FOR THE RADIO ENTHUSIAST...

Practical Wireless

AUGUST 1983

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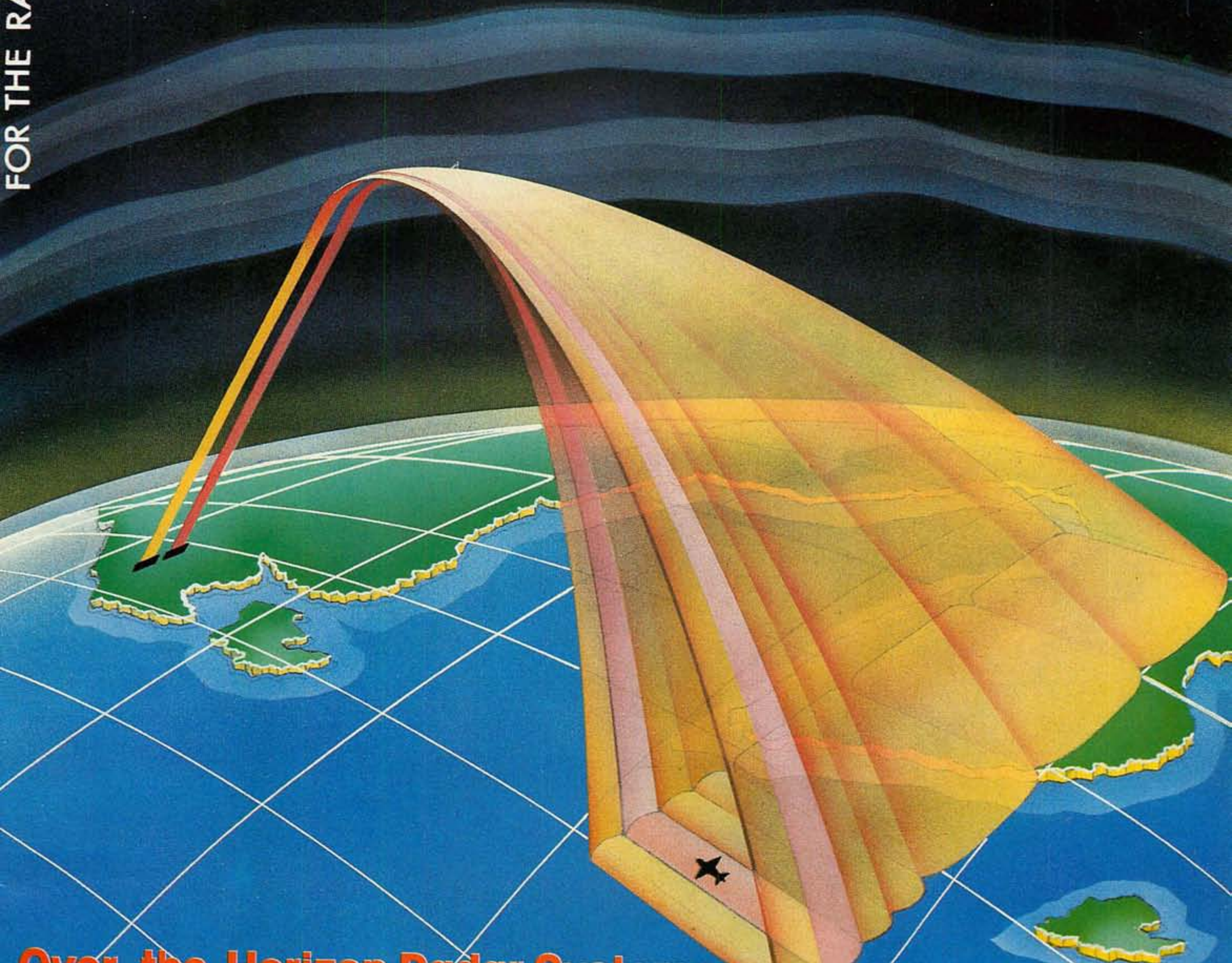

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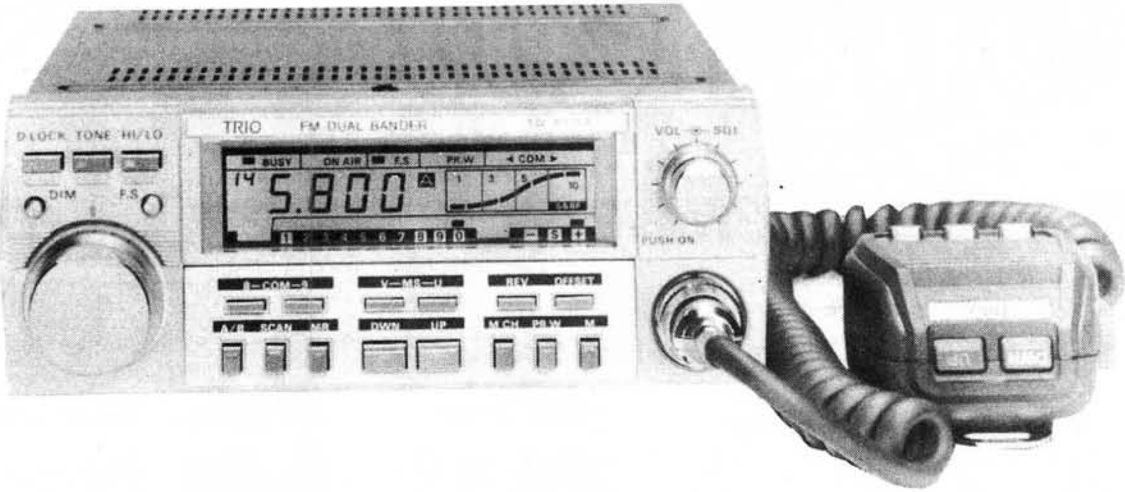

TW4000A

the dual band fm mobile transceiver

The TW4000A is the latest step forward in Trio's programme of providing today's radio amateur with the very best in equipment. Following the success story of the Trio TS780 dual band base station transceiver, the TW4000A gives the mobile operator a superb FM transceiver for both 70 centimetres and the 2 metre band. Not only for mobile operation is the TW4000A perfect but also for shack use where the rig with its scanning and dual band facilities enable the enthusiastic amateur to keep in touch with the local scene.

★ The TW4000A covers in one compact transceiver both the 2 metre band (144.000 to 146.000 MHz) and also the full 10 MHz of the 70 centimetre band (430.000 to 440.000 MHz). Measuring 60mm high, 161mm wide, 217mm deep and weighing only slightly more than 2.0 kg, the TW4000A is smaller than most current 2 metre transceivers.

★ Added to the exceptional receive performance, now a Trio standard by which others are judged, is the TW4000A's 25 watt capability on both 2 metres and 70 centimetres. Using the TW4000A not only can you hear weak signals on either band but they can hear you too. A HI/LO switch reduces the output power to 5 watts when required.

★ A green backlit liquid crystal display gives frequency, memory channel, repeater offset, VFO A or B, scan function, channel occupied and "ON AIR" information. Brightly illuminated, the display can easily be read under unfavourable conditions. All important controls are illuminated for easy operation during darkness.

★ Ten memory channels are provided which store frequency, band and repeater offset (on 2 metres minus 600 KHz shift, on 70 centimetres plus 1.6 MHz shift). Memory 1 is used for priority watch, memories 8 and 9 for instant recall and memory 0 for split channel use (cross band operation). An internally fitted lithium battery gives memory backup.

