JUNE 1987 £1·10

ISSN 0141-0857

Practical Wireless

The Radio Magazine

THE PW 'DOWNTON' FREQUENCY TO VOLTAGE CONVERTER

AN ADD-ON SIDETONE OSCILLATOR

THE YAESU FT-767GX REVIEWED

PW 144MHz QRP CONTEST RULES

Reg Ward & Co. Ltd.

1 Western Parade, West Street, Axminster, Devon, EX13 5NY.
Telephone: Axminster (0297) 34918

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	60-950MHz Scanning RX	550.00	(—)
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 30V	70cms, 3W in, 30W 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)
MML144/100-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

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

IC761	New Super HF Transceiver	P.O.A.	(—)
IC751A	HF Transceiver	1465.00	(—)
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	239.00	(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)

SPECIAL OFFERS

	WAS	NOW
Yaesu FT770RH	£495	£395
Yaesu FT703(4)	£295	£189
Yaesu FT209RH(4)	£315	£239
Yaesu FT709R(4)	£325	£199
Yaesu FT757GX	£895 }	
Yaesu FP757GX	£199 }	
	WAS £1168	
	NOW £999	
	WAS	NOW
KDK FM740	£339	£299
Kenwood TM201 2m/25w FM mobile		£269

Dalong 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	66.95	(2.00)
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)
STAR	Master Key MkII	54.70	(3.00)
STAR	Master Key cmos memory keyer	95.00	(3.00)
KENPRO			
KP100	Squeeze CMOS 230/13.8v	109.25	(3.00)
KP200	Memory 4096 Multi Channel	234.55	(3.00)

Kenwood

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	220.05	(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	269.00	(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)
TH205	2M H/H	218.01	(3.00)
TH215	2M H/H Keyboard	258.00	(3.00)
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	65.00	(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	450 Degrees, Medium/Heavy Duty	325.00	(3.50)
KR1000SDX	450 Degrees, 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 KP21N	2 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)

Transverters

MICROWAVE MODULES			
MMT50/28S	10m-6m Transverter	289.80	(3.00)
MMT50/144	2m-6m Transverter	289.80	(3.00)
MMT144/28R	2m-10m 25W O/P	289.80	(3.00)
MMT144/28	2m-10m 10W O/P	139.84	(2.50)
MMT432/28S	70cm-10m Transverter	195.50	(3.00)
MMT1296/144	23cm-2m Transverter	258.75	(3.00)

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Practical Wireless
The Radio Magazine

JUNE 1987 (ON SALE 14 MAY) VOL. 63 NO. 6 ISSUE 963

THIS MONTH

Regular Features

NEXT MONTH

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Prestel 202671191

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It may be important

to other amateur radio manufacturers to offer equipment that, first and foremost, is built around an all-singing, all-dancing microprocessor. It may be that the real need of the radio amateur, to communicate with the least fuss possible, was forgotten long ago. The approach from KENWOOD has always been different. Equipment reviewers have spoken for many years of "excellent ergonomics", the ability to pick up a piece of KENWOOD equipment and operate it first time with no reference to the user's handbook. **The three new models featured on this page** continue this design policy; equipment built to a high specification that are a pleasure to own and use.

NEW from KENWOOD the TH215E handheld,

Having used a TR2600E since its introduction, I must admit I could not see how it could be greatly improved. However, by making one simple change from previous models, the TH215E 2 metre handheld has become much easier to use. On the earlier TR2500 and TR2600E two buttons had to be pressed each time a frequency in memory was required. On the TH215E a memory is selected by pressing one button. A small alteration but one that has changed the character of the handheld and brought it even more into line with the amateurs requirements.

A rugged diecast metal case adds to the strength of the handheld. For greater flexibility the TH215E operates on DC voltages from 7.2 to 16 volts. An external power supply connection is included on the rig's top panel (use optional power cable PG2V or PG3C). Output power is dependent on voltage. Switched to its high power setting, the TH215E produces 2.5 watts at 8.4 volts. This increases to 5 watts when supply is 13.8 volts. On its low power setting the output is approximately 500 milliwatts.

Making the microcomputer work for you as opposed to you working for the microcomputer has resulted in a truly flexible piece of equipment. The stepping rate when using up/down frequency shift buttons can be user programmed in either 5, 10, 15, 20 or 25 kHz steps. The repeater offset can also be programmed to shift from 100 kHz to 9.900 MHz.

Length of operation has always been a problem with the handheld transceiver. The TH215E with its battery saver successfully gets over this by switching off the receiver. The actual length of time the receiver is off can be determined by the user. In addition a comprehensive range of optional nicad packs are available which will extend operation. These are the PB1 (12V, 800mAh), PB3 (7.2V, 800mAh) and the PB4 (7.2V, 1600mAh).

The TH215E has ten memories which store frequency, frequency step and whether the rig is to operate in simplex or repeater mode. Memory 1 is also used as a priority channel and memories 8 and 9 serve to define the limits of programmable scan. There are three modes of frequency scan, band, memory and programmable. The receiver also has three stop/resume scanning modes. These are seek where the scan instruction is cancelled once a signal is found, time where the set holds on an occupied channel for approximately 5 seconds and carrier where the scan is held until the carrier drops.

The transceiver also has reverse repeater, an illuminated display for night operation, priority channel operation so that an expected call is not missed, a lock which disables either transmit or keypad functions and an indicator which tells that the battery voltage has fallen below the level for good communications.

The KENWOOD TH215E comes complete with PB2 nicad (8.4V, 500mAh), nicad charger and helical aerial.

TH215E . . . **£258.00** inc VAT, carriage £7.00.

a **NO NONSENSE**, high power 2 metre mobile, the TM221E..... **£334.60** inc VAT, carriage £7.00

AND a new dual band FM mobile, the TW4100E..... **£766.37** inc VAT, carriage £7.00

The NEW TW4100E dual band (2 metres and 70 centimetres) FM mobile transceiver follows on from the well-known TW4000A. Producing 45 watts on 2 metres and 35 watts on 70 centimetres the transceiver is 150 mm wide, 200 mm deep and 50 mm high. Unlike its predecessor, the TW4100E has full duplex facilities (you can transmit on 2 metres whilst, at the same time, receiving on 70 centimetres or vice versa).

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OSCAR720 . . . Dual band (144/430 MHz) whip. **£24.59 inc VAT, carriage £2.00.**

HS770 . . . 144/430 MHz diplexer for use with OSCAR720. **£18.02 inc VAT, carriage £1.50.**

GSS . . . Gutter mount (requires RG4M cable assembly). **£6.26 inc VAT, carriage £1.25.**

RG4M . . . Cable assembly for GSS base, complete with SO239 and PL259 plug. **£6.25 inc VAT, carriage £1.00.**

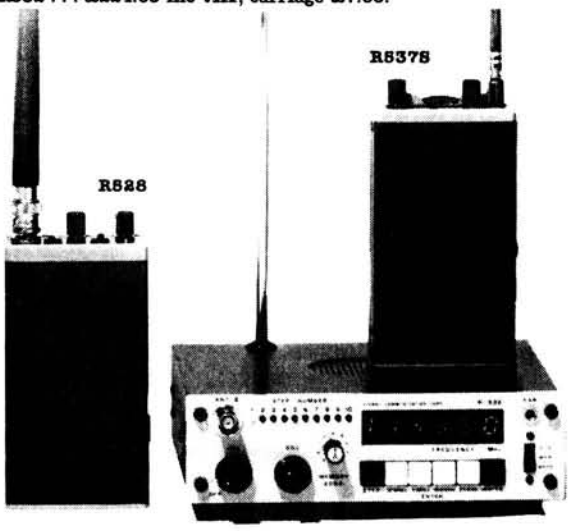
12B . . . Car wing mount with SO239 top and bottom. **£5.75 inc VAT, carriage £1.00.**

HSTMB . . . Car boot mount including cable and PL259. **£15.42 inc VAT, carriage £1.50.**

MA200S . . . High quality mag mount with cable and strong protective cover to prevent paintwork damage. **£22.90 inc VAT, carriage £2.00.**

airband receivers

R537S . . . a tunable airband receiver covering 118 to 136 MHz plus the facility for two crystal controlled channels (crystals not included).
R537S . . . £69.51 inc VAT, carriage £2.00. Crystals £4.60 each.
R528 . . . an airband receiver scanning four out of six crystal controlled channels (crystals not included). The R528 also has a manual channel selection switch.
R528 . . . £125.36 inc VAT, carriage £2.00. Crystals £4.60 each.
R532 . . . not needing crystals, the R532 is a synthesized receiver covering the airbands from 110 to 136 MHz and having 100 programmable memory channels (ten banks of ten). Operating on 12 volts DC, the R532 can be used either mobile or at home with the optional mains power supply. Add a nicad battery pack and carrying case and the R532 is also ideal for portable use.
R532 . . . £224.05 inc VAT, carriage £7.00.



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CN410M . . . Frequency range 3.5 to 150 MHz, forward power switchable 15/150 Watts, reflected 5/50 Watts, SO239 connectors.

CN460M . . . Frequency range 140 to 450 MHz, forward power switchable 15/150 Watts, reflected 5/50 Watts, SO239 connectors.

NS448 with remote head . . . Frequency range 900 to 1300 MHz, forward power switchable 5/20 Watts, reflected 1.6/6.6 Watts, N type connectors.

NS660P . . . switchable meter reading (average, normal PEP and hold PEP) and provision for optional remote head (U66V), frequency range 1.8 to 150 MHz, forward power switchable 15/150/1500 Watts, SO239 connectors.

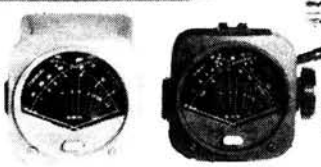
U66V . . . remote head, frequency range 140/525 MHz, max 300 Watts, N type connectors.

SC20 . . . extension cable for U66V, approx 20 metres long.

CN410M . . . £61.72 inc VAT, carriage £1.50.

NS660P . . . £115.00 inc VAT, carriage £2.50.

CN460M . . . £65.40 inc VAT, carr £1.50.



NS448 . . . £86.60 inc VAT, carriage £2.50.

LOWE RADIO EVENING IN TELFORD.

On Wednesday, 17th of June, meeting at 7.30 for a prompt 8pm start, LOWE ELECTRONICS have booked the functions room of the CHARLTON ARMS HOTEL, Church Street, Wellington, Telford, Shropshire for a radio evening. Two talks are planned, John Wilson G3PCY, technical director of LOWE ELECTRONICS will speak on "REMINISCENCES OF A RADIO AMATEUR" and John Thorpe on "THE DESIGN AND DEVELOPMENT OF THE HF125 SHORTWAVE RECEIVER". For those who don't know, this is a new receiver (30 kHz to 30 MHz, £375.00 inc VAT) designed by John Thorpe and being built in the UK by LOWE ELECTRONICS.

A cup of coffee and a biscuit will be available FREE OF CHARGE to the first 50 people to arrive and before, between and after the lectures a bar at the back of the room will be open. The latest models from KENWOOD plus the HF125 receiver will also be on view.

In order to navigate the Wellington town centre one-way system a knowledgeable talk-in station has been arranged which will operate on two metres (channel S22) from 7.00pm.

It promises to be an excellent evening. Please, don't miss it!

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IC-761, HF TRANSCEIVER with General coverage receiver.

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For the serious operator the 100kHz-30MHz general coverage receiver and 105dB dynamic range make it ideal for DX chasing. Frequency selection is by the main VFO or via the front panel direct access keypad.
And for when reception is difficult, pass band tuning, I.F. shift, notch filter, noise blanker, pre-amp and attenuator should enable you to copy even those weak DX stations whether amateur or broadcast.
The C.W. operator will appreciate the electronic keyer, 500Hz filter and full break in (40wpm) other filter options are available.
The IC-CR64 high stability crystal is standard as is the CI-V communications interface for computer control. Twin VFO's and split mode for cross band contacts the IC-761 features program scanning, memory scan and mode select scan and the 32 memories can store frequency and mode.
The transceivers operating system is held permanently in ROM and is not dependant upon the lithium battery. The cell is used for memory back up only. A new style meter gives P.O., A.L.C., IC, VC, COMP and SWR readings.
This new equipment is fully compatible with existing ICOM accessories such as the IC-2KL 500 watt linear amplifier. Here we believe the IC-761 will set a new trend that others will surely follow. For more information please contact your nearest ICOM dealer.

IC-735.

IC-735

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- 100 watts.
- 105dB Dynamic Range.
- FM Standard.
- 12v Operation.
- Large LCD Readout.
- 12 Memories.
- CI-V Communications Interface.
- HM12 Microphone.

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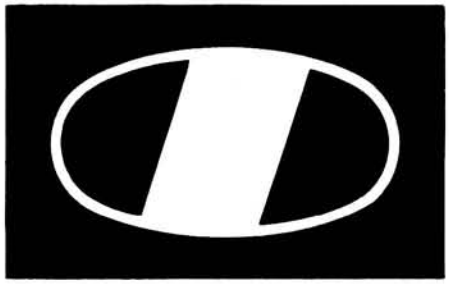

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IC-475 ICOM's fantastic all mode UHF transceiver brings fixed mobile and portable operations to the discriminating amateur and OSCAR operator. Featuring 25 watts output, 99 memories, scanning, priority channels. Only 5 seconds for 99 memory channel scanning. Direct digital synthesiser and CI-V communications interface.
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IC-MICRO 4 ICOM's micro 70 centimetre FM handportable, small in size, big in features, 10 memories, LCD readout, power saving, 1.5 watts output., Includes A.C. wall charger, flexible antenna, wrist strap, BP22 Battery pack. Options available, variety nicad packs, and cases, HS10 boom microphone and headset HS10SB., BC50 fast charger.

ICOM TEST METERS ICOM have introduced a range of test meters for the radio amateur. These new models would be a useful addition to any ham shack.
The DM10 is a digital pen type volt/resistance meter. The LCD display shows measurement in the range, D.C. volts 0.1mV-500V, A.C. volts 1mV-500V. Resistance 0.1.ohm-20M ohm. Its small size (21W x 31H x 161L) makes it an ideal handheld test meter.
The DM20 is a digital pocket type volt/resistance meter. The large LCD display shows measurement in A.C. and D.C. volts 1mV-450V, and resistance 0.1.ohm-200K ohms. This test meter is ideal for portable use, its size (51W x 106H x 10D) making it a useful piece of equipment to carry in your pocket.
The DM500 is the top of the range digital meter. The large LCD display shows measurements in the range, D.C. volts 0.1mV-1000V, A.C. volts 1mV-750V. Resistance 0.1ohm-20M ohms. DC current 0.1uA-10A. This meter measures 70W x 14H x 34D and is ideal to cope with most applications in your radio shack.

STOP PRESS! The ICOM Micro 2, 2 meter mini handportable is now reduced in price. The new R.R.P. is £239.00 and remember, all ICOM handportables include an antenna, a nicad battery pack, a wall charger, wrist strap, and full operating instructions. A host of accessories are available to complement this superb range of hand portable amateur equipment.

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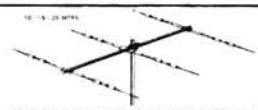

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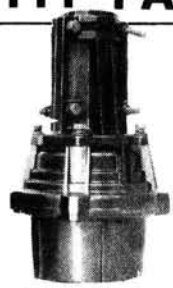

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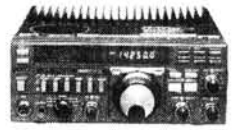

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! Free Finance !

Waffers

Miss Sarah Rutt (Letters, *PW*, April 1987) is to be congratulated on her achievement in passing both her RAE and Morse Test at so early an age. I hope that amature radio will provide her with much pleasure for many years to come.

She must, however, learn not to be discouraged too easily. Listening on the bands it will become evident to her that most amateurs run out of things to say about a third of the way through their QSOs. None that I have heard have let that prevent them completing the other two thirds.

L. P. Coombes G4KXA
Woking

Clichés

Do we really need these clichés and Q-codes which are prevalent on two metres?

As I understand it the Q-code, because of its brevity, was devised for ship to shore communications, and quite obviously there is still a need on c.w. for "QSY", "QTH", "73", "88", etc., even the ubiquitous "HI", but I seriously question whether there is any earthly use for them on 'phone.

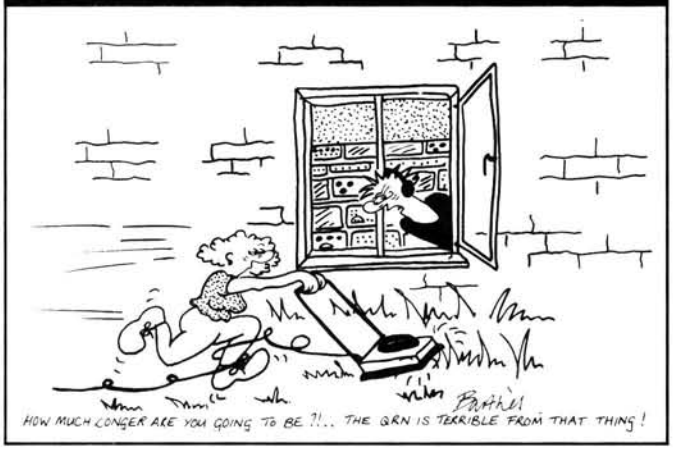
Neither, in my opinion, is there any need when using the f.m. mode for the increasing spate of "go ahead", "over over", or the American trucker expression "come back". Surely the dropping of the carrier should be self-evident to the opposite party that the transmission has been passed.

But I must reserve as my final pet aversion the ludicrous "HI" brigade. What a nonsense it is. Are these perpetrators really incapable of emitting a genuine unabbreviated chuckle? Perhaps it is just as well that we do not have an abbreviation for clearing one's throat.

Let us have an end to these superfluous clichés, using them only where they were intended to be used—on c.w.—and get on with some good old-fashioned English as she is spoken!

Roy Aitken G4VCT
Morecambe, Lancs.

LAUGH WITH BARTHES



QRO Handhelds

After reading through many of the adverts for new amateur gear, I noticed that quite a few of the latest hand-portables coming onto the market are capable of delivering up to 5 watts of r.f. While this has the advantage of increasing the working range somewhat, could there be a possible problem associated with this increase in power that's been kept a little quiet? And I don't mean the extra load on the NiCad pack!

Some people may remember all the scaremongering, myth-telling and general

PW COMMENT

Send Three-and-fourpence . . .

. . . We're Going to a Dance! According to legend, this is how a message arrived at a military headquarters after being relayed by word of mouth from messenger to messenger on its way across the battlefield from the front line. What it had started out as was: "Send reinforcements; we're going to advance!"

Much the same sort of alteration (known technically on message-handling circuits as "mutilation") seems to have been inflicted on news of the changes currently taking place in *Practical Wireless* and *Short Wave Magazine* as it has passed around the radio hobbyist community. Some of the letters and 'phone calls we've had, and some of the comments made at exhibitions and rallies, have been nothing short of amazing. Goodness knows where the ideas on future contents came from.

No! *PW* is not going back to electronic gadgets and musical instruments—we changed to being an all-radio magazine in June 1981 and that's the way we plan to stay. Some of our articles may well be on the fringes of radio, but they've always got a direct application to it. Neither are we going to fill the magazine with constructional articles to the exclusion of things like equipment reviews. And just because most of our previous coverage of the strictly listening side has been transferred to *SWM*, it doesn't mean that we shan't continue to cover receiver topics; Chas E. Miller's popular series on *Valved Communications Receivers* will be restarting in a couple of months, for example.

What we hope to produce is a balanced magazine, with something to interest most readers in every issue, though the accent will certainly change month by month. The July issue, for example, will major once again on the ever-popular topic of antennas.

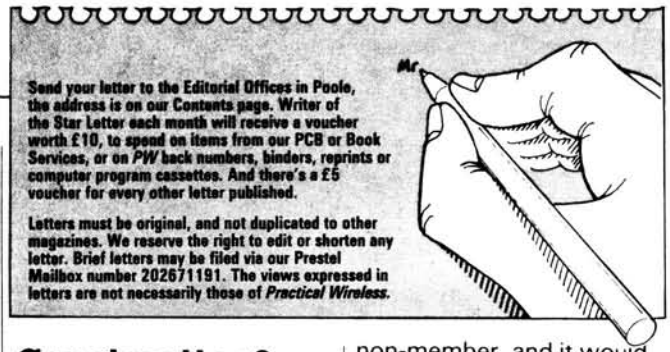
Neither is *SWM* going to become a CB magazine, as one correspondent thought, nor any of the strange beasts which others have dreamed up. On the contrary, it is now purely and simply a magazine for enthusiasts in sound and vision reception, of many different kinds of service.

Rumours like these often come about because of simple misunderstanding. Different people interpret information about changes in totally different ways, just because their experience and outlook on life are different too. More worrying is the deliberate distortion of information, whether for political purposes, as in spreading propaganda, or as practised by those who delight in "winding-up" other people.

These egotistical "wind-up" artists unfortunately seem to have become more active on the amateur bands in recent years, obviously thinking it an ideal way of misleading or upsetting not only their particular hapless victim of the moment, but possibly several hundred listeners "on the side" as well. Malicious rumour such as: this or that radio dealer who gives customers a poor deal, or who is about to go out of business; outrageous changes in amateur licence conditions about to be perpetrated by the Whitehall mandarins; these are bad enough. Even more sickening though is the way that some amateurs who may be handicapped, or simply shy, are picked on time and time again by the "wind-up" artists, to the extent that some of them actually give up what should be a most rewarding hobby, because they can take no more.

It is, I suppose, just another symptom of the ailing society in which we live today, but that does not make it any more acceptable. I sometimes wonder whether those who suggest that a psychological test should form part of the Radio Amateurs' Examination may not have a point!

Geoff Arnold



controversy that surrounded microwave ovens, and in more recent times the introduction of 934MHz CB services. Of course, much of this was just a load of exaggerated twaddle, bandied about by people with nothing better to talk about. However, it is a fact that exposure to r.f. radiation can present certain health hazards, especially radiation at v.h.f. and above. With this in mind, just how safe is it to operate a hand-portable running 5W of 144 or 430MHz into an antenna only a few inches away from your eyes and head? If a risk does exist, what are the long-term effects likely to be?

Dave Barber G6TLZ
Stoke-on-Trent

The last information we recall seeing said that there was no risk from hand-portables of normal power levels at 144 or 430MHz. Problems only start to arise in the microwave region above about a gigahertz. Perhaps one of the radiation experts among our readers could bring us up to date.—Ed.

Vin Plonk

I was very interested in the Vin Plonk Special (*PW,* April 1987), having recently had a c.w. QSO with Vladivar UX9HIC, who was using this antenna, known in the USSR as a Smirnoff Special. I should like to make one correction. Tests on the above QSO revealed a gain of some 6dB when the bottle was filled with vodka, a worthwhile improvement. However, this should not be done using powers of more than 15W, as Vlad reported that, using a 500W linear, inductive heating effects in the core resulted in an explosion that wrecked his QTH.

James Lockeyear G4JQG
London

QSO?

In his article in *PW,* March 1987, Peter Chadwick G3RZP is unreasonable to blame those who maintain that "the final courtesy of a QSO is a QSL" for the failure of others to participate in the exchange.

P. Thompson G6MEN
Shrewsbury

Construction?

I think transfer of much of the sometimes unreadable listeners reports to the new *Short Wave Magazine* should improve *PW.* However, as one of those opting out of construction on account of the transistor, the drying up of war surplus and now the ingenuity of the Japanese, I hope we are not going to be overwhelmed with this subject. Particularly, as a purchase of equipment is something one has to live with for a long time, reviews are always useful, as are all tips on the optimum utilisation of expensive items.

On another point, Peter Chadwick may think we should support the London Wireless Club, but I would not now touch it with a bargepole and I have resigned. I am not the only non-member, and it would be helpful to know what we can do about extending the courtesy of a QSL card—properly made out, of course—to contacts who wish one. A list of overseas bureau addresses would help for a start, but in the longer term I hope the UK DX Foundation becomes sufficiently established to undertake this service among others. The LWC certainly needs competitors!

Alex L. Dick (Sandy)
GM6KKP,
Dundee

Although we do plan to have extra constructional articles in PW *in the future, we intend them to be for simple projects where the commercial manufacturers cannot usually compete. We also hope to include more equipment reviews, now that our test lab is fully operational again.—Ed.*

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.

Cirkit Help Line

Many people in our communities who would like the benefit of the use of an economical kit or project find themselves at a disadvantage when it comes to construction.

The elderly may have failing eyesight. A handicapped person, restricted or no limb movement.

To help these people overcome this problem Cirkit is using their IBM System 36 computer to create a "constructor" data base from Clubs or individuals who are competent builders and testers in their own right.

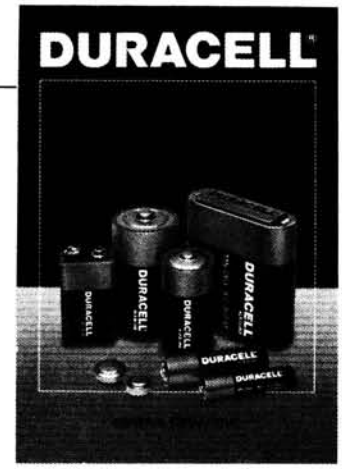
This listing will be issued free of charge to anyone who requests it. They hope to sort the list by geographical location so that the list is as local as possible to the user of this service.

If you can help then please send details of your address, name and telephone number and the area of expertise, i.e. computer. r.f., general, etc., to: ***Cirkit Distribution Ltd., Home Constructors Help Line, Park Lane, Broxbourne, Herts EN10 7NQ.***

Free from Duracell

Duracell UK now have available the latest copy of their free technical price list for trade purchasers, which is effective from March 1987. It lists the range of the company's standard battery products including Alkaline, Silver Oxide, Mercury, Lithium battery systems and the new Zinc Air batteries and cells. Also listed are the award winning Durabeam range of torches.

Technical specifications on the various cells and batteries is available in the *Designers Guide* which is also available free from



John Bellamy, Duracell Technical Division, Duracell House, Church Road, Lowfield Heath, Crawley, West Sussex RH11 0PQ. Tel: 0293 517527.

Remote Imaging Group

This group was set up to disseminate information relevant to weather satellite reception and other sources of "remote images" via regular distribution of a newsletter. They provide a single point of liaison for official bodies, such as the European Space Agency, NOAA, the Met Office and relevant departments of the DTI.

Since this group was formed the Weatherwatch UK Programme has been set up at Lasham airfield near Farnborough. This is the UK site for the reception of NOAA and Meteosat data. They have assumed the role of disseminating the NOAA information via pre-recorded 'phone-in service and a mailing list.

RIG is a non-commercial organisation and is run by a group of amateurs in their spare time. The subscription for 1987 is £4 sterling, and back issues of the newsletter are available.

The subscriptions for the group should be sent to ***Des Watson, Norton, Gote Lane, Ringmer, Nr Lewes, East Sussex BN8 5HX.*** Other information about the group in general should be addressed to ***Phil Seaford G8ZTW, 14 Nevis Close, Linslade, Bedfordshire LU7 7XD.***

Cancelled

We have a very unhappy announcement to make on behalf of the **Milton Keynes Amateur Radio Exhibition.**

Due to the vagaries and anomalies concerning the Sunday Trading Act and the legality of Sunday trading at exhibitions, to protect the Society's good name and in the interests of exhibitors, they have sought legal opinion. The outcome of which is that if they proceed and hold the Exhibition on a Sunday, the Society, the Exhibition Hall management and the individual exhibitors can be liable to prosecution by the county and/or the local council.

Accordingly, they have reluctantly accepted this advice and have decided not to hold this year's exhibition on a Sunday and cancelled the event totally. However, all is not lost for they plan to hold next year's exhibition on a Friday/Saturday during late May or early June.

Ruby Anniversary

The York Amateur Radio Society are celebrating their 40th Anniversary this year. A series of special event stations are being mounted and GB2HWW is being operated each Friday evening from the clubroom. In addition, each member is using a special QSL card during 1987.

Contacts, especially with anyone who, over the years has been mixed up with York ARS, will be welcome.

If you would like more details then contact the club secretary, ***Keith Cass G3WVO, 4 Heworth Village, York.***

The 405 Line Society

The aim of this society is to help members preserve and restore all items of 405-line television history.

Following the closure of the world's first high definition television service, at the end of 1984, it became apparent that many enthusiasts had preserved a considerable quantity of 405-line equipment, dating from 1936 onwards, which is now obsolete and unusable.

Consequently, a number of enthusiasts decided not only to preserve this equipment, but to keep it in working order.

Annual subscription is £2 plus four s.a.e.s for the quarterly newsletter which, amongst other things, will carry free advertisements for members wishing to sell or exchange 405-line equipment.

If you are interested, write to ***Mr H.H. Journeaux, 7 Blair Avenue, Poole, Dorset BH14 0DA.***

The RIS

In 1986 the DTI Radio Investigation Service (RIS) contacted 60 000 radio users about the licensing requirements of their radio transmitters and problems concerning reception and interference. Figures now available show the wide range of activities undertaken by the RIS during the year.

Much of RIS time is taken up with inspection of stations and advising users on their operation. During the year the RIS issued 2800 formal warnings about unlicensed radio use, mainly to users of Citizens' Band radio, illegal cordless telephones, p.m.r. and marine radio.

Almost 5000 reports from householders concerning television and radio interference and reception problems were dealt with during the year—a £21 charge is made to diagnose individual reception problems.

NEWS... compiled by G4LFM

Club Changes

The **Bromsgrove & District ARC** have a new club secretary. His name and address is G. Lloyd G3RBL, 4 Fir Close, Marlbrook, near Bromsgrove. Or telephone 021-445 4672. The club have their own shack and equipment too.

The **Stamford & District Radio Society** now meet twice monthly, on the first and third Wednesdays of each month, at either the Scotgate Public House (Cellar Bar), or alternately the Rugby Club in Stamford. Both meetings start around 7.30pm. David Bradberry G4OZM on 0780 54433 can supply further details.

The **Exmoor Radio Club** have dropped us a line to say they meet most Thursday evenings in Physics II Lab, South Molton School & Community Centre, South Molton. John Stacey on 07695 3382 can tell you more.

Following their AGM, the **Biggin Hill ARC** have a new committee. The secretary, and man to contact for all the latest information, is now Geoffrey Milne G3UMI. He can be contacted on 01-462 2689.

The **Greater Peterborough ARC** club meet at Stanground Junior School, Peterborough at 7.30pm every 4th Thursday in the month. All enquiries should be directed to G1UGA on 0733 69822.

The **Torbay ARS** have a new secretary too. He is John Dart and can be contacted on 0803 51995. If you require details of the TARS Award then John is the man to contact there as well.

Another AGM has brought about changes, this time for the **Morecambe Bay ARS.** The secretary is now D. H. Wood G4ZJL. His address is 29 Oakville Road, Higher Heysham, near Morecambe, Lancashire.

Yet another committee change at the **Chiltern ARC** this time. The chairman of the club is now Chris Cunn G4KVI, who can be reached on 04946 3372 if you want more information on the club.

Special Event Stations

GB2SMC: From August 8 to 23 there will be a special event station to celebrate the 850th Anniversary of the founding of St Magnus Cathedral in Kirkwall in 1137. The primary mode will be s.s.b. on the h.f. bands from 3.5 to 28MHz. There might even be activity on 144MHz. More details from Bill GM3IBU, QTHR.

GB6BH: This station is being sponsored for every contact it makes, so it's looking for lots of people to give them a call. It is being staged to raise money for the Barlborough Hall appeal near Chesterfield. They have 24 hours to do their best from 1300 on July 4. Each contact will receive a QSL, and there will be simultaneous operation on 3.5, 14, 144 (f.m.), 144 (s.s.b.) and 430MHz, with RTTY being used as well. The equipment for the special station is being loaned by SMC (Jack Tweedy) Ltd. More details from ***Rev P. McArdle G0DAG QTHR.***

K1BV Awards Listing

K1BV compiles a list of awards, both past and present. To do this requires a great deal of input from all around the world. K1BV is helped in his task by national collators. So if you have details of an amateur radio award, why not tell the UK and European Agent. He is ***John K. Harvey G4IVT, 38 Bodenham Road, Birmingham B31 5DS.***

Service Reps

Representatives of the Royal Signals ARS and the RAFARS will be at the Blackwood Rally and the Bridgend Rally again this year.

So far they have been "on show" at the Barry College of FE RS rally and they would like to thank the organisers for the space they provided.

They are looking forward to meeting both old and new friends alike, so keep an eye open for them at forthcoming rallies.

Southern 10FM Group

Now, just a year old, the group has over 250 members stretching from southern Spain to the Orkneys.

Membership is open to anyone and everyone interested in 10m (28MHz), including s.w.l.s and Class B operators who can, of course, operate crossband to 28MHz.

The latest edition of the newsletter not only includes things like a single transistor low-cost 30W 28MHz p.a. design, an article on antennas, another on filter designs plus news and items for sale but the whole thing is printed on very brightly coloured paper so you won't lose it!

For a complementary copy of the newsletter and membership information contact their membership secretary ***Barry G0DWZ, 9 Highlands Road, Portslade, Sussex BN4 2BN.***

Can You Help?

J.P. Hailey has written with an unusual plea. He is acting as a design consultant in the design of a unit to prevent "cot death" syndrome. He has found that he doesn't have the experience or information to hand on a design for a small transmitter.

The design requires a 173MHz miniature transmitter, running from a battery and e.r.p. of 1mW to 10mW, to conform with MPT1309.

Alternatively a 470MHz transmitter may be used, but this would require setting up using instruments he does not possess.

His own expertise is in general l.f. work and so he feels a little out of his depth.

If you think you can help, write to ***J.P. Hailey, Towy View, Bethlehem Road, Ffairfach, Llandeilo, Dyfed.***

J.W. Dainty G4PDN has acquired a Trio R300, but without an operation manual and diagram. He needs these as the marker is ineffective hence the frequency read-out is "off the beam". Drop a line to ***J.W. Dainty G4PDN, 43 Copse Avenue, West Wickham, Kent BR4 9NN.***

Mr McCabe has an old Hallicrafters Sky Champion RX to restore. He needs the valves, service manual, etc. If you can help drop him a line, ***John McCabe, 29 Churchill Park, Portadown, Co. Armagh, N. Ireland BT62 1ER.***

Lee Fuller has just bought a Trio 9R-59D. Unfortunately it doesn't have an instruction book and he is having difficulty understanding the band spread marked from Dial A to Dial D. If you can help then write to ***Lee Fuller, 21 Coxwold Grove, Gipsyville, Hull HU4 6HH.***

Does anyone know the whereabouts of a Hilton transformer for the PW Marchwood project. ***G1HYL, QTHR*** would like to find one.

Mr West has been trying to find a service sheet for a car 'phone, the Suntron Autofon-003. He is also looking for a company to service this make of car phone, so far with no success. If you can help write to ***Mr J.E. West, 302 Drumbeg North, Craigavon, Co. Armagh BT65 5AF.***

Frequency Chart

The Radio Regulatory Division of the DTI have produced a Table of UK Radio Frequency Allocation. It is a colour gatefold A4 chart and is available free of charge from ***The DTI, Radiocommunications Division, Information and Publicity Section, Library, Room 605, Waterloo Bridge House, Waterloo Road, London SE1 8UA.***

NEWS ... compiled by G4LFM

RAE. Old v. New

Many people criticised the introduction of a multiple choice format to the RAE. Claims that it is easier to pass now and anyone can get through have been heard time and time again.

It is interesting to read in a survey done by the DTI that this is not the case. After the introduction of the multiple-choice, the average pass rate was 67 per cent while for the seven years before the average rate was 63 per cent. The lowest pass rate after the multiple-choice was 63 per cent and the highest was 69.9 per cent; in the previous seven years it was 61.4 and 66 per cent respectively. This means that a mere 4 per cent of candidates are passing the RAE now who might not have done under the old system.

When it is considered that some knowledgeable amateurs may, for one reason or another, have had difficulty in expressing their knowledge in prose, a small improvement was to be expected.

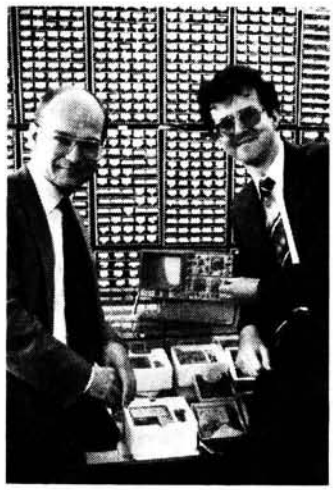
Nobody is likely to have done worse as a result of multiple-choice, it may simply mean that their command of the English language is no longer being tested.

Cirkit Prize

Philip Mearns, an electronics enthusiast has won the first prize in a national electronics quiz organised by Cirkit Holdings plc.

Philip visited the Park Lane HQ to receive his prize of a sophisticated dual beam oscilloscope valued at more than £300 from Paul Bennett, head of the company's consumer division.

Philip reckons that his prize will be extremely useful in his hobby and enable him to carry out some jobs that have been impossible until now.



Can ET Now Phone Home?

In-flight trials of the first worldwide satellite telephone service for air travellers will start this autumn.

BTI and the telecommunications authorities in Norway and Singapore are to work towards providing global coverage for the "phones on planes" service.

BTI's Skyphone service will allow passengers to make their own telephone calls from planes, paying by credit card only. It will also offer telephone and data message facilities for airliner operations.

Passengers will be able to use push-button telephones mounted on the walls or on seat-backs. Initially it will not be possible to receive incoming calls.

A special antenna mounted on the aircraft transmits the signals to the INMARSAT satellite, where they are downlinked to the earth station, and then automatically switched to the public telephone network.

Mission Impossible

Well, here on *PW* (and *SWM*) we know we can usually do the impossible!, but this is one of the most difficult problems we have ever been set.

René Cornec F6AZC wishes to trace a British radio amateur answering to the name of "Stan". He knew him 40 years ago in the services during WWII.

So, if you are that Stan, please get in touch and we'll be able to help F6AZC.

