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Practical Wireless

THE RADIO MAGAZINE

PW REVIEW

YAESU FT-757

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TS430S	160m-10m Transceiver	779.55	(—)
PS430	Matching Power Supply	119.43	(3.00)
SP430	Matching Speaker	30.99	(1.50)
MB430	Mobile Mounting Bracket	12.00	(1.50)
F. 1430	FM Board for TS430	36.48	(1.00)
TS130S	8 Band 200W Pep Transceiver	576.66	(—)
SP120	Base Station External Speaker	27.99	(1.50)
AT130	100W Antenna Tuner	98.95	(1.50)
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MC35S	Fist Microphone 50K ohm IMP	15.49	(0.75)
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TR9130	2M Multimode	458.72	(—)
TW4000A	2M/70cm mobile	488.70	(—)
TM201A	2M 25W mobile	279.00	(—)
TM401A	7cms FM 12W	310.32	(—)
TR2500	2M FM Synthesised Handheld	243.36	(—)
TR3500	70cm Handheld	265.85	(—)
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PB25	Spare Battery Pack	26.50	(1.00)
MS1	Mobile Stand	33.91	(1.00)
R600	Gen. Cov. Receiver	272.83	(—)
R2000	Synthesiser 200KHz-30MHz Receiver	436.75	(—)
HC10	Digital Station World Time Clock	71.96	(1.50)
HS5	Deluxe Headphones	24.48	(1.00)
SP40	Mobile External Speaker	14.98	(1.00)

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TONO (G series)

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MML144/100-HS	inc preamp (25w i/p)	149.95	(2.50)
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LPM 144-10-100	2m, 10W in, 100W out, preamp	149.50	(2.50)
LPM 144-25-160	2m, 25W in, 160W out, preamp	207.00	(2.50)
LPM 144-3-180	2m, 3W in, 180W out, preamp	235.75	(2.50)
LPM 144-10-180	2m, 10W in, 180W out, preamp	235.75	(2.50)

SWR/PWR Meters

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FS200	1.8-150MHz 20/200 Pep	55.95	(1.00)
FS210	1.8-150MHz 20/200 Auto SWR	59.80	(1.00)
FS5E	3.5-150MHz 20/200/1000W HF	41.00	(1.00)
FS500H	1.8-80MHz 20/200/2000W Pep	77.80	(1.00)
FS7	145 & 432MHz 5/20/200	44.85	(1.00)
FS710H	1.8-60MHz 15/150/1500W Pep	97.75	(1.00)
FS711U	430-440MHz 5/20W Head	41.00	(1.00)
FS711H	2-30MHz 20/200 W Head	41.00	(1.00)

WELZ

SP15	1.8-160MHz PWR/SWR	41.00	(1.00)
SP45	130-470MHz PWR/SWR	59.75	(1.00)
SP10X	1.8-150MHz PWR/SWR	28.75	(1.00)
SP200	1.8-160MHz PWR/SWR	82.00	(1.00)
SP250	1.8-60MHz PWR/SWR	57.75	(1.00)
SP300	1.8-500MHz PWR/SWR	115.00	(1.00)
SP350	1.8-500MHz PWR/SWR	69.95	(1.00)
SP400	130-500MHz PWR/SWR	82.00	(1.00)
SP600	1.8-500MHz PWR/SWR	106.00	(1.00)

TOYO

T430	144/432 120 W	39.49	(1.00)
T435	144/432 200 W	43.50	(1.00)

YAESU

YS200	1.8 60MHz	52.90	(1.00)
YS2000	1.8 60MHz	69.79	(1.00)

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Icom Products

IC751	HF Transceiver	1099.00	(—)
IC745	HF Transceiver	839.00	(—)
IC730	Mobile HF Transceiver	659.00	(—)
PS15	P.S. Unit	119.00	(4.00)
PS30	Systems p.s.u. 25A	229.00	(—)
SM6	Base microphone for 751/745	34.50	(1.00)
IC290D	2m 25w M/Mode	499.00	(—)
IC271E	2m 25w M/Mode Base Stn.	649.00	(—)
IC271H	100W version of above	P.O.A.	(—)
IC25H	2m 45w FM	359.00	(—)
IC27E	25W FM mobile	319.00	(—)
IC45E	70c 10w FM	345.00	(—)
ICBU1	B/U Supply for 25/45/290	24.50	(1.00)
ICR70	General Coverage Receiver	565.00	(—)
ICR71	General Coverage Receiver	649.00	(—)
IC02E	2m H/Held	239.00	(—)
IC2E	2m H/Held	179.00	(—)
ML1	2m 10w Linear	69.00	(2.00)
IC4E	70cm H/Held	229.00	(—)
BC30	Base Charger	56.35	(—)
HM9	Speaker mic	16.50	(0.75)
IC3	Carry Case	5.00	(0.75)
ICBP3	Std Battery Pack	25.00	(0.75)
BP5	High Power Battery Pack	48.00	(0.75)
CP1	Car Charging Lead	4.95	(0.75)
DC1	12v Adaptor	12.50	(0.75)

Mutek Products

SLNA 50	50MHz Switched preamp	44.90	(1.20)
SLNA 144s	144MHz Low noise switched preamp	39.90	(1.20)
SLNA 145sb	Preamp intended for 290	27.40	(1.20)
GLNA 432e	70cm Mast head preamp	149.90	(2.50)
RPCB 144ub	Front end FT221/225	79.90	(1.20)
RPCB 251ub	Front end IC251/211	79.90	(1.20)
BBA 500u	20-5000MHz Preamp	32.90	(1.20)
GFBA 144e	2m Mast head preamp	139.90	(2.50)
SBLA 144e	2m Mast head preamp	89.90	(2.50)
RPCB 271ub	Front end for IC271	89.90	(1.20)

Datong Products

PC1	Gen. Cov. Con.	137.40	(1.00)
VLF	Very low frequency conv.	29.90	(1.00)
FL2	Multi-mode audio filter	89.70	(1.00)
FL3	Audio filter for receivers	129.00	(1.00)
ASP/B	r.f. speech clipper for Trio	82.80	(1.00)
ASP/A	r.f. speech clipper for Yaesu	82.80	(1.00)
ASP	As above with 8 pin conn	89.70	(1.00)
D75	Manual RF speech clipper	56.35	(1.00)
D70	Morse Tutor	56.35	(1.00)
MK	Keyboard morse sender	137.40	(1.00)
RFA	RF switched pre-amp	33.90	(1.00)
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	(1.00)
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PTS1	Tone squelch unit	46.00	(1.00)
ANF	Automatic notch filter	67.85	(1.00)
SRB2	Auto Woodpecker blanker	86.25	(1.00)

CW/RTTY Equipment

Tono 9000E	Reader/Sender	P.O.A.	(—)
Tono 550	Reader	299.00	(2.50)

MICROWAVE MODULES

MM2001	RTTY to TV converter	189.00	(1.25)
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HK704	Up down keyer	19.25	(1.00)
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HK802	Up down solid brass	82.85	(1.00)
HK808	Up down keyer	39.95	(1.00)
MK704	Twin paddle keyer	12.00	(1.00)
MK705	Twin paddle keyer marble base	24.65	(1.00)

KENPRO

KP 100	Squeeze CMOS 230/13.8v	77.05	(2.00)
KP200	Memory 4096 Multi Channel	165.62	(2.50)

Yaesu

FT1	HF Transceiver	P.O.A.	(—)
FT980	HF Transceiver	1329.00	(—)
SP980	Speaker	61.55	(2.00)
FT102	HF Transceiver	719.00	(—)
FC102	Tuner	185.00	(2.00)
FV102DM	VFO	239.00	(2.00)
SP102	Speaker	55.00	(2.00)
AM/FM	Unit	49.00	(1.00)
FT77	Mobile HF Transceiver	479.00	(—)
FP700	PSU	145.00	(5.00)
FC700	Tuner	103.85	(2.00)
FT77s	10w. version	449.00	(—)
FMU77	FM Board for FT77	28.55	(1.00)
FT757	HF Transceiver	719.00	(—)
FC757	Auto A.T.U.	245.00	(2.00)
FP757HD	Heavy Duty PSU	179.00	(2.00)
FP757GX	Switched Mode PSU	145.00	(2.00)
FT480	2m M/Mode Transceiver	399.00	(—)
FL2050	Linear Amplifier	119.00	(2.00)
FT290	2m M/Mode Port/Transceiver	279.00	(—)
FT290	With Mutek front end fitted	309.00	(—)
FL2010	Linear Amplifier	66.55	(1.00)
FT790	70cm M/Mode Port/Transceiver	259.00	(—)
MMB11	Mobile Bracket	28.19	(1.00)
NC11	Charger	10.55	(0.75)
CSC1	Carrying Case	4.45	(0.75)
YHA15	2m Helical	5.65	(0.75)
YHA44D	70cm ½wave	9.00	(0.75)
YM49	Speaker Mike	19.25	(1.00)
FT230	2m 25w FM	269.00	(—)
FT730	70cm 10w. FM	239.00	(—)
MMB15	Mobile Bracket	14.65	(1.00)
FT208	2m H/Held	209.00	(—)
FT708	70cm H/Held	189.00	(—)
MMB10	Mobile Bracket	8.45	(0.75)
NC9C	Charger	9.20	(0.75)
NC8	Base/station Charger	56.75	(2.00)
PA3	Car Adaptor/Charger	16.00	(0.75)
FNB2	Spare Battery Pack	23.00	(0.75)
YM24A	Speaker Mike	22.50	(1.00)
FT726R	2m Base Station	775.00	(—)
430/726	70cm Module for above	259.00	(2.50)
FRG7700	HF Receiver 15-30MHz	385.00	(—)
FRG7700M	As above with memory	455.00	(—)
FRT7700	A.T.U. for above	48.25	(1.00)
MH1B8	Hand 600 8pin mic	15.70	(1.00)
MD1B8	Desk 600 8pin mic	56.00	(1.00)
MF1A3B	Boom mobile mic	18.95	(1.00)
YH77	Lightweight phones	12.50	(0.75)
YH55	Padded phones	12.50	(0.75)
YH1	L/weight Mobile H/set-Boom mic	15.75	(0.75)
SB1	PTT Switch Box 208/708	17.00	(0.75)
SB2	PTT Switch Box 290/790	14.50	(0.75)
QTR24D	World Time Clock	35.00	(0.75)
FF501DX	Low Pass Filter	28.99	(0.75)
YP150	Wattmeter/Dummy Load 150w	99.00	(1.00)

Power Supplies

DRAE			BNOS		
4 amp	30.75	(2.00)	6 amp	52.90	(2.50)
6 amp	49.00	(2.50)	12 amp	95.45	(3.00)
12 amp	74.00	(3.00)	25 amp	138.00	(4.00)
24 amp	105.00	(4.00)	40 amp	276.00	(4.00)

Aerial Rotators

9502B	3 core Lighter Duty	57.50	(2.00)
AR40	5 core Medium Duty	98.90	(2.00)
KR400	Med/H Duty	99.94	(2.50)
KR500	6 core Elevation	126.50	(2.50)
KR400RC	6 core Medium Duty	118.45	(2.50)
CD45	8 core Heavy Duty	149.50	(2.50)
KR600RC	8 core Heavy Duty	167.90	(3.00)
HAM1V	8 core Heavier Duty	264.50	(4.00)
T2X	8 core Very Heavy Duty	332.35	(4.00)

Switches

Sigma	2 way SO239	11.50	(0.75)
Sigma	2 way 'n' Skts	15.50	(0.75)
Welz	2 way SO239	20.75	(0.75)
Welz	2 way 'n' Skts	37.00	(0.75)
Drae	3 way SO239	15.40	(0.75)

Miscellaneous

DRAE	Wavemeter	27.50	(1.00)
T30	30W Dummy load	7.10	(0.50)
T100	100W Dummy load	28.00	(1.00)
T200	200W Dummy load	41.40	(1.50)
CT300	300W Dummy load	58.00	(2.00)
GT4	Digital World Time Clock	49.95	(2.00)
	Altai Dip Meter	49.00	(1.00)

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WMT707	Workshop Manual FT707	£13.00

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FT77S	8 Band Rx/Tx 10W output	£449.00
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FC700	Matching antenna tuner	£103.85
FV700DM	Digital VFO unit	£209.00
MKT77	Marker unit	£10.85
FMUT77	FM unit	£28.55
AMUT77	AM unit	£24.00

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FT980	Transceiver General Coverage Rx	£1329.00
SP980	Ext. speaker with audio filter	£61.55
XF455.8MCN	300Hz CW filter (455KHz 8 pole)	£49.00
XF8.9HC	600Hz CW filter	£29.50
XF8.9GA	6KHz AM filter	£29.50
FIF**	Computer interface	(see FT757GX units)
D410004	Interconnect lead FT980 – FC757AT	£26.99
TST980	Technical Supplement FT980	£8.50

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FT757GX	Transceiver General Coverage Rx	£719.00
FC757AT	Automatic antenna tuner	£254.00
FP757GX	Switch mode PSU (50pc duty)	£145.00
FP757HD	Heavy duty PSU (100pc duty)	£179.00
FIF80	Computer interface for PC8001 NEC	£105.00
FIF65	Computer interface for Apple II	£54.00
FIF232C	Computer interface RS232C	£59.00

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What price

HF Equipment		
IC–751	All band AM,FM,SSB,CW – Gen Cov Rx 32 Memories	1049.00
PS35	Internal switched mode power supply	149.00
SM6	Desk microphone	34.50
HM12	Hand microphone with up/down scanning	16.50
EX310	Voice synthesizer module	39.00
RC10	Frequency controller unit	29.95
CR64	High stability xtal unit	49.95
FL32	9MHz CW/RTTY filter – 500Hz	39.00
FL63	9MHz CW/RTTY narrow filter – 250Hz	39.00
FL33	9MHz AM filter – 6KHz	32.50
FL70	9MHz SSB wide filter – 2.8KHz	35.50
FL52a	455KHz CW/RTTY filter – 500Hz	79.00
FL53a	455KHz CW/RTTY narrow filter – 250Hz	79.00
IC–745	All band SSB,CW,AM(Rx only), Gen Cov Rx 16 mems	839.00
PS35	Internal switched mode power supply	149.00
SM6	Desk microphone	34.50
HM12	Hand microphone with up/down scanning	16.50
EX310	Voice synthesizer unit	39.00
EX242	FM unit Tx & Rx	32.50
EX241	Marker unit	15.95
EX243	Curtis keyer unit	39.00
FL45	9MHz CW filter – 500Hz	45.00
FL44a	455KHz SSB narrow filter – 2.4KHz	79.00
FL52a	455KHz CW/RTTY filter – 500Hz	79.00
FL53a	455KHz CW/RTTY narrow filter – 250Hz	79.00
FL54	9MHz CW/RTTY narrow filter – 270Hz	39.00
IC–740	No longer available. Accs still in stock	
PS740	Internal switched mode power supply	149.00
SM5	Desk microphone	34.50
EX241	Marker unit	15.95
EX242	FM unit	32.50
EX243	Curtis keyer	39.00
FL44	455KHz SSB filter – 2.4KHz	79.00
FL45	9MHz filter – 500Hz	45.00
FL52	455KHz CW/RTTY filter – 500Hz	79.00
FL53	455KHz CW/RTTY narrow filter – 250Hz	79.00
FL54	9MHz CW/RTTY narrow filter – 270Hz	39.00
IC–730	10–80 Mtrs compact transceiver	659.00
PS15	External power supply – 20amps	119.00
PS20	External power supply with speaker – 20 amps	176.00
SM5	Desk microphone	34.50
HM7	Hand microphone with pre amp	14.95
EX202	LDA unit for use with AT100/500	13.50
EX203	CW audio filter	14.50
EX205	Transvertor unit	14.00
EX195	Marker unit	17.00
FL44	455KHz SSB filter – 2.4KHz	79.00
FL45	9MHz CW filter – 500Hz	45.00
FM04	FM unit Tx & Rx	49.00
IC–720A	No longer available. Accs still available.	
PS15	External power supply – 20 amps	119.00
PS20	External power supply with speaker 20 amp	176.00
CF1	Cooling fan for PS20	24.00
SM5	Desk microphone	34.50
FL32	CW narrow filter	39.00
FL34	AM xtal filter	34.00
BC10	Memory back up unit	5.95
FM03	FM unit Tx & Rx	89.00
IC–R70	General Coverage Receiver 0.1-30MHz	549.00
EX257	FM unit	32.50
FL63	CW narrow filter	39.00
FL44a	455KHz SSB filter	79.00
CK70	DC cable kit	5.75
7072	Interface unit to transceive with IC720A	97.50
IC–R71	All mode Gen Cov Rx, k pad entry, 32 memories	649.00
RC11	Remote control unit for above	49.00
IC–2KL	1KW PEP Linear, auto band switching, complete with –	
2KLPS	Power supply to run 2KL linear	1303.33
IC–AT100	100Watt Automatic antenna tuner	269.00
IC–AT500	500Watt Automatic antenna tuner	369.00
IC–PS30	Systems power supply, 25 amps continuous	229.00
IC–AH1	Mobile antenna, 3.5MHz–30MHz	199.00
VHF Equipment		
IC–271E	Multimode base station, 25w, 32 memories	629.00
IC–271H/E	High power version of above, 100w	789.00
PS25	Internal switched mode power supply	89.00
EX310	Speech synthesizer unit	39.00
AG20	Internal receive pre-amp	49.00
SM6	Desk microphone	34.50
IC–290D	25W Multimode mobile, 5 memories, scanning mic	469.00
IC–27E	25W FM mobile, 9 memories, multi function display	319.00
UT16	Voice synthesizer unit	25.00
IC–25H	45W FM mobile, high power version of old IC25E	359.00
BU1	Memory back up unit for mobiles	24.50
	DC leads,(flat 4 pin or square 6 pin)	4.50
	DC Plugs (flat 4 pin)	.30
	DC Sockets (flat 4 pin)	.30
IC–2E	Synthesized hand portable, 1.5 watts	169.00
IC–O2E	Synthesized hand held, keypad entry, LCD display	229.00
ML1	10 watt booster unit for 2E	69.00
BP3	Standard battery pack	25.00
BP2	Low volts high capacity (long life)	38.00
VP4	Empty battery pack, takes 6 x AA size cells	7.95
BP5	High volts high capacity (high power)	48.00
BP7	High volts high capacity (for use with O2E ONLY	59.00
BP8	Low volts high capacity	49.00
DC1	12v regulator pack (2E ONLY)	12.50
CP1	12v charger lead for cigar lighter	4.95
FA2	Helical antenna	7.50
LC1	Leatherette case (BP5)	5.00
LC2	Leatherette case (BP4)	5.00
LC3	Leatherette case (BP3)	5.00
LC11	Case for O2E (BP3)	5.00
T/L1	Heavy duty leather case (all batt packs)	21.27
BC25E	240v wall charger for 2E	6.69
BC25U	110v wall charger for 2E (USA)	6.69
BC16E	240v wall charger for O2E (BP8/BP7)	9.95
BC30	Desk top drop in charger (fast and slow) old packs	56.35
BC35E	Desk charger all packs new & old (fast/slow)	56.35
HM9	Speaker microphone	16.50
IC–202S	SSB Portable, + CW, 3 watt output	199.00
BC15E	AC Charger 240v	41.80
BC20	DC Charger 13.8v	41.80
	DC lead	1.75
	Telescopic antenna	1.50
LC25	Leatherette carrying case	8.25
FA1	Helical screw in antenna	7.50
UHF Equipment		
IC–471E	Multimode base station, 25watts, 32 memories	699.00
IC–471H	High power version of above, 75watts.	879.00
PS25	Internal switched mode power supply	89.00
EX310	Voice synthesizer unit	39.00
SM6	Desk microphone	34.50
IC–490E	Multimode mobile, 10 watts, 5 memories	495.00
IC–45E	FM mobile, 10 watts, 5 memories	329.00
BU1	Memory back up unit for mobiles	24.50
	Spare DC leads (flat 4 pin or square 6 pin)	4.50
	DC plugs & sockets (flat 4 pin)	.30
AG1	Mast head pre-amp for 471/451/490	49.00
IC–4E	Synthesized hand portable, 1.5 watts	219.00
IC–O4E	Synthesized hand held, k'pad entry, LCD	T.B.A
FA3	Flexi 1/4 wave antenna	7.50
	Accessories same as IC2E/O2E	
IC–402	SSB portable + CW, 3 watts output	257.00
BC15E	AC charger 240v	41.80
BC20	DC charger 13.8v	41.80
	DC lead	1.75
LC25	Carrying case	8.25
1.2 GHz Equipment		
IC–120	FM mobile, 1 watt output, 40MHz coverage mems	439.00
BT23E	Bit Zero 23e, 1296MHz linear, lw in – 7/8w out	179.00
50 MHz Equipment		
IC–551	Multimode base station, supplied SSB/CW only	379.00
EX106	FM unit	112.00
EX107	VOX unit	49.00
EX108	Pass band tune unit	97.50
IC–505	Multimode portable, 3/10watt, supplied SSB only	382.00
EX282	FM unit	28.50
BP10	Nicad pack	59.00
BC15	Charger unit	6.50
LC10	Carrying case	22.50
Mobile Mounting Brackets		
MMB5	Mount for 251E, 451E, 720A, 730	12.50
MMB6	Mount for 240,	12.50
MMB7	Mount for 245E	12.50
MMB8	Mount for 255E, 260E	12.50
MMB9	Mount for 290E, 490E	12.50
MMB10	Mount for 25E, 45E, 120	12.50
MMB11	Mount for 22U, 24G	12.50
MMB12	Mount for R70, 740, 271E, 471E	12.50
MMB16	Mount for 2E, 4E, O2E, O4E	6.95
MMB18	Mount for 751	T.B.A.
SS1	Shoulder strap for handhelds	7.50

IC-751, £1049.

The IC-751 now has an interesting and useful addition, a remote push-button frequency selector pad, so you can either twiddle knobs or press buttons.

The IC-751 could be called the flagship of the ICOM range as it features 32 memory channels, full HF receive capability, digital speech synthesizer, computer control and power-supply options. The 751 is fully compatible with ICOM auto units such as the AT- 500 and IC-2KL.

Standard features include: a speech processor, switchable choice of J-FET pre-amp or 20dB pin diode attenuator and two VFO's, marker, 4 variable tuning rates, pass band tuning, notch, variable noise blanker, monitor switch, direct feed mixer in the front end, full break-in on CW and AMTOR compatibility.

For more detailed information on this excellent set, please get in touch with us.

IC-R71E, £649.

The best has just been made better! The ICOM IC-R70 receiver has had some important additions made to its specifications and this model is named the IC- R71E. Here are some details:–

100 KHz – 30 MHz all mode (with FM option). Quadruple conversion superhet. IF frequencies 70 MHz 9 MHz and 455 KHz with continuous bandpass tuning and notch filter. Virtually immune from adjacent channel interference with 100 db dynamic range. Adjustable AGC, noise blanker and switchable pre-amplifier. Direct entry keyboard into twin VFO's with 32 programmable memories. Auto squelch tape record function.

Options:– Synthesized voice readout, infra-red remote controller, 12V DC kit, mobile mounting bracket, two CW filters 500 and 250 Hz, FM unit, computer interface, headphones.

The IC-R70 will still be available at £549.00. Ask for a leaflet giving the full details of these two fine receivers.

perfection?

Microphones

HM3	4 Pin hand microphone (IC240)	12.50
HM5	4 Pin hand microphone noise cancelling	20.00
HM7	8 Pin hand microphone (IC-24G, 730, 720A)	14.95
HM9	Speaker microphone for hand helds	16.50
HM10	8 Pin microphone with up/down scanning	29.00
HM11E	8 Pin microphone with up/down scanning + tone call	22.50
HM12	Up/down scanning mic for new sets (271/471/751/745)	16.50
SM2	4 Pin base microphone	34.50
SM5	8 Pin base microphone	34.50
SM6	Base microphone for new sets (271/471/751/745)	34.50

Ext Speaker/Headphones/Headsets

SP3	Matching speaker for ICOM sets	45.00
SP4	Mobile speaker with magnetic mount	19.55
HP1	Good quality headphones	28.50
HS10	Headset and boom mic for ICOM hand helds	18.40
HS10SB	PTT switch box for HS10	18.40
HS10SA	VOX unit for HS10	20.70

ICOM Global digital clock

Attractive gold colour, gives time in cities all over the world. Pulsating red LED's, LCD readout with alarm. 195mm	59.00

TONO CW/RTTY/ASCII Terminals

9000E	Communications computer, RTTY, CW, ASCII, TX/RX	669.00
550	CW/RTTY decoder, inc CW practice, and CW transmit	299.00
5000E	Comunications terminal & k'board, inc AMTOR, VDU.	799.00
9100E	As 9000E with amtor	699.00
CRT1200G	High quality video monitor with green display	136.00

TONO Linears

MR250W	144–146MHz, 10–15W drive, 180–200W out, RX pre-amp	325.00
MR150W	144–146MHz, 10–15W drive, 120–140W out, RX pre-amp	169.00
MR100W	144–146MHz, 10–15W drive, 80–90W out, RX pre-amp	99.00
2M50W	144–146MHz, 1–3W drive, 30–45W out, no pre-amp	59.00

NEW "G" Series

2M40G	144–146MHz, 1–3W drive, 20-35W out, RX pre-amp	79.00
2M90G	144–146MHz, 10–15W drive, 70–90W out, RX pre-amp	115.00
2M130G	144–146MHz, 10-15W drive, 110–130W out, RX pre-amp	160.00
4M60G	430MHZ, 3–15W drive, 40–60W out, RX pre-amp	159.00

TONO Pre-amps

RX144	2 metre mast head pre-amp & control box	65.00
RX430	70 cm mast head pre-amp & control box	70.00

TELEREADER Equipment

CWR685E	CW/RTTY/ASCII terminal & k'board, with VDU, TX/RX	730.99
CWR675E	RX only version of 685E, with inbuilt printer/VDU	599.00
CWR670E	CW/RTTY/ASCII RX only, use with TV or VDU	349.00
	12 pin plug for 670/675/685	6.00
CWR610	CW/RTTY decoder, slow morse practice	159.00
CWR610E	As 610 with adjs baud rate from front panel (45–600)	175.00
	13 pin plug for 610/610E	4.75
CM40PS	40 character dot matrix printer, 11.5cm paper roll	199.00

ZENITH Monitors

123E	12 inch with green display, good quality	109.25
122E	12 inch with amber display, good quality	125.00

TAL, ASP Series System 6 antennas

ASP2016	138–512MHz 1/4 wave whip with threaded adaptor	2.56
ASP3976	66–138MHz 1/4 wave whip with threaded adaptor	5.21
ASP3936	130–174MHz 1/2 wave whip with barrel/spring, 3dB	18.63

Mounts for above

K57	Fits 1/2 wave, 3/8 inch hole, snap-in type	3.10
K440	Fits 1/4 wave, 3/8 inch hole, snap-in type	1.55
K145	Fits 1/2 wave, 3/4 inch hole, snap-in with claw mount	5.43
K65	Fits 1/4 wave, 3/4 inch hole, deep claw with 17ft cable	9.31
K47	Fits 1/2 wave, 3/4 inch hole, wing mount	7.17
KR47	Fits 1/2 wave, 3/4 inch hole, narrow wing mount	12.42
K220	Fits 1/2 wave, magnetic mount with 17ft cable	12.10
K220A	Fits 1/4 wave, magnetic mount with 17ft cable	12.10
M161	Fits 1/2 wave, boot lip mount, needs K57	3.88
M161	Fits 1/4 wave, boot lip mount, needs K440	3.88
KR193	Fits 1/2 wave, swivel ball mount	4.03
K67	Ground plane kit for all whips	16.30

3000 Series System 6 antennas

TAP3006	60–110MHz, 1/4 wave whip with threaded hinge	7.76
TAP3016	110–512MHz, 1/4 wave whip with threaded hinge	7.76
TAP3026	144–174MHz, VHF 1/2 wave, 3dB gain, threaded hinge	10.86
TAP3676	144–174MHz, VHF 1/2 wave, 3dB gain, with spring	12.42
TAP3456	420–440MHz, UHF 3dB gain, with threaded adaptor	14.74
TAP3466	450–470MHz, UHF 3dB gain, with threaded adaptor	14.74
TAP3696	420–440MHz, UHF 5dB gain, with shock spring	18.63
TAP3666	450–470MHz, UHF 5dB gain, with shock spring	18.63

Mounts for above

K68	Snap in adaptor for 3/8 inch hole	2.32
K145	Snap in adaptor with claw fits 3/4 inch hole	5.43
K72	Wing mount with 17ft of cable, fits 3/4 inch hole	11.64
K66	Claw mount with 17ft of cable, fits 3/4 inch hole	7.76
K65	1/2 inch deep claw mount with 17ft cable, 3/4" hole	9.31
K220	Magnetic mount with 17ft of cable	12.10
ASPR332E	Gutter clip with 10ft of cable	11.79
M161	Boot lip mount needs K68	3.88
KR223	Duraflex noiseless spring	10.86
K67	Ground plane kit	16.30

Base station antennas

ASP655	130–174MHz economy base, 1/2 wave with g-plane	27.94
TAP4009	156–174MHz Colinear, 3dB gain	50.45
ASPD682	160–166MHz Colinear, 4.5dB gain	194.00
ASPE682UK	164–172MHz Colinear, 4.5dB gain	194.00
ASPD700	450–460MHz Colinear, 7dB gain	163.00
ASP2006	156.174MHz Unity gain	47.44

Low profile/Heavy-duty antennas

ASP2001	66–88MHz dome shape, -12db	55.89
ASP2000	105–108MHz TX – 138–141MHz RX dome shape, -4.5dB	73.74
ASP2002	162–174MHz dome shape, -3.5dB	55.89
ASP2021	162–173MHz fin shape, -1dB	55.89
ASP4005	450–470MHz dome shape, -0.5dB	31.05

Marine antennas 156–162MHz

ASM37E	1/2 wave unity gain, deck mount, with 20ft cable	26.90
ASM38E	Colinear 3dB gain, deck mount, with 20ft cable	39.32
ASM77E	1/2 wave unity gain, mast mount, with 3ft cable	19.67
ASM88E	As above with 60ft of cable	27.83
ASM98E	Dipole, with deck/bulkhead mount & 20ft of cable	24.21
TAM1001	1/2 wave unity gain, lightweight whip style	24.84
TAM1003	Emergency antenna, (CH16) c/w special bracket	23.28

Mounts/Accessories for above:

ASM42	Heavy duty rachet mount all angles	25.68
ASM91	Vertical deck mount, fold over	10.35
K509	Stand off bracket (13cm) for 1001, 1005, 1006, 88E	5.74
TAM108	Antenna extension rod (1.5m)	31.05
ASM93	Antenna support bracket	5.16
CS100	Good quality extension speaker	11.37

Antenna matching units

AMU100	1.5–99MHz 200 watts pep	99.00
AMU400	1.5–60MHz 400 watts pep	116.43

Prices include VAT at 15%.
We reserve the right to change prices without giving prior notice.
As well as ICOM equipment, we also stock the following TONO & TELEREADER, CUE DEE, DATONG, MICROWAVE MODULES, MUTEK, LAR, WELTZ, YAESU, JAYBEAM, TAL, G-WHIP, DRAE, B.N.O.S., BEARCAT, TRIO and many accessories. Items listed are subject to availability.

Tono 5000E, £799.

From the famous TONO stable comes the new THETA – 5000E now ready to send and receive AMTOR as well as CW, RTTY, and ASCII.

Features include:– 5" high resolution monitor displaying 400chr. × 16 lines × 2 pages, ARQ/FEC, time clock, Selcal (Selective calling), high speed RTTY demodulator – up to 300 bauds (600 baud using TTL level); 3 shifts (170, 425 and 850 Hz) and two tones (2125 and 1275 Hz); manual or automatic Tx/Rx; Battery back-up memory (72 chars × 7 channels and 24 chars × 5 channels); type ahead correctable buffer memory; Morse code 5 – 100 wpm (variable weights) + autotrack on receive; CW practice feature with random generator; Automatic CR/LF with wrap around display; Automatic letters code insertion; Printer interface; Bargraph LED meter for tuning; TOR A, B and L – the list goes on and on . . . Power requirements by the way are AC mains or 13.8v DC.

Tono 9100E, £699.

The famous TONO THETA 9000E has had AMTOR modes A, B and L added to its functions providing transmit and receive facilities with selective calling on AMTOR, RTTY (with 3 selective shifts and 2 tone pairs), CW with built in practice function and random generator, and ASCII with full Duplex facility. The 9000E requires an external VDU. The battery backed memory covers 256 characters × 7 channels with Channel 6 which is divided into 16 subsections of 16 characters each and Channel 7 into 8 subsections of 32 characters. Any of the subsections may be used individually and messages can be repeated 1 – 9 times from a keyboard command.

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HF TRANSCEIVERS		£
0490	YAESU FT757GX	685.00
0130	YAESU FT102	685.00
0100	YAESU FT980	1265.00
0380	YAESU FT77	486.00
2021	ICOM IC745	839.00
2005	ICOM IC751	1099.00
1450	TRIO TS930S	1150.00
1530	TRIO TS430	752.10

VHF TRANSCEIVERS		
1000	YAESU FT230	259.00
—	ICOM IC27E	329.00
5779	FDR 750X	319.00
1932	TRIO TM201A	269.00

VHF MULTIMODE TRANSCEIVERS		
0810	YAESU FT290R	269.00
—	YAESU FT480R	395.00
1020	YAESU FT726R	739.00
2396	ICOM IC271E	649.00
—	ICOM IC290D	499.00
1980	TRIO TS9130	442.52

2M HANDHELD FM TRANSCEIVERS		
0700	YAESU FT208R	198.00
0930	YAESU FT203R	149.00
2480	ICOM IC2E	179.00
2475	ICOM ICO2E	239.00
1680	TRIO TR2500	237.82

2M/70cm TRANSCEIVERS		
1020	YAESU FT726R	739.00
1934	TRIO TW4000	469.00

70cm HANDHELD TRANSCEIVERS		£
0710	YAESU FT708R	179.00
1780	TRIO TR3500	256.45
2490	ICOM IC4E	229.00
2476	ICOM ICO4E	T.B.A.

70cm MULTIMODE		
0890	YAESU FT790R	249.00
2440	ICOM IC471	735.00
2450	ICOM IC490E	549.00

HF RECEIVERS		
2250	ICOM ICR70	565.00
2249	ICOM ICR71	649.00
1090	YAESU FRG7700	369.00
1100	YAESU FRG7700M	435.00
1820	TRIO R2000	421.36
1800	TRIO R600	263.12
5573	SONY ICF7600D	179.00

VHF RECEIVERS		
5650	JIL SX200	299.00
—	JIL SX400	598.00
5641	AOR 2001	325.00
—	REVCO SCANNER	258.00
5610	BEARCAT 20/20	289.00
5780	ATC720 HANDHELD	159.00
5781	RX40 HANDHELD	142.00
—	REVCO HANDHELD	248.00
5573	SONY ICF7600D	179.00

ANTENNA TUNERS		£
2320	ICOM AT500	399.00
2310	ICOM AT100	285.00
0510	YAESU FC757	231.50
0140	YAESU FC102	179.00
1555	TRIO AT250	273.01
0420	YAESU FC700	98.90
—	AMTEC 300	49.00
1460	TRIO AT930	145.00
5080	WELZ AC38	73.95

RECEIVER ANTENNA TUNERS		
1170	YAESU FRT7700	46.00
—	GLOBAL AT1000	46.00

TELE READERS CW & RTTY/AMTOR		
5280	TONO 550	299.00
5420	TASCO CWR610E	179.50
—	TONO 5000	795.00
5270	TONO 9100	695.00
4780	12" VDU GREEN/AMBER	89.00
4900	ICS AMTOR	265.00

POWER SUPPLIES		
0500	YAESU FP757	149.50
0505	YAESU FP757HD	162.50
0410	YAESU FP700	125.00
2110	ICOM ICPS15	119.00
2392	ICOM ICPS25	89.00
2006	ICOM ICPS35	149.00
5820	BNOS 25 AMP	138 00
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5800	BNOS 6 AMP	52.00
4680	DRAE 4 AMP	34.00
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5741	ALINCO ELH230D	69.00
—	ALINCO ELH230G	59.00
5742	ALINCO ELH260D	114.95

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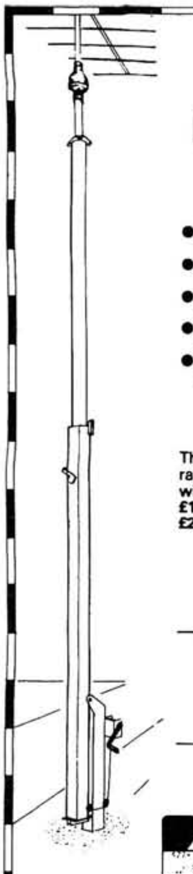

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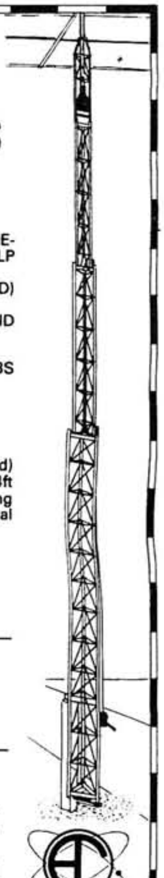

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Microwave Modules Ltd. Is a full time professional organisation, established over **15 years** ago in **1969**, and currently employs over **30 full time**, on site staff based in our two modern, purpose built factories. In addition, a similar number of 'Outworkers' are involved in assembly and mechanical operations.

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Our product range now exceeds **50 Individual items** in total and is the widest range available from any one manufacturing company. Our technical resources have enabled us to not only become **the largest** and **most successful** designer and manufacturer of R F Products, such as **Linear Amplifiers** and transverters, but also designers and manufacturers of **innovative** microprocessor and digital products such as **The Morsetalker**, MMSI, and the RTTY to TV decoder, MM2001.

ALL BRITISH . . .

Every product in our range is designed and manufactured in the UK by our own employees, and wherever possible British Components are utilised.

GUARANTEED . . .

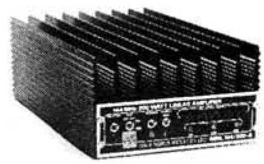
All Microwave Modules Products are **Fully Guaranteed for 12 months**. This includes all semi-conductors and **PA Transistors**. We have built our reputation around our customer service and back-up which is second to none.

OUR RANGE OF LINEAR AMPLIFIERS . . .

MML144/30-LS

MML144/50-S

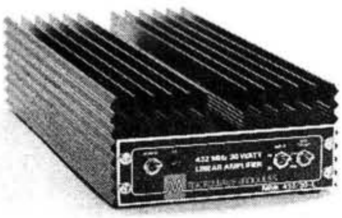
MML144/100-LS



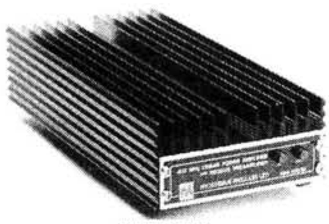
MML144/200-S

PRODUCT	INPUT POWER	OUTPUT POWER	MODES OF OPERATION	PRE AMPLIFIER GAIN	PRE AMPLIFIER NF	POWER REQUIREMENTS	RF* VOX	PRICE INC VAT
MML144/30-LS	1 or 3W	30W	SSB.			13.8V @ 4A	√	£75 (p&p inc £3)
MML144/50-S	10W	50W	FM.			13.8V @ 6A	√	£92 (p&p £3)
MML144/100-S	10W	100W		12dB	<1.5dB	13.8V @ 12A	√	£149.95 (p&p £3.50)
MML144/100-HS	25W	100W	AM.			13.8V @ 12A	√	£149.95 (p&p £3.50)
MML144/100-LS	1 or 3W	100W	CW.			13.8V @ 14A	√	£169.95 (p&p £3.50)
MML144/200-S	3, 10 or 25W	200W				13.8V @ 30A	√	£245 (p&p £4.50)

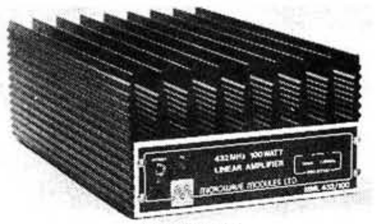
* THE RF VOX CAN BE OVERRIDDEN AND HARDWIRED



MML432/30-L



MML432/50



MML432/100

PRODUCT	INPUT POWER	OUTPUT POWER	MODES OF OPERATION	PRE AMPLIFIER GAIN	PRE AMPLIFIER NF	POWER REQUIREMENTS	RF* VOX	PRICE INC VAT
MML432/30-L	1 or 3W	30W	SSB.	12dB	2dB	13.8V @ 6A	√	£139.95 (p&p £3.50)
MML432/50	10W	50W	FM, AM, ATV.	12dB	2dB	13.8V @ 8A	√	£129.95 (p&p £3.50)
MML432/100	10W	100W	CW.	—	—	13.8V @ 20A	√	£245 (p&p £4.50)

* THE RF VOX CAN BE OVERRIDDEN AND HARDWIRED

CONNECTORS . . .

144MHz Products— Our standard connector on these products is SO239. We use a high quality PTFE socket of superior quality, but we are able to supply the choice of BNC or 'N' type at no extra charge. Please specify.

432MHz Products— The MML432/30-L is fitted with BNC connectors, 'N' type available, please specify. The MML432/50 and MML432/100 both have BNC input sockets and 'N' type output sockets. If this is not to your preference please specify when ordering.

DATA SHEETS . . .

A full printed data sheet is available on each product, and is free on request.

CATALOGUE . . .

A copy of our latest catalogue can be obtained by sending a large SAE (23p) or by sending 40p in stamps to the address below.

RALLIES & EXHIBITIONS . . .

We shall be attending most of the 1984 rallies and exhibitions. Come and see our products for yourself.

AVAILABILITY . . .

Our products are normally available from stock, either direct from ourselves or any of our 75 UK outlets.

ACCESS — BARCLAYCARD VISA

Goods normally despatched within 10 days

MICROWAVE MODULES (PW)
BROOKFIELD DRIVE, AINTREE, LIVERPOOL L9 7AN, ENGLAND
Telephone: 051-523 4011. Telex: 628608 MICRO G.
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MONDAY-FRIDAY
9-12.30, 1-5.00
E & O.E.

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These are high power 240V linears using 4C × 150 or 4C × 250 or 4C × 350 Eimac Tubes NOT using the grounded Grid system.
Fully protected, no thermal damage to PA finals possible.

DRESSLER AMPLIFIERS

D70cm 325wfm 500 PEP	£725.00
D200 2mtr 350wfm 600w PEP	£625.00
D200S 2mtr 400wfm 1KW D.C. in	£725.00
D200C 2mtr 100w. Few left at	£279.00

DRESSLER GASFET MASTHEAD PRE-AMPS

EVV 200 GAAS 750W SSB	£70
EVV 2000 GAAS 1KW SSB	£80
VV2 RPS SO259 receive only	£25
VV2 RPS 'N' TYPE receive only	£29
VV7 RPS SO259 receive only	£25
VV7 RPS 'N' TYPE receive only	£29
New V V 200 VOX 250W PEP VOX operated	£80
EVV 70 70cms 500W PEP	£80
VV INTERFACE FOR ABOVE	£21

The above pre-amplifiers have the following specifications 0.7-0.9 Db noise 0.2 Db insertion loss – 17-19 Db gain.

