JANUARY 1982

Practical Wireless

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Practical Wireless

JANUARY 1982 VOL. 58 NO. 1 ISSUE 898

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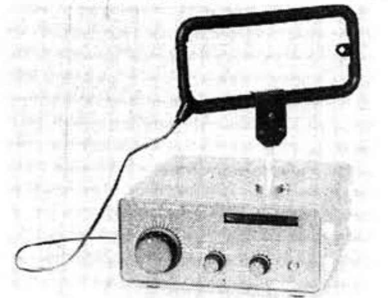
RECEIVERS & ACCESSORIES

		Inc VAT	Carr
R1000	Synthesised 200KHz-30MHz receiver. Price includes dc kit fitted	**297.85**	4.50
HC10	Digital station world time clock	**58.88**	1.50
HS5	Deluxe headphones for all TRIO equipment	**21.85**	.75
HS4	Economy headphones	**10.35**	.75
CS201/TW2	Two way 50 ohm coax switch 0-500MHz	**11.98**	.75
FBB9A	1:1 50 ohm balun. 1KW pep rating. For use as dipole centre	**11.50**	.75
DPX	Allows single feed line to VHF/UHF aerials. Reduces cable cost	**10.50**	1.00
SRX30D	Digital readout HF receiver. 500KHz-30MHz. AM/SSB/CW	**215.00**	4.50

UL-1000

£39.50 inc VAT. carr. £1.50



The UL-1000 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 UL-1000 is a self-contained variable gain, tuned preamplifier suitable for use with various aerial systems. A particular feature of the UL-1000 is the use of a high Q loop aerial for the 500KHz-1.6MHz band.

THE DAIWA FAMILY

			Inc VAT	Carr
CN520	1.8-60MHz mini cross needle power/SWR meter	**28.26**	**32.50**	1.50
CN540	50-150MHz mini cross needle power/SWR meter	**30.44**	**35.00**	1.50
CN620A	1.8-150MHz cross pointer power and SWR meter. Up to 1KW	**45.92**	**52.81**	1.50
CN630	140-450MHz cross pointer power and SWR meter. Up to 200W	**65.22**	**75.00**	1.50
CN650	1.2-2.5GHz cross pointer power and SWR meter. Up to 20W	**82.61**	**95.00**	1.50
CNW518	3-30MHz 8 band hi power tuner and cross needle power meter	**152.17**	**175.00**	2.00
CNA1001A	Fully automatic all band ATU. Includes cross pointer power meter	**135.65**	**156.00**	2.00
CNA2002	As for CNA1001A but 2KW rating for tuner and power meter	**198.26**	**228.00**	2.00
SW110A	SWR/power meter 1.8-150MHz. 0-20 and 0-200W. Not cross pointer	**26.00**	**29.90**	1.25

THE AOR FAMILY

		Inc VAT	Carr
AR740	70cm FM synthesised handheld transceiver	**195.00**	2.00
AR240A	2m FM 1W synthesised handheld complete with NiCad pack etc.	**158.00**	2.00
AR245	2m FM 5W synthesised handheld complete with NiCad etc	**178.00**	2.00
ARMS	External mic/speaker	**10.50**	1.00
ARCC	Carrying Case	**4.10**	.75
ARHA	Optional helical antenna	**4.10**	.75
ARBC	12V battery charger. (Mains charger included with transceiver)	**4.10**	.75
AR30	25W 2 metre linear. RF switched 12V powered	**38.50**	1.75

The TR9500, a 70 cm multimode mobile giving SSB, FM and CW operation in a compact rig based on the phenomenally successful 2 metre 9000. Combining the convenience of FM with the "DX ability" of SSB on the 70 cm band this is the rig all discerning VHF and UHF amateurs have been waiting for.

TR-9500 *70cm multimode*

£449.88 inc VAT carriage £4.50

TRIO

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Trio 8400 the new way to 70cm FM mobile, a fully synthesized 430 440MHz 10 watt output, mobile transceiver with memories, 2 separate VFO's all in a truly amazing compact package. Complete with up/down frequency shift microphone and car mounting bracket the TR8400 is the way to go . . . 70cm is on the move.

TR-8400 *70cm FM mobile*

£334.88 inc VAT. Securicor carriage £4.50

TR-9000 The exciting TR-9000 2-metre all-mode transceiver combining the convenience of FM with long distance SSB and CW in a very compact, very affordable package. Because of its compactness the TR-9000 is ideal for mobile installation, add on its fixed station accessories and it becomes the obvious choice for your shack.

TR-9000 *2 Metre Multimode*

£374.00 inc VAT. Carriage by Securicor £4.50

TR-7800 Trio's remarkable TR-7800 2-metre FM mobile transceiver provides all the features you could desire for maximum operating enjoyment. Frequency selection is easier than ever, and the rig incorporates new memory development for repeater shift, priority, and scan. The TR-7800 by Trio, the only FM mobile.

TR-7800 *The Ultimate 2 Metre Mobile FM rig*

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Tel: 02273 63859

IC290E. TWO METRE 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 100Hz tuning steps. Instant rev-repeat.

IC25E. 25W 2M FM MOBILE. Amazingly small. 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.

IC24G. 10W 2M FM MOBILE. This is the low-cost, easy to use economy model. Full band – 80 channels at 25KHz spacing by easy to use press button switches. 12½KHz spacing if reqd. and the same reliable performance as the famous IC240. **Price £169.**

IC202S/402. 3W 2M or 70cm SSB PORTABLES. These two have been around for a long time and are well proven. SSB, CW and side-tone. They come fitted with 144-144.4 (IC202S) and 432-432.4 (IC402). Battery or 12V operation. Built-in antenna or socket for external antenna.

THE POPULAR IC2E HANDY TALKY – EVERYBODY HAS ONE!

CHECK THE FEATURES:
FULLY SYNTHESIZED – Covering 144-145 99s in 400 5kHz steps.
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.
SEND/BATTERY INDICATOR – Lights during transmit, but when battery power falls below 6V it doesn't 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.
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

IC ML1	
10 Watt Mobile Booster for IC2E	**£49.00**
BP5 11 Volt Battery Pack	**£30.50**
BP4 Empty Battery Case For, 6 × AA Cells	**£5.80**
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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**
IC1/2/3 Cases	**£3.60 each**

All Prices include V.A.T.

ASK ABOUT THE 70cm VERSION THE IC4E – NOW AVAILABLE

BUY DIRECT FROM US OR OUR AGENTS AND GET
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And to match the IC720A:– **IC2KL** 500W output all mode linear amplifier. Similar size and completely automatic – no tuning. **ICAT500** completely automatic antenna tuner.

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350	CW/RTTY/ASCII Terminal Rx Only	**259.00**
CRT120G	VDU 12 inch Green Screen Mains Power	**125.00**
HC900	Intelligent Line Printer 4 Cases +	**590.00**
HC800	Line Printer Centronics	**449.00**
SK7	Plug Adaptor For Printers	**8.50**
	Linears	
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2M-100W	90 Watt Linear For 2 Metres	**115.00**
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MR-250W	210 Watt Linear For 2 Metres	**259.00**
MR28	100 Watt Linear For 10 Metres	**65.00**
UC70	50 Watt Linear For 70cms	**149.00**

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RX-430	Mast Head Preamp For 2 Metres	**70.00**
	SWR/Power	
ASW-180	1.8-160 Mhz	**45.80**
ASW-430	430 Mhz	**49.50**
	TASCO TELEREADER	
	Communications	
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Voltages stated are on full load
Continuous Ratings

30 VOLT RANGE (Split Sec)
Sec Voltages available 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30V or 12V-0-12V or 15V-0-15V.

Ref.	Amps 30V	Amps 15V	Price	P&P
112	.5	1	**2.90**	1.00
79	1	2	**3.93**	1.00
3	2	4	**6.35**	1.20
20	3	6	**7.39**	1.44
21	4	8	**8.79**	1.60
51	5	10	**10.86**	1.60
117	6	12	**12.29**	1.72
88	8	16	**16.45**	1.96
89	10	20	**18.98**	1.84
90	12	24	**21.09**	O.A.
91	15	30	**24.18**	O.A.
92	20	40	**32.40**	O.A.

50 VOLT RANGE (Split Sec) Pri 120/240V
Sec 50V Voltages available 5, 7, 8, 10, 13, 15, 17, 20, 33, 40 or 20V-0-20V or 25V-0-25V

Ref.	Amps 50V	Amps 25V	Price	P&P
102	.5	1	**3.75**	1.20
103	1	2	**4.57**	1.20
104	2	4	**7.88**	1.44
105	3	6	**9.42**	1.60
106	4	8	**12.82**	1.72
107	6	12	**16.37**	1.84
118	8	16	**22.29**	2.20
119	10	20	**27.48**	O.A.
109	12	24	**32.88**	O.A.

MAINS ISOLATORS (SCREENED)
Pri 0-120; 0-100-120V (120, 220, 240V) Sec 60-55-0-55-60 twice to give 55, 60, 110, 115, 120, 125, 175, 180, 220, 225, 230, 235, 240.

Ref	VA	Price	P & F
*07	20	**4·84**	1.20
149	60	**7·37**	1.20
150	100	**8·38**	1.44
151	200	**12·28**	1.72
152	250	**14·61**	2.04
154	500	**22·52**	2.20
155	750	**32·03**	O.A.
156	1000	**40·92**	O.A.
157	1500	**56·52**	O.A.
158	2000	**67·99**	O.A.
159	3000	**95·33**	O.A.

*Pri 0-240V Sec 115 or 240V
State sec. volts required

CASED AUTO TRANSFORMERS
240V cable in 115V USA flat pin outlets

VA	Price	P & P	Ref
20	**6·55**	0.95	56W
75	**8·50**	1.20	64W
150	**11·00**	1.44	4W
250	**13·39**	1.44	69W
500	**20·13**	2.04	67W
1000	**30.67**	2.20	84W
2000	**54.97**	O.A.	95W

60 VOLT RANGE (Split Sec)
Pri 120/240V. Voltages available 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 or 24V-0-24V or 30V-0-30V.

Ref	Amps 60V	Amps 30V	Price	P&P
124	.5	1	**4.27**	1.20
126	1	2	**6.50**	1.20
127	2	4	**8.36**	1.60
125	3	6	**12.10**	1.72
123	4	8	**13.77**	1.96
120	6	12	**19.87**	2.04
121	8	16	**27.92**	O.A.
122	10	20	**32.51**	O.A.
189	12	24	**37.47**	O.A.

12 OR 24V OR 12-0-12V
Pri 220-240 volts

Ref	Amps 12V	Amps 24V	Price	P&P
111	0 5	0 25	**2·42**	0.95
213	1 0	0 5	**2·90**	1.00
71	2	1	**3·86**	1.00
18	4	2	**4·46**	1.20
85	0 5	2 5	**6·16**	1.20
70	6	3	**6·99**	1.20
108	8	4	**8·16**	1.44
72	10	5	**8·93**	1.60
116	12	6	**9·89**	1.60
17	16	8	**11·79**	1.72
115	20	10	**15.87**	1.84
187	30	15	**19.72**	2.04
226	60	30	**40.41**	O.A.

SCREENED MINIATURES

Ref	mA	Volts	£	P&P
238	200	3-0-3	**2·83**	0.50
212	1A, 1A	0-6, 0-6	**3·14**	1.00
13	100	9-0-9	**2·35**	0.50
235	330, 330	0-9, 0-9	**2·19**	0.60
207	500, 500	0-8-9, 0-8-9	**3·05**	0.95
208	1A, 1A	0-8-9, 0-8-9	**3·88**	1.20
236	200, 200	0-15, 0-15	**2·19**	0.60
214	300, 300	0-20, 0-20	**3·08**	1.00
221	700 (DC)	20-12-0-12-20	**3.75**	1.00
206	1A, 1A	0-15-20	**5.09**	1.20
203	500, 500	0-15-27	**4.39**	1.20
204	1A, 1A	0-15-27	**6.84**	1.20
239	50	12-0-12	**2·88**	0.50
234	500	6-0-6	**2·19**	0·44

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Voltages available: 105, 115, 190, 200, 210, 220, 230, 240, for step up and step down.

Ref.	VA (Watts)	£	P&P
113*	15	**2.73**	1.00
64	80	**4.41**	1.20
4	150	**5.89**	1.20
53	350	**10.00**	1.44
67	500	**12.09**	1.84
84	1000	**20.64**	2.20
93	1500	**25.61**	O.A.
95	2000	**38.31**	O.A.
73	3000	**65.13**	O.A.
80	4000	**84.55**	O.A.
57	5000	**98.45**	O.A.

*0, 115, 220, 240.

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171	500 mA	**2·30**	0.60
172	1A	**3·26**	1.00
173	2A	**3·95**	1.00
174	3A	**4·13**	1.20
175	4A	**6·30**	1.20

NEW RANGE TRANSFORMERS
Pri 120/240V
2 windings 0-36V-48V/36V-0-36Vm 48V-0-48V 72V or 96V.

Amps	Ref.	Price	P&P
1.0	431	**8.12**	1.44
2.0	432	**13.35**	1.22
3.0	433	**16.17**	1.96
4.0	434	**20.65**	2.04
5.0	435	**29.30**	2.20
6.0	436	**36.69**	O.A.
8.0	437	**40.03**	O.A.

Split Bobbin Type. Pri 0-115, 0-115. Sec 0-12-15-20-24-30 to give 3, 4, 5, 6, 8, 10, 12, 15, 18, 20, 24, 30V, 2 amps **£4.65.** P&P £1.10 + VAT.

1 amp PRI 0 220-240V sec as 2 amp. **£2.93.** P&P £1.00 + VAT.

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0-10A, 0-30V. Freestanding large scale easily read meters with top screw terminals for quick connections. **£4.50** P&P 66p + VAT. Size 75 × 78mm scale.

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25W Soldering Iron to BS Spec. **£1.75** P&P 30p + VAT 15%.

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£4.58 each. Safety Stand **£1.75** P&P 52p each.

P.W. Purbeck oscilloscope transformer 250-0-250; 6·3V; 12·9V (author approved) **£9.42** £1·04

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Plugs into 13A socket 3, 6, 7·5, 9, 12V DC + 300 mA output **£5.10** P&P 60p + VAT.

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43mm · 43mm		82mm · 78mm	
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0-1mA	**5·95**	0-1mA	**6·70**
0-30V	**5·95**	0-30V	**6·70**

BRIDGE RECTIFIERS

100V	25A	**£1.80**	500V
100V	50A	**£2.20**	PM7A6
200V	2A	**£0.52**	12A
200V	4A	**£0.75**	**£3·75**
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400V	4A	**£0.98**	P&P 20p
400V	6A	**£1.44**	+ VAT.

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Made by one of the world's electronics giants, this unique HF communications receiver is as easy to use as a calculator, and so compact you can slip it into your briefcase. Its combination of keyboard entry and LCD provides exact, drift-free reception right across its range, AM/SSB/CW 150kHz-30MHz and FM 76-108MHz. To operate it just enter the frequency you want via the keyboard, and you can automatically scan for stations between any two frequencies. There are also up to 6 station pre-sets, where you key desired frequencies into the memory and recall them with a single key stroke. LCD is used for frequency readout, indication on pre-sets, error indication and Sleep Timer settings (up to 90 minutes), and there is also a Phase Lock Loop synthesiser for exceptional tuning accuracy and drift-free SSB reception.

SPECIAL CHRISTMAS OFFER PRICE £139
OR £159 WITH MATCHING POWER SUPPLY

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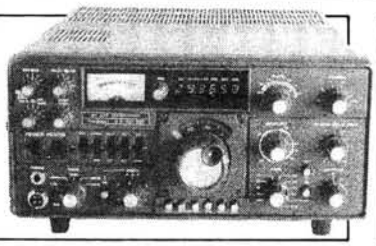

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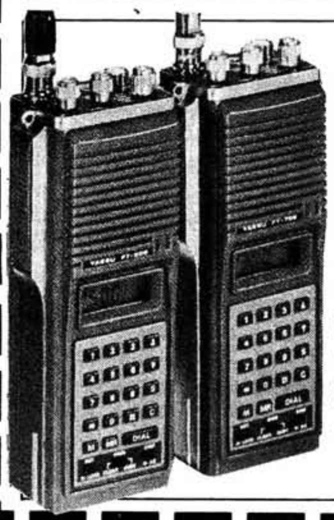
Another of our sophisticated scanning receivers. Similar functions to the BEARCAT, but even wider frequency coverage, and with AM and FM right across its range. **£262.75** inc. VAT.



FT-208R/FT-708R

Yaesu's marvellous new hand-held for either 2m or 70cm operation. Its LCD display (with night-lamp feature) is coupled to a 4-bit microprocessor giving 10 memories, up/down scanning in 12·5/25/50kc steps (manual or auto) plus memory scan and scanning between two desired frequencies, priority channel with search-back, keyboard entry allowing split frequency for non-standard repeaters . . . and lots more.
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Converter specifications • Phone for Prices

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FRV-7700C	140-150MHz	150-160MHz	160-170MHz
FRV-7700D	118-130MHz	140-150MHz	70-80MHz

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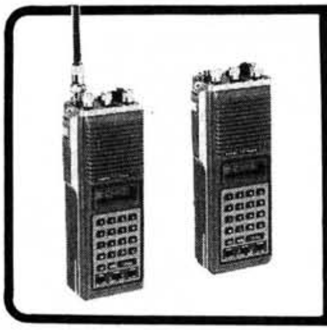
£169.00 buys you a Yaesu FT207R an IC2F or an AR240 (with £10.00 change) synthesised handheld transceiver. The FT207R steps in 12½ KHz (Not 10 KHz with added "5 up" switch) it scans for occupied or empty channels (no scanning) it has 4 channels of memory (none) and "auto revert" priority mode (none), programmable and ± 600 KHz splits (±600 KHz only), one could go on – but we would probably not have any left by the time you read this!!

FT720

A unique modular VHF/UHF FM transceiver system at a remarkable price. Take a tiny FT720R control head for £115.00 plug in a 720R' 2M ('V 10w £130.00, 'VH 25w £140.00) or 70cm ('U 10w £150.00) RF deck or operate it remotely with a 200cm or 400cm (E72S £15.00 or E72L £20.00) extension cable. Better still, buy a switching box (S72 £55.00) to enable control of a 2m and a 70cms deck from one control head, for the neatest installation around.



FT208R £209.00
2.5w, 2m
12.5/25 KHz
Synthesised

FT708R £219.00
1w, 70cms
25 KHz
Synthesised

FRG7700 £329

0.15-30 MHz General Coverage Receiver AM/SSB/CW/FM (Memory Version £409).

★FT902D £800
★FT902DE £790

FT902DM £885

10-160m. SSB, CW, AM, FM, Deluxe digital, Keyer, fan, variable bandwidth etc.

902

FTV901R	Transverter Frame, 3 band	**£195**
FV901DM	Digital VFO. 40 mem. Scan	**£260**
YO901P	Monitor scope/Panadaptor	**£330**
FC902	Antenna tuner unit	**£135**
SP901	Speaker (Patch version £55)	**£31**

FT707 £569

10-80m. 100w PEP. SSB, AM, CW. Variable IF bandwidth, Digital (10w model £485).

707

FP707	Mains P.S.U. (20A)	**£125**
FC707	Antenna tuner	**£85**
FV707DM	Digital VFO 6 Mem	**£203**
FTV707R	Transvertor Frame, 1 Band	**£90**

50TV **£70,** 70TV **£80,** 144TV **£100,** 430TV **£185.**

FT209R £249

2m, synthesised. 25 + 12½ KHz steps FM, 1 KHz + 100 Hz steps SSB. 2½W PEP.

FT480R £379

2m Synthesised, 25 12½, 1 KHz steps FM. 1 KHz, 100, 10 Hz steps SSB. 10W PEP.

FT107M £725

10-160m. 100w PEP, SSB, AM, CW. Variable IF. Deluxe all solid state. (DMS version £799).

107

FP107E	Mains PSU External	**£113**
FP107	Mains PSU Internal	**£102**
FTV107	Transvertor frame 2 band	**£119**
FV107	External VFO	**£98**
FC107	Antenna Tuner	**£112**

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30 VA 70 x 30mm 0.45 Kg Regulation 18%	1X010	6 + 6	2.50	£5.28 + 0.87p P/P	£4.48 + 0.87p P/P
	1X011	9 + 9	1.66		
	1X012	12 + 12	1.25		
	1X013	15 + 15	1.00		
	1X014	18 + 18	0.83		
	1X015	22 + 22	0.68		
	1X016	25 + 25	0.60		
	1X017	30 + 30	0.50		
50 VA 80 x 35mm 0.9 Kg Regulation 13%	2X010	6 + 6	4.16	£5.83 + £1.10 P/P	£4.93 + £1.10 P/P
	2X011	9 + 9	2.77		
	2X012	12 + 12	2.08		
	2X013	15 + 15	1.66		
	2X014	18 + 18	1.38		
	2X015	22 + 22	1.13		
	2X016	25 + 25	1.00		
	2X017	30 + 30	0.83		
	2X028	110	0.45		
	2X029	220	0.22		
	2X030	240	0.20		
80 VA 90 x 30mm 1 Kg Regulation 12%	3X010	6 + 6	6.64	£6.51 + £1.43 P/P	£5.47 + £1.43 P/P
	3X011	9 + 9	4.44		
	3X012	12 + 12	3.33		
	3X013	15 + 15	2.66		
	3X014	18 + 18	2.22		
	3X015	22 + 22	1.81		
	3X016	25 + 25	1.60		
	3X017	30 + 30	1.33		
	3X028	110	0.72		
	3X029	220	0.36		
	3X030	240	0.33		
120 VA 90 x 40mm 1.2 Kg Regulation 11%	4X010	6 + 6	10.00	£7.55 + £1.43 P/P	£6.38 + £1.43 P/P
	4X011	9 + 9	6.66		
	4X012	12 + 12	5.00		
	4X013	15 + 15	4.00		
	4X014	18 + 18	3.33		
	4X015	22 + 22	2.72		
	4X016	25 + 25	2.40		
	4X017	30 + 30	2.00		
	4X018	35 + 35	1.71		
	4X028	110	1.09		
	4X029	220	0.54		
	4X030	240	0.50		
160 VA 110 x 40mm 1.8 Kg Regulation 8%	5X011	9 + 9	8.89	£9.92 + £1.43 P/P	£8.44 + £1.43 P/P
	5X012	12 + 12	6.66		
	5X013	15 + 15	5.33		
	5X014	18 x 18	4.44		
	5X015	22 + 22	3.63		
	5X016	25 + 25	3.20		
	5X017	30 + 30	2.66		
	5X018	35 + 35	2.28		
	5X026	40 + 40	2.00		
	5X028	110	1.45		
	5X029	220	0.72		
	5X030	240	0.66		
225 VA 110 x 45mm 2.2 Kg Regulation 7%	6X012	12 + 12	9.38	£11.83 + £1.73 P/P	£10.06 + £1.73 P/P
	6X013	15 + 15	7.50		
	6X014	18 + 18	6.25		
	6X015	22 + 22	5.11		
	6X016	25 + 25	4.50		
	6X017	30 + 30	3.75		
	6X018	35 + 35	3.21		
	6X026	40 + 40	2.81		
	6X025	45 + 45	2.50		
	6X033	50 + 50	2.25		
	6X028	110	2.04		
	6X029	220	1.02		
	6X030	240	0.93		
300 VA 110 x 50mm 2.6 Kg Regulation 6%	7X013	15 + 15	10.00	£13.67 + £1.73 P/P	£11.66 + £1.73 P/P
	7X014	18 + 18	8.33		
	7X015	22 + 22	6.82		
	7X016	25 + 25	6.00		
	7X017	30 + 30	5.00		
	7X018	35 + 35	4.28		
	7X026	40 + 40	3.75		
	7X025	45 + 45	3.33		
	7X033	50 + 50	3.00		
	7X028	110	2.72		
	7X029	220	1.36		
	7X030	240	1.25		
500 VA 140 x 60mm 4 Kg Regulation 4%	8X016	25 + 25	10.00	£18.17 + £2.05 P/P	£15.53 + £2.05 P/P
	8X017	30 + 30	8.33		
	8X018	35 + 35	7.14		
	8X026	40 + 40	6.25		
	8X025	45 + 45	5.55		
	8X033	50 + 50	5.00		
	8X042	55 + 55	4.54		
	8X028	110	4.54		
	8X029	220	2.27		
	8X030	240	2.08		
625 VA 140 x 75mm 5 Kg Regulation 4%	9X017	30 + 30	10.41	£25.10 + £2.20 P/P	£21.54 + £2.20 P/P
	9X018	35 + 35	8.92		
	9X026	40 + 40	7.81		
	9X025	45 + 45	6.94		
	9X033	50 + 50	6.25		
	9X042	55 + 55	5.68		
	9X028	110	5.68		
	9X029	220	2.84		
	9X030	240	2.60		

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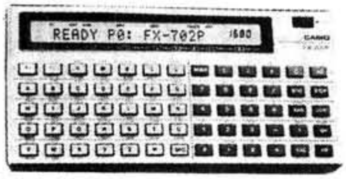

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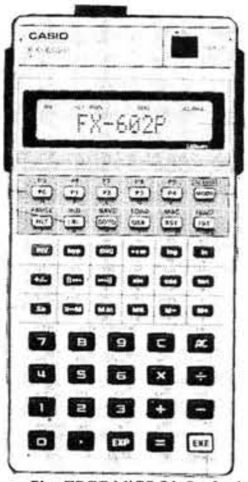

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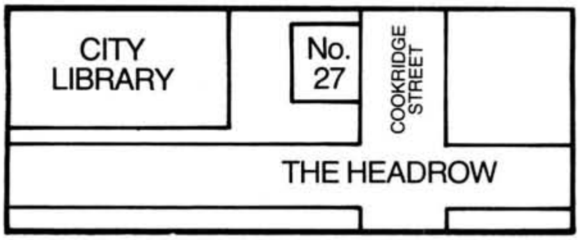

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comment...

Frustration

WELL! We paid our £12·50 over to the Home Office, and on **June 11** we were issued with our very own "Evaluation and Demonstration Licence for Citizens Band Radio Apparatus" to the new UK 27MHz and 934MHz f.m. specifications. And here we are at the end of October, still waiting to lay hands on some rigs.

We've seen some; we've even heard some working (not too impressed), but as for having a couple to try out and review — no luck! We've talked to a dozen manufacturers and importers, but they don't actually seem to have any sets that they're prepared to let out of their sight, though some do say they'll have lots ready for legalisation day.

By the time this appears in print, that fateful November 2 will have passed, but I wonder what the state of CB in the UK will be.

★ ★ ★ ★ ★ ★

We seem to be getting more and more letters and phone calls from readers having problems in getting their copy of *Practical Wireless* each month. So far as UK readers are concerned, there is the choice of going to a newsagent or station bookstall, or taking out a subscription (see details below). Some smaller newsagents may not normally stock *PW*, but they can all get it from their wholesaler if you place an order. If you do have difficulties, please write and let me know, but do include the name and address of your newsagent or bookstall.

Without that information it's impossible for us to check out the problem.

For overseas readers, the subscription can actually work out cheaper in some countries than buying locally through a newsstand. And *PW* isn't distributed in every country — we're trying to improve that situation but there are still quite a few gaps.

If you do want to get hold of a past issue, write first to our Post Sales Department (details below again), stating the month and year. Some copies of each month's *PW* are put aside, but demand is rapidly outstripping the warehouse space we can afford to allot to back numbers, and many issues are now out of print. If it's a particular article that you're after, say so, as we may be able to help you with just that item if the whole magazine isn't available.

But if you want to avoid the frustration and disappointment of missing an issue or an article, there's only one thing to do: either place a regular order or take out a subscription.

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.

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

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

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

Beginner
A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently. Generally this category will be used for simple projects, but sometimes for more complicated ones of wide appeal. In this case, construction and wiring will be dealt with in some detail.

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

Advanced
A project likely to appeal to an experienced constructor, and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Constructional information will generally be limited to the more critical aspects of the project. Definitely not recommended for a beginner to tackle on his own.

SUBSCRIPTIONS
Subscriptions are available to both home and overseas addresses at £13.00 per annum, from **"Practical Wireless" Subscription Department, Room 2613, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

BACK NUMBERS AND BINDERS
Limited stocks of some recent issues of *PW* are available at 95p each, including post and packing to addresses at home and overseas.

Binders are available (Price £4.30 to UK addresses and overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

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

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

One of the prime requirements of effective microwave operation is the ability of the operator to align his antenna (dish) accurately on the station he is trying to work. Beam widths of a few degrees are usual and not all microwave operating takes place in weather which allows the operator to align his antenna by optical sighting. On the longer paths, above say 40km, this is usually impossible anyway, since the clarity of the British atmosphere is seldom good enough to allow sightings of more than 30 to 50km! Once antenna alignment is correct, whether the path works or not is dependent on the topography of the path and the equipment and operator capability.

Thus, familiarity with the use of the Ordnance Survey (OS) maps, the use of the National Grid Reference (NGR), the use of the compass and the calculation of bearings and distances becomes essential.

The British Isles is well mapped and a whole series of highly detailed, different-scaled maps is available from the OS. Perhaps the most generally useful series is the 1 : 50 000 (1km = 2cm or approximately 1 mile = 1·25 inches) which uses some 200 plus individual sheets to cover the mainland of England, Scotland and Wales, together with outlying islands, but omits Eire, the Channel Islands and, obviously, the Continent.

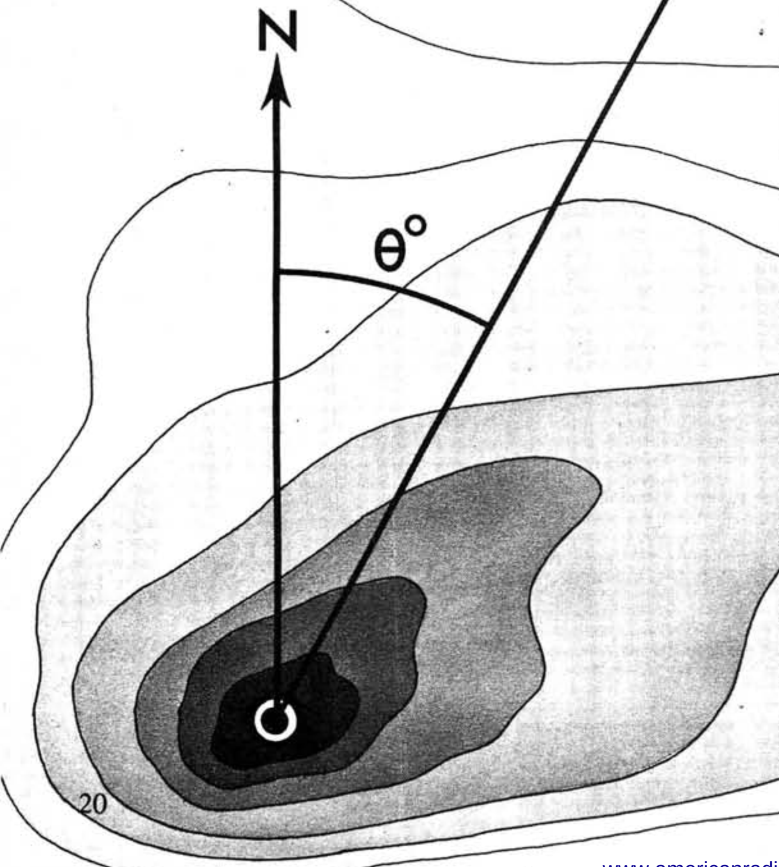
However, it is the purpose of this article to concentrate on the fundamentals of map reading, bearing calculation and distance estimation so that the beginner in the microwave field can go out to his mountain top with reasonable confidence that he will be able to beam his

WHERE ARE YOU? WHERE AM I?

M.W. DIXON PhD G3PFR

signals in the right direction! It should be added that it is not essential for the operator to be equipped with the 200 or so OS sheets mentioned above—only those of the areas of interest (begged or borrowed) so that an operating site can be chosen and its NGR ascertained.

As a preliminary to site selection, it should be mentioned that the OS publishes a 1 : 625 000 scale (about 10 miles to 1 inch) Physical Map of Great Britain. Sheet 2 is of particular interest, covering the whole of the mainland from the Lake District and North Yorkshire Moors southwards. This map will give the operator a chance to assess his particular mountain top with respect to other potential sites of interest. It is a simple, colour-contoured map showing names and spot heights of the more important hills, river courses and the like; it contains no other detail such as roads, railways, forests or towns.