Rally Dates

★ **May 24:** The Ipswich RC and Martlesham RS are holding the 11th Annual East Suffolk Wireless Revival at the Civil Service Sportsground, Straight Road, Bucklesham, Ipswich. There will be the usual features of traders, car boot sale, antenna testing range, transceiver clinic, bring and buy, vintage radio display, non radio stands, children's play area, model flying display amongst other attractions. For more details contact ***Jack Tootill G4IFF on 0473 464047.***

June 7: The Southend and District RS are holding their rally at the Rocheway Centre, Rochford, Essex. Doors open at 10.30am. More details from ***Ron G6SOH, QTHR.***

June 7: The Spalding and District ARS are holding their rally at Springfields Gardens, Spalding. Gates open from 10am to 5pm. For more details contact ***Dennis Hoult on 077 586 382.***

★ **June 14:** The Royal Naval ARS are holding their annual mobile rally at HMS Mercury, East Meon, Petersfield, Hampshire. Gates open from 10am to 5pm. Admission will be £1 for adults and 50p for children. All stands are under cover in case of bad weather, there are amusements and rides for the children, refreshments of various kinds as well as all the usual attractions of HMS Mercury. More details from ***Cliff Harper on 0703 557469.***

June 21: The Denby Dale and District ARS are holding their rally at Shelley High School, Shelley. Doors open at 11am (10.30am for the disabled). There will be the usual trade stands and club stands, free parking, lucky draw, bring and buy, children's entertainments and the "usual good food". More from ***G3SDY on 0484 602905.***

August 2: The Rolls Royce ARC are holding their rally at the Rolls Royce Sports and Social Club, Barnoldswick. Doors open 11am. More from ***G4ILG on 0282 812288.***

September 6: The South Bristol ARC are holding their 1987 Bristol radio rally at the Hareclive Youth and Hartcliffe Community Centres, Hartclive Road, Hartcliffe, Bristol. Doors are open from 10am to 5pm. General traders and the bring and buy are in the community centre and the radio dealers are in the youth centre. Admission is 50p. For more details contact ***Len Baker G4RZY on 0272 834282.***

June 14: The 18th Elvaston Castle Mobile Radio Rally takes place from 9am to 5pm. For non-radio members of the family there will be things like an escapologist and stunt driving, mini motor bikes, a bouncing castle, helter skelter, Punch and Judy . . . so no one should get bored.

Admission is free, but car parking will cost you 50p (levied by the local authority). A new attraction this year will be a craft show.

August 30: The Annual rally of the British Amateur Radio Teleprinter Group (BARTG) will be taking place at Sandown Park racecourse.

This rally is not only THE rally for the RTTY enthusiast but has a limited number of regular rally stands to give this the mix that makes the rally of interest to all radio amateurs.

There will be the BARTG stand, a car boot sale, ample free car parking, easy access by car and talk-in on S22. Doors will be open from 10.30am to 5pm.

More details can be obtained from ***Peter Nicol G8VXY, BARTG Rally Manager, 38 Mitten Avenue, Ruberry, Rednal, Birmingham B45 0JB.***

September 6: The West Kent ARS are holding their rally at the Angel Centre, Tonbridge, Kent. Doors are open from 10.30am to 4pm. Talk in will be on S22, SU8 and 29.5MHz f.m. There will be many trade stands, free parking, a bring and buy, club stands and a stamp fair. More details from ***G4KIU, QTHR. Tel: 0892 515678.***

November 15: The Bridgend and District ARC will be holding their rally at the Bridgend Recreation Centre, Angel Street, Bridgend. Doors open at 11am (10.30am for the disabled). There is free car parking, a bring and buy, Morse tests (please pre-book with the RSGB), bar facilities and talk-in on S22. For more information contact ***GW1OUP (QTHR). Tel: 0656 723508.***

★ = PW will be attending

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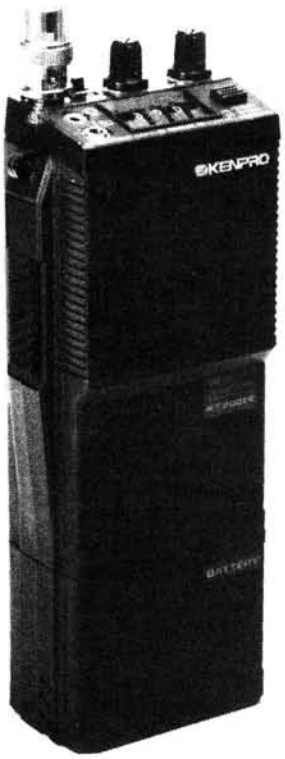

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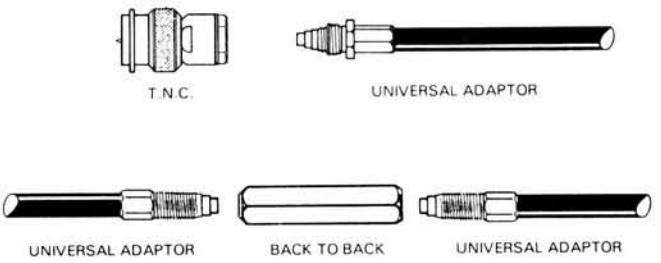

For many of our readers the fitting of r.f. plugs and sockets onto coaxial feeder cables remains a nightmare. The soldering of the inner core to the plug pin without melting the dielectric seeming to be impossible.

Well, salvation could be at hand as I have just heard about a new system that does not require any soldering to be carried out. The Kwikfit system is claimed to be the culmination of four years of intensive research and development.

The system allows the fitting of a Snap-in base and whip antenna onto a vehicle in the optimum position for both receiving and transmitting up to 1.2GHz without the use of a soldering iron, from the outside of the vehicle as there is no need to gain access to the underside of the mount. The Snap-in's impedance is 50Ω and it is serrated to bite into the edges of the 10mm diameter hole, forming a perfect earth to the vehicle body.

Any industry standard r.f. connector, such as BNC, TNC, "N" Type or PL259, can be fitted to the universal adaptor which forms the backbone of the system. This adaptor is easily fitted onto the end of a length of coaxial cable with a simple screw action. This leaves the cable end fitted with an adaptor onto which the standard r.f. plug chosen can be screwed.

To further simplify the fitting operation the special spanner supplied incorporates a measuring gauge to ensure that the outer sheath and screen are cut back by the correct amount.

The universal adaptor also screws into a special back-to-back connector to enable lengths of cable to be joined together. It is claimed by the manufacturers that the performance of the system is not compromised by the solderless design.

The company also manufacture the Whippet range of antennas which have been designed to compliment the Kwikfit connector system.

For full technical details and prices of the Kwikfit System and Whippet antennas contact ***HBC Agencies Ltd., Bay 5, Southworks, Peartree Lane, Dudley, West Midlands DY2 0QP. Tel: (0384) 263884.***

ASTRID is Alive and Well

It was in the February 86 Products that I first mentioned that a new low-cost satellite earth station was being launched onto the market. Astrid, an accronym for Automatic Satellite Telemetry Receiver and Information Decoder, was originally designed to let BBC-B and Spectrum 48K home computer owners access to the educational scientific satellites UoSAT 1 and UoSAT 2, allowing them to display the masses of scientific news and data from these satellites.

Now ASTRID's designer's, Steve Webb, has set up his own company, SRW Communications Ltd., to manufacture and market the unit.

The price is still £129.57 plus VAT but it now works with all the Spectrum range (48K up), all the BBC range and also the Amstrad range. For the Amstrad computers, however, you will need the correct Amstrad serial port and some extra software.

Extra software is now available for the BBC and Spectrum computers and graphs can be produced form the "whole orbit data", the telemetry can be fully decoded without using "look-up" tables and satellite orbits can be predicted and displayed over maps. On Spectrum computers even the UoSAT 1 pictures can be displayed.

ASTRID is a complete, ready to operate system which includes everything to set up your own satellite earth station. However, SRW Communications can supply alternative antennas to the standard dipole, including a special circularly polarised, 2-element antenna priced at £35 plus VAT.

For full details of ASTRID contact Steve Webb at ***SRW Communications Ltd., Astrid House, The Green, Swinton, Malton, N. Yorks YO17 0SN. Tel: (0653) 697513.***

Kanga Kits

Kanga Products is a new venture by a group of amateurs who are trying to promote home construction within the hobby.

All too often amateurs have bits and pieces lying around, and when a kit is bought which has components that could be found in the junk box thoughts of "if only" come to mind.

The range of kits supplied by this small company leave out those expensive, but easily obtainable, items so that you can build as and when you want to. To help those who do not have a large junk box, an order form is supplied complete with order codes which you complete and send to the named suppliers with your cheque.

As an idea of what they have in the range here is a list of kits.

Marker Kit for making up a versatile marker unit at £9.45. A v.f.o. kit for use between 1 and 10MHz at £9.45. Single band receiver for the lower h.f. bands at £19.95. Top band transceiver at £46.50 and a digital dial which offers any i.f. offset up to 20MHz at £19.95.

Full details from ***Kanga Products, 3 Limes Road, Folkestone, Kent CT19 4AU.***

DXCC Countries Guide

Geoff Watts, who was editor of the *DX News-sheet* from 1962 to 82, has just sent me some details of his latest publication, the *DXNS DXCC Countries Guide*.

It lists DXCC countries alphabetically, with present and past prefixes back as far as 1945, together with a reference list of previous names of countries to help you keep up with those frustratingly frequent name changes that seem to take place so regularly in the distant parts of the globe. It also contains other useful notes and a list of deleted countries with full information.

It should be very useful to DXers who have retired and are possibly thinking of applying for the DXCC Award after taking up the hobby again following a long period of inactivity.

Those on the Honour Roll may wish to begin working islands instead of countries, and the list gives the IOTA reference number of all those islands on the DXCC list, well over the one hundred necessary to claim the basic IOTA CC-100 Award and get onto the IOTA Honour Roll.

Also included is a comprehensive Oblast listing for those interested in obtaining the USSR R-100 Oblast Award.

The 11 page booklet costs £1.00 in the UK or $2.00 (6 i.r.c.s) overseas airmail direct from ***Geoff Watts, 62 Belmore Road, Norwich NR7 0PU.***

Bernie, I'm running out of coffee.....

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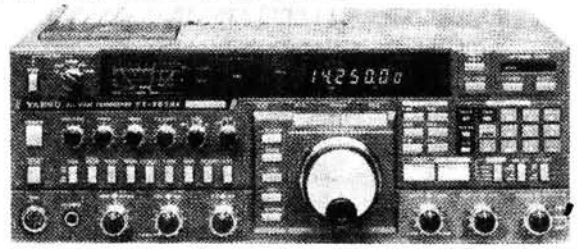

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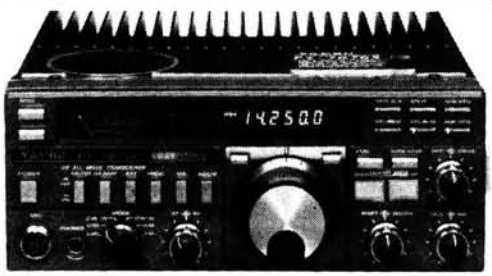

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Ever wished your expensive digital voltmeter would turn into a frequency meter? Well, your wish has been granted by R. A. Penfold. This add-on converter enables your d.v.m. to read frequency from 200kHz up to 60MHz.

The PW "Downton" Frequency to Voltage Converter

The stimulus to design this converter was the need to have reasonable accurate frequency measuring equipment when developing receivers, oscillators, etc, combined with a reluctance to spend the sums needed to by or build a "proper" digital frequency meter which would only receive occasional use. The unit is just a form of frequency to voltage converter which gives a 0 to 1.999 volt output that is fed to a digital multimeter, giving ranges of 0 to 199.9kHz, 1.999MHz, 19.99MHz, and 199.9MHz. Note though, that the maximum usable frequency on the highest range is in the region of 60MHz due to the limitations of the input circuitry.

Obviously this system has its limitations, with the most obvious one being that the resolution of a $3\frac{1}{2}$ digit display puts firm limitations on the precision of the equipment, and unlike a conventional (counter type) frequency meter it is not possible to use over-ranging to effectively increase the number of digits. On the other hand, the basic cost of the components is very low (possibly less than the cost of the case used to house the project), and the accuracy is as good as the display resolution will permit. I must admit to being initially rather sceptical about the degree of accuracy that this means of measurement would achieve, but using the unit in conjunction with a Sinclair DM2 (dual slope integration type) multimeter and using a number of accurate crystal controlled market signals for test purposes, readings were mostly spot-on, and were never wrong by more than the one digit margin of error that has to be accepted with practically any digital system. Of course, good results are dependent on the linearity of the multimeter being up to the task, but most digital multimeters offer excellent performance, and if used with a $4\frac{1}{2}$ digit type the equipment should justify the extra digit and provide even better accuracy.

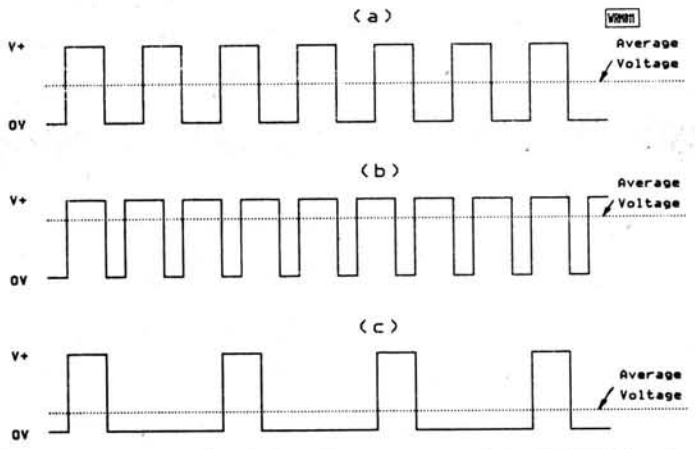


Fig. 1. The average output voltage from a non-retriggerable monostable is proportional to the input frequency

F to V Conversion

There are numerous methods of frequency to voltage conversion but most of these are variations on the monostable type of converter utilised in this unit. Although this system may seem to be too simple to give really good accuracy, provided certain criteria are met it does in fact provide a very high level of performance indeed. The monostable must be of the non-retriggerable variety, so that the circuit triggers on an input transition of the correct type, and the output pulse duration is totally independent of the input pulse length.

The waveforms shown in Fig. 1 help to explain the way in which this method of frequency conversion operates. In Fig. 1a the input frequency is such that the output from the monostable has a 1:1 mark-space ratio, giving an average output voltage of half the supply voltage. In Fig. 1b the input frequency has been increased, and this results in a higher number of output pulses in a given period of time, but the pulse width remains the same. Consequently the mark-space ratio is increased to 2:1, giving an average output voltage of two thirds of the supply voltage. The input frequency is lower in Fig 1c, giving a mark-space ratio of about 1:2, and an average output voltage of one third of the supply voltage. Obviously the average output voltage

varies in sympathy with the input frequency, and if you work out a few mathematical examples you will find that there is a linear relationship between the two.

We are assuming here that the output of the monostable switches between the zero volts and the full positive supply potential. In the interest of good accuracy it does not actually matter if the peak positive voltage is less than the full supply voltage, since the reduction in output levels with no effect on the linearity. The situation is different if the "low" output level is above the earth potential, as this would boost the average output voltage with low input frequencies, producing poor linearity.

There are other factors which can adversely affect linearity, and the main one is the switching speed of the monostable. It is important that the rise and fall times of the output waveform should be negligible for the frequencies concerned, since there will otherwise be significant distortion of the waveform, and this would again affect the linearity of the converter, particularly at the low frequency end of the range.

In order to obtain a d.c. output voltage equal to the average output voltage it is merely necessary to use a low-pass filter to smooth the output signal. To ensure good results this must provide a low ripple output, and it is important that the "high" and "low" output impedances of the monostable are well matched, or that the filter or other circuitry effectively balances these.

System Operation

The block diagram of Fig. 2 shows the general make-up of the unit. A high input impedance buffer amplifier is included at the input of the unit, and this is followed by a broadband amplifier. At most frequencies the unit requires an input signal level of about 24mV r.m.s., but sensitivity reduces somewhat at the extremes of the freqency range covered.

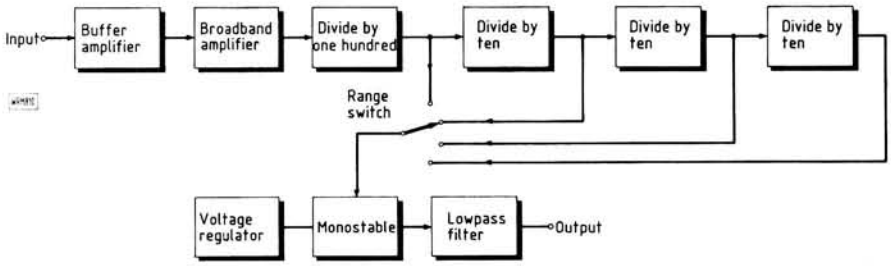


Fig. 2. Block diagram for the d.v.m. to d.f.m. converter

Two divide-by-ten counter circuits connected in series divide the output frequency from the amplifier by a total of one hundred, and on the 199.9kHz range the output from this divider stage drives the input of the monostable. This keeps the input frequency to the monostable under 2kHz, and at this modest maximum frequency there is no difficulty in producing a monostable circuit which has suitably fast rise and fall time. On the other hand, the output frequency is never so low that proper smoothing, commensurate with a reasonably rapid response time, ever becomes a problem.

The other three ranges are obtained by switching one, two, or three additional divide-by-ten stages into the divider chain. A simple passive low-pass filter at the output of the monostable smoothes the pulses to give a low ripple output signal for the digital multimeter, and a voltage regulator stabilises the supply voltage. A well stabilised supply is essential since the inevitable variations in battery voltage would otherwise be reflected as changes in the output voltage.

The Circuit

The circuit diagram for the input stages and supply regulator is shown in Fig. 3, while Fig. 4 shows the range, monostable, and output filter circuits.

Transistors Tr1 and Tr2 form the input buffer amplifier, and these are source and emitter follower stages respectively. Resistor R1 sets the input at 1MΩ, but the input capacitance of around 20pF results in the input impedance dropping dramatically at high frequencies. Transistors Tr3 and Tr4 form a broad-band amplifier, in which Tr3 is in common emitter mode providing voltage gain, and Tr4 acts as an emitter follower buffer stage. In the original design a two-transistor Schmitt trigger was included at the output of the amplifier, but this only seemed to improve results at low frequencies, which were not of any real interest, while actually reducing performance at high frequencies, which were of interest. This circuit has therefore been omitted from the final design.

The divided-by-one-hundred function is performed by IC1 (74HC390), this is a dual decade counter configured here to give ÷ 5 ÷ 2 ÷ 5 ÷ 2. This device is one of the high-speed c.m.o.s. range, designed to operate at frequencies normally associated with 74HS series, approximately 60MHz, but

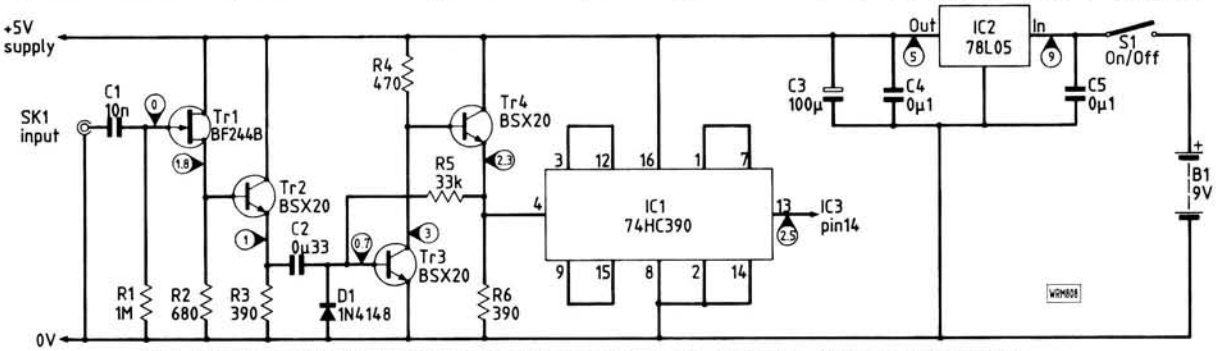


Fig. 3. Circuit diagram of input and voltage regulator stages. All measurements made with d.v.m. set to d.c. volts, signal input 20mV 1MHz

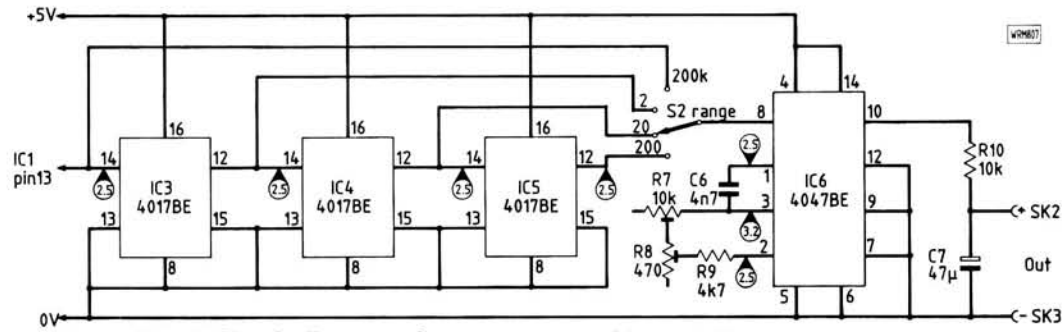


Fig. 4. Circuit diagram of range, monostable, and filter stages. All measurements made with d.v.m. set to d.c. volts, input signal 20mV 1MHz

with the low current consumption afforded by c.m.o.s. circuitry.

The 9V battery supply is stabilised by IC2 to provide a 5V output which is used to power the entire unit (not just the monostable). Varying the input voltage over a range of 7.5 to 9.5 volts, the approximate range covered by a 9 volts battery during its working life, gave no change in output readings, and an ordinary monolithic voltage regulator seems to be perfectly adequate for the present application. The current consumption of the unit is largely dependent on the input frequency and varies from just over 20mA on standby to about 30mA with a 30MHz input signal.

Turning now to Fig. 4, the three divide-by-ten stages are all 4017 c.m.o.s. devices operating as straightforward divide-by-ten circuits with only the "carry out" outputs being used. The input frequency to these stages is always under 200kHz, and ordinary c.m.o.s. devices are therefore more than adequate here.

Switch S2 couples the selected divider output through to the input of the monostable, and this is built around a c.m.o.s. 4047 astable/monostable device (IC6). This is well suited to this application as it provides a "low" output voltage which is within a millivolt or two of the zero volts supply rail, thus avoiding any d.c. offset problems. It also supports two non-retriggerable monostable modes, either of which are suitable for this application, but it is the positive edge-triggered mode which is used here. Capacitor C6 is the timing capacitor while the timing resistance is the total series resistance of R7, 8 and 9. Preset resistor R7 is used to roughly calibrate the unit, with R8 then being used for fine trimming.

Resistor R10 and C7 are the output filter which is a simple single-pole passive type.

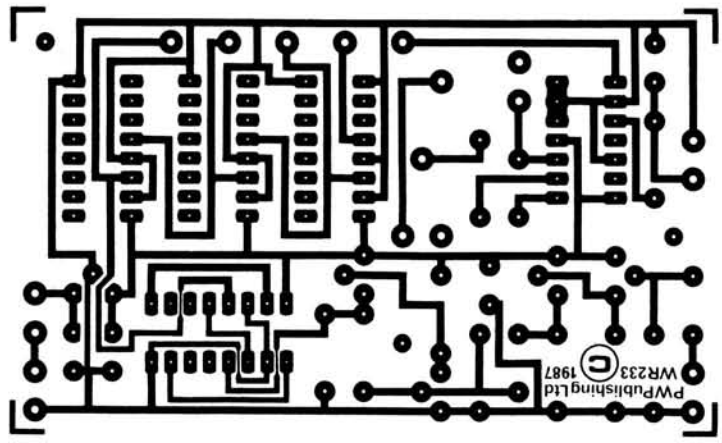
Construction

Details of the p.c.b. and wiring appear in Fig. 5. Construction of the board offers little difficulty, but remember that apart from IC2 the integrated circuits are c.m.o.s. types, and that standard anti-static handling precautions should be taken when dealing with these. In particular, it is advisable to use sockets for these devices, and they should not be plugged into place until construction is in all other respects finished. Veropins are fitted where all off-board connections are to be made.

The power requirements of the unit are easily satisfied, using a single 6-F22 (PP3) size battery for occasional use, or a set of six R6 (HP7) size cells fitted in a suitable carrier, for longer periods.

Switch S2 must be a break-before-make type, as other types of switch could short the divider circuits together momentarily each time the switch was operated.

On the prototype, SK1 is a 50Ω chassis mounted BNC socket, which makes the unit compatible with readily available oscilloscope test leads. However, SK1 can be any type of socket that is appropriate for the frequencies involved here. The lead from SK1 to the board must be in screened wire or problems with stray pick up and instability due to feedback are almost certain to occur. Sockets SK2 and SK3 are specified as 4mm sockets, but again, any convenient type of connector in your particular set-up can be used if preferred.



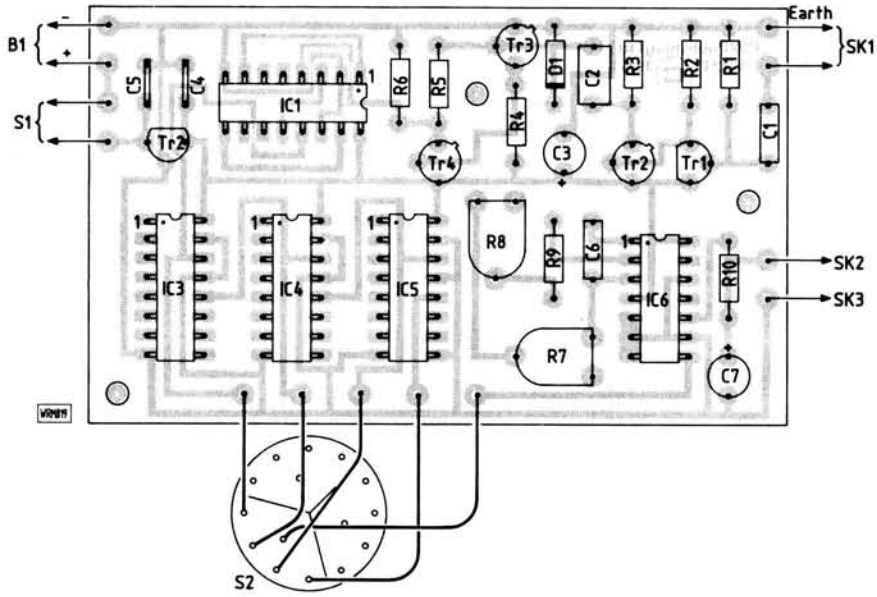
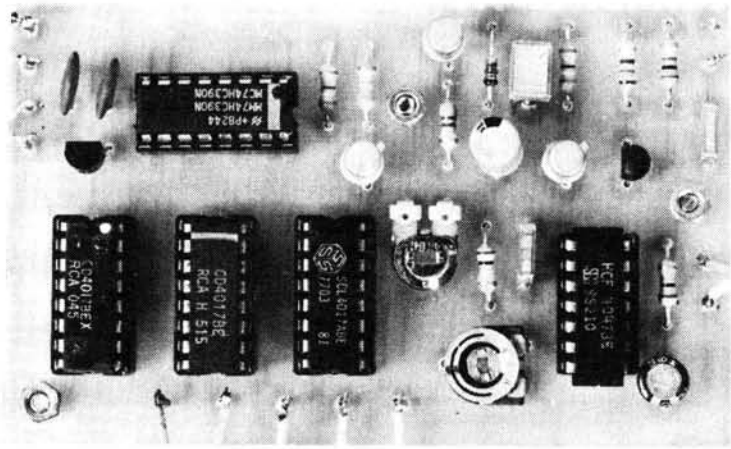


Fig. 5. Single-sided track pattern and component layout of converter (shown full size)



Plan view of finished p.c.b.

Adjustment and Use

In order to calibrate the unit a signal of accurately known frequency somewhere within the range of the unit is required, and the calibration frequency should preferably represent about 50 to 100 per cent of the full scale value of the range on which the unit is calibrated. It does not matter which range is used for calibration purposes, and with the divider method of range selection the degree of accuracy is identical for all four ranges. With the

calibration signal coupled to SK1, and S1 set to the appropriate range, it is just a matter of adjusting R7 for approximately the right reading, and then setting R8 to give exactly the right reading.

Calibration

If a suitable calibration oscillator is not available, the oscillator circuit of Fig. 6 can be constructed. Although the crystal is shown as a 1MHz type, the circuit will work with crystals having frequencies of anything between about 500kHz and 4MHz. A cheap surplus crystal should be perfectly satisfactory, but even new types seem to be available at quite low prices these days.

When using the unit, bear in mind that it is only intended for use with low level circuits, and does not have input protection against signals of more than a few volts peak to peak. It is difficult to envisage the unit being used with high level signals, as transmitter testing usually calls for more precise equipment than this, but if necessary high level signals can be accommodated by using a 10:1 probe (a ready-made oscilloscope type is suitable).

Zero Reading

Under stand-by conditions a reading of zero should be obtained from the multimeter, but the unit is quite sensitive, and this assumes that any stray pick up is kept below the point at which triggering of the circuit occurs. Note that there is no risk of misleading results if the range in use is too low for the input frequency. This will always result in an output voltage of more than 1.999 volts, and an overload indication from the multimeter.

In Practice

If you have a general coverage receiver with an accurate digital readout, bear in mind that this can be used as a frequency meter if the signal is loosely coupled to the antenna socket. In practice I have found that this method can be slow and possibly misleading due to spurious receiver responses, harmonics from the signal to be measured, or simply the wrong signal being received. It can work well in conjunction with this unit, which can be used to give a fairly accurate indication of the signal frequency, with the receiver then being quickly tuned to the right signal to obtain a reading to the nearest 25Hz, or whatever. ***PW***

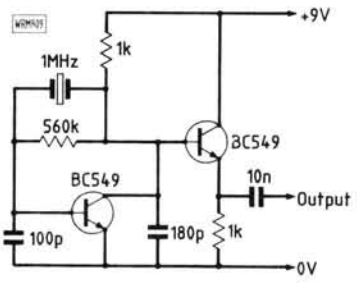
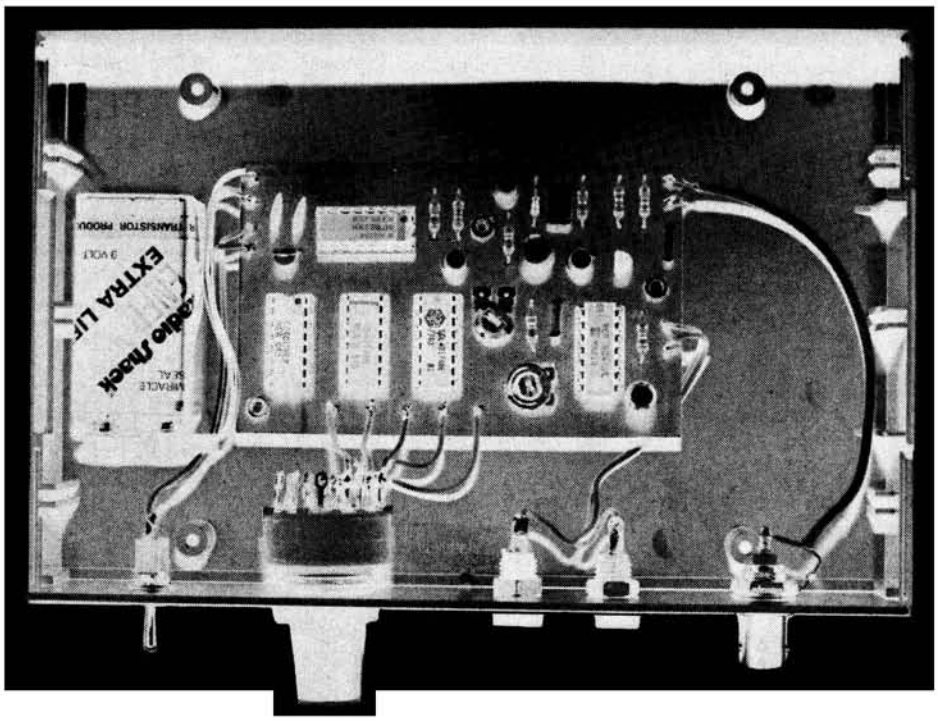


Fig. 6. Circuit diagram for simple calibration oscillator



Internal view of completed unit ▶

SHOPPING LIST

Resistors

0.25W 5% Carbon film

390Ω	2	R3, 6
470Ω	1	R4
680Ω	1	R2
4·7kΩ	1	R9
10kΩ	1	R10
33kΩ	1	R5
1MΩ	1	R1

Horizontal skeleton preset

470Ω	1	R8
10kΩ	1	R7

Capacitors

Polyester layer

4.7nF	1	C6
10nF	1	C1
330nF	1	C2

Electrolytic p.c.b. type 10V

47µF	1	C7
100µF	1	C3

Ceramic disc

100nF	2	C4, 5

Semiconductors

Diodes

1N4148	1	D1

Transistors

BF244B(1)	1	Tr1
BSX20(1)	3	Tr2–4

Integrated circuits

74HC390	1	IC1
78L05	1	IC2
4017	3	IC3–5
4047	1	IC6

Miscellaneous

Panel mounting BNC socket, SK1; 4mm socket, SK2–3 (2); Miniature toggle switch s.p.s.t, S1; Break-before-make rotary switch 4W 3p, S2; Battery 6-F22 (PP3); Battery connector; Verocase (75–3007C) 180 × 120 × 40mm; 14-pin d.i.l. i.c. socket; 16-pin d.i.l. i.c. socket (4); p.c.b.; Knob; Veropins; Nuts, bolts, washers, wire.

(1)Cricklewood Electronics Ltd
40 Cricklewood Broadway
London NW2 3ET
Tel: 01-450 0995

Practical Wireless 144

0900-1700UTC (GMT), 21st June 1987

The fifth *PW* QRP contest is this year scheduled for the longest day, Sunday June 21. As in previous events, we hope for a high level of activity from hill-top sites around the UK, which should make the contest interesting for anyone with a 3 watt transceiver. This contest has become a firm favourite with many operators, from newcomers to experienced groups, as it allows the user of simple equipment to compete effectively.

A summary of the results will be published in *Practical Wireless* later in the year, with details of the leading stations and photographs of many entrants. The full detailed results list can be obtained by sending an s.a.e. with the entry. The overall leading station will receive the winner's cup, and certificates will be awarded to the leading station in each locator square and in various other categories (e.g. leading single operator) at the adjudicator's discretion. Also this year there will be a certificate for the leading station using a single antenna (i.e. no more than one Yagi).

Another new award will be given this year, the PW Tennamast Trophy. This will be awarded to the highest scoring GM station in the contest. It is hoped that this trophy will promote activity in Scotland, and is obviously being donated by Tennamast. It will be presented at the Scottish Convention on September 13.

It is essential that all operators read the rules carefully before the contest, and again before submitting the entry to make sure that all required information has been given—some entrants have lost substantial points in previous events by omitting some of this.

Enjoy the contest, good luck, and keep your fingers crossed for some good conditions.

RULES

1. General

The contest is open to all licensed radio amateurs, fixed stations or portable, using s.s.b., c.w. or f.m. in the 144MHz (2m) band. Entries may be from individuals or from groups, clubs, etc. The duration will be from 0900 to 1700UTC on 21 June 1987.

All stations must operate within the terms of the licence. Entrants should observe the band plan and keep clear of normal calling frequencies (144.300MHz and 145.500MHz) and those used by GB2RS during the morning (144.250MHz and 145.525MHz). Keep clear of any other frequency that is obviously in use for non-contest purposes.

The station must use the same callsign throughout the contest and may not change its location. Special event callsigns may not be used.

2. Contacts

Contacts will consist of the exchange of the following minimum information:

(i) callsigns of both stations
(ii) signal report, standard RS(T) system
(iii) serial number: a 3-digit number incremented by one for each contact, starting at 001 for the first
(iv) locator (i.e. full 6-character Universal Locator for the location of the station).

Information must be sent to, and received from, each station individually, and contact may not be established with more than one station at a time.

If a non-competing station is worked and is unable to send his full universal locator, his old-style QTH locator ("QRA") or his location may be logged instead. However, for a square to count as a multiplier (see rule 4), either a full 6-character universal locator, or full 5-character QTH locator must have been received in at least one contact with a station in the square.

Contacts via repeaters or satellites are not permitted.

3. Power

The output power of the transmitter final stage shall not exceed 3 watts p.e.p. If the equipment in use is usually capable of higher power, the power shall be reduced and measured by satisfactory means. The simplest way is often to apply a (variable) negative voltage to the transmitter a.l.c. line, reached via the accessory socket. The output power can be accurately measured using the simple circuit of Fig. 1. Connect this to the 50 ohm output of the transmitter and adjust the power so that the voltmeter does not exceed 16.7V on a good whistle into the microphone.

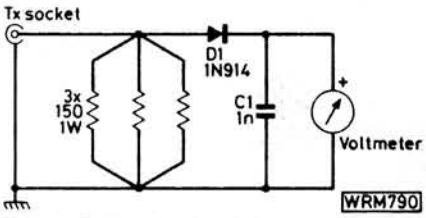


Fig. 1: Suitable circuit for low power measurement in a 50 system. The resistors should not be wirewound. All leads (except those to voltmeter) should be as short as possible (10mm maximum). The meter will read (100p)—0.6v for a power of P watts (16.7V at 3W

4. Scoring

Each contact will score one point. The total number of points gained in the eight-hour period will then be multiplied by the number of different locator squares in which contacts were made (a "square" here is the area defined by the first four characters of a universal locator).

Example: 52 stations worked in IO81, IO90, IO91, IO92 and JO01 squares; final score = 5 × 52 = 260.