NOW MODELS WITH AN EVEN HIGHER INTERCEPT POINT

NEW FROM DRESSLER

ARA 30 ACTIVE RECEIVING ANTENNA. 1.2m long, fibre glass whip, 10 Db gain, mast mounted. Indoor or outdoor vertical omni-directional complete with 7m of coaxial cable P.S.U. and interface **£85.** Delivered Free. Also the **ASA 12,** masthead mounted coaxial 2 in 1 out switch 'N' type connectors. 1 Hz/Ghz, 1 kw PEP 0.15 Db insertion loss at 1 GHz. **£43.**

FT 726

NOW £770 inc. Satelite Board

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ICO2E LCD Push button up to 5W FM latest portable **£215**

£159 SPECIAL

IC 271

Inc. Mutek Board
£649.00

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AUTHORISED YAESU

F1 Gen. Coverage Tx/Rx
FT980 Gen. Cov. Cat System
FT507 Gen. Coverage
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FC102 A.T.U.
FV102 V.F.O.
SP102 Speaker
FT77 — NEW — inc. M/C
FP700
FC700
FTV700 D.M.
FRG7700 Gen. Coverage Rx
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FT290R with mods FM/SSB
FT208 2mtr portable FM
FT708 70cm portable FM
FT230 2mtr FM mobile
FT730 70cm FM mobile
FT216 16-20-70 (X Band)
FRV7700A 118-150
FRV7700B 50-60/118-150
FRV7700C 140-170
FRV7700D 70-80/118-150
FRT7700 Aerial Tuner
FRA7700 Active Antenna
FF5 Filter
MMB11 FT290 Car Mount
NC11C Charger
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FT203 New Model

FOR YOUR GIVE AWAYS AND THE VERY LATEST DRESSLER PRICES WHICH WON'T HURT YOUR POCKET 01-556 1415

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CNW419. 500W PEP. Gen. Coverage A.T.U.	£145.00
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AF606 P.L.L. Active filter	P.O.A.
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PS430 PSU	£110.00
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All Trio Kenwood equipment available from us carries a 1yr full warranty.

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See the new Standard C5800 Multimode 25W	
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TONNA

50 5 ele	£34.00
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HiMound HK702	£12.95
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PHONE DRESSLER FOR LATEST PRICE – 01-556 1415

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Q5000 Antor, CW, RTTY etc Complete with 12" VDU – green, amber or chocolate available.	£700.00
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CWR 670 Reader No VDU	£285.00
CWR 610 Basic model	£160.00
Q550 RTTY/CW Terminal	£280.00

SCANNING RECEIVERS

JIL SX200N	£285.00
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AOR 2001	
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JAYBEAM ANTENNA

All Jaybeam Antenna In Stock	P.O.A.

ALL ACCESSORIES AVAILABLE – PLUGS SKTS CO-AX 2MTR COLINEAR £33.00 70CM COLINEAR £33.00

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PRICES INCLUDE VAT AT THE PRESENT RATE OF 15%
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HIGH QUALITY MODULES FOR STEREO, MONO & OTHER AUDIO EQUIPMENT

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O/No.	POWER O/P R.M.S.	MAX SUP. VOLTAGE	PRICE
AL 30A	10 Watts	30V	**£4.95**
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Output current 2.5 Amps

O/No.	AC Input	Price
SPM 120/45	40-48V	**£8.05**
SPM 120/55	50-55V	**£8.05**
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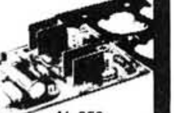
AL 250

Stereo
Pre-Amplifier

O/No.	Supply Vtg.	Price
PA 100	30/55V	**£18.50**

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O/No.		Price
MM 100	Suitable for Disco Mixer	**£14.75**
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Magnetic Cartridge Pre-Amplifier
O/No. MPA30. Sup Vtg. 20-30V. Price **£4.29**

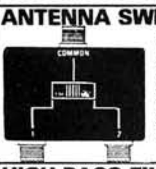
Monographic Equaliser
GE 100 MKII 10 Channel
OUR PRICE ONLY **£20.00**
Full Specifications and Data available on request. Please send self-addressed envelope.


GE 100 MKIII

PRECISION MORSE KEYS

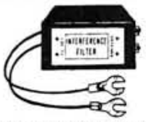
Well designed beginners key. Fully adjustable. Dims: Base 82mm × 45mm. O/No. VP 122. **£1.85**

ANTENNA SWITCH 2 and 3 WAY



Co-axial switch for one transceiver to two antennae or one antenna to two transceivers. Dims: 86 × 55 × 32mm (Body).
O/No. VP 113 **£4.50**
As above but 3-way.
O.No. VP 114 **£4.75**

HIGH PASS FILTER/SUPRESSOR



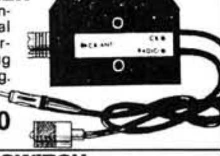
CB/TV. High pass filter. Reduces unwanted signals picked up by antenna. Dims: 45 × 25 × 17mm.
O/No. VP 115 **45p**

LOW PASS FILTER

Designed to reduce harmonics on the VHS and TV band.
Cut-off frequency: 30MHz.
V.S.W.R.: Less than 1.2 to 1.
Insertion loss: −0.2dB @ 27MHz
Impedance: 50ohms.
Dims: 80 × 55 × 40mm.
O/No. VP 116 **£2.75**

ANTENNA COUPLER

Transceiver/car radio antenna coupler. With co-axial cables. One co-axial terminates in antenna plug and the other in PL259 plug. Dims: 67 × 46 × 30mm.
O/No. VP 117 **£2.00**



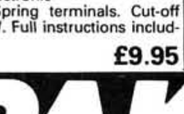
TAPE RECORDER SWITCH

Unit to control motor of tape recorder. 1.8m cord and 2.5mm plug attached. On/Off switch. Dims: 55 × 20 × 20mm.
O/No. VP 127 **£1.00**

DC-DC POWER SUPPLY

DC to DC adaptor. Plugs into car cigar lighter aperture. Output 3, 4.5, 6, 7.5, 9, 12V @ 800mA. Has universal output spider plug, also 9V battery snap and polarity reversing facility.
O/No. VP 119 **£2.45**

SPEAKER PROTECTOR

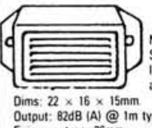


Limits voltage to speaker or to the permissible max., by automatically introducing a resistor in series with speakers. When excessive voltage is reduced the unit resets itself. Electronic voltage-sensing relay circuit. Spring terminals. Cut-off level adjustable from 10W-120W. Full instructions included. Dims: 85 × 74 × 25mm.
O/No. VP 118 **£9.95**

ELECT & PIEZO BUZZERS

PIEZO
Miniature round piezo-electronic buzzer. White plastic. Low consumption.
Frequency: 4kHz approx.
Output: 70dB (A) @ 1, typ.
Power: 12Vd.c. 4mA.
Dims: 22 (dia.) × 11.5mm.
Fixing Centres: 26.5mm.
O/No. VP 107
95p

PIEZO
Piezo buzzer. White plastic. 90mm leads. For use on a.c mains.
Frequency: 3.5kHz approx.
Output: 85dB (A) @ 1m typ.
Power: 240Va.c. 5mA.
Dims: 32 (dia.) × 14mm.
Fixing centres: 38mm.
O/No. VP 108
£1.15



ELECTRONIC
Miniature electronic buzzers. Solid state. Ivory plastic. 150 leads. Frequency: 500 Hz approx.
Dims: 22 × 16 × 15mm.
Output: 82dB (A) @ 1m typ.
Fixing centres: 26mm.
3V 25mA: O/No. VP 82. 6V 25mA: VP 83
9V 25mA: O/No. VP 84 12V 25mA: VP 86
80p each

SUB-BOX

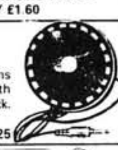
A neat swivelling disc provides close tolerance substitution resistors of 36 preferred values from 5ohms to 1Kohm. Simply fix clips into circuit and swivel until optimum result is achieved.
O/No. VP 112 £4.75

MINIATURE VICE

Miniature plastic and metal vice with strong suction base for portability. Single action to secure or release suction. Plastic jaws with rubber pads 20mm wide, open out to 40mm. Dims: 85 × 65 × 60mm approx.
FANTASTIC VALUE
O/No. VP 95 **ONLY £1.60**

LEARN A LINGO!
PILLOW SPEAKER

Slim under pillow unit. 8ohms 2" speaker. 1.5m lead with 3.5mm mono jack plug. Black. Dims: 65 (dia.) ×17mm.
O/No. VP 88 **£1.25**



METRIC & BRITISH MEASURES

Steel tapes in sturdy ABs plastic case. Silk wrist strap. These yellow coated convex tapes have inch and metric graduations. Automatic push-button return

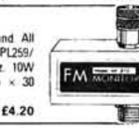
2m long × 13mm wide.	O/No. VP 89	**£1.00**
3m long × 13mm wide.	O/No. VP 90	**£1.50**
5m long × 16mm wide.	O/No. VP 91	**£2.00**

BATTERY TESTER

Tests all types of battery including standard, NICAD, Alkaline etc. Takes all standard sizes including 6V lantern batteries and watch/hearing aid cells. Also tests fuses and lamps by means of internal 9V (PP3) battery. Can also be used to recharge NICAD batteries by means of external 3-12Vd.c. power supply (not included).
Full instructions provided. Dims: 185 × 103 × 30mm (approx.)
O/No. VP 101 **£7.00**

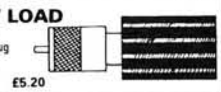
FM MONITOR

FM monitor for 2 metre band. All metal. Attached earphone. PL259/SO239 connectors. 144MHz. 10W maximum. Dims: (Body) 55 × 30 × 23mm
O/No. VP 120 **£4.20**



DUMMY LOAD

50 ohms. 30W.
UHF co-axial plug fitting (PL259).
O/No. VP 121 **£5.20**



PICK-UP COIL

Large telephone pick-up coil for high sensitivity. Suction pad to stick to telephone. 90cm lead to 3.5 jack plug. Connects direct to cassette recorder. Dims: 32 (dia.) × 17mm (body) 36mm (dia.) sucker. **£1.00**
O/No. VP 87

VALUE PACKS

Pak No.	Qty	Description	Price
VP1	300	Assorted Resistors Mixed Types	£1.00
VP2	300	CarbonR esistors ¼-½ Watt Pre-Formed	£1.00
VP3	200		£1.00
VP4	150	½ Watt Resistors 100 ohm-1M Mixed	£1.00
VP5	200	Assorted Capacitors All Types	£1.00
VP6	200	Ceramic Caps Miniature - Mixed	£1.00
VP7	100	Mixed Ceramics Disc. 1pf - 56pf	£1.00
VP8	100	Mixed Ceramic Disc. 68pf - .015pf	£1.00
VP9	100	Assorted Polyester/Polystyrene Caps	£1.00
VP10	60	C280 Type Caps Metal Foil Mixed	£1.00
VP11	100	Electrolytics - All Sorts	£1.00
VP12	60	Bead Type Polystyrene Min Caps	£1.00
VP13	50	Silver Mica Caps Ass. 5.6pf - 150pf	£1.00
VP14	50	Silver Mica Caps Ass. 180pf - 4700pf	£1.00
VP15	50	High Voltage Disc Ceramic 750v - 8Kv Mixed	£1.00
VP16	50	Wirewound Res. 9W (avg) Ass. 1 ohm - 12K	£1.00
VP17	50	Metres PVC Covered Single Strand Wire Mixed Colours	£1.00
VP18	30	Metres PVC Covered Multi Strand Wire Mixed Colours	£1.00
VP19	40	Metres PVC Single/Multi Strand Hook-Up Wire Mixed	£1.00
VP20	6	Rocker Switches 5 Amp 240v	£1.00
VP21	20	Pcs. 1 - 2 & 4 mm Plugs & Sockets Matching Sizes	£1.00
VP22	200	Sq. Inches Total Copper Clad Board Mixed Sizes	£1.00
VP23	20	Assorted Slider Pots. Mixed Values	£1.00
VP24	10	Slider Pots. 40 mm 22K 5 × Log. 5 × Lin	£1.00
VP25	10	Sld er Pots. 40 mm 47K 5 × Log. 5 × Lin	£1.00
VP26	20	Small .125" Red LED'S	£1.00
VP27	20	Large .2" Red LED'S	£1.00
VP28	10	Rectangular .2" Green LED'S	£1.00
VP29	30	Ass. Zener Diodes 250mW - 2W Mixed Vlts. Coded	£1.00
VP30	10	Ass. 10W Zener Diodes Mixed Vlts. Coded	£1.00
VP31	10	5 Amp SCR's TO-66 50-400v Coded	£1.00
VP32	20	3 Amp SCR's TO-66 Up To 400v Uncoded	£1.00
VP33	200	Sil. Diodes Switching Like IN4148 DO-35	£1.00
VP34	200	Sil. Diodes Gen. Purpose Like OA200/BAX13/16	£1.00
VP35	50	1 Amp IN4000 Series Sil. Diodes Uncoded All Good	£1.00
VP36	8	Bridge Rects. 4 × 1 Amp 4 × 2 Amp Mixed Vlts. Coded	£1.00
VP37	8	Black Instrument Type Knobs With Pointer ¼" Std	£1.00
VP42	10	Black Heatsinks To Fit TO-3, TO-220 Ready Drilled	£1.00
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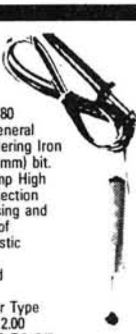

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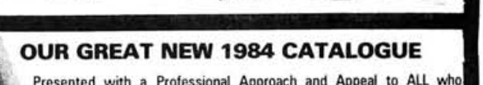

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PW Comment

Availability

MORE AND MORE OF OUR READERS seem to be having problems in getting hold of their monthly copy of *Practical Wireless,* to judge from complaints arriving in my postbag and from comments at exhibitions and rallies. We always follow these up, providing the necessary details of dates and name and address of the newsagent concerned are given, but where the smaller shops are concerned it usually comes down to lack of shelf-space for "specialist" publications like ours, battling against the flood of computer magazines. There are over a hundred computer titles now available in the UK, though not all of them are on the magazine shelves, thank goodness.

Incidentally, it's no good chasing a newsagent for back numbers of *Practical Wireless.* When the new issue comes out, any remaining from the previous month are withdrawn from the newsagents and from the wholesalers' warehouses, and the newsagent can't get hold of them any more. Instead, write to our Post Sales Department as mentioned under "Back Numbers and Binders" below.

If you are having difficulty finding *PW* each month, you should be able to get round it by placing a firm order with the newsagent. If that's not convenient, taking out a subscription will bring your copy of the magazine dropping through your letter-box each month. For rates and where to write, see under "Subscriptions" below.

★ ★ ★ ★ ★ ★

"Where can I get printed circuit boards for *PW* projects?" is a query that seems to feature often in phone-calls and letters.

A quick read through the advertisement pages of recent issues reveals the answer—two firms, namely C Bowes Electronics Ltd and Proto Design, have been offering p.c.b.s for our designs for some years, and other companies may be added to that list from time to time. If the board you want isn't listed, a call to either firm will bring you details.

Remember—all our advertisements are there as a service to you, the reader. Please do read them and make use of them.

Geoff Arnold

PW Services

QUERIES

While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the **Editor, "Practical Wireless", Westover House, West Quay Road, Poole, Dorset BH15 1JG,** giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the "Buying Guide" box included in each constructional article.

PROJECT COST

The approximate cost quoted in each constructional article includes the box or case used for the prototype. For some projects the type of case may be critical; if so this will be mentioned in the Buying Guide.

INSURANCE

Turn to the following page for details of the PW Radio Users Insurance Scheme, exclusive to our readers.

CONSTRUCTION RATING

Each constructional project will in future be 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. Generally this category will be used for simple projects, but sometimes for more complicated ones of wide appeal. In this case, construction and wiring will be dealt with in some detail.

Intermediate

A project likely to appeal to a wide range of constructors, and requiring only basic test equipment to complete any tests and adjustments. A fair degree of experience in building electronic or radio projects is assumed.

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. Constructional information will generally be limited to the more critical aspects of the project. Definitely not recommended for a beginner to tackle on his own.

SUBSCRIPTIONS

Subscriptions are available at £13 per annum to UK addresses and £14 overseas, from **"Practical Wireless" Subscription Department, Room 2816, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

BACK NUMBERS AND BINDERS

Limited stocks of some recent issues of *PW* are available at £1 each, including post and packing to addresses at home and overseas.

Binders are available (Price £5.50 to UK addresses, £5.75 overseas, including post and packing) each accommodating one volume of *PW.* Please state the year and volume number for which the binder is required.

Send your orders to **Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.** All prices include VAT where appropriate.

Please make cheques, postal orders, etc., payable to IPC Magazines Limited.

Radio and Electronics Fair

The West Kent Amateur Radio Society will hold a Radio and Electronics Fair at the Royal Victoria Hall, Southborough (between Tonbridge and Tunbridge Wells) on Saturday, 21 July 1984, and doors will be open to the public from 10.30am to 5.00pm. Adequate car parking facilities are available nearby.

All available exhibition space has been sold and the organisers anticipate a very large attendance of people interested in electronic based hobbies, which will include amateur radio, computers, viewdata, electronic construction and video games.

To celebrate the holding of the Fair, WKARS will be operating two special event stations, GB0WKS and GB2WKS, from 22 June until 20 July. GB2WKS will also be used, at the Fair, as a demonstration and talk-in station.

Further information from: *The Event Organiser, Dave Green G4OTV, 13 Culverden Down, Tunbridge Wells, Kent. Tel: (0892) 28275.*

Irish Radio Transmitters' Society

The Annual General Meeting of the above society took place on Sunday 29 April 1984, at the Metropole Hotel, Cork City.

The AGM was preceded on the Saturday by the Annual Banquet, where the guest speaker was Owen Curtin, Deputy Lord Mayor of Cork.

Both functions were very well attended and the Cork Radio Club ran a special event station with talk-in on 144MHz.

At the Banquet l-r: John Cooney EI3[illegible], Treasurer; Paul Martin EI2CA, Vice-President; Tom O'Connor EI9U, National President; Cllr. Owen Curtin, Deputy Lord Mayor of Cork and Con Hunter EI9V, Secretary

Photo: Mike Hoare EI9FE

Insurance

Readers who are interested in applying to the *PW Radio Users Insurance Scheme* are advised to use the coupon published on page 18 of last month's issue.

Ambit becomes Cirkit

Ambit International (Broadcasting Limited), Solent Component Supplies, Broxlea Limited and Projex Distribution—which represent the electronics distribution and custom manufacturing activities of A. F. Bulgin & Company PLC—were renamed Cirkit from 1 May 1984 as the first stage in a major development programme.

The move is intended to provide industry and the home-user with a comprehensive and efficient one-stop service including the supply of latest high-technology components, modules and service aids, plus a custom manufacturing and test facility.

Cirkit's headquarters are located at Park Lane, Broxbourne, Hertfordshire, where a substantial investment has been made in communication and data processing equipment to ensure that customer requirements are serviced quickly and efficiently. There are also branches at Portsmouth, Croydon and Brentwood.

More than 10 000 product lines are stocked by Cirkit, and later this year the company will publish its first consolidated catalogue to replace the present Ambit, Solent and Projex publications.

Among Cirkit's exclusive UK agencies are Alps, claimed to be the world's largest manufacturer of electromechanical devices and Toko, a world leader in wound components. Cirkit is expanding its share of the growing home-user market through mail-order and retail outlets. A new range of graded kits and modules has been introduced as a part of this programme. These enable electronics to be applied to a wide variety of everyday applications and cater for beginners as well as experts.

On the Move

Arrow Electronics Ltd. have moved to new and larger premises at Hatfield Peverel in Essex.

The new showroom, which opened on 30 March 1984, saw almost 500 customers through its doors on the opening day, who came to look round the enormous stock of competitively priced stock Arrow carry, and to join the Directors in a goodwill toast to the new enterprise.

For further information, contact: *Arrow Electronics Ltd., 5 The Street, Hatfield Peverel, Nr. Chelmsford, Essex CM8 3YL. Tel: (0245) 381673 and 381626.*

ATV Group

The Home Counties Amateur Television Group meet at Richings Park Sports and Social Club, Iver, Buckinghamshire, at 8.30pm every fourth Wednesday in the month.

This versatile group operate both slow and fast scan monochrome and colour television on the h.f. bands, as well as the 430MHz, 1·3GHz and 10GHz bands.

Their next meeting is on 25 July, when visitors will be very welcome.

Further details from: *P. W. Andrews G6MNJ, 4 Greensward, Kings Court, Ashfield Avenue, Bushey, Herts. WD2 3HQ.*

Are Lowes at it again?

Readers of this column will be aware that recently Lowe Electronics have been expanding and opening new branches throughout the UK.

We hear through the grapevine that David Monkhouse, Lowe's AR man, has been observed recently, with a bundle of plans under his arm, at shop premises at 223/225 Field End Road, Eastcote, Middlesex (next to Eastcote tube station). Is this to be the location of their new shop when they move from their Pentonville premises?

Whilst on the subject of Lowe Electronics, I understand that they have been selected by Trio as distributors of the Trio range of PMR (Private Mobile Radio) equipment, and those parties interested in dealerships are invited to contact: *Lowe Electronics, Bentley Bridge, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2430 and 2817.*

50MHz News

We understand that around the time this issue of PW is published, the 50MHz beacon GB3NHQ (GB3 New H Q) located at the RSGB building in Potters Bar, should come on-air on a 24-hour basis—subject to DTI approval.

The beacon has been air tested recently and these tests were monitored by stations within the UK, which resulted in reports of good reception throughout southern/midlands UK, with tropo enhancement into Wales and meteor scatter pings/bursts into Scotland.

When operational the beacon, on 50·050MHz, will transmit the f.s.k. callsign routine, followed by the full 6-figure Maidenhead system locator reference. No doubt all reports will be very welcome at RSGB HQ.

RSGB, Alma House, Cranborne Road, Potters Bar, Herts, EN6 3JN. Tel: (0707) 59015.

UOSAT-2—The Phoenix Rises!

With the ink hardly dry on the July issue of *PW* the very good news that UOSAT-2 was still alive and beginning to start kicking again arrived via a missive from AMSAT UK Hon. Sec., Ron Broadbent G3AAJ.

Once again, following extensive efforts to track and detect emissions from UOSAT-2, the Stanford Research International team were contacted by UOS and asked for high level assistance. (This team of professional "amateurs" was responsible for the previous recovery of UOSAT-1/OSCAR-9).

As reception of the 145·825MHz general beacon had been unsuccessful (including a spell at Jodrell Bank) the SRI team considered looking for other identifiable emissions from the spacecraft. From information provided by UOS the team's efforts concentrated on approx 1·2GHz—the frequency of the microwave command receiver local oscillator. This device runs at a level of +7dBm and feeds a mixer which affords some 30dB of isolation. By estimating the likely level of radiated local oscillator signal allowing for path loss it was hoped that sufficient signal could be detected on the ground. A 30m SRI dish antenna located at Sondre Stromfjord, Greenland, normally used for experimental L-band radar, was used in conjunction with a 50K noise temperature receiver. Signals were obtained twice during 11 May, exhibiting characteristic Doppler shift. Not only was this reception an incredible feat in itself, to make it happen required the dish to be slewed at high rate—something that it was not designed for. So to overcome this and to verify it was the correct object, coordinates were obtained from a NASA visual tracking facility and the dish set so that UOSAT-2 would pass through its extremely narrow beamwidth which it subsequently did literally in a matter of moments! Given the good news UOS attempted to command the spacecraft using the 144MHz uplink at 10.24GMT on 14 May, still with no response. A second attempt was made at 11.01GMT using the 438MHz uplink, resulting in recommencement of the 145·825MHz beacon at 11.05. At the time this was written (18.5.84), the 144MHz beacon is working at the same level as its initial switch on. Telemetry data has been more encouraging and indicates the general status to be good and the craft spinning. No attempts will be made to stabilise the spacecraft until a thorough investigation of the 11-week hibernation is completed. All ground station monitoring reports will be welcomed by UOS.

Welcome back UOSAT-2 and another big thank-you to Bob Leonard KD6DG and the team at SRI, definitely another "pints all round" job.

Special Event Station

On behalf of the RNARS, members of the Yeovil Amateur Radio Club will be operating a special event station, callsign GB2FAA, at the Air Display—Open of the Fleet Air Arm Establishment at HMS Heron, Yeovilton, Somerset, on Saturday 4 August, 1984.

The Establishment is located between Sparkford and Ilchester on the A303 and further details can be obtained from: *G3BEC, QTHR.*

Marconi win US Order

Marconi Communications Systems have secured a very significant order to supply a complete radio communications system to the United States Navy. Won against fierce US competition, the contract is expected to be worth about US $15 million.

The equipment to be supplied is a version of the already well-proven ICS3 radio—already fitted in 41 European naval ships—which will be installed in the LHD-1, the first of a new class of amphibious landing assault ships.

This will be the first time a British company, in this case Marconi Communication Systems Ltd., has been selected to supply such a complete radio communications system to the United States Navy.

Mobile Radio—The Future

The DTI published a green paper on May 23 which, following on from the earlier accepted Merriman Report, sets down several key issues relating to the future use of the vacated TV bands I (41–68MHz) and III (174–225MHz). Comments on this consultative document are invited before the end of July in order to allow a full evaluation of any future awards to mobile radio.

If the government go ahead and release this spectrum for mobile use it will amount to probably the largest ever addition to this UK service, effectively doubling the capacity. At least 1000 channels could become available in London within the old Band III alone.

Government thinking currently suggests that "service providers"—companies offering communications services to others, would be the most appropriate major operators in the new allocations. Many facts are presented in the paper—for instance the two already licensed 900MHz cellular operators must have achieved virtually (90%) national coverage for mobile telephones by 1989. A new block of spectrum should be made available to act as a stimulus for new technology—the government propose part of Band III for single sideband and time division code multiplexing techniques, since in their words "these offer the means of meeting future growth in demands for radio communication". Companies with an interest in developing advanced systems are asked to put forward their proposals.

Of specific interest to the radio amateur is a reference made towards the back of the 41-page document which again says "The interim Merriman report recommended that, subject to the detailed planning of Banu I, the radio amateur service should be given an allocation in the 50–54MHz band. The size and location of any allocation to the amateur service will depend in large part upon the demands from other users for the band but it seems probable that an allocation within 50–52MHz would be made. (It would be possible for any initial allocation to be larger than the long-term allocation to the radio amateurs, given that the use of Band I would probably develop over a period.) Keep your fingers crossed folks!

As a final on this item it is planned to exempt a range of "low power devices" in certain specific bands from the requirement to obtain wireless telegraphy licences. One of the reasons quoted for doing this is to make it possible for people to have access legally and without unnecessary bureaucracy, to low power devices that have a minimal potential for causing interference to users. Many devices of this type operate at about 49MHz and it would seem appropriate to set aside a small band to be used with a minimum of restriction by low power devices. Has the horse bolted already?

Comments on this green paper, which is available for £4.15 from HMSO, should be addressed to the *Radio Regulatory Division, Department of Trade and Industry, Room 713, Waterloo Bridge House, Waterloo Road, London SE1 8UA* by the end of July 1984.

an introduction to Antennas

Part 1 by Gordon J. King T.Eng(CEI), AMIERE, G4VFV

A radio signal is part of the electromagnetic wave family—like light, infra-red, X-rays, etc—and can be regarded as a form of dynamic energy. It has the astonishingly high velocity of 300 000km/s which means that it will travel 300m in 1μs. Nothing can travel faster than an electromagnetic wave—nothing, that is, which we know of at the present? It is called an electromagnetic wave because it consists of two intrinsically linked component parts—an electric field and a magnetic field—which have the ability to exist in a vacuum without any conductive supporting medium. The velocity of wave travel just given, in fact, applies to space travel.

The carrier wave is generated by a powerful oscillator and the energy is launched into space by the transmitting antenna. The electric and magnetic components are perpendicular to each other and to the direction of wave travel. This means that an electromagnetic wave is a transverse wave as distinct from the longitudinal type of wave, such as a sound wave whose supporting particles vibrate in the same direction as the wave travels.

In Fig. 1.1(a) I have attempted to give an impression of an electromagnetic wavefront advancing towards you out of the page, while Fig. 1.1(b) gives a rough idea of how the electric and magnetic components effectively link together at right-angles on their trip through space. The two components, of course, are alternating in polarity at the carrier frequency of the radio signal. Let us consider the wave starting on an alternating electric field. This automatically creates an alternating magnetic field which then produces an alternating electric field, and so on, each one being at right-angles to the other as the wave spreads out into space.

Near the transmitting antenna the electric and magnetic fields alternate 90 degrees out of phase with each other, but as the wave spreads away from the antenna and the wave becomes what is known as a plane wave, so the two components get into step and remain that way. An electromagnetic wave can thus be looked upon as a sinewave. This, of course, applies to the carrier wave part of the radio signal. Unless a pure tone is being carried by the wave the audio information will be far removed from a simple sinewave. I will go into this modulation business later.

Frequency and Wavelength

Let us suppose that the radio signal falls in the very high frequency (v.h.f.) f.m. band (Band II) at say, 96MHz. This means that the vibration rate or frequency of the carrier wave is 96 million times per second—obviously, far too fast for human ears to detect—and we can represent it by a sinewave as shown in Fig. 1.2. Now, the distance occupied in space by one cycle of this signal is equal to the velocity in space divided by the frequency. When the frequency is given in MHz, the formula merely resolves to:

$$\text{wavelength } (\lambda) = \frac{300}{\text{frequency (f)MHz}} \text{ metres}$$

You will see from this that the distance occupied in space by one cycle has now been called wavelength since wavelength is, in fact, equivalent to one complete cycle, as shown on Fig. 1.2.

In radio antenna applications we often work in sub-multiples of wavelength such as $\lambda/2$ and $\lambda/4$, where you will have noticed that the term wavelength is signified by the Greek letter lambda (λ). Frequency is denoted by the lower case f while wavelength is given in metres (m) or sub-multiples thereof. Using the above formula, therefore, we find that our v.h.f. f.m. signal at 96MHz has a wavelength of 300/96 which works out to 3·125m. The $\lambda/2$ is thus close to 1·56m and the $\lambda/4$ close to 0·78m. It is very important to remember that these apply to the radio signal in space. When a radio signal travels through an an-

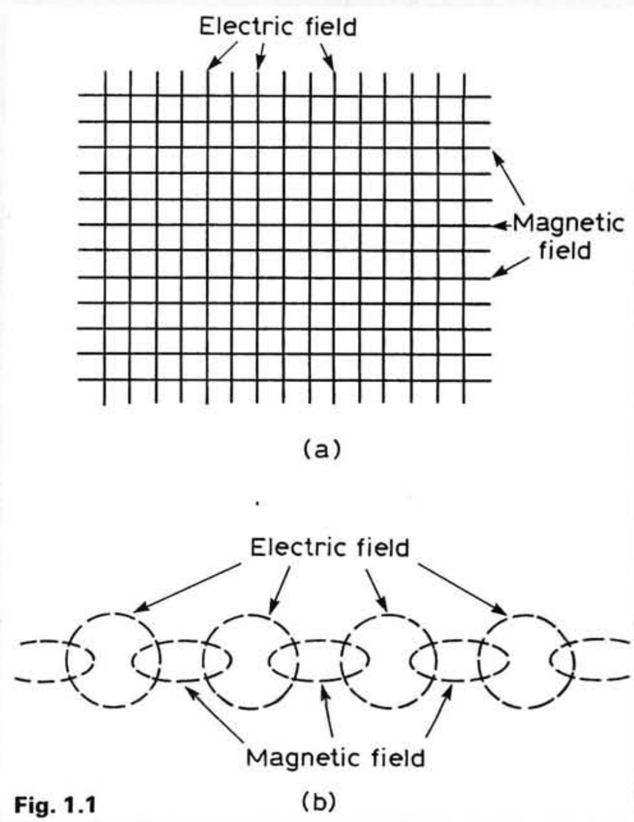


Fig. 1.1

tenna conductor or along a feeder then its velocity is reduced from the space value by factor v which is known as the velocity factor, more about which anon. Anyway, knowing either λ or f we can easily find the other for example,

$$f(\text{MHz}) = \frac{300}{\lambda(\text{m})}$$

Radio Wavebands

Table 1.1 lists the various radio wavebands with their frequencies and wavelengths. For "entertainment" radio we are mostly interested in the f.m. v.h.f. part of the spectrum which so far extends from about 88 to 108MHz (3·4 to 2·7m). If we have a tuner with a.m. bands then we might also be interested in the long waveband (l.w.) from about 150 to 285kHz (2000 to 1185m) and the medium waveband (m.w.) from about 535 to 1600kHz (560 to 187m). Some tuners, especially those destined for overseas markets, are also equipped with an h.f. (high frequency) band or bands, the full scope of h.f. extending from 3 to 30MHz (100 to 10m), as shown in Table 1.1, and sometimes called the short waveband. The range of a radio signal is influenced both by its frequency or wavelength and the nature of the lower and upper atmospheres above the earth's surface; but before we delve into this let's get some clearance on modulation.

Table 1.1

Band	Frequency Range	Wavelength	Definition
v.l.f.	3 to 30kHz	100k to 10km	myriametric
l.f.	30 to 300kHz	10k to 1km	kilometric
m.f.	300 to 3000kHz	1000 to 100m	hectometric
h.f.	3 to 30MHz	100 to 10m	decametric
v.h.f.	30 to 300MHz	10 to 1m	metric
u.h.f.	300 to 3000MHz	1 to 0·1m	decimetric
s.h.f.	3 to 30GHz	10 to 1cm	centimetric
e.h.f.	30 to 300GHz	1 to 0·1cm	millimetric
	300 to 3000GHz	0·1 to 0·01cm	decimillimetric

Modulation

The part of the radio signal which carries the audio information is, as we have seen, the electromagnetic carrier wave. The audio signal can be applied to this in various ways, but the two ways in which we are most interested are by varying the amplitude of the wave and by varying its frequency slightly either side of the mean carrier frequency. The first is called amplitude modulation (a.m.) and the second frequency modulation (f.m.).

Amplitude modulation is used on the signal in the long, medium and short wavebands, though there are a.m. stations transmitting in the higher frequency bands. What happens is that after the carrier wave has been generated the audio information is super-imposed upon it in such a way that the amplitude of the wave is caused to alter in sympathy with the audio. Let's suppose that the audio is a pure tone, represented by a sinewave, then the carrier plus the modulation gives rise to the nature of the signal shown in Fig. 1.3(a). When frequency modulated the amplitude of the carrier remains constant but this time the frequency of the carrier itself deviates slightly either side of its nominal value by an amount corresponding to the intensity of the sound being carried and at a rate corresponding to its frequency. The rate of deviation is thus greater for a modulating signal of 10kHz than one of 1kHz, while the extent of the deviation is greater for a loud signal than a soft one. The modulation index, as it is called, is equal to the frequency of deviation divided by the frequency of the modulation or:

$$\text{Modulation index (M)} = \frac{f_d}{f_m}$$

The f.m. case is shown in Fig. 1.3(b) and it is the modulation index (M) which determines the sideband structure of the net signal in a somewhat complex mathematical manner. It is obviously outside the scope of this particular series of articles to delve deeply into the

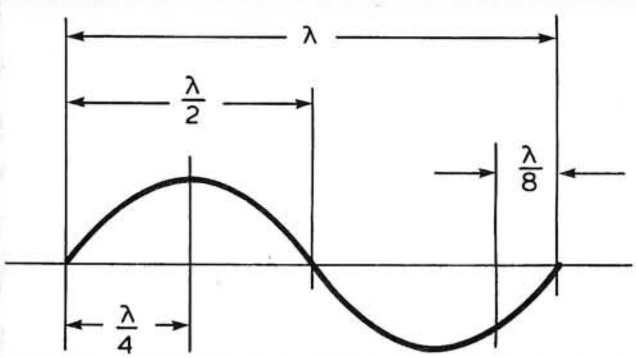


Fig. 1.2

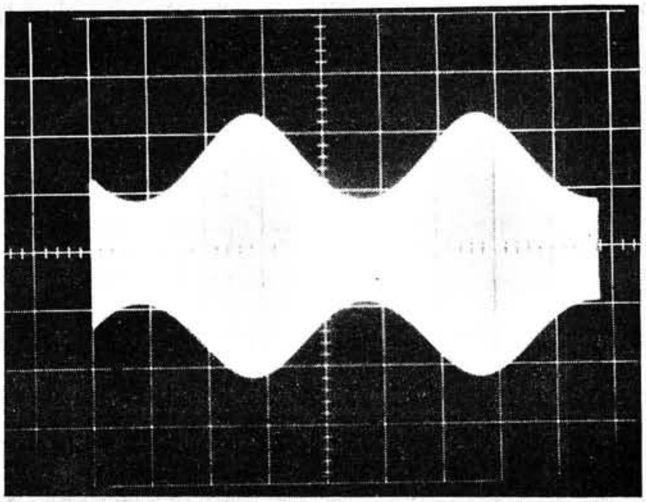
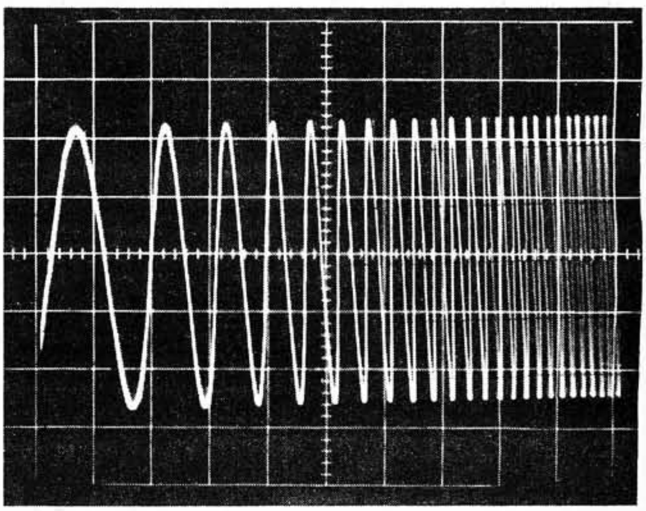


Fig. 1.3(a) ▲

▼ Fig. 1.3(b)



mathematics of modulation; but if we have a pure audio signal of say, 1kHz amplitude modulating a carrier wave of frequency f then the net signal can be analysed to reveal the carrier at f and two sidebands, the lower at f −1kHz and the upper at f + 1kHz. Sideband amplitude depends on the modulation depth, each being half the amplitude of the carrier when the modulation is 100 per cent (when the troughs of the top and bottom modulation envelopes meet) and non-distorting.

The maximum modulation on Band II is fixed at ±75kHz deviation so that M would be around 5 assuming an upper frequency response at 15kHz, though this can be modified by pre-emphasis, the quality of the programme material and by the stereo sub-channel components. However, instead of the one pair of a.m. sidebands, our 1kHz modulating frequency in the f.m. case produces multiple pairs of sidebands either side of f at ±1kHz, f±2kHz, f±3kHz etc (all spaced from each other by 1kHz, the modulating frequency). These spread quite a long way from f depending on the modulating signal itself (eg M), and their amplitudes are also influenced by M. Fig. 1.4(a) shows a pair of a.m. sidebands, while (b) shows a lab spectrogram of the multiple sidebands of an f.m. stereo signal.

The bandwidth required by an a.m. signal is thus less than that required by an f.m. signal when both are modulated with the same audio. If we modulate to, say, 15kHz on a.m. we can get away with a bandwidth of 2×15kHz, or 30kHz, while on f.m. for the same modulating frequency we require a band width of 200kHz or more at ±75kHz deviation, especially in stereo mode,

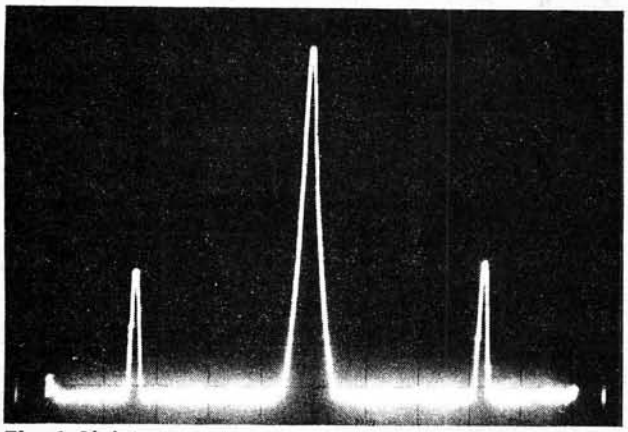


Fig. 1.4(a) ▲

▼ Fig. 1.4(b)

and even then we may not be fully embracing *all* the upper-order pairs of sidebands, but fortunately we do not need to bother too much about the least significant sideband pairs as they do not contribute much to the audio quality, anyway.

You can appreciate now that it would be impossible to fit a viable number of f.m. stations into the l.w. and m.w. bands, which is the reason why v.h.f. is used for f.m. where there is much more elbow room. Channel spacing is 200kHz f.m. and only 9kHz a.m. so now you can also understand why it is impossible to achieve hi-fi results on the l.w. and m.w./a.m. system since 9kHz bandwidth implies an upper frequency audio response around 4·5kHz, which is hardly hi-fi! Frequency modulation also has other attributes, including enhanced signal/noise ratio and hence dynamic range, capture effect where the tuner is "captured" by the stronger of two signals on or near the same frequency when the wanted one is only slightly stronger than the unwanted one (on a.m. this would cause an annoying whistle) and, of course, the prevailing capability of stereo reproduction—though this is also possible on a.m.

Reflected, Refracted, Diffracted

It is useful to see where the "radio" bands reside in the overall electromagnetic wave spectrum, and for this I have included the simplified diagram in Fig. 1.5. As a radio wave approaches the wavelength of light so it behaves more and more like light. That is, it is reflected, refracted, diffracted and has a tendency to cause shadows behind large objects—not visible ones, of course, but radio shadows as they are called where radio reception is cut off. To some extent these characteristics are demonstrated at v.h.f. which we use for f.m., they are demonstrated more dramatically at u.h.f. the frequencies we use for TV, and even more so at s.h.f. and e.h.f. (standing for ultra high frequency, super high frequency and extremely high frequency).

Propagation

This, then, neatly brings us to the topic of propagation. This again is highly mathematical and somewhat abstract so I do hope the more knowledgeable readers will forgive my venture into simplification. A radio signal emanates from a transmitting antenna as an expanding sphere of electromagnetic energy, though the design of the antenna may be such to concentrate the energy more in one direction than others round the compass, perhaps to elevate it skywards or to concentrate it in a "beam" more or less horizontal to the ground.

Just how the signal is propagated depends on its frequency and hence wavelength, the conductivity of the terrain or water over which the signal is passing, the release of electrons by ionisation of the gases of the earth's outer atmosphere due to ultra-violet (u.v.) radiation from the sun and hence the conditions prevailing on the sun, time of day, time of year, and the earth's local atmosphere (troposphere) as dictated by the weather conditions.

Our planet is protected (fortunately!) by a gaseous atmosphere extending to a height of about 1000km above its surface which has the highly desirable effect of filtering out excessive u.v. radiation. Sadly, so it is being inferred, we earth inhabitants are tending to destroy this filtration by different kinds of pollution with the effect of a rise in u.v. emission at the surface of the earth, a change in the weather pattern and so I would forecast, a probable change in radio wave propagation which I can't help feeling I am beginning to detect already.

The Ionosphere

The u.v. emission from the sun alters over an 11-year cycle which is denoted by the so-called sun-spot number (though is now seems that the cycle is longer than this). When the sun-spot number is at its peak the u.v. emission strengthens the ionisation, the electron density and hence the degree by which the ionosphere, as it is called, returns radio signals back to earth. Sunspot cycles have been recorded for many years and the average number works out to about 120.

Ionisation is negligible in the earth's lower atmosphere but reaches a value sufficient to affect radio waves at a height approaching 100km. The ionisation is brought about by the solar radiation—u.v. radiation and X-ray radiation—stripping the electrons from the atoms of the rarefied gases. A relatively high value of ionisation is maintained up to about 300 to 500km, the electron density then tapering off with increasing height. Rather than being held in a thick band, the ionisation separates into defined regions, called layers, at different heights. Each layer has a changing electron density whose most dense region is known as the peak of the layer. This maxima or peak may not be at the centre of the layer and neither does the ionisation vanish completely between the so-called layers.

The degree of the ionisation is almost wholly governed by the intensity of the u.v. radiation from the sun, and different wavelengths of radiation ionise different gases. The u.v. radiation is progressively absorbed owing to energy lost in the production of the ionisation as the radiation passes down through the atmosphere so by the time it reaches the earth's surface it is almost completely filtered out. Recombination of the ions and free electrons is relatively slow at the higher reaches of the atmosphere owing to the scarcity of gas molecules, but closer to the earth's surface gas molecules are more abundant so here recombination happens quickly—the atoms soon being returned to neutrality.