Looking at the Map

The reader should open out his OS map at this point and note a number of important features. Firstly, that the map is divided into 1km squares by a series of light blue lines—the Grid Lines. Alongside these lines at each edge of the map are a series of figures. It is these figures which are used to make up the so-called National Grid Reference. It is important that the figures are noted in a particular way in order to be able to write down a correct NGR.

On the right-hand margin of each map there is a diagram which gives the Grid Letter of the particular map, for instance Sheet 109, Manchester, covers part of Grid

Letter references SD (Northern half) and SJ (Southern half). In the example to be given, reference will be made to a well-known microwave path—that from Winter Hill near Bolton to Brown Clee Hill near Ludlow, a distance of 128km, which is easily workable at the 1–4mW level on 10GHz under normal weather and propagation conditions, using such equipment as the *PW* "Exe".

Winter Hill uses the Grid Letters SD, and Brown Clee SO. Next to be read are the so-called "Eastings"—these are the figures at the top and bottom of the map. Take the nearest grid line to the *left* (west) of the point and note the figures. Then, estimate the tenths of a square from the left hand grid line already noted, giving a three figure reference. For example, Winter Hill is 66 (main grid line), plus three tenths, giving 663. Repeat the exercise for the "Northings", the figures on the left and right margins of the map, this time taking the grid line immediately *below* (south) the reference point and estimating tenths as before. Winter Hill, again, is 14 (main grid line) plus six tenths, giving 146. Thus, the full NGR becomes SD663.146 for Winter Hill and, similarly, Brown Clee is SO594.867. It should be noted that these references are accurate to 100 metres or about 330 feet.

Bearings and Distance

The direction from the home station to the distant station, and their distance apart, can be calculated once the two NGRs have been worked out in the manner described and converted into a numerical grid reference.

The first step is to convert the Grid Letters into the corresponding numbers (Table 1): when the whole grid reference is expressed as numbers, the resultant gives the number of kilometres East (West) or North (South) of the National Grid origin and enables standard trigonometry to be applied to the references in order to work out angles (bearings) and distances. Converted in this way, Winter Hill (SD663.146) becomes 366·3, 414·6 and Brown Clee (SO594.867) becomes 359·4, 286·7. These figures are now in a usable form at last!

Referring now to the figure, what we want to calculate is the bearing θ from the home station to the distant station and the distance D. This is done using the following trigonometrical expression:

$$\text{Angle } \theta = \frac{1}{\tan}\frac{|\Delta E|}{|\Delta N|} = \text{arc tan}\frac{|\Delta E|}{|\Delta N|}$$

where ΔE is the difference between distant Easting and home Easting (the first group of four figures for the distant and home stations), and ΔN is the difference between distant Northing and home Northing (the second group of four figures in each case). The vertical bars on each side of ΔN and ΔE in the expression means that the values are taken as positive even if they are actually negative.

Let us now work out the actual example

Distant	*Home*
NGR Brown Clee 359·4, 286·7	NGR Winter Hill 366·3, 414·6
DN = 286·7	HN = 414·6
DE = 359·4	HE = 366·3

$\Delta N = DN - HN = 286{\cdot}7 - 414{\cdot}6 = -127{\cdot}9$

$\Delta E = DE - HE = 359{\cdot}4 - 366{\cdot}3 = -6{\cdot}9$

Angle $\theta = \arctan \dfrac{6{\cdot}9}{127{\cdot}9} = 3{\cdot}08°$. (Using tables or a scientific calculator)

To calculate the actual bearing, a further small sum must be done, this time taking note of the signs (+ or –) of the values of ΔN and ΔE.

Table 1

Letters	Numbers E,N	Letters	Numbers E,N
NR	1,6	SM	1,2
NS	2,6	SN	2,2
NT	3,6	SO	3,2
NU	4,6	SP	4,2
NX	2,5	TL	5,2
NY	3,5	TM	6,2
NZ	4,5	SS	2,1
SC	2,4	ST	3,1
SD	3,4	SU	4,1
SE	4,4	TQ	5,1
TA	5,4	TR	6,1
SH	2,3	SW	1,0
SJ	3,3	SX	2,0
SK	4,3	SY	3,0
TF	5,3	SZ	4,0
TG	6,3	TV	5,0

If ΔN + ve and ΔE + ve — Bearing = θ
ΔN − ve and ΔE + ve — Bearing = $180 - \theta$
ΔN − ve and ΔE − ve — Bearing = $180 + \theta$
ΔN + ve and ΔE − ve — Bearing = $360 - \theta$

Thus, in our example, since ΔN and ΔE are both negative, the bearing becomes $180° + 3° = 183°$. The answer indicates that the distant station is almost due (Grid) south of the home station. However, in order to be able to take a bearing using a compass, a correction has to be made since the magnetic north, as indicated by the compass, differs from the Grid North which has been used in the calculation. The actual magnetic deviation varies from place to place in the country: for example, it is 6°W of North near the East Coast and 9°W of North in Wales. An average figure can be taken as 7·5°W of North, but the actual figure is, again, given on each OS sheet in the right hand margin. This magnetic deviation must be *added* to the calculated bearing. In the example given, the correct bearing becomes

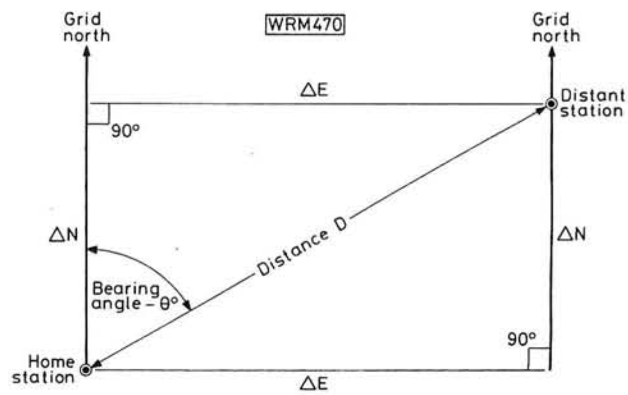
$$183° + 7{\cdot}5° = 190{\cdot}5° \textit{ magnetic}$$

Using the ΔE and ΔN values obtained above, it is now possible to calculate the length of the path (distance D in the figure) using

$$D = \sqrt{\Delta E^2 + \Delta N^2}$$

In this case

$$D = \sqrt{127{\cdot}9^2 + 6{\cdot}9^2}$$
$$= \sqrt{16358 + 47{\cdot}6}$$
$$= 128\text{km}$$



You did remember that "the square of the hypotenuse equals the sum of the squares of the other two sides", didn't you?

The calculation of bearing and distance has taken much more time to describe than to carry out! The potential operator should practise the method by taking NGRs from his map and calculating: perhaps two points a few kilometres apart which are clearly visible. This will enable him to check by sighting that the calculated bearings are indeed verified by the compass in the field.

Beware, when taking bearings with the compass, that any large ferrous object—car, fence wire, electricity pylon, etc.—can affect the accuracy of the compass. Microwave operation will often take place in the vicinity of your car. Be sure to get far enough away for the compass bearings to be correct!

It is not intended to describe how to use a compass in the field: the leaflet which comes with any good compass, e.g. Silva, Suunto, will tell the user the correct method, but please buy a good compass of reputable make!

The QRA System

One exchange of information needed in microwave contacts, and used on both v.h.f. and u.h.f., is the QRA locator. This information is essential if, for instance, the operator wishes to enter contests or claim one of the QRA Square awards (RSGB) available on v.h.f., u.h.f. and microwaves.

Once again, the information needed to calculate your QRA is contained on the OS map as figures on the extreme edge of the sheet—indeed, the information 'frames' the actual map. These figures give the station's latitude and longitude in degrees and minutes (seconds must be estimated) North and West respectively. For Winter Hill, the latitude is 53° 37′ 30″ North, longitude 2° 30′ 35″ West. The calculation is as follows:

Refer to Tables 2, 3, 4, 5 and 6.

Step 1 Subtract from the longitude the largest number in Table 2 which will leave a positive remainder. The letter corresponding to this number is the first letter of the QRA. Note the letter.

Step 2 Subtract from the latitude the largest number in Table 3 which will leave a positive remainder. The letter corresponding to this number is the second letter of the QRA. Note the letter.

Step 3 Subtract, from the remainder of Step 1, the largest number in Table 4 which will leave a positive remainder. Note the corresponding number.

Step 4 Subtract, from the remainder of Step 2, the largest number in Table 5 which will leave a positive remainder. Note the corresponding number.

Step 5 Add together the numbers derived from Steps 3 and 4. This will give the number part of the QRA.

Step 6 From inspection of Table 6, decide the combination of numbers which, when subtracted from the remainders of Steps 3 and 4, give the smallest positive remainders. The letter corresponding to this combination of numbers is the last letter of the locator.

Further tables are needed for locators east of the Greenwich Meridian. Although seldom used in microwave operation (since the vast majority of activity is to the west of the Greenwich Meridian) Tables 7, 8 and 9 give the additional information needed for such stations. Table 7 is used in Step 1, Table 8 in Step 3, and Table 9 in Step 6 instead of Tables 2, 4 and 5 respectively. Otherwise the method is identical.

Let us actually work out the QRA for Winter Hill!

Table 2

First Letter Longitude

0°W	Z
2°W	Y
4°W	X
6°W	W

Table 3

Second Letter Latitude

50°N	K
51°N	L
52°N	M
53°N	N
54°N	O

Table 4

Number Longitude

0′W	10
12′W	09
24′W	08
36′W	07
48′W	06
1° 0′W	05
1° 12′W	04
1° 24′W	03
1° 36′W	02
1° 48′W	01

Table 5

Number Latitude

0′ 0″N	70
7′ 30″N	60
15′ 0″N	50
22′ 30″N	40
30′ 0″N	30
37′ 30″N	20
45′ 0″N	10
52′ 30″N	0

Table 6

Last Letter Latitude and Longitude

4′W + 5′ 0″N	A
0′W + 5′ 0″N	B
0′W + 2′ 30″N	C
0′W + 0′ 0″N	D
4′W + 0′ 0″N	E
8′W + 0′ 0″N	F
8′W + 2′ 30″N	G
8′W + 5′ 0″N	H
4′W + 2′ 30″N	J

Table 7

First Letter Longitude

0°E	A
2°E	B
4°E	C
6°E	D

Table 8

Number Longitude

0′E	01
12′E	02
24′E	03
36′E	04
48′E	05
1° 0′E	06
1° 12′E	07
1° 24′E	08
1° 36′E	09
1° 48′E	10

Table 9

Last Letter Latitude and Longitude

4′E + 5′ 0″N	A
8′E + 5′ 0″N	B
8′E + 2′ 30″N	C
8′E + 0′ 0″N	D
4′E + 0′ 0″N	E
0′E + 0′ 0″N	F
0′E + 2′ 30″N	G
0′E + 5′ 0″N	H
4′E + 2′ 30″N	J

continued on page 42▶▶▶

THE PW 'WINTON' Stereo Tuner

Part 4

E. A. RULE

In this part of the Winton series we will deal with the construction of the chassis. When cutting the aluminium great care should be taken as accuracy is absolutely essential.

Note the diagrams of the chassis and fascia panels are shown **half full size.**

Next month we will finish with the interwiring and full setting up instructions.

Chassis

The main chassis is made in the form of a folded "U" from aluminium sheet and the overall size before bending is 461 × 298mm plus twice the bend allowance for the thickness of metal used. Therefore when using 1·2mm thick (18 s.w.g.) aluminium the size will be 461 × 300·4mm. It is possible to get aluminium sheet cut to size at most d.i.y. suppliers and it is well worth having this done as it ensures that the metal has "square sides" and makes measurements more accurate.

The blank sheet should be marked out as shown in Fig. 13, but be sure not to forget the two lines scribed to allow for the metal thickness when bending. The centre height of the push-button knobs must be within 0·5mm of 20·5mm for smooth operation and this is the reason for two scribed lines; if the bottom line is used as a guide line in the bender the holes should be correctly positioned after bending.

Cut-Outs

After drilling the cut-outs, all the holes should be deburred and the edges of the large cut-outs should be lightly filed to leave a smooth finish. These large cut-outs are so that in the event of service being required it will be possible to get to the underside of the p.c.b.s for taking voltage measurements or changing components. This task would be impossible if the cut-outs were not present. Once all the holes and cut-outs have been made the chassis can be bent up, but do make sure that you bend it the correct way!

A useful tool for making the large cut-outs is a standard hacksaw fitted with an Abrafile blade. This is a round blade and makes cutting odd-shaped holes a very easy task.

Front Fascia Panel

The front fascia panel is made to the same drawing as the front part of the chassis (Fig. 12) and the use of 2mm thick aluminium is recommended but be sure to allow the extra length of metal on **all** four sides. This is to provide an overlap when fitting into the cabinet. Note that the extra depth allowed is larger along the bottom edge; this is to allow for the bend thickness of the chassis and because the height of the screw fixing under the chassis prevents the chassis lying "flat" onto the bottom of the cabinet. Note that the five countersunk holes are not required on the fascia panel, only on the chassis.

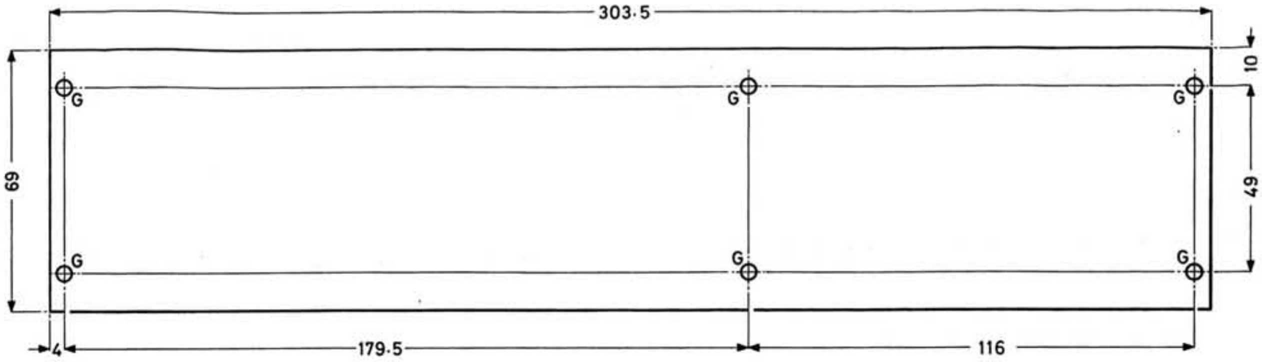
Cut-Out Covers

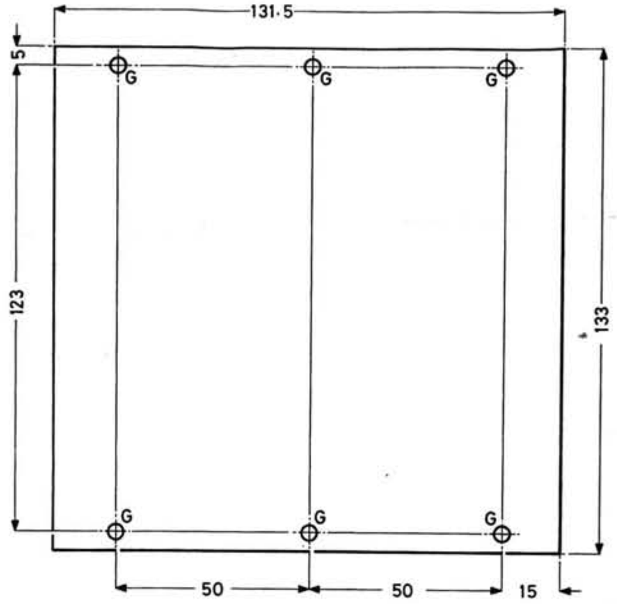
The cut-out covers are simply rectangular pieces of metal drilled as shown in Fig. 12 and fitted over the cut-outs when the tuner is completed so that screening is maintained.

Meter Cut-Outs

The meter cut-outs should be cut out so that the meters to be used are a firm push-fit into the hole. Cut the required hole slightly smaller than that finally required and file to the correct size to ensure a firm fit of the meter into the cut-out. Do not force the meters into place.

The a.m. r.f. unit has a number of fairly large pins protruding from the bottom and these have to be fitted into the holes of the p.c.b. The best method is to "walk" them into place in the same manner as the push-button switches, i.e., start from one side with the whole unit at a slight angle and lower the pins into the holes in turn as the unit is lowered. Make sure that all the pins are through before soldering.



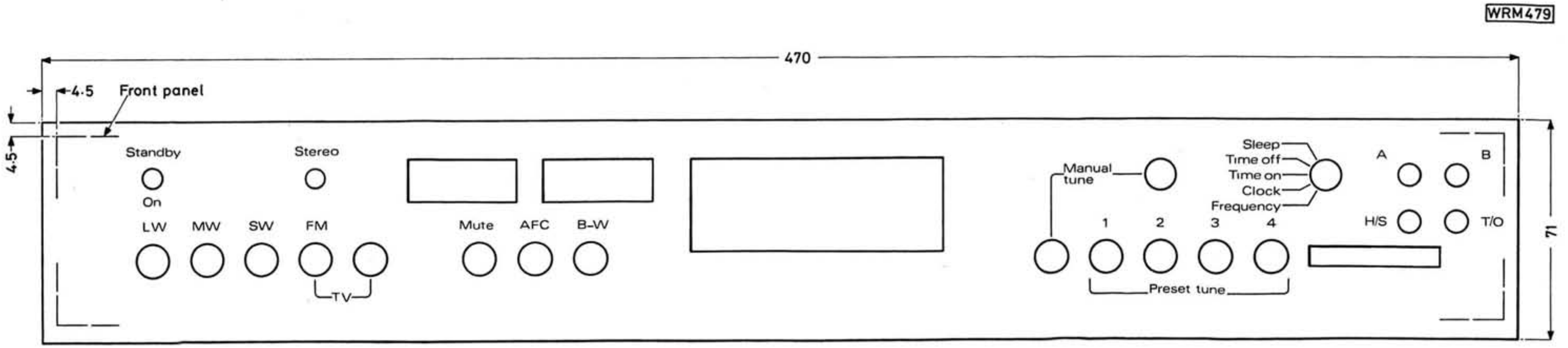


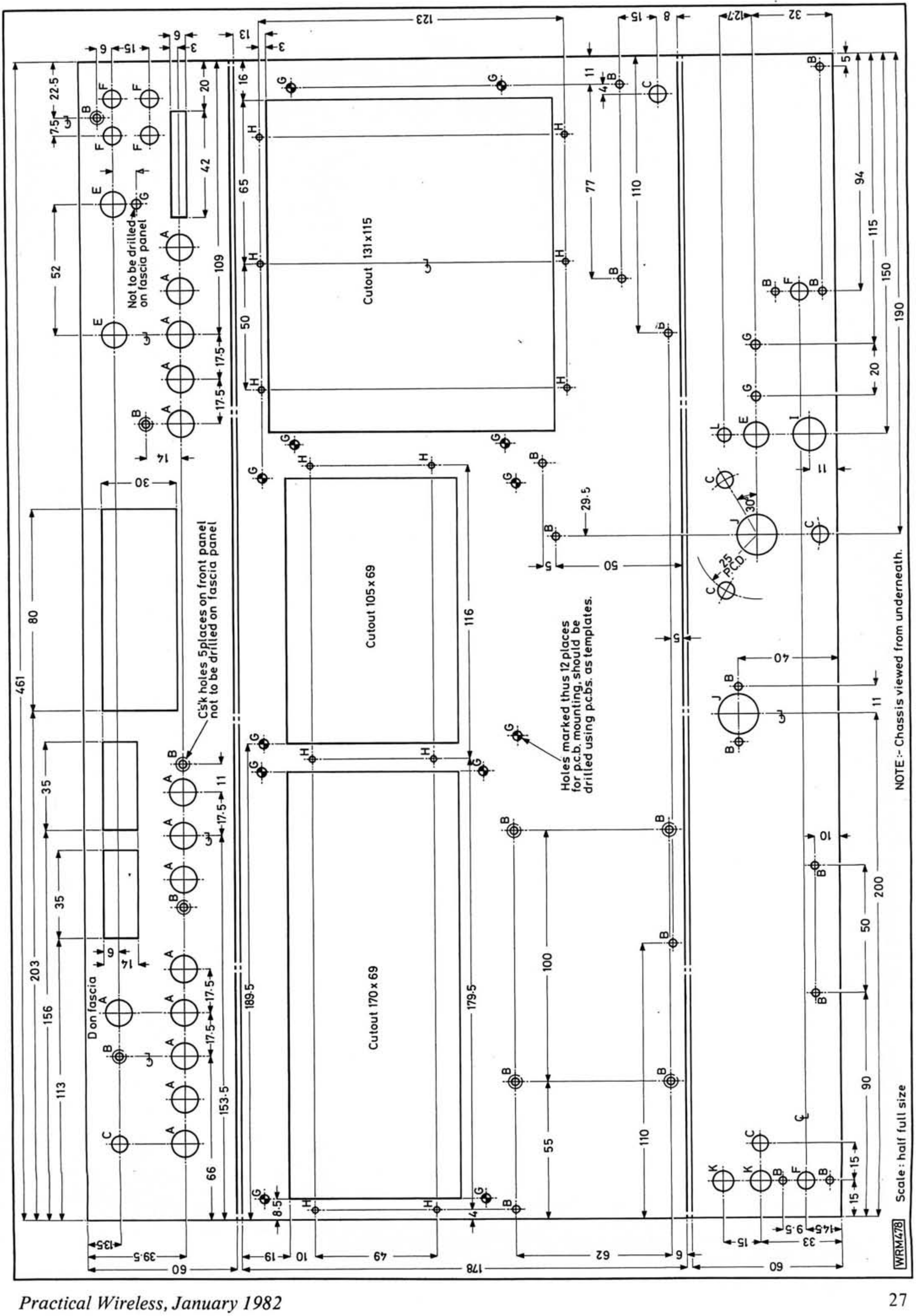
Hole	Dia
A	10·8
B	3·0
C	6·6
D	6·3
E	10·0
F	7·4
G	4·0
H	2·5
I	13·0
J	16·0
K	8·0
L	5·5

Scale: half full size

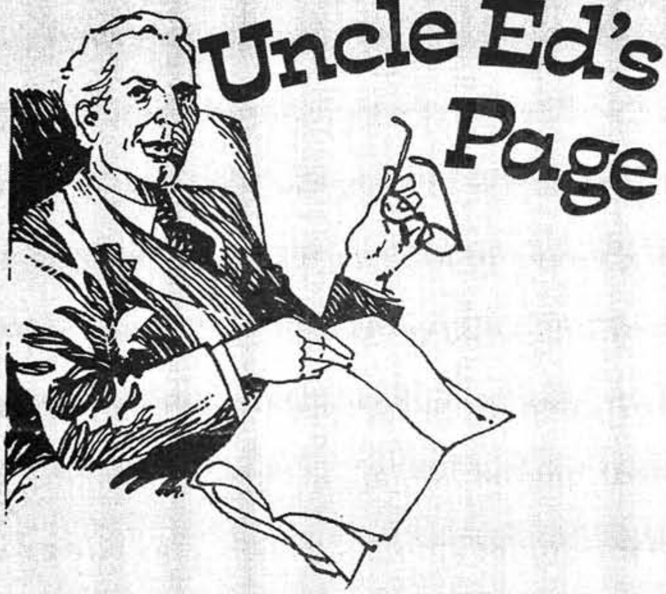
NEXT MONTH
Wiring and setting up

Fig. 12: Front panel and cut-outs (half full size)
Fig. 13: Chassis (half full size) shown opposite




Cutout 131 x 115
Cutout 105 x 69
Cutout 170 x 69
Not to be drilled on fascia panel
C's'k holes 5 places on front panel not to be drilled on fascia panel
Holes marked thus 12 places for p.c.b. mounting, should be drilled using p.c.bs. as templates.
D on fascia
25 P.C.D.
NOTE:- Chassis viewed from underneath.
Scale: half full size
WRM478

Uncle Ed's Page



A monthly look at some aspect of the radio/electronics hobby that seems to bug the beginner, or occasionally a more advanced topic seen from an unusual angle.

DECIBELS—2

In the first article on decibels, I talked about what happens when P2 or V2 are larger than P1 or V1, though I did hint that things could be the other way round. This happens when you are looking at the effect of an attenuator on a circuit, or of turning the volume control on your radio down (Ah, peace!).

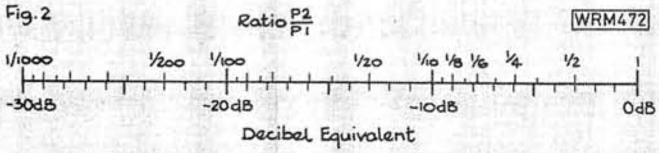
Now, if P2 is less than P1, then the ratio P2/P1 will be less than unity (unity just means the number "one"). To be a little more exact, it must also be greater than "zero"—in other words it must be a positive number less than "one". If you can harken back to your school days again, you may recall that the log of 1 is zero, and the log of a number less than 1 is negative. Thus if P2 is a tenth of P1 the ratio P2/P1 will be 0·1, its log is 1·0 or −1·0 (depending upon which school you went to) and so

$$N_{dB} = 10 \log_{10} \frac{P2}{P1}$$
$$= -10$$

In Fig. 2, which is really just a mirror image of Fig. 1 in the previous article, you can see the relationship between **power** ratio and decibels up to 1:1000 (−30dB). Again, the scales could be extended, but this time to the left. The 0dB points of Fig. 1 and Fig. 2 are the same point, and you could join the two end-to-end.

Negative decibels (meaning the signal has been attenuated) are frequently encountered when talking about the selectivity of tuned circuits. Figures often quoted are: 1. The bandwidth at the points where the power has dropped to one half of its value at the frequency of maximum response. Half power is equivalent to −3dB and this bandwidth is called the 3dB bandwidth. Because of the square-law relationship between power and voltage, the signal **voltage** at this point is 0·707 of the maximum ($0{\cdot}707^2 = 0{\cdot}5$ approx). 2. Other figures of interest are bandwidth at the −6dB points, where the signal voltage is halved and the power is reduced to a quarter ($0{\cdot}5^2 = 0{\cdot}25$) and the −60dB points, where the signal voltage is reduced to a thousandth of the maximum. The ratio of the bandwidths at the −60dB and −6dB points is an indication of the selectivity of the tuned circuit. The smaller this ratio, called the shape factor, the better (nearer the ideal) is the tuned circuit. Thus, in Fig. 3, circuit "A" is far better than circuit "B". Note that shape factor is always greater than 1.

Fig. 2



When talking about response curves, there is often confusion between positive and negative decibel ratios. At the point where the response is at −6dB, we also say it is 6dB down, or the attenuation is 6dB. In the same way, an interfering signal at frequency f_2 in Fig. 3 would be attenuated by 60dB by circuit "B". If f_2 was the frequency of the channel next to the one we were listening on (f_1), called the adjacent channel, we would say we have an adjacent channel rejection of 60dB. Many people (including me) tend to be a little lazy sometimes about whether we should put the minus sign in or not, which can confuse the beginner.

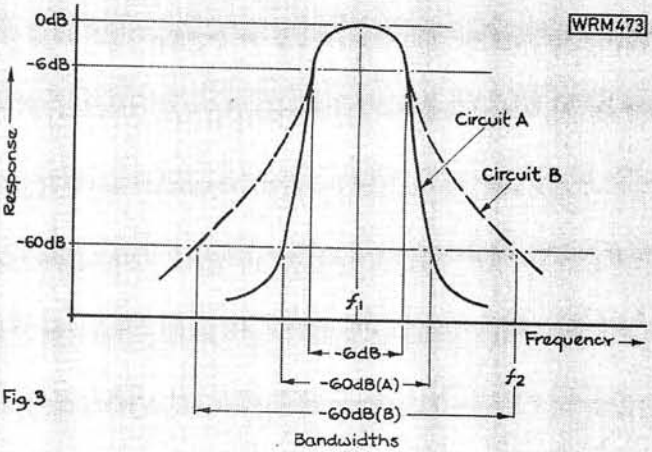


Fig. 3

"Special" Decibels

There's really nothing different about these decibels; it's just that one or more letters are added to the abbreviation dB to indicate what the reference point (the P1 or V1 value) is. Here are some of the most commonly encountered.

First, two connected with antenna performance measurements: **dBi**—gain compared with that from an isotropic antenna (one with equal response in every direction); **dBd**—gain compared with that from a dipole antenna, normally in its most favourable direction (at right angles to its length).

Next, two which state voltage levels, often encountered when specifying the input to apply to a receiver from a test signal generator: **dBV**—level compared with 1 volt; **dBμV**—level compared with 1 microvolt. These two are of course directly related, so that 1V = 0dBV = 120dBμV. Also, 1μV = 0dBμV = −120dBV.

Where the receiver input impedance is known, the voltage applied will cause a known power to be dissipated in that impedance, and we can set our reference (0dB) level as a certain power. This is often a milliwatt (1/1000 watt) and the abbreviation used is **dBm**. For a 600Ω circuit, 0dBm = 0·775V. For a 75Ω circuit, 0dBm = 0·274V, and for a 50Ω circuit 0dBm = 0·224V. Thus a −3dBm signal in 50Ω would be 0·158V. Remember that a figure in dBm is meaningless if the circuit impedance is not known. You may sometimes come across **dBW**, which means level compared with 1 watt. You might encounter the abbreviation **dBm0** if you stray into professional communications literature, but it's rather too complicated to explain here.

I mentioned last month that for the square-law relationship between voltage gain and power gain in an amplifier to hold good, the input and output impedance must be

continued on page 35▶▶▶

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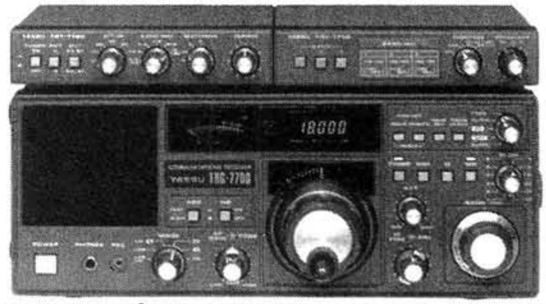

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5.) Open and close Squelch
6.) Press **MANUAL**
7.) Press 1 7 4
8.) Press **LIMIT**
9.) Repeat steps 7 and 8
10.) Press **SEARCH**
11.) Press **RECALL**
12.) Press **SEARCH** and Receiver will search 146-133MHz and 91MHz down to zero.

To search above 512MHz substitute 5 1 2 for 1 4 6, Receiver will search up to 999.9MHz
To enter any frequency on which signals have appeared, go to required channel, recall frequency, open squelch, switch set off and the frequency will stay in channel memory.

HOW TO PROGRAMME YOUR BEARCAT 220FB TO SEARCH OUTSIDE ITS SPECIFIED RANGES

1.) Press **88**
2.) Press **ENTER**
3.) Press **LIMIT**
4.) Press **144**
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Synchronous Detector

R. MYERS G8LUL*

PART 2

Having looked at the principle of Synchronous Detection of a.m. signals in Part 1, the design aspects of a complete radio module which takes full advantage of the synchronous technique will next be described in detail.

The well-known range of Plessey SL600/1600 devices have been used throughout this design, along with comprehensive operational amplifier support systems. The circuitry is of particular interest (several of the techniques are the subject of patent applications) and will be explained in complete sections as they appear in Fig. 9.

Synchronous Detector Section

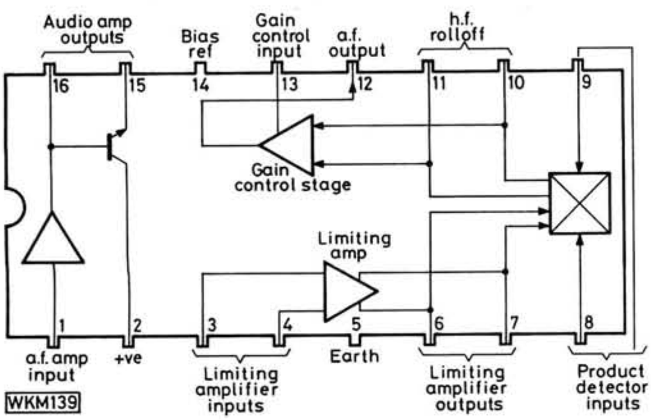
The Plessey Semiconductors SL624 i.c. contains a double balanced mixer and a limiting amplifier, necessary to achieve synchronous detection, with the added advantage of an audio output easily able to drive a power output stage or headphones direct, together with a wide range d.c. controlled audio gain stage. A block diagram of the SL624 is shown in Figure 7.