★ Frequency scan is extremely versatile in that the rig can be programmed to scan either all memory channels or those holding either 2 metre or 70 centimetre frequencies. The rig can also be programmed to skip those channels which the operator does not wish to monitor. The scan direction can also be changed by using the UP/DOWN switch on the microphone. In order that an important contact is not missed, when in priority watch mode, the rig switches back from the frequency in use to memory channel 1 for one second out of ten. The two most used frequencies can be placed in memories 8 and 9 respectively, common channel scan checking each alternatively for approximately 5 seconds.

★ The use of GaAs FET's in the RF amplifiers on both 2 metres and 70 centimetres, as well as the use of high performance MCF's in the 1st IF section, provides a high receive sensitivity and an excellent dynamic range.

★ Two VFO's are provided tuning in either 5 or 25 KHz steps, the UP/DOWN shift switch on the microphone providing control.

★ Full repeater facilities are included giving the correct 1750 Hz access tone, and of course the essential repeater shift.

★ The use of advanced diecasting techniques in the fabrication of the combined chassis/heat sink, as well as in the RF shielding results in greatly improved mechanical strength, plus a higher immunity to RF interference.

OPTIONAL ACCESSORIES
PS430 matching power supply.
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for the VHF operator, the **TR7930** mobile transceiver

£305.21 inc vat carriage £6.00

Any amateur who has used or owns a Trio TR7800 has had the finest piece of 2 metre mobile technology at his fingertips. The TR7800 had simply everything that the keen mobile operator could ever want. Of course, there were a few points which customers said could be improved on and, I must admit, we, in the majority of cases, agreed. Trio, with the introduction of the new TR7930, have taken note of this feedback of information and the result, I am sure you will agree, is as close to perfection as you will find in a rig.

The improvements are, a green floodlit LCD readout which does not disappear in strong sunlight, additional memory channels, both timed and carrier scan hold on occupied channels, selectable memory channel for the priority frequency and automatically corrected mode selection (simplex or repeater) without having to instruct the rig. The most significant change is the liquid crystal frequency readout on a green illuminated background, but closely following this must be the ability to omit specific memory channels when scanning, and the programmable scan between user designated frequencies. This gives the rig the ability to scan simplex channels only, without holding on repeaters.

The Trio TR7930. The mobile 2 metre FM rig designed with ease of operation coupled to outstanding performance.

for the serious UHF and VHF operator, a DXing transceiver, the **TS780**.

With the arrival of the TS780, the dual bander rig has come of age, giving the two band multimode facilities of the original concept, plus a wealth of additional operating facilities. Taking a trip across the front panel of the rig we have the repeater facilities, a non-locking tone switch, ideal now that most repeaters are tone accessed and carrier maintained. The tone, of course, only works whilst the rig is in the FM mode. Below the tone switch is the TX offset switch giving plus or minus 600 KHz or 1.6 MHz, depending on whether 2 metres or 70 cm is selected and last, but certainly not least, reverse repeater – to my way of thinking proof that the TS780 was designed for amateurs by amateurs.

The meter functions on receive as S. meter, ALC meter or as a centre meter, the functions being controlled from a panel switch. On transmit the meter reads relative RF output. Immediately above the digital frequency and memory/VFO indicator are indicating leds: "a busy" led indicating in FM mode whether the squelch is open thereby, assuming the squelch level is correctly set, that the other station is transmitting. A "frequency lock" led tells that the F lock switch is pressed and the VFO knob inoperative. The "on air" led indicates the rig is transmitting and the "offset" led reminds you that the TX offset switch is set to repeater.

The memory operation has been updated: instead of having to progressively move through the memory content in sequence, by means of a rotary switch any of the ten memories (two more than the TS770's) can be selected at will. Entering frequencies into the memory is easier, as anyone who has a TS770 series will explain. Two priority frequencies are included: 9 and 10. Push buttons to the left of the VFO knob allow either of the two programmed frequencies to be quickly selected, immediately cancelling the previous instructions given to the rig. Just the thing for local net frequencies. SSB mic gain needs no explanation, as does the AF/RF gain control.

On the same control knob as the squelch level is a switch enabling the frequency width of scan to be determined. Briefly, when the rig is set to scan either in FM, FM step or SSB mode you can determine the amount of band to be covered.

The ranges are 0.5, 1, 3, 5 and 10 MHz, thus you can limit the rig to scan just the section of the band used by the mode you have selected.

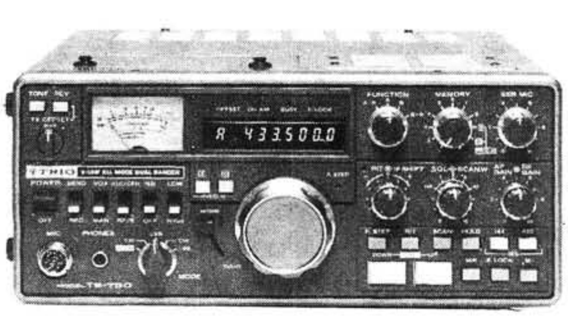
Example: scan width 0.5 MHz, VFO set at 144,000, coverage – 144.000 to 144.5 mode side band – result: free scanning of the SSB portion of the band. On FM the scan locks if a signal is present. On SSB the scan does not stop but you are made aware that there is activity on the band.

Another new control on the TS780 is the IF shift. Available for some time on HF equipment to cope with crowded band conditions, obviously the Trio design engineers have recognised that the 2 metre SSB end of the band can become crowded during contests or when there is "a bit of a lift on". At these times a rig that has the "IF shift" facility will certainly "score points".

The send/receive Vox/Man, meter function, NB, low/high power switches are all well known and have been found on previous generations of Trio base station equipment and again require no explanation. I could say the same thing about the mode switch but here you will notice alongside the standard FM position another marked FM CH. Put the mode switch in this position and instead of a free-running VFO you have a mechanical "click" step feel, the frequency now moving in either 12.5 KHz or 5 KHz steps. Of course the rig will also scan in these steps, controlled either by the scan switch or the up/down shift microphone. Again the Trio amateurs who design the equipment have here a major triumph.

By now you may be seeing why I am so enthusiastic about the TS780 but there is still more to come. How about a memory scan system that will scan either the 2 metre frequencies stored in the memory or the 70 cm ones or, if you wish, both. Well that's another feature of the TS780. Add to this list variable VFO steps of either 20 Hz or 200 Hz, a selectable braked feel to the VFO knob, rapid up and down MHz switching and you have the most comprehensive rig ever seen.

Too complicated some may say. Rubbish say I. Trio thrive on rigs designed to be simple to operate. Do you remember what John wrote in Radcom about the TR7500 and its competitors? And, finally, how about a rig that without resorting to a MHz switch will, by use of the VFO knob, tune from 144 to 146 MHz and from 430 to 440 MHz – only one rig –



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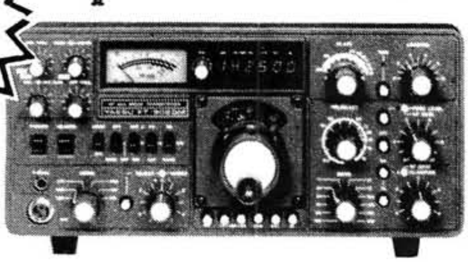

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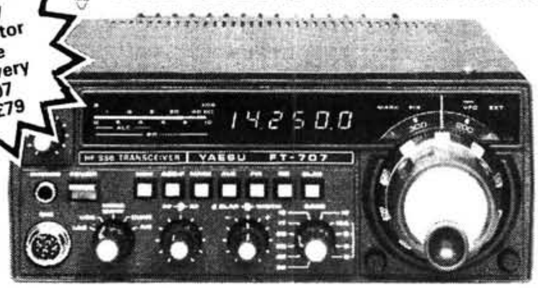

