FOR THE RADIO ENTHUSIAST

MARCH 1982

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NEW TRIO RECEIVER

R600 £235 inc. VAT

TRIO		£	Carr.
TS830S	160-10m Transceiver 9 Bands	694.00	(—)
VFO230	Digital V.F.O. with Memories	215.00	(2.00)
AT230	All Band ATU/Power Meter	119.00	(2.00)
SP230	External Speaker Unit	34.96	(1.50)
DFC230	Dig. Frequency Remote Controller	179.00	(1.50)
YK88C	500Hz CW Filter	29.60	(0.50)
YK88CN	270Hz CW Filter	32.66	(0.50)
TS130S	8 Band 200W Pep Transceiver	525.00	(—)
TS130V	8 Band 20W Pep Transceiver	445.00	(—)
VFO120	External V.F.O.	85.00	(1.50)
TL120	200W Pep Linear for TS120V	144.00	(1.50)
MB100	Mobile Mount for TS130/120	17.00	(1.50)
SP120	Base Station External Speaker	23.00	(1.50)
AT130	100W Antenna Tuner	79.00	(1.50)
PS20	AC Power Supply – TS130V	49.45	(2.50)
PS30	AC Power Supply – TS130S	88.50	(5.00)
MA5	5 Band Mobile Aerial System	86.00	(5.00)
MC50	Dual Impeadance Desk Microphone	25.76	(1.50)
MC35S	Fist Microphone 50K ohm IMP	13.80	(0.75)
MC30S	Fist Microphone 500 ohm IMP	17.90	(0.75)
LF30A	HF Low Pass Filter 1kW	19.30	(0.75)
TR9000	2M Synthesised Multimode	389.00	(—)
BO9	Base Plinth for TR9000	34.90	(1.50)
TR7800	2M Synthesised FM Mobile 25W	284.00	(—)
TR7730	2M Synthesised FM Compact Mobile 25W	247.00	(—)
TR2300	2M Synthesised FM Portable	166.00	(—)
VB2300	10W Amplifier for TR2300	58.00	(1.50)
MB2	Mobile Mount for TR2300	17.71	(1.50)
RA1	Flexible Rubber Antenna for TR2300	6.90	(0.50)
TR2500	2M FM Synthesised Handheld	207.00	(—)
ST2	Base Stand	46.00	(1.50)
SC4	Soft Case	12.00	(0.50)
MS1	Mobile Stand	28.20	(0.75)
SMC25	Speaker Mike	14.49	(1.00)
PB25	Spare Battery Pack	22.30	(0.75)
TR8400	70cm FM Synthesised Mobile Transceiver	334.00	(—)
PS10	Base Station Power Supply for 8400	64.00	(2.00)
TR9500	70cm Synthesised Multimode	449.00	(—)
R1000	Synthesised 200KHz-30MHz Receiver	297.00	(—)
SP100	External Speaker Unit	26.90	(1.50)
HC10	Digital Station World Time Clock	58.80	(1.50)
HS5	Deluxe Headphones	21.85	(0.75)
HS4	Economy Headphones	10.35	(0.75)
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R600	Gen. Cov. Receiver	£235.00	(—)

ICOM			
IC730	HF Mobile Transceiver 8 Band	586.00	(—)
IC720A	HF Transceiver & Gen. Cov. Receiver	883.00	(—)
PS15	Power Supply for 720A	99.00	(3.00)
IC251E	2M Multimode Base Station	499.00	(—)
IC25E	2M Synthesised Compact 25W Mobile	259.00	(—)
IC290E	2M Multimode Mobile	366.00	(—)
IC2E	2M FM Synthesised Handheld	169.00	(—)
IC L1/2/3	Soft Cases	3.50	(0.50)
IC HM9	Speaker/Microphone	12.00	(0.75)
IC BC30	230V AC Base Charger and Hod	39.00	(1.50)
IC BC25	230V AC Trickle Charger	4.25	(0.75)
IC CP1	Car Charging Lead	3.20	(0.50)
IC BP2	6V Nicad Pack for IC2E	22.00	(1.00)
IC BP3	9V Nicad Pack for IC2E	17.70	(1.00)
IC BP4	Empty Case for 6×AA Nicads	5.80	(0.75)
IC BP5	11.5V Nicad Pack for IC2E	30.50	(1.00)
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IC ML1	10W Booster	49.00	(1.00)

TV INTERFERENCE AIDS		
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Toroid Filter TV Down Lead	2.00	(0.50)
Low Pass Filter LP30 100W	3.95	(0.50)
Trio Low Pass Filter LF30A 1kW	19.30	(0.75)
Yaesu Low Pass Filter FF501DX 1kW	22.25	(0.75)
HP4A High Pass Filter TV Down Lead	5.95	(—)

ANTENNA BITS		
H1-Q Balun 1:1 5kW pep (PL259 Fitting)	9.95	(0.75)
T Piece Polyprop Dipole Centre	1.00	(0.20)
Ceramic Strain Insulators	0.40	(0.10)
Small Egg Insulators	0.40	(0.10)
Large Egg Insulators	0.50	(0.10)
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300 ohm Twin Feeder – Per Meter	0.14	(0.02)
URM67 Low Loss 50 ohm Coax-Per Meter	0.60	(0.20)
UR76 50 ohm Coax-Per Meter	0.25	(0.05)

Please send total postage indicated. Any excess will be refunded.

MICROWAVE MODULES			
MMT144/28	2M Transverter for HF Rig	99.00	(—)
MMT432/28S	70cm Transverter for HF Rig	149.00	(—)
MMT432/144R	70cm Transverter for 2M Rig	184.00	(—)
MMT70/28	4M Transverter for HF Rig	115.00	(—)
MMT70/144	4M Transverter for 2M Rig	115.00	(—)
MMT1296/144	23cm Transverter for 2M Rig	184.00	(—)
MML144/25	2M 25W Linear Amp (3W I/P)	59.00	(—)
MML144/40	2M 40W Linear Amp (10W I/P)	77.00	(—)
MML144/100S	2M 100W Linear Amp (10W I/P)	129.00	(—)
MML432/20	70cm 20W Linear Amp (3W I/P)	77.00	(—)
MML432/50	70cm/50W Linear Amp	119.00	(—)
MML432/100	70cm 10/100W Linear Amp	228.64	(—)
MM2000	RTTY to TV Converter	169.00	(—)
MM4000	RTTY Transceiver	269.00	(—)
MMC50/28	6M Converter to HF Rig	27.90	(—)
MMC70/28	4M Converter to HF Rig	27.90	(—)
MMC144/28	2M Converter to HF Rig	27.90	(—)
MMC432/28S	70cm Converter to HF Rig	34.90	(—)
MMC432/144S	70cm Converter to 2M Rig	34.90	(—)
MMC435/600	70cm ATV Converter	27.90	(—)
MMK1296/144	23cm Converter to 2M Rig	59.80	(—)
MMD050/500	500MHz Dig. Frequency Meter	69.00	(—)
MMD600P	600MHz Prescaler	23.00	(—)
MMDP1	Frequency Counter Probe	11.50	(—)
MMA28	10M Preamp	14.95	(—)
MMA144V	2M RF Switched Preamp	34.90	(—)
MMF144	2M Band Pass Filter	9.90	(—)
MMF432	70cm Band Pass Filter	9.90	(—)
MMS1	The Morse Talker	115.00	(—)

DATONG PRODUCTS			
PC1	Gen. Coverage Converter HF on 2M Rig	120.75	(—)
VLF	Very Low Frequency Converter	25.30	(—)
FL1	Frequency Agile Audio Filter	67.85	(—)
FL2	Multi-mode Audio Filter	89.70	(—)
ASP/B	Auto RF Speech Clipper (Trio Plug)	79.35	(—)
ASP/A	Auto RF Speech Clippers (Yaesu Plug)	79.35	(—)
D75	Manually controlled RF Speech Clipper	56.35	(—)
RFC/M	RF Speech Clipper Module	26.45	(—)
D70	Morse Tutor	49.45	(—)
AD270	Indoor Active Dipole Antenna	37.95	(—)
AD370	Outdoor Active Dipole Antenna	51.75	(—)
MPU1	Mains Power Unit	6.90	(—)

D75 MORSE TUTOR
£49.45

MORSE EQUIPMENT			
MK704	Squeeze Paddle	10.50	(0.50)
HK707	Up/Down Key	10.50	(0.50)
HK704	Deluxe Up/Down Key	14.50	(0.50)
EKM1A	Practise Oscillator	8.75	(0.50)
EK121	Elbug	29.95	(0.50)
EKM1A	Matching Side Tone Monitor	10.95	(0.50)
EK150	Electronic Keyer	74.00	(—)

ROTATORS			
KR250	Kenpro Lightweight 1-1½" mast	44.95	(2.00)
Hirschman	RO250 VHF Rotor	49.95	(2.00)
9502B	Colorotor (Med. VHF)	49.95	(2.00)
KR400RC	Kenpro – inc lower clamps	99.95	(2.50)
KR600RC	Kenpro – inc lower clamps	139.95	(3.00)

DESK MICROPHONES		
SHURE 444D Dual Impeadance	33.00	(1.50)
SHURE 526T Mk II Power Microphone	46.00	(1.50)
ADONIS AM502 Compression Mic 1 O/P	39.00	(—)
ADONIS AM601 Compression Mic+Meter 1 O/P	49.00	(—)
ADONIS AM 802 Compression Mic+Meter 3 O/P	59.00	(—)

MOBILE SAFETY MICROPHONES		
ADONIS AM 202S Clip-on	20.95	(—)
ADONIS AM 202F Swan Neck+Up/Down Buttons	30.00	(—)
ADONIS AM 202H Head Band+Up/Down Buttons	30.95	(—)
DAIWA RM940 Infra Red Link	45.00	(0.75)

HAND MICROPHONES		
T.A. 600 Fist Mic.	4.95	(0.50)
Power Mic. Wide Impeadance	9.95	(0.75)
TRIO MC30/35 600/50K IMP	13.80	(0.75)
YAESU YE7A/YD846 600/50K IMP	5.75	(0.75)
SHURE 201 High IMP. Quality Mic.	14.50	(0.75)

TEST EQUIPMENT		
Drae VHF Wavemeter 130-450MHz	24.95	(—)
FXI Wavemeter 250MHz MAX	28.00	(0.75)
DM81 Trio Dip Meter	51.75	(0.75)
MMD50/500 Dig. Frequency meter (500MHz)	69.00	(—)

Co-AXIAL SWITCH		
5 Way Rotary (H.F.)	10.95	(0.50)
2 Way Diecast (V.H.F.)	10.00	(0.50)
2 Way Toggle (V.H.F.)	6.50	(0.50)

HELIAL ANTENNAS		
2M BNC or PL259 (state which required)	4.50	(0.50)
2M Thread for TR2300 or FT290R (state which)	4.50	(0.50)
70cm BNC	4.50	(0.30)

YAESU			
FT902DM	160-10m 9 Band Transceiver	885.00	(—)
FC902	All Band A.T.U.	135.00	(1.50)
SP901	External Speaker	31.00	(1.50)
FT101Z	160-10m 9 Band Transceiver (FM)	590.00	(—)
FT101ZD	160-10m 9 Band Transceiver (FM) Digital R.O.	665.00	(—)
DCT101Z	DC/DC Power Pack	42.55	(1.50)
FAN101Z	Cooling Fan for 101Z/ZD	13.80	(0.75)
FT707	8 Band Transceiver 200W Pep	569.00	(—)
FT707S	8 Band Transceiver 20W pep	485.00	(—)
FP707	Matching Power Supply	125.00	(5.00)
FTV707R(2)	Transverter – 2M	198.00	(—)
FV707DM	Digital V.F.O.	186.00	(—)
FC707	Matching A.T.U./Power Meter	85.00	(1.00)
MR7	Metal Rack for FT707	15.70	(1.00)
MMB2	Mobile Mounting Bracket for FT707	16.10	(1.00)
FRG7	General Coverage Receiver	189.00	(—)
FRG7700	200KHz-30MHz Gen. Coverage Receiver	329.00	(—)
FRG7700M	As above but with Memories	409.00	(—)
FRT7700	Antenna Tuning Unit	37.00	(1.00)
FT208R	2M FM Synthesised Handheld	209.00	(—)
FT290R	2M Portable Synthesised Multi-mode	249.00	(—)
FT708R	70cm FM Synthesised Handheld	219.00	(—)
NC7	Base Trickle Charger	26.88	(1.30)
NC8	Base Fast/Trickle Charger	44.10	(1.50)
NC9C	Compact Trickle Charger	8.00	(0.75)
FBA2	Battery Sleeve for use with NC7/8	3.05	(0.50)
FNB2	Spare Battery Pack	17.25	(0.75)
PA3	12V DC Adaptor	13.40	(0.75)
FT480R	2M Synthesised Multimode	379.00	(—)
FT780R	70cm Synthesised Multimode (1.6MHz Shift)	459.00	(—)
FP80	Matching 230V AC Power Supply	63.00	(1.50)

★ AS REVIEWED ★

FT290R 2M Portable Synthesised Multimode 249.00 (—)

MMB11	Mobile Mounting Bracket	20.70	(1.00)
CSC1	Soft Carrying Case	3.45	(0.75)
NC11C	240V AC Trickle Charger	7.65	(0.75)
FL2010	Matching 10W Linear	59.75	(1.20)
Nicads	2.2 AMP HR Nicads Each	2.50	(—)
FL2100Z	160-10m 1200 Watt Linear	385.00	(5.00)
FF501DX	H.F. Low Pass Filter 1kW	22.25	(0.75)
FSP1	Mobile External Speaker 8 ohm 6W	9.60	(0.75)
YH55	Headphones 8 ohm	9.95	(0.75)
YH77	Lightweight Headphones 8 ohm	10.75	(0.75)
QTR24D	World Clock (Quartz)	25.70	(0.75)
YM24A	Speaker/Mic 207/208/708	16.85	(0.75)
YD148	Stand Microphone Dual IMP 4 Pin Plug	19.15	(1.50)
YM34	As 148 but 8 Pin Plug	18.80	(1.50)
YM38	As 34 but up/down Scan Buttons	22.60	(1.50)

FDK VHF/UHF EQUIPMENT			
Multi 700EX	2M FM Synthesised 25W Mobile	189.00	(—)
Multi 750E	2M Multimode Mobile	289.00	(—)
Expander	70cm Transverter for M750E	169.00	(—)

STANDARD VHF/UHF			
C78	70cm FM Portable	219.00	(—)
CPB78	10W Matching Linear	67.50	(1.50)
C58	2M Multimode Portable	239.00	(—)
CPB58	25W Matching Linear	79.50	(1.50)
CM8	Mobile Bracket	19.95	(1.00)
CL8	Soft Carrying Case	6.95	(0.75)
C12/230	Charger	7.59	(0.75)

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All with Over-Volts – Current Limit and Thermal Protection

4 AMP	27.95 (1.50)	12 AMP	69.00 (2.00)
6 AMP	44.95 (2.00)	24 AMP	99.00 (3.00)

WELZ SP15M
£29.00

SWR – POWER METER			
Model 110	H.F/2M Calibrated Power Reading	11.50	(0.50)
SWR25	H.F/2M Twin Meter	11.50	(0.50)
UH74	2M/70	14.30	(0.50)
WELZ SP15M	H.F/2M 200W	29.00	(0.75)
WELZ SP200	H.F/2M	59.00	(0.75)
WELZ SP300	H.F/2M/70	79.00	(0.75)
WELZ SP400	2M/70	59.00	(0.75)
DAIWA SW110A	H.F/2M	35.00	(—)
DAIWA CN620A	H.F/2M Cross Pointers	52.80	(—)
DAIWA CN630	2M/70 Cross Pointers	71.00	(—)

DUMMY LOADS				
DL30	PL259	30W MAX	5.00	(0.50)
DL60	PL259	60W MAX	8.80	(0.70)
DL60	N TYPE	60W MAX	16.50	(0.70)
DL600	SO239	600W MAX	29.95	(1.50)
DL1000	SO239	1000W MAX	39.95	(1.50)

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contents

20 **Call for Help**
A. Smith G4FAI

25 **Mini "X" Beam for 10 Metres**
F. C. Smith GW2DDX

26 **Passport to Amateur Radio—8**
John Thornton-Lawrence GW3JGA

32 **Radio Special Product Report**
Drake TR-7 h.f. Transceiver

37 **No More Snap, Crackle & Pop?**

40 **DX Dipole for Restricted Sites**
D. J. Howe G3XAA

41 **Kindly Note**
RF Noise Bridge, Jan. 82
DFC4 Special Offer, Feb. 82

44 **3-Band Short Wave Converter—2**
R. F. Haigh

48 **About our Gatefold Pull-out**

50 ***PW* Iambic Keyer**
Jeff Maynard G4EJA

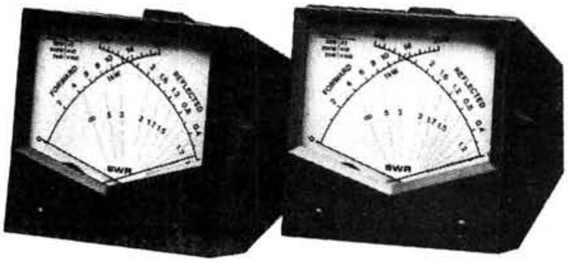
56 **Air Test**
Microwave Modules MM1296/144 Transverter

61 ***PW* "Winton" Stereo Tuner—6**
E. A. Rule

67 **CB Rig Check**
Tandy TRC–1001 Hand-held

EXTRA THIS MONTH
(between pages 48 & 49)
A gatefold pull-out of operating data for your shack wall

95 Advert Index
56 Air Test
67 CB Rig Check
19 Comment
60 Ideas Department
48 Letters
42 Mods
22 News
47 Next Month
68 On the Air
38 Production Lines
19 Services



CN540

50MHz · 150MHz
£35.00 inc VAT

CN520

1.8MHz · 60MHz
£32.50 inc VAT carr £1.50

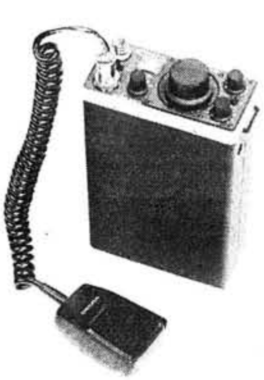
The UL1000 is a new concept in receiving station accessories and will help any keen listener to improve the performance of his station, particularly in the difficult conditions existing in the medium wave band (500KHz-1.6MHz).
The UL1000 is a self-contained variable gain, tuned preamplifier suitable for use with various aerial systems. A particular feature of the UL1000 is the use of a high Q loop aerial for the 500KHz-1.6MHz band.

UL1000

£39.50 inc VAT Carriage £1.50

HONOR

Carriage on meters £1.00
KRT100 £5.75   KRT200 £10.50   KRT500 £19.50



For those of you who enthuse over portable SSB operation on the hills and mountains of the UK, or wish to chat to the local lads whilst seated by your fireside, then the Mizuho SB2X 2 metre SSB portable is the rig for you. One watt output on the SSB frequencies 144.000 to 144.600 and the ability to listen to the beacon frequencies from 144.800 to 145.000 (also transmit).

£165.00 inc VAT Carr £4.50

MIZUHO SB2X

NEW

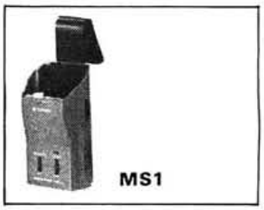
TR2500

The TR-2500 is a compact 2 meter FM handheld transceiver featuring an LCD readout, 10 channel memory, lithium battery memory back-up, memory scan, programmable automatic band-scan and Hi/Lo power switch.

TR-2500 FEATURES:
● Extremely compact size and light weight 66 W × 168 H × 40 D, mm, 540 g, with Ni-Cd pack. ● LCD digital frequency readout, with memory channel and function indication. ● Ten channel memory, includes "MO" memory, for non-standard split frequencies. ● Lithium battery memory back-up, built-in, saves memory when Ni-Cd pack discharged. ● Memory scan, stops on busy channels, skps channels in which no data is stored. ● UP/DOWN manual scan in 5 KHz steps. ● 2.5 W or 300 mW RF output. (HI/LOW power switch.) ● Programmable automatic band scan allows upper and lower frequency limits and scan steps of 5 KHz and larger (5, 10, 15, 20, 25, 30 KHz . . . etc) to be programmed. ● Repeater reverse operation. ● Optional power source, MS-1 mobile or ST-2 AC charger/power supply allows operation while charging. (Automatic drop-in connections.) ● Battery condition indicator. ● Two lock switches for keyboard and transmit. ● Flexible rubberized antenna with BNC connector. ● 400 mAH heavy-duty Ni-Cd battery pack. ● AC charger.

OPTIONAL ACCESSORIES:
● ST-2 Base station power supply and quick charger (approx. 1 hr.) ● MS-1 13.8 VDC mobile stand/charger/power supply. ● SMC-25 Speaker microphone. ● PB-25 Extra Ni-Cd battery pack, 400 mAH, heavy-duty.

TR-2500 £207 inc VAT. Carriage £5.00/ST1 £46.23/SC4 Soft Case £12.19/MS1 £28.29/Speaker, mike £14.99



MS1

ST1

PB25

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IC25E. 25W 2M FM Mobile.

Amazingly small, yet very sensitive. Two VFO's, five memories, priority channel, full duplex and reverse, LED S-meter, 25KHz or 5KHz step tuning, same multi-scanning functions as the 290 from mic or front panel. All in all the best 2M FM mobile ICOM have ever made.

IC-490E. COMING SOON!

At last an ICOM 70cm. multimode mobile. SSB, CW, and FM. 10W output, 430-439·99 Mhz. Similar features to the 2m. brother IC-290E. Price around £445!

Call us for advance details

IC290E. 2M Multimode Mobile.

10W RF output on SSB, CW and FM. Standard and non-standard repeater shifts. 5 memories and priority channel. Memory scan and band scan, controlled at front panel or microphone. Two VFO's. LED S-meter. 25KHz and 1KHz on FM – 1KHz and 100KHz tuning steps. Instant listen input for repeaters.

IC24G. 10W 2M FM Mobile.

This is the low-cost, easy to use economy model. Full bank – 80 channels at 25KHz spacing by easy to use press button switches. 12½KHz spacing if required, and the same reliable performance as the famous IC240. Price £169.

IC2E £159 - IC4E £199

– Nearly everybody has an IC2E – the most popular amateur transceiver in the world – now there is the 70 cm. version which is every bit as good and takes the same accessories. Check the features:

Fully Synthesized – Covering 144 – 145.995 in 400 5KHz steps. (430-439.999 4E).

Power Output – 1.5W with the 9v rechargeable battery pack as supplied – but lower or higher output available with the optional 6v or 12v packs.

BNC Antenna Output Socket – 50 ohms for connecting to another antenna or use the Rubber Duck supplied (flexible ¼ λ whip – 4E)

Send/Battery Indicator – Lights during transmit but when battery power falls below 6v it does not light, indicating the need for a recharge.

Frequency Selection – by thumbwheel switches, indicating the frequency. + 5KHz switch – adds 5KHz to the indicated frequency.

Duplex Simplex Switch – gives simplex or plus 600KHz or minus 600KHz transmit (+ 1.6MHz and listen input on 4E).

Hi-Low Switch – reduces power output from 1.5W to 150mW reducing battery drain.

External Microphone Jack – If you do not wish to use the built-in electret condenser mic. an optional microphone/speaker with PTT control can be used. Useful for pocket operation.

External Speaker Jack – for speaker or earphone. This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

A full range of accessories in stock.

		£ p
ICMLI	10W mobile booster for IC2E	49.00
BP5	11 volt battery pack	30.50
BP4	Empty battery case for for 6 x AA cells	5.80
BP3	Standard battery pack	17.70
BP2	6 volt pack	22.00
BC30	Base charger for above	39.00
BC25	Mains charger as supplied	4.25
DC1	12 volt adapter pack	8.40
HM9	Speaker/microphone	12.00
CP1	Mobile charging lead	3.20
ICI/2/3	cases	3.60 each

All prices include VAT

The IC4E is going to revolutionise 70cm!

or our agents and warranty on all equipment.

ICOM produce the complete HF line-up!

IC730. 100W HF All Band Mobile.

80 – 10M, 8 bands SSB, AM and CW. Two VFO's with 10Hz – 100Hz and 1KHz steps. Memory for each band. Noise blanker, vox, CW monitor, APC and SWR detector. Speech processor and fan. Switchable RF pre-amp and WWV. 13v DC operation or use ICPS15 mains.

IC720A. 100W HF +Gen Coverage Transceiver.

This is the best money can buy. AM, SSB, RTTY and CW. Built-in fan, speech processor, two VFO's and APC. Tuning rates down to 10Hz and memories. General coverage receiver from 100KHz to 30MHz (transmit too if you have a licence!) Run from 13vDC or use PS15 mains PSU.

For the complete station.

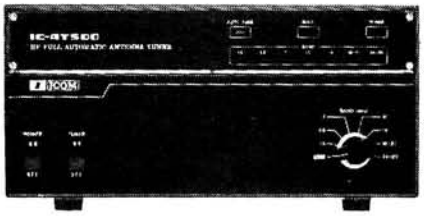
Controlled remotely from the ICOM range (or by one switch for other HF rigs):-

IC2KL.

The superb solid state linear to give you the legal limit on all HF bands with no tuning and a very clean signal.

Please Ring us for the Latest Prices, you may call after hours using our Ansaphone on: 02273 63850.

ICAT500.



Automatic ATU which really is automatic and even selects the correct antenna for you! Faster than its competitors. Handles 500W (1Kw PEP) – 100W version is AT-100.

IC251E and IC451 2M and 70cm. All Mode Base Stations.

Both well proven designs with twin VFO's, variable tuning rates and power output, scanners and memory channels, automatic repeater operation with full reverse, 144 – 146 or 430 – 440, low output on FM, SSB and CW, built-in 12 and 240v supplies. None other like them.

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MR-250W	210 Watt Linear For 2 Metres + switchable pre-amp.	259.00
MR28	100 Watt Linear for 10 Metres + switchable pre-amp.	65.00
UC70	50 Watt Linear For 70cms + switchable pre-amp.	149.00
	Preamps	
RX-144	Mast Head Preamp For 2 Metres	65.00
RX-430	Mast Head Preamp For 2 Metres	70.00
	SWR/Power	
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ASW-430	430 Mhz	49.50
	TASCO TELEREADER	
	Communications	
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CWR-680	CW/RTTY Terminal Rx Only No VDU	189.00
CWR-670	As Above But De-Luxe Model	259.00

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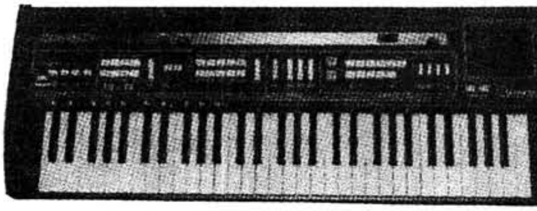

Complete Programmable Polyphonic Keyboard (RRP £555) **ONLY £495**

- ★ Input an entire piece of music, specially scored in bar code and read by a light pen attached to the instrument.
- ★ Alternatively, program your own melodies, chords and tempo, from the keyboard, into the extensive memory, (up to 5 minutes playing or more) with full editing facilities.
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- ★ 20 "breathtakingly clear and bright" pre-set instruments and voices.
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World's Most Powerful BASIC Pocket Computer?

CASIO FX-702P
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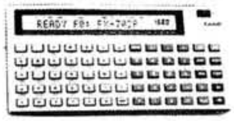
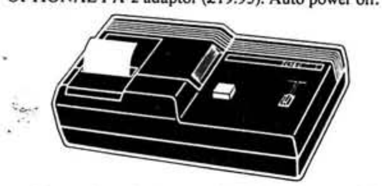


Plus FREE MiCROL Professional Programming pack (RRP £9.95)

Alpha/numeric dot matrix scrolling LCD. Variable input from 1680 steps, 26 memories, to 80 steps, all retained when switched off. Up to 10 programs. Subroutines; 10 levels. FOR:NEXT looping; 8 levels. Debugging and Correlation, all usable in programs. Program/Data storage on cassette via OPTIONAL FA-2 adaptor (£19.95). Auto power off. 17×165×82mm. 176g.



NEW CASIO FP-10 MINI PRINTER
(RRP £49.95)
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Compatible with the FX-501P, FX-502P, FX-601P, FX-602P and FX-702P
Manual and program results printout. Memory and program listing.

Electric discharge printer gives a remarkably legible 5×7 dot matrix printout of 20 characters per line. Stores up to 30 characters with print-out over 1½ lines, with overload symbol. Fast 2 lines per second print speed. Aluminised paper rolls approx 2,500 lines (30 feet) long and cost £2.50 per pack of 5. FP-10 connects directly to the calculator or via FA-2 remote control cassette interface. Four AA batteries will print approx 6,000-9,600 lines. Rechargeable pack, NP-4M prints approx 13,000 lines, (£6.90). AC adaptor, AD-4150, recharges NP-4M in situ, (£5). Dims: 43.5H × 157.5W × 82.5D (1¾ ×6¼ × 3¼"). Weight: 372g (13.1oz), incl. batteries.

MiCROL PROCOS. 702P professional programming solutions on tape. **£24.95**

FX-602P Calculator. 512 program steps, + **FREE MiCROL PPP** (£9.95) **£74.95**

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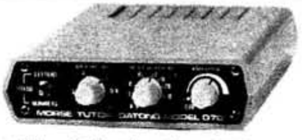
MORSE TUTOR

The uniquely effective method of improving and maintaining Morse Code proficiency. Effectiveness proven by thousands of users world-wide.



- ★ Practise anywhere, anytime at your convenience.
- ★ Generates a random stream of perfect Morse in five character groups.
- ★ D70's unique "DELAY" control allows you to learn each character with its correct high speed sound. Start with a long delay between each character and as you improve reduce the delay. The speed **within** each character always remains as set on the independent "SPEED" control.
- ★ Features: long life battery operation, compact size, built-in loudspeaker plus personal earpiece.

Price **£49.45**

ACTIVE RECEIVING ANTENNAS

Datong active antennas are ideal for modern broadband communications receivers – especially where space is limited.

- ★ highly sensitive (comparable to full-size dipoles).
- ★ Broadband coverage (below 200 kHz to over 30 MHz).
- ★ needs no tuning, matching or other adjustments.
- ★ two versions AD270 for indoor mounting or AD370 (illustrated) for outdoor use.
- ★ very compact, only 3 metres overall length.
- ★ professional performance standards.

Prices: Model AD270 (indoor use only) **£42.55**
Model AD370 (for outdoor use) **£56.35**
Both prices include mains power unit.

VERY LOW FREQUENCY CONVERTER

If your communications receiver gives poor results below 500 kHz Model VLF is the answer.

- ★ Connects between antenna and receiver input.
- ★ Converts signals between DC and 500 kHz to the range 28 to 28.5 MHz with low noise and high sensitivity.
- ★ Crystal controlled for high stability.
- ★ Quality construction in diecast aluminium box (size 112 x 62 x 31mm), SO239 connectors, LED indicator, in/out switch.
- ★ Operates from internal 9 volt battery or external supply (5-15 volts DC).

Price: only **£25.30**

Our full catalogue plus further details of any product are available free on request.
All prices include VAT and postage and packing.
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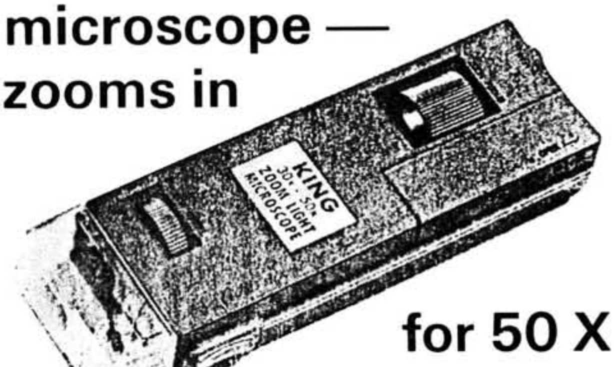
MICROSCOPE

Illuminated pocket microscope — zooms in



for 50 X magnification

Measuring only 130 × 40 × 18 mm, this Intel illuminated pocket microscope has a normal magnification of 30 X which can be increased to 50 X by using the zoom facility. Focus control and illumination are built-in so that the instrument can typically be used in the close inspection of specimens, samples and tissues by medical students, doctors, technicians and medical laboratory scientists. It uses longlife batteries and comes in a plastic case.

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AF124	0.34
AF125	0.32
AF126	0.32
AF127	0.32
AF139	0.42
AF239	0.42
AU106	2.06
AU107	1.75
AU110	2.00
AU113	1.48
BC107	0.10
BC107B	0.10
BC108	0.10
BC109B	0.10
BC140	0.31
BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC148	0.09
BC149	0.09
BC157	0.10
BC158	0.09
BC159	0.09
BC160	0.28

BC170B	0.10
BC171	0.08
BC172	0.09
BC173B	0.10
BC182	0.09
BC183	0.12
BC184LA	0.09
BC212	0.09
BC212L	0.09
BC213	0.09
BC213L	0.09
BC237	0.09
BC238	0.09
BC307	0.09
BC327	0.10
BC337	0.10
BC461	0.30
BC478	0.20
BC547	0.10
BC548	0.10
BC549A	0.08
BC557	0.07
BC558	0.07
BD131	0.32
BD132	0.35
BD133	0.40
BD135	0.30
BD136	0.30
BD137	0.28
BD138	0.30
BD139	0.32
BD140	0.30
BF179	0.34
BF180	0.29
BF183	0.29
BF194	0.11
BF196	0.11

BF197	0.11
BF198	0.10
BF199	0.14
BF200	0.30
BF258	0.25
BF259	0.26
BF336	0.34
BFX29	0.30
BFX84	0.26
BFX85	0.28
BFX86	0.30
BFX88	0.25
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BFY51	0.21
BFY52	0.25
BFY90	0.77
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BU108	1.69
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RU126	1.22
BU205	1.30
BU208	1.39
BU208A	1.52
BU326A	1.42
MJE340	0.40
MRF450A	11.50
MRF475	2.50
MRF477	9.50
OC71	0.22
R20088	1.70
R2010B	1.70
R2540	2.48
TIP29	0.40
TIP29C	0.42
TIP30C	0.43

TIP31C	0.42
TIP32C	0.42
TIP41C	0.45
TIP42C	0.47
TIP47	0.65
TIP2955	0.84
TIP3055	0.66
TIS91	0.20
2N3054	0.59
2N3055	0.52
2N3702	0.12
2N3703	0.12
2N3704	0.12
2N3705	0.12
2N3706	0.12
2N3708	0.12
2N5294	0.38
2N5296	0.48
2N5298	0.38
2N5496	0.66
2SA715	0.95
2SC495	0.80
2SC496	0.80
2SC1096	0.80
2SC1172Y	2.20
2SC1173	1.15
2SC1306	1.25
2SC1307	1.85
2SC1449	0.80
2SC1678	1.25
2SC1945	2.10
2SC1953	0.95
2SC1957	0.80
2SC2028	1.15
2SC2029	1.60
2SC2078	1.45
2SC2091	0.85

Many other items available
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Allow 14 days for delivery

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The 2001 sweeps the board at only £78*

Get all the waveforms you need – 1 Hz to ·1 MHz in five overlapping ranges: stable, low-distortion sine waves, fast rise/fall-time square waves, high linearity triangle waves — even a separate TTL square wave output. Plus high- and low-level main outputs.

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*price excluding P&P and 15% VAT

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Global Specialties Corporation (UK) Limited Dept. 6HH
Unit 1, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ

Model 2001 Sweepable Function Generator	£91.42. (inc. P&P and 15% VAT)	Qnty Reqd.		For FREE catalogue tick box ☐

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I enclose PO/Cheque for £.............................. or debit my Barclaycard/Access/American Express No .... exp date ....

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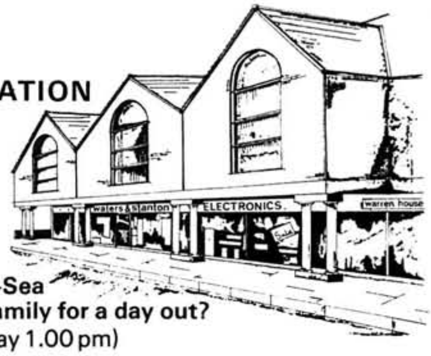

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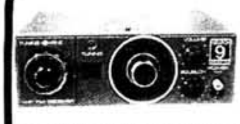


SR9 VHF RECEIVER AMATEUR/ MARINE

£46 inc. VAT

The SR9 must be one of the most popular monitors for 2 metre amateur radio enthusiasts. (Also available as a marine version at the same price). It is fully tuneable across the band with the option of also installing up to 11 xtal controlled channels. Power requirements are 12v DC negative earth at 200ma approx. The unit comes complete with mobile mounting kit and built-in speaker.

PROFESSIONAL AIRCRAFT MONITOR
R517 £49.50
(as supplied to pilots, ground crew etc.)

The R517 is a professional aircraft monitor receiver, having superb sensitivity and capable of tuning across the entire aircraft band 118-143mHz. For easy tuning there is both a coarse and fine tuning control. In addition there is a 3 position switch for selecting xtal controlled channels (xtals £3.00 extra) for your local airport. The unit is completely portable running off self-contained batteries.

SPECIAL OFFER

AMATEUR RADIO PORTABLE MONITOR "008" WITH NI-CADS & AC CHARGER **£39**

This portable receiver is designed for monitoring the 2 metre band. It scans up to 8 separate channels (crystal required for each channel) and automatically locks on to a channel as soon as a signal appears. Manual overide and channel lockout is included together with telescopic whip. The unit is self powered with ni-cad batteries and an AC charger is also included. Crystals for channels S20 and S22 are supplied with the receiver and extra crystals are available at £3 each.

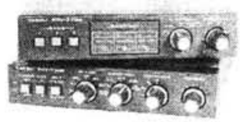
TUNE INTO THE WORLD . . . FROM YOUR ARMCHAIR!

FRG7700 £319

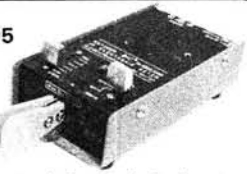
Securicor £5.00 extra

Here's a complete monitoring system that builds up into a comprehensive listening system for a wide variety of transmissions, both locally and from the other side of the World. As communications engineers, we know there is good equipment and poor equipment. We rate the FRG7700 very highly. It forms the main unit of the system and provides one of the most cost effective ways of listening to the entire shortwave band. Listen to all the World news direct as it comes in from stations stretching round the Globe, international family requests from Australia and New Zealand, sport from America, topical news comment from Russia and China. If you're interested in Amateur Radio then the SSB facility lets you listen in on conversations with amateurs from places far and near. Hear a mobile operator motoring through the traffic in Manchester or going home from work in Perth, Australia. Listen to expeditions in Africa or the Antarctic. It's all possible and the more skilled the operator, the more interesting it becomes. The possibilities are endless, ship to shore radio, aircraft on the Atlantic run, foreign news agencies, etc.
And if this is not enough plug in the optional VHF converter and listen to private, commercial and military air traffic over the U.K., local airports, local shipping, taxis, radio amateur repeaters and many other interesting transmissions. To improve reception, there's also the matching aerial tuning unit. So why not send S.A.E. today for full coloured leaflets and enjoy a new hobby from the comfort of your fireside. Go on – treat yourself!

AERIAL TUNER £37.00
VHF CONVERTERS From £69.95



EK121 £29.95 Electronic Keyer



Experienced radio operators, both professional and amateur, know the advantages of an electronic key. Fatigue-free operation and smooth and consistant morse code. The EK121 will work with all modern amateur radio transceivers and operates from either internal batteries or external 6v DC. Speed is 4-30 wpm. A nice key at an incredible price.

SWR/POWER/FIELD STRENGTH MEASURING METER SPECIAL OFFER
£11.95 +60p p&p

As used by CB and Amateur radio operators.

The YW3 is used by amateur radio and CB operators around the World. It's offered to you at a really low price because we import them direct from Japan. It tells you the VSWR, power output and field strength and covers 3.5 to 150mHz. If you want the strongest signal in town – you'll find the YW3 the sure answer.

DATONG ELECTRONIC MORSE TUTOR **£49.45** + 75p p&p

We've put together a nice little morse training kit comprising the famous HK708 morse key and matching oscillator unit complete with volume control and built-in speaker. If you aspire to a G4 this will help you on the way.

SPECIAL DISCOUNT OFFER
£229 inc. VAT
BEARCAT 220FB

We've managed to purchase a small quantity of the Bearcat 220FB receivers at a very favourable price. Probably the best known VHF/UHF monitor available. During these dark and wintery evenings what could be better than sitting at home and listening in on the outside world of radio. Radio amateurs operating from their private cars or through the country's network of repeaters. Aircraft weaving their way through complex air traffic corridors or communciating with the local airfield. Police, fire brigade, taxis and marine, etc., you'll find it all on the Bearcat. Operation is from 230v mains or 12v DC and the digital display gives precise information regarding frequency.

RADIO SPECTRUM MONITOR

SX200N 26-500MHz **£260** inc. VAT p&p £2.00

Here's a really wide coverage receiver going all the way from 26mHz to 500mHz (with just a few gaps). Mains or battery operation, FM or AM, means it can be used just about anywhere for anything. Channel memory, scanning and built-in clock are just a few of its features. If you're interested in amateur radio, aricraft, Police, taxis, etc., then this receiver covers them all.

MAIL ORDER SLIP to: Waters & Stanton Electronics, Warren House, Main Road, Hockley, Essex.

Name .... Goods required ....
Address ....

Please rush me the above. Cheque enclosed for £............/Please charge to credit card No ....

WATERS & STANTON ELECTRONICS

18/20 MAIN ROAD, HOCKLEY, ESSEX. TEL (0702) 206835

SPECIAL OFFER

FDK PIV

430 MHz UHF Portable

STAR BUY

NORMAL PRICE £152

including:
- ★ helical aerial
- ★ AC mains charger
- ★ ni-cad batteries
- ★ 2 channels fitted

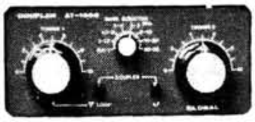
FOR LIMITED PERIOD

£125

COMPLETE

The Palm IV is an ultra compact UHF transceiver operating in the 430-440mHz amateur band producing 1 watt of output power. Provision is made for six channels. Two are ready supplied, one on SU20 the calling channel, plus one repeater channel of your choice. A 1.6mHz repeater shift is incorporated but there is no tone-burst, hence the special price. As well as the ni-cad battery pack and the charger supplied, there is also an optional leatherette case at an extra £5.75. The above offer is limited to existing stocks, so please hurry as we cannot obtain any further stocks at this price!

SHORTWAVE LISTENER ATU



GLOBAL AT1000

£31.95

carriage free

The ultimate in ATU's, specially designed to enhance the performance of all short wave receivers – no other model can approach its performance.

WELZ SP15M £29.95

Professional RF power & swr meter

Welz are known for their professional quality RF measuring equipment and the SP15M lives up to that tradition. This self-contained power/SWR meter will give you highly accurate power measurements and can be left permanently in line with the aerial.

WELZ AC38 8 BAND ATU £59

The AC8 aerial tuner is designed to work with all current amateur radio transceivers at power levels of up to 400 watts. Designed specifically for coaxial fed aerial systems, it is an ideal unit for use with solid state transceivers that require to see a low SWR in order to give full power output.

AM601 MIC. including SPEECH PROCESSOR

£44

The AM601 is specially designed to give optimum speech quality with Amateur Radio transceivers. A built-in meter enables the operator to monitor the amount of speech processing whilst a switch enables the operation to select the correct audio response for either SSB or FM.

AZDEN POWER MIC

The new Azden DX-354 desk mic is purpose made for ham radio & CB by one of Japan's foremost audio engineering companies. With its heavy die cast metal casing, built-in variable compressor and 500-50k ohm o/p, it matches any transceiver. Our ridiculously low price makes it a must.

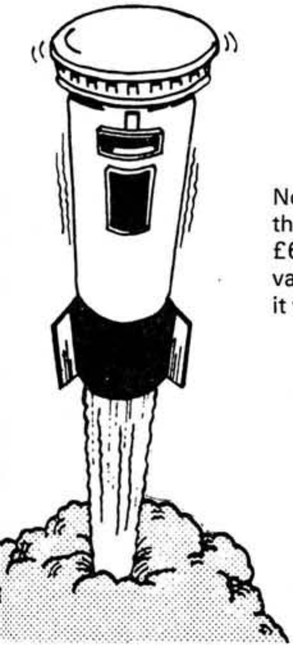
£29.00

AZDEN MEX-55

MOBILE SAFETY MIC

£25

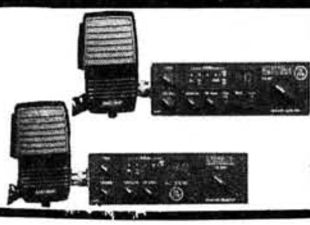
The MEX-55 has been designed for safe mobile operation by radio amateurs. The high quality microphone is mounted on an anti-dazzle goose neck that attaches to the sun visor fixing point. This makes for safe mobile operation with both hands on the wheel and the transmit/reciever switch is housed in a small control box that attaches to the gear lever.



GREAT NEWS. WE'VE REDUCED THE PRICE OF TRIO'S R1000 TO £235 AND CALLED IT THE "R600"

No it's not quite as good as the R1000 but at a saving of £65 it represents incredible value. We've tried it and like it very much – so will you!