Only one contact with a given station will count as a scoring contact, even if it has changed its location, e.g. gone /M or /P. If a duplicate contact is inadvertently made, it must still be recorded in the log, and clearly marked as a duplicate.

5. Logs

The log submitted as an entry must be clearly written on **one side only** of A4 sized (210 × 297 mm) paper (the normal way up, not sideways), ruled into columns showing:

(i) time UTC
(ii) callsign of station worked
(iii) report and serial number sent
(iv) report and serial number received
(v) locator received (or location).

Underline or highlight the first contact in each of the locator squares worked.

MHz QRP Contest 1987

PRACTICAL WIRELESS 144MHz QRP CONTEST

Date	Callsign	Locator	Sheet N° of

Time GMT	Callsign	Report & serial N°		Locator
		Sent	Received	

At the top of each sheet, write:
(a) callsign of your station
(b) your locator as sent
(c) sheet number and total number of sheets (e.g. "sheet no. 3 of 5".
The sample shown here illustrates how each sheet should be headed.

6. Entries
Accompanying each entry must be a separate sheet of A4 sized paper bearing the following information:

(a) name of entrant (or of club etc. in a group entry) as it is to appear in the results table

(b) callsign used during contest (including any suffix)

(c) name and address for correspondence

(d) details of location of station during contest; for portable stations, a national grid reference is preferred

(e) locator **as sent**

(f) whether single- or multi-operator (a single-operator is an individual who received no assistance from any person in operating the station, which is either his permanent home station or a portable station established solely by him/her); if multi-operator, include a list of operators' names and callsigns

(g) total number of contacts and locator squares worked

(h) list of the locator squares worked

(i) a full description of the equipment used including TX p.e.p. output power

(j) if the transmitting equipment is capable of more than 3W p.e.p. output, a description of the methods used (i) to reduce and (ii) to measure the output power

(k) antenna used and approximate station height a.s.l.

Failure to supply the previous information may lead to loss of points or disqualification. For example, omission of item (h), and failure to highlight the first contact in each square in the log, usually leads to a 5 per cent deduction from the total score.

The following declaration must then be written and **signed by the entrant** (by one responsible person in the case of a group entry): "I confirm that the station was operated within the rules and spirit of the event, and that the above information is correct".

This declaration concludes the entry, which should be sent, with the log sheets, to: Practical Wireless Contest, c/o Dr. N. P. Taylor, G4HLX, 87 Hunters Field, Stanford-in-the-Vale, Faringdon, Oxon SN7 8ND. A large s.a.e. should be enclosed if a full set of contest results is required.

Entries must be postmarked no later than 6 July 1987. Late entries will incur a heavy points penalty.

Any other general comments about the station, the contest and conditions during it are welcome, but should be written on a separate sheet of paper. Photographs of the station are also invited (but please note that these cannot be returned); if these are not available by the time the entry is submitted they may be forwarded later, to arrive by 7 August 1987.

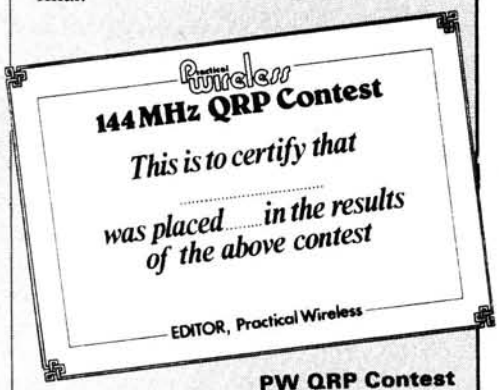
7. Miscellaneous
When operating portable, obtain permission from the owner of the land before using a site. Always leave the site clean and tidy, removing all litter. Observe the Country Code.

Take reasonable precautions to avoid choosing a site which another group is also planning to use. It is wise to have an alternative site available in case this problem does arise.

Make sure your transmitter is properly adjusted and is not radiating a broad or poor-quality signal, e.g. by overdriving or excessive speech compression. On the other hand, be aware that your receiver may experience problems due to the numerous very strong signals it will have to handle, and that this may lead you to believe that another station is radiating a poor signal. Before reaching this conclusion, try heavy attenuation at the receiver input. The use of a high-gain r.f. pre-amplifier is likely to worsen strong-signal problems, so if you do use one, it is best to be able to switch it off when necessary.

8. Adjudication
Points will be deducted for errors in the information sent or received as shown by the logs. You can avoid this by careful logging, and by sending callsigns etc. clearly in contacts; use standard phonetics, and always give the whole callsign—never drop the /P suffix if there is one (a common error in previous contests). Unmarked duplicate contacts will carry a heavy points penalty, so during the contest maintain a check-log of stations worked and keep it up-to-date, refer to it for each contact to avoid duplicates.

A breach of these rules may lead to disqualification. In the case of any dispute, the decision of the adjudicators will be final.



Alexander Popov– Prophet or Propaganda ?

The work of Alexander Popov, Russian Pioneer of radio, has always caused problems for researchers. His real contribution to the technology has always been surrounded with not so much mystery, as difficulty. The problems of language, distance and even politics provide barriers often very difficult to cross. In 1983 the A. S. Popov Central Post and Telecommunications Museum in Leningrad, very kindly supplied a large number of historical photographs, and the translated text of an A. S. Popov Inventor of Radio *exposition that had been touring Russia. Using this documentation together with the limited published information in this country, Tim Wander has attempted to piece together the story behind the prophet and the propaganda.*

Alexander Popov 1859–1906. The Russian reads "Inventor of Radio"

Alexander Stepanowitch Popov (also spelt Popoff) was born 16 March 1859 in the town of Bogoslоosky Zawod (now called Krasnoturyinsk), in the Northern Ural district of Russia where his father was the village priest. Alexander's scientific career commenced in 1877 after he graduated from the theological seminary and entered the department of physics and mathematics at the University of St. Petersburg. In 1882 he duly graduated, and although offered a Physics Professorship, he decided to teach at a Naval technical school for engineers. In early 1883 he moved to the Mine Officers Class in Kronstadt (or Cronstadt), in order to have a larger field for research into the practical applications of electricity. It was at the Naval school, between 1883 and 1901, that Popov was to give many lectures on higher mathematics, practical physics, electricity, dynamos, motors and the mysterious phenomenon of "wire-less" telegraphy. In his spare time during this period Alexander Popov also created his system of wireless electrical communication, working in a makeshift laboratory in the Naval school's garden pavilion. Popov started his first experiments with radio communication in the spring of 1895 using Heinrich Hertz's newly discovered "Hertzian" waves, and Edouard Branly's coherer to study natural atmospheric electricity.

The coherer was perhaps the most important of the early electromagnetic wave detectors. It made use of a phenomenon that bedevils home constructor and manufacturer alike, the dreaded dry joint. The imperfect contact between two conductors normally exhibits a very high electrical resistance due to the very thin oxide films that coat their surfaces. When a small voltage (a few millivolts) is applied across the joint or conductors, this high resistance drops quite markedly. The coherer multiplies this effect by actually filling a glass tube with thousands of dry joints in the form of metallic dust lying between two conductors. Between 1890 and 1891 Branly, while working at the Catholic University of Paris had discovered that these great changes in resistance could just as easily be produced with radio frequency voltages. Branly (and Popov) favoured the term "radio conductor" for his device as he was actually able to measure the change to a low resistance state after the passage of an electric wave, but it was Sir Oliver Lodge who described it's action as "cohesion" and the name stuck. The main disadvantage of the coherer was that once it had cohered, the only way to restore it to its high resistance state was to physically disturb the metallic dust.

Popov's coherer consisted of a glass tube 800mm long and 10mm in diameter. Its lower half had two electrodes consisting of strips of platinum which connected the coherer to the receiver's circuit. Iron filings, slightly oxidated,

The St Petersburg Electrotechnical Institute headed by Popov at his death

(Top right) Popov's transmitter—Induction coil and Hertz oscillator. (Bottom left) Popov's early receiver

(Top) The Mine Officers Class for Naval Engineers. (Bottom) The Russian newspaper *Kronstadt Herald* reports Popov's experiments

(Bottom left) Popov's circuit. (Top right) Title page of the *Russian Physico-Chemical Society* January 1896

were spread over the electrodes and filled about half the tube's volume. During 1895 Popov continually developed his experiments and apparatus. He soon replaced the original galvanometer indicator with the electromagnet of the telegraph relay linked into the circuit of a battery and a small electric bell. If the contents of the coherer, under the influence of the electromagnetic waves, were rendered conductive, the electromagnet drew down its armature, closed the contacts and allowed the bell to strike. At the same moment the circuit was interrupted, and the striker fell back into its original position, but in doing so it shook the coherer.

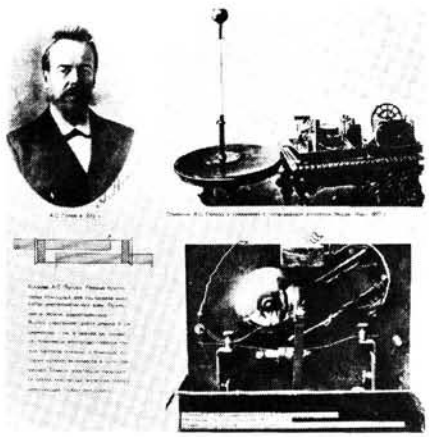
This automatic "tapping back" mechanism restored the detecting action of the metallic dust and can be regarded as an important step in the history of radio communication. However, the same mechanism is also known to have been used by Sir Oliver Lodge although the two inventions may indeed have been developed independently. Popov's initial experiments centred around the sporadic triggering of his apparatus by local thunderstorms, although he also spent many hours trying to activate his detector from a distance by means of a large Hertzian radiator.

In operation Popov's apparatus announced the passing of an "etheric wave" with the ringing of a bell, and it then returned the coherer to its "listening" state. The telegraph relay also actuated another circuit which contained a Richard's register for setting down graphically the "electric perturbations" of the atmosphere.

By this time Popov seems to have been fully aware that his apparatus had a great future, as soon as a powerful transmitter could be developed. His remarks in a subsequent note (dated December 1895) to a paper read in April 1895 before the Physico-Chemical Society of St Petersburg stated:

"I entertained the hope that when my apparatus is perfected it will be applicable to the transmission of signals to a distance by means of rapid electric vibrations—as soon as a sufficiently powerful generator of these vibrations is discovered."

Popov followed his paper with a practical demonstration on 7 May 1895 (April 25 of the old calendar) before the Physico-Chemical Society of Russia, in the Physical Laboratory of the University of St Petersburg. For the experiment the receiving station was located some 40m from the transmitter on the other side of the laboratory. It is here perhaps that the element of doubt must enter the story for all other sources describe Popov's system as still being very crude. However, the scene we are told was one of a packed lecture theatre. Popov stood at one end of the room triggering the Hertzian radiator to generate sparks, so sending Morse code. As each signal was received, the President of the Society wrote the letter on the blackboard. A romantic picture is painted of the intense enthusiasm of the audience as these letters slowly spelled out the name "Heinrich Hertz". This event is sometimes quoted as being the first practical demonstration of a system of wireless telegraphy. Its authenticity is, however, now impossible to prove. All that can be said is that the Russian community now recognise the 7 May 1895 as being the day of the invention of Radio. Indeed, throughout the world today, where ever Russian influence has hold, it is Mr Popov not Mr Marconi who is known as the inventor of Radio.



(Top left) Popov in 1896. (Bottom right) Popov's radio receiver. (Bottom left) Popov's coherer. (Top right) Popov's receiver connected to a Morse telegraph, March 1897

On 12 May 1895 (April 30) the newspaper *Kronshtadsky Vestnik* (Kronstadt Herald) carried a story about Popov's experiments.

"The ground for all these experiments is a theoretical possibility of signalisation at a distance without conductors, just as in optical telegraph, but by means of electrical rays."

It is interesting to note that Popov's arrangement was very similar to the system used by Marconi. The similarity became very pronounced when later in 1895 Popov discovered that reception was improved when a vertical conductor or "exploring rod" of several metres length was used. Popov was able to ring the small bell from different parts of the Naval College at Kronstadt, but he seems to have concluded from his experiments, that 40m would be the limit of range for wireless transmission until a more powerful generator was discovered. If the demonstration on May 7 is taken with a pinch of salt, the Russian experimentor had in fact done little to extend the pioneering work of the music professor David Edward Hughes.

Seven years earlier, in 1888 Hughes had attained ranges of over 500 yards from his home in Great Portland Street in London, and Hughes' name must be considered if the title inventor of radio can seriously be given to any one man. At this point Popov seems to have reverted to his original field of investigation, carrying out further experiments to ascertain the nature of thunderstorm discharges and the conductivity of the atmosphere.

"Another application of the device . . . will be its capacity of recording the electric oscillations which are present in a conductor when this conductor is subject to electromagnetic perturbations occurring in the atmosphere."

Popov's first practical application of his apparatus was the so-called "thunderstorm recorder" produced in July

(Bottom left) Popov's patents. (Top right) Popov's telephone receiver looking remarkably like the Ducretet version. (Bottom right) Popov's autocoherer

Popov's thunderstorm recorder

(Top) Popov's thunderstorm recorder diploma. (Bottom left) Title page of the book *Fundamental of Meteorology*. (Bottom right) Popov's thunderstorm recorder

1895. This equipment could record distant lightning flashes, which being electrical spark discharges produce strong pulses of radio waves. The system was first put into service at the meteorological observatory of the St Petersburg Forestry Institute. This was described in the book *Fundamentals of Meteorology and Climatology* by D. Latchinov, a professor at the Forestry Institute, as Popov's "discharge recorder". For his new "instrument for the exploration of thunderstorms", Popov was awarded a special diploma at the all-Russia Industrial Exhibition in Nizhny-Novgorod in 1896.

Popov published his experiments and conclusions in the Proceedings of the Physical Society of Russia in the January of 1896. This contained a detailed description and a circuit diagram of the receiving station, and can be found in *The Journal of the Russian Physico-Chemical Society (vol. XXVIII)*. A summary of this paper also appeared in the *Journal de Physique* in November 1897. Popov also delivered a report to the Kronstadt division of the Russian Technical Society, where he demonstrated at length his wireless system in an attempt to show the importance of his experiments to the Navy.

The next few years of Popov's career are sketchy. No more was heard of Popov's system until after the reports of Marconi's success in England. On 24 March 1896, Popov is reputed to have demonstrated during a sitting of the Physical section of the Russian Physico-Chemical Society "wireless equipment working in the range of centimetre waves". The shortest waves attained by Hertz were in the region of 30cm whereas Righi had already been able to generate waves in the order of 2·5cm. On 14 April 1896 Popov's devices were demonstrated in the Petersburg Electrotechnical Institute for the officials of the Post and Telegraph Department, description and results published in the *Post and Telegraph Journal (1896, Vol. 4)*.

In April 1897, using a Hertzian exciter of 300mm diameter, with a Siemens and Halske's relay, Popov succeeded in transmitting signals over a distance of 1km. By using a Bjerknes exciter of 900mm diameter he subsequently increased this distance to 1·5km, and finally to 5km. In all these transmissions he used vertical exploring rods some 18m in height. One terminal of his coherer was connected to a conductor fastened to a mast about 10m high on the top of the Institute building, and the other terminal of the coherer was earthed. Some time during the autumn of 1897 Popov moved the base for his experiments on board the ships of the Russian Navy to test the feasibility of communication at sea. By the end of September 1900 he had actually organised the production of wireless telegraph devices in the Kronstadt workshops for the Russian Navy Department.

In the spring of 1899, during their experiments at the Kronstadt school. Popov's assistants P. Rybkin and D. Troitsky discovered the self-restoring or auto-coherer. By replacing the metal filings in the coherer with carbon granules, it was found that it required no mechanical disturbance to decohere them. Since no tapper was now needed, the circuit could be kept very simple, with just the coherer in series with a battery and two earpieces. Other versions of this device used steel particles made by crushing tempered steel ball bearings while another actually used steel needles resting between carbon end plates. Popov studied this new phenomenon, and apparently made it work in a new model of receiver which he called his "telephone receiver", and also patented the new coherer in Russia, France and England.

The English Patent, number 2797 applied for on 12 February 1900, described two platinum electrodes filled with steel pearls crushed to grains, a radioconductor (or coherer) that didn't need jogging to restore its action. The patents acceptance on 7 April 1900 must go some way to establishing Popov's work. However, it is interesting to note that devices of a similar nature were constructed and marketed by a French firm of instrument makers, the Ducretet establishment on the Rue Claude Bernard in Paris. This had the coherer mounted on a swivel so that it could be inclined for the best sensitivity. Controversy exists to this day as to whether the inventions were in fact made independently. The photographs quoted as being Popov's telephone receiver do bear a marked similiarity to the French manufacturers equipment shown in *Wireless Telegraphy and Telephony* by D. Mazzotto, but regardless of inventor, for the time it was an exceptionally good receiver.

Popov's "coherer of particular sensibility" is claimed by the Russians to be the first radio wave detector in the world. Using this new device, by January 1900 Popov is thought to have established a regularly working practical system of wireless telegraph over a distance of 45km between the Islands of Gogland (Hohland) and Kutsalo in the Gulf of Finland. The event occurred when a Russian warship broke down and could not be moved before the freeze set in, and she had to sit the winter out trapped in the ice. Popov was given the task of setting up wireless communication with the isolated spot using three stations, one on board the beleaguered vessel, one on the mainland near the town of Kotka and the third on the ice breaking vessel *Ermack*. Between January and April when the ice eventually broke over 440 messages had been reliably exchanged. Indeed the system is also credited with saving the lives of 27 fishermen trapped on a drifting ice flow. In 1901 Popov was appointed Professor of Physics at the Peterburg Electrotechnical Institute and four years later in November 1905, he was elected Director of that Institute.

Looking back at Popov's work, it is without doubt that the Russian inventor certainly made useful contributions to the science, but he was constantly misled in always looking for a more powerful generator to cure his reception problems. I don't doubt that Popov's work was his own, but like many people working at the time he must have been influenced by the work of others. The fact that certain ideas and

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TH215E	2M Handheld with Keypad Entry	**258.00**	(4.00)
PB1	Nicad Pack 12v 800mAh	**60.40**	(2.00)
PB2	Nicad Pack 8.4v 500mAh	**36.10**	(2.00)
PB3	Nicad Pack 7.2v 800mAh	**40.95**	(2.00)
PB4	Nicad Pack 7.2v 1600mAh	**66.64**	(2.00)
BT5	Dry Battery Case	**12.50**	(1.50)
BC7	Rapid Charger	**102.74**	(3.00)
SC12	Case for (PB2/3)	**14.58**	(1.50)
SC13	Case for (PB1/4)	**15.27**	(1.50)
PG2V	DC Power Cable for TH205E/215E	**4.16**	(1.50)
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SMC30	Speaker Mic for TH21E/41E/2600/3600E	**29.85**	(2.00)
HMC1	Headset Unit with VOX for TH21E/41E/2600/3600E	**34.71**	(2.00)
RA2	Rubber Flexible Antenna for TR2400/2500/2600E	**10.41**	(1.50)
RA3	Telescopic Whip Antenna for TR2400/2500/2600E	**13.88**	(1.50)
TM221E	2M FM Mobile Transceiver 45W	**334.00**	(5.00)
TM421E	70cms FM Mobile Transceiver 35W	**372.00**	(5.00)
TH405E	70cms Handheld Transceiver	**288.00**	(4.00)
TH415E	70cms Handheld with Keypad Entry	**315.00**	(4.00)
TR851E	70cms All Mode Transceiver	**792.00**	(5.00)
TW4100E	VHF/UHF FM Mobile Transceiver	**766.00**	(5.00)

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NC11	Charger	**10.50**	(1.00)
CSC1A	Carrying Case	**6.50**	(1.00)
FT209RH	NEW 2m H/Held C/W FNB4	**315.00**	(—)
FT709R	70cm H/Held	**319.00**	(—)
MMB10	Mobile Bracket FT209/709	**10.00**	(1.50)
NC9C	Charger	**10.35**	(1.50)
PA3	Car Adaptor/Charger	**20.50**	(2.00)
FT726R	2m Base Station	**999.00**	(—)
430/726	70cm Module for above	**349.00**	(3.00)
SAT726	Duplex unit for FT726R	**130.00**	(3.00)
MH1B8	Hand 600 8pin mic	**20.00**	(1.50)
MD1B8	Desk 600 8pin mic	**79.00**	(3.00)
MF1A3B	Boom mobile mic	**25.00**	(2.00)
YH77	Lightweight phones	**19.50**	(2.00)
YH55	Padded phones	**19.95**	(2.00)
YH1	L/weight Mobile H/set-Boom mic	**19.00**	(1.50)
YH2	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)
NEW			
FT767GX	HF Gen. Coverage trans. with optional VHF/UHF/6M modules	**1550.00**	(—)
FEX-767-2	2m module for FT767	**169.00**	(3.00)
FEX-767-7(B)	70cms module for FT767	**215.00**	(3.00)
FEX-767-6	6m module for FT767	**169.00**	(3.00)
FL7000	Solid State linear with built in auto ATU	**1600.00**	(—)
FT727R	Dual Band handheld transceiver 144-146MHz, 430-440MHz up to 5W on each band	**425.00**	(3.00)
FT290RMK II	2M multimode portable/mobile/base	**429.00**	(3.00)
FT23R/FNB10	2M mini handheld with LCD display 5W	**249.00**	(2.00)
FT73R/FNB10	70cms mini handheld with LCD display 5W	**269.00**	(2.00)

Royal Blue

Photo Acoustics have pleasure in presenting the ROYAL BLUE — a Short Wave Listeners folded dipole antenna that covers 2-30MHz. Its neat and compact design (just 6' tall) makes it ideal for unobtrusive outdoor or indoor use. It will work quite happily on your roof or stood in the corner of your shack. It is a truly versatile antenna that will pull in the DX and which works exceptionally well with modern receivers such as the Yaesu FRG8800, Icom R71, Trio R2000 and so on.

To buy this superb new antenna, just send us £25, plus £3 for postage and packing and we will rush one to you.

Receivers

		P&P
Trio R2000 HF general coverage receiver	**637.26**	(7.00)
Trio VC10 VHF converter for R2000 118-174MHz	**170.76**	(3.00)
Trio R5000 NEW HF general coverage receiver	**895.00**	(7.00)
Trio VC20 VHF converter for R5000 108-174MHz	**176.32**	(3.00)
Yaesu FRG8800 HF general coverage receiver	**639.00**	(7.00)
Yaesu FRV8800 VHF converter for FRG8800 118-175MHz	**100.00**	(3.00)
Icom R71E HF general coverage receiver	**825.00**	(7.00)
Icom RC11 remote control unit for ICR71E	**62.00**	(2.00)
AR2002 VHF/UHF scanner 25-550MHz and 800-1300MHz	**487.00**	(5.00)
FRG9600 VHF/UHF scanner 25-950MHz	**525.00**	(5.00)
Icom R7000 VHF/UHF scanner, all modes 25-2000MHz	**957.00**	(7.00)
Icom RC12 remote control unit for R7000	**62.00**	(2.00)
NEW		
HF125 HF general coverage receiver 30KHz-30MHz (Made in Britain)	**375.00**	(5.00)
R532 synthesised airband receiver 110-139.995MHz	**224.05**	(4.00)
R537S Air band portable. Tunable 118-136MHz	**69.51**	2.50

Icom

IC751A	HF Transceiver	**1465.00**	(—)
IC735	New HF Transceiver	**949.00**	(—)
PS15	P.S. Unit	**158.00**	(4.00)
PS30	Systems p.s.u. 25A	**343.85**	(—)
SM6	Base microphone for 751/745	**46.00**	(1.00)
IC290D	2m 25w M.Mode	**542.00**	(—)
IC02E	2m H/Held	**299.00**	(—)
IC04E	70cm handheld	**299.00**	(—)
BC35	Base Charger	**70.15**	(1.50)
HM9	Speaker mic	**21.85**	(1.50)
BP3	Std Battery Pack	**29.90**	(1.50)
BP4	Empty Battery Pack	**9.20**	(1.50)
BP5	High Power Battery Pack	**60.95**	(1.50)
CP1	Car Charging Lead	**6.90**	(1.50)
DC1	12v Adaptor	**17.25**	(1.50)
NEW			
IC-275E	2M Multimode Base Station inc. PSU. 25W	**1039.00**	(7.00)
IC-475E	70cms Multimode Base Station inc. PSU. 25W	**P.O.A.**	(7.00)
IC-1200	23cm FM Mobile, 10W output, style similar to 28E	**P.O.A.**	(4.00)
ICOM 761	HF general coverage transciever with internal PSU and auto ATU	**1999.00**	(7.00)
IC48E	10W 70cms FM mobile	**449.00**	(3.00)
IC28E	25W FM mobile (Tiny)	**359.00**	(3.00)
IC28H	45W FM mobile (Tiny)	**399.00**	(3.00)
IC-Micro	2 mini hand portable LCD display 1W	**239.00**	(3.00)

Power Supplies

DRAE			**BNOS**		
4 amp	**40.50**	(2.00)	6 amp	**75.00**	(2.50)
6 amp	**63.00**	(2.50)	12 amp	**125.00**	(3.00)
12 amp	**86.50**	(3.00)	25 amp	**185.00**	(4.00)
24 amp	**125.00**	(4.00)	40 amp	**385.00**	(4.00)

Aerial Rotators

DAIWA MR750E	Heavy Duty rotator. Can have up to 4 motors	**254.10**	(4.00)
KR400	Med/H Duty	**139.00**	(3.50)
KR500	6 core Elevation	**149.95**	(3.50)
KR400RC	5 core Medium Duty	**169.00**	(3.50)
KR600RC	6 core Heavy Duty	**219.00**	(3.50)
KC038	lower mast clamps	**17.45**	(2.00)
KS065	Rotary Bearing	**26.00**	(2.50)
AR1002	Lightweight VHF Rotator	**52.95**	(3.50)

Switches

Sigma	2 way SO239	**20.20**	(1.00)
Sigma	2 way 'n' Skts	**22.95**	(1.00)
Welz CH20A	2 way SO239	**30.75**	(1.00)
Welz CH20N	2 way 'n' Skts	**54.00**	(1.00)
Drae	3 way SO239	**15.40**	(1.00)
Drae	3 way 'n' Skts	**19.90**	(1.00)

CW/RTTY/Equipment

BENCHER		**P&P**
BY1	Squeeze Key, Black base	**67.42** (2.00)
BY2	Squeeze Key, Chrome base	**76.97** (2.00)
HI-MOUND MORSE KEYS		
HK708	Straight Key	**21.50** (2.50)
HK702	Deluxe version of above on Marble Base	**42.50** (3.00)
HK706	Straight key	**23.00** (2.50)
HK707	Straight key	**22.25** (2.50)
MK704	Squeeze paddle	**20.00** (2.50)
MK705	Squeeze paddle on Marble Base	**32.20** (3.00)

CW/RTTY/Equipment (cont.)

NEW			
RTTY-EQUIPMENT			
PK-232	Packet, Amtor, RTTY, CW, ASCII transceive in one unit. Works with any computer equipped with an RS232 interface. 12V operated	**269.95**	(3.50)
FAX-1	NEW HF Fax receiver. Obtain weather maps, press photographs and satellite cloud cover detail on any Epson FX-80 compatible printer. 12V operated	**279.95**	(3.50)
AMT-2	Terminal Unit RTTY/AMTOR/ASCII/CW	**245.00**	(3.00)
AMT-2/CBM64	Software for the above for the Commodore 64	**51.75**	(2.50)
AMT-2/VIC20	Software for the above for the Commodore VIC 20	**51.75**	(2.50)
AMT-2/BBC B	Software for the above for the BBC B	**44.85**	(2.50)
CD660	Data Receiver for CW/RTTY/TOR/AMTOR/ASCII	**264.97**	(5.00)
CD670	As above but with built in LCD display	**327.77**	(5.00)
KEYERS & ACCESSORIES			
Star Master Key	Electronic Keyer	**54.70**	(3.00)
NEW Star	Masterkey electronics CMOS memory keyer	**95.00**	(3.00)
TRX3	Morse Oscillator	**13.65**	(1.50)
Datong	D70 Morse Tutor	**56.50**	(2.50)

Heatherlite

HF	Explorer amplifier 1Kw output	**1050.00**	(15.00)
2M	Explorer amplifier with single 4CX250B and built in PSU	**535.00**	(15.00)
2M	Explorer with single 4CX350A and built in PSU	**475.00**	(15.00)
YAESU MOBILE SAFETY MICROPHONES			
FT227	4 pin, no scan buttons	**23.00**	(1.50)
FT227RB	6 pin, scan buttons	**25.00**	(1.50)
FT202 207 208	6 pin gold, no scan buttons	**25.00**	(1.50)
FT720	6 pin gold, scan buttons	**27.00**	(1.50)
FT290 790 230 730	7 pin, scan buttons	**25.00**	(1.50)
FT480 680 780 726 77	8 pin, scan buttons	**25.00**	(1.50)
FT2700 270	8 pin, scan buttons	**25.00**	(1.50)
FT757	8 pin, scan buttons	**25.00**	(1.50)
TRIO MOBILE SAFETY MICROPHONES			
TR7500 8300 2200 2300	4 pin, no scan buttons	**23.00**	(1.50)
TR7800 8300 8400 7930 9000 9130	6 pin, scan buttons	**25.00**	(1.50)
TR4000 711 811 770 780	8 pin, scan buttons	**25.00**	(1.50)
TM201 401 2550	8 pin, scan buttons	**25.00**	(1.50)
ICOM MOBILE SAFETY MICROPHONES			
IC240	4 pin, no scan buttons	**23.00**	(1.50)
IC255 260 290	8 pin, no scan buttons	**23.00**	(1.50)
IC3200 271 27	8 pin, scan buttons	**25.00**	(1.50)
KDK MOBILE SAFETY MICROPHONES			
2030	6 pin, scan buttons	**25.00**	(1.50)
2033	6 pin, scan buttons	**25.00**	(1.50)
2016, 2025	4 pin, no scan buttons	**23.00**	(1.50)
FDK MOBILE SAFETY MICROPHONES			
	4 pin, no scan buttons	**23.00**	(1.50)
	6 pin, scan buttons	**25.00**	(1.50)
STANDARD MOBILE SAFETY MICROPHONES			
ALL except C58	7 pin, scan buttons	**25.00**	(1.50)
C58	7 pin, scan buttons	**25.00**	(1.50)
FOR HAND PORTABLES			
SW1	IC2E IC4E IC02 IC04 with single earphone	**14.00**	(1.50)
SW1M	no earphone	**12.50**	(1.50)
SW2	TR2500 3500 TH21 TH41 with single earphone	**14.00**	(1.50)
SW3	TR2400 with single earphone	**14.50**	(1.50)
SW3M	no earphone	**12.50**	(1.50)
SW4	FT209 203 with single earphone	**14.50**	(1.50)
SW4M	no earphone	**12.50**	(1.50)

Aerials

12 ele ZL	special for 2 metres	**25.00**	(4.00)
G5RV	Full size 102'	**16.75**	(2.50)
G5RV	Half size 51'	**14.25**	(2.50)
HB9CV	2 metres	**3.95**	(3.00)
HB9CV	70cms	**3.95**	(2.00)
2 metre	Slim Jim	**8.95**	(3.00)
1-1 & 4-1	Baluns	**12.95**	(2.00)
3.7 and 7.1MHz	Traps (pair)	**9.50**	(2.00)
Dipole	Centrepieces	**2.25**	(0.50)
Copper wire	50M rolls hard drawn	**7.95**	(2.50)
2NE	2M 5/8 wave 4.5dB gain	**24.50**	(3.00)
2E	2M 5/8 wave	**14.75**	(3.00)
320E	2M 1/4 wave	**3.50**	(1.50)
430E	70cms 3×5/8 wave 6.3dB gain	**27.75**	(3.00)
Oscar 720	2M/70cms mobile	**24.75**	(3.00)
70N2DX	High Gain 2M/70cms mobile	**37.75**	(3.00)
Gutter Mounts		**6.50**	(2.00)
4M Leads		**6.50**	(2.00)
Limpet Mag Mounts		**20.50**	(3.00)
BOOKS	Confidential Frequency List (NEW Edition)	**5.95**	(0.75)
	Air Traffic Radio	**2.25**	(0.75)
	VHF/UHF airband frequency list	**3.95**	(0.75)
	The Complete guide to VHF/UHF frequencies 25-2000MHz (NEW)	**4.95**	(0.75)
	The International VHF FM guide	**2.00**	(0.75)
	GUIDE TO FACSIMILE STATIONS	**9.95**	(1.00)
	Towards the RAE (Questions and answers book)	**4.25**	(0.75)
	Logbooks	**3.50**	(0.75)
SPECIAL OFFER			
Alinco ALR206E	25W FM mobile transceiver	**249.95**	(3.00)
Tonna	21 ele ATV old style (few only left)	**27.90**	(5.00)

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Feature

Test Methods and Equipment Part 3

The measurement of alternating current (a.c.) is not as simple as the measurement of direct current (d.c.). The complications arise because of the shape of the a.c. waveform: whether it is square, sinusoidal, triangular, etc. The period of the waveform (duty cycle) will also affect the reading and for power and power measurements, the phase angle (current leading or lagging the voltage) is important. In Part 3, Ray Steele examines these aspects.

The most common methods of measuring a.c. are:

1: The electrostatic method which will measure the attraction between two metal plates.

2: Thermal instruments which measure the heating effect of current.

3: Rectification to convert from a.c. to d.c.

4: Moving iron instruments based on attraction or repulsion principles.

Electrostatic Instruments

Coulomb's Law states that the force between two parallel plates is proportional to the voltage applied. This is the basis of the electrostatic voltmeter shown in Fig. 3.1. The instrument is capable of measuring up to 300kV and usually incorporates a series resistor to prevent damage from short circuits. The instrument works on the attraction principle, i.e. applying a.c. to the plates gives them an opposite polarity. Therefore, in the rest position, with no input voltage, the spring tension prevents the plates from overlapping.

The electrostatic voltmeter can be used for d.c. as well as a.c. measurements and it is independent of the shape of the wave. It consumes a little power during the initial charge-up period but presents an infinite impedance after that, to the circuit under measurement.

Thermal Instruments

One way round the measurement of alternating current with a complex waveform is to measure the heat generated and relate this to a quantity of direct current which will produce the same heating effect. At present, thermocouples are used, i.e. dissimilar metals joined to form a bimetal strip. The forerunner of this was the hot wire instrument shown in Fig. 3.2. Wire XY carries the current and expands with the heating effect. The spring restores the tension in XY and the needle pivots forward to register a reading.

Thermocouples work on the principle that the heat generated at the junction of a bimetal strip is proportional to the square of the current:

$P = I^2R$

where: P is the power (heat)
I is the current
R is the resistance

Therefore, an instrument panel calibrated to read current or voltage from a thermocouple will be crowded at the bottom end, Fig. 3.3, and spread out at the upper end.

How a bimetal strip would be used in a circuit to measure a.c. is shown in Fig. 3.4. The a.c. would produce a heating effect across the point B where the two metals are joined. This heat would in turn produce a voltage across the other ends of the two metals—at P and Q—which is measured by the meter. In practice, points P and Q are in thermal contact with points A and C respectively to compensate for ambient temperatures. An insulator is inserted between P and A, and Q and C, so that there is no electrical contact.

These instruments can be used up to 50MHz and for currents from 0.5A to about 20A. The wires will be tubes at the higher frequencies. For currents below 0.5A, bridge methods are more accurate and a bridge can be employed as in Fig. 3.5, with thermo-junctions in each of the four arms.

Rectification

The most obvious method of measuring alternating current is to rectify it and measure the direct current equivalent. However, this has its own problems as we shall see. Silicon and germanium diodes are used as rectifiers. The former can easily handle 500mA with a reverse voltage of 1000V and germanium diodes can handle about 100mA with a reverse voltage of 300V. Copper oxide and selenium rectifiers were in use some years ago but these can only handle low currents and have quite low breakdown voltages. Rectifiers have a reasonable performance at room temperatures and must be shielded from extremes by enclosing in a constant temperature oven.

How a diode would be connected to provide half wave rectification is shown in Fig. 3.6, as you can see only every half cycle is rectified. Full wave rectification using diodes connected in a bridge formation is shown in Fig. 3.7, here both half cycles are rectified. It is

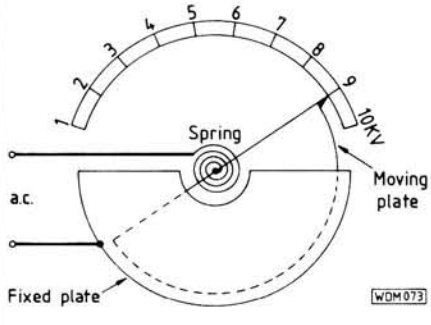


Fig. 3.1

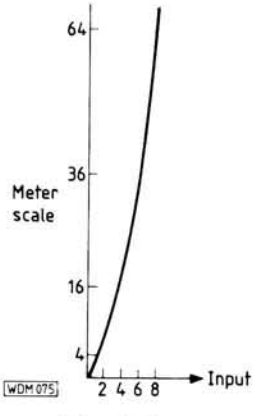


Fig. 3.3

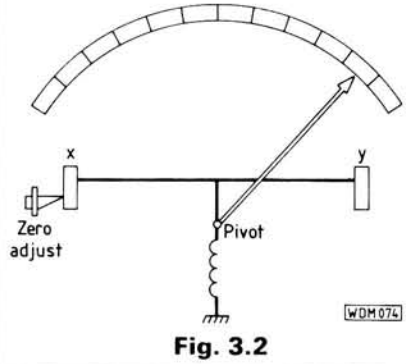


Fig. 3.2

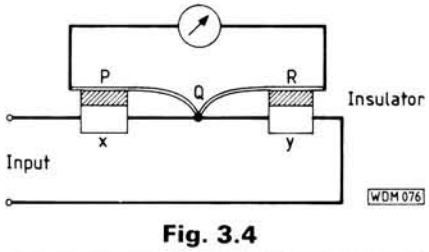


Fig. 3.4

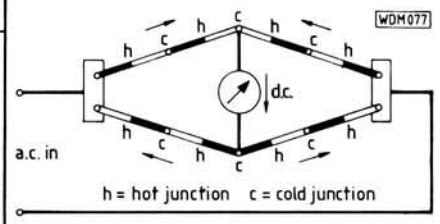


Fig. 3.5

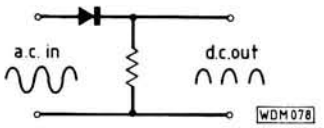


Fig. 3.6

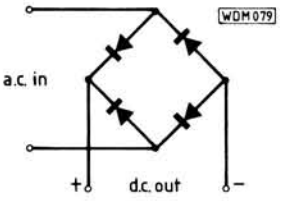


Fig. 3.7

interesting to compare the d.c. equivalent of an a.c. waveform with its heating effect, Fig. 3.8. The heating effect as described in the previous section is the root mean square of the current. If I_P is the peak value of the current, then:

$$I_{r.m.s.} = \frac{\sqrt{2}\, I_P}{2} = 0.707 I_P$$

This relationship is true for a sinusoidal waveform only. The d.c. equivalent of an a.c. wave is:

$$I_{d.c.} = \frac{2}{\pi} I_P = 0.636 I_P$$

The ratio of $I_{r.m.s}$ to $I_{d.c.}$ is called the form factor and for a sine wave this is:

$$\frac{I_{r.m.s.}}{I_{d.c.}} = 1.11$$

For other waveforms the form factor will be different.