The AGC Problem

The SL624, while being an excellent synchronous detector, suffers the disadvantage of having no easily usable a.g.c. output. Application notes for the device have suggested the use of a separate amplifier/detector, connected to monitor the input to the synchronous detector, a.g.c. being derived from this auxiliary system. As the auxiliary a.g.c. detector is of the simple (non-synchronous) type, it therefore responds to broad-band noise and will in consequence produce an a.g.c. output on the noise, even if the synchronous detector sees nothing coherent.

As the whole idea of a.g.c. is to hold steady the signal being listened to, correct automatic control of gain can only be achieved by allowing the a.g.c. system to operate by reference to the levels produced by the synchronous detector itself.

Fig. 7: Block diagram of the SL624



Extracting the AGC Voltage

As mentioned in Part 1 of this article, a synchronous detector does produce a standing d.c. level if a steady carrier is applied to its input. In order that the desired a.g.c. action may be achieved, this d.c. level must first be reliably extracted from the SL624.

Fortunately the differential outputs of the product detector contained on the SL624 chip are brought out to pins 10 and 11, in order that a capacitor may be connected between them, thus removing the high order mixing products and tailoring the audio rolloff point. It is to these pins that an external system may be connected which, provided it does not load the standing bias levels of the SL624, may be used to measure the differential output and translate it into a voltage with respect to some reference point—usually the zero rail for an a.g.c. system.

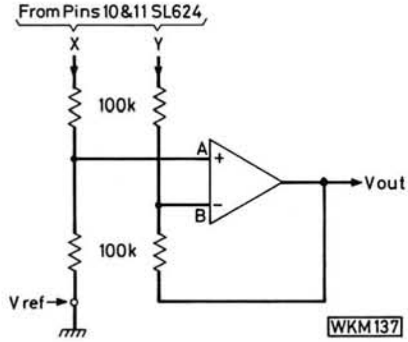


Fig. 8: The self-balancing bridge circuit

The standing bias on these pins varies markedly with temperature but is typically 8·4 volts at 20°C, with both sitting at this level if there is no input carrier. As the input signal increases, pin 11 moves proportionally more positive, pin 10 more negative, with respect to the standing bias level.

To reliably translate the differential output into a single ended voltage, with respect to the zero rail, a form of self-balancing bridge is used. Figure 8 shows the schematic layout of such a device.

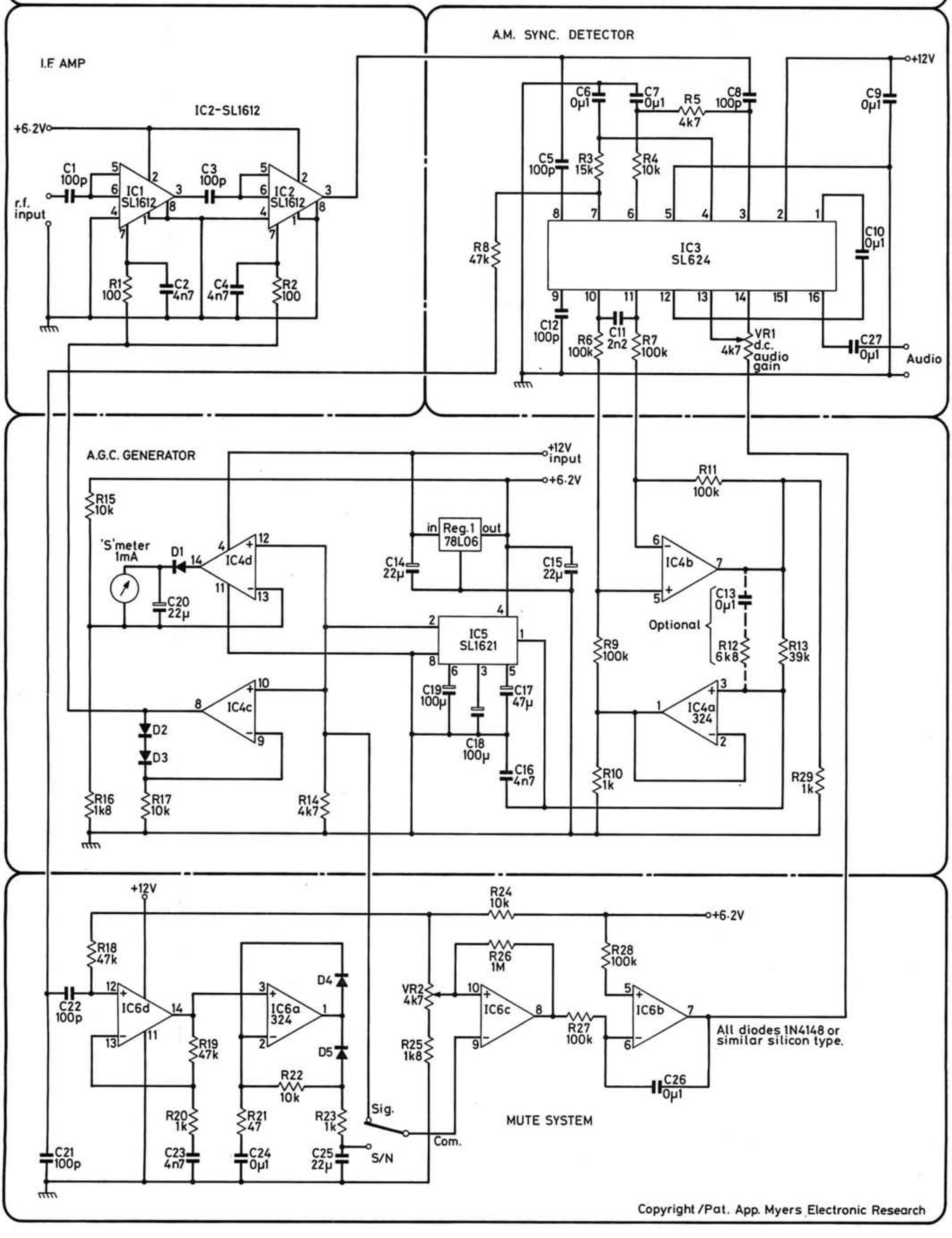
The interesting thing about the circuit of Fig. 8 is that it will totally ignore any change in voltage made to both inputs X and Y, due to temperature variation of the SL624, but will reliably respond to any differential change produced by a signal input to the detector.

To test this, consider the effect of connecting X and Y and taking them to a convenient level, for easy maths let's say 8 volts. As the Vref. point has in this example been connected to the zero rail, the two 100kΩ resistors in the left hand section of the bridge bring point A to 4 volts. The op. amp. responds by swinging its output until point B is

*Myers Electronic Research

WKM136

Fig. 9: The complete circuit diagram of the Myers Electronic Research AMS synchronous detector module



also 4 volts: this can only occur when the output has become in this case zero. This is what is required—there is no differential input and consequently, no output with respect to the Vref. point. With the inputs X and Y shorted, the output always sits at the same level as the Vref. point.

Next, test the effect of raising point X to 10 volts and lowering point Y to 6 volts, a differential input of 4 volts. As X is at 10 volts, point A will be potential divided to 5 volts. Remembering that the op. amp. will always arrange the voltage at point B to be equal to that at point A, the output must sit at the anticipated 4 volts.

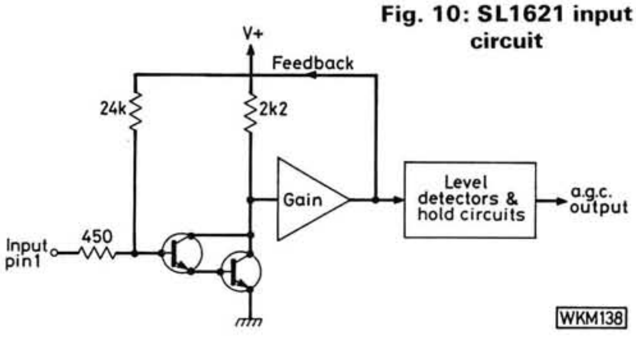
The output voltage from the op. amp. could be used directly for a.g.c. purposes (after a suitable *CR* time constant), as it is linearly proportional to the synchronously detected output of the SL624. The AMS module however employs a far more sophisticated a.g.c. system; the explanation of the self-balancing bridge is only a step on the way to full understanding.*

AGC Generator System

The a.g.c. generator of the AMS module uses a Plessey Semiconductors SL621/1621 audio based a.g.c. i.c. in a highly unusual manner in order to derive carrier based gain control.*

The SL1621 was designed to produce intelligent a.g.c. action by reference to the audio output of an s.s.b. detector. It contains the equivalent of 24 semiconductors and has the ability to deal with different types of noise and fading in the most appropriate manner. It would occupy too much space to describe the device fully, but the relevant data sheets should be consulted for detailed information. The technique used in the AMS module allows all the advanced features of the SL1621 to be applied to controlling an a.m. synchronous detector system by reference to the level of the input carrier.*

Fig. 10: SL1621 input circuit



To explain how this has been achieved, the internal input circuitry of the SL621/1621 must first be considered, shown schematically in Fig. 10.

The input consists of a two transistor inverting amplifier followed by more gain, shown here simply as a block. The gain block is connected back to the input transistor base via a 24kΩ resistor, the loop therefore being self biasing, the output voltage rises until the two base-emitter junctions switch on, at typically 1·2 volts at 20°C. The input signal in conventional use is an audio waveform capacitor-coupled to pin 1, the i.c. functioning by measuring the amplitude of the negative-going peaks of the audio, or noise, waveform. The d.c. component produced by a carrier is lost due to the necessity for the coupling capacitor.

Drift Problem

Any attempt to couple the voltage output of an a.m. detector directly to the input of the SL1621 is doomed, as only 7mV input swing is required for full a.g.c. output, but the drift with temperature of the two base-emitter junctions amounts to 4mV per °C. The a.g.c. threshold would therefore drift wildly with temperature, just two degrees changing the threshold by more than two, a figure totally unacceptable in a high quality system.

The Solution

The key phrase to overcoming all such problems is constant current. If the a.m. detector output voltage is first converted to current, by some form of constant current generator, this current can be sunk from the input pin of the SL1621 i.c., thus fooling it into seeing the negative-going peak of an audio signal.

As the current is sunk by a constant current device, any voltage drift of the SL1621 input pin, due to the temperature dependence of the two base-emitter junctions, causes no ill-effect whatsoever. The instantaneous value of the current is directly proportional to the voltage output of the detector stage and, although varying with carrier strength and modulation, is termed constant, as the change in bias voltage on the SL1621 input pin is unable to alter it.

This arrangement is a most significant step, allowing the SL1621 to produce advanced a.g.c. in an absolutely reliable and drift free manner, by reference to both the carrier and audio components of a signal applied to the SL624 synchronous detector. To complete the step requires the voltage output of the detector to be converted to constant current.

Producing a Constant Current Sink

The output of the self-balancing bridge explained previously consists of a voltage proportional to the strength of carrier injected into the SL624 synchronous detector. The circuit can be easily modified to produce constant current operation, but does require explanation.

Referring to the AMS module circuit diagram shown in Fig. 9, there are two sections of op. amp. IC4 directly below the SL624 detector. The upper section of IC4 is easily recognised as being part of the self-balancing bridge, the resistors R6, R7, R9 and R11 being the bridge network. Notice that the lower end of R9 is the Vref. point explained earlier. At this stage it is best to forget resistors R10 and R29, as they only serve to assist the op. amp. outputs in pulling down to near zero volts, to guarantee correct operation of the a.g.c. system under simultaneous worst case components and maximum temperature conditions. The lower section of IC4 serves only as a buffer, any voltage applied to the input pin 3 appearing at very low impedance at output pin 1.

In a similar manner to the explanation of the balanced bridge, imagine pins 10 and 11 on the SL624 to be shorted. Having therefore no differential input, the output of the self-balancing bridge, pin 7 of IC4, will sit at whatever voltage the Vref. point has been taken to. As the lower section of IC4 buffers the Vref. point, the input pin 3 of IC4 becomes the reference input of the system.

Looking carefully at the circuit it can be seen that pin 1 of the SL1621, which sits at about 1·2 volts at 20°C, is acting as the reference as it is connected to input pin 3 of IC4. The balanced bridge output, pin 7, consequently sits at the same voltage as the SL1621 input pin, resulting in no current being sunk from the SL1621 as both ends of the 39kΩ resistor, R13, are at the same potential.

If the SL624 detector applies a differential voltage to the balanced bridge inputs, that voltage will appear by the same means across R13 and therefore cause a current to be pulled out of the SL1621 input pin. Any drift of the SL1621 input bias voltage, due to temperature change, merely shifts the Vref. input to the balanced bridge and consequently has no effect on the current whatsoever. The capacitor C16 ensures h.f. stability of the constant current system and has no effect on any audio frequency input to the SL1621. The optional components C13 and R12 shunt R13 at audio frequency, giving a degree of audio levelling by increasing the gain of the system at audio frequencies only.

"S" Meter Drive

As the AMS module offers precision measuring ability, it is necessary to allow for the change in resistance of an "S" meter winding with temperature, a swing of 10°C will otherwise cause typically 4·3 per cent change in reading for any fixed input signal strength.

The a.g.c. output of the SL1621 is metered by a quite separate system which drives constant current through the "S" meter winding. The impedance of resistors R15 and R16 is arranged to allow a 1mA f.s.d. meter movement to hit the stop as the r.f. input reaches the maximum level before overload of the SL1612 input stage. The voltage ratio of these resistors permits the meter to begin moving only as the a.g.c. voltage applied to the SL1612 stages reaches the gain reduction threshold.

Diode D1 serves merely to prevent the meter touching the back stop when there is no input signal. The temperature dependence of this diode has no effect as both it and the meter movement are in the feedback loop of IC4. The capacitor C20 may be required to damp any meter swing, but with a good movement is normally found unnecessary. The "S" meter provides a usefully open scale for low signal strengths, becoming less sensitive towards the end stop. This makes the stop suitably hard to reach, a not insignificant 500mV peak-to-peak being required with a typical meter.

Temperature Compensation of IF Gain

Unfortunately, when gain control voltage is applied to the SL1612 devices, the degree of gain reduction for any fixed a.g.c. voltage varies with temperature.

The SL1612 amplifiers exhibit this behaviour as they have two uncompensated base/emitter junctions in their a.g.c. input circuits. In order to correct this, the a.g.c. output of the SL1621 is first processed to have equal, but opposite, characteristics by the remaining section of IC4. The temperature compensation diodes D2 and D3 are mounted physically close to the SL1612 stages and the current density in them is arranged to be equal to that of the internal junction of the SL1612, by the value of R17. Temperature compensation obtained by this method is excellent and also helps straighten the non-linear voltage versus gain curve of the SL1612. This completes the description of the advanced a.g.c. generator functions.

IF Amplifier

The gain section of the module consists of two SL1612 amplifiers coupled by 100pF capacitors, this value allowing operation well into the long wave band should it be required. The maximum voltage gain of the two stages is 2500. The a.g.c. input, pin 7, of each stage has a *CR* filter, to prevent any unwanted r.f. coupling between stages, which has no effect on the normal a.g.c. time constant.

Muting System

The mute system operates by monitoring either signal to noise ratio or signal level. In the signal to noise mode, reference is made to the output of the limiting amplifier in the synchronous detector. If there is a clean r.f. sinewave present at the input of the detector stage, the output of the limiting amplifier will be a symmetrical squarewave at the signal frequency.

The average of a symmetrical squarewave at any frequency is half its amplitude, the resistor R8 and capacitor C21 performing the averaging. Resistor R8 is placed as close as possible to the limiting amplifier output pin to reduce capacitive loading to the minimum.

If the input signal contains noise, the zero crossing points of the limiting amp. will be interfered with, causing the limiting amp. to switch alternately early and late as the input noise either adds to, or subtracts from, the i.f. sinewave. As the limited output is no longer a steady symmetrical squarewave, but one which randomly varies about the mean, the average voltage appearing at the top of C21 begins to vary. The two left hand sections of op. amp. IC6 act as an amplifier/detector for this noise signal, the detected d.c. output appearing at the top of the filter capacitor C25.

The next section of IC6 is the threshold switch which compares the output of the noise detector or a.g.c. level (link selectable) with the setting of VR2, the user mute control. Resistor R26 provides a degree of hysteresis which reduces when the pot is set to detect signals well in the noise, and increases when the user wishes the module to take only excellent signals. Once the threshold is reached, pin 8 of IC6 swings cleanly either to near zero or supply rail, depending on the signal being better or worse than the set condition.

The remaining section of IC6 is used as a true integrator which linearly ramps the audio gain control voltage applied to the SL624 providing fast but click free on/off switching of the audio with no unnecessary squelch "noise tail" as exhibited by many systems.

Typical Applications

As the AMS module operates over a wide range of frequencies without adjustment, it may be considered to be a universal i.f. system as it will easily deal with all the common intermediate frequencies.

If the module is used to add true a.m. detection to an existing s.s.b. or f.m. receiver, it may be connected at will to the first or second conversion i.f. strip of that receiver to quickly determine where the best signal to noise ratio is obtained.

As the module has excellent a.g.c. range, it may similarly be used to trace a signal through a receiver to check if adjustments made to a particular stage are improving the signal to noise ratio. This measurement is very easy as the AMS module has monitoring points for both its signal level and signal to noise detecting systems, allowing meters to be used to help sort out what goes on at any stage in a receiver.

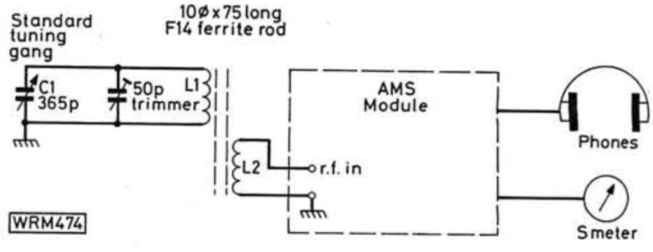


Fig. 11: A basic m.w. receiver

Complete Receiver

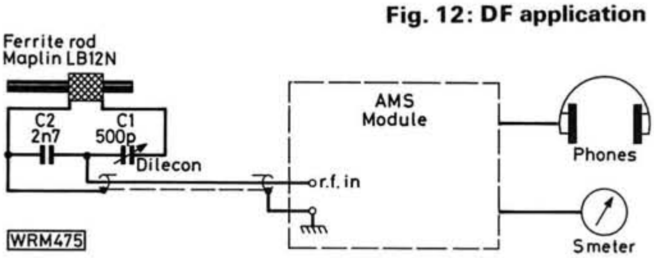
The module becomes a complete receiver with the addition of a suitable tuned circuit. A simple *LC* combination tuning the medium wave band using a ferrite rod antenna, allows broadcast signals to be synchronously detected.

The optional audio levelling provided by the module is particularly valuable in car radio applications as the audio level may be set just above the vehicle noise, the system holding the desired level despite changes in signal strength and modulation depth. This helps to prevent the continual adjustment of the volume control as the program content changes.

Direction Finder

If a ferrite rod tuned circuit covering the l.w. band is used, a compact and highly stable marine beacon receiver may be constructed and operated direct from a 12 volt supply.

Fig. 12: DF application



As the input signal levels are measured with extreme precision and repeatability, the readings produced by known beacons in line of sight may be noted to give an accurate idea of distance, should fog prevent a visual estimate. The open meter scale at the lower signal levels allows easy detection of the null when rotating the ferrite rod for d.f. purposes.

Modification for SSB/CW

The basic a.m. board can be easily modified for s.s.b. and c.w. reception. First locate and remove 100pF capacitor C8. Next, identify the vacated pad connected to pin 3 of IC 3, this is the b.f.o. injection point. All that remains to be done to complete the conversion is to connect, via miniature screened cable, the b.f.o. Connect the cable screen to an earth post on the underside of the AMS board nearest to the old C8 location, and the centre core to pin 3 as detailed above. As the injection point is highly sensitive, only a few millivolts of b.f.o. injection are required. It is recommended that the cable centre core insulation is left intact at the b.f.o. end, just wrapping a turn or two of the centre core around a suitable point in the b.f.o. should suffice. **Do not** connect d.c. or high level b.f.o. output to the injection point.

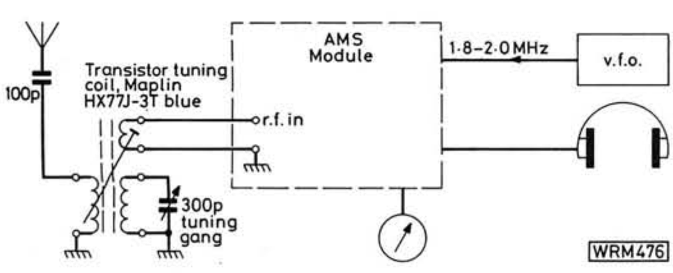


Fig. 13: Direct conversion of s.s.b./c.w.

Direct Conversion

The AMS module provides the basis for an excellent direct conversion receiver. For Top Band use, for instance, a ferrite rod or conventional tuned circuit may be used to preselect the frequency of interest.

Injecting a 1·8 to 2·0MHz v.f.o. into the AMS module limiting amp. input allows the required s.s.b./c.w. station to be tuned with the v.f.o. When used in this way the module functions as a "superhet" with an i.f. of zero. The front end tuned circuit needs to be high *Q* and/or multi-section to keep the monster m.w. broadcast signals out of the amplifier stages.

General Information

The AMS Synchronous Detection Module is a new device offering advanced receiver facilities on a single board and making the synchronous technique easily available to the experimenter. The input frequency may lie between 200kHz and 20MHz, the filter or tuned circuit applied to the input totally defining the operating frequency with no other adjustments. The module may therefore be used as a complete i.f. unit or a tunable receiver. Due to the extreme stability of the signal measuring functions, long term checks and adjustments to antennas, pre-amps or converters feeding the module may be made with absolute confidence in the meter reading.

Items in the text marked * are the subject of patent applications by Myers Electronic Research. ●

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equal. For voltage amplifiers, where power levels are so low as to be unimportant, the abbreviation **dBVg** (decibels of voltage gain) may be encountered—here the input and output impedances may be different.

One which has always seemed a bit unnecessary to me is **dBr**, meaning dB relative. Relative to what? Well, what it was before you started making adjustments, or to what the specification says it should be.

Working With Decibels

To close, a few useful pointers to help you get used to decibels. An amplifier with a gain of 13dB—what does that mean in power ratios? Well, 10dB is "times 10", and 3dB is "times 2": 13dB is "times 20", so in other words, you multiply the power ratios but you add the corresponding decibel figures. Just like using logarithms to solve multiplication problems.

You may find it helpful to draw out your own versions of Figs. 1 and 2 for voltage values, remembering that all the decibel values on the bottom scales are then multiplied by 2. You'll often be using an oscilloscope or voltmeter to check signal levels, and these indicate voltage, not power. Output powers quoted in specifications are easily converted to voltages using the formula $V = \sqrt{WR}$, where R is the load impedance.

If you're checking out an amplifier frequency response, using a voltmeter to measure the output, remember that the −1dB point is very nearly equal to the point where the reading has fallen by 10 per cent from your starting value.

NEWS NEWS NEWS

Out of Thin Air

It gives us great pleasure to announce that the *Practical Wireless* publication, *Out of Thin Air*—A Guide to Aerial Theory, Design and Propagation, has been reprinted.

For further details and an order form, see page 38.

Catalogues

Marco Trading inform me of the availability of their latest components catalogue which includes in its lists i.c.s, transistors, resistors, diodes etc. In addition, they have produced a "special" test equipment catalogue in which all the products listed are offered at very reduced prices. One example of these products is a Russian built multimeter, type U4324, which has an impressive list of functions and features a meter with a taut band suspension movement. The U4324 is offered at only £10.50 plus £1.50 p&p.

To obtain your copies of the catalogues, send an s.a.e. to: *Marco Trading, The Old School, Edstaston, Wem, Shropshire SY4 5RJ. Tel: Whixall (094 872) 464/465.*

First Ch. 4 TV TXs Ready To Go

The first pair of TV transmitters for the Independent Broadcasting Authority's Channel 4 service have been connected to their channel combiners and handed over ready for use when the IBA brings Channel 4 into service during 1982.

The two transmitters, Marconi 15kW Type B7445 u.h.f. equipments, have been installed and commissioned at Winterhill, Lancashire, by Marconi Communication Systems Ltd. Marconi is equipping a further eleven sites throughout the UK with similar suites, as well as installing a one-B7445/one-B7442 (4kW) u.h.f. combination at a further thirteen sites, all for the Fourth Channel network. All these, as well as some twenty-five further sites throughout the UK, are being equipped with Marconi-designed channel combining units which will enable all four TV channels (2 × BBC and 2 × IBA) to be transmitted from the same mast.

Marconi Communication Systems Ltd., Marconi House, Chelmsford CM1 1PL.

Computing on Short Wave

An experiment, thought to be the first of its kind, was conducted recently by Radio Netherlands during its regular "Media Network" international short wave broadcast programme.

A simple direction and bearing computer program devised by Professor John Campbell, Head of the Computer Science Department at Exeter University, in easy-to-use BASIC was transmitted from the Lopik, Holland transmitters and via satellite linked relay stations at Bonaire and Madagascar.

No modifications were made to the standard a.m. broadcast signal, used to pass the tone encoded data. Results fed back to Radio Netherlands indicated 42 per cent of listeners who participated in the experiment obtained successful results; of those listeners unable to retrieve the program, problems relating to tape recording levels and too narrow bandwidth appeared to be the most prominent.

If you are interested in participating in the next experiment, which is scheduled for 28 January, 1982, send 1 IRC (for postage, obtainable from main post offices) for a frequency listing to: *Radio Nederland, P.O. Box 222, 1200 JG Hilversum, Holland, marked Computer Information Release.*

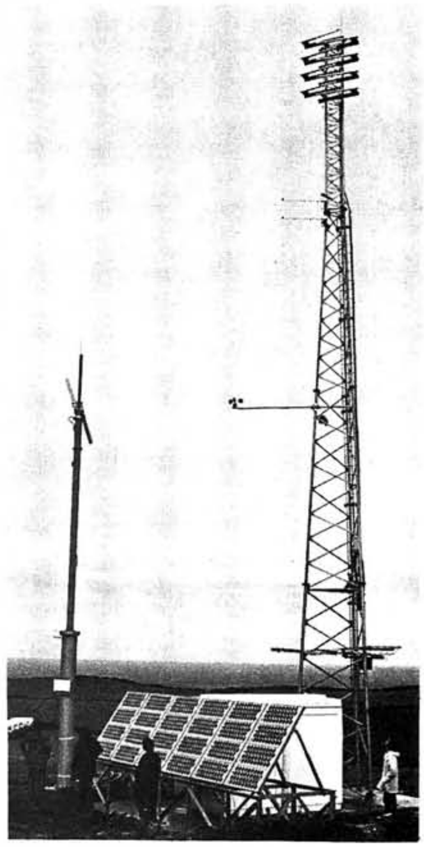
Solar/Wind Powered TV

The use of natural, renewable energy sources has been a matter of concern to IBA engineers not only from the viewpoint of energy conservation but also as potentially providing an alternative energy source in locations where it would be unduly expensive to install cables from the electricity mains supply, for communities numbering a few hundred people. The result of this concern has been the installation of the first TV transmitting station in the UK to be powered by the wind and sun at Bossiney in Cornwall.

All power for the transmitting station will normally be provided by either the wind or solar generators or from a bank of 36 large lead-acid batteries (about 1000Ah) that will be kept charged by excess power from the generators.

The wind generator has an output of 150W at a windspeed of 7 metres/second and the array of 24 solar panels, comprising 864 silicon solar cells, can provide a maximum of 780W in peak sunlight. The transmitting equipment has a power consumption of about 150W.

The attraction in the UK of both wind and solar power is that weather conditions can usually be expected to favour one or other of these energy sources. Only in long periods of still fog—unusual in Cornwall—is there thought to be any risk of the batteries becoming fully discharged.



Although this experimental station is connected to the electricity mains supply, this source of power will normally only be used to operate the sophisticated data recording system that will provide some 30,000 readings over the next five years.

Independent Broadcasting Authority, 70 Brompton Road, London SW3 1EY. Tel: 01-584 7011.

NEWS

Book Catalogue

Babani Books have their new 1982 catalogue of Radio, Electronic and Computer Books available.

To obtain your free copy, send your name and address to: *Bernard Babani (Publishing) Ltd., The Grampians, Shepherds Bush Road, London W6 7NF. Tel: 01-603 2581/7296.*

Rallies and Events

Leeds and District Amateur Radio Society will be holding their Christmas Rally on Sunday, 13 December 1981 at the Pudsey Civic Centre, Dawsons Corner, Pudsey, West Yorkshire, commencing at 1100hrs. There will be all the usual rally attractions plus a number of "non-radio" stalls which should appeal to wives and families.

Further details from: *The Secretary, Chris Gledhill G6CNP, tel: Pudsey (0532) 567702.*

CB Day

2 November, 1981, the day Citizens Band Radio became legal, saw at the "early-opening" post office at Trafalgar Square, Mr Al Gross the first ever CB'er applying for the first CB licence to be issued in the UK.

Later in the day, yours truly G8ZPW met Al W8PAL at the Eyeball Bistro, 2 Princes Street, London W1 and the photograph shows us examining some of the original experimental CB prototypes, designed and built by Al, to operate on 250MHz.

Among many CB licences for experimental work on 250MHz and 460-470MHz, issued between 1944 and 1948, Al holds the first official American CB licence, 19W0001, issued on 22 March 1948.

RAE-nothing to it!

H.A.CROOKES

I got involved in the world of "Amateur Radio" in a rather precarious way, taking my life—not to mention the soldering iron—in my hands in installing the antenna and suffering many scathing remarks from my wife. But, undaunted, I am now the proud owner of a "communications receiver" and quite a few QSL cards. Also a rather depleted bank balance.

Well, one evening I was seated at the receiver, weary and ill at ease—weary with having cleaned up the solder I had dropped on the carpet and ill at ease thinking of what excuse I could tell the wife—when I had this brilliant idea. Why not go in for the RAE and transmit? I could see it all now—me in front of the "rig", microphone in one hand, Morse key in the other, the cat watching in utter amazement. The more I thought about it the more excited I got.

At that moment the wife came in and noticing how excited I was—she's very quick at noticing things, especially the solder still stuck to the carpet—said "That's it! I knew you would. You've electrocuted the cat!" She calmed down a bit when the cat appeared unharmed. Now, I thought, is the moment to tell her—the wife, not the cat—about my bright idea. When she had stopped laughing she gave me some encouraging remarks like "Pass the maths? You can't add up to ten without using a calculator!" and similar ego boosters.

I could not sleep that night thinking about the RAE and how I could get the rest of the solder off the carpet short of cutting a six inch square hole out of it. I decided to ignore the carpet and concentrate on the RAE. The following morning I purchased a pencil, ruler and a book on maths. The pencil and ruler I could understand, the book on maths I could not, so I used it to cover up the hole in the carpet. Next I thought "How do I study?" Now evening classes are OK if you can attend regularly but I had already run out of excuses for dodging doing the decorating and to say I was going out two nights a week . . . well I am in enough trouble about the carpet as it is. Then I had another brilliant idea—do a home study course. You can study when you like and where you like so I sent for some details, brochures and an estimate for a new carpet. In due course they arrived, the brochures and the carpet estimate. Now, being rather crafty I first showed the wife the estimate for the carpet and while she was imagining an Axminster with a four inch pile, I mentioned the home study course, not too loudly you understand, and the Gods must have been smiling because she said yes, what a good idea. Afterwards she said she was referring to the carpet, not my course. But by then it was too late. I had enrolled, or rather I had signed the form and sent the money.

I could hardly wait for the course to arrive. I fully expected at least one book but when it did come it consisted of twenty-four. When I came home from work that evening the wife said, "Dinner is ready"—but how can you even consider food when all day you have been putting yourself on a level with Einstein, Newton and other brainy people. I wanted to devour the course, not food, so I immediately cleared the table, putting all the dishes, cutlery etc in the sink but in my enthusiasm I inadvertently put the cat in as well. Anyway, peace was restored and the cat dried out by the fire and the wife dried up the dishes.

Now the great moment had arrived. I opened the first book, "Elementary Maths". I really did think they would have given me a chance and started me off on tables. But no, there were things like fractions and decimals and all sorts of other complicated ways to add two numbers together. My confidence was, like my bank balance, ebbing away fast. But by eleven o'clock that evening and after countless cups of coffee I had mastered it—yes, I could do fractions, and decimals were not as bad as they at first seemed.