CB ANNOUNCEMENT



WE HAVE A GOOD SELECTION PRICED FROM £69

AMSTRAD, FIDELITY, CT BERNET, LOWE, PLANET

FDK PALM II FM 2M TRANSCEIVER

£109 inc. VAT

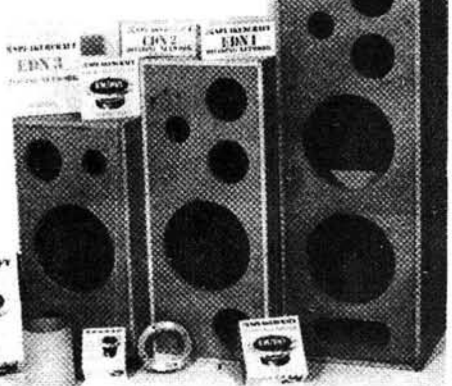
- ★ 1 Watt output
- ★ 6 channels
- ★ Repeater shift
- ★ Helical aerial
- ★ Ni-cad batteries
- ★ AC Mains charger

The Palm II has become well respected in view of its simplicity and yet effective range. Over 1 watt of FM at 144mHz enables good reliable contact over several miles. The repeater shift enables you to operate through your local repeater, thus extending the range considerably. A tone-burst module option is available at an extra £12. Two crystal controlled channels are fitted as standard (S20 and S22). The Palm II is a low priced, cost effective transceiver, ideal for portable operation and small enough to be slipped into a pocket. Send for details today.

THE ELECTRONICS CENTRE FOR THE ENTHUSIAST
OUR REPUTATION IS YOUR GUARANTEE
TELEPHONE CREDIT CARD ORDERS ACCEPTED

So you've fancied some WHARFEDALE E90 speakers –

But the bank manager won't co-operate! Don't despair – now there are Wilmslow Audio flat-pack kits for the Wharfedale E50, E70 and E90. A few hours of easy and interesting work will complete your speakers at a very considerable saving on buying 'assembled' E systems.



The kits contain all cabinet components – accurately machined for easy assembly – all drive units, crossover networks, acoustic wadding, reflex port trim, nuts, bolts, terminals, grille fabric, etc. The cabinets can be painted or stained or finished with iron-on veneer. Easy, foolproof assembly instructions are supplied — no electronic or woodworking knowledge necessary.

Prices: E50 kit **£182** per pair including VAT, carriage and insurance £ 8
E70 kit **£220** per pair including VAT, carriage and insurance £ 8
E90 kit **£330** per pair including VAT, carriage and insurance £10

Credit terms available: Deposit 20%, balance over 12 months (charges currently 26.9 APR)
Through a leading Finance House. Written details on request.

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B12H	3.90	EF95	0.65
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DAF96	0.70	EF183	0.80
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DY802	0.70	EL32	1.10
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E88CC/01	3.10	EL37	4.40
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E182CC	4.95	EL86	0.95
EA76	2.25	EL90	1.00
EABC80	0.60	EL91	4.20
EB91	0.60	EL95	0.80
EBC33	1.15	EL504	1.70
EBC90	0.90	EL803	5.90
EBF80	0.60	EL509	2.70
EBF83	0.60	EL802	1.70
EBF89	0.80	EL821	8.20
EC52	0.65	EL822	9.95
EC91	3.40	EM31	1.60
EC92	0.85	EM80	0.85
ECC81	0.65	EM81	0.85
ECC82	0.60	EM84	0.85
ECC83	0.65	EM87	1.30
ECC84	0.60	EY51	0.95
ECC85	0.60	EY81	0.65
ECC86	1.70	EY86/87	0.60
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ECC804	0.90	EZ81	0.70
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ECF82	0.65	GY501	1.30
ECF801	1.05	GZ32	1.05
ECH34	2.25	GZ33	4.20
ECH35	1.70	GZ34	2.75
ECH42	1.20	GZ37	3.95
ECH81	0.70	KT66	6.30
ECH84	0.80		9.20*
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ECL82	0.75		13.80*
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PC86	0.95
PC88	0.95
PC97	1.50
PC900	1.15
PCC84	0.50
PCC89	0.85
PCC189	1.05
PCF80	0.80
PCF82	0.70
PCF84	0.75
PCF86	1.50
PCF87	0.50
PCF200	1.80
PCF201	1.65
PCF800	0.50
PCF801	1.75
PCF802	0.85
PCF805	2.45
PCF806	1.20
PCF808	2.75
PCH200	1.35
PCL81	0.75
PCL82	0.95
PCL84	0.90
PCL86	1.05
PCL805/85	1.25
PD500/510	4.30
PFL200	1.10
	2.80*
PL36	1.25
PL81	0.85
PL82	0.70
PL83	0.60
PL84	0.95
PL504	1.45
PL508	1.95
PL509	2.90
PL519	3.20
PL802	3.20
PY33	0.70
PY80	0.70
PY81/800	0.85
PY82	0.65
PY83	0.80
PY88	0.85
PY500	1.70
PY809	6.45
PY801	0.80
QQV03/10	2.85
QQV03--20A	14.40
QQV03-25A	21.20
QQV06/40A	16.10
QV03-12	4.20
SC1/400	4.50
SC1/600	4.50
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TT21	16.50
U25	1.15
U26	1.15

U27	1.15
U191	0.85
U281	0.70
U301	0.65
U600	11.50
U801	0.90
UBC41	1.20
UABC80	0.75
UAF42	1.20
UBF80	0.70
UBF89	0.70
UBL21	1.75
UCC84	0.85
UCC85	0.70
UCF80	1.30
UCH42	1.85
UCH81	0.75
UCL82	0.95
UF41	1.35
UF80	0.95
UF85	0.95
UL41	2.30
UL84	0.95
UM80	0.90
UM84	0.70
UY82	0.70
UY85	0.85
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VR150/30	1.35
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Z749	0.75
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Z801U	3.75
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1A3	0.85
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1R5	0.60
1S4	0.45
1S5	0.45
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3D6	0.50
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3E29	19.00
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5B/255M	14.50
5B/258M	12.50
5C22	29.90
5R4GY	1.80
5U4G	0.75

5V4G	0.75
5Y3GT	0.80
5Z3	1.50
5Z4G	0.75
5Z4GT	1.05
6/30L2	0.90
6AB7	0.70
6AC7	1.15
6AG5	0.60
6AH6	1.15
6AL5	0.60
6AL5W	0.85
6AK5	0.65
6AK8	0.60
6AL5	4.20
6AM6	1.50
6AN8A	2.50
6AQ4	3.40
6AQ5	1.00
6AQ5W	1.80
6AS6	1.15
6AT6	0.90
6AU6	0.60
6AV6	0.85
6AX4GT	1.30
6AX5GT	1.30
6BA6	0.55
6BE6	0.60
6BG6G	1.60
6BJ6	1.30
6BQ7A	0.85
6BR7	4.80
6BW6	6.20
6BW7	0.80
6C4	0.50
6CB6	0.55
6CH6	8.20
6CL6	1.70
6CX8	3.80
6CY5	1.15
6D6	0.70
6EA8	3.20
6F6	1.60
6F6G8	1.10
6F7	2.80
6F8G	0.85
6F12	1.50
6F14	1.15
6F15	1.30
6F17	1.15
6F23	0.75
6F24	1.75
6F33	10.50
6FH8	4.20
6GA8	0.90
6GH8A	0.95
6H6	1.60
6J4	1.35
6J4WA	2.00
6J5	2.30
6J5GT	0.90
6J6	0.85
6J6W	0.90
6JE6C	2.95

6JS6C	2.95
6K7	0.80
6L6M	2.80
6L6G	2.50
6L6GC	2.10
6L6GT	1.25
6L7G	0.85
6L18	0.70
6LQ6	2.95
6LD20	0.70
6KG6A	2.70
6Q7G	1.30
6SA7	1.00
6SG7	1.15
6SJ7	1.05
6SK7	0.95
6SL7GT	0.85
6SN7GT	0.80
6SR7	1.10
6SQ7	0.95
6V6G	1.50
6V6GT	0.95
6X4	0.75
6X4WA	2.10
6X5GT	0.65
6Y6G	0.80
6Z4	0.70
7B7	1.75
7Y4	1.25
9D2	0.70
9D6	2.90
10C2	0.85
10F18	0.70
10P13	1.50
11E2	19.50
12A6	0.70
12AT6	0.70
12AT7	0.65
12AU7	0.60
12AV6	0.95
12AX7	0.85
12BA6	0.90
12BE6	1.25
12BH7	1.10
12C8	0.65
12E1	18.95
12J5GT	0.55
12K7GT	0.70
12K8GT	0.80
12Q7GT	0.60
12SC7	0.65
12SH7	0.65
12SJ7	0.70
12SQ7	1.45
12SQ7GT	0.85
12Y4	0.70
13D3	0.70
13D5	0.90
13D6	0.80
14S7	1.15
19AQ5	0.85
19G3	11.50
19G6	8.50
19H5	39.55

20D1	0.80
20F2	0.85
20E1	1.30
20P1	0.65
20P3	0.75
20P4	1.25
20P5	1.35
25L6GT	0.95
25Z4G	0.75
30C15	0.50
30C17	0.50
30C18	2.45
30F5	1.15
30FL2	1.40
30FL12	1.25
30FL14	2.15
30L15	1.10
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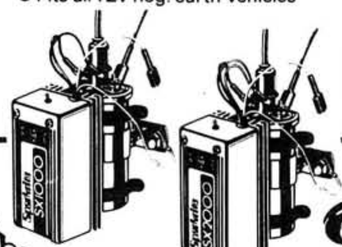

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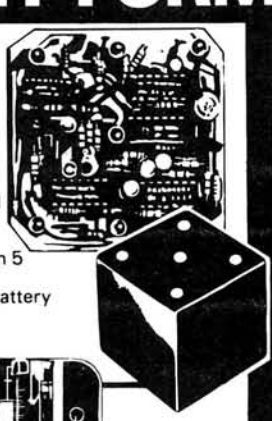

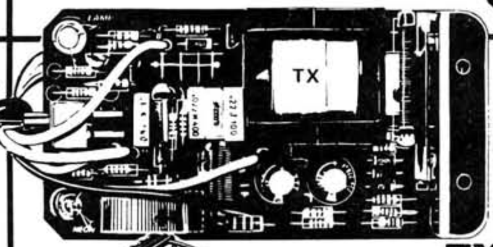

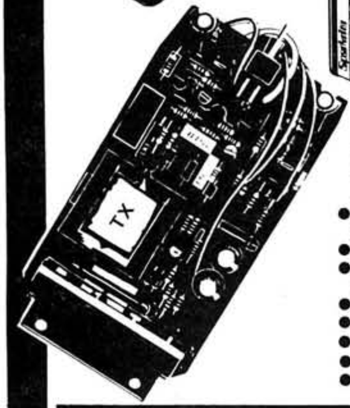

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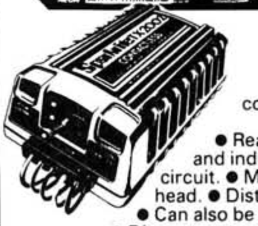

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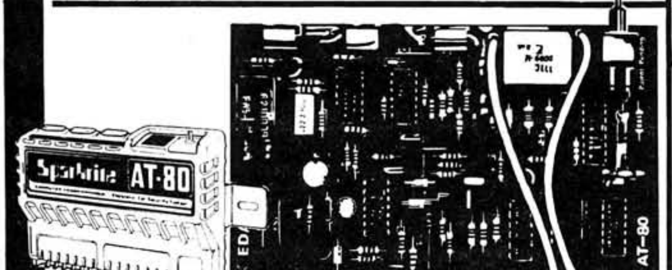

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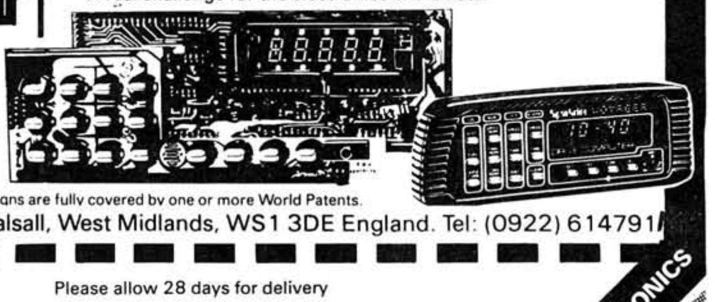

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Test Questions

THE RADIO AMATEUR'S EXAMINATION is basically intended to test whether candidates know enough about radio theory and techniques, and about the licensing regulations, to be let loose on the air to experiment with radio transmitters. When the repeater jammers, foul-mouths and other pests are out in force, I sometimes wonder whether it should also include a psychological test, to check on a candidate's attitude towards his fellow men. Or perhaps it already does, and that's why some of the questions are framed in such peculiar ways.

Since the RAE changed to the multiple-choice format in May 1979, we have received complaints from candidates and tutors after each and every examination. We understand that the December 1981 papers included several questions on topics not mentioned in the syllabus, nor covered in any of the recognised examination study texts. Plus at least one question whose correct answer was not among the options offered. We can all make mistakes, but the City and Guilds' highly secretive attitude towards their question papers (and their statistical analyses — everything we've prised out of them so far has been marked "Not for publication"), does nothing to allay suspicions that all is not well in the way that the questions are set and marked.

Our attempt to pursue allegations of inconsistent marking of candidates in the May 1981 examinations produced a response so fatuous as to be unbelievable. Basically, the CGLI's answer was that our complainants, with their wide professional experience in radio engineering, should not be surprised when their "guesses" at the answers did not match up with the "reality" of the "correct" answers, which were selected by a panel of experts in the light of the results of pre-testing of the examination papers on a sample of candidates.

Do the City and Guilds really consider the questions to be so obscure that they cannot be answered correctly by an individual with a lifetime of experience in radio engineering? The committee approach might be acceptable in the social sciences, but it is totally unacceptable in an engineering science, at least at the technical level at which the RAE operates.

The multiple-choice Radio Amateur's Examination has now run for three years, and is due for reappraisal and revision in the light of experience gained. I hope that very positive steps will be taken to overcome the many valid criticisms of those three years.

Geoff Arnold

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.

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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.

CONSTRUCTION RATING

Each constructional project will in future be given a rating, to guide readers as to its complexity:

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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.

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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.

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call for help

A.SMITH G4FAI

How do you call for help when your country has been devastated by a volcanic eruption leaving more than 15 000 homeless and all normal communications to the outside world disrupted?

The Premier of the Caribbean island of St. Vincent used the services of amateur radio operators who stepped in to provide emergency radio services in April 1979. They set up a communications centre linked with police stations throughout the island and handled all relief communications with nearby Barbados.

Meanwhile Coastguard cutters and transport planes from the Canal Zone, responding to the call for help, used amateur band frequencies for much of their communications during the relief operations.

This incident is but one example of how radio amateurs worldwide put their specialised skills at the disposal of the authorities and voluntary services in time of emergency or disaster.

Rail Disaster

On Saturday evening 10 November 1979, a freight train was derailed as it sped through an industrial area to the west of Toronto. Tanks of propane exploded, with flames reaching far into the sky, as other tanks containing chlorine gas began to leak their deadly contents insidiously over the surrounding area. Wind spread the gas even further and it soon became necessary to begin to evacuate the population of the city of Mississauga from the creeping terror.

Within two days the entire population, nearly a quarter million people, had been moved from an area of some 60 square miles. This vast, unprecedented operation, strained the resources of the regular emergency services and those of many voluntary services as well.

Once again radio amateurs were called on to take their share of the burden; when the Red Cross alerted the Ontario section of the Amateur Radio Emergency Service, ARES, on November 11, Canadian amateurs embarked on one of the largest operations they had ever known.

Communications were provided between 12 evacuation centres, Red Cross headquarters, and the site of the train crash. Radio links were provided for ambulances evacuating patients from a local hospital, a special group handled welfare enquiry traffic, and, finally, when the emergency passed, much assistance was given with resulting transport problems as thousands of people began to return to their homes. Emergency service communications were provided for a continuous period of 80 hours, involving 255 amateurs right across Ontario.

This is the public service facet of amateur radio. Weeks, months, and years of preparation are often behind it. In many countries organisations like ARES hold endless practices and exercises to ensure the highest professional standards, then, when the call comes, it is total commitment without qualification.

Radio amateurs come from all walks of life. Some radio professionals and electronics experts are participants but many have no connection with the subject outside the hobby, although their standard of performance and expertise often equals that of the professionals.

The emergency communications systems offered can be adapted with great skill and ingenuity to meet virtually any situation. Mobile or handheld equipment can be provided, as well as base stations, linked as necessary to the emergency headquarters. When coverage is required over a large area amateur repeater stations are used to amplify and relay signals from mobiles and portables to give wider coverage.

Ambulance Crisis

Emergency radio in the UK is provided by the Radio Amateurs Emergency Network, RAYNET, which has about 3600 members belonging to 270 RAYNET Groups nationwide.

In November 1978 Birmingham, the second largest city in the UK, was completely without its ambulance service as a result of industrial action. The volunteer St. John Ambulance Brigade stepped in to provide an effective round-the-clock emergency service, assisted by radio communications provided by members of RAYNET.

West Midlands RAYNET and adjacent county groups were alerted on the evening of November 18 and in less than two hours 17 mobiles were available at SJAB headquarters where a control base station had become operational.

The emergency lasted for 18 days and nights during which the RAYNET station was in *continuous* operation. Over 7000 messages were handled by the 170 amateurs involved and more than 1000 emergency cases were dealt with.

RAYNET origins go back to 1953 when disastrous storms brought floods, death and destruction to the east coast of Britain. All communications, including telephones, government wireless stations, and utility services were closed down for days and radio amateurs put their stations, skills, and communications experience at the disposal of the authorities.

It had long been felt that there was a need for some formal organisation to co-ordinate the services of amateur radio on such occasions and out of the 1953 experience the idea crystallised and RAYNET was formed.

The use of amateur stations to carry third party traffic was quite illegal in 1953, even in emergency situations, so to put RAYNET on a legal basis the terms of the amateur radio licence had to be amended to rectify this.

Today amateur stations can legally operate under emergency or exercise conditions at the request of the Police, British Red Cross, St. John Ambulance Brigade, or County Emergency Planning Officers. RAYNET can provide emergency communications at county shows and similar functions, and in addition Home Office approval was given in 1979 for operations up to two miles off-shore during oil pollution operations.

RAYNET is a completely voluntary organisation. Its equipment is usually the property of individual members although many groups have base stations installed ready for use in Police stations, hospitals, county or borough emergency headquarters, Red Cross and St. John premises, etc., sometimes assisted by the host authority. In London for instance the Borough of Southwark has purchased £1000 worth of equipment for RAYNET use as part of the borough contingency plans for Thames flooding.

In Cornwall the County Council installed permanent antennas and feeders for RAYNET in County Hall, Truro, following a five day operation over the New Year of 1979 when blizzards caused a complete traffic standstill throughout Cornwall. Many parts were completely cut off and RAYNET provided the only communication system available for co-ordinating emergency information throughout the county.

Fortunately the UK is rarely subjected to the vast natural disasters which afflict other parts of the world but there are still many crises, both man-made and natural, which require emergency communications. Apart from those already described RAYNET has been involved in recent years in forest and heath fires, flooding, emergency evacuation of blocks of flats, telephone exchange failure, search and rescue operations and several oil pollution incidents.

RAYNET Groups can be heard throughout the UK on the amateur bands, mainly on 2 metres, during regular practice sessions, exercises with the "requesting" authorities, and, sometimes, the real thing. There is more dedication and hard work than there is drama but that is the natural order of things if a constant state of readiness is to be preserved.

RAYNET FREQUENCIES

80m
3·780MHz c.w./s.s.b./RTTY
4m
70·350–70·400MHz all modes
2m
144·260MHz±QRM s.s.b.
144·800–144·875MHz all modes
145·200MHz f.m.
145·225MHz f.m.
145·800MHz f.m.
70cm
433·200MHz f.m.
434·800MHz f.m.

Bush Fires in Australia

In Australia emergency amateur radio operations are co-ordinated by the Wireless Institute Civil Emergency Network, WICEN, in close co-operation with the various State Emergency Services, SES. Each State is divided into WICEN regions or zones and each is associated with the local SES group so that radio amateurs provide a valuable back-up for the authorities in a more formal way perhaps than in other countries.

In December 1979 three major bush fires in an arc about 13 miles north of Sydney, together with many others in different locations, burned more than 379 000 acres of land in New South Wales. Several thousand persons were involved in the fire-fighting operations, including the emergency services, the armed forces, and many volunteer organisations, including over 100 volunteer Bush Fire Brigades.

For 52 hours Sydney North WICEN provided continuous communications between operational headquarters and WICEN mobile units attached to Bush Fire Brigades from distant areas, who were not equipped with the Bush Fire Council emergency channel. Mobile canteens feeding the fire-fighters were accompanied by WICEN vehicles to ensure that all crews were fed despite the limited visibility from the heavy smoke and the continuous movement of the fire brigades, and, additionally, WICEN provided operators to keep the official emergency channel operational at two different locations.

The three major fires were under control by the evening of Wednesday 19 December, and WICEN was put on standby. On the following Sunday afternoon one of the other fires, fanned by strong winds, threatened a line of towns about 60 miles west of Sydney. WICEN was again called out and provided the communications centre for the Bush Fire Brigades sent from the Sydney area to assist the local brigades. The assisting brigades were able to communicate with each other, but were not able to maintain reliable contact with their base stations. WICEN provided this vital link for them until stand-down on Christmas Eve.

During this period the Emergency Fire Controller urgently requested a radio teleprinter link between his headquarters and a fire control centre some 30 miles away, a somewhat more complicated matter than a simple radio link. It says much for the flexibility and commitment of the amateur radio service that within three hours of the request being made at 2100 on a Sunday night the teleprinter link was installed and operational.

As Sydney North stood-down, Central Coast WICEN were called out when fire broke out again, this time in very rough country about 50 miles north of Sydney. Central Coast went into the field on 27 December to provide links from the fire-fighters to fire control centre, and liaison communications for Army Units who were also in action. Only four-wheel drive vehicles could negotiate the terrain and speed was reduced at times to 5 miles an hour. Central Coast worked in these conditions for 40 hours until the fire was declared safe and they reverted to standby.

During the period 17th to 28th December, 86 WICEN members assisted in the recurring emergencies, plus many non-amateur supporters who provided assistance in various ways. Over 1750 manhours were spent in the field and several thousand hours on standby by relief crews.

Emergencies Cannot be Planned

One has only to follow the news media to know that disasters and emergencies are daily occurrences throughout the world. Whenever these happen and help is needed

continued on page 82▶▶▶

NEWS NEWS NEWS

Russian Sputniks

If you have not already heard there are 6, yes SIX, RS series satellites now in orbit. The following table will provide you with the basic details. Up-to-the minute info is available by monitoring the AMSAT-UK net on 3·780MHz ± QRM, at 1900GMT every weekday, lasting approximately 30 minutes.

Satellite No.	**3**	**4**	**5**	**6**	**7**	**8**
Ref. Orbit No.	33	33	34	34	34	34
Period (mins)	118·52	119·4	119·55	118·72	119·2	119·8
Increment °W	29·76	29·98	30·015	29·81	29·93	30·07
Eq. Cross (GMT)	1921	2027	1902	2004	1945	1945
Degrees West	124	140	117	135	130	130

The above details were taken on Sunday 3 January 1982. As a rough guide add 22 minutes to equatorial crossing times for UK.

Only three of these satellites are active transponders (like OSCAR 8 mode A), these being RS4, RS6 and RS8.

	RS4	**RS6**	**RS8**
Uplink (u.s.b./c.w.)	145·860-145·900MHz	145·920-145·960MHz	145·960-146·000MHz
Downlink (l.s.b.)	29·360-29·400MHz	29·410-29·450MHz	29·460-29·500MHz

HF Beacons are active on all devices. The non-transponding satellites, RS3, 5 and 7, feature a robot auto reporting system which will output a signal report in c.w. if, after hearing for example, "RS5 QSL" you respond by replying "RS5 de G4XYZ AR".

The robot system uses the following frequencies:

	RS3	**RS5**	**RS7**
Uplink	145·820MHz	145·830MHz	145·840MHz
Downlink	29·321MHz	29·331MHz	29·341MHz

Our very grateful thanks for this information go to Ron Broadbent G3AAJ, the tireless hon. sec. of AMSAT-UK.

For full details of membership of AMSAT-UK, which is available to all interested parties, send a large s.a.e. to: *AMSAT-UK, 94 Herongate Road, London E12 5EQ.*

The 1981 Girl Technician Engineer of the Year

The 1981 Girl Technician Engineer of the Year is Mrs Patricia Haynes, age 24, a Third Engineer (Contracting) with the Eastern Electricity Board, from Billericay, Essex. At a ceremony in London on 7 December, 1981, she was presented with the prize of £250 and an inscribed rose bowl by Sir Kenneth Corfield, Chairman and Chief Executive of Standard Telephones and Cables Ltd. and Chairman Designate of the Engineering Council. A special award was also made to the runner-up, Mrs Linda Gardner, age 29, a Higher Scientific Officer with the Ministry of Defence from Pershore Worcestershire.

Sponsored by The Caroline Haslett Memorial Trust and The Institution of

Electrical and Electronics Technician Engineers, this Award aims to focus attention on electrical and electronic engineering as a worthwhile career for women.

IEETE, 2 Savoy Hill, London WC2R 0BS. Tel: 01-836 3357.

Be Warned!

The Home Office issued this advice to the CB trade and prospective CB buyers on 7 December, 1981:

"Don't be misled by unfounded rumours claiming that the use of illicit 27MHz a.m. sets will be legalised; the Government has no intention of making any changes to the new legal 27MHz f.m. CB service."

The warning to traders and CB users follows a large number of inquiries to the Home Office concerning rumours of a.m. legalisation, and reports of a.m. sets carrying labels stating that the apparatus cannot be used "until April 1982" or similar wording.

Any such stickers or labels which imply pending changes in the UK CB service are quite simply hoaxes.

DXpedition to the UK

Members of the Surrey Amateur Radio Club, from the town of Surrey, British Columbia, will be coming to the UK to operate a special event station GB2BC, from British Columbia House, Regent Street, London, between 26 March and 1 April 1982.

The event is to commemorate the 110th Anniversary of the establishment of British Columbia House, and the party will be led by their Vice-President Ralph Webb VE7BVG. Two stations covering the h.f. bands are planned and contacts will be confirmed with a purpose designed QSL card.

The event is being supported by members of the Sutton and Cheam Radio Society from Surrey, with their Hon Vice-President Ron McDonald G3DCZ, acting as UK co-ordinator. Bernie Godfrey G4AOG, of Amateur Radio Exchange, has kindly offered assistance with the loan of equipment.

It would be greatly appreciated if any amateur could assist in providing accommodation, preferably on an "at cost" basis, to enable our Canadian friends to keep costs of the exercise down to a minimum. If you can help, or would like further information, please contact: *Ron McDonald, 60 Dudley Drive, Morden, Surrey SM4 4RJ.*

More on pages 39 & 43

MINI 'X' BEAM for 10 metres

F. C. SMITH GW2DDX

Miniature antennas have a fascination in their own right; but when the miniature antenna gives a DX performance only just short of the full size unit, it gives added satisfaction. The Mini "X" Beam is such an antenna.

The folded dipole elements make for a better feed line match, together with a broader bandwidth, than is obtained with single dipole elements; two essential conditions when shortened coil-loaded elements are used. Had the beam been made with rod elements constructional difficulties would have arisen; the estimated gain would have been 3dB; or less, and more important, difficulty in feed-line matching would result.

The "X" configuration brings the current loops closer together, thus giving power to the reflector element more efficiently than would be the case with a two element Yagi. The "X" elements also give a better front-to-back ratio than a two element Yagi.

It is well known that the centre portion of an antenna which carries most of the current does 90 per cent of the radiation, the λ/8 end-sections serve mainly to bring the antenna to resonance, thus folding these end sections back caused very little loss in the performance. This method was followed, and it left 2·74m of the dipole for radiation.

It may be mentioned that the parallel elements for a two element beam, would have demanded 3·35 metre span coil-loaded, with the Mini "X" this length of spacing, is cut down to a mere 2·134m without loss of radiation efficiency; a space saving of 1·219m. This is obtained, of course by the shape of the X configuration. The actual dimensions of the Mini "X" are just 2·134 × 1·829m and therefore small enough to fit in the attic.

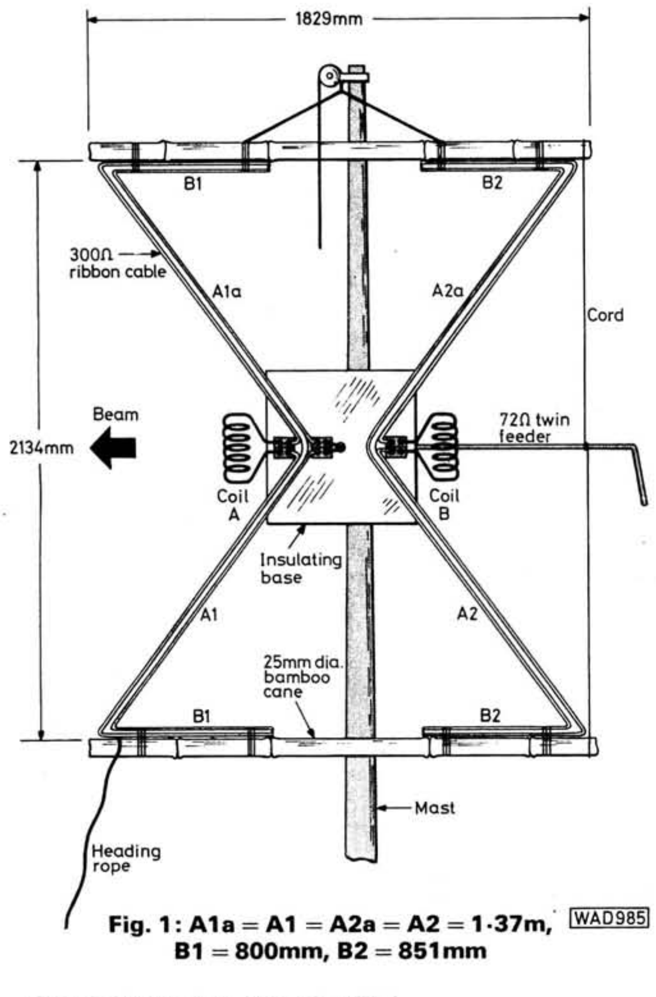


Fig. 1: A1a = A1 = A2a = A2 = 1·37m, B1 = 800mm, B2 = 851mm

Gain

The estimated gain of a folded dipole in the "X" configuration is given as 6dB. The gain of the Mini "X" has not been measured by the writer; but with the restrictions in size, it should be around 5dB. For its size, and this amount of gain, it adds up to quite an antenna.

For best results the beam should be hoisted to a height of 7·5 to 9m. It can, of course, be used horizontally but in the writer's case it is mounted vertically for convenience. If vertically polarised, as in Fig. 1, the feeder cable is led past

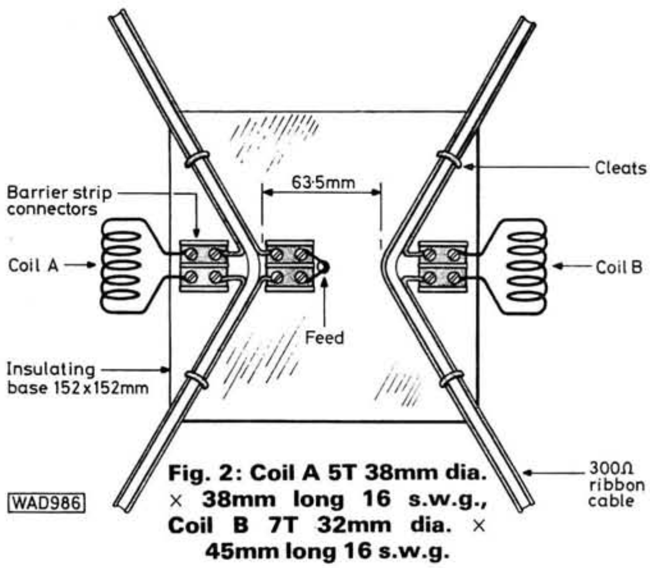
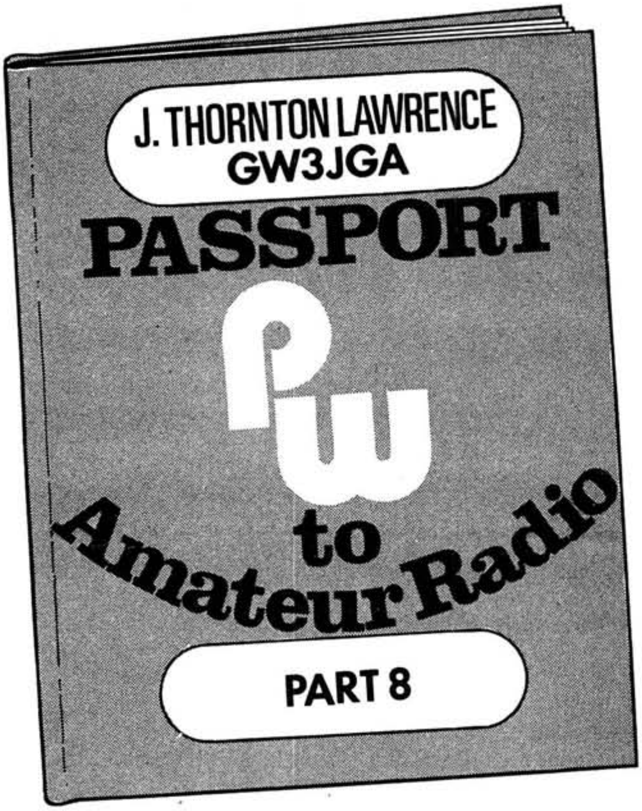


Fig. 2: Coil A 5T 38mm dia. × 38mm long 16 s.w.g., Coil B 7T 32mm dia. × 45mm long 16 s.w.g.

continued on page 64▶▶▶



This month we move on to look at transmitter measurements and receivers.

Frequency Measurements

The Licence requires that;

1) "A satisfactory method of frequency stabilisation shall be employed in the sending apparatus comprised in the station."

If the transmitter is crystal controlled (the basic frequency determining oscillator employs a quartz crystal), then excluding faulty operation, the frequency stability will be adequate; also, if the crystal is of reputable manufacture and calibrated, then the oscillator frequency will be known.

If the transmitter contains a variable frequency oscillator (v.f.o.) then it must be of good mechanical and electrical design, employ stable components and be operated from stable supplies, for the output frequency to have satisfactory stability.

The Licence also requires that;

2) "Equipment shall be provided capable of verifying that the sending apparatus is operating with emissions within the authorised bands."

If the transmitter is crystal controlled then an absorption wavemeter of suitable range and accuracy is necessary to check that the desired harmonic of the crystal frequency is selected.

If the transmitter is not crystal controlled then a wavemeter based on a crystal oscillator is also required. This may be of the heterodyne type or a digital frequency counter may be used.

Wavemeters

There are two main types of wavemeter; the absorption wavemeter and the heterodyne wavemeter.

Absorption wavemeter: Fig. 63, this consists of a coil and variable tuning capacitor with a calibrated dial.

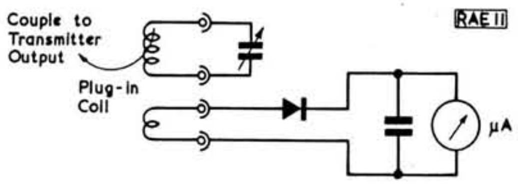


Fig. 63: An absorption wavemeter circuit

It absorbs power from an r.f. circuit when the coil is held close to the circuit in question and the wavemeter is tuned to the same frequency.

This is indicated by a variation or "dip" in the anode/collector current of the stage associated with the circuit being tested.

Sometimes a rectifier diode is coupled to the wavemeter circuit and a microammeter used to indicate power absorbed from the transmitter circuit. The absorption wavemeter is not very accurate, about 2-5 per cent, but gives an unambiguous indication and is very useful for checking a transmitter output frequency and the operation of frequency multiplying stages.

When used with a crystal controlled transmitter, it satisfies the licensing requirement for determining that emissions are within the band. The wavemeter frequency range should extend to the second and third harmonic of the highest frequency to be transmitted, so that it can also be used to check the output of the transmitter for harmonics and other spurious emissions.

Heterodyne wavemeter: This uses a high stability variable frequency oscillator having a finely calibrated or vernier tuning scale. A mixer stage and headphone amplifier are included for comparing the incoming frequency with the variable oscillator and for checking the variable oscillator against a built-in crystal oscillator. The v.f.o. output can also be used to calibrate a receiver. A block diagram is shown in Fig. 64.

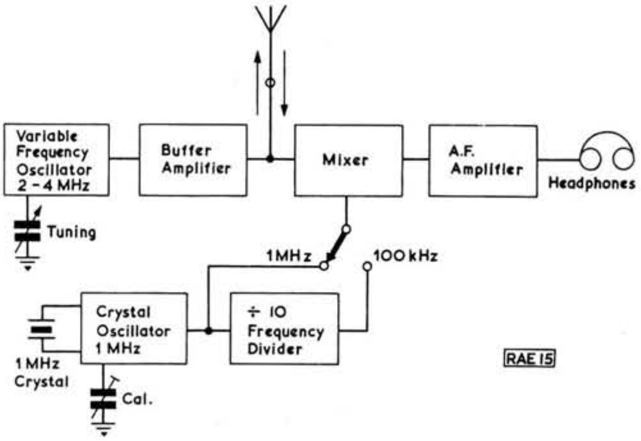


Fig. 64: Block diagram of a heterodyne frequency meter

Initially the 1MHz crystal oscillator is set on frequency by zero-beating either its 5th harmonic with a standard frequency transmission (e.g. MSF or WWV on 5MHz) using a separate receiver, or alternatively, the second harmonic of the 100kHz signal with Droitwich (Radio 4) on 200kHz.

The v.f.o. is calibrated by tuning over the frequency range and recording the dial readings where each zero beat note with the crystal oscillator is obtained; 1MHz points first, then 100kHz points. Frequencies in between can be determined by interpolation or drawing a graph.

A transmitter frequency within the v.f.o. range can be measured by loosely coupling the wavemeter to the transmitter (a short length of wire lead near the transmitter is adequate) and tuning the v.f.o., for zero beat. The dial reading is recorded and the frequency determined from the graph or from the nearest crystal calibration points above and below the frequency, as shown in the example in Fig. 65.

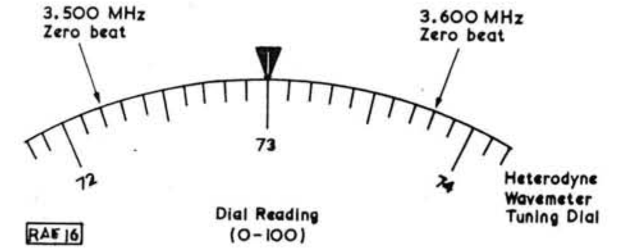


Fig. 65: Interpolating between crystal calibrator points

A receiver can be calibrated by tuning it to the v.f.o. fundamental or harmonic frequency output.

Crystal Calibrator

The crystal calibrator employs a crystal oscillator and frequency divider(s) to generate a number of harmonically related "marker" frequencies, e.g. 1MHz and 100kHz as shown in Fig. 66.

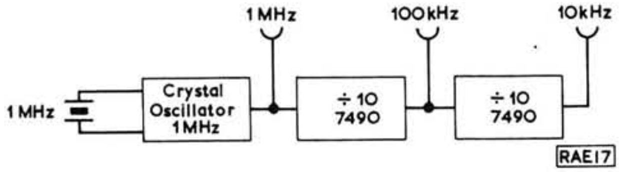


Fig. 66: Block diagram of a crystal calibrator unit

These output frequencies can be used to calibrate a receiver and this in turn can then be employed to check the frequencies of a transmitter by noting the receiver tuning dial reading and interpolating between the nearest crystal marker points.

The 100kHz and 10kHz markers may conveniently be used up to a few MHz but at higher frequencies the spacing between the marker points is inconveniently small and the 1MHz marker should be used.

A crystal calibrator, used with a receiver having a suitable bandspread dial and an absorption wavemeter as described previously, would enable the frequency checking requirement of the licence to be met.

Input Power Measurements

For c.w., a.m. and f.m. emissions the Amateur Licence requires that the maximum d.c. power input to the device energising the antenna, shall not exceed the stated figure for the particular frequency band as given in "The Schedule", see Appendix B of *How to Become a Radio Amateur*.

The d.c. power input is the product of the supply voltage and the supply current to the output device, as shown in Fig. 67. Provision for measuring the voltage and current may be incorporated in the transmitter. Alternatively, external voltage and current meters may be required and adequate safety precautions should be taken, bearing in mind the high voltage which may be present.

Output Power Measurements

Transmitter output power can be calculated by measuring either the r.f. current into, or the r.f. voltage across, a non-inductive "dummy load" resistor connected to the transmitter output.

Suppose the transmitter is operating with d.c. input power to the output device of 150 watts and that this device is 66·6 per cent efficient, then the output power would be $150 \times \frac{66 \cdot 6}{100} = 100$ watts.

A dummy load resistor of 50Ω connected to the output would have a current of 1·41 amps r.m.s. flowing through it and 70·0 volts r.m.s. across it.

$$I_{r.m.s.} = \sqrt{\frac{W_{r.m.s.}}{R}} = \sqrt{\frac{100}{50}} = \sqrt{2} = 1 \cdot 41 \text{ amps r.m.s.}$$

$$V_{r.m.s.} = \sqrt{W_{r.m.s.} \times R} = \sqrt{100 \times 50} = 70 \cdot 7 \text{ volts r.m.s.}$$

Modulation Measurements

It is most important that a transmitter is not over-modulated as this will cause spurious signals to be radiated. Amplitude modulation A3E (A3) can be checked using an oscilloscope with the vertical deflection plates connected across the dummy load as shown in Fig. 67.

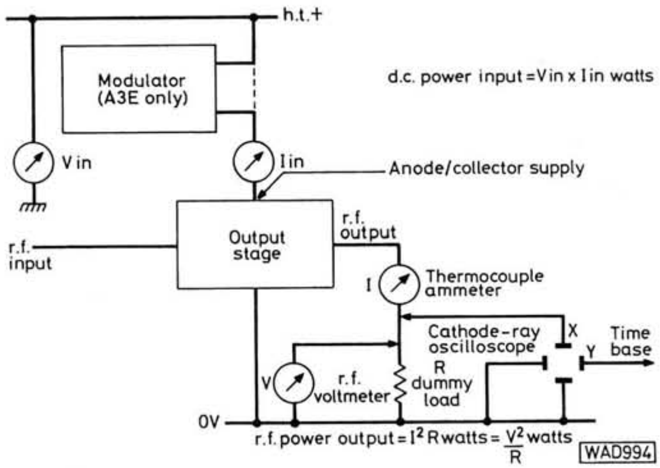


Fig. 67: Transmitter power measurement

In the modulated condition the r.f. carrier will give a certain amplitude of deflection, as shown to the left of Fig. 68(a).

With sine wave modulation applied, the amplitude of the r.f. voltage across the load is seen to vary from zero to twice the unmodulated amplitude.

The depth of modulation (per cent) is given by $\frac{a}{b} \times 100$, which in this case (as a=b) is 100 per cent. If a was half the amplitude of b then the depth of modulation would be 50 per cent.

Peak Envelope Power (p.e.p.)

The r.f. r.m.s. power output at the peak of the 100 per cent modulation envelope (where the voltage across the load is doubled) is given by,

$$W = \frac{V^2}{R} = \frac{(70 \cdot 7 \times 2)^2}{50} = \frac{(141 \cdot 4)^2}{50} = \frac{20\,000}{50}$$

=400 watts peak envelope power

A fully modulated A3E transmitter running 150 watts input (with an efficiency of 66·6 per cent) produces an output of 400 watts p.e.p.

The licence requires that the output power of an s.s.b.transmitter R3E, J3E (A3A, A3J), under linear operation, shall be limited to 2·667 times the d.c. input power, appropriate to the frequency band concerned.

To continue with our previous figures, 150 watts d.c. input × 2·667=400 watts p.e.p.

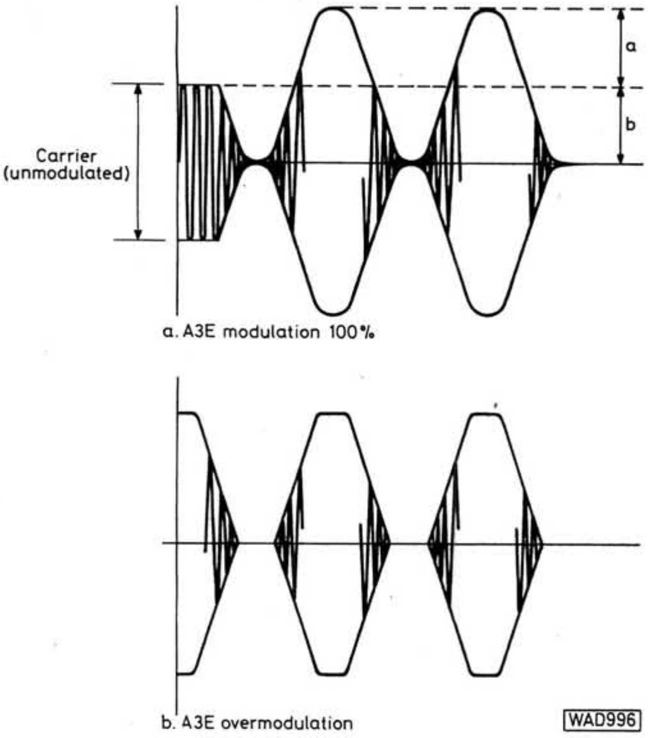


Fig. 68: Modulation patterns for an A3E signal. Note that in the overmodulated condition flattening of the peaks will usually occur

So the maximum p.e.p. output allowed by the Licence is the same for a.m. A3E (A3) or s.s.b. R3E or J3E (A3A or A3J).

