won't start regular programmes for some time to come as to be effective a broadcast service must be fairly reliable. I wonder how well "down under" receive the VOA Poro, Philippines relay transmitter on 26·000 from 0000–0200.

Reception has been variable on the 21MHz (13m) band with unstable conditions. The band closes soon after dark here. Radio RSA in Johannesburg, S. Africa on 21·590 heads the popularity list in the UK. They broadcast towards Europe from 1000 until 1556. **John Nash** (Brighton) noted considerable variations in their signal over two weeks ranging from SIO 111 to 444. Their programmes are in Portuguese, English and French and they welcome comments and reports. **Leslie**

A Gregory Adrian, London.
B Leslie Biss, Knaresborough.
C Alan Curry, Stockton-on-Tees.
D Roy Degg, Stoke-on-Trent.
E Neil Dove, Lockerbie.
F David Edwardson, Wallsend.
G Davy Hossack, Winchburgh.
H Bill Kelly, Belfast.
I Alexander Little, Glasgow.
J Gerry Lovell, Weston-Super-Mare.
K David Middlemiss, Eyemouth.
L George Morley, Redhill.
M John Nash, Brighton.
N Kari Nieminen, Turku, Finland.
O Michael Osborn, Chelmsford.
P Fred Pallant, Storrington.
Q John Parry, Northwich.
R Philip Rambaut, Macclesfield.
S Bill Reid, Finchampstead.
T John Sadler, Bishops Stortford.
U Tim Shirley, Bristol.
V Leighton Smart, Trelewis.
W Jim Willett, Grimsby.