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YOU'LL MEET THE MOST INTERESTING PEOPLE

IC-25E

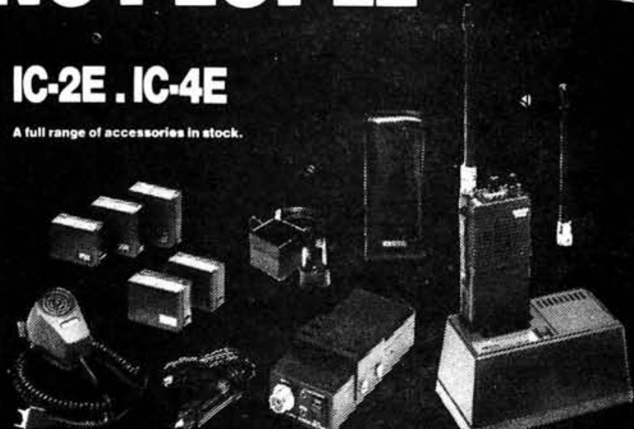
The FM mobile of choice has to be the ICOM IC-25E. It is amazingly small yet has a powerful voice (25 Watts) and a sensitive receiver. There are five easily programmable memories and facilities for changing the repeater shift from the default value of 600kHz. You can tune the VFO while in a memory without losing or changing the memory. Of course you can instantly listen on the input and there are also priority channel facilities should you want to be sure of not missing that private message. The HM10 scanning mike is supplied as standard, but the HM11, with tone call on the mike, can be used.

290H . 490E

The recently introduced IC-290H has proved so popular that we have decided to concentrate on this (25W) model 2m multimode. With its bright green display, 5 memories, scan facilities on either memories or the whole band, tone-call button on the microphone and instant listen input for repeaters, this little box really is a beauty. The 70cm version, the IC-490E has similar features (although the output is only 10W in this case). These two multimodes make an ideal pair.

IC-2E . IC-4E

A full range of accessories in stock.



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

Fully synthesized – Covering 144 – 145.995 in the 400 5KHz steps. (430-439.999 4E).
Power output – 1.5W with the 9v. rechargeable battery pack as supplied – but lower or higher output available with the optional 6v or 12v packs. Rapid slide-on charging facility.
BNC antenna output socket – 50 ohms for connecting to another antenna or use the Rubber Duck supplied (flexible 1/4 whip – 4E)
Send/battery indicator – Lights during transmit but when battery power falls below 6v it does not light, indicating the need for a recharge.
Frequency selection – by thumbwheel switches, indicating the frequency. 5KHz switch – adds 5KHz to indicated frequency.
Duplex simplex switch – gives simplex or plus 600KHz or minus 600KHz transmit (1.6MHz and listen input on 4E).
Hi-Low switch – reduces power output from 1.5W to 150mW reducing battery drain.
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CWR-610E

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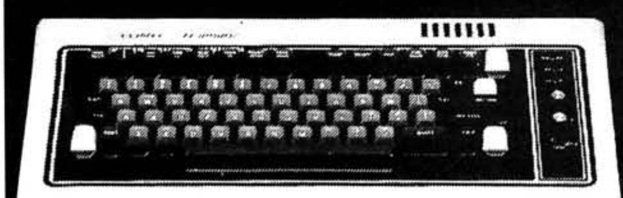
ICOM produce a perfect trio in the UHF base station range, ranging from 6 Meters through 2 Meters to 70 cms. Unfortunately you are not able to benefit from the 6m product in this country, but you CAN own the IC-251E 2 Meter station and the 451E for 70 cms.



9000E

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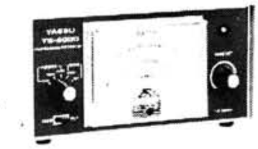
MMA28	10m preamp	16.95	(1.00)
MMA1296	23cm preamp	34.90	(1.00)
Frequency Counters			
MMD650/500	500MHz digital meter	75.00	(1.00)
MMD600P	600MHz pre scaler	29.90	(1.00)
MMDP-1	Probe	14.90	(0.50)
Filters			
MMF144	2m band pass 40W max.	11.90	(1.00)
MMF452	70cm band pass 40W max.	11.90	(1.00)
Various			
MMS384	384MHz signal source	29.90	(1.00)
MMR15/10	15db 10W attenuator	11.90	(1.00)
HI-MOUND MORSE KEYS			
HK702	Up down keyer marble base	24.50	(0.50)
HK704	Up down keyer	16.68	(0.50)
HK705	Up down keyer	12.50	(0.50)
HK706	Up down keyer	13.75	(0.50)
HK708	Up down keyer	11.96	(0.50)
HK808	Up down keyer marble base	39.57	(0.50)
MK704	Twin paddle keyer	10.95	(0.50)
MK705	Twin paddle keyer marble base	22.00	(0.50)
MOULDINGS			
IK	Iambic keyer	19.95	(0.50)

TOKYO HY POWER			
HC150	HF ATU SWR/Power meter 200W PEP	62.50	(n/c)
HC2000	HF 2kW ATU SWR/Power meter 6 POS ant. switch. 6 to 1 vernier high Q coils 2kW peak 1kW continuous	276.55	(n/c)
Antenna Rotators & Accessories			
9502	Channel master med duty up to 8 ele.	57.00	(3.50)
9523	Alignment bearing for 9502	15.81	(1.25)
KR400	Med/Heavy duty 180° meter	90.85	(3.50)
KR400RC	Med/Heavy duty 360° meter Load 200Kg 1½"-2" masts	114.94	(3.50)
CASTING	Lower casting set	15.00	(1.25)
KR600RC	Heavy duty 360° meter Load 200Kg Rot600Kg/cm Brake 4000Kg/cm 1½"-2" masts	163.30	(3.50)
Antenna Switches			
SA450	SO239 connectors 1 in 2 out	9.75	(0.50)
SA450N	"N" type connectors 1 in 2 out	12.75	(0.50)
Baluns			
BL50A	RAK 50 ohm ferrite BALUN 1:1 1.8-38MHz 1kW	12.88	(1.50)
BL-40X	Balun 2K PEP 1.1	11.52	(1.50)
Dummy Loads			
T30	30W DC 500MHz PL259	6.61	(0.50)
T100	100W DC 500MHz SO239	20.12	(1.00)
T200	200W DC 500MHz SO239	31.36	(1.50)
T210	Wide band 10W 1.2G-2.4G	24.50	(0.75)
AW05	Pocket RF wattmeter 5W up to 500MHz BNC	19.75	(1.00)
DRAE PRODUCTS			
DRAE4	4 amp PSU	30.75	(2.00)
DRAE6	6 amp PSU	48.00	(2.50)
DRAE12	12 amp PSU	74.00	(3.00)
DRAE24	24 amp PSU	105.00	(4.00)
DRAE WM	135-450MHz wavemeter	27.50	(1.00)
"N" Connectors (Silver Plated)			
N58	"N" Male connector RG58	2.25	(0.25)
N8	"N" Male connector RG8	2.40	(0.25)
N308	"N" T adaptor (three female)	2.40	(0.25)
N307	"N" L adaptor (1 male 1 female)	2.40	(0.25)
N306	"N" Double female adaptor	1.90	(0.25)
N310	"N" Double male adaptor	2.50	(0.25)
NB304	"N" Female to BNC male adaptor	2.10	(0.25)
N402	"N" Plug to SO239	2.05	(0.25)
N403	"N" Socket to PL259	2.00	(0.25)
N404	"N" Socket to SO239	1.80	(0.25)
TOKYO HY POWER			
HL32V	VHF 30W linear 1-5W drive HI-LOW output	53.50	(n/c)
HL82V	VHF linear preamp output meter 2-12W in 35-85+ out	144.50	(n/c)
HL160V	VHF linear preamp output meter 1-10W in 160W+ out	242.40	(n/c)
HL45U	UHF linear preamp 2-15W in 10-45W out	119.75	(n/c)
YAESU			
YH55	Headphones Low Z	10.00	(0.50)
YH77	Lightweight headphones Low Z	10.00	(0.50)