You will notice that the Schedule in Appendix B gives the d.c. power input and the equivalent p.e.p. output for R3E (A3A) and J3E (A3J) operation on the various bands.

The most convenient way of measuring the p.e.p. output of an s.s.b. transmitter, is to use a two-tone test. This involves modulating the s.s.b. transmitter simultaneously with two sinusoidal tones, of equal amplitude, typical frequencies being 1kHz and 1·5kHz. The resultant modulation envelope, when displayed on an oscilloscope, is shown in Fig. 69.

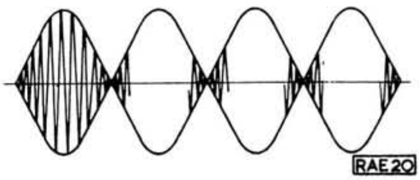


Fig. 69: Oscilloscope display of an s.s.b. signal modulated by two sinusoidal tones of equal amplitude

The mean power output of a correctly adjusted s.s.b. transmitter using a two-tone test is half the peak envelope power.

Returning to our s.s.b. transmitter, this means that when the output is 400 watts p.e.p. the mean power into the dummy load is 400/2=200 watts.

The two-tone test enables the transmitter peak envelope power to be assessed using conventional mean power measurements.

To summarise the s.s.b. p.e.p. measurement (based on an extract from the UK Licence):

1) Apply two non-harmonically related sinusoidal tones of equal amplitude to the s.s.b. transmitter, with the carrier fully suppressed and adjust the input power to give a mean radio frequency output power, under linear operation, of half the allowed peak envelope power, when measured into a resistive load by means of an r.f. meter. Under this condition, note the peak-to-peak deflection on the cathode ray oscilloscope.

2) Replace the tone by speech; the maximum vertical deflection on the cathode ray oscilloscope shall not be greater than the previously recorded deflection obtained with the two-tone input.

Frequency Selection for Receivers

A radio receiver must be capable of selecting the desired signal from possibly hundreds of other radio signals arriving at the receiver simultaneously.

The "selectivity" or passband of the receiver must be appropriate to the signal being received. If it is too narrow, some information may be lost or distorted, if it is too broad, adjacent transmissions may be received as interference. The receiver must also be free from spurious responses away from the normal tuning range.

Amplification (Gain)

Desired signals arriving at the receiver antenna terminal may vary in strength from about a microvolt (or less at v.h.f.) to several hundred millivolts or more. If the signal is weak, it may require considerable amplification to raise it to a suitable level for detection.

Demodulation

Demodulation, as the name suggests, is the process of extracting the transmitted information (modulation) from the r.f. signal. The detector or demodulator stage and its operation must suit the type of modulation in use.

Receivers employ various techniques to achieve these functions and the ultimate performance usually depends on the degree of sophistication utilised—which is often reflected in the price.

A communications receiver used by radio amateurs will normally cover one or more of the allocated frequency bands and be capable of interpreting several modes of modulation.

The Tuned Radio Frequency Receiver

In its simplest form, the t.r.f. receiver consists of a variable frequency band-pass filter, to select the required signal, followed by a demodulator stage to extract the information.

This is the basic circuit of the old "crystal set" or the present-day absorption wavemeter shown in Fig. 70. A single tuned circuit provides the selectivity and a diode performs the demodulation of an amplitude modulated A3E (A3) transmission. See Fig. 44 in Part 6.

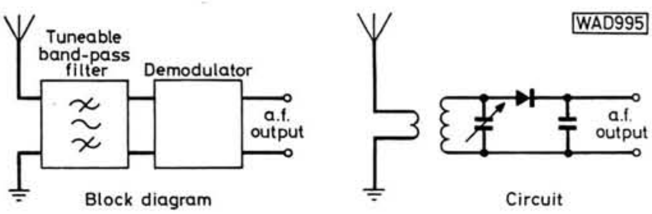


Fig. 70: "Crystal Set"—absorption wavemeter

An improvement in selectivity and sensitivity can be obtained by increasing the number of tuned circuits, by using positive feedback (reaction or regeneration) to increase their "Q" and by incorporating one or more stages of amplification.

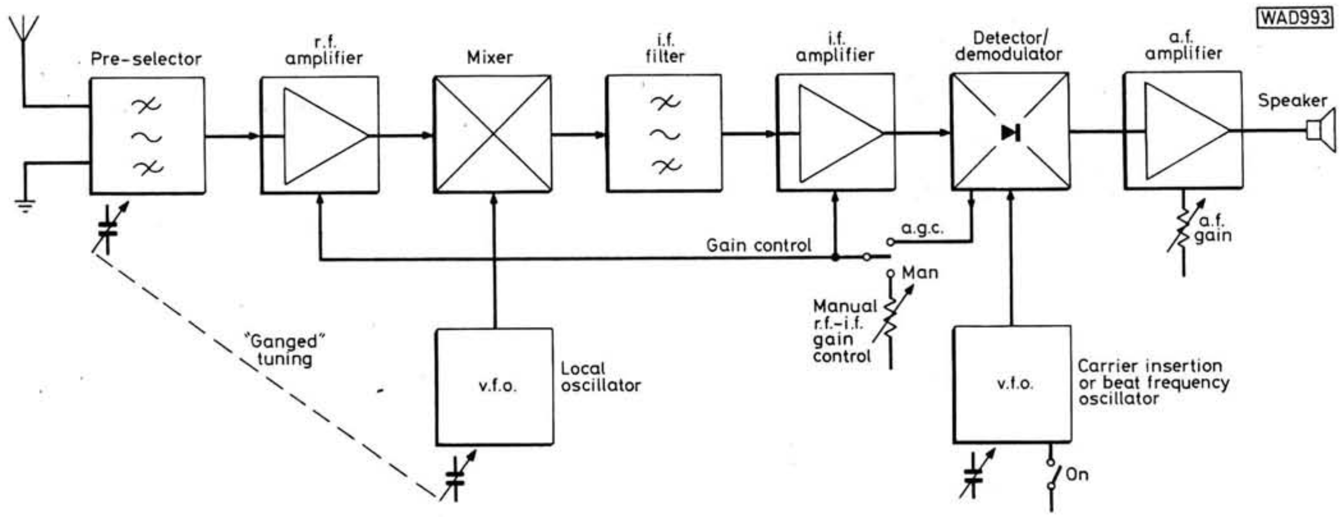


Fig. 71: Block diagram of a basic superheterodyne

The t.r.f. receiver has a strong place in the history of radio communication going back into the early days of broadcasting and there are many old timers who will tell you how they first received America on a home-built 0-V-1 (detector and one a.f. stage).

However, the t.r.f. receiver is no longer adequate for serious communication purposes in present day conditions but serves to illustrate a principle and provide a comparison with the superheterodyne receiver.

The Superheterodyne

The fundamental difference between the t.r.f. and the superhet receiver is that the selectivity of the former is obtained in its tuned circuits at the incoming radio frequency whereas in the superhet, incoming signals are converted in the frequency-changer section, to a fixed intermediate frequency (i.f.). Here the required selectivity and amplification can readily be obtained, prior to feeding the appropriate demodulator stage. A block diagram of a basic superhet receiver is shown in Fig. 71.

To convert the incoming signal frequency to the i.f. a local oscillator and mixer stage are employed as the frequency changer. The local oscillator has a frequency which is different from the incoming signal by an amount exactly equal to the i.f. For example:

Local oscillator frequency = 2·350MHz
Intermediate frequency = 0·450MHz
Input signal $f_{osc} - f_{i.f.}$ = 1·900MHz

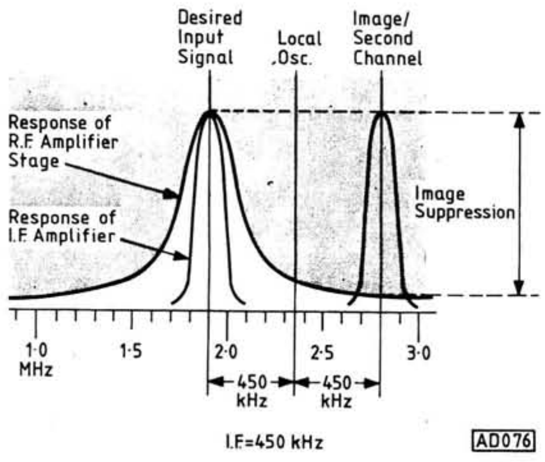


Fig. 72: Suppression of the second channel or image response

Note that it is the local oscillator and intermediate frequencies which determine the signal frequency being received; in the example the incoming signal is 450kHz below the local oscillator.

However, using the same i.f. and local oscillator frequencies we find that our superhet will also receive signals on a different frequency, known as the image frequency or second channel.

Local oscillator frequency = 2·350MHz
Intermediate frequency = 0·450MHz
Image $f_{osc} + f_{i.f.}$ = 2·800MHz

This is demonstrated in Fig. 72.

Second Channel Image Response

To reduce the unwanted image or second channel response, it is essential that the tuned circuits in the r.f. stage and prior to the mixer, only accept the desired signal and reject the image. This means that as the receiver is tuned over the frequency band the local oscillator and r.f. tuned circuits (although on different frequencies) must "track" one another. This is done by mechanically "ganging" the tuning capacitors and choosing appropriate values in the tuned circuits.

The amount by which the image response is reduced or suppressed depends on the selectivity of the r.f. stages and the relative frequency of the i.f. In general a higher-frequency receiver will require a higher frequency i.f. Typical examples are given in the table.

Receiver Type	Input r.f.	Typical i.f.
Domestic Radio	600kHz–1·6MHz	470kHz
Communications	1·5MHz–30MHz	1·6MHz
VHF	144MHz–146MHz	10·7MHz

In the higher frequency receivers, employing a high frequency i.f. it is sometimes necessary to convert again to a lower i.f. in order that the desired selectivity is achieved: this is known as double conversion.

Mixer Stage

There are many mixer circuit configurations used in practical receivers each having desirable (and some *un*desirable) features. The mixer stage is required to accept the local oscillator signal and the incoming signals (ranging from microvolts to volts) and to produce sum and difference frequencies, one of which will be filtered out as the i.f. for subsequent amplification and demodulation.

An important feature of the mixer stage is its linearity and absence of cross-modulation. Cross-modulation is an effect which occurs when a very strong signal enters the mixer (or other stage) and drives the stage into a very non-linear condition where modulation of the weaker signal by the stronger signal takes place.

A simple transistor mixer stage is shown in Fig. 73(a). Mixer stages employing bipolar transistors usually have poor cross-modulation characteristics. A mixer comprising a "ring" of diodes gives good cross modulation performance but requires more signal from the local oscillator. Its circuit is shown in Fig. 73(b). To achieve optimum performance, a set of diodes with matched characteristics are employed.

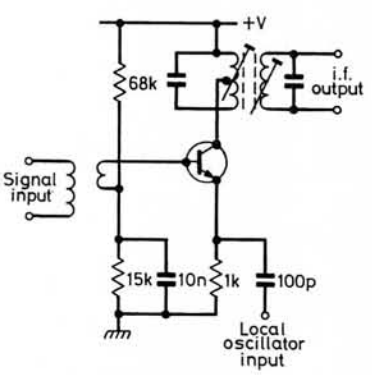


Fig. 73(a): ▲Transistor mixer stage

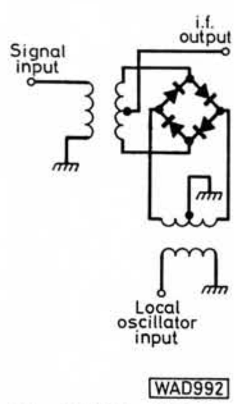


Fig. 73(b): ▲Diode ring mixer

Local Oscillator

The frequency stability and tuning accuracy of a superhet receiver is determined by the local oscillator. Considerable design effort, good mechanical construction and expensive high quality components go into a good variable frequency oscillator. The oscillator is usually isolated from the mixer stage by a buffer amplifier.

However, the availability of low cost digital integrated circuits has made the frequency synthesiser circuit an attractive way of generating the local oscillator frequency.

Frequency Synthesiser

A typical frequency synthesiser consists of a voltage controlled oscillator, a variable frequency divider and a phase comparator. The output frequency of the v.c.o. is a function of an applied control voltage. The output of the phase comparator is a voltage which is proportional to the phase difference between the signal at its two inputs. This output controls the frequency of the v.c.o. so that the phase comparator input from the v.c.o. via the variable frequency divider remains in phase with the reference input from a crystal oscillator. The oscillator stability is directly related to the stability of the crystal oscillator plus any phase noise in the phase comparator. To minimise this noise a low pass filter is usually fitted in the d.c. path between the phase comparator and the v.c.o. as shown in Fig. 74.

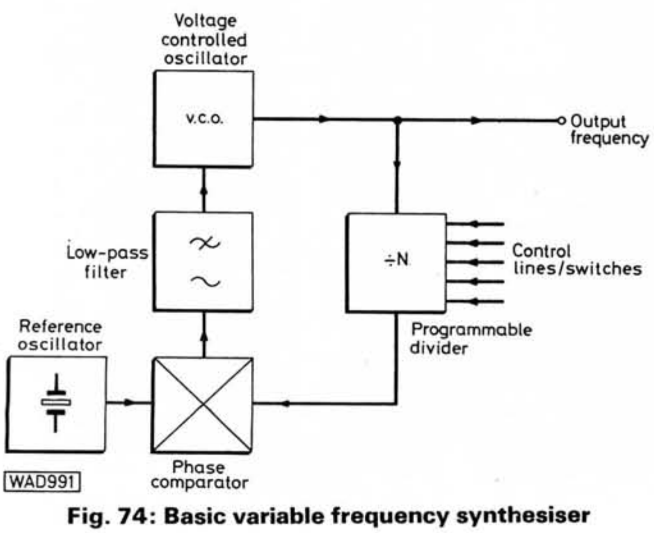


Fig. 74: Basic variable frequency synthesiser

The i.c. programmable divider may be operated by switches for tuning the specific channel frequencies. Alternatively, the divider may be controlled by an up-down counter driven by the "tuning" knob to give the effect of continuous tuning, but actually changing frequency in discrete steps of typically 100Hz.

The basic frequency synthesiser shown illustrates the principle of operation. Practical synthesisers employ more complex circuit arrangements to suit the receiver requirements.

In a transmitter-receiver, the same synthesised v.f.o. may be used both on transmit and receive, and it may be controlled by an i.c. memory for storing various frequency settings.

Preselector and RF Amplifier

The purpose of this stage is to select the desired input signal and to reduce as much as possible the image or second channel response. With a low i.f. the image is relatively close and this demands fairly high "Q" tuned circuits which must be ganged with the local oscillator tuning to keep in step or "track" as the receiver is tuned.

If a relatively high i.f. frequency is used then the frequency of the image response will be far removed from the primary response and the tuning requirements for the r.f. amplifier will be less stringent. A fixed frequency broad band filter may provide adequate r.f. selectivity for this purpose.

The r.f. amplifier should contribute a minimum of noise to the incoming signal and as it will be handling signals from microvolts to volts it should have excellent linearity so that strong adjacent signals do not cause cross modulation of the desired weaker signal.

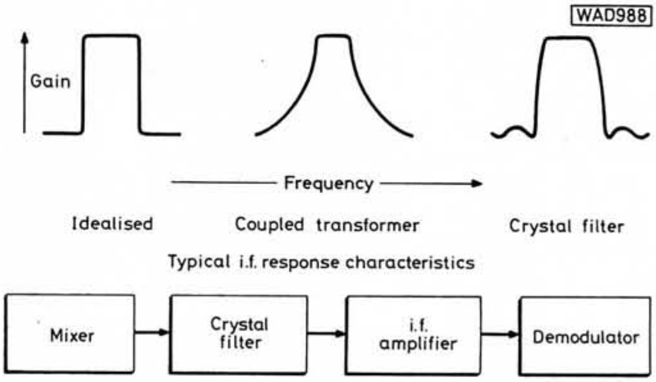


Fig. 75: Using a crystal filter to obtain i.f. selectivity

IF Filter

In most modern receivers the i.f. selectivity is obtained by the use of a multiple crystal filter unit having a specific bandwidth and response shape. The bandwidth is chosen to suit the transmission mode.

Mode	Typical Bandwidth
c.w. A1A-A1	0·3-0·6kHz
s.s.b. J3E-A3J	2·7kHz
a.m. A3E-A3	5·5kHz
n.b.f.m. F3E-F3	6-10kHz

For multi-mode receivers the appropriate filter will be switched in as required.

The i.f. filter, having defined the receiver passband, is followed by a broad band amplifier to bring the signal up to the required level for demodulation. Automatic Gain Control (a.g.c.) is provided to adjust the overall i.f. gain to suit the demodulator stage and to counter any fluctuations of the received signal.

The crystal filter unit is relatively expensive and low cost receivers may use several amplifier stages each with double tuned i.f. transformers or ceramic filters to provide a passband approaching (but not equalling) the characteristic of a crystal filter, as shown in Fig. 75.

A3E Demodulation

In Fig. 76, the output from the i.f. amplifier is rectified by D1. An i.f. filter is formed by C15 and R17 and C16 which removes the i.f. "ripple", leaving a direct voltage, the value of which is dependent upon the strength of the incoming signal. The amplitude modulation appears as an a.f. signal, superimposed on this voltage, across the a.f. "gain" control VR2. The a.f. signal is passed by C17 to an a.f. amplifier stage. The demodulator waveforms are similar to those shown in Fig. 45.

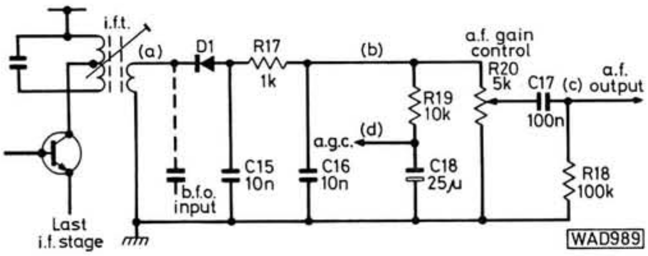


Fig. 76: Circuit of a basic a.m. (envelope) demodulator

Automatic Gain Control

The direct voltage appearing across R20 can be fed back via the a.g.c. line to control the gain of the r.f. and i.f. stages. A strong input signal will thus reduce the gain of the receiver and vice versa, resulting in a relatively constant level of output even when propagation conditions cause fading of the received signal.

The low-pass filter formed by R19 and C18 allows a slowly-changing voltage to be fed back to compensate for fading but prevents a.f. signals from reaching the a.g.c. line.

Beat Frequency Oscillator

When receiving c.w. it is necessary to mix the i.f. signal appearing at the demodulator with another oscillator to produce an a.f. beat note. Suppose we decide that a comfortable listening pitch would be 1kHz and the intermediate frequency is 450kHz, then the beat frequency oscillator would be adjusted to 451kHz (or 449kHz) to produce a difference frequency of 1kHz.

SSB Demodulation

The same b.f.o. can be used when receiving s.s.b. signals to re-insert the carrier (b.f.o. becomes carrier insertion oscillator c.i.o.), so enabling the signal to be demodulated. In this mode, as with c.w. it is more satisfactory to switch out the a.g.c. and to use the manual r.f. gain control in order to adjust the signal level at the demodulator stage for optimum results.

The c.i.o. must insert the carrier in the correct position relative to the s.s.b. signal or the a.f. modulation will be shifted in frequency (and sound like Donald Duck, or worse).

Receivers designed specifically for s.s.b. reception employ a balanced demodulator as shown in Fig. 77. Compare this with Fig. 54 in the Transmitter section.

The b.f.o./c.i.o. tuning range will be restricted to about 5kHz above and below the i.f.

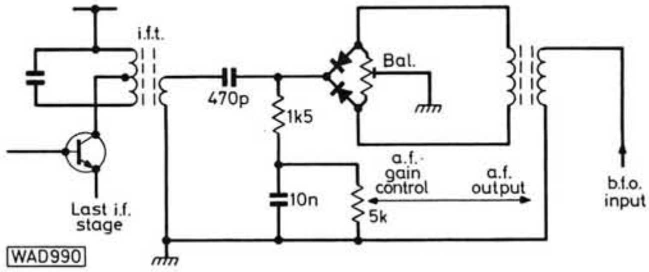


Fig. 77: The balanced demodulator

Narrow Band FM Demodulation

Where the receiver is used for the reception of n.b.f.m. signals, a separate demodulator is required. There are several popular circuit configurations, the circuit shown in Fig. 78 is the Ratio Detector.

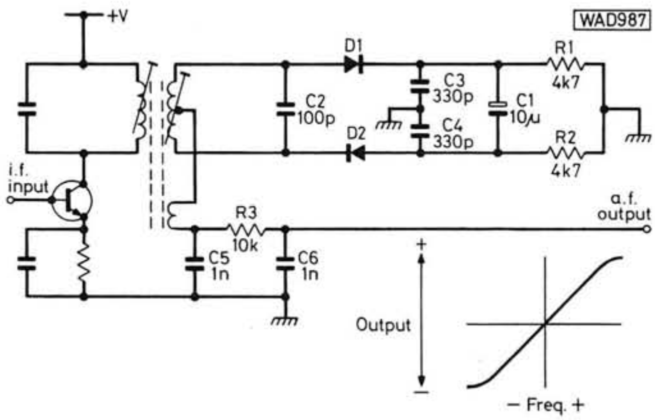


Fig. 78: Ratio detector f.m. demodulator

The tuned secondary winding of the i.f. transformer is made resonant at the i.f. centre frequency. An untuned coupling winding feeds a reference signal to a centre tap on the tuned secondary winding.

As the rectifier diodes are in series, the same rectified current flows through each. The d.c. causes equal voltage to appear across R1 and R2, the sum of these voltages across each diode is equal and this results in zero volts at the secondary centre tap and across C5.

When the i.f. is frequency modulated, the relative phase of the voltage from the tuned secondary winding and the reference winding varies and unequal voltages appear across the diodes. This produces an audio voltage across C5 proportional to the deviation of the i.f. signal. I.f. filtering is provided by R3, C6.

continued on page 59▶▶▶

RADIO SPECIAL PRODUCT REPORT

DRAKE TR7

TR7 HF TRANSCEIVER

This month, we look at one of the few amateur radio transceivers currently available in the UK which do not originate in Japan. The Drake TR-7 is designed and manufactured to very high standards in the USA.

The TR-7 is all solid-state, with a broadband transmitter output stage requiring no tuning. Frequency coverage is in bands 500kHz wide, with the band-switch selecting segments with lower extremes at 1·5, 2·5, 3·5, 5, 7, 14, 21 and 28·5MHz. Pressing the UP or DOWN buttons then shifts the tuned frequency in 500kHz steps up to limits shown on the band-switch, giving general coverage reception. Transmission is automatically inhibited in any 500kHz segment not containing one of the pre-WARC'79 h.f. amateur bands, though a special board (Type AUX-7) and modules are available to extend coverage to other frequencies, such as the new 30, 17 and 12m amateur bands, or (for reception only) down to v.l.f.

On receive, the signal from the antenna socket is fed via low-pass and high-pass filters selected by the band-switch, then via a 30MHz low-pass filter to a high-level double-balanced mixer where it is heterodyned with the synthesiser v.c.o. output to produce the first i.f. signal at 48·05MHz. This is amplified in a j.f.e.t. stage having high dynamic range and low noise, and then passed via a 4-pole monolithic crystal filter with a bandwidth of 8kHz, which protects subsequent stages from strong interfering signals.

After a further stage of amplification, the signal is converted to the second i.f. of 5·645MHz in the 2nd mixer. This signal then passes via the optional noise-blanker (Type NB-7) and the main i.f. crystal filter (with optional alternative bandwidths) to three stages of i.f. amplification, and the envelope or product detector as appropriate to the mode in use. An i.c. audio amplifier drives the loudspeaker or 'phones.

The drive to the 2nd mixer and the b.f.o./c.i.o. drive are both derived from a crystal oscillator which can be "pulled" over a limited range by the front-panel variable passband tuning (p.b.t.) control. It is therefore possible to shift the second i.f. signal within the bandwidth of the main i.f. crystal filter, to eliminate interfering signals on adjacent frequencies, without changing the pitch of a c.w. or s.s.b. signal, since both drives change in frequency by the same amount.

On transmit, audio signals from the microphone drive the balanced modulator and VOX circuits. The d.s.b.s.c. output from the modulator has one sideband removed by passing it through the main i.f. crystal filter, and the resulting s.s.b. signal is applied to a summing amplifier. Here, carrier can be added to produce a.m.-compatible s.s.b. (H3E—A3H) when the a.m. mode is selected. On c.w., the balanced modulator is disabled and the output of a keyed oscillator running at 5·6458MHz is applied to the summing amplifier. The output of the summing amplifier goes to a variable attenuator controlled by the automatic level control (a.l.c.) circuitry, which sums the forward and reflected power readings at the antenna terminal and adjusts the transmitter drive to provide v.s.w.r. protection and to prevent flat-topping and overdrive of the final power amplifier stage. A nominal 50 per cent of output power is maintained into a load with 4:1 v.s.w.r. The front panel CARRIER LEVEL control also operates on the a.l.c. circuit.

From the variable attentuator, the signal goes to the 2nd mixer and then follows the path to the antenna socket as described for the receiver, but in the reverse direction. The transmit driver and power amplifiers are inserted between the band-switched high-pass and low-pass filters.

The frequency of the v.c.o. driving the 1st mixer is monitored by a 6-digit frequency counter with 100Hz resolution. This counter normally operates with a 48·05MHz offset, but it can be switched to give direct readout of the frequency of an external signal applied to a rear-panel socket, up to 150MHz.

Controls & Connections

Both digital (8mm high red l.e.d.) and analogue frequency readouts are provided. The band-switching arrangements have already been described. The illuminated "S" meter indicates forward or reflected power on transmit.

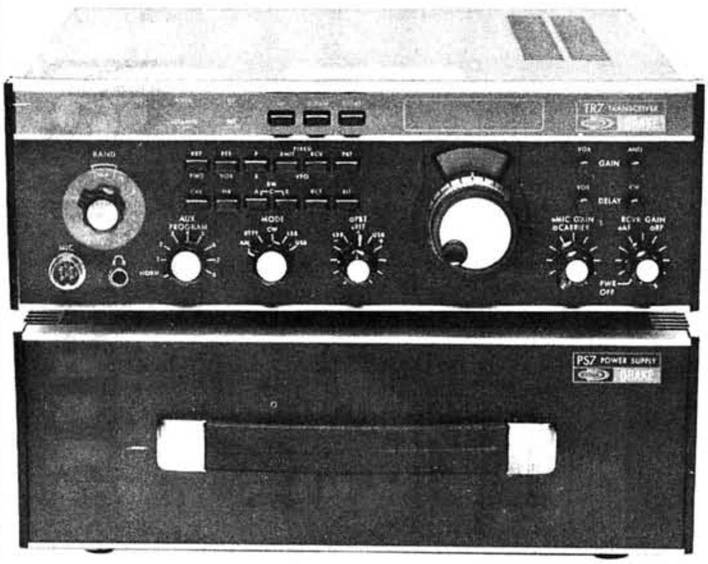
Push-button switches control the following functions: reflected/forward power monitoring; VOX inhibit; fast/slow a.g.c. decay; optional fixed-frequency (crystal-controlled) transmit and receive; p.b.t.; r.i.t.; 25kHz calibrator; noise blanker; receive bandwidth; remote frequency control.

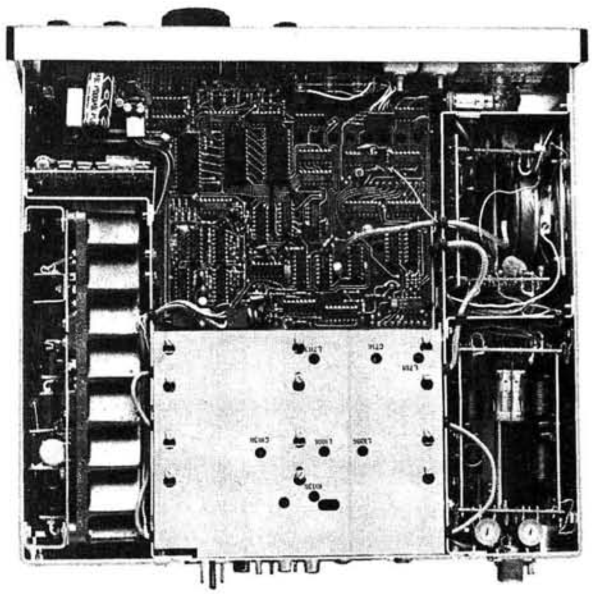
Variable controls are provided for: p.b.t.; r.i.t.; microphone gain; carrier level; receiver r.f. and a.f. gain. Front-panel preset controls adjust VOX gain and hang-time; anti-VOX gain; c.w. hang-time. An indicator lamp shows correct operation of the a.l.c. circuit.

On the rear panel, there are connectors for: 13·6V d.c. power input; a.c. mains p.s.u. control; external loudspeaker; low-level audio output; external receive antenna input; antenna output to separate receiver; v.l.f. receive antenna; Morse key; linear amplifier VOX and a.l.c.; remote v.f.o., accessory inputs and outputs; frequency counter input; and (of course) antenna and earth. There is also a 117V a.c. socket (powered from the a.c. mains p.s.u. transformer) to drive the optional p.a. fan which is required for 100 per cent duty-cycle operation on SSTV and RTTY.

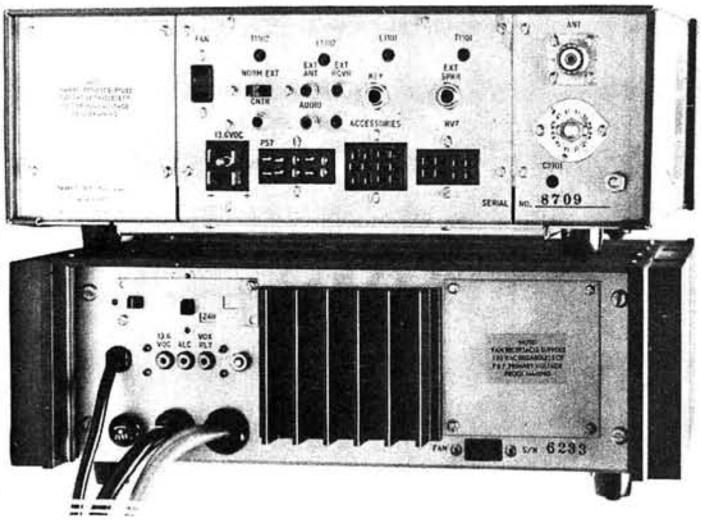
Operating Impressions

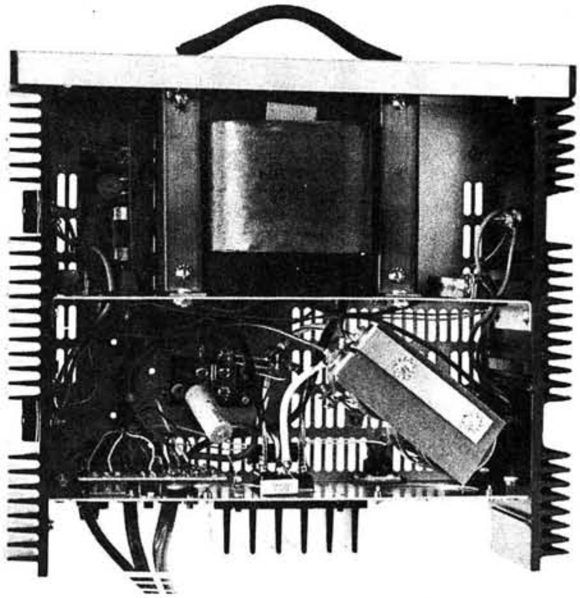
The TR-7 has a reputation for reliability and ruggedness. A two-year round-the-world voyage on board the brigantine *Eye of the Wind* without need for service or repair, and full-power key-down c.w. operation into a dummy load without distress for the duration of the 1980 Leicester ARRA exhibition are just two examples.





Front and rear views of the TR-7 and PS-7, and what they look like inside. The p.a. heatsink is mounted internally, to allow forced draught cooling by the optional fan





We worked a considerable amount of RTTY on the review rig at the Breadboard Exhibition last November, and although I suspect we exceeded the 33 per cent duty-cycle, 5-minute transmission limits for an "un-blown" p.a., it never protested. The combination of special RTTY mode-switch setting and optional 1·8kHz i.f. filter is very effective. We also had the optional 500Hz (c.w.) filter and 6kHz (a.m.) filter fitted, the former being a great help on the crowded h.f. bands.

The review TR-7 has been run on trapped verticals, trapped dipoles, Yagis and long wires, all with success, and is a joy to operate on all modes. Reports of speech quality are "excellent". The tuning rate of 25kHz per revolution of the main tuning control gives easy resolution of sideband signals, and the receive side handles well in every respect.

The associated PS-7 a.c. mains power supply (13·6V 25A d.c. output) is fitted with 1·7m-long leads which plug into the back of the TR-7. This, plus the fact that the a.c. input to the PS-7 is switched on the TR-7 front panel, means that you can hide the power supply away under the desk—a great space-saver at the operating position. The frequency counter facility (50mV sensitivity, 2V maximum input) gives coverage up to the 2m amateur band, and is a nice bonus.

After the bouquets, the brickbats, though there aren't many of those. To my mind, the TR-7 has only one feature which I would term a gimmick, and just one feature missing. The gimmick is a STORE button on the digital frequency readout. When pressed, this latches the display to the last reading, and disconnects it from the tuning control. The idea is that you can use the display as a "scratch-pad" memory for the channel you were on whilst you go off and check another part of the band, using the analogue readout. The snag is that if you forget you've pressed the button, and retune whilst listening rather than looking, when you look back at the digital display you're not on the frequency *it says* you are. This caused me to commit the crime of transmitting beyond the band edge, and I resolved there and then never to press the STORE button again! The missing feature is a speech processor, but there is a separate r.f. processor unit, the SP-75, available from Drake.

★ specifications

Frequency coverage: (transmit)	1·5–2·0MHz (160m) 3·5–4·0MHz (80m) 7·0–7·5MHz (40m) 14·0–14·5MHz (20m) 21·0–21·5MHz (15m) 28·0–30·0MHz (10m)
Frequency coverage: (receive)	1·5–30·0MHz
Types of emission:	A1A (c.w.), H3E (a.m.-compatible s.s.b.), and J3E (u.s.b./l.s.b.)
Power input:	A1A 250W d.c. H3E 80W carrier plus upper sideband J3E 250W p.i.p.
Carrier suppression:	Greater than 60dB
Unwanted sideband suppression:	Greater than 60dB at 1kHz
Spurious output:	Better than −50dB
Harmonic output:	Better than −45dB
Intermodulation distortion:	30dB below p.e.p. (24dB below one of two tones)
Frequency stability:	Total drift less than 100Hz after warm-up. Less than 100Hz change over 11–16V d.c. input supply range
Antenna impedance:	50Ω unbalanced
Receiver sensitivity:	A1A/J3E 0·5μV for 10dB (S+N)/N H3E 2μV for 10dB (S+N)/N
A.G.C.:	Less than 4dB output change for 100dB input change, referenced to a.g.c. threshold
Receiver selectivity:	2·3kHz at −6dB, 4·1kHz at −60dB
Receiver i.f.s.:	1st i.f. 48·05MHz 2nd i.f. 5·645MHz
Image rejection:	Greater than 80dB
I.F. rejection:	Greater than 80dB below 22MHz Greater than 60dB above 22MHz
Spurious response rejection:	Greater than 60dB
Audio output:	2W into 4Ω @ less than 10% t.h.d.
Power requirements:	11–16V d.c. (13·6V nominal) 3A receive, 25A transmit
Case size:	116 × 346 × 317mm
Weight:	7·75kg

★ test measurements

TRANSMITTER

Outputs in A1A (c.w.) mode:

Band (m)	Max. output (W)	Harmonic outputs (dBc)	Spurious outputs (dBc)
160	130	−46	below −70
80	130	−56	−70
40	145	−53	−50
30	145	−52	−70
20	145	−58	−56
17	125	−62	−58
15	120	−64	−58
12	120	−64	−52
10	120	−59	−53

Carrier suppression:	−60dB relative to full-power A1A
Sideband suppression:	Output u.s.b. −50dB Output l.s.b. −55dB
Two-tone intermodulation:	−35dB relative to either tone
Frequency stability:	See text

RECEIVER

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

Band (m)	J3E (Standard 2·3kHz filter)	A1A (Narrow 500Hz filter)	A3E (Wide 6kHz filter)
160	0·45	0·22	2·0
40	0·28	0·22	1·6
10	0·28	0·13	1·6

I.F. rejection:	68dB on 160m band 104dB on 40m band 75dB on 10m band
A.G.C.:	Output change for 100dB input change relative to 1μV: J3E 3·5dB, A3E 6dB (30% 1kHz mod.)
Blocking:	Input signal level (relative to 10dB (S+N)/N level), 10kHz above wanted signal, to degrade (S+N)/N ratio by 3dB = 73dB

Test equipment used: TF2002AS and TF2008 signal generators, TF2370 spectrum analyser, 2435 frequency counter, TF2163 attenuators, all by Marconi Instruments; Avo CT378A signal generator; AWA E247 psophometer a.f. voltmeter; Bird Model 43 power meter, load and sampler.

Apart from the figures given in our Test Measurements table, our lab tests showed up the following points. When on a.m., the receiver does not take kindly to input levels exceeding 100mV. The output becomes distorted with 160mV input and disappears completely at 300mV. On s.s.b. there were no problems up to the signal generator limit of 1V.

Frequency stability did not meet the specification given in the handbook, though it would not pose any problem in normal operation. After a 30-minute warm-up, upward drift in frequency in subsequent 60-minute periods was: 380Hz, 134Hz, 126Hz, 68Hz, settling down to an average of about 45Hz/hour thereafter.

The output power meter was somewhat pessimistic, as measured power into a 50Ω load was about 25W higher than indicated on 80m, rising to some 40W higher than indicated on 10m. The Operator's Manual does warn users to

continued on page 41▶▶▶

CUT IT OUT!

A 'Western Which Report' about:–

ROTATORS

Various advertisers will naturally try to persuade you that their product is best (and we are no exception, of course!) but what we will not do is mis-lead you. So the following are FACTS taken from Manufacturers' specifications on their products.

Fact 1. Even small rotators will turn a fairly large antenna, what they will not do is KEEP IT STATIONARY under strong wind conditions. To do this requires good BRAKE TORQUE. This is measured in Kg. cms.

Fact 2. Low voltage rotators (24v ac) require higher current. This causes a greater voltage loss along the cable than with a higher voltage motor unit. Cable voltage loss will reduce rotational torque.

Fact 3. Some rotators use un-balanced braking. Under strong winds, this places an un-balanced stress on the casing of the motor unit and can cause it to fracture. Balanced braking is thus superior.

Position	*Make*	*Model*	*Brake Torque Kg. cms.*	*Price*	*Comment*
1=	CDE	AR22XL	520	49.45	
1=	CDE	AR40	520	65.55	
3	Ken	KR250	600	44.85	
4=	CDE	CD-45	920	113.85	
4=	CDE	Big Talk	920	91.42	
6	Western	WE-1145	1000	34.95	
7=	Western	FU-400	1500	64.95	
7=	Emoto	103sax	1500	86.25	63% better braking torque than CD45
9=	Ken	KR400RC	2000	101.00	Very good value for money
9=	Daiwa	DR-7500	2000	108.00	
11=	Ken	KR600RC	4000	132.25	
11=	Daiwa	DR-7600	4000	144.90	
11=	Emoto	502sax	4000	125.35	
14	CDE	Ham-4	5700	189.75	Un-balanced braking
15	Emoto	1102	10000	189.75	75% better braking torque than Ham. Has 2 balanced brakes
16	Ken	KR2000RC	10000	?	
17	CDE	T2X	11300	270.25	Costs 42% more than Emoto 1102 for 11% more braking torque

From this you will see that the WE-1145 rotator is a very good buy! We even think we are selling it too cheaply!
And here's another FACT. When we used to sell another brand of rotator, we had to increase our stock of spares to over £1,200 to ensure that we had adequate spares! We have been able to reduce that stock by 90% by selling Emoto due to their reliability.
You don't believe us? Then next time you go to an exhibition just take a look at the Emoto range and then the other brands. See which ones have 'grotty' little screws underneath to which you have to try and attach the multi-way cable! See which have decent input plugs. See which have stainless steel hardware and then come back and tell us! (We told you so!).

BEST BUYS

WL145, EMOTO 103SAX
FU400, EMOTO 502SAX
EMOTO 1102

YAESU AND TRIO EQUIPMENT

OUR COMPETITORS ARE SCARED TO DEATH, IT SEEMS!

WHAT OUR COMPETITORS SAY	WHAT WE SAY
We have 'Yonks' of professional experience.	So have the LADIES OF PICCADILLY.
We have the biggest stocks!	Jolly good! Hope you're not one of the customers to get an older set which hasn't got the latest 'mods' on! Our stocks are smaller, turned over faster so that you get the latest factory released equipment.
We have the best Service Dept.	(So when did they walk round ours?) All we claim is that we have a very extensive (and expensive!) Department with everything from a crowbar (for those fine adjustments!) to a H.P. Spectrum Analyser (just back after service, incidentally, at a cost of £1200!) And you think your service charge was expensive!
We are the 'Greatest'	Perhaps you are! It depends what you're talking about. If it is size of land, we are on a ONE ACRE site! Haven't been around our competitors to compare (and who cares!)
We have the best showroom	Maybe you have been round all the Showrooms; we haven't. Ours is set out with YAESU AND TRIO; we have no axe to grind one way or the other. We haven't seen one larger than ours but then we don't claim to have seen them all.
We have the most experience	Who first introduced the brand name of YAESU MUSEN to the UK? (Answer, Western Electronics of 24, Hook St., Hook, Swindon in 1970.) So who has most experience with Yaesu! Talking about experience, our M.D. has considerable HF operating experience having been: 2nd. World-wide SSB Contest; 1st. RSGB & Mhz SSB Contest; 1st. RSGB 21/28 Mhz Contests (So who's kidding whom about experience!)
We'll give you "FREE" (this, that and the other!)	So you really believe that you can get something for nothing in this World! Take a look at the prices in this periodical. We presume that you know that RETAIL PRICE MAINTENANCE IS ILLEGAL!

Now which Company do you think you should support? The 'Con Merchants'? The Scare Mongers? The Price Rings? **OR WESTERN**

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FRG-7	**£189**	FT-101ZD	**£599**	FT-227RB	**£229**	FP-707	**£119**	FL-2100Z	**£399**
FT-101Z	**£539**	FT-101ZD/AM	**£619**	FT-290R	**£235**	FT-720RV	**£239**	FRG-7700	**£315**
FT-101Z/AM	**£555**	FT-101ZD/FM	**£635**	FT-480R	**£360**	FT-720RU	**£264**		

We will not be under-cut! Phone for prices of many other items not listed here. Please note: Prices may have changed by the time this advert appears due to changes in the rate of exchange of the £.

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PS-20	**£47.95**	SP-120	**£23.00**	SP-230	**£35.00**	TS-830S	**£699.00**	VB-2300	**£45.00**	BC-5	**£16.50**	TR-9000	**£359.00**
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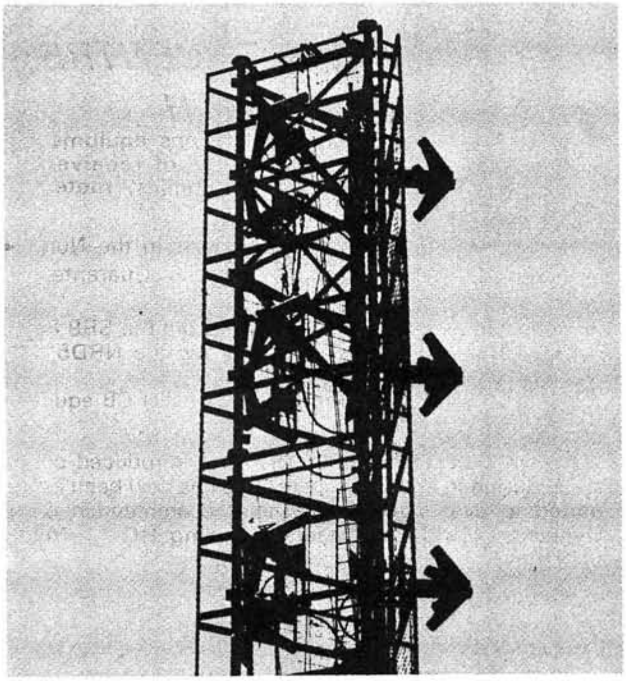


◀ **A close-up of part of the crossed-dipole array at one of the BBC's v.h.f. relay transmitters**

no more snap, crackle and pop?

The first major step in the BBC's programme to bring better radio reception to UK listeners, announced last summer, was taken on December 11 when new Band II transmitters, antennas and mast came into service at the Wrotham, Kent, transmitting station.