Freq (MHz)	Station	Country	UTC	DXer
3.230	R. RSA	S. Africa	0301	I
3.235	AIR Gauhati	India	1659	I
3.270	SWABC Windhoek	Namibia	2300	I,W
3.355	AIR Kurseong	India	1600	H
3.365	GBC Radio 2	Ghana	2250	J,W
3.395	R. Zaracay	Ecuador	0230	W
3.903	AIR Delhi	India	2330	H,K
3.915	BBC Krankji	Singapore	0220	I,W
3.925	AIR Delhi	India	1625	H,I
3.925	NSB Tokyo	Japan	0744	F
3.940	PBS Hubei Wuhan	China	2340	F,H
3.945	NSB Tokyo	Japan	0749	F
3.965	RFI Paris	France	2310	H
3.980	R. Pakistan	Islamabad	1600	Q
3.985	SRI Berne	Switzerland	0755	H
4.005	RRI Padang	Indonesia	0300	W
4.060	R. Moscow Kharkov	USSR	1655	B,I,U
4.220	Xinjiang	China	1650	F,H,I
4.500	Xinjiang	China	2330	F,H,I
4.635	R. Dushanbe, Tadzhik	USSR	1706	I
4.725	BBS Rangoon	Burma	1457	G
4.735	Xinjiang	China	2345	F,S
4.740	R. Afghanistan	via USSR	1620	B,H,I
4.750	R. Bertoura	Cameroon	1845	H,P,R
4.760	ELWA Monrovia	Liberia	2012	F,I,O,P,U
4.760	Yunnan Kunming	China	1547	H,I
4.770	FRCN, Kaduna	Nigeria	1920	C,E,H,I,J,O,P,R,U,W
4.770	R. Mundial, Bolivar	Venezuela	0320	W
4,780	RTD	Djibouti	1655	F
4.785	R. Baku	USSR	1839	F,N,R
4.785	RTM Bamako	Mali	1850	P,R,S
4.785	R. Tanzania	Dar-es-Sal	1630	B,H
4.790	R. Atlantida	Peru	0735	F
4.790	Azad Kashmir R.	Pakistan	1614	F,I
4.795	R. Douala	Cameroon	2232	I,J,R
4.795	R. Ulan Ude	USSR	0152	F
4.800	AIR Hyderabad	India	1607	F,H,I
4.810	RSA	S. Africa	1703	P
4.815	R. diff TV Burkina	Ouagadougou	2103	B,E,H,I,P,R
4.820	R. Botswana	Botswana	1855	B,E,F,I,J,P,R
4.820	La Voz Evangelica	Honduras	0240	G,I,W
4.830	Africa No. 1	Gabon	1930	A,B,C,D,E,F,H,I,M,P,R,T,U,V
4.830	R. Reloj	Costa Rica	0312	I,N
4.830	R. Tachira	Venezuela	0110	E,F,H,W
4.835	RTM Bamako	Mali	2000	A,D,F,H,I,J,P,R
4.845	R. Nacional, Manus	Brazil	2246	H,I
4.845	ORTM Nouakchott	Mauritania	1850	H,I,J,P,R
4.850	R. Capital, Caracus	Venezuela	0145	G
4.850	R. Columbia Pt	Costa Rica	0430	W
4.850	R. Yaounde	Cameroon	1800	H,I,J,U,W
4.860	AIR New Delhi	India	0026	I
4.860	R. Chita	USSR	2050	B
4.860	Kalinin	USSR	1832	D,R
4.865	PBS Lanzhou	China	2336	F,H,I,J,O,S
4.870	R. Cotonou	Benin	832	I,O,P,R
4.880	R. Bangladesh	Dhaka	0110	F
4.880	SABC Radio 5	S. Africa	1845	B,C,E,F,G,I,L,P,Q,R,U,V
4.880	Swaziland Comm. R.	Swaziland	1800	H,I,R
4.885	R. Clube do Para	Brazil	0230	H,I
4.890	ORTS, Dakar	Senegal	1831	B,F,P,R
4.895	Ashkhabad	USSR	0024	C,E,K,L
4.900	R. diff Nat. Conakry	Guinea	1935	E,P,R
4.905	N'djamena	Chad	2200	F,H,P
4.910	R. Zambia	Zambia	2030	I,P
4.915	Accra	Ghana	2010	I,L,R
4.915	R. Anhanguera	Brazil	0324	O
4.920	AIR Madras	India	1536	I
4.920	VLM4 Brisbane	Australia	0847	F
4.920	R. Nat. N'djamena	Chad	2110	B,E,H,P,R
4.920	R. Afghanistan	via USSR	1900	B,E,L,R
4.930	Ashkabad	USSSR	2046	I,L,Q
4.930	R. Tbilisi	USSR	1829	L,R
4.935	SWABC Windhoek	S.W. Africa	1645	B
4.940	Kiev	USSR	1550	F,I,R
4.940	R. Yakutsk	USSR	0455	H
4.945	R. Nat. Porto Velho	Brazil	2226	I
4.945	RSA	S. Africa	1840	E,L,P,R
4.955	RRI Banda Aceh	Indonesia	1559	F
4.958	Azerbaijan	USSR	2005	E,H,R
4.970	R. Rumbos	Venezuela	0300	I,W
4.970	Xinjiang	China	1623	F
4.975	Dushanbe	USSR	1650	E,H,R
4.980	Ecos del Torbes	Venezuela	2320	A,E,F,H,I,O,Q,W
4.990	FRCN, Lagos	Nigeria	1800	A,F,H,I,P,R,S,U
4.990	Radio RSA	S. Africa	2255	H,I
4.995	R. Ulan Bator	Mongolia	1750	P
5.005	R. Cristal La Paz	Bolivia	0200	U
5.005	R. Nacioal, Bata	Eq. Guinea	1825	J,R
5.005	R. Nepal	Khumaltar	1554	L
5.010	R. Garoua	Cameroon	1824	C,H,I,P,R,S
5.010	R. Singapore	Singapore	1550	I
5.015	Arkhangeslsk	USSR	0720	H
5.020	ORTN Niamey	Niger	1823	I,R
5.025	R. Uganda, Kampala	Uganda	1822	R
5.035	Alma Ata	USSR	1941	B,H,L,R,S,U
5.035	R. Bangui	C. Africa	1822	I,R
5.040	George	USSR	2015	E
5.040	R. Tbilisi	USSR	1820	B,F,R
5.045	R. Cultura do Para	Brazil	2158	O
5.045	R. Togo Lome	Togo	1855	G,I,P,R
5.050	R. Singapore	Singapore	1647	I
5.050	R. Tanzania	Dar-es-Salaam	1828	R
5.057	R. Tirana	Albania	2240	E,I,M
5.060	PBS Xinjiang	China	0050	F,I
5.065	R. Candip	Zaire	0400	I
5.075	R. Beijing	China	2310	S
5.095	R. Pakistan	Islamabad	0053	I
5.095	R. Sutatenza, Bogota	Colombia	2258	E,I,J,O
5.260	R. Alma Ata	USSR	0145	F

Stations heard chart

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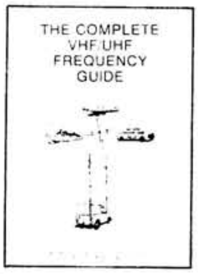

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Lyon (Scarborough) says his reports usually cover a week of listening and they include favourable or unfavourable comments about the programmes, as both are usually acceptable. He has received several QSL cards from Radio RSA confirming reports.