One final point about rectifiers. We have seen that they are temperature sensitive, they are also frequency sensitive. At high frequencies the capacitance of the *pn* junction diode becomes significant and acts as an r.f. bypass. The readings could alter by as much as 0.5 per cent for each 1kHz increase in frequency. This point has to be born in mind whenever a standard multimeter is used to measure r.f. currents and voltages.

Moving Iron Instruments

These instruments work on the magnetic attraction or repulsion principle between concentric or radial vanes. Therefore the vanes need to be magnetised in opposite directions for attraction and of the same polarities for repulsion. As with a diode's transfer characteristic, the magnetisation curve is not linear either, and this is one of the major limitations. A typical magnetisation curve is shown in Fig. 3.9 and an instrument needs to be operated on the linear portion of the curve.

The other limitation is frequency and the instrument is not effective above about 125kHz since low readings are obtained with increasing impedance. Two moving iron instruments, one with radial vanes, and the other with concentric vanes are shown in Fig. 3.10. The pointer moves against the torque of a spring and since most pointer type instruments employ torque springs, it follows that the accuracy can be greatly improved by good quality springs.

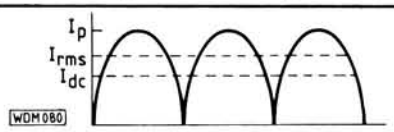


Fig. 3.8

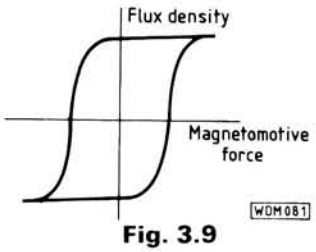


Fig. 3.9

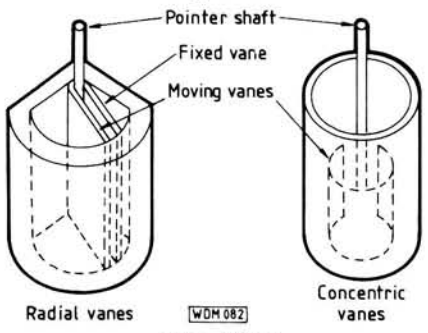


Fig. 3.10

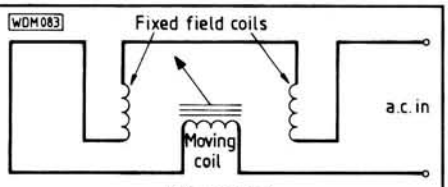


Fig. 3.11

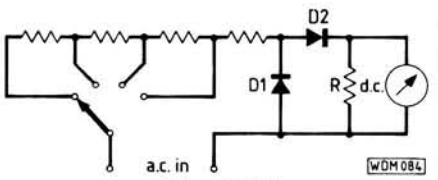


Fig. 3.12

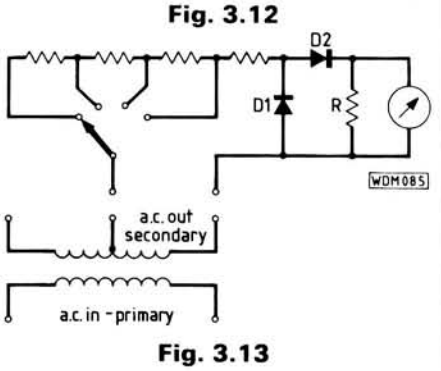


Fig. 3.13

Electro-dynamometers

The d'Arsonval movement can be altered into an electro-dynamometer. In the d'Arsonval movement, a permanent magnet was used but in the electro-dynamometer the field coils carry the same current that flows through the moving coil, Fig. 3.11. The sensitivity is only 10–30Ω per volt and is useful up to about 10kHz only. However, it is the basis of the wattmeter as we shall see later and its frequency limitation does not matter since the domestic supply is only 50Hz. A d.c. movement provides a better sensitivity, therefore rectification is preferable in the general purpose multimeter.

Multi-range Meters and Transformers

The main elements of an a.c. multirange meter are:

1: The meter movement
2: An a.c. to d.c. converter
3: A range of series resistors
4: A range of shunt resistors

The series resistors may be provided individually or all in series (the Ayrton switch), which avoids the make-before-break contact.

In addition the a.c. to d.c. converter may be a half wave or full wave rectifier. For full wave rectification $I_{d.c.} = 0.9 I_{r.m.s.}$ and half that r.m.s. value for half wave rectification. Most meter movements work off half wave rectification and Fig. 3.12 shows the arrangement together with an Ayrton switch. Diode D2 conducts on positive half cycles and the value of R is such that D2 operates in its linear region. Diode D1 conducts on negative half cycles and bypasses the meter.

Since both a.c. and d.c. use the same meter face, the d.c. values need to be scaled down or the a.c. values need to be scaled up when half wave rectification is employed. Resistive dividers can play a useful part in measuring high voltages. However, high demands for heat dissipation can limit the usefulness of resistive dividers. In addition wire wound resistors exhibit reactance.

A simpler method of stepping down currents and voltages is to use a transformer, Fig. 3.13. This has two advantages: the high voltage is isolated from the instrument and the tapping on the secondary supplies a low voltage sample for measurement.

Ignoring eddy current losses etc., in a

transformer, which are minimal, the power transfer equation is:

$$V_1I_1=V_2I_2$$

where: V_1 is the voltage in the primary
I_2 is the current in the primary
V_2 is the voltage in the secondary
I_2 is the current in the secondary

The following equations also apply to an ideal transformer:

$$I_1N_1=I_2N_2 \text{ and } \frac{V_1}{V_2}=\frac{N_1}{N_2}$$

where: N_1 is the number of windings in the primary
N_2 is the number of windings in the secondary

So, if the transformer of Fig. 3.13 has 1000V applied to its primary and it has a 1:1 transfer ratio, then 1000V will appear at the secondary. If, in addition, it has 1000 turns in each primary and secondary and 100 turns are tapped off in the secondary, then this is the voltage under measurement. The reading will of course have to be multiplied by ten since only a tenth of secondary windings were tapped off. This assumes that the current is sufficiently low for the meter. If it is not, it will have to be stepped down by according to the power transfer equation, the voltage then goes up in the secondary windings. This is no problem since a sufficiently low voltage can still be tapped off.

Single-Phase and Three-Phase Power

You can see how a dynamometer has been modified to read single-phase power as used by the Electricity Board on domestic premises in Fig. 3.14. In this arrangement one coil is connected across the supply to sense the voltage and the other coil in series with the supply to sense the current. An aluminium disc spins under the influence of both fields and registers the number of watts and kilowatts consumed.

Damping of the disc is by means of two permanent magnets positioned on the edge of the disc, Fig. 3.15. The position of these magnets determines the spinning speed at full load. These magnets are also essential to stop the disc spinning when the whole load is removed. A further calibration is required at 10 per cent of full loading. This is achieved by inserting a screen to modify the influence of the coil across the supply.

The Electricity Board also supplies three-phase power to large consumers, mainly factories. In a three-phase supply the voltages lead one another by 120 degrees, Fig. 3.16.

Fortunately, three wattmeters are not required and a small saving can be made here since two wattmeters are sufficient. Blondel's theorem states that the number of wattmeters required to measure the total power is one less than the number of phases if one wire of a polyphase system can be made common to all the potential circuits. Shown in Fig. 3.17 is how one wire is made common to all the potential circuits in a three phase supply. For d.c. and resistive loads, the voltage is in phase with the current but for altering currents and reactive loads the current leads or lags the voltage depending on whether the resultant reactance is inductive or capacitive.

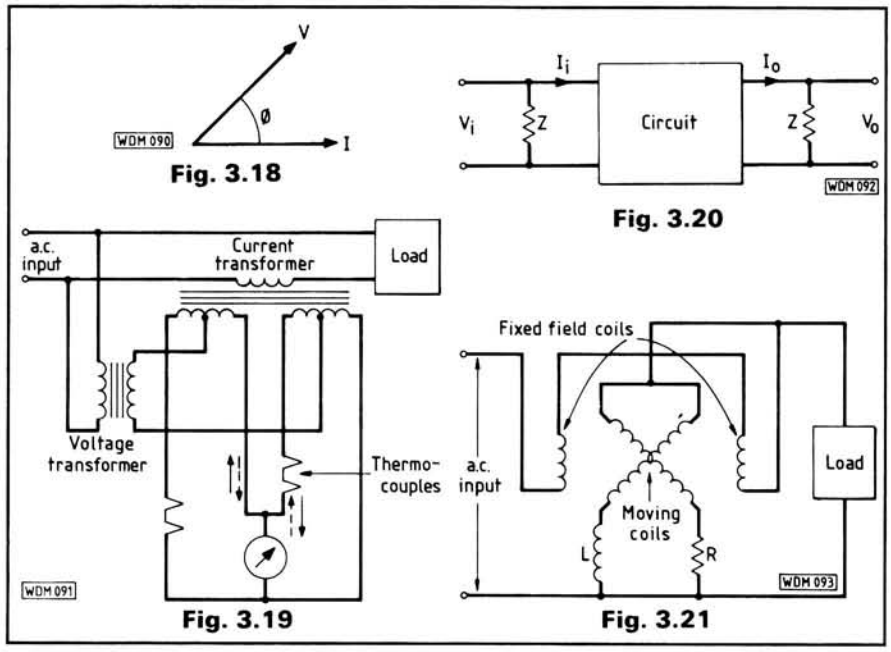
Even when a.c. is propagated along a length of copper wire and no inductor or capacitor is deliberately introduced, there is a certain amount of capacitive leakage through the insulation. This leakage becomes greater, the greater the frequency. If, in a particular a.c. circuit the voltage leads the current by θ degrees, Fig. 3.18, let us manipulate the mathematics and the attempt to simulate the results by an electrical circuit. The current I will have components along the x and y axis and so will the voltage V. Taking the sum of these along the x axis gives $I + V\cos\theta$. The difference along the x axis is $I - V\cos\theta$. The resultant P and Q are given by Pythagoras theorem:

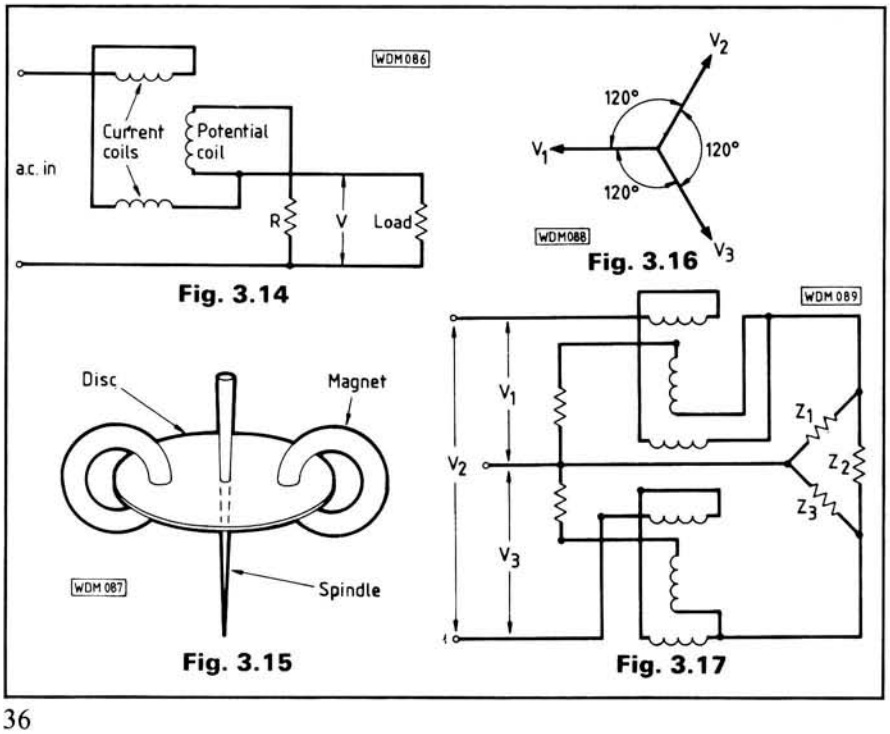
$$P^2 = I^2 + V^2 + 2IV\cos\theta$$
$$Q^2 = I^2 + V^2 + 2IV\cos\theta$$

Subtracting the second equation from the first gives:

$$P^2 - Q^2 = 4IV\cos\theta$$

The power in a reactive circuit is $IV\cos\theta$, so the right-hand side gives four times the required reading. No problem, it can be scaled down by four, but can we simulate the left-hand side to give the required result? Remembering that the heating effect is proportional to current square (P^2 and Q^2), thermocouples can be employed. Further, if the currents are flowing in opposition, Fig. 3.19, $P^2 - Q^2$ is simulated. A chain of thermocouples is employed to give a sufficient indication on the meter.





At high frequencies and low powers some of the devices we have examined cannot cope. For instance at microwave frequencies and for powers below 1 watt, a calorimeter is used to heat up water and hence calculate the amount of power. At even lower powers, bolometers are used, i.e. a thermistor with negative temperature coefficient. A thermistor is a semiconductor bead and a barretter can be made from a thin wire or film on a glass sheet.

Decibels

Electronics engineers speak of circuit gain or loss in terms of decibels (dB). This is convenient for two reasons. Gains or losses can be added or subtracted directly. The second is that the eyes and ears respond on a logarithmic scale and decibels are based on logarithms to the base 10. The power relationship is as follows:

$$dB = 10 \log_{10} \frac{Po}{Pr}$$

where: Pr is the reference power
Po is the output power

This relationship is for a sinewave and Pr is 1mW across 600Ω. The unit is really the bel which is too large for most purposes and the decibel is one tenth of a bel. It is also possible to write this relationship for voltages and currents but once again they must be across similar impedances. The reference voltage is 0.775V across 600Ω and multimeters with a dB scale will have 0dB corresponding to 0.775V of the voltage scale.

With reference to Fig. 3.20, assuming that input and output impedances are similar, the following relationships apply for calculating the gain or loss of a circuit.

$$dB = 20 \log_{10} \frac{Vo}{Vi}$$

$$dB = 20 \log_{10} \frac{Io}{Ii}$$

Phase Measurements

The angle θ by which current leads or lags voltage may require measuring perhaps for the purpose of increasing or decreasing this angle. The basic dynamometer can easily be modified to measure phase angle. The movable coil is a pair of crossed coils with a resistor in series with one coil and an inductor in series with the other, Fig. 3.21. The field coils sense the voltage.

The movement of the crossed coils relative to the fixed coils is a measure of the phase angle, θ. The scale may also be calibrated in terms of the power factor, cosθ. With d.c. systems, power is a maximum since $\theta = 0$ and $\cos\theta = 1$. So for any other angle, $\cos\theta < 1$.

Conclusions

This part has examined all aspects of a.c. measurement: current, voltage, power and phase angle. Apart from rectification, thermal, magnetic and electrostatic principles were discussed. The sensitivity of some of these instruments, particularly at the higher frequencies, is not good.

Part 4 looks at the different types of potentiometer used in test measurements.

▶ 32

devices were discovered seemingly simultaneously in different countries may in fact be perfectly true, for the whole climate of scientific thought and experience at this time was right for such breakthroughs to occur. During the closing years of the nineteenth century, the work of the early pioneers of wireless was gradually leading to a grand climax. James Clerk-Maxwell and Heinrich Hertz had applied the match and the scientific world had taken up the torch.

In Italy, Onesti and Augusto Righi; in France, Branly; in England, Lodge and Captain Henry Jackson RN; in Germany, Slaby and Braun; in America, Nikola Tesla and in Russia Mr Popov. All these brilliant minds devoted thought and ideas to the common cause, endeavouring to find solutions to the problems that reliable radio communication posed. Progress was often slow, but soon the great labours of the earlier investigators were to bear fruit, and wireless telegraphy—the dream of the preceding century—was to become an accomplished fact.

As all the world knows, the first to apply the latent possibilities of Hertz's discoveries so that they became a commercial success was a young Italian called Guglielmo Marconi, born in Bologna, Italy on 25 April 1874. His early work was discussed in the May/June 1984 issues of *PW* and it was Marconi who provided the one thing lacking to make Popov's system practical, a sensitive receiver in the form of his magnetic detector. By 1895, Marconi's experiments had achieved reliable ranges of over 3km. Within six years he was to make wireless span the Atlantic Ocean.

In his career, Alexander Popov published some thirty-eight scientific works and rose to the highest ranks of Russian science. On 13 January 1906, at the comparatively early age of 47, Alexander Stepanowitch Popov suddenly died of a brain haemorrhage. It is sad that he never lived to see radio become a practical and reliable means of communication, but the title "Inventor of Radio" could never really be his. Many people, some famous, some not so well-known, all played their part, but above them all must be the man who took all the ideas, theories and experimental laboratory work and turned it into a communications revolution. Thomas A. Edison wrote, "I have great admiration and high regard for Marconi, the pioneer inventor of wireless telegraphic communication", but perhaps the last word on the matter belongs to Popov himself.

On Saturday 5 July 1902, Marconi aboard his floating laboratory the *Carlos Alberto,* set sail for the Russian naval port of Kronstadt near St Petersburg. The port's five grim fortresses at the entrance to the roadstead and the onion shaped spires of the port's churches belied the warm welcome he was to receive from the Russian people. While in port Marconi was visited by many emminent men including Czar Nicholas II who was entertained with a somewhat staged demonstration of wireless telegraphy while onboard. Not long after a Russian gentleman came to call. He politely told the Italian sailor who helped him aboard, "I want to pay my respects to Marconi, the father of wireless." His name . . . Alexander Stepanowitch Popov, pioneer of radio. ***PW***

Further Reading

Early Radio Wave Detectors by Vivian J. Phillips. Peter Perginus Ltd.

Pioneers of Wireless by Ellison Hawks. Methuen.

Wireless Telephony by R. A. Fessenden. Paper to the American IEE, Vol XXVII, No. 7, July 1908.

The Story of Radio by W. M. Dalton. Adam Hiliger.

The Electrician 1897, page 232.

SWAP SPOT

Have Enya 35BB unrun, Veco 19. Large stock of Balsa wood, various other aero modelling bits. Would exchange for PW Exe in good condition. Anything for 3cm or 70cm. James. Tel: 0343 2097. *C680*

Have Apple II Europlus, two disc drives, monitor, printer, 80 column, card, grappler, RAMEX, microsoft card, tabs, apple clock, PASCAL, Visicalc, Business graphics, Centronics printer card, parallel interface, Applesoft II plus lots more. Would exchange for wide range scanner. Vicki. Tel: 01-882 8661 ext 302. *C685*

Have Epson PX-8 portable micro, Technics professional portable cassette recorder. Would exchange for a Trio TR-7400A. Icom 245E or any modern military radio accessories, especially Racal. Cash adjustment available. Bob. 120 Birmingham Road, Redditch, Worcs B97 6EP. *C691*

Have piano accordion 48 base. In mint condition, cost £200. Would exchange for 430MHz rig in working order. G8LBW. Tel: 0707 872948. *C726*

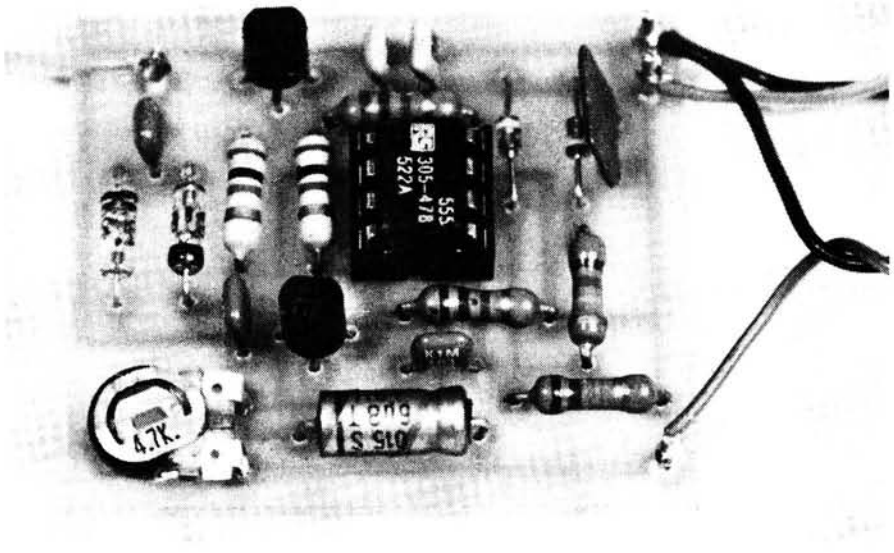
Side-Tone Oscillator

The change in the licence conditions, allowing Class B Amateurs the use of Morse on the v.h.f. bands, has brought about a flurry of interest in c.w. related projects. Here, J. Stebbings G4BTV caters for this interest with a device not generally found on v.h.f. equipment.

A number of differing oscillator designs were tested, all of which suffered from chirp due to r.f. pick up. Finally, the circuit shown in Fig. 1 was adopted, having been found to produce a clear note. The prototype was built up on Veroboard and installed in an Icom IC-202E, its installation being outlined in this article. Having said this, the unit does lend itself for use in other transceivers, with the necessary switching, or as a free-standing unit with its own speaker.

For operation within a transceiver it is necessary for the oscillator to be switched off during reception, and during the transmission of voice. The circuit is r.f. actuated, when sending c.w., and must therefore be supplied with 13.8V on c.w. standby. The switching functions may conveniently be achieved on most modern transceivers by connection to, or modification of, the function switch. On the IC-202E the modification does away with the external v.f.o. option.

The IC-202E mode switch wiring and modification are shown in Figs. 3, 4 and 5. All the modifications are related to clearing and reallocation of switch contacts normally wired for external v.f.o. use.



Circuit

The circuit for the side-tone oscillator is shown in Fig. 1. A short length of insulated wire forms an r.f. pick up antenna, which is coupled via C1 to a rectifier network formed by D1 and D2. The rectified voltage built up across C2 causes Tr1 to conduct. The resultant voltage drop across R3 reduces the base voltage of Tr2 which cuts off. The collector voltage of Tr2 rises almost to the potential of the positive supply rail, switching on the oscillator formed by IC1. The oscillator is built around a 555 timer i.c. arranged to oscillate in the region of 1kHz. The generated side-tone is taken from pin 3 of IC1 via a blocking capacitor C5 and a volume control R7.

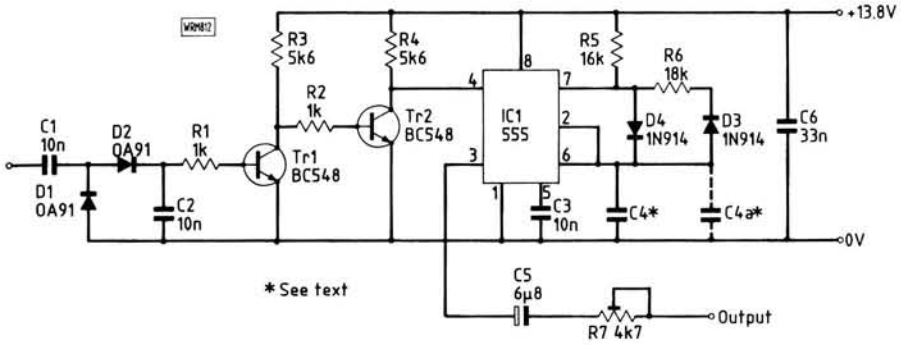
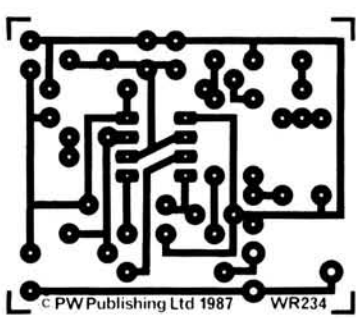


Fig. 1: Side-tone oscillator circuit



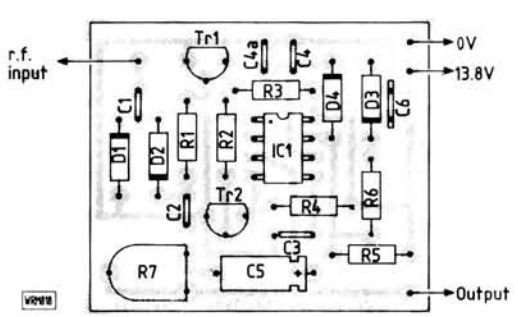


Fig. 2: Side-tone oscillator full size track pattern and component layout

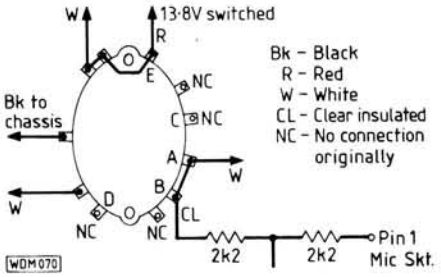


Fig. 3: IC-202E function switch

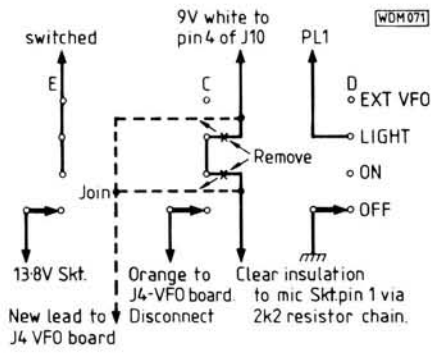


Fig. 4: Original function switch wiring and modification to 9V supply

Construction

There are no major points of note, as regards the project's construction. It will depend to some extent as to how you intend to use the side-tone oscillator. If you desire to use it as a free-standing unit, you will need to provide a means of hearing the side-tone. This is easily done with the addition of a medium impedance telephone earpiece connected between the p.c.b. output pin and 0V. The whole unit can then be housed in a metal project box of your choice, fitted with the requisite leads for external d.c. supply and r.f. sensing plus any additional switching.

The p.c.b. for the project is shown in Fig. 2. The transistor types are not critical and many other small-signal *npn* silicon types should work.

Adjustment and Use

The exact procedure for installing the unit within a transceiver will depend on the design and layout of the rig.

For use within the IC-202E a short length of insulated wire is run from near the base of the whip antenna to the r.f. input of the side-tone generator. The p.c.b. can then be fitted in the battery compartment of the set using Sticky Fixers, this portable facility was not used by the author. If the oscillator is used as a free-standing unit, a sense antenna consisting of 300mm of insulated wire should be connected to the r.f. input and placed near the transmitter's output lead. This will require some experimentation in order to obtain sufficient r.f. pick up to trigger the side-tone oscillator.

Adjust R7 for comfortable audio output, if when used with the IC-202E the volume is still too great on headphone operation, try connecting a 10Ω resistor between the side-tone output and 0V. This value will depend upon the value of the headphones. A 4.7μF capacitor in parallel with this resistor may improve the tone.

The frequency of oscillation is determined by capacitor C4 connected between pin 6 of IC1 and earth. In the author's case a suitable tone was obtained with three capacitors in parallel 47nF, 10nF and 4.7nF making 61nF in all. Another sample of the 555 i.c. required quite different values.

The modification information given applies to the IC-202E. There are later versions of the IC-202 which have sideband switching, an examination of the circuit is advisable to determine any necessary variations in the described method of modification.

PW

SHOPPING LIST

Resistors

0.25W 1% Metal film

1kΩ	2	R1, 2
5.6kΩ	2	R3, 4
16kΩ	1	R5
18kΩ	1	R6

Horizontal skeleton pre-set

4.7kΩ	1	R7

Capacitors

Monolithic ceramic

10nF	4	C1, 2, 3, 4a
33nF	1	C6
47nF	1	C4

Axial electrolytics 25V

6.8μF	1	C5

Semiconductors

Transistors

BC548	2	Tr1, 2

Diodes

OA91	2	D1, 2
1N914	2	D3, 4

Integrated circuits

NE555	1	IC1

Miscellaneous

Veropins; wire; Sticky Fixers; Telephone earpiece*(1); Miniature s.p.s.t. on-off switch*; Aluminium project box*; Grommet*.

(1)J&N Bull Electrical,
128 Portland Road, Hove,
Brighton, Sussex BN3 5QL.
Tel: 0273 734648
*Optional

How Much? & How Difficult?
£11
Intermediate

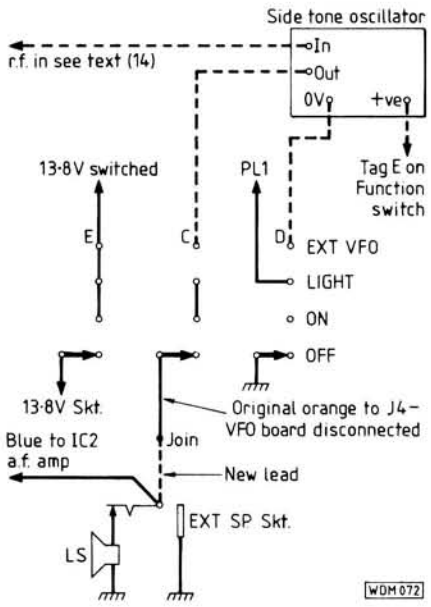
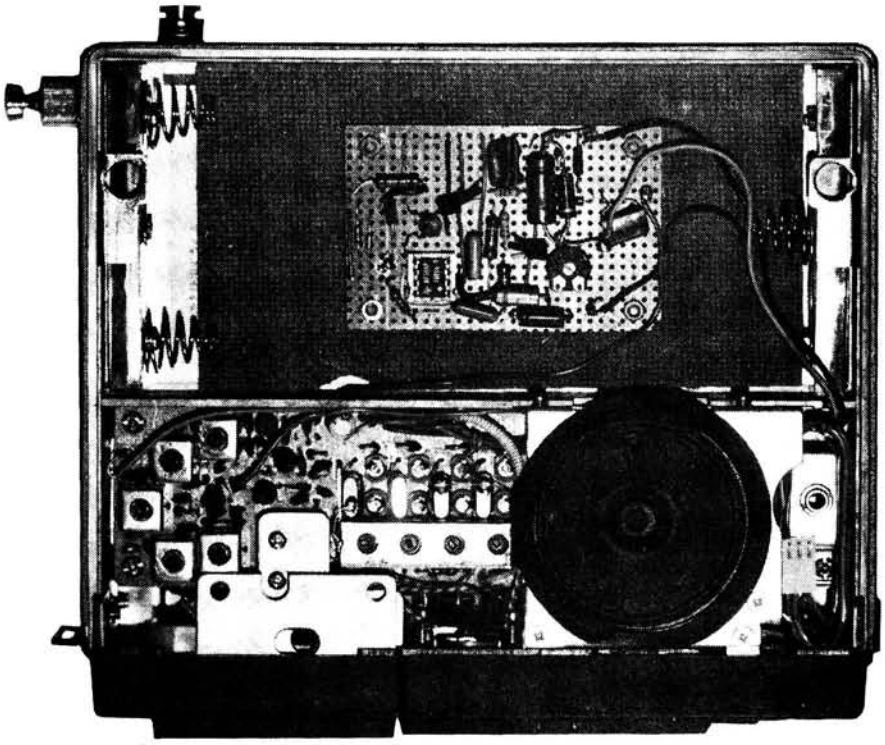


Fig. 5: New wiring between function switch and oscillator



Prototype oscillator installed in IC-202E battery compartment

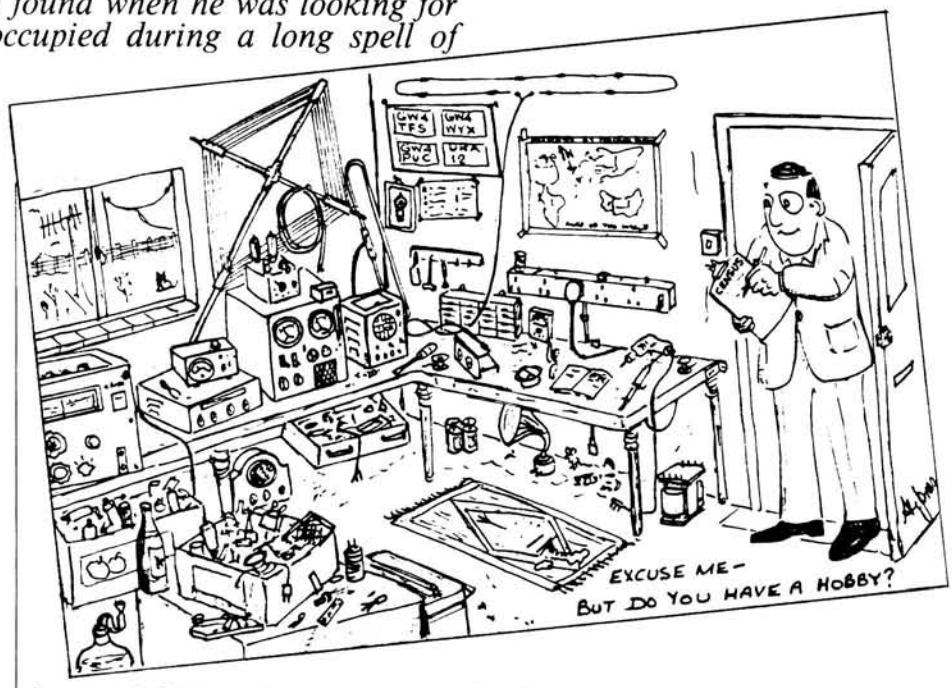
Feature

A Wet Shoestring Makes a Good Antenna

You don't have to spend a fortune to enjoy the amateur radio hobby, as Dave Cutts G4YJQ found when he was looking for something to keep himself occupied during a long spell of unemployment

Have you ever wondered why (or even how) so many radio amateurs manage to spend so much money on their hobby? Well, join the club! I listen in amazement when I hear the new amateur on the band tell of his brand-new rig complete with its flashing l.c.d. and little twiddly noises when he keys and de-keys.

Well, you don't have to be a millionaire or be willing to get into debt up to your armpits to enjoy this wonderful hobby.



Class B Licensees

Many things can be done with a hand-held transceiver. For example, you can pick up a second-hand set like an Icom IC-2E for about £100. During my first year on the air, using a '2E plus a 4-element beam picked up for £3 at a junk sale, I managed to work up to about 100 miles even under flat conditions.

Also try asking around among other amateurs or at club for items like converted commercial p.m.r. equipment which they have discarded and are willing to sell for a song. I agree that with most of the gear you will get, you will be limited in what you can do, but I feel I had more fun trying to get the best of the meagre radio equipment I had than I do now with the black box I've worked up to.

Class A Licensees

You have the whole world available to you, and an obvious direction must be towards QRP working. This is to my mind the most enjoyable and rewarding aspect of amateur radio. For further information, contact the G-QRP Club, via Chris Page G4BUE, "Alamosa", The Paddocks, Upper Beeding, Steyning, West Sussex BN4 3JW.

The 28MHz band (10 metres) is another avenue to explore, because of the multitude of convertible ex-CB equipment available, and the willingness of the more able amateurs to convert a radio for you. Conversion kits are offered by several advertisers in *PW* too.

If you can't afford any of this, let it be known that you wouldn't mind borrowing equipment, because you will be amazed at the amount of surplus equipment some amateurs have, and their willingness to help the new or not-so-well-off amateur. Be sure, though, to reach some sort of agreement before you borrow, regarding the amount of time you can keep the item, and whether you could afford to pay for any repairs if the item went wrong. This is only fair to the person doing the lending.

You too could find that amateur radio on a shoestring, or at least within your budget, will be much more enjoyable than just using an expensive new radio which cost you a big lump out of a year's wages. It may also help to keep a bit more of the amateur in amateur radio. **PW**

DID YOU KNOW?

That the first wireless transmission of speech across the Atlantic occurred in 1906?

In that year, the American experimenter R. Aubrey Fessenden succeeded in modulating the output of a high-frequency alternator and so transmitting speech. The alternator had a large number of poles and ran at tremendous speed, generating a frequency of 50 kilohertz or a wavelength of 6000 metres, which was commonly employed at the time. On Christmas Eve 1906, Fessenden tested a new type of alternator, and wireless operators on duty in ships at sea were astonished to hear a human voice in their headphones, followed by the sound of a woman singing and then a violin playing. Piles of delighted letters from enthusiastic listeners poured in to Fessenden's base at Brant Rock, Massachusetts, and he learned that his transmissions had carried more than 4800km with every word audible across the Atlantic in Scotland.