The layers are conventionally labelled D, E and F with increasing height, and during daylight hours the F region divides into two layers—the lower called F1 and the higher F2. The D layer, whose height is around 50km, is only present during daylight hours and this applies also essentially to the E layer, whose height falls around 100 to 150km, though less active E layer ionisation is also detected at night at m.f.; but in essence, because of fairly speedy recombination, the E layer can only hold a high level of ionisation when in sunlight, its effect on radio propagation tailing off quite significantly when the sun sets on the layer which, at 100km, is about 30 minutes after local sunset.

Intermittent ionisation also occurs in thin layers of about 2km or less embedded in the E region. It is of an irregular and patchy makeup and can spread over a range to about 2000km. Its level of ionisation is greater than that of the normal E layer and it has the characteristic of being opaque to the lower h.f. waves while partially reflecting the upper h.f. waves—and sometimes v.h.f. waves as well. Because of its intermittent nature it is called sporadic E (E_s or sp–E). Although it can support night-time h.f. signals it is mostly active during the daylight hours of summer.

The F layer is the highest of all the layers and extends from around 150km to 800km or more. It is present both during daylight and night-time hours but, as already noted, splits into two distinct layers during the daylight hours. The F1 layer has a nominal peak around 200km and holds fairly steady at this height summer and winter.

The Troposphere

The earth's lower atmosphere or troposphere as it is called also has an influence on the propagation of radio waves, especially at frequencies at upper h.f., v.h.f. and above. The temperature of the troposphere decreases with height at the rate of 6°C/km down to about −55°C. This is because the air near the earth is not heated by the sun but by convection currents from the heated earth. The drop in temperature results from the adiabatic expansion of the air as it moves into decreasing pressure with increasing height.

The troposphere where our weather conditions develop extends to a ceiling of about 10km. Owing to the variation of temperature, pressure and moisture content with height upper h.f., v.h.f. and radio waves of higher frequency are refracted over a greater distance than explained by the

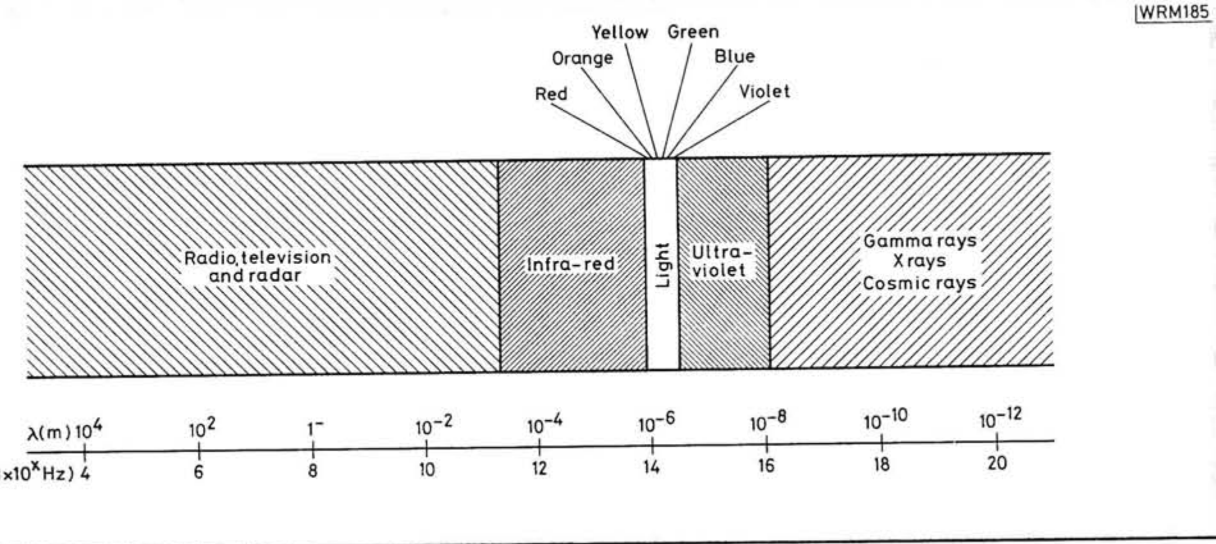


Fig. 1.5

geometric horizon distance between the transmitting and receiving aerials, which is equivalent to assuming that the earth's radius is increased by a factor k.

The ionosphere itself becomes progressively more transparent to waves of these frequencies which means that they pass through the layers into the outer space beyond so that propagation then becomes essentially tropospheric. Maximum possible distance (d_m) for direct-ray transmission can be expressed as:

$$d_m = 3{\cdot}565k(\sqrt{h_t} + \sqrt{h_r})$$

where d_m is in km, h_t and h_r the heights of the transmitting and receiving antennas respectively in m and k the factor expressing the apparent increase in the earth's radius. For a homogeneous atmosphere k is around 1·33, but it can increase above this value under certain weather conditions thereby propagating the direct-ray signal further. For example, when the barometric pressure starts to fall after a spell of steady anticyclonic pressure the k factor can rise dramatically and bring in relatively long-distance signals.

Irregularities

Moreover, the temperature, pressure and moisture content can vary from point to point and with time thereby producing irregularities in the refractive index which, especially when elevated, can scatter signals over large distances.

Another distance enhancing factor is a sudden discontinuity or, indeed, inversion in the normal temperature gradient. It is known that tropospheric stratification is more frequent than previously thought, and these sheets or layers of large vertical gradient can affect the propagation of signals quite substantially.

Ducting

Tropospheric variations of these kinds normally influence v.h.f., u.h.f. and higher frequency waves more than the lower frequency ones; but propagation tests at 27MHz have indicated that waves in this frequency range can also be distance-enhanced by tropospheric propagation (in addition to ionospheric propagation!). Strong refraction over water and ducting of the waves through the troposphere are other mechanisms involved. Some time ago G6DH noted the enhancement of signals as low as 3·5MHz arriving along a sea path during weather conditions producing tropospheric ducting at v.h.f., while more recently *Radio Science* carried a convincing paper supporting super-refraction ducting over sea paths from 20MHz upwards.

I have depicted in Fig. 1.6 the space immediately above the earth's surface, showing the troposphere and the ionised layers which I have so far discussed.

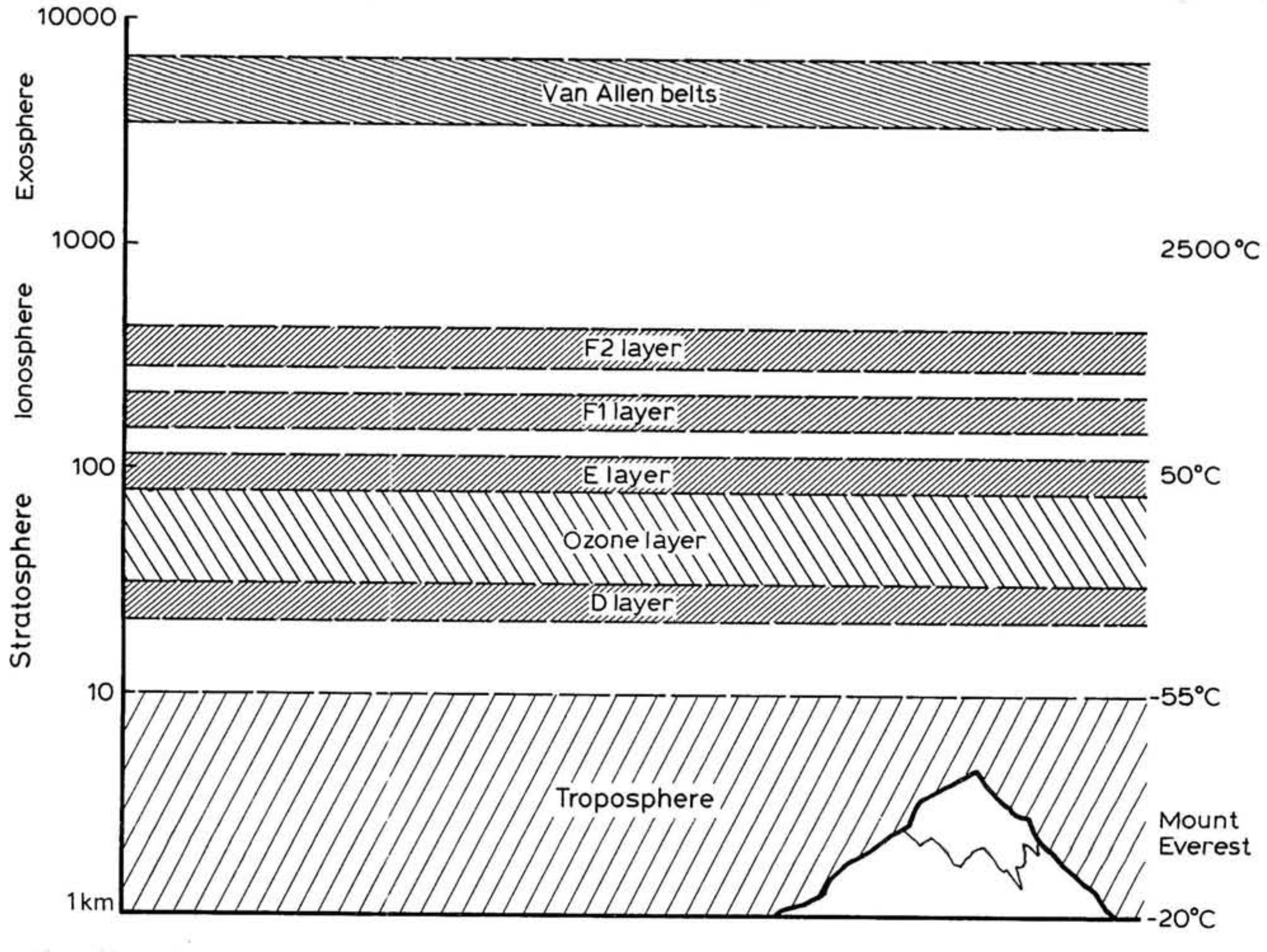


Fig. 1.6

an RF POWER METER

by
James A. Brett
G6EBR

This article describes the design requirements and construction details of an r.f. power meter suitable for amateur and CB use. The instrument can be used over the frequency range 1·8 to 146MHz, with input power levels from 20mW up to 10W and intermittently up to 50W. Above 146MHz the accuracy falls off, but comparative checks up to the 430MHz amateur band can be made.

Design Principle

The basic principle used in this design is to measure the peak voltage developed across a 50Ω load resistance and to calibrate the meter in a square law to indicate the resulting power. The final circuit takes the form of a switched range peak-reading voltmeter and load resistor, as shown in Fig. 1.

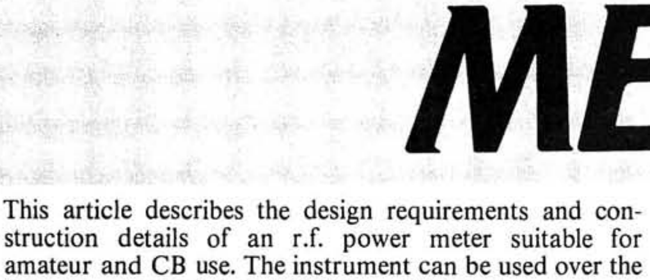


Fig. 1: Circuit diagram of the r.f. power meter. Values of R2–5 (1–50W) are given in Table 1

For reliable operation the first consideration is the 50Ω load resistor, which needs to have negligible inductance. With tubular and composition resistors becoming very rare, the popular carbon film was considered and proved to be quite satisfactory.

Carbon film resistors are made by coating the outer surface of the substrate with a film of carbon. A spiral is cut into the deposited layer to increase the path length until the desired resistance value is reached. Several makes of 1kΩ 1W rating resistors were over-run to burn off the protective paint coating and the exposed spiral examined. In each case the spiral amounted to between four and six turns. By calculation, using published formulae, the average inductance was found to be 0·06μH which at 150MHz amounts to approximately 50Ω. This reactance is effectively in series with the 1kΩ resistance. By adding algebraically, the resulting impedance of the 1kΩ resistor increased by less than 0·15 per cent. This can obviously be neglected when considering the basic 5 per cent resistor value tolerance.

By arranging 20 of these resistors in parallel as shown in Fig. 3, a 50Ω load presenting a good match up to 150MHz results. An s.w.r. bridge measurement of the assembly indicated below 1·1:1 over the range 1 to 150MHz.

The next consideration was the choice of rectifier diode. Germanium diodes are not satisfactory since they all have a high reverse leakage—silicon high-speed diodes are the answer. Reference to Table 1 shows that at 50W the peak voltage across the 50Ω load resistor is 70V. In the half-wave rectification mode the diode is thus subjected to a reverse voltage of 140V.

Examining component specifications, the most suitable diode readily available at low cost is the 1N4148; but most manufacturers only quote a peak reverse voltage rating of 100V—in some cases 75V. It is, however, quite acceptable to connect two diodes in series; these should be from the same manufacturer and ideally from the same batch, or at least purchased at the same time.

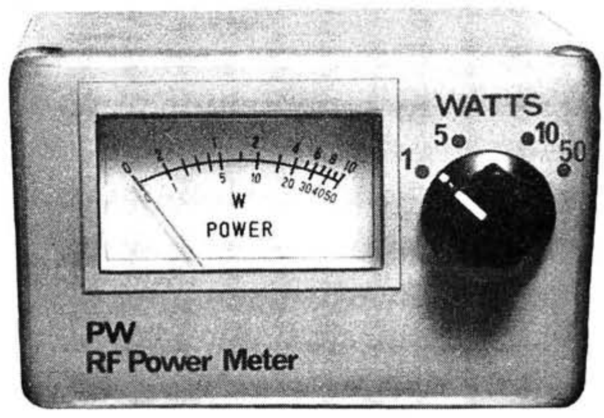
The peak voltages mentioned previously and shown in Table 1 are easily calculated for each range: Watts $= \frac{V^2}{R}$ where V is the r.m.s. voltage, but $V_{r.m.s.} = \frac{V_p}{\sqrt{2}}$ where V_p is the peak voltage; thus Watts $= \frac{V_p^2}{\sqrt{2}^2 \times R} = \frac{V_p^2}{2 \times R}$.

Re-arranging, we get $V_p = \sqrt{2 \times R \times W}$ volts.

One must, however, allow for and deduct the forward volt drop of the two diodes in series, approximately 1·4V altogether. This "practical" value of the peak voltage will appear across the capacitor C1 and is shown in Table 1 as "Resulting DC Volts".

Table 1

Full Scale Watts	Peak Volts	Resulting DC Volts	Series resistor 100μA meter	Series resistor 200μA meter
1	10·0	8·6	82kΩ	39kΩ
5	22·4	21·0	180kΩ	100kΩ
10	31·6	30·2	270kΩ	150kΩ
50	70·7	69·3	680kΩ	330kΩ



★ components

Resistors

¼W, 5% carbon film

82kΩ	1	R2	100μA meter
180kΩ	1	R3	100μA meter
270kΩ	1	R4	100μA meter
680kΩ	1	R5	100μA meter
39kΩ	1	R2	200μA meter
100kΩ	1	R3	200μA meter
150kΩ	1	R4	200μA meter
330kΩ	1	R5	200μA meter

1W, 5% carbon film

1kΩ 20 R1

Capacitors

Disc ceramic

10nF, 25V 1 C2
1000pF, 100V 1 C1b*

Ceramic feed-through

1000pF, 100V 1 C1a* *See text

Semiconductors

Diodes

1N4148 2 D1, 2

Miscellaneous

100μA or 200μA moving coil meter (see text); single pole 4-way rotary switch; pointer knob; chassis mounting r.f. socket; die-cast box 115 × 65 × 55mm; solder tags, screws and nuts

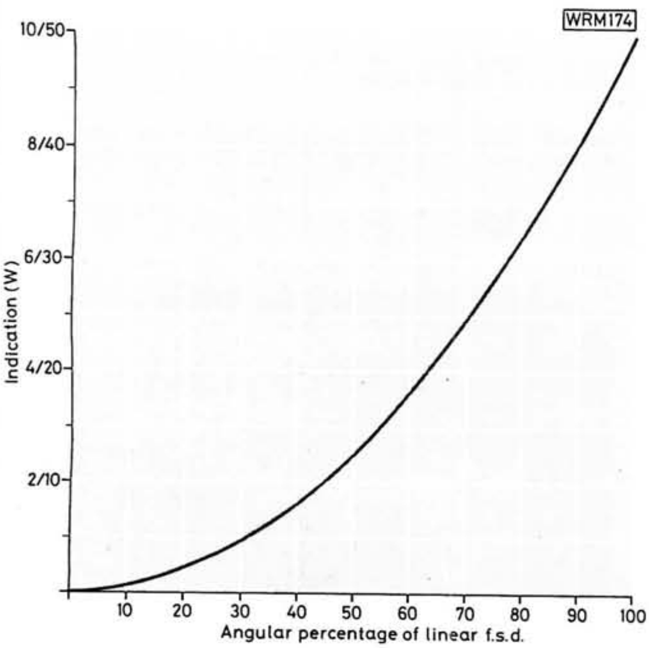


Fig. 2: Graph of indicated power against linear scale meter deflection to allow meter calibration

The value of capacitor C1 must be selected in conjunction with the meter series resistor (R2–5) to give a *CR* time constant which is long compared with the period of the lowest frequency. A suitable value for *CR* would be 100 times the longest period. At 1·8MHz *CR* should be 100 × 0·55μs. If, for example, a 100μA meter is to be used, consider the case with the lowest series resistor:

$$C1 = \frac{100 \times 0{\cdot}55 \times 10^{-6} \times 10^{12}\,\text{pF}}{82 \times 10^{3}} = 670\text{pF}.$$

For a 200μA meter C1 would be 1340pF. In practical terms, a 1000pF ceramic capacitor would be satisfactory for either meter.

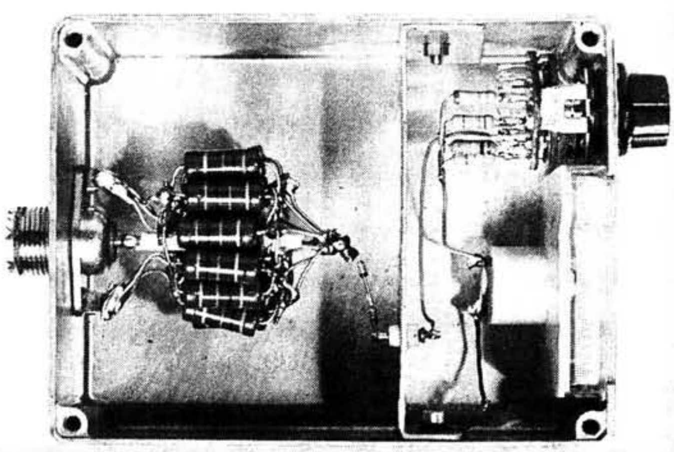
Capacitor C2 is fitted across the meter terminals to bypass any stray r.f. energy picked up by the wiring to the meter. Any r.f. current flowing in the meter can become partially rectified by mechanical junctions, such as the point at which the balance-spring is clamped, etc. This current could cause reading errors.

Table 2

Percentage of f.s.d.	10W Range	50W Range
15	0·2	1
25	0·6	3
32	1·0	5
45	2	10
55	3	15
63	4	20
70	5	25
77	6	30
89	8	40
100	10	50

Meter Indication

The meter itself presents the final problem. Since we are using the meter to measure volts across the load, but wish to indicate power, we must take account of the fact that: "Power is proportional to the voltage squared across a constant value of resistance". This means that the scale of the meter is required to follow a square law or that we must convert the linear meter reading using a calibration graph. A suitable graph is given in Fig. 2, which relates the



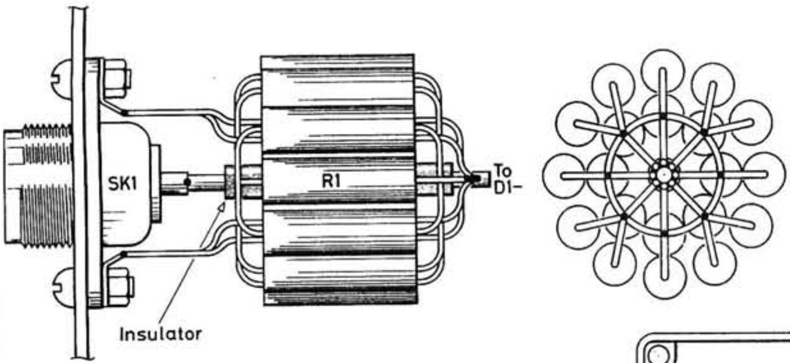
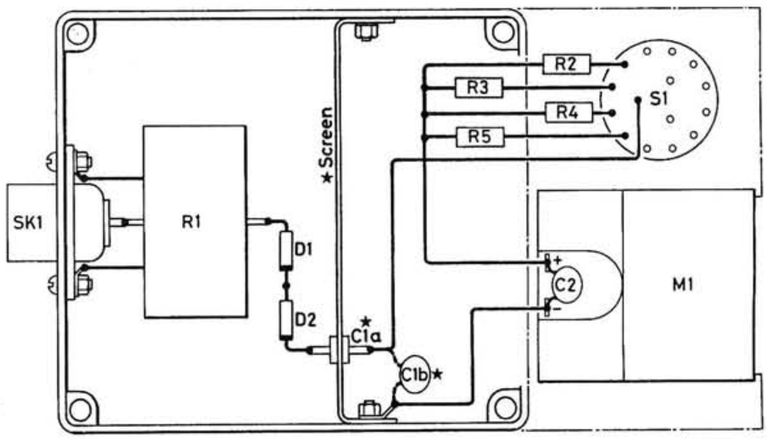


Fig. 3: The constructional arrangement of the composite load resistor R1. For reliable operation the coaxial layout shown must be adopted, all lead lengths being kept to the minimum. The centre pin extension of SK1 is fitted with a sleeve insulator to avoid any possibility of shorting against the "earthy" side of R1



★ See text

WRM172

Fig. 4: General layout details of the r.f. power meter. For h.f. band use only the screen and feedthrough capacitor C1a are not essential, however greater overall accuracy will be achieved by the use of these items which are incorporated to reduce the effects of induced currents/stray r.f. rectification within the d.c. meter assembly

linear meter reading as a percentage of the full-scale value to the actual watts for each range.

Alternatively, the dial of a linear moving coil meter can be re-marked. This is not as difficult as it sounds if the following procedure is adopted. First, open the meter carefully—the dial can usually be removed by taking out a couple of fixing screws and then sliding it out, avoiding damage to the pointer. The old markings can usually be removed by gently scraping with a razor blade or sharp modelling scalpel. If half the scale is left, new points can be marked using black drawing ink before the rest of the scale is removed. Reference points can be taken from the graph of Fig. 2 or Table 2. If the old marking on the dial cannot be scraped off, the end points of the scale should be marked by light centre punching and the arc of the scale traced. The dial can be repainted—white eggshell emulsion paint is ideal. When dry, the arc of the scale is re-marked on the dial, the position being fixed by the centre punch marks showing through the paint. Again, black drawing ink is ideal for completion of the marking.

BUYING GUIDE

All components are readily available. Suitable meters and switches can usually be obtained at very modest prices from most radio rallies

Approximate Cost
£10

Construction Rating
Intermediate

Construction

The 20 1kΩ resistors forming R1 should be mounted in coaxial fashion as shown in Fig. 3, supported on the r.f. input connector and ensuring a good contact with the enclosure and socket body. Several solder tags should be used. The centre connection of the connector is brought through the centre of the bank of resistors using 1·5mm diameter solid wire and well soldered to the "hot" end of the load resistors.

It is preferable to fit the screen between the load resistor bank and the d.c. part of the circuit as this further reduces the effects of induced currents in the meter, ensuring greater accuracy. If the screen is used, C1b is replaced by a feed-through capacitor. Other than this the actual layout is dictated by the size of the box which should be close fitting—diecast types are ideal. A general layout is shown in Fig. 4.

In its finished form the unit is connected directly to the transmitter output by a length of 50Ω coaxial cable. At powers of 10W and above the unit should only be used intermittently to avoid over-heating the load resistors. At 50W, for example, five seconds on and thirty seconds off is recommended as a safe duty cycle. ●

BATC CONVENTION REPORT

by Tony Marsden G6JAT and Colin Redwood G6MXL

The 1984 Convention of the British Amateur Television Club took place on Sunday 13 May at the Post House Hotel, Rugby—a new venue for this event. Although not quite as well attended as last year's convention, there were still plenty of people around to fill up this new and more spacious venue. Certainly, the move southwards was appreciated by those living below Potters Bar.

As usual, the trade stands in the exhibition area attracted large numbers and seemed to be doing a brisk trade. Some of the firms exhibiting new products are mentioned below—apologies in advance to any left out—it just wasn't possible to speak to everyone.

The emphasis this year was clearly on 1·3GHz (24cm), with most of the trade stands exhibiting a number of products for this band.

Wood & Douglas put on their usual excellent display of r.f. kits and modules; two new products were being shown for the first time, a 1·3GHz down-converter designed to be compatible with existing f.m. ATV products (priced at £24.95 for the kit version, with an optional box at £5.50). Also shown was a new Varactor tripler which accepts a typically 10W (maximum 15W) input at 430MHz and triples it with an average 50 per cent efficiency to within the 1·3GHz band. Priced at around £50, this product is only available as a ready-built unit.

One new exhibitor this year was L Wave, who were showing a single stage 1·3GHz linear using a single 2C39A valve to provide 13dB minimum gain from 1·5W input. The unit is housed in an attractive metal case and comes complete with mains power supply for £235 plus p. & p. Two other products were a 900MHz and a 1·3GHz in-line directional power meter, both priced at £35 plus p. & p.

Davtrend were demonstrating their new Drae SSTV receive converter which conforms to the normal amateur picture standards and is available now at £189. Soon to follow is a plug-in transmit converter at about £100.

LMW was another firm exhibiting at the BATC Convention for the first time—their range includes a variety of modules designed for 1·3GHz band operation—pre-amps, local oscillators, mixers, linear amplifiers and an ATV down-converter.

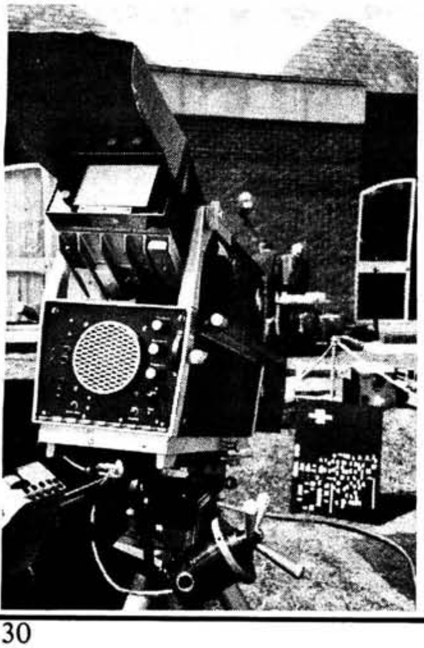
Sandpiper Communications had their new 1·3GHz helical antenna special offer—as described in CQ-TV 126.

Fortop Ltd. were exhibiting a new QRP 430MHz band transmitter kit, suitable for feeding one of their linears if more power is required at a later date. The transmit frequency of 437MHz has been chosen to be as high as possible in the band, so as to minimise the possibility of interference with repeater inputs. A complete 1·3GHz transmitter and separate receiver were also on show, which generated a lot of interest. The day of the 1·3GHz TV "black box" has arrived!

Allan Latham G8CMQ, of Solent Scientific, was showing a 1·3GHz f.m. converter, receiver and low-power transmitter. The transmitter is intended as an alignment aid for the other units, and so is available ready-built and fully aligned, while both the other units are available either as a kit of parts, an assembled board, or fully built in a robust box.

The GB3VR (Worthing) 1·3GHz repeater group had a very busy stand, manned by Roy G4WTV, Geoff G8DHE, Robin G8XEU and Martin G8KOE. As well as selling antennas for 1·3GHz and a variety of ATV computer software (profits to the repeater group funds), the group were publicising the repeater, which came on air in February this year, having taken nearly 3 years and almost £400 to design and construct. A well-produced videotape showing activity in the Worthing area was also shown.

The Narrow-Band TV Association was represented by Doug Pitt and Jeremy Jago, demonstrating a working 32-line mechanically scanned camera, a test generator and a fascinating look at the inside workings of an uncompleted



The o.b. camera complete with home-brew sun visor—it was a nice day!

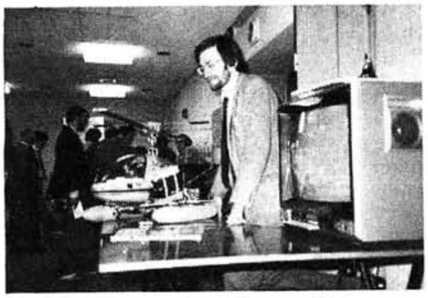
Development model 430MHz/ 1·3GHz Varactor tripler from Wood and Douglas

mirror-drum camera. It is encouraging to see such skill and enthusiasm at work.

Besides the exhibition and trade stands, there was a "sell-your-own-whatnots" fleamarket, and Brian Summers G8CQS and his stalwart team manned his o.b. van and produced some fine pictures—luckily the weather held out! As usual, following the morning's a.g.m., a lecture programme was arranged for the afternoon session. The first lecture was by Mike Walters G3JVL, on "Techniques for 23cms", discussing amongst other topics, the choice of suitable feeders, connectors, changeover relays etc. for operation on this band. Lecture number two was entitled "Digital TV" and was given by David Stone G8FNR of Quantel, who explained very well the basic principles of digitising video, particularly as used in slow-scan TV, and then went on to suggest possible further applications of advanced digital techniques in amateur television. It is obviously not possible to do justice to these lectures in this short space, but the speakers must have been encouraged by the capacity audiences they both addressed.

An unusual exhibit was a video camera and transmitter mounted on a radio-controlled helicopter. The constructor of this project, Brian Parkin G1EGD of Norwood in London, hopes to have the package in, and on, the air very shortly, having been working on it for some considerable time. Brian is using a Wood & Douglas 430MHz transmitter, and predicts the model will have a transmission range of approximately 3km, which is fortunately well within the range of the radio control. Brian first had the idea about ten years ago, but it was not feasible until the development of an all solid-state camera made a significant reduction in the size and weight of the video equipment. Brian was able to complete his project by the generosity of Hitachi (UK) Ltd, who have loaned him one of their latest VKC 2000E domestic colour cameras, which uses a c.c.d. array in place of a pickup tube.

For more information on the BATC, please send a large s.a.e. to the new Membership Secretary: Mr D. Lawton, 'Grenehurst', Pinewood Road, High Wycombe, Bucks. HP12 4DD. ●


Brian Parkin, G1EGD, and his temporarily earthbound "eye in the sky"


Where would we be without a good "junk" display?—some good stuff here


These o.b. types seem to get everywhere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NOISE in HF Receivers

by G.P. Stancey BSc G3MCK

The standard books which deal with the design of h.f. receivers usually make the following statement: "At h.f., receiver noise is usually not too important as it is masked by the external noise level". They then go on to discuss other aspects of receivers. However, a closer study of this simple statement is well worthwhile as it provides a useful insight into such areas as receiver sensitivity and cross-modulation performance. By understanding the true significance of these parameters, it is possible to correctly appraise the suitability of a receiver for a particular purpose. In fact by the end of this article the reader may well conclude that his old World War II receiver is more than adequate for his requirements. Or that he can design and build a better receiver than he can afford to buy.

First, let us consider a receiver which is taking in a signal and its associated noise, and which amplifies both of them, Fig. 1. The noisiness of the receiver NY is the signal-to-noise ratio at the input divided by the signal-to-noise ratio at the output. This ratio is always greater than one, as the action of amplifying the signal degrades it and this effectively amplifies the input noise more than the input signal. Expressing the above words mathematically gives:

$$NY = \left(\frac{S_i}{N_i}\right) \div \left(\frac{S_o}{N_o}\right)$$

$$= \frac{S_i}{N_i} \times \frac{N_o}{S_o} \qquad \textbf{eq. 1}$$

For a signal to be detected it must be stronger than the noise level. Hence the **minimum discernible signal** (m.d.s.) at the output is when $S_o = N_o$, i.e. the signal is just at the noise level. Under these circumstances, which in amateur radio often occur when one is looking for weak DX signals, we can write $NY = S_i/N_i$. This tells us that the lower the noisiness of the receiver the weaker the signal (with respect to external noise) we will be able to hear. This statement does not appear to agree with the opening statement on the relative unimportance of receiver noise levels, so a little further mathematical analysis is required.

Let us now look more deeply inside the hypothetical receiver which we considered in Fig. 1. We can consider the receiver to consist of two separate parts, a noiseless amplifier and an ideal noise adder, Fig. 2. For this hypothetical receiver, **eq. 1** still applies as all we have done is to describe what is happening inside the outlined box. The function of the ideal noise adder is to add the noise, which we have removed from the amplifier to make it noiseless, to the noise input. Now going into the realms of mathematics, if the gain of the noiseless amplifier is G, then we can write:

$$S_o = G \times S_i$$
$$N_o = G \times (N_i + N_r)$$

where N_r is the receiver's internal noise. Substituting for S_o and N_o in **eq. 1** gives

$$NY = \frac{S_i}{N_i} \times \frac{G(N_i + N_r)}{G \times S_i}$$

$$= \frac{(N_i + N_r)}{N_i}$$

$$= \frac{N_i}{N_i} + \frac{N_r}{N_i}$$

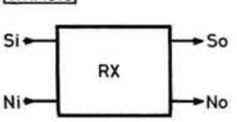
$$= 1 + (N_r/N_i) \qquad \textbf{eq. 2}$$

This equation shows that when the external noise is large compared with the receiver's internal noise level, then NY will be close to unity. In other words, we have proved the correctness of the handbooks!

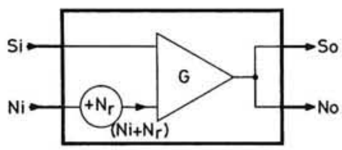
So far, apart from refreshing our minds with a bit of mathematics, we have not really learnt anything new. The useful bit now starts when we put values to **eq. 2** which correspond with the real world. **Eq. 2** shows that the noisiness of a receiving system depends on two factors, the internal noise of the receiver and the external noise applied to the receiver. In order to make comparisons between receivers it is therefore necessary to make the external noise N_i some known standard, say N_s. When this is done the noisiness NY of the system is called the **noise factor** or **noise figure** of the receiver. This is the noise parameter which is published in receiver specifications. The noise figure is merely 10 log (noise factor), i.e. a noise factor of 5 is the same as a noise figure of 7dB. Whilst referring to receiver specifications it should also be noted that signal-to-noise ratios are usually expressed in dB and are defined as 10 log (signal + noise)/noise. In the preceding analysis the writer chose to define the signal-to-noise ratio as being signal/noise. Both notations are correct: you just have to know which one is being used.

To put the noise figure of a receiver into true perspective, we need to analyse the situation that occurs when a receiver is attached to an antenna. Let's consider a

WRM913



▲ **Fig. 1: Hypothetical receiver**



▲ **Fig. 2: Hypothetical receiver showing noise adder and noiseless amplifier.**

receiver with a noise figure of 7dB which is typical for a high-performance modern receiver and see what happens when it is used at 3·5MHz. First of all let's calculate N_r, the internal noise of the receiver, in terms of N_s, the standard of external noise, which will be explained later.

$$\text{Noise figure} = 7\text{dB}$$
$$\therefore \text{Noise factor} = 5$$

Applying **eq. 2** and substituting N_s for N_i

$$5 = 1 + N_r/N_s$$
$$\therefore N_r = 4N_s$$

To continue the analysis, we need to know N_i the external noise at 3·5MHz in terms of N_s. Reference to Fig. 3 and ref. (1) show that this is 40–60dB greater than N_s so if we consider the best case, i.e. 40dB, we can see that at 3·5MHz the external noise level is 10 000 times (40dB) greater than our standard of external noise N_s, i.e. $N_i = 10\,000 \times N_s$. We can now calculate NY from **eq. 2.**

$$NY = 1 + \left(\frac{4 \times N_s}{10\,000 \times N_s}\right)$$
$$NY = 1{\cdot}0004$$

Now apply this to **eq. 1** for m.d.s. conditions, i.e. $S_o/N_o = 1$:

$$1{\cdot}0004 = S_i/N_i$$

In other words, for a signal to be just audible at the output it only needs to be 1·0004 times as strong as the noise level at the input. Or to express it in dB, the signal must be 0·0017dB greater than the noise level. As an ideal receiver would not generate any internal noise it would be possible for it to receive a signal just on the noise level. The difference between an ideal receiver and a receiver with a 7dB noise figure is so small that we can say that we have virtually got an ideal receiver.

Now let's consider the case of a World War II receiver at 3·5MHz. Such a receiver probably has a noise figure of 16dB which on the face of it makes it look very inferior to our modern 7dB noise figure receiver. However, repeating the above analysis:

$$\text{Noise figure} = 16\text{dB}$$
$$\text{Noise factor} = 40$$
$$40 = 1 + N_r/N_s$$
$$N_r = 39 \times N_s$$
$$NY = 1 + \frac{39 \times N_s}{10\,000 \times N_s}$$
$$= 1{\cdot}0039$$

That is, the incoming signal now has to be 0·017dB stronger than the noise level for it to be just detectable. From this result it can clearly be seen that for all practical purposes the old World War II receiver is just as good for weak signal reception at 3·5MHz as the modern high-quality receiver. So why should you bother to change your old receiver? If your interests lie solely on the lower h.f. bands it is most unlikely that you will achieve any significant improvement in the area of weak signal reception.

However, if your interests are more with the higher bands, the story could well be much different. The reason for this is that at, say, 30MHz, the atmospheric noise is much lower, a typical value being 20dB over N_s. Analysis of this situation gives the following results:

Receiver figure (dB)	NY	S_i over N_i
7	1·04	0·17dB
16	1·40	1·46dB

From this it can clearly be seen that the modern receiver shows a significant advantage over the World War II receiver.

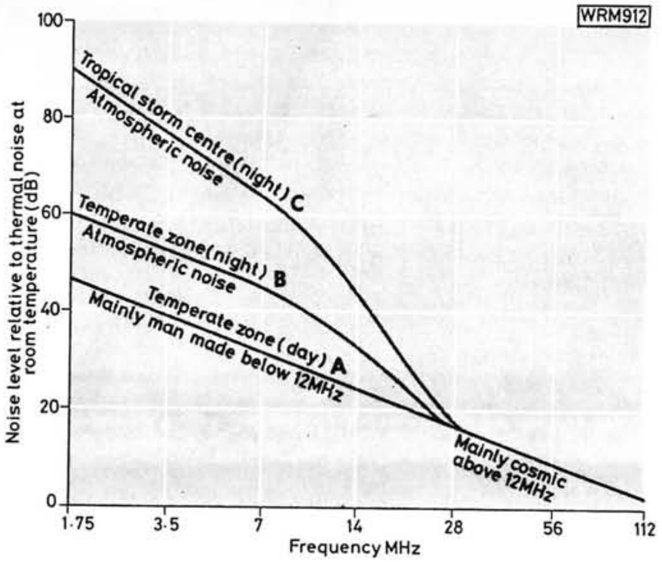


Fig. 3: Variation of external noise level with frequency. Curve A shows that during the day in temperate zones the noise is mainly man-made at frequencies below about 12MHz. In these zones, atmospheric noise adds considerably to the total noise level at night (curve B). In tropical zones the atmospheric noise is relatively severe: curve C represents the worst conditions in these zones. The vertical scale indicates the number of decibels by which the noise level in a perfect receiver would increase if it were disconnected from a dummy aerial and fed from an efficient aerial of similar impedance.

(Reproduced from RSGB *Radio Communication Handbook*, with permission)

It is of interest to note a professional viewpoint that it is pointless to aim for better than 12dB noise figures for h.f. communications receivers even if they are to be used at quiet sites (2).

Having now put receiver noise figures into their true perspective, it is interesting to turn to the question of receiver sensitivities and show that for a particular band there is a sensitivity below which it is pointless to go. Again let's consider 3·5MHz where we have already shown that for practical purposes receivers can be considered as being noiseless, i.e. $NY = 1$. In this case the m.d.s. must be a signal equal to the noise input N_i which we know is equal to $10\,000 \times N_s$. The question now becomes, what is N_s?

The basic standard of noise is the noise developed by random motion of electrons in a resistor. It is given by the following equation, known as the kTB equation:

$$\text{Noise} = k \times T \times B \text{ watts}$$

Where k = Boltzmann's constant = $1{\cdot}38 \times 10^{-23}$
T = temperature of resistor in kelvin
B = receiver bandwidth in hertz

For standardisation purposes T is taken as being 290K (17°C).

Hence for a receiver with a 500Hz bandwidth the noise power available from the noise standard is therefore

$$1{\cdot}38 \times 10^{-23} \times 290 \times 500 = 2 \times 10^{-18} \text{ watts}$$

Now we know that the external noise level is 40dB greater than this (1), so the noise power at the input of a

3·5MHz receiver is 2×10^{-14} watts. If the input is 50 ohms this corresponds to a voltage of one microvolt. Hence for c.w. reception on 3·5MHz there is no need to have a receiver with a better sensitivity than one microvolt for m.d.s. Note that if you require a 10dB signal-to-noise ratio at the output, you will require a signal of three microvolts at the input, so your minimum sensitivity requirements are even lower. Also, if you wish to receive s.s.b. in a 2·5kHz bandwidth, the noise power at the input increases and this again means that a lower sensitivity is acceptable.

Three questions immediately arise:

Q1 Why do manufacturers proudly quote 7dB noise figures and 0·3 microvolt for 10dB signal-to-noise ratios?

A1 They make receivers that are expected to perform well at 30MHz where such low figures can be used. Most of the above analysis was done at 3·5MHz but sufficient information has been given to enable the reader to repeat the analysis at 30MHz.

Q2 What's wrong with having too much sensitivity and too low a noise figure?

A2 Nothing, except that improvements in sensitivity tend to be at the expense of cross-modulation performance. If your real need is to improve cross-modulation performance, the easiest ways will degrade sensitivity and noise figures. Historically the trend has been to improve these figures. However, we are now at the point where receiver sensitivity and noise performance are governed by the external noise level, and perhaps the real limiting factor to receiver performance is strong signal handling. For example, on 7MHz it is likely that most receivers are limited by their strong-signal handling performance well before they reach the theoretical sensitivity level of the band.

Q3 How can I use the preceding information?

A3 You should assess exactly what you want your receiver for, e.g. mode(s), band(s), weak signal reception (i.e. m.d.s. work), listening to "S9" signals, etc. Then determine NY and sensitivity requirements (hint, assume $NY \leqslant 1 \cdot 1$ for a practical ideal receiver). Then compare the calculated value with the actual values of your receiver and decide whether you really need to change it. Perhaps if your major interest is single band, single mode, e.g. 7MHz c.w., you may well conclude that you can make a better receiver than you can buy (3).

Summary

This article has shown that high sensitivity and low noise figures in h.f. receivers are not necessarily needed to obtain near optimum results, especially on the lower bands. A knowledge of what you really need can save money and disappointment by preventing one from unnecessarily replacing an older receiver by a newer more expensive one. ●

References:

(1) *Radio Communications Handbook* RSGB, chapter 15.

(2) *Report on I.E.E. HF Communication Convention, RSGB Bulletin* 1963 p165.

(3) *Solid State Design for the Radio Amateur*, ARRL, p113.

Modifying The FRG-7

by Peter D. Rouse
Part 1

In this series of articles we will be looking at the FRG-7 short wave receiver manufactured by Yaesu-Musen. We will look at the shortcomings of the set and how to eliminate them as well as how to add extra facilities without major surgery to the front panel.

History

Development of the prototype FRG-7 started in 1975 and the first production sets went on sale in Japan early in 1976. Soon after the set was exported world wide and, between then and late 1981 when production ceased, 50 000 sets were made. Yaesu say the design policy had been to produce a general communications receiver at a reasonable price which would fit the middle of the range market. The numbers sold show that they clearly judged their market well and the set will rightly take its place amongst h.f. receiver history. Many buyers will clearly remember it for the introduction of technology that had hitherto only been seen on far more expensive amateur, commercial and military equipment. Many people, the author included, who had been weaned on traditional t.r.f.s and single conversion superhets with their image problems and vague dial readings, were delighted by the relatively accurate and drift-free tuning together with up-conversion. However, it is not intended here to go into detail about the Barlow-Wadley loop tuning or other aspects of the circuitry as these have been quite adequately detailed in the FRG-7 handbook and previous articles.