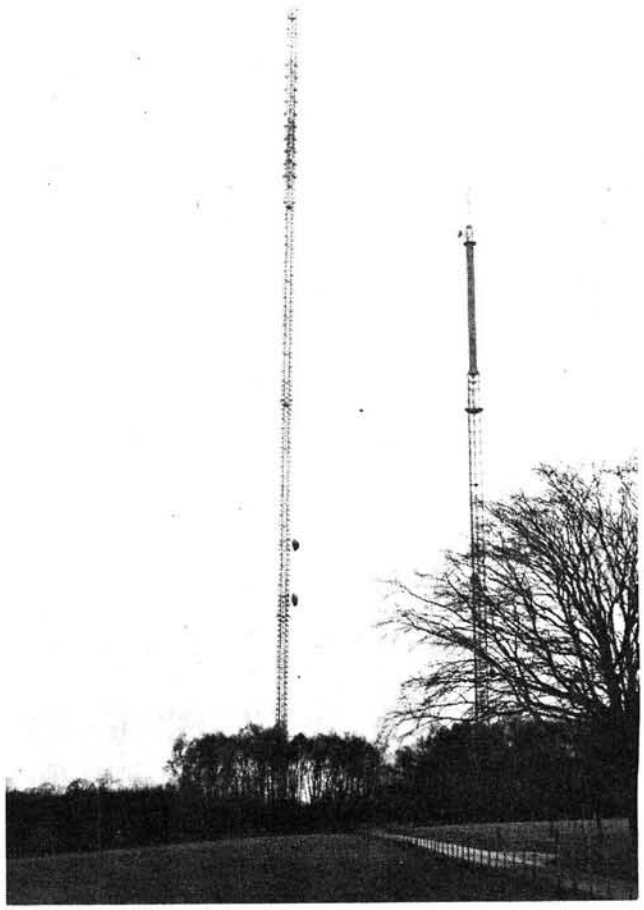
Wrotham is the oldest of the BBC's 101 v.h.f. radio transmitting stations, dating from 1949 when the first experimental a.m./f.m. transmissions began there. Programme service commenced in May 1955 using f.m. and horizontal polarisation, judged best at the time. The subsequent rapid development of v.h.f. transistors and their widespread use in portable and car radio receivers to give Band II coverage brought practical problems due to receiving antenna directivity. The most recent v.h.f. relay stations use mixed polarisation, and can be received equally well using vertical or horizontal antennas. Now, Wrotham has become the first main station to have mixed polarisation.

The original transmitters, which have now become uneconomic to run, have been replaced by six new 20kW transmitters made by Marconi Communication Systems Limited. Two of these operate in parallel for each channel—Radios 1/2, 3 and 4—giving double the prevous power output and increased reliability. The three signals are combined in a system of directional couplers and tuned cavities and fed via a single coaxial cable up the new 177 metre-tall mast to a 3-bay antenna system. Each bay comprises 10 sets of crossed dipoles in front of a mesh reflector. The dipoles are bent back into a shallow "V", so that each crossed pair is somewhat like an umbrella frame with only four spokes. This has been found to improve the regularity of the radiation pattern around the mast. The antenna system covers the frequency range 88–108MHz.

With the exception of the coaxial feeder, all the equipment used in the re-engineering of Wrotham is of British manufacture. The work took 11 months to complete and cost £1 million, and it should give greatly improved reception of BBC programmes on the move in southeast England.

Removing the original transmitters has left sufficient space for a further four new ones, so that two more channels could be added when the remainder of Band II above 97·6MHz is vacated by the fire and police services and some nationalised industries. This move is not expected to be completed before 1995, but the BBC believes that the date should be brought forward to about 1986 to coincide with the anticipated implementation by our West European neighbours of the new plan resulting from the 1982/84 conferences on Band II reallocation. Until the whole of Band II is released to broadcasting, there is no prospect of giving Radio 1 and Radio 2 separate channels on v.h.f. ●

The new mast (left) and the old mast (right) don't really lean towards each other—it's just a photographic effect ▶



PRODUCTION LINES

ALAN MARTIN G8ZPW

Overvoltage Protection

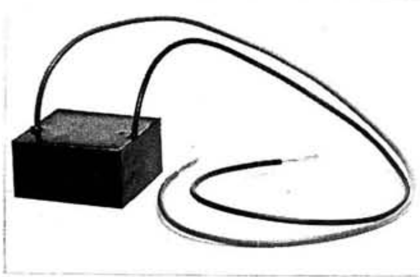
Frémark Electronics has recently introduced a Crowbar Overvoltage Protection Module, designed to protect rigs, or indeed any electronic equipment, against power regulation circuitry going short-circuit, which is probably the most frequent and disastrous failure encountered in power supplies.

The loss of regulation generally results in the full unregulated supply voltage being applied to the equipment connected to the output. In such an overvoltage situation the Crowbar module shunts the overvoltage to ground causing the in-line fuse to rupture, thus preventing the destruction of voltage sensitive elements, such as, electrolytic capacitors and semiconductor devices.

Designed for operation at 12 or 13·8V d.c., the module consists of a 25 amp thyristor and a Zener diode, encapsulated with epoxy resin in a box measuring 40 × 40 × 20mm, which should be small enough to fit inside most p.s.u.s, alternatively, it may be installed externally between the p.s.u. and the equipment being powered. Should the Crowbar module operate for no apparent reason, transients or voltage spikes may be present, this problem is solved by connecting a 470µF or 1000µF capacitor across the module. Resetting the device is achieved by turning the supply off.

It is essential that the supply from the p.s.u. contains a fusable element; if the p.s.u. should not possess this facility, each module is supplied with an in-line fuse holder and correctly rated fuse.

The module is manufactured by the supplier, costs £4.75 which includes VAT and carriage and is available by mail order from: *Frémark Electronics, Unit 1, Strattons Walk, Melksham, Wiltshire SN12 6LA. Tel: (0225) 705516.*



DFC7 for the FRG7

Following on from the special offer last month of the Timestep DFC4 digital frequency counter, Timestep have announced the availability of a very similar kit designed, by them, specifically to complement the Yaesu FRG7 communications receiver.

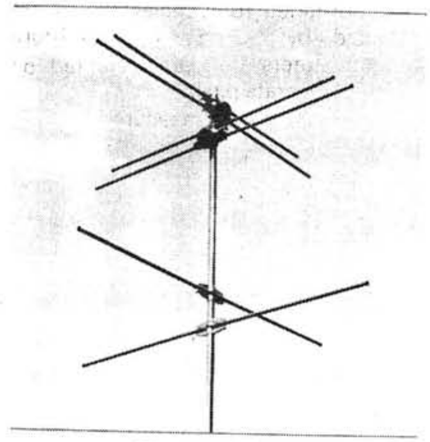
The new kit, called the DFC7, covers the entire frequency range of the FRG7, with a resolution of 1kHz, and all the components except the mains transformer are mounted on a completely redesigned, smaller p.c.b. The only link required to connect the counter to the FRG7 is a short length of coaxial cable, the centre conductor of which goes to tag TP404, which stands prominently from its p.c.b., and the screen to an earth tag which fits beneath one of the self-tapping screws. A purpose designed case is available which is also suitable for the DFC4 special offer kit and costs £3.95 plus 50p p&p.

VAT inclusive prices for the DFC7 are, kit version £14.95, ready-built £19.95, plus £2.50 p&p. Further details are available in return for an s.a.e. from: *Timestep Electronics Ltd., Egremont Street, Glemsford, Sudbury, Suffolk.*

UOSAT Antennas

Recent introductions to the range of specialist antennas provided by South West Aerial Systems, include a crossed dipole/reflector system for use at 145·825MHz for reception of the UOSAT-OSCAR 9 satellite.

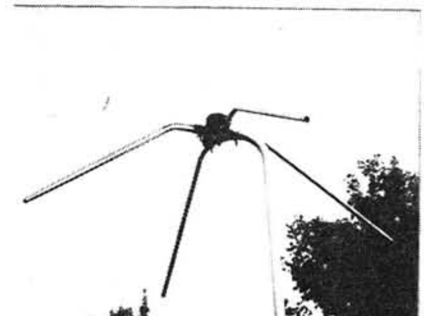
Apart from the use by licensed radio amateurs, schools and further education establishments, many readers, who wish to participate in this unique project, will find this antenna system ideal for the purpose, allowing for its easy installation within a compact space.



The WB6/AB

The antenna is supplied complete with a four foot mounting mast and looks very similar to the photograph showing the WB6/AB antenna, but utilises a straight dipole radiator and reflector. The price which includes VAT and carriage is £31.75.

Providing slightly less gain is the WB7/AB, a crossed dipole antenna which is supplied with a 12 inch mast and costs £25.50 inclusive of VAT and carriage.



The WB7/AB

When ordering please state that the antennas are specifically required for UOSAT reception, and for 50p the company will supply a 1982 catalogue listing the complete range of their antennas and related equipment; apply to: *South West Aerial Systems, 10 Old Boundary Road, Shaftesbury, North Dorset. Tel: (0747) 4370.*

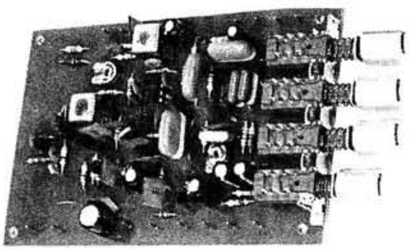
PRODUCTION LINES

ALAN MARTIN G8ZPW

Economy Stereo f.m. Tuner

The Bi-Kits S.453 stereo f.m. tuner comprises push-button vari-cap tuning and phase-locked-loop decoder for the reception of mono or stereo broadcasts. The unit is fitted with a four position switch for selecting any of the four pre-tuned frequencies which are selected by tuning four multi-turn potentiometers that are mounted on a small, separate p.c.b.

The tuner p.c.b. measures 125 × 80mm and the pre-set potentiometer p.c.b. 45 × 80mm; other specifications include: tuning range 88–108MHz;



sensitivity 4µV for 30dB S/N; audio output 200mV for 75kHz deviation; stereo separation 30dB; supply voltage 18–25V and current consumption 43mA for Vs = 22V. Also provision exists for the addition of an l.e.d. stereo indicator, a centre zero tuning meter and a mono/stereo switch.

The ready-built module is supplied complete with installation instructions, costs £19.00 plus £2.85 VAT, 50p p&p and is available from: *Bi-Pak Semiconductors, P.O. Box 6, Ware, Herts SG12 9AG.*

CB from SMC

South Midland Communications have recently launched the first of their Oscar series of 27MHz CB transceivers.

The Oscar One (CBM271) is a full 40 channel 27MHz f.m. mobile CB transceiver designed easily to exceed the minimum specifications set out in MPT1320.

It is a completely solid state, compact, communications module built to withstand the shock and vibrations experienced in the mobile environment, and the frequency synthesiser incorporated provides excellent frequency stability at both temperature extremes.

Oscar One is the first of nine different transceivers that SMC intend to introduce during 1982, costs £85.00 which includes VAT and carriage and is available from: *SMC Ltd., SM House, Osborne Road, Totton, Southampton SO4 4DN. Tel: Totton (0703 86) 7333.*

Toroidal Transformers

Barrie Electronics Ltd. have been appointed a franchised distributor for the "Budget Range" of toroidal transformers manufactured by Cotswold Electronics Ltd.

The 58 toroidal transformers will complement the 150 stacked laminated types stocked by Barrie Electronics on an off-the-shelf basis.

For further information contact: *Barrie Electronics Ltd., 3 The Minories, London EC3N 1BJ. Tel: 01-488 3316/7/8.*

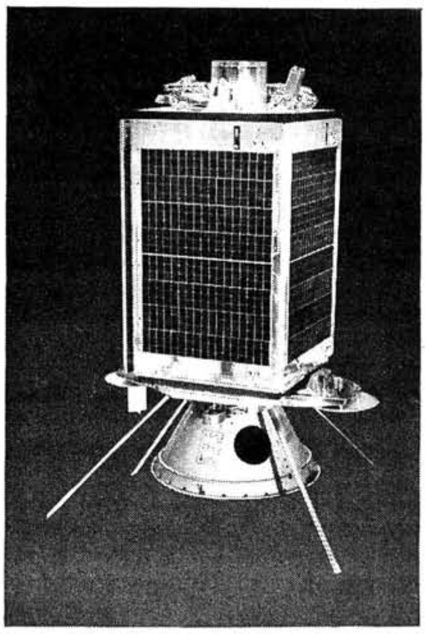
NEWS

UOSAT

The University of Surrey-AMSAT UK, joint project satellite, UOSAT-Oscar 9, launched by NASA on 6 October 1981, from the Western Space and Missile Centre, Vandenberg, California, aboard a Delta 2310 launch vehicle, continues to operate within the laid down parameters.

The current orbit data is as follows: period at orbit zero 95·4643 minutes; period drag factor 0·00016 minutes per orbit (subtracted); increment at orbit zero 23·8675 degrees W per orbit; increment drag factor 2·5E-05 degrees per orbit (subtracted); inclination 97·462 degrees; mean altitude 554·596km.

This initial data may be compared with the details of a reference orbit during 3 January 1982. Orbit No. 1344; period 95·3675 minutes; increment 23·852375°; equator crossing



time 1100 hours plus 38 seconds; longitude west 299·65°.

UOSAT is currently spin stabilised with a body spin around the Z-axis of 1 revolution/35s, and nutating with a period of 25s at an angle of 79° to the inertial angular momentum vector. This stable motion is the first stage in the complex attitude manoeuvres to achieve gravity gradient stabilisation.

Once overall stability has been achieved, and the 15·24m gravity gradient boom deployed, the 7, 14, 21 and 29MHz h.f. beacon antennas will be deployed. Further beacons will become operational at 2·401GHz and 10·47GHz.

Up-to-date orbital information and status reports can be obtained from a recorded message on Guildford (0483) 61202.

At the time of writing the 450mW general data beacon on 145·825MHz is readily copyable during an average of four daily "close" passes, using simple circularly polarised antennas.

New AR Club

Radio amateurs and s.w.l.s living in the Lytham St Annes and the southern parts of The Fylde in Lancashire, may be interested to know that a new amateur radio club has been formed in their area.

Meetings are held at the County Hotel, Church Road, Lytham on the second and fourth Tuesdays of each month.

Further information may be obtained from: *The Chairman, John Parkinson G6DNK, 60 North Promenade, St Annes. Tel: (0253) 727676 or 22110 in office hours.*

DX DIPOLE for restricted sites

D.J. HOWE G3XAA

Space limitations make it increasingly difficult to erect full size antennas for the h.f. bands that have directional properties. It must often happen that a vertical antenna is used not so much from choice but because it can be accommodated in the space available. However, the omnidirectional radiation pattern of the vertical is not always desired, and some form of directional antenna is often preferred.

There can be little doubt that the simplest form of directional antenna is the dipole with its "figure of eight" radiation pattern. It is easy to construct and erect between suitable supports. This can be fine if contact is desired with a relatively fixed global bearing and the site allows the dipole to be erected in a position to optimise its radiation pattern.

Often though, the site dimensions do not allow the dipole to be erected so that it radiates in the desired direction, and this was the position the author found himself in some time ago. It was desired to make USA contacts but the QTH would only allow a full-size dipole to be erected in a position that would produce little radiation towards the States.

Radiation Patterns

A way round the problem was found when studying the radiation patterns of dipoles which are not centrally fed. These produce several narrow radiation lobes at various angles compared with a centre fed dipole.

The final design is simple, with directivity helping to overcome the problems of a restricted site and can be used for multi-band operation on the usual DX bands, 20, 15, 10 metres. Maximum radiation from an antenna occurs when it is resonant at the transmitting frequency, and this happens when its length is electrically equal to $\lambda/2$ or multiples of $\lambda/2$.

So, it was necessary to use an antenna length that would represent a complete number of half-waves at each of the desired operating frequencies. It was found that an antenna cut for a half wave length on 40 metres was suitable for use right through to 10 metres, as shown in Table 1.

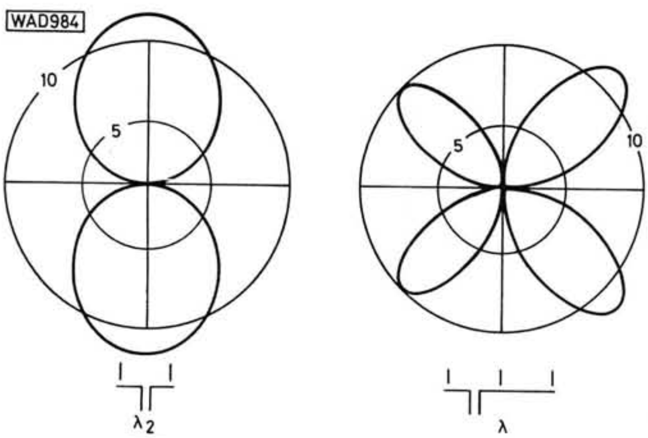


Fig. 1: Radiation patterns, (left) centre fed $\lambda/2$, (right) offset fed λ

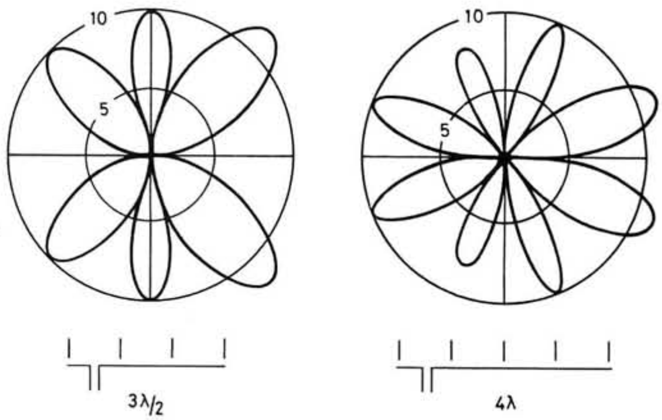


Fig. 2: Radiation patterns of offset fed dipoles

Table 1

Frequency (MHz)	$\lambda/2$
7.1	1
14.2	2
21.3	3
28.4	4

Dipole Length

The length of this half-wave dipole was calculated from the formula

$$L = 142{\cdot}6/f$$

where L is in metres and f is in MHz

and was found to be just over 20 metres.

This length could be accommodated at the QTH if part of it was erected over the house. The "shack" being upstairs at the back meant a fairly short run of coaxial cable would be required to connect on to the dipole.

Use was made of 50Ω feeder cable and it was necessary to connect this at a current maximum position on the antenna to achieve a good match between the antenna and the feeder. The problem then arises that there is no single position on the 20 metre length of antenna that will be at a current maximum for each of the three required operating bands.

It was necessary to select a preferred band and make the connection to suit that band; for the other bands it will be necessary to use an a.t.u. The maximum current point will be at a quarter wave-length from one end (on the selected band). This length is calculated from the above formula.

For a chosen band of 20 metres or 15 metres, the maximum current position will be 5·0 or 3·35 metres from one end, but the overall antenna length will remain the same. Some slight trimming of the lengths may be necessary to achieve minimum s.w.r. on the chosen band.

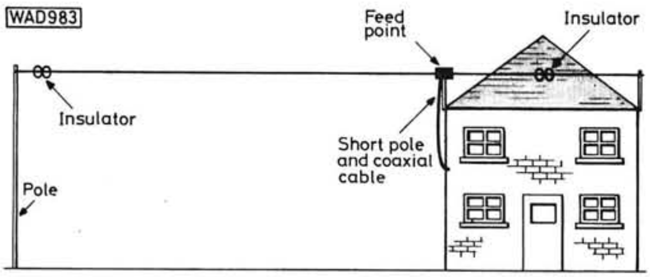


Fig. 3: The author's final layout for the DX dipole

The author decided to use 15 metres as the main band, mainly because it meant that the greatest length of the antenna was clear of the house. The total length ended up at 29·003m, with the feed point being 3·334m from one end, and the s.w.r. measured across this band is shown in Table 2.

Table 2

Frequency (MHz)	SWR
21.00	2.1 : 1
21.30	1.6 : 1
21.45	1.7 : 1

The axis of the antenna is on a bearing of about 300 degrees, and has been used mainly on 20 metres and 15 metres. It has been successful in contacting Stateside stations as well as Australia and Japan, while good coverage of European countries is also provided.

This "offset" dipole is cheap and easy to construct and has shown itself to be more versatile than the conventional centre fed dipole. It is well worth consideration for sites which do not permit many options for orientating a dipole antenna. ●

DRAKE TR-7 REVIEW

▶▶▶*continued from page 34*

expect errors due to non-linearity of the power meter circuitry.

The Operator's Manual gives a brief description, specification, details of accessories, installation requirements, operating instructions, theory of operation, block diagram. No circuit diagram or maintenance details are given, as repairs are felt to be beyond the capabilities of TR-7 owners. However, a service manual is available at extra cost.

Prices

The Drake TR-7 is imported into the UK by **Radio Shack Limited, 188 Broadhurst Gardens, London NW6 3AY, telephone 01-624 7174,** to whom our thanks go for the loan of the review sample. Prices of the various items mentioned are as follows (all include VAT at 15%): TR-7 transceiver with DR-7 digital readout/general coverage receive module fitted as standard £1035; PS-7 power supply £207; additional i.f. filters £39.10 each; AUX-7 range programming board with 1 receive module £32.20; RRM-7 range receive modules for the AUX-7 £5.75 each; RTM-7 range transceive modules for the AUX-7 £5.75 each; NB-7 noise blanker £66.24; FA-7 fan £20.70; 7804 service manual for TR-7 £18.50; SP-75 speech processor £79.35.

Drake have just announced the TR-7A, generally similar to the TR-7 but incorporating 500Hz and 9kHz filters and the NB-7 noise blanker as standard, plus built-in lightning protection and mic audio connection on the rear panel.

Geoff Arnold

kindly note!

RF Noise Bridge, January 1982
The toroidal transformer should be wound with 22 to 26 s.w.g. enamelled copper wire.

Special Offer. DFC4 Digital Frequency Counter Kit, February 1982
The i.f. offsets provided are as follows:

kHz	MHz		
−452·5	+10·68	−10·60	−10·69
−454·5	+10·71	−10·61	−10·70
−456·5	+10·75	−10·62	−10·72
−465·5	+10·79	−10·63	−10·73
−467·5	+10·82	−10·65	−10·82
−469·5	−10·58	−10·66	

A green filter and bezel unit is supplied with the module to obscure parts of characters not illuminated. The oscillator uses a 6·5536MHz 20p.p.m. crystal (+10°C to +60°C).

MODS

IMPORTANT—The ideas presented here are suggestions only, and as they are untried by this magazine, we cannot accept responsibility for any resultant damage, however caused. Before alterations are attempted, care should be taken to ensure that any guarantee is not invalidated, and it should also be borne in mind that modifications usually have an adverse effect on resale prices. In cases where specialist skills or equipment are needed, most dealers will undertake the work for a reasonable fee.

Roger Hall G8TNT (Sam)

No. 14

The Bearcat

I have received numerous requests for mods to the Bearcat range of scanning receivers. The latest is from Mr H. C. Young, G3HIA, who would like to be able to fill in some of the gaps on his Bearcat 220FB. I'm sure that he will be pleased to hear that this can be done without physically modifying the set in any way.

The first time that I heard about tricking the microprocessor that controls these sets was when Liam Curran wrote in from Ireland with one of the strangest mods that I've seen for a long time. He pointed out that there are two major differences between the Bearcat 250FB and the Bearcat 220FB. The 250 will scan 50 channels but it will not cover the 144–146MHz band, whereas the 220, which does cover the 2-metre band, will only scan 20 channels. This would seem to be why most amateurs tend to prefer the 220, even though it scans less channels.

This may well alter when I reveal that Liam has found a way of making the 250 cover the 2-metre band. This does not involve delving inside the set, just a strange sequence of button pushing.

First find a clear channel. Then punch in 1 4 6. Then press LIMIT. Then punch in 1 4 6 again and then press LIMIT again. Then press STORE. Now open and shut the Squelch. Then press MANUAL. Now punch in 1 7 4 and then press LIMIT. Punch in 1 7 4 again followed by LIMIT again. Now press SEARCH, then press RECALL. If you now press SEARCH again, the receiver will search down from 146 to 133MHz.

Following on from this amazing revelation, Liam then goes on to describe how to persuade the set to carry on scanning far beyond its usual pre-set limit of 512MHz. If you repeat the preceding procedure, but this time substituting the numbers 5 1 2 for the numbers 1 4 6, then the set should scan from 512MHz all the way up to an almost unbelievable 999MHz.

Liam follows this up by explaining how to enter one of these "new" frequencies into a memory. To store a frequency you should go to the required channel, recall the frequency, open the Squelch, switch the set off and then on again and you will then find that the required frequency has been stored in the appropriate memory.

When I first read Liam's letter, I will admit that I had doubts about the effectiveness of these mods. I couldn't believe that anyone could figure out such a complex sequence of moves. I also couldn't believe that anyone would bother to write in unless they had something that they thought would be worth passing on and so I took the letter to Terry Edwards. He's the proprietor of Radio Shack Ltd, the importers of the Bearcat range. His initial reaction was much the same as mine, disbelief, but he decided to try it out on one of his sets. We were both surprised to find that the mod does work and I'm very pleased to be able to pass it on. Many thanks to Liam for passing on this most original idea.

In the months since I first showed Liam's letter to Terry, he has come up with a variation on the same theme, this time for the 220FB model. This time the sequence is, press 8 8 and then press ENTER. Then press LIMIT followed by 1 4 4. Now press LIMIT again. Now press SEARCH and then LIMIT again. If you now press SEARCH again, you will find that your receiver now covers the gap between 88 and 108MHz.

Terry has asked me to point out that as these additional frequencies are outside the original specifications, there is no guarantee that the sensitivity figures quoted in the handbook will apply.

SX-200N

I have a rumour of a similar mod available for the SX-200N but I have not yet been able to find anyone who knows it. Can you help?

Wanted

I seem to receive far more requests for mods than I do mods and that means that a backlog of requests waiting to be published soon builds up. Here's a selection of the latest—please help if you can.

Mr Dempster of Birmingham would like to make his Trio R-1000 receive n.b.f.m. He says that he would have no problems building an f.m. board but he would like to know the take-off points inside the set.

Mr Howard, GW3DEX, would like some mods for the Trio TS-7200G. He is considering changing the first f.e.t. for a BF900 in an attempt to cure the lack of r.f. sensitivity and he would appreciate comments.

John McGowan wrote in from Delgany because he has a Pye domestic receiver which he would like to be able to use to listen to s.s.b. transmissions. Unfortunately it does not have a built-in b.f.o. I think John that the answer to your problem may lie in a current *PW* project—the *3-band Short-wave Converter*. This is a relatively simple and inexpensive unit which will convert almost any transistor radio into a general coverage receiver. It also contains a b.f.o. for the reception of s.s.b. and Morse signals.

The last request this month is from Tony, G3RIT. He has asked if there are any reprints available of previously published mods. Unfortunately Tony, the answer is no. If you missed a particular mod, you will have to buy the entire issue from our Back Numbers Department, the full details are given at the front of the magazine.

If you can help with any of these mods, or if you have a request for a particular mod or if you have any information that you would like me to pass on, please write to R. S. Hall, Room 301, Hatfield House, Stamford Street, London SE1 9LS.

73s
Sam

NEWS NEWS

Repeater News

The Fylde Coast Repeater GB3FC, working on channel RB2, went "On Air" on 1 January 1982 after an absence of nearly twelve months.

The new site is the Norbreck Castle Hotel situated on the cliffs above the Blackpool seafront. A Pye 460 transceiver base station, utilising GB3US logic, is situated in an equipment room in the uppermost part of the hotel enabling the use of short feeders whilst siting the antennas 180 feet above sea level.

Separate antennas are used for receive and transmit, a 7dB colinear for receive and two phased Jaybeam Yagi's for transmit which are so positioned as to prevent undue radiation to seaward.

Further information about GB3FC 70cm repeater is obtainable from: *Mick Green G4EZM, QTHR.*

The Repeater Working Group of the RSGB are currently working on proposals for VHF Phase 6, to be submitted to the Home Office during 1982.

Among the proposals are recommendations for sites for: GB3OC–R5–Orkney and Caithness, located on the Orkneys; GB3PA–R1–Paisley Scotland (W. Glasgow); GB3LU–R3–Shetlands. By the time this report is published VHF Phase 5 will have passed to the H.O.

Negotiations are advancing well towards the establishment of three fast scan TV repeaters, working in band on 23cm (1296MHz). They are: GB3UD–Mow Cop, Stoke on Trent; GB3TV–Luton and GB3UT–Bath, all to operate in same channel.

UHF Phase 6 proposals are now with the H.O. and awaiting licence issue.

UHF Phase 7 is now being prepared by the R.W.G. and is even bigger than Phase 6 (evidence of increasing interest in 70cm), with the first GU repeater amongst them. Amongst the proposals are: GB3GH–Gainsborough; GB3LA–RB13–Leeds City Centre; GB3HK–RB14–Hawick; GB3KR–RB4–Kidderminster. A new 70cm r.t.t.y. repeater GB3RY–RB12 is proposed for Ealing.

Management Changes: Three repeaters are currently changing control due to site and equipment changes. These are GB3NN at North Norfolk, GB3WS and GB3HN at Hitchin. When new groups have been established they will have to go through the usual R.W.G. vetting process.

Other News: Eire is to adopt the RB channelised system for its u.h.f. repeater network, thus making it compatible with the UK system of 1·6MHz shift, output lower than input.

Wood You be Interested?

If you're into restoring antique radios, or building wooden cabinets for new ones, why not pop along to the Practical Woodworking Exhibition at the Wembley Conference Centre, open between 4 and 7 February, 1982.

3-BAND SHORT-WAVE CONVERTER

1·6–6 MHz

4–15 MHz

7–30 MHz

PART 2

R. F. HAIGH

Circuit description and p.c.b. details for this project were given last month. This month we conclude construction details and give some hints on connecting the unit to suitable m.w. receivers.

Mechanical Construction

A slow tuning rate and mechanical rigidity are essential attributes of a short wave receiver, especially one to be used for the reception of amateur s.s.b. transmissions.

Details of the slow motion drive assembly are given in the photograph. The relatively inexpensive arrangement shown is completely free from backlash and affords a reduction ratio of approximately 190 to 1. Drive drums smaller than the one specified can be used, but the faster tuning rate will make it more difficult to resolve signals on the crowded amateur bands. The spindle which accepts the drive cord can be produced by filing a scrap length to the profile shown; the prototype was filed whilst turning in an electric drill. A bush can be salvaged from an old potentiometer.

It is prudent to obtain all of the components before marking out and drilling the chassis, which is formed from a standard aluminium box. The annotated photograph shows the component layout in the prototype. The trimmer capacitors shown are not now readily available so the method of fixing is determined by the type chosen. Beehive trimmers, if used, are best held in place by soldering them to short tag strips fixed to the chassis as close as possible to the coils. Miniature polypropylene dielectric trimmers could, alternatively, be soldered directly to the coil terminal pins. It was not found necessary to make provision for the adjustment of the trimmers from the outside of the chassis.

The height of the brackets which support the tuning capacitor C2/C8, may need adjusting to suit the drive drum and capacitor used, and they must be as rigid as possible. The tuned circuits all operate at different frequencies. Risk of instability is, therefore, far less than with a t.r.f. receiver, and no problems of this kind were encountered. The coils have, however, been positioned to minimise interaction. If this precaution is not taken, dead spots could be caused by absorption effects preventing Tr2 oscillating at some frequencies.

Full size details of the three printed circuit boards were given in Figs. 4, 5 and 6. Care should be taken when soldering the polystyrene capacitors, as they are rather heat sensitive, and the transistors should be soldered into circuit last. Veropins inserted into the boards at the lead out points aid wiring up. Metal stand-offs must be used beneath the boards, as the negative supply line connection is via the chassis.

Reasonably heavy gauge, plastic insulated wire should be used for the interconnecting leads, which must be as short and direct as possible. Solder tags placed beneath the coil former mounting bolts serve as earthing points for the r.f. coil windings.

Wiring details for the band change switch S1, are given in Fig. 3 and the on/off switch S2, in Fig. 2. Particular care must be taken to ensure that the oscillator and b.f.o. coil windings are connected as shown in Table 1, or the unit will not function at all.

Front Panel and Dial Assembly

The chassis is bolted to 11mm plywood side cheeks which are secured to the front panel by wood screws. Holes must be formed in the cheeks to give access to the coil cores and for the connecting leads to the r.f. gain control and S2. Sinkings must be formed in the plywood front panel to allow the bushes of these controls to pass through sufficiently far to accept the fixing nuts.

A white card dial is fixed to the outer face of the front panel, and protected by a sheet of glass or Perspex mounted in a wooden frame. The dial is traversed by a scribed, Perspex cursor fixed to an extension on the tuning capacitor spindle. The spindle is a tight push fit into a hole drilled in the cursor to which it is secured by means of "Superglue" or other suitable adhesive. Details of the cursor are given in Fig. 8.

A professional finish was imparted to the prototype by giving the front panel and dial frame several coats of matt black cellulose paint.

Receiver Connection

The converter is connected to a medium wave receiver by means of a short length of coaxial cable. If a car antenna socket is available on the set, there should be no problems, the cable merely being terminated by an appropriate plug.

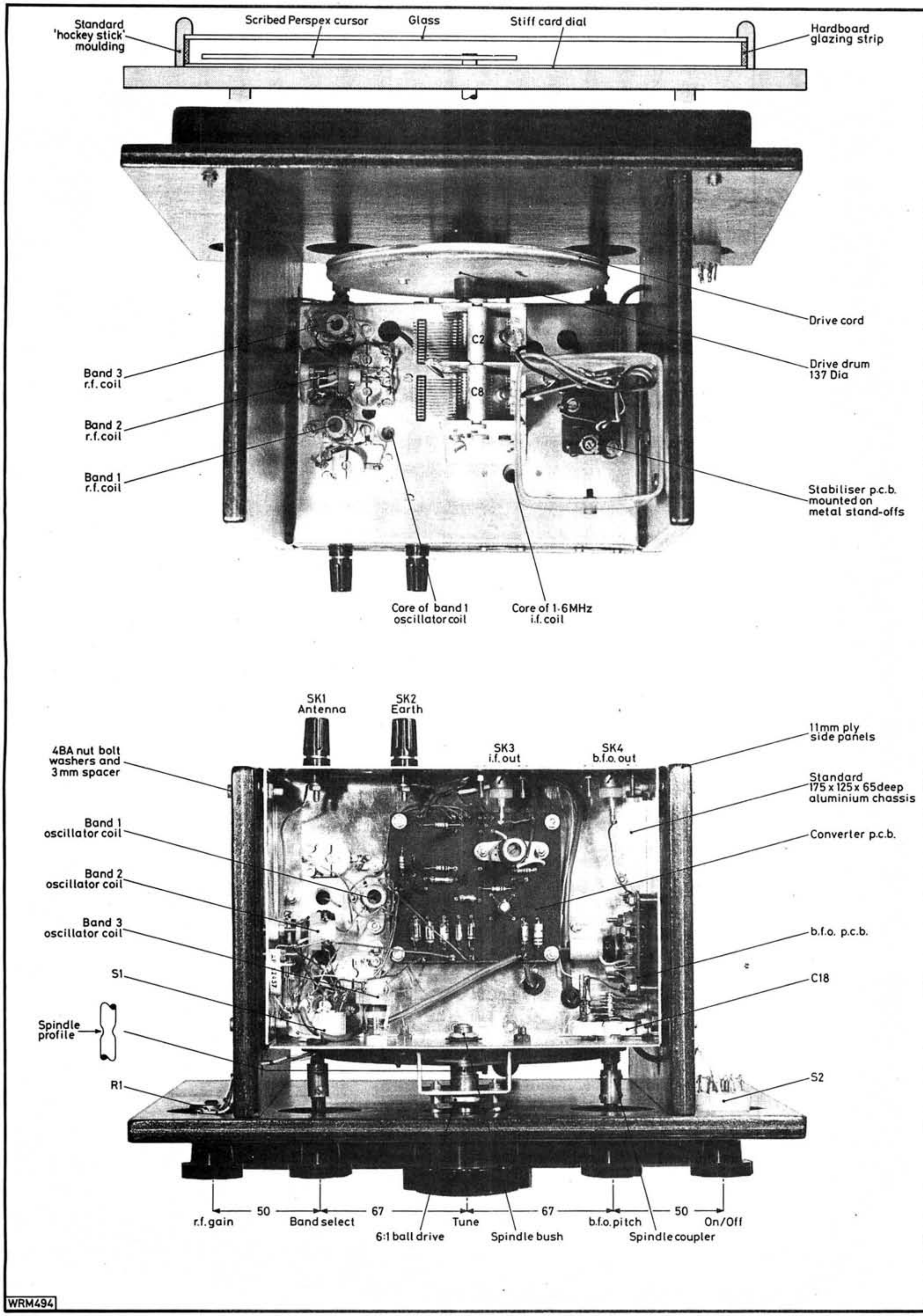
Should the set not have an external antenna socket, wind about 12 turns of insulated wire around its ferrite rod and connect one end of this winding to the centre core, and the other to the outer braiding, of the coaxial cable. It is most important that the outer braiding be connected to the chassis or "earthy" side of the medium wave receiver wiring also, or unwanted signals may be picked up. If the ferrite rod antenna is not very accessible, wind about 12 turns of wire around a 25mm length of ferrite rod, wedge this next to the antenna in the set and connect up the coil as described above.

The converter can be used with other than portable receivers by taking the inner lead and outer braid of the coaxial cable to the set's antenna and earth terminals respectively. **Do not** attempt to connect the converter to an old a.c./d.c. receiver, because the chassis of these sets is live.

The converter has been tried with two high quality portables of British manufacture, an inexpensive receiver, an extremely cheap imported set and a superhet incorporating the Hitachi 1197 i.c. All of these combinations worked well.

Setting Up and Alignment

Check the converter wiring, especially the connections to the transistors and the oscillator and b.f.o. coils. Screw


Standard 'hockey stick' moulding
Scribed Perspex cursor
Glass
Stiff card dial
Hardboard glazing strip
C2
C8
Drive cord
Drive drum 137 Dia
Band 3 r.f. coil
Band 2 r.f. coil
Band 1 r.f. coil
Stabiliser p.c.b. mounted on metal stand-offs
Core of band 1 oscillator coil
Core of 1·6MHz i.f. coil
SK1 Antenna
SK2 Earth
SK3 i.f. out
SK4 b.f.o. out
11mm ply side panels
4BA nut bolt washers and 3mm spacer
Standard 175 x 125 x 65deep aluminium chassis
Band 1 oscillator coil
Converter p.c.b.
Band 2 oscillator coil
Band 3 oscillator coil
b.f.o. p.c.b.
S1
C18
Spindle profile
R1
S2
50
67
67
50
r.f. gain
Band select
Tune
b.f.o. pitch
On/Off
6:1 ball drive
Spindle bush
Spindle coupler
WRM494

the coil cores into the formers until they are flush with the terminal ring end, and set the trimmers, C1* and C7*, to about quarter mesh.

Connect the converter to a receiver in the manner described, switch on the receiver, advance the volume control slightly, and tune it to a quiet spot at the high frequency end of the medium wave band. The receiver should be tuned as near as possible to 1·6MHz (approximately 190 metres), but this is not at all critical. What is more important is to find a quiet spot on the dial and mark it with tape so that the same setting can be returned to when the converter is in use.

Connect an antenna and 9 volt battery to the converter, set S1 to Band 2, turn up the r.f. gain control R1 to maximum, set the pre-set potentiometer R8 to minimum resistance and switch on. A loud hissing noise should result, indicating that the Tr2 drain voltage is too high, and R8 must be increased until the hissing stops. If the tuning control is then rotated, strong signals should be heard around the dial. Check that signals can be received on Bands 1 and 3; if the hissing returns, increase the resistance of R8 a little more until the noise disappears.

Having established that some signals can be received on all three Bands, the converter can be aligned. Select Band 2 and tune in a weak signal with the vanes of the tuning capacitor near full mesh. Then adjust the core of the r.f. coil for maximum response. Next, select a weak signal with the vanes almost open, and set the trimmers for best results. Repeat this procedure, adjusting cores at the low frequency, and trimmers at the high frequency end of the Band, until no further improvement can be obtained. Bands 1 and 3 should be tackled in the same way.

If a 500pF tuning capacitor is used, it may be found that there is a dead spot on Band 3 when the vanes are nearing full mesh. This is because the poor *LC* ratio is preventing Tr2 oscillating. There is so much overlap on the three ranges that this is of little consequence. However, careful adjustment of pre-set R8 should enable oscillation to be maintained up to maximum capacitance.

The cores and trimmers of the oscillator coils, L5* and 6*, have a marked effect on frequency coverage. Because of this, the trimmers of the Band 3 coils must be set to the lowest possible capacity consistent with proper alignment, or the high frequency coverage of the unit will be curtailed. The cores are a loose fit in the formers, and strips of rubber cut from thin rubber bands, or lengths of soft string, must be inserted to tighten the cores before alignment begins. When alignment has been completed, trimmers and cores should be locked in place with a drop of nail varnish or similar.

The i.f. transformer L3/L4 is tuned very broadly by self-capacitance to about 1·6MHz, and wide variation of the core setting will not result in any noticeable change in performance. Note: C5 is a 0·1µF disc ceramic component.

BFO Unit

The b.f.o. unit re-inserts the carrier missing from s.s.b. transmissions, or beats with the interrupted carrier of c.w. Morse signals, so that they can be rendered audible by the diode detector in the usual way. It works in conjunction with the i.f. amplifier in the receiver used with the converter.

The length of the coaxial cable feeding the b.f.o. output to the receiver should be limited to about 300mm or the signal will be excessively attenuated. Attach about 150mm of insulated wire to the centre core of the cable and tape it to the outside of the m.w. receiver case, as close as possible to the i.f. circuitry. This arrangement for the injection of the b.f.o. signal into the receiver is in no way critical, but individual results may be improved by the adjustment of the length or position of the unscreened wire taped to the set.

Set the vanes of C18 to half mesh, tune in an a.m. signal with the converter, switch on the b.f.o. and adjust the core of L7/L8 until a loud heterodyne is produced. Set the coil core for zero beat, whereupon rotation of C18 either side of the half mesh position will result in a note gradually rising in pitch. Care is needed in adjusting the b.f.o. coil core, as there are a number of false settings which will result in heterodynes. When the setting is correct, a strong heterodyne will be produced with every a.m. station received as the converter is tuned across the dial.

With the b.f.o. unit switched off, s.s.b. signals are reproduced as very badly distorted speech. There are generally several transmissions of this kind during the early evening, and on Sunday mornings, on the 80m (3·6-3·8MHz) amateur band. After tuning in one of these signals, switch on the b.f.o. and rotate C18 away from the zero beat setting until the speech becomes intelligible. Unless the signal is a weak one, the r.f. gain control should be turned well down or it may not be possible to resolve it. The correct setting for the b.f.o. control depends on whether the upper or lower sideband has been suppressed at the transmitter. If rotating C18 clockwise of the zero beat position does not clarify the signal, the control should be turned anti-clockwise until the speech is resolved. The correct setting is fairly critical, and adjustments must be made carefully. With c.w. signals, the b.f.o. acts as a pitch control and it may be set above or below the zero beat position in order to minimise interference. The tuning of the b.f.o. unit is affected by the self-capacity of the connecting cable, and changes in its length will, therefore, necessitate the re-setting of the core of L7/L8.

Calibration

The tuning scale resulting from the calibration of the original receiver is shown in Fig. 7. Setting of coil cores and trimmers, and the value of the tuning capacitor used, have a very significant effect on coverage. The dial shown can only, therefore, be regarded as a rough indication of the calibration to be expected with a 500pF tuning capacitor.

The prototype was calibrated by means of a modulated *LC* oscillator set to 100kHz by zero beating it with the

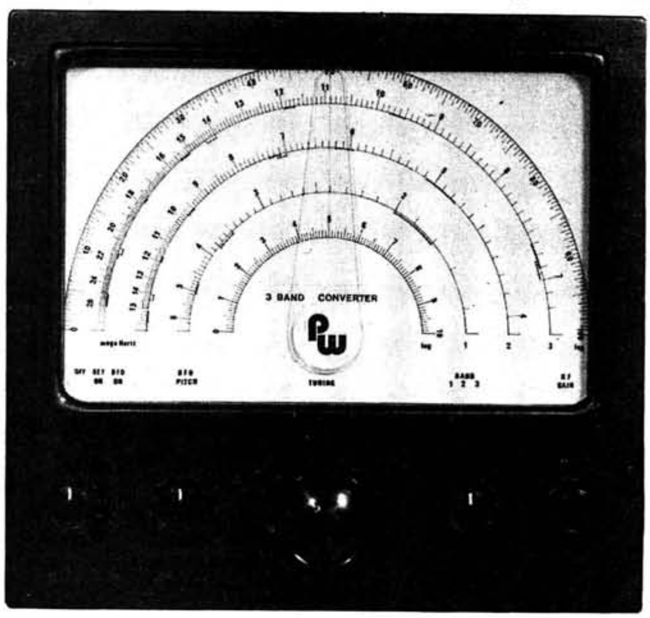
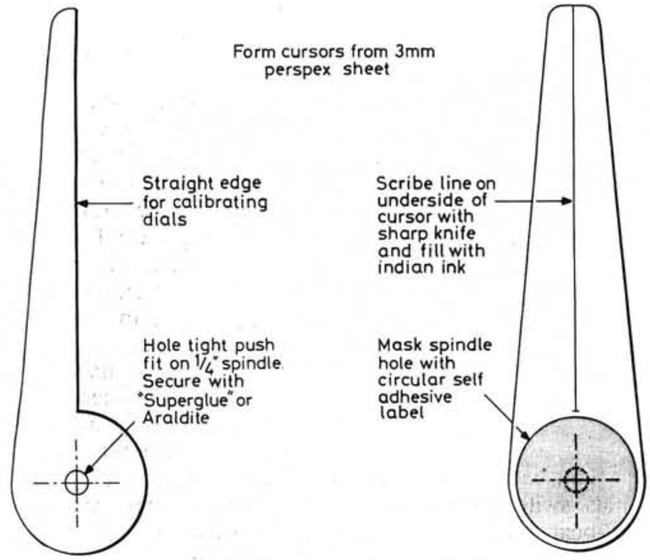


Fig. 7: Showing the tuning scale



WAD005

Fig. 8: Cursors used for calibrating the dial and the completed converter

200kHz BBC Radio 4 transmission on the l.w. band. Injecting this signal into the converter unit produced 100kHz marker points, and a similar 1MHz oscillator was used to define scale markings at 1MHz intervals. Fig. 8 shows the special cursor, cut to a straight edge along the hair line, which was used to mark out the dial and the normal cursor.