Well, I sent my first test off and waited for the results and to my utter amazement I passed so I started on the next and so on. I plodded on and on through all the books and logarithms, roots and all and passed each test. By now I am so confident I have applied to take the RAE in May but that will be another story. So you see, if I can do it, then why not you? Admittedly it cost me a new carpet and a lot of hard work but should I pass in May then it will be another step up the ladder of this addiction they call "Amateur Radio". ●

RADIO SPECIAL PRODUCT REPORT

IC-25E ICOM

2m FM MOBILE TRANSCEIVER

Not another 2 metre f.m. only rig you sigh! Ah well it seems that the clever gents from the Land of the Rising Sun reckon that we will change our rigs at the drop of a hat as soon as they make our present model obsolete.

Icom's IC-25E could fall into that category but on closer inspection it does offer several different and useful features.

First impressions are that Icom have toned down their styling. Gone is the angular almost military look although the front panel layout still bears a resemblance to previous Icom mobile rigs. The overall size is much smaller than the IC-255E which it is intended to replace. In fact the rig is not much larger than a conventional car radio and this should make it easier to find somewhere to install it. The speaker is fitted into the bottom of the rig and in most installations will face downwards. Provision is made, however, on the back panel for an external speaker.

The most obvious difference between the two rigs is the way in which the repeater shift is obtained. The IC-25E has an independent split and this is set to 600kHz on initial switch-on. If it is required the split can be re-programmed but for most UK users this will not be necessary.

The two v.f.o.s are used in a novel way. One tunes in steps of 5kHz and can also have its frequency set into any of the five memory channels while the second v.f.o. tunes in 25kHz steps but cannot be used to set the memories up.

Setting the five memories up is simple, the VFO/MEMORY switch is set to VFO and the desired frequency selected with the tuning knob. The VFO/MEMORY switch is then turned to select the required memory and the WRITE button pushed. It took me some time to get used to the fact that the display changes from the desired frequency to whatever happens to be in the memories as the switch is operated, but the memories are retained so long as power is connected to the rig.

A priority channel facility is built in so that any of the five memory channels can be automatically monitored every five seconds. This is a very useful facility.

Full scanning facilities are provided and these can be controlled from the microphone as well as the front panel. It is possible to select two frequencies and then scan all frequencies between them. As supplied the rig scans for busy channels but it can be changed to scan for vacant ones by an internal plug and socket change. Scan speed and dwell time can also be altered internally.

The two independent v.f.o.s allow you to scan for a free channel with one v.f.o. while retaining your original operating frequency in the other. A simple push of the VFO button returns you to the original frequency while retaining the vacant channel in the second v.f.o.

For repeater operation a 1750Hz toneburst is fitted and this is operated by pushing the TONE button. This is convenient but is a bit of a problem if your repeater needs an immediate period of valid audio after the tone. You need to be an octopus to operate the TONE button followed immediately by the p.t.t. button and drive the car. (The cure lies not with the rig designers but with the repeater logic designers who dream up these tortuous access routines.)

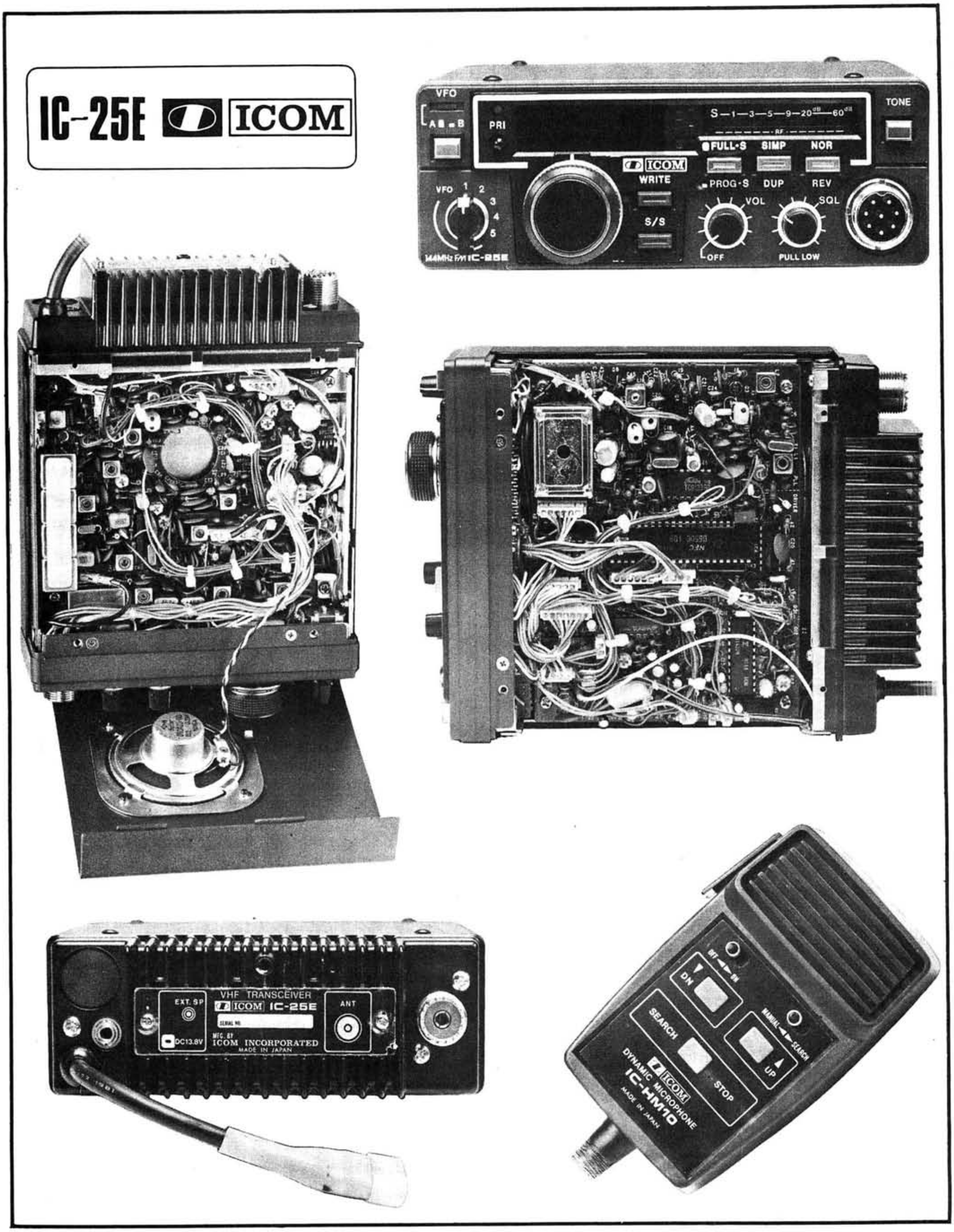
In real mobile use the IC-25E proved to be easy to drive—once fully programmed—and put out a very good signal with reports of excellent audio quality. The controls are compact but not fiddly to use and Icom seems to have at last taken note of the comments on the action of their tuning controls and this one is very smooth and pleasant to use.

The mobile mounting bracket is Icom's standard hinged and clipped style which makes for very rapid and simple removal and installation and also allows you to fit a small padlock for improved security, a very useful point with the increase in stolen rigs.

The construction is up to Icom's usual high standards and initial reports from the importers indicate a very high level of reliability. The p.a. is modular and even with long overs the heat sink did not get over hot.

The instruction manual is in the Icom tradition and is comprehensive including a full circuit diagram and p.c.b. layouts to aid with fault-finding if needed.

There was a certain amount of audible synthesiser hum breaking through on to the final audio stages and this was very noticeable with no signal present and the squelch ad-



vanced. The volume control made no difference to the level of this hum. Reports from other stations indicated that there was no trace of the hum on the transmitted signals and with a signal being received the hum was not noticeable.

This rig is certainly very nice both to look at and to use and its very compact dimensions coupled with 25W of r.f. output should make it very popular although I can't help thinking that it would be even better if it was a multimode and not just f.m. I may be wrong but many of the features seem to be wasted on f.m. operation.

★ specifications

GENERAL

Frequency coverage:	144·000–145·995MHz
Frequency resolution:	5kHz and 25kHz steps
Frequency control:	Microcomputer based 5kHz step digital p.l.l. synthesiser. Independent dual v.f.o. capability
Frequency stability:	Within ±1·5kHz
Memories:	5 channels
Antenna impedance:	50Ω unbalanced
Power supply:	13·8V d.c. ±15% (negative ground) 6A max
Current drain (at 13·8V d.c.):	Transmit 25W 4·8A 1W 1·3A Receive At max audio output 0·6A Squelched 0·4A
Dimensions:	50 × 140 ×177mm
Weight:	1·5kg

TRANSMITTER

Output power:	25W, 1W *(24·5W, 0·6W)*
Emission mode:	F3E
Modulation system:	Variable reactance frequency modulation
Max deviation:	±5kHz
Spurious emission:	60dB below carrier
Microphone:	1·3kΩ dynamic microphone with built-in preamplifier and push-to-talk switch
Operating mode:	Simplex, Duplex (any inband split)
Tone burst:	1750Hz ±0·1Hz

RECEIVER

Receiving system:	Double-conversion superheterodyne
Intermediate frequency:	1st: 16·9MHz 2nd: 455kHz
Sensitivity:	>30dB SINAD at 1 μV <0·6μV for 20dB quieting
Squelch sensitivity:	<0·4μV
Spurious response rejection ratio:	>60dB
Selectivity:	>±7·5kHz at −6dB point <±15kHz at −60dB point
Audio output power:	2·0W
Audio output impedance:	4 to 8Ω

Test results in italics

Our thanks go to **Thanet Electronics, 143 Reculver Road, Beltinge, Herne Bay, Kent. Tel: 0227 363859** for the loan of the review sample.

Price

The IC-25E costs £259.00 including VAT and is equipped with a scanning microphone as standard.

Dick Ganderton

WHERE ARE YOU? WHERE AM I?

▶▶▶*continued from page 22*

	Long.		*Lat.*	
	2°30′ 35″ W		53° 37′ 30″ N	
From 2 + 3	2° 0′ 0″	= Y	53° 0′ 0″	= N
Remainder	30′ 35″		37′ 30″	
From 4 + 5	24′ 0″	= 08	30′ 0″	= 30
Remainder	6′ 35″		7′ 30″	
From 6	4′ 0″		5′ 0″	= A
Remainder	2′ 35″ (Ignore)		2′ 30″ (Ignore)	

QRA locator = YN38A

Again, the reader is advised to try it out for himself until the method becomes familiar.

Finale

Now you know how to work out where you are and the station you wish to work is located! Having set up the dish direction correctly, all will be lost if the dish alignment in the *vertical* plane is not exact. Thus, by means of a small circular spirit level attached to the top of the transceiver box, ensure that the equipment is level. All should then be set up correctly and the attempted QSO can commence!

The use of a talk-back 2m frequency of 144·33MHz is mentioned in the "Exe" series. This should be regarded only as a microwave "calling frequency". Once 2 metre contact has been established, the operators should move up or down in frequency to a channel which will not interfere with the most-used s.s.b. frequencies. It is common to move off to a frequency below 144·20MHz.

The methods of calculating bearings, distances and QRA locators are 'frequency independent'. That is, they are universally applicable to any band and the accuracy of antenna setting which is possible using the figures is only perhaps appropriate to the very narrow beam-widths of the parabolic dish antennas commonly used at microwave frequencies.

The beginner should aim to increase the distances worked step-by-step, first of all over a few kilometres, then over tens of kilometres, and finally to the magic figure of "150km plus". For those operators who are members of the RSGB, there are awards available for varying degrees of operating skill (and luck!). A certificate is available for distance worked (Table 10) on all the major microwave bands and other certificates for QRA squares worked (on 10GHz, 5 or more). These awards really are *earned* by dint of patience, perseverance and planning.

Good Luck!

Table 10 Distance Awards (RSGB)

Band	Distance (First contact) any mode/any power
1·3 GHz	600km+
2·3 GHz	500km+
3·4 GHz	400km+
5·7 GHz	300km+
10·0 GHz	150km+
24·0 GHz	150km+

Note: all claims must be supported by QSL cards and are only available to members.

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. 12

Mods this month is devoted entirely to the **Trio TR-9000.** The first mod, which was sent in by Mr. B. R. Abrams G8CCI, provides battery back-up for the 5 memories so that you don't have to reload them every time you disconnect the rig.

Memory Back-up

First remove the bottom cover and locate the blue wire that runs from the memory back-up socket on the back of the set—it's harnessed with some other wires and they are all in a channel on the right-hand side of the rig between the outer side rail and the inner chassis.

Cut this wire approximately halfway along its length and then make up the series circuit shown in Fig. 1.

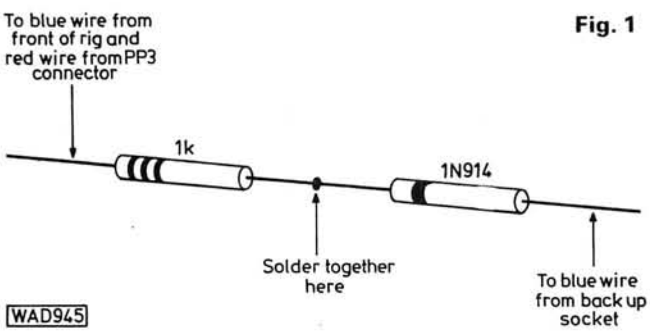


Fig. 1

Strip back the insulation from the newly cut end of the part of the blue wire which runs back to the socket and solder it to the free end of the 1N914 diode. Sleeve the resistor/diode assembly with approximately 40mm of suitable heat-shrink sleeving and then slide it back to show the free end of the resistor. Strip the insulation from the remaining cut end of the blue wire and solder this, along with the positive lead from a PP3 connector, to the free end of the resistor. Slide the heat-shrink sleeving back along the assembly so that it covers all the joints and then shrink it. Now carefully introduce this assembly back into the harness along the side of the rig.

Solder the negative wire from the PP3 connector to any convenient chassis earth point. Plug in a PP3 NiCad to the connector and use double-sided foam sticky things to attach it to the bottom cover. There are several possible positions but you must make sure that there is sufficient clearance when the cover is replaced.

With this mod, the NiCad is charging all the time that the set is connected to a 12 volt supply and when the supply is disconnected, memory back-up can be maintained for up to 36 hours. Mr. Abrams points out that this mod is valid only if a supply is normally maintained on the power socket, as the resistor value that has been chosen to provide the charging current will dictate a charging time of approximately 24 hours to fully charge a totally discharged battery. The charging rate is within the limits for continuous charging of a PP3 NiCad.

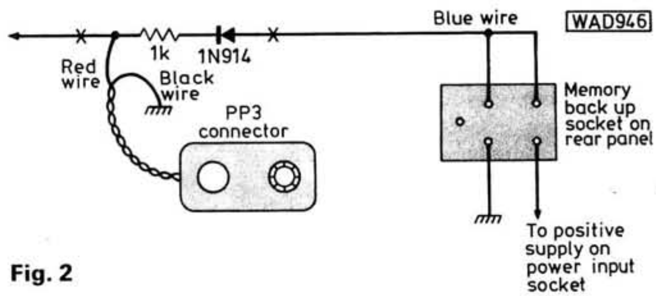


Fig. 2

Semi-Reverse Repeater

The second mod this month is for semi-reverse repeater (listen on the input) and it was sent in by Jim GI6BSQ. Jim has not supplied the "nuts and bolts" details for this mod, just the outlines, but I'm sure that most of you will be able to carry it out from the information that has been given.

To achieve a 600kHz shift it is necessary to break into the digital output lines which lead from the control board to the p.l.l. board. Connections 31 and 23 on the p.l.l. printed circuit board must then be made to reverse their logic states, i.e. 31 which is *1* must be made *0* and 23 which is *0* must be made *1*.

Jim mentions that this could be done very simply with a double-pole change-over switch but he has not used this method because it would mean cutting a hole in the case to mount the switch assembly. Instead he has used a quad 2-input NAND integrated circuit, either a 4011 or a 4093. This is connected up as in Fig. 3 and then the entire circuit, which was mounted on a piece of strip-board, can be wrapped in cling film, for insulation, and then fitted into the set. Jim recommends allowing it to lie at the front of the rig, just behind the display, as the interior of the TR-9000 is very cramped.

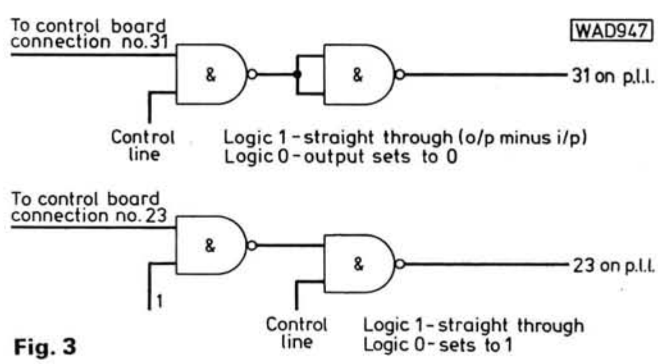
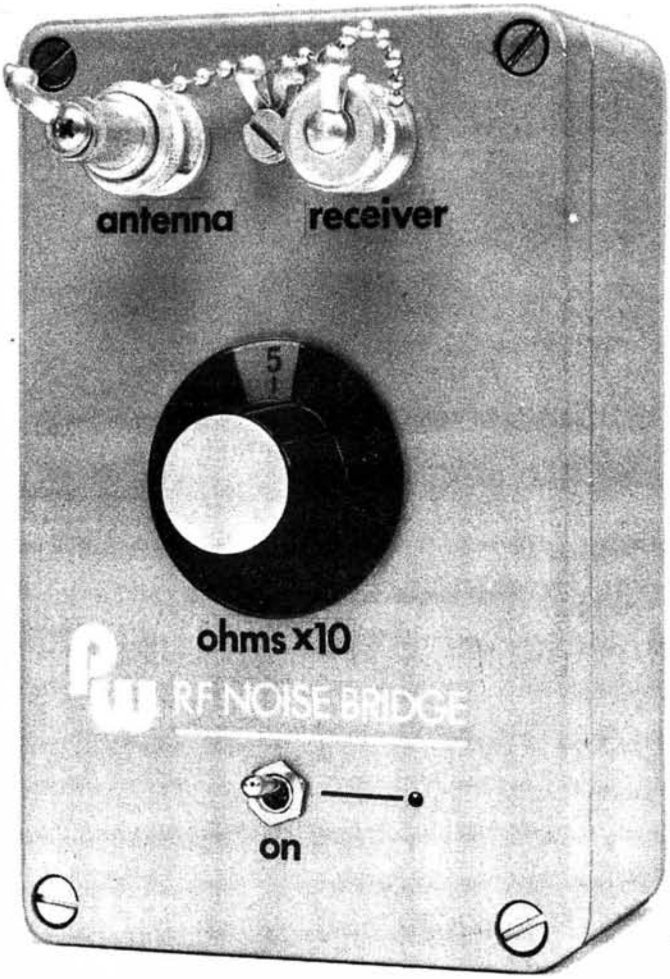


Fig. 3

continued on page 58▶▶▶

RF NOISE BRIDGE

E. A. RULE G3FEW



This simply constructed but accurate unit will allow antennas to be matched over a wide frequency range. It can also be used to check the input impedance of receivers and antenna pre-amplifiers as well as signal generators. It has an impedance measuring range of from 10 to 100 ohms to cover the normal 50 and 75 ohm impedances used in practice, and will measure over a frequency range of from a few hundred kilohertz to above 146MHz.

As a broad-band noise generator it also has a number of other uses and should be a useful tool to the experimenter. Construction is simple and only a few components are required. The author makes no claim that it is an original design as the circuit is based on well tried and proven techniques.

Circuit

The diagram (Fig. 1) shows a block layout of the r.f. bridge. It consists of a noise generator feeding a bridge circuit which allows an unknown impedance to be compared with a known one. The output from the bridge is fed into a receiver which acts as a frequency-selective null indicator.

The complete circuit is shown in Fig. 6. Zener diode D1 acts as a broad-band noise generator, its noise output amplified by the three stage broad-band amplifier Tr1, Tr2 and Tr3. The output from Tr3 is fed via a short length of coaxial cable to the bridge. The l.e.d. D2 acts as POWER ON indicator, and is wired in series with the supply so that it operates using the current already flowing into the amplifier and noise diode circuit. This keeps the battery drain to a minimum. The slight voltage drop across the l.e.d. will not affect the operation of the circuit. Capacitors C1, C5, C6 and C8 decouple the supply rail and also prevent r.f. noise from getting into these circuits and re-radiating into the bridge, preventing an accurate balance from being obtained at v.h.f.

The RF Bridge

Although simple, this part of the circuit is critical and the construction details should be followed carefully if good results are to be obtained at v.h.f. Carefully constructed the bridge will enable measurements to be made at frequencies in excess of 146MHz.

The heart of the bridge is a Mullard toroid core type FX1598 or Neosid 28–511–35. This is wound with four identical windings of five turns each. L1 and L2 form the primary winding, L3 and L4 form the secondary. To keep the stray capacities even, L2 is used to maintain even distribution of winding capacity even though one end is not connected. This end is, in fact, adjusted by bending it closer to or further from the core to obtain balance of the stray capacity at v.h.f. and will be dealt with later in the section on setting up. The centre tap of the secondary is fed, via a suitable socket, to the receiver being used to indicate the null. If the unknown impedance is the same value as the impedance of R9, then the output at the centre tap will be at a minimum. At other values the secondary circuit will not be balanced and some noise output will be obtained and indicated on the receiver. A receiver with an "S" meter is to be preferred.

Construction

The bridge is built into a suitable diecast metal box. The actual size is not critical providing it is large enough to house the components without difficulty, but do not try to use a smaller box than that shown as it is important that the actual bridge part of the circuit be spaced apart from the noise generator.

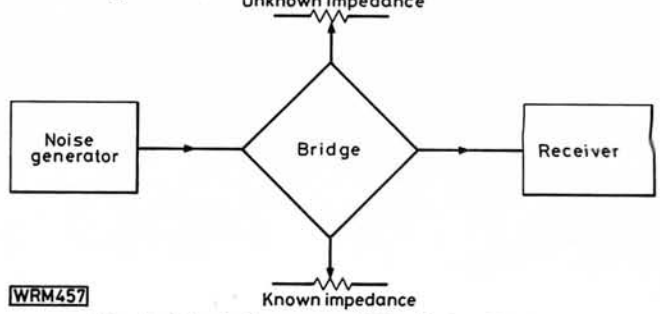


Fig. 1: Block diagram of the Noise Bridge

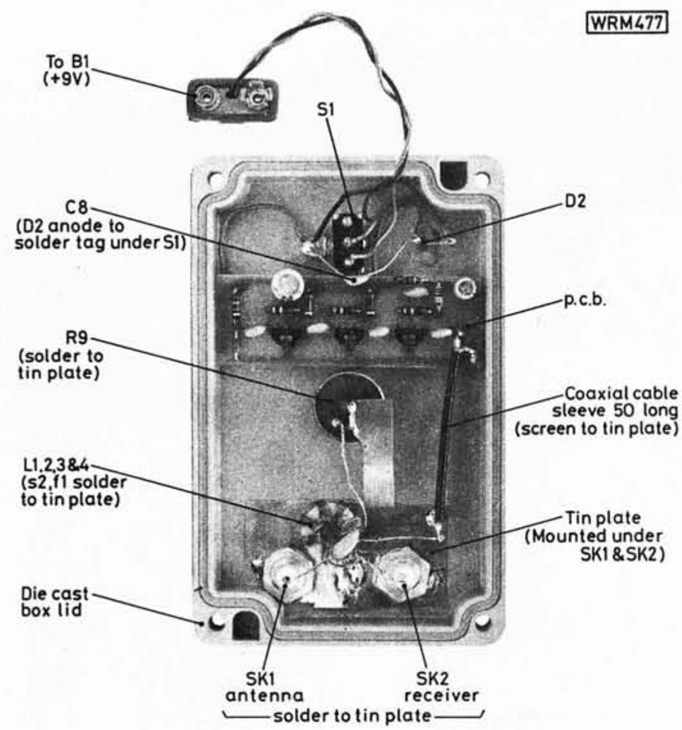


Fig. 2: The physical layout and wiring of the completed noise bridge showing the relative positions of the components. The p.c.b. is held in place with Sticky Fixers. In this model the two individual pieces of tin-plate have been replaced by one piece cut to shape

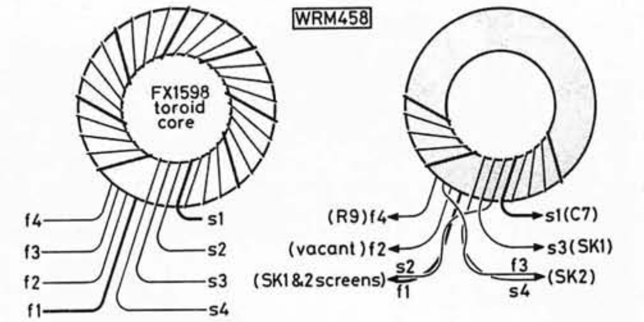


Fig. 3a: (Left) winding details of the toroidal transformer. Fig. 3b: (Right) details of the method of connecting the various windings

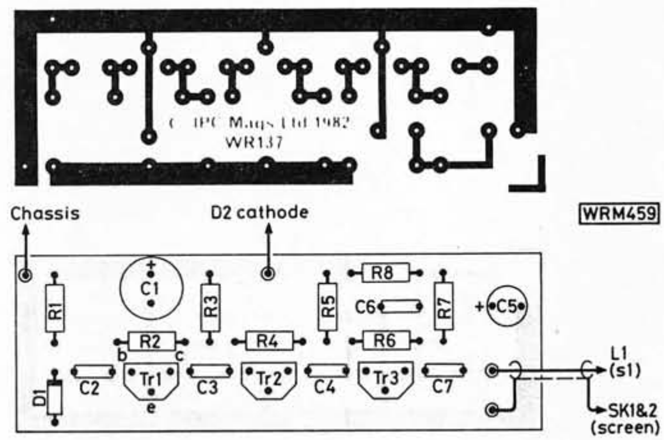


Fig. 4: (Top) the p.c.b. copper track pattern shown full size. Fig. 5: (Above) the component placement diagram for the printed circuit board

The sockets can be BNC, Belling Lee, SO239, or any other good quality r.f. socket. Do not be tempted to use screw terminals as balancing the bridge will be almost impossible.

Toroidal Transformer

Although the toroidal transformer is simple, its actual construction is very critical if good balance at v.h.f. is to be obtained. First, measure four lengths of wire. These should each be 200mm long and completely free of any kinks. It is a good idea to stretch the wire slightly to remove any kinks. Place the four wires side by side and wind evenly around the core as shown in Fig. 3a. Do not rush this part of the construction. The ideal winding is where all four windings are **exactly the same;** in practice this is not easy, but the closer you can get to this ideal, the easier it will be to get a good v.h.f. balance.

When you have finished winding, prepare and tin the ends. Check that the start and finish of each winding is as shown, this can be checked with an ohmmeter or battery and lamp. Once you have identified the windings, connect them as shown in Fig. 3b. The ends to be joined together should be twisted close to the core and tinned along the full length of the twist. Recheck that you have, in fact, made the correct connections, as it will not work unless these are as shown.

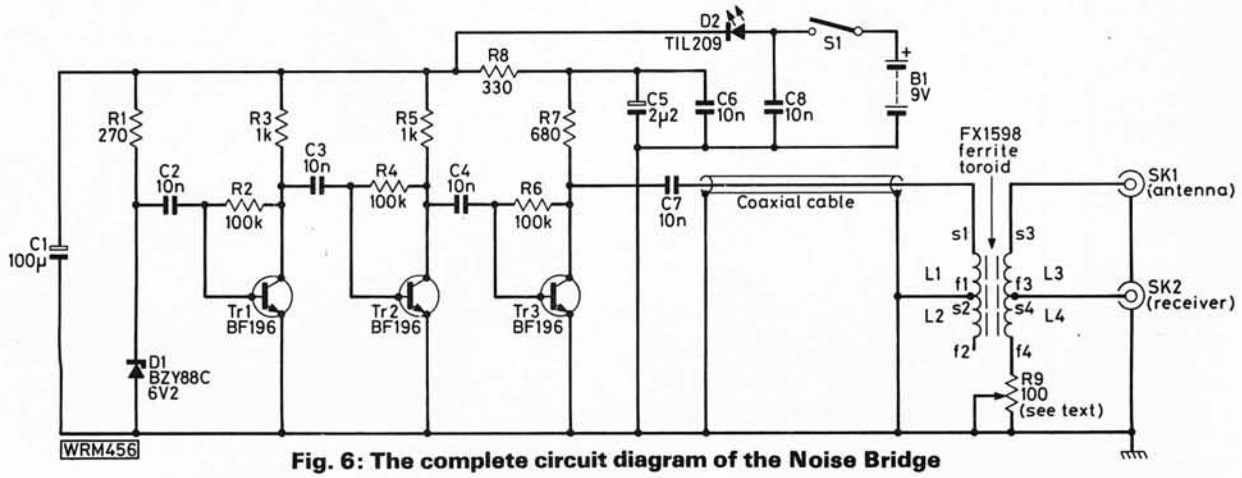


Fig. 6: The complete circuit diagram of the Noise Bridge

Circuit Board

As the circuit is so simple, the writer did not use a printed circuit board but used plain matrix board, using the component wires to connect up on the back of the board. However, a p.c.b. makes construction simpler and Fig. 5 shows the layout of the board.

The potentiometer R9 must be the type specified with a Cermet track (e.g. RS type 162–776). **A wire-wound type is not suitable and will not work.**

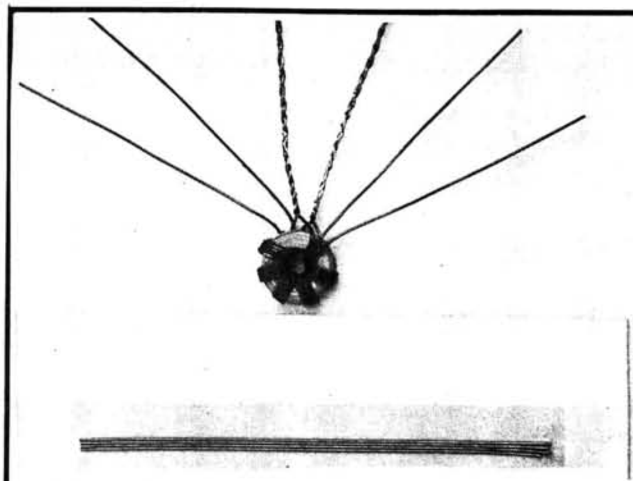
Assembly

The general assembly and final wiring is shown in Fig. 2. First, fit the toggle switch, not forgetting the solder tag underneath. Next, fit the sockets with the tinplate backing plate as shown. This backing plate is to enable good soldered earth connections to be obtained around the r.f. section and should not be left out. R9 should then be fitted and the pins arranged as shown ready for soldering to the tinplate earthing strip shown in Fig. 2.

Before fitting the component board, the two connections must be made. First, solder a short positive supply lead to the junction of R5 and R8. Connect a length of coaxial cable to the output of C7 and the earth solder tag. This coaxial cable should be 50mm long with about 5mm extra for the ends. Keep the braided connection as short as possible and use a heat shunt to avoid melting the inner insulation when soldering the braid. The board can now be fitted into the diecast box. Next, solder the tinplate earthing strip to the two pins of R9 as shown, and solder the other end of the earthing strip to the tin backing plate. Bend the strip to suit.

The toroid can now be wired into place. It is self-supporting. Solder the earth connection first (junction L1 and L2). The coil should be about 10mm above the chassis with the earth connection directly below it and onto the tinplate earthing strip where it is soldered to the backing plate. Connect the coaxial inner to the start of L1. The finish of L2 is left floating but cut to about 5mm long. The centre connection of L3 and L4 goes to the receiver socket. The start of L3 is wired to the antenna socket and the finish of L4 is wired to R9 wiper.

The short lead from the junction of R5 and R8 is now connected to the l.e.d. The other side of the l.e.d. goes to the switch and also a 10nF capacitor to the earth solder tag under the switch. Connect the battery leads and fit the battery which is held in place with Sticky Fixers.



Winding four exactly equal windings onto a small toroid is not the easiest of tasks. The pictures shown here are of a completed transformer along with the method used to keep the four enamelled copper wires accurately aligned during winding. The four lengths of straight wire are placed, side by side, on a length of double-sided adhesive tape. The tape is then carefully wrapped over the four wires and trimmed to width with a sharp scalpel. The four wires can now be wound onto the toroid as one, ensuring that the four windings are identical and neat.

CONSTRUCTION RATING **Intermediate**

BUYING GUIDE

Readers should have little difficulty in obtaining the components for this useful project.

The diecast box used for the prototype model was an Eldon Compact Series CM160 and is provided with a rubber seal for the lid as well as being painted. A standard diecast box could be used if it is desired to cut the cost to minimum but at the expense of the protection afforded by the sealed box.