Shortcomings

Having praised the set's main features, it must be said that there were a few shortcomings, not least of which was the massive 6kHz bandwidth. This and the lack of any fine tuning control on early production sets (the addition of fine tuning was the only modification in the entire production history) was the only major gripe and other areas looked at in this series of articles are really just improvements.

These areas include the power supply, mains input and earthing arrangements on UK models, the rather high frequency span of the fine tuning and inaccuracies in the kilohertz reading dial.

Bandwidth

Selectivity in the FRG-7 takes place at the final i.f. of 455kHz and the characteristics are determined by a ceramic filter designated LFC6. Whilst 6kHz bandwidth may be alright for general listening to relatively powerful broadcast stations, it has serious deficiencies for the DX hunter particularly in crowded amateur bands when tuning for s.s.b. stations. The effect on the 3·5MHz band (80m) for instance can be that you hear several stations together and can make little sense of what any of them are saying.

The solution is to fit a narrow band filter. The problem then though is that such a filter will restrict the audio bandwidth of a.m. stations and although a 2kHz filter will not cause too much degredation of speech it can make music unpleasant to listen to. Yet even in making that point it must be said that such a filter can be useful when trying to identify a weak broadcast station that is otherwise masked by more powerful ones when the 6kHz filter is used.

Clearly the answer is to have a switched filter system although users who do not normally listen to s.s.b. may find that merely changing the existing filter for a 4kHz one will improve selectivity enough. Such filters are available as straight replacements from various suppliers. A list of suppliers will be given at the end of this series.

Switched Filtering

In the next part we will be presenting a switched filter system using the existing filter together with a 2·1kHz filter which has an excellent shape factor. For those readers who prefer to buy a ready-made unit though, Cirkit (formerly Ambit) offer one specifically designed for the FRG-7. It uses diode switching to bring a 2kHz or 4kHz filter into circuit. At a cost of more than £30 users must decide whether or not this is a case of overkill on such a modest receiver. Having said that, it must be pointed out that you do get a superb filter for your money. The 2kHz filter is a mechanical one manufactured by Kokusai and is the same as the one used in the highly respected NRD515 professional monitor costing nearly £1000

Fitting the unit is very easy. It is wired in place of the existing filter and switching can be carried out using spare contacts on the MODE switch so that the narrow position is automatically selected for s.s.b. Incidentally, the next part will also offer several switching options which can be adopted for this unit as well.

Fine Tuning

The lack of fine tuning on early models can be a nuisance particularly when tuning s.s.b. and even more so if a narrow filter is fitted. However, it is not too difficult to fit such a control and South Midlands Communications can offer a kit comprising a variable capacitor, two fixed ones and a control knob that matches the others on the front panel. For those wishing to go it alone, the FRG-7 circuit diagram shows a variable capacitor value of 5pF although the one actually fitted to production sets appears to be about 10 or 15pF. In fact these latter values appear to be the lowest commercially available and so note should be taken of the suggestions that follow.

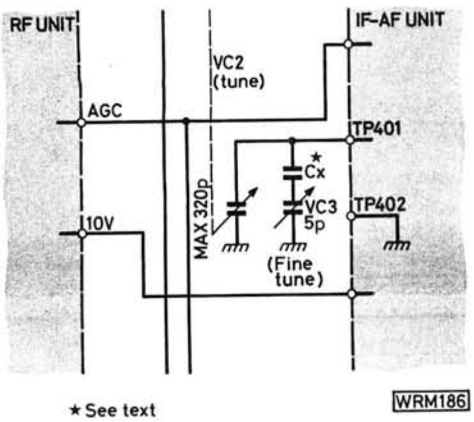


Fig. 1.1

Reduced Fine Tuning Span

The span of the FINE tuning control fitted to later models appears to cover several kilohertz and in practice it has little to offer over and above the geared-down main tuning. This is possibly because the actual variable capacitor fitted appears to have a higher value than that shown on the circuit diagram for the FRG-7. The result is that s.s.b. stations are still a little difficult to resolve especially when a narrow filter is used.

Luckily it is quite easy to alter the actual capacitance swing merely by incorporating a low value fixed capacitor in series with the variable. Just break the fixed wire connection between the variable and TP401 on the IF/AF Board and insert a 5pF capacitor. There is no reason why other values should not be tried so as to get the tuning span to meet personal preference.

However, with the 5pF shown, the author finds the tuning rate to be very similar to the r.i.t. or clarifier controls found on other equipment.

Digital Readout

Although the FRG-7 dial is accurate at worst to a few kilohertz, many people have found a digital readout to be a useful extra. It also has the added advantage that it turns the set into quite a useful 150kHz–30MHz frequency meter. Quite a number of commercially made units have appeared over the years using both l.e.d. and l.c.d.s. Digital frequency meters are still available from several sources from upwards of about £20.

Fitting instructions are supplied with these units but is perhaps worth mentioning two areas that can give rise to problems. First, if batteries are used to power the set it may be advisable to wire the supply of the d.f.m. to the light switch circuit so that power can be conserved. Secondly, most of the d.f.m.s available use c.m.o.s. circuitry which can introduce a noticeable degree of noise into the rest of the receiver through the positive supply line and direct radiation. The d.f.m. should be housed in a well shielded box and if severe problems are encountered it is advisable to try extra de-coupling capacitors on the d.f.m. circuit board. In extreme cases it may even be worth trying a filter choke in the d.c. input line to the d.f.m.

DC Problems

Talking of d.c. problems brings us to the power supply. Users may have noticed that if the audio is driven hard, distortion sets in and even the dial light will start to dim on peaks. This problem is caused by the mains transformer not being able to supply enough current. A simple test showed that it can only deliver about 600mA whereas the current consumption of the receiver peaked well over 750mA when a beefier outboard 13·8V supply was fed into the external d.c. socket.

For many users this will not be a problem but, if like the author, the user occasionally feeds the set into such things as RTTY units then there can be drawbacks. Tests on the receiver under such conditions have shown that the internal supply, which on the unregulated side runs at about 14·5V, can drop alarmingly. In fact it can go so low on peaks that even the regulated supply sags and can cause slight pulling on the b.f.o. which in the case of RTTY can pull the signal tone out of the passband range of the f.s.k. decoder.

The Solution

The obvious answer is to fit a larger transformer and there is certainly plenty of space inside the FRG-7 to do this. The transformer already fitted is rated at 10·6V a.c. which is a non-standard value but tests by the author have shown that a 12V transformer does not cause either the regulator transistor (Q411) or the audio i.c. to run any warmer than usual. The latter by the way is run from the unregulated d.c. supply.

There is however an even better solution, sadly though a more expensive one, and this is to use a well regulated 12V d.c. (in fact 13·8V now seems to be the norm) supply separate from the set. The supply should be capable of delivering at least 1A, preferably more, and its use will help us cure yet another problem: noise from the mains earth.

Hums and Buzzes

FRG-7s sold in the UK through the official suppliers were fitted with a three core mains cable which had the earth wire soldered to a tag on the chassis. It has long been recognised that the mains earth can be a source of r.f. noise and is only intended as a safety path. The use of a separate earth is highly recommended but even this will have little effect if the mains earth is still connected to the

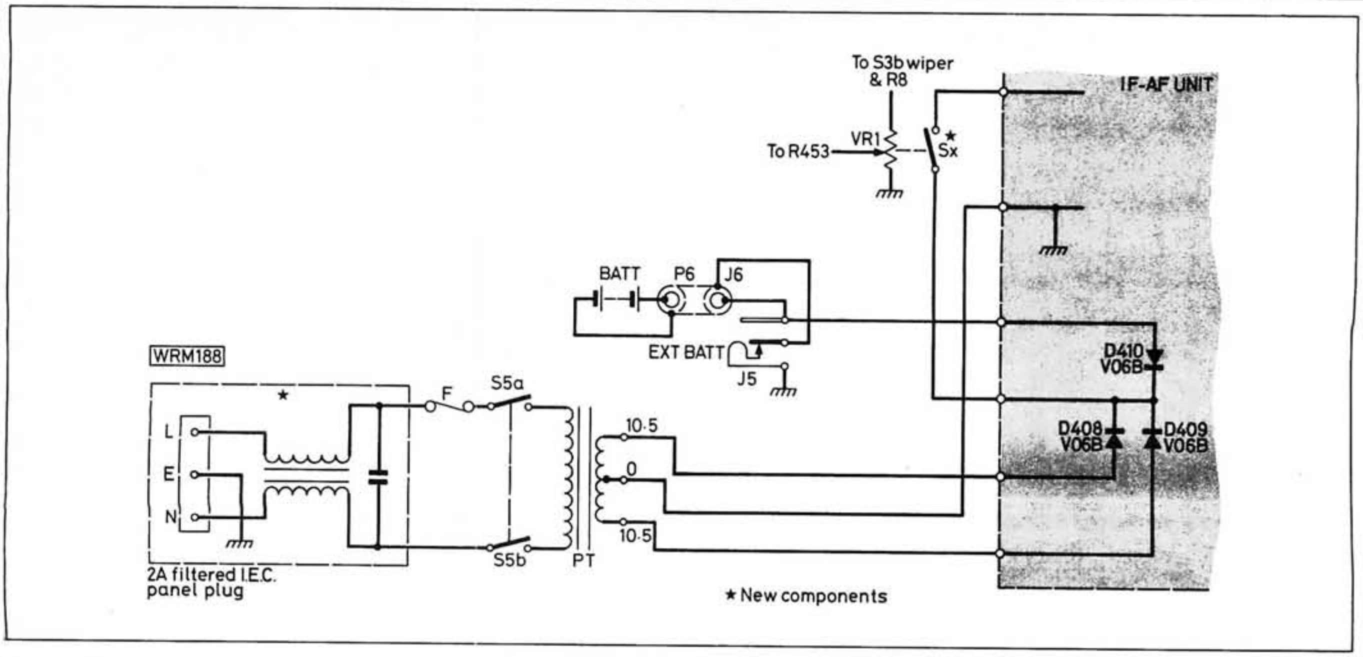


Fig. 1.2

set. It must be remembered that at r.f. the potential between actual earth and the earth connection on the set will be very different.

The answer may at first appear to be to disconnect the mains earth from the set but this is against current safety regulations. The only acceptable solution appears to be the use of a separate power supply as mentioned above and this must have a floating output (i.e. not connected to the earthed case of the p.s.u.).

All of this may seem like a sledgehammer to crack a nut but for anyone living in an area where there is a high level of r.f.i. the improvement can be quite dramatic (the author's home, like most in Guernsey, is surrounded by vineries with automatic ventilators, thermostats, electronically ignited heating, etc).

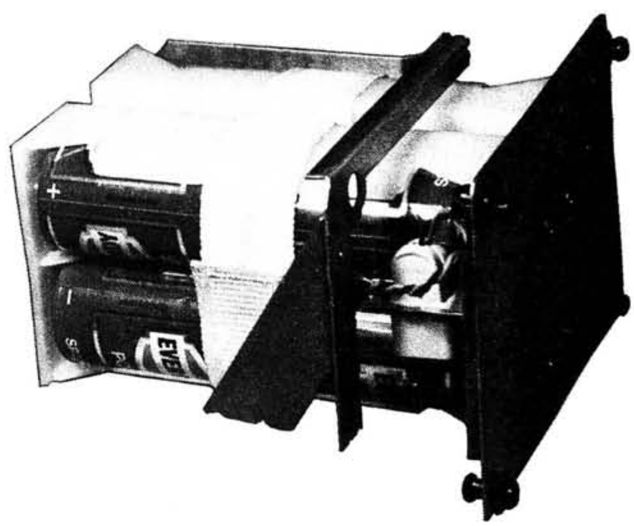
Power Switching

Having mentioned safety regulations, owners may care to update the power switching arrangements on their sets which certainly do not meet present safety standards. The problem lies in the power switch S5 which carries both mains and d.c. Making the set safer is neither complicated nor expensive but consists of using S5 to switch both live and neutral and transferring the d.c. to a switched volume control. This will mean that the existing volume control will have to be replaced but note that a standard European style one with $\frac{1}{4}$in. shaft will not be suitable. Don't discard the existing volume control if you intend adding the f.m. unit as it will fit the space behind the RECORD socket and so act as the squelch control. However, a replacement Japanese version with 6mm shaft is available from Cirkit (Alps 10kΩ log with d.p. switch).

When the set is used with a separate supply or on batteries the mains lead is something of a nuisance and so one final improvement in this area is to remove it and fit a mains chassis plug to the back panel and a line socket to the lead. One of the small circular types made by Bulgin is ideal or a rectangular IEC type can be used which may, if desired, incorporate mains filtering (useful for flat dwellers who can't run a proper earth).

Battery Packs

Later batches of FRG-7s sold in the UK were supplied with a slide-in battery pack that houses eight U2 type cells. Owners who do not have one can still get one from South Midland Communications but they warn that supplies are limited. Anyone who uses batteries regularly may find that it is worthwhile fitting NiCads. Even though the U2 types are very expensive, they could still be a worthwhile investment in the long run and it is an easy matter to incorporate a charging circuit in the set.



Hearing it Sideways

Another worthwhile add-on for the set is an f.m. demodulator. This allows reception of the increasing amount of f.m. traffic on both the 27MHz CB band and 28MHz Amateur band and also provides good results when using a 144MHz converter.

It is of course possible to use slope-detection where the set is tuned slightly to one side of the carrier but this does have drawbacks. Results with weak stations are poor and when trying to listen to stations of unequal signal strength it is usually necessary to have to re-tune slightly between overs.

There is plenty of space inside the set to fit a separate demodulator and at least one company (Timestep) make one specially for the FRG-7. Other units are available from the companies listed and for owners who wish to build their own, a suitable circuit featuring all-mode squelch will be included later in this series.

How and Where to Switch

At the start of this article we mentioned that no major surgery would be involved on the front panel and so we now include a list of how certain existing controls can be modified to cope with other functions. Owners who intend carrying out modifications are advised to plan ahead as various options are available and the final choice will depend on what or how many add-ons are to be included.

(i) Narrow Filter Only. Several options are available:

(a) Using existing spare wafer contacts on the MODE switch so that the narrow filter is selected when switched to s.s.b. Although this is a quick and easy solution the disadvantage is that the narrow filter cannot be used for a.m.

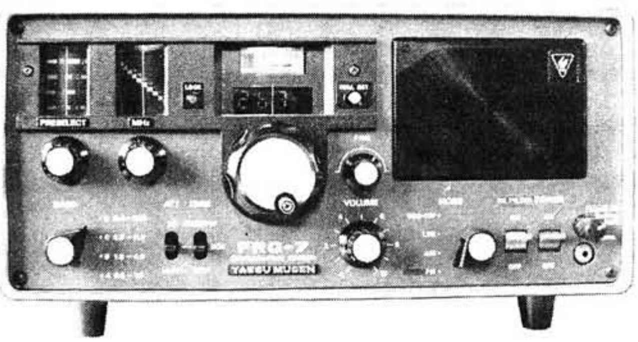
(b) As above but disconnect the noise-blanker so that the switch position can be used to give narrow band a.m.

(c) Re-site the RECORD socket on the rear panel and use the space to fit a miniature toggle switch. This has the advantage of retaining all facilities.

(ii) FM Demodulator Only. Again several options:

(a) The logical place is on the MODE switch in the noise-blanker position with the squelch control replacing the RECORD socket (an Alps potentiometer will fit).

(b) Use a Pull-on switched potentiometer for the squelch (again Alps potentiometer with push-pull switch). Cut the connection from the MODE switch to the volume control and wire the control to the centre pole of the switch. Outputs from the MODE switch and demodulator are then taken to the two other contacts.



(iii) Switched Filters and FM. Here the options are very limited and the suggested method involves forfeiting the noise-blanker (it has little effect anyway in the author's view).

(a) Use the NB position on the mode switch for FM selection (full details of which contacts to use will be included in a later article).

(b) Re-site the RECORD socket on the back panel, use the hole for a squelch control with push-pull switching and transfer the dial light wiring from the existing switch to the one on the potentiometer.

(c) Use the dial light switch (which has the necessary d.p.d.t. contacts) for switching the filters.

Whatever switching arrangements are made, the new functions of each switch can be re-labelled by using small strips of dark grey card with suitable wording in white rub-down lettering. These can be attached to the front panel with a light adhesive such as Copydex which can be removed later if required.

Parting Thoughts

These notes together with the articles that follow will turn the FRG-7 into a more versatile machine and better performer; the switched filter unit in particular provides a stunning improvement to the point where it is difficult to believe you are using the same receiver. All the modifications and add-ons should be well within the scope of anyone who can use a soldering iron and read a circuit diagram and no special test gear is needed for setting up.

The author is still exploring other possible areas for improvement in particular the b.f.o. where the tendency to drift becomes more noticeable when narrow I.f. filters are used. Meanwhile readers may themselves have found ways of improving the set and are invited to submit their ideas. These together with the rest of the author's work could form the basis of yet another article.

Further Reading

Owners of FRG-7s are reminded that the January 1984 edition of *Practical Wireless* featured an article by A. J. Cawthorne which looked at ways of improving the antenna input stage. Details were given to reduce problems of interference from television receivers, fluorescent lights and antenna static and how to modify the set for single antenna input for both m.f. and h.f.

Modification Techniques

Great care should be taken when modifying any piece of commercially made equipment. Apart from the obvious consideration of safety with regard to mains power supplies it is generally regarded that modifications devalue the equipment when it comes to re-sale.

In this series of articles, great care has been taken to ensure that with the exception of the fine tuning control, no holes need be drilled in the front panel and most modifications and add-ons can be removed.

Standard of Workmanship

Having made the above warning, it is the author's view that modifications can in fact add to the value of equipment as long as certain guidelines are followed.

The standard of workmanship must be high and with present day materials and tools there can be little excuse for it not being so. A vast range of hardware for mounting circuits, harnessing wire and so forth is available and often a few pence spent on such items can give a thoroughly professional look. The final requirements cost nothing, only patience and care.

Proof of success is when you look at the work and it seems as if it was there in the first place.

Documentation

In keeping with standard workshop practices, all mods should be documented together with notes and circuit diagrams kept with the main service manual/circuit diagram of the equipment. This is not only useful for later servicing or removal of modifications but will impress a buyer that the work has been done competently.

HINTS FOR THE FIRST CW QSO

by G. P. Stancey BSc G3MCK

Congratulations! You have passed the Morse Test.

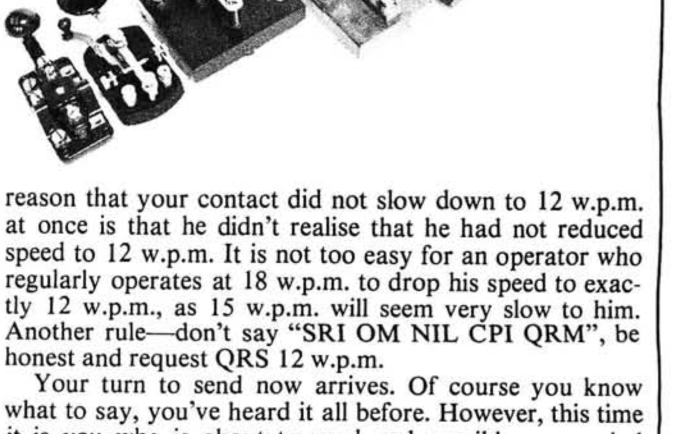
Great, you're going to have a go on the key. There is no doubt that for most of us the first few c.w. QSOs are a traumatic experience. However the novice operator can do a lot to reduce the trauma and at the same time make them exciting and pleasant experiences. All that is needed is a bit of preparation and common sense. This article gives a few hints that should be of use in this area.

First of all the main thing to realise is that you and all the other c.w. operators on the band have one thing in common. This is that you all started as novices. The masters of the art progressed and so can you. The next thing is that, as a body, radio amateurs are a helpful lot and will want to try to help you. It is up to you to help them to help you.

Whilst you were learning c.w. it is most probable that you have done a fair amount of listening to amateur c.w. QSOs so you should know the usual format of a QSO as well as general operating practices and procedures. If you have not done this, then do it. Also talk to the more experienced amateurs at your club. You must of course be familiar with the common Q-codes, RST meanings, abbreviations, etc. It is a good idea to have the common ones written down and pinned to the wall where you can easily read them. You might remember them now but forget them in the excitement of those early contacts.

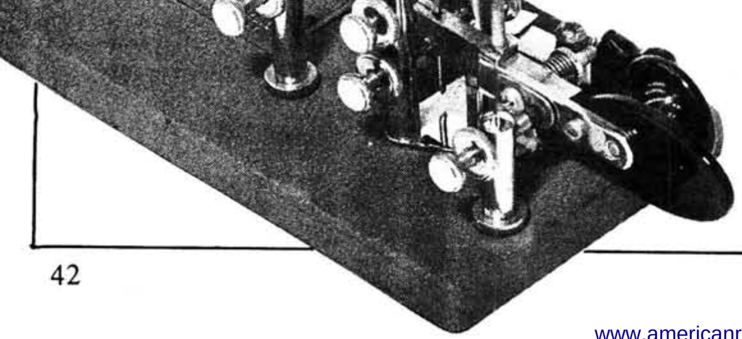
So now collect pencil, paper and watch and you are ready to think about your first c.w. QSO. At this point you have the choice of two actions, either call CQ or look for somebody who is calling CQ or is finishing a contact. The latter approach has a lot to recommend it as you can select a loud clear signal which is sending good steady c.w. Let's consider this approach and when he invites replies call him. Simple isn't it? But have you already made your first error? Most novices can send Morse faster than they can read it. Therefore if you hear a station calling CQ at 18 w.p.m. and go back to him at 18 w.p.m. you are saying "I want to work you and can handle code at 18 w.p.m.". If this is not true your problems have already started and you have only yourself to blame. So, rule one—don't send faster than you can receive.

Contact has been made, you are sending at 12 w.p.m. and the station you have called has dropped his speed from 18 w.p.m. to 15 w.p.m. to work you. You find this too fast. Tell him so by sending QRS. The most likely



reason that your contact did not slow down to 12 w.p.m. at once is that he didn't realise that he had not reduced speed to 12 w.p.m. It is not too easy for an operator who regularly operates at 18 w.p.m. to drop his speed to exactly 12 w.p.m., as 15 w.p.m. will seem very slow to him. Another rule—don't say "SRI OM NIL CPI QRM", be honest and request QRS 12 w.p.m.

Your turn to send now arrives. Of course you know what to say, you've heard it all before. However, this time it is you who is about to send and possibly your mind goes blank just as you touch the key. The remedy for this is simple; write out a standard c.w. QSO and pin it to the shack wall and send it. You will of course be using the well known abbreviations and properly using the Q-code won't you? A typical first over might go as follows: "R GE FRED TNX FER RPRT ES QSO = RST 589 589 QTH STAINES STAINES = NAME GERALD GERALD = HW?" Note, no redundant words like "my name is", or "my QTH is" which really means my my location is is!

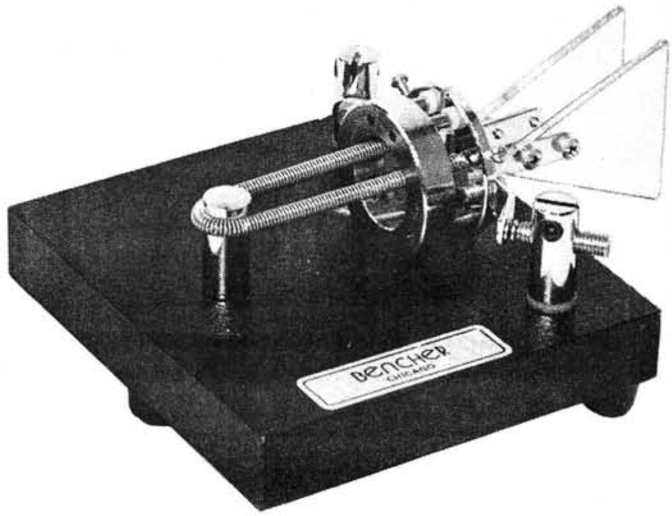


Also, only the important information or unusual words are repeated. Whilst on the subject of sending each word twice the general rule is don't. However, as with all rules there are exceptions such as when important or unusual words are being sent, for example your location but not the name of your rig. If you feel the only way you can copy a transmission is if it is sent double, then by all means ask for it. However, unless the other operator asks, do not send him doubles. Just put yourself in his place, and he can read Morse probably at a considerably higher speed than you are sending and has no need for it. Also having to receive unnecessary doubles is very irritating.

All the above advice also applies if you initiate a contact by means of a CQ call. Only in this case you have no control over who comes back. They might be weak signals which can be hard for any operator to copy.

Like all things proficiency comes with practice and pleasure comes with proficiency so keep at it. Try to aim for a clean steady fist. Speed will come with practice. A station that is putting out a slow clear signal and using correct procedures is far more enjoyable to hear (and work) than one who is sending poorly formed characters and using sloppy procedures.

Finally a few comments about the instrument used to produce c.w., i.e. the key. A good basic grounding on the straight key is never wasted. These days when electronic keyers are mainly used and heavily advertised it may seem that one is not "with-it" unless one is using a new fangled device. In fact for the majority of people there is no real point in using other than a straight key unless one is going to graduate to speeds in excess of say 20 w.p.m. The choice of a straight key is a very personal matter and bears little relation to the price. Find out what sort of key you like, mount it in a position where it is comfortable to use and where you have control over it. In general set the gap to be wide rather than close as this will reduce the tendency to send jerky Morse. A gap which gives a knob movement of 1–2mm will give you excellent control over the key even though you may feel you are opening and closing a barn door! Don't neglect the tension, too slack and the key feels dead, too tight and it is unnecessarily hard work and tends to produce jerky Morse. My favoured way after setting the gap is to set a light tension on the key. Then tap the key and increase the tension until the key comes to life. At this stage a slight readjustment of the gap may be desirable.



CW operating can be great fun, some people will say is great fun. A little thought and preparation will enable you to take the plunge with confidence and so discover the joys of the key. ●

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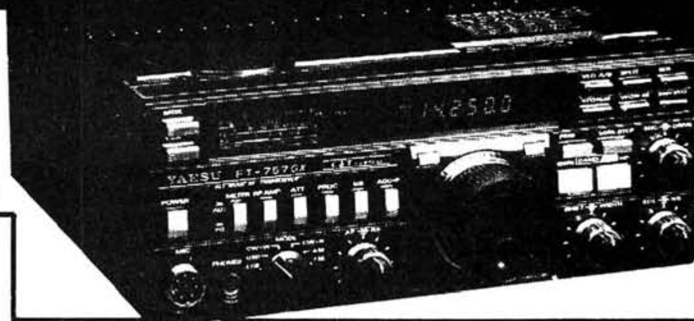

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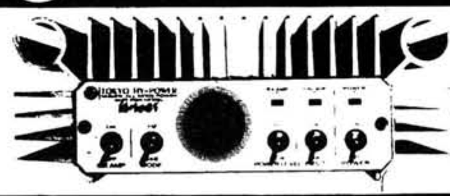

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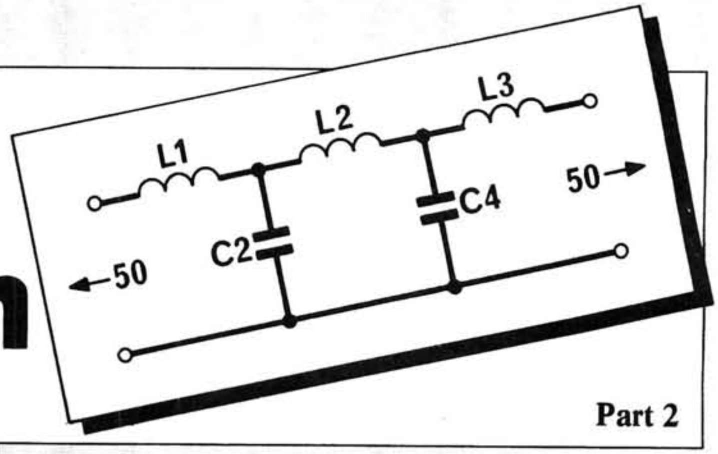


by Edward Wetherhold W3NQN

Part 2

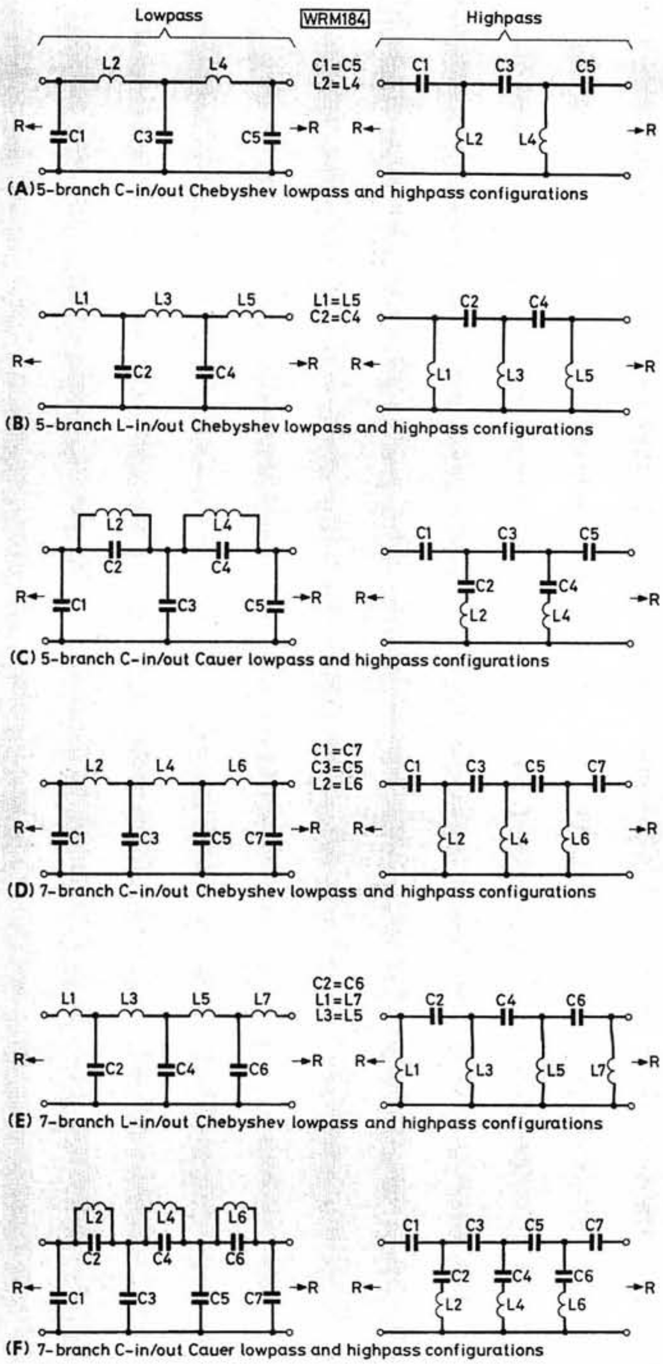
As explained last month, only the Chebyshev and Cauer responses are of interest for the filtering of sinusoidal waveforms encountered by the radio amateur. Consequently, the following discussion is concerned only with these two responses. Also, the number of filter elements, the number of different filter configurations and other characteristics will be limited to those most frequently needed by the radio amateur. Readers seeking more complicated filters are referred to the texts in the reference listing.

The Chebyshev and Cauer configurations most frequently needed by the radio amateur to form lowpass and highpass filters are shown in Fig. 2.1. These configurations are arranged in alternating shunt and series (or vice versa) branches numbered from left to right. The component (or components) in each branch is given the number of its branch for identification.

The filter theorist uses the term "degree" or "order" when defining the complexity of a filter, but for the amateur, the term "branch" is more meaningful. Thus, the filter configurations in Fig. 2.1(A) are 5-branch lowpass and highpass Chebyshev filters with capacitor input and output. Fig. 2.1(B) shows the same type except the input and output elements are inductive. Usually, capacitive input/output filters are preferred to minimise the number of inductors since inductors are usually more bulky, expensive and lossy than capacitors. However, occasionally the *L*-input lowpass filter is needed when the filter input impedance in the stopband must rise with increasing frequency. For example, some r.f. transistor amplifiers become unstable when terminated in a filter having a decreasing input impedance, such as with a *C*-input filter. In this case, an *L*-input filter may eliminate the instability[9].

The first branch in the filter configuration may be either shunt or series, and any number of branches may be used. Because the Chebyshev and Cauer designs with an odd number of branches have advantages over those with an even number, and because the 5- and 7-branch designs provide satisfactory filtering with a minimum of components, only these two types are considered. Chebyshev filters with an odd number of branches have repeating element values and odd-numbered Chebyshev and Cauer filters have equal termination impedances, thus simplifying construction.

The 5-branch Chebyshev filters provide about 6dB of attenuation per octave, per element, or about 30dB one octave from the cutoff frequency. A 5-branch filter is useful when only a moderate amount of attenuation is necessary. For example, the second harmonic of a Class A or B transistor r.f. amplifier is about 20dB below the fundamental, and a 5-branch Chebyshev lowpass filter will provide the additional attenuation needed for adequate harmonic



(A) 5-branch C-in/out Chebyshev lowpass and highpass configurations

(B) 5-branch L-in/out Chebyshev lowpass and highpass configurations

(C) 5-branch C-in/out Cauer lowpass and highpass configurations

(D) 7-branch C-in/out Chebyshev lowpass and highpass configurations

(E) 7-branch L-in/out Chebyshev lowpass and highpass configurations

(F) 7-branch C-in/out Cauer lowpass and highpass configurations

Fig. 2.1

reduction. Fig. 2.1(C) shows the Cauer 5-branch *C*-in/out lowpass and highpass configurations. The alternate Cauer *L*-in/out configuration is seldom used and is omitted. The components comprising the resonant circuits are associated with the similarly labelled attenuation peaks shown in Fig. 1.1 last month.

The 7-branch Chebyshev and Cauer lowpass and highpass configurations are shown in Fig. 2.1(D), (E) and (F). The comments on the 5-branch configurations also apply to the 7-branch configurations. The 7-branch Chebyshev configurations provide about 42dB of attenuation one octave from the cut-off frequency, and this filter type is frequently used to attenuate the harmonics of Class C transistor r.f. amplifiers(10). The second harmonic level of a Class C transistor amplifier is only 10 to 15dB below the fundamental(11), and more attenuation is needed than that provided by the 5-branch filter. In this case, the more selective 7-branch Chebyshev or 5-branch Cauer is required.

The 7-branch Cauer provides both higher stopband attenuation and a narrower transition band as compared to all filters listed. A typical application of the 7-branch Cauer is the filtering of speech signals where an abrupt rise in attenuation is desired immediately following the cutoff frequency.

Calculation of Filter Component Values

After selecting the filter function (lowpass or highpass), response type (Chebyshev or Cauer), number of branches (5 or 7) and input element, the next step is to calculate the component values. This is normally accomplished by referring to tables of normalised lowpass filter designs that are available in many well-known references by Saal, Zverev, Geffe and others. These designs are normalised to an impedance of one ohm and a ripple cutoff frequency (*F-Ap*) of one radian per second, and all capacitances and inductances are in farads and henries. The Saal and Zverev tables are calculated for reflection coefficients of 1 to 5 per cent in 1 per cent steps, and for 8, 10, 15, 20, 25 and 50 per cent. Some references have normalised tables based on *Ap* values such as 0·01, 0·1, 0·25 and 0·5dB. These particular values of *rc* or *Ap* were used because they are nice round numbers, but any *rc* or *Ap* value within an appropriate range is equally suitable. To design a lowpass filter, a desired response is selected from the appropriate normalised table, and the lowpass component values are scaled to the cutoff frequency and impedance level selected by the user (equal source and load impedances are assumed). In the case of designing a highpass filter, the reciprocals of the lowpass normalised values are used to transform them into highpass values. Although this is a relatively simple arithmetic process, it causes problems to those unfamiliar with the procedure.

A 50 ohm lowpass filter is calculated for a ripple cutoff frequency (*F-Ap*) of 5·0MHz using the normalised lowpass values of Zverev for a *C*-input 7-branch Chebyshev design (see Fig. 2.1(D)) having a reflection coefficient of 1 per cent (from p.258 of (1)). The normalised C1, C3, L2 and L4 values are 0·5354F, 1·464F, 1·179H and 1·500H, respectively. Of course, these component values are ridiculously large, but they will become reasonable after they are scaled to the new impedance level and cutoff frequency.

The frequency and impedance scaling factors for inductance can be combined into one factor equal to $R/(6{\cdot}2832 \times f)$ where R is the source and load impedance in ohms and f is the ripple cutoff frequency in Hz. Thus, for a 50 ohm impedance level and a cutoff frequency of 5MHz, the inductance scaling factor is: $50/(6{\cdot}2832 \times 5 \times 10^6) = 1{\cdot}592 \times 10^{-6}$. In a similar way, the frequency and impedance scaling factors for capacitance can be combined into one factor. The capacitance scaling factor is: $1/(R \times 6{\cdot}2832 \times f)$. Thus, the *C*-scaling factor is: $1/(50 \times 6{\cdot}2832 \times 5 \times 10^6) = 636{\cdot}6 \times 10^{-12}$.

The normalised values are scaled to the desired cutoff frequency and impedance level by multiplying them by their scaling factors. Thus:

$L2 = L6 = 1{\cdot}179\text{H} \times 1{\cdot}592 \times 10^{-6} = 1{\cdot}877\mu\text{H}$,
$L4 = 1{\cdot}500\text{H} \times 1{\cdot}592 \times 10^{-6} = 2{\cdot}388\mu\text{H}$,
$C1 = C7 = 0{\cdot}5354\text{F} \times 636{\cdot}6 \times 10^{-12} = 340{\cdot}8\text{pF}$, and
$C3 = C5 = 1{\cdot}464\text{F} \times 636{\cdot}6 \times 10^{-12} = 932{\cdot}0\text{pF}$.

The fact that the inductance values are not standard values is of little concern because the inductors are usually hand-wound on powdered-iron toroidal cores with the proper number of turns to give the calculated inductance value. In comparison to the inductors, it is not feasible to hand-wind capacitors, and they must be purchased from an electronics distributor. The fact that the calculated C1, 3, 5 and 7 capacitor values are non-standard complicates the building of the filter.

Because of the established practice of using 20, 10 and 5 per cent tolerances in the electronic component industry, a series of capacitor values based on the 6th, 12th and 24th roots of ten has been adopted. For example, the 20 per cent series of standard values is: 10, 15, 22, 33, 47, 68 and 100. The 10 per cent series starts out with 10, 12, 15, 18, 22, etc. The 5 per cent series begins with 10, 11, 12, 13, 15, 16, 18, 20, 22, etc. It would be of considerable convenience to the radio amateur if only those filter designs requiring standard-value capacitors would be tabulated for easy selection. Obviously, the present standard design procedure using normalised tables is inappropriate for the radio amateur because it requires tables that may not be conveniently available, and it requires unfamiliar calculations that invariably result in designs with non-standard capacitor values.

A solution to this problem is to tabulate only those designs that are based on the capacitor standard values instead of on the *rc* values now used. This can be done by: 1. finding all the normalised designs that have the same capacitor ratio as the ratios of all the standard values, and: 2. using a cutoff frequency that causes the capacitors to have standard values. As a consequence, the *rc* values will be quite odd, but that is of no concern in this case.

By a fortunate coincidence, the 7-branch *C*-in/out Chebyshev design for *rc* = 1 per cent has a normalised *C*-ratio (1·464/0·5354 = 2·734), and this is virtually identical to the standard-value ratio of 820/300 = 2·7333. If the proper cutoff frequency is used, a standard-value capacitor (SVC) lowpass filter design could be calculated using the normalised values previously given. The reader is encouraged to explore this possibility by calculating a lowpass SVC design using a cutoff frequency of 5·68MHz.

A 7-element highpass filter with the configuration shown in Fig. 2.1(D) can be calculated by using the reciprocals of the previously given normalised lowpass values for C1, C3, L2 and L4. Thus, the normalised highpass component values for C1, C3, L2 and L4 are 1·868F, 0·6831F, 0·8482H and 0·6667H, respectively. The *rc* and other related parameters remain the same. An SVC highpass design can be calculated as previously demonstrated if an *F-Ap* cutoff frequency of 7·25MHz is selected.

By using a BASIC-programmed computer, many lowpass and highpass SVC filter design tables have been calculated for most of the filter configurations shown in

TABLE 2.1

ABBREVIATED LISTING OF 5-ELEMENT 50 OHM CHEBYSHEV SVC-FILTER DESIGNS

LOWPASS DESIGNS

NO.	-----FREQUENCY (MHZ)----- F-CO	3-DB	20DB	40DB	MAX. VSWR	C1,5 (PF)	L2,4 (UH)	C3 (PF)
1	1.04	1.37	1.94	2.94	1.085	2200	9.82	4700
2	1.43	1.94	2.77	4.21	1.068	1500	6.96	3300
3	2.14	2.91	4.16	6.31	1.068	1000	4.64	2200
4	3.14	4.26	6.10	9.26	1.067	680	3.17	1500
5	4.91	6.45	9.13	13.8	1.087	470	2.09	1000
6	7.48	9.56	13.4	20.2	1.110	330	1.40	680
7	10.4	13.7	19.4	29.4	1.085	220	.981	470

HIGHPASS DESIGNS

NO.	-----FREQUENCY (MHZ)----- F-CO	3-DB	20DB	40DB	MAX. VSWR	C1,5 (PF)	L2,4 (UH)	C3 (PF)
1	1.43	1.06	.738	.486	1.068	3300	4.44	1500
2	2.15	1.58	1.11	.730	1.068	2200	2.96	1000
3	3.17	2.33	1.63	1.07	1.067	1500	2.01	680
4	4.39	3.34	2.36	1.56	1.087	1000	1.41	470
5	6.03	4.72	3.36	2.23	1.110	680	1.00	330
6	9.43	7.15	5.04	3.33	1.085	470	.658	220

Fig. 2.1. In addition to tabulating the component values, the computer also calculated and tabulated the *F-Ap* cutoff frequencies and the frequencies of the 3, 20 and 40dB attenuation levels of the Chebyshev, and the *F3, F-As* and the frequencies of attenuation peaks for the Cauer filters. For example, Table 2.1 shows an abbreviated listing of 5-element 50 ohm lowpass and highpass Chebyshev SVC filter designs using the 20 per cent tolerance capacitor series and a selected v.s.w.r. limit of 1·110:1.

In the next part of this article, tables with many more designs will be presented for the Chebyshev family of SVC lowpass and highpass filters, in which the 5 per cent tolerance capacitor series is used. In this case, the increment in cutoff frequency from one design to the next is so small that virtually any cutoff frequency can be obtained by simply scanning the appropriate table for a suitable design and reading the design values directly. Because the radio amateur most frequently designs filters for a 1–10MHz decade and a 50 ohm impedance level, all designs are based on these values. However, a simple scaling procedure will be explained in which SVC designs for any frequency decade and any impedance level can be obtained while using the table in the "scan mode".

References

References 1–8 were listed in Part 1.

9. R. Frost, *Large-scale s parameters help analyze stability, Electronic Design*, Vol. 28, No. 11, 24 May 1980.

10. E. Wetherhold, *Lowpass filters for attenuating r.f. amplifier harmonics*, Parts 1 and 2, *Short Wave Magazine*, December 1983 and January 1984.

11. M. F. "Doug" DeMaw, *On QRP Transmitters and Harmonic Output*, *SPRAT* (The Journal of the G-QRP Club), Nr. 35, Summer 1983.

APPENDIX A

The following equations relate the parameters associated with modern filter design.

1. $rc = 100 \times \sqrt{(1-0\cdot1^{x})}$
   where *rc* is reflection coefficient in per cent, $x = Ap/10$, and Ap = maximum passband attenuation in dB.

2. $Ap = -4\cdot3429 \times \log_e [1 - (rc/100)^2]$.
   See Equation 1 for explanation of terms.

3. v.s.w.r. $= [1 + (rc/100)]/[1 - (rc/100)]$.

4. $rc = 100 \times$ (v.s.w.r. − 1)/(v.s.w.r. + 1).