Other methods of calibration can be adopted. The easiest involves the use of a signal generator covering the s.w. bands, but care must be taken to avoid harmonics. Calibration could also be accomplished by comparison with another s.w. receiver with an accurate dial. Perhaps the most protracted method of all is by listening for transmission frequency announcements and marking the dial accordingly. This calls for much patient listening, but it should be possible to identify the various amateur and broadcast bands fairly quickly.

Performance

A short length of wire connected to the antenna terminal will enable a wide range of transmissions to be received. For serious DX listening, however, a good length of wire erected as high as possible and clear of earthed objects will give much improved results. An earth connection can sometimes aid reception.

The converter and associated receiver form a double superhet, and this ensures good image rejection. Audio quality, selectivity and a.g.c. characteristics are, of course, determined by the receiver used with the converter. Connected to a quality portable, performance on the broadcast bands is excellent, and a large number of stations can be received. Despite the fact that the selectivity of such a combination falls short of that afforded by specialised communications equipment, the reception of s.s.b. transmissions is quite satisfactory. Although the tuning rate is not as slow as that found on receivers designed especially for the amateur bands, the drive system described enables s.s.b. signals to be resolved without too much difficulty. ●

Letters to the Editor intended for publication must be original, and not duplicated to or copied from other publications. We reserve the right to shorten or edit them if necessary.

Letters

So Who Needs Esperanto?

Sir: It so happens that I took a year off from wielding the soldering iron during 1980 in favour of actually using all the home-made equipment on the air, so I decided to try for one or two new countries.

Apart from working 226 countries, I was soon becoming very amused at the odd comments and "funny English" overheard on the air.

I hope to see you again, maybe the next time . . . SP9
I am very old man. I am 42. I have not hair on my head . . . DL2
Your transceiver is very very good: my transceiver is on the level . . . YV2
I have only a cigarette in my hand . . . so now I have fired it . . . OZ1
I'm sorry my bare-foot is not strong . . . PY2
I am not so good on my back with the beam . . . UA6
Pardon me, my brain is not so fresh . . . UA6
Which way do I beam for Antarctica . . . G4
British beam; is good all way around . . . JA1
You are also 5 by 9 but you are much weaker than John . . . UA9
I am a very young old man; I am 14 years old . . . JH3
My condition is home-made too . . . UK6
I'm beaming on the rong (sic) path . . . JA0
What's the weather like in Greenland . . . G4
We're eight degrees south of the equator, so it's winter time . . . VQ9
Just a moment, I have a problem with the energy . . . OE/YK (Golan Heights)
The raining is now in England coming here . . . I4
Whisky Echo Tango, I don't remember pronunciation . . . I4
When a guy's down that's definitely the time to kick him . . . W0
Happy Father's Day . . . G4 (to HV . . . a Jesuit Priest in the Vatican)
My wife and I, both of us voted for Nixon, and both of us voted for Carter, so we figured the country would be better of if we didn't vote at all this time . . . W4

So, whether or not you share my sense of humour, I hope you can get something out of this; those who are accustomed to peculiar foreign jargon on the amateur bands will no doubt recognise a few of the gems.

All good fun; I've learnt a lot and made many friends over a year of operating.

Dr. A.G. Gray G3XQU
Brentwood
Essex

EXTRA — OUR GATEFOLD PULL-OUT

This month, we feature the first of two double-sided pull-out charts for your shack wall.

The maps on this month's chart and the tables and graphs on the chart coming in our May issue are aimed at the v.h.f./u.h.f. enthusiast, giving QRA Locator Squares and Amateur Callsign Prefixes for the European area, plus various conversion and calculator charts and tables. We plan to publish a supporting article on weather and radio propagation for you very shortly.

For the h.f. bands operator, the other side of the May chart will carry an Amateur Callsign Prefix map for the whole world, complemented by the Prefix list on the back of this month's chart. Within the space of a chart, we obviously cannot detail the breakdown of prefix groups within a country, but for this we recommend the *Amateur Radio Operating Manual* published by the Radio Society of Great Britain, 35 Doughty Street, London WC1N 2AE, price £4.96 including post and packing.

We have tried to choose information for each side of the charts to appeal to amateurs with different interests, though inevitably there is some overlap. If you can't make up your mind which side you want, all I can suggest is that you buy an extra copy of March and May *Practical Wireless!*

Can You Help

Sir: Could you please ask any *PW* reader if they could supply me with a copy of a circuit diagram for a communications receiver called the "Hambander" manufactured by Radiovision of Leicester.

T. Taylor
25 Suffolk Street
Barrow-in-Furness
Cumbria

Another Convert?

Sir: My husband decided to go back into amateur radio after a break of some years. So what, you may say—well I'll tell you what. Finding the "rig" was rather a problem, equipment is hard to come by in Zimbabwe and spares are something else. Anyway that's another story. Just as desperation was about to set in and a deep depression settle over the house, we heard of someone in Bulawayo selling his rig as he was emigrating to South Africa. "What about an antenna" I asked, and was told we would worry about that later. The royal "we" you will notice—and this "we" certainly wasn't worried and neither would be. How can "we" worry about something "we" know nothing about? The rig arrived, and surprise—an antenna came with it. Well "we" thought it was a strange antenna, not a bit like the rabbit ears sitting on top of the telly! But the other half of the "we" thought it looked just right.

My husband decided that the antenna would be launched into space on a weekend that our son was home from boarding school and when our teenage daughter had her usual crowd of boyfriends at the house. Our domestic worker was roped in too, and a few casual labourers. This was an experience I hoped never to repeat. My heart sank as I saw the antenna rising, and expected at any minute to see it crash through the roof or through my car roof which would be even worse, as cars are as hard to come by as radios here.

Well to cut a long story short, the antenna went up and stayed up, but apparently "we" still have problems. This "we" admits to being thick and knowing nothing, but I thought my other half, being so perfect in every way according to him, knew better. The antenna is useless, the measurements are all wrong, the boss has boobed! So guess what? This weekend "we" are taking down the antenna, reassembling it and then putting it back up again. I may leave home and not come back! I helped with the hut, sorry, radio shack, losing my finger nails, knuckles and temper while doing so. I even helped with the concrete slab that the hut sits on, but no way am I going through the nightmare of antenna erection again! It's too much to ask. "We" is flying solo this time.

A small confession before I close. I rather like the radio shack, it's cosy, and I really do like being a common garden type "we". So I'm learning Morse, and studying for the RAE. One day you may hear me with my own call sign, but at the moment I sign myself xyl of ZE1GL (ex G3MEY, ZC4JL, UR3Y).

Mrs. C. Lawrence
Eiffel Flats
Zimbabwe

Beginner's Receiver

Sir: Having successfully built the "Beginner's Short-Wave Receiver" following the article by Mr. R. J. Howgego, in the September 1981 issue of *Practical Wireless*, I thought the following comments might be of interest to your readers.

Firstly, being unable to obtain a 100pF ceramic capacitor for C3, I used any old thing, and the set wouldn't work, until I substituted a Philips "beehive" trimmer with the vanes practically unmeshed, when it suddenly burst into life—and how! I'm listening to Radio Luxembourg on about 6MHz on it, with low impedance headphones, as I write this letter. The antenna is a long wire, just a flexible plastic covered cable, strung between chimney stacks on this old 2-storey terraced house. No a.t.u., although I will be using mine before long.

Secondly, I intend using a 4-pole 3-way wavechange switch to bring in the broadcast band and give coverage from about 500kHz to 30MHz. This will switch points a, b, c and e on Fig. 1.

Finally, may I express my kindest regards to Mr. Howgego and the staff of *PW* for a truly excellent project.

D. M. Aldridge G8YWX
Sunderland

Repeaters

Sir: It is interesting that the editor should have felt the need to add such a misleading and erroneous statement after Eric Dowdeswell's totally justified comment in the July issue.

Amateur repeaters are a copy of Public Service Land Mobile talk-through systems (excepting a few access and logic modifications to suit the different circumstances). The comparisons the editor makes are not valid. While it is true that we have seen many "Commercial" users operating "Clapped out" or misaligned ancient base stations into ground-planes at the end of 100ft runs of lossy cable and attempting to work mobiles with non-resonant whips on the rear bumper, this is not where the comparisons should be made. In many cases PMR ranges are deliberately restricted to avoid co-channel interference.

At the other end of the "Commercial" spectrum there are recent Pye and Motorola systems that make amateur repeaters seem decidedly passé. Without being specific, these are multi-channel and multi-level systems that carry more than voice traffic alone. It is however not the province of amateur radio to ape commercial techniques designed for relatively unskilled operators. Nevertheless it seems that the ego of some amateurs needs to be fulfilled by pretending to the uninitiated that they have shown commercial practice "The way to go", in areas where they have patently not. A few microprocessors thrown in to act "Big Brother" and tell the punter when he is over-deviating, doesn't change the picture, especially when the heart of many amateur repeater systems is a modified Pye or Storno unit.

The effect of repeaters on the 145MHz amateur band has been detrimental to standards and the practice of amateur radio as defined by the RSGB. This is not merely a point of view, it is a statement which can be proven or otherwise by unbiased observation of the facts. We are sick of spurious excuses and justifications and comments along the lines of: "If you don't like them don't use them". In many areas of the country if you don't use them you don't work anybody; result a lot of expensive, under-used equipment. Away from large centres of population, although so-called amateurs are still numerous, 145·5MHz seems a virtual graveyard for nearly 90 per cent of the time.

These are the facts:

1. The various repeaters which we are in range of are abused for large amounts of time. This is abuse by amateurs and not just "jammers".
2. They are continually abused by fixed stations who either can work each other direct or could do so with a modest antenna improvement.
3. They are continually abused by stations who strive to work through distant repeaters and talk about them "Opening up the country".
4. They are abused by stations who drive to high spots to work entirely through distant repeaters and they are massively abused during "Lifts" when most users accept them as a substitute to working real DX. We have heard members of repeater groups "Hope the DX will be good" through their repeater.
5. Most seriously they are abused by a majority of fixed stations who monitor them for large amounts of their time in the shack. This siphons off activity since at any one time a large number of fixed stations are "Listening through".

We are sure many readers will recognise the instances we have mentioned and wonder how they accord with the stated objectives of only improving mobile or portable communication.

Occasional sanctimonious reminders by the RSGB fall on deaf ears, but it is naive, we believe, to expect to have repeaters without this abuse. Human nature dictates that a majority of amateurs will tend to listen where the "Action" is. So which is more important, mobile operation or the hobby in general? So-called "improvements" to one are definitely detrimental to the other and it is time amateurs stopped pretending they aren't.

H. Irwin GI8ROJ, J. Finnegan GI4FFL,
R. Ashe GI8RLE, G. Frazer GI5MPS,
Armagh, N.I.

At the risk of incurring the further wrath of the above gentlemen, I should perhaps explain my comments in July.

1. When licensed amateurs were called upon to provide emergency communications during the ambulance drivers' strike not so very long ago, I understand that the results were compared very favourably indeed with the usual PMR service operating in similar areas in several parts of the UK.

2. So far as I know, PMR talk-through stations do not yet operate with such narrow separation of transmit and receive frequencies as do the amateur 2m and 70cm repeaters. Though the latter do have the advantage of being individually built rather than coming off a production line, this nevertheless represents a considerable technical achievement.

The "modified Pye or Storno unit forming the heart of a repeater" is a very small part indeed when compared to the design and construction expertise required to produce the control logic, the duplex filtering and everything else which goes to make up the complete repeater, capable of continuous operation without recourse to reserve equipment.

I would agree that repeaters are abused, but so are simplex channels. It is an unfortunate fact of human nature that any service of any sort, radio or otherwise, will be abused by some people.

I think that repeaters have done much to popularise amateur radio with many people who would not otherwise have become interested in the hobby. Certainly mobile operating would not have taken off in the way that it has, and there would have been far fewer amateurs to talk to over the air generally. *G3GSR*

What is an iambic keyer? The term iambic derives from poetry, where it means a sequence of syllables, first short or unaccented, then long or accented, and so on. The *Oxford Companion to Music* quotes as an example:

"The *dusk-* |y *night* |rides *down* |the *sky*"

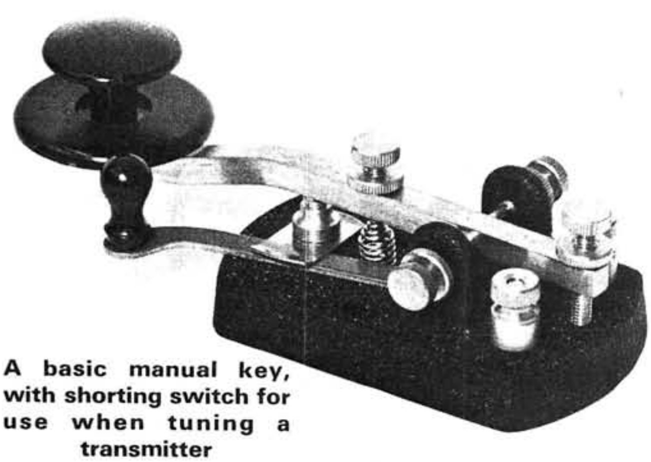
where the italic syllables are the accented ones.

But what is the connection between poetry and Morse code? Well, that's perhaps best explained by looking first at the various sorts of key available, remembering that each Morse code character is made up from elements called "dots" and "dashes", which are short and long in duration.

Basic Keys

The basic telegraph key consists of a metallic bar, pivoted somewhere near its centre on a horizontal axis and with a knob or handle at one end to give the operator a good grip. A pair of contacts are provided, one on the moving bar and one on the fixed base, and usually situated near the operator's end. These contacts close and complete the transmitter keying circuit when the operator presses down on the knob or handle against the tension of a spring. Some sort of stop fixes the "rest" position of the key bar. This stop often consists of a second pair of contacts at the end of the bar furthest from the operator—these contacts are normally closed and open when the key is pressed.

The contacts nearest the operator are called the front contacts, whilst those at the far end are called the back contacts. The back contacts are sometimes used to control some secondary functions when keying a transmitter.



A basic manual key, with shorting switch for use when tuning a transmitter

Because the back contacts will open before the front contacts close, and will not close again until after the front contacts have opened, there is a time overlap which can, for example, be used to protect an associated receiver by removing its antenna and/or applying a desensitising bias whenever the transmitter is radiating. In the modern transceiver, such functions are usually carried out by an internal transmit/receive relay, or electronic switching.

In the best quality keys, the pivots will often be ball-races, but in cheaper versions, sleeve bearings are more likely to be used. The contacts should be some sort of precious metal, such as silver, if constant problems due to tarnishing are to be avoided.

Two operator adjustments are provided: "gap" and "tension". These are fairly self explanatory; "gap" setting the amount of vertical movement of the key bar, and "tension" the amount of pressure needed to overcome the spring.

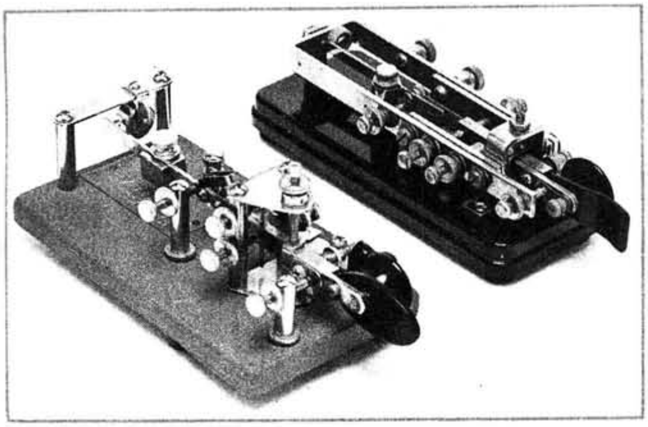
The keybar should always be connected to the "earthy" side of the keying circuit. Anyone learning Morse should use a basic "up and down" type key until he has learned the characters and got up to a reasonable sending speed. In the Post Office Morse test for the UK Class A Amateur Licence, you can use no other sort.

"Bug" Keys

The speed at which an operator can send Morse code characters is limited by the rate at which he can form short series of "dots". In an effort to overcome this limitation, the mechanical "bug" key was invented. In this type of key, the key "bar", which is mounted on vertical pivots, is divided into several parts, and the operator moves the handle sideways—to the left to send "dashes" and to the right to send "dots".

The "dashes" must be made and timed individually by the operator, but moving the handle to the right will send a string of "dots" automatically. This is done by means of a weighted section attached to the far end of the bar by a leaf spring, which oscillates from side to side when it is moved away from a damping stop. A moving contact is mounted on the weighted section and a fixed contact on the key frame. When the contacts close briefly on each vibration, a "dot" is formed. The bob weight can be slid along a track to change the rate at which the "dots" are sent; the further from the spring, the slower the "dots".

A mechanical bug key requires a fair amount of skill to adjust and operate properly. There are typically nine adjustments, including two spring tensions, two gaps, two stops, bar height and pivot end-play. The most difficult



Two "Bug" keys. On the left, an American Vibroplex "Lightning Bug", and on the right a Japanese version, both dating from the early 1950's

part of operating is maintaining the correct spacing when changing over from a "dot" to a "dash" or vice versa within a single letter.

By the adoption of digital techniques, it is possible to design an electronic key which overcomes all the disadvantages of the mechanical "bug", and allows perfect Morse to be sent without effort.

Electronic Keyers

I'm not sure whether there were any electronic keyers based on valves, but there were certainly transistorised ones, followed by t.t.l. designs. All of them use the same principle of a triggered pulse generator running at "dot"-rate, and controlling "dot" and "dash" generators.

The keyer circuit is controlled by a "paddle", similar in some ways to the "bug" key already described, but without the vibrating arm. Moving the paddle handle to the right closes one pair of contacts (usually the "dot" contacts), and moving it to the left closes another pair (usually the "dash" contacts). A contact closure starts the pulse generator and connects it to either the "dot" generator or the "dash" generator, as appropriate. These generators are arranged so that:

1. A "dash" is three times as long as a "dot".
2. A "dot or "dash", once started by closing the appropriate contact, will last for the correct time even if the contact is opened again too soon (called self-completing elements).
3. If a "dot" or "dash" has just been sent, and one of the contacts is made immediately afterwards, the next element will not start until a gap or space equal in length to a "dot" has been left (called self-completing spaces).

These features make the electronic keyer much easier to use than the mechanical "bug", because the problem of changing over from "dot" to "dash" or vice versa (mentioned previously) is virtually eliminated. All you have to do is to change over within the period of a "dot"-length space.

Iambic Keyers

An iambic keyer is an electronic keyer with an added refinement, and operated by a special paddle with a double handle, so that you can close the "dot" contacts, or the "dash" contacts, **or** both at the same time by squeezing the two handles together (hence the alternative name of "squeeze keyer").

And what, you ask, happens when both sets of contacts are made at the same time? No, the keyer doesn't blow a fuse! If the "dot" contacts are closed first, followed by the "dash" ones, the keyer sends a "dot-dash-dot-dash . . ." sequence until the contacts are opened. If the "dash" contacts are closed first, followed by the "dot" ones, the keyer sends a "dash-dot-dash-dot . . ." sequence until the contacts are opened. Hence the name iambic, and the poetic associations mentioned at the beginning of the article.

The beauty of the iambic keyer comes when you want to send something like the letter "F" ("dot-dot-dash-dot" or as we would usually say "di-di-dah-dit"). Because of the "dot" and "dash" memories in the keyer, it can store an instruction to send a "dot" which you give to it whilst it is actually sending a "dash", and vice versa. This means you can press and hold the "dot" paddle to start the letter "F", then whilst it's sending the second "dot" give a quick tap on the "dash" paddle. The keyer will remember you wanted a "dash" and insert it after the second "dot" and its following space have been concluded. Providing you are still holding the "dot" paddle when that following space ends, the keyer will send the concluding "dot" of the "F". You must obviously release the "dot" paddle before that "dot" ends.

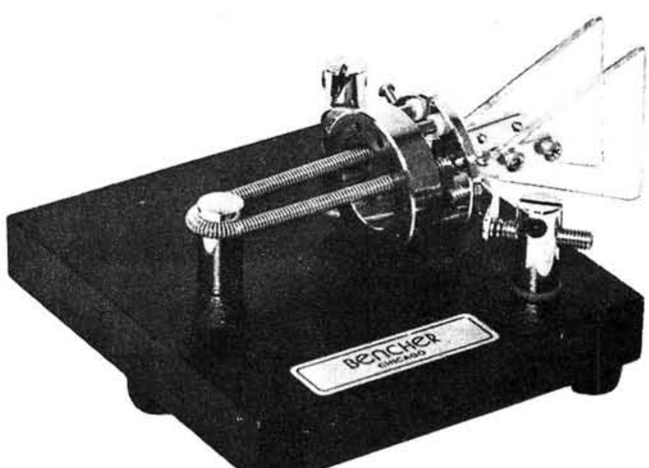
The system described above is known as a Type "A". There is also a Type "B", favoured by some manufacturers, which differs in that it will remember an instruction given to it by **continuing** to hold one paddle whilst the keyer is sending an element of the opposite type. For example, going back to our letter "F", if you released the "dot" paddle whilst the "dash" was being sent, the final "dot" would automatically be inserted after the "dash" and its following space.

Operating an iambic keyer takes some practice, and the secret, as in any manipulative skill, be it driving a car, playing a musical instrument or pounding a Morse key, is to start slowly and work your way up. The advantage is that you can also use it as a simple electronic keyer until you get the confidence to go iambic "on the air".

An iambic keyer reduces the number of operator movements required for all Morse characters, and generates perfectly timed code. The operator has only to ensure that inter-character and inter-word gaps are correctly timed.

Going Iambic

My first iambic system was entirely home-made and included paddles cut from Perspex, drilled to accept brass bushes and tensioned with small springs from the junk box. The contacts were small BA screws on "L" brackets. The electronics for this system proved reasonably satisfac-



The Bencher iambic paddle

tory although the mechanics were definitely not so. Nevertheless, the system was enough to whet the appetite and, some time later, a commercial paddle was acquired.

This was the Bencher, advertised in the American amateur radio press as the "Ultimate Iambic Paddle". I have not had the opportunity to try all available paddles and so I cannot endorse the "ultimate" accolade. However, the paddle is undoubtedly a joy to use, having a heavy steel base with non-skid feet, which ensure that the paddle remains where the operator puts it. The nylon and steel bearings are self-adjusting and need no lubrication. The contacts are gold-plated solid silver, easily adjustable and with locking set-screws.

The first few QSOs after obtaining the Bencher paddle were conducted using an existing electronic keyer, based on five c.m.o.s. chips. It soon became clear, though, that an "ultimate" paddle deserved an "ultimate" keyer. The requirements for such a unit were identified as follows:

Iambic mode—clearly needed to enable squeeze keying to be used.

Dot and dash memory—fits in nicely with squeeze keying as it allows a "dot" or "dash" to be keyed during the preceding elements without it being lost. This feature allows the operator to key slightly ahead of the transmitted Morse.

Low power consumption—battery power in the range 5–10V d.c. with low quiescent current consumption eliminates external power supply requirements and keeps the unit compact.

Self-completing elements—the operator need only touch the relevant paddle for a correctly timed and spaced transmission.

RFI immunity—to operate reliably in the proximity of high field strength r.f., the circuit must be totally immune to interference.

Sidetone—with adjustable level and pitch for comfortable operating.

Versatile output—the circuit should be capable of driving any transmitter, and so should have (switch-selectable) positive or negative keying via high-voltage transistors. A t.t.l. output should also be provided, plus a facility for holding the transmitter on (a "tune" switch).

Weighting—whilst the circuit is normally to produce Morse with ideal (3-1-1, "dash-"dot"-space) timing, the facility for a heavier "dash" and "dot" to cut through QRM is to be available.

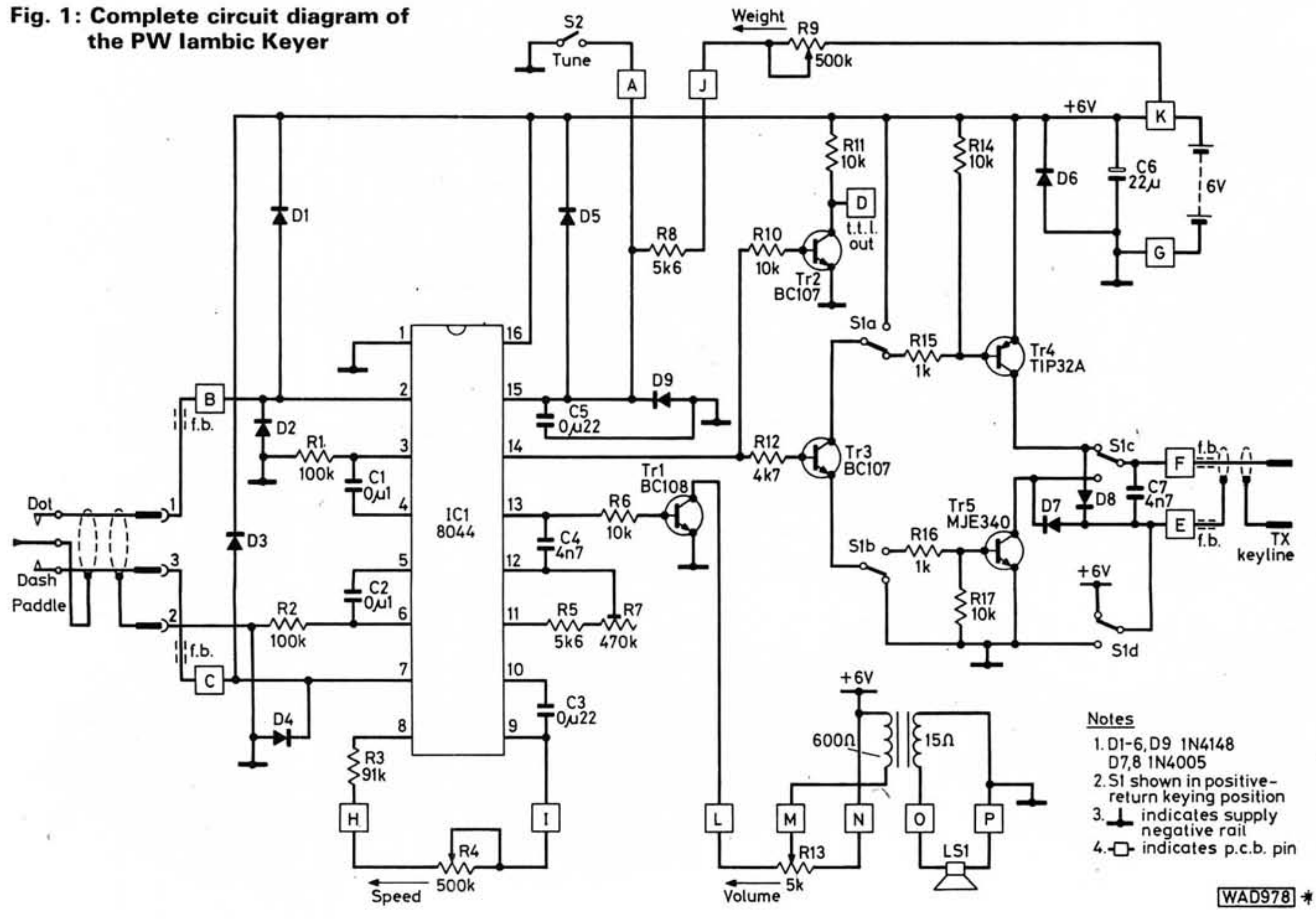
Curtis 8044

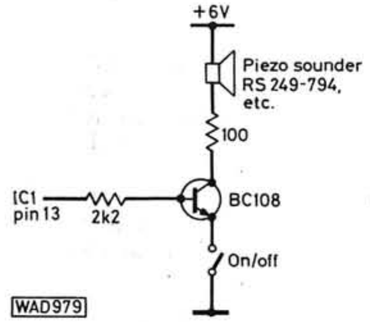
All the above features are provided by the circuit shown in Fig. 1, which uses a Curtis 8044 integrated circuit at its heart. This chip is custom-made for iambic keying, and can be obtained direct from Curtis Electro Devices, Inc., as detailed in the Buying Guide box.

The c.m.o.s. technology of the 8044 ensures a low stand-by current (measured at 5 microamps or less in the prototypes) so eliminating the need for an on/off switch! Without sidetone the key-down consumption is about 6 milliamps, rising to around 25–30 milliamps with sidetone operating.

Referring to Fig. 1, the paddle is connected with the "dot" contact to pin 2 of IC1 and the "dash" contact to pin 7. The paddle common is returned to circuit ground. Diodes D1 to D4 protect the i.c. inputs. Debouncing of the key inputs is provided by R1/C1 for the "dot" contact, and by R2/C2 for the "dash" contact. The one millisecond time constant is adequate for this without being long enough to interact with the user's keying speed. A recent note from Curtis advises that R1/R2 and C1/C2 should

Fig. 1: Complete circuit diagram of the PW Iambic Keyer





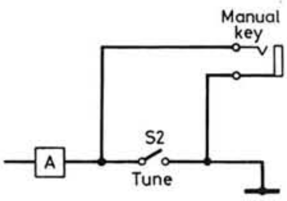


Fig. 2 (left): Alternative sidetone oscillator using a p.c.b.-mounting piezo sounder
Fig. 3 (right): A socket for a manual key can be connected across the TUNE switch

be changed to 1MΩ and 10nF disc ceramics respectively. The prototypes worked satisfactorily with the values shown in Fig. 1 and the components list, and the revised values have not yet been tested.

Keying speed is set by the panel-mounted potentiometer R4, in conjunction with C3. A speed range of approximately 8 to 30 words per minute is available with the components shown. For other ranges, the value of R3 can be changed.

Sidetone is available from pin 13. The combination of R5, R7 and C4 determine the pitch; the user should adjust R7 for the most pleasing note. Transistor Tr1 drives the loudspeaker (in the prototypes a telephone handset earpiece was used) via the matching transformer T1. Volume of sidetone is adjusted by means of R13; if desired this can include a sidetone on/off switch, useful with rigs having built-in sidetone. An alternative method of producing sidetone is by using a piezo-sounder, as shown in Fig. 2. This does not have volume adjustment.

The "dot"-"space" ratio is normally 1:1, however, "weight" may be added by varying R9 from its zero (anticlockwise) setting. If the weighting feature is not required, R9 can be omitted, and R8 returned direct to the positive power line by linking p.c.b. pins J and K. Connecting pin 15 of IC1 to circuit ground via p.c.b. pin A and the TUNE switch S2 will turn IC1 outputs on. A socket for a manual key may be connected across the TUNE switch, as shown in Fig. 3.

The keyed output is available from pin 14 of the 8044 (key down equals "high"). An inverted output (key down equals "low") is provided via Tr2, and can be interfaced with logic or computer systems if desired. If this feature is not required, R10, R11 and Tr2 can be omitted.

The drive for a transmitter key-line is provided by Tr4 or Tr5, depending upon the setting of S1 for positive or negative keying. The equivalent circuits for each setting

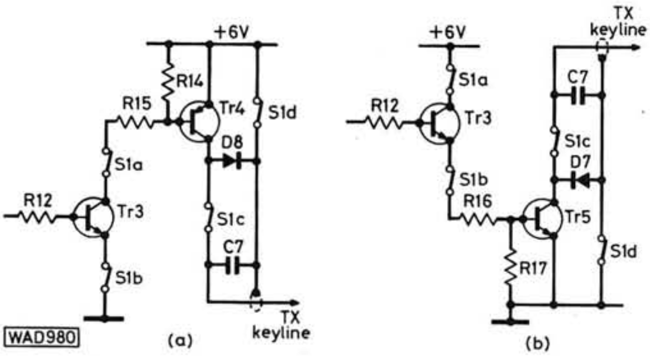


Fig. 4: Transmitter keying circuit shown in simplified form: (a) Positive-return keying. (b) Negative-return keying

★components

Resistors		
½W, 5% carbon film		
1kΩ	2	R15, 16
4·7kΩ	1	R12
5·6kΩ	2	R5, 8
10kΩ	5	R6, 10, 11, 14, 17
91kΩ	1	R3
100kΩ	2	R1, 2*
Miniature horizontal preset		
470kΩ	1	R7
Midget carbon potentiometers		
5kΩ	1	R13 (log. law)
500kΩ	2	R4, 9 (lin. law)
Capacitors		
Polyester		
0·1μF	2	C1, 2*
0·22μF	2	C3, 5
Ceramic		
4·7nF	1	C4
Ceramic disc, 500V d.c. minimum		
4·7nF	1	C7
Tubular electrolytic, 10V		
22μF	1	C6
Semiconductors		
Diodes		
1N4005	2	D7, 8
1N4148	7	D1–6, 9
Integrated circuits		
8044	1	IC1
Transistors		
BC107	2	Tr2, 3
BC108	1	Tr1
MJE340	1	Tr5
TIP32A	1	Tr4

Miscellaneous

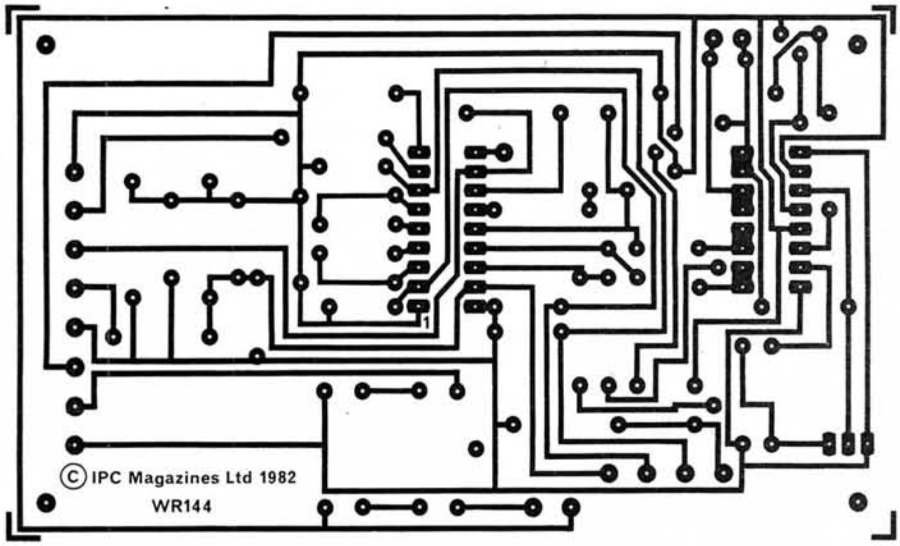
T1 600Ω/15Ω audio transformer, RS Components 217–781; S1 4p 2w d.i.l. switch, RS Components 337–510; S2 s.p.d.t. min toggle switch; LS1 Telephone earpiece; Verobox 202-21038H; 3-pole DIN plug and socket; SP11 batteries (4) with holder; Printed circuit board and pins (16); Ferrite beads (4); Knobs (3); Plug to mate with transceiver key socket.

*See text

are shown in Figs. 4(a) and (b) respectively. If selection of keying polarity is not required, the redundant keying transistor Tr4 or Tr5 can be omitted and the switch connections hard-wired. If a dual-in-line switch (d.i.l. switch) is not available, the keying selection can be done with a d.i.l. header.

Construction

The bulk of the components for the keyer are mounted on a printed circuit board, whose track pattern and com-



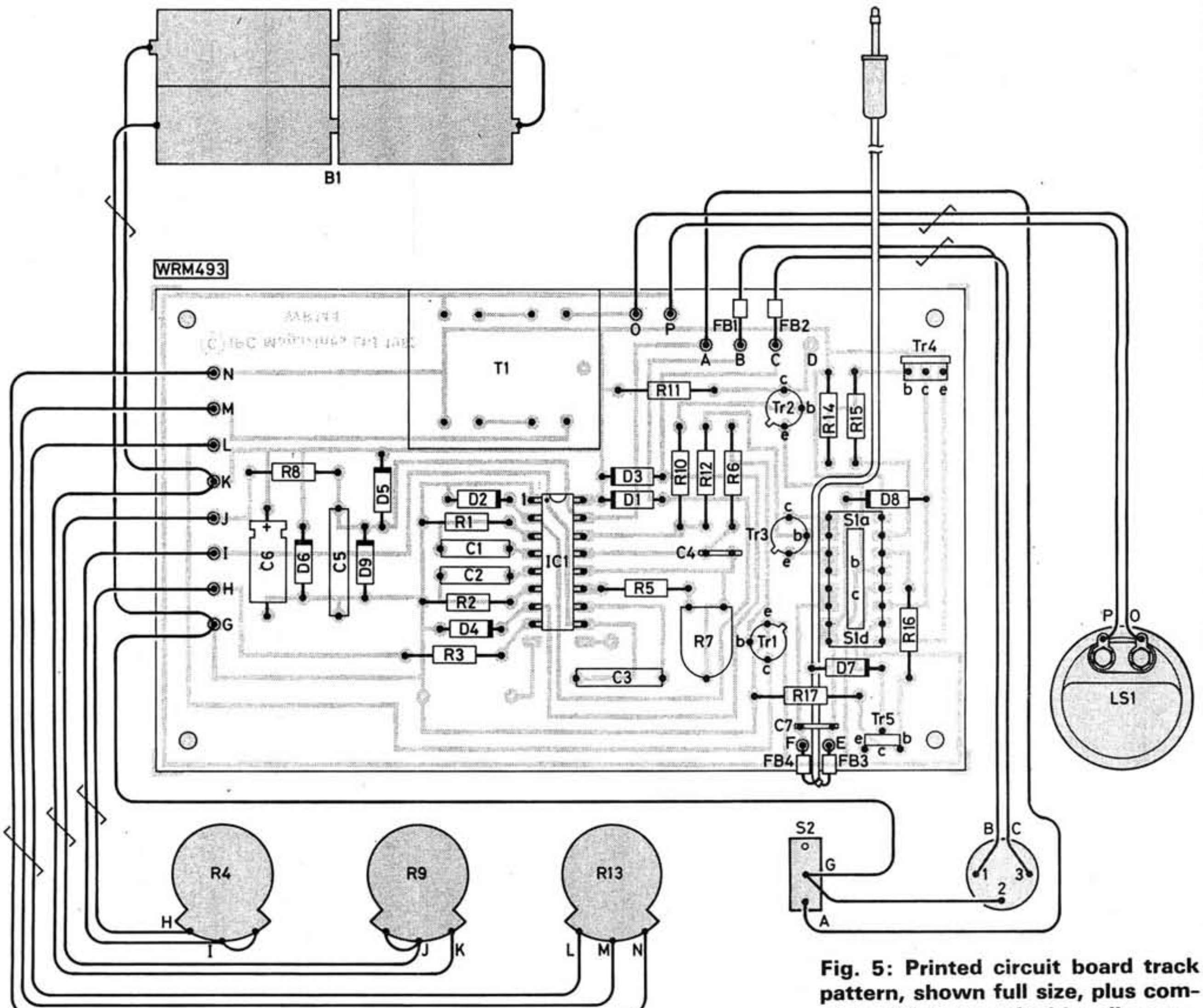
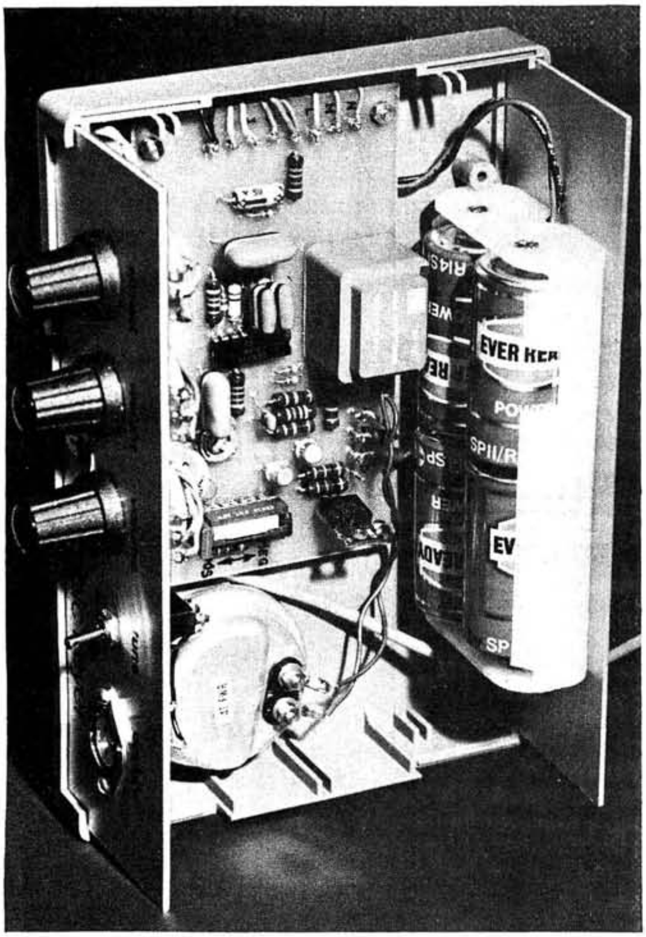


Fig. 5: Printed circuit board track pattern, shown full size, plus component layout and wiring diagram



ponent layout are given in Fig. 5. The p.c.b. as shown includes all the facilities described; the constructor may of course omit those not required.

The two small unused sections of track next to pins 8 and 9 of IC1 are intended to accommodate the Curtis 8044M chip, which is identical to the 8044 except that it includes a "Speed-meter" drive facility, available through two extra pins. The remainder of the pin connections are as shown in Fig. 6 for the 8044. Full details of the speed-meter circuit are given in the data-sheet which comes with each i.c.

The layout and wiring of the keyer are shown in Fig. 5 and the photographs, no special construction techniques being required for this unit. However, it is prudent to fit

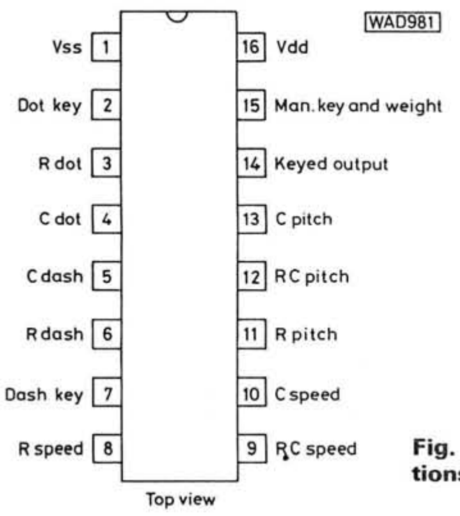


Fig. 6: Pin functions for the Curtis 8044

"Things will certainly be different when I get the Rotovator up there!"

. . . heard by G8TLB

"Switch off your mod and let's hear your carrier." (pause) "OK, now switch off your carrier and let's hear your mod."

. . . heard by S. Unwin

CONSTRUCTION RATING Intermediate

BUYING GUIDE

The 8044 series i.c.s are available direct from Curtis Electro Devices Inc., Box 4090, Mountain View, Ca 94040, USA. Current prices are $14·95 each for the 8044 or 8044B, $19·95 each for the 8044M or 8044BM, plus $5·00 in each case for airmail despatch to UK addresses. Payment accepted by International Money Order, or by Visa or Master-Card (Access) credit cards. You can telephone credit card orders to Curtis on 0101 415 494 7223.

The remaining components are all available from our regular advertisers.

APPROXIMATE COST £32

ferrite beads to the leads to the paddle and transmitter, to further reduce any chance of r.f.i.

The keying transistors, Tr4/Tr5, do not require heat-sinks. The transformer specified for T1 in the components list will fit directly onto the p.c.b. If an alternative type is used, it will be necessary to connect it by means of flying leads. The telephone earpiece can be stuck to the floor of the Verobox using Sticky Fixers. A few small holes drilled underneath it allow more sound to escape to the outside world.

The SPEED control can be calibrated in words per minute if desired. For a given setting of the control, the speed in words per minute is approximately equal to the number of dashes sent in a five-second period. More accurately, the speed is given by the number of dots in a minute divided by 25 (2·4 dots per second). ●

MICROWAVE MODULES MMT 1296/144 TRANSVERTER

If the cut and thrust, contest-crammed h.f. bands have failed to stimulate your interest and 24GHz seems just beyond your horizon at the moment, why not contemplate operation at 23cm?

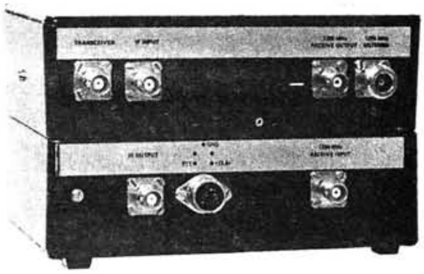
Microwave Modules, renowned for their range of r.f. products, produce the MMT 1296/144 transverter which, when used in conjunction with a 2m multi-mode transceiver, provides a ready means of access to the lowest of the amateur microwave bands.