Eric Westman

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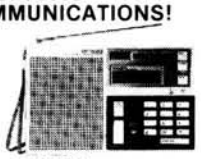

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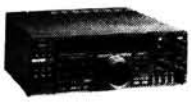

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Sony AN-1 active whip antennae 150kHz-30MHz internal/external	**£49.00**
AD270 active indoor dipole + psu (9ft long)	**£51.75**
AD370 active outdoor dipole + psu (9ft long)	**£69.00**
CWR-880 RTTY/CW reader with LCD display	**£269.00**

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Packet Radio

In Part 2, Roger Cooke G3LDI continues his look at this fast growing mode of communication.

Jargon, as defined in the dictionary, is "meaningless talk, confused words". It is also an inherent part of amateur radio. Have you ever stood in a queue with another amateur, both avid DXers, talking about the latest QSO with a BY you had on c.w. on 21 and watched the peoples' faces? The looks on their faces almost indicate a summoning of the men in white coats! I must quote the "ultimate" in jargon. Obviously you are familiar with the 23rd Psalm. Imagine it in the latest Hi-tech language (jargon?) and it would look like this:

> David Lyric Two-three.
>
> "The Lord and I are in a sheep/shepherd situation and I am in a position of negative need. He prostrates me in a green belt grazing area: he conducts me directionally parallel to non-torrential aqueous liquid. He returns to original satisfaction levels my psychological make-up; he switches me on to a positive behavioural format for maximal prestige of his identity.
>
> It should indeed be said that notwithstanding the fact that I make ambulatory progress through the umbrageous inter-hill mortality slot, terror sensations will not be instantiated within me due to para-ethical phenomena. Your pastoral walking aid and quadruped pickup unit introduce me into a pleasurific mood-state.
>
> You design and produce a nutriment-bearing furniture-type structure in the context of no-co-operative elements; you act out a head-related folk ritual employing vegetable extract; my beverage utensil experiences a volume crisis.
>
> It is an ongoing deductible fact that your inter-relational empathetical and non-vengeance capabilities will retain me as their target focus for the duration of my non-death period: and I will possess tenant rights in the housing unit of the Lord on a permanently open-ended time basis."
>
> Source Unknown.

Obviously packet radio can be very confusing, especially for the newcomer to the mode, listening to packeteers "chewing the rag". However, with a bit of experience and a few QSOs to your credit you will be using the same jargon as the rest of us (and at times be just as confused as us!). Some of the terms Protocol, TNC, Ack, FCS, SSID, etc., were dealt with in my last article, so let's assume you are operating on h.f. for the first time. Switching on the TNC brings up the signing-on message and automatically puts it into command mode.

Command mode is the default mode and is used to enter instructions which alter the TNCs operating parameters. Cmd will appear at the beginning of each input line in this mode. The first thing to do is to enter your own callsign using **Mycall.**

While you are in Command mode, set the rest of the parameters necessary for h.f. operation. These are as follows:

Frack 4. The wait time in seconds before repeating a packet requiring an acknowledgement. This allows for other users on the same frequency.

Maxframe 1. This is the maximum number of unacknowledged packets that the TNC can have outstanding at any one time. If this was set to the default, normally higher than 1, with a poor link requiring retries, this can make it extremely difficult to communicate at all.

Paclen 40. I have found this to be the most useful figure but it really is dependent on several factors, conditions and your own h.f. set-up being the two main considerations. Obviously on v.h.f. the default of 128 is quite OK for local working.

TX-Delay 4. My TAPR 1 specifies 40ms intervals so the delay is thus 160ms. I have found this to be adequate for the IC-751, but this depends on the transceiver you are using and you should be prepared to experiment with this parameter. During the period of TXDelay the TNC is sending flag characters, waiting for the transceiver to switch from receive to transmit. If the change-over time is too long and TXDelay is short, part of a packet will be missing. Problems can also exist the other way round. If the delay is too long, some of the flags may be transmitted and become corrupted (quite easily on h.f.) so keep this parameter as short as your transceiver will allow.

Retry 0. Setting this parameter to 0 on h.f. will prevent a disconnection under adverse conditions.

Echo. If you don't see what you type, set it to ON. If you see two of what you type, set it to OFF.

Monitor. Set it to ON so that you can see what is on the frequency. If you don't want other packets displayed when in QSO, select Command mode and switch it OFF. Modern TNCs have different levels of monitoring and reference to the manual would be advised.

Having set these parameters put the transceiver on to l.s.b. on 14.103MHz displayed frequency and get used to tuning packet stations. If you want to find out how well you are being received, find two stations chatting to each other and then try to connect to one. If you are a good signal with him you will receive "(Callsign) busy. ***Disconnected". He will also have "***Connect-request (Your Callsign)" on his screen.

Once you have connected to a station you see "***Connected to (Callsign)" on your screen. This is quite a satisfying message to see, especially if it is a new country! Once you see this you are in Converse mode, automatically selected by the TNC when connected to a station.

In Converse mode, anything typed in at the keyboard will be assembled into a packet and transmitted when the SendPac character is selected, usually CR by default, although this can be changed if desired. In this mode it is also possible to select a variety of input editing characters to allow editing of text, selection of another mode, etc. This is normally accomplished by us-

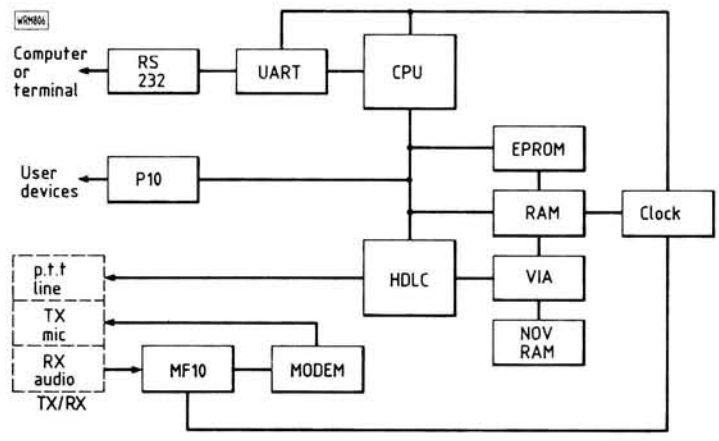

Fig. 2.1: The functions of the TNC

ing certain control characters and care should be exercised here as some computers dislike control characters and will "lock-up", a problem that can lead to lots of confusion. In the latest range of TNCs it is possible to filter these characters from monitored packets.

Transparent mode is the mode that is most suited to the transfer of computer data such as programs, etc., where all the information contained in that program is sent exactly as-is with no input editing features, no control characters or send-packet characters. The TNC sends the packet when the **packet length** is reached. Exit from this mode is by a pre-determined routine, normally described in the manual.

Beacon Use

A few words on the use of beacons. In the early days of packet the use of beacons to announce a presence was very useful, but it is not really necessary now except for CQ calls, Mailbox posting, or as it was used originally, on a new band. Please do not make frivolous use of the beacon and send something like "I am not here right now so do not call me".

Let us now take a look at the function of the TNC (Briefly!). Refer to Fig. 2.1.

The heart of any TNC is the c.p.u. (Central Processor Unit). It manages the whole operation of the TNC under software control. The software control comes from a program stored in EPROM (Eraseable and Programmable Read Only Memory). When power is first applied the default parameters appear and these are then adjusted to suit operating needs. With my TNC 1 these are stored in NOVRAM which is a special chip, which in its non Volatile state is a kind of Electrically eraseable PROM, which means that parameters are not lost after a power on/off/on cycle. More modern TNCs now use battery-backed RAMS. The RAM (Random Access Memory) is used for data which will change, such as incoming and outgoing packets. Anything here, of course, will be lost when power is off.

The HDLC (High-level Data Link Controller) is a very important device which performs several functions. It compiles the data from the c.p.u. into packets for transmission, initiates the transmitter p.t.t. command and sends the serial data to the MODEM. It also generates and checks the Frame Check Sequence, used for error detection. Thirdly, it processes packets received, checks for errors and passes the required data to the c.p.u. for further processing.

The serial I/O consists of a UART (Universal Asynchronous Receiver Transmitter). This device receives data from the c.p.u. in parallel format and sends it in serial format to the terminal or computer for display. It also does the reverse, receiving data in serial format from the computer and sends it in parallel format to the c.p.u. for processing.

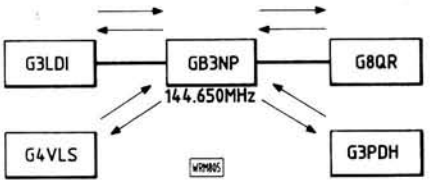

Fig. 2.2: A Packet switch

Fig. 2.3: Packet switches licensed as of 11/86

Callsign	QTH	Antenna
GB3AP	Dudley, W. Mids.	V
GB3BP	Bristol, Avon.	V
GB3DB	Honiton, Devon.	V
GB3DP	Weymouth, Dorset.	V
GB3CD*	Crewe, Cheshire.	V
GB3EP	Exeter, Devon.	V
GB3HP	Winchester, Hants.	V
GB3HQ	Potters Bar, Herts.	H
GB3JP	St. Helier, Jersey.	V
GB3KP*	Kingston-on-Thames.	H
GB3NP	Norwich, Norfolk.	V
GB3UP	Guildford, Surrey.	H
GB3XP*	New Malden, Surrey.	H
GB3YP*	Harrogate, N. Yorks.	V

The MODEM consists of a phase locked loop type DEModulator, converting the audio tones from the receiver into binary data for the HDLC. The MODulator converts the serial binary data from the HDLC to the two tones which are used to modulate the transmitter when the packet is sent. A switched capacitor filter using an MF10 is used to provide input tone balance to the DEModulator. Filter characteristics and tone selection are determined by plug-in headers. The standard tone frequencies for h.f. working are 1600 and 1800Hz thereby producing the same centre frequency of 1700Hz as the wide shift tones of 1200 and 2200Hz.

The VIA (Versatile Interface Adapter) communicates with the NOVRAM, provides a programmable baud clock for the HDLC and also provides a system software real-time clock, used by the software for timing operations, etc.

The system clock generates all the timing necessary for the c.p.u., the UART serial I/O, HDLC and the MODEM.

DIGIpeating

This can be quite an interesting and fun thing to do at h.f. where we have all the vagaries of QRM, selective fading, QSB, computer noise etc., to mention a few! If you put DIGI to ON it can be surprising to find after finishing a QSO with somebody, while making up the log, the gear suddenly bursts into life without you having anything to do with it. However, it is not advisable to try more than one or two digipeat paths at h.f. because all stations are affected with the same problems and attempts at just one packet can take a lot of time. Having said that, I have had several interesting contacts this way. I have also unwittingly been the digipeater for a ZS who worked the USA this way.

On v.h.f. there are a number of licensed repeaters working on 144.650MHz. These are purely repeater stations called packet switches and can of course support several pairs of stations working via the packet switch who could not normally talk to each other. With reference to Fig. 2.2, assuming G3LDI could not hear G8QR and similarly G4VLS could not hear G3PDH, then those four stations could work simultaneously via GB3NP, the Norwich packet switch. This would then be termed a Local Area Network (LAN). With MONitor set to ON it is possible for all four to conduct a net.

In this way, several pairs can work and all can see exactly what is being said, although essentially only two stations are connected with each other. As more packet LANs become active there is a possibility of linking stations over a wide area using link stations with access to two areas. As of November 1986, the DTI licensed 10 out of 14 applications for packet switches. It is hoped that the other four (marked *) will be operational soon. See Fig. 2.3.

Just to whet your appetite, a list of the countries known to be active on h.f., mostly to be found on 14MHz. Incidentally, take care not to operate too close to the beacon frequency of 14.100MHz. A4N, CN, CT, DJ, DU, EA, EA8, F, G, GI, GJ, GM, GW, GU, HA, HB, HC, HK, HP, I, JA, KP4, KL7, KH2, LA, LU, LX, OE, OH, EI, ON, OX, OZ, PA, PJ, PY, ST, SM, SV, TF, TG, TI, VE, VK, VP2M, YB, YJ, YU, ZF, VS6, XE, ZL, ZS, 4U1, 4X4, 5H, 5V7, 6T2, 9H, 9K2, 9M2, 9V1, W.

We have a friendly competition locally regarding countries worked. Reg G8QR has worked 44 and is just tailing me with 51, having just worked ZL at last, wonder if you have anymore?

Don't forget the 3.600MHz activity on Sunday mornings and also late evenings. LA, SM, DL, GM, GW and several G stations can be found there from about 2100Z onwards. I am also trying to activate 10.147 and 21.105MHz but with little successs so far. My BBS is usually on 14.105 when I am at home and has proven to be a very useful device. (As well as a headache to get going!) More on that next month as I hope to be covering the setting-up, operation and commands for the BBS. Happy Packeting.

Practical Wireless

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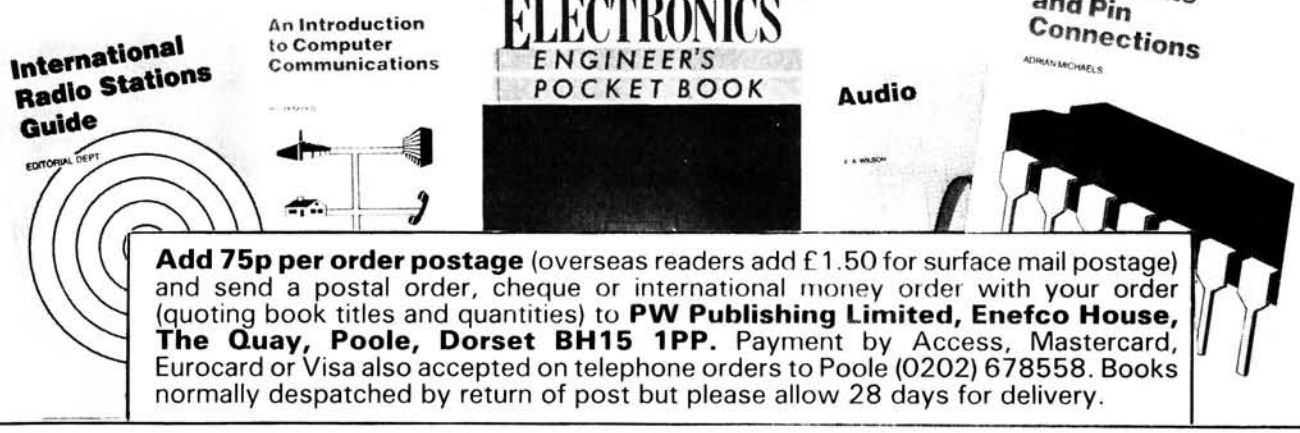

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DID YOU KNOW?

That in 1906 the giant German Nauen station transmitted with a spark 2·5 metres long?

This powerful transmitter was set up in an attempt to break all national transmitting records. Its massive antenna system covered 186 000 square metres; its battery of capacitors was composed of 360 Leyden jars each a metre high; and more than 150 000 volts were used to create a spark a fantastic 2·5m long. So dire were the effects of the station's performance, that personnel had to wear dark glasses to protect their eyes from the ultra-violet rays emitted by the blinding sparks, and to plug their ears with cottonwool soaked in petroleum jelly to protect their eardrums from the thunderous noise. Even the air they breathed was made toxic by ozone and zinc fumes streaming from the hot zinc of the electric arc. The sparking could be heard aurally in the nearby town of Nauen, but the transmissions could be received by wireless apparatus anywhere in the world.

Eric Westman

PW REVIEW

The latest offering from Yaesu is an h.f. base station with a galaxy of features. Ken Michaelson G3RDG puts the FT-767GX through its paces

The FT-767GX is the latest arrival from the Yaesu stable, incorporating up-to-the-minute developments in technology. It is a solid-state, all-mode, synthesised unit, the specification of which includes an automatic antenna tuning unit, built-in power supply and provision for up to three optional internal v.h.f. and u.h.f. modules. On the receive side there is a general coverage receiver with continuous coverage from 100kHz to 30MHz. The optional extra plug-in modules cover 50 to 54MHz, 144 to 146MHz (or 148MHz according to local regulations) and 430 to 440MHz (or 440 to 450MHz again according to local regulations). There are nine transmitting ranges, plus the extra three made available by the plug-in modules.

The transceiver has a most impressive appearance and is finished in battleship grey with a slightly lighter grey for the front panel and edging. Three quarters of the top of the case is taken up with finning for cooling purposes. Yaesu have a special "Duct Flow Cooling" system where air is circulated over the circuit boards and throughout the chassis by an internal cooling fan where operating temperatures rise. The speaker, albeit a small one, is situated at the front left of the top panel. There is a carrying handle on the right-hand side and four rubber feet on the left, so that the unit can be placed on the ground without damage.

Daunting

At first sight the appearance of the front panel is a bit daunting. There are 34 different "push on/push off" switches apart from six special "function" ones and, of course, the numerical keypad. The 34 switches are finished with a faintly gold, satin-brushed surface, which gives the front panel an attractive look while also being very workman-like. There are six single rotary controls as well as six dual-purpose, concentric, rotary ones, and finally there is the five-position multimeter switch.

It is an all mode transceiver (l.s.b./u.s.b., c.w., a.f.s.k., a.m. and f.m.), in which four internal microprocessors are used in the FT-767GX with a "custom gate array" to provide a high level of digital integration.

There are several unusual features in the equipment that I have never seen in amateur gear, among them an auto-calculating s.w.r. meter, digital r.f. wattmeter and synchronous tracking of

the two v.f.o.s. There are several more new facilities in the unit which I shall mention later.

I found the stability of the receiver excellent, and I used it in the reception of facsimile Meteo broadcasts from Bracknell and other stations. As will be appreciated, it is necessary that the receiver remains absolutely stable so that the weather map can be printed. The FT-767GX never shifted. The oscillator stability figure quoted in the manufacturer's data is "better than ± 3p.p.m. after 15 minutes warm-up", in a temperature range of −10 to +50°C, and I feel that one would have to go a long way to better that figure.

The receiver is a triple conversion superheterodyne. There are ten memories, which store both frequency and mode, a continuously variable noise blanker and both i.f. shift and i.f. notch rotary controls.

Multimeter

Looking at the front panel and starting at the top left we have the "multimeter". This is controlled by a five-position switch and a "push-on/push-off" button labelled DISC. The five readings it gives are IC (transmit current), a.l.c. level, compression level, power output and VCC (voltage at the collectors of the final transistors). Pressing the DISC button turns the meter into an f.m. discriminator centre-tuning meter (instead of signal strength), indicating centre-scale when in tune. Other functions of the meter are unaffected. Below the DISC button is the POWER ON/OFF press switch and below that the manual p.t.t. switch labelled MOX. On a level with these two switches and arranged horizontally are six rotary controls, the knobs of which are rubber-covered. They are labelled, from left to right, VOX GAIN, PROC, MONI, TX SHIFT, AGC and DIM. Four of these operate in conjunction with four out of the nine "push-on/push-off" switches on a horizontal line below them. The labelling of the switches from left to right is VOX GAIN, PROC (speech processor level), MONI (sets volume of c.w. sidetone and i.f. monitor), TX SHIFT, (adjusts the transmitting frequency ± 100Hz), T ENC which activates either a tone burst generator when the FTE-2 tone burst unit is installed, or the CTCSS (sub-audible) tone generator on f.m. transmissions when the optional FTS-8 tone squelch unit is installed. Neither of these options were available on the review unit so I am unable to comment on them. Following on from that is NAR which selects narrow i.f. filtering in the c.w. and a.m. modes, RF AMP (activates the receiver front-end r.f. amplifier for extra sensitivity on the h.f. bands where needed and finally ATT. This switch inserts a 20dB attenuator between the antenna and the receiver front-end to avoid overload on the h.f. bands. When this switch is depressed a green l.e.d. is illuminated as one of four in a line below the display window. Below these switches horizontally are the MIC socket, PHONES socket and three concentric rotary controls, from left to right MIC/DRIVE, SQL/NB and AF/RF.

To the right of this assembly is a vertical row of "push-on/push-off" switches. They are, from top to bottom, D LOCK (disables the tuning knob), MUTE (disables the receiver audio but leaves the unit on standby), NB (activates the noise blanker), APF (activates the audio peak filter for c.w.), and NOTCH which activates the i.f. notch filter. Each of these switches has its own l.e.d. indicator which is illumi-

nated when the switch is operated; D LOCK is red, MUTE is yellow and the other four are green. Above the tuning knob are two oblong horizontal "push-to-make" switches marked DOWN and UP with the word PROGRAM underneath. They are to operate the tuning steps of the unit. The default steps before programming are 5kHz on all modes but they may be set to different steps for different modes. If you keep the key held down for more than half a second manual scanning (repeated stepping) will occur at about three steps per second. The FAST button (of which more later), does not alter the step size itself but changes the scanning rate, increasing it to about 45 steps per second. Above these switches, and on the same line as the manufacturer's logo, are four green l.e.d. indicators labelled from left to right CAT (which I will mention later), ATT (which illuminates when the attenuator switch is on), TRACK (this shows when the TRACK facility is operative, bringing both v.f.o.s into step) and GEN. When this indicator is illuminated it shows that the receiver is operating as a general coverage unit from 100kHz to 30MHz and is toggled between general coverage and amateur bands only by one of the keys in the keypad unit labelled H/G ENTER.

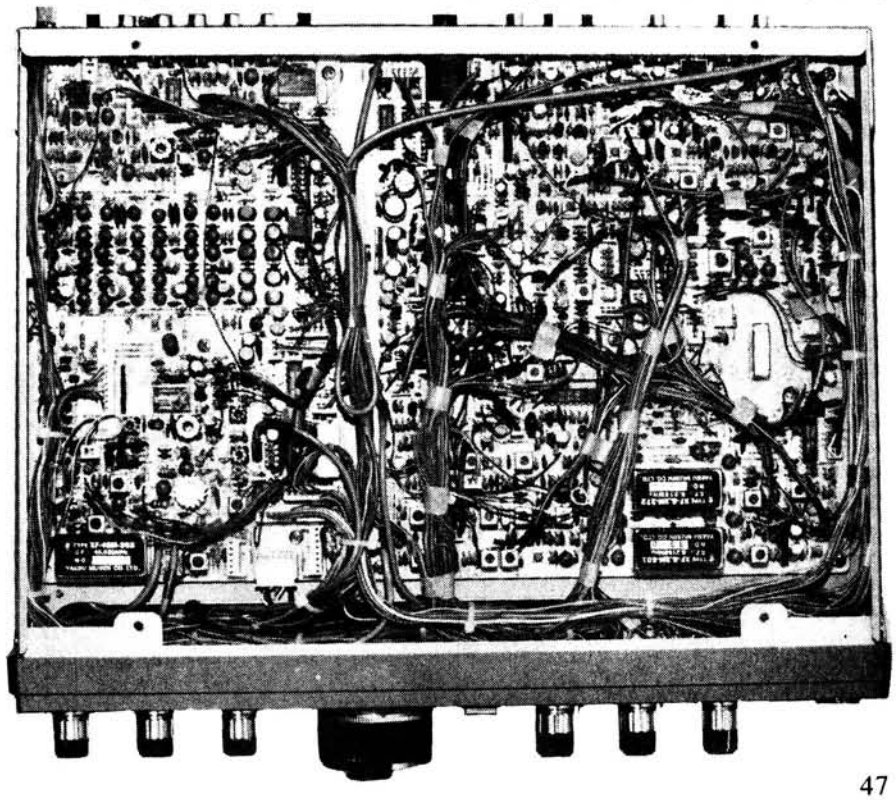
To the right of the tuning knob is a bank of six "push-to-make" switches headed by the label MODE. From top to bottom at left LSB, USB and CW, while the right column is AM, FSK and FM. Any of these modes can be used on any of the amateur bands in accordance with the licensing conditions of the country where the unit is being operated. Below these are two larger "push-to-make" switches labelled, over the top, BAND M CH. The left-hand one is DOWN and right one UP. When one of these is pressed in the general coverage option the receiving frequency changes by 500kHz per operation, but when in the HAM position, the steps are those of the actual amateur bands, i.e. 1.6MHz, 3.5MHz, 7.0MHz, etc. The transmitter is, in fact, disabled when outside the 500kHz segments of the various amateur bands, whether in the GC or the HAM mode.

We now come to the antenna tuning corner! The rig is fitted with an automatic antenna tuner, and at the top right of the front panel is a display opening with two "push-on/push-off" switches under it. The left-hand switch is labelled TUNER and the right one START. When the antenna is connected and the unit in operation, you press TUNER. There is a click and the word READY appears in the opening. Next you press START the word WAIT appears and the motors of the automatic a.t.u. commence turning. Provided that you are using an antenna with an s.w.r. of 3:1 or less with coaxial feeder (50 ohms unbalanced), the unit will find the correct match for you and stop operating, returning the display to READY. You can now transmit. Should the a.t.u. be unable to find a match for the antenna due to the s.w.r. being too high, then the word WARN will appear in red on the right-hand side of the window. If this happens you need to look at your antenna! To the left of this are two more "push-on/push-off" switches, the top one being DIGITAL SWR and the lower one RF POWER. These two facilities are, in my opinion, great aids to operating. Think what it is like, if you are a little doubtful about your s.w.r. figure, to merely press the upper switch and see the actual figure appear in the display area. The same thing applies to the lower switch which gives a readout of actual power into the antenna!

Keypad

Below this very interesting array is the keypad, consisting of fifteen keys, all of which have a double action. The default function is clearly marked on the upper part of each key, and the alternative function, labelled in reverse-out lettering, is brought into operation by one press on the orange key. I shall not list all the thirty different operations available but just give an example! The left-most key on the bottom row is marked H/G ENTER. When this is pressed normally it toggles between general and amateur coverage in the receiver, but if the orange key (FUNC/T SET), is pressed first and a frequency keyed in with the numerical keypad, the H/G ENTER key when pressed, will enter the frequency which has been keyed, into the v.f.o. or Memory Channel depending on which is being used. However, if the orange key is pressed twice in succession the sub-audible tone frequencies for the optional FTS-8 tone squelch unit can be selected by the BAND/MCH keys. One of the more important operations available, to my mind, is the "clarifier". This operates in rather an unusual fashion and is toggled in or out by the middle key of the bottom line also labelled "1". There is no separate control for what I am used to calling "r.i.t." (receiver incremental tune), but I was able to turn the tuning knob, thus altering the receiving tuning point while the actual transmitting frequency remained unchanged. The opposite operation, transmitting offset, is accomplished, as mentioned above, by the TX SHIFT switch and its associated rotary control. Another thing to note is that once the clarifier offset is tuned it remains in a special memory even though the clarifier itself is turned off, and can only be erased by pressing the AC key next to it.

Below this keypad assembly are three "push-on/push-off" switches. From left to right they are FAST, MIC U/D and KEYER. When FAST is depressed, it provides coarse tuning steps for four different facilities, MIC, PMS (programmable memory scan), DIAL and PROGRAM UP/DOWN. The MIC U/D key selects the size steps of the microphone UP and DOWN keys on the optional scanning microphone. Such a microphone was provided for the unit under review and was found to be a great help under certain conditions. It had, in addition to the UP, DOWN and FAST buttons on the top surface, a two-position tone switch on the back. When the MIC U/D key is out the mic button steps are the same as the tuning knob, but when depressed the frequency change rate is altered to that of the PROGRAM keys. The third key turns the internal c.w. keyer on and off. The final three, concentric, rotary controls at the bottom right of the front panel are, from left to right, SHIFT/TONE, NOTCH/APF (audio pass filter) and KEYER/PITCH. The inner of this control sets the speed of the internal keyer while the outer, PITCH, control is a three-position switch selecting 600,



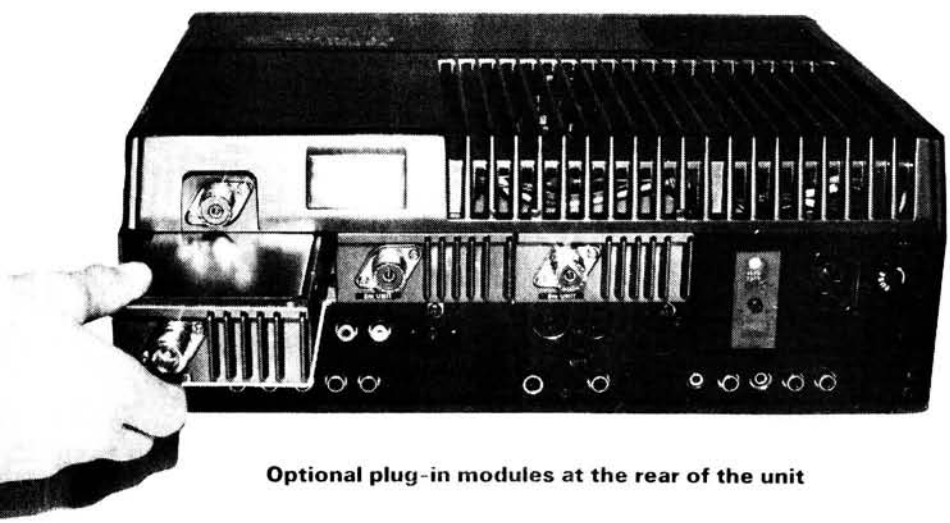
700 or 800Hz c.w. carrier offset and sidetone. The operation of the other two concentric controls is obvious.

The Display

This brings me to the end of the description of the front panel of the FT-767GX apart from the display, the clarity of which is one of the contributory factors in making this unit such a pleasure to use. The display opening is approximately 230 × 2.5mm and on the far left is the analogue multimeter. As I mentioned above, it has five functions. Well, six really, since if the DISC button is depressed the meter acts as a centre-zero tuning indicator for f.m. reception. To the right of the meter are two l.e.d.s. Green for BUSY when receiving (unless the squelch is operative, when the BUSY light is extinguished), red for ON AIR. The actual digital display has four columns, each of three digits, to the left of the frequency readout, the left two of which show the selected mode of emission (l.s.b., u.s.b., c.w., a.m., f.s.k. and f.m.). The next column shows OFFSET, SPLIT and CLAR and lastly VFO A, VFO B and MR (memory recall). Next there is the seven digit display of the frequency which also covers the readout for the OFFSET display, TONE frequency, WATTMETER and SWR. Next a smaller size figure indicates the MEMORY CHANNEL, with the letters CH alongside. Below CH is the word TONE which illuminates when the CTCSS sub-audible tones are used, and lastly we have either SWR or W to define the s.w.r. or r.f. power figures for a given circumstance.

The rear panel incorporates nearly as many controls and switches as the front panel and requires some thought before operation. The unit received for on-air testing did not have any of the three optional v.h.f./u.h.f. modules installed (though they were in the one tested in the *PW* labs), but they would be plugged into the openings made for them and have the necessary antenna sockets, together with cooling fins, arranged on the back. Looking at the rear panel, at the top left is the h.f. antenna socket, an SO 239 type for a 50 ohm unbalanced antenna. Below this is a "push-off" switch which disconnects the lithium battery back-up system for the memory and v.f.o. data. This should normally be left undepressed unless the unit is going to be stored for some time. To the right of this and on the same level are two phono sockets coloured red and yellow giving output voltages and two "push-on/push-off" switches. The left red socket has an output of +13.5 volts d.c. at 200mA and the yellow socket an output of 8 volts d.c. at 100mA. The left-hand switch activates a calibrating carrier in multiples of 25kHz throughout the h.f. range of the receiver and the right-hand switch, when depressed, enables QSK transmit/receive switching control by an external linear amplifier which is designed for full break-in operation, such as the new Yaesu solid-state FL-7000. Normally this switch as well as the calibrating switch, would be in the out position. Again to the right of these are two DIN sockets. The left-hand one is an eight-pin type which is intended to provide control and band selection data to the FL-7000 linear amplifier. The right-hand socket is a six-pin version and is intended to take the serial input/output, a.g.c. and p.t.t. data for external computer control. The data rate is 4800 bits/sec at t.t.l. levels. This is the c.a.t. (computer aided tuning) system which I mentioned earlier. It allows control of v.f.o./Memory data entry, selection and tuning; i.f. shift and CTCSS tone selection from the operator's personal computer. It also provides access to the p.t.t. line to allow keying of the transmitter and, in addition, the a.g.c. signal on pin 5 provides a high impedance analogue sample of the receiver a.g.c. voltage running from 4 volts with no signal to 0 volts with a strong signal. This voltage may be applied to an analogue-to-digital converter to provide a digital signal for signal strength indication and scanning control by the computer. The necessary interface was not supplied with the review unit which was a pity, so I am not in a position to comment on this facility. On the bottom line at the far left is the GROUND terminal post. Next to it are two phono sockets and a "push-on/push-off" switch. These give the operator a choice of connection for the antenna. If the switch is out the receiver is connected to the main coaxial h.f. antenna socket at the top left for transmit and receive. If, however, the switch is depressed, the receiver input is transferred to the phono socket just to the right of the switch. This enables a separate antenna to be used for receive only, using the main one for transmit. The second phono socket enables a separate h.f. receiver to be used sharing the main h.f. antenna when the FT-767GX is not transmitting. The possibilities of these arrangements are very great. Next to this array are three more phono sockets, from left to right, RF OUT, EXT ALC and TX GROUND. Then there is a small rotary control labelled PO ADJ. This control sets the sensitivity of the PO function of the multimeter on the front panel, and allows it to agree with the reading of the digital r.f. power meter shown on the left of the display. Then there is the $\frac{1}{4}$in three-contact, stereo jack which accepts a c.w. key or key paddles for use with the built-in electronic keyer. Another phono socket follows as we move to the right, and that is the p.t.t. socket which is wired in parallel with the MOX switch on the front panel which allows activation of the transmitter by external devices such as a packet t.n.c. or a foot switch. Two more rotary controls follow, DELAY and ANTI-TRIP, which are used with the VOX amplifier and the semi break-in function of c.w. Finally, there are a series of terminals called i.f. unit jacks. They are EXT SPKR, AF OUT, DATA IN/OUT (a three-contact 3.5mm stereo socket which allows direct connection to the f.m. receiver demodulator and f.m. transmitter modulator for digital terminal equipment such as a packet radio t.n.c. on v.h.f. or u.h.f.), PATCH IN (which accepts an input from a phone patch, external a.f.s.k. generator or other source of 600 ohms impedance) and finally FSK which is a phono socket which provides 8 volts d.c. whenever f.s.k. is selected. This could be used as a control line for a terminal unit to turn it off when operating on other modes.

I have mentioned the operation of the H/G ENTER key (bottom line left), but there are some others which require a few words. One of these is TRACK (top line left). The FT-767GX has two v.f.o.s which are normally at a random frequency separation. By pressing TRACK the two v.f.o.s will change in frequency together. At the same time a green l.e.d. lights up in the line above the tuning knob. This is convenient for tuning repeater bands where all the repeaters have the same offset. The alternative action performed by this key (when the orange key is pressed), causes the blinking display digit selected for keypad entry to move one place to the right. The key below this, VFO AB/CE toggles between VFO A and VFO B in its normal state but when activated with the orange FUNC key, cancels the entry made on the keypad. The nine keys on the numerical part of the keypad have different operations as follows, when activated by the FUNC key. Starting from the top



Optional plug-in modules at the rear of the unit

★ PW LAB TESTS

TRANSMITTER

Outputs in c.w. mode:

Freq. (MHz)	Max. Output (W)	Spurious outputs (dBc) at 100W (10W v.h.f./u.h.f.)			
		Harmonics			Other
		2nd	3rd	Higher	
1.81	105	−59	—	—	—
3.51	107	—	—	—	—
7.01	106	—	—	—	—
10.11	106	−67	−69	—	—
14.01	106	−69	—	—	—
18.11	100	−68	—	—	—
21.01	106	−67	—	—	−57 @±3MHz
24.91	110	−63	−65	—	−46 @±4.8MHz
28.01	110	−60	−61	—	−57 @−10.9MHz −53 @±6MHz −53 @5MHz
50.10	10	−66	†	†	−60 @−5MHz
145.0	10	†	†	†	†
432.1	10	†	†	†	†

Notes: dBc = dB referenced to carrier.
— = better than −70dB.
† = better than −60dB.

2-tone Intermodulation products:
(100W p.e.p. at 14.1MHz using 700 and 1600Hz tones)
Wanted signals 0dBc
3rd order products −38dBc
5th order products −39/−40dBc
7th order products −52/−58dBc
9th order products −54/−55dBc

Carrier suppression: 53dB (1kHz modulation)

Unwanted sideband suppression: 60dB (1kHz modulation)

Frequency response: (s.s.b.)
320–3100Hz (to 6dB points)

RECEIVER

Sensitivity: (input p.d. in µV for 10dB S+N/N)

Freq. (MHz)	c.w./ s.s.b.	a.m. (70% mod)	f.m.* (3kHz dev)	Input for S9
1.81	0.32	1.2	—	157
3.51	0.31	1.1	—	142
7.01	0.29	1.2	—	163
10.11	0.48	1.9	—	235
14.01	0.36	1.3	—	161
18.11	0.34	1.3	—	154
21.01	0.39	1.6	—	196
24.91	0.42	1.8	—	134
28.01	0.44	1.7	—	134
29.01	0.44	1.7	1.1	203
50.1	0.07	—	0.17	
145.0	0.1	—	0.24	
432.1	0.07	—	0.15	

Note: * = for 12dB SINAD

Dynamic range: (3rd. order i.m.d.)

Signal separation from carrier (kHz)	Dynamic range (dB)
20/40	86
50/100	90

Squelch threshold: 0.5—3.2µV (f.m.)

S-Meter calibration: (at 14.01MHz u.s.b.)

Reading	Input required	
	µV p.d.	dBµV
S1	6.9	17
S2	8.3	19
S3	10	20
S4	13	23
S5	18	25
S6	29	29
S7	45	33
S8	81	38
S9	161	44
S9+20dB	823	58
S9+40dB	3.28mV	70
S9+60dB	16.5mV	84

Image and i.f. rejection: 1.5–30MHz: better than 80dB
v.h.f./u.h.f.: better than 70dB

AGC threshold: 1dB gain reduction threshold
12µV (s.s.b.)