5. $F3/F\text{-}Ap = 0\cdot5 \times (K + 1/K)$.
   where $K = (2/e)^{1/n}$
   where n = number of branches
   $e = p/\sqrt{(1-p^2)}$, and $p = rc/100$
   Equation 5 is applicable for Chebyshev lowpass designs for $Ap < 0\cdot1$dB, $rc < 15\%$

For example, for $n = 5$, $rc = 6\cdot3\%$, $Ap = 0\cdot0172714$dB v.s.w.r. $= 1\cdot134$, $e = 0\cdot0631254$, $K = 1\cdot99602$ and $F3/F\text{-}Ap = 1\cdot2485$. If $F\text{-}Ap = 1\cdot462$MHz, then
$F3$ (lowpass) $= 1\cdot825$MHz and
$F3$ (highpass) $= 1\cdot171$MHz.

TO BE CONTINUED

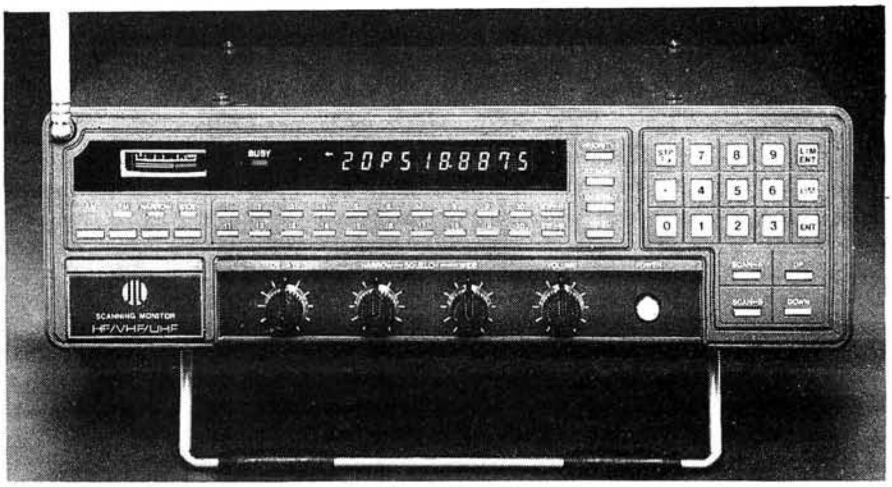
Did You Know...

That five of the world's great scientists huddled in a packing case to watch Marconi demonstrate his apparatus?

To discover whether his invention was suitable for communicating over water to lighthouses, Marconi set up his transmitter on the island of Flat Holme in the Bristol Channel, and his receiver three miles away on the Welsh coast at Lavernock Point. On 11 and 12 May 1897, before distinguished observers, the experiment was a failure. Sick with despair, Marconi accepted a suggestion that he remove his receiving apparatus from the cliff to the beach and so extend his 27 metre-high antenna vertically by a further 18m. On 14 May, during a storm, the five distinguished witnesses—including the celebrated Professor Slaby, who had been sent by the German Emperor—crammed themselves for shelter into a large packing case that had been laid on its side a few feet from the waves. To Marconi's relief, all went well, and he transmitted signals over the sea for the first time. Professor Slaby, describing the uncomfortable yet thrilling incident in his autobiography, wrote: "It will remain in my memory for ever."

Eric Westman

SX-400 Scanning Monitor Receiver



As indicated in the January 1984 *Products* page, the SX-400 v.h.f./u.h.f. scanning monitor receiver is now available in the UK, from Garex Electronics.

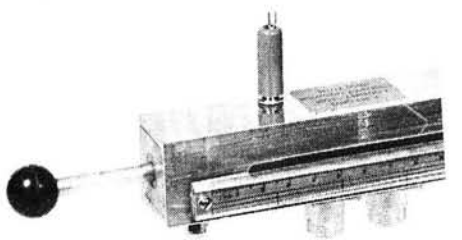
The SX-400 embodies all the features of the highly successful SX-200 and includes many additional features that, in addition to radio amateurs, should provide considerable interest to commercial and professional users.

Major features of the receiver include full coverage from 26MHz to 520MHz over 12 bands, programmable a.m. and f.m. throughout the range, switchable i.f. bandwidth, switchable channel spacing, 10·7MHz and 455kHz i.f. outputs, S-meter, computer handshaking for data recording and limitless memory capacity.

Two optional scalers (r.f. converters) will be available, that enable the receiver's coverage to be extended down to 150kHz and up to 3·7GHz; also available is a dedicated regulated power supply unit and data interface unit.

Priced at £598, which includes VAT, the SX-400 is available from: *Garex Electronics, 7 Norvic Road, Marsworth, Tring, Herts. Tel: Cheddington (0296) 668684.*

Cavity Wavemeter



A means of frequency (wavelength) measurement apparatus is required under the terms of the amateur licence. Frequency counters are today available with ranges well into the GHz region—but even with current l.s.i. techniques still cost a considerable amount of money. Furthermore, input attenuators are required if the sampled emission is at even modest (in amateur terms) power levels.

A recently introduced device, utilising an old technique, is the cavity wavemeter manufactured by G4ONF. This unit provides a ready means of measuring wavelength and by simple arithmetic deriving the applied frequency. A quarter wave line is formed by an adjustable plunger, running parallel to a millimetre rule used for the measurement. Applied r.f. is coupled into the cavity via a link probe across BNC or N-type sockets, allowing termination into a suitably rated load. A 3·5mm socket/jackplug fitted with detector diode is provided to drive your own milli-ammeter.

The device is approximately 0·6m in length and calibrated at 144, 430 and 1296MHz. The manufacturer's notes indicate that frequencies up to 2500MHz, with applied r.f. of as little as 50mW, can be worked out.

The v.h.f./u.h.f. cavity wavemeter together with a self-assembly 10GHz cavity wavemeter kit is available from: *Paul Sergent, 6 Gurney Close, Costessey, Norwich NR5 0HB. Tel: (0603) 747782.* The current price of the wavemeter is £32.50 incl p&p.

Also available are a range of Morse keys and coaxial relay kits—further details via s.a.e.

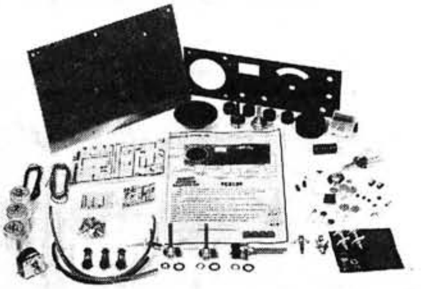
General Coverage Receiver Kit

Nowadays many radio enthusiasts are inclined to buy, rather than build, the equipment they require. Of course, if the requirement is for the latest technological facility then it is probably essential to buy. However, in addition to learning the basics of the hobby, nothing can replace the satisfaction experienced in building a piece of equipment and succeeding in getting it to work.

Commutech (Devon) Ltd. introduce a new general coverage receiver kit, called the FCR130, which utilises modern design techniques and uses good quality components throughout.

The kit has been designed with the beginner as well as the enthusiast in mind and the comprehensive instructions are written in plain, understandable language.

When built, the FCR130 is a four stage t.r.f. receiver that covers the frequency range 1 to 30MHz over three bands. Tuning is via a 30:1 geared tuning knob and other front panel controls and indicators include regeneration a.f. tone and S meter.



The model FCR130 General Coverage Receiver Kit is constructed on an "L" shaped chassis measuring 280mm wide × 102mm high × 182mm deep, costs £75.30, which includes VAT, plus £2.40 p&p, and is available from: *Commutech (Devon) Ltd., Chapel Street, Holsworthy, Devon EX22 6AR. Tel: (0409) 253504.*

If you please

Please mention this column when applying to manufacturers or suppliers featured on these pages.

Products

1·3GHz ATV Products

We have just received details of a range of 1·3GHz ATV equipment designed and manufactured by Solent Scientific. Three items are currently under production and include a basic ATV converter with a flat response over the range 1240-1325MHz. Typical noise figure is 3dB across the bandwidth and the i.f. output is available to your choice on any 11 consecutive channels in the u.h.f. TV channel groups 21 to 41 or 48 to 68. This unit is available ready built or as a kit/part kit. Reception of a.m. or (by slope detection) f.m. transmissions is possible.

The second item available is a state-of-the-art 1·3GHz (23-24cm) f.m. TV receiver system suitable for all current amateur m.d.f.m. TV transmissions and with possibilities for 4GHz satellite reception. Input from the appropriate down-converter feeds into an on-board u.h.f. tuner which is fully variable over the range 470-870MHz allowing a very wide choice of possible i.f. A tuning meter output is provided for accurate reset. The 6MHz sound sub-carrier is processed to provide a 1W audio output to drive into 8Ω. Output from the unit is video at the standard level of 1V p.p. into 75Ω. Specially developed threshold extension circuits are incorporated to improve picture quality under low level conditions and a.f.c. operates over a 20MHz range with a pull-in of ±5MHz. Video modulation sense is switchable as is the de-emphasis. A signal strength meter driving circuit is also on-board.

Once again this unit comes ready built or as a kit and does not require any special techniques to set-up as the highest frequency used (after the pre-aligned tuner) is 40MHz, most of the board being video or audio. Full back-up service is available.

The final item is essentially a piece of 1·3GHz test equipment in the form of a micro TV transmitter, ideal for anyone experimenting on this band.

The object was to design a portable "standard" for m.d.f.m. TV on 1·3GHz at an affordable price, in this case, fully built, tested and aligned at £29.95 + £1 p&p.

Although only producing 10mW output the unit will allow m.d.f.m. transmissions to be set anywhere in the permitted range of 1·3GHz. Deviation is set so that a 1V p.p. video signal at the input gives a 3MHz shift from sync to white level. No frequencies below the fundamental are present at a detectable level in the output. Harmonics are typically less than 10μW. As with all the products listed a supply of 12V d.c. is required. As the designer, Allan Latham G8CMQ, says, "if your receive set-up can get a picture from 100m away with a 60mm piece of wire for an antenna at each end, you won't miss much on 23/24cm ATV."

For further details/price etc, send an s.a.e. to: *Solent Scientific, 75 Chalk Hill, Southampton, or tel: (0703) 464675.*

DC to DC Converters

Davtrend Ltd. of Gosport have extended the Drae family of 24/12V switched-mode converters with the addition of a range of isolated versions.

The isolated models have identical electrical and acoustic characteristics as the non-isolated models of the same size, but offer higher input voltage capability.

Because of their low noise figures (2mV r.m.s. max. below 1MHz, 1mV r.m.s. max. above 1MHz) the converters are ideally suited to land mobile/marine applications—for example, powering transceivers, radios, audio and video equipment designed for 13·5V d.c. power sources.

Two typical converters in the range have input/output specifications of 24V (20 to 40V) to 12V (13·5V), giving up to 6A continuous, and 12V (10 to 20V) to 12V (13·5V), also providing 6A continuous.

UK prices for these two models are less than £60 each including VAT, and special versions of the converters in the range may be provided in accordance with customer specifications.

For further information, contact: *Davtrend Ltd., Sanderson Centre, Lees Lane, Gosport, Hampshire PO12 3UL. Tel: (07017) 20141.*

The G4VQS Check Log

The G4VQS Check Log book is intended as an alternative to a card index system for keeping a record of first contacts or competition contacts for UK radio amateurs.

Each 2-page "opening" contains a matrix of 26 × 26 lettered squares, each square containing 26 letters plus a space for checking off callsigns with 2-letter suffixes. In this way, each "opening" caters for all callsigns with the same G+number prefix, and since there are nine "openings" to the book, it copes with all the current UK prefixes.

The way in which you deal with differentiating between frequency bands and/or callsign variants (GM, GW, etc.) is up to your own ingenuity and needs, though the instructions put forward some suggestions. The back cover is ruled up for use as a special event station log.

As the check log measures 396 × 265mm (396 × 530mm when opened), it does need rather more space on your operating desk than a card index system, which could be a problem in some shacks. Unfortunately it is not practical to make it any smaller. Hwfa Jones G4VQS who devised the log suggests that it should normally live on a shelf when not in use, and be updated at the end of each operating session, rather than whilst actually on-air.

The G4VQS Checklog is available price £2.50 plus 27p post and packing from *T. P. Forms, 357 Upton Road, Noctorum, Birkenhead, Merseyside.*

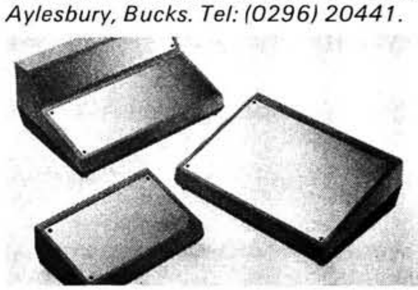
Smart Case

With constructors demanding a professional finish to their projects, readers may be interested in a new range of low-cost desk cases from West Hyde Developments.

Entitled the Seville range, the cases are made from ABS plastic in two screw-together halves in an attractive cream and tan colour combination. The top panels are aluminium with an anodised finish.

Three models are available, the largest of which has two split-angled panels, and each is supplied complete with plug-in feet.

For further details and prices, contact: *West Hyde Developments Ltd., Unit 9, Park Street Industrial Estate, Aylesbury, Bucks. Tel: (0296) 20441.*



Microphone Pre-Amp With AGC

by Jon Gudgeon G4MDU

With some hand-held microphones it is apparent that if your mouth is more than a few centimetres away they become completely useless for communication purposes.

This was found to be a serious disadvantage to the author who required a microphone that would provide a constant audio output to the transmitter in use, when speaking into the microphone between 50mm and 5m away. Additionally a switch to key the transmitter, so as to leave both hands free to make adjustments to other equipment in the shack, was highly desirable.

The pre-amplifier assembly to be described satisfies both these requirements, while maintaining a very good quality of audio for transmission.

Circuit Description

The circuit shown in Fig. 1 utilises the functions of a 6270 i.c. which incorporates a built-in voice operated gain adjusting device (v.o.g.a.d.). A low impedance microphone is fed to the inputs of a differential pre-amplifier whose output is then connected to the main amplifier by an external coupling capacitor, C3. The main amplifier's output is monitored by an automatic gain control (a.g.c.) detector, which is used to control the gain of the pre-amplifier stage.

The main amplifier's gain is set internally by a 10kΩ feedback resistor. High frequency roll-off, if desired, can be set by capacitor C4 between the input and output of the main amplifier.

The a.g.c. section's job is to ensure that for an input range of 60dB to the pre-amplifier, the main amplifier provides a constant output of approximately 90mV.

With this particular i.c. it is possible to control the speed at which the a.g.c. regulates the output level. However, it is normally required to respond quickly and the values shown in Fig. 1 will be suitable for this purpose.

The circuit will operate satisfactorily with a supply voltage of between 4·5 and 10V d.c. and requires a typical supply current of 5mA. In this application a 6-F22 (PP3) battery will be quite adequate if switched out when not in use. A separate switch is provided to key the transmitter, replacing the pressel of the hand-held microphone.

Construction

The circuit is constructed on a single-sided printed circuit board as shown in Fig. 2, although a Veroboard layout would also be suitable. The i.c. should be mounted in a socket to prevent any soldering damage problems. Both the p.c.b. and 9V battery are housed in an aluminium diecast box measuring 114 × 64 × 30mm. Leads from the microphone and to the transmitter should be screened and kept as short as possible, using appropriate plugs/sockets.

★components

Resistors

¼W 5% Carbon film

22kΩ	1	R1
1MΩ	1	R2

Miniature horizontal pre-set

1kΩ	1	R3

Capacitors

Monolithic ceramic

4·7nF	1	C4
0·1μF	1	C2

Electrolytic 16V, single-ended

1μF	1	C3
10μF	1	C5
22μF	1	C6
100μF	1	C1

Integrated Circuits

6270	1	IC1

Miscellaneous

Diecast box 114 × 64 × 30mm; Sub-miniature s.p.s.t. toggle switch (2); 6-F22 (PP3) battery; battery connector; microphone plug/socket; p.c.b.; 8-pin d.i.l. i.c. socket.

WRM187

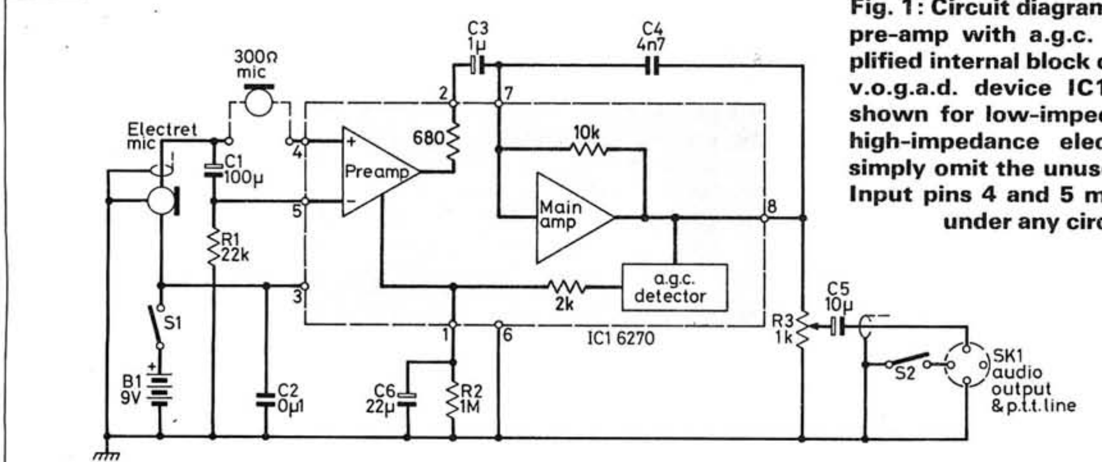
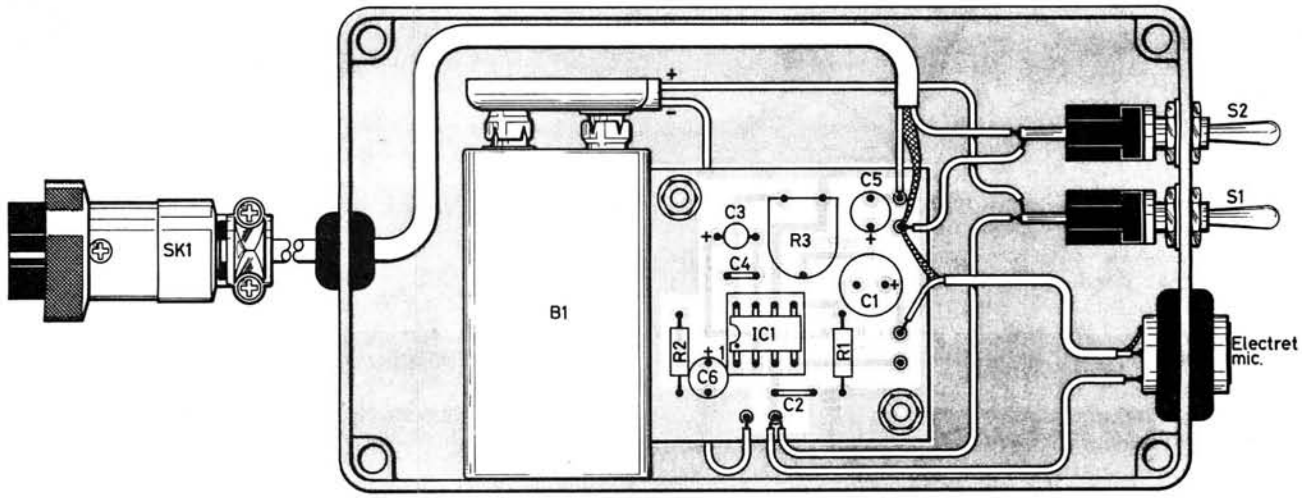


Fig. 1: Circuit diagram of the microphone pre-amp with a.g.c. including the simplified internal block diagram of the 6270 v.o.g.a.d. device IC1. Connections are shown for low-impedance dynamic and high-impedance electret microphones, simply omit the unused alternative type. Input pins 4 and 5 must not be earthed under any circumstances

WRM189



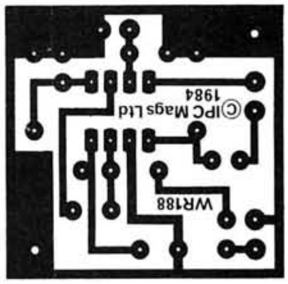
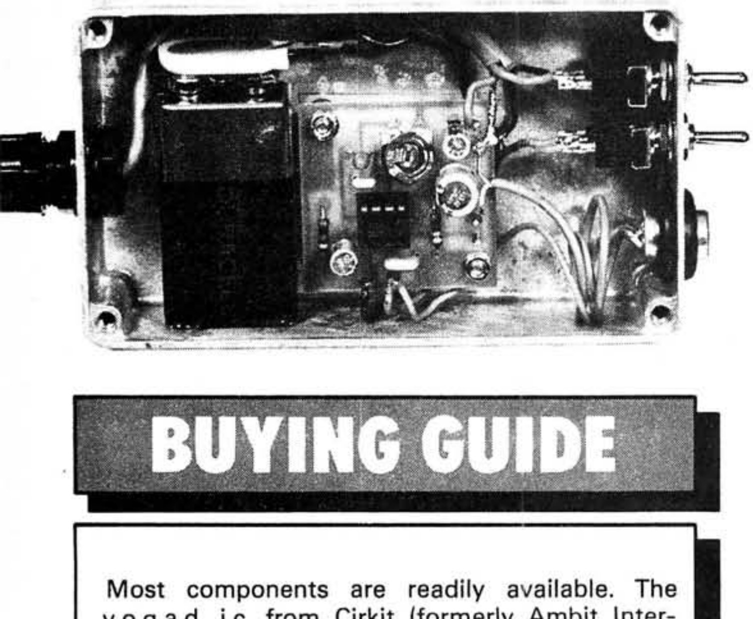


Fig. 2: Component layout and p.c.b. track pattern shown full size. The version shown uses an electret insert mounted in the enclosure wall within a rubber grommet. An appropriate socket/captive plug would be fitted in place of the insert if used with the original transceiver hand-held microphone



Setting-Up Procedure

There is very little to set up and the circuit should work first time. All that need be adjusted is the 1kΩ pre-set potentiometer R3 which sets the output level to the input of the transmitter in use. The best way of doing this is to use a monitor receiver with a pair of headphones—switch the transmitter on and then adjust the pre-set until the required level is found. If this level is too great echoes will be a problem and the gain should be just backed off from this point. If you then walk away from the microphone the audio level heard in the monitor receiver should remain at the same level over a considerable distance.

In practice the microphone pre-amplifier works well and is frequently used by the author while active on fast scan ATV where it is often required to pan a TV camera around the shack and give a commentary at the same time. ●

BUYING GUIDE

Most components are readily available. The v.o.g.a.d. i.c. from Cirkit (formerly Ambit International) or RS Components and the electret insert from Tandy shops

Approximate Cost £9.50

Construction Rating Intermediate

Kindly Note

PW Radio Programs—5 Cassette—March 1984

Unfortunately the Kindly Note giving the details of the error in "DATA" got mixed up. It should have read:
480 LET C = C*10 ↑–12.

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1197	SP-102P	External speaker & phone patch	69.00
1198	FV-102DM	VFO Scanner	219.00
1199	FC-102	ATU	170.00
1206	FAS-1-4R	Antenna Switch	39.00
1204	FT-1	Transceiver All Mode/General Coverage	1399.00
1224	FT-101Z/AM	Transceiver with AM unit	515.00
1225	FT-101ZD/AM	Transceiver (digital) with AM unit	589.00
1228	DIG101	Digital Unit	99.00
1274	Fan B	Fan	13.00
1229	FT-77	Compact Transceiver	439.00
1230		Marker Unit for FT-77	10.00
1231		FM Unit for FT-77	25.90
1232	FP-700	PSU	119.00
1252	FC-700	ATU for FT-77/707	94.00
1256	FV-700DM	Digital VFO	190.00
1247	FT-980	Transceiver (CAT)/General Coverage	1149.00
1243	SP-980	Speaker	56.00
1244	FT-757GX	All Mode Transceiver/General Coverage	650.00
1245	FP-757GX	AC PSU	139.00
1264	FC-757AT	ATU	219.00
1248	FRG-7700	General Coverage Receiver	349.00
1249	FRG-7700M	General Coverage Receiver with Memory	399.00
1254	FRT-7700	ATU	44.00
1255	FRA-7700	Active Antenna	36.00
1257	FRV-77000	Converter 118/130, 140/150, 70/80MHz	83.00
1273	MEM7700	Memory Unit	59.00
1246	FL-2100Z	HF 1200W Linear Amplifier	499.00
1251		Cabinet for SP-101	17.00
1276		AM Unit for FT-101Z	20.00
1200	NC-1	Desk Charger for FT-202R	19.00
1201	PA-1	12V Adapter for FT-202R	19.00
1205	FP-4	AC PSU, 4 Amp	42.00
1220	FP-80A	AC PSU, 4.5 Amp	53.00
1234	FT-290R	2m All Mode Transceiver, portable	259.00
1202	CSC-1A	Carrying Case	3.95
1210	MMB-11	Mobile Mount	25.50
1211	NC-11C	Charger	9.50
	FL-2010	2m 10W Linear Amplifier	60.00
1241	FT-720RU	70cm Mobile Transceiver, 10W	219
1217	E-72L	Extension cable, 4m	14.50
1218	S-72S	Switching box	37.00
1233	FT-208R	VHF Handie FM Transceiver	189.00
	FT-708R	UHF Handie FM Transceiver	199.00
1253	NC-8C	Fast Charger for FT-208/708	49.00
1258	NC-7C	Base Charger for FT-208/708	29.00
1260	FBA-2	Battery Sleeve for NC-718	3.00
1261	MMB-10	Mobile Bracket	7.50
1262	NC-9C	Compact Trickle Charger	8.00
1263	FT-230R	2m FM Mobile Transceiver, 25W	249.00
1237	FT-726R	VHF/UHF Multiband, multimode Transceiver c/w 2m	699.00
1238	430/726	70cm module	239.00
1239	SAT726	Satellite Unit	90.00
1259	PA-3	Battery eliminator/charger for 12V	13.00

MICROPHONES/ACCESSORIES

Cat. No.	Item	Description	Price £
1208	MH1B8	Hand mic., scanning	14.00
1214	YM-35	Hand mic., scanning, for FT-1/102/707 series	15.95
1215	YM-36	Noise cancelling mic., 4-pin, 50K	15.95
1221	YD-148A	Desk mic., 50K/600 ohms, 4-pin, for FT-101 series	22.75
1235	YM-38	Desk mic., scanning, for FT-1/102/707 series	26.50
1250	YM-49	Speaker/mic. for FT-290/230R	17.00
1213	QTR-24D	24-hour quartz clock	32.00
1216	YH-55	Lightweight headphones	10.50
1219	YH-77	Lightweight headphones	11.00
1278		Battery Holder for FRG-7	3.90

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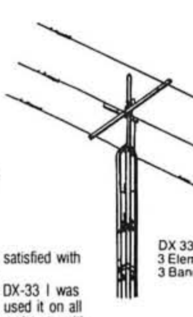
Cat. No.	Type	Description	Price £ Inc. VAT + Carr.
1331	TS-930S	Transceiver, HF, w gen. cov. receiver	1099.00
1330	TS-930S	+ ATUAs above, with automatic ATU	1199.00
1329	SP-930	Speaker and filters	57.00
1313	MC-60A	Desk Top Microphone, scanning	54.00
1357	YK-88A1	6kHz AM filter	32.00
1356	YK-88C1	500Hz CW filter	32.00
1348	YG-455C-1	500Hz CW filter	75.00
1349	YG-455CN-1	270Hz CW filter	75.00
1324	TS-430S	Transceiver, HF, w. gen. cov. receiver	719.00
1310	PS-430S	DC power supply, de luxe cooled	113.00
1319	SP-430	External speaker	30.50
1334	FM-430	FM Unit	33.75
**1321	MB-430	Mobile Mount	12.50
1313	MC-60A	Desk Top Microphone	54.00
1320	AT-130	Antenna Tuning Unit	
1354	YK-88C	500Hz CW filter	
1315	YK-88CN	250Hz CW filter	36.00
1352	YK-88SN	1.8kHz SSB filter	
1353	YK-88A	6kHz AM filter	
1314	PS-30	DC PSU	
1326	TS-530S	Transceiver, HF	609.00
1327	SP-230	External Speaker	45.00
1325	AT-230	Antenna Tuning Unit	149.00
1313	MC-60A	Desk Top Microphone	54.00
1312	MC-50	Desk Top Microphone	32.00
1302	KB-1	De luxe VFO knob	11.50
1354	YK-88C	500Hz CW filter	
1315	YK-88CN	270Hz CW filter	36.00
1352	YK-88SN	1.8kHz SSB filter	
1328	R-600	Receiver	259.00
1333	DCK-1	DC Operation Cable kit	8.26
1332	R-1000	Receiver	299.00
1318	SP-100	External Speaker	33.00
1333	DCK-1	DC Operation Cable Kit	8.26
1335	R-2000	Receiver	399.00
1355	YG-455C	500Hz CW filter	
1337	TR-2400	Transceiver, 1.5W FM, 10CH Mem.	195.00
1301	ST-1	Base Stand	45.00
1309	MC-30S	Hand Microphone	14.00
**1322	AT-250	Automatic ATU	280
1338	TR-2500	2m FM Transceiver	219.00
1304	ST-2	Base Stand	52.00
1360	MS-1	Mobile Stand	32.00
1342	VB-2530	25W Amplifier	75.00
1306	SMC-25	Speaker microphone	17.00
1361	BT-1	Manganese Battery Case	6.50
1311	PB-25	Nicad Battery	26.00
1305	SC-4	Soft case	14.00
1362	LH-2	De luxe leather case	
1363	TU-35A	Variable Tone Encoder	
1364	TU-35B	Programmable Tone Encoder	
1365	DC-25	DC Adaptor for 12VDC	
1366	RA-4	Rubber Antenna	
1367	RA-3	Telescoping Antenna	
1343	TR-8400	70cm Transceiver	279.00
1368	PS-10	DC PSU	52.50
1369	SP-40	Compact Mobile Speaker	15.75
1371	MC-46	Auto-patch Up-Down microphone	41.50
1313	MC-60A	Desk Top Mircophone, built-in pre-amp	50.00
1339	TR-9130	2m All Mode Transceiver, 25W	419.00
1372	BO-9A	System Base	
1373	SP-120	External Speaker	
1374	PS-30	DC Power Supply	114.00
1370	BC-1	AC Adaptor for memory back-up	6.43
1371	MC-46	Touch-tune microphone	41.50
1313	MC-60A	Deluxe Desk Top Mic. + pre-amp.	52.00
1369	SP-40	Compact Mobile Speaker	
1341	TR-9500	70cm All Mode Transceiver	429.00
1372	BO-9/9A	System Base	48.50
1373	SP-120	External Speaker	34.00
1307	PS-20	DC Power Supply	59.00
1370	BC-1	AC Adaptor for memory back-up	8.00
1313	MC-60A	De luxe Desk Top Mic. + pre-amp	50.00
1369	SP-40	Compact Mobile Speaker	15.75
1316	TL-922	2KW HF Linear Amplifier	799.00
1376	SM-200	1.8-150MHz Station Monitor	250.00
1351	HC-10	Digital World Clock	65.00
1350	PC-1A	Phone Patch	50.00
1303	RA-1	Antenna	8.00
1379	MC-42S	Spare – Up/Down Microphone	16.00

Penetrate the four corners of the earth with the

DX "PENETRATOR"



DX 33
3 Element
3 Bands

HERE'S THE SPECIFICATION . . .

- ★ 3 elements on each band.
- ★ heavy duty 2kW rated
- ★ Gain up to 8dB
- ★ Broadband operation.
- ★ Stainless steel hardware.
- ★ SWR less than 1.3:1.

HERE'S WHAT THE CUSTOMERS SAY!

1. VK7NOW "I have recently installed a DX-33 beam and I would like to advise you that I am extremely satisfied with it. It certainly outperforms the TH3JNR which I previously used and also the VSWR is lower."
2. G3AAE "This letter is to tell you how pleased I am with the DX-33 antenna . . . On unpacking the DX-33 I was immediately impressed with the quality of the hardware, and in operation it is just as impressive. I have used it on all three bands and have been obtaining excellent reports from DX stations all over the world. I have conducted tests with other stations and these show that the electrical figures included in the DX-33 specification are fully met in practice. Congratulations on a very fine product!"

NOW IN USE FROM VK7 TO VE7!

PRICES (INC. CARR. AND VAT)

ANTENNAS

WESTERN ANTENNAS (Carriage paid)

Cat. No.			Price
1075	DX 7/2	7MHz 2 ele. Yagi. Gamma matched, 20' boom	239.00
1076	DX 7/3	7MHz 2 ele. Yagi. Gamma matched, 40' boom	354.20
1077	DX 51	Rotary dipole for 28,24,21,18 and 14MHz	90.85
1080	DX 6V	10 80m Multi band vertical plus 30m	99.00
1081	DX 31	Dipole 10/15/20m 2Kw p.e.p.	81.65
1082	DX 32	2 element 10/15/20m 2Kw p.e.p.	125.35
1083	DX 33	3 element 10/15/20m 2Kw p.e.p.	182.85
1084	DX 34	4 element 10/15/20m 2Kw p.e.p	256.45
1085	DX 31/32	Conversion Kit	50.60
1086	DX 32/33	Conversion Kit	63.25
1087	DX 33/34	Conversion Kit	75.90
1089	DX 103	3 element 10m Yagi	90.85
1090	DX 105	5 element 10m Yagi	113.85
1093	DX 4K	Converts DX 31/2/3/4 to 40m dipole	69.00
1094	DX 27/1	Rotary dipole for 27MHz C.B	12.65
1095	DX 27/3	3 ele Beam for 27MHz Gamma matched	36.80
1096	DX 240	2 ele quad 2, 10, 15 & 20m	199.99
1097	DX 260	2 ele quad 2, 10, 15, 16 & 20m	224.25

ANOTHER Western WINNER! . . .

Remember . . . the ulti-mase was so called because it is the

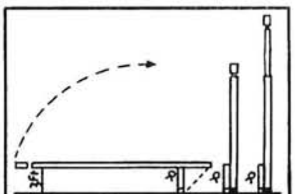
ULTIMATE IN DESIGN

*Our structural engineering department came up with the maximum of strength for the minimum of cost. It's impossible to get **MORE** strength for **LESS** cost*
. . . so beware of cheap copies
. . . they may not have the correct materials.

Slim, unobtrusive
For VHF and HF antennas
Simple ground fixing

One-winch operation
Telescopic and Tilt-over
Self-supporting

AT 100M.P.H. WINDSPEED THE ULTIMAST TAKES 115% *MORE* HEADLOAD THAN THE SM.30. ULTIMAST TAKES 3.87 SQ. FT.



PRICES (inc. Carr. & VAT)
Ultimast UM-1 . . . . £263.35
Reducor head, UHD £8.05
Rotor head, UHD-2 . . . . £35.65

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BASIC QSOs in ITALIAN

Part 2

by G.W. Roberts GW4JXN and Paolo Pellegrineschi I5IJP

Rig and Antenna (continued)

With horizontal/vertical/circular polarisation.	Con polarizzazione orizzontale/verticale/circolare.	Con polaritsatseeonay oritsontalay/vertikalay/tshirkolaray.
With a gain of . . .	Con un guadagno di . . .	Con wn gwadanio dee . . .
A quad/a long wire/an end fed Zeppelin/a centre fed Zeppelin.	Una cubica/a filo/una Zeppelin alimentate agli estremi/al centro.	Wna kwbika/a feelow/wna Tsepelin aleementata alli estraymee/al tshentrow.
The antenna is about . . . metres above ground level.	L'antenna é a circa . . . metri dal suolo.	Lantenna ay a tshirka . . . metri dal swolo.
The QTH is . . . metres above sea level/at sea level/below sea level.	Il QTH é a . . . metri sul livello del mare/al livello del mare/sotto il livello del mare.	Il Kwtayha ay a . . . metree swl livaylo del maray/al livello del maray/soto il livello del maray.
The antenna has a rotator.	L'antenna usa un rotore.	Lantena wza wn rotoray.
I'll turn the antenna on you during the next over.	Girerò l'antenna su di te al prossimo cambio.	Djirerow lantenna sw dee tay al prosseemow kambeow.
I rotate the antenna by hand.	Giro l'antenna a mano.	Djirow lantena a mano.
The antenna is in the garden/attic on a . . . metre high mast.	L'antenna é in giardino/attico su di un tubo portante alto . . . metri.	Lantena ay in djiardeeno/atico sw dee wn twbo portantay alto . . . metree.
I am testing the rig.	Sto provando l'equipaggiamento.	Shto provando lekwipadjiamentow.
I am glad of your report.	Sono contento del rapporto che mi hai dato.	Sono contento del raporto kay me ay dato.
I like my . . . I want to change my . . .	Mi piace il mio . . . Voglio cambiare il mio . . .	Me peatshay il meeo . . . volio kambeare il meo.
How do you like your . . .	Quanto ti piace il tuo . . .	Kwanto tee peatshay il two.

Weather and Radio Conditions

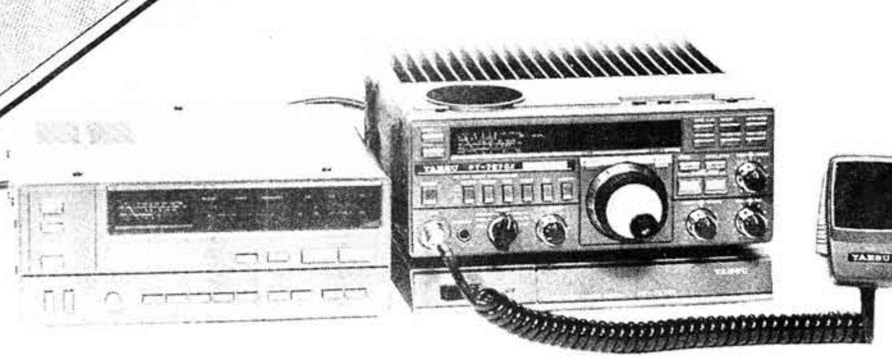
Today the weather is fine/sunny/(very) cold/hot/misty/windy. It is raining. It is snowing. The snow is 30cm thick. The weather has been fine.	Oggi il tempo é bello/soleggiato/(molto) freddo/caldo/nebbioso/ventoso. Piove. Nevica. La neve é alta di trenta cm. Il tempo é stato bello.	Odje il tempo ay belio/solaydjeato/(molto) fredo/caldo/nebiozo/ventozo. Peovay. Neveeka. La nevay ay alta dee trenta tshentimetree. Il tempo ay stato bello.
Today/yesterday/during the weekend it has been raining. It has been snowing.	Oggi/ieri/durante il fine settimana ha piovuto. Ha nevicato.	Odjee/eeayree/dwrantay il finay setimana a peovwto, aa nayvycato.
Spring/summer/autumn/winter has come.	E arrivata la primavera/l'estate/l'autunno/l'inverno.	Ay arrivata la privavera/lestatay/lawtwno/linverno.

The wind has been strong. There has been thunder and lightning.	Il vento é stato forte. Vi sono stati lampi e tuoni.	Il vento ay stato fortay. Vee sono statee. Lampee ay twonee.
Working conditions are poor/bad/moderately good/very good/excellent.	Le condizioni di lavoro sono pessime/cattive/moderatamente buone/molto buone/eccellenti.	Lay conditsionee dee lavoro sono pessimay/kativay/modermanentay bwonay/molto bwonay/etshelentay.
All the bands are open. The 10, 15, 20 metre band is open/closed to North/Central/South America. Eastern/Northern/Southern/Western Europe, Asia, Australasia, Africa, the Far East, Japan.	Tutte le bande sono aperte. I 10, 15, 20 metri sono aperti/chiusi per il Nord/Centro/Sud America. Europa Orientale/Settentrionale/Meridionale/Occidentale, Asia, Australasia, Africa, Estremo Oriente, Giappone.	Twte lay banday sono apertee ee deaytshee, kwindeetshee, ventee metri sono apertee/keewzee per il Nord/Tshentro/Swd Amerika. Oyropa oreeentalay/Setentrionalay/Meridionalay/Otsheedentalay, Asia, Awstralasia, Africa, Estraymo Oree-entay, Djiapponay.
I have just heard a . . .	Ho appena ascoltato . . .	Ow apayna ascoltato . . .
I can hear but cannot work a . . .	Posso ascoltare ma non collegarmi con . . .	Poso ascoltaray ma non coliegarme con . . .
There is an opening on 2 metres.	C'é una apertura sui due metri.	Tshe wna apertwra swwee dway metree.
This lift is getting better/worse. Let's hope it lasts.	Questo aumento migliora/peggiora. Speriamo che duri.	Kwesto awmento miliora/pedjeeora. Shpereeamo kay dwree.
Nice to speak to you under lift conditions.	Bene poterti parlare in condizioni di propagazione.	Benay potertee parlaray in conditsionee dee propagatsionay.
It is . . . o'clock approx here local time/GMT.	Sono circa le ore . . . locali/GMT.	Sono tshirka le oray . . . localee/gee-emm-tea.
What time is it in.	Che ore sono in . . .	Kay oray sono in . . .
Arranging Sked		
May I speak to you again?	Posso parlarti ancora?	Poso parlartee ankora?
Are you free tomorrow/this time next week at . . . hrs GMT?	Sei libero domani/alla stessa ora la prossima settimana alle ore . . . GMT.	Say libero domanee/alla staysa owra la proseema seteemana alay oray . . . gee-emm-tea.
How about this frequency or alternatively let's try the 10, 15, 20 metre band.	Proviamo circa su questa frequenza od in alternativa proviamo la banda dei 10, 15, 20 metri.	Proveamo tshirka sw kwesta frekwentsa od in alternateeva proveamo la banda dei deeaytshee, queendeetschee, ventee metree.
No I'm sorry I'm not free at that time.	No, mi dispiace non sono libero a quell'ora.	No, me dispeeatshay non sono libero a kwelora.
I am usually on 20 metres at . . . GMT on (days of week) except . . .	Di solito sono sui venti metri alle ore . . . GMT (days of week) ad eccezione di . . .	Deesoleto sono swi ventee metree allay oray . . . gee-emm-tea (days of week) ad etshetsionay dee . . .
I have to go to bed/to work now.	Debbo andare a dormire/a lavorare ora.	Debow andaray a dormiray/a lavoraray ora.
Technical		
I have a new rig/linear/antenna which I am testing.	Dispongo di un nuovo equipaggiamento/lineare/antenna che sto provando.	Dispongo dee wn nwovo ekweepadjeamentow/linayaray/antena kay sto provando.
Is my modulation OK? Your modulation is good/bad.	La mia modulazione é OK? La tua modulazione é buona/cattiva.	La mea modwlatsionay ay OK? La twa modwlatsionay ay bwona/cateeva.
What is my exact frequency?	Quale é la mia frequenza esatta?	Kwalay ay la mea freqventsa esatta?
I'm using a speech compressor.	Sto usando un compreessone microfonico.	Sto wzando wn compresonay mikrofonekow.
Does this make any difference?	Cambia qualche cosa?	Kambea kwalkay kowza?
Thank you for the test.	Grazie per la prova.	Gratsiay per la prova.
Social		
From the shack I can see mountains/sea/moors.	Dalla mia stazione posso vedere le montagne/il mare/le brughiere.	Dala meea statseeonay poso vaydayray lay montaniay/il maray/lay brwgeayray.
I have a friend/wife/children in the shack with me.	Con me in stazione ho un amico/la moglie/i ragazzi.	Con may in statseonay oh wn ameeko/la moleay/ee ragatsee.
He is a visitor/a short wave listener.	É un visitatore/un ascoltatore in onde corte.	Ay wn visitatoray/wn asholtatoray in onday cortay.
He intends to do his radio exam.	Pensa di fare gli esami per la radio.	Pensa dee faray lea esamee per la radio.
I am at home/at work/at a friend's house.	Sono a casa/al lavoro/in casa di un amico.	Sono a caza/al lavoro/in caza dee wn ameeko.
This is a demonstration/special station.	Questa é una dimostrazione/una stazione speciale.	Kwesta ay wna dimonstratsee onay/wna statseonay shpetsialay.
I have visited your country.	Ho visitato il tuo paese.	Oh visitato il two payayzay.
I hope to visit your country.	É stato piacevole.	Ay stato peeatshayvolay.