UAE Radio Dubai on 21·605 also beam to Europe from 1000 until 1500. Programmes are mainly in Arabic with some interesting items in English. **Robert Taylor** (Edinburgh) uses a Toshiba RP F-11L receiver and its whip antenna to receive them SINPO 54445 in his log at 1045.

Other signals heard on 13m during daylight in the UK were detailed by **Philip Rambaut** (Macclesfield) Radio Cairo, Egypt on 21·465—programmes in Thai, Indonesian and Malay directed to Asia 1115–1445; Radio Nederlands on 21·480 in English to Asia via the Madagascar relay from 1130–1225; VOA on 21·550 in French for Africa from 1200–1330 via the Monrovia Liberia relay and NRK Norway on 21·700 (in Norwegian for E. Africa from 1200–1245).

Simon Illingworth (Johannesburg, S. Africa) says the 13m band has its "ups and downs", the BBC World Service is not always reliable. The BBC Masirah Island, Oman relay can be heard on 21·470 between 0900 and 1130, followed by a Daventry transmitter from 1130 until 1345. Sometimes the synchronised transmission at 1100 from Daventry and Rampisham on 21·710 (intended for the Middle East and N. Africa) is a better signal.

During the morning Simon can usually hear Radio Nederlands, via the Madagascar relay on 21·485—signals to Asia are sometimes good around 1100, but often poor; RBI Berlin on 21·540—fairly good signals at 1000, programmes in English, Hindi, and German beamed to Asia from 0645 to 1445; Radio RSA on 21·590—ground wave usually very weak; UAE Radio Dubai on 21·605—fair at 1100 beaming towards Europe; RFI Paris on 21·620—in French to Africa from 0700–1500 signals often good around 1100; NRK Norway on 21·700—E. African broadcast fairly good at 1215; Radio Prague on 21·705—fair at 0900 programmes in English and Czech to Asia from 0730 to 0930; Radio Moscow on 21·725—World Service beamed to Africa from 0800 until 1500 but signals often weak by 1200.

Simon has been receiving good signals from the 100kW s.s.b. transmitter in Varburg, Sweden on 21·555 (u.s.b.) at 1200. The Swedish Home Service is beamed to the Middle East from 0930 until 1200 and Africa from 1200 until 1600. This is one of the few s.s.b. broadcasts, it is usually well received in the UK with a suitable receiver.

The 17 and 15MHz Bands

The 17MHz (16m) band also is unreliable just now, although several continents can usually be heard during daylight the band closes during the evening in the UK.

Radio Australia's transmission to Asia on 17·715 can be heard 0830. English programmes are transmitted from Carnarvon, Western Australia 0100–0910. On 17·875 around 1138 FEBA in the Seychelles broadcasts in Arabic to the Middle East. **George Morley** (Redhill) logged them as SIO 122 recently, so don't expect a strong signal!

Programmes in Arabic and English from UAE Radio Dubai can be found on 17·775 between 1000 and 1500. **Alan Curry** heard their news at 1036, SINPO 55545. A programme in Czech, intended for central Europe, is made by Radio Free Europe and transmitted from Gloria, Portugal on 17·835 from 0600 until 1700. Although seldom mentioned it has been heard at 0845 by **Maurice Andries** (Dendermonde, Belgium) SINPO 44434.

Radio Pakistan on 17·660 transmit a dictation speed news broadcast heard by **Sheila Hughes** (Morden). Their programmes commence at 0715 in Urdu, with items in English from 1005 to 1010 and from 1110 until 1115. Philip Rambaut mentioned the Cyclops, Malta relay of Radio DW, Cologne on 17·815, it beams programmes in Indonesian to S.E. Asia from 1330 until 1420. He also detailed the World Service in English on 17.655 and the Russian Service on 17·580 from Radio Moscow beamed to Africa between 0900 and 1600. He mentioned their transmission in Russian to Europe on 17·745 from 0900 until 1730.

Using a Trio R600 receiver plus a trap dipole antenna, **Leslie Biss** (Knaresborough) monitored Radio Japan via the Moyabi, Gabon relay on 17·785 from 1500. He noted some improvement and quotes SINPO 34333 instead of the 22333 mentioned last month. RCI in Montreal broadcast topics in six languages on 17·820. From 1300–1700 programes in French and English are beamed to C. America and the Caribbean. Europe programmes in Russian, Ukrainian, English, French, Polish and German until 1800, their programmes in English and French are beamed to W. Africa until 2200. Signals are usually well received here, SINPO 44444 noted by Robert Taylor at 1615 is typical.