RF attenuator: 19.5dB at 14.01MHz

Test equipment used:
2017 and 2019 signal generators, TF2370/KT2373 spectrum analyser, 2435 frequency meter, TF2304 modulation meter, TF2337A distortion meter, TF2005R two-tone generator, TF893A power meter, all by Marconi instruments; Bird Model 43 r.f. power meter; Tektronix 2215 oscilloscope.

★ MAKER'S SPECIFICATIONS

TRANSMITTER

Frequency coverage:
1.5–2.0MHz (160m)
3.5–4.0MHz (80m)
7.0–7.5MHz (40m)
10.0–10.5MHz (30m)
14.0–14.5MHz (20m)
18.0–18.5MHz (17m)
21.0–21.5MHz (15m)
24.5–25.0MHz (12m)
28.0–30.0MHz (10m)
Option: 50.0–54.0MHz (6m)
Option: 144.0–146.0MHz (2m)
Option: 430.0–440.0MHz (70cm)

Power output: (h.f.) a.m.: 25W carrier
s.s.b./a.m./f.m./f.s.k.: 100W
(v.h.f./u.h.f.) a.m.: 2.5W carrier
s.s.b./a.m./f.m./f.s.k.: 10W

Antenna impedance: Below 4MHz: 25–100Ω
4–30MHz: 20–150Ω
v.h.f./u.h.f.: 50Ω

Carrier suppression: More than 40dB

Unwanted sideband: Better than −50dB

3rd Order i.m.d.: Better than 35dB below either of two tones

Harmonic radiation: h.f.: Better than −50dB
v.h.f./u.h.f.: Better than −60dB

Audio response (−6dB): 350–2900Hz

Microphone impedance: 500–600Ω

RECEIVER

Frequency coverage: 100kHz–30.0MHz
Option: 50.0–54.0MHz
Option: 144.0–146.0MHz
Option: 430.0–440.0MHz

Intermediate frequencies: 45.03MHz, 8.215MHz and 455kHz

Sensitivity: Input in µV for 10dB S+N/N

Mode	<200kHz	200 to 500kHz	0.5 to 1.5MHz	1.5 to 30MHz	v.h.f. & u.h.f.
s.s.b./c.w./ f.s.k.	2.5	1	4	0.25	0.25
a.m.	25	4	20	1	1
f.m. (12dB SINAD)				0.5	0.32
Squelch sens. s.s.b./a.m./ c.w./f.s.k.	20	10	20	2	1
f.m.				0.32	0.32

Image and i.f. rejection: 1.5–30MHz: 70dB min.
v.h.f./u.h.f.: 60dB min.

Selectivity: (−6/60dB)
s.s.b./c.w./a.m. (N) 2.7/4.5kHz
c.w. (N) (Option) 600/1300Hz
a.w. (W) 6/16kHz
f.m. 15/30kHz

Notch filter: Better than −30dB

Variable i.f. shift: ± 1kHz

Audio output: 1.5W into 4Ω with 10% t.h.d.

Audio load impedance: 4–16Ω

GENERAL

Power requirements: 100–117 or 200–234V
50/60Hz a.c.
55VA receive; 650VA transmit

Dimensions: W368 × H129 × D295mm

Weight: 15.5kg with options
13.5kg without options

★ PW LAB TESTS (cont)

Selectivity: (−6/60dB)
c.w./s.s.b. 2.5/4.6kHz
c.w. (N) 500/1300Hz
a.m. 8/13.7kHz

I.F. Notch filter: 32dB

Audio output: 1.5W into 4Ω with 1.7% t.h.d.
3W with 10% t.h.d. for 1.9µV input at 14.01MHz

line, "7"=SCAN, "8"=M TO VFO, "9"=VFO TO M, and the next line, "4"=MR (memory recall), "5"=SPLIT and "6"=VFO + M (exchanges the memory of the selected v.f.o. with the memory and mode of the selected memory channel). And on the bottom row, "1"=CLAR, "2"=MCK (memory check) and "3"=OFFSET. The FT-767GX can also operate with packet radio either on v.h.f. or u.h.f. One has to determine the a.f.s.k. signal levels which would be provided by one's t.n.c., for transmission as well as the levels required by the t.n.c. for reception. Again, I did not have any packet equipment to try this facility out for myself, but the instructions in the Owner's Manual are quite explicit.

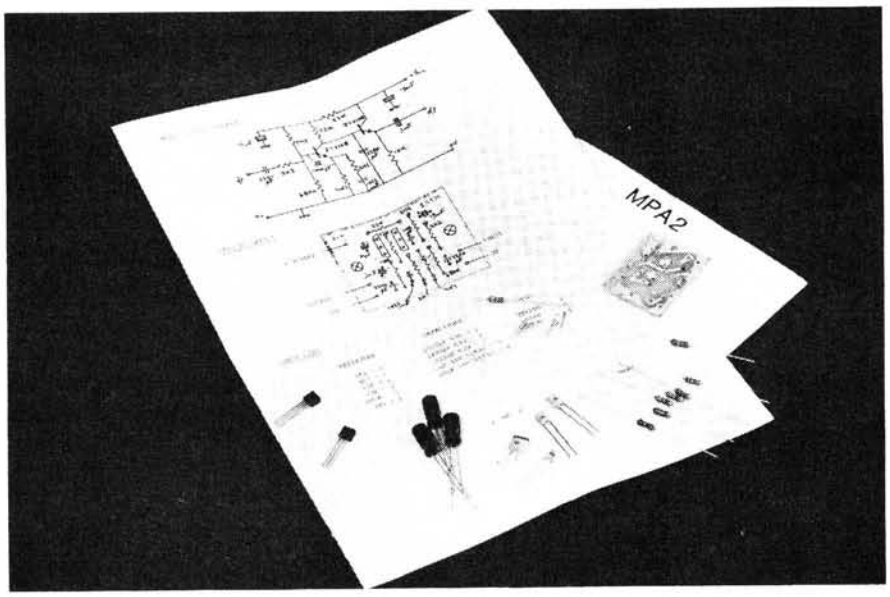
Operating Reactions

This, in fact, brings me to the end of the general description of Yaesu's latest baby! Now for my reactions in operating it. I have only used it for two weeks so I cannot give a long-term opinion, but its performance is impressive. If the excellently written Owner's Manual is read and re-read very carefully, no one could possibly complain about the immense range of facilities which are available. I would imagine that an owner of the FT-767GX would not need to think about updating their equipment for many years. Having said that, it was disappointing to find that one could hear a rattle from the cooling fan. This was not very loud but could be heard when the unit was operating at low volume levels. A design point which I, personally, did not like was the method of memory entry and memory recall. It seemed to me unduly complicated compared with other units which I have previously reviewed. The clarifier, too, was fiddly in operation. I did not like the type of keyswitch used, they were too close together for my choice and I found that on occasion, I was pressing two of them at once. I have commented on this type of keyswitch before, and to operate them successfully I had to use my finger nail. I also found the tuning knob too free for my liking, and there was no provision for a "friction brake" as is fitted to some other units. I also noticed some play on the tuning knob shaft, which I felt to be wrong for a piece of equipment in this price range. I appreciate that the tuning is performed by some form of rotary encoder, and that the actual play has no effect on the operation, but it would have been more pleasant to operate a piece of gear with a silky feel.

But these are really minor criticisms, because the overall impression that I was left with was of admiration for the great number of facilities the FT-767GX had available. I must comment on the impressive operation of the notch filter which, when used in conjunction with the i.f. shift control, was able to cut out completely any interference when listening to a weak c.w. station. It was quite an experience to switch the filter out and hear all the noise come back. As regards operating using s.s.b., I had a number of contacts on 3.5MHz, and when asked, all the other stations considered that the audio quality was excellent. The speech processor, too, was a help on a noisy 3.5MHz band in the evening. I also operated AMTOR, with complete success, so that the speed of changeover from transmit to receive in this mode was obviously satisfactory. The operation of the general coverage facility of the unit was very satisfactory, the audio quality of the a.m. stations on the medium wave band being certainly of "listenable" quality. Further up the spectrum I have already mentioned reception of the Meteo broadcasts, and when tuned into the short wave bands world-wide reception was possible.

All in all, I think that this transceiver is the shape of things to come. The fact that it had to be returned to SMC after such a short time was my loss. I would suggest that, provided that (and I know I repeat myself) the Owner's Manual is read and thoroughly understood, it is at the moment, top of the market. The price of the FT-767GX is £1550 and thanks are due to ***South Midlands Communications Ltd, SM House, School Close, Chandlers Ford Industrial Estate, Eastleigh, Hants SO5 3BY. Tel: 0703 255111*** for the loan of the equipment.

Kit Construction– It's Easy



This month's kit is a very useful little microphone pre-amp from Wood & Douglas, the MPA-2. This is an improved version of their earlier and popular MPA1, the main difference being the addition of a buffered output. The unit's prime function is fairly obviously to boost the output of a low output microphone to a level suitable for feeding into a transmitter, as Elaine Richards G4LFM finds out.

Construction

The kit arrived in good condition and was well packed. All the components were of good quality as per Wood & Douglas' usual standard, and the glass fibre printed circuit board had correctly spaced holes of the right size. The supplied instructions were adequate for a constructor with some experience, although with the small size of the project some fine soldering is required. To help with the orientation of the components a p.c.b. layout and a sketch showing mounting detail are included in the instructions. Construction was carried out in the normal order with resistors first followed by capacitors, p.c.b. pins and finally the transistors. With a total component count of only 17 the construction time for the review kit was about 15 mins.

Circuit Description

The circuit is obviously fairly simple as there are only 17 components! The input signal from a microphone is capacitively coupled to the base of an *npn* transistor configured as a common emitter amplifier. The first transistor provides the voltage gain and the frequency response tailoring. This tailoring is achieved by varying the negative feedback at the emitter of this stage. The output of this first stage is directly coupled to a simple emitter follower buffer which provides a degree of isolation to minimise the effects of any external load.

Performance

The unit was put through its paces in the *PW* test lab. The photograph in Fig. 1 shows the frequency response of the review kit and clearly demonstrates the effectiveness of the response tailoring.

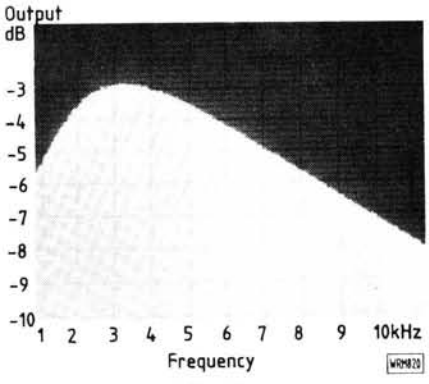


Fig. 1

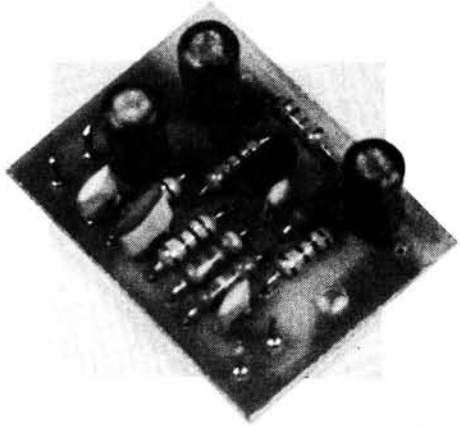
The measured gain was 16dB at 2.8kHz and the maximum output at the onset of clipping was 1.6V r.m.s. While in the lab the harmonic distortion was also measured and returned a very respectable 0.5% at 400Hz with an output level of 1.5V r.m.s. Power consumption was very low at 0.45mA with a 13V supply, which should make it easy to find a suitable power source within the rig. The final size of the completed kit was a mere 32mm × 15mm, which should enable one to easily hide it away inside a rig.

Summary

This pre-amp has obviously been carefully designed and refined to provide optimum response and gain for most situations. The unit is well suited for use with most low output communications microphones, providing their output is less than 600mV p-p, any more than this is likely to overload the pre-amp.

Included with the kit was information to help the user alter the characteristics of the pre-amp to suit individual requirements. These mods were mainly concerned with providing increased gain with a variable output. By using the supplied modifications the gain can be varied between 13dB and about 40dB, but you lose the response tailoring in the process. As with any sensitive unit used in an r.f. environment it is important to ensure that the kit is mounted in a screened enclosure and that screened leads are used for all signal connections. In conclusion a very simple but effective kit that will find a place in many amateurs' shacks.

The MPA-2 kit costs £4.60 plus £1.00 post and packing and is available from **Wood & Douglas, Unit 13, Youngs Industrial Estate, Aldermaston, Berks RG7 4PQ.**



This feature will become a regular part of the magazine and will be very wide ranging. It will cover small constructional articles to help you get building and also articles explaining in simple language the sort of things you may have found confusing. Input from you as to what you would like to see described, or useful projects to build, would be most welcome and should be sent to me either QTHR or via the editorial office. I look forward to hearing from you.

Practically Yours

by Glen Ross G8MWR

Wherever two or three v.h.f. enthusiasts are gathered together there you will hear talk of antennas; this is a basic requirement of the amateur radio faith. The problem is that so much antenna talk, coupled with an unswerving belief in the s.w.r. meter, is based on misconception and half truth. The choice collection of antenna myths and fallacies has partly come into being due to the difficulty of making accurate measurements under typical amateur conditions.

Published Figures

The manufacturers of antennas have a great advantage over us in that we cannot check up accurately on the published figures. This is not to say that they deliberately cheat us but most antenna gains are quoted using a particularly favourable frequency and a particular set of mounting and feed arrangements. We are rarely told what these conditions were.

Choice

We also have to bear in mind that our choice of an antenna is not only determined by the maximum gain available; other factors may also be important. Perhaps a very high front to back ratio is undesirable, while minimal sidelobes and a wide frequency coverage may be important in your requirement.

There's no "Gain"

No antenna produces gain in the sense that it radiates more power than you feed into it. It only produces apparent gain in a favoured direction by reducing the radiation in other directions. A convenient way to compare antennas is to evaluate the performance against a "standard" and for many years the reference used was the dipole. More recently manufacturers found that they could get much larger figures by referring the gain to that of an isotropic radiator which allows them to quote figures that are 2.14dB up compared to the dipole reference.

Table 1

Elements	NBS (dBi)	Krautz (dBi)
3	9.25	10.95
5	11.35	12.15
6	12.35	13.20
12	14.40	15.13
15	15.55	16.55
17	16.35	16.90

Shows gain for various numbers of elements

Top Whack?

A lot of research has been done into the maximum gain which can be obtained from a given number of elements assembled in a Yagi configuration and of these the NBS figures are perhaps the best known. Slightly higher maximum figures are given by Krautz. This method assumes that the antenna has no side lobes and no resistive losses which is obviously impossible in a practical array so the figures are a maximum theoretical gain. They are obtained by measuring the vertical and horizontal 3dB points and then calculating the gain. The figures are given in Table 1.

How Many Elements

There is a belief that the more elements you fit on the boom the more gain you are going to get. In fact, assuming that the elements have been spaced at the optimum locations, the gain of the antenna is related to the boom length rather than the number of elements. Adding additional elements may increase the frequency bandwidth, will give more space for the birds to roost and will increase your bill for aluminium. The gain to be expected from a given number of elements when they are mounted on a boom of optimum length is shown in Table 2. These are the gain figures that you can reasonably expect from normal home construction techniques when the array is carefully tuned to the centre frequency of interest.

Stacking

A frequently heard argument is whether it is better to get more gain by adding more elements to an existing array or by stacking two arrays. If the usual requirement of getting extra gain and keeping a low radiation angle is important then you should opt for stacking. Adding elements to a Yagi array does not affect the radiation angle to any great extent, although the additional elements will sharpen up the directivity of the array. Stacking two arrays one above the other will get the extra gain by reducing the vertical angle of the beam but will still give you roughly the same horizontal beamwidth as you had from the smaller array.

Added Benefits

This can be very beneficial because you have now got high gain over a wide horizontal arc so your signal is really covering some ground. Adding the necessary boom length and extra elements to convert your small Yagi into a long Yagi of similar gain, to the stacked ones will get you the gain, but usually at the expense of a much reduced frequency response in the antenna, a higher s.w.r. at the band edges and a lot more beam-swinging in an opening. It's fine if you can accept a lot of gain over a small section of the band.

Next month we shall look into some of the problems of stacking, the advantages and disadvantages of various types of antennas and the thorny subject of element lengths and spacings for best results. There will still be various types of transmission lines to evaluate and that supreme diety of the antenna enthusiast, s.w.r., to look into.

Table 2

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

Relationship between number of elements, boom length and gain

On The Air
On The HF Bands

Reports to Paul Essery G3KFE
Practical Wireless, Enefco House, The Quay, Poole, Dorset BH15 1PP.

There is still some of the Ham Spirit about: GW4GAF and the author suffered an alternator failure on the way to the NEC RSGB Show. A wiring problem was rectified by the help of a soldering-iron on the home construction stand, and Alan G0BFZ escorted us right through to Stourbridge on the way home, found us a possible source of help, and finally led us to a new battery so we could complete the journey home. Thanks!

Lately

Recent activity on the bands have been dominated by the Andamans and Nicobar DXpeditions, VU4APR and VU4NRO, which wrapped up on March 31. There was also activity from Aves 4M0ARV. Libya has been activated again by SP6RT, and Lloyd and Iris Colvin have wrapped up their latest expedition in Kenya; they have returned to the USA to prepare for their presentation at Visalia.

Just in case you didn't notice it, there was a capful of wind about over the NEC show weekend, and we gather that quite a few people lost their skywires; indeed we feared for our own one when a neighbour's shed door blew open and threatened to take the entire shed through our antenna guy wire, over the fence and into the road, before we managed to recapture it! Is there an award for Caught All Garden Sheds, we wonder?

Now

The recent activities of VE3FXT's DXpedition have now wrapped up; George made some 21 000 contacts from ZS. Incidentally, at the time rumour had him on Marion Is., ZS8, he was actually in the UK!

Soon

Of course, we can only tell you of what we know about under this heading. Often the one YOU specially want will pop up at such short notice that it has come and gone by the time you read this; which is a good reason for subscribing to the RSGB's (late Geoff Watts) *DX News Sheet* each week, plus any other ones you fancy; the author has *The DX Bulletin* from California and the *CARF* magazine.

If you are interested in activity from Christmas Is., T32, we hear that KH6GDR will be signing /T32 for an extended stretch, although one needs the band to be open around 0200Z when one checks his operating spot at 14.178MHz.

An interesting one is the Saharan Arab Democratic Republic, once known as Rio de Oro, under which name it was dropped from the DXCC list back in 1976. We hear that a Spanish group are hoping to activate this one, signing S0RASD, in August. SADR is recognised by the other OAU states, but whether it will be a counter for DXCC remains to be seen. If it is, it'll cause a fair old rumpus!

Also of interest is the fact that American reports of activity claiming to be from North Korea are being heard; the latest one noted is P9AF. Beam headings are right, and signals peaked at the right time. However, the operator was calling for QSLs via the North Korean Bureau "which will open soon". ARRL, however, have no knowledge of such a Bureau. WFWL applies—work 'em first, worry later!

If you are after Zone 23 to complete a WAZ, it is worth nothing that BY0AA is in that rare area, and likes to stick around 14.024MHz.

A slightly easier one to find is FP, St. Pierre, where we hear K1RH will leave behind his entire antenna system when he leaves there in mid-June—a tribander, Butternut vertical and a G5RV, not to mention rotators and power supplies. Anyone fancy a DXpedition?

Pepi

Contests

Whether you like them or hate them, you need to know when the Big Ones are on.

Sad to say, we have a clash on the May 30–31 weekend, with the CQ WW WPX c.w. contest taking up the full 48 hours, of which 30 may be used by the single-op station. Rules are pretty well as before, and like the Phone leg, logs to be sent to *CQ Magazine,* 76 N. Broadway, Hicksville, NY 11801, USA, the mailing deadline being July 10.

The other one is the ARCI QRP c.w. Sprint, running 0500–0900Z May 30. Get the rules from KA5NLY, as they are a bit complex for a shortie. Exchange RST, country, and power output or ARCI membership number. Mailing deadline for logs is June 30, addressed to KA5NLY, Pentagon P.O. Box 46599, Washington DC 20050 6599. G-QRP club members will be active and interested in this one; look for contacts around the normal QRP frequencies on each band—and if you are a QRP operator you'll know those for sure!

And, of course, we haven't mentioned the minor QSO Parties and similar activities.

Reports

Since the heavy snow in January, **G2HKU** (Isle of Sheppey) has been suffering severe powerline QRM rising to S9 at 1.8MHz, and of course getting worse in wet weather. Thus Ted managed to work DJ2MM on 1.8MHz c.w., UC1AWR on 10MHz c.w., his usual sked s.s.b. contact with ZL3FV on 14MHz, and c.w. with K1TN/VP2M. However, at the time of writing Ted was on his way to visit G3RJV, along with G3VTT and G3ROO.

Using just ten watts to a one wavelength wire of height between 2 and 6m above ground, on Friday 13, **G4AGQ** was highly delighted to get a 599 report from 5A0A, who was himself only 559. Even more of a pleasure as it broke the spell, being the first "new one" for 18 months.

G3NOF (Yeovil) of course sticks to the h.f. bands most of the time, and s.s.b., where he has a potent signal and usually snaps up anything on offer. On 28MHz, Don noted just Europeans and one EA6, and mentions no actual QSOs. The 21MHz band saw short-path openings to the Middle East, VK, VU, YB around noon, and Africans between 1300–1700Z occasionally staying in to 1800. North Americans were heard most days between 1300–1600; conditions generally were patchy. There were s.s.b. bookings with A4XKB, A92BE, C53FH, CN8LS, CX7ABS, J28EM, TL8DC, ON7VD/5N6, OX3KM, TU2QQ, TZ6BG, TZ6MG, TZ6VV, VK9YW (Cocos-Keeling), VP8BLZ, VU4APR/RBI (Andaman Is.), YB0TK, ZC4EE, ZS1ABH, ZS3BI, ZS3PQ, 3D6BW, 5B4LT, 5N0WRE, 7Q7LW, 9J2EZ. On 14MHz, the morning long-path opening started with JA, moving round to ZL and VK 0800–1000Z. Around noon came the short-path opening to Asia, JA, BY, 3D, VK9 and so on; Africans were heard around 1600–1900Z, and a few West Coast Ws around 1700. The s.s.b. contacts following were made with: BY1QH, DU9RG, EA9PY, FT8WA, FY5YE, JA1WRE, JA4AO, JR8BUU/5N8, KA2CC/JD1, OD5SM, ON7VD/5N6, TU2LB, TZ6MG, VE3FXT/ZS3, VE7ALC, VKs including VK9LM (Lord Howe), VK9YS (Cocos-Keeling), VK9XS (Christmas Is.), VQ9KE, W7CHZ, W0YBF (Colorado), WB0TEC (S. Dakota), ZSs, 3C1MB, 5N8HES, 5N0WRE, 9L1IS, 9Y4MJK.

G2NJ (Peterborough) usually sticks to daytime QRP signals on the 3.5MHz band, but during last autumn's total eclipse, Nick was on the band, to see what the eclipse would do to the bands. However, he did come across a YL, Frauke DF3JD/P of Willich, Dusseldorf, working OK4FIN/MM who was near Copenhagen; the signals were very steady, and after the QSO the OK was kept busy by other German ops, so propagation must have been unaffected by the eclipse.

DXpedition

VE3JLP (Metcalfe, Ont.) wrote saying his winter has begun to break now, though when he wrote on March 6 there was still a foot of snow on the ground. However, Paul eased the pain somewhat by chartering a 11m yacht for a week and sailed south through the Grenadines from St. Vincent, J88 land, with just one regret: he hadn't booked a second week!

G3BDQ (Hastings) hasn't been so active since he sent off for his Top Band

DXCC—which we notice is the case with G4OBK also! John's 1.8MHz list for the past month included VE1ZZ, UV9FM, UA9CBO, 4X4VE, UA9KAA, UL7ECH, VS6DO twice, W1XP and N4WW at 2230Z on February 17, YB0JH who caused a huge pile-up, 4X4NJ, a 3A2EE that John has doubts about, UA9MS, OY7ML, W7AWA/OY, W2SM at midnight, 9H1CG, and 4X4YM—so despite the lack of activity John was still pretty active! On 7MHz, G3BDQ had seven sessions which realised VK2KM, TR8JJC, VU2TTC, UH8AAW, 5A0A, VE3KZ, VE3CDX, VE2FU, 8P9HG, PY6HL, EA8ACL, VK3DSU, 4X6MP, PY1QP, JA5RH, UJ8SAF, TK4DR, VU2DHC, UA1ODX (Franz Josef), and VU2TTC.

Turning now to **G4XDJ** (Billingham), Brian notes that he now for the first time has a commercial rig, an FT-200, to replace his home-brew QRP rig, which gives him a change from 7MHz only. On the skywire side, trials are going on of a delta loop which is found to be far better than any dipole tried, and on 3.5MHz there is a quarter-wave wire, loaded, with some 100m of wire out as radials. On 7MHz there was a s.s.b. QSO with LX1MK/50, an anniversary station, and on 3.5MHz SM6LJU, G0GXM for a two-way QRP contact, G4RAW, SM6LJU again, and DH8YAG/QRP on s.s.b. On 14MHz, we see c.w. with VK4XA, VE3HBF, VP8PTG who lives locally, OX3UD, W8PJ, OD5EA, VO2AM, plus s.s.b. with 4S7PVR, JR1BLX, KA1OCW and ZL2ALY. Brian is also active on RTTY and SSTV.

Leighton Smart (Trelewis) listened on 3.5MHz s.s.b. and found VO1QF, with 5B4JE, YV5IPF with YT3EW, YV1CLM, W2LU, 3A2AH, T77T, WB3GCG, JY9OL, J6LPS, NK2H, 9Y4VT, and VE1BCI. On 28MHz Leighton heard PY5EG at 1826 on March 21, and on 21MHz CU3LA was working into Scotland. The 14MHz band yielded TI5MRC, HP9AHL, and 5X5GK who was calling VEs.

South America Contest

We have a letter from **PY1CC** who wrote to advise us of the first WWSA c.w. contest over the weekend June 13–14. The contest is sponsored by *Electronica Popular* magazine of Brazil, GACW of Argentina, and PPC the oldest c.w. group in Brazil. Essentially, the contest runs from 1500Z-1500Z on the given dates, on 1.8, 3.5, 7, 14, 21 and 28MHz. The exchange is RST plus serial number, the call CQ SA Test. QSO with own country 0 point but counts as a multiplier, own continent 2, other continents 4 points. Multiplier is DXCC countries and different South American prefixes worked on each band. Final score is total QSO points scored times the sum of the multiplier points on all bands. Separate log for each band, and mailing deadline is August 31, addressed to WWSA Contest Committee, PO Box 18003, 20772 Rio de Janeiro RJ, Brazil, South America. They also have a series of awards—details from the author, via *PW*.

Late Show!

Most of this month's letters have just arrived, all of six hours before my mailing deadline, so we must don our best pair of skates!

G3NOF's current letter notes that the only known opening on 28MHz was on March 21, when some Ws were heard by others around 1600. Don didn't check the band until 1800, at which time he noted several LUs, then TZ6VV, CXs, PYs, and closing with EA8 at 1930; Don understands there was some sort of ionospheric disturbance on this day. QSOs using s.s.b. were made with CX6JV, LU8UF, TZ6VV, and VP8BGX on 21MHz; nothing was heard on the long path to VK and ZL or from the Pacific. On the short path, Asians were noted about 1100, YB/YC 1200–1500, a few VKs around 1100, Africans around 1000 and again 1500–1800, starting with those in the south and working north as one progressed towards evening. Little was heard of N. America. Contacts on s.s.b. were completed with AP2SQ, A25/VE3FXT, CE3DPD, CP8HD, CT3DL, CX0XY (South Shetlands), J28EM, OD5RF, TA3C, TR8SA, TU2RJ, TU2QQ, TU2QZ, TZ6VV, VU4APR/RBI (Andamans), XQ3DPD an Extra Class CE, many YB/YCs, ZC4MR, ZD9BV, ZP9CT, ZS3BI, ZS3PQ, ZS6AED/1, ZS6AFM, ZS6BXB, ZS6NK, ZS6NPSA, ZY0SA (St. Peter & St. Paul Rocks), 3B8BD, 3D6CW, 3D6/VE3FXT, 3G2EPB (a CE), 4M0ARV, (Aves Is.), 4S7EA, 5B4FN, 5B4LP, 5B4SA, 5L2BA, 5N8HZN, 5N0JCR, 5N0JKO, 5T5NU, 6W7PE, 7P8DP, and 9L1IS.

As for 14MHz, here there was activity on the morning long path; around 0900 there was the odd Pacific opening with signals over the North Pole. It added up to s.s.b. QSOs with A25/VE3FXT, D44BC, FH4ED, FP5HL, FR/G/FH4EC, HL9YG, JA4FKA, JF7TYA, K2GBH/V44, K8MN/OH0, KX6DS, PJ9MS, TI2CLR, TU2QQ, TU4A, TZ6MG, UL7PE, V44KI, V85GA, VK2UT, VK5ZN, VU4APR/RBI, ZB2GR, ZD8RP, ZL2AAA, ZL2AN, ZS5VF, ZS6AZQ, ZS6X, 4M0ARV, 5N0JCR, 5N9BHA, 5T5NU, 5Z4KG, and 9N1MC.

G2NJ mentions that on March 15, the TOPS c.w. club net on 3.508MHz at 1400 was joined by a YL, Shelagh G4UUH, from Rugby, with a good fist and signal. The Net control, GS6AQ, uses an HRO on the receive side, and a home-brew ten watt transmitter built in 1939, to a W3EDP antenna—this should rate a photograph, we would have thought!

G4HZW (Knutsford) is a 28MHz band addict, who has a TS820S into a two-element quad in a 3 x 3m garden. Tony agrees with G3NOF's opinion—just the one opening, on March 21 which netted him contacts with TZ6VV, and C56/DK7PE, plus hearing CX, LU, PU, and VP8BGX.

G0AZJ (Lancaster) has been a supporter for a long time, first as a s.w.l. and more recently as a licensed type. However, Jon has been QRT since November 1986, as his FT-200 won't transmit. Somebody has told him that it's the PA valves, and at £30 a throw that's a bit too much when you are out of a job. So . . . Jon is an s.w.l. again for the moment, and wishing he was able to transmit.

On a different tack altogether, G0AZJ asks about the preferred s.w.g. for wire antenna; he has used some thickish stuff but reckons he sees burn marks on it. We would doubt that these burn marks are the result of over-thin wire as such, and our own counsel is "use what you have around" so long as you allow for the possibility of stretching. For example we have a Best Bent Wire for the 3.5MHz band, made of 28 s.w.g., and that normally sees 100 watts and on occasion has been treated to The Lot with no ill-effect. More likely the "burn" marks are the result of voltage on a less than good insulator, or plain soot deposits!

R. Watters (St. Austell) uses an FRG-7700 with the FRT-7700 a.t.u. which he runs with an inverted-L wire of some 20m long, and around 6m high. This netted Robert loggings of 3A2AH on 3.5MHz, SV8RX on 7MHz, and, on 14MHz, A4XRS, AA4EE, AF4Y, KM9P/P0, PT7BZ, SL0EG/4, TU2QS, V44KQ, VK4ALV, VP9LL, YI1BDG, ZD8HH, 5L7Q, 5N0JCR and 5Z4FE.

Information

This is always useful. Most people know of Geoff Watts' Prefix List, and that it costs just £1 to get a bang up-to-date copy, giving the normal prefix, any special prefixes, the continent in WAC terms, the ITU callsign block allocation, the DXCC status, the ITU Zone number and the CQ Zone number for each country. Now Geoff has added another offering; this one is the DXCC Countries Guide; this lists DXCC countries alphabetically, with present and past prefixes back to 1945, a reference list of previous names of countries, a list of DXCC-deleted countries, the IOTA Award reference for all those islands on the DXCC list, and a comprehensive Oblast listing for those interested in the R-100-0 Oblast Award. Either list costs just £1 or sent overseas for $2 or six IRCs. Order from Geoff Watts, 62 Belmore Road, Norwich NR7 0PU. These are very useful listings, especially when you stumble into a pile-up and wonder what you've hooked, or, more often, when you've just worked a new one and wonder where the blazes he hangs out! Seriously—value for money.

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VHF Up

Reports to Norman Fitch G3FPK
40 Eskdale Gardens, Purley, Surrey CR2 1EZ

March proved to be a disappointing month for the serious v.h.f. operator which accounts for a slightly smaller postbag. Even so, some readers have increased their annual table scores quite well. In March 1986 I was reporting a similar state of affairs, in particular the tremendous gales towards the end of the month.

This year saw that very deep depression with its inevitable storms wreaking havoc in southern England with frequent gusts over 70 m.p.h. on the 27th. One violent gust at G3FPK was strong enough to overcome the powerful disc brake on the 144MHz (2m) antenna rotator and twist the beam about 30° off course, something that has never happened before at this QTH.

DXpedition News

Many DX enthusiasts were looking forward to a trip to western Ireland by a group of amateurs, to activate the four U squares. It was scheduled to start on March 22 and operation from UL took place, followed by UM. For a variety of reasons they did not operate after the 26th so UN and UO squares were not activated after all.

In spite of some atrocious weather, they managed to complete QSOs with many stations including some at 700km range in mediocre conditions. At G3FPK, frequent m.s. pings were heard from them and from time to time they were R5 on tropo from IO42VH on 144MHz. Some 430MHz (70cm) operation took place too.

The station comprised a borrowed Icom IC-275, a 160W solid state amplifier and a pair of 15-ele Cue Dee Yagi antennas. These Swedish made antennas stood up to the violent gales, with estimated gusts of 100 m.p.h., in an exemplary fashion. For much of the time they were plagued with static rain which caused so much hash in the receiver that it was impossible to copy weaker signals.

The four members of the group lived in a mobile home which they managed to drive high up to mountain sites. Consequently the vehicle took a battering from the gales and was blown onto a brick wall sustaining considerable damage, at one stage. In such circumstances they must be congratulated on making several hundred QSOs in the limited amount of operating time from such remote places.

The only c.w. "machine" was an electronic keyer which gave up the ghost. That was a pity since more contacts would have been possible on c.w. than on s.s.b. when the signals were only just above the noise.

This trip was funded solely by the four amateurs and proved to be a very expensive exercise. Even so, they feel they gave their best and will obviously have gained a lot of experience should any of them contemplate other such DXpeditions. They were full of praise for the assistance of local people and particularly mention our contributor Charles Coughlan EI5FK, who has successfully operated portable from UL and UM squares himself last year and who is very familiar with the mountains and weather in this region.

Looking ahead to the autumn, **Jan Alblas G4XNL** (SXE) has provided details of proposed operation from the North Sea from England to Denmark and back aboard a DFDS ferry. Locator squares will be BM, BN, CN, CO, DO and DP and continuous operation on the outward journey is promised from 2100 on October 9 to 0600 the next day, and on the return trip from 2100 on the 10th to 0600 on the 11th.

Propagation and weather conditions are usually good at this time of the year. Equipment comprises for 144MHz an Icom IC-290D and Trio TS-9130 at 25W plus 5-ele Yagi, and for 430MHz a Yaesu FT-780 at 10-50W with 9-ele antenna. The callsign will be OZ1EVA/MM and the QRG 144.240MHz with QSY to 432.240MHz as required. The other members of the team are Flemming Jul-Christensen G4MJC/OZ1EVA, Shaun Cline G4MDZ and Simon Pryce G6VYH. Should there be any big pile-ups they will call selectively; e.g. for specific squares or prefixes, so please do not call out of turn.

QSLs via the bureau or direct to G4XNL (QTHR) with s.a.e. from UK or two IRCs from overseas station for a direct card.

Beacon Notes

Geoff Holland G3GHS is the Hon. Sec. of the Mid Cornwall Beacon and Repeater Group and the beacon keeper for GB3CTC. He writes that the Gas Board, the owner of the mast on which the antennas are fixed, is replacing it with a new one which means that the transmissions on 70.03, 144.915 and 432.970MHz will likely have ceased when you read this. The building housing the equipment will remain.

The Group's committee has discussed whether these beacons are still needed and wonders who is going to pay for the new coaxial feeders and antennas. Geoff wrote: "The group feels if amateurs really want the beacons, then donations to help with the funds would be welcome. Unless enough cash can be found, there will be no GB3CTC beacons from this group."

There is no denying that beacons are an important part of the v.h.f. scene. They enable us to study propagation on a continuing basis, not only for tropo mode but for Sporadic-E, Auroral and m.s. too. However, unlike repeaters which are most use to local amateurs, beacons are more useful to others at ever increasing distances. Therefore it makes no sense to expect a local club to fund one or more beacons out of their own income.

My suggestion is that all approved, established beacons be funded through IARU money. After all, they are of international use and RSGB members contributed £13 156 to the IARU last year so surely some of this could be used for such purposes?

A proposal was made for a GB3CTC beacon on 1.296GHz two years ago. Having heard nothing from the RSGB, when the group enquired they found out that their application had been mislaid and never passed to the DTI.

If anyone would like to assist Geoff's group in any way, his QTH is Tanglewood, Off Portheast Way, Gorran Haven, Cornwall, PL26 6JA (Tel. 0726 84 3487).

Awards News

Congratulations to **Norbert Graf DD3KF** (DK2lb) from Aachen, West Germany who is member number 78 of the 144MHz QTH Squares Century Club. His certificate was dated March 13 and included stickers for 125 and 150 squares since 166 QSLs were listed. All the QSOs were on s.s.b., four via Ar, five by m.s., ten via Es, the rest by tropo propagation. No station or personal details were given but Norbert did mention he hoped to apply for the 432MHz QTHCC certificate in the future.

Dave Dibley G4RGK (BKS) was awarded stickers for 150, 175 and 200 squares for his 144MHz QTHCC certificate No. 44 on Feb 18. He now has 203 confirmed. His analysis of the 78 new QSLs was 57 on c.w. and 21 on s.s.b. 21 contacts were on tropo, 38 by m.s., 13 via Es and six by Ar modes.