The transverter is an all solid-state, linear device and will provide 1·3W of r.f. in the range 1296 to 1298MHz, for an input 144MHz drive level of approximately 400mW.

A Zener diode controlled crystal oscillator, running at 96MHz using a 5th overtone high stability quartz crystal, provides the basis of a highly accurate and stable local oscillator source. A pair of frequency doubler stages produce a signal at 384MHz which is then passed to a conventional high *Q* filter, before being amplified and tripled to the transceive local oscillator frequency of 1152MHz. A printed multi-section side-coupled filter reduces the unwanted products of the preceeding ×12 multiplication stages to −50dB, before application to the stripline quadrature mixer.

Signals from the antenna system are fed to the receive converter section of the transverter via an N type socket. A two-stage, signal frequency, microstrip pre-amplifier, housed in its own diecast enclosure, provides gain before the first r.f. amplifier, a low noise NEC silicon transistor. Accurately controlled d.c. conditions and microwave matching techniques ensure a very low inherent noise figure front end. Microwave Modules quote a maximum noise figure of 2·9dB and typical overall gain of 25dB.

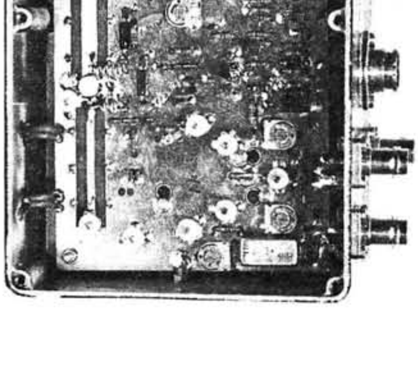
The received signal is routed through a multi-section, λ/2 side-coupled microstrip filter to a BFR34a, second r.f. amplifier. The amplified signal frequency r.f. is subsequently applied to one of the ports of the hybrid mixer, which incorporates a pair of low-noise Schottky diodes. The 144MHz output



of the mixer stage then passes via dual gate MOSFET amplifier stages to the i.f. b.n.c. OUTPUT port.

The transmission path starts with 2m drive applied to the b.n.c. TRANSCEIVER socket. A 15dB, π section, in-line attenuator is provided with the transverter to allow drive levels of up to 10W; approximately 400mW being required to achieve the full rated 1296MHz output.

From the TRANSCEIVER port the 2m input signal is passed through an on-board variable attenuator, before being applied to a discrete balanced mixer stage, formed by a pair of BFR34a devices, to produce the wanted signal at 1296MHz. Two stages of linear amplification follow the mixer before application to the separate, diecast box mounted, p.a. compartment.



The linear final p.a. stage features a rugged, well proven, silicon transistor to obtain a continuously rated r.f. output of 1·3W. Printed stripline techniques are used with antenna changeover switching accomplished by a *pin* diode λ/4 relay, which has an insertion loss of under 0·5dB.

To allow independent operation of the receive converter b.n.c. sockets are provided on the front panel, together with coaxial jumper links. Constructional layout consists of a pair of 195 × 115 × 55mm, black enamelled, diecast enclosures, mounted back-to-back; 12V d.c. and p.t.t. line "hard switching" is routed via a five pin DIN socket. RF VOX is provided as a standard feature; indicators on the unit illuminate on TRANSMIT and whilst power is applied.

Internal construction follows the usual Microwave Modules "compartmentalised" technique and proves to be very satisfactory from both the r.f. and mechanical viewpoint. All components are readily accessible for servicing and are mainly mounted on high quality glass fibre and Teflon p.c.b.s.

Operation

The review sample MMT 1296/144 has been put to good use over the last six months, principally by fellow microwave enthusiast and *PW* contributor, Nick Foot G8MCQ.

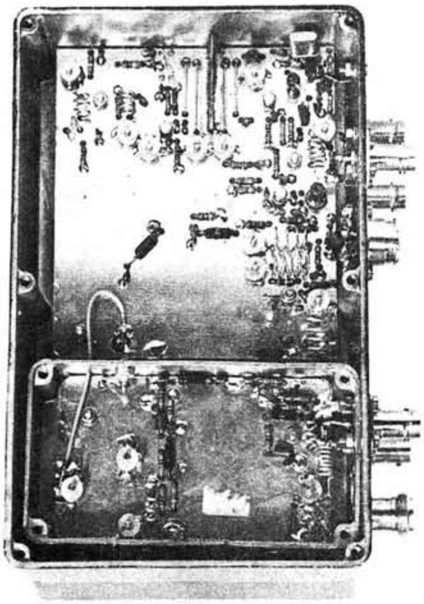
Initial operation occurred during the 1981 v.h.f. NFD from Bulbarrow Hill, YK19a, 11km West of Blandford in Dorset, using the callsign G4GTH/P. The transverter was first used to drive a home brewed 15W p.a. stage, consisting of two 2C39 valves. The p.a. output was fed to a single G3JVL, quad loop Yagi at 12m a.g.l. via a length of RG8U cable (estimated 3dB cable loss). An additional relay was found to be required in the antenna path to prevent r.f. leakage into the receive converter. When operating the unit barefoot no problems of this nature were encountered.

continued on page 59▶▶▶

AIR TEST

▶▶▶continued from page 56

The station check log lists many contacts, including a 5/9 exchange with G3XDY/P in AM67f, a distance of 283km. As is usually the case, rain occurred during the evening and the outboard p.a. stage slowly decomposed due to the combined effects of a cathode to grid short and flash-over of the h.t. supply! (G4GTH/P was located in a tent). Further contacts were made using the, still fully operational, barefoot transverter, s.s.b. being superseded at one point when our own G4LFM pounded the key during the early hours.



From his home QTH in Poole, 30m a.s.l., using a single quad loop Yagi at 10m a.g.l., Nick has since had a considerable number of 1296MHz contacts. The Martlesham Heath beacon, GB3BPO on 1296·830MHz is normally audible over what is by any standards a fair distance. During periods of lift Nick comments that only the relatively low occupancy of the band limits DX operations, propagation effects bear a close resemblance to the lower v.h.f./u.h.f. bands, and lifts occur with surprising regularity.

In flat conditions contacts are readily made over seemingly obstructed paths, once again showing the characteristics of 70cm and most definitely not just "line of sight".

With such a short wavelength at 1296MHz (23cm), antenna systems possessing high gain become mechanically manageable, parabolic dishes are a practical proposition and finding favour for e.m.e. use.

Maybe 1982 will see the long overdue increase in use of our lowest microwave band. See you there.

JOHN M. FELL.

1296 BEACONS (UK)

GB3NWK	AL51b	1296·810MHz
GB3BPO	AM77j	1296·830MHz
GB3AND	ZL63b	1296·870MHz
GB3DUN	ZL08e	1296·890MHz
GB3IOW	ZK34a	1296·900MHz
GB3CLE	YM48h	1296·910MHz
GB3LEL	ZM24j	1296·920MHz
GB3MLE	ZN32b	1296·930MHz
GB3EDN	YP04g	1296·990MHz

Thanks to **Microwave Modules, Brookfield Drive, Aintree, Liverpool L9 7AN. Tel: 051 523 4011,** for the loan of the review model MMT 1296/144 which is available at £184.00 direct from MM or their approved distributors.

Passport To Amateur Radio-8

▶▶▶continued from page 31

The circuit is inherently insensitive to amplitude variations and provides good rejection of a.m. signals and noise.

AF Amplifier

The receiver a.f. stage is usually quite conventional and would normally provide sufficient power output to drive a small loudspeaker or headphones.

Converters

A converter is basically a self-contained frequency changer stage which can be used ahead of the receiver to allow it to tune a different frequency range. For example a two metre converter would convert the 144-146MHz input to, say 28-30MHz output for reception on a receiver capable of tuning these frequencies. A block diagram of a 2-metre converter is shown in Fig. 79. Note that here the oscillator frequency is fixed and the receiver is used as a "tuneable i.f.".

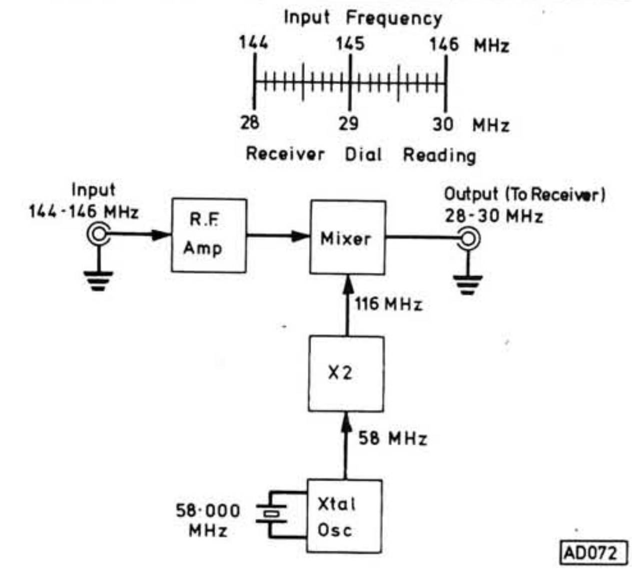


Fig. 79: Block diagram of a 2-metre converter, and how the input frequency and receiver dial reading are related

Construction

If you are a budding transmitter or receiver constructor, please remember that the circuits appearing in this series are typical examples with typical component values; they are not presented as tried and tested, ready-to-build designs. Layout, component lead length etc., greatly influence r.f. circuits, so if you are just itching to build something, stick to a fully detailed design, at least for *your* first attempt.

Next month we will look at the topics of propagation and antennas.

Ideas DEPARTMENT

Some original circuit ideas provided by our readers. These designs have not been proved by us, and we cannot therefore guarantee their effectiveness. They should at least provide a basis for experimentation.

Why not send us your idea? If it is published, you will receive payment according to its merits. Articles submitted should follow the usual style of PW in circuit diagrams and the use of abbreviations. Diagrams should be clearly drawn on separate sheets, not included in the text.

Each idea should be accompanied by a declaration that it is the original work of the person submitting it, and that it has not been accepted for publication elsewhere.

Bi-polar Current from IC555

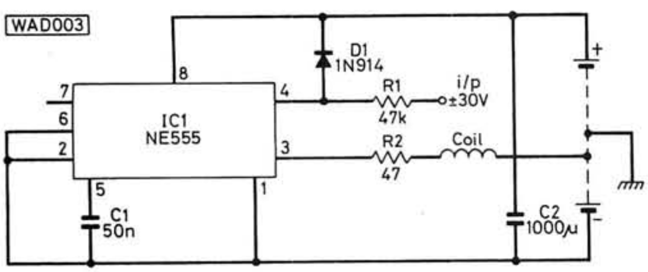
The IC555 is normally used as a single current output device, that is, the output is taken from pin 3 to either positive or negative supply of the battery. If the output is taken instead from pin 3, to the centre-tap of the battery, we can get a double current output, that is, the output current can swing in either direction. This mode of connection can be used for loads which require bi-polar current, such as a teleprinter coil.

The $\pm 30V$ output from the telegraph receiver discriminator is fed to the reset transistor base, pin 4 of the i.c., via R1. When a negative voltage corresponding to a SPACE signal comes, the reset transistor conducts and the output at pin 3 goes low, thereby SPACE currect flows through the coil.

When a positive voltage corresponding to a MARK signal comes, the reset transistor is cut-off, but the output at pin 3 goes high, as the lower comparator input, pin 2, has been connected to the negative supply. When the output at pin 3 goes high, a MARK current flows through the coil.

The diode D1 prevents high voltage (+30) going to pin 4. Pin 5 has been connected to the negative supply through capacitor C1, and pin 6 is connected to the negative supply to avoid any spurious response. Resistor R2 limits the current through the coil to about 30mA. As the current through the coil is bi-directional, no transient voltage reflects back to the i.c. Capacitor C2 decouples the power supply; such a high value is required as the load is of a keying type.

M. F. Ahmad
India

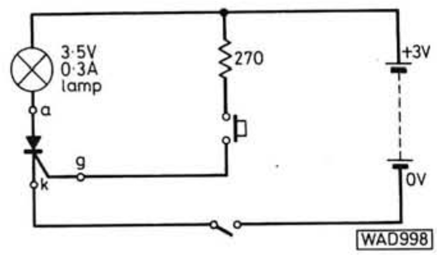


Thyristor Tester

A thyristor acts as a diode which can be switched on by passing current into the gate and will then remain on until the forward current through the thyristor falls to zero or below the specified holding current.

To test a thyristor using this circuit, close the toggle switch and at this stage the lamp should be off. Then press the push button switch to turn on the thyristor and the lamp will light. On releasing the button the lamp will remain on until the circuit is broken by opening the toggle switch.

A. P. Cooper
Bournemouth
Dorset



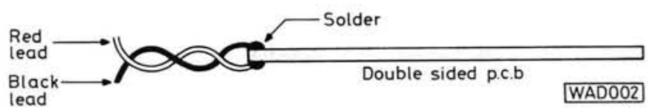
What Current Does it Take?

If you have ever needed to measure the current taken by a transistor radio from the batteries, then the simple device described here may prove to be a time and trouble saver.

Cut a strip of thin double-sided copper p.c.b. about 50mm × 10mm. Attach a pair of leads of about 600mm in length, one black and one red, as shown below. The leads can be twisted together and the solder joint protected by wrapping it with adhesive tape or heat shrink sleeving.

The probe is then used by pushing it between two of the cells so that the red lead connects to the positive side of one of the cells and the black lead to the negative side of the adjacent cell. The leads are then connected to the corresponding terminals of a current meter.

J. T. Capon
Sevenoaks
Kent



THE PW 'WINTON' Stereo Tuner

Part 6

E. A. RULE

In this the final part of the Winton Tuner we are concerned with the setting up of the various functions. We also mention how the Winton Amplifier and Winton Tuner should be interfaced.

Before testing the *PW* Winton tuner carefully check over the wiring between the power supply section and the rest of the tuner, in particular check the wiring to the digital unit. If a wrong voltage or reversed polarity is applied to this, the very expensive l.s.i. will be destroyed. It is a good idea to leave the l.s.i. in its original wrapping until the voltages applied to the digital p.c.b. have been checked by actual measurement. Check the voltages around the other p.c.b.s and if they seem within reasonable tolerance of those given in the table, proceed as follows (don't forget to fit the l.s.i. back into the socket but switch the tuner off completely before doing so). Before attempting any alignment the digital unit should have its crystal set to the correct frequency. The ideal method is to connect another digital frequency counter to pin 16 of IC5 and adjust C109 for exactly 3·2768MHz. However it is possible to set the frequency with reasonable accuracy by the following method. Set C109 to the mid-point between the vanes fully "open" and fully "closed". This setting will be accurate enough for all alignment purposes.

Set the clock to the exact time and leave running, after a few hours (or days) recheck the accuracy of the clock, if it is wrong then C109 will require adjustment. Regretfully trial and error is the only way if a frequency counter is not available, in any case, the amount of error should be small.

Switch the tuner controls to: LW, Manual Tuner pressed in, all other buttons out. The DISPLAY switch should be set to Frequency, then turn the manual tuning potentiometer R56 fully anticlockwise. Turn the STANDBY switch to on, connect a mains supply to the mains input lead. The display should now be indicating approximately 130 to 140kHz.

Next turn the manual tuning pot fully clockwise and the display should change to approximately 280 to 290kHz. Repeat the same instructions on each band in turn and the display should indicate as follows:

Manual Tuning	Anti-clockwise	Clockwise
LW	approx 130–140kHz	280–290kHz
MW	approx 490–510kHz	1625–1630kHz
SW	approx 3·25–3·33MHz	6·30–6·50MHz
FM	approx 75–78MHz	108·50–110·0MHz
TV	approx 200	500 (logging scale)

The TV logging scale may be different to the above until the alignment procedures have been completed, however it should show a similar tuning range.

Apart from the TV band all the other displays should be as indicated as the various r.f. units are pre-aligned, if a large discrepancy exists the varicap supply voltages should be re-checked, the voltage at the low voltage end of R56 should measure 1 volt if the full frequency coverage is to be obtained at the low voltage end. The value of R67 may require changing up or down in value but if the correct value pre-sets and manual tuning potentiometers have been used a wrong voltage may be due to a fault in the circuit of either Tr5 or Tr6. Note that on the a.m. bands these two transistors are turned "off", as the supply is removed from the f.m. i.f. printed circuit board.

Incorrect wiring to the digital p.c.b. could also cause the wrong display to be shown. The possible permutations for errors are almost endless and the warning about taking care in wiring may be found to be only too true! If the display is incorrect the most likely fault is incorrect wiring.

Assuming the displays are correct, proceed by switching back to LW (make sure the TV button is released). Before alignment can proceed the signal strength meter requires adjustment and this is carried out with the a.m. tuner set to a point where no stations are received. Adjust R89 so that the meter just indicates to the extreme left-hand side (0 on the scale). Tune the manual tuning potentiometer so that 200kHz is indicated, the l.w. BBC transmitter should now be heard (assuming that the tuner audio output is connected to an amplifier and speaker etc.), adjust the long-wave ferrite antenna coil L10 for maximum signal by moving it along the ferrite rod. It will be found to tune to maximum at a position near the end of the rod. The ferrite coils are affected by hand capacity and a non-metal rod should be used to find the optimum position. Once this coil is adjusted, tune the i.f.t. coils L11, L12, L13 and the i.f.t. on the r.f. unit (Fig. 16) for maximum signal.

Use the correct trimming tool to avoid damage to the tuning slugs. The signal should now be strong enough to indicate on the signal strength meter and the alignment should be repeated carefully using the meter to obtain the optimum tuning point for each coil.

The a.m. i.f. alignment is now complete and the l.w. band can now be optimised. Tune to a station around 165kHz and adjust the l.w. ferrite coil for maximum signal, then repeat the two adjustments until no improvement can be obtained. The l.w. alignment is then complete and Fig. 16 shows the position of the various trimmers.

Switch the tuner to MW and tune to a station around 550kHz, adjust the m.w. ferrite coil L6 for maximum signal, this coil will also be found to tune to a maximum near the end of the ferrite rod. Next tune to a station around 1500kHz, adjust the m.w. trimmer for maximum signal. Repeat the two adjustments until no improvement can be obtained. Remember that during the daytime, signals will be much weaker than during the evenings and alignment may be easier to do later in the day. However, late evening signals are prone to fading and this could make the correct tuning points hard to find. In all cases a signal generator could be used instead of the actual stations, with more accurate results, but it is assumed that not many readers will have access to such equipment.

Connect an external antenna and switch to SW, tune to a signal around 3·6MHz and adjust the "SW trim LF" for maximum signal. Tune to a station around 6MHz and adjust the "SW trim HF" for a maximum. Note that s.w. signals are very prone to fading at all times and the adjustments may have to be repeated several times for optimum results.

The a.m. alignment is now complete. The ferrite rod antenna coils should be fixed into the final positions with a suitable sealing wax or nail varnish (candle wax is all right; this should be melted and then allowed to drip on to the end of the coil and rod to hold the coil in position). Do not seal the i.f.t. slugs as it would be impossible to adjust them at a later date if required to do so without breaking the slugs. Likewise do not put any wax into the a.m. r.f. unit.

FM Alignment

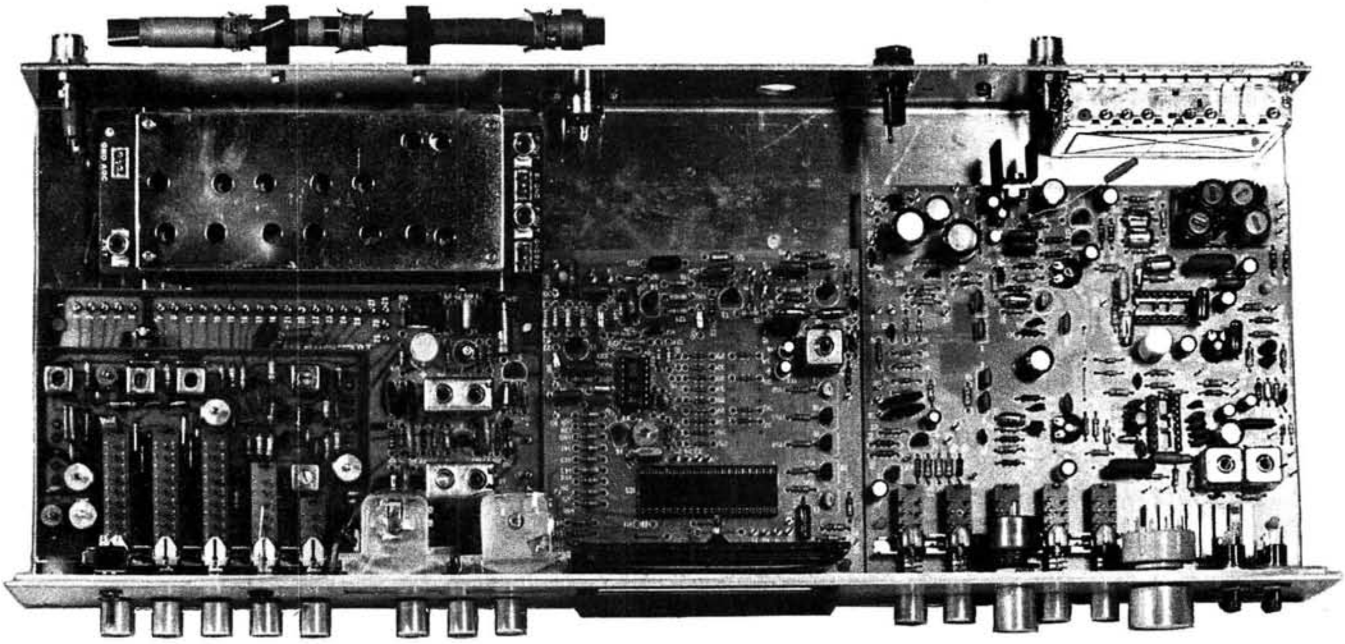
Switch the tuner to FM and MANUAL TUNE, all other buttons out. Tune to approximately 100MHz or where no stations are present. A background hiss should be heard in the loudspeaker, note the position of the centre-tune meter, it will almost certainly be deflected to one side. Adjust L4 until the meter indicates the centre position (there may also be a slight decrease in the hiss level at the correct tuning point). Listen to the hiss level and adjust L3: at the correct tuning point there will be a reduction in hiss level and also a slight movement of the centre-tune meter. The correct tuning point for L3 is the point of minimum hiss. If an output meter is used the exact point is easier to locate. Re-adjust L4 to the centre tune position on the meter, L4 and L3 are now correctly aligned.

Locate a local f.m. v.h.f. station (an antenna must be connected) and carefully tune it so that the centre-tune meter indicates the centre point. Note the signal strength on the signal-strength meter, carefully adjust IF1 and IF2 on the f.m. r.f. unit (Fig. 16). First adjust for maximum signal strength, then if the centre-tune meter has deflected to one side, slightly adjust either IF1 or IF2 for a centre indicating tuning point. Do not re-adjust the manual tuning while doing this. If the signal strength indicated shows a noticeable drop due to this slight re-adjustment then instability is present and must be cured before proceeding.

Instability can be caused by omitting decoupling capacitors between chassis and certain wiring points or due to poor wiring layout. It may in some cases prove necessary to increase the number of points decoupled to chassis, and ceramic disc type 0·01μF capacitors should be used for this. The correct points will have to be found by trial and error and more than one may be required.

Providing the wiring has been carried out as recommended no problems should arise, but r.f. circuits are tricky at the best of times and each layout will be slightly different and require slightly different treatment. Keep all decoupling capacitor leads as short as practical. Once the i.f. section has been aligned correctly, carefully tune in a station so that the centre-tune meter indicates the centre point and note the position of both the centre-tune meter and the signal-strength meter. Switch to the Narrow bandwidth position (selectivity button depressed). The centre-tune meter should stay in the same position and the signal-strength meter should only indicate a slight change in signal strength (if any).

Tune to a point between stations (or remove the antenna), press the MUTE button in and adjust R56 until the background hiss just disappears. Then tune along the f.m. band and re-adjust R56 if hiss is heard at any other points, ignore any stations heard. The object of the adjustment of R56 is to mute the interstation hiss anywhere in the f.m. band. Reconnect the antenna if it has been removed and tune into one or more stations. Nothing should be heard



Photograph of the interior of one of the first tuners from Hart Electronics

until the station is tuned in correctly and of enough strength to override the mute. Switch the MUTE off (button out). Note that when the mute is in use the signals are muted when the centre-tune meter is deflected to either side as well as when the signal is of low strength.

When you detune from the station until the centre-tune meter indicates to one side, switch AFC on (button depressed); the a.f.c. action should "pull" the tuning point indicated towards the centre. Check this on both sides of the centre tuning point. The f.m. alignment is now complete.

TV Alignment

Switch to TV, both the FM and TV buttons must be depressed. Tune the manual tuning potentiometer fully anticlockwise and adjust L15 on the digital p.c.b. until the display indicates 200 (ignore the kHz sign). Then tune to the fully clockwise position, the display should indicate between approximately 500 and 550. Next connect a TV antenna to the antenna socket and carefully tune in a TV sound signal. Remember it is possible to tune to the image frequency on the TV band but the correct signal will be the strongest and also the one indicating the highest logging number. A further check is that if you are tuned to the image frequency the a.f.c. will "push" the signal off tune instead of "pulling" it on tune.

Having found the correct signal adjust the tuning slug located underneath the TV r.f. unit for maximum signal strength. The tuning on TV is at a faster rate than on f.m. and must be carefully done. The a.f.c. may be switched on during the alignment once the correct tuning point is reached as this may help. The TV alignment is now complete.

Pre-set Tuning

First locate the required station on the main tuning display for the band in use. Select one of the pre-set buttons and then adjust the appropriate pre-set potentiometer until the same display reading is obtained. Repeat for other stations on each of the pre-set positions. The buttons are numbered from left to right 1 to 4 and the pre-set potentiometers are numbered 1a, 1b, 2a, 2b, etc., the "a" pre-set is wired on f.m. and "b" wired on TV providing the wiring has been carried out as recommended. The a.f.c. and mute circuits work on both f.m. and TV.

Stereo Decoder Alignment

Switch the tuner to FM and select the wide-band selectivity position, MUTE and AFC off. Tune into a stereo station (check in your *Radio Times*, etc.) and adjust R48; there should be two points where the l.e.d. goes out and between these two points it should stay alight. The correct setting is midway between the two points where the l.e.d. goes out. Note, it will not light unless the station is transmitting a stereo signal.

Unless an oscilloscope is available, R45 should be set to its centre position. If an oscilloscope is available connect it to the junction of R94 and C87 (emitter of Tr7), tune in a stereo signal (or use a stereo signal generator), wait until the programme modulation has a pause and adjust R45 for minimum output of the residual pilot tone signal. The 'scope will need to have a sensitivity of 10mV/cm in order to make this adjustment. It is not critical as pilot tone filters are fitted in any case. Now your *PW* Winton Tuner is ready for use.

Cabinet Fixing

Four holes are provided in the chassis for cabinet fixing screws but one of these will be found to be "blocked" by the f.m. r.f. unit flange. A drill should be carefully used to clear this hole after the f.m. r.f. unit has been fitted.

Modification

It is possible to modify the tuner to allow stereo reception in the narrow-band and TV positions. If this is required it is only the stereo l.e.d. D13 h.t. lead that needs changing, instead of connecting to the front tag of S1 it is transferred to the centre tag. The tuner will then receive stereo or mono signals automatically. However, the narrow-band position will introduce more distortion on stereo signals although the signal to noise ratio on weak signals may show improvement.

Strong Signal on AM

The external antenna socket is common to all a.m. wavebands and when an external antenna is connected for short-wave reception it is possible to overload the input on m.w. and l.w. local stations under certain conditions. If this occurs it is suggested that the external antenna be disconnected on the m.w. and l.w. bands. To do this simply disconnect the coil L8 on the ferrite rod antenna and leave pin a5 blank. The ferrite rod antenna will be found to provide ample sensitivity under most conditions.

Finishing Off

The lettering on the fascia panel can be done with black dry-print transfers. Before attempting to transfer the lettering wash all grease from the fascia panel with hot soapy

Transistor	Collector	Base	Emitter	Switched to
Tr1	10	2	1·2	f.m. narrow band
Tr2	10	2	1·2	f.m. wide band
Tr3	11	2	1·4	f.m.
Tr4	3·8	11	1·8	f.m.
Tr5	2·5	4·6	5·2	f.m. a.f.c. on
Tr6	24·5 drain	2·5 G1 G2	2 source	f.m. a.f.c. on
Tr7	11	1 6	2	a.m. m.w.
Tr8	10	3·3	2·6	a.m.
Tr9	10·8	10·9	11·5	voltages depend on signal level
Tr10	11·8	7·4	6·8	f.m.
Tr11	11·8	7·4	6·8	f.m.
Tr12	6	1·8	2·2	TV
Tr13	9·8	3·8	3·2	
Tr14	4·9	1·6	0·9	
Tr15	4·9	1·6	0·9	
Tr16	−18	5	5	
Tr17–21	−8·5	4·8	5	

Rectifier diodes	Anode	Cathode
D14	−19V	15V a.c.
D15	15V a.c.	19V
D16	15V a.c.	19V
D17	15V a.c.	42V
D18	0V	15V a.c.

Pin	IC1	IC2	IC3	IC4	IC5	IC6
1	2	10	18	2	5	9
2	2	3·4	0	1	*	0
3	2	4·8	12	0	*	5
4	0	0·7		0	*	
5	0	7·4		0	*	
6	5·5	7·4		1	*	
7	5·5	0		0	*	
8	5·5	11		0·2	*	
9	5·5	5·2		5	*	
10	5·5	2·6		1·4	*	
11	11·5	2·6		0	*	
12	4·6	2·6		2·6	*	
13	0	2·6		2·6	*	
14	0	2·6		5	*	
15	4·7	0			*	
16	3·8	0			*	

* Other voltages will depend on function and are not given.

A lead should be taken from an earth tag on the front plate to the case of the i.f. transformer on the a.m. r.f. unit.

In the wiring chart published in part 5 there was an error on page 49. In the fifth box the first yellow wire should go from b24 to d32a via c6 not c9 as printed.

Revised circuit diagrams are available from the Editorial Offices, Poole. Please send a 10 × 8in s.a.e.

water and dry thoroughly. The lettering will then be found to transfer on to the panel without problems.

The display and pre-set cut-outs can be covered with pieces of clear plastic to prevent inadvertent damage. Two pieces of plastic are required for each cut-out. The smaller piece fits into the cut-out with a firm fit and the larger piece, which is glued to the smaller, covers the opening with a slight overlap all around. Cut the smaller piece slightly oversize and file or sandpaper until it is a firm press fit in the cut-out. A piece of green transparent gelatine should also be placed between the chassis front and the fascia panel to improve the visual appearance of the display.

Strips of foam (draught excluder) are placed along the edges of the display cut-out between this and the 6-LT-09 display. These may be coloured black and will hide the gap between the two.

The Winton Amplifier

To use the *PW* Winton Tuner and Amplifier together connect the audio output from the tuner into the TUNER input of the amplifier, the signal levels and matching are correct. In some instances, mains-borne interference may be found on the a.m. bands due to the interference being transmitted by the mains transformer in the *PW* Winton amplifier into the ferrite rod antenna of the tuner. To prevent this, connect a 0·22μF polyester capacitor across each half of the secondary of the amplifier mains transformer to chassis. The easiest method of doing this is to connect one end from each 0·22μF capacitor to pins 14 and 15 respectively on the main p.c.b. and connect the other ends of the 0·22μF capacitors to the negative tag of C40 which is adjacent. The 0·22μF capacitors should be 250V d.c. minimum rating. ●

MINI 'X' BEAM

▶▶▶continued from page 25

the reflector and supported by a length of strong cord. The 72Ω flat line matches very well, with a low s.w.r. The output from the transmitter is coupled by a 2 turn link to a coil 76mm diameter having 6 turns of 16 s.w.g. wire. Then into two series capacitors of 140pF each coupling the 72Ω line to the antenna.

Adjustments

The beam was tuned for 28·1MHz with the reflector tuned 5 per cent lower in frequency using a g.d.o. The two coils may need slight adjustment and this is carried out by opening or closing the turns to resonate the beam to the correct frequency. With the dimensions given, this adjustment should be marginal.

Weatherproofing

If the beam is to be used outdoors, it is essential to protect the coil loaded section with a weatherproof covering. This can take the form of a suitable plastic box. The ribbon elements will have to be fitted through the box sides, by cutting slits before the end sections are connected to the canes. Also a hole is needed to take the feed line. The plastic box can then be glued down to the coil mounting base. The bamboo canes should be painted for extra protection. ●

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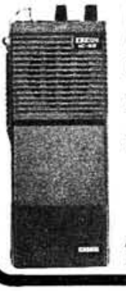

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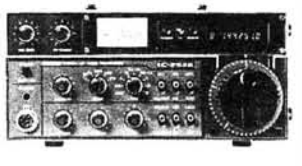

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70 cms 0·5W Synthesiser Package	70PAC2	128.00	163.00
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2M RF Switched Pre-Amplifier	144PA4/S	14.40	18.95
Toneburst	TB2	3.85	6.20
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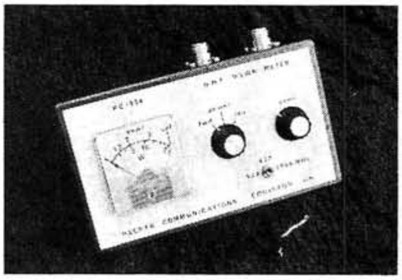

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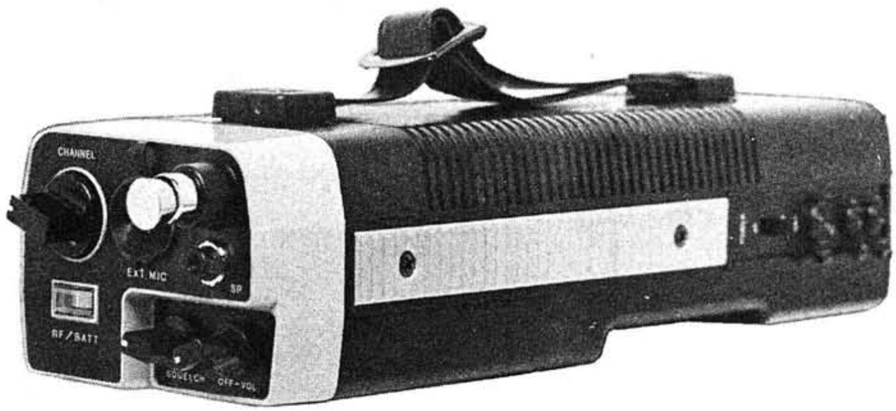
CB RIG CHECK



REALISTIC TRC-1001

CB is a mobile short-range telephone system. You require a licence to use it, £10 p.a. from Post Offices.

Tandy's first hand-held CB rig is this 40-channel fully synthesised 4 watt model. It is of interest mainly because it claims to deliver 3·5W r.f. output in a hand-held format complete with built-in microphone and telescopic antenna.

FACILITIES

All 40 channels are provided, selected by a rotary switch mounted on the top panel. Also on the top panel are SQUELCH, ON/OFF VOLUME, external mic. socket, speaker socket, telescopic antenna and the RF/BATT meter. Channel indication is by bright l.e.d. display on the front just above the internal speaker. The internal microphone is at the lower end of the front. The p.t.t. switch is on one side of the rig and incorporates a push button to enable the channel display to be turned on as required.

The other side carries the HI/LOW r.f. power switch together with sockets for an external antenna and charger and power sockets. Both sides have large metal panels to couple your body to the rig.

Accessories supplied with the rig are a carrying case with straps, two dummy batteries and an instruction manual.

DESIGN AND CONSTRUCTION

The overall impression is one of solidity, especially when the rig is in its carrying case. Out of its case it looks plastic which it is of course. The telescopic whip antenna has to be extended during use otherwise damage could occur to the output stages. With the antenna fully extended the rig becomes even more cumbersome.

One p.c.b. is used with extensive internal screening, a vital factor especially when a plastics case is used. A substantial metal frame surrounds four sides of the board and this is connected to the two side plates by screws. The p.a. transistor is mounted on a large finned heatsink centrally positioned.

Workmanship looked neat from the component side of the p.c.b. which was the only side easily accessible. The instruction manual warns that unauthorised tampering will render the rig "illegal".

A p.l.l. synthesiser is used with i.f.s of 10·695MHz and 455kHz. This use of two i.f.s seems to be universal among designers from the Far East. The synthesiser circuitry is totally screened.

The 16-page handbook gives enough information for the average user and includes a block diagram but no circuit diagram. The warning about tampering with the rig is very pertinent and this is the first handbook that we have seen that offers this advice. The instructions are clear and concise and the drawings of the rig showing the controls and sockets are particularly good.

HOW IT HANDLES

The main problem with this rig is its large size coupled with the enormous whip antenna all of which makes it very awkward to handle. Care must be taken when transmitting to avoid poking the antenna into the face of anyone foolish enough to be standing within one and a half metres behind you. It is also awkward to use indoors as the whip hits most ceilings.

The controls are quite easy to operate and the small size of the top panel is no great problem.

The biggest headache comes with trying to decide how to power the rig in the most economical manner. The battery compartment takes either eight HP7 type batteries or ten similar size NiCads, hence the two dummy batteries. Either way it is going to prove expensive on batteries. The NiCad option would be the long-term solution but this will make the initial cost of the complete outfit very high. Another alternative is to use a 12V d.c. supply for indoor use and save up for a set of NiCads and charger for portable use. Obviously you can use the car battery when within reach of the vehicle.

The l.e.d. display is bright enough to be easily read and is only on immediately after operating the channel selector switch or pushing the button inset into the p.t.t. switch. This nice touch helps to conserve battery power.

The audio output was pleasant to listen to with sufficient volume for normal use.

The rig seemed to work quite well although no outstanding results were obtained during user evaluation. A considerable improvement in both receiver and transmitter performance was noticed when using a 12·5V power supply instead of batteries.

HOW MUCH?

At a list price of £119 from Tandy shops throughout the UK the TRC-1001 is rather expensive especially when you realise that this price excludes the batteries. Eight HP7s will set you back around £1.30 while you can add at least £20 for a set of ten rechargeable NiCads and charger.

Our thanks to Tandy Corporation, Bilston Road, Wednesbury, W. Midlands WS10 7JM for the loan of the review rig. ●

IN THE LAB

Feature	Spec	On test
Transmitter		
Power out: HI	3·5W	4·5W(3)
LOW	0·3W	0·4W(3)
Spurious:	<0·25μW	(4)
Frequency tolerance:	±0·002%	0·0001%
Receiver		
Sensitivity:	0·5μV	0·35μV(1)
Selectivity: (±4·5kHz)	−6dB	
Adjacent channel:	−60dB	
Audio output: (8Ω, 10% t.h.d.)	1W	—

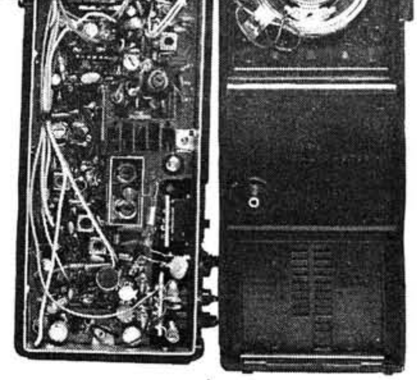
Feature	Spec	On test
General		
Consumption: (2)		
Standby	65mA	46mA
Transmit	1A	900mA

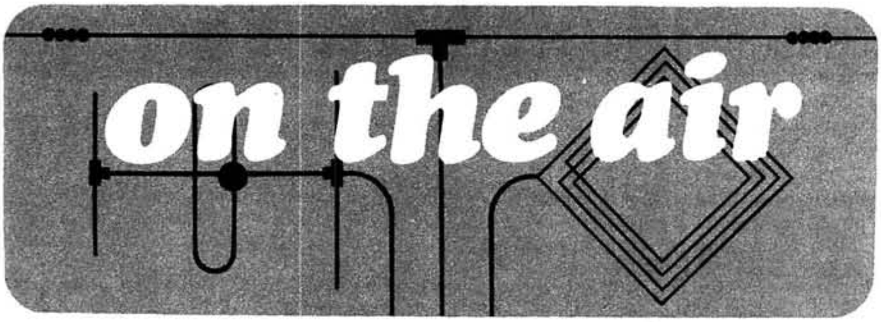
Size: 270 × 90 × 65mm (excluding antenna). Antenna 1·2m long fully extended.

Weight: 1kg approx. (with batteries).

Notes

1. For 10dB (S + N)/N.
2. Tests carried out using 12·5V d.c. stabilised power supply.
3. 1·8W and 0·2W on battery power.
4. Test equipment available for these tests would not measure below 0·4μW. All spurious outputs below this level.





Amateur Bands

by Eric Dowdeswell G4AR

Reports to: Eric Dowdeswell G4AR
Silver Firs, Leatherhead Road,
Ashtead, Surrey KT21 2TW.
Logs by bands in alphabetical order.

The review by the City and Guilds of the answers given to the questions in the May 1981 RAE commented on the lack of understanding by many candidates of the function of the beat frequency oscillator (b.f.o.) in a superheterodyne receiver. For the life of me I don't see why one particular stage should give rise to problems — and more than any other. Maybe the mysterious b.f.o. is often regarded as something of an afterthought, something added to a receiver if one wants to copy single sideband telephony or the Morse code (c.w.).

But since the b.f.o. is a very necessary part of any communications receiver or transceiver it may be a good idea to review its functions.

The diagram shows, Fig. 1, what is just about the simplest arrangement for a superhet receiver, comprising a mixer stage, intermediate frequency stage (i.f.), local oscillator, detector or demodulator, and audio amplifier. Assuming the receiver is working on the 20m amateur band a typical signal on 14 000kHz is fed to the mixer together with a signal from the local oscillator of 14 455kHz, the tuned circuits of the two stages being tuned simultaneously, typically with a ganged tuning capacitor, so that the frequency difference is always 455kHz. This i.f. signal of 455kHz carries any form of modulation, such as speech, that was present on the original signal of 14 000kHz.

The heart of any superhet is the i.f. amplifier, usually comprising several stages in practice, where most of the receiver's gain is achieved and where the band of frequencies passed is tailored to suit a particular mode, speech using amplitude modulation (a.m.) or its variations, upper or lower sideband (u.s.b./l.s.b.) used in s.s.b., or continuous wave signals (c.w.), usually known in the form of the Morse code. The critical component in the i.f. amplifier is the i.f. filter which may be a tuned i.f. transformer/s, ceramic, mechanical or crystal filter, immediately following the mixer stage.

From the i.f. stages the 455kHz signal passes to the detector, or demodulator, stage where the 455kHz r.f. part of the signal is filtered out and the audio portion, representing the original modulation on the signal, is passed on to the audio amplifier and speaker or headphones.

But what if the speech signal is u.s.b. or l.s.b. where the carrier has been suppressed at the transmitter and thus is absent from the detector stage so that demodulation cannot take place? All we have in any sideband is the carrier frequency plus (or minus) the speech frequencies. However we can replace the missing carrier with a signal generated in the receiver itself, by the beat frequency oscillator (b.f.o.) or carrier insertion oscillator (c.i.o.) in modern parlance.

While the same a.m. detector circuit can be used for s.s.b. the level of the b.f.o. signal required for proper demodulation of the s.s.b. signal is fairly critical which led to the development of the more tolerant product detector. If s.s.b. is copied using an a.m. detector results can be optimised by varying the r.f. gain control to get the right level of signal for the fixed b.f.o. voltage.

On c.w. the b.f.o. does a straightforward job beating with the 455kHz carrier in the detector circuit to produce an audible beat note when the b.f.o. is tuned to either side of the nominal 455kHz. For example if the b.f.o. is on 454kHz the beat note will be 1kHz (1000Hz) as it will be if the b.f.o. is on 456kHz. On s.s.b. the b.f.o. is tuned to one side or the other, depending on whether u.s.b. or l.s.b. is being used, until the speech sounds natural. These two positions should be noted on the b.f.o. panel control for future reference.

Now back to the basic circuit shown, and the transmit side this time, with signals taken from the local oscillator and b.f.o., 14 455 and 455kHz respectively and fed to a second mixer stage whose output circuit is tuned to the difference frequency of 14 000kHz, the same as our input signal. Hence we now have a drive source which can be amplified and used as a transmitter, a very simple but practical idea for a c.w. transceiver, the basis of all the sophisticated transceivers on the market today.

It is possible to get much the same results on receive by feeding the equivalent of the b.f.o. signal into the antenna circuit together with the wanted c.w. or s.s.b. signal but at, or around, the signal frequency. This may be done experimentally by feeding in a signal generator and adjusting its frequency around 14 000kHz until the speech or c.w. is resolved clearly, but stability and correct coupling make this a rather difficult operation.

In receivers having dual conversion the b.f.o. would be fed to the last i.f. stage detector in just the same way as before. When adding a b.f.o. to an existing receiver it is worth spending some time in getting the injected voltage just right for satisfactory results on s.s.b. by adjusting the value of the coupling capacitor between the b.f.o. and detector circuit.