SWR/Power Meters			
YAESU			
YS200		52.90	(n/c)
YS2000		69.79	(n/c)
Other Makes			
RF2000	Twin meter 3.5-150MHz F/Scale 200/2000W	18.25	(1.00)
YM1X	Twin meter 3.5-150MHz F/Scale 12 or 120W	14.99	(1.00)

COMPUTERS

Commodore 64. 64K, sprites, sound chip etc.	343.85	(n/c)
Vic 20 + C2N datasett + intro to base part 1 + 4 games. Special price	139.99	(3.00)
Commodore 1541 174K disk drive	299.00	(n/c)
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Vic 16K ram pack	74.95	(0.25)
Vic 20 reference guide	9.95	(0.25)
Commodore 64 reference guide	14.95	(0.50)
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Cat. No.			£
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1222	FT-101Z	Transceiver	539.00
1223	FT-101ZD	Transceiver	599.00
1224	FT-101Z/AM	101Z plus AM unit	555.00
1225	FT-101ZD/AM	101ZD plus AM unit, digital	619.00
1226	FT-101/FM	101Z plus FM unit	570.00
1227	FT-101ZD/FM	101ZD plus FM unit	635.00
1263	FV-101	Remote VFO	109.00
1274	Fan B	Fan for FT-101	13.00
1275	DC Unit	DC/DC PSU for FT-101	40.00
1230	FT-107	Solid state broad band	699.00
1231	FP-107	PSU for FT-107	99.00
1232	DMS-107	Memory for FT-107	89.00
1264	FV-107	VFO for FT-107	95.00
1265	SP-107	Speaker	28.00
1266	FC-107	ATU	106.00
1268	FT-902DM	SSB/AM/FM TCVR	850.00
1244	SP-901	Spkr for 101Z/902	30.00
1267	SP-901P	Phone patch/spkr	55.20
1247	FV-901DM	Remote VFO for 901	250.00
1245	FC-902	ATU for 101Z/902	130.00
1269	FTV-901R	T.VTR plus 2M unit	270.00
1270	430TV	70cm Unit for above	170.00
1271	144TV	2M Unit for FTV-901R	95.00
1272	YO-901P	Monitor scope/pan ad	315.00
1239	FT-707	Mobile TCVR	549.00
1238	FP-707	AC PSU	119.00
1237	FC-707	ATU for FT-707	82.00
1273	MR-7	Rack for FT-707	15.00
1203	MMB-2	Mobile mount for '707'	16.00
1246	FL-2100Z	HF 1200W linear	399.00
1206	FRG-7	Receiver	189.00
1248	FRG-7700	Receiver	315.00
1255	FRV-7700A	Conv 118/130 130/140 140/150Mhz	69.75
1257	FRV-7700D	Conv 118/130 140/150 70/80Mhz	72.45
1254	FRT-7700	Antenna tuner	37.00
VHF Equipment			
1233	FT-227RB	2M FM 10W TCVR	179.00
1234	FT-290R	2M Multi-mode	235.00
1202	CSC-1	Case for FT-290R	3.90
1210	MMB-11	Mounting bracket 290	22.00
1211	NC-11C	Charger for FT-290R	8.00
1595	C Nicads	Set of 8 for FT-290R	21.20
1348	FL-2010	10W linear for FT-290R	62.00
1252	FT-208R	2M Hand held	199.00
1251	FT-708R	70cm Hand held	209.00
1236	FT-480R	2M All mode	360.00
1243	FT-780R	70cm Multi-mode	435.00
1220	FP-80A	AC PSU, 4.5A	59.00
1200	NC-1	Desk charger	19.00
1204	NC-2	Charger	39.00
1201	PA-1	DC Unit	19.00
1205	FP-4	AC PSU 4A, 13.8v	42.00
1258	NC-7	Base trickle charger	26.00
1253	NC-8	Base fast/trickle charger	42.00
1260	FBA-2	Battery sleeve for NC-7, NC-8	3.00
1262	NC-9C	Compact trickle charger	8.00
1349	FNB-2	Spare battery pack	17.00
1350	FL-2050	Linear amp FT-480R etc	120.00
1351	YM-24A	Spkr/Mic, FT-208/708	16.00
1241	FT-720RU	70cm FM mobile transceiver	264.00
1242	FT-720RV	2m FM mobile transceiver	239.00
1263	FT-230R	2m FM mobile transceiver	229.00
HEADPHONES, MICS, Etc.			
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1213	QTR-24D	Quartz 24hr clock	27.00
1215	YM-36	Noise cancelling mic	13.00
1214	YM-35	Hand, scanning	13.00
1352	YM-37	Hand mic	6.90
1353	YM-38	Desk scanning	24.00
1221	YD-148	Desk mic	20.00
1216	YH-55	Headphones	10.00
1217	E72-L	Remote cable for FT-720	19.50
1218	S72	Switching box, FT-720	52.00

TRIO-KENWOOD PRICE LIST. 2 YR WARRANTY. FREE DELIVERY.

Carriage Free

Cat. No.		Item	Inc VAT £
1301	ST-1	Base stand/charger for TR-2400	42.94
1302	MB-2	Mobile mount for TR-2300/VB-2300	16.50
1303	SC-3	Soft vinyl case for TR-2400	10.95
1305	BO-9	Base plinth for TR-9000/TR-9500	35.00
1307	PS-20	DC PSU for TR-9000	47.95
1308	PB-24k	Spare battery pack for TR-2400	16.00
1309	MC-30S	Hand microphone; 500 ohm	12.95
1310	PS-30	DC PSU for TS-120S/130S/180S	89.00
1312	MC-50	Desk microphone; 500 ohm/50k	26.45
1315	YK-88CN	270Hz CW filter for TS-130S/830S	30.00
1316	YK-88SN	1.8kHz SSB filter for TS-130S/830S	24.50
1317	MB-100	Mobile mount for TS-130S	16.50
1318	SP-100	Matching speaker for R-1000	25.00
1319	SP-120	Matching speaker for TS-130S etc.	23.00
1321	AT-130	Antenna tuner to match TS-130S	79.00
1322	TS-130S	Solid state HF transceiver	515.00
1323	DFC-230	Dig. rem. frequ. controller	175.00
1324	TS-180S	Solid state TCVR, 160-10m	669.00
1325	AT-230	Antenna tuner to match TS-830S	119.00
1326	TS-530S	All-band HF TCVR, digital	529.00
1327	SP-230	Speaker to match TS-530S/830S	35.00
1330	TS-830S	All-band HF TCVR, digital	679.00
1332	R-1000	Gen. cov. receiver, digital	295.00
1333	DCK-1	DC operating kit for R-1000	8.26
1334	TR-2300	2m FM portable TCVR, synth.	164.95
1337	TR-2400	2m FM hand portable transceiver	195.00
1338	TR-7625	2m FM 25W TCVR + memory	215.00
1341	TR-9500	70cm FM/SSB/CW mobile TCVR	440.00
1343	TR-8400	70cm FM mobile TCVR, synth.	289.00
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1345	SMC-24	Speaker/microphone for TR-2400	15.95

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DX "PENETRATOR"

HERE'S THE SPECIFICATION . . .