The toroid can be either the Mullard or Neosid types and the latter is available direct from Neosid Small Orders Department.

APPROXIMATE COST **£15**

Testing and Setting Up

To test the bridge, a suitable receiver covering the range of frequencies it is intended to use, and a dummy load, are required. A suitable dummy load is shown in the photograph, but could be constructed if a commercial dummy load is not available.

Connect the input of the receiver to the RECEIVER socket of the bridge. The receiver should be set to a low frequency to start with, say around 1 to 10MHz, although the actual frequency is not critical at this stage. The receiver should be at maximum gain and ideally should have a signal strength meter. The receiver must also be suitable for a.m. or s.s.b. reception if no meter is fitted. An f.m. receiver can only be used if a signal strength meter is fitted, as the noise generator will not produce any audio output from an f.m. receiver. If no meter is fitted to the a.m. or s.s.b. receiver, an output meter could be connected across the loudspeaker output, or the amount of noise present judged by ear.

Connect the dummy load (50 or 75 ohm) to the ANTENNA socket of the bridge and switch on. The l.e.d.

should light up and there should be a considerable increase in the noise present on the receiver. Adjust R9, the noise present on the receiver should reach a null at one setting of R9, and this should be very sharp. If the bridge is working, the unit can be calibrated and setting up proceeded with.

Calibration

Switch the bridge off and disconnect the receiver and dummy loads. Connect an ohmmeter to the ANTENNA socket. The meter should be able to read accurately over the range of 10 to 100 ohms. Turn R9 to zero resistance (fully clockwise) and mark the scale. Turn R9 to maximum resistance (anti-clockwise) and mark the scale. These are the two end limits of the scale. Now turn R9 from maximum and mark off each division of ten ohms, starting with 100, then 90, 80, etc. down to 10 ohms.

If an ohmmeter is not available mark the two limits as before and then divide the scale into equal divisions: as R9 is linear, this should provide a reasonably accurate calibration except at the two ends where some error will occur. An ohmmeter is the only real way to calibrate the bridge.

Once the scale has been calibrated, the unit can be checked at r.f. Connect the receiver back to the RECEIVER socket and the 50 ohm dummy load to the ANTENNA socket. Switch the bridge on. The null should now occur when the scale pointer is set to 50 ohms. Tune the receiver to the highest frequency to be used. This should be around 145MHz if possible. Set the scale pointer to 50 ohms (with the 50 ohm dummy load); there should be a null, but it may be broad and not so sharply defined as at the lower frequencies.

With the pointer set to the 50 ohm mark, adjust the floating end of L2 for best balance. Then slightly adjust the other ends of L3 and L4 for best balance. Re-adjust the floating end of L2. Repeat these adjustments until a sharp null is obtained at the 50 ohm scale marking. Failure to obtain a sharp null means that either the bridge is still unbalanced due to stray winding capacities or that there is a reactive component in the dummy load or possibly long connecting leads. Once correctly set up, the bridge should indicate the same point of balance at all frequencies up to around 146MHz when used with the dummy load (assuming that the dummy load is suitable at v.h.f.—many are not).

★ components

Resistors		
¼W 5% carbon film		
270Ω	1	R1
330Ω	1	R8
680Ω	1	R7
1kΩ	2	R3,5
100kΩ	3	R2,4,6
Potentiometers		
Cermet		
100Ω	1	R9 (see text)
Capacitors		
Disc ceramic		
10μF	6	C2,3,4,6,7,8
Electrolytic p.c.b. mounting		
2·2μF 63V	1	C5
100μF 16V	1	C1
Semiconductors		
Diodes		
Red l.e.d.	1	D2
BZY88C6V2	1	D1
Transistors		
BF196	3	Tr1,2,3

Miscellaneous

Toroid core Mullard FX1598 or Neosid 28–511–35; Min. toggle switch s.p.s.t.; Battery connector, Diecast box 80 × 125 × 54mm Eldon CM160; p.c.b.; Sockets, see text (2); Knob; Tinplate, wire, etc; 50Ω dummy load.

Using the Bridge

All measurements are made at the working frequency of the impedance being tested. An antenna for, say, 14MHz must be checked with the receiver also at 14MHz. Connect the unknown load to the ANTENNA socket. Tune the receiver to the required frequency and switch the bridge on. There should be an increase in the receiver noise level. Adjust R9 for the best null and read off the impedance. If the null is sharp, it means that the unknown impedance is mainly resistive. But if the null is broad and uncertain, it means that there is an amount of inductive or capacitive reactance present in the unknown load. A perfect match will be mainly resistive and a good null should be obtained. Adjustments to the load can be made, and a re-check done, until the best null is obtained.

Coaxial cable can be checked by connecting a dummy load at the far end, and then checking on the bridge for a null. A mismatched cable will show an uncertain null while a perfect match will show the same sharpness of null as when the dummy load is directly connected to the bridge. However, remember that when measurements are made at high frequencies, a short length of lead between the load and bridge can upset the results by a large amount.

Other Uses

The bridge can also be used as a broad-band noise source which can be used for peaking up tuned circuits of receivers, etc. It will provide a useful noise output down to the audio frequencies and up to around 500MHz or higher. However, do not expect the actual bridge to function much above 150MHz. To use as a broad-band noise source, connect the ANTENNA socket to the equipment being checked and leave the RECEIVER socket disconnected. The potentiometer R9 should be set at minimum resistance. Note, the noise output is not uniform over the frequency range and comparisons should not be made of, say, receiver sensitivity at different frequencies. They may be made between different receivers at the same frequency.

To check the actual antenna input impedance of a receiver, two receivers are required. One is used as the null indicator as before; the receiver to be tested is connected to the ANTENNA socket and treated as if it were the load being tested. **Both** receivers must be tuned to the same frequency. The bridge will then measure the input impedance of the receiver under test. Antenna pre-amps can also be tested in this way for optimum matching.

The output impedance of a signal generator can also be checked in the same way. ●

PRODUCTION LINES

ALAN MARTIN G8ZPW

2m Preamplifier

muTek Ltd., the Devon based r.f. specialists, have recently announced the availability of the SNLA144s r.f. switched, low-noise 2m pre-amplifier.

The unit features excellent bandpass filtering—greater than 40dB rejection at 130 and 160MHz, a typical gain of 15dB and an associated noise figure of 1·2dB.

Switching controls allow considerable flexibility in operation, for instance, r.f. sensing with switch selectable "fast" or "hang" modes, hard switching via grounded transmit line and r.f. override of the hard option which should eliminate the bulk of expensive accidents. Straighthrough, bypass operation occurs in the power-off situation. Power requirements are 11 to 15V d.c. at approximately 50mA.

Housed in a diecast box measuring 100 × 50 × 25mm, the SNLA144s is supplied with 50Ω BNC r.f. connectors and costs £33·90 which includes VAT plus 60p p&p.

Further information is available from: *muTek Ltd., Bradworthy, Holsworthy, Devon EX22 7TU. Tel: (040 924) 543.*

Antenna Rotators

South Midland Communications Ltd. inform me that they have recently extended their range of antenna rotators to include the new Kenpro series.

The photograph shows the KR400RC which has been designed to accommodate medium sized antennas, such as those for v.h.f. band II and TV, or compact h.f. beams.

Most of the range are supplied with the new, stylish 360° meter indicator which gives an instant reading of the antenna heading.

For further details contact: *S.M.C. Ltd., S.M. House, Osborne Road, Totton, Southampton SO4 4DN. Tel: (0703) 867333.*

Pre-amp Microphone Offer

Thanet Electronics Ltd. have available, at a heavily discounted price, approximately 100 HM7 microphones which feature built-in pre-amplifier and p.t.t. switch.

The HM7 microphone was originally supplied, by Icom, with the IC251E, IC255E and IC720E; however, when Thanet sold these rigs they fitted the HM10 Up/Down scanning microphone, which left them with these HM7s in stock.

Supplied with full wiring data, the HM7 can be adapted for use with the IC240, IC211E, IC202S and IC701E by merely changing the connector, as these rigs have a power facility wired to the microphone socket.

The HM7 can be used with most rigs; however it should be noted that the microphone *insert* impedance is 600Ω but the output impedance of the pre-amp is 1·3kΩ.

Priced at only £6.50 which includes VAT and carriage, the HM7 is obtainable on a first-come-first-served basis from: *Thanet Electronics Ltd., 143 Reculver Road, Herne Bay, Kent. Tel: (02273) 63859.*

Latest from MM

Microwave Modules Ltd. have sent me information on two of their latest products.

First, the MMS2 Advanced Morse Trainer, which possesses all the facilities of their speech synthesised Morse Tutor, MMS1, plus the additional feature of providing talkback of Morse keyed into the unit by the pupil.

Speed range is 6 to 32wpm, with six learning levels, and variable group length and single character facility. Price is £155 including VAT.

Second, the MM1000 and MM1000KB ASCII to Morse Converter. This microprocessor controlled converter enables any parallel ASCII keyboard to send variable speed Morse in the range 12 to 32wpm. A high speed facility of 600 characters per minute is included for meteor scatter use etc.

The converter has a 50 character memory store together with a 40 character keyboard buffer store. Character set includes: A-Z, 0-9, including punctuation () ? : ; . , / plus four merged or barred characters are programmed for single key operation, they are $\overline{AR}$, $\overline{BK}$, $\overline{SK}$ and $\overline{KN}$.

The VAT inclusive prices are £59 or with the keyboard £89. These products should be available by the time this issue of *PW* is on sale.

Further details from: *Microwave Modules Ltd., Brookfield Drive, Aintree, Liverpool L9 7AN. Tel: 051-523 4011.*

PRODUCTION LINES

ALAN MARTIN G8ZPW

Portable 20MHz Oscilloscope

Electronic Brokers have added to their range of test instruments the new Hameg Model HM203, a 20MHz bandwidth general-purpose dual trace oscilloscope.

Main features are stable sweep triggering (to 30MHz) and high measuring accuracy (±3%). The display area is approximately 100 × 80mm and with the aid of the electronic stabilisation of all operating voltages plus the thermically favourable arrangement of the drift sensitive components, an outstanding display stability is obtained. Both brightness and display definition of the c.r.t. are excellent.

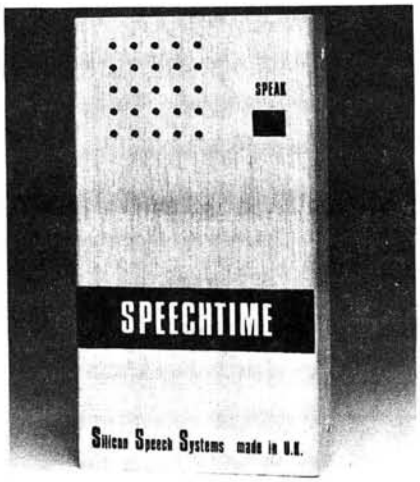
Optional accessories include: attenuator probes ×1, ×10 and ×100; demodulating probe; various test cables; component tester; four channel unit; viewing hood; carrying case etc.

Priced at only £220.00 plus VAT, the HM203 is available from: *Electronic Brokers Ltd., 61/65 Kings Cross Road, London WC1X 9LN. Tel: 01-278 3461.*

Speaking Clock

Silicon Speech Systems (a Powertran subsidiary) has recently introduced a speaking clock called Speechtime which should be particularly useful to blind people.

The clock has at its heart a speech synthesiser i.c. (type SC02) which has a 24 word vocabulary; 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 30, 40, 50, and by combining these words it is possible for the unit to speak any time in hours and minutes. The clock is timed by a 32·768kHz standard clock crystal and a trimmer capacitor which allows a ±1Hz variation to this frequency.



Measuring only 122 × 66 × 20mm and powered by a PP3 battery, the Speechtime has a claimed accuracy of one minute per year.

The Speechtime is offered at a special Christmas offer price of £24.50 for the kit and £29.50 ready-built. Both prices include VAT and p&p and the unit is obtainable from: *Silicon Speech Systems, Portway Industrial Estate, Andover, Hants SP10 3NN. Tel: (0264) 64455.*

Economy 10m Dipole

Bredhurst Electronics have in stock a number of 11 metre λ/2 dipoles of tubular aluminium construction, which have been rendered illegal-to-use by the Home Office regulations for 27MHz CB.

Naturally, at this frequency the antennas are quite large and are supplied complete with mounting bracket at only £7.50, to personal callers.

Anyone looking for a 10m dipole, and able to spend a few minutes trimming these antennas to resonance, will recognise the excellent value for money they represent.

Further details from: *Bredhurst Electronics, High Street, Handcross, West Sussex. Tel: (0444) 400786.*

If you please

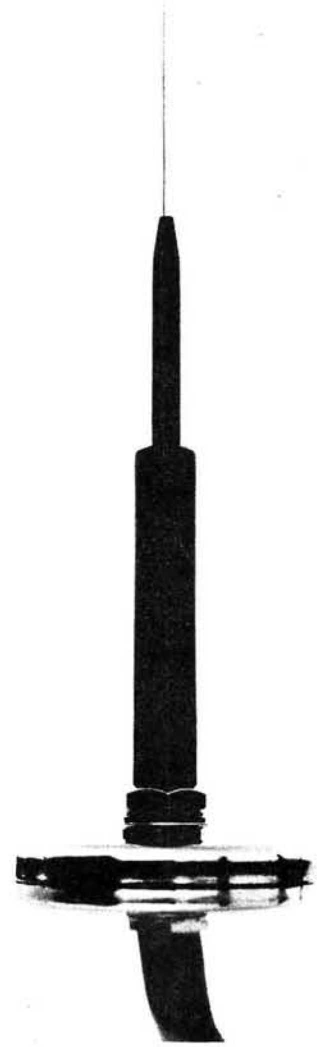
Please mention "Production Lines", when applying to manufacturers or suppliers featured on these pages.

CB Mobile Antenna

Recently introduced by C-Brit Ltd. is the Whiplash, a CB mobile antenna which F. C. Judd, the respected antenna designer and *PW* contributor, has found in field trials to match the performance of a well-known American manufactured antenna which retails at over £25.00. The Whiplash retails at £11.95.

With an overall height of 1·5m and a base loading coil, the Whiplash totally conforms to the CB Licence requirements. Designed specifically to work efficiently over the legal 27MHz frequency range, v.s.w.r. is a nominal 1·1:1 at the band centre, rising to no more than 1·5:1 at the band ends. Impedance is 50 ohms and power handling has been safety-tested up to 100 watts.

The Whiplash is available now from C-Brit and electrical dealers nationally. Anyone who has difficulty in obtaining the antenna should contact the distributors: *C-Brit Ltd., Unit 3–5 Wembley Commercial Centre, East Lane, Wembley, Middlesex HA9 7XD.*



OBITUARY

T. Graham Farish

To most of our readers the name of Graham Farish means small scale electric model railways. However, the more senior reader will remember well the early days of *PW* when Graham Farish was in the forefront of wireless components and broadcasting in general.

Thomas Graham Farish founded the company which still bears his name in 1920. His aim was to make the most of what he saw as a potential boom industry and this he very successfully did until the market changed some thirteen years or so later and he decided not to enter the manufacture of completed wireless sets.

After this he successfully steered his company through electric fires, snap vacuum seals for jam jars, land mines, and Plantoids—ingenious tablets of plant food. The company now makes model railways at a factory he bought near Wareham in Dorset.

Practical Wireless had been hoping to interview Mr. Graham Farish but this was not to be. He died peacefully at his home in Poole on Saturday 10 October 1981 in his eightieth year.

Graham Farish advertised regularly in *PW* from the very first issue in 1932 and the advertisement reproduced below is typical of his company's style in the early '30s.

NEW BOOKS

The following books are published by Bernard Babani (publishing) Ltd.

AN INTRODUCTION TO RADIO DXING
by R. A. Penfold
96 pages, 175 × 112mm. Price £1.95
This book introduces the reader to the various forms of radio DXing with advice on suitable equipment and the techniques employed when using that equipment. Divided into two main sections one on amateur band reception and one on broadcast reception.

POWER SUPPLY PROJECTS
by R. A. Penfold
91 pages, 180 × 109mm. Price £1.75
Mains power supplies are an essential part of many electronic projects, and this book gives a number of suitable designs. The information included in the book should guide the reader towards designing his own power supplies.

ELECTRONIC TEST EQUIPMENT CONSTRUCTION
by F. G. Rayer T.Eng (CEI), Assoc. IERE
92 pages, 180 × 107mm. Price £1.75
This book describes the way in which simple test equipment is constructed and how to use that equipment.

ELECTRONIC PROJECTS USING SOLAR CELLS
by Owen Bishop
110 pages, 177 × 112mm. Price £1.95
Most of the projects in this book were designed to operate at low voltages and to consume small current making them ideal for using small arrays of solar cells.

ELEMENTS OF ELECTRONICS
by F. A. Wilson
Book 4—Microprocessing Systems and Circuits
231 pages, 180 × 109mm. Price £2.95
Continuing on the same principles as its three predecessors book four in the series deals with the fundamentals of microprocessors. Topics include computers, the microprocessor, microprocessing systems and microprocessing circuits.

ELEMENTS OF ELECTRONICS
by F. A. Wilson
Book 5—Communication
248 pages, 180 × 109mm. Price £2.95
Written basically for readers who are finding an interest in electronics or those who need revision. A good book for those who intend to study at technical colleges and also for the person who wishes to study at home. The subject of mathematics is dealt with as the reader progresses through the book and not all at once.

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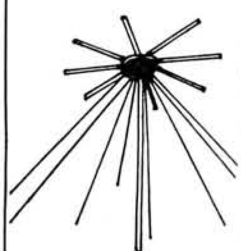

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MK-2. Chimney lashing kit, including hardware and lashing wire. **£2.95** p.p. £1.00

CK-1. Low loss coaxial cable kit, 10 metres, with connectors and fixing clips. **£3.75** p.p.£0.75

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MICROPHONE OFFERS: P.A./C.B. hand held mikes with thumb switch + curly lead, 1. 600Ω dynamic **£3.95p,** 2. 600Ω noise cancelling type **£7.25p,** 3. CB power type with volume control **£7.95p. EM103** Electret Condenser Mike, 600Ω, Omni, 50-1600Hz, aluminium case 172 × 22mm with battery **£7.25p.**
ANTEX SOLDERING IRONS: Models C15, CX17 and X25 all **£4.45** each.
STABILISED POWER SUPPLY, 240 vac input 13.8 volts at 3/5 Amps DC output. **£12.25p** + 87p P+P.
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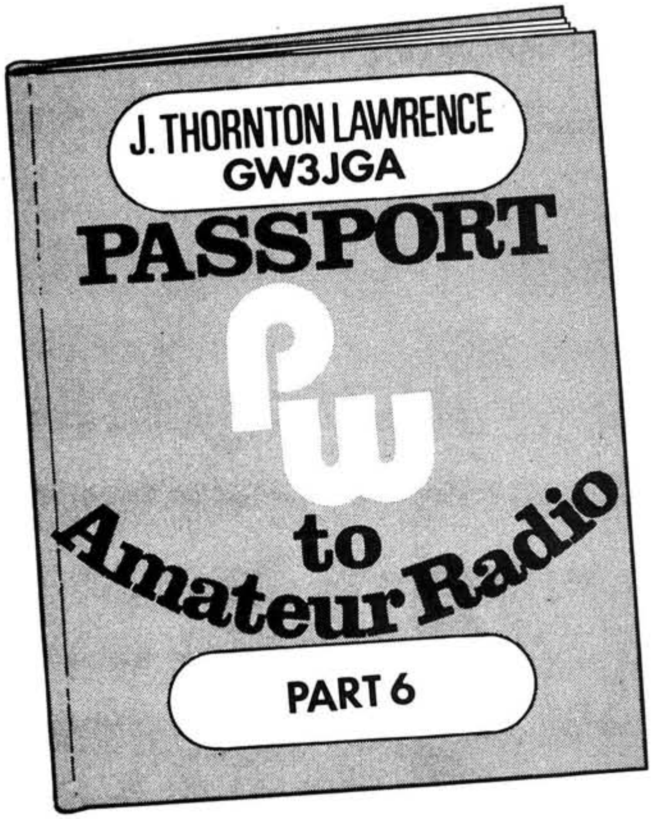
Cash with order please, official orders welcome from schools etc., please add 30p postage and packing. VAT inclusive. New catalogue at printers. Sorry for delay. All S.A.E.'s sent are being held until catalogue is ready.

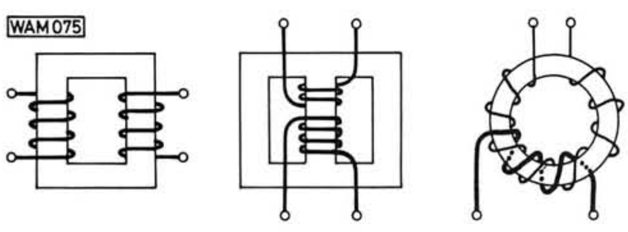
31, CHEAPSIDE, LIVERPOOL L2 2DY



In this part of the series we continue with transformers and then move on to oscillation, semiconductors and circuits.

Iron Core Transformers

This type of construction is only suitable for mains power and audio frequencies. The core is formed into a closed magnetic loop to ensure that practically all the field set up by the current in the primary will cut the turns of the secondary coil.



Square core   Window core   Toroidal core

Fig. 37: Transformer core arrangements

A most useful feature of the iron cored transformer lies in its ability to transfer electrical energy from one circuit to another without a direct connection. In the process it can also readily change it from one voltage to another. For example a supply of 12V a.c. can readily be obtained from the 240V a.c. mains supply by the use of a suitable "mains" transformer.

Turns and Voltage Ratio

For a particular magnetic field, the voltage or e.m.f. induced in a coil in the field will be proportional to the number of turns in a coil. In the case of a transformer with a closed core, the primary and secondary coils will experience the same magnetic field, so it follows that the induced voltages will be proportional to the number of turns in each coil. In the primary, the induced e.m.f. is practically equal to and "opposes" the applied voltage (see the section on self-inductance) and the induced voltage in the secondary, ignoring any losses, is given by:

$$V_{out} = \frac{N_{sec}}{N_{pri}} \times V_{in}$$

where V_{out} = secondary voltage
V_{in} = primary voltage
N_{sec} = number of secondary turns
N_{pri} = number of primary turns

The ratio of secondary to primary turns, $N_{sec}:N_{pri}$, is known as the **turns ratio** of the transformer. For example:

A 240V mains transformer has a primary winding of 1200 turns and a secondary of 60 turns (turns ratio 20:1). What is the output voltage?

$$V_{out} = \frac{60}{1200} \times 240$$
$$= \frac{1}{20} \times 240$$
$$= 12V$$

Effects of Secondary Current

The small current that flows in the primary winding when no current is being drawn from the secondary is known as the magnetising current. For a well designed transformer this will be quite low, just sufficient to supply the losses due to core material and resistance of the primary winding.

When power is taken from the secondary winding, the current in the secondary produces a magnetic field which opposes that produced by the primary current. The primary current must now increase to restore the field to its original strength so that the induced e.m.f. in the primary equals the applied voltage.

Ignoring any losses, the total current flowing in the primary is entirely due to the current being delivered by the secondary. Assuming that the magnetic fields set up by the primary and secondary currents are equal, the primary current multiplied by the number of primary turns must equal the secondary current multiplied by the secondary turns.

$$_{in} = \frac{N_{sec}}{N_{pri}} \times I_{out}$$

For example:
The current drawn from the secondary of the transformer described in the previous example is 2 amps, ignoring any losses, what is the primary current?

$$I_{in} = \frac{60}{1200} \times 2A$$
$$= \frac{1}{20} \times 2A$$
$$= 0{\cdot}1A$$

Construction

The mains transformer has windings designed to suit the expected operating conditions. If the transformer has to provide a high value of current (as in the example) then the windings are of heavy gauge (thick) wire, appropriate to the current, so that the overall resistance of the winding is small and the power lost is also small. The mains transformer often has an electrostatic screen between the primary and secondary windings. This is connected to "earth" and prevents any capacitive leakage or other effects from affecting the secondary windings. The windings themselves consist of enamelled copper wire wound on a bobbin with layers of insulating material between each winding.

The core is made up of thin laminations of special iron to reduce "eddy current" losses. Eddy currents are produced in the core by induction (remember that iron is also a conductor), and the laminations provide many breaks in the electrical continuity of the core material, thus preventing the flow of eddy currents while leaving its magnetic properties largely unaffected.

Transformers for audio frequencies are similar in construction to power transformers but the core material is specially made to operate over a wide frequency range and to cause negligible distortion.

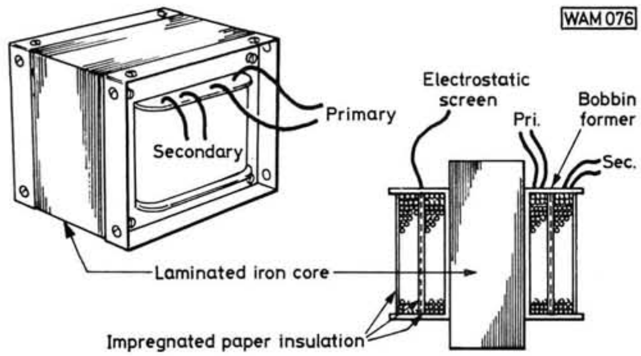


Fig. 38: The physical construction of a mains transformer

Intermediate frequency transformers usually consist of two windings which are each tuned to the operating frequency by associated capacitors and adjustable tuning iron-dust cores. The magnetic coupling between the windings is critical and is set in manufacture to provide the desired selectivity characteristic.

Radio frequency transformers vary widely in design and construction and may be wound on a former with or without an adjustable core. RF transformers for use over a wide range of frequencies are sometimes wound on a ferrite ring. The secondary winding may be separate from or interwound with the primary.

Because of the imperfect coupling between the primary and secondary of resonant i.f. and r.f. transformers, the turns ratio becomes an approximation and the working "Q" and tightness of coupling become the dominant factors.

The RF Oscillator

The oscillator circuit is one of the most fundamental but vital parts of a transmitter or receiver. It is used in the superheterodyne receiver to perform the tuning function and as a carrier insertion or beat frequency oscillator in a communications receiver. It is the essential part of any transmitter as the fundamental frequency source, variable or locked, and as the heterodyne oscillator in a mixer system.

More has probably been written about oscillators than any other radio circuit. Many eminent engineers have their name associated with a particular oscillator circuit arrangement, for example Colpitts, Clapp, Franklin, Hartley, Gouriet etc. All have the same objectives, to maintain oscillation in a resonant circuit whilst retaining good frequency stability.

Tuned Circuits

A mechanical approximation to the parallel tuned circuit is given by the pendulum. In Fig. 39 (a) the pendulum and the parallel tuned circuit are shown in the rest or zero position.

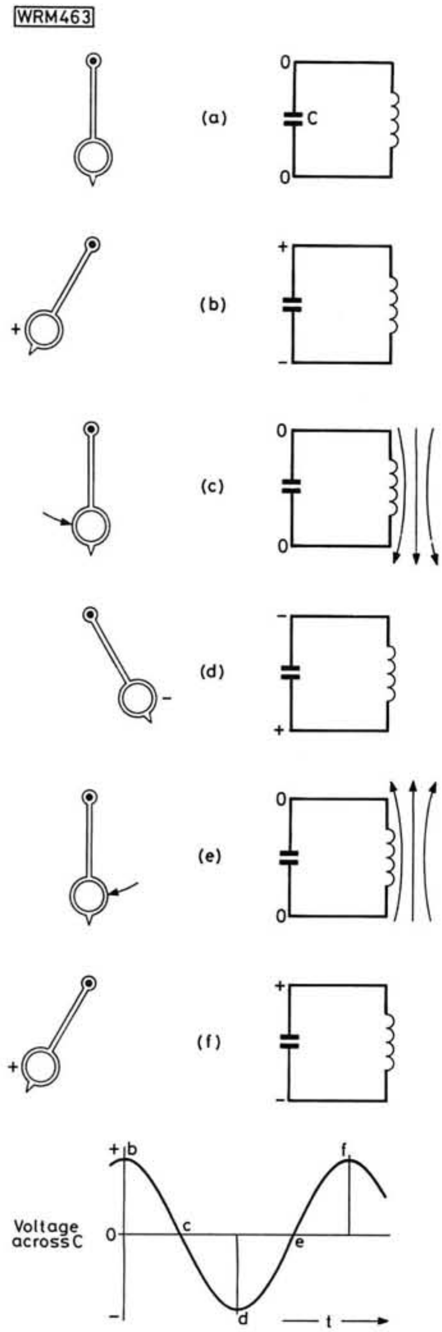


Fig. 39: Tuned circuit and pendulum analogy

In (b), the pendulum is raised to one side and then released. It then swings with increasing speed until it reaches the zero position (c) where it overshoots and, with decreasing speed, comes to rest on the opposite side at a point (d), equal in height to its starting point. The sequence is then repeated but in the opposite direction (e) and (f).

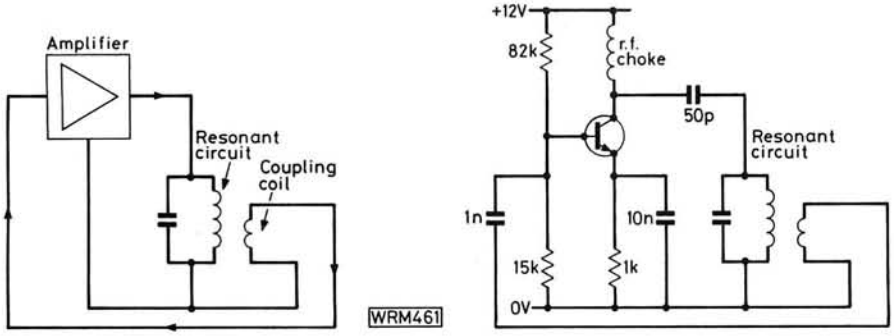


Fig. 40: Amplifier maintains oscillation in resonant tuned circuit

In the electrical circuit at (b) the capacitor is charged externally in the direction shown, the charge then causes current to flow through the coil producing an increasing magnetic field until the capacitor is discharged (c). The magnetic field then begins to collapse inducing a reverse e.m.f. which recharges the capacitor in the opposite direction (d). As in the pendulum, the sequence is then reversed (e) and (f).

In perfect conditions, the process, once started, would continue indefinitely. However, frictional losses in the pendulum and electrical losses in the tuned circuit damp the oscillation so that the amplitude of each swing becomes progressively smaller until all the initial energy is dissipated.

To maintain continuous oscillation in a tuned circuit (as in a clock pendulum) a small "kick" of energy must be injected into the circuit, in the correct direction and at the correct time to counteract the energy losses.

This can easily be done by taking a little of the energy circulating in the tuned circuit, amplifying it, then returning it in the correct phase to maintain oscillation. A block diagram and typical circuit is shown in Fig. 40.

If too much energy is fed back, the amplitude of the oscillations build up until increasing losses once again stabilise the amplitude. A change in amplitude does not directly cause any change in the frequency of oscillation.

For good stability of the oscillation frequency, the Q of the tuned circuit should be made as high as possible by keeping the losses in the coil and capacitor very low. The coupling to the amplifier should be minimal but sufficient to start and maintain reliable oscillation.

The frequency stability of a "good" oscillator will be determined almost entirely by the resonant circuit itself. In an LC resonant circuit the inductor (coil) usually has a positive temperature coefficient; in other words, its inductance increases with increasing temperature (causing a decrease in resonant frequency). To combat this effect, the tuning capacitance is sometimes made up of a combination of different capacitors, some having a negative temperature coefficient (decrease of capacitance with increasing temperature). The overall effect is to improve the oscillator stability by reducing the effect of ambient and equipment temperature.

The output from an oscillator has to be fed to the next stage in the equipment. To prevent this loading or adversely affecting the oscillator performance, an intermediate buffer stage is often used. An emitter-follower or common-collector stage (see next section) is ideal for this purpose, having a high input impedance and low output impedance.

Semiconductor Devices

Several of the reference books listed at the beginning of this series contain sections on the nature and behaviour of semiconductor materials and so we will omit these and pass on to describe briefly the construction and applications of the semiconductor diode and transistor.

Semiconductor Diode

A semiconductor junction diode consists of a piece of p-type semiconductor and a piece of n-type semiconductor joined together as shown in Fig. 41 (a).

The p-type material has an excess of holes and the n-type has an excess of electrons. At the junction, electrons and holes cross the junction and re-combine leaving a region virtually depleted of all charge carriers, known as the **depletion layer.** Since the p-type has lost a few holes it acquires a slight negative charge and the converse is true for the n-type which acquires a slight positive charge. Thus there exists a small **reverse bias** across the junction.