Club Time

Little else may be booming just now but the clubs certainly are, with several having to seek larger premises to accommodate increased membership. With AGM time coming round again there have been changes in club secretaries and editors not to mention the odd chairman. There is a definite influx of XYLs and YLs into club committees taking up the

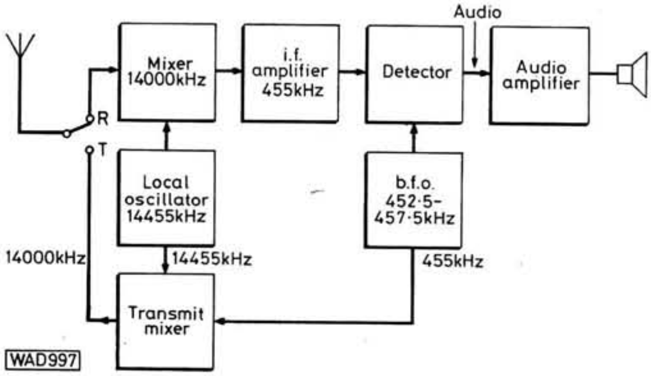


Fig. 1: Block diagram of a basic superheterodyne receiver with additional outputs from the b.f.o. and local oscillator taken to a transmit mixer stage to provide a signal of the same frequency as the one being received. Thus a basic c.w. transceiver is formed

duties of secretary and the like. Any club so endowed can think itself lucky!

Bournemouth RS If this issue of *PW* is out on time you will want to know that Reg Titt G3CMJ will be telling all on Radio and Astronomy, being one of the meetings held regularly on the first and third Fridays at 8pm. Elaine Howard G4LFM of *PW* just happens to be the editor of the club's newsletter so once again we can look forward to regular news of the club.

Pontypool ARS An RAE class and 20 members have started this old club going again after a lapse of four years. Meetings every Tuesday at 7pm at the Settlement, Pontypool, and new or potential members most welcome says A. J. Duck GW6GFY, 15 Ambryn Road, New Inn, Pontypool, Gwent.

Meirion ARS Mrs Jean Jones GW4KYK it should be noted is hon sec and awaits enquiries on the club at 25 Fford Dyfrig, Tywyn, Gwynedd, or will be glad to meet everyone on the first Thursday of the month at the Royal Ship Hotel, Dolgellau at 7.30. A film show is promised for Feb 4th.

Halifax & District ARS Since re-forming the club membership has blossomed to the extent that the venue has had to be changed already and is now the Claremount Liberal Club, Belgrave Avenue, which is off Claremount Road in Halifax, and it is the first and third Tuesday of the month. The former is generally devoted to lectures and visits with the latter concentrating on c.w. classes and general nattering. So it is Alan Sayles G4LEC, 70 Dean Lane, Sowerby, Sowerby Bridge, Halifax or (0422) 33080.

Hastings Electronics & RC Interesting club mag *Vital Spark* says third Wednesdays at the West Hill Community Centre, Hastings are the main meetings with the club room at 479 Bexhill Road, St Leonards-on-Sea open on Monday nights for the computer gang and socially on Fridays. Coming up is Tony Holder holding forth on transmission lines on Feb 17th. If you have nothing to do on Tuesdays there is always the RAE course at the William Parker School between January and May. Sec George North G2LL is at 7 Fontwell Avenue, Little Common, Bexhill-on-Sea or on Cooden 4645.

Salop ARS Thursdays 8pm, Albert Hotel, Smithfield Road, Shrewsbury says sec Edwin Arnold G6AKE, 30 Leamore Crescent, Belle Vue, Shrewsbury. Feb 4th is natter night, with John G8ARS describing prototype production of PCBs on the 11th. The 25th has Richard G3VZG talking on Noise—electrical, one presumes!

Mid-Warwickshire ARS First and third Tuesdays at 8pm at 61 Emscote Road, Warwick, with Feb 16th devoted to Geoff Foster G8UKT discoursing on the intriguing subject of DFing on Top Band. Another lady ready to help prospective members is sec Mary Palmer G8RZR, 12 Edmondes Close, Woodloes Park, Warwick or 499730.

Barking Radio & Electronics Society Also G3XBF and G8XBF, meeting four nights a week no less, at Westbury Rec Centre, Westbury School, Ripple Road, Barking, Essex. Mondays is rig clinic night, Tuesdays for Morse classes with personal instruction for those at 8wpm or less until they can join the main class, club station operation on Wednesdays and main club meetings on Thursdays. A surplus gear sale will occupy Feb 11th. Contact is A. Sammons G8IZN, 80 Lyndhurst Gardens, Barking, Essex.

Southgate RC QTH is St Thomas Church Hall, Prince George Avenue, Oakwood, London N14 but PRO S. G. Lindell G4IEH, 73 Old Park Ridings, London N21 2ER has all the details of club meetings ready to hand for any prospective members.

Conwy Valley ARC Second Thursdays at 7.45pm at Green Lawns Hotel, Bay View Road, Colwyn Bay, with Feb 11th welcoming an engineer from the interference branch of British Telecom, hopefully with some practical advice forthcoming. Dr David Last is a popular annual speaker at the club so it should be a full house on March 11th. Drop a line to Norman Wright GW4KGI at 11 Bryn Derwen, Abergele or ring 823674.

Radio Club of Thanet Feb 26th will be devoted to a talk on antennas, with advance notice for those taking part in the construction contest on March 12th. Meeting place is the Burchington Village Centre but drop a line to Ian Gane G4NEF, 17 Penshurst Road, Ramsgate, Kent for more info.

Wirral ARS Another club on the move, to Minto House School, Birkenhead Road, Hoylake, Wirral, every first and third Wednesday at 7.45. Coming is a meeting on Feb 4th chaired by Alan Smith G4EFP to discuss contest and field events in 1982. Homebrew or bought radio equipment will figure in an exhibition on the 18th and you ought to know now of a film night on March 4th. New sec of the club is Gordon Lee G3UJX, 30 Manor Drive, Upton, Wirral, Merseyside or try 051-677 1518.

Wakefield & District ARS Also club station G3WRS. Meets "Alternate Tuesdays" at Holmfield House, Denby Dale Road, Wakefield. Only dates to hand are on March 9th with a visit to the studios of Pennine Radio and an IBA film on the Emley Moor radio tower on March 23rd. So how about writing to R. Sterry G4BLT, 1 Wavell Garth, Sandal, Wakefield, W. Yorks, or dial Wakefield 255515.

Torbay ARS Headquarters is Bath Lane, Torquay, at the rear of 94 Belgrave Road, Torquay. Main preoccupation of members is the annual dinner scheduled for March 13th at 7.30pm at the Templestowe Hotel in Torquay after a hectic season achieving top spot in NFD on 160m, a successful mobile rally, been hosts to fellow amateurs from the twin town of Hamlin, with some measure of success in contests. L. G. Mays G2CWR, Atlantis, Clennon Avenue, Paignton is PRO so is ready to fill you in.

Cannock Chase ARS The club and twin town Datteln radio stations will be the link in a rifle shoot between the towns now being organised. An equipment and junk sale will feature on Feb 18th at the Bridgtown War Memorial Club, Union Street, Bridgtown, Cannock, where meetings are held every Thursday around 8pm. Try Joe Gregory G8HZP, 22 Tower View Road, Parklands, Great Wyrley, Walsall for the missing details.

Stirlingshire ARG Some new interest in the club is awaited by club sec Grant Stewart GM6CRQ, 2 Mayfield Mews, Falkirk. The club meets on the first Tuesday of the month at 7.30pm but you'll have to contact Grant for the location etc. and event details.

Acton, Brentford & Chiswick ARC This long established club has prospered with its sec W. G. Dyer G3GEH since the 50's so he's obviously doing a good job. He hangs out at 188 Gunnersbury Avenue, Acton, London W3. Meeting at the Committee Room, Chiswick Town Hall, High Road, Chiswick, on the third Tuesday of the month it is an open discussion on Feb 16th on antennas for restricted spaces, chaired by G3IGM. New members and visitors are always welcomed.

Isle of Wight RS Informal get-togethers on Friday evenings with operating nights on club station G3SKY on Tuesdays at the County Hall, Wooton Bridge. Soon to come is a visit to the Niton radio station of ancient vintage. Contact Ian Moth G4MBD, Claygate, Colwell Road, Solent Hill, Freshwater, IOW.

North Bristol ARC Sec W. E. Bidmead G4EUV, 4 Pine Grove, Northville, Bristol BS7 says the club is thriving but not averse to a few new members and, of course, interested visitors at the weekly meetings on Fridays at 7.30pm at the Self-Help Enterprise 7, Braemar Crescent, Northville, Bristol.

Southampton ARS Wednesdays at 7.15pm at the Old Toc H, Little Oak Road, Bassett, Southampton, where, on Feb 10 G3OZT will deal with the Intruder Watch while on March 10 it will be G4BDQ dispensing info on antennas. You should contact Peter Lewis G4LDK on Bursledon 3451 if you want to know more.

Vale of the White Horse ARC First Tuesdays, 8pm, at the White Hart Inn, Harwell Village which could be Oxon or Berks, according to Alan G4FLX, since the boundary has been moved. I like Alan's post code Oxon OX10 0DX. Rather like a winning line in the pools! However for more details you must QSO Ian White G3SEK, 83 Portway, Didcot, Oxon.

Edgware & District RS The Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware, Middx, at 8pm on second and fourth Thursdays but newcomers, and others, can feel in touch by listening to the slow Morse from G3ASR both over the air and at meetings. An Introduction to Amateur Radio ought to draw the crowds on Feb 11th delivered by John Bluff G3SJE, supplemented by the ARRL film The World of Amateur Radio on the 25th. More from hon sec Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx or 01-952 6462.

Braintree ARS Something for everyone in the club mag *BARSCOM* including a jumbo crossword, set off by an article on microphone pre-amps. First and third Mondays, including Bank Holidays, at the Braintree Community Centre, Victoria Street, Braintree, Essex which happens to be next to the bus station. First Mondays tend to be informal meetings with lectures and the like on the third. A nice gesture in the mag is to give brief details of meetings of three other local clubs. Publicity sec is Norma Willicombe, a soon-to-be G6, at 355 Cressing Road, Braintree, Essex, XYL of editor Bob.

Cheltenham ARA Meets at the Old Bakery, Chester Walk, Clarence Street, Cheltenham, with Roger Dixon G4BVY dealing with receiver performance on Feb 4th, and the 19th devoted to nattering, with a timely warning of the constructor's contest on March 4th. Newcomers should not deride "natter nite", an old and revered amateur institution, often a source of much useful information and a getting together of young and old to exchange ideas. Get hold of Grant Cratchley G4ILI, 47 Golden Miller Road, Cheltenham.

General Items

Some 10 months ago **Peter Hawkes** departed this column for Zimbabwe from where he now writes. After a while in Umtali he has settled in Salisbury boasting a 31 deg C climate at present while I try to survive −10! So far he hasn't had much time to contact the local amateurs but hopes to have a TS830 on the air during 1982. Present rig is an AR88 from home plus 91 metre longwire, with the swimming pool providing a nice ground plane seemingly! G's logged on 15m include G5JZ, GD3PIU, G3CRT, G3OUA, G3WRI, GI4KOF with G4JDT and G3RXC on 20m in case any of these wonder where their signals get to.

Rhys Thomas BRS4875 (Bridgend) decided wisely to stick to his RAE studies instead of DXing and duly took the December exam. This in addition to his studies at Bristol University. A spell on 2m and 70cm is envisaged while getting up his code speed for the final G4 ticket.

A reader of *PW* "for more years than I care to think of" in Lincs apologises for his handwriting but if mine is as good at 76 I'll be delighted! It puts some of the younger people to shame! However main purport of the letter was a request for information on getting hold of a Codar CR70A receiver which he feels is best suited to his needs now. Contact me if anyone feels like helping a deserving cause.

"In the cause of science" is how **Frank Ogden** G4JST (Ardingly, W. Sussex) describes his appeal for a manual or circuit diagram of the Telequipment oscilloscope D52. He is presently engaged in building a frequency synthesiser and full power linear for the h.f. bands (editor—please note!) held up by scope problems. Ring him on 0444 892059 if you can help. All expenses paid of course.

DX Time

The snow and blizzards sweeping across the country do not seem to have blunted the DXing appetite of readers although the next lot of mail may bear a different story. No doubt many fragile beams will have bit the dust, or is it slush, in this reversion to the Ice Age.

Very briefly from **A. Magrath** BRS48064 in Ramsgate, Kent, his Trio R1000 aided by a longwire in the loft found JY9RC on 28MHz plus 7P8BX, VQ9DO and VU2OF on 21MHz. An interesting letter from **Ian Millar** in La Nucia, Alicante, Spain, points out that he gave up his call 5H3AP in 1975 yet still gets cards for recent QSOs particularly from the USA and Japan, so beware of pirates!

In spite of studies for the December RAE **Clive Cowan** BRS48987 of Rugeley, Staffs, managed to get his FRDX400 on to several bands, and, with the help of a 10m dipole and a Windom logged VK1HF, YC1CBL, YS1SC, and CE5CN on 28MHz, plus VS5DD, YN7YN on 21MHz, then VP2MH on Montserrat and 9Y4KG on 14. Good calls on 3·5MHz were VE3FJE, TG9AL, HC8MD and PY2XX.

John Hayes BSR48544 (London N9) sent in strings of calls heard on his FRG-7700 with FRT-7700 a.t.u. and longwire, ending with a Datong FL2 filter. Seems all bands were equally good as far as John was concerned. Sorting it out I found A6XTH, C5AAP, C6ANU, FP8HL, HC8MD, J3AH, J6LT, J28DL, JX7FD, S83H, TL8DC, TN8AJ, V3ME (Box 367, Belize City), VK1HF, VK9NYG, YI1AS, Z21AN, DF3NZ/ST2, 5N8BRC, 6W8AR all on 10m. Goodies on 15m included D68AM, HH2A, TU2KC, VS5SP, 6Y5MJ (QSL via K8ZBY), 7P8BO. The 20m band showed A71AA, HK0FBF, J3AH, J6LT, KC6IN, VP2VJ, VP9HK, 6W8AR, 9X5SL while 40m came up with CM8KW, J3AH, YB0WR, 6W8DY. Of note on 80m were 3A2EE and 9H1EU.

Another reader likely to leave the column soon is **Rob Gibson** in Wadhurst, E. Sussex, who took his RAE in December. Outstanding DX for Rob was S42A from the new republic of Ciskei in SW Africa on 10m. The FRG-7 and fan dipole for 10, 15 and 20m also accounted for 5N0ATW, 6T2NI (Sudan), 9Q5FL, AH2L on Guam, C6ANI, HC2VL, V3ME, VS6HH and SM0GMG also on 10m. The 20m band netted 9X5SL, C5AAP, HS1BV, UPOL22 (North Pole Expedition), VP8QI and S79MC.

A letter from **Ean Retief** ZS6UD explains that shipping problems caused the abandonment of the DXpedition planned by ZD7HH and others. Next window is late 82 or early 83, so don't switch off! It seems that Arthur ZD9GH has now left Tristan da Cunha so there are now no landbased stations there. Ean adds that a 10m beacon is under construction, to be ZD9GI, due on the air in March this year on 28·2125MHz.

School and other commitments kept **Jon Kempster** of Berkhamsted, Herts away from his receiver but he still found time to catch CT2CR, 6Y5MJ, EP2TY, 7X2BK and TF3A on 28MHz s.s.b., plus 9X5SL on 21MHz and EA3VY for his best DX on 160m.

Just beating the Christmas rush with his letter **Jim Dunnett** of Prestatyn, Clwyd, tells of putting up a folded dipole for 20m using wire stripped from an old auto-transformer and wooden spreaders boiled in wax. That's the idea OM, that's amateur radio at its best! He has also tuned the thing down to 80m with his a.t.u. with good results. Plans call for the May RAE and code test and so on the air. It is all modes with Jim I'm glad to say so starting on c.w. it was EA9EO, FC0FOO, UH8EAA and 4N1U (YU land) on 7MHZ, then V3MS and 9Y4KG on 14MHz. On 21MHz FM7WO and 8P6J showed up, with 28MHz producing FM8GA, HC8MD, VP2MFM, VP9BA and 9Y4KG. In the s.s.b. mode on 14MHz it was A71AD, VE8RCS and 8P6PC/P, with nice ones HC8MD, HR1AVS, HR1MZM, PZ9AB and 8P6DG on 28MHz. Finally on RTTY loggings included IT9IYG, GJ4HSW, PY8ZBJ and VE1TX on 14, KB2VT, LU1HCE, 4X4MR on 21, with AK1B, N8AKF, SVB1OE, SV0AN and YV5GU/1 on 28MHz.

In Highworth, Wilts, **John East** perseveres with his HAC TRF3 on 10, 15 and 20m and a 9 metre dipole. Fearful of the RAE, he did at last get a handbook on the subject which allayed his fears no end. He intends to go it alone now and has plans for a three-transistor transceiver in due course! Best of the bunch on 20m was A71AU and QSL via DJ9ZB, HK0FBF on St Andrews Island, and HZ1TC POB 2578 in Ryadh. Two on 15 were HR1AVS and ZP5MJV with CO2OM, FP8HL POB 1107 St Pierre, VE3NFR/P/4U who wants cards via VE3IDW, and 5N0ATW QSL POB 3197 Lagos.

Just in time is a long letter from **Anne Edmondson** BRS47285 of Edinburgh, who seems to have all the gen on the new country of Ciskei noting S42A, G and CIG, all QSL via ZS2BM. Banking on the Arabian Net around 0500 on Fridays Anne got the coffee ready, pencils sharpened and eyes open recently only to have the band fold up on her. That is what makes it all so exciting, Anne! She did a lot of listening in the CQ WW CW contest to keep her hand in and was most impressed as the end came at midnight "the silence was deafening, as if Monty Python's foot had descended on the whole world", a very nice summing up. There are those who wish that that would really happen to the contesters! So the best of Anne's log are A71AD POB4747, Doha, Qatar, on 20m, JG3RID and JH6SAK on 15m, plus OY7ML and TF3OF on 160m indicating that Iceland is also on Top Band now. Anne uses a Realistic DX200 and an indoor wire.

There it is for another month, wishing it were really March and the end of this deep freeze routine! Don't forget logs and letters to arrive with me by the 15th of the month.

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Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

"I was under the impression that audio filters were only of use with c.w." writes **Trevor Corns** from Sheffield, who is referring to Mike Barraclough's gear mentioned in the January issue. Trevor goes on to say that "perhaps other readers would be interested to learn more of these devices and their uses". Well, there are all sorts of filters so perhaps a quick run down of some of them might be of interest.

Low-Pass Filter

A low-pass filter as the name suggests, will pass all frequencies lower than its "cut-off" frequency. This is usually denoted by f_c. Fig. 1 shows a low-pass filter. The tone control of a radio receiver is an example of an audio low-pass filter; it attenuates the higher tones but allows lower ones to pass through it.

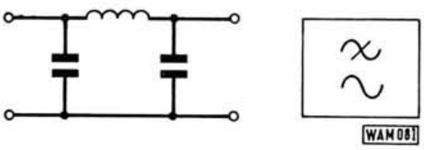


Fig. 1

High-Pass Filter

As we might expect, this one passes all frequencies higher than f_c and one is shown in Fig. 2. My BRT400 has a switch marked SPEECH/MUSIC. In the speech position there is a 400Hz audio high-pass filter in circuit which removes all the low notes and is very useful for eliminating rumble etc.

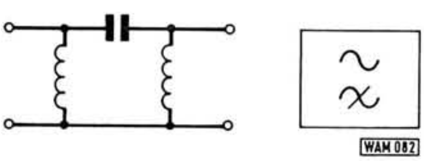
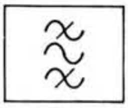


Fig. 2

Band-Pass Filter

This one passes a band of frequencies, everything above and below the two cut-off frequencies being attentuated. You can make one by joining a high-pass and a low-pass in series. A high-pass filter with a cut-off of 1kHz in series with a low-pass filter with a cut-off of 2kHz will make up a band-pass filter for the range 1kHz to 2kHz. A filter with a narrow passband centred around 1000Hz would be useful for picking out c.w. and this is probably the type Trevor had in mind. Fig. 3 is the symbol for a band-pass or acceptor filter.



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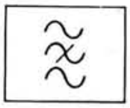

Fig. 3 **Fig. 4**

Band Stop Filter

A high-pass with a cut-off of 2kHz in series with a low-pass with a cut-off of 1kHz would make up a band-stop filter with a stop band between 1kHz and 2kHz. Fig. 4 is the symbol for a band-stop or rejection filter. A notch filter is just a band-stop with a very narrow rejection band and such a device is very useful to the broadcast band DXer for removing heterodynes and whistles.

I use the Tunable Audio Notch Filter supplied by Cambridge Kits, who advertise in *PW*. It is placed in circuit between the receiver and phones or loudspeaker. The "tuning control" moves the notch around the audio range so that you can tune-out a whistle of any pitch. The quality of the audio is not affected by the notch as its width is too narrow to be noticed.

Find That Station

"I picked up a very faint signal somewhere between 700kHz and 900kHz" writes reader **John Corless** of Claremorris in Ireland. The station John heard is WNBC in New York on 660kHz and he goes on to ask if I know where he can get an accurate frequency scale for his receiver.

Few receivers, even expensive ones have accurate tuning scales, hence the popularity of digital readout. One solution to the problem is to use a crystal calibrator to provide markers at known intervals across the bands but this is unnecessary on the medium waves as a set of markers already exist. They are the 120 channels of the Geneva Plan. Starting at 531kHz they occur at intervals of 9kHz right up to 1602kHz, each channel being a multiple of 9kHz and each one being occupied by a European broadcasting station.

How do we use these markers? We need a frequency list such as the one in the *World Radio and TV Handbook* or in *Dial Search,* which was mentioned last month. During the daytime, locate your local stations and put a mark on the scale or its cover glass, corresponding to each of them. After dark the band will be alive with signals but it should be possible to identify the stronger ones with the aid of our frequency list. Some of these stations can be marked on the scale as well. We should now be in a position to get fairly close to any chosen frequency.

How do we find 660kHz? From John's QTH it should be easy to locate RTE2 Athlone on 612kHz. Now tune up the band until the BBC World Service appears, which is on 648kHz. There is an East German on 657kHz and a West German on 666kHz so WNBC, if it is audible, should be found between the two.

It is a lot easier than it sounds to find your way about the band this way. This is the method used by the visually handicapped—on the short waves as well as the medium waves!

Medium Wave What Now

This is the title of a five-page information pamphlet produced by *Media Network,* the popular Thursday programme from Radio Netherlands. The pamphlet gives constructional data on a standard one metre-square medium wave loop antenna. There are instructions how to use the loop and how to identify some man-made interference (QRM) that creates problems for the medium wave DXer. There is also the circuit of a single f.e.t. amplifier that can be used with the loop. It is not a differential matching amplifier (d.m.a.) which is the type normally used with loops and the writer recognises

Pennant from Radio Segovia in Spain

the danger of using a straight amplifier as he recommends its use to DXers who live in a quiet area.

The pamphlet then goes on to cover image interference, cross-modulation and overloading and it ends with a list of medium wave DX clubs and DX information available over the air. The pamphlet is available free of charge and I would highly recommend it to anyone interested in exploring the medium waves. Write to Jonathan Marks, Producer: Media Network, Radio Netherlands, Box 222, Hilversum, Holland.

Local Radio

Local radio is certainly expanding these days, a fact brought home when I looked through my copy of the IBA *Pocket Guide to Transmitting Stations.* The guide says that an initial nineteen stations in eighteen areas came into operation in 1973–76. Ten more programme companies begin broadcasting in 1980–81 and the Home Secretary has approved a further fifteen localities for the next stage of development. There is also the BBC network.

The pocket guide is a useful aid to the local radio DXer and for those who missed it a couple of months ago, it is obtainable for the asking from IBA Information Service, Crawley Court, Winchester, Hampshire, SO21 2QA. As well as listing stations on the medium waves it covers radio on v.h.f. and TV on u.h.f.

Reader **Ted Jones** (Woking) has sent me a lot of information about Chiltern Radio which came on the air on October 15. It is on 828kHz (362m) with a power of 500 watts and is located near Dunstable in Bedfordshire. The station will QSL a correct reception report with their three-colour QSL card (return postage or an IRC is appreciated) and they have already had reports from Sweden, Norway and Finland. The address is Chiltern Radio, Chiltern Road, Dunstable, Beds, LU6 1HQ.

DX Heard

"Thanks to your information about North American m.w. DX in the November issue of *PW.* I have located two so far" is the message from **Simon Hamer** of New Radnor. Using his Grundig Satellit 1400, along with a 9 metre-long wire connected to his Grundig Melody Boy which is used as a coupler to the Satellit, he picked up WNEW in New York City at 0030 on November 4. The programme was called *Thanks for the Memory* being a tribute to Bob Hope. This was followed by the station identification. CJYQ in St John's in Newfoundland on 930kHz was also picked up at this time with pop music and identification. Simon is trying to hear Torshavn in the Faroe Islands which broadcasts on 531kHz. Sign-on on weekdays is at 0715 and this is the best time to catch it. Torshavn is also on the air from 1830 to 2305 but QRM is strong at this time. I had excellent reception of Torshavn from the Shetlands a couple of years ago but unfortunately I did not have a tape recorder with me. I won't forget one when I'm back there later this year.

Rumour has it that Trans World Radio may be opening a 200kW station at Torshavn and they may be starting tests in 1982 so this elusive broadcaster may soon be heard by all.

Chiltern Radio

Short Wave Broadcast Bands

by Charles Molloy G8BUS

Reports: as for medium wave DX, but please keep separate.

It was while purchasing a three-way antenna switch based on PL259 plugs and sockets that a lightning arrestor caught my eye. It had a PL259 plug at one end and a SO239 socket at the other. On the body is a terminal for a connection to earth and the device seems to contain an internal spark gap. I have fitted the arrestor between my long wire and the antenna switch, which is used to connect the antenna to either of two receivers. The third switch position now connects the antenna to earth when it is not in use and I feel rather pleased with the new set-up. The switch of course could be used to give a choice of three antennas to a single receiver.

Lightning Protection

The purpose of a lightning arrestor is to prevent any static build-up on the antenna (such as might occur during a thunderstorm), from discharging through the receiver and perhaps damaging the input circuits or the DXer. I doubt if there is any real protection against a direct hit. Some measure of protection against static build-up can be obtained by connecting a resistor of about 10kΩ or an r.f. choke from the receiver antenna socket to earth, but I prefer to keep the problem away from the receiver if possible. Model LA15 Lightning Arrestor is the name of the device I bought. It appears to be designed for CB radio and I got mine, along with the antenna switch, from Progressive Radio, Cheapside, Liverpool, who advertise regularly in *PW.*

Images

"Can you suggest why I hear stations well away from those noted?" asks reader **Neil Cummings** who lives at Port Sunlight in Merseyside. Neil goes on to say that he can hear the BBC around 5·1MHz which is on the edge of the 60m tropical band.

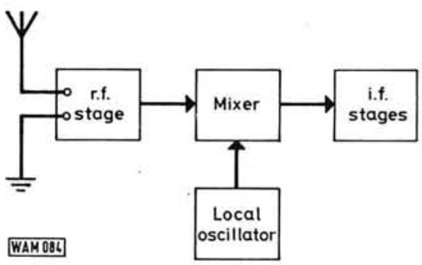

Fig. 1

In order to answer this question we have to look at the way a superhet receiver works. Fig. 1 shows a typical "front end". When a receiver with an intermediate frequency (i.f.) of 465kHz is tuned to a station on 6·19MHz in the 49 metre band then the local oscillator will generate 6·655MHz (6·19 plus 0·465) and the difference between the two (465kHz) will come out of the mixer stage into the i.f. stages for further processing. A station on 7·12MHz which is in the 41 metre band will also produce a difference signal of 465kHz when it beats with the local oscillator (7·120 minus 6·655) and this too will be fed to the i.f. stages. The signal on 7·12 is called the image of the one on 6·19MHz.

What this means is that images of strong signals on the 41m band can appear when the receiver is tuned to the 49m band. Similarly images of stations in the 49m band can appear near 60 metres. The BBC uses 5·975MHz on the 49m band and the image will appear when the receiver is tuned to 5·04MHz which is not far away from Neil's station "on around 5·1MHz."

Remedies

Receiver manufacturers of course do their best to suppress images. If you look at a receiver specification you may come across "image rejection 40dB." This means that any image will be 40dB weaker (1/100th) than the correct signal. This reduction can be achieved in two ways. By using a high value for the i.f.

which means that you will have to have a second, lower value i.f. to obtain good selectivity, which in turn leads to a multi-conversion receiver. The other way is to have a number of selective tuned circuits between the antenna and the mixer.

A simple set may only have a single tuned circuit before the mixer and if the i.f. has a low value (typically 465kHz) then image rejection will be poor. Such a receiver will pull in plenty of stations, many of them at two places on the dial. A more complicated receiver with good image rejection will, strangely enough appear a lot quieter since stations, including interference, will appear only once on the tuning scale. If you do pick up a station at two places on the dial then try each for optimum reception. The QRM on the image may not be the same as on the correct frequency.

Is there anything we can do to improve reception on a receiver with poor image rejection? Yes, a preselector will help. This is a tuned r.f. stage in a separate box with its own power supply. It is adjusted to give a boost to a selected frequency but not to others. There is a danger though as a preselector may cause overloading if it is used in a crowded band. It is not possible to use a preselector with a portable receiver operating on its own whip antenna.

Preselectors are available commercially or you can make one. Radio Canada International will supply a plan for a preselector covering the range 5·5MHz to 22MHz, which can be constructed in a mini-box. Write to RCI, PO Box 6000, Montreal H3C 3A8, Canada, and ask for a copy of their *Inexpensive FET Preselector* leaflet.

EDXC Country Landlist

In the September 1981 issue I referred to the *Reporting Guide* published by the European DX Council. Michael Murray, who is Secretary General of the EDXC has now sent me a copy of their Country Landlist which he thinks may be of interest to readers. It is a 16-page list of existing and former radio countries for

Radio Netherlands

use in conjunction with QSL ladders and DX diplomas. A total of 316 countries is listed. A copy of the *EDXC Publications List* is available from PO Box 4, St Ives, Huntingdon, Cambs. PE17 4FE, for return postage or one IRC and the *Country Landlist* costs £1 or six IRCs

Readers' letters

Is there such a thing as a short wave loop antenna? asks **Julian Clover** of Norwich. The ordinary loop will work up to about 2·5MHz if you take off turns to get it to resonate above 1·6MHz. Above 2·5MHz the directional effect gradually disappears, especially after dark. A few receivers have an internal ferrite rod antenna for use up to 12MHz and one I handled recently did seem to null out stations on the short waves. You can also get some sort of directional effect from a receiver with a whip antenna if you place the whip horizontally and point it in different directions.

Rick Lewis is having problems with his dipole. Each section of it is 15·5 metres long and he wonders whether it is a 30-metre or a 15-metre dipole. The formula 142·5/L gives the resonant frequency, L being the total length of the top between the insulators at either end. In this case the antenna is a half-wave dipole at 142·5/31 = 4·6MHz which is approximately 65 metres. **Alan Williams** G3KSU writes again to say that a dipole fed via a lossless feeder such as 300Ω ribbon or 600Ω open-wire plus an a.t.u. can be used on any frequency either above or below that for which it is cut. Yes, but tuned feeders are a complex subject on their own. Alan's suggestion that the correct "cut" for most s.w.l. dipoles is determined by the length of the back garden is probably the last word on the subject.

Images have been troubling **Ian Kelly** (Reading), who uses a portable radio cassette with 18 metres of wire run around his bedroom. TV buzz is also a problem but Ian has persevered and pulled in Radio Free Canada on 15·045 at 2200, VNC (the time signal station in Australia) on 12MHz at 0817, WWVH Hawaii on 15MHz at 0200 and Radio Nacional Brasil on 17·83MHz at 0256.

Broadcasts Heard

A Yaesu FRG-7000 with Joystick and a.t.u. pulled in two rather good catches for **John Godwin** of Rugeley. Radio New Zealand came in on 11·945MHz at 0830 but with some QRM while the VOA in the Philippines was heard on 26MHz in the 11m band at 1300GMT. **Neil Cummings** (Port Sunlight) has a Realistic DX-100 which pulled in Radio Japan on 15·195MHz at 2210 for him. In reply to **Stephen Blanchflower,** sorry but I cannot handle information on pirates or unauthorised broadcasters. **Mark Slater,** Beckenham uses a Wien Mach 7 Radio Cassette along with a 30 metre long-wire and a.t.u. He picked up the Voice of Nigeria on 15·12MHz at 2140 and International Christian Radio Toronto on the 31m band at 2105. He wonders if anyone can identify this one for him.

Finally a couple of items of interest. Swiss Radio International is now on 25·78MHz in the 11 metre band at 1100 with its African programme, and Tahiti in the Society Islands has been coming in well on 11·825MHz in the 25 metre band before it signs off for the "night" at 0730.

VHF Bands

by Ron Ham BRS15744

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

"I hope you Europeans soon get the 6m band," said an amateur in the USA to an HB9 while working cross-band 6–10m at midday on December 13. Quite right too, because, apart from the enjoyment, there is still a lot to learn about ionospheric propagation at 50MHz and, after all, it was the old timers who originally pioneered the band in the late 1930s and there are many amateurs today eager to carry on where they left off.

Solar

Both **Cmdr Henry Hatfield,** Sevenoaks and I recorded individual bursts of solar radio noise at 136 and 143MHz respectively (Fig. 1), on November 17, 18, 19, 20, 28 and 29 and December 2, 5, 13 and 15 and noise storm conditions on November 19 and 30 and December 7, 12, 13 and 15. "Having monitored the MSF signal on 60kHz every day for the past two months, I am confident that there is no direct correlation between its signal strength and activity on the sun in visible light or at a wavelength of 2m," writes Henry who will continue to develop equipment for v.l.f. and make comparisons with his regular solar observations.

Ted Waring, Bristol, using his optical equipment, counted 22 sunspots on November 16, 33 on the 28th, 44 on December 1 and 50 plus on the 12th.

The 10m Band

Conditions were well up at 0915 on November 16 when I received strong signals from ZL3SA in Christchurch while he was in QSO with G3VWR on the Isle of Wight, yet, and this may be due to the solar activity, at 0900 on the 19th the band was generally quiet except for a lone CQ DX from VK6NJV. I again heard signals from VK on December 1 and 6, and from Japan on November 17, 20, 21 and 25 and December 3, 6 and 11. Although DX from the Far East seemed limited, strong signals from Canada and the USA pounded in almost every afternoon between November 16 and December 16. Band conditions were

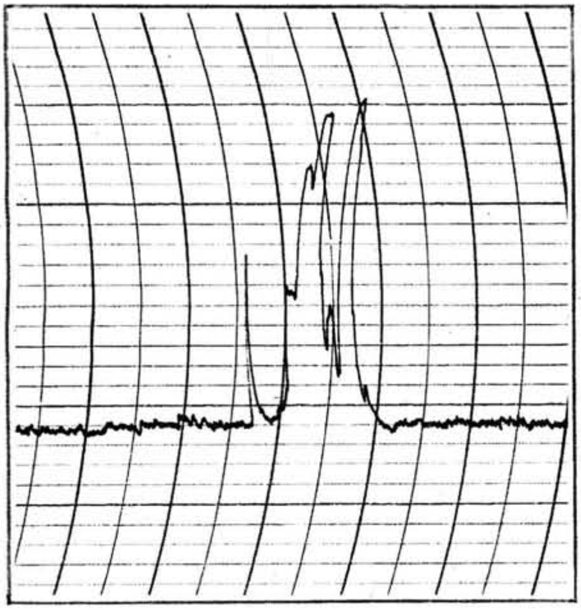

Fig. 1: One of the many one-minute duration solar bursts recorded by the author in November

sometimes strange with echoes on some European stations on November 16 and 22 and December 5, and at 0858 on the 13th, I heard two "G" stations carrying out antenna direction tests and talking about "round-the-world echoes". At 1510 on November 28, **Harold Brodribb,** St Leonards-on-Sea, heard VE3FYN make his first contact with a station in Cyprus, both sides of a QSO between VE1BLS and VE3MLH and Ws 1,2,4,8 and 0 working into Europe. Harold has also been keeping a watch on the m.u.f. and received signals up to 46MHz on November 20, 48MHz on the 25th, 44MHz on the 28th and 47MHz on December 8.

10m Beacons

During the 31-day period between November 16 and December 16, I received signals of varying strengths from the 10m beacon stations in Australia VK2WI on 15 days and VK5WI on 6 days, Bahrain A9XC and Bermuda VP9BA on 31 days, Cyprus 5B4CY on 27 days, Germany DL0IGI on 31 days, Hong Kong VS6HK on 8 days and a new one which I know nothing about, U2ABJ, almost daily until December 10. **J. F. Coulter,** Winchester, Henry Hatfield and Ted Waring, Bristol, have also logged U2ABJ and like myself, want to know more about it. Any ideas?

"On November 28, Adelaide VK5WI was very strong while Sydney VK2WI was weak, usually the reverse is the case," writes **Arthur Swatton,** Westcliff-on-Sea, who listened for beacon signals on 21 days during November and almost daily heard A9XC, DL0IGI, VE2TEN, VP9BA, U2ABJ and 5B4CY. Ted heard the Canadian and South African beacons, VE2TEN and ZS6PW on most days between November 15 and December 9 and like Henry and me, Ted heard the Caracas beacon YV5AYV on November 16.

We all noted that signals from the Hungarian beacon HG2BHA were a bit sparse but when it did come up its signals were very strong, sending the meter on my FR-101 to S9 at 0900 on December 10. Both Henry and Ted have been checking 28·277MHz for DF0AAB which they heard on a few days in November and occasionally in early December.

J. F. Coulter runs an FRG-7 and during his beacon check on December 14, he read the following "de Florida Beacon WD4HES, 1930 Neptune Drive, Englewood, Fl, 33533, Merry Christmas 73".

The 6m Band

Toward the end of November, **Peter Turner** G4IIL, Brighton (Fig. 2), heard stations from Canada, Gambia, Libya, South Africa and the USA on 6m. Peter told me about "SMIRK", an organisation called Six Metre International Radio Club, whose UK members can be heard on 28·885MHz looking for cross-band QSOs with overseas stations around 50·2MHz. I heard signals from K1JRW, KA1PE, K2QEI and W1EJ during the period December 7 to 15 when the band was open on most days between approximately 1200 and 1500. A 6m group for the UK is in the process of being formed by an ad hoc committee under the acting chairmanship of Harold Rose G4JLH. Among the aims of the group are: to obtain the use of the 6m band for UK

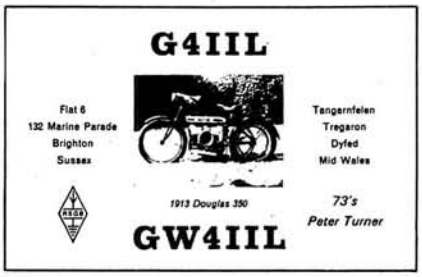

Fig. 2: Peter Turner's unique QSL card

amateurs, to seek affiliation with the RSGB through the v.h.f. committee and the 6m representative and to publish a newsletter for members about five times per year. Membership is open to all licensed amateurs and s.w.l.s interested in the 6m band, and details are available from G4JCC, QTHR. Among the list of beacons that Peter kindly sent me are FY7THF 50·0386MHz, ZB2VHF 50·035MHz, ZS6DN 50·050MHz and 5B4CY 50·501MHz.

The 4m Band

From his QTH in Tregaron, 305m a.s.l. Peter Turner becomes GW4IIL (Fig. 2), and using a FT-200 into a Magnum 4 and a 4-element quad antenna frequently works EI2W, EI9Q, GD2HAZ, GI3TLT, GM3WOJ, RSGB past president Basil O'Brien G2AMV, and his neighbour GW3MHW on 4m. Although many skeds are arranged on 3·718MHz around 0830, Peter is always looking for 4m QSOs and reminds us to keep an ear open during the sporadic-E season for the Gibraltar beacon ZB2VHF on 70·120MHz. When in Wales, Peter calls during the evening, on the hour, for 5 minutes, beaming west and north looking for s.s.b/c.w. contacts on 70·200MHz.

RTTY

The British Amateur Teleprinting Group are introducing three new operating awards to promote interest in RTTY operation in the v.h.f. and u.h.f. bands. The awards are available when satisfactory proof is submitted to BARTG that 100 different stations have been heard or worked on 2m, 50 and 70cm and 10 on 23cm using RTTY as the mode of communication. Application for BARTG membership and full details of these awards are available from Mrs Double, 89 Lindern Gardens, Enfield, Middx. EN1 4DX.

Congratulations to G3NNG on winning the single-operator section of the Autumn VHF RTTY contest and to G4BPO on winning the multi-operator section. The cups, donated by the Ealing and District Amateur Radio Society, were presented at the BARTG AGM last November.

Between November 16 and December 16, I copied 180 RTTY stations spread over 26 countries, CN, DL, EA, F, G, GI, GW, HA, HB9, I, JA, K, LX, OE, OK, ON, OZ, PA, SK, SP, SV, UK, VE, VK, YU and 3A. Among the interesting QSOs I watched on the video display were those between F8DP and I6OHF and OZ1CBX and ON6IU around 0930 on November 16, DF6UD and DJ8QQ at 0925 on the 23rd, NL7G in Alaska and DL3SAC making his second RTTY QSO (he only received his DL call on the 20th), at 0905 on the 25th, DL9FAV and I0UNT at 0925 and WB3EPT and WB9NKH at 2046 on the 27th, I1EVJ and DF1GW at 0845 on the 28th, OZ1CBX and DJ1UR at 0930 on December 2, OE2LCL and HB9BZZ at

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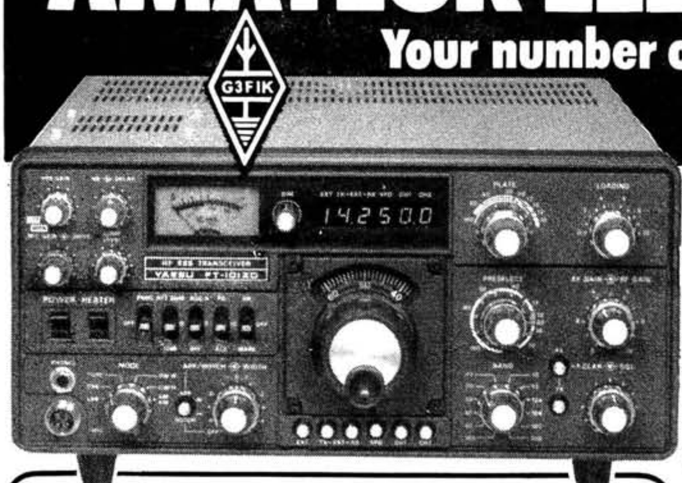

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R2	4.0291	8.0583	12.0875	14.9944	18.1312	44.9833
R3	4.0298	8.0597	12.0895	14.9972	18.1343	44.9916
R4	4.0305	8.0611	12.0916	15.0000	18.1375	45.0000
R5	4.0312	8.0625	12.0937	15.0027	18.1406	45.0083
R6	4.0319	8.0638	12.0958	15.0055	18.1437	45.0166
R7	4.0326	8.0652	12.0979	15.0083	18.1468	45.0250
S8	—	—	12.1000	14.9444	18.1500	44.8333*
S9	—	—	12.1020	14.9472	18.1531	44.8416*
S10	—	—	12.1041	14.9500	18.1562	44.8500*
S11	—	—	12.1062	14.9572	18.1593	44.8583*
S12	—	—	12.1083	14.9555	18.1625	44.8666*
S13	—	—	12.1104	14.9583	18.1656	44.8750*
S14	—	—	12.1125	14.9611	18.1687	44.8833*
S15	—	—	12.1145	14.9638	18.1718	44.8916*
S16	—	—	12.1167	14.9667	18.1750	44.9000*
S17	—	—	12.1187	14.9694	18.1781	44.9083*
S18	—	—	12.1208	14.9722	18.1812	44.9166*
S19	—	—	12.1229	14.9750	18.1843	44.9250*
S20	4.0416	8.0833	12.1250	14.9777	18.1875	44.9333
S21	4.0423	8.0847	12.1270	14.9805	18.1906	44.9416
S22	4.0430	8.0861	12.1291	14.9833	18.1937	44.9500
S23	4.0437	8.0875	12.1312	14.9861	18.1968	44.9583

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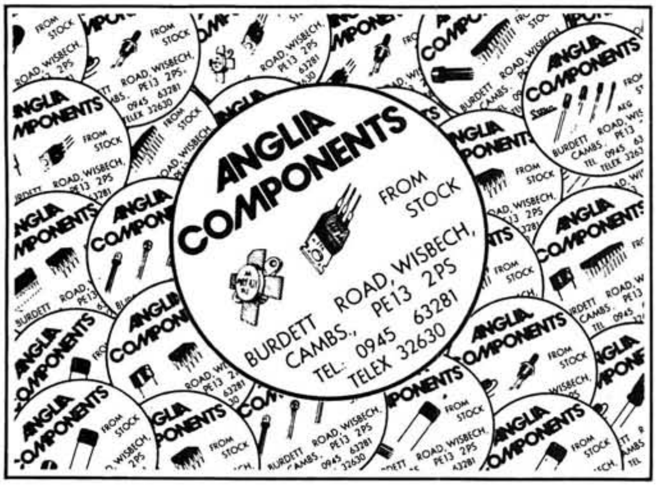

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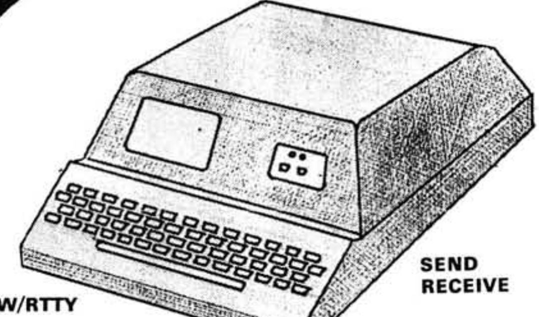

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1106 on the 6th, DL9KM and YU2OH at 1415 on the 9th, HB9NB and DJ8QQ at 0928 on the 11th and ON4UN and PA0GKO at 1252 on the 13th. From the 180 QSOs I copied, 12 were on the 15m band and only 3 on 10m, the rest were on the 20m around 14·090MHz.