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

HERE'S WHAT THE CUSTOMERS SAY!

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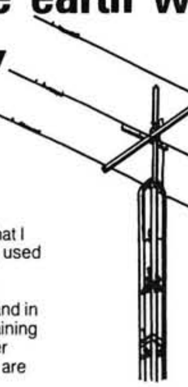

DX 33
3 Element
3 Bands

NOW IN USE FROM VK7 TO VE7!

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DX-33	3-element, 2kW, 10-15-20m	£149.50
DX-34	4-element, 2kW, 10-15-20m	£212.75
DX-6V	Vertical 10-80m	£74.75
DX-103	3-element, 10m	£74.75
DX-105	5-element, 10m	£97.75
TD1/10/80	Trapped dipole, 10,40,80m	£45.42
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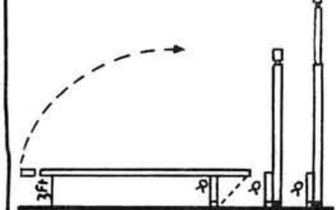
The ULTIMATE in MAST design (i.e. STRENGTH OF MAST FOR £ SPENT!)



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The ULTIMAST is a tubular steel two-section mast which is telescopic and tilt-over. Constructed of two steel tubes – the lower square section and the upper round section – and hot-dip galvanised for corrosion resistance, the ULTIMAST telescopes up to 30ft (9m) and down to 15ft (4.5m). Secured to a square section tubular base post, the mast can be tilted over to only 3ft (1m) above ground for ease of access to antennas. Two head units allow clamping of rotor to 2" (50mm) dia. stub, or internal flat plate mounting.

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- ★ For HF and VHF antennas

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The PM-2000A is an accurate means of measuring your peak envelope output of power on SSB. The unit has been inspected by the home office and found suitable for its purpose. SWR measurements can also be made, but the PM 2000A does what all other SWR meters cannot do; i.e. tell you your peak output power as required in your licence.

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FT1012FM	160 10m 9 Band Transceiver	535.00
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SP901	External speaker	31.00
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FP707	230 volts AC power supply	99.00
FC707	Aerial tuner (unbalanced only)	85.00
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MMB2	Mobile mounting bracket	16.00
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MMB 11	Mobile mounting bracket	22.25
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IC290H	2m multimode mobile 25W	419.00
IC2E	2m FM synthesised handheld	169.00
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ICL1 2 3	Soft cases	4.25
ICHM9	Speaker microphone	15.00
ICCP1	Car charging lead	3.75
ICBP2	6V Nicad pack for IC 2E	33.00
ICBP3	9V Nicad pack for IC 2E	23.00
ICBP4	Empty case for 6 × AA Nicads	6.95
ICBP5	11.5V Nicad pack for IC 2E	44.00
ICDC1	12V adaptor pack for IC 2E	9.75

TRIO-KENWOOD

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TS930	Gen. coverage transceiver **NEW**	1100.00
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AT130	100W antenna tuner	79.00
TR2500	2m FM synthesised handheld	217.00
HC10	Digital desk World Clock	58.75
DM801	Dip meter	P.O.A.
R600	Gen. coverage receiver	235.00
R2000	Gen. coverage receiver	395.00

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	ARE Communications	
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	Fairmate	
AS32320	VHF UHF scanning receiver, air band military police	149.00
	FDK Air Band	
ATC720	720 channel air band handheld	129.00
ATC720SP	Professional version of above	189.00
	JIL	
SX200N	16 channel memory, synthesised AM FM	259.00
	Maximal-Mickey	
MK4000	8 channel memory, 70 80MHz, 140 176MHz, synthesised	99.00
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2M 50W	144MHz 30 50W	69.00
2M 100W	144MHz 100W + preamp	129.00
MR 150W	144MHz 130 150W + preamp	169.00
MR 250W	144MHz 250W + preamp	325.00

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TeleReader CWR685 RTTY CW ASCII	769.00
TeleReader CWR670E As above Rx only	345.00
TeleReader CWR610E Basic unit	189.00

TOKYO HY-POWER

HL32V	VHF 30W linear 1 5W drive HI LOW output	53.50
HL82V	VHF linear preamp output meter 2 12W in 35 85 + out	144.50
HL160V	VHF linear preamp output meter 1 10W in 160W + out	242.40
HL45U	UHF linear preamp 2 15W in 10 45W out	119.75
HC150	HF ATU SWR/Power meter 200W PEP	62.50
HC2000	HF 2kW ATU SWR Power meter 6 POS ant. switch. 6 to 1 vernier high Q coils 2kW peak 1kW continuous	276.55

HI-MOUND MORSE KEYS

HK702	Up down keyer marble base	24.50
HK704	Up down keyer	16.68
HK705	Up down keyer	12.50
HK706	Up down keyer	13.75
HK708	Up down keyer	11.96
HK808	Up down keyer marble base	39.57
MK704	Twin paddle keyer	10.95
MK705	Twin paddle keyer marble base	22.00

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12/6A Power supply, 13.8V.6 amp fully protected	48.30
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12/24A Power supply, 13.8V.25 amp, fully protected	125.45
12/40A Power supply, 13.8V.40 amp, fully protected	225.40

DRAE

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4 amp	30.75	6 amp	49.00
12 amp	74.00	24 amp	105.00

VHF Wavemeter 130/450MHz	27.50
Morse Tutor	49.00

ALINCO

ELH 230	2M RF amp 3W in/30W out	39.00
ELH 720	70cm RF amp 1W in/10W out	59.00
EMR 400	Rotator – heavy duty	89.00

TET ANTENNAS

AX210N	10 ele. yagi for 2m crossed	74.95
HB10F2T	2 ele. 10m mono band beam	51.50
HB10F3T	3 ele. 10m mono band beam	74.95
HB15F2T	2 ele. 15m mono band beam	60.66
HB15FT	3 ele. 15m mono band beam	93.46
HB15M25P	VP mini size 15m 2 ele	69.50
HB15M35P	VP mini size 15m 3 ele	102.30
HB34D	4 ele. tri band beam 10/15/20m	222.90
HB33SP	3 ele. tri band beam 10/15 20m	192.50
HB35C	Tri band array 10 15 20m	283.95
HB35T	5 ele. 10 15 20m	278.50
MV3BH	Vertical for 10/15/20m	37.99
MV4BH	Vertical for 10/15/40m	48.90
MV5BH	Vertical for 10 15 20 40 80m	63.95
MLA4	Loop antenna 10 15 40 80	105.60
SQ22	Phased 2 ele. swiss quad 2m	58.95
SQY06	6 ele. quagi 2m	45.75
SQY08	8 ele. quagi 2m	52.75
HB210S	10 ele. dual driven yagi 2m	47.99
TE214	14 ele. long yagi 2m	74.40
SSL720	9 × 2 ele. (18) slot fed 70cm	77.20
HB23SP	2 ele. tri band beam 10 15 20m	135.60
SSL218	9 × 2 ele. (18) slot fed 2m	144.79
TPH2	Phasing harness 2m	17.25
QYU10	10 ele. quagi 70cm	67.90
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9502B	Colorotor (Med. VHF)	56.60
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KR 600RC	Kenpro inc. lower clamps	P.O.A.