Leighton Smart (Trelewis) uses a Grundig 1400SL receiver plus a long wire antenna. He heard the VOA broadcast to W. Africa at 1600 via Bethany, E. USA on 17·785—this transmission ends at 2300. **Chris Wood** (Washington, Co. Durham) mentioned the programmes in English and Dutch from Radio Surinam at 1700—they are relayed to Europe via an RNB transmitter in Brazil on 17·755 until 1745.

The 15MHz (19m) band has been generally more reliable than the higher frequencies during daylight. The band has been staying open for several hours after sunset here. Many high power transmitters moved on to this band to provide a better service for the listener—unfortunately illegal jamming has increased too. Despite the jamming, countries can usually be heard during the day in the UK and some of them stem from unusual places too. **Bill Reid** (Finchampstead) logged KYOI in Siapan, N. Mariana Islands on 15·190 at 0839. Sheila Hughes logged KTWR in Agana, Guam on 15·115 at 0830 (both worth looking up on a Great Circle Map!).

Some signals from a southerly direction have been coming in well. **Davy Hossack** (Winchburgh) logged the Voice of Nigeria on 15·120 at 0915. **David Middlemiss** (Eyemouth) heard news in English from Africa No. 1, Gabon on 15·200 at 0905. He also heard Radio Nederlands broadcast to E. Africa at 1630 via the Madagascar relay on 15·570. VOIRI in Tehran, Iran beaming to S.E. Asia and Australia was noted as SIO 333 by **Julian Wood** (Buckie) on 15·085 at 1100. **Alexander Little** (Glasgow) heard Radio RSA on 15·185 broadcasting in Swahili to Aftrica at 1600. **Neil Dove** (Lockerbie) logged them at 1540 on 15·220 at SINPO 44544. The BBC World Service via the Ascension Island relay on 15·400 was logged by Gerry Lovell (Weston-super-Mare) at 1430 using a Sony ICF 7600D and whips antenna. **Michael Osborn** (Chelmsford) noted Radio Portugal, Lisbon on 15·105 SINPO 55545 at 1612. **Gregory Adrian** (London) heard Morocco on 15·335 at 1458, broadcasting in Arabic. He also picked up the Kigali, Rwanda relay of Radio DW, Cologne at 1440 on 15·410.

Bill Stewart (Lossiemouth) heard from RCI in Montreal on 15·315 at 1530 broadcasting in French and English. **Tim Shirley** (Bristol) also heard RCI, but on 15·325 at 1600. Programmes for Europe on 15·325 start at 1430 and are in Russian, Ukrainian, French, English, Polish, German, Hungarian and Czech! Tim noted VOA braodcasting to W. Africa on 15·410 via Greenville, E. USA in English from 1600 until 2200. **Daniel Masterson** (Stoke-on-Trent) heard WYFR via Okkechobee, Florida USA on 15·440, they beam to Europe from 1600 until 1845.

The DX programme at 2130 from VOA, Radio HCJB in Quito, Ecuador on 15·20 is a favourite of Tim Shirley.

Exciting news comes from **Donald Wood** (Kingston-upon-Thames). He picked up Radio New Zealand on 15·150 using a new Sony ICF 2001D receiver at 1845. His reception has been confirmed with a QSL card and a long letter from their manager Rudi Hill. Congratulations Donald.

The 11, 9, 7, and 6MHz Bands

Conditions on the 11MHz (25m) band have been fairly good. Radio New Zealand has been absent on 11·780, despite DXers looking for their signal.

Using a Grundig 1400SL receiver, **Simon Hamer** (New Radnor) has been hearing KYOI in Siapan, N. Mariana Islands on 11·900 at 1200 broadcasting to Asia. **John Sadler** (Bishops Stortford) listens to an interesting DX programme on Tuesdays at 1515 by Radio Budapest on 11·910. At 1600 he picked up Moyabi, Gabon relaying programmes in English from FRI in Paris to N. Africa on 11·705. Two more relay stations were mentioned by **Colin Diffell** (Corsham)—the BBC Ascension Island relay on 11·820, broadcasting the World Service to Africa at 1832 and RHC Habana, Cuba relaying Radio Moscow's World Service to N. America on 11·840 at 1857. Using a Sony ICF2001D receiver plus AN-1 antenna he heard a broadcast to S.W. Europe in Arabic, Spanish and French from RHC Habana, Cuba on 11·950 at 1918. Their programmes in English are on 11·795 at 1830.

Radio Kuwait, which is not often reported, was logged by **Darren Taplin** (Tunbridge Wells) at SINPO 55544 on 11·675 at 2029. He uses a Realistic DX-150A receiver plus 25m wire antenna and hears Radio RSA in Johannesburg on 11·900 from 2100 until 2156. It is advisable to tune above 12MHz, he logged Radio Cairo, Egypt on 12·050 broadcasting in Arabic at 2000.