Excuse my Italian.	Scusami per il mio Italiano.	Skwzame per il meeo Italiano.
I wish I could speak your language as well as you speak mine.	Vorrei poter parlare la tua lingua come tu parli la mia.	Vorray poter parlaray la twa lingwa comay tw parlee la mea.
Can you continue in English?	Puoi continuare in Inglese?	Pwoi continwary in inglayzay?
May I say it in English?	Lo posso dire in Inglese?	Lo poso diray in inglayzay?
May I explain it in English?	Lo posso spiegare in Inglese?	Lo poso shpegaray in inglayzay?
QSL		
Could you please send me your QSL card?	Puoi inviarmi la tua cartolina QSL?	Pwoi inviarme la twa cartoleena Kw-es-el?
I would be very pleased to get a QSL card from you.	Sarei molto lieto poter ricevere la tua cartolina QSL.	Saray molto leayto poter retshayvayray la twa cartoleena kw-es-el.
I shall send you my QSL card via the bureau/direct.	Ti invierò la mia cartolina QSL via Associazione/diretta.	Tee inveeayro la mea cartoleena kw-es-el veea Asosiatsone/direta.
My name is in the American/British callbook.	Il mio nome é sull'Annuario Americano/Inglese.	Il meo nomay e swl Anwareeo Americanow/Inglyazay.
Is your name and address in the callbook?	Il tuo nome ed indirizzo é sull'Annuario?	Il two nomay ed indiritso ay swl anwareeo?
Can you give me your address and telephone number over the air?	Puoi darmi direttamente via radio ora il tuo indirizzo e numero del telefono?	Pwoi darme diretamentay veea radio ora il two indiritso ay nwmero del telefono?
What is your postal code/telephone code?	Qual'é il tuo codice postale/telefonico?	Qwalay il two koditshay postalay/telayfoniko?
This is my address and my telephone number.	Questo é il mio indirizzo e numero telefonico.	Kwesto ay il meeo indiritso ay nwmero telefoniko.

Continued next month

PW REVIEW



YAESU FT-757GX HF TRANSCEIVER

The FT-757GX transceiver provides an attractive package of features in a very small size, giving 100W output capability on all h.f. amateur bands between 1·8 and 30MHz. It comes fitted as standard with f.m., wideband a.m. and narrowband c.w. filters, electronic keyer, an a.f. speech processor, dual v.f.o.s and an 8-channel memory system. No less than three microprocessors are used!

A quick run-through the various controls and displays will give an idea of what the FT-757GX can do. Starting at the left-hand end of the front panel, we find a push-button ON/OFF switch plus connectors for headphones and microphone (remote UP/DOWN frequency control with a suitable mic.). Push-buttons for MOX (manually operated transmit/receive switching) and VOX (voice operated T/R switching) are to the left of the S-meter. This meter is used on transmit to indicate power out, a.l.c. (automatic level control) operation, or v.s.w.r., according to the positions of two switches. The digital frequency readout is a 6-digit blue fluorescent display, indicating to the nearest 100Hz step, although the transceiver actually tunes in 10Hz steps. More of this later. Also incorporated into the display are indicators to show which v.f.o. is in use, or if the frequency is being set by the memory and if so which memory channel; whether the clarifier is in use; whether split-frequency operation (transmit on one v.f.o., receive on the other) has been selected; if DIAL LOCK is in use.

A row of push-buttons below the S-meter control: meter function a.l.c./p.o. on transmit; r.f. amplifier; r.f. attenuator; speech processor, noise blanker, a.g.c. fast/slow. Below them are the mode switch and concentric r.f./i.f. gain controls. The main tuning knob, which has a rate of 10kHz per revolution, has an adjustable friction brake. Above this knob are push-buttons for the clarifier (this most unusually operates over the whole frequency range of the receiver, rather than the usual plus/minus a few kilohertz), and the dial lock which isolates the tuning knob and the up/down frequency buttons on the microphone.

The receiver tunes continuously from 500kHz to 29·9999MHz without a bandswitch. To speed up retuning to a different frequency a pair of up/down buttons are provided which step from one amateur band to the next. To select segments of the 28–29·7MHz band, or to move outside the amateur bands, pressing a button marked 500K STEP will cause the up/down buttons to shift the frequency in 500kHz steps.

Seven other push-buttons are involved in the tuning/memory facilities, and I can deal only briefly with their operation here. When I tell you that no less than six pages of the operating manual are devoted to explaining these facilities, you will understand why.

As already mentioned, there are two v.f.o.s which can be used separately, or both used together for split frequency operation. Also the clarifier can be used to shift the received frequency for split frequency operation. The clarifier setting can be stored in one of the memories for future use, if desired, rather than losing it when switching the clarifier off, as would normally happen. The various memory buttons also allow you to:

1. Swap the contents of the v.f.o. register and the memory register back and forth, without losing either. The current operating frequency is always the one displayed on the digital readout, and this can be altered by the tuning knob.

2. Call up the frequency stored in the memory register and use it to control the transceiver. This frequency cannot be changed by the tuning knob. The v.f.o. frequency setting is not lost, and can be called back again.

3. Transfer the v.f.o. setting into the memory register, over-writing what was previously there.

4. Transfer the memory register contents into the v.f.o. register over-writing what was previously there. In either "3" or "4", the two registers are equalised.

In each example when I talk about a v.f.o. register this can be either "A" or "B" v.f.o., and when I talk about a memory register, this can be any one of the eight. The up/down band-change buttons are used to step through the memory channels when memory recall has been selected.

One final feature of the memory is a programmable scan, which can sweep through the frequency range between a selected memory channel and the next one above it.

The memory is powered by a lithium battery with a life of some five years.

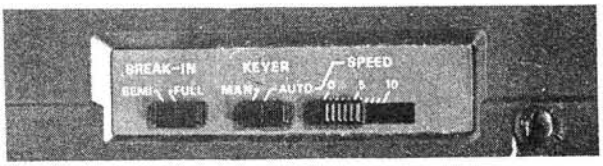
There are three other controls on the front panel, each dual concentric. They are: i.f. shift and width, squelch threshold and noise blanker time constant, microphone gain and carrier drive level.

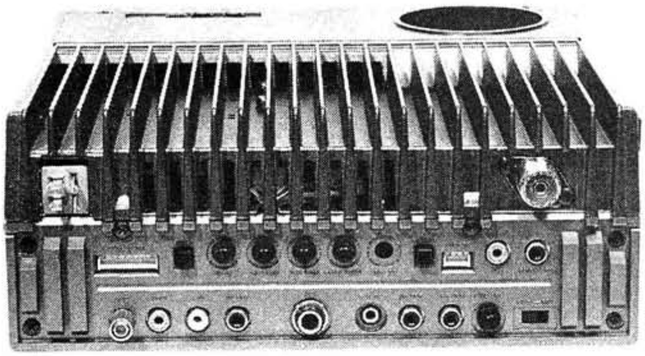
On the top of the transceiver case are the loudspeaker, plus switches for semi/full break-in operation, manual/auto keyer control and the electronic keyer speed control, which is arbitrarily calibrated from 0 to 10.

As seems to be the fashion nowadays, the back panel looks almost as complicated as the front. There's the usual SO-239 antenna socket and a ground terminal, the plug for the 13·5V d.c. supply, a $\frac{1}{4}$in jack for conventional or paddle-type Morse key and a 3·5mm jack for an external loudspeaker.

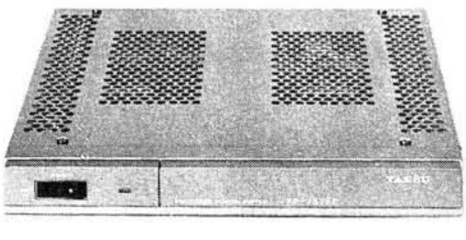
Besides these there are RCA "phono" jacks for: +8V 100mA d.c. and +13·5 500mA d.c. for powering accessories; low-level r.f. out (−6dBm or 0·1V r.m.s. at 50Ω) for driving

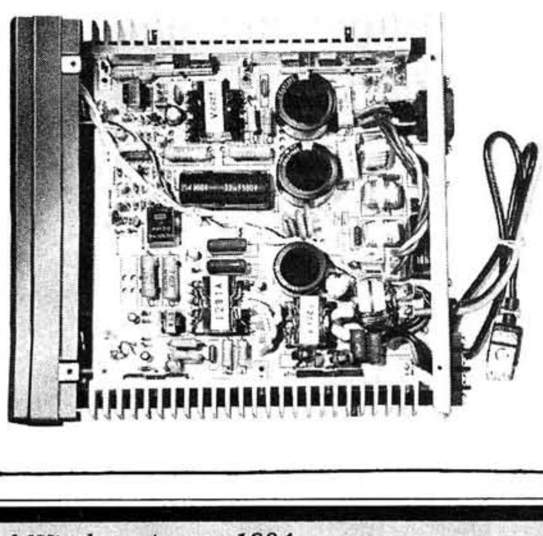
The Transceiver



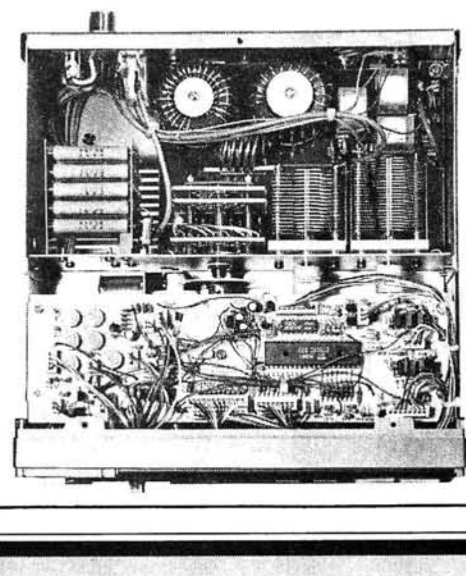


The Switch-mode PSU





The ATU



★ specifications

TRANSMITTER

Frequency coverage: 1·5–1·99999MHz (160m)
3·5–3·99999MHz (80m)
7·0–7·49999MHz (40m)
10·0–10·49999MHz (30m)
14·0–14·49999MHz (20m)
18·0–18·49999MHz (17m)
21·0–21·49999MHz (15m)
24·5–24·99999MHz (12m)
28·0–29·99999MHz (10m)

Types of emission: c.w. (A1A), u.s.b./l.s.b. (J3E), a.m. (A3E), f.m. (G3E)

Power output: c.w., s.s.b., f.m. 100W p.e.p. (slightly less on 28MHz band)
a.m. 25W carrier

Carrier suppression: Better than 40dB

Unwanted sideband: Better than −50dB

Spurious radiation: Better than −50dB

3rd Order i.m.d.: Better than −35dB referenced to peak output

Frequency accuracy: Better than ±10 p.p.m. from 0–40°C after 15 min. warm-up

Max. f.m. deviation: ±5kHz

Antenna impedance: 50Ω unbalanced

Microphone impedance: 500–600Ω

Audio response: Better than 6dB, 300–3000Hz

GENERAL

Tuning steps: 10Hz, 500kHz (band step)

Power requirements: 13·5V d.c. (negative ground)
2A receive
19A transmit

Dimensions: 93 × 238 × 238mm, approx., excluding knobs and feet

Weight: 5·2kg approx.

RECEIVER

Frequency coverage: 500kHz–29·99999MHz

Clarifier range: Unlimited

Intermediate frequencies: 1st i.f. 47·060MHz
2nd i.f. 8·215MHz
3rd i.f. 455kHz
f.m. i.f. 455kHz

Sensitivity (min): Input for 10dB (S + N)/N:

Mode (B/W)	<1·5MHz	>1·5MHz
c.w. (W)/s.s.b./f.s.k.	1·0μV	0·25μV
c.w. (N)	0·8μV	0·16μV
a.m.	2·0μV	1·0μV
f.m.		0·6μV for 12dB SINAD

Image rejection: Better than 70dB

I.F. rejection: Better than 70dB

Selectivity: WIDTH control at maximum

Mode (B/W)	−6dB	−60dB
c.w. (W)/s.s.b./f.s.k.	2·7kHz	4·8kHz
c.w. (N)	600Hz	1·3kHz
a.m.	6kHz	18kHz
f.m.	12kHz	24kHz

Dynamic range: Better than 100dB (c.w. (N), 14MHz)

Audio output: 3W min. in 4Ω, less than 10% t.h.d.

Audio output impedance: 4–16Ω

transverters; low-level a.f. out (200mV peak at 50kΩ) for driving modems, etc., a.l.c. input from an external linear amplifier; p.t.t. line for external control by foot switch, etc., or to provide a p.t.t. signal for an external linear; a.f. input (600Ω) for use with phone-patches (where permitted) or a.f.s.k. modems.

An 8-pin Molex connector provides band-data and d.c. power for the FC-757AT automatic antenna tuner, plus high-speed synchronised T/R switching control for a full QSK linear, and a 3-pin Molex provides access to the serial microcomputer data lines of the CAT system for external computer control via one of the optional interface units (available for Apple II, NEC PC8001 or IEEE RS-232C bus). The CAT control facilities on the FT-757GX are not as comprehensive as those on the FT-980 (see *PW*, May 1984, page 58), and do not include the full hand-shaking arrangements.

There are six rotary pre-set controls on the rear panel. Three of these set the delay, gain and anti-trip levels of the vox circuit. Others are for speech-compressor level, a.m. carrier level, and output-power meter sensitivity. This last control, in conjunction with a slide-switch alongside it, is used for the v.s.w.r. indicator function mentioned earlier.

Rounding off the back panel features are a push-button switch associated with safety interlocks when a full QSK linear or the automatic a.t.u. are used, and another push-button controlling a 25kHz marker generator. If both these buttons are pushed in at the same time, power from the lithium battery to the memories is disconnected, clearing all the memories unless the main 13·5V d.c. supply is connected to the receiver.

Operating Impressions

To squeeze a 100W all-mode h.f. transceiver into a box the size of the FT-757GX there must inevitably be some compromises, but Yaesu are to be congratulated in doing it so well. The new ducted cooling system obviously helps quite a lot here, and I was glad to find that the thermostatically controlled fan is reasonably quiet although evidently quite powerful as it cycles on and off rather than staying on for long periods. It would be nice if some of the rear-panel controls could have been on the front panel instead, but a quart has already been squeezed into a pint pot there, and in practice it's not too great a drawback that they are less accessible.

The slow tuning rate of the main tuning knob can be a bit of a pain at times. Even using the 500kHz stepping buttons to take you to the nearest point, you can still be left having to make up to 25 turns of the knob to get to the wanted frequency. Modern equipment designers obviously have a problem here. They want to do away with a separate fine tune or clarifier control because it takes up panel

★ test measurements

TRANSMITTER

Outputs in c.w. mode: (13·6V d.c. supply)

Freq. (MHz)	Output (W)	Harmonic outputs (dBc)*				Spurious Outputs (dBc)*
		2nd	3rd	4th	5th	
1·81	100	−57	−63			
3·51	100					
7·01	100		−57			
10·11	100	−57	−67			−65
14·01	100		−66			−61
18·11	100					−66
21·01	100					−65
24·91	100	−68				−54
28·01	100		−65			−62
29·01	100	−62	−66			−62

* dBc = decibels reference to carrier level.
A blank space indicates no outputs found at levels greater than −70dBc.

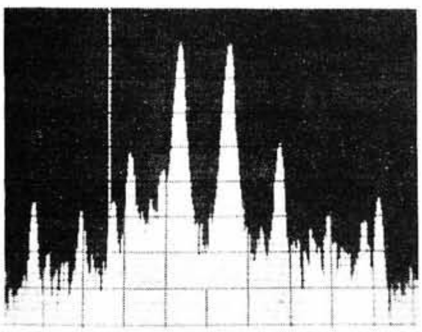
Maximum Output at 14·1MHz:

Mode	Power Out (W)
c.w.	125
s.s.b.‡	125
a.m.	25†
f.m.	125

‡ 2-tone test † carrier

Carrier suppression: 52dB relative p.e.p.
Unwanted sideband suppression: 61dB (1kHz tone at 14MHz)
3rd Order i.m.d.: 36dB below p.e.p.
Max. f.m. deviation: 4kHz

Test equipment used:
2017 and 2019 signal generators, TF2370/TK2373 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.



Spectrum analyser plot of 3rd order i.m.d. at 14·1MHz. Tones 800 and 1400Hz. Scale 10dB/div. vertical, 500Hz/div. horizontal. The suppressed carrier is just to the right of the bright line

RECEIVER

Sensitivity: (pre-amp in circuit)

Freq. (MHz)	Input e.m.f. (μV) for 10dB (S + N)/N			Input e.m.f. (μV) for S-9 (s.s.b.)
	c.w. (W)	s.s.b.	a.m.	
1·81	0·19	0·25	1·6	160
3·51	0·2	0·26	1·5	130
7·01	0·3	0·35	1·5	112
10·11	0·23	0·32	1·9	190
14·01	0·22	0·25	1·9	202
18·11	0·3	0·36	2·5	265
21·01	0·27	0·33	2·1	265
24·91	0·29	0·38	2·3	212
28·01	0·31	0·39	2·6	280
29·01	0·3	0·35	2·6	260
29·01	1·4μV e.m.f. for 12dB SINAD on f.m. (3kHz dev. at 1kHz)			

Squelch threshold: 0·5μV min., 3μV max.

S-Meter calibration: (At 14·01MHz u.s.b.)

Reading	Input required	
	μV e.m.f.	dBμV
S1	3·6	11
S2	6·6	16
S3	13	22
S4	24	28
S5	35	31
S6	56	35
S7	81	38
S8	116	41
S9	202	46
+20dB	560	56
+40dB	3·9mV	72
+60dB	31mV	90

Image rejection: Better than 73dB
I.F. rejection: Better than 70dB
Selectivity: WIDTH and I.F. SHIFT controls centred

Mode (B/W)	−6dB	−60dB
s.s.b.	2·2kHz	3·7kHz
c.w. (W)	1·2kHz	3·6kHz
c.w. (N)	550Hz	3·1kHz
a.m.	7·5kHz	12·5kHz

AGC: Output change for 116dB input change, relative to 5μV threshold: 1·5dB
RF Attenuator: 20dB from 1·5–30MHz
Pre-amplifier: 16dB at 1·8MHz; 14dB at 29MHz
Audio output: 3W into 4Ω with 3% t.h.d. (100μV input at 14·1MHz)

space, so they use the main tuning knob for both functions. If the tuning rate is too high, it's not very satisfactory for resolving s.s.b. signals—if it's too low it makes retuning tedious.

When we used to have receivers tuned by ganged variable capacitors, the problem was got around by putting a nice heavy flywheel on the mechanism, so that a deft spin of the knob would shift you from one end of the band to the other. Now, when tuning is controlled by a train of pulses generated by a photo-interrupter system on the back of the knob, you can't afford to spin the knob too fast. If you do, the digital circuit counting those pulses can't respond quickly enough, and the tuned frequency doesn't follow the turning of the knob as it should. The solution, of course, is to provide a keypad for frequency entry as well as the main tuning knob. But a keypad needs front panel room, and so the argument goes on.

Receiver performance in general was good. As an avid c.w. operator I liked the narrow filter being a standard item. There are a number of internally generated spurii but all those I could find were at or below atmospheric noise level and therefore of no practical consequence. More disturbing were little "hiccups" in the tuning coinciding with the change in the 100Hz digit of the frequency readout, which sound as if the synthesiser is going momentarily out of lock. In between these points the frequency changes smoothly in 10Hz steps. The effect of the glitches is noticeable only on c.w., and is worse for strong clear signals than for weak noisy ones with lots of QRM.

Frequency stability was good, though the rig settled down to an offset of just under 400Hz high when warmed up. This error could undoubtedly be trimmed out in the importer's workshop.

On the transmit side, speech quality with and without the processor was reported as "most acceptable". The in-built electronic keyer also performed well, with no apparent vices. I didn't measure the speed range, but at a guess I would say it must be around 5 to 35 w.p.m. The transmit/receive duty-cycle permitted for various transmission modes is affected by the power supply used. The FT-757GX itself has a time limit for full-power f.m., a.m. or RTTY transmission of 30 minutes. This assumes the use of a heavy-duty supply such as a vehicle battery or a mains p.s.u. of the calibre of the FP-757HD which has a 50 per cent duty-cycle rating and a similar continuous full-power capability of 30 minutes. (Our lab tests on the FT-757GX were done using a *PW* "Marchwood" supply which will run at 30 amps all day long, so no problem there!).

The slim-line FP-757GX switch-mode power supply (s.m.p.s.) shown in our photographs also has a 50 per cent duty-cycle but will support full-power operation for only 30 seconds at a time on continuous-carrier modes. For longer transmissions, only half maximum power output is possible. I've always been very wary of switch-mode power supplies because of their great interference-generating potential. The FP-757GX has generous filtering on input and output and appears to cause no worsening of the noise level on receive, as compared with conventional power supplies. It measures just 39 × 238 × 238mm and weighs about 2kg.

Automatic ATU

The FC-757AT is a fully automatic antenna tuner designed to complement the FT-757GX, but usable also with the FT-980 or (with manual selection of frequency band) with any other transceiver of up to 150W output power.

This unit incorporates a 4-bit microprocessor which controls a modified pi-L impedance matching network. In conjunction with lithium battery-backed RAM, it stores the antenna selection and the tune/load settings for each band ready for subsequent use. Power and s.w.r. metering and a 100W 50Ω dummy load are added features.

In its basic form, the FC-757AT incorporates a 2-position antenna switch, but this can be increased to 5 positions by means of an optional 4-way antenna selector unit FAS-1-4R which can be mounted remotely at the mast-head if required.

The automatic tuning mechanism will normally match a load impedance in the range 10–250Ω (25–100Ω on the 1·8–2·0MHz band) to a 50Ω transmitter with a v.s.w.r. of 1·5:1 or better. Manual tune/load buttons are provided for use by the operator who feels he could do better or for reception outside the amateur bands. A minimum of 10–15 watts output from the transmitter is needed to drive the v.s.w.r. calculating circuitry. A straight-through switch position lets you bypass the unit if desired.

A bank of l.e.d.s indicate which band the tuner is set to, three other l.e.d.s show that the unit is still tuning (WAIT), tuned up (READY), or has a badly mismatched load (WARNING).

Auto-tuning time for a previously used band is normally not more than about 10 seconds. The memory will store settings carried out manually, as well as those done automatically.

Prices

The Yaesu FT-757GX (less microphone) is currently priced at £719, the FP-757GX is £145 and the FC-757AT is £245, all inclusive of VAT. Our thanks to **South Midlands Communications Ltd., SM House, Rumbridge Street, Totton, Southampton SO4 4DP, telephone (0703) 887333** for the loan of the review transceiver, p.s.u. and antenna tuner.

Geoff Arnold

"I didn't get your callsign and I think you gave your QTH as Wigan . . . you are five and one with me".

. . . heard by G2AIH

"I have heard quite a few northern stations are going down with a list of aurora".

. . . heard on 2m s.s.b. by G8SVF

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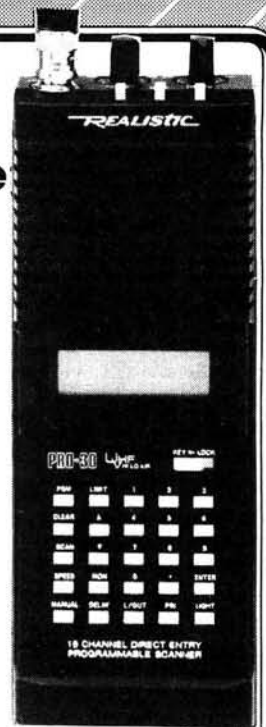

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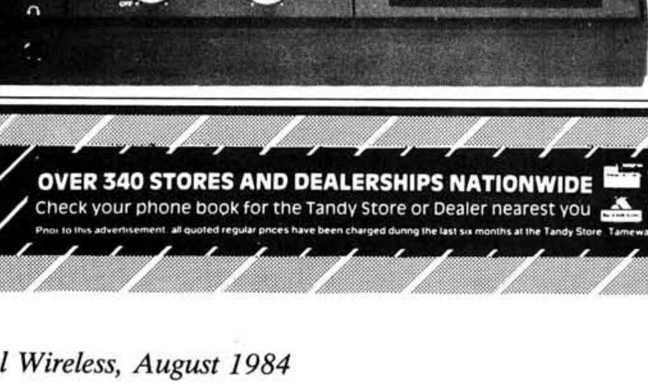

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Have Thomas electronic organ and Rolleiflex t.l.r. camera. Would exchange for h.f. transceiver, TS-530S, FT-101ZD or similar. Cash adjustment. G6NUZ. Tel: Boston (0502) 65209. *U623*

Have Standard C78, Belcom Liner 2, Pye Cambridge v.h.f., a.m., Polaroid Sun 600 camera. Would exchange/barter for FDK 430MHz expander or similar and about £20 worth of 10GHz gear. G6MEN. Tel: 0704 74792. *U631*

Have MM2000 RTTY receiver converter, ZX-81 plus 16K Memotech. Would exchange for SX200N scanner. Tel: Stoke-on-Trent 322478 after 6pm or weekends. *U641*

Have 2 Pye Bantams, batteries, charger with notes for converting to 70MHz. Would exchange for 144MHz linear 25W suitable for FT-290R. A. Lowe, 47 Springfield Park Road, Chelmsford, Essex. *U645*

Have electric piano. Would exchange for v.h.f. communications receiver. K. Dewis, 30 Nuneaton Lane, Higham on the Hill, Nuneaton, Warks. *U853*

Have 48K Spectrum and printer plus 5 rolls of paper and many programs, Morse, QRA locator and games. Would exchange for 144MHz multimode, any make considered. 13 Excelsior, Queensway Est, Wellingborough, Northants NN8 3SL. *U862*

Have 19 set, excellent condition, connectors, control box and variometer. Would exchange for FRG-7, 144MHz rig, camera or w.h.y. G3SCJ. Tel: 0676 40147 (near Coventry). *V201*

Have AR88LF chassis less output trans, smoothing capacitor and scale. Would exchange for g.d.o.—home-brew OK. P. W. Sharp. Tel: Swindon 826325 (after 7pm). *V202*

Have Sharp MZ-700 micro, built-in recorder, assorted software, real Dragon-Slayer! Would exchange for 430MHz multimode, h.f. mobile or h.f. receiver. Will haggle over cash adjustment either way. Can collect/deliver N. England. Arthur. Tel: Halifax 68021 after 8pm or weekends. *V211*

Have FDK-700EX 144MHz f.m. 25W mobile plus Jaybeam 10XY for 144MHz. Both in excellent condition. Would exchange for MMT432/144-R transverter and 430MHz beam in similar condition. Tel: Gravesend 59346 evenings. *V235*

Have Edwards Speedivac vacuum pump with 240V $\frac{1}{3}$ h.p. motor (0·001 torr ultimate). Would exchange for 144MHz or 430MHz transceiver. Tel: 01-593 3617. *V246*

Have AR88 and CR100 receivers, both in good working order and spare valves. Also Skippmaster SK42000 base mic. Would exchange for DX160 receiver and frequency meter for DX160. Callers after 6pm please. P. Howlett, 41 Preston Road, Toddington, near Dunstable, Beds. *V251*

Have FRG-7, used very little and fitted with f.m. mod. Would exchange for Commodore 64K. Tel: Atherton 896116. *V254*

Have Realistic DX100L communications receiver 140kHz–30MHz, excellent condition. Would exchange for any home computer with over 12K RAM—not ZX-81. R. Hensman. Tel: Dartford 92833. *V256*

Have Beaver electric power spade with cable and extra attachments, value £100 in v.g.c. Also have Pye SX4454 new car radio unused. Would exchange for 430MHz multimode. Tel: Leicester 773312. *V275*

Have Realistic PRO2001 scanner, brand new, programmable with memories, covers all v.h.f., u.h.f. bands. Would exchange for h.f. transceiver. Tel: St. Albans 39333. *V276*

Have large quantity radio books and magazines ranging from 1925 onwards, *PW, PE, SWM* etc. Would exchange for radio equipment including home-brew w.h.y. List on receipt of s.a.e. G1AMR. 20 Walpole Ave, Whiston, Prescot, Merseyside. Tel: 051-426 9207. *V285*

Have Realistic DX200 receiver, good condition, 0·4–30MHz, boxed. Would exchange for 144MHz linear/pre-amp, FT-290R or v.h.f. rotator in good condition. Alan. 72 Wager Street, Bow, London E3 4JF. *V286*

Have Prinzflex super t.t.l. s.l.r. camera, 55mm, auto Reflecta f1.7 lens and 35mm Prinzflex auto reflex f2.8 lens, filters, lens hoods, e.r.c. and holdall. Would exchange for good a.t.u., KW or SEM or similar. Harry Hodson. Tel: Sheffield 386021. *V305*

Have Zenith speech processor and Leson base microphone, worth £65, still boxed. Would exchange for VB2300-10W amplifier for Trio 2300, must be in good working order. Lee. Tel: 01-310 6612. *V313*

Have h.f. receiver, Realistic DX160 150kHz–30MHz, with speaker. Also 28–29MHz all mode transceiver, antenna, s.w.r. meter 1·5–144MHz, matcher, field strength meter. All in very good condition. Would exchange for FT-290R, 144MHz multimode transceiver with accessories if possible. Chris. Tel: Deeside 811687. *V319*

Have Arado-95 v.l.f. metal detector in as-new condition, used two hours only, cost £299. Would exchange for FT-290R in best condition. Details Tony G4SVY. Tel: Sandown, I.O.W. 405190. *V326*

Have MMT 432/144R transverter, 1·6 shift, 10W out, standard 15dB attenuator plus 7dB attenuator (suits FT-290R) mint. Would exchange for Spectrum, short-wave RX, 144MHz f.m. mobile 10–25W (FDK, KDK or similar), IC-2E or anything interesting. Tel: 01-247 6097. *V327*

Have Kodak Carousel S-AV slide projector with case in v.g.c. Would exchange for 144MHz mobile rig (cash adjustment if necessary). Tel: Medway 406745 evenings/weekends. *V331*

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on the air

AMATEUR BANDS *by Eric Dowdeswell G4AR*

Reports to: Eric Dowdeswell G4AR, 57 The Kingsway, Ewell Village, Epsom, Surrey, KT17 1NA.
Logs by bands in alphabetical order.

On World Amateur Radio Day in April we were all enjoined to try something different from our usual style of amateur operating. I decided to listen to the satellite downlink band between 29·4 and 29·5MHz and was pleasantly surprised to log stations on both c.w. and s.s.b. from as far apart as the USA and UA0 on the far side of the USSR. The satellites concerned are the RS5/6/7/8 launched by the USSR in 1981 although two of the original six launched from the rocket are now defunct. The up-link frequencies in the 144-146MHz (2m) amateur band, are converted to 29MHz by a transponder in the satellite, see table.

For a long period of development the transponders were tested out by amateurs from the top of a tall building in Moscow. Most intriguing however are the beacons carried by each satellite which transmit not only the individual callsign quite frequently for identification purposes but also simple telemetry giving details of the battery voltage and charging state and other conditions inside the capsule, all in straightforward Morse code that is easily copied. Details of the code used for the telemetry is readily available.

As the satellites were launched almost simultaneously their orbit periods are very similar ranging from 118·5 to 119·8 minutes approximately. On one occasion I was able to hear all four satellites transmitting at the same time. Generally speaking a simple ground-plane antenna for 29MHz is adequate for reception and although a beam antenna will give better signals one then needs to know where the satellite is above the horizon in order to follow it with the beam, preferably both in bearing (azimuth) and elevation.

The up-link signal in the 144MHz band does not have to be unduly strong, a 10W output into a simple beam antenna can do the trick. It must be remembered that the total output of the transponder is only of the order of milliwatts, shared among the number of stations accessing it at any one time. As so often happens in AR, a minority abuse the system, in this case some ground stations using excessive power, frequently in an effort to overcome the deficiencies of their receivers. It has to be remembered that most h.f. band transceivers and receivers tend to fall off in performance in the 28 to 30MHz range so an additional pre-amplifier is usually recommended for satellite work.

I have always stressed in the past that the amateur getting a "B" licence should make every endeavour to pass the Morse code test as soon as possible and get an "A" licence while in the "exam" frame of mind even if it is felt at the time that the h.f. bands are of no interest. Satellite operation is a happy amalgam of v.h.f. and h.f. band interests that should appeal to many amateurs.

There are thousands of amateurs already active in this sphere of satellite operation, co-ordinated in the UK by AMSAT-UK, the secretary/treasurer being Ron Broadbent G3AAJ, 94 Herongate Road, Wanstead Park, London E12 5EQ. (An s.a.e. will provide membership details.) Members of AMSAT UK receive up-to-date information on all the amateur satellites plus the met. satellites NOAA7 and 8 which provide the weather charts we often see on TV.

If you are fed up with the S-9 signals from stations around the world with their high power and beam antennas try listening for the DX between 29·4 and 29·5MHz coming from the milliwatts of power radiated from a tiny satellite over 1600km up in space. You may have to spend a few hours monitoring the band before you hear any signals as, obviously, not all the two-hourly orbits are suitable for the UK. Just leave the receiver running and you will soon notice the activity when a satellite is "in view".

I was rather surprised to learn that one of my readers who takes his DXing quite seriously only uses a loudspeaker. I took it almost for granted that any op worth his/her salt used headphones automatically! The advantages are so great as to make any discussion unnecessary. Reduction of outside noise, the audio transducer (headphones to you) where it should be, on the "lugholes", no annoyance to the family listening/watching the *Archers* or *Coronation Street,* thus avoiding being banished to the garden shed, ability to hear and copy very much weaker signals, are just some of the advantages.

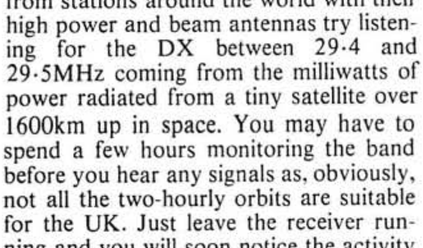

Fig. 1: Simple circuit for a unit providing rapid changeover from speaker to headphones when VR1 is adjusted for comfortable listening level

However, there is more to it than just plugging in the 'phones in place of the speaker, especially if the 'phones socket is on the back of the set, as it so often is today with the mobile v.h.f. transceivers and the already overcrowded front panels, mainly when they are used as base stations. So the simple unit shown in Fig. 1 can be built into a plastics box to give speaker-only operation, or speaker plus 'phones, or 'phones only with pre-set control over the signal level so that the set's volume control does not have to be re-adjusted when switching from speaker to 'phones or vice versa.

The 'phones socket should be for $\frac{1}{4}$in plugs and for stereo use so that either conventional or stereo headsets can be used, with an external adaptor for 3·5mm plugs. The input plug should suit the audio output socket of the receiver. The resistor R1 acts as a dummy load when the speaker is switched off and should be of roughly the same value as the impedance of the speaker. This value is often marked on the speaker chassis itself, or can be found in the set's manual, generally around 8 ohms.

In the unit I use I have two input leads, from the h.f. bands TS-530 transceiver and from the FT-480R v.h.f. set with an extra changeover switch on the panel. The internal speakers of most sets are automatically muted when the external plug is inserted in the SPKR socket and as they are invariably very small the use of a much larger and better quality speaker externally is a big advantage.

	Uplink	Downlink
RS5/6	145·910–145·950	29·410–29·450
RS7/8	145·960–146·000	29·460–29·500

Frequencies in MHz

In General

The RSGB *News Bulletin* recently reported a case heard in the Manchester Crown Court involving an illegal CB transceiver, the Court concluding that "the offence had been established by the fact that the set was available for immediate use at any time". This very important decision seems to devolve from the new Telecommunications Act which became law recently. Until then it was necessary to catch the operator actually on the air with the illegal transmitter whether it was a CB rig, amateur bands equipment or any unlicensed transmitter whatsoever.

Even if, say, an illegal CBer went to the door to answer a knock from a Post Office inspector and left the rig running, he could not be apprehended because he was not caught in the act of transmitting, once more making the law a laughing stock. We have had illegal broadcast stations on both the medium wave and v.h.f. BC band which could not be closed down because of loopholes in the old law but hopefully this situation will now change.

All too often licensed radio amateurs have had to bear the brunt of complaints from neighbours of interference to radio and audio equipment when the cause has been a nearby unlicensed CBer.

QRP Corner

I'm afraid that almost no material is to hand in this category this month but I'm sure I shall get plenty once last month's issue gets around. For those keen on the idea of working the world on ridiculously low power it is essential to belong to the G-QRP Club (17 Aspen Drive, Chelmsley Wood, Birmingham B37 7QX) which has world-wide membership although what constitues "QRP" tends to vary from country to country. Among the club's many services for QRPers is the magazine *Sprat* (it deserves a more dignified name!) full of constructional articles, for which p.c.b.s are usually available, for receivers, transceivers and ancillary equipment of all kinds. Mods for commercial equipment to make it suitable for the QRPer are covered and there is also a QSL service, news of the bands and of members' activities and achievements.

Around the Bands

It was pleasant to hear from **J. Tomlinson** of Stanley, near Wakefield, now retired and a "wireless op" in the RAF during the war, who has built the regenerative l.m.s. receiver featured in February 1983 *PW*. An ideal set for copying c.w., which is the primary interest of JT. He has a 30m-long wire antenna in the loft and has copied such as UA0BAP, VK4AAG, VK3AQN, EA6PL on 14MHz and plenty of Euros on 7 and 3·5MHz. JT is using a speaker at the moment but I have suggested that he'd do very much better using headphones. An a.t.u. is already in the pipeline and that ought to help considerably.

Dave Price (Wellington, Som) has had a look at 21MHz and found YC4FAU, FR7BT, KH6WU, OD5LT, OX3BM, ZD8RC, ZD7CW, 9H1FBS (a blind op, Charles, QSL to N5APW), VU2DQP and J73CB. On 14MHz it was just KL7IWF, CY0SAB on Canadian Sable Island, VY1CW in the Yukon, and OD5AO. Sole entry on 28MHz was JY9CL. The rig is a Yaesu FRG-7 with a 40m-long wire and a 21MHz quad.

Yours truly, G4AR, operating the Dollis Hill RC NFD station in June 1939. Note the Vibroplex bug key, dry battery (120V) for the transmitter and receiver and the mighty changeover switch! The accumulator for the 2V filament valves was on the ground. Fellow club member Fred Crane has just unearthed this and other NFD photos from his album after 45 years!

In Stowmarket, Suffolk, our regular correspondent **David Palmer** has a Racal RA17L and 20m-long wire about 8m high. On 14MHz he caught AH2AW on Guam, A92F, HH6WR, KH6BOG, SU1AH, TR8DR, XT2BR, while on 21MHz he logged A71BK, F6GNS/TU, J28DX (QSL F1CFD) and VQ9RE on Chagos Island. TR8SY, VU2HI and YC0DPO were the only ones of note on 28MHz. David finds neither the 3kHz nor 1·2kHz filters ideal for s.s.b. reception and is thinking of getting the RA63 adaptor for his set. He has also been having a go at c.w. reception and hopes he will get proficient enough to start sending in some c.w. logs. I used to get several every month but they have all dried up now and yet there must be plenty of readers, especially Class "B" licensees, who copy c.w. at the low ends of the h.f. bands. More c.w. logs please!

Pat Cullen up in Saltburn-by-Sea, Cleveland, stuck to the 14 and 21MHz bands with his Panasonic DR48 plus a "spiral wound" 40m of wire in the loft. So on 14MHz he found AH9AB on Wake Island, C53AL, HH2SD, HR1OL, J39BS on Grenada, KH6FK, SU1ER, TR8SJC, VP5EE in the Turks and Caicos Islands, YJ8RG, 4S7PVR, 5H3QM and 9Q5RN. Up to 21MHz and AP2ZR, DF4RD/SV9 on holiday I presume in Crete but cards to DF2RG, J28DX in Djibouti, TR8IG, TU1BS, VP8AOS on the South Orkneys, XU1SS, YJ8RG again, ZD9BV, 5W1EJ in Western Samoa and 9L1SL. Wonder what Pat would copy with a decent antenna!

John Clarke (G8KA) writes from France to say that his call FC6FPH mentioned in the May column has now become TK5FF. With the change in prefix John was also able to choose the suffix FF which he finds a lot easier to say! A note from **Roy Hathaway** G3JHI says that the special event station GB2SX was heard by Matt ZI4JO on the 28MHz band. The two of them have had daily skeds, around 14·337MHz, since the 1950's.

Revitalised by a holiday in France **Marcus Walden** of Harrogate got in some early morning DX especially on 7MHz, with his DX302 and a.t.u. fed by a 20m-long wire in the loft. This band produced VK2AVA, ZL4BO, ZL4IG, ZL2BT in particular, plus ZP5CDV. On to 14MHz and FM7WG, HH2MT, HS1BV, V2AO, VK7KH/mobile, and 9Q5MA. The 21MHz band seemed to be the best of the bunch with CE3ACA, C53FG of Box 273, Banjul, D44BS, DU9AB/1, HK0HEU with cards to HK0FBF, KA6FXJ/HI8 (Box 770, Santo Domingo), PZ1AR, XU1SS, YC4FAV, ZD9BV (QSL W4FRV), 6W1AR of Box 3285 Dakar, 9J2FC, 9U5JB (QSL ON5NT) and 9Y4M. Just three of note on 28MHz were JY9CL, ZS6CAX and 5B4KX.

With his Eddystone receiver under repair **Dave Wilkinson** of Ventnor, IOW, got hold of a Uniden CR2021 which, he says, seems to perform very well with his 30m-long wire as witness, on 28MHz, A71AD, CE8ABF right down in Tierra del Fuego, J28DX, ZS1DL and Z21DL. Interesting on 21MHz was VP8HK/MM, the *RRS Bransfield* midway between South Georgia and Rio. Otherwise it was 9K2BE, CX2CO, HI8JO, VU2GI and Z21GC.

Down in Bournemouth **Mel Fisher** G4WYW (was G6OQZ) is very busy with his FTDX-401 and a 20m dipole which is only 2m above the ground and sagging a bit in the middle at that! That did not stop him working ZP5HEB, IY4FGM located in Marconi's old home, ZL4BC, A92P, J39BA on Grenada, an excellent catch in CE0ERY on Easter Island, YT1BGD another rarity, JY5RBM, VP2VA, VK7GK and ZB2HR and lots more. All-night sessions are commonplace at the moment says Mel, paying off handsomely. Any s.w.l.s needing help with the RAE or code are welcome to contact him, at 41 Setley Gardens, B'mouth. Thanks for the nice gesture, OM.

Michael Newell in Kenilworth, Warks, has been busy swotting for his "O" levels and CSE exams and still finding time to prepare for the RAE he took in May. At 16 Michael says he was "unfortunate" enough to have been a CBer but at least it "introduced him to amateur radio". Nothing wrong with that but, personally speaking, I do wish suchlike would not bring so many irksome operating habits into AR! Michael started with an ex-Army R1475 but swopped it for a Hallicrafters SX140 used with a short wire round the bedroom wall. He'd like to borrow a handbook on this receiver and anyone able to help can reach him at 11 Lancaster Place, Kenilworth, Warks. Apart from masses of Euros Michael logged JA4AAU, VK3XI, VP2MM and 3D6BF on 7MHz, and JY9A and ZL2AUB on 14MHz. Catches on 21MHz were FM0OEN, VP2XV and VP2AOB.

In London W6 **Denis Norton** has an FRDX-500, a.t.u. and Datong FL2 audio filter, fed by a 20m-long wire antenna and a half-wave vertical for the 28MHz band. A 14AVQ antenna has been acquired and should be pointing heavenwards by now. On 3·8MHz good loggings were FM7WS and SU1XJ with AL7BL in Alaska and OD5LT from war-torn Lebanon. The 21MHz segment was very good with AP2P (Box 999 Rawalpindi), A71AD, HK8BVN, J28DX, YC8LD, 5H3QM, 6W1AR, 9M2PV and 9V1VG.

Following the mention of an ET2 station being logged by a reader, **Frank Frost** ex-ET3FF wrote in to say that all amateur activity ceased in 1977 and recent info suggested the situation is even less favourable now. The only licensed station is ET3TRC of the Telecoms Radio Club but this also is not operational. So if you have ET2BR in your log the chances are that it is phoney. Thanks Frank.