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SP250	1.8-60MHz 20-200-2kW	49.50
SP350	1.8-500MHz 5-20-2kW	59.95
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MMC 432 28S	7cm converter to HF Rig	37.90
MMC 432 144S	70cm converter to 2m Rig	37.90
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SP300	SWR PWR Meter H.F./2M/70cm	97.00	(1.50)
SP400	SWR PWR Meter 2M/70cm 150W	69.95	(1.50)
SP600	SWR PWR Meter H.F./2M/2KW	97.00	(2.00)
SP10X	SWR PWR Meter H.F./2M	24.45	(0.75)
SP350	SWR PWR Meter H.F./2M/70 200W	59.95	(1.50)
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TRIO TS830S

TRIO R2000

DATONG PRODUCTS

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KR400RC	Kenpro – inc lower clamps	125.00	(2.50)
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PW Comment

Jamming

AT THE RECENT European DX Council Conference in London, undoubtedly the topic arousing the most interest among broadcasters and listeners alike was jamming of the short-wave broadcast bands. Jamming (the creation of deliberate interference) is not new, but seems to have reached a new peak of intensity during the past two to three years.

The jamming transmitters are located mainly within the USSR and Eastern Bloc countries, though they have also been used recently in Argentina, Chile, China, the Middle East and southern Africa. Representations have been made in the past to the offending administrations by the International Telecommunications Union in Geneva, and through diplomatic channels, but to little effect. The offenders admit that they do carry out jamming, but justify it on the grounds that they are preventing civil unrest by stopping their citizens from hearing news and comment which they see as propaganda against the state.

For the broadcasters, jamming is something of a political hot potato. You will often hear apologies for poor reception "due to ionospheric disturbance", but never because of deliberate interference. Perhaps it might help if the jamming was more openly acknowledged and discussed over the air, although there is of course the counter argument that it might encourage the jammers by letting them know their effectiveness.

The broad signals from the jamming transmitters affect not only the broadcast at which they are aimed, but also those on the two adjacent channels and sometimes beyond. The simultaneous use of several frequencies by broadcasters in an attempt to "get round" the deliberate interference wastes valuable spectrum space, which is now being squeezed still further by the reduction in maximum usable frequencies brought about by the changing sunspot cycle.

In 1984, the first of two special World Administrative Radio Conferences for the short-wave broadcast bands is sure to see great pressure for increased frequency allocations from the administrations of the developing countries. These administrations have previously been somewhat unsympathetic to the case against jamming, dismissing it as a problem affecting only Europe. But the congestion which jamming causes across the whole of the short-wave broadcast bands must affect them too, in their efforts to develop their own national and regional services.

Member clubs of the European DX Council pledged themselves at the EDXC Conference to pursue a programme of gathering information on jamming and to communicate their concern to the appropriate authorities. Pressure by individual DXers, in letters to their MPs or other elected representatives or to the listeners' letters features of stations such as Radio Moscow, on behalf of all short-wave listeners around the world, can surely help. And when better to do it than in 1983—World Communications Year.

Geoff Arnold

PW Services

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

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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.

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

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

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

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Name in full (State Mr, Mrs, Miss or Title)

Address

Post Code

Occupation Age Phone No. (Home) (Work)

I/We hereby apply to insure the equipment detailed below

BLOCK LETTERS

	Manufacturer's Name	Model	Serial No.	Description of equipment to be insured e.g. Base station; Mobile; CB; etc.	VALUE £
1					
2					
3	Antennas (Aerials), s.w.r. meters, etc.				

Please continue list of equipment on a separate sheet if necessary **TOTAL SUM TO INSURE £**

DECLARATION: I/We hereby declare that: 1. The sums insured represent the full replacement value of the equipment. 2. I/We have not* had insurance cancelled, declined, restricted, or other terms imposed in any way other than the normal Policy terms. 3. This proposal shall be the basis of the contract and that the contract will be on the Underwriters normal terms and conditions for All Risks and Legal Costs/Expenses cover unless otherwise agreed. 4. I/We have not* sustained any loss or damage to any radio communications equipment or been involved in litigation relating to use of radio equipment during the past three years, whether insured or not. 5. All the above statements made in connection with this proposal are true and no material information has been withheld. 6. I/We understand no liability shall attach until this proposal shall have been accepted by Laymond's and the premium paid in full and a Certificate issued.

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Date Signed

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Mods

No.24 Roger Hall G4TNT(Sam)

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.

As promised a few issues ago, this month's column is an index. Copies of the mods appearing in this list can be obtained by buying the appropriate issue from our back numbers department at: Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Each issue will cost £1 including postage, though some issues are now unfortunately out of print and no longer available. Copies are on file at larger public reference libraries.

Mods No. 1—Nov 1980

Trio TR-2400: How to extend the frequency range and how to run the set from an external power supply.

Mods No. 2—Dec 1980

Yaesu FT-480: A simple external up/down device for mobile mics, listen on the input (semi-reverse repeater) and automatic tone burst.

Mods No. 3—Jan 1981

Trio TR-2400: Extended frequency range without opening the case. **Trio R-1000:** How to alter the bandwidth filters.

Mods No. 4—March 1981

Cambridge Kits: How to extend the range of their Low Frequency Converter. **Trio TS-520:** How to turn off the heaters when only receiving. **Trio TR-2400:** The source of a cheap replacement microphone.

Mods No. 5—April 1981

Trio R-1000: Another way to alter the bandwidths. **Standard C-8800:** Full reverse repeater (a Kindly Note appeared in May 1981).

Mods No. 6—May 1981

Trio TR-2300: Reverse repeater, how to use the l.e.d. to show that the batteries are charging and how to make it light when the toneburst is switched on.

Mods No. 7—June 1981

Icom IC-2E: Semi-reverse repeater, how to extend the frequency range (4 or 10MHz) and two ways of using the set in conjunction with external power supplies.

Mods No. 8—Aug 1981

Trio R-1000: How to make the a.g.c. switchable. **Trio TR-9000:** How to make the HI/LO power switch operate on s.s.b. **Yaesu FT-480R:** A tip on using the auto-clarifier.

Mods No. 9—Sept 1981

Icom IC-2E: A tip on the type of switch to use for listen input. **Trio TR-2400:** How to add a HI/LO power switch to conserve the batteries.

Mods No. 10—Nov 1981

Tweezers: A novel use for the plastic tweezers that were given away with the Dec 1980 issue. **Trio TS-770E:** Full reverse repeater. **Icom IC-2E:** More hints on how to use this set with an external power supply.

Mods No. 11—Dec 1981

Yaesu CPU-2500RK: Semi-reverse repeater and extending the frequency range.

Mods No. 12—Jan 1982

Trio TR-9000: How to fit a battery back-up for the memories and semi-reverse repeater.

Mods No. 13—Feb 1982

Trio TR-9000: Memory scan, extended frequency range and how to alter the channel spacing.

Mods No. 14—March 1982

Bearcat: Extending the frequency ranges of both the 220FB and 250FB.

Mods No. 15—April 1982

First index.

Mods No. 16—Aug 1982

This month's page was devoted to readers' requests for help with their mods.

Mods No. 17—Nov 1982

Icom IC-25E: Extending the frequency range (10MHz) without opening the case. **Trio TR-9000:** Extending the frequency range (10MHz) without opening the case. **Azden PCS-3000:** Extending the frequency range (10MHz). **Yaesu FT-290:** Improving the audio.

Mods No. 18—Dec 1982

Yaesu FT-290: Various ways in which the frequency range can be extended and the channel spacing altered.