Many 9MHz (31m) band reporters mention the bird call, station announcement and time signal followed by the world news and weather report from Radio New Zealand on 9·600 from 0858! **Jim Willett** (Grimsby) says he didn't expect to hear them, but was delighted to get positive identification at 0900 and log them at SIO 222 with his Yaesu FRG-7 receiver. **David Edwardson** (Wallsend) and his Trio R600 receiver heard them on three mornings at SIO 33. No doubt his 5m high inverted "V" 22m trap dipole antenna helped. **Alan Jarvis** (Cardiff) has also heard them several times, but their signal is so weak that if he had not known where to look he would have missed it! **Stewart Russell** (Forfar) has been getting good reception from Radio Australia on 9·655 broadcast to Europe from 0700 intil 1030. Using a Vega receiver, **John Court** (Birmingham) has been listening at 0300 to TWR, Bonaire, Nederlands Antilles on 9·535.

Stewart Russell also heard Radio Australia on 7·205 (heard from 1530 until 2040). **John Parry** (Northwich) heard AIR New Delhi, India on 7·412 at 1530. **Roy Degg** (Stoke-on-Trent) heard broadcasts in English from Radio Polonia on 7·125 at 2230. The 6MHz (49m) broadcasts to Europe from Radio Australia commence at 1530 on 6·035—**Kari Niemenen** logged them in Turku, Finland as SIO 544.

As for the 5, 4, 3 and 2MHz bands, the chart is evidence enough.

Station Addresses

Radio Bucharest, P.O. Box 111, Bucharest, Romania. TWR Bonaire, P.O. Box 37, Bonaire, Nederlands Antilles. Vatican Radio, 00120 Citta del Vaticano, Vatican State.

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Have Yaesu FT-707 (100W). Yaesu FC-707 a.t.u., FV-707DM (22A p.s.u.), no antennas. Would exchange for 144MHz f.m. l.c.d. rig, mobile or TR2500/2600 with accessories. Also interested in add-ons for Spectrum. Syd. Tel: Bursledon 4333. Must be collected. *C384*

Have C12S (h.f. transceiver ex-WD). Would exchange for 18 set or Mk 1 28 set or HW7/8. Tel: Medway 253056. *C388*

Have Newbrain Ad/Display computer, p.s.u., all leads, 5 business tapes, 4 manuals, circuits, club magazines, as used for machine control. Value £100+. Would exchange for portable or mobile 430MHz TX/RX. Cash adjustment as required. Allen. Tel: 0327 703964 (daytime). *C402*

Have Honda motorcycle CM 125C "B" reg in v.g.c. with panniers only 1000 miles, owing to ill health. Would exchange for 430MHz basestation, Icom or Yaesu preferred. Buyer collects. John G8ZZD. Tel: 0209 716411. *C406*

Have 934MHz Cybernet Delta 1, PA7E colinear antenna, P7ME mobile antenna, Creslbyte AP104/AMP, SSE S-unit meter and 15m H100 cable. All new in May '86. Would exchange for general coverage receiver, Yaesu, Trio etc. Tel: Lowestoft 86594. *C408*

Have Diawa Search 9 receiver in v.g.c. Would exchange for top band transceiver, anything considered but must have a.m. and c.w. at least. Also wanted, Kenwood T-599S h.f. TX. Peter G1TXI. QTHR. Tel: 0603 748338. *C410*

Have Spectrum 128 computer. Would exchange for FRG-7 or similar. W.h.y? Ross, 9 Brandywells, Kingsnympton, Umberleigh, Devon EX37 9SP. *C414*

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Have Drae Morse tutor, as new. Would exchange for suitable a.t.u. unit for 100W or parts to make same, w.h.y? Tel: Redruth 213542. *C456*

Have Eumig S912GL Super 8mm sound projector, would exchange for audio multifilter or any RX radio gear, w.h.y? Mr B. Porter, 25 Bourtonville, Buckingham, Bucks MK18 1AY. Tel: Buckingham 814961. *C459*

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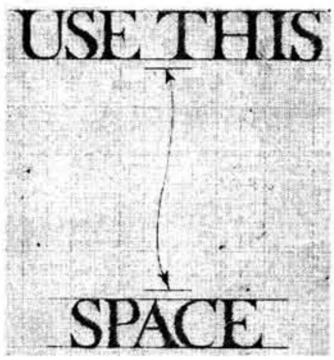

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