Yes OM, the tower is 200ft high and well counterbalanced although the wind is rather gusty

Pepi

His best DX on the various modes were; tropo SM0HAX (JT) 1466km, Ar RQ2GAG (MQ) 1707km, Es RB5AO (QL) 2375km and m.s. UR2RHF (QL) 1878km. Dave's station consists of a Yaesu FT-101ZD and transverter with a BF981 front end. The p.a. was a 2SC2630 running 80W now replaced by a home-brew 4CX250BM valve amplifier based on a quarter wave stripline design by K1JX. The antenna is a 16-ele by Tonna.

If you would like details of *PW* v.h.f./u.h.f. awards send an s.a.e. to *Practical Wireless*, Enefco House, The Quay, Poole, Dorset BH15 1PP. Please mark the envelope "Awards" in the top left corner.

Dubus Magazine plans to sponsor a squares awards program similar to ours. It is called WAEL, Worked All European Locators and e.m.e. contacts will not be valid. There are Bronze/Silver/Gold versions for confirmed QSOs with 200/300/400 squares on 144MHz; 50/100/150 on 430MHz; 50/75/100 on 1296MHz; 30/40/50 on 2.32GHz; 10/20/30 on 3.456, 5.76 and 10.368GHz. More details will be published when they arrive.

Contests

The 432MHz Trophy and s.w.l. contest is scheduled for May 30, 1600-2400. The three sections are F, fixed; O, all others and L, listener and entries go to G4WAD at "Tanglewood," Bridge Street, Lower Moor, Pershore, Worcs WR10 2PL. On May 31 there is the 1.3GHz Trophy event with F and O sections. Times are 0900-1500 and entries go to G8TFI at Highlands, Townsend, Nympsfield, Glos.

On June 14 there is a new contest, 430MHz f.m. from 0800-1200 promoted to encourage more activity and to explore the DX potential on the mode on u.h.f. Again there are two sections, F and O and operation should be in the sub-bands 432.5-432.8 and 433.4-433.575MHz. Entries go to G4FRE at 15 Ferry Lane, Cavendish Park, Felixstowe, Suffolk IP11 8UR. The June leg of the 10GHz cumulatives is on the 21st, 0900-2100.

The Worked All Britain organisation is holding its v.h.f. contests on June 28. The QRP section is from 0900 to 1200, the QRO part from 1400-2100. For details of the rules send an s.a.e. to G4GEE at 135 Farren Road, Wyken, Coventry CV2 5EH. If you want a supply of contest log sheets send him a 9 x 4in s.a.e. and three first class postage stamps.

An Auroral Record?

Under this heading in the March VHF Bands in *SWM*, I mentioned the confirmed

Make sure your reports reach Norman in time; make a note of the dates

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QSO of Feb 7 1986 between G4VBG and UA3IFI (KO76WT) during the big Ar event. I borrowed an Ordnance Survey 1:50000 map of the Gateshead area and found G4VBG's QTH, Springwell Village, and calculate the true ellipsoidal distance to be 2322km ±5km. This is an 8.6 per cent increase over the previous record held in Britain by Roger Thorn G3CHN.

The 50MHz Band

Gerald Nenner DL8FBD (EK75f) is keen to try some cross-band m.s. tests with UK 50MHz (6m) stations. He would use either 28MHz (10m) or 144MHz. I have suggested he contact Paul Turner G4IJE who would likely wish to assist. On 144MHz Gerald can transmit c.w. up to 1200 l.p.m. running 400W to a 15-ele Yagi. His transceiver is a Yaesu FT-690R and by now he has probably finished the 5-ele Yagi he was building.

Dave Ackrill G0DJA (WMD) has not been very active but has worked G4FXW in Sheffield again using just 300mW to an indoor delta loop antenna. He has heard G3CCH (NLD) but up to March 2 no QSO had resulted.

Ken Ellis G5KW (KNT) has provided some interesting news. He will be on from the Isles of Scilly in WJ square from mid-June to the end of July, a region from which he has done some pioneering work on the band. **Ted Collins G4UPS** (DVN) will be QRV from Andorra (AC) from May 20 to the end of June with his call C30DAW and is bound to be well sought after and workable via Es. Ted reported the reinstatement of the Rosemarkie beacon GB3RMK (IO77UO) on 50.06MHz on March 8. He heard meteor pings from it and it went Auroral for 15 minutes from1635 that day.

On March 11 at 1220, Ken and Ted attempted a QSO. G4UPS was received at RST519 in Kent but only received m.s. pings from G5KW. Ken also passed on some news of what John Baker GW3MHW (PWS) has been working. On March 8 at 1120 he had s.s.b. tropo contacts with EI6AS and EI4CL both in County Dublin. At 1200 he worked GM4DGT (CTR) and at 1228 GD3FOC, again tropo s.s.b.

The RSGB has submitted proposals to the DTI concerning the future of the 50MHz band, the main ones being that it be released to Class B licensees, extended to 52MHz, the maximum e.r.p. be increased by 2dB and that location and vertical antenna restrictions be lifted. It had been suggested that a major statement on these matters might be made by Mr John Butcher, MP, the Parliamentary Under Secretary to the DTI, when he performed the opening ceremony at this RSGB's Birmingham exhibition on March 27. However this did not happen. As this is being written the DTI is still studying the proposals but is believed to be amenable to them.

The 70MHz Band

Pat Billingham G4AGQ (SRY) has found activity outside of contest periods to have been minimal. For example on March 22 he called CQ for 2½ hours on c.w. and not one QSO resulted. In his report covering February and March **John Jennings G4VOZ** (LEC) confirms the flat conditions. He uses the Cornish beacon GB3CTC as a useful indication of band conditions.

Annual v.h.f./u.h.f. table
January to December 1987

Station	70MHz Counties	70MHz Countries	144MHz Counties	144MHz Countries	430MHz Counties	430MHz Countries	1296MHz Counties	1296MHz Countries	Total Points
G1KDF	—	—	68	8	52	7	14	2	151
G6HKM	—	—	54	13	41	9	13	4	134
G1SWH	—	—	56	8	35	6	—	—	105
G1LSB	—	—	46	9	38	10	—	—	103
G4NBS	28	2	*2*	*3*	40	10	14	6	100
G4DEZ	—	—	24	9	37	8	7	4	89
G1EHJ	—	—	39	7	25	6	—	—	77
G4MUT	18	1	28	7	11	2	*3*	*1*	67
G3FPK	—	—	53	10	—	—	—	—	63
G6MGL	—	—	25	6	25	2	1	3	62
G6AJE	—	—	17	7	27	5	—	—	56
GW6VZW	—	—	49	7	—	—	—	—	56
G8XTJ	—	—	47	8	—	—	—	—	55
G1PDW	—	—	44	10	—	—	—	—	54
G4TGK	—	—	46	8	—	—	—	—	54
G4VOZ	21	3	—	—	25	4	—	—	53
G4YIR	—	—	40	9	—	—	—	—	49
G1CRH	—	—	34	9	—	—	—	—	43
G1GEY	—	—	35	8	—	—	—	—	43
G4SEU	25	3	—	—	4	2	—	—	34
G4WND	25	4	—	—	—	—	—	—	29
G4AGQ	7	1	3	3	10	3	—	—	27
G2DHV	3	1	17	2	3	1	—	—	27
G1VTR	—	—	4	1	16	5	—	—	26
G6XRK	—	—	9	6	1	1	—	—	17
GW4HBK	5	2	—	—	—	—	—	—	7

Three bands only count for points. Non-scoring figures in italics.

John mentioned G0GTI as a new station on the band. He has a poor v.h.f. home QTH so was out portable and expects to continue this activity in the summer. G4ULS (HRW) was another station worked for the first time on s.s.b. Many Pye Westminster f.m. transceivers have found their way into radio amateurs' hands recently in the Midlands. Even so, G4VOZ reports f.m. contacts are scarce but he did work G4FMC (WMD) on March 13. In the March 15 leg of the cumulative contest, six countries were workable but John did not manage them all. He reckons it is slowly dawning on "the exotic stations" that things are easier if they spread out more on the band.

GW3MHW has now found the valve he was seeking for his 70MHz station and worked G4VOZ on March 23 for the first time this year. G4VOZ says that his 70MHz signals are always better than his 50MHz ones in Ullesthorpe. One final thought; if and when the 50MHz band is released to Class B licensees it is logical that the 70MHz band will be too. This ought to enhance activity and take some of the pressure off 144MHz perhaps.

The 144MHz Band

This past month there have been times at G3FPK when I was convinced that my RX had died. One Sunday afternoon, when there is almost always activity on s.s.b. in the London area, there was not one signal to be heard in the entire c.w. and s.s.b. sections. This state of affairs is reflected in your letters and on air comments.

G0DJA reports his only DX from Birmingham as a station in Gloucester on c.w. Dave's last real DX were GM0FRT and GM4RTN in the c.w. contest way back on Feb 8, worked with 25W and a 5-ele Yagi in his loft.

Philip Everitt G1CRH (CBE) did not report last month as his FT-290R was in hospital. When he got it back he took part in the 144/432MHz contest on March 7/8 but concluded it was a waste of time due to low activity and bad conditions. Although on for the majority of the time he only made 40 QSOs. By contrast, Phil found the four hour Derby Club contest on March 15 more rewarding with 23 stations worked. He is looking for Tyne and Wear so I suggest G1GEY. (See next paragraph.)

Annual c.w. ladder

Station	Band (MHz) 70	144	430	µWave	Points
G4XEN	—	134	7	—	141
G4OUT	—	90	—	—	90
G0DJA	—	51	—	—	51
G4ZVS	—	46	—	—	46
G4YIR	—	27	—	—	27
G2DHV	—	23	—	—	23
G4AGQ	6	6	10	—	22
G4VOZ	14	—	8	—	22
EI5FK	—	10	6	—	16
G1XEO	—	12	—	—	12

Number of different stations worked since January 1.

Roger Betts G1EHJ (SFD) has been busy chasing awards so did not have time to write last month. With his 8W he had worked 39 counties and seven countries up to mid-March. Welcome to **Don Stoker G1GEY** (TWR) who enters the tables. He is only QRV on 144MHz at present, his equipment comprising a Yaesu FT-707, MuTek transverter, 4CX250B amplifier and MGF1402 r.f. preamp. His antenna is a 9-ele Yagi. Since May 1984 Don has worked 26 countries and 124 squares.

Ian Rose G1PDW (ESX) has not spent too much time operating as he has been busy improving his c.w. Even so, he has reached double figures in the countries column the latest two being GI4TAP/P and PE0MAR/P both worked in the March contest.

Gerry Schoof G1SWH (MCH) uses a Trio TS-780 and 180W BNOS solid state amplifier with a 19-ele MET antenna. His latest country, new for the year, was PE0MAR/P in the March contest and he has already notched up 56 countries.

Welcome to **Angie Sitton G1EXO** (HFD) whose licence arrived on Feb 16. I see she has contributed to the h.f. bands feature in earlier issues under her BRS 88639 number. She is a very keen c.w. fan and took her exam on March 27 and told me she is 99 per cent sure she has passed this time. Angie likes contests and took part in the Derby one but was a bit disappointed to have only worked 19 stations. She assumes her low power of about 10W is why she did not do better. Next time I hope her entry in the c.w. ladder will be under a new G0H. . call. By the way, you do count your own county and country in the annual table, Angie.

Ian Cornes G4OUT (SFD) sent in his usual, neat computer list of c.w. QSOs and, up to March 27, had 90 in his 1987 log. Of these, 58 were worked in the c.w. contest back in February, but only seven more since.

John Wimble G4TGK (KNT) wrote as storm force winds were trying to destroy his 16-ele Tonna Yagi. Hope it survived as mine did. In the March 7 contest he worked GI4TAP/P (DWN) and G0CLP/P (CBA) but most rewarding was a first ever contact with Sark, GU2FRO on the 12th, John's 68th British county. He still needs ten difficult ones in GM and GI.

John Palfrey G4XEN (NHM) says he always thinks the early part of the year to be rather boring for v.h.f. folk with little chance of any decent tropo propagation. At 1640 on March 5 he heard GM4UFD (GRN) calling CQ, tone A. He worked the GM but no other stations were heard. This was John's first Ar QSO from his new QTH. On the 14th he completed an m.s. sked via random meteors with YU7EF in KN04 or KE if you prefer.

He has been dogged by persistent, crackly QRM from the east for sometime so went out mobile with his wife, G4XEM, to try to trace the source. They discovered what is probably a faulty power line over 3km away so have contacted the local electricity board hoping for a sympathetic response.

June Charles G4YIR (ESX) is a happy lady having at last worked Lancashire for the first time since being licensed as G6WXX in August 1983. In the March contest she worked GD, a GM in Borders region and a GI in Co. Down. Her station comprises an Icom IC-260E, Mirage B108 amplifier giving 80W and an 8-ele Yagi antenna at 8m a.g.l. No doubt there will be some friendly rivalry with G1XEO in the c.w. ladder this year.

Mike Johnson G6AJE and friends describe themselves as the Leicester Branch of the Warrington Contest Group and had planned to help staff their two stations, GW4CDA/P and GW3CKR/P, in the March 7/8 contest. However 1.2m snowdrifts prevented their getting further than three quarters way up the final hill so they drove back home. Mike then worked his friends in Clwyd plus FF1MKJ (BK), PE0MAR/P (JO21), ON4ASL/A (JO01), FF6TNB/P (JO00) and GI4TAP/P (IO74).

Ela Martyr G6HKM (ESX) also operated in the March contest her first QSO being with GI4TAP/P. Clwyd and Lincolnshire stations were also worked. On the 13th she gave GW1XDZ (GNM) his best DX to date. Ela took part in the Derby Club contest describing conditions as strange. She lost three contacts in a row, one of which was to Cornwall. However, she did gain Durham, Waterford and Wicklow. On the 22nd she monitored 144.255MHz for the EI expedition stations but could only hear west country stations working them.

Ron Reynolds G6WEM (ESX) thinks he may not get on the band at the right time and found March conditions even worse than February. On the 11th he contacted FC1JPH at good strength and heard G4VBG (TWR) saying the Wrotham beacon, GB3VHF, was S9. Like Ela, he could hear the west country folk working the EI stations on the 22nd but not a whisper from them.

John Fitzgerald G8XTJ (BKS) penned a letter just in time being delayed by clearing up gale damage to his office at this work place. New this year were G0CLP/P (CBA), G1GEY/P (TWR) and GI4TAP/P in the contest. G1SMI/M was contacted in several Humberside WAB areas on the 18th and GW6JNE/P (GNW) on the 22nd. John heard the EI folk but not strong enough to attempt a QSO.

He is still suffering from Ambassador telephone QRM and BT say it is not coming from the premises he thought. John included some WAB information including Newsletter No. 54 and a huge list of numerous awards winners, etc. It could well be said that these WAB activities are keeping the band alive in these otherwise boring weeks.

Paul Baker GW6VZW (GWT) has been suffering from bad rain static at times which, coupled with the quite poor propagation conditions, have meant it has been difficult to work any real DX. In the March contest he only worked 20 stations including ON4ASL/A, ON7XC/A (BL), PE0MAR/P, FF6TNB (AK) and PA3DZL (CL). Paul's QQVO6-40A p.a. valve is only producing less than 10W in his QM70 transverter which he thinks explains why he was unable to work GI4TAP/P in the contest.

Outside the contest period, new 1987 counties were G1PAM (SPE), GU2FRO, GW1ESU/M (PWS), G4XBN (NHM) and G3XBY (WKS). Paul was Zone E winner in the RSGB's 1986 Trophy contest and the December Fixed event. His station comprises Sommerkamp h.f. separates, the FL-200B and FR-100B plus the QM70 transverter. His antenna is a 4-ele quad by Jaybeam only 8m high and below roof level. He would like any s.w.l. reports from northern G, GM, GI and EI.

Bob Nixon G1KDF (LNH) mentions a half hour of Ar conditions from 1600 on March 21 in which GM3JIJ (WIL) and GM4TXX (SCD) were heard. On the 23rd he heard weak signals from EI3VVF/P (UL) and on the 25th he worked both EI3VVF/P and EI5FK/P (UM) in County Kerry for an all-time new county and square. He mentions the GM3TSL, who used to live in Blackpool, now has a very good QTH near Aberdeen and is QRV on the band.

During the gales on March 27 Bob's 144 and 430MHz antennas came down and his rotator worked off its bolts so he was QRT for a time. He describes the wind as a tornado.

At G3FPK, March produced nothing resembling real DX. I had a few contacts in the Barking Club contest on the 29th but did not hear anyone far away. The club station operator thought there had been insufficient publicity for the event. However, I mentioned it in the March *SWM* in VHF Bands.

The 430MHz Band

EI5FK discovered that his 21-ele Tonna Yagi was tilting towards the ground and now he has set it up properly it appears to have the edge over the quagi. Charles can work GW3KJW (GDD) easier now that he has 50W available and is up to 19 squares worked. He operated in the March 7/8 contest and made a few QSOs but reckons that conditions were the worst for some time.

G0DJA has a nice commercially built coaxial cavity amplifier which cost Dave nothing. He needs a hefty transformer for a p.s.u. and is looking for a suitable snail fan to cool the beast. He has also acquired a pair of Pye f.m. base station units, his long term aim being to experiment with packet radio on the band. To this end he has managed to get his ZX-81 computer to "talk to a Pac-Com 220 TNC".

EI5FK/P (UM) heard G1KDF on March 25 at RS31 but Bob could not copy them in Ormskirk. G1SWH has a Trio TS-780 on the band plus BNOS 100W amplifier, Ger-

QTH Locator Squares Table

Station	1.3GHz	430MHz	144MHz	Total
G8TFI	79	141	126	346
G8GXP	30	140	307	477
G4FRE	63	136	84	283
G3XDY	78	131	180	389
G3JXN	80	126	172	378
GJ4ICD	59	117	241	417
G3IMV	—	116	397	513
G3UVR	63	113	217	393
G4TIF	—	106	178	284
G6DER	70	104	177	351
G6YLO	32	104	128	264
G1LSB	—	103	75	178
G3COJ	44	102	175	321
GW4LXO	45	100	240	385
G4NQC	63	99	250	412
G4XEN	—	98	232	330
G6HKM	12	98	152	262
G4NBS	56	95	86	237
G8PNN	58	94	128	280
G4RGK	35	92	230	357
G6MGL	50	89	135	274
GW4TTU	37	87	238	362
G4MUT	24	87	140	251
G1EZF	32	86	200	318
G8XVJ	—	86	213	299
G1KDF	21	85	138	244
G4MCU	25	82	201	308
G6DZH	—	82	136	218
GW8UCQ	—	81	128	209
G4JZF/P	—	80	—	80
G4DCV	25	71	248	344
DL8FBD	—	69	274	343
G6HKS	—	65	186	251
G6XVV	16	62	188	266
G4KUX	—	57	322	379
G4ZTR	35	57	82	174
G4SSO	—	54	164	218
GM0BPY	—	54	123	177
G0FOT	—	54	49	103
G4HGT	—	52	142	194
G4COM	—	52	94	146
G6AJE	3	52	90	145
G8MKD	—	49	117	166
GW8VHI	—	48	101	149
GW3CBY	18	46	107	171
G8ZDS	—	41	123	164
G1EGC	—	40	144	184
G6CSY	16	39	34	89
G3BW	15	38	269	322
YO2IS	—	37	341	378
G4YCD	—	36	155	191
G6XLL	—	36	109	145
G4RSN	2	34	92	128
G4DEZ	44	33	246	323
G6MXL	6	33	57	96
GJ6TMM	—	31	128	159
GM8BDX	13	31	41	85
G1GEY	—	30	124	154
G1DOX	20	27	49	96
G4MJC	—	25	182	207
G1VTR	—	23	6	29
EI5FK	—	19	131	150
G0FBG/PA	—	17	54	71
G8RWG	—	13	105	118
GM0GDL	—	7	38	45
G1HGD	—	7	38	45
G2DHV	1	4	27	32
G6XRK	—	1	117	118
G4IJE	—	—	338	338
G4DHF	—	—	290	290
G4SWX	—	—	239	239
G3FPK	—	—	219	219
I4YNO	—	—	214	214
G4SFY	—	—	208	208
G6ECM	—	—	200	200
G4IGO	—	—	198	198
G4MEJ	—	—	198	198
G8LFB	—	—	197	197
G0CHE	—	—	181	181
G4YUZ	—	—	177	177
G4XEK	—	—	167	167
G4DOL	—	—	154	154
G8TGK	—	—	101	101
G8XTJ	—	—	98	98
G1DWQ	—	—	72	72
GW6VZW	—	—	69	69
G1PDW	—	—	55	55
GU4HUY	—	—	54	54
G1CRH	—	—	50	50

Starting date January 1 1975.
No satellite or repeater QSOs.
"Band of the month" 430MHz.

ry's antenna being a 21-ele from Tonna. Looking through his list of new 1987 counties, EI5FK (Cork), GM6TIA (SCD), G4KZY/P (DVN) and GW6TEO (DFD) are worthy of mention.

Stuart Field G1VTR (SFK) now has a little more power on the band from a Microwave Modules amplifier. He used it during the Fixed contest on Feb 22 and says it made a change for others to be able to hear him.

G4VOZ always leaves his RX on 432.200MHz when searching on 70 and 50MHz. Almost by default, John says, his table score is progressing well. He contacted on March 2 G4CYA (YSS) and on the 3rd G1GEY (TWR) both on s.s.b. In the contest on the 7th he worked G0FRR/P (DOR), G4VBG/A (TWR), G6CSY/P (KNT) and G4KZY/P (DVN). On the 11th he had a half hour QSO with G4KUX (DHM) and on the 21st John found G1JGS/P (IOW) who does a lot of -/P operating due to having a poor home QTH.

G4XEN's last bout of activity was in the Feb 22 contest when John made 86 contacts, well down on his 1986 total. Best DX was DL2KBB at 499km. G6AJE also covered the February contest and lists G4NBS (CBE), G6XVV (YSS), G4NOK (YSW), G8XVJ (CHS), G1KDF (LNH), G0FRE (GLR), G4BLX (SXE), G4RFR (DOR) and G1DOX (CBA) as the best worked from Ratby. Mike also went on the band in the March 7/8 event and contacted PE0MAR/P, G4RFR/P (DOR), G1KMI/P (DVN) and G1ORC/P (YSW). He is trying out a new Avantek GaAsf.e.t. preamp and promises notes on the results later.

In the March contest G6HKM worked GI6ATZ/P (DWN), LX2GB, DL0GS/P (EI) and DK0SV/P (DJ) among others. Mike Huggins G6XRK (ESX) has just got started on the band with a Yaesu FT-790R running 1W and a new type 21-ele Yagi from Tonna fed with H-100 feeder. He plans to raise his antennas to 18m a.g.l.

The Microwave Bands

Precious little to report this time. G0DJA has not worked any new stations on 10GHz nor has Dave yet made any QSOs on 24GHz. He was looking forward to the first Cumulative contest on April 12. G1KDF asks me to remind southerly stations to listen to the north on 432.200MHz for operators on YN square who often call to the south and southeast on 1.3GHz (23cm). This cross-band activity often results in respectable microwave QSOs once initial contact has been made on 430MHz. On March 12 Bob worked G6UWO (NOT) for an all-time new county on 1.3GHz but failed with G6JQL in the same county. On the 25th he had a good contact with G8GXP (YSW).

G6AJE was progressing with his 1.3GHz transverter in odd spare moments. Another who will probably be on the band by the time this appears is John Hunter G3IMV (BKS) who has built a kit transverter and bought some final components at the NEC show. He has done exceptionally well from a rather ordinary QTH on 144 and 430MHz so it will be interesting to see how well he will do on 1.3GHz.

Miscellany

On March 23 u.h.f. repeater GB3BV became operational. It is sited southeast of Hemel Hempstead (IO91SR) and its directional antenna is designed to cover the town and area to its northwest. Reports to G3MEH or G8BQH both QTHR. It is on channel RB1.

In Belgium there have been some licence changes. The Class A licence is for beginners permitting 5W of telephony on 144MHz. Class B licences are similar to the UK ones the prefixes being ON1 and ON9. The Class C licence is like our Class A category with prefixes in the series ON4 to ON8.

In Austria, radio amateurs are now permitted to monitor the 50-54MHz band and to operate cross-band as do most other European amateurs already. Why they should actually need permission to listen to any amateur radio band is beyond me, though.

Random Meteor Scatter

Anyone listening during a major meteor shower on the random s.s.b. m.s. frequencies of 144.200 and 144.400MHz will appreciate that things get quite chaotic. In an attempt to create some sort of order out of this chaos the RSGB's VHF Committee published John Matthews's G3WZT plan in last August's *RadCom*, page 582.

Several readers have criticised the proposals as being too complicated and unworkable. One is Dave Dibley G4RGK who wrote to Messrs. Fisher G3WSN and Appleby G4ZNU to give his reasons. These, and many other, matters will have been discussed at the IARU Region 1 Conference a few weeks ago when you read this. It is hoped that some sensible proposals will be agreed and that some half-baked scheme will not be foisted on the m.s. fraternity by people with little, possibly no, practical operating experience of the mode.

The first authentic report of the Conference was promised for the VHF Convention at Sandown Park on April 26 from Keith Fisher and I will cover that in the next issue.

That's it for this month. Next issue it is possible there could be some Sporadic-E to report on 144MHz and we are surely due for a decent spell of tropo propagation.

RTTY

Reports to Ron Ham
Faraday, Greyfriars, Storrington, West Sussex R20 4HE.

Having worked c.w. QRP on 7MHz for about 3 years **Brian Fields G4XDJ** (Cleveland), decided to use his FT-200 transceiver and Spectrum 48K computer to investigate the world of RTTY. His first rewards came between February 13 and 17, when he worked stations in EA8, G, HV, I, OE, OH and YU on 14MHz.

We can imagine his delight following an exchange of keys, for nearly an hour, with JA2EJU during the morning of March 6. "My very slow typing does not create many long QSOs, but with the help and patience from other stations I find myself enjoying every contact," said Brian. Welcome to the mode, Brian, and no doubt you will soon be helping other newcomers to find their way in this fascinating world of data communications.

"Data mode reception this period has again been sporadic, with some good openings occurring into the mid evenings," commented **Len Fennelow G4ODH** (Wisbech), about the month prior to March 18, Len pointed out that it was contest activity that increased his otherwise thin log, to a reasonable 42 prefixes.

Len received RTTY traffic from 3 countries on 3.5MHz, 5 on 7MHz, 39 on 14MHz and 2, Botswana and W. Germany, on 21MHz. His 14MHz log included GD, a new one for him, and two rare countries, San Marino and St Vincent. "As always, the 14MHz band can offer something of interest, but one has to be persistent when tuning up and down the data segment," wrote Len. He also copied AMTOR signals from all the countries listed in Fig. 1.

There is always plenty of activity during a contest and the event on March 21/22 was no exception. Each time I checked the bands from 3.5 to 14MHz, many stations were sending "CQ BARTG CONTEST". Several operators also took this chance to try the 21MHz band and in 10 minutes, around 1530 on the 21st, I logged RTTY signals from Brazil, Nigeria and South Africa plus Italy and the UK at 0930 on the 22nd. My best DX on 14MHz, for the period, was Brazil at 1029 on March 7, Canada at 2007 on the 1st and Japan at 0835 on the 11th.

During the month preceding March 23, **Steve Beazley** (Chingford), had a good RTTY haul and increased his total number of countries copied to 65. Steve's log for the period lists 14 countries on 3.5MHz, 5 on 7MHz from Scandinavia to the USSR and 36, including Australia, Brazil, Canada and 7 USA call areas, on 14MHz.

Country (Prefix)	Frequency (MHz) 3.5	7	14
Canary Is (EA8)			X
France (FE)			X
Italy (I,IK,IT)			X
Sweden (SM)	X		
USA (W)			X
Venezuela (YV)			X
West Germany (DF,DJ,DL)	X	X	X

Fig. 1: The chart of stations heard using AMTOR

My thanks to Brian, Len and Steve for their RTTY logs, which, all combined, enabled me to compile our monthly list of prefixes received, Fig. 2.

The Annual Rally of the British Amateur Radio Teleprinter Group will take place again this year, from 1030 to 1700, on August 30 (bank holiday Sunday), at Sandown Park Racecourse, Portsmouth Road, Esher, on the A307. "This is not only **THE**

Make sure your reports reach Ron in time; make a note of the dates

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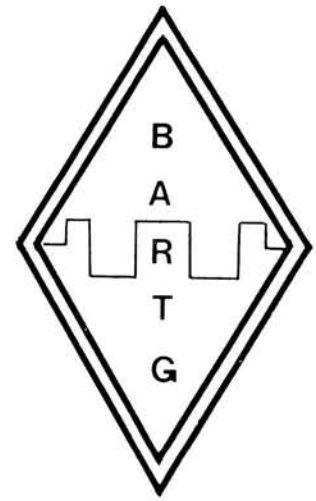
Country (Prefix)	Frequency (MHz) 3.5	7	14	21
Australia (VK)			X	
Austria (OE)			X	
Balearic Is (EA6)			X	
Belgium (ON)	X		X	
Botswana (A22)				X
Brazil (PY)			X	X
Bulgaria (LZ)			X	
Canada (VE)			X	
Canary Is (EA8)			X	
Ceuta & Melilla (EA9)			X	
Cyprus (ZC4)			X	
Czechoslovakia (OK)			X	
Denmark (OZ)	X	X	X	
Dominican Rep. (HI)			X	
East Germany (Y2)	X	X	X	
Ecuador (HC)			X	
England (G)	X	X	X	X
Finland (OH)		X	X	
France (FE)	X		X	
Gozo & Comino (9H4)			X	
Greece (SV)			X	
Haiti (HH)			X	
Holland (PA)	X		X	
Hungary (HA)	X		X	
Indonesia (YB)			X	
Isle of Man (GD)			X	
Israel (4X)			X	
Italy (I,IK,IT)		X	X	X
Japan (JA)			X	
Jersey (GJ)			X	

Country (Prefix)	Frequency (MHz) 3.5	7	14	21
Kenya (5Z)			X	
Lebanon (OD)			X	
Luxembourg (LX)	X			
Madeira Is (CT3)			X	
Malta (9H1)			X	
Mexico (XE)			X	
Moldavia (UO)			X	
Netherland Antilles (PJ2)			X	
Nigeria (5N)			X	X
Norway (LA)	X		X	
Poland (SP)	X		X	
Portugal (CT)			X	
Puerto Rico (WP4)			X	
Rumania (YO)			X	
San Marino (T7)			X	
Sardinia (IS)			X	
Scotland (GM)	X			
Sicily (IT9)			X	
South Africa (ZS)				X
Spain (EA)		X	X	
St Vincent (J8)			X	
Sweden (SM)	X		X	
Switzerland (HB)	X	X	X	
Tanzania (5H)			X	
Ukraine (UT)			X	
USA (W)		X	X	
USSR (UA,UB)	X	X	X	
West Germany (DF,DJ,DL)	X	X	X	X
Yugoslavia			X	

Fig. 2



rally for RTTY enthusiasts, but it has a limited number of regular rally stands to give the mix that makes this event of interest to all radio amateurs," said Rally Manager **Peter Nicol G8VXY**. Talk-in will be on S22 and special features include, BARTG's own stand, Car Boot Sale, ample free car parking plus catering and bar facilities. An s.a.e. to Peter, at 38 Mitten Avenue, Rubery, Rednal, Birmingham B45 0JB, or phone 021 453 2676.

Amateur Satellites

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

OSCAR-10

If users, the battery, the temperature gradient and even good fortune have all played their part, we should have OSCAR-10 back with us for a further four months of useful transponder operation by now, lasting until the end of August this year. Very little has been heard of this satellite in the past two months up to and including the time of writing this column, as not only has the battery charging been insufficient to give any evidence of operation, but the spacecraft attitude has given bad antenna pointing too.

We previously curtailed our content on using OSCAR-10 due to the likelihood of the total loss of the satellite. As it now would appear that we may well have a further period of useful life, we shall now proceed with some starting information on this optimal DX satellite in future columns. Furthermore, the new Phase III spacecraft will soon be with us, and much of the information will be common to both of the elliptical orbiters.

For those who would like to follow the anticipated activity on OSCAR-10 this month, Fig. 1 shows a computer program from the AMSAT AMS-81 program for the Spectrum, giving the time of acquisition of signal (ADS), the loss of signal (los) and the time of optimum DX with position. Note that from 18–21 May inclusive two passes per day are available. Fig. 2, from the same program, gives the tracking of a typical pass from AOS to LOS for Sunday May 24 as seen from East Anglia. (Other parts of the UK may vary by a few minutes only). The column reads time in UTC hours, minutes and seconds, azimuth, elevation, range, phase (mean anomaly) and the offset Doppler shift of the beacon frequency.

Phase III-c

Gordon Hardman KE3D, reports that the flight Integrated Housekeeping Unit (IHU) for the new high elliptical satellite, still planned for a midsummer launch this year, which was built to W2FPY's design, has now been powered up, and found to be running perfectly. The £70 000 worth of specially radiation hardened integrated circuits that comprise a special Sania COSMAC 1802 CPU and the Harris HS6564RH memory chips donated last year could potentially withstand the onslaught of radiation that caused the failure of the current OSCAR-10 IHU. In fact they should have no need to do so, as a successful launch and kick-motor firing should mean the ideal inclination and optimum perigee for the new bird. It should see an eventual orbit that misses the worst of the radiation in the Van Allen belts, as the intended perigee of some 1500km should take it below the worst of the ionisation that was suffered by OSCAR-10 which ended up at twice the intended height, and of course the 35–38 000km apogee will be well above it.

The intended path about our earth is shown by Figs. 3 and 4, where Apogee 2 is the Phase III-c apogee, and P2 its perigee. (The drawings are not to scale). The OSCAR-10 inclination, which varies either side of the equator by 26 degrees is shown at equator by Apogee 1, and its perigee through the Van Allen belt is shown by point P1, both on the equatorial and polar views. The higher inclination, and the reduced perigee as seen by the closer to earth Phase III-c continuous line on Fig. 4 should keep the new spacecraft out of the worst of the radiation belt that is at maximum density and thickness over the earth equator. The Van Allen belt can be visualised as a half-moon shape surrounding the earth, with the points approaching the poles, and the centre around our equator, as Fig. 3 shows. It is not a good place for sensitive depletion layers to be, and an even worse place for manned spacecraft, as more than 10 000 000 Rads per annum can be expected!

```
AMSAT AMS-81 TRACKING SYSTEM
ACCESS SKED FROM:  18MAY87 000000
   >>G3IOR          VIA OSCAR 10 <<
 DAY    AOS   LOS    MAX  DX/EL   AZ
18MAY  0457  1034   0549  17538   088
18MAY  2042  2303   2042  17483*  296
19MAY  0507  0942   0508  18076   080
19MAY  1343  2226   1647  17553   273
20MAY  0515  0844   0515  18057*  075
20MAY  1225  2145   1606  17051   265
21MAY  0547  0736   0547  17892*  069
21MAY  1126  2104   1525  16547   257
22MAY  1030  2022   1444  16036   249
23MAY  0940  1939   1403  15525   240
24MAY  0850  1857   1322  15036   230
25MAY  0804  1814   1240  14600   219
26MAY  0719  1731   1159  14252   206
27MAY  0636  1647   1118  14030   192
28MAY  0553  1603   1037  13962   178
29MAY  0514  1519   0956  14058   163
```

Fig. 1

```
AMSAT AMS-81 TRACKING SYSTEM
  TRACKING FROM 24MAY87 084500
   >>G3IOR          VIA OSCAR 10 <<
 UTC       AZ  EL  RANGE  PHS  DOPPLER
0851:44  210  00  20794    29  145.81
0914:27  206  09  23520    37    -1.0
0947:32  204  17  27177    49    -0.9
1039:22  207  25  31838    68    -0.7
1209:33  219  32  36762   101    -0.4
1319:46  230  34  37928   127    -0.1
1430:00  240  34  36750   152     0.1
1605:26  250  35  30959   187     0.5
1752:48  257  42  16953   227     1.1
1810:42  223  43  13765   233     1.4
1819:39  212  42  12177   236     1.4
1827:05  201  40  10933   239     1.4
1833:04  190  36  10053   241     1.2
1839:02  179  30   9349   244     1.0
1845:00  167  22   8907   246     0.6
1850:58  156  12   8812   248     0.1
1855:27  149  04   9001   250    -0.3
1857:23  141  00   9159   250    -0.6
```

Fig. 2

JO-12

We had hardly got into print with the new schedule proposed for the Japanese satellite when the satellite reverted to a full weeks activity on Mode "JA", to return to the given schedule again for a further week. At this time, the satellite is proving to be rather difficult to find, as it is currently off each Monday, Wednesday, Friday and Sunday. On Tuesdays, Thursdays and Saturdays it will be found on Mode "JD", every other two hour orbit, with the following two hour period silent. Within the activated orbit it will have five minutes on followed by five minutes off.

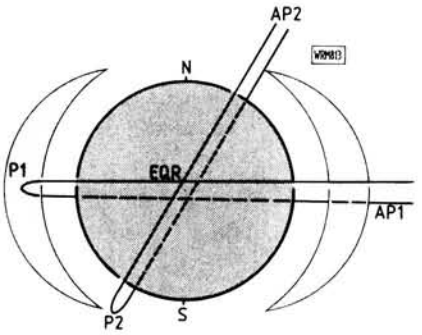


Fig. 3

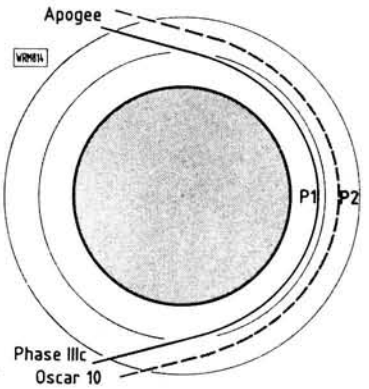


Fig. 4 ▶

This does not facilitate easy tracking and use, and **Peter Guelzow DB4OS,** has said that one has barely located the satellite and established a QSO when off it goes for a five minute QRX, only to cause the need to recommence the whole finding, tracking, Doppler shifted equivalent frequency to attempt to re-establish the contact when it comes on again! Soon now we should have the tests completed, the memory loaded, Mode "JD" fully operational, and a long term planned schedule should result.