Mods No. 19—Jan 1983

Yaesu FT-290R: Pushbutton reset to 145MHz, how to adjust the mic gain, how to improve the performance of the output meter and how to modify the squelch for reduced hysteresis, reduced hiss level and faster operation.

continued on page 25▶▶▶

QUESTION?

How did we learn most of the skills we now have? How did we learn to speak, to walk, to write, to ride a motorbike or drive a car?

ANSWER:

Proficient Teachers, Practice and **Practical Experience**

How do we learn Morse? The answer must surely be as above.

LEARNING MORSE

By D.M. Gray G3YPL

THE PROFESSIONAL OPERATOR

● The professional operator, when being trained, is allocated several hours per day, dedicated to the task of learning Morse.

● Firstly he will listen to the Morse being sent—usually learning just four or five letters at a time.

Once he has learnt the characters, albeit at slow speed, **he will then be taught to send Morse**—again at slow speed. This way he learns to form the Morse symbol correctly and becomes thoroughly familiar with the sending key. He will also be taught figures and punctuation during this initial learning period. It is much easier to get the learning over and done with than return to it later.

Although he will be practising his sending only approximately 10 per cent of the time—it is a very important and integral part of the learning process.

● From the earliest opportunity, the professional operator is practising his sending and gaining practical experience at the same time.

● Every so often, perhaps once or twice a week, he will have a 2 minute or sometimes 9 minute speed test—at a speed of at least 2 words per minute **slower** than practice speed.

● These tests are designed to find out which letters, figures or punctuation marks, if any, he is experiencing difficulty with.

● For example, he could be confusing "F" for "L" or "A" for "N", "S" for "H" etc. If this does occur, he is given specially structured tracts of Morse to listen to and practise with, which will emphasise the problematical characters, thereby helping him to overcome these problems quickly.

● The method of achieving reasonable speed in receiving and sending Morse can be summed up in a single but often misunderstood word: "practice" the right sort of practice.

● It may help to be more specific on this point because if the learning process is to be understood, it will become obvious why it is essential that: "less than 100 per cent copy is desirable and conversely 100 per cent copy is undesirable".

This may sound paradoxical but the reason for this is to make your brain react a little faster than it normally does!—this reaction must also be a subconscious one.

For example:

> If you can copy 75 per cent of Morse at, say, 15 w.p.m. you may feel demoralised at missing 25 per cent of it. In reality, however, by trying to copy 100 per cent and achieving 75 per cent you have subconsciously taught your brain to react just that little bit faster.
>
> Conversely, if you can copy 100 per cent of what is sent, say at 10 w.p.m.—you get that "good for the ego" feeling of success, and that is all you have done—boosted your ego, not increased your speed. (Ego boosting is also part of the learning process with Morse.)

● When the ears detect the sound of a Morse symbol, the brain has to literally translate this sound into a physical action such as writing the appropriate letter onto paper. Eventually, with enough practice, this action becomes second nature and you no longer have to concentrate so hard on listening and writing.

● When just starting to learn Morse, there is quite a lengthy "thinking" time whilst the translating is going on. The main task is to reduce this "thinking" time to a minimum, and then to eliminate it by letting the subconscious do the translating.

● To sum up, the professional operator is taught Morse under more or less ideal conditions. I was taught Morse under these conditions in HM Forces—in 14 weeks I was working at 20 w.p.m. and tests at 18 w.p.m.

THE AMATEUR OPERATOR

The amateur operator has a fairly tough task, which requires a large amount of self discipline, dedication and patience. Usually you will be learning in conditions far from ideal—often on your own and perhaps with very little guidance.

● You are tired after a day's work and the brain is not reacting as it should. Maybe you have only 30 minutes to give today (last time it was 15 minutes—2 weeks ago!)

● Your local radio club may help (not all clubs give Morse tuition) but that is limited to maybe an hour a week.

There are always the RSGB Slow Morse Transmissions—these are very helpful for learning to receive—but no help at all for sending practice **and correcting any sending faults.**

THE ALTERNATIVES

If you have an "A" class licensee friend, maybe you can enlist his or her help.

Let us assume that you have been lucky and found a G2–3–4 who can **give** you their **time**—and it does require quite a heavy commitment of time by the teacher as well as the pupil. You only have to learn Morse once—they may have taught many others before you!!

Don't forget either they will have to come round to your place, or you to theirs. Whichever way it is—it is a disruption to home life whilst you both secrete yourselves away for a "C.W." session. Finding a relatively quiet corner in either house can also prove difficult.

However, with a pupil : teacher ratio of 1:1 this would be just about ideal. With plenty of time for both receiving and sending in a ratio of approximately 90:10. In fact, **time is of the essence.**

To achieve speeds of 12–15 w.p.m. a considerable amount of time **must** be devoted to the task.

The problem is time!

Time (when)
Time (how long)
Time (how often)

All these factors to the amateur are variable and **limited.**

You would be a lucky and rare person indeed if you could devote all your spare time to the hobby. However, the car needs attention—the XYL wants the kitchen shelves put up—junior op. wants his bike mended—boss wants that urgent report—garden needs weeding—garage needs tidying up—dog needs a walk—**and you still have to find time to learn Morse—when?**

When you can—the odd half hour here or there. The problem is that although these "odd" half hours soon add up, they are irregular in arriving and they don't often give much warning either.

When they do come—is your teacher available at such short notice? Maybe he also has shelves to put up, bikes to mend, gardens to weed, a dog to walk or even a rig to try to use! Travelling between the two homes can often take up much of the spare half-hour, too.

What do **you** do with the odd half hour? In the shack no doubt and on the air!

Just think of it—wouldn't it be great if there were just a few kHz on 144MHz (say 100–150kHz in the "multimode" section) where **Class "B"** licensees could receive and **send** Morse with Class "A" **and** "B" licensees. Perhaps using F2 mode (telegraphy by on-off keying of a frequency modulating audio frequency, or on-off keying of a frequency modulated emission)—maybe no more than 5 watts or so.

Yes—just think about all the advantages there would be:

1 It would encourage Class "A" licensees to be more active on 144MHz with Morse. (I have spent many hours calling CQ in Morse on 144·050 with only 4 contacts in 2 years!)
I for one would be only too pleased to send to, and listen to, slow Morse from a learner during my "odd" half hour.
2 It would be well within the spirit of amateur radio in as much as "part of the self training of the licensee in communication by wireless telegraphy" (*sic*).
3 144MHz because more Class "B" licensees have equipment for this band than for the h.f. bands. Radio amateurs in the UK have sole usership of the 144MHz band, too.
4 F2 Mode because I would estimate 99·9 per cent of Class "B" licensees have at least f.m. receive and transmit (even the ubiquitous "hand held" with a "rubber duckie" can be used in F2 mode).
To send F2 all you need to do is use an audio oscillator coupled into the microphone circuit (the tone burst for access to repeaters is in fact F2 mode!). The receivers require no modification at all.
5 Low power—because the intention is as defined in para. 2 and not for DX chasing!
6 The rate of converting from Class B to Class A would be increased.
7 The Class B licensee would have the opportunity to **practise** by sending **when** he can—on air—with others invoking a kindred spirit of self help.
8 It would complement and supplement existing slow Morse transmissions.

DISADVANTAGES

(i) There are likely to be some awful squeaks and hisses and some of the grottiest Morse anyone had ever heard!
(a) firstly, confining within 100–150kHz should help to eliminate interference to other users.
(b) secondly, lowish power should contain the "noises" geographically.