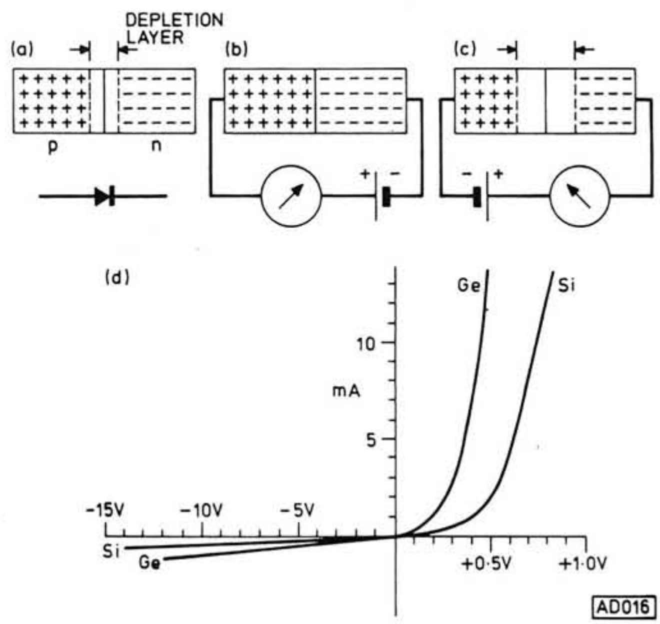


Fig. 41: The semiconductor diode: (a) without external bias, (b) forward biased and (c) reverse biased. In (d) is shown the current/voltage characteristic

In Fig. 41 (b) we show the **forward biased** condition. The applied voltage has first to exceed this built-in reverse bias before current will flow. For silicon materials, this is 0·6–0·7 volts and for germanium, 0·2–0·3 volts. Once this potential has been exceeded, current flows readily in the forward direction.

The reverse biased condition is shown in Fig. 41 (c). Here the depletion layer has been increased in width, i.e. there is a large region where there are no free charge carriers and only a very small leakage current flows.

Increasing the voltage to a very high level will eventually cause the diode to break down. If the current is not limited in any way this will permanently damage or destroy the diode. The characteristic of a semiconductor diode is shown in Fig. 41 (d).

Semiconductor diodes have many applications as rectifiers in power supplies, detectors, demodulators, switches etc.

Diode Applications

Power Supplies: Radio and electronic equipment operating from the a.c. mains supply commonly contains a power supply circuit consisting of:

a. A mains transformer to provide the appropriate a.c. voltage.

b. A rectifier which converts the alternating supply into a unidirectional but pulsating output.

c. A filter or smoothing circuit which reduces the pulsations to give a steady direct voltage output.

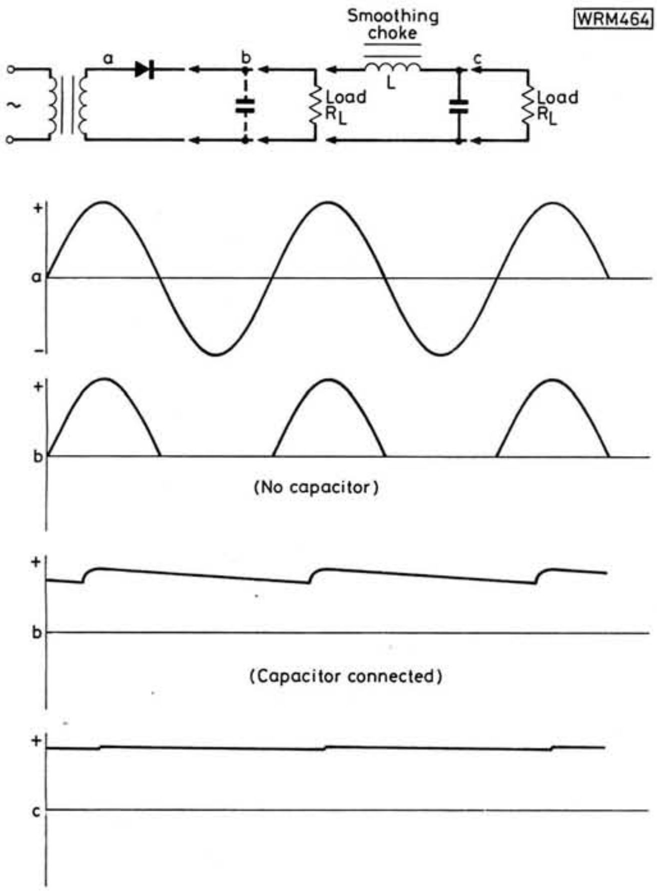


Fig. 42(a): A half-wave rectifier circuit with voltage waveforms produced at various points

A power supply circuit employing a single diode in a **half-wave rectifier** circuit is shown in Fig. 42 (a). Alternating voltage is fed to the diode anode and as the diode conducts only in the forward direction when the anode is more positive than the cathode, the current only flows during the positive half-cycles. This results in only the positive half-cycles appearing across the load resistor R_L.

By connecting a capacitor across the load, to act as a "reservoir", the pulsating voltage can be smoothed to give an almost constant output. The capacitor is charged or recharged on each positive half-cycle and is discharged by a small amount between each half-cycle by the current drawn by the load. The output voltage waveforms are shown in Fig. 42 (a).

By adding an extra diode and a further winding to the transformer, in which the voltage is of the opposite phase to the existing one, a **full-wave rectifier** is produced in which the two diodes conduct alternately on each half-cycle as shown in Fig. 42 (b). This has the effect of doubling the **ripple frequency** and reducing significantly the ripple across the smoothing capacitor. Further reduction of ripple can be obtained in each case by adding a choke-capacitor or resistor-capacitor filter.

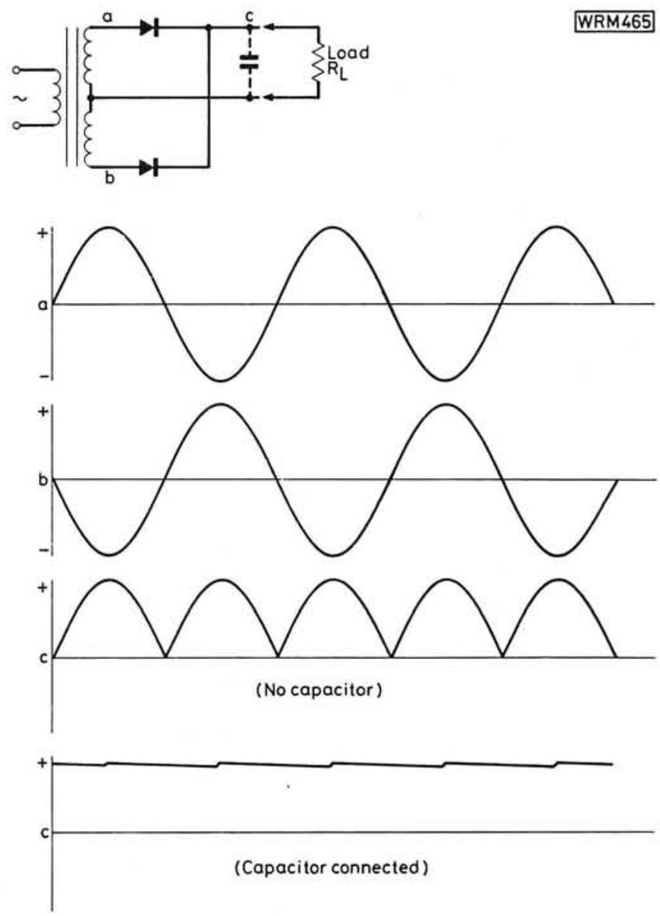


Fig. 42(b): A full-wave rectifier circuit with waveforms. The ripple frequency is doubled compared with the half-wave case easing the smoothing problems

Full Wave Bridge Rectifier: By arranging four diodes in the form of a "bridge", full-wave rectification from a single transformer winding can be obtained. This arrangement is very popular because of its relatively low overall cost. The forward current flow around the diode bridge circuit is shown in Fig. 43.

Semiconductor diodes used in power supplies are chosen to have adequate ratings in terms of average forward current and peak reverse voltage.

Diode Detector: The circuit in Fig. 44 shows a simple amplitude modulation detector stage. The circuit resembles the half-wave rectifier power supply circuit in Fig. 42 (a) but here the alternating voltage is taken from the secondary winding of a receiver i.f. transformer. The diode rectifies the i.f. signal voltage and filtering is provided by C1. The audio modulation appears superimposed on the

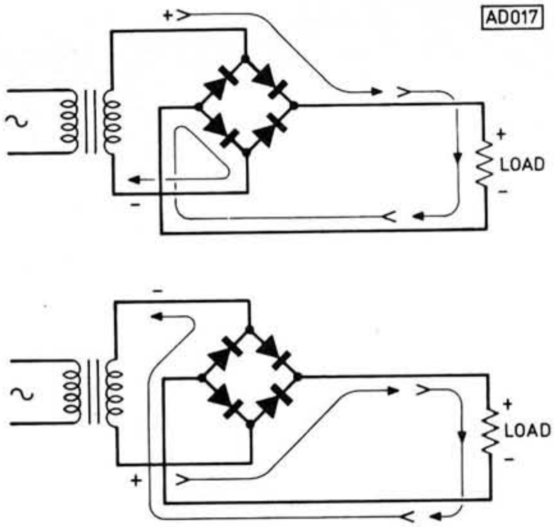


Fig. 43: Current flow around a bridge rectifier circuit

average d.c. level across R1, the a.f. gain control. The d.c. component of the signal is removed by the coupling capacitor C2 and the remaining a.f. signal is fed to the audio stages of the receiver.

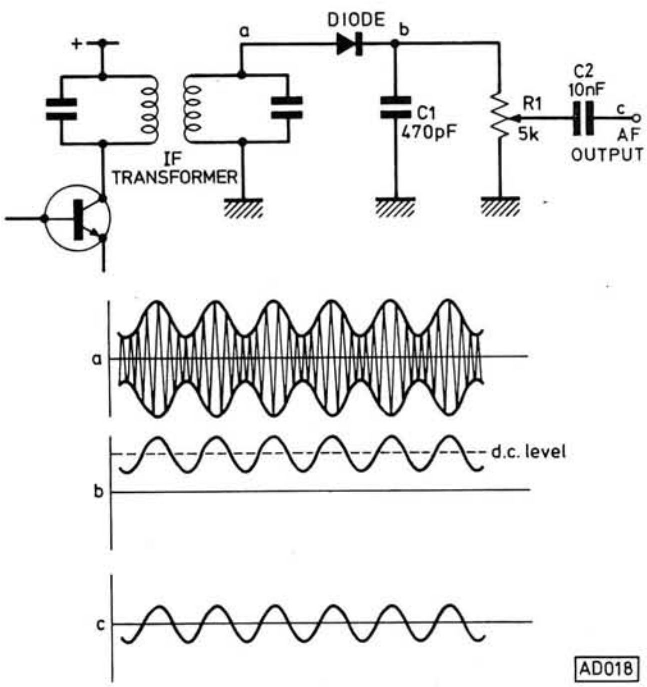
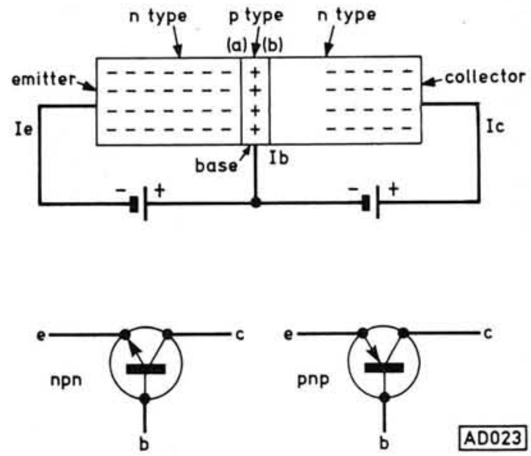


Fig. 44: A diode detector circuit with waveforms produced at various points

Transistors

The diagram in Fig. 45 shows an *npn* transistor. Note that the base-emitter junction (a) is forward biased whilst the base-collector junction (b) is reverse biased.

The base region in a transistor is made very thin so that current carriers, entering from the emitter, experience the attraction of the collector voltage and are able to pass right through the base region and cross the base-collector junction to the collector. A small proportion of current carriers from the emitter will recombine in the base region and these form the base current.



These currents can be expressed simply as:

$I_e = I_c + I_b$

For example, typical values might be:

$1\text{mA}\ (I_e) = 0{\cdot}98\text{mA}\ (I_c) + 0{\cdot}02\text{mA}\ (I_b)$

The actual ratio of the emitter, base and collector currents depends on the type and construction of the transistor.

The ratio of the collector to emitter current is known as the **d.c. alpha.**

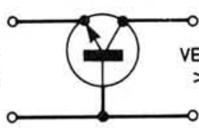
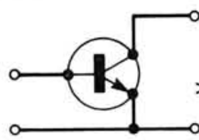
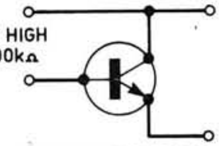
$$\text{d.c. alpha } (a) = \frac{I_c}{I_e} \text{ e.g. } \frac{0{\cdot}98\text{mA}}{1{\cdot}00\text{mA}} = 0{\cdot}98$$

and the ratio of collector to base current is known as the **d.c. beta** or $\mathbf{h_{FE}}$.

$$\text{d.c. beta or } h_{FE} = \frac{I_c}{I_b} \text{ e.g. } \frac{0{\cdot}98\text{mA}}{0{\cdot}02\text{mA}} = 49$$

The d.c. beta or h_{FE} is the usual method of quoting the d.c. current gain of a transistor.

As you can see, there is a fixed relationship between the currents in a particular transistor, if you vary one then the other two will also vary in proportion.

INPUT IMPEDANCE		OUTPUT IMPEDANCE	CURRENT GAIN	POWER GAIN	INVERSION OF SIGNAL
LOW <100Ω	 COMMON BASE	VERY HIGH >100kΩ	0·99	1000 (30dB)	NO
MED 1kΩ	 COMMON EMITTER	HIGH >10kΩ	50	10,000 (40dB)	YES
VERY HIGH >100kΩ	 COMMON COLLECTOR (EMITTER FOLLOWER)	LOW 100Ω	50	40 (16dB)	NO

AD024

Fig. 46: General characteristics of circuit configurations

In transistor amplifiers, input signals may be applied to the emitter or the base and the output taken from the collector or emitter. The general characteristics of each type of circuit configuration are shown in Fig. 46. The circuits have the biasing and supplies omitted for the sake of clarity.

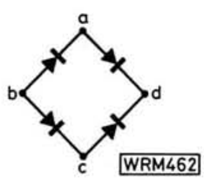
In the common-base arrangement (where the input signal is applied to the emitter), the emitter and collector currents are almost equal but, because the input impedance is low (forward-biased junction) and the output impedance is high (reverse-biased junction), there is a power gain. The signal power (I^2R) in the collector is higher than the power (I^2R) in the emitter.

In the common-emitter arrangement not only is there some power gain due to the output impedance being higher than the input, but there is also current gain (beta) from the base to the collector, giving the highest power gain of all the configurations. It is also the circuit which inverts the signal (positive-going signal in produces a negative-going signal out). The common collector-circuit, or emitter-follower as it is popularly known, has less power gain but its useful features are a high input impedance and a low output impedance.

RAE Practice Questions

1 The output voltage ripple frequency of a 50Hz full-wave mains bridge rectifier is

a 25Hz
b 50Hz
c 150Hz
d 100Hz



2 The circuit shown above is a bridge rectifier. The a.c. supply would be connected to

a d and b
b a and c
c a and b
d a and d

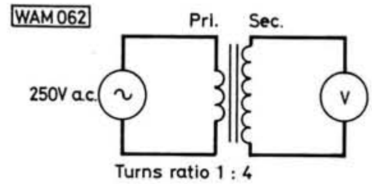
3 The input impedance of a common-base transistor amplifier is

a medium
b very high
c the same as the output impedance
d low

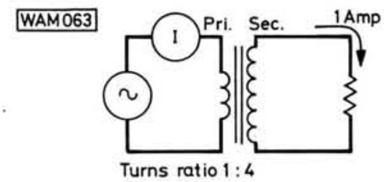
4 The increase in the inductance of a coil in an oscillator circuit due to a rise in temperature can be minimised by the use of a

a Zener diode
b Capacitor with a negative temperature coefficient
c Tunnel diode
d Capacitor with a positive temperature coefficient

5. In the transformer circuit shown below the secondary voltage will be?
a. 4000V
b. 1000V
c. 62·5V
d. 50V



6. In the transformer circuit shown below the current drawn from the secondary is 1 amp; assuming no losses, the primary current will be?
a. 1 amp
b. 0·25 amp
c. 4 amps
d. 3·14 amps



Answers
1. d. 2. b. 3. d. 4. b. 5. b. 6. c.

MODS No. 12

►►►*continued from page 43*

The connection numbers are marked on the p.l.l. board, which is easy to get at as it is inside the top of the rig, under a cover. The control board is almost inaccessible.

It should be noted that the display is driven differently and it will not show the frequency change.

This mod can be activated by a switch on the microphone (Fig. 4) but you will need to change the microphone cable for one that has more cores. Jim used one from a Yaesu FT-707 microphone. It is not possible to change the whole microphone assembly instead of the cable because the Yaesu switches (UP, DOWN etc) do not close to low resistance contacts and so they are incompatible with the Trio.

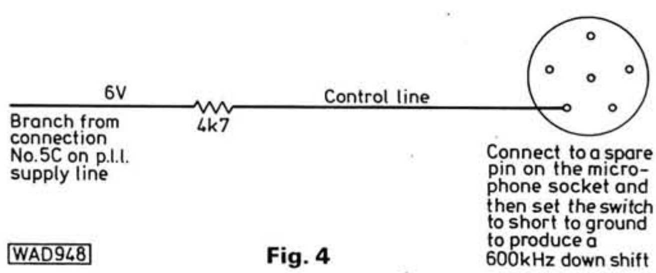


Fig. 4

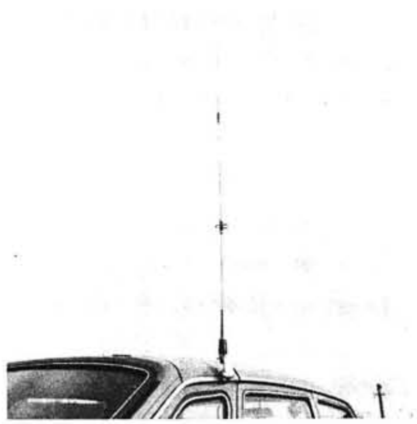
As you will have gathered from the lack of constructional details, you should attempt this mod only if you know what you are doing.

Next month we will continue with more mods for the TR-9000.

air test

USER REPORTS ON SETS AND SUNDRIES

SMC-HS 358 3x$\frac{5}{8}\lambda$ 432 MHz Co-linear Mobile Antenna



On the basis that the more metal you put up into the aether the better you will get out with your signal, then a three-element antenna must be better than a similar two-element structure. SMC's three-element co-linear for 432MHz certainly seems to bear this out.

I have been using this antenna for mobile use for about a year instead of the original two-element version from the same manufacturer. During this time it has given excellent service both from an electrical and mechanical viewpoint.

The antenna fits onto the SMC gutter mounting bracket simply screwing into the SO239M socket on the mount. This enables it to be quickly removed when leaving the vehicle in a public car park. For easy parking in a garage or other low roofed areas the main antenna can be lifted against a spring and hinged over the roof of the car. In this respect I preferred the screwed locking ring of the two-element version as offering a more positive electrical connection than the spring-loaded taper seat of the three-element antenna.

Wind noise was no greater than that from the two-element type although wind loading on the mount is obviously greatly increased. In fact the three-element antenna was mounted onto a magnetic base in the centre of the roof of the Maxi during some of our tests and at speeds over 65m.p.h. the magnetic mount was actually pulled off the roof with a terrifying bang. The antenna survived this treatment twice with no more damage than the loss of the small metal ball at the very tip.

The various elements are held together with socket-headed grub screws and this also allows the antenna to be trimmed for best v.s.w.r. when fitted. The kit comes with full instructions, the appropriate Allen keys and a large nut which has no apparent use. (If anyone has found a use for it then several people I know would appreciate the answer.) Over the test period none of the grub screws has come loose and the v.s.w.r. has not changed.

The overall length of the three-element co-linear is 1·36m, and after the two-element version the extra length twanging around on low trees takes a bit of getting used to. However this is worth putting up with for the improved performance obtained. SMC claim a 6·3dB gain over a $\frac{1}{4}$wave for the three element compared with 5·5dB for the two element. The improved performance probably stems from the fact that the three-element version is really the two-element one mounted on top of another $\frac{5}{8}\lambda$ element so raising it almost half a metre higher and away from the car.

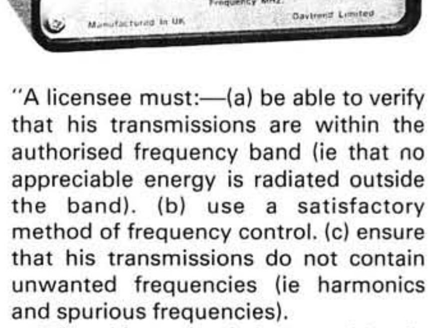
I also found that it loaded acceptably for use with a 2m rig on the few occasions when I work such low frequencies.

Taken overall the three-element co-linear antenna offers a good performance coupled with mechanical reliability.

Dick Ganderton

We would like to thank **SMC Ltd., SM House, Osborne Road, Totton, Southampton, SO4 4DN Tel: 0703 867333** for the loan of the antenna. The SMC-HS Model 358 three-element co-linear antenna costs £14.37 including VAT. The SMCGCD gutter mounting together with the SMCSOCA cable assembly costs £6.90 including VAT.

DRAE VHF Wavemeter



"A licensee must:—(a) be able to verify that his transmissions are within the authorised frequency band (ie that no appreciable energy is radiated outside the band). (b) use a satisfactory method of frequency control. (c) ensure that his transmissions do not contain unwanted frequencies (ie harmonics and spurious frequencies).

When his station is inspected by officers authorised by the Secretary of State, the licensee will be expected to demonstrate that he can conform with the requirements of (a) to (c) above."

continued on page 74▶▶▶

This project provides details of a versatile audio oscillator designed primarily for morse practice, but shown here with two other possible functions. No doubt the inventive streak in the readership of *PW* will devise a number of other uses!

A morse practice oscillator requires the minimum of sophistication, indeed some would argue that a buzzer and battery are sufficient. However, if the unit is to be used at home, even in a spare bedroom, then the benefits (if only to the rest of the family) of a volume control will be most evident. For long periods of use it is also helpful to have the ability to adjust the tone of the output signal to suit the user.

Basic Oscillator

The practice oscillator shown here uses the ubiquitous 555 timer for all the active functions. Figure 1 shows the basic circuit, the frequency of oscillation being given by the formula:

$$f = \frac{1{\cdot}44}{(Ra + 2Rb)\,C}$$

A number of manufacturers' handbooks provide nomographs for the selection of suitable values of components for a particular frequency or range of frequencies.

The dotted line from the reset pin 4 indicates the method used to activate the oscillator, resistor R4 being included to maintain a low potential. With pin 4 unconnected the oscillator does not function; when pin 4 is taken to V_{CC} the oscillator produces its output. The output from pin 3 can sink or source up to 200mA and so can directly drive a small speaker. The prototype used a telephone handset earpiece as the output transducer, simply because one was available.

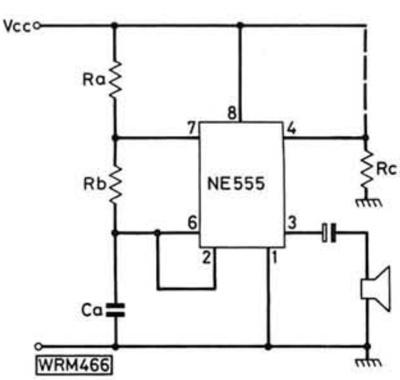


Fig. 1: The basic oscillator circuit

To implement the oscillator and provide the facilities outlined earlier as desirable Ra, Rb and C are replaced by suitable components. These are shown in Figure 2, the complete circuit diagram, as R1, R2 and C1. By adjusting R2 the user can select a suitable pitch of operation or if desired replace R2 with a fixed value resistor giving the desired pitch.

The output is fed via potentiometer R3 to provide volume adjustment. The morse key is connected across sockets SK1 and SK2; closure of the key contacts, in the key down situation, enables the oscillator and drives the speaker.

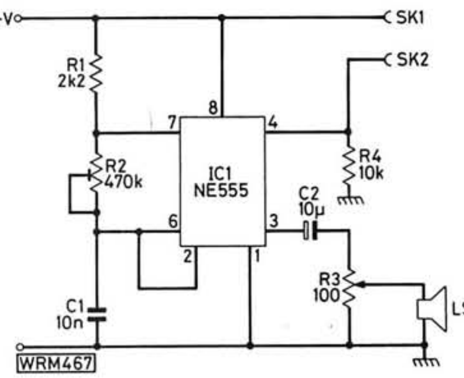


Fig. 2: Morse practice oscillator/continuity tester circuit

Alternative Uses

Instead of a morse key the user may connect a pair of probes to SK1 and SK2 to provide a continuity tester function. Similarly the completed unit could be used in any circumstances that require a tone to be produced with a contact closure action.

Once the morse test is passed and the Class A licence obtained, the unit can be put to a new use with the additional components shown in Figure 3. This additional

CONSTRUCTION RATING Beginner

BUYING GUIDE

Constructors of this project should have no difficulty obtaining the components from advertisers in the magazine

APPROXIMATE COST £7

★ components

Resistors
¼W, 5% Carbon film

2·2kΩ	1	R1
10kΩ	1	R4

Miniature horizontal preset

470kΩ	1	R2

Wirewound potentiometer

100Ω	1	R3

Capacitors
Disc ceramic

10nF	2	C1, 3
1nF	1	C4

Sub-miniature electrolytic, 16V working

10μF	1	C2

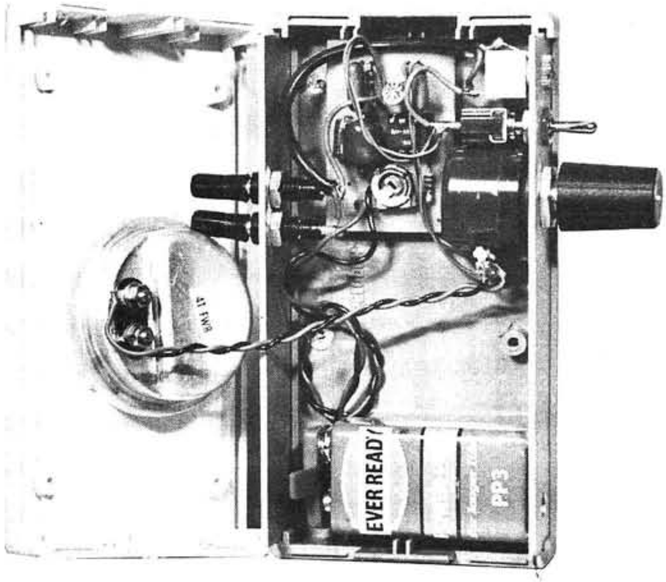
Semiconductors
Diode

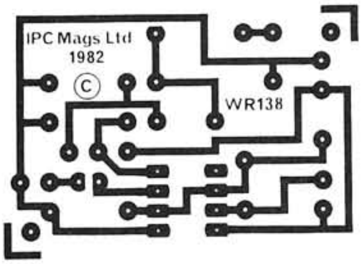
1N4148	1	D1

Integrated circuit

NE 555	1	IC1

Miscellaneous
10mH choke, Maplin HX19V or equiv; Telephone type earpiece; s.p.d.t. miniature toggle switch; 2mm sockets (2); Box 150 × 80 × 50mm.





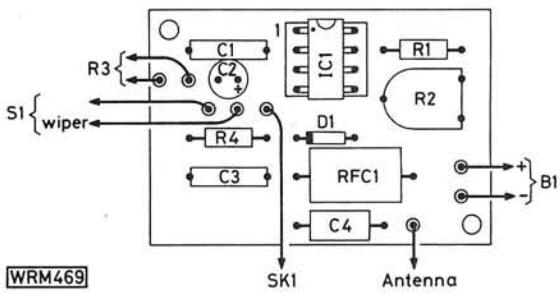


Fig. 4: Track pattern and component layout

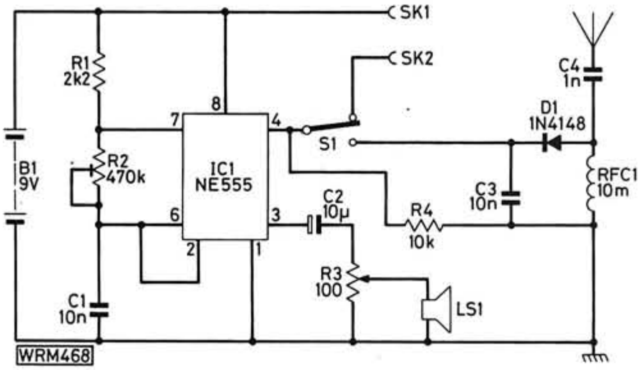


Fig. 3: Multi-function oscillator circuit diagram

circuitry uses the property of the 555 requiring a high level on pin 4, to enable the device to provide an r.f. activated sidetone oscillator.

The circuit of Figure 3 will oscillate in the presence of a strong r.f. field, so the unit placed near to a transmitter being keyed for morse will provide sidetone. The circuit will only operate, of course, for c.w. type A1-A1A, carrier on/off telegraphy. This will add the facility of sidetone without the need to modify the transmitter.

A short length of wire is usually more than adequate as an antenna. Additional sensitivity can be obtained, if necessary, by wrapping the end of the antenna wire around the coaxial cable feeding the transmitter output to the main antenna system.

Construction

Construction of the unit requires no special considerations. A printed circuit board layout is provided although such a simple circuit can be readily put together on veroboard if preferred. The unit complete with 6-F22 (PP3) 9 volt battery and speaker can be housed in any small plastics or metallic enclosure. If the sidetone oscillator function is not required components S1, D1, R4, C3, C4 and RFC1 can be omitted.

The standby current of the 555 i.c. is quite high, typically 5 to 10mA and so an on/off switch should be incorporated in the power supply lead, ideally in combination with volume control potentiometer R3. Note that the lower power c.m.o.s. version of the 555 has a much lower quiescent current but it will **not** drive the earpiece directly. ●

on the air

You generally did not seem too keen on the smaller type we used for the past two months, so we are going back to the old size, but keeping the smaller headings, etc. Thank you to all who wrote with their views.

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.

Many readers realise that it is pretty pointless spending something akin to £300 or so on a communications receiver covering at least 1·8 to 30MHz and then feeding it with a simple dipole antenna that is cut for resonance on, say, the 20m band, where it performs quite well but is rather poor on the rest of the bands. Since a separate antenna for each band is out on several scores, including cost, it comes down to a multiband antenna.

The final choice is often the trapped dipole. But which one? And what's this W3DZZ job? What's the difference? Why has one design got only one pair of traps and another several traps? All good questions. The basic object of all these types of antenna is to get resonance on a number of h.f. bands and yet require only a single low-impedance feeder and, preferably, no tuning unit. The trapped dipole goes a long way towards achieving this by inserting high-impedance parallel tuned circuits at the ends of what is a half-wave antenna for the highest frequency band under consideration, Fig. 1(a), thus electrically cutting off whatever may be beyond the two traps, Fig. 1(b).

The whole antenna works as a half-wave antenna at the, usually, next lower frequency band, but is shorter than a standard half-wave because of the electrical loading effect of the inductor in the trap, Fig. 1(c).

Now, as the antenna is a half-wave electrically on both bands the polar diagram will be the same on both bands, namely the standard pattern at right angles to the wire, Fig. 2(a). The W3DZZ variation of the standard trapped dipole is ingenious insofar as, if the dimensions of the antenna are chosen carefully, it will work reasonably well on all bands from 10 to 80m. It will even work on the new 18MHz band! The centre dipole is cut for the 40m band, the parallel traps being made resonant at about 7·1MHz before being inserted. The outer wires make up, with the loading effect of the inductor, a half-wave on the 80m band.

Now for the clever bit! On the 20m band the overall length approximates to three half-waves, the centre impedance being a bit high for the usual 70Ω feeder often used with trap dipoles, but acceptable in practice. On the 40 and 80m bands the antenna is a half-wave as before, but on the 10 and 15m bands it is a multi-half-wave antenna. It should be evident that the centre impedance must vary over such a wide band of frequencies so the transmitting amateur may be wise to arrange the lengths of the wires to give minimum standing wave ratio (s.w.r.) on a couple of bands that are used more than others. For the listener this point is of no great importance.