RTTY News

The BARTG are holding their spring RTTY h.f. contest between 0200GMT on March 20 and 0200GMT on the 22nd, and their v.h.f./u.h.f. contest, covering three bands, 144, 432, and 1296MHz, from 1800 on April 3 to 1200 on the 4th. The h.f. event usually attracts entries from around the world and the v.h.f./u.h.f. event will be scored as three separate contests in single- and multi-operator and s.w.l. sections. Full details from Ted Double G8CDW, QTHR. Details of the BARTG Rally at Sandown Park Racecourse, near London, on August 29 are available from Edward Batts G8LWY, 27 Cranmer Court, Richmond Road, Kingston-upon-Thames, Surrey.

Tropospheric

The atmospheric pressure, measured at my QTH, rose sharply from 30·0in (1015mb) at 2200 on November 23 to 30·4 (1029mb) at 1400 on the 25th, and by midnight it was falling and by 0600 on the 27th it was back to the 30·0in. The pressure hovered around this level until midnight on the 30th when it suddenly took off, reaching 30·45 (1030mb) by Midday on December 2, peaking 30·55 (1034mb) at noon on the 3rd, and at 1400 a sharp decline began and by midnight on the 4th it was 30·2 (1022mb) and down to 29·6 (1002mb) at midnight on the 6th. Incidentally, that sudden fall on the 3rd was the beginning of the Arctic conditions which hit the UK in early December, and sometimes caused some strange v.h.f. conditions. During the evening of December 1, **Alan Baker** G4GNX, Newhaven, heard signals through the Leicester repeater GB3CF on R0, the French repeater FZ1VHF and the 2m beacon FX0THF.

On November 26, **George Grzebeniak** G6GGE made his first QSO on 23cm with **Bill Green** G3TDG about 35km away. George was using 1W output to a 19-element Yagi at 8m a.g.l. During the lift on December 1, George, using 300mW worked into Shrewsbury with a 52 report and France with a 53 report on 2m.

Band II

David Hackwell using a Grundig Melody Boy 600 with its own telescopic antenna, began DXing last year and writes: "I have received broadcasts from Italy and Spain via sporadic-E, and France, Germany and Ireland via tropo". Like **Simon Hamer** in Wales, David keeps an ear on those local stations and so far has heard Radios Lincoln, Newcastle, Pennine, Scotland and Ulster. Between 1910 and 2230 on December 1, Simon received broadcast signals from BBC Radios London and Manchester, ILR Chiltern, Essex and Swansea. On the 2nd he heard stations in France and ILR Piccadilly and as the high pressure fell on the 3rd he received signals from Belgium, France and Holland, BBC Radios London and Medway and ILR Capital, Chiltern and LBC between 87 and 100MHz. During the three days he heard talks and Rock music from France, folksong from Holland and Independent Radio News from Essex. "I maintain the record of receiving stations from France every day in October, November and the first 10 days of December," writes **Ian Kelly** from Reading, who has spent a lot of time experimenting with antennas and pre-amplifiers for Band II. During the afternoon and evening of November 21 and the evening of December 2, he received strong stereo signals from BRT-2 in Belgium on 98·6MHz. There were many complaints from the general public to their radio dealers about the poor reception of broadcast stations in Band II during the blizzard on December 13; this is not surprising because the pressure fell sharply to around 29·0 (982mb) as the atrocious weather passed over.

First for Dorset RAYNET

This exceptional weather on the 13th caused widespread power failures and blocked roads as winds, sometimes reaching 100 m.p.h. made the heavy snow drift. During the day, some 30 members of South East Dorset RAYNET answered the call for help which they received from the Police and the County Emergency Planning Officer via the IBA local radio station, 2CR (Two Counties Radio). Information about road conditions required by the authorities was collected by members of the group on 2m (144·875MHz) and passed by h.f. link, on 80m, to Dorset County Hall. Communications from within the county were sent via the Dorset repeater GB3SC, R1, which was running on its standby battery power. **John Fell** G8MCP, our Technical Editor is secretary of the Dorset 2m Repeater Group and like the other members of the group, who helped build the repeater and operated on the day, was delighted with its performance. Need we say more than thank you, to the true spirit of amateur radio.

News Items

Stan Reece from Ashford is a keen listener to 11m broadcast stations and writes: "Very few commercial radios cover the 11m band" so, he retuned the oscillator and antenna coils of a CB receiver and says that it goes like a bomb.

Members at the November AGM of the Brighton and District Radio Society decided to change their name to the Brighton and District Amateur Radio Society and to elect George Miles G3VBE as secretary and re-elect Robin Bellerby G3ZYE, Alan Baker G4GNX and Ron Bray G8VEH as President, Chairman and Treasurer respectively.

Among the visitors welcomed to the Brighton ARS meeting on December 2 was Peter Bucher HB9PLW/G5MYL, from Switzerland. Peter, a member of the Oberargau section of USKA, is a keen v.h.f./u.h.f. operator and while studying in the UK he was operating mobile with a TR-7400. From his home in Trimbach, he uses a 10-element crossed Yagi for 2m and his best DX on s.s.b. is a QSO with a station in southern Italy.

Toward the end of November, **Jon Kempster** BRS45205, Berkhamsted, installed a new, home-brew, 2-element beam for 2m and a vertical dipole for 28MHz hanging down the back of his house which is conveniently a half-wavelength high.

Good luck to Dave Williams and his wife in Doncaster who are both studying for the RAE and looking forward to getting their Class B licences.

Congratulations to ZS1ZZ/M and F6GFM/MM, both using 200mW and simple antennas, who established contact over a distance of 1000km on 145MHz. I would certainly like to hear more about this.

Congratulations also to Dave Whitbread G6EQM, Plymouth, on a write-up in his local paper, *Express and Echo,* about the superb models of fighting soldiers which he makes. In addition to his model engineering skills, Dave has just finished a 20-element ZL-Special antenna for 2m and also has three of the *PW* Exe Dishes. I look forward to hearing more from you Dave.

TV

by Ron Ham BRS15744

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

As the weather plays such a vital part in our TV DXing on Bands III, IV and V we normally look for the good stuff when the atmospheric pressure is high and the weather settled, but after the atrocious conditions and very low pressure on December 13 brought a variety of complaints about television reception, I thought it may be worth our while to make a dedicated study on such occasions and maybe, find yet another area of specialised interest in DXTV.

"I did pick up a number of German signals on Band IV on Sunday, December 13," writes **Nicholas Wythe** from Folkestone, who, between 1130 and 1215 saw a programme about events in Poland called *Wochenspiegel.*

During the lift on November 20 and 21, **Brian Renforth,** Chippenham, received very steady pictures from London Weekend at Crystal Palace on Ch. 23 and Bluebell Hill on Ch. 45. "After a warning from the BBC on December 3, I turned my antenna to the east and had really excellent reception of Anglia TV and BBC1 East from Sudbury," writes Brian, who enclosed a photograph of his new u.h.f. antenna (Fig. 10). At 0930 on December 2, I received a strong colour test card from RTE-1 on Ch. H and a weak picture from the IBA transmitter at Lichfield on Ch. B8. At 1410 on the 3rd I received pictures from RTB, Belgium on Ch. E10 and during the evening, **George Garden,** Bracknell, heard the IBA apologise for the interference and noted, like Brian Renforth, that his reception of Anglia TV was much stronger than usual. He also received colour pictures from Midland, Tyne Tees and Yorkshire TV. Around 2200 George tried 405-line v.h.f. and saw the Yorkshire clock on Ch. 7, and later Southern TV from Dover and Chillerton Down on Chs. 10 and 11 respectively. Between 1800 and 1830 on the 3rd, **Simon Hamer,** Presteigne, watched the BBC1 programme *Look East* in good colour from Sandy Heath on Ch. 31, *Nationwide* from Crystal Palace on Ch. 26 as well as the IBA transmissions from Thames and Anglia on Chs. 23 and 24 respectively. At 2215, Simon, using a Jaybeam MBM 48-element antenna and a u.h.f. pre-amp., received pictures from the BBC at Rowridge on Ch. 31 and at 2227 he received signals from the Southern IBA transmitter at Hannington.

"I often receive Dutch TV in colour," writes **David Gindlestone** from Norwich who uses a Hitachi CNP190 receiver and sent me three pictures (Figs. 1, 2, 3), plus a Dutch test pattern (Fig. 4), which looks to me like the mystery test card published in our January issue. David is a regular viewer of Yorkshire TV and often receives Thames and Tyne Tees.

Simon Hamer remembers seeing that mystery test card on July 29 and **Julian Clover,** also from Norwich, believes it comes from Netherlands Ch. 2 and is used as a substitution of the main test card. "It's the Philips monochrome PM 5540 test card used by NOS, Holland and the West German Hessischer Rundfunk on Ch. E8," writes Brian Renforth, "and Dutch TV," says Nicholas Wythe. Thanks lads, I am sure you have answered Fraser Lees' question.

Fifteen-year-old Julian Clover began TV DXing last summer and received u.h.f. pictures from Belgium, Holland and Germany, together with BBC transmissions from Leeds and London and IBA pictures from Southern and Yorkshire. Keep it up Julian, I look forward to your future reports.

It is my readers' reports that fired the imagination of **Edward Gittins** BRS45158, Wrexham, who hopes to join us soon with some new equipment. I am sure you will enjoy it as much as we do, Edward.

Sporadic-E

In addition to F2 activity during the winter months on Chs. E2 and R1 there are frequent bursts of television signals of

Fig. 1: Dutch news programme

Fig. 2: Dutch TV advert

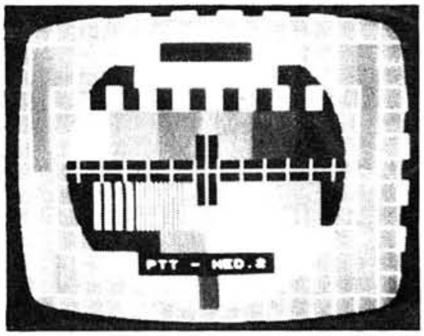

Fig. 3: Test card received by David Gindlestone

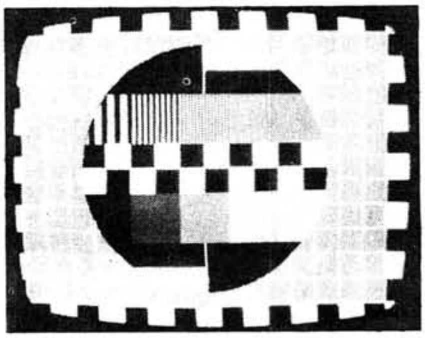

Fig. 4: Test pattern from Holland

Fig. 5: Caption received by David Hackwell

Fig. 6: Signal from Spain received by Henrik Nykvist in Sweden

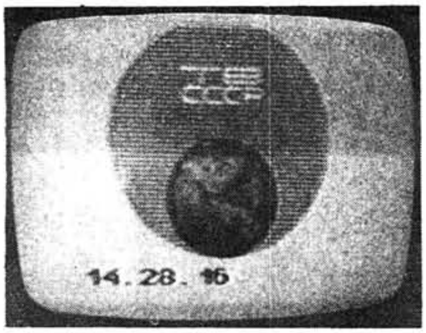

Fig. 7: Russian caption received by Henrik Nykvist in Sweden

Fig. 8: F2 signal received in Sweden by David Appleyard

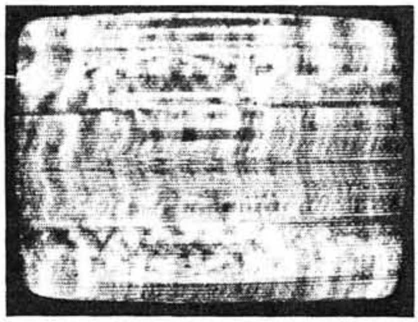

Fig. 9: F2 signal received by David Appleyard

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PS-75	Sideband Duty P.S.U. for TR-7 120/240v	**138.00**	*5.00*	**P-75**	Phone patch	**59.80**	*2.00*
RV-7	Remote V.F.O. for TR-7	**132.25**	*2.00*	**7804**	Service Manual for TR-7	**18.50**	*2.00*
MS-7	Matching Speaker for TR-7 and R-7	**29.90**	*2.00*	**7805**	Service Manual for R-7	**18.50**	*2.00*
R7A	Digital Receiver 0-30 MHz	**989.00**	*5.00*	**7037**	TR-7 Service Kit	**37.95**	*1.00*
SL-300	CW Filter for TR-7 and R-7 (300 Hz)	**39.10**	*0.50*	**L-7E**	Linear Amp. 2kw. 10m-160m with tubes (2)	**897.00**	*10.00*
SL-500	CW Filter for TR-7 and R-7 (500 Hz)	**39.10**	*0.50*	**3-500Z**	Tube for L-7E and L-75E	**69.00**	*2.00*
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MMK-7	Mobile mounting kit for TR-7	**34.50**	*2.00*	**Manuals**	Spare Operating Manuals	**6.00**	*1.00*
MN-7	ATU/RF Wattmeter. 160-10 m (250w)	**124.20**	*5.00*	**Interface**	R-7/TR-7 connecting cable	**20.70**	*1.00*
MN-2700	ATU/RF Wattmeter 160-10m (2kw)	**207.00**	*5.00*	**AK-75**	Multiband Antenna	**23.00**	*2.00*
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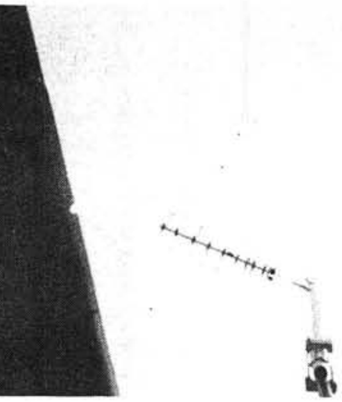

Fig. 10: Brian Renforth's u.h.f. antenna

varying duration. The short bursts are most likely to occur when the signals are reflected from random meteor trails in the atmosphere and I feel sure that the longer ones are due to some form of Sporadic-E. Among the bursts I positively identified were test cards from Poland on November 16 and 20 and December 2, 4, 8, 10, 11 and at 0840 on the 12th I saw two people sitting at a table and a large caption across the screen, "POLSKIE RADIO PROGRAM 11". Test cards from ORF FS1, Austria were seen on December 6 and 13, Budapest on November 20, Czechoslovakia on the 23rd and 26th and a clock showing one hour ahead of GMT at 0834 on the 20th.

Around 1600 on December 11, Brian Renforth received excellent signals from RTVE, Spain on Chs. E2, 3 and 4 with various adverts and a programme beginning with the caption "RADIO-TELEVISIN ESPANOLA".

David Hackwell, Warrington, uses a Hugh Cocks v.h.f./u.h.f. up-converter into a Decca mono TV which he can use directly for u.h.f. David began TV DXing last August and with a home-brew Band I dipole, at 6m a.g.l., received test cards from several countries on Chs. E2, E3 and R1 and has often seen the Russian news programme BPEMR. Among the strong signals David received is RTVE GAMONITEIRO (Fig. 5). Around the same time **Henrik Nykvist,** my opposite number in the Swedish journal *Fading* also received pictures from Spain (Fig. 6), and an interesting caption from the USSR (Fig. 7).

F2

Around 1300 on November 29, Simon Hamer saw what looked like a caption bearing two shaded white circles with a black background, at the bottom end of Band I. "Unidentifiable and very smeary," writes Simon. Between 1130 and 1215 on November 14, **David Appleyard,** Uppsala, Sweden, noted one station on Chs. E2 or R1 (48·25/49·75MHz) showing vertical bars mixing with another putting out a programme which looked like ancient art. At times David saw the odd portrait and next some captions with mysterious characters (Fig. 8). At 1205 he identified a male announcer just before the F2 disturbance became progressively weaker. Around 0850 on the 16th I saw a broken Russian test card, and at 0950 a multi-image announcer in what looked like a news programme, and around 1000 David saw another broken test card (Fig. 9). David Hackwell caught a glimpse of Russian test cards from the smeary mess and Brian Renforth identified pictures from the USSR on December 5, 6 and 12.

According to reports, F2 disturbances occurred during the mornings of November 16, 17 and 25 and December 1, 3, 6, 7, 8, 10 and 13.

Amateur TV

On September 27, **Ron Bray** G8VEH was among the members of the Worthing Amateur TV Group who made a video film of the Wireless Day at the Chalk Pits Museum in Sussex. Ron, using a JVC GX88 camera shot about two hours of a Fuji E120 video cassette in a JVC recorder. Later, he edited the tape, between his 2200 and a JVC 7700 recorder to about 30 minutes of thoroughly good entertainment which he has since shown to radio clubs and transmitted through his home-brew equipment and 19-element Tonna to fellow members of the group.

On November 16, **George Grzebeniak** G6GGE, tried out his Bush TV171 and 9-element Yagi for amateur TV and received signals from G8MNY and G8RZO about 80km away.

Call for Help

▶▶▶*continued from page 21*

people show their real worth and come forward with assistance in many ways. When it is help which is the result of much preparation and training for something which may or may not happen, the real meaning of dedication becomes apparent. Radio amateurs are only one of many such groups but they illustrate the total concept.

The authorities can make any amount of preparation for emergency situations, but until such a situation abides by the rules and regulations of the planners and results only in that which the procedures have foreseen, there will be a need for voluntary back-up, such as that provided by amateur radio emergency groups, to assist with the unexpected, totally demanding, problems which arise in an emergency.

The Stories are Endless

American amateurs provided extensive assistance from the time Mount St. Helens in the State of Washington began erupting in March 1980, bringing death and destruction in its wake. Sadly, two amateur operators were included in the death toll.

Just previously a flood disaster in Southern California destroyed or damaged over 1500 homes and displaced 8000 people. Damage costs ran into untold millions and 24 people died.

Storms in Hawaii caused power loss for over 60 per cent of the State, enormous property damage and several deaths. Hurricanes David and Frederic in 1979, and Allen in 1980, left trails of death and devastation throughout the Caribbean Islands.

The stories are endless. They cannot all be told here but whenever normal communications are overloaded, or are non-existent, radio amateurs are there providing their specialised help willingly and feeely.

By implication a hobby is an activity of self-indulgence which enhances the pleasurable aspects of leisure time. Amateur radio shows that there can be more to a hobby than that. There is a part of the American Radio Relay League Amateur Code which says "His knowledge and his station are always ready for the service of his country and his community".

Amateurs around the world have demonstrated the truth of this by their constant readiness to answer the call for help.

Further information for potential members, licensed or unlicensed, together with details of local RAYNET Groups, can be obtained from Graham Cluer, G4AVV, RAYNET Publicity Officer, 12 Bingham Road, Croydon CR0 7EB. ●

Uncle Ed will be back next month

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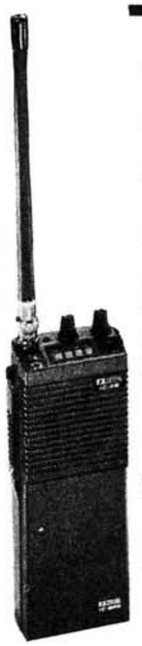

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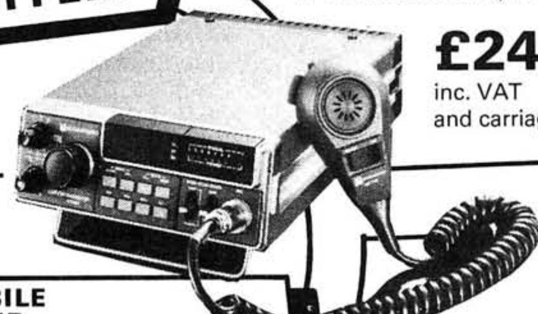

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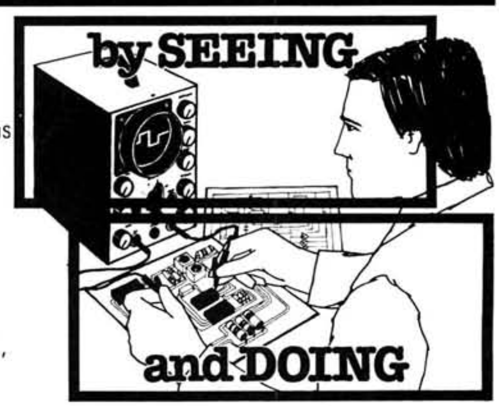

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SLIDER POTENTIOMETERS
0·25W log and linear values 60mm track

5KΩ 500KΩ Single gang	**70p**
10KΩ 500KΩ Dual gang	**110p**
Self-Stick graduated Alum. Bezels	**40p**

CERAMIC CAPACITORS 50V
Range: 0·5pf to 10nf **4p**
15nF, 22nF, 33nF, 47nF **5p** 100nF **7p**

PRESET POTENTIOMETERS

0·1W 50Ω-2·2M Minl. Vert. & Horiz.	**7p**
0·25W 100Ω-3·3MΩ Horiz. larger	**10p**
0·25W 250Ω-4·7MΩ Vert.	**10p**

POLYSTYRENE CAPACITORS
10pF to 1nF, **8p** 1·5nF to 12nF, **10p.**

RESISTORS–5% carbon, High Stab. Miniature, Low Noise.

	Range	Val.	1-99	100+
0·25W	2Ω2-4M7	E24	**2p**	**1p**
0·5W	2Ω2-5M1	E12	**2p**	**1p**
1W	2Ω2-10M	E12	**5p**	**3p**
2% Metal Film 10Ω-1M		E24	**6p**	**4p**
1% 0·5W 51Ω-1M		E24	**10p**	**8p**

N.B. 100+ price applies to Resistors of each type not mixed values.

OPTO ELECTRONICS

LEDs plus clip		3½ Digit LCD	**525**
TIL209 Red 3mm	**13**	4 Digit LCD	**650**
TIL211 Grn 3mm	**18**	OCP71	**120**
TIL212 Yel 3mm	**18**	ORP12	**86**
·2" Red	**14**	2N5777	**45**
·2" Green or Yellow	**18**	(Infra Red Emitter)	
Rectangular LED's		LD271	**46**
Red, Green, Yellow		TIL32	**58**
with bezel	**29**	Detector	
7 Seg. Displays Red		SFH205	**91**
·3" C Cath	**99**	TIL78	**55**
·3" C Anod	**99**		
·3" ±1 Red or Grn	**150**		
·5" C Cath	**115**		
·5" C Anod	**115**		
·6" C Cath	**180**		
·8" Orange	**275**		
Burgraph 10 seg.	**225**		

CRYSTALS

100KHz	**270**
455KHz	**370**
1MHz	**295**
1·008M	**295**
1·6MHz	**395**

VEROBOARDS: 0·1"

	Clad	Plain
2½×3¾"	**73p**	**52p**
2½×5"	**83p**	—
3¾×3¾"	**83p**	—
3¾×5"	**95p**	**79p**
3¾×17"	**326p**	**211p**
4¾×17"	**426p**	—

Pkt of 100 pins **50p**
Spot face cutter **118p**
Pin insertion tool **162p**

'VQ' Board **150p**
'DIP' Board **330p**
Vero Strip **144p**

PROTO – DECs
Veroblock **375p**
S-DeC **350p**
Eurobreadboard **520p**
Bimboard 1 **550p**
Superstrip SS1 **£13**

COPPER CLAD BOARDS

Fibre Glass	Single-sided	Double-sided	SRBP 9·5"×8·5"
6"×6"	**90p**	**110p**	**95p**
6"×12"	**150p**	**200p**	

FERRIC CHLORIDE
1 lb **195p** + 50p p&p

DALO ETCH RESIST PEN plus Spare Tip **90p**

SOLDERCON PINS
100 pins **70p;**
500 pins **325p**

VERO WIRING PEN
+ spool **310p**
spare spool **75p;** combs **6p.**

DIL SOCKETS

	Low profile	Wire wrap
8 pin	**8p**	**25p**
14 pin	**10p**	**35p**
16 pin	**10p**	**42p**
18 pin	**16p**	**52p**
20 pin	**22p**	**60p**
22 pin	**25p**	**70p**
24 pin	**25p**	**70p**
28 pin	**28p**	**80p**
36 pin	—	**105p**
40 pin	**30p**	**99p**

EDGE CONNECTORS TEXAS

	·1	·156
2 10 way	—	**135p**
2 15 way	—	**140p**
2 18 way	**180p**	**145p**
2 22 way	**199p**	**200p**
2 25 way	**225p**	**220p**
2 30 way	**245p**	—
2 36 way	**295p**	—
2 40 way	**315p**	—
2 43 way	**395p**	—

DENCO COILS
Dual Purpose 'DP'
VALVE TYPE
Ranges: 1-5 Bl. Yl. Rd. Wht. **122p**
6-7 B, Y, R **110p**
1-5 Green **150p**
'T'-type (Transistor Tuning).
Ranges: 1-5 Bl. Yl. Red, White **150p**

B9A Valve Base	**42p**
RDT2	**145p**
RFC 5 chokes	**140p**
RFC 7 (19mH)	**160p**
1FT 13/14/15/16 17	**120p**
1FT 18/1·6	**135p**
1FT 18/465	**152p**
TOC1	**124p**
MW 5FR	**122p**
MW/LW 5FR	**154p**

JACKSONS VARIABLE CAPS.

Dielectric 100/300pF	**220p**
500pF	**250p**
6:1 Ball Drive 4511/DAF	**185p**
Dial Drive 4103 6:1/36:1	**775p**
Drum 54mm	**59p**
0-1-365pF	**350p**
00-2-365pF	**435p**
00-2-650pF	**650p**
0-2-365pF with slow motion Drive	**495p**
00-2-208/176	**435p**
" " with slow motion drive	**495p**
C804: 5pF; 10	**278p**
25pF	**290p**
50pF	**290p**
100:150pF	**350p**
'L' 3×310pF	**725p**
00-3×25pF	**575p**

TRANSISTORS

AC125	35	BD140	40	OC170/1	85	2N3771	179
AC126/7	25	BD144/5	198	OC200	85	2N3772	195
AC128	25	BD205	110	TIP29	34	2N3773	270
AC141/2	30	BD214	115	TIP29A	36	2N3819	22
AC176	28	BD245	45	TIP29B	56	2N3820	45
ACY17/18	70	BD378	70	TIP29C	60	2N3822/3	65
ACY19/20	75	BD434	55	TIP30	48	2N3866	90
ACY21/22	75	BD517	75	TIP30C	58	2N3903/4	18
ACY28	75	BD695A	99	TIP31A	45	2N3905/6	15
AD149	79	BD696A	99	TIP31C	55	2N4037	46
AD161/2	42	BDY56	180	TIP32A	48	2N4058	10
AF106	70	BF115	35	TIP32C	60	2N4061/2	10
AF118	95	BF167	29	TIP33A	65	2N4427	80
AF139	40	BF180	38	TIP33C	78	2N4859	78
AF178	75	BF194/5	12	TIP34A	74	2N4871	55
AF239	78	BF196/7	12	TIP34C	88	2N5172	18
BC107	10	BF198/9	16	TIP35A	160	2N5179	45
BC107B	12	BF200	30	TIP35C	185	2N5191	75
BC108	10	BF224	24	TIP36A	170	2N5305	24
BC108B	12	BF244	30	TIP36C	199	2N5457	36
BC108C	12	BF244B	30	TIP41A	55	2N5485	36
BC109	10	BF256	35	TIP41B	68	2N5642	750
BC109B	12	BF257/8	32	TIP42A	60	2N5777	45
BC109C	12	BF259	35	TIP42B	75	2SA715	60
BC140	30	BF274	42	TIP120	90	2SC495	70
BC141/2	30	BF336	40	TIP121	99	2SC496	70
BC143	30	BF451	35	TIP142	120	2SC1096	85
BC147	9	BF594	30	TIP147	120	2SC1173	125
BC147B	10	BF595	39	TIP2955	60	2SC1306	150
BC148	9	BFR39	23	TIP3055	60	2SC1307	220
BC148B	10	BFR40/41	23	TIS43	32	2SC1449	80
BC148C	10	BFR79	23	TIS44/5	45	2SC1678	140
BC149	9	BFR80/1	24	TIS88A	50	2SC1923	50
BC149C	10	BFR98	105	TIS90	30	2SC1945	225
BC153/4	27	BFX29/84	28	TIS91	32	2SC1953	90
BC157/8	10	BFX85/6	28	ZTX107	11	2SC1957	90
BC159	11	BFX87/8	28	ZTX109	12	2SC1969	198
BC160	45	BFY51/2	23	ZTX300	13	2SC2028	85
BC167/8	10	BFY56	32	ZTX301/2	16	2SC2029	180
BC168C	10	BFY64	35	ZTX303	25	2SC2078	155
BC169C	10	BFY81	120	ZTX304	17	2SC2091	85
BC170	15	BRY39	40	ZTX314	25	2SC2314	85
BC172/3	11	BSX20	20	ZTX326	30	2SC2166	165
BC177/8	20	BSY95A	25	ZTX341	30	2SC1679	190
BC179/81	20	BU105	170	ZTX500	14	2N6027	32
BC182/3	10	BU205	190	ZTX501/2	15	3N128	112
BC184	10	BU208	200	ZTX503	18	3N140	112
BC182L	10	E421	250	ZTX504	25	40311	60
BC183L	10	MD8001	250	ZTX531	25	40313	125
BC184L	10	MJ400	150	ZTX550	25	40315	68
BC187	26	MJ491	175	2N697	23	40316	85
BC212	10	MJ2955	90	2N698	40	40361	50
BC212L	10	MJE340	54	2N699	48	40362	50
BC213	10	MJE370	100	2N706A	19	40408	95
BC213L	10	MJE371	100	2N708	19	40411	280
BC214	10	MJE2955	99	2N918	35	40467	95
BC214L	10	MJE3055	70	2N1131/2	24	40468	60
BC236	10	MPF102	66	2N1303	60	40594	90
BC237	14	MPF103/4	36	2N1304/5	65	40595	98
BC307B	15	MPF105	36	2N1671B	160	40603	90
BC308B	16	MPF106	40	2N2219A	28	40673	95
BC327	15	MPSA05	25	2N2220A	26		
BC338	15	MPSA06	25	2N2221A	25		
BC441	34	MPSA12	32	2N2222A	25		
BC461	34	MPSA55	30	2N2369A	17		
BC477	40	MPSA56	30	2N2646	45		
BC516/7	40	MPSA70	30	2N2904/5	21		
BC547/8	14	MPSU06	55	2N2906/7	26		
BC549C	14	OC28	130	2N2926G	10		
BC557/8	15	OC35	125	2N3053	26		
BC559	15	OC36	120	2N3054	58		
BCY70	16	OC41/2	120	2N3055	48		
BCY71/2	20	OC43	55	2N3442	140		
BD131/2	48	OC44	120	2N3663	15		
BD133	60	OC45	40	2N3702/3	10		
BD135	45	OC70/71	40	2N3704/5	10		
BD136/7	40	OC74/76	50	2N3706/7	10		
BD138/9	40	OC81/82	50	2N3708/9	10		
		OC83/4	40	2N3710/11	10		

74LS (TEXAS)

74LS00	12	LS15	15	LS221	60
LS01	13	LS20	15	LS240	96
LS02	14	LS21	15	LS241	96
LS03	14	LS22	15	LS242	85
LS04	15	LS26	18	LS243	85
LS05	15	LS27	15	LS244	80
LS06	15	LS28	20	LS245	118
LS08	15	LS30	18	LS247	40
LS09	15	LS32	15	LS248	65
LS10	15	LS33	16	LS249	68
LS11	15	LS37	16	LS251	40
LS12	15	LS38	16	LS253	40
LS13	30	LS40	16	LS257	48
LS14	48	LS42	35	LS258	40
		LS47	40	LS259	85
		LS48	80	LS261	195
		LS49	60	LS266	25
		LS51	15	LS273	90
		LS54	15	LS275	290
		LS55	30	LS279	88
		LS63	150	LS280	250
		LS73	25	LS283	45
		LS74	25	LS290	57
		LS75	28	LS293	46
		LS76	20	LS295	215
		LS78	24	LS298	130
		LS83	50	LS299	420
		LS85	70	LS300	175
		LS86	38	LS302	175
		LS90	35	LS320	270
		LS91	80	LS323	270
		LS92	36	LS324	200
		LS93	36	LS325	320
		LS95	45	LS326	330
		LS96	120	LS327	315
		LS107	43	LS347	150
		LS109	30	LS348	190
		LS112	30	LS365	37
		LS113	40	LS366	37
		LS114	35	LS367	37
		LS122	44	LS368	90
		LS123	55	LS373	75
		LS124	105	LS374	75
		LS125	30	LS375	48
		LS126	30	LS377	90
		LS132	45	LS378	69
		LS133	35	LS379	65
		LS136	28	LS384	250
		LS138	35	LS390	62
		LS139	38	LS393	60
		LS151	39	LS395	199
		LS153	39	LS398	275
		LS155	39	LS399	220
		LS156	39	LS445	140
		LS157	35	LS447	195
		LS158	36	LS490	245
		LS160	41	LS541	135
		LS161	41	LS668	175
		LS162	41	LS670	175
		LS163	41	LS673	550
		LS164	48	LS674	750
		LS165	145		
		LS166	85		
		LS170	170		
		LS173	72		
		LS174	72		
		LS175	58		
		LS181	130		
		LS183	275		
		LS190	58		
		LS191	58		
		LS192	58		
		LS193	65		
		LS194	40		
		LS195	40		
		LS196	58		
		LS197	85		
		LS200	345		
		LS202	345		

74S

74S00	60
74S132	138
74S138	240
74S158	240
74S188	210
74S189	158
74S194	360
74S201	620
74S241	540
74S262	850
74S287	325
74S288	210

VOLTAGE REGULATORS
1A +ve 5V, 12V 15, 18, 24V **50p**
1A –ve **55p**
100mA –ve 5V 6, 8, 12, 15V **30p**
100mA –ve **65p**
LM309K **135p**
LM317K **350p**
LM323K **500p**
LM723 **38p**
78H05 **550p**
78HG05 **650p**
79HG **800p**
TBA625B **75p**

BRIDGE RECTIFIERS

1A/50V	18
1A/100V	22
1A/400V	29
2A/50V	35
2A/400V	46
2A/600V	65
6A/100V	83
6A/400V	95
10A/200V	215
10A/600V	350
25A/200V	240
25A/600V	395
BY164	56
VM18 DIL	55

SCRs THYRISTORS

1A/200V	58
5A/100V	32
5A/400V	40
5A/600V	48
8A/300V	60
8A/600V	95
12A/400V	95
12A/800V	188
BT106	150
BT116	180
C106D	38
TIC44	24
TIC47	35
2N4444	130

TRIACS

3A/100V	48
3A/400V	56
3A/800V	85p
8A/100V	60
8A/400V	69
8A/800V	115
12A/100V	78
12A/400V	82
12A/800V	135
16A/100V	105
16A/800V	220
25A/400V	185
25A/800V	295
30A/400V	525
T2800D	120

DIAC
ST2 **25p**

DIODES

AA119	15
BY100	24
BY127	12
CR033	250
0A9	40
0A70	12
0A79	15
0A81	15
0A85	15
0A90	8
0A91	8
0A95	8
0A200	8
0A202	8
1N914	4
1N916	5
1N4001/2	5
1N4003/4	6
1N4005/6	6
1N4007	7
1N4148	4
3A/100V	15
3A/400V	16
3A/600V	17
3A/1000V	19
6A/400V	50
6A/800V	65

LINEAR IC's

702	75	LF355	85	NE567V	140
709C 8 pin	35	LF356	90	NE570	425
710•	48	LM10	395	NE571	420
733	75	LM301A	26	RC4136D	69
741 8 pin	14	LM308T	95	S566B	245
747C 14 pin	65	LM311H	70	SAB2917	485
748C 8 pin	36	LM318	240	SAB3209	425
753 8 pin	185	LM324	30	SAB3210	295
810	159	LM339	70	SN76013N	250
9400CJ	350	LM348	90	SN76023N	240
AY-1-0212	675	LM349	115	SN76033N	195
AY-1-1313A	660	LM379	415	SN76477	175
AY-1-1320	225	LM380	75	SP8629	299
AY-1-5050	99	LM381N	145	TA7120	150
AY-1-5051	160	LM382	125	TA7130	160
AY-3-1270	840	LM386	99	TA7205A	225
AY-3-8500	390	LM387	120	TAA621AX1	295
AY-3-8910	600	LM389	99	TAA661A	190
AY-5-1224A	235	LM733	75	TAD100	159
AY-5-1230	450	LM1458	45	TBA120S	70
AY-5-1317A	639	LM3900	60	TBA540	275
AY-5-8100	735	LM3909N	85	TBA550Q	330
CA3011	110	LM3911	125	TBA641-A12/ BX1 or BX11	350
CA3014	157	LM3914	220	TBA651	190
CA3018	68	LM3915	240	TBA800	80
CA3020	186	LM3916	225	TBA810S	95
CA3023	191	LS7220	280	TBA820	80
CA3028A	80	M252AA	625	TBA920Q	290
CA3035	235	M253AA	1150	TCA965	120
CA3036	115	MB3756	440	TDA1004	290
CA3043	275	MS1513L	230	TDA1008	310
CA3045	365	MS1515L	320	TDA1022	575
CA3046	71	MC1303	88	TDA1024	105
CA3048	214	MC1304P	260	TDA1490	295
CA3059	225	MC1310P	150	TDA2020	320
CA3075	213	MC1494	694	TL061CP	40
CA3080E	65	MC1495	350	TL062CP	60
CA3081	190	MC1496L	92	TL064CN	98
CA3089E	215	MC1596	225	TL071CP	30
CA3090AQ	375	MC1710	79	TL072CP	50
CA3123	150	MC3340P	120	TL074CN	100
CA3130	90	MC3360P	120	TL081CP	25
CA3140	48	MC3401	52	TL082CP	45
CA3189	295	MC3403	89	TL083CP	75
ICL7106	795	MC3405	150	TL084CN	95
ICL7107	975	MFC6040	97	UAA170	170
ICL8038CC	340	MK50398	635	UAA180	170
ICM7205	1150	MM5303	635	UAA1003	895
ICM7215	1050	MM5307	1275	UPC575	350
ICM7216A	1950	MSM5526	820	UPC1025H	375
ICM7217A	790	NE543K	225	XR2206	350
ICM7555	80	NE544	210	XR2266	320
LA3350	250	NE555	16	ZN414	95
LA4031P	340	NE556DB	45	ZN424E	130
LA4032	295	NE560	325	ZN425E	415
LA4400	440	NE561	398	ZN426E	325
LC7130	495	NE562B	410	ZN427	560
LC7210	300	NE564	420	ZN1034	200
LD130	452	NE565A	120		
		NE566	120		

COMPUTER ICs.

2114L 300n	87
2114L 200n	87
2532 32K	450
2708	175
2716-5V	210
2732 450	400
2764	£19
4116	75
4118-200	400
4315 CMOS	795
6116	175
6502	399
6520	175
6522	350
6530	750
6532	485
6551	785
6800	300
6802	400
6810	120
6821	125
6840	420
6845	1195
6850	150
6852	255
8080A	350
8085A	650
81LS95	115
81LS96	115
81LS97	115
8251	320
8253	799
8T26A	99
8T28A	150
8T95N	99
8T97N	99
AY-3-1015	300
AY-5-1013	300
AY-5-2376	700
MC1488	55
MC1489	55
MC14411	695
MC14412	795
RO-3-2513	600
SFF96364E	800
SFC71301	820
TMS6011	365
Z80ACPU 4	385
Z80 DART	550
Z80PIO	290
Z80APIO	320
Z80 CPU	350
Z80A DART	575
Z80CTC	300
Z80A CTC	325

TTL 74 (TEXAS)

7400	11	90	28	74181	140
7401	11	91	45	74182	75
7402	11	92	30	74184	99
7403	14	93	30	74185	99
7404	14	94	34	74188	290
7405	18	95	50	74190	70
7406	28	96	45	74191	70
7407	28	97	120	74193	65
7408	16	100	85	74194	75
7409	16	104	54	74195	65
7410	14	105	55	74196	65
7411	20	107	32	74197	65
7412	20	109	35	74198	99
7413	24	110	40	74199	99
7414	32	111	55	74221	80
7416	25	112	170	74246	150
7417	25	116	88	74247	150
7420	16	118	80	74248	150
7421	20	119	90	74249	150
7422	20	120	75	74251	80
7423	22	121	30	74265	65
7425	28	122	45	74273	195
7426	30	123	50	74278	160
7427	27	125	42	74279	90
7428	28	126	40	74298	100
7430	16	128	42	74365	55
7432	26	132	48	74366	55
7433	27	136	35	74367	55
7437	27	141	70	74368	55
7438	27	142	190	74390	99
7440	17	143	250	74393	99
7441	68	144	250	74490	120
7442	38	145	70		
7443	90	147	99		
7444	90	148	75		
7445	65	150	80		
7446	55	151	45		
7447	50	153	45		
7448	50	154	75		
7450	16	155	75		
7451	16	156	75		
7453	16	157	45		
7454	16	159	99		
7460	16	160	60		
7470	35	161	60		
7472	30	162	62		
7473	30	163	64		
7474	25	164	64		
7475	40	165	62		
7476	30	166	65		
7480	48	167	185		
7481	120	170	168		
7482	70	172	290		
7483	50	173	65		
7484	80	174	72		
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		4066	36	4519	29
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		4068	22	4521	200
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		4082	21	40100	215
		4085	65	40101	130
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INDEX TO ADVERTISERS

A.H. Supplies ... 88
A.J.H. Electronics ... 86
Allweld Engineering ... 87
Amateur Electronics ... 77
Amateur Radio Exchange ... 23
Ambit International ... 12
Amcomm Services ... 71
Anglia Components ... 78
Antex Electronics ... Cover III
Auto Marine Development Company 72

Barrie Electronics ... 12
Bedford Audio ... 58
Bi-Pak ... 10, 11
Birkett J. ... 89
Black Star ... 36
Bredhurst Electronics ... Cover II
British National Radio & Electronics School ... 88, 92
Brookes ... 72
Bull J. ... 89

C.R. Supply Co. ... 90
C.Q. Centre ... 58
Cambridge Kits ... 92
Caranna, C. ... 91
Catronics ... 24
Chordgate Ltd. ... 93
Colomor Electronics Ltd. ... 14

Datong Electronics ... 6

E.D.A. ... 15
Electrovalue Ltd. ... 14
Electronic Mail Order ... 93

Garex Electronics ... 24
Global Specialities Corporation ... 7, 43
G.T. Technical Information Service ... 91
G2 Dym Aerials ... 90
Golledge Electronics ... 90

H.A.C. Shortwave ... 58
Hart Electronics ... 58
Heathkit ... 87
Home Radio Components Ltd. ... 89
Henry's Radio ... 86
Holdings Photo Audio Centre ... 95

I.C.S. Intertext ... 89
I.L.P. Electronics ... 93
Intel Electronic Components ... 6

Lee Electronics ... 83
Leeds Amateur Radio ... 18
Lexton Harvey ... 65
Lowe Electronics ... 2, 3

M.H. Electronics ... 92
Maplin Electronic Supplies ... Cover IV
Marco Trading ... 86
Microwave Modules ... 57
Modular Electronics ... 93
Monolith Electronics ... 86

P.C. Electronics ... 90
P.M. Components Ltd. ... 7
Packer Electronics ... 66
Partridge ... 24

Photo Acoustics Ltd. ... 72
Pole Mark Ltd. ... 78
Powell T. ... 88
Progressive Radio ... 72
Proto Design ... 92

Quartslab ... 78

R.S.T. Valve Mail Order ... 87
Radio Component Specialists ... 57
Radio Shack ... 81

S.E.M. ... 66
Scientific Wire Co. ... 92
Sinclair Research Ltd. ... 84, 85
Sota ... 10
South Midlands Communications Ltd. 16, 17
South West Aerial Systems ... 90
Stephens-James Ltd. ... 36

Tandy Corporation (UK) Ltd. ... 13
Technomatic Ltd. ... 96
Tempus ... 6
Thanet Electronics ... 4, 5
Titan Transformers ... 96

Vintage Wireless Co. ... 90

Waters & Stanton ... 8, 9
Watford Electronics ... 94
Webb R.M. ... 78
Western Electronics ... 35
Williams A.R. ... 36
Wilmslow Audio ... 14
Wood & Douglas ... 66

Zycomm Electronics ... 36

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7411	20p
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74161	60p
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74166	70p
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4068	18p
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2N5459	40p
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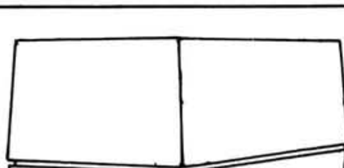

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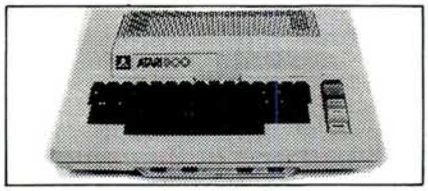

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