(ii) **It is illegal!!**

Really it does not appear to make sense that it is illegal. After all is said and done—the new schedule from the Home Office states in Section "D" of the footnotes, "Data transmission may be used within the band 144–145MHz and above, provided:
(a) the station call sign is announced in Morse or telephony once every 15 minutes.
(b) the emission is contained within the band width normally used with telephony.

A literal interpretation of this footnote would suggest that the Class B licensee can identify his data transmissions in **Morse** as an alternative to voice!—but I'm sure that is not the intention nor is it my intention to suggest "splitting hairs on technicalities".

If a Class B licensee is not permitted to send Morse "live" and "on air" on 144MHz, an analogy would be to say that a learner driver is not allowed to drive a car on any public road until he has passed his test! Or a non-swimmer is not allowed to go to public swimming places until he can prove his proficiency in swimming!

I am not advocating the initiating of a "novice" licence but a piece of practical help.

"Please Mister Home Office—can you help? Please may the B licensees use Morse for practice?"

G3YPL

PW RADIO PROGRAMS-2

STRUCTURED MORSE LEARNING COURSE

ZX81+16K

by D.M. Gray G3YPL

The concept of a Structured Morse Learning Course grew from a simple request by a G6 for a random Morse program to run on a low-cost microcomputer. In writing the program presented on the *PW* Radio Programs-2 cassette I have drawn on the methods used in my own training and incorporated these into the program. I was lucky in that I was taught Morse professionally and as well as being paid to learn I was given the daytime for my lessons.

The program concept takes into account that the student need **not** have prior knowledge or experience of Morse. Some Morse teaching devices and programs rely on the student knowing the Morse code, albeit at about 2w.p.m.

Unless the "tutor" not only sends the Morse symbol but **also** displays, or "tells", the student what has been sent, **and** does so **immediately after** sending the character, **it does not teach Morse.** It does, however, help to increase speed proficiency.

Even those "tutor" devices or programs which do tell the student what has been sent are limited in as much as:

Most of them teach the whole alphabet in one go, sending randomly any one of the 26 letters, or all the numbers, etc.

Learning Morse is a matter of **repeatedly** listening to a symbol—most "tutors" and programs do not repeatedly send the same symbol other than one chance in 26 (multiplied by the random factor of its software).

Most do not teach amateur punctuation.

The Structured Learning Course overcomes these pitfalls.

Features

This program incorporates some unique features which the author has not yet seen in any other "tutor" or computer program.

The student only learns 4 letters **or** 5 numbers at any one time.

The letters which the student learns are grouped together in such a way that he will learn "opposites", e.g. A ·– N –· D –·· U ··– This also helps in overcoming problem letters later on in the course.

The "learning" programs give the student 2 modes of operation:

Mode 1 sends a letter (or other symbol) at a single character speed of 12w.p.m. and then immediately displays the character in the centre of the screen. After a suitable pause (simulated 2w.p.m.) **the same character** is sent again and displayed for a similar period. This "Send and Display" routine is repeated three times. After the third time the letter is changed to any one of the other three letters in its groupset. A special routine prevents a letter being sent if it has just been sent three times.

Mode 1 operates for about 15 minutes and the student is advised to listen to the character and then look at the screen for the first two times that the letter is sent. On the third time he should listen and then **write it down.** This process of learning can be summed up in three stages

Listen and look
Listen and look
Listen and **write**

This sequence is repeated over and over again with the chosen four letters.

The student is also advised that the aim is to be able to **not** look at the screen but to listen, write and then look. Once he can write the four letters down without looking at the screen he should change to Mode 2 with the same letters or numbers. After only two or three sessions of Mode 1 the student should be able to use Mode 2.

Mode 2 sends 25 groups of five letters (or other symbols) at 3w.p.m. The groups will be made up from the four letters of the groupset that was learnt in Mode 1. The letters are not displayed until after all 25 groups have been sent to stop the temptation to look at the screen and break concentration. The 3w.p.m. is synthesised, i.e. the character is sent at 12w.p.m. and the inter-character spacing is set to simulate 3w.p.m.

Once the student is conversant with a groupset he is advised to practise it between learning new groupsets. Once all the groupsets have been learnt and practised the student should change to *Program 8 (Speed Practice).*

Speed Practice

This program gives the student a choice of letters or numbers, a choice of quantity of 5 letter groups made up from letters or numbers but not both, and a choice of speed from 3w.p.m. up to well in excess of 100w.p.m. At the end of sending the appropriate quantity of groups the groups are displayed, five per line, as a check back.

In all modes the check back is held on the screen for as long as the student needs it. Pressing any key (except BREAK) allows the program to proceed to the next stage. This allows the student to repeat the last mode used or to return to "Program Control".

Punctuation

The main additional symbols or punctuation characters used in the Amateur Service are also included in the program. They are, of course, not essential in learning Morse for the Amateur Test but have been included to give the student experience with them so that they are not a surprise when he hears them on the air.

Synthetic Speed

Below 12w.p.m. the characters are sent at 12w.p.m. with the inter-character spaces lengthened to give a synthetic lower speed. This has an intrinsic benefit to the student who now has to learn the rhythm or syncopation of the sound of a character as opposed to trying to count the dots and dashes making up that character. This is the usual cause of the well-known 8w.p.m. hang-up.

Above about 8w.p.m. the character takes on a different sound and it is this sound that we must learn. Another sound change takes place at 45–50w.p.m., but never mind that!

The character speed of 12w.p.m. was chosen as this is the speed of the official Morse Test, and this speed gives the student the actual sound throughout the course.

Speed of Learning

If you listen to Morse at a speed at which you can copy 100 per cent then the only thing that will benefit is your ego! Learning Morse requires Effort with a Big E. It demands your time, concentration and determination to make it and get that G4 licence.

To increase speed proficiency you should copy c.w. at 2w.p.m. faster than the highest speed at which you can copy 100 per cent.

It is also very important to write down every letter—if you miss one, put a dot in its place in the middle of the line. This allows you to check back more easily and you can identify the letters that you are weak on.

Copying at 2w.p.m. faster will cause you to think that you are not making any progress because of all those dots on the paper. **Don't believe it!** You will be improving all the time. Try just 10 or 15 minutes at 3w.p.m. faster and then go back to 2w.p.m. faster and see just how many fewer dots there are.

But don't over-do it. 30 to 60 minutes per session is more than ample, and probably 15 to 30 minutes is better to start with. Take at least 30 minutes' break between sessions, and as a final shot at the end of a session give your ego a boost and slow the Morse down to be able to copy 100 per cent for two to three minutes. Then forget all about Morse until the next day! Just half-an-hour every day will get you there soon enough.

Supplementary Practice

Once you have achieved 8 to 10w.p.m. start to try to copy live c.w. off air. It won't be easy, but you will start to recognise some letters and the odd word here and there, but it all helps. Watch out for the anticipation factor, though!

Mixed Letters and Numbers

A sales gimmick used by manufacturers of tutors is to give a mixed letters and numbers feature. In reality, you, as a Radio Amateur, will never be called upon to copy mixed letters and numbers (callsigns and QTH Locators apart). Even as a professional military wireless operator I was **never** required to copy mixed letters and numbers. So why bother to worry yourself with a mode of learning that you will never need? Use the time more usefully in becoming more proficient with letters or numbers.

The argument could be extended to 5 figure or letter groups, but here there is an advantage to the student. Using 5 letter groups removes the anticipation factor from the learning process. Anticipation is a bad habit to get into. It is essential to write down what is being sent—not what you think he might be sending.

For example, anticipating the ending of a word before it is sent stops the brain from working hard for a brief instant. The only way to become proficient at Morse is to