Now we come to the major differences between the first trapped dipole described, and the W3DZZ version. The first has maximum radiation at right angles, Fig. 2(a) on the 40 and 80m bands but on the other bands the W3DZZ takes on the characteristics of a wire carrying several half-waves, Fig. 2(b) and (c). As the number of half-waves increases so the lobes of the pattern move towards the line of the wire.

This effect explains why some readers are often puzzled because they can receive, say, the Pacific area well on 20m but poorly on the higher frequency bands. The polar pattern is changing with the number of half-waves on the wire. The multi-trap dipole is one answer to this problem as each pair of traps isolates the appropriate centre section of the antenna so that only a half-wave is being used on any band. Hence the radiation/reception is always at right angles to the line of the antenna.

It is worth noting that the two bands covered by a trapped dipole do not have to be related in any way as long as the traps are resonant at the higher frequency. It could be a 10m centre section,

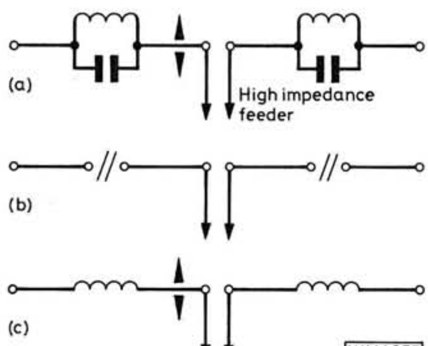


Fig. 1(a) Typical trapped dipole configuration. In (b) the traps effectively isolate the centre section, cut for a particular band, from the outer sections. On the next lower frequency band (c) the effect of the trap capacitors is negligible but the inductors act as loading coils with the outer section

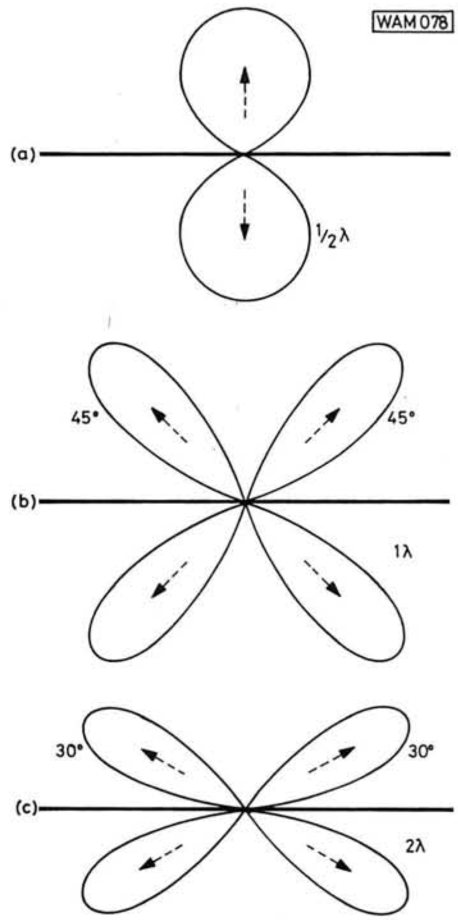


Fig. 2(a) The polar pattern for a half-wave antenna with maximum radiation/reception at right angles to the wire. As the number of half-waves on the wire is increased, (b) and (c), the lobes of the pattern move in towards the wire ▶

BIGEAR 500A

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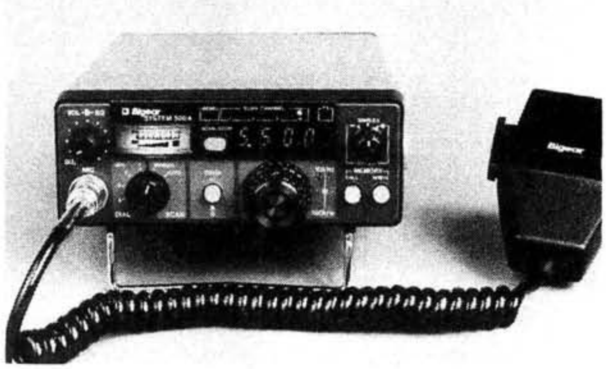

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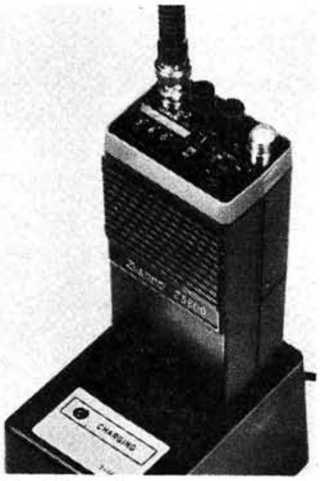

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Ted Bowen (G4JKQ), Coalville Communications, 6 Ashby Road, Coalville, Leicestershire 0530-38779 (Day) 0530-60396 (Evenings)

with 10m traps, and end sections to resonate on the medium wave band, if you have enough space!

Top Band addicts can always extend the standard W3DZZ 10 to 80m trapped dipole by adding 80m traps at the ends and then adding about 16·5 metres of wire to these traps and adjusting to resonance on Top Band.

Around the Clubs

Clubs are still reporting an influx of new members derived from the CB fraternity, and very welcome they are, too. However, one or two clubs have had to put a temporary stop to recruitment because of the inadequacy of club premises. Let us hope that they can soon deal with this problem. Every encouragement should be given to CBers, legal and otherwise, to move up to amateur radio.

Horndean & District ARC Second Tuesday of the month at Merchiston Hall, Horndean at 7.30pm with future events including talks on home-brew antennas, film shows, and not forgetting the Christmas party! A Horndean Award is promised for the new year, says the new sec Dan Bernard of 33 Greenfield Crescent, Cowplain, Portsmouth, Hants or H'dean 593429. Seems members of the club have been asking why, in this age of computers, the Home Office should take so long to issue new amateur licences! A good question, but note the rate at which the new CB licences will be issued at £10 a throw!

Braintree & District ARS New publicity secretary is Norma Willicombe who says the club meets first and third Mondays at the B'tree Comunity Centre, Victoria Street, next to the bus station. Next event of importance is the social pm on Dec 18, a good occasion to take your first peep at the club's activities. Special meetings for junior members are also held. Norma can be found at 355 Cressing Road, B'tree, Essex or on B'tree 45058.

Edgware & District RS The committee is hard at work getting events organised for '82 with the necessary co-operation with the Verulam, Harrow and Grafton clubs to avoid clashes of dates, which sounds a jolly good idea! Don't forget it is second and fourth Thursdays, 8pm, Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware, Middx with next event being a surplus equipment sale on Dec 10. No excuse for any "B" tickets at this club, with G3ASR giving code classes and on-the-air practice. Drop a line if you are interested to sec Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx or 01-952 6462.

Salop ARS First time, I think, in these columns. Edwin Arnold G6AKE says you should all congregate at the Albert Hotel, Smithfield Road, Shrewsbury, every Thursday at 8pm; or he will gladly send a copy of the club's newsletter if you'll contact him c/o 30 Leamore Crescent, Belle Vue, Shrewsbury or on (0743) 66969.

Southdown ARS First Monday, Chaseley Home for Disabled Ex-servicemen, Eastbourne at 7.30pm. Editor of club newsletter D. G. Morgan G4FDW wonders if any members ever read that fount of all information judging by the lack of response to requests for news and articles! He comments "at least *PW* and *SWM* read it, passing on info about our society. Wonder when RSGB will get round to reading it!" G4FDW can give details of two RAE courses being run in Eastbourne, if it's not too late. Try him at 3 Aylesbury Avenue, Eastbourne or 31620. Sec is R. E. Holtham G4EKS, 2 Benbow Avenue, E'bourne or 32777.

Worcester & District ARC "Meetings more and more popular with new faces appearing every month" so says new sec Dave Pritt G8TZE of 15 Paxhill Lane, Twyning, near Tewkesbury, or try (0684) 293890 or even the office on Cheltenham (0242) 32301, replacing long-time reporter Mike G4EKG. So it's first Monday at the Old Pheasant, New Street, Worcester around 8pm. Dec 7 is c.w. operating techniques night expounded by Ray Dobdinson G3RGD, aimed at encouraging the "B" lads to go one up. Time to tell you also of Dick Marshall G4ERP (nice!) talking on earth-moon-earth (eme) communications on Jan 4.

Royal Naval ARS Not the usual run of societies covered in this column but mammoth 54-page newsletter gives some idea of the wide coverage of interests of the society's members, many of whom also belong to local clubs, of course. Seems a communications interest in the RN or any other navy is basic qualification for membership but sec CRS M. Puttick G3LIK, 21 Sandifield Crescent, Cowplain, Portsmouth will explain all, or try Waterlooville 55880.

Cheltenham ARA Meets at the Old Bakery, Chester Walk, Clarence Street, C'ham, with Dec 18 designated natter-night but contact Grant Cratchley G4ILI, 47 Golden Miller Road, C'ham or 43891 for more info.

Chelmsford ARS A. C. Mead G4KQE, 9 Abraham Drive, Silver End, Witham, Essex says the club meets first Tuesday of the month, 7.30pm, at the Marconi College, Arbour Lane, C'ford. Too late to tell you of early Dec activities but Jan 5 is the annual film show of RSGB and other productions. Intending to win next year's NFD a Datong Morse Tutor has been bought by the club! (unfortunately something more than that is needed — experience!). Still it's an idea that could be copied to advantage by other clubs.

Derby & District ARS Every Wednesday at 7.30pm at 119 Green Lane, Derby, plus Tuesdays and Thursdays for Morse classes from 7 to 9pm. Membership has reached new club record totalling 208! "Where they all come from is a mystery" says club chairman Richard Buckby G3VGW, "we hear that similar things are happening at other East Midland clubs". No prize for the first correct answer! Ah, yes, Dec 9 is a night on the air, 16th constructor's contest, 23rd Christmas Party (hurrah!) and the 30th "the year in retrospect" (boo-hoo). Still, Jenny Shardlow G4EYM, 19 Portreath Drive, Darley Abbey, Derby is around to fill you in on the details of this very old club's activities, or on (0332) 556875.

Radio Club of Thanet Pleasant variation on the usual run of club titles, meets at the Birchington Village Centre at 8pm. Dec 6 is "Rig Evening" while Jan 9 is devoted to a social evening. Try Ian Gane G8HLG, 17 Penshant Road (hope that's right) Ramsgate, Kent or (0843) 54154.

Chesham & District ARS Second Wed at the Whitehill Centre, Chesham, Bucks and, if you hurry up, Andy G8PUC (QTHR) or (0494) 785625 will tell you all about the exciting foxhunt organised on the 2m band. The programme for 1982 is under active consideration by the committee so there's plenty to look forward to.

Collingwood RS At HMS Collingwood, Newgate Lane, Fareham, Hants, and open to present or past members of RN, RM, RNR and civvies employed by the MOD(N) with regular lectures and film shows plus construction projects always under way. Wednesdays at 8pm ought to be OK but contact R. N. Byford G4MKR at the above QTH for more information.

St Neots & District ARS "Alternate Mondays", which, working forwards looks like Dec 7 and 21 at the Ernulf Community School, at 7.30pm, with regular outside visits, plus talks, being planned for 1982. Darryl Davies G6EDB of 4 Winchfield, Great Gransden, Sandy, Beds (076) 77623 sent the info but advises contacting either G8TQI on Huntingdon 74642 or G8GRT on H'don 890737 for more gen.

St Helens & District ARC Weekly, Thursdays, at the Conservative Club, Boundary Road, St. Helens at 7.45pm with code classes for half an hour beforehand. Club call is now G4LCK, with club net on S23 at 1130am Sundays. Four foxhunts a year are held with a "ladder" established for the leading teams. Mark Edwards G4LHL, 2 Oliver Road, Toll Bar, St Helens, Merseyside, which is also St H. 31846.

Harwell ARS Ann Stevens G8NVI, 78 Whitehorns Way, Drayton, Abingdon, Oxon says the club's AGM-cum-construction contest takes place on Dec 15 at the East Wing of the Social Club at the AERE at Harwell. With the local RAE courses overbooked the club is thinking of starting up one of its own so if you are interested give Ann a tinkle on Drayton 430 soonest.

Wolverhampton ARS HQ at the W'hampton Chamber of Commerce and Industry, 93 Tettenhall Street, W'hampton, with a slide history of the club on Dec 7, "Canals of the W. Mids" by G8ZZU on the 14th, social evening on the 21st, with no meeting on the 28th as is only to be expected! Excellent newsletter keeps members au fait with all the club goings-on. John Cook G8EDG, 75 Windmill Lane, Castlecroft waits to hear from prospective members, or a bell on W'hampton 763617.

Wirral ARS First and third Weds at 7.45pm, but note new club QTH is Minto House School, Birkenhead Road, Hoylake, so says G. O. O'Keefe-Wilson G4MIA (congrats OM!) of 20 South

Drive, Upton, or 677 1531. New venue has ample facilities for constructional work and antennas plus parking space, apart from being easy to reach. Only event in Dec seems to be the Christmas Party so contact G4MIA for details.

Silverthorn RC Fridays from 7.30pm at the Friday Hill House, Simmons Lane, Chingford, London E4 reports sec C. J. Hoare G4AJA, 41 Lynton Road, Chingford, London E4 9EA. Typical activities include construction contests, film shows, contest operation plus the annual camp near to Gilwell Park using special call GB4SRC. Magazine reports that the camp long wire for 80m "reached OZ, SP and LA". Some wire! Yes, I really do read all your newsletters!

Sefton ARC Public interest in the GB2NG station at the National Giro event was most marked especially with the RTTY set-up. Future events include a foxhunt, talk and demo on electronic organs, G8ZWZ on WWII radio equipment, pirate BC stations by G6BPE, and, hopefully, a visit from local RSGB rep. Len Gurney G4LBJ, 1 Endborne Road, Orrell Park, Liverpool L9 8DP or 051-523 6074 is the source of more info on the club's activities.

White Rose ARS A warm winter welcome for visitors to the Moortown RUFC, Moss Valley, King Lane, Leeds around 8pm on a Wednesday evening. Programme details from Dave Coomber G8UYZ at the above QTH or QTHR.

Sutton Coldfield RS Gathers at the SC Public Library with next meeting on Dec 14 at 7.30pm with microprocessors and a.t.u.s the order of the day. Visitors always assured of a ready hand says sec Derek Turner G8TUR, 10 Jervis Crescent, Sutton Coldfield, W. Mids B74 4PW.

Southgate RC Second Thursday of the month at 7.30pm at St Thomas Church Hall, Prince George Avenue, Oakwood, London N14 but check for meeting details with sec V. Austin G4MCD, on 01-360 5832.

Verulam ARC Dec 22 AGM and social evening at the Charles Morris Memorial Hall, Tyttenhanger Green, near St Albans, at 7.30pm. Hilary Claytonsmith G4JKS, 115 Marshalswick Lane, St Albans, Herts, has all you need to know on the formal meetings as well as the second Tuesday of the month informal gatherings, at the RAFA HQ, Victoria Street, St Albans.

Fareham & District ARC Room 12, Portchester Community Centre, at 7.30 on Wednesdays with a night-on-the-air on Dec 9 and a slide show from G8VOI on the 16th, with advance notice of Jan 6 when G4ITF discourses on Logic. It's Brian Davey G4ITG, 31 Somervell Drive, Fareham, Hants for further details.

Mid-Sussex ARS Meets at the Marle Place Further Education Centre, Leylands Road, Burgess Hill, West Sussex at 7.30pm from which QTH G3ZMS will be glad to answer your queries on dates. An RAE course is in full swing under instructor G3BPV.

Torbay ARS Club calls G3NJA and G8IUI at Bath Lane, rear of 94 Belgrave Road, Torquay, with informal meetings every Friday at 7.30pm and more formal meets on the last Saturday of the month, same place, same time. Club is gloating at the moment having got top spot on 1·8MHz in NFD. Sec is Hugh Davies G4DZH, 18 Bowland Close, Paignton or 523063.

DX Corner

Welcome first letter from **C. A. Cowan** of Rugeley, Staffs who got fed up with abuse, QRM and idiots on CB a.m. and sold his gear in favour of a Yaesu FRDX-400 with 2 and 4m bands fitted, a step that will not be regretted! Antennas are Windom, 10m vertical and 2m Slim Jim. Enrolment on RAE course run by G4DBR should result in a pass at least in May '82. On 10m C.A.C. found VK6YO and ZM4BU while 15m came up with 9N1MM, 9V1TL, CT3CN, KA1FCQ/P/6W8, VK9NYG and ZL2BFU with J73CB (Box 389, Roseau, Dominica) as outstanding on 20m.

Jim Dunnett (Prestatyn) has been busy with a tuning unit for his RTTY set-up but TVI seems to get into everything, he reports. Still, with his SRX-30/AR88D/DC-receiver plus several long wires he did manage to copy a lot of c.w. on 20m like YA1CP, FG7BP and UA3XBP/4K1 in Antarctica. On 15m it was J87WW, FM7WO and JY9RV, leaving only 10m where he got OA4AWD, 8R1J, VU2BK and VK6IA. In the s.s.b. mode on 15m VP2VD, J6LOU, KA2MZS/SV9 (Crete) showed up. **John Hayes** of Edmonton, London N9 wrote again to say he's added an MM2000 reader to his RTTY rig which runs from an FRG-7700/FRT-7700 plus long wire which brought in VE3JEV. However s.s.b. won the day with HC1NP, OA7TS, TU2JD, YC3FM, ZD8RH and 5N6GGJ on 10m, DU1EO, HS1BV, KA2MZS/P/SV9, 7P8BJ and 8P6CC on 15m, plus, on 20m CE0AE (QSL WA3HUP), KL7EC and VK9NL, finishing with ZL4KF on 80m.

In Edinburgh **Anne Edmondson** BRS47285 has got away from her RAE studies long enough to visit local clubs and to finish off an a.t.u. for her Realistic DX200. Much better than buying one, eh? She reports A71AD asking for cards to the QTH of A7XD in the '81 callbook, and that the A7XM on c.w. on 20m is a phoney. Her DX looks like all 20m, all s.s.b. with A71AD, CT2CY, JY2RZ, SV0AO, V3AWS (QSL Box 306, Belize City — was VP1WS), YK1AA and 6Y5MS.

Allan Stevens (Crowthorne, Berks) found 10m amazing during the month to mid-Oct, topped by the launch of UOSAT, he says. His Trio 9R59DS has a PR40 preselector but fed only by a 2 metre whip, however he has now acquired a 2m receiver, so looks like we could lose Allan to the Ron Ham mob! DX on 28MHz was noted for CO2OM, VK8GF, VU2VTM and IV3OSH/5R8, with only KL7EC of note on 21MHz. In Llanmorlais, Swansea, **Philip Morris** is getting along fine with his CR100 now, having fitted a stabiliser to the h.t. line. He is also BRS48851 now though time goes mainly on "A" level studies, but on 7MHz he did find TR8DX, 9K2DR and VU2NKA, while 14MHz supplied T30DB, C21AH (QSL ZL1AQB), ZK2EL (QSL OE2DYL), a fine one in JT1AN and FG7TD/FS7. On 21MHz he logged HV3SJ, A22ZM and 5H3JR.

In Wadhurst, E. Sussex, **Rob Gibson** was delighted to log W6RO located on the Queen Mary in Californian waters, and to get a QSL. Enrolment for the Dec RAE is coupled with code practice to take his G4+3 right away. In the meantime his FRG-7 plus a.t.u. plus pre-amp and dipole at 10 metres produced the following on 10m: 9X5SL, HL9FR, J28DP, P29KM, VS6CT, XT2AN and ZP5RG, with T32AB on 20m.

D. Coggins (Knutsford, Cheshire) found 7MHz in very good shape with things like CO5GV, FR7CE, HM1EJ, KB7IJ/KH2 on Guam, VE8YQ on King William Is, on his FRG-7700/FRT-7700 and 30 metres of wire. On 14MHz his set-up provided AH8A on American Samoa, CE0AE, FK0RR, KH3AB on Johnson Is, VK9NS, VR6TC, ZL3PA/C on Chatham Is, 3B8LH (QSL DL0LH) and 3X1Z. Things came good on 28MHz with A22BW, DU1RD, FG7BG, FR0FLO/P/J if you can credit such a callsign, G3MUV/CE0 on Easter Is and QSL to KA4MGH, H5AK, S79WHW, S83W, YJ8NPS, ZS2FDC portable in Namibia, 9V1TL (on c.w.) and 9Q5FL (QSL K4AEB).

Ed Baker, sec of ISWL, bemoans missing K7LAY/BY, but I think everyone else did OM! Present rumour has ZA2HAM on a DX-pedition with some EAs and EA2DK as QSL manager. **David Warr** (Weymouth) is all excited about the Dec RAE so good luck OM and don't get distracted by the DX in the meantime, you'll be working it soon. The 9R59DS and ZL-Special antenna for 15m brought in A22ZM (QSL ZS5CU), A71AD, FP0FSZ who is really VO1FB larking about, ZB2GW, ZD8TC, 7P8BT and 9X5SL.

Now this is where your scribe eats humble pie! **John East** of Highworth, Wilts, wrote in for the first time to say he'd built an HAC three-transistor receiver which, with 10 metres of wire, got him a list of stuff on 20m s.s.b. as long as the proverbial arm. I suggested he might be listening to the wrong end of some of the nets but as he had some 15 years previous experience at the game I had to give him best! Apologies OM. So from the 140 choice stations listed I give a few like A71AD, AP2LB, C5AAP, CE6COR, CE9AH, DU7GB, FY7BW, HC1GZ, J3AH, lots of JAs, JW5OD, KC4VZ, millions of PYs, TA2KS (skip the VKs and ZLs), VP2MH, VP2VB, VP8AJL, VP8QI, VP9CP, VU2AU, 5N21ATT, 5T5ZZ, 8P6OR, 9M2GD, 9X5NH and 9Y4NP. Don't know what he'd do with a proper receiver!

Pet grievance of **Basil Woodcock** of Leeds at the moment is the lack of courtesy of stations that do not QSL even when sent IRCs and s.a.e.s. The RSGB bureau is a laugh he says, with 27 returns from over 200 QSLs sent that way. Well, OM, I'd prefer to place the blame on the overseas bureaux as I'd consider ours to be one of the best. Simple answer, get your ticket and a ZA call and I'll guarantee 100 per cent returns! Anyway the JR310 turned in A6XJC, 9Q5FL, TA1AB and XZ9A on 10m, A22ZM, HK1KO, V3AWS in Belize, and YK1AO on 15m, ending with 5N21CRN, 7P8BJ, TA2KS, 5T5ZZ and YJ8RG on 20m. Looks like the 5N boys are having a 21st.

Bill Rendell, Truro, Cornwall professes not to have too much time to spare at the moment for his HRO but managed J73FP, VK2AVA and ZL4AV on 7MHz, with 28MHz giving DU6LL (Box 797, Bacolod City, Philippines), FR7CB (QSL Box 9743, Santa Marie), VP2MFL, YC1CBL, and 9Q5L with cards to K3FN.

From Seaton, Devon, comes word from **Stephen Littley** that 28MHz has been very good although he seems to have looked at most of the bands with his FRG-7 and long wire. On 3·5MHz HH2MC was a useful one, with OA4AKD and 6Y5MJ on 7MHz, plus UK1PGO (in Franz Josef Land), and VP8AGY on Rothera Base on 14MHz. Nice ones on 21MHz were A7XD, JT1WA, S79WHL and TL8DC with 28 fetching up with ZE1JC and VP1BEH. A log only from **Len Stockwell** in Grays, Essex says he used an FRG-7 with a Datong active antenna to get 5B4JM on 10m, 5H3JR and J6AW on 15m, and NL7D, TU2CJ, ZC4NB and 3B8AE/P/3B9 on 20m.

Regular 15-year-old reader **Andrew Chadwick** of Bury, Lancs, has deserted the BC bands I'm glad to say and has been using his Heathkit RA1 plus just 3 metres of wire in his bedroom to log such stuff as AP2IZ, C5ACG, J28DG, J6LB (QSL Box 732, Castries City, St Lucia), KG6RN, PJ4CR via WB2LCH, TA2KS (QSL G3SCP), TU2JL, UK1PGO QSL to UK3SAB, VK9NL, VP5BAM, VP8QI, VQ9CI, 5N0FCA and 6Y5MC all on 14MHz s.s.b. Catches on 28MHz were EL9B, VK9NS of Box 19, Norfolk Is, and 5H3TM of Box 429, Mbeya.

Final Notes

Dr Bernard Peter Bint of Altea, Spain, thinks that he has found a very old friend in J. R. Cond mentioned in the column recently. The Doc was a BRS before the war and was stationed at Hendon when things began to happen. Now it's thumbs up with the May RAE results and a bash at the code exam in Gibraltar very soon. Funnily enough Doc was in the Royal Signals for seven years in WWII but never touched the code. We'll be looking for you soon from EA-land OM.

Archie Magrath near Ramsgate couldn't find a suitable club in his area but with G4KEJ they got together and formed one at Birchington now thriving with 40 members and new faces every week. Just shows what can be done with a bit of initiative. If you can't find a club, form one! Archie is all set for the RAE in December but in the meantime has acquired an R-1000, plus 22 metres of wire in the loft. He is also BRS48064 for the time being.

Alec Bell G4MHQ of Lee-on-the-Solent was so pleased with an unusual QSO he had with WD9HCY that he decided to tell me all about it. At 0525Z one morning he put out a CQ on the 10m band, optimistically I'd have thought, and heard the WD9 way down in the noise. Anyway it transpired that he was using between 2 and 3W input on s.s.b. to a home-brew rig for the first QSO with the UK at that power level. Alec was using an FT-101ZD and HF5 vertical antenna.

> On page 65 of December *PW* I stated that cards can be sent out via the RSGB's QSL Bureau even if one is not a member of the Society. **This is incorrect.** One must be a member to use this facility. Non-members **can collect** cards from sub-managers by sending an s.a.e. to them. My apologies to the RSGB and QSL Bureau manager E. G. Allen G3DRN for any inconvenience caused.

Right, that's that for another year. Hope it has been a good year for you and may it be an even better one in 1982. A Very Happy Christmas to one and all.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

Last time we looked at ways in which we could improve reception on the medium waves. We examined the directional properties of the internal ferrite rod antenna to be found in the majority of m.w. receivers these days, and saw how to use this antenna to cut down interference from other stations and to reduce electrical noise and static. We also found out that an outdoor antenna positioned away from the house would pick up more signal and less noise than an indoor one, to give an improved signal-to-noise ratio. Is there anything else we can do?

Overloading

Modern receivers are more prone to overloading than older valved types and if we connect an outdoor antenna to the former we may end up with cross-modulation, whistles and spurious responses with stations appearing on more than one part of the dial.

If the receiver does not have an antenna socket then wrap the lead from the outdoor antenna round the receiver in a single turn. Coupling between antenna and receiver will be by induction and should be loose enough to avoid overloading. If the receiver does have an antenna socket then you could also try putting an attenuator between the antenna plug and the receiver's antenna socket. Fig. 1 shows a simple attenuator which can be mounted in a small box beside the receiver. Adjust the attenuator for the loudest output that does not cause overloading.

At first sight we seem to have put up an outdoor antenna to pick up more signal only to reduce it again either by loose coupling or an attenuator. Even if we do end up with a signal not much stronger than before, the station will be cleaner and easier to listen to, as we have reduced noise, static, etc., and improved the signal-to-noise ratio.

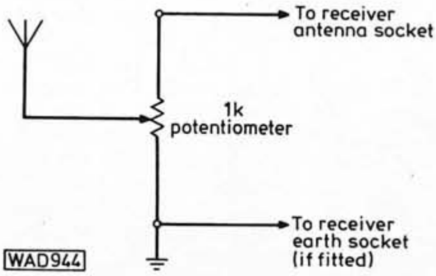

Fig. 1: A simple attenuator

Fading

Reader **B. A. Watt** of Shepton Mallet is interested in AFN Frankfurt, West Germany on 873kHz which he can pick up during the day. He wonders why it fades after dark. During the day it is the ground wave that is arriving at his receiver. Any radiation upwards from the transmitting antenna is absorbed by the D layer of the ionosphere. After dark the D layer disappears and the sky wave now travels higher into the ionosphere to the E layer where it is bent back to the earth. At the receiving antenna the ground and sky waves combine. Sometimes they are in step and add together, on other occasions they are out of step and subtract. The two signals go in and out of phase with one another because of the ever-changing length of the path of the sky wave and fading is the result. If we go farther away from the transmitter, beyond the range of the ground wave we will still get fading, this time from signals that have travelled on different paths through the ionosphere due to different angles of radiation from the transmitter.

What can be done about fading? If you sit beside your receiver and turn down the gain (volume) as the signal increases in strength and turn it up again as the signal fades, you can (if the fading is slow, as it usually is on the medium waves) counter fading. A tedious method that does work but only to the point when the gain control is set to maximum. If the signal continues to fade then our efforts to counter it will now fail.

No need to manually adjust the gain

control. Modern receivers are equipped with Automatic Gain Control (a.g.c.) which will do the job for us, but only with moderate to strong signals. The remedy is obvious. Put up a good outdoor antenna, feed more signal to the receiver (overloading permitting) and give the a.g.c. a chance to work properly.

TV Buzz

Fred Ainslie, who is a TV service technician as well as a m.w. DXer, refers to the line timebase radiation from TV receivers which he says comes mainly from the scan coils and to a lesser extent from the line output transformer. "The scan coils can be likened to a ferrite antenna connected to a transmitter. It is worse in colour than monochrome TVs due to the larger scan power. Due to live chassis circuitry the TV cannot be earthed, so a certain amount of the noise is fed into the mains wiring for distribution all over the house."

Fred reckons the only real solution for the DXer, who picks up TV timebase harmonics across the medium waveband, is to get his antenna as high and as far away from the TV as possible. He uses a loft antenna fed by coaxial cable which cuts out TV buzz quite well, and disconnected the mains earth from his receiver which is now earthed direct to the garden, which brings an improvement.

DX Heard

Seventeen-year-old **Keith Dwyer** of Presbury in RSA uses an old Concerto valved receiver with a 30 metre-long wire for m.w. DXing. He reports hearing Malawi on 740kHz with a fair signal at 2145, BBC Cyprus on 1323kHz at 2200 and Islam (Duba in Saudi Arabia) fair on 1521kHz at 2235. Fred Ainslie (Hartlepool) has a home-brew receiver which uses a combination of valves and f.e.t.s and has a s.s.b. mechanical filter to get 2·7kHz bandwidth with good skirt selectivity. When connected to his loft long wire this rig pulled in CJYQ St John's in Newfoundland on 930kHz, CHNS Halifax Nova Scotia on 960kHz, WINS New York City on 1010kHz and WCAU Philadelphia on 1210kHz.

An FRG-7 and one-metre loop with differential matching amplifier are in use at Letchworth by **Mike Barraclough** whose log includes a good bag of DX from the Caribbean. Stations heard include ZDK in Antigua on 1100kHz at 0058, Radio Globo Sao Paulo, Brazil on the same channel at 2215, Radio Iracema at Fortaleza in Brazil on 1300kHz at 2345, Radio Cayman, Cayman Islands on 1555kHz at 0010, Caribbean Beacon in Anguilla on 1610 at 2330 plus WITS Boston on 1510kHz at 2314.

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Beyond 1600kHz

The medium waveband ends on 1602kHz, which is the top channel of the Geneva Plan though there is usually a certain amount of illegal activity beyond the band edge. The station that interests me most in this region is Radio Ierapetra which is located on the southern coast of Crete and is currently listed in the *World Radio and TV Handbook* as being on 1614kHz with a power of 1kW. R. Ierapetra is not a pirate as it is licensed by the Greek government, and recently it has been joined by two other official broadcasters. Vatican Radio has been heard for a while now on 1610kHz and Caribbean Lighthouse, reported by Mike Barraclough, would probably be logged more often if DXers knew it was on 1611kHz. The address of Caribbean Lighthouse is PO Box 690, The Valley, Anguilla, West Indies.

Transmitting Stations

According to Sweden Calling DXers, a new edition of a pocket guide called *Transmitting Stations* is now available from the IBA. It lists all ITV and ILR stations in the UK and can be had free of charge from the IBA Information Service, Crawley Court, Winchester, Hants SO21 2QA. A useful addition to the local radio DXer's library.

Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

As regular readers of this column will have noticed, I use the SIO reporting code instead of the more complicated SINPO. SIO is used by the BBC and RCI and I prefer it because it is simple, unambiguous and gives an adequate description of how a signal is coming in. Reader **Keith Sholton** has re-opened the subject of reporting codes by sending me a copy of an interesting article called *Easy SINPO* which appeared in a recent issue of the RBI Journal *Radio Berlin International*. The article discusses the validity of some SINPO ratings and suggests a way in which listener reports could be made less subjective. For the benefit of newcomers it might be useful to have another look at the SINPO code, before going on to RBI's comments on it.

SINPO

The five letters SINPO are the initial letters of the five parameters used in the code. S stands for Signal Strength, I for Interference from other stations, N for Atmospheric Noise (Static), P for Propagation Disturbance, O for Overall Merit. P is often taken to mean fading and the code is therefore sometimes called SINFO. Each letter is given a rating in the range 1 to 5.

	S	I.N.P.	O
5	Excellent	Nil	Excellent
4	Good	Slight	Good
3	Fair	Moderate	Fair
2	Poor	Severe	Poor
1	Barely audible	Extreme	Unusable

Problems arise with the letter O as it seems to be a matter of opinion what is meant by overall merit. To quote from RBI, "Now and then our engineers come across ratings in our mail bag which are strange if not unbelievable. The DXers SINPO numbers in other words contradict the SINPO system. Although we must admit here that it is not easy to use the SINPO signal rating system".

RBI then go on to argue that a rating of 55552 does not exist. "The overall merit O can't be poor if all the other code letters are excellent" a conclusion most of us would accept. How about a rating of 25555? Some DXers including Keith and myself feel that the rating for O should not be higher than the lowest of the other numbers i.e. the rating should be 25552. Others maintain that O should be the average of the first four i.e. 25554. It seems pointless to use this method of assessing O as it does not convey any additional information. If you only recorded SINP then the station could work out O for itself. RBI quotes another system, which is not new. O should stand for readability (QRK). On this basis 25555 is legitimate "every detail of the transmission is understood at weak signal strength: QRK5".

"Easy SINPO" then suggests less subjective ratings for the letters I, N and P, ratings which could be used when reporting to RBI. This leaves S, the rating for signal strength, untouched though one wonders how subjective it may be. If you use an "S" meter don't rely on the readings too much. They are only relative values and clearly they will depend on the antenna in use.

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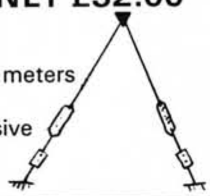

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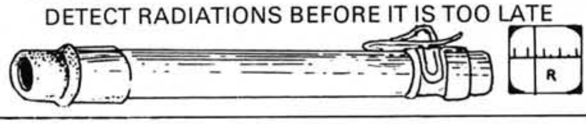

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An interesting project for a DX club meeting would be to play a few recordings of DX signals and then ask the audience to write down the SINPO rating of each. I'd like to hear from anyone who tries it. In the meantime though I'll stick to SIO though I do feel a little uneasy when I think of the suggestion made over *DX Digest* some time ago that an SI code would do instead! Incidentally RCI's *DX Digest* has been renamed *Short Wave Listeners Digest*, an indication perhaps of changing times on the short wave bands.

Receiver Shopping List

"Can you recommend a short wave receiver?" is a question often asked by readers who do not realise that there isn't a simple answer to this apparently simple question. What is suitable depends on what you want to use it for, how much you are prepared to spend, whether you want a portable, the type of antenna available and so on.

Receivers currently in use range in price from about £30 to £900. The lowest priced will, with their own antenna, pull in major broadcasters from all over the world, but if you want to listen to the weaker ones or to DX, then you will need something better. Do you want to listen to amateurs, if so you will want to receive s.s.b. which is a facility usually found on communications receivers but seldom on other types. Can you put up an outside antenna? You might be better off with a portable if you can't. There is also personal choice—you have to like a receiver to derive any pleasure from it.

The *Receiver Shopping List* has been produced by Radio Netherlands in response to requests from listeners for information about receiver types. The list is in price order. Receivers are divided into four categories and there is a section giving general hints to guide readers into making a suitable choice. In reply to reader **Colin Gillibrant,** I suggest you obtain a copy of this list which is available free of charge from Media Network, Radio Netherlands, PO Box 222, Hilversum, Holland.

Radio Free Grenada

The London Office of the High Commissioner for Grenada has written to explain the QSL policy of Radio Free Grenada (RFG). Correspondence of a technical nature is appreciated by the station "for how else can RFG ascertain the quality of its reception world-wide?" The letter goes on to say that the station is short-staffed and along with other government departments operates on a very limited budget which has led to a "less than speedy response to correspondence, which should have by now been rectified."

Many thanks to the High Commission for providing this information and it is gratifying to learn that there is at least one broadcaster who is interested in DXers. RFG is currently on 15·10MHz, its address being PO Box 34, Morne Rouge, St George's, Grenada, and it would seem to be a good idea to enclose at least one IRC with the reception report.

Readers' Letters

Twelve-year-old **Peter Manson** of Glasgow has a Grundig Melody Boy which pulled in Radio Algiers on 9·151MHz and Brazil on 17·81MHz. He joined the World DX Club (WDXC) seven months ago which "helped me no end with everything about DXing." **Mike Barraclough** has sent me a copy of the September issue of *Contact* which is the monthly bulletin of the WDXC and is packed with information on all aspects of DXing. Mike referred to the mid-monthly *Express News Service* which has 16 pages of up-to-date DX news and station schedules and is available for an additional subscription. A sample copy of *Contact* can be had for 40p or three IRCs from 17 Motspur Drive, Northampton, NN2 6LY.

Martin Whittington's exotic QSL card from Hawaii

Broadcasts Heard

An FRG-7 with 60 metre-long wire, Codar RQ10 *Q* Multiplier and Datong Audio Filter are in use at Letchworth by Mike Barraclough who reports hearing Mauritius on 4·855MHz at 1640, Cayenne in French Guyana on 6·17MHz between 2330 and 0100 sign-off, AWR Sri Lanka on 9·72MHz on Sundays between 1500 and 1530, Radio Singapore on 5·052MHz in English at 1530 (sign-off at 1630). **Martin Whittington** (Dartford) used a Sony ICF 5900 with internal antenna to pick up Alma Ata in Kazakhstan USSR on 9·78MHz at 2300 and KTWR Trans World Radio in Guam on 15·13MHz at 2130. Martin also received a QSL card from WWVH in Hawaii which is a time signal station operating on both 10MHz and 15MHz with a power of 10kW. The address taken from the QSL is: Radio Station WWVH, PO Box 417, Kekaha, Hawaii 96752.

VHF Bands

by Ron Ham BRS15744

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

When conditions are about average and there is little DX to shout about, do not give up, because, as records show, an unexpected solar event can suddenly liven things up. This is why the first item in this column is usually devoted to the sun and the second to the 10m band and the signals from the propagation beacons.

From observations with his reflecting telescope in Bristol, **Ted Waring** counted 33 sunspots on September 22, 29 on the 30th and 40 on October 2nd and 13th, and **Cmdr Henry Hatfield,** Sevenoaks and I recorded several individual bursts of solar radio noise between October 9 and 17 and noise storms on days 9, 12, 13, 14, 15 and 18, at 136 and 143MHz respectively. During the morning of the 13th, Henry located 8 sunspot groups with his spectrohelioscope and noted that one group looked active and contained 3 large spots and about 20 small ones. Also on the 13th, **Phil Hodson** G8RBY, Melton Mowbray, received a warning from **Charlie Newton** G2FKZ, the RSGB auroral coordinator, that a major proton burst had occurred on the sun and in turn, Phil telephoned a list of interested observers. During the life of the solar storm, Henry noted that the MSF beacon on 60kHz, which he monitors daily, took on a rough tone and Phil said that a weak aurora, lasting about 45 minutes, manifested during the late evening of October 14. Between 1332 and 1350 on the 13th the normally consistent MSF signal jumped up in strength, having dropped down at 1256 for about 20 minutes.

The 10m Band

Among those enjoying the DX on 10m is **Harold Brodribb,** St Leonards-on-Sea, whose log shows signals from Bahrain, Indonesia and the USSR on September 20, many from Canada and the USA on the 28th, several from the USA amid a high noise level on October 4, Canada and the USSR on the 5th and strong signals from the USSR on the 9th. Harold also listens to the harmonics on 10m from the lower frequency broadcast stations and often hears Alma Ata around 29·80MHz which he positively identified last year. "October 5 was an especially good day with utilities heard up to 41MHz" writes Harold, who often spends time hunting through the *World Radio TV Handbook* looking for the origin of the harmonics. Apart from a few short periods of blackout, due to solar activity, between October 8 and 14, the band was generally good and although I received signals from JA, VE, VK and W on most days between September 22 and October 18, I only heard ZLs on September 30 and October 1 and 6 and the New Zealand beacon ZL2MHF on September 23, 24 and 30. **Barry Ainsworth** G4GPW, Lancing, noted that 10m was dead during the morning of October 8 and said that 20m dropped out during the previous evening. I noticed pronounced echoes on signals from France on September 24, UK on the 30th and especially DJs and a QSO between the scout station GB2CLD and VK6DT on October 18. In fact it sounded as though both these stations were in a box.

10m Beacons

Arthur Swatton, Westcliff-on-Sea, listens on the 10m beacon frequencies for about 30 minutes during the morning and afternoon using a valved converter into an early domestic receiver and a Windom antenna cut to 28MHz. During the 27-day period between September 22 and October 18, I received signals from the International Beacon Project stations, at varying strengths, in Australia VK2WI on 17 days and VK5WI on 5 days, Bermuda VP9BA on 15 days, Caracas YV5AYV on 11 days, Cyprus 5B4CY on 18 days and Germany DL0IGI on 19 days.

Gerald Clothier RS31665, Bristol using a FRG-7 and a long wire antenna for 28MHz, has heard the Hong Kong beacon, VS6HK 28·290MHz, once and I heard it for the first time at 1332 on October 13 and again around 0900 on the 18th. "September was a good month for ZS signals" writes Ted Waring from Bristol who logged the South African beacons ZS6DN on 23 days and ZS6PW on 15 days. Ted's previous best month for ZS signals was May and says "It's interesting that May and September were the peak months for ZS here in 1980". A good observation Ted, these are the sort of points that are brought out by consistent observations. While I heard signals from the Hungarian beacon, HG2BHA at 1330 on September 22, Henry Hatfield, also using an FRG-7 and a long wire antenna, received it on the 20th and 22nd. It was heard too by Gerald on October 5 and Arthur on the 10th.

Between September 20 and October 14, Henry received signals almost daily from DL0IGI, VP9BA, YV5AYV and 5B4CY. Arthur also received these between October 5 and 10 and they both heard the Canadian beacon VE2TEN. Between September 15 and October 14, Ted logged VE2TEN on 17 days, VP9BA on 22 days and YV5AYV on 19 days. Henry, Ted and I noted that the Bahrain beacon, A9XC, came up again on October 8 having been off the air or not audible in the UK for several weeks. Phil Hodson and Henry commented about the foul tone on 5B4CY which developed, according to my log, on October 15. I see from Gerald's log that he received signals from ZE2VV on September 24 and October 3 and 5.

The 6m Band

"I am very interested in 6m DX and during September I went on holiday, about 2000km north of Broome, in the north west of VK6 to work JAs" writes **Graham Rogers** VK6RO, from Bunbury, Western Australia. On this occasion, Graham used a FT-680R (6m version of 480R) with 10W s.s.b., 1W f.m., 3W a.m., or 10W or 1W c.w. and a home-brew 1/4 wave antenna on the car roof. Between September 3 and 15, Graham worked a total of 434 JAs, 233 on s.s.b., 89 on a.m., 65 on f.m. and 47 on the key. Between 0830 and 1000 on the 5th, he heard the beacon VK8VF at 539, "unusual for this time of the year" said Graham, and on the 6th he heard Malayan TV sound on 53·75MHz, for about 3 hours. At 0310 on the 9th, he received a 519 signal from the Japanese beacon JA2IGY on 50·008MHz and very strong f.m. broadcast, possibly Chinese on 50·642MHz. Since October 1979, Graham has worked 754 JAs on 6m from his mobile plus KG6DX and HL2JD. A fascinating report Graham and I will look forward to hearing more about your exploits.

RTTY

In answer to many questions, it really is simple to use a microprocessor RTTY-to-TV converter, in the loudspeaker circuit of a communications receiver, to resolve teleprinter signals and give no end of pleasure to the short wave listener. Although RTTY signals can be heard on most amateur bands, I find 14·090MHz is consistent and most rewarding. For instance, between September 22 and October 18, I copied 122 stations spread over 19 countries, DF, EA, F, G, HB9, I, LZ, OE, OH, OK, SM, SV, UA, VE, VK, W, YU, YV and 3A. Of these 116 were on 20m and the other 6 were on 15m and 10m received during the CARTG contest on October 17 and 18, when the h.f. RTTY slots were packed with action and I wished I had more time to tune around. Although the majority of the signals I copied were one sided or CQ calls, I did copy two-way QSOs between EA7CLH and YU7BCD around 1330 on September 22, EA7CFW and DF2ME at 1350 on October 1, DA2KT and DJ7CO at 1334 and DF6UD and I7OGB at 1851 on the 5th, UA3HR and VK5XO at 0825 on the 11th, and during the contest, K8ND and SM4AIQ, K8ND and 3A2EE, DK0OW and ON7AZ, GB2ES and HB9JV and DK0ED and HB9LP. The event was full of interest and in a mere 12 minutes from about 0820 on the 17th, I logged 12 stations in 7 countries ranging from Europe through Scandinavia to the USA.

Fig. 1: Ralph Barrett with his WS-18 with Peter Penfold winding the generator

Another RTTY enthusiast is **Jim Dunnett,** Prestatyn, who uses two communications receivers, AR88D and SRX-30, with separate RTTY terminal units, one the BARTG ST-5 and the other is digital with facilities for putting traffic on to magnetic tape. Jim's h.f. antennas are two long wires feeding the sets via a.t.u.s, and for 2m he has a vertical two-element beam in the loft and an early *PW* design converter. Looking through Jim's log I counted 4 countries on 80m, 13 on 20m, 10 on 15m, 1 on 10m and 2 on 2m. I am always pleased to hear the news and views from RTTY enthusiasts.

Tropospheric

There is little wonder that v.h.f. conditions were generally poor between September 21 and October 18 when we consider that the atmospheric pressure, measured at my QTH at midday on the 21st was 29·5in (998mb) and apart from a few hours at 30·1in (1019mb) on October 7 and 16, it remained below 30·0in (1015mb) until October 18, with real lows of 29·3in (992mb) on September 26 and 29.

Band II

Although **Simon Hamer** feels that v.h.f. DXing "came down with a bump" after an enjoyable sporadic-E season, his log for Band II, despite the poor tropospheric conditions, looks to me as good as ever. He received programmes from TDF France, Brest, Caen and Lille, on September 20, 24 and October 3, 4 and 11, BRT Belgium on the 24th and October 3, and bursts of signal from SDF-1 W. Germany, between 1122 and 1222 on the 4th. At the same time short bursts of signal from the French station at Rouen blocked out Simon's reception of BBC Radio Derby. On October 13 and 14, **Nick Brown,** Rugby, heard the IBA test transmissions from the new ILR station Chiltern Radio due to serve Beds, Bucks and Herts on 97·5MHz.

News Items

Can anyone help **James Bennett,** 10 Glendevon Rd, Huyton, L36 0XL, with a circuit or operational information on the ex-Govt receiver type 1359 which covers 130 to 520MHz. James is an instructor with the Sea Cadet Corps and would also like circuits using Nixie tubes for clocks and counters, etc., to aid his instructions.

N. Beadsworth, Londonderry, asked about BRS numbers for station identification. These are allocated to non-licensed members of the Radio Society of Great Britain and application forms for membership are available from RSGB, 35 Doughty St, London WC1N 2AE.

"Hams here in Bergen are beaming west nearly every day" writes **Arild Garmannslund** LA8WAA, from Norway, who uses a FT-480R and a 10-element Yagi on 2m. On August 29 he worked GM4LBE in the Shetlands and on the 30th he worked about 30 stations, some direct and others through the repeaters in Aberdeen GB3GN R7, Elgin GB3SS R0 and the Faeroes.

Among the visitors to the Chalk Pits Museum, Amberley, Sussex, on October 4 were our readers, **Andrew** and **Russel Tyler** from Horsham, and while Andrew uses a Lowe SRX-30 communications receiver with a long wire antenna on 21 and 28MHz and is studying for the RAE and Morse, Russel is a collector of early 1950s broadcast sets and enjoys hunting through boxes of junk.

Congratulations to my fellow Mid-Sussex Amateur Radio Club member, Tony Bailey G3WPO, who was awarded the Ostermeyer Trophy by the RSGB for his article, *The RX80 MK2* featured in several issues of the Society's journal, *Radio Communication*. Tony, first licensed in 1967 and a founder member of AMSAT UK, has always been a keen home constructor and one of his early designs was a frequency counter used as a club project followed by a 2m scanning transceiver nick-named the "WOPO BOX" by club members, a hand-held and then the RX80 h.f. receiver. Tony's dedication to amateur radio was honoured a few years ago when he became an honorary life member of the Mid-Sussex club.

Readers wishing to join 10-UK, an organisation for promoting the use of 10m, should contact J. Harris G3LWM, The Oaks, Cricketfield Lane, Bishop's Stortford, Herts with a membership fee of £3.50.

Among my regular contributors to join in the special "Wireless Day" at the Chalk Pits Museum on September 27 were Simon Hamer who travelled from Mid-Wales, the Brownlow family who operated two stations, Alan Baker G4GNX, with his home-brew electronic keyer, Ralph Barrett with his wartime transmitters, Fig. 1, Stan Williams G3LQI operating h.f. c.w. from his car, Ron Allen and Ern Downer with their microwave gear and Ken Smith and Peter Penfold who acted as stewards. My thanks to them and to the members of Chichester ARC who ran the "junk" sale, Crawley ARC for their direction-finding exhibit, the Medway ARTS contest group with their exhibition station, members of Sussex Raynet, British Telecomms radio interference vehicle, the Home Office for their display of official radio equipment, members of the British Vintage Wireless Society, Mike Tatham G3RSY for his display of QSL cards and RSGB council member Robin Bellerby G3ZYE, who all helped to make the day a great success.

Although Gerry Brownlow, G3WMU/P found the h.f. bands quiet on October 11, while operating his station at the Chalk Pits grand open day, he was visited by Brian Jackson G3NZM, licensed around 1960, Ed Dennett G8XJY from Petersfield, Hants, who is a member of the UKFM (Southern) Group and old-timer Ken Salmon G2AKM, first licensed in 1939, who has always operated on the key with 15 watts from a home-brew rig, a "best bent wire" antenna and an HRO communications receiver. Among the exhibitors was Gerry Kennedy, G3OGK/VP8LZ with his collection of vintage sparking plugs, a working 1929 Bradford stationary engine which he fully restored and a 1940 JAP engine, running very sweetly having been fully restored by his 11-year-old daughter, Dorli. Incidentally, can anyone help Gerry, QTHR, with a Champion spark plug made about 1910 with a tap on the side.

During the day I met father and son, Les and Jeremy Miller from Smallfield, Nr Horley, Sussex, who told me that they were taking an RAE course and that the *Passport to Amateur Radio* series in *PW* had proved most helpful, good luck lads and let me know your callsigns when you get them.

TV

by Ron Ham BRS15744

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

Although the 1981 sporadic-E season has finished and the openings during the next few months will be mainly tropospheric and confined to Bands III and V, it is still worth an early morning check on Chs. E2 and R1 for television DX coming via the F2 region of the ionosphere. Such pictures are smeary and not easy to identify, but your vigilance and consequential reports on any distinguishing features will, as usual, be much appreciated.

Amateur TV

Despite the poor weather conditions prior to September 27, Wireless Day at the Chalk Pits Museum, Amberley, Sussex, was, apart from one short shower, predominantly sunny and a good time was had by all concerned. One of the highly successful exhibits was that of the Worthing Amateur Television Group, G3UEQ, G4JEI, G6AIW and G8s KOE, VEH, WXS, XEU, XRX and ZWM, who established a base station in a tent, with several receivers running. Some members of the group wandered around the museum's 36 acres with "back pack" transmitter, camera and recording equipment, interviewing people and in general televising the whole show. They even took their gear for a ride on top of the museum's open-top bus, and their efforts added a great deal of humour to the day.

Both the Chairman, Mike Rowe G8JVE, and Secretary, Sid Talbot G8FCX, of the Chichester Amateur Radio Club are now operational with ATV equipment and are working in conjunction with the Worthing Group. Mike uses a Pye Lynx camera, and a Trio 2300 feeding a Microwave Modules Transverter giving about 6 watts on 70cm to a MBM48 antenna at 8m a.g.l., while Sid uses a Philips camera and a Microwave Modules Transverter, fed from a home-brew 2m transmitter, into a crossed-12 Yagi.

Mike and Sid use similar home-brew converters in front of a domestic TV set for receiving the ATV signals.

"There is a great interest in ATV in the Chichester club" Mike told me, and I am not surprised because this is yet another field which is still wide open for the amateur radio experimenter. I would be pleased to hear from any other clubs or individuals who are active in this field.

Mystery Signal

During the 1981 sporadic-E season, **Fraser Lees,** Ringmer, Sussex, received a test card in Band I, Fig. 1, which he cannot identify, and asks if any of my readers can help.

Sporadic-E

At 1100 on September 14, **Harold Brodribb,** St Leonards-on-Sea, Sussex, received weak pictures from Norway on Ch. E2 48·25MHz. On September 22, **Nick Brown,** Rugby, received the RAI-1 test card from Italy on Ch. 1A 53·75MHz and pictures in the late afternoon of the 23rd from TVE Spain on Chs. E2, E3 55·25MHz and E4 62·25MHz. "The E2 signal came from the TVE-2 transmitter at Santiago and the E3 from Gamonitiero," writes Nick, who also noted the RTP-1 pattern from Portugal, floating over the Spanish signal on E3. Between 1055 and 1132 on October 5, Nick received the circular test pattern from TSS, Russia on Ch. R1, and an unidentifiable station transmitting colour bars on Ch. R2 59·25MHz. "Any ideas?" says Nick.

I received long bursts of test card from Austria, Czechoslovakia and Poland at 1350 on September 23, Poland at 0900 on the 25th, Austria, Czechoslovakia and the USSR at 0905 on October 2, Switzerland at 1335 on the 6th, Poland's clock at 0900 on the 10th and Poland at 1310 on the 12th and 0800 on the 17th. A final showing of my Ch. R1 videotape covering the sporadic-E events in early September revealed a language

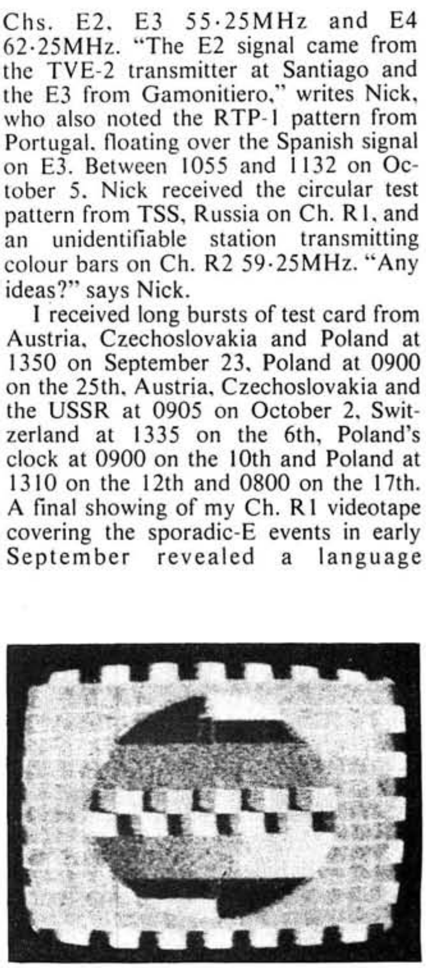

Fig. 1: The mystery test-card pattern from Fraser Lees

Fig. 2: Russian language programme received by the author on Ch. R1

Fig. 3: Russian language programme received by the author on Ch. R1

Fig. 4: Part of a puppet programme received by the author on Ch. R1

programme, Figs. 2 and 3, a programme about puppets, Figs. 4 and 5 and an eye-catching YL announcer, Fig. 6. I cannot positively identify the countries from whence these pictures came, so any help you can give will enhance the records.

F2

I saw the first sign of the winter TV DX via the F2 region of the ionosphere at 1340 on October 15, again at 1245 on the 16th and at 0835 on the 17th and 18th. At first I heard the television synchronising pulses come up on Ch. R1 followed by the usual mixture of strong, smeary unidentifiable pictures which were still there when I checked again at 1400 on the 17th. Early on the 18th, in addition to the pictures, I could hear music on the Ch. R1 sound frequency 56·25MHz which is another good DX spot to keep a watch on.

Way up North

Congratulations to **Ian Anderson,** Lerwick, on his article and pictures in the September issue of *Shetland Life* entitled *Long distance radio and TV reception in Shetland.* Ian has given the lay reader an insight into the enjoyment that we all get from DXTV and made the point that even with simplified equipment, long-distance reception requires that dedication to search the bands daily.

Fig. 5: Part of a puppet programme received by the author on Ch. R1

Fig. 6: Announcer received on Ch. R1 by the author in September

In Norway, **Arild Garmannslund** uses a 14in Panasonic receiver and a 2-element beam on Band I, and during the 1981 sporadic-E season he received pictures from Germany and Holland. On July 22, Arild logged both sound and pictures for nearly 12 hours from Radiotelevision Beograd.

From Wales comes a good tip from DXer, Simon Hamer, who suggests that the *Heute Direkt* programme on BBC2 should be ideal for seeing news captions, YL announcers and other identifying points from German-speaking TV stations.

AIR TEST

▶▶▶*continued from page 59*

The above is an extract from the written advice given by the Home Office to all amateur licensees, but how many amateurs could demonstrate at very little notice that they could meet these requirements?

If you run a crystal controlled rig on 2 metres then the Drae VHF Wavemeter will meet the basic conditions of enabling you to check up to and above the third harmonic.

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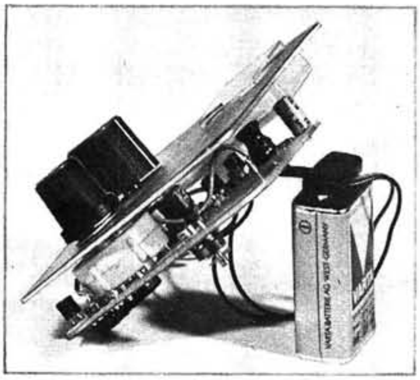

Operation proved to be simple but the tuning scale is a little vague. However the instruction leaflet supplied with the instrument explains how to use it and interpret the results obtained.

The Drae VHF Wavemeter is well made, inexpensive and should prove very useful for the 2 metre fanatic. But when—oh when will the 70cm operator get a similar instrument at a reasonable price? What about it Davtrend?

Dick Ganderton

Our thanks to **Davtrend Ltd., 89 Kimbolton Road, Portsmouth, Hants., PO3 6DA. Tel: 0705 816237** for the loan of the review instrument. The Wavemeter costs £24.95 and is available direct from the makers or selected retailers.

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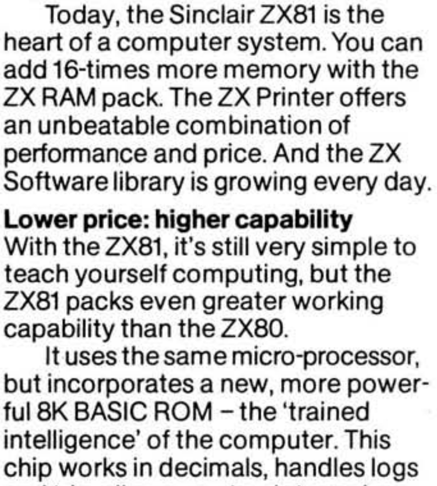

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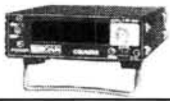

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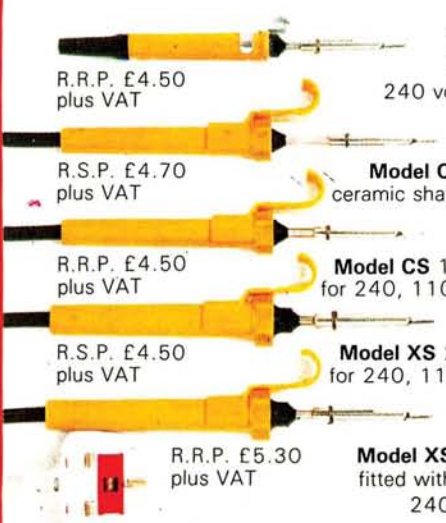

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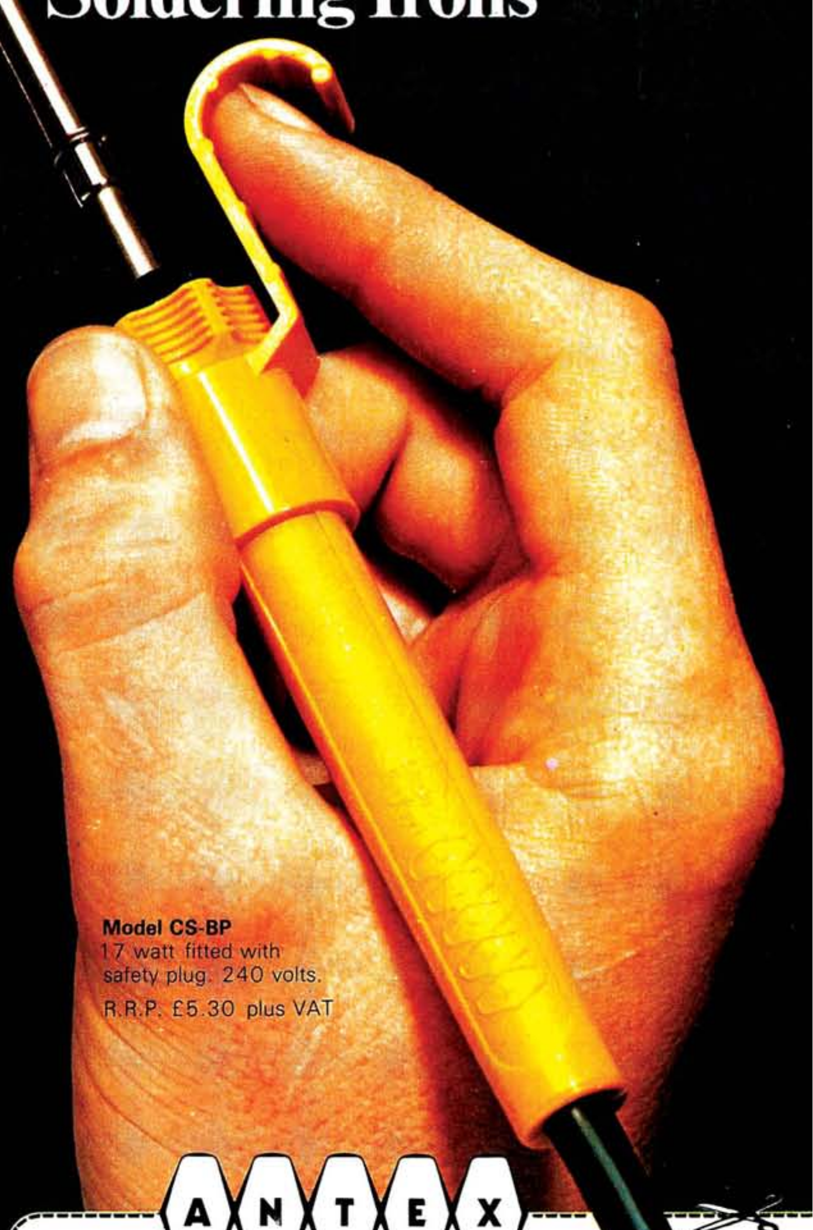

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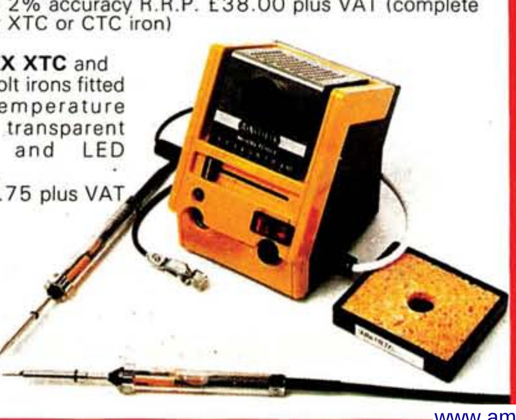

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