Despite the difficulties encountered, some excellent QSOs have been made by using the "JD" mode as a digipeater, though the memory to hold and take a stored message has yet to be programmed and activated. What is believed to be the very first transatlantic "JD" QSO between Jim Miller G3RUH, and Tom Clarke W3IWI, was made at 2218UTC on February 28 for posterity. G3RUH has also worked ON6UG, DB2OS, and HB9XJ via the same mode.

On the analogue mode, lots of activity has been evidenced when the satellite has been in this mode. **Dave Rowan G4CUO** is a keen exponent of JO-12 Mode "A", and has been extremely active in working many of the stations available. Dave points out that many North American stations are within range of the UK, but as yet he has not reached W5, despite the fact that Nicki Boyd K5ADQ in New Mexico and several Texas operators are very active. So far this year Dave has worked KA1SU in Massachusetts, W1BIH in Connecticut, WB1BRE and WA3ETD (Yes—3!) in New Hampshire, KC2GG, N2AAH, N2BKT and WA2LQQ in New York, and K3EAV in Pennsylvania. N4QQ is also in the third call area, as he is actually in Maryland. In the fourth call area are N4AT, W4VE, W4ODW and N4QQ in Florida, with WA4MVI and NY4W in North Carolina. Five, six and seven are keenly awaited, but in the eighth call area KA8HOK, K8TL, W8MMC, and W8YX in Ohio have been worked, as has W8VXH in Michigan. W9ODI in Illinois is the one "nine" and KA0OOQ in Minnesota the lone "zero" representative.

In Canada, Dave has made good contacts with VE2JR, VE2LI, VE3LVS and VE3ELV, whilst among the rarer of the many Europeans are SV1OE, UA4NM, and YO9CM. In Asia, 4X4AS is the one contact so far, with Africa still being hunted. Class B licensees should note that George VE2LI, who never uses s.s.b. will often call s.s.b. stations using excellent c.w. in the hope that they are progressing with their Morse enough to resolve his callsign. If you have yet to be able to use c.w., that fast c.w. coming up may well be George, so stick with it for possibly your first Canadian contact, as he is very active, and will always try hard to make a QSO with a newcomer. KA0OOQ is on most passes common with the USA, and is also looking for new European stations to work.

The recommended "spot" frequencies to look at on OSCAR-12 Mode "A" are 435.810MHz c.w. and 435.845MHz s.s.b. as centre points of activity. Very little activity seems to be in evidence at the high frequency end of the transponder downlink passband, and there would seem to be plentiful space for those who wish to experiment with RTTY and SSTV.

UoSAT

No sooner had the information appeared in the April *PW* that the simultaneous OSCAR-11 145.825/435.025MHz beacons would be operative each Sunday from 0000 to 1200UTC than a change of schedule was decided. For those among you who thought you had deaf 435MHz receivers, poor antennas, or lossy feedlines, let it be known that the dual beacon experiment has now been moved to Wednesday in the same time slot. The content will alternate weekly, being the bulletin mixed with status messages for one week with all content at 1200 baud, then a "DSR" (Digital Store and Readout) experiment at 4800 and for the next week, followed by 1200 baud for the next, and so on.

The gravity gradient lock has been recaptured using fully automatic on-board computer control, and de-libration algorithms are now being evaluated and refined to see just how precisely earth pointing can be maintained.

On the CCCD camera front, a test pattern comprising vertical black and white bars has been transmitted to allow stations to check out their reception, decoding and display equipment. A few problems exist with getting good earth images, as unlike OSCAR-9, OSCAR-11's camera does not continuously point at earth, as it sweeps the earth periodically. For this reason, "snaps" have to be taken by hand whilst the satellite is within range of the University of Surrey, synchronising with the sweep of the spacecraft past earth. The success rate is rather low so far, but sooner or later the desired combination of pointing, minimal cloud cover, optimum lighting, best sun-angle, etc., will all come about, to produce good pictures. Keep watching!

The digitalker of OSCAR-11 will operate for 15 seconds, followed by 4 minutes of telemetry each Wednesday from 0000–1400UTC, and from 1400–2359 a continuous WOD dump will result.

Despite much searching by many stations with good receivers, antennas and low noise levels, the 21.0018MHz OSCAR-9 beacon has not been identified. Readers are asked to continue listening, and to report to the University of Surrey their results, to the QTH in the last issue. Also, reports would be welcomed on the 145.825MHz OSCAR-9 beacon, as some listeners have reported noise on this transmission. Except for Wednesdays, this beacon will continue to transmit a sequence of Telemetry, Bulletin, and Whole Orbit Data.

RS Spacecraft

As dependable as ever, both the USSR pair came back from a long cold eclipse season to us yet again in late March for full time operation, exactly on the dates forecast. Many of the old and familiar callsigns re-appeared, and several new ones also. The same degree of reliance cannot be placed upon the new pair that we have awaited now for so long, as **Leo Labutin UA3CR** reported in mid-March that events had overtaken the plan to launch in late March or early April.

A complete change of plan is now evolved, as that which we knew as "RS-9", carrying the145MHz to 29MHz transponder similar to RS-5, etc., is now postponed indefinitely. The satellite with the multi-band transponder, with the 145 to 29MHz 21 to 29MHz and 21 to 145MHz uplink to downlink relationships, hitherto known as "RS-10" will now be termed "RS-9" to follow the numerical series sequence, and is currently planned for a June 1987 launch. Whether we have the earlier intened 2 hour orbit or the last 105 minute orbit period is as yet undetermined, but more information will be appearing in this column as it becomes available.

MIR

Considerable activity has been in evidence on the space station, followed by many visual sighters and observers of the regular 143.625MHz transmissions. Two way communications can often be heard in the UK and Northern Europe, as the cosmonauts come into the range of the USSR ground control as they overfly our area, but, even K1KSY in New England reports good copy. This is at the times that the crew communicate with the tracking and telemetry ship *Yuri Gagarin*, moored off the coast of Nova Scotia, Canada.

Part of the research programme is gravity free metallurgy, a means to avoid the density and differential melting point separation of the molten alloys prior to solidification which normally occurs when fabricated in earth's gravitational field, thus opening the way for new bondings for solid state circuitry and the like. A major ecological research programme underway is the surveillance of all the waters, rivers and lakes in the USSR from early Spring to late Summer conditions, involving the hydrology from the frozen to the free running state.

Progress-27 was unpacked, undocked and jettisoned to permit 'MIR' to be ready for the arrival and docking of the 20 tonne Astro-physical laboratory *QUANTUM* equipped with the international complex X-ray camera to study sources in nearby

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active galaxies, galaxy clusters, binary systems and super-novae remnants. On July 22 a Soyuz launch mission of three cosmonauts, two from the USSR and one from Syria is expected. A space walk is also on the menu of planned activities. No Ham in Space radio amateurs are yet in evidence, but sooner or later these should evolve.

Keplerian Elements and EQXs

As promised, a new set of Keplerian elements for the main satellites of interest are included again this month as Fig. 5. Two sets of equator crossing times are given for all the satellites of interest to continue a two weekly update. Your author apologises for the slip made with NOAA-9 in the April column—several of you spotted that the first crossing of that satellite for March 15 was given as 0000UTC at 313 degrees equatorial longitude, which was quite a major departure in both time and bearing! The computer has since been remonstrated with, and has promised to do better with the weather satellites this month, given in lists Fig. 6 and Fig. 7.

Super Space DX

In early March the first super-nova "1987A" appeared in our galaxy since 1604 AD, the previous in 1572, both of these before the invention of the telescope. It took place in the Magellenic cloud of the South of the Milky Way, a distance of 155 000 light years, with a Type 2 (Hydrogen line emission) spectrum. Despite the incredible distance, the radio spectrum transmitted was picked up by Parkes Radio Observatory run by NASA near Canberra, Australia. To some degree of even greater amazement, Neutrinos, sub-atomic particles that react little with mass, were detected as a series of bursts in the heavy cleaning fluid tanks located deep in the Swiss mountains five hours before the event gave rise to radio or visible emissions! This, and a whole lot more connected with the event will give an enhanced understanding of physics and our understanding of the universe.

Pioneer-9, launched in 1969 into solar orbit, has finally been abandoned by NASA, as it was last heard in 1983. It played a valuable part in observing the solar wind, magnetism and cosmic rays, and played a major part in the manned lunar landings, giving an hourly solar report, as a solar flare could have proved fatal to living beings unprotected by a magnetic field in an ionosphere. Pioneer-9 was planned for a six months' lifetime, but in fact lasted fourteen years!

SAT-QSL

The QSL Fig. 8 sent out for from GB1CSR, the special station of the Civil Service Amateur Radio Society set up for the 25th. anniversary of OSCAR satellites. Detailed information of this event was given by **Paul Thompson G6MEN** in the April *PW* column, to whom we are indebted for the QSL.

Fig. 5

Satellite	OSCAR-9	OSCAR-10	OSCAR-11	OSCAR-12
Catalogue Number	12888	14129	14781	16909
Epoch Time	87063.86797194	87023.13103915	87063.71954221	87063.83338712
Set Number	1003	287	207	33
Inclination	97.6528	27.1040	98.1137	50.0163
RAAN	78.1774	38.6101	131.5529	346.1024
Eccentricity	0.0001278	0.6022546	0.0014661	0.0011060
Argument of Perigee	190.9582	178.8941	66.4779	18.8413
Mean Anomaly	169.1631	183.0539	293.7963	341.2816
Mean Motion	15.29271460	2.05877501	14.62107277	12.44393098
Decay (Drag Factor)	$1.504e^{-05}$	$-8.7e^{-07}$	$7.9e^{-07}$	$-2.5e^{-07}$
Revolution (Orbit No.)	30079	2717	16043	2539

Satellite	RS5	RS7	MIR
Catalogue Number	12999	13001	16609
Epoch Time	87063.67043373	87058.19901986	87068.90614360
Set Number	388	303	513
Inclination	82.9581	82.9629	51.6143
RAAN	325.0958	320.7138	305.6852
Eccentricity	0.0008097	0.0021677	0.0011324
Argument of Perigee	237.8586	153.3049	56.8828
Mean Anomaly	122.1751	206.9132	303.3127
Mean Motion	12.05053961	12.08700275	15.69067895
Decay (Drag Factor)	$1.3e^{-07}$	$1.2e^{-07}$	0.00087788
Revolution (Orbit No.)	22924	22927	6043

Satellite	NOAA-9	NOAA-10	SALYUT-7	AJISAI
Catalogue Number	15427	16969	13138	16908
Epoch Time	87063.89709098	87063.95836678	87068.91415248	87052.35226180
Set Number	149	28	526	28
Inclination	99.0380	98.7282	51.6145	50.0120
RAAN	28.7214	95.5323	12.9436	21.3618
Eccentricity	0.0015984	0.0014489	0.0000701	0.0010975
Argument of Perigree	137.3078	145.6166	195.6552	352.2114
Mean Anomaly	222.9350	214.5953	164.4453	7.8547
Mean Motion	14.11478627	14.22489381	15.30922508	12.44368076
Decay (Drag Factor)	$6.4e^{-07}$	$6.1e^{-07}$	$2.017e^{-05}$	$-2.5e^{-07}$
Revolution (Orbit No.)	11631	2392	28077	2397

ALLSATS EQX ON 17/5/87

SAT	UTC EQX	Brg W	Next +min	Orbit +inc	Next +min	Day +deg
F12	0000	113	115.7	29.2	64.3	20
RS5	0129	331	119.4	30	113.4	30
RS7	0157	346	119.1	29.9	108.7	29
Mir	0007	279	91.3	23.2	21.7	12
Sal	0037	197	94	23.8	65.2	22
RS1	0020	41	120.3	30.2	3.9	3
U01	0045	92	94.1	23.5	66.7	17
U02	0022	36	98.4	24.6	37.3	9
N09	0120	152	102	25.5	90.3	23
N10	0010	68	101.2	25.3	78.2	20
M13	0024	134	104	26.1	16.6	6
M14	0109	227	104	26.1	16.9	6
M/1	0030	187	109.3	27.4	90.8	25

Fig. 6

ALLSATS EQX ON 31/5/87

SAT	UTC EQX	Brg W	Next +min	Orbit +inc	Next +min	Day +deg
F12	0120	188	115.7	29.2	64.3	20
RS5	0013	334	119.4	30	113.4	30
RS7	0141	3	119.1	29.9	108.7	29
Mir	0024	10	91.3	23.2	21.7	12
Sal	0131	291	94	23.8	65.2	22
RS1	0125	79	120.3	30.2	3.9	3
U01	0051	93	94.1	23.5	66.7	17
U02	0104	47	98.4	24.6	37.3	9
N09	0029	139	102	25.5	90.3	23
N10	0003	67	101.2	25.3	78.2	20
M13	0101	168	104	26.1	16.6	6
M14	0005	236	104	26.1	16.9	6
M/1	0000	203	109.3	27.4	90.8	25

Fig. 7

Fig. 8

AMSAT News

AMSAT plans to hold a formative meeting of AMSAT international in Brazil as the host of BRAMSAT, the PY national organisation, at the Centro Technico Aerospacial at Sao Jose des Campos, just west of Sao Paulo in mid-summer this year. The purpose will be to discuss the specific objectives for an international AMSAT organisation so as to co-ordinate resources, capabilities, techniques and understandings to a fully co-operative mutual agreement. This will enhance the design, building and launch opportunities of future spacecraft by the fusion of talents, ideas and funding from the many bodies now existing around the world. Invitations have gone out to AMSAT groups in G, ZL, PY, F, ON, VE, LU, 4X, PA, SM, XE, I, DL, VK, CE, ZS, and DOSAAF (UA) as well as specific invites to ARRL, JARL, UoS, Project OSCAR, the Budapest Technical group, etc. and the AMSAT Board of Directors.

Propagation

Reports to Ron Ham
Faraday, Greyfriars, Storrington, West Sussex R20 4HE

From Johannesburg, **Bob Anderson** reports a single sunspot observed on February 26, 27 and 28. From his home in Selsey, **Patrick Moore** also recorded this spot, Fig. 4, at 1400 on the 28th and again at 1050 on March 3.

Ron Livesey (Glasgow), the auroral co-ordinator for the British Astronomical Association, received reports of auroral arcs, rays and glow, from Karl Cooper (Kirkwall), the Kirkwall Met. Office and the Ocean Weathership *Cumulus*, for the night of February 20/21. Karl also observed auroral glow between 2100 and 2300 on the 22nd. The NOAA laboratories in Boulder, Colorado, found conditions unsettled from the 23rd to 28th and the magnetometer, operated in Saltash by Karl Lewis, recorded unsettled conditions after 2200 on the 18th, from 0400 to 0900 on the 20th, after 0300 on the 21st, 0400–1300 on the 22nd, up to 2000 on the 23rd, after 1500 on the 27th and, at times, after 0900 on the 28th. His instrument was very

unsettled after 2100 on the 22nd and recorded periods of storm from 0850 on the 20th and between 1915 and 2230 on the 24th.

"The 2800MHz solar flux started February slightly above 70 solar flux units (s.f.u.), but fell to 69 for one day only on the 5th," wrote **Neil Clarke G0CAS** (Ferrybridge). He continued, "Between the 5th and 23rd, it rose slowly to reach 72 s.f.u., after which it climbed to 75 s.f.u. for the last 4 days of the month".

From his observatory in Sevenoaks, **Cmdr Henry Hatfield,** using his spectrohelioscope, found a medium size, but fairly faint, sunspot and a small inactive plage on March 3. He also located a few filaments and 4, fairly bright, plages on the sun's disc and comments, "I think these probably indicate the real early stages of the new cycle activity." By 1055 on the 5th, this spot had gone and Henry logged 3 filaments and 3 small plages. On the 9th, he found a large spot, the possible remains of a small flare, 4 filaments and a tall prominence on the north east limb. At 1155 on the 10th, this spot and the prominence was still visible and the number of filaments had doubled. Henry's 136MHz radio telescope received a large burst of radio noise from 1103 to 1115 on the 7th and small bursts, of 3 minute duration, at 1155 and 1250 on the 9th and 18th, respectively. The latter may well have been associated with the 3 plages and 2 filaments that he saw at 1220 on the 19th.

From his QTH in Wisbech, **Len Fennelow G4ODH,** heard signals, with an auroral tone, on February 23 from the 50MHz beacon GB3NHQ (Potters Bar) and the 144MHz beacons in Cornwall GB3CTC and Wrotham GB3VHF. Len also copied tone-A signals from CTC again on the 25th and March 5.

The 28MHz Band

"Despite frequent sorties into the band, between 0900 and 1400 daily, I have drawn a blank this time," wrote **Bill Kelly** (Belfast) on March 17. "The first time I have a complete blank on all sigs," said **Ted Owen**, from his QTH in Maldon, on the 21st. However, Ted did hear a couple of G stations on the 8th. **David Lingard G0CLH** (Ely), received signals from Israel on February 20, Brazil, Germany and Spain on the 22nd, Uruguay on the 27th, South Africa on March 21 and Italy, Morocco and Spain on the 22nd.

Propagation Beacons

"The 14MHz beacons, listed in Fig. 2, have shown a typically scattered pattern again this time, OH2B only manifested 3 times and LU4AA was only logged twice fairly late in the evening," said Len Fennelow. Like several of us, he did not hear any 28MHz beacons throughout the period.

"The log is rather thin this month, but some peculiar refraction must have taken place in the ionosphere between 1600 and 1700 on March 5 which caused me to log six 28MHz beacons," wrote **Don Hodgkinson G0EZL** (Hanworth). He added, "I certainly haven't heard 3B8MS at that time of day before.

"PY2GOB seems to have a new callsign; PY2ALS, giving Box No. 22, Sao Paulo, which I believe GOB use to and it's on the same frequency," said **Gordon Pheasant G4BPY** (Walsall). Gordon copied the German beacons on most of the days listed in Fig. 3 and reports hearing normal keying from 3B8MS on March 9 and a plain carrier on the 15th and 16th. He also logged back

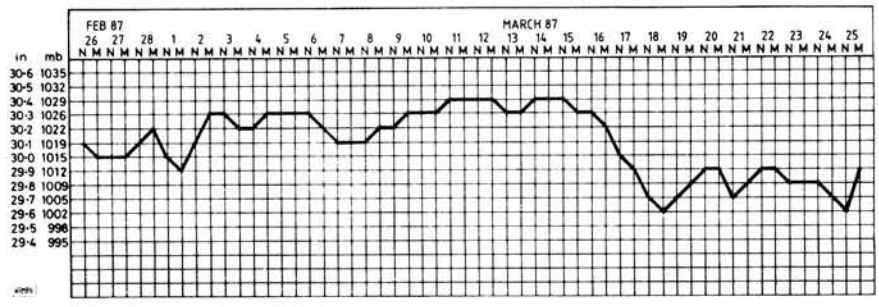


Fig. 1

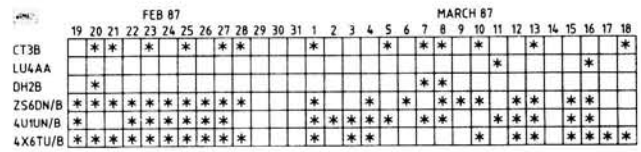
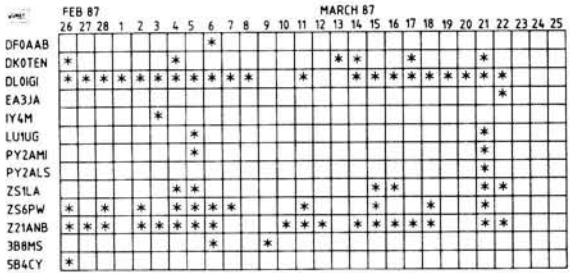


Fig. 2

Fig. 3



scatter signals from DK0TEN on March 5 and 21 and from DL0IGI on the 21st.

At 1017 on the 17th, **Fred Pallant G3RNM** (Storrington), heard a very weak signal on 28.262MHz which he thinks was VK2RSY. On 28.210MHz, at 1155 on the 23rd, he listened to a steady carrier which keyed "OK???", before disappearing in QSB. Although Fred logged PY2AMI on the 5th and ZS6PW and Z21ANB on days 5, 6 and 7, he considered this period, like most of us did, as "rather dreary". However, your beacon logs, empty or not, are still much appreciated, because without them I could not have compiled Fig. 3.

Between February 26 and March 21, **Norman Hyde G2AIH** (Epsom Downs), received signals via meteor scatter, from the 50MHz beacons in Anglesey GB3SIX on most days, Potters Bar daily and Scotland GB3RMK each day from March 12 onward. "Meteor reflections from the Scottish beacon were invariably of good strength, quite long and very frequent," said Norman.

Len Fennelow can normally just about hear the 144MHz beacons in Angus GB3ANG and Cornwall and reports that ANG was up to S6 on March 8, 10 and 11 and CTC to S6 on February 23 and S9, S5 and S7 on March 1, 2 and 11 respectively.

A similar report came from **Jim Cond G6SFU** (Birmingham) who also checked these beacons from February 16 to March 22. From his computer histogram, I see that ANG drifted between S1 and S3 for most of the period and CTC, normally about S1 at Jim's QTH, perked up to S3/4 on March 5, 13 and 20.

Geoff Holland G3GHS, the beacon keeper of GB3CTC and secretary of the Mid-Cornwall Beacon and Repeater Group, tells me that CTC will be off the air from late spring, for an indefinite period, while the mast is being replaced by its owners. This beacon has given valuable service to the amateur fraternity for many years and, owing to the very high salt content from the sea, the original antenna and cable must now be replaced. Readers may not realise that most beacons within the amateur service are maintained by dedicated

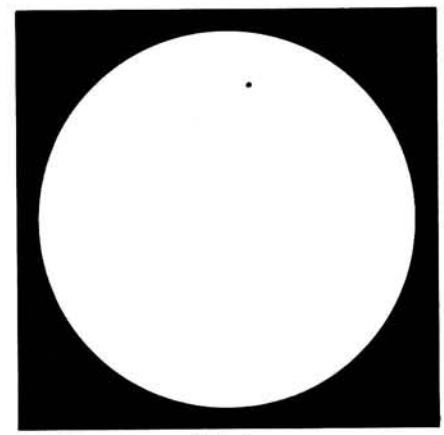


Fig. 4

groups, who rely on donations to fund the equipment and usually on the good offices of public utilities and official organisations to provide antenna space for the beacons on their strategically sited masts.

Tropospheric

The slightly rounded atmospheric pressure readings, recorded on my barograph at noon and midnight between February 26 and March 25, appear as a graph in Fig. 1. It is well worth comparing any DX in your v.h.f./u.h.f. log with these figures to see what influence the prevailing pressure had on those QSOs. The extremes recorded by Ted Owen's barometer were similar to mine showing a high of 30.5in on March 12 and a low of 29.5in on the 18th.

Between 0430 on the 11th and 0605 on the 13th, Bill Kelly heard QSOs through the 144MHz repeaters in England, at Burnley, Caldbeck and Duns and in Ireland, at Dublin, Sligo and Waterford.

In The Hague, **Chris van den Berg**, logged the 144MHz repeaters in Hastings on February 26, Danbury on March 12, Dover on the 6th, 11th and 12th as well as Maidstone on days 26 and 5, 6, 8, 11 and 13. He also heard signals through the Belgian repeaters ON0AN and ON0OV on most days from February 26 to March 13 and again on the 18th and 19th.

During the weekend February 21/22, Dave Lingard logged signals from 22 different repeaters at various times and strengths and on March 3 he had a short QSO with a GI. On the 7th he worked into Belgium and heard stations in France, Germany, Holland and Sweden and on the 12th, he again received signals from France and Holland.

934MHz

From Bedford, **John Raleigh DW-04**, The Secretary of The Four County 32cm Club, found 934MHz conditions generally flat from February 18 to March 19. However a pressure rise to 30.4in on March 3, enabled **Bill Ellis** (Houghton-Regis) to copy stations in North London. "The pressure fell again overnight and did not come up until the 10th when we again recorded 30.4in," said John. He heard several East Coast operators in QSO, but could not contact them.

By the evening of the 11th, the pressure was just over 30.5in and around 2100, John exchanged words with stations in Grimsby and Skegness.

In Leighton-Buzzard, **David Hogges GB-01** worked into Birmingham and Wiltshire and heard stations in Hull. As the pressure fell on the 12th, David's QSOs ranged from Brighton to Stratford-on-Avon. One of the QSL cards, Fig. 5, sent to John came from the Untouchables DX Group in Hastings.

"The Personal Radio Club of Great Britain began in mid-1968 and one of the main reasons for starting the club was to give 934MHz users in the UK more information about the various problems relating to the band and try to obtain a good working relationship with the DTI," wrote PRCGB President **James Finch** on March 28.

The Club's Newsletters, published in June 1986 and February 1987 are very informative and include copies of correspondence and a report of a meeting between the PRCGB and the Radio Regulatory Division of the DTI.

Readers requiring membership details and more information about the work of the PRCGB should send an s.a.e. to James, at 41 Twyford Avenue, Shirley, Southampton SO1 5NZ.

Fig. 5

Fig. 6

Issue	Deadlines
August '87	May 22
Spetember '87	June 26
October '87	July 24

Broadcast Round-up

Peter Shore

The World Administrative Radio Conference for High Frequency Broadcasting, WARC-HFBC, ended in Geneva on Sunday 8 March 1987. The aim of this major Conference was to attempt to sort out some of the chaos which exists on the shortwave broadcast bands at the present time. Readers will recall that in last month's column some of the problems facing the Conference delegates were outlined, and it was suggested that one solution would be to adopt a partial planning system in the higher frequency bands. It transpired that this forecast was almost correct. Many delegations had expressed reservations about the International Frequency Registration Board's computer program for the planning system which generated a number of anomalies when making frequency allocations—lack of continuity being one of the more significant stumbling blocks. Whilst some delegations were in favour of the adoption of a planning system throughout the bands immediately, some of the other larger broadcasters wished to see the system improved prior to its introduction.

Compromise was reached, albeit meaning that decisions were in effect postponed to some yet to be decided date in the future, with the Conference agreeing to implement an improved h.f. planning system in the new extension broadcast bands. There is also hope that the area of the shortwave spectrum allocated to broadcasters may be extended at a future WARC around 1992.

In order to conserve the precious h.f. resource, it was decided to introduce s.s.b. transmissions as soon as practicable, and certainly not later than the year 2015.

Good news for radio amateurs is that the band 7.000–7.100MHz is to be vacated by international radio stations, with administrations urged to cease using that band as soon as possible. WARC also urged administrations to cease creating harmful interference, or jamming, and resolved to introduce monitoring of the source and effect of this nuisance.

All in all, WARC-HFBC proved to be moderately successful for long term affairs, but in the short term, it looks as though things are likely to remain as they are for some time to come.

International Broadcasting News

Note: all times are UTC (GMT)

Europe

BRT International's English service to Europe is heard at 1730 and 2100 on 5.910 and 1.512MHz, with Frans Vossen's *Radio World* heard on Saturday and Sunday. A "hot-tips" telephone answer line has been installed recently, enabling would-be contributors to the programme phone in their most important news. The number is (from the UK) 010-32-27 37 54 93.

Despite international broadcasting usually being a direct line to the latest news, this doesn't always work out. On the evening of the Zeebrugge ferry disaster, tuning into the late evening English news from Brussels on BRT proved less than illuminating, as the cast contained no mention of the tragedy. The news had evidently been recorded before the English team went off-duty on Friday afternoon . . .

Radio Prague will be reorganising its European English language service on May 3. Instead of the current evening schedule, Prague will broadcast in English at:

1800–1830 on 5.930, 7.345MHz
1900–2000 on 5.930, 7.345MHz
2200–2230 on 6.055, 1.287MHz

The latest schedule of Radio Finland reflects the changes in broadcasting highlighted in last month's column. English is now heard beamed to Europe:

0430–0455 on 6.120MHz
0630–0655 on 11.755, 9.560, 6.120MHz
0700–0725 on 11.755, 6.120MHz (Saturday only)
0830–0855 on 11.755, 6.120MHz
1830–1855 on 11.755, 9.610, 6.120MHz
2100–2125 on 6.120MHz

The transmissions at 0630, 0700 (Saturday), 1830 and 2100 are also carried on 963, 558 and 254kHz.

The station has introduced a toll-free information and answer line telephone service in the United States, giving programme and frequency information, and allowing callers to leave comments about Radio Finland. The number is (800)-221 YLEX (9539). Here in Europe we have to pay for our calls on 010-358-0-401 3733 or 401 3534 Monday to Friday 1000-1200.

Radio France Internationale started a 24 hour French "world service" on 29 March.

Deutschlandfunk has two interesting feature programmes in May: on 9 May,

Sue Cook reports on Radio Bremen Four, Germany's first all pop and rock station; on 15 May, *Journey to Berlin* looks at an important exhibition at the renovated railway station of Hamburger Bahnhof, forming part of the 750th anniversary celebrations in Berlin.

Radio Netherlands made only one change to frequencies for the English Language service from 29 March: at 1630, the broadcast to Southern and East Africa is now heard from Madagascar on 9.515 and 6.020MHz.

Radio Exterior de Espana's English service to Europe is heard at:

1730–1830 on 7.275, 9.765MHz
2200–2300 on 6.020, 7.275MHz

with a broadcast at 1830 to Africa and the Middle East on 15.125 and 15.375MHz.

Radio Sweden International broadcasts in English to Europe at: 1100-1130 on 6.065, 9.630MHz (Sat/Sun: 6.065 carries German).

1830–1900 on 9.755MHz
2000–2030 on 6.065, 9.755MHz
2100–2130 on 6.065MHz

Broadcasts at 1700, 2000, 2100 and 2300 are also heard on 1.179MHz.

Finally, news of a new station of sorts starting on Europe Day, May 9. Tune into 648kHz on that date and you'll find a different sound and name: BBC 648. Up to now, this medium wave channel has carried the English language World Service for much of the day, with opt-outs into French and German programmes periodically. But for six months, there is to be a trial of a new multi-lingual service, with English, French and German programmes flowing together with multi-lingual continuity. The programme will carry AA "Roadwatch" reports for northern Europe, weather and localised news, as well as the regular WS and language programmes. An interesting experiment—comments to BBC, Bush House, London WC2. . .

Africa

Radio RSA has introduced a new frequency of 15.185MHz for the English service from1500-1557, replacing 21.590MHz at this time.

Far East and Australasia

Radio Pakistan may be heard in English in Europe:

0800, 1000, 1100 on 15.606, 17.660MHz
1720 on 9.560, 7.100MHz

Radio Australia's excellent morning frequency of 9.655MHz is now audible for a further 40 minutes now that Norway has ceased using this channel for European broadcasts at 0930. Australia signs off at around 1010 on this frequency.

South America

RAE Argentina may be heard in English to Europe at:

1745–1840 on 15.345MHz
2100–2155 on 15.435MHz and 6.060 (and 11.710MHz on Sat and Sun)

North America

The new station run by the respected newspaper *The Christian Science Monitor,* has finally reached the airwaves, despite having an original planned introduction of their service on 25 December 1986!

The station announces a schedule as:

0000–0200 on 7.365MHz
0200–0400 on 9.456MHz
0400–0600 on 9.840MHz
0600–1000 on 7.365MHz
1000–1200 on 17.640MHz
1600–1800 on 15.270MHz
1800–2000 on 21.640MHz
2000–2200 on 9.465MHz
2200–2400 on 7.365MHz

The station's address is:

World Service Of The Christian Science Monitor
WCSN
Box 860, Scott's Corner
Maine 02123
United States of America.

The station has a 500kW transmitter in Scott's Corner.

That wraps up the news from around the broadcast bands for this month. Good listening and 73!

SWAP SPOT

Got a camera, want a receiver? Got a v.h.f. rig, want some h.f. gear to go with your new G-zero? In fact, have you got anything to trade radio-wise?

If so, why not advertise it FREE here. Send details, including what equipment you're looking for, to "SWAP SPOT", *Practical Wireless,* Enefco House, The Quay, Poole, Dorset BH15 1PP, for inclusion in the first available issues of the magazine.

A FEW SIMPLE RULES: Your ad. should follow the format of those appearing below, it must be typed or written in block letters; it must be not more than 40 words long including name and address/telephone number. Swaps only—no items for sale—and one of the items MUST be radio related. Adverts for ILLEGAL CB equipment will not be accepted.

The appropriate licence must be held by anyone installing or operating a radio transmitter.

Have PRO2021 v.h.f./u.h.f. scanning receiver, boxed in mint condition. Also have DX400 receiver, also mint condition. Would exchange for Yaesu FRG-9600 up to 950MHz. Must be good condition. Steve. Tel: Bloxwich 493331. *C581*

Have Sony ICF-7600D synthesised receiver, 2 months old, still in box with guarantee. Would exchange for Dressler ARA 30 active antenna or a Royal Blue folded dipole and s.w. audio filter, w.h.y? Davy Hossack, 73 Tippet Knowes Road, Winchburgh, Edinburgh EH52 6UN. *C586*

Have QRO 10GHz klystron, 75mW WG flange output, micrometer tuned. Would exchange for small computer. G4FFO. Tel: Cambridge 860150. *C592*

Have valves value £10. Two EL84, four EF86, two 6BW6 and one GZ30. Would exchange for selection clean resistors, capacitors, plain p.c.b. without copper tracks, w.h.y? Tel: 0449 740321 evenings. *C598*

Have FDK-700E, 144MHz f.m. mobile rig 0–25W, o/set, t/burst, mobile bracket, handbook, 5-ele Yagi, AEC.50 s.w.r./p.w.r. meter, CO-50 antenna matcher. Would exchange for FC102, FTV102DM + cash. Brian G1UWV. Tel: 0425 615860. *C608*

Have Spectrum+ 48K, RX4 programme data-corder, p.s.u., etc, Zetagi B300P h.f. linear, frequency counter 6-digit 0–350MHz. Would exchange for system L Secam TV, Drae Slow Scan RX or 2 × 21-element Tonna 70cm ATV w.h.y? S. Bishop, 22 John Street, Brightlingsea, Essex. *C612*

Have hundreds of old 78 r.p.m. records pre-war to 1950s, dance bands, vocal, etc. As new condition. Would exchange for Trio 2300 or similar, w.h.y? Stan. Tel: 0827 58004. *C617*

Have Regency ACT-T-720 v.h.f. air scanner. Would exchange for FRG-7 or DX302 or similar communications receiver. Frank Gingell, 82 Coulpark, Alness, Ross-shire. Tel: Alness 884227. *C622*

Have Realistic PRO-2009, 8-channel v.h.f./u.h.f. scanner. Would exchange for any good short wave receiver with antenna. M. Mayer. Tel: Nuneaton 373294 after 6pm. *C628*

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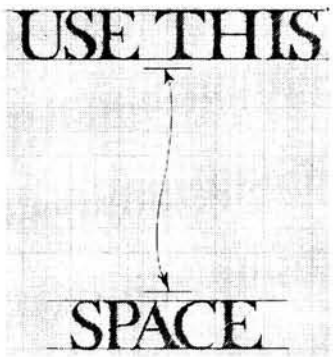

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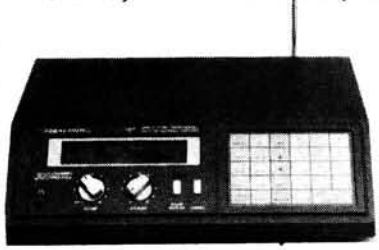

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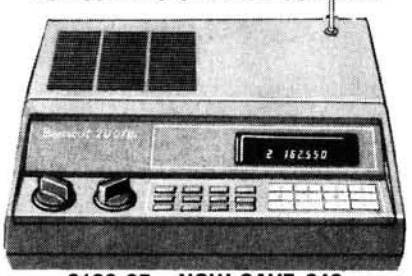

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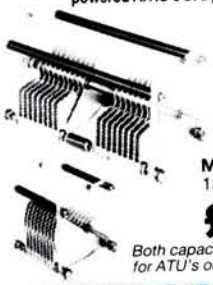

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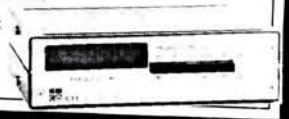

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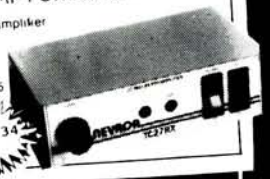

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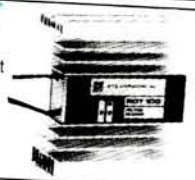

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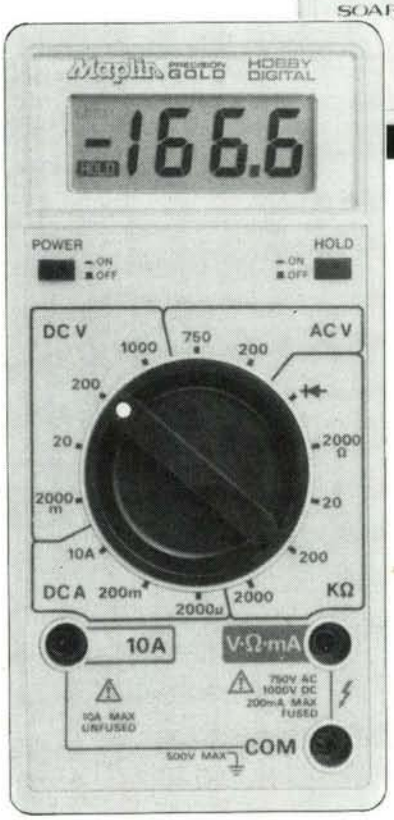

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