Once again it is my pleasure to tell you of the annual s.w.l. contest, run by the Cray Valley Radio Society, which is very well supported with world-wide entries. It is an excellent occasion on which to pit your receiving abilities against other s.w.l.s, with certificates of merit at the end for the winners. It runs from 1800Z Saturday September 8 to 1800Z on the Sunday with a maximum of 18 hours logging allowed out of the 24 hours available. So you can pick your sleeping time when the bands are poor. Sections are telephony and c.w. with single or multi-op entries on all h.f. bands 1·8 to 28MHz except for the new WARC bands (wonder why?). Details and log sheets are obtainable from **Owen Cross** G4DFI, 28 Garden Avenue, Bexleyheath, Kent DA7 4LF on receipt of a large self-addressed and stamped envelope. Good hunting!

Club Time

The summer months are the time when the club-minded amateur is most deeply involved in club activities, with visits to exhibitions often via a coach laid on by a thoughtful secretary, field days for h.f., v.h.f. and u.h.f. enthusiasts, d.f. foxhunts for the map-reading experts, not to mention special event stations often for the benefit of local or national charities. Field days present a wonderful opportunity for the newly-licensed op to get his/her baptism of operating in a contest but depending on just how seriously the club is taking a particular contest. Even sitting beside the operator on duty and logging the QSOs as they occur is very instructive and a responsible job, not to be sneered at. Are you a member of the local amateur radio club? No? Then you don't know what you are missing!

The long winter months of talks, lectures and studying for the RAE and the code test eventually come to fruition and many a shaky hand has gone on the air for the first time at a field day station. Don't forget the presence of an ever-increasing number of YLs and XYLs at these events which add to the general excitement. I wonder how long it will be before a field day station will be run entirely by the fair sex!

308 Radio Club Every Tuesday at 8, The Coach House, St Marks Church, Surbiton, Surrey, with refreshments available and a Morse code training session before going home. July chats include "Now that you've passed"—talk on AR and AR equipment, plus, hopefully, a visit from nearby resident Frances Wooley G3LWY of the RAIBC. More from Dave Davis G6YQD, 13 Maple Road, Surbiton, Surrey.

Acton, Brentford & Chiswick ARC G3IIU A good attendance is anticipated for the discussion on the Radio Interference Service to be held on Tuesday July 17 at the Chiswick Town Hall, High Street, Chiswick, London W4, at 7.30. Potential members and visitors are more than welcome says sec W.G. Dyer G3GEH, 188 Gunnersbury Avenue, London W3.

Abergavenny & Nevill Hall ARC Don't forget the club's special event station GB2ABC at the A'gavenny & Border Counties Show on Saturday July 28 and GB2PYF at the Pen-y-fal Hospital fête on Saturday August 4. The club meets at the hospital every Thursday at 7.30, above male ward 2. Further info from D.F. Jones GW3SSY, 80 Croesonen Parc, A'gavenny, Gwent.

Ainsdale ARC Slated for August the club will be running GB2WR (probably) at the Woodvale Rally at Woodvale RAF station mainly for radio control and vintage car enthusiasts. A portable ATV unit relaying signals back to GB2WR is planned. Operation on most modes on the h.f. bands is scheduled. It's David Norris G4TUP, 148 Sefton Street, Southport for more details and dates.

Axe Vale ARC First Friday at 7.30, The Cavalier Hotel, West Street, Axminster, Devon, just west of the parish church on the A35. Meet there on July 6 and you can travel in convoy to the IBA site at Stockland Hill for the long-awaited visit. Note, too, the 144MHz foxhunt on August 3, from the Cavalier at 8pm. PRO is Roger Jones G3YMK, 10 Oak Tree Close, Upottery, near Honiton, Devon, or Upottery 468.

Barking Radio & Electronics Society G3XBF G8XBF Station GB2DTS will be run by the club at the Dagenham Town Show in Central Park over the weekend of July 14/15, with displays of v.h.f., h.f., ATV and RTTY for the benefit of the public. A demo of reception from a broadcast satellite is also on the cards. More on the club from Ray Woodberry G6YZV at the club HQ, Westbury Recreation Centre, Westbury School, Ripple Road, Barking, Essex or 01-594 4009.

Barry College of FE RS GW3VKL GW4BRS GW6BRC Thursdays at 7.30, The Annex, Weycock Cross, Barry, with code practice available in addition to the usual events. New sec is Margaret Beynon GW4GSH, Bungalow 1, Racal-Decca Transmitting Station, Llancarfan, Barry, S. Glam.

Basingstoke ARC G3TCR G8JYN Second Tuesdays at 7.30, the Swan Inn, Sherbourne St John, Nr B'stoke, Hants, with club net on S19 f.m. Mondays at 8pm. Interested? then check with sec Eddie Thompson G4SQZ, 21 Wigmore Road, Tadley, B'stoke, Hants.

Bath & District ARC G4TMH All facets of AR are catered for by the club, says PRO Colin Ashley G4UMN, 57 Stonebridge Drive, Frome, Somerset, or try Frome 63939. The Englishcombe Inn, E'combe Lane, Bath, is the club QTH, meeting "alternate Wednesdays" so check with Colin for precise dates.

Biggin Hill ARC G4RQT G6TBH Don't overlook the big date, July 17, when Chris Page G4BUE will deal with his favourite subject, QRP operating, 8.30 in St Marks Church Hall, Church Road, Biggin Hill, Kent. So, it's the third Tuesday of the month, with a fair share of the 57 members waiting to greet newcomers and visitors, according to Ian Mitchell G4NSD, Greenway Cottage, Tatsfield, Westerham, Kent or (09598) 376.

Braintree ARS A 144MHz net on S15 on second and fourth Mondays at 8pm keeps the club together when it is not meeting on the first and third Mondays, at the Braintree Community Assoc Centre in Victoria Street, next to the bus station, at 7.30. For those thinking of going QRO there is a talk on nuclear power on July 16 by the CEGB! August 6 is devoted to an operating evening on the club rigs. Sec Pat Penny G6TAF, 13 Newnham Close, B'tree is also on (0376) 26487.

Bury RS Main meeting, second Tuesday, for July, is on the 10th when the club visits the IBA TV site at Emley Moor. A d.f. foxhunt is laid on for August 14 if you want to get some practice in, in the meantime. The other Tuesdays of the month are more informal, at 8pm, at the Mosses Centre, Cecil Street, Bury. You are invited to contact the sec Brian Tyldsley G4TBT, 4 Colne Road, Burnley, Lancs or buzz B'ley 24254 for more info.

Carmarthen ARS Second and fourth Fridays are general and activity evenings respectively, at the West Wales Hospital Social Club, The Quay, Carmarthen. This from Millicent Meredith, 50 Caecoed, Llandybie, Ammanford, Dyfed, who, hopefully, will have learned of her success in the May RAE by this time, so that she can get on the rig of OM GW1ABP, sorry, now GW4XLK.

Cheltenham AR Association G5BK Looks like the first and third Fridays at the Stanton Room, Charlton Kings Library, C'ham with a natter night on July 20 although you may read this in time to catch the talk on July 6 by G3KKN on communications in Africa. Gillian Harmsworth G6COH on C'ham 525162 can help further.

Cheshunt & District ARC G4ECT G6CRC Every Wednesday at 8, Church Room, Church Lane, Wormley, near Cheshunt, Herts, with July 11 and 25 natter nights and an external visit on the 18th, destination unknown but Roger Frisby G4OAA, 2 Westfield Road, Hoddesdon, Herts can fill in the details on H'don 464795. Incidentally, the club supplied the 28MHz beacon 9L1FTN to the Freetown club and I heard it at good strength recently.

Chester & District RS G3GIZ G8GIZ Every Tuesday, except the first, at the Chester RU Football Club, Hare Lane, Vicars Cross, Chester, at 8pm, with G4MOU willing to give code practice if you get there half an hour earlier. It's barbeque and club station night on July 10 with a special event station being run for the Chester Oldfield Scouts at Bala on the 28th, namely GB2COS. PRO is Dave Hewitt G8ZRE, 31 Broadmead, Vicars Cross, Chester likewise (0244) 316673.

Civil Service ARS G3CSR/A Re-formed some two years ago this club now meets on the first and third Mondays at 12.30pm at the Civil Service Recreation Centre, Monck Street, Westminster, London SW1. It is expected that a club station will soon be operative there but in the meantime G3CSR/A is on every Tuesday evening at 7.30pm on 144·575MHz until 8pm with a QSY to 3720kHz s.s.b. Sec George Costin is on 01-632 3875 or try Bob Treacher on 01-212 4846. It seems that there are also regional reps around but no further info on that.

Colchester Radio Amateurs July 22, a Sunday, is Anglian Mobile Rally time at Stanway School. Otherwise second and fourth Thursdays at 7.30, the Colchester Institute, Sheepen Road, C'chester, with visitors very welcome. Sec is G3FIJ, 29 Kingswood Road, C'chester, or (0206) 851189.

Cornish RAC Meets at the Church Hall, Treleigh, which is on the old Redruth bypass with Thursday, July 5 a natter night and a Your Questions Answered session. Note that Thursday, August 2 will have G3VWK talking on the early days of radio. The Computer section of the club meets at the same spot and on Monday July 16 Ken Ball holds forth on Boolean algebra. Another important fixture is the Cornish Mobile Rally at Cornwall Tech, Redruth, on Sunday July 15. More from sec S. Rodda G4PEM, Cliff Hotel, Penrose Terrace, Penzance also P'zance 3948.

Coulsdon ATS G4FUR Venue is St Swithuns Church Hall, Grovelands Road, Purley, Surrey, at 8pm with a lecture on Monday July 9 with Thursday July 26 devoted to Morse code tuition and club constructional projects. Richard Goring G6VYT, 54 The Glade, Old Coulsdon, Surrey is your contact, otherwise Downland 54319.

Dunstable Downs RC Fridays at 8, Chews House, High Street South, Dunstable, Beds, but highlight to come is the first live demo of the club's TV repeater GB3TV located on Dunstable Downs on Friday July 20. A technical talk is arranged for July 6 with a d.f. hunt on both 144MHz and Top Band for the 15th. Sec is Phillip Morris available on D'stable 607623.

East Kent RS G3LTY G6EKR The bad news is that the mobile rally scheduled for August 19 has had to be cancelled because of circumstances outside the control of the club. However life carries on first and third Thursdays at the Cabin, Kings Road, Herne Bay, Kent, at 8pm. More from hon sec Stuart Alexander G6LZG, 66 Downs Road, Canterbury, Kent, or C'bury 68913.

Edgware & District RS G3ASR An outside trip is arranged for Thursday July 12, destination so far unrevealed. Normally second and fourth Thursdays at 8pm at 145 Orange Hill Road, Burnt Oak, Edgware, Middx, with slow-Morse exercises at the club and on the air on 144MHz and Top Band normal routine, in addition to talks, lectures and demos. Publicity man is Michael Harlock G4TOC, 91 Flamborough Road, Ruislip Manor, Middx or ring R'lip 72855.

Exeter ARS G4ARE PRO Roger Tipper G4KXR says talk on "Static & Chips" held over from March will now take place on Monday July 9 at the Community Centre, St Davids Hill, Exeter. That makes meetings on the second Monday of the month but on other Mondays it's informal time at the Scout Hut, Emmanuel Hall, Okehampton Road, Exeter, wherein are to be found the club rigs and c.w. practice facilities. Roger can be located on Exeter 68065.

Fareham & District ARC G3VEF G8KGI July 11 and 25 are natter nights cum on-the-air sessions while on the 18th G3WLY will describe operating conditions on St. Kilda. So, Portchester Community Centre, Westlands Grove, Portchester, Wednesdays at 7.30. Activities include operation in the major 144 and 432MHz contests. Write or ring Brian Davey G4ITG, 31 Somervell Drive, Fareham, Hants/F'ham 234904.

Fylde ARS Past events are dead news normally but I have to mention the recent visit of members of the club to *HMS Inskip*, the Navy's premier transmitting station providing world-wide communication from Whitehall and comprising banks of 50kW rigs, four 200m masts and accompanying forest of antennas. The enjoyable and informative visit was concluded in the Mess. Nuff sed! Otherwise the meetings are held at the Kite Club, Blackpool Airport, first and third Tuesdays at 7.45pm with July 17 being a more or less open gathering plus code classes. PRO G4CSA can be found at Tarn Hows, 91 Blackpool Road, Ansdell, Lytham St Annes, Lancs or buzz Lytham 737680.

Gloucester ARS New venue is St John Ambulance HQ, Heathville Road, Gloucester every Wednesday evening at 7.30. Many outside activities are planned for the summer months including special event stations. Potential members and visitors extremely welcome according to Tony Martin G4HBV, 12 Redwood Close, Podsmead, Gloucester.

Greater Peterborough ARC G4EHW Southfields Junior School, Stanground, P'boro at 7.30, the fourth Thursday except during school holidays. Try Frank Brisley G4NRJ for more details, at 27 Lady Lodge Drive, Orton Longueville, Peterborough.

Hastings Electronics & RC G6HH It's summer barbeque time on Saturday July 7 at the club's VHF FD contest site at Fairlight Helipad Picnic Area, near Hastings. Basically it's third Wednesdays at West Hill Community Centre, Croft Road, West Hill, Hastings, and big draw for July is antenna expert Dickie Bird G4ZU on the 18th. Other club goings-ons take place at the clubhouse in Downey Close, St Leonards-on-Sea, namely Morse practice and a basic micro course on Tuesdays and a chat night on Fridays, the last Friday usually including a film show. Right, more from sec Dave Shirley G4NVQ, 93 Alfred Road, Hastings.

Haverhill & District ARS Meets Fridays at Copse Hall Farm. Sec Rob Proctor G4PZW of 10 Hunts Hill, Glemsford, Sudbury, Suffolk, is willing to divulge all if you ring him on (0787) 281359. On July 6 there is a foxhunt while the 20th concerns the club's antennas. Note now that August 3 will concentrate on noise suppression on mobile outfits.

Inverness ARC GM4TPF GM1DZU Every Thursday at 7.30, Cameron Youth Club, Planefield Road, Inverness, is all I know so contact the new sec David Jones GM4SXD, Beachan, Farr, Inverness also on (08083) 240 for detailed info on the club.

Ipswich RC G4IRC It's Morse code instruction mainly on July 11 with d.f. hunt down for the 25th, start point unknown but ending in the clubroom. That makes it the second and last Wednesdays at 8pm, the club room of the Rose & Crown at 77 Norwich Road, Ipswich where, I am asked to say, the clubroom is separate from the public bars. Jack Tootill G4IFF lives at 76 Fircroft Road, Ipswich, Suffolk, and will be glad to help anyone interested in the club, on (0473) 44047.

Medway AR & T Society G4MW G8MWA Not heard from for a while but still meeting at St Luke's Church Hall, King William Road, Gillingham, Kent, every Friday with two films on July 6, *Ham Radio* and *Moving up to Amateur Radio* while G8VR will tell members how to improve DX working on 144MHz on the 20th. It is time to mention a talk on satellite communciations by G8XLH on August 3 with a real, live demo on the 17th. Andy Wallis G4TQS is sec, at 13 Stoneacre Close, Parkwood, Rainham, Gillingham, Kent, otherwise (0634) 363960.

Midlands ARS A sad report, as the club's HQ was broken into and the h.f. rig and other items of equipment stolen, and, unfortunately, they were not covered by insurance. I imagine this episode will speed up the intended move to better premises. An alternative spot outside the city centre has already been offered. The main July meeting has G6DRN talking on amateur TV systems but contact Tom Brady G8GAZ for the latest details on the club, at 57 Green Lane, Great Barr, Birmingham B43 5LE, or 021-357 1924.

Mid-Warwickshire ARS Second and fourth Tuesdays at 61 Emscote Road, Warwick at 8pm with a talk on the St John Ambulance Service on July 10 and a foxhunt and barbeque on the 24th. Much more from Carol Finnis G4TIL on Southam 4765.

Nene Valley RC G4NWZ G6GWZ The Dolben Arms, Finedon, near Wellingborough, Northants, at 8 every Wednesday with a "Tube Sale" (valve or c.r.t.?) on July 11 run by G4MEO, a lecture on Crime Prevention by a member of the local constabulary on the 18th and a natter night on the 25th. Hon sec remains Lionel Parker G4PLJ, 128 Northampton Road, Wellingborough, Northants.

Norfolk ARC G4ARN HQ is situated at the Valley Drive Community Centre, Plumstead Road, Norwich, with gatherings every Wednesday at 7.45. Peter Forster G3VWQ, 12 Thor Road, Thorpe-St-Andrew, Norwich, is also on N'wich 37709 and he has details of the current programme.

Oldham ARC Mondays at 8.30, the Devonshire Arms, Elliot Street, Lees, near to Oldham, with a warm welcome promised for visitors. It's Fiona Butterworth G4SPX on 061-652 8862 who can fill in the details for you.

Radio Society of Harrow Every Friday at 8, the Harrow Arts Centre, High Road, Harrow Weald (opposite the Alma pub, or opposite the bus garage, for the benefit of teetotallers!) plus talk-in on GB3HR on RB14. Talk on July 6 deals with basic microwave practice with airborne radio the subject for the 20th. Publicity officer is Dave Atkins G8XBZ, 25 Maxwell Close, Rickmansworth, Herts or try R'm'worth 779942.

Severn Valley RS First and third Tuesdays at the King's Head Hotel, Whitburn Street, Bridgnorth, Salop, with visitors and newcomers most welcome. More from the society's secretary Julian Sutcliffe G6TMP on (0952) 883752.

South Bristol ARC G4WAW A 430MHz activity evening is slated for July 11 and a computer bring-and-buy plus general on-the-air activity on the 18th. HF activity will be catered for on the 25th. A "pocket-phone" rally sounds like a new idea, on August 8. So, every Wednesday at the Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol. Enquiries to Len Baker G4RZY, 62 Court Farm Road, Whitchurch, Bristol, or ring (0272) 834282.

South Manchester RC G3FVA G3UHF G8SMR A long title for the chat by G4ROM on July 13—"The synthesis of the Elements, or Hitch Hikers Guide to the Universe"! The 20th will be a radio clinic, or how to get those failed projects to work. Attraction on the 27th is G8TTY on microprocessor design. For August there is a Top band d.f. hunt on the 3rd. That makes it every Friday at 8pm, the Sale Moor Community Centre, Norris Road, Sale, with informal meetings also, every Monday evening. Contact Dave Holland G3WFT, 32 Woodville Drive, Sale, Cheshire on 061-973 1837 for information.

South East Kent (YMCA) ARC G3YMD G8YMD This busy club gathers on Wednesdays at 7.45 for regular meetings, with Mondays devoted to RAE classes and Tuesdays for code tuition. Venue is the Dover YMCA, as you may have gathered, Godwynehurst, Leyburne Road, Dover. A special event station will be run at the Waldershare Vintage weekend at Waldershare Park on July 28/29. Further details from Alan Moore G3VSU, 42 Nursery Lane, Whitfield, Dover, or Dover 822738.

Southend & District RS Every Friday at the Council Offices, Rayleigh, opposite the church I understand, at 7.30. No more info on current happenings so try Brian Wood, the club's liaison officer, at 27 Fernlea Road, Benfleet, Essex (03745) 50494.

Stevenage & District ARS G3SAD G8SAD First and third Tuesdays at 8pm, *TS Andromeda,* Fairlands Valley Park, Shephall View, Stevenage, Herts, although if you get there a bit earlier you can join in the Morse classes if you so desire. Trevor Tugwell G8KMV, 11 The Dell, Stevenage, is Publicity Secretary and anxious to hear from newcomers.

Stourbridge & District ARS G6OI G6SRS First and third Mondays at the Robin Hood Centre, School Street, off Enville Street, Stourbridge, but note that there are no meetings in August. Make it 8pm for the main meetings, usually the first Monday. Hon sec is Malcolm Davies G8JTL, 25 Walker Avenue, Quarry Bank, Brierley Hill, or Lye 4019.

Stratford-upon-Avon & District RC G3PGU Second and fourth Mondays at 7.30pm at the Control Tower, Bearley Radio Station, Bearley, which is about three miles north of Stratford. Ample equipment is at hand for constructional projects at the club, apart from all the usual club activities. Your man is Clive Ousbey G6DCL, Ormond Lodge, Newbold-on-Stour, Stratford-upon-Avon, Warks.

Sutton & Cheam RS German war radio equipment forms the subject for G3IEE on July 20 at the Downs Lawn Tennis Club, Holland Avenue, Cheam, Surrey. Other meetings are held at the alternative venue of the Sutton College of Liberal Arts in Sutton. Secretary Alan Keech G4BOX, 26 St Albans Road, Cheam, can bring you up to date.

Torbay ARS G3NJA G8NJA Every Friday for informal meets at Bath Lane, the rear of 94 Belgrave Road, Torquay, with the last Saturday more formal concerning club business and a talk or film show or demo to follow. Diary note is the rally at the STC Social Club on Sunday August 26 but more on this and club events from Margaret Rider, 7 Kingston Close, Kingskerswell, Newton Abbot, S. Devon.

Vale of White Horse ARS First and third Tuesdays at 7.30, the Lansdown Club, Milton Trading Estate, near Didcot, Oxon, the sec being Ian White G3SEK, 52 Abingdon Road, Drayton, Abingdon or (0235) 31559 who will be glad to hear from those with AR interests.

Verulam ARC The RAF Association HQ, New Kent Road, off Marlborough Road, St Albans, is the spot on the second and fourth Tuesdays with Louis Varney G5RV discoursing on h.f. wire antennas on July 10 so don't be late. Hilary Claytonsmith G4JKS, 115 Marshallswick Lane, St Albans, Herts is the hon sec and source of info on the club.

West Bromwich Central RC G4WBC Unusually, Sunday evenings at 8, the Victoria, Lyng Lane, W. Brom, with help offered on the RAE and the code. SWLs and anyone interested in AR are invited to join the club. John Bates G6ZLW is on 021-553 0531 or drop a line to 28 Westbourne Road, West Bromwich, W. Mids.

Westmorland RS Fairly new, the club meets on the second Tuesday at 8pm, the Strickland Arms, Sizergh, near to Kendal, so more members are very welcome. Contact sec Frank Burrow G8BME, Holly Trees, Church Close, Levens, or Sedgewick 60803.

Wimbledon & District RS Friday July 13 has a video show but there is no meeting on the 27th as the club will be at its annual camp at Chessington from Thursday 26th to Sunday 29th with the club's 21st anniversary call GB0WIM in use. Normal meetings are held at the St John Ambulance HQ, 124 Kingston Road, London SW19 at 8pm second and last Friday of the month. Geoff Mellett G4MVS, 26 Paget Avenue, Sutton, Surrey is the sec, welcoming calls from those interested in the club, on 01-644 8249.

Winchester ARC Saturdays have been picked by the club for their gatherings, at 7.30 at the Log Cabin, Stockbridge Road, W'chester, on the third Saturday of the month. July 21 sounds very inviting with a safari picnic to Farley Mount with YLs and XYLs and the family most welcome. Code practice tapes are available for those who wish to study at home in addition to the club course. RAE classes start in the autumn at Peter Symond's College. Bob Stone G4FPC can be QSOd on W'chester 64747.

Wisbech Radio & Electronics Club It's the Five Bells, Parson Drove, "every other Thursday" which is rather confusing but I make it July 5 and 19, at 7.30pm. Features to come include a barbeque, Top Band d.f. hunt, radio-controlled car rally and the like. More members are being sought so contact sec Ken G4UQN at 14 St Peter's Road, Wisbech, Cambs, or W'bech 61029.

Yeovil G3CMH G8YEO Thursdays at 7.30, the Recreation Centre, Chilton Grove, Yeovil, with G3MYM looking at the 50MHz band, on July 12, and with j.f.e.t. r.f. amplifiers the following week, and natter night on the 26th. More details from Eric Godfrey G3GC, Dorset Reach, 60 Chiltern Grove, Yeovil, Somerset or buzz (0935) 75533.

Would club secs, PROs and all those kind enough to write in to me please note my now permanent QTH as shown in the heading to this feature. Lots of mail is still being redirected from my old QTHs at Ashtead and New Malden.

MEDIUM WAVE BROADCAST BAND DX *by Charles Molloy G8BUS*

Reports to: Charles Molloy G8BUS, 132 Segars Lane, Southport PR8 3JG.

The reception of broadcasts on the medium waves varies considerably according to location, a fact easily verified with a car radio. In the Lake District, for example, reception is generally poor, due to the screening effect of the mountains. On the other hand, BBC Radio Merseyside, which transmits with only 2kW on 1485kHz and is inaudible in the Lakes, comes roaring in along the southern coast of South West Scotland. We are talking, of course, about daytime ground-wave reception, where radio waves travel along the surface of the earth and are affected by the terrain over which they pass. How about sky-wave reception at night?

The part of the ionosphere nearest to the earth is called the D layer. It absorbs medium wave signals, but fortunately this layer disappears very quickly at sunset. When this happens, medium wave broadcasts travel further into the ionosphere where they are sent back, refracted, to return to the earth some distance away from the transmitter. This is the reason why the band suddenly fills with signals after dark. It also explains why DXing is

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ECC83	1.60
ECC85	2.20
ECC88	1.70
ECC91	3.00
ECC189	2.10
ECF80	1.45
ECF86	2.50
ECF801	1.85
ECH81	2.50
ECL82	1.50
ECL83	2.50
ECL86	1.70
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EF80	1.35
EF85	1.65
EF86	1.75
EF89	2.30
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6AN8A	2.70
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6AQ5W	1.90
6AQ8	2.20
6AR5	2.85
6AS6	5.50
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6AU6A	1.80
6AV6	1.30
6AW8A	2.65

6AZ8	3.80
6BA6	1.60
6BA8A	2.75
6BE6	1.90
6BH6	2.00
6BJ6	1.85
6BK4C	4.15
6BL6	68.50
6BL7GTA	3.80
6BL8	1.45
6BM6	93.95
6BM8	1.50
6BN8	2.45
6BQ5	1.60
6BR8A	2.95
6BX6	1.35
6BZ6	2.50
6C4	1.85
6CA4	1.65
6CA7	3.50
6CB6A	1.90
6CF6	1.90
6CG7	2.25
6CH6	9.95
6CJ3	2.30
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6CL6	3.30
6CM5	2.30
6CN6	4.95
6CQ6	2.20
6CW4	6.50
6CW5	1.95
6CY5	3.80
6CY7	3.00
6CZ5	3.15
6DA6	2.30
6DC6	2.45
6DC8	1.50
6DJ8	1.70
6DK6	3.95
6DT5	2.30
6DW4B	2.30
6E5	4.20
6EA8	2.45
6EH5	1.65
6EH7	2.00
6EJ7	2.00
6EL4A	4.15
6ES8	2.10
6EV7	2.85
6EW6	1.50
6FG6	2.00
6FH8	16.50
6FQ7	2.25
6FS5	2.25
6GB5	2.80
6GE5	2.90
6GF5	2.10
6GH8A	1.80
6GJ5A	3.00
6GJ7	1.85
6GK6	1.95
6GW8	1.70
6GX6	3.00
6GY6	3.00
6H6	3.00
6HA6	3.05
6HB6	3.05
6HE5	4.00
6HF5	3.85
6HG5	1.95
6HG8	2.50
6HS6	3.95
6HZ6	2.75
6J5	3.15
6J5GT	2.95

6J6	2.20
6J6A	3.00
6JB5	4.00
6JB6A	4.20
6JC6A	3.50
6JE6C	4.95
6JG6A	3.85
6JH8	3.25
6JK6	2.20
6JM6	3.95
6JS6C	3.95
6K6GT	2.75
6K8	4.85
6K11	2.55
6KD6	5.90
6KD8	2.00
6KE8	3.90
6KG6	6.00
6KM8	3.50
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6L6GC	3.50
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6SA7	3.00
6SL7GT	1.95
6SN7GTB	2.85
6SR7	3.80
6U4	1.50
6U8A	2.00
6V4	1.95
6V6GT	1.95
6X4	2.00
6X5GT	1.85
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12AT7	1.60
12AU6	2.00
12AU7A	1.60
12AV6	2.00
12AX7	1.60
12AX7WA	4.80
12B4A	2.90
12BA6	2.00
12BA7	3.00
12BE6	1.90
12BM7A	2.50
12BY7A	2.65
12BZ6	3.70
12DK6	1.50
12DW7	4.25
12E1	25.00
12FQ8	12.00
12GN7A	4.00
12K7GT	1.80
12SL7GT	3.95
13E1	155.00
20PE11	25.00
20PE13A	21.00
20PE14	25.00
20PE15	220.00
20PE19	25.00
20PE20	27.50
21JZ6	3.40
30KD6	5.00
40KG6	5.50

40KG6A	5.75
42EC4	4.00
75C1	2.80
83A1	12.00
90C1	3.50
90CG	12.00
90CV	14.20
150B2	6.50
150C2	3.10
150C3	4.95
150C4	4.50
212E	170.00
290A	1150.00
350A	22.50
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404A	12.00
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811A	14.90
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813 (NAT)	28.50
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829B	17.20
833A	61.50
843	10.00
845	48.30
857B	708.00
866A	15.50
868	24.00
872A	19.00
922	12.50
927	17.80
930	14.70
931A	18.50
931B	25.00
934	18.80
935	35.80
1051D	110.00
1052S	144.00
2050	2.85
2050A	2.85
4532U	250.00
4833U	215.00
4848	25.00
4875U	215.00
5517	14.50
5544	72.50
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5557	24.50
5559	51.50
5581	16.85
5582	24.00
5583	20.65
5632	22.50
5636	7.00
5642	8.20
5644	17.00
5651	2.85
5654	2.90
5665	120.00
5670	2.75
5684	28.80
5684NE	39.50
5696	3.30
5718	6.20
5726	1.80
5727	2.00
5749	2.50

5750	1.90
5751	3.30
5763	4.50
5796	29.50
5814	3.00
5822A	300.00
5847	12.00
5866A	112.00
5867A	120.00
5868	170.00
5869	40.00
5870L	20.00
5870ST	20.00
5876A	27.60
5879	3.80
5886	10.00
5894A	41.25
5894B	45.00
5920	8.50
5963	1.80
5965	2.20
5991	20.00
6005	1.90
6011	29.90
6012	9.90
6014	20.00
6021	3.70
6058	10.50
6063	3.70
6065	7.25
6073	5.50
6080	9.20
6083	72.00
6084	13.10
6085	8.60
6094A	420.00
6101	2.20
6130	24.50
6146A	7.50
6146B	7.50
6155	49.00
6156	59.00
6159B	12.50
6201	6.50
6227	12.95
6267	1.75
6293	14.00
6360A	5.50
6426	1690.00
6442	18.00
6484	42.00
6528	48.00
6550A	7.25
6688	8.50
6689	9.25
6693	90.00
6779	19.50
6856	52.50
6857	66.80
6858	99.20
6859	103.50
6883B	14.20
6922	3.90
6939	19.50
6973	3.70
6975	66.00
7014	44.50
7015	50.00
7017	66.50
7018	18.50
7022	66.80
7023	103.50
7025	2.50
7027	4.60
7034	42.50
7056	2.50
7136	175.00

7189A	2.40
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7203 (EIM)	49.00
7233	6.75
7234	72.50
7247	3.20
7262A	26.00
7289	39.00
7308	7.50
7322	604.00
7360	9.00
7486AL	80.00
7527	73.30
7527A	140.00
7534	23.50
7543	2.00
7551	5.50
7558	9.50
7581A	18.25
7586	11.50
7587	19.00
7591A	5.00
7723NE	28.65
7735A	26.00
7815AL GE	48.00
7815R AL	48.00
7868	4.20
7903	115.00
7905	13.50
7984	13.50
8008	18.80
8020	35.00
8032	14.20
8056	15.00
8068	13.00
8072	69.20
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8121	90.00
8122	90.00
8163	82.00
8164	298.00
8233	44.00
8278	39.00
8298A	7.50
8321 (EIM)	70.00
8321 (AMP)	68.00
8416	15.70
8417	5.55
8422	20.00
8438	80.00
8541	33.00
8552	14.20
8553	280.00
8608	27.50
8643	66.70
8754	17.35
8794	2330.00
8844	23.00
8874	165.00
8906AL	55.00
8908	10.50
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2N3927	11.82
2N4416	0.75
2N4427	0.75
2N5090	13.90
2N5109	2.00
2N5160	4.80
2N5190	1.50
2N5589	6.00
2N5590	8.50
2N5591	8.90
2N5643	13.00
2N5913	2.50
2N5945	8.95
2N5946	15.63
2N6080	6.00
2N6081	8.75
2N6082	9.00
2N6083	12.00
2N6084	13.20
2N6094	8.00
2N6095	8.50
2N6255	3.45
2SC382	0.65
2SC458	0.22
2SC458B	0.36
2SC458C	0.22
2SC460	0.25
2SC460B	0.25
2SC461B	0.25
2SC535	0.38
2SC535A	0.38
2SC535B	0.38
2SC535C	0.35
2SC540	24.95
2SC608	0.75

2SC644	0.25
2SC684	0.28
2SC703	36.00
2SC710	0.45
2SC710D	0.28
2SC715D	0.40
2SC715E	0.40
2SC717P	0.38
2SC730	4.10
2SC731	3.95
2SC732	0.25
2SC741	2.50
2SC821	6.60
2SC28B	0.30
2SC29B	0.25
2SC890	8.50
2SC891	18.00
2SC900	0.18
2SC900F	0.19
2SC908	4.50
2SC911A	18.00
2SC945	0.21
2SC945R	0.21
2SC952	0.60
2SC982	0.30
2SC994	2.50
2SC998	3.90
2SC1001	9.90
2SC1011	15.00
2SC1070	1.15
2SC1096L	0.90
2SC1096M	0.90
2SC1117	£1.50
2SC1120	12.50
2SC1121	24.00
2SC1122	18.00
2SC1162B	0.90
2SC1165	6.95
2SC1169	4.85
2SC1176	14.00
2SC1177	17.25

2SC1178	18.00
2SC1209D	0.64
2SC1213A	0.40
2SC1213C	0.40
2SC1239	2.50
2SC1241	15.00
2SC1251	10.00
2SC1260	1.11
2SC1303	5.00
2SC1306	1.00
2SC1307	1.50
2SC1311	0.40
2SC1311E	0.32
2SC1314	25.00
2SC1318	0.40
2SC1368B	1.00
2SC1383B	0.50
2SC1424	1.35
2SC1509	6.00
2SC1546	0.45
2SC1568	0.45
2SC1589	5.00
2SC1622	0.33
2SC1623	0.30
2SC1688	19.80
2SC1674	0.25
2SC1675	0.20
2SC1678	1.25
2SC1729	18.00
2SC1730	0.25
2SC1740Q	0.20
2SC1765	7.75
2SC1815Y	0.28
2SC1906	0.33
2SC1907	0.30
2SC1945	2.10
2SC1946	18.75
2SC1946A	16.50
2SC1947	9.88
2SC1955	7.20
2SC1966	11.00

2SC1967	15.00
2SC1968	17.50
2SC1968A	22.00
2SC1969	1.50
2SC1970	1.50
2SC1971	4.00
2SC1972	11.00
2SC1978	7.50
2SC2001	0.45
2SC2026	0.75
2SC2053	0.80
2SC2097	36.00
2SC2099	15.00
2SC2100	24.00
2SC2103	18.00
2SC2105	15.00
2SC2116	1.60
2SC2118	9.00
2SC2221	5.50
2SC2233	0.90
2SC2237	16.00
2SC2281	13.00
2SC2283	9.00
2SC2287	11.00
2SC2289	12.50
2SC2290	27.50
2SC2347	0.30
2SC2369	2.00
2SC2370A	18.00
2SC2379	15.00
2SC2395	15.00
2SC2407	1.00
2SC2420	18.00
2SC2494	16.00
2SC2509	6.00
2SC2531	1.30
2SC2538	1.10
2SC2539	15.00
2SC2540	24.95
2SC2545E	0.29
BRF90	1.50

BFR91	2.00
BRF96	2.00
BFY90	1.50
BLW29	10.00
BLW60C	15.00
BLW60CF	15.00
BLW64C3	65.00
BLW78	61.80
BLW80	10.25
BLW81	14.90
BLW90	13.00
BLW98	110.00
BLX39	13.75
BLX65	2.45
BLX67C	9.50
BLX67CF	9.50
BLX68C3	10.00
BLX68CF	10.50
BLX69A	20.00
BLX94A	36.00
BLX98	132.00
BLY87C	7.50
BLY88C	11.00
BLY88CF	11.00
BLY89C	13.00
BLY90	45.00
BLY91CF	11.00
BLY94	45.00
MRF208	12.00
MRF212	12.00
MRF221	12.05
MRF229	3.50
MRF231	12.36
MRF232	13.50
MRF233	14.30
MRF234	16.00
MRF237	3.10
MRF238	12.60
MRF239	20.00
MRF240	24.50
MRF243	35.00

MRF245	30.00
MRF247	30.10
MRF260	5.00
MRF264	11.00
MRF309	42.00
MRF316	55.00
MRF317	73.00
MRF321	35.00
MRF323	35.00
MRF326	63.00
MRF327	70.00
MRF329	58.06
MRF412	18.51
MRF421	36.85
MRF422	42.00
MRF426	23.00
MRF427A	21.00
MRF428	57.00
MRF428A	75.00
MRF433	16.21
MRF449A	14.95
MRF450	11.90
MRF453	14.00
MRF453A	14.00
MRF454	21.00
MRF454A	24.00
MRF455	16.00
MRF455A	21.00
MRF458	19.95
MRF466	24.50
MRF472	4.40
MRF475	2.00
MRF475	2.25
MRF477	12.50
MRF492	27.50
MRF497	18.50
MRF515	3.90
MRF517	3.50
MRF620	18.00
MRF644	27.50
MRF646	28.00

MRF648	33.00
MRF750	6.50
MRF846	46.00
MRF901	2.75
MRF904	2.95
MRF911	2.50
MRF5175	22.50
MRF5176	30.00
MRF5177	43.00
MRF8004	2.00
PT3134A	1.50
PT3134B	2.75
PT3134C	12.00
PT3134D	12.50
PT3134E	30.00
PT3161A	1.75
PT3161B	1.75
PT3161C	8.50
PT3161D	14.00
PT3161F	30.00
PT3503	6.95
PT4261A	16.00
PT4261B	24.00
PT4261C	60.00
PT4316C	12.00
PT4316D	18.00
PT4316E	25.00
PT4316F	30.00
PT5661C	14.00
PT8751	24.00
PT8820	15.00
PY8831	2.75
PT8837	10.00
PT8838	15.00
PT8854B	18.00
PT8861A	15.00
PT8864A	30.00
PT8874	18.00
PT9795	12.50
PT9797	14.00
PT9841	16.00

PT9847	16.00
SD1005	8.20
SD1006	2.10
SD1012-3	10.00
SD1012-4	10.50
SD1013	10.00
SD1014-6	10.50
SD1015	17.50
SD1018-6	13.00
SD1019	24.70
SD1019-5	24.70
SD1020	1.50
SD1074	16.10
SD1076	18.50
SD1077	1.60
SD1078	26.50
SD1080	1.55
SD1080-6	7.50
SD1080-7	7.50
SD1088	26.00
SD1089	28.50
SD1089	40.10
SD1115-2	7.50
SD1115-7	2.10
SD1127	2.50
SD1131	3.25
SD1133	9.50
SD1133-1	10.00
SD1134-1	2.50
SD1134-2	10.00
SD1134-8	10.00
SD1134-STUD	7.60
SD1135	10.25
SD1135-3	12.00
SD1136	12.50
SD1143	9.45
SD1143-1	10.00
SD1144-1	2.50
SD1158	7.95
SD1201	7.35

SD1202	7.50
SD1212-4	6.00
SD1212-7	4.00
SD1214	8.70
SD1216	11.00
SD1219	18.00
SD1219-4	18.00
SD1220-1	9.50
SD1222-5	11.00
SD1222-STUD	11.00
SD1224-2	13.00
SD1229-F1	10.95
SD1229-STUD	10.95
SD1244-6	12.75
SD1256	6.95
SD1262	15.00
SD1270	3.75
SD1272	10.95
SD1272-2	10.95
SD1278	13.75
SD1278-1	13.75
SD1285	12.75
SD1300	1.25
SD1303	2.50
SD1316	2.10
SD1317	8.00
SD1405	21.00
SD1407	27.50
SD1407MP	55.00
SD1410	21.06
SD1410-1	21.00
SD1410-3	21.00
SD1412	36.00
SD1412-3	24.00
SD1413	18.00
SD1414	36.00
SD1416	33.00
SD1418	30.00
SD1421	36.00
SD1428	24.00
SD1429	15.98

TERMS: C.O.W. **POSTAGE/PACKING:** Add £1 to order under £50 value. **VAT:** All prices are excluding VAT, please add 15% to order and postage. **GUARANTEE:** All goods are of current production and sold with the manufacturer's warranty. **ENQUIRIES:** Are welcomed for other types/brands of valves. Please send SAE. Normally stock items are shipped by return post.

only possible when there is a path of darkness between transmitter and receiver.

The Sky Wave

Is the sky wave affected by the terrain below? Unlikely, as the radio waves are many miles above the earth's surface. How about screening? Clearly, if you listen out towards the sea then incoming signals right down to the horizon will reach the receiver. If hills obstruct the horizon then only those waves arriving at angles great enough to clear the obstruction will be received.

Last summer I put this to the test. Using my DX160 with a short random wire antenna on a caravan site on the coast of Cumbria, I had no difficulty picking up CJYQ on 930kHz just before sunrise. The following night I repeated the test from a site at Bowness on Windermere where daytime reception on the medium waves is poor. CJYQ was picked up again. We have the anomalous situation where it is difficult to hear local radio during the day but St John's Newfoundland comes in well in the small hours! Perhaps we should not be surprised. The slow cyclic fading which is a characteristic of DX signals on the medium waves is usually explained by the arrival, in and out of phase, of signals travelling along paths of different lengths from the TX and arriving at different angles at the RX. So location may not, after all, matter too much to the medium wave DXer. Unless you live on the side of a steep hill or in the middle of a wood, you should be able to pick up some DX. I'm referring to natural obstructions, though. Steel framed buildings, gasholders and the like are another matter.

Images on the Long Waves

"I am a great radio enthusiast and a radio collector," writes **Michael H. Thomas** of Gateshead, who says that he has a number of two-band radios that cover medium and long waves. "Even on the cheap ones the m.w. is generally satisfactory, but l.w. is giving great problems—plagued by images of m.w. stations." Michael wonders if I can explain this and if I can suggest an answer.

The cause of the problem is lack of selectivity between the antenna and the mixer stage. The set-up in most receivers is shown in Fig. 1. When the RX is tuned to 150kHz (3000m) the oscillator will be tuned to 150 + 455 = 605kHz, assuming a 455kHz i.f., and the image will be 605 + 455 = 1060kHz. With the RX at 300kHz (1000m) the image is 1210kHz. So, if we tune across the long waves we are liable to pick up images in the range 1060 to 1210.

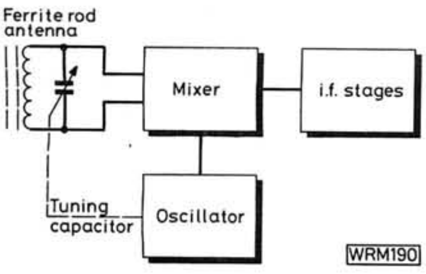
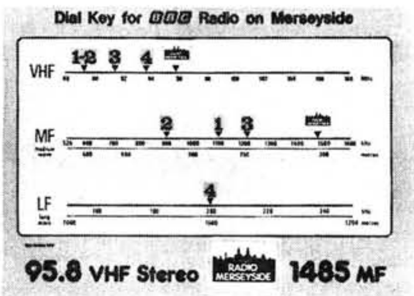


Fig. 1

The function of the antenna-tuned circuit is to accept the long wave signals and reject those in the medium waves. The receiver tuning knob is connected to a twin-gang variable capacitor, one section being for the oscillator and the other for the antenna circuit. Alignment is the procedure adopted to make sure that the two tuned circuits keep step with each other. It is usually accomplished by using fixed and variable capacitors, called padders and trimmers. A simple pocket receiver may dispense with these, hoping that the alignment is not too far out and is adequate for the m.w. signals likely to be picked up by its own antenna.

For long wave DXing you need a set with good image rejection, because of the number of strong images on the medium waves. My DX160 has two properly aligned tuned circuits between the antenna and mixer and I can use a long wire without trouble. If you connect an external antenna to a pocket receiver, or if you use the set near a m.w. transmitter where the signal is strong, then images are inevitable. They appear as tunable whistles as well as unwanted programming.

If a simple set develops a fault so that the antenna-tuned circuit is not even approximately tuned to the incoming signal, then medium wave stations will dominate the long waves. A broken wire, slipped winding on the ferrite rod which could alter the inductance, or even a broken rod, are the sort of faults to look for.



Radio Merseyside Information Sheet

Mods to the ICR-70

Reader **Jan van der Horst** who lives at Arnhem in the Netherlands has been modifying his ICR-70 receiver. "I can use the s.s.b. filters in the a.m. mode and I can use the pre-amp in the m.w. band. For these mods you don't have to take the receiver's p.c.b.s out.

"By cutting wire G (r.f. unit) you can use the 10dB pre-amp below 1·6MHz. The amplifier works normally between 1600 and 400kHz, amplification decreases between 400 and 280kHz and below 200kHz if attenuated. Use the 'OFF' position to get normal sensitivity."

For the filter mods you need two 2-pole switches, a 2·2kΩ resistor and some wire. Anyone interested in following up these mods should write to our reader, enclosing an International Reply Coupon, at PO Box 1184, 6801BD, Arnhem, Holland. "Now you have three a.m. bandwidths, 6kHz, 2·7kHz and 2·1kHz. The 2·1kHz is very good for transatlantic m.w. DX," concludes our reader.

Readers' Letters

Mike Davies of Coleford, Gloucester, who uses a Panasonic RF3100, was very interested in Ron Wyres' method of joining an external antenna to a set and using an a.t.u.—see this column in the December 1983 *Practical Wireless*. "I have tried this and am delighted with the improvement." Ron's method is to connect an external antenna and an earth to an a.t.u. The output of the a.t.u. is clipped onto the telescopic antenna of the RF3100, which is retracted, and the earth is joined to the receiver's antenna socket. Incoming signals can then be peaked with the a.t.u.

Peter Jarrett (Scarborough) uses a Nordmende Globe Trotter 808 which has an internal ferrite rod antenna. "Could you please tell me if by using a random wire I'm overloading the frequencies." You can only tell if a receiver is being overloaded by listening to it. When this happens you will usually hear a number of whistles, stations will appear on parts of the dial where they shouldn't, while interference and noise will increase. What is happening is that the additional antenna is feeding stronger signals to the RX than it was designed to handle, and consequently the set objects in this way.

"Thank you for saying something about local radio in the UK, people don't realise how hard local radio DXing can be," writes **Damien Read** of Newport. Damien goes on to say that, "If you don't live near any of the ILR stations on 1152kHz you are lucky—when it's time for news I get five news jingles from five stations. Another frequency is 1548kHz, also with five stations on it." Try using the directional properties of your receiver's internal antenna, if it is a portable. Turn the whole receiver slowly and you should be able to null out some of the occupants of 1152kHz and 1548kHz.

"Greetings from a very hot and sunny Tunisia," says **Edward Baker**, whose normal address is in Northumberland, but who was holidaying at Monastir. Using an RF3100 and telescopic antenna, our reader pulled in Cyprus on 1322, Egypt on 621, Jordan on 801 and Saudi Arabia on 1512kHz. "The hotel mains is plagued by S-7 hum so I'm having to use batteries to overcome this pest." It is better to use batteries if you can while abroad. Non-standard mains voltage, poor regulation and noise are not uncommon.

SHORT WAVE BROADCAST BANDS

by Charles Molloy G8BUS

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

Reader **Julian Wong** of Singapore has a Toshiba RP-F11 World Radio Receiver which has nine short wave bands. He wonders what the lines on the tuning scale are for. For example, on band 2, which is marked 5·9MHz–6·3MHz, thére is a straight line running from 5·95MHz to 6·2MHz. What does it indicate? Well, the official 6MHz band, also known as the 49 metre band, runs from 5·95 to 6·2, so broadcasting ought to be confined to this segment alone. In practice it spreads out beyond the official limits and Toshiba have catered for this by giving coverage from 5·9 to 6·3MHz.

Short Wave Broadcasting Bands

Unlike the medium waves, which is allocated exclusively to broadcasting though there are a few navigation beacons as well, the short waves i.e. from 1·6MHz to 30MHz are shared by a number of users.

Broadcasting is confined officially to segments called bands, that are to be found right across the short waves. Why not simply allocate one large band and put them all together? Propagation of radio waves around the earth varies considerably from one end of the s.w. spectrum to the other and in order to take advantage of this, segments between 2·3MHz and 26·1MHz are allocated to broadcasting. The higher frequency bands are used for long distance paths in daytime only. The lower frequencies are better for short range working during the day and longer distances after dark.

The modern way of designating the bands is by frequency, measured in megahertz and abbreviated MHz. Sometimes kilohertz (kHz) are used. Conversion is easy. 1MHz = 1000kHz. Just shift the decimal point three positions.

There is an alternative, obsolete, but still widely used system that uses the wavelength in metres. Conversion between metres and megahertz is not too difficult especially with a pocket calculator.

MHz = 300 ÷ metres
Metres = 300 ÷ MHz

◄ Radio New Zealand

International Broadcasting Bands

MHz Band	MHz Range	Metre Band	Metre Range
4	3·950 to 4·000	75	75·95–75·00
6	5·950–6·200	49	50·42–48·39
7	7·100–7·300	41	42·25–41·10
9	9·500–9·775	31	31·58–30·70
11	11·700–11·975	25	25·64–25·05
13	13·600–13·800	22	22·06–21·74
15	15·100–15·450	19	19·87–19·42
17	17·700–17·900	16	16·95–16·76
21	21·450–21·750	13	13·99–13·79
26	25·600–26·100	11	11·72–11·49

The 4MHz international band is for Europe only while the 13MHz band is not yet in use (officially).

Tropical Bands

2MHz	2·300–2·495	120m	130·43–120·24
3	3·200–3·400	90	93·75–88·24
4	3·900–4·000	75	76·92–75·00
5	4·750–5·060	60	63·16–59·29

The Tropical Bands are, as the name suggests, used in the region between latitude 30°N and 30°S, plus parts of Asia. Outside this area the frequencies are shared with commercial users which cause a lot of interference (QRM) for the DXer.

That part of the 4MHz band between 3·950 and 4·000 is also used for broadcasting in Europe.

Radio Earth, Santo Domingo

Single Sideband Tests from Austria

The amplitude modulation system used by international broadcasters on the short waves and by domestic radio on the long, medium and tropical bands consists of a carrier plus two sidebands. The carrier is on the assigned frequency of the station while the two sidebands occupy the space immediately above and below the carrier. There is a spread on either side of the carrier, the total width being twice the frequency of the highest audio frequency transmitted. Since the information sent i.e. the programme, is contained in either of the two sidebands, the system is very wasteful of transmitted power and frequency space. All we have to do then is to transmit a single sideband on its own, omitting the carrier and the other sideband. Why has this not been done? Radio amateurs have been using s.s.b. for years!

▲ Radio Singapore (5·52MHz) all received from Philip Hodgson

The problem lies with the receiver. If you leave out the carrier at the TX then it will have to be replaced at the receiving end. This means complications inside the receiver and more difficult tuning so broadcasters and domestic RX manufacturers have steered away from the problem. The pressure for frequency space is now intense and since the introduction of single sideband working (s.s.b.) would double the number of channels in the existing bands, the problem can no longer be avoided.

By international agreement, s.s.b. will be introduced into international broadcasting by stages over a period of 20 years. The first stage is a system in which the carrier is reduced in level by just 6dB, that can be received on an ordinary s.w. receiver. The Austrian State Radio (ORF) has now started tests on 6·155MHz from 1700 to 1900UTC (1830 to 1900 in English) until September this year. They are using a 500kW transmitter which has s.s.b. capability and the test will be conducted using 6dB reduced carrier. According to ORF, more careful tuning will be required, voice quality should be clearer but the "fullness" will be missing from music. The upper audio limit will be 3·2kHz instead of 4·5kHz.

ORF are asking for reception reports which should be sent to Austrian Radio, Short Wave Service, A-1136, Vienna, Austria. These should, I would think, include an assessment of audio quality and ease of tuning. Deutsche Welle in West Germany is also starting s.s.b. tests but no details are available at the time of writing.

Short Wave Converters

Reader **G. Stapleton** of North Harrow is looking for the circuit of a non-tunable short wave converter whose output could be picked up with a normal m.w. receiver. "I have found a number of circuits but they are either too elaborate or require several ready made coils." Why is this type of converter so complicated?

The converter is inserted between the antenna and the antenna socket of the receiver. Right away we have a problem as we need to find a set that has a socket for an external antenna for the medium waves and does not have an internal antenna. Most m.w. receivers have an internal ferrite rod antenna for the m.w. and if we use such a set with a s.w. converter it will pick up m.w. signals as we tune across the m.w. band. These will mix with the signals from the converter and whistles, interference, etc., will be the result. Medium wave breakthrough in other words.

A second problem is to do with frequency range. The international s.w. bands lie between 6MHz and 26MHz, a range of 20MHz. The medium waves go from 530kHz to 1600kHz, a range of just over 1MHz. Our converter would have to have 9 bands, one for each s.w. broadcast band.

Such converters do exist for use with a car radio but here we are dealing with a well screened receiver and a similarly screened converter. I have such a converter which works very well. There is a push button for each s.w. band, which means a lot of switching, many tuning inductors and expense. Though it does provide s.w. listening while on the move, the modern portable does a more effective job at home.

Readers' Letters

"I wonder if a G5RV antenna is suitable for DXing" writes **Ingvar Berggren** from Ljungbyhed in Sweden. Has anyone tried this antenna? Our reader mentions WRNO New Orleans on 15·440MHz at 1730. This station has not been heard too well in Europe lately and it was suggested recently by *Sweden Calling DXers* that the majority of its audience seems to be in North America.

Reader **N. Pound** writes, "My problem concerns a short wave antenna. I put up a long wire from the top of my bedroom window to a long pole in the garden, a length of about 10m and sloping at 45°. I plugged this into my Grundig Satellit 1400—and hey presto—nothing but noise. What is wrong?"

You are overloading your set as the antenna you are using is too long for it. Try a shorter one, a longer one will make matters worse.

The address of Radio Free China, for reader **T. Shirley** is 7 Lin Sen North Rd, Taipei, Taiwan though I'm sure that Taipei, Taiwan would reach them. It is not always essential to know the full address when writing to an international broadcaster e.g. BBC London England would surely be enough to ensure delivery.

VHF BANDS *by Ron Ham BRS15744*

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

Several aspects of solar observation, auroral, tropospheric and sporadic-E openings, new beacons heard on the 28MHz band, another 1·3GHz band (23cm) repeater and VKs visit Yorkshire, are among the items I enjoyed writing about for this month's issue.

There is little doubt that the severe radio noise, Fig. 1, recorded by **Cmdr Henry Hatfield,** Sevenoaks, at 136MHz and me at 143MHz on April 16 and 17 was caused by the sunspots around the central meridian, Fig. 2, observed by **Patrick Moore** in Selsey, at 0745 on the 16th. It was interesting to watch the rapid rise of the radio noise to full scale, Fig. 1, as the sun entered the beamwidth of my solar antenna. The sun was quiet from the 18th to 24th when Patrick warned, "tremendous group coming over the limb", Fig. 3. Fortunately, the skies remained clear enabling Patrick to plot the group's progress on the 25th (Fig. 4) and 26th (Fig. 5). As the radio noise increased with the daily progression of the spots, I was not surprised when our Technical Editor, **John Fell** G8MCP, reported aurora on the 26th and hearing the radio noise from the setting sun bouncing off the auroral curtain.

Ted Waring, Bristol, counted 19 sunspots on April 16, 44 on the 25th, 60 on the 29th, 7 on May 6 and 45 on the 11th and writes, "yet another large group crossed the central meridian on May 12." Quite right Ted! Henry and I recorded a violent noise storm on May 13 and 14, and Henry, using his spectrohelioscope, saw very active areas within this group. The clear skies gave Ted the chance to study the large active areas which crossed the central meridian on April 28 and described what he saw as, "a rectangular region containing about 40 spots, five with penumbra and the easterly component was an immense 'M' shaped penumbra which split on the 26th."

Dave Coggins, Knutsford, heard the solar hissing on the 28MHz band at various times on April 15, 21, 26 and 29 when his beam was facing south east. **Fred Pallant** G3RNM, operating from the Chalk Pits museum station GB2CPM, Amberley, reported a possible blackout and high noise level on 28MHz during the afternoon of May 4. During his optical observations on May 7, Henry saw an active plage among the sunspots on the north east limb which no doubt contributed to the radio noise recorded on the 9th and 10th.

The variety of solar reports this month should give **Steven Bagshaw,** Upminster, who is interested in radio astronomy, a good idea of what happens when the sun is active and the importance of combining the observations of all concerned in this fascinating subject.

Aurora

"There were several reports of auroral activity on the nights of April 2-5, amounting to glows, rayed arcs and rays", writes **Ron Livesey.** He is auroral coordinator of the British Astronomical Association and adds "on the evening of the 25th magnetometers gave early warning of possible activity. The aurora which appeared later, and continued to the following morning, was seen in central Scotland, Cumbria and as far south as Leeds."

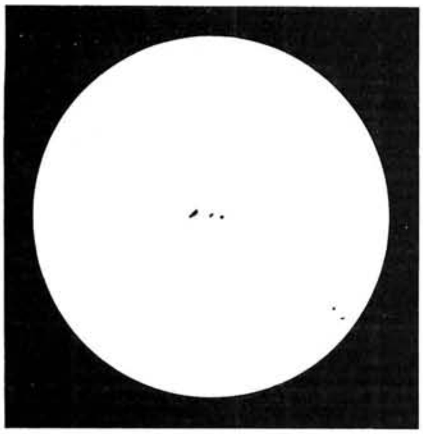
At 1720 on the 26th, John Fell G8MCP, Corfe Mullen, Dorset (YK20c), already aware of the prevailing solar activity, heard several whispery s.s.b. and tone-A c.w. signals on the 144MHz band. Using 30W of r.f. his 19-element MET Yagi facing 30 degrees east of north, between 1730 and 1826, John made auroral QSOs, averaging 4/3A both ways, with EI8EF (VO49j), GI BFS, G6YJD, GM4JCM (YQ45b) and GM6LJE (YP76h). Dave Coggins received auroral signals around 2000 on the 25th and 1900 on the 26th and heard GB0PAC on c.w. calling CQ aurora on 28MHz at 1740 on the 26th. Not far from Dave, **Tony Usher** G4HZW, heard a GM on 28MHz, via aurora, later in the evening and tone A signals from television transmitters on Ch. R1 49·75MHz. The 50MHz beacon GB3SIX was heard by Dave around 1730 on the 26th.

Sporadic-E

At 1204 on May 6, Dave Coggins received signals from the 50MHz band beacon in Gibraltar ZB2VHF and s.s.b. signals from GW3LDH. During what was possibly the first big disturbance of the 1984 sporadic-E season, between 0800 and 1000 on the 11th, **Harold Brodribb,** St Leonards-on-Sea, and I counted about 30 very strong signals from east-European f.m. broadcast stations between 66 and 73MHz.

Fig. 1

Fig. 2 ▼



28MHz Beacons

Although **Chris van den Berg,** The Hague, heard the American beacons KA1YE and W3DV on March 21, he had not heard them again by the time he wrote to me on April 14; however, W3DV did reappear but only on April 19 and 25. Like other readers, Chris logged the beacons TR8DX, VK2RSY and VS6TEN during March but by May 14, when I closed this month's beacon chart, Fig. 6, their signals had not been heard by my regular contributors. To make the beacon chart I used the logs from Dave Coggins, John Coulter, **Bert Glass,** Henry Hatfield, **Norman Hyde** G2AIH, Epsom Downs, **Bill Kelly,** Belfast, **Greg Lovelock** G3III, Shipston-on-Stour, **Ted Owen,** Maldon, Peter Lewis, Ted Waring and Chris van den Berg. Both Bill and Greg reported hearing LU8EB and Ted heard EA3VHF give its QTH as AA12c. At 2100 on May 8, Bert Glass BRS32693, Plymouth, received PY2AMI and logged it sending a series of Vs and, "de PY2AMI pwr 10w ant gp lat 22 45s long 47 16w Americana Sao Paulo" at a good strength 6. "April 22 was a very interesting day" writes Chris who heard the German beacons DK0TE and DL0IGI become very strong for a short while around 1100 and Dave Coggins logged DL0IGI on the 22nd and the Norwegian beacon LA5TEN on the 23rd, via sporadic-E.

28MHz Satellites

"One of the two Radiosputniks launched in October 1978 is still on the air probably it is the Radio 1" writes Chris van den Berg. He continues, "I sometimes receive its signals on the beacon frequency 29·402MHz; the telemetry system does not work any more. Instead of telemetry groups it transmits continuously the group 5015, 15 times, followed by 55 once, then again 5015, 15 times and so on. I heard these signals for the first time on 29 January 1983 while trying to receive the beacon of OSCAR-8. The last time I received it was on April 12 at R3 and S3." Since they were launched, Chris, a Dutch s.w.l. NL-9165/R18, has listened out for, and has a good knowledge of, the signals from the RSs 1 to 8 and the OSCARs 7 and 8. Bill Kelly reports hearing much international amateur activity around 0730 on April 20 and orbital data from RS7 at 0900 on the 21st. At 0857 on May 1, John Coulter received the following from RS3A; "Lubitelej swazi oerez isz pozdrawlaem pradzdnikom imaa, 73 dx de RS3A" which in other words, says John, means, "We congratulate amateurs via sputnik on the May 1 holiday." He adds, "isz is a useful abbreviation to know as it means artificial earth satellite, i.e. Sputnik." During the month prior to May 12, John also heard signals from DJ, EA, F, I, K, LA, OE, OK, ON, OZ, PA and UK via the satellites.

Tropospheric

The atmospheric pressure, measured at my QTH, began this period, on April 17, where all v.h.f. operators like to see it, high at 30·4in (1029mb). The pressure remained at this level until 1600 on the 18th and then gradually fell to 30·1 (1019), still good for v.h.f. and staying at this level until 0400 on the 29th when it dropped to 30·0 (1015). Between April 30 and May 6 it slowly fell from 30·0 to 29·7 (1005) and back to 30·1 and between May 7 and 14 the pressure averaged around 30·2 (1022) before it fell to 29·7.

During the lift on April 27, Bill Kelly heard signals through the 144MHz band repeaters in Cumbria GB3AS on R1, Gwynedd GB3AR R4, Clwyd GB3MP and Belfast GB3NI on R6 and EI1DK and EI3DAR on R0. On April 28, **Jim Burchell** G1DPR, Rayleigh, using a FDK-750 and 8-element Jaybeam antenna worked into ON and PA on the 144MHz band adding to the 100 or so stations he has worked on the band since he became licensed in February. Jim is a member of the Southend and District Radio Society, one of the oldest radio clubs in the UK.

At 0805 the Leicester repeater GB3CF on R0 was very strong with me and I heard stations from Bedford, Hertford, Kent and Northampton working through it and the one in Hertford was only using 2·5 watts!

Fig. 3

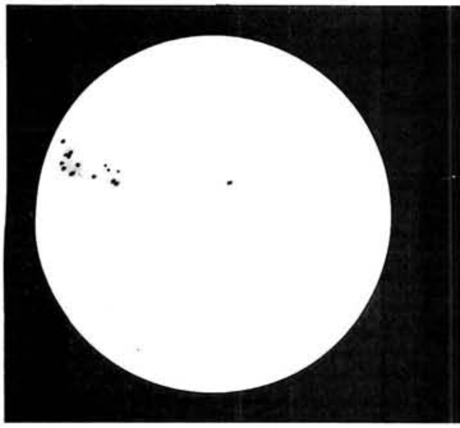


Fig. 4

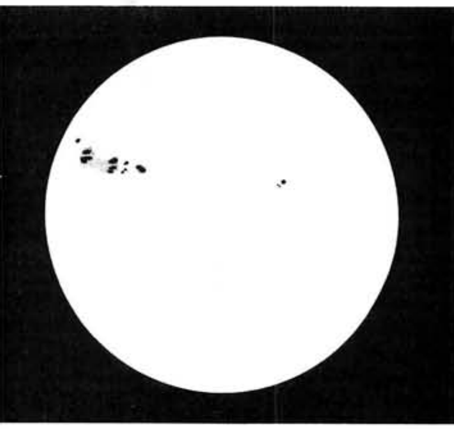
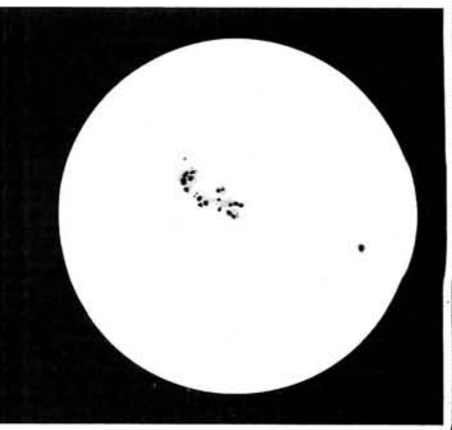


Fig. 5



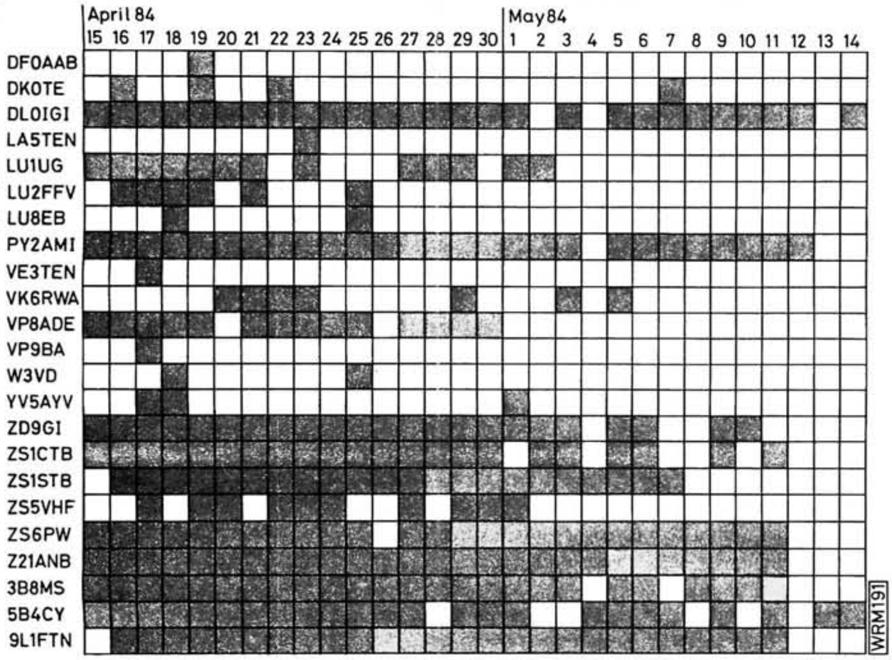


Fig. 6

"The band has, as usual, been dominated by Europeans," writes **Peter Lincoln,** Aldershot, and he continues "at times the Japanese have been quite active on both 14 and 21MHz." Peter also noted some openings to most of the Americas during the very late evenings with FM7BX, 9Y4AJC, CX2GB, CE3CEW and LU1DG being active, at good strength, on the 14MHz band between 2200 and 0100GMT. "I received a QSL card from XE3ABC for RTTY mode and my total is now 121 countries heard and 59 confirmed," writes Peter, who does not expect to reach his 75 target in 1984.

During the period April 15 to May 14, I copied RTTY signals from 16 call areas, CT, EA, EA8, HA, I, IT9, OE, OH, OK, OX, SM, UA, UB, VK, W1 and YU on the 14MHz band (14·090MHz) and 12 areas CT, G, I, K1, K8, Ws 1, 2 and 4, 4X6, 5N7, 9K2 and 9M2 on the 21MHz band (21·090MHz) which was all very pleasing, especially the OX, Greenland, because I only spent a limited time at the rig.

As from April 13, the 144MHz band repeaters at Hastings GB3ES and Worthing GB3SR exchanged channels, so, now we can look for ES on R3 and SR on R7. "The effect of the change on the Hastings unit has been all that we hoped, the interference experienced from users of GB3NL has disappeared, rendering ES a more usable repeater without detrimental effect on SR's performance" writes G8TJQ, from the Sussex Repeater Group. He also told me that GB3CP, the group's second 1·3GHz (23cm) repeater was operational from 2030 on April 24 to serve the Crawley area on Ch. RM3, input 1291·075MHz and output 1297·075MHz.

From his home QTH in Corfe Mullen, John Fell G8MCP, using a converter loaned by **Nick Foot** G4WHO and a JVL Electronics 24-element quad loop Yagi, logged signals from the 1·3GHz beacon GB3PO at Martlesham Heath. John is very pleased with these "primitive" experimental results considering the converter was temporarily roped to the antenna mast, 12m a.g.l., and the front end was a "noisy" BFR34A bipolar device. He writes, "this all looks promising for when my GaAsf.e.t. pre-amp and 2m parabolic dish antenna are finished." Quite true John! Norman Hyde G2AIH is now active on 1·3GHz with mobile equipment and by May 14 he had completed six QSOs.

Band II

At 0833 on April 20, Andrew Guy, Newport, using a Crown 6300 music centre and ribbon dipole antenna received signals from the ILR station LBC and at 0840 on the 26th BBC Radio London. While the pressure was high on April 18, Harold Brodribb received signals from 10 French and 3 Belgian or Dutch stations and on the 26th he logged the usual (for him) French stations plus Belgian and Dutch and the US Forces SHAPE stations. Harold uses a Bush VHF80 and loft dipole. He noted that French stations were again plentiful on the 27th.

On the 18th, I used the Band II section of my Plustron TVR5D, from my car in Ashdown Forest and heard several French programmes between 98 and 104MHz.

One of our Band II DXers, **Damien Read,** Newport, is a member of the British DX Club and says that any readers interested in membership should write to Nick Van Stigt, 37 Pope's Grove, Twickenham, TW1 4JZ.

RTTY

Albert Moulder G8VBQ, Rainham, uses a BBC microcomputer with a G3WHO programme to generate the RTTY signals for his Icom 144MHz transceiver and 5/8λ ground plane antenna. Apart from his 144MHz activities, Albert is a keen h.f. and broadcast bands listener and, with his ICR70 receiver and long wire antenna, he is after a broadcast QSL card from every European country. He is also interested in hi-fi and vintage equipment.

Between April 16 and May 15, **Norman Jennings,** Rye, logged RTTY signals from 40 countries of which 24 were European. Then at 0845 on May 15, on the 14MHz band he copied T7OA/WTD and asks, "what does the WTD stand for?" Any ideas? Norman's best during the period were JA8UBH, OD5NG and PJ2MI. "From 1100 to 1200 on May 13, 21MHz was dead," he says and adds, "then out of the blue AP2KS was calling CQ, with no answers."

VK4s in Yorkshire

"It has been a lovely stay here in UK and the North Wakefield Amateur Radio Club have been so good to us, it was unbelievable," writes our reader, **Sheri Chalmers** VK4VMB whose QSL card I published in our May issue. Sheri and her husband, Ray VK4BRC, were over here shortly before Easter as guests of John and Patricia Muzyka G4RCG and the NWRC, who laid on a trip to the White Rose Rally on April 1. "It was a credit to the members Ron, very well presented and it was great to see so many amateurs in one place at one time," said Sheri who used the call G1VK4MB to operate on 144MHz during their stay. Radio Leeds and the Wakefield Express were quick to interview them and the paper made the point that Ray and Sheri often helped the North Wakefield Club members by giving them points from VK during contests. At the special Australian Night held by the club on April 19 and attended by about 100 amateurs from many parts of Yorkshire, the Chalmers were presented with an engraved plaque, Fig. 7, by Martin Stokes G3ZXZ, NW president and Steve Thompson G4RCH, NW secretary, on behalf of the club to mark their visit.

Fig. 7

TELEVISION

by Ron Ham BRS15744

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

Two thousand SSTV contacts completed, news of DX from India, the late April tropospheric opening and the first signs of the 1984 sporadic-E season are the subjects which make up the meat of this month's television report.

Sporadic-E

"Things are looking up, the sporadic-E season is underway again", writes **Mike Bennett,** Slough, having logged Norwegian test cards from Kongsberg and Oslo on April 30 on Ch. E4 and Gamlemsveten and Bremanger on May 5 on Chs. E3 and 4 respectively. Also on the 5th, Mike saw a crescent moon with a star in a light colour on a dark background which he thinks was a white moon and star on a red background. Any ideas about this caption, readers? "I received some interesting DXTV on April 28", writes **Gordon Pheasant** G4BPY, Walsall and adds, "from about 1710 to 1720 on Ch. E3 there was a programme with Greek captions and then an identity caption EPT and from about 1730 this was swamped out by Italy RAI on Ch. A". Any ideas on this one?

Between 0800 and 1000 on May 11, I received pictures from the USSR on Ch. R1 during possibly the first strong sporadic-E event of the 1984 season. At 0855 I saw a male announcer, followed by the TB CCCP caption and at 0903 an analogue clock appeared showing 1203, 4 hours ahead of GMT. Then came one of the usual Russian test cards which ebbed and flowed in strength until it finally faded away around 0945. During my routine looks around the bands I noted bursts of test card from Austria on Ch. E2 at 0805 on April 29, Czechoslovakia at 1324 on the 24th and 0849 on May 7 and Poland at 0930 on the 4th, 1435 on the 10th and 1020 on the 11th.

DXTV Reports from India

Between 2030 and 2330, local time, on March 9, **S. Krishna,** Kodaikanal, South India, received pictures of a Bengali news reader, Fig. 1, a programme announcement in Bengali, Fig. 2, an advertisement in English, Fig. 3 and news in English, Figs. 4 and 5, from Dhaka, Bangladesh, a distance of about 2000km. "The reception was due to sporadic-E, which I verified on the 10th at the solar observatory in Kodaikanal", writes S. Krishna. He uses a 13-element Yagi and pre-amplifier to feed his set at his QTH some 2150m a.s.l. His photographs, Figs. 1 to 5, were taken off the screen with a 35mm camera at f5.6 and 1/15 second exposure.

During a sporadic-E opening at 1925 on April 8, **Major Rana Roy** began receiving strong pictures on Ch. 2 from Dubai and from 1935 to 1950 he watched an American documentary about naval operations during WW-II. At 1950 Rana tuned to Ch. 3 and found a girl singing a religious song, Fig. 6, from another Arabic station. "We alternately watched Dubai on Ch. 2 and the Arabic station on Ch. 3 until 2115 when the signals faded away," writes Rana, who also saw a ballet and a competition between two groups of girls during the time.

While a tropospheric opening was in progress on March 12, Rana received pictures of a young lady, Fig. 7, from Lahore, Pakistan, announcing the live telecast of the cricket match, Fig. 8, between England and Pakistan at Faisalabad on Ch. 5 Band III. At 2315 on the 13th he watched an episode of the American series *Trapper John MD,* Figs. 9 and 10, followed by an advert, Fig. 11, from Rawalpindi TV on Ch. 8 in Band III.

SSTV

At 1007 on May 7, **Richard Thurlow** G3WW, March, exchanged SSTV pictures on the 14MHz band with TF3LJ in Iceland, which not only gave Richard his 112th two-way SSTV country, but also chalked up his 2000th two-way first time QSO since November 1972, which surely must be a world record. Many congratulations Richard, I am sure all the slow scan fraternity will be delighted with this news.

To date, **Peter Lincoln,** Aldershot, has received signals from SSTV stations in 34 countries with 15 confirmed and during the month prior to May 14, he logged pictures from Austria, Brazil, Fig. 12, Canary Islands, France, Germany, Hungary, Fig. 13, Italy and Yugoslavia.

Tropospheric

Although not exceptional, conditions were right for DX during the last ten days of April. The daily weather maps in **Harold Brodribb's** newspaper show the centre of a high pressure system (1016mb) coming toward the UK, from the Atlantic, on the 21st, increasing to 1032mb and moving over the North Sea on the 23rd and 25th, moving near to Scandinavia on the 26th and more over Denmark on the 28th. My summary of the cuttings Harold sent is brief, so take a look for yourselves, they are full of information and I would think invaluable to the student of tropospheric propagation.

While on a visit to his parents in Bexhill over the Easter holiday, **Tim Anderson,** Stroud, set up his DXTV gear just in time for the opening. Among the stations he received were from Belgium RTBF on Chs. E3 and E8 and BRT on E10 and E25, France TF1, Antenne 2 and FR3 often in noise free colour, Germany WDR 1 on E9 and Holland PTT and NOS on E4, 26 and 29. One of the stronger pictures Tim received during the weekend was a test card from France, Fig. 14, on Ch. E6 which was also seen by Harold Brodribb on Ch. E54. The strongest was between 1100 and 1200 on April 21 when Tim saw a blank system L carrier and heard a tone around Ch. E5. "The tone stayed on but the carrier was switched off for about 5 minutes and then on for 5 minutes etc", said Tim.

George Garden caught the opening when he moved to his new QTH in Dundee, at 1902 on the 25th, using his JVC CX610GB, he received pictures from Germany ZDF on Ch. 34. He watched news followed by a test card enscribed NDR-SB-SFB on Ch. 44 and at 2219 he saw a station close down with the identity Cuxhaven on Ch. 48; this was also seen by **Tony Palfreyman,** Fig. 15.

Between the 22nd and 27th, Tony at his QTH in Sheffield, received pictures from Belgium RTBF from Liege on Ch. 42, Fig. 16, Germany WDR and ZDF on several u.h.f. channels and Holland PTT NED 1 and 2 on Chs. 39 and 45. Tony also saw a test card with Niebull on it and he received Anglia TV on Ch. 59 for long periods on several occasions.

At 1400 on the 22nd, Harold received pictures from France Antenne 1 and 2 and FR3 on several spots between Chs. 21 and 69, Belgium RTBF 1 on Ch. E8 at 0900 on the 24th. At midday on the 28th, he took his Plustron TVR5D to a site on the South Downs, north of Beachy Head and received strong pictures from France on Chs. 29, 34, 37 and 42, BRT from Egem on Ch. 43 and PTT NED 1 from Goes on Ch. 29.

I received test cards from Holland on Chs. E4 and 5 at 0800 on the 23rd and the test cards, PTT NL and PTT NED 1, around the same time on the 26th.

Station Reports

Further to the test card enscribed KRS-3 which I published in our April issue, **Philip Hodgson,** Stamford tells me that he has seen one of these, but labelled KRS-8, radiated by HTV Wales before *TV-AM* programmes begin.

John Head, Bexleyheath, received a Sony KV6000BE colour receiver for his birthday and says that it covers Chs. E2–12 v.h.f. and Chs. 21–68 u.h.f. I am sure John you will get a great deal of fun out of the v.h.f. section when conditions are right. Don't forget John sporadic-E will bring the DX in Band I Chs. E2–4 mainly between May and August and keep an eye on Band III Chs. E5 to 12 and the u.h.f. band for a tropospheric opening, especially when the atmospheric pressure is high and the weather changes.

on the air

Fig. 1

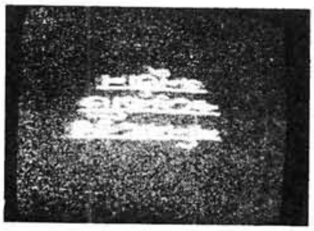


Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Fig. 13

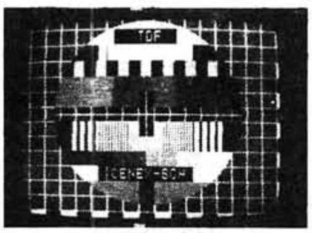


Fig. 14

Fig. 15

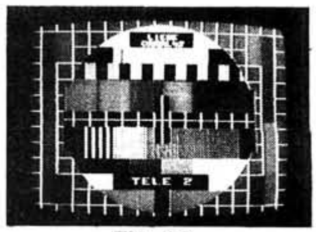


Fig. 16

"**Nick Foot** G4WHO, is doing well from Wimborne on 1·3GHz with ATV. He has worked into London using approximately 30 watts to 4 × 24 quad loop Yagis", writes **John Fell** who also tells me that many stations are getting active on 1·3GHz with ATV. So, what about it, lads and lasses, drop me a line and let's tell the world what amateurs can do.

The Spring 1984 edition of the London DXTV Group's news letter contains reception reports from members in Aberdeen, Eastbourne and Leeds, positive/negative video conversion for the Plustron TVR5D and Vega 402 receivers and a comparison between the Yagi and stacked bowtie antennas for the u.h.f. band. The group's publication, *A Beginner's Guide to Long Distance Television Reception* has some 11 pages of information on such subjects as antennas, frequencies, television systems, propagation, photography and some receivers and converters. In my view, this document is ideal for anyone taking their first steps into the field of DXTV. Details of membership and the group's publications are available from Dave Lauder, 18 Burnside Close, Barnet, Herts, EN5 5LN.

the things people say

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(Some pre-amp—nearly 80dB gain!)

. . . heard on 2m s.s.b. by G8WUM

"Good reception. Due probably to the 'wonderful' antenna system I have; comprising pieces of wire recovered from the Port Julia rubbish dump—about 22ft of it."
(Presumably what is one man's "rubbish" is another man's "treasure"—or antenna in this instance.)

. . . heard by VK5TL

"I'm sure the s.w.r. is 1:1 all the way across until I put the s.w.r. meter in line."

. . . heard on 27MHz f.m. by M. J. Gayler

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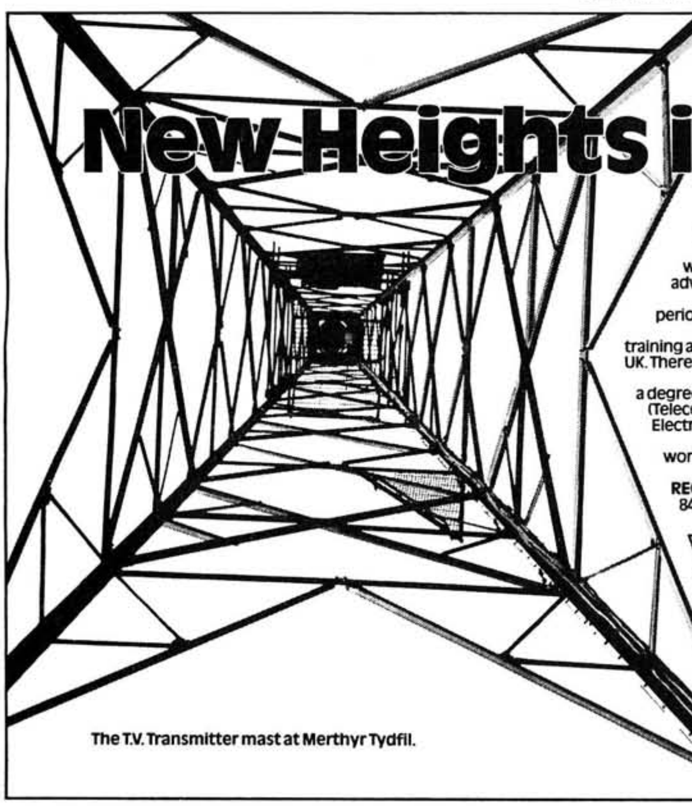
Access



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5751	2.95
5763	4.95
5814A	3.25
5842	11.00
5965	2.25
6060	2.25
6080	4.75
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6973	4.95
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SL901B	5.50
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AC187	0.25
AC187K	0.28
AC188	0.25
AD142	0.79
AD149	0.70
AD161	0.39
AD162	0.39
AF124	0.65
AF125	0.35
AF126	0.32
AF127	0.32
AF139	0.40
AF239	0.42
AU106	2.00
AU107	1.75
AU110	2.00
AU113	2.95
BC107	0.11
BC108	0.10
BC109B	0.12
BC139	0.20
BC140	0.31
BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC148	0.09
BC149	0.09
BC157	0.12
BC158	0.09
BC159	0.09
BC160	0.28
BC170B	0.15

BC171	0.09
BC172	0.10
BC173B	0.10
BC182	0.10
BC183	0.10
BC184LA	0.09
BC212	0.09
BC212L	0.09
BC213	0.09
BC213L	0.09
BC237	0.10
BC238	0.09
BC307	0.09
BC327	0.10
BC461	0.35
BC478	0.20
BC547	0.10
BC548	0.10
BC549A	0.08
BC557	0.08
BC558	0.10
BD131	0.42
BD132	0.42
BD133	0.40
BD135	0.30
BD136	0.30
BD137	0.32
BD138	0.30
BD139	0.32
BD140	0.30
BD508	0.85
BD538	0.65
BD597	0.75
BDX32	1.50
BDY57	1.65
BF179	0.34
BF180	0.29
BF183	0.29

BF194	0.11
BF196	0.11
BF197	0.11
BF198	0.16
BF199	0.14
BF200	0.40
BF258	0.28
BF259	0.28
BF336	0.34
BFX86	0.30
BFX88	0.25
BFY50	0.21
BFY51	0.21
BFY52	0.25
BFY90	0.77
BT106	1.49
BT116	1.20
BU105	1.22
BU108	1.69
BU124	1.25
BU126	1.60
BU205	1.30
BU208	1.39
BU208A	1.52
BU326A	1.42
MRF450	13.50
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R2008B	1.70
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TIP29C	0.42
TIP31C	0.42
TIP32C	0.42
TIP41C	0.45
TIP42C	0.47

TIP47	0.65
TIP146	2.75
TIP2955	0.80
TIP3055	0.55
TIS91	0.20
2N3054	0.59
2N3055	0.52
2N3702	0.12
2N3704	0.12
2N3705	0.12
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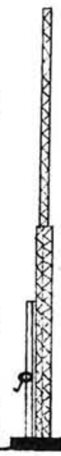

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MAPLIN'S TOP TWENTY KITS

THIS MONTH	LAST MONTH		DESCRIPTION OF KIT	ORDER CODE	KIT PRICE	DETAILS IN PROJECT BOOK
1.	(1)	◆◆	75W Mosfet Amp Module	LW51F	£13.95	Best of E&MM
2.	(2)	◆◆	Modem	LW99H	£44.95	5 XA05F
			Case also available: YK62S Price £9.95.			
3.	(3)	◆◆	Car Burglar Alarm	LW78K	£7.49	4 XA04E
4.	(8)	▲	Spectrum Easyload	LK39N	£9.95	10 XA10L
5.	(4)	▼	Partylite	LW93B	£9.95	Best of E&MM
6.	(6)	◆◆	Syntom Drum Synthesiser	LW86T	£12.95	Best of E&MM
7.	(11)	▲	Ultrasonic Intruder Detctor	LW83E	£10.95	4 XA04E
8.	(9)	▲	8W Amp Module	LW36P	£4.45	Catalogue
9.	(10)	▲	Logic Probe	LK13P	£10.95	8 XA08J
10.	(12)	▲	VIC20/64 RS232 Interface	LK11M	£9.45	7 XA07H
11.	(7)	▼	Spectrum Keyboard	LK29G	£28.50	9 XA09K
			Also required: LK30H £6.50; Case: XG35Q £4.95 — Total £39.95. Also available complete ready-built: XG36P £44.95.			
12.	(14)	▲	Spectrum RS232 Interface	LK21X	£19.95	8 XA08J
13.	(5)	▼	ZX81 I/O Port	LW76H	£10.49	4 XA04E
14.	(16)	▲	Noise Gate	LK43W	£9.95	Best of E&MM
15.	(New)	▲	Car Battery Monitor	LK42V	£6.95	Best of E&MM
16.	(13)	▼	Harmony Generator	LW91Y	£17.95	Best of E&MM
17.	(19)	▲	Guitar Tuner	LW90X	£12.95	Best of E&MM
18.	(New)	▲	50W Power Amplifier	LW35Q	£15.95	Catalogue
19.	(New)	▲	80m Amateur Receiver	LK41U	£15.95	10 XA10L
20.	(17)	▼	Burglar Alarm	LW57M	£49.95	2 XA02C

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The descriptions above are necessarily short. Please ensure you know exactly what the kit is and what it comprises before ordering, by checking the appropriate Project Book mentioned in the list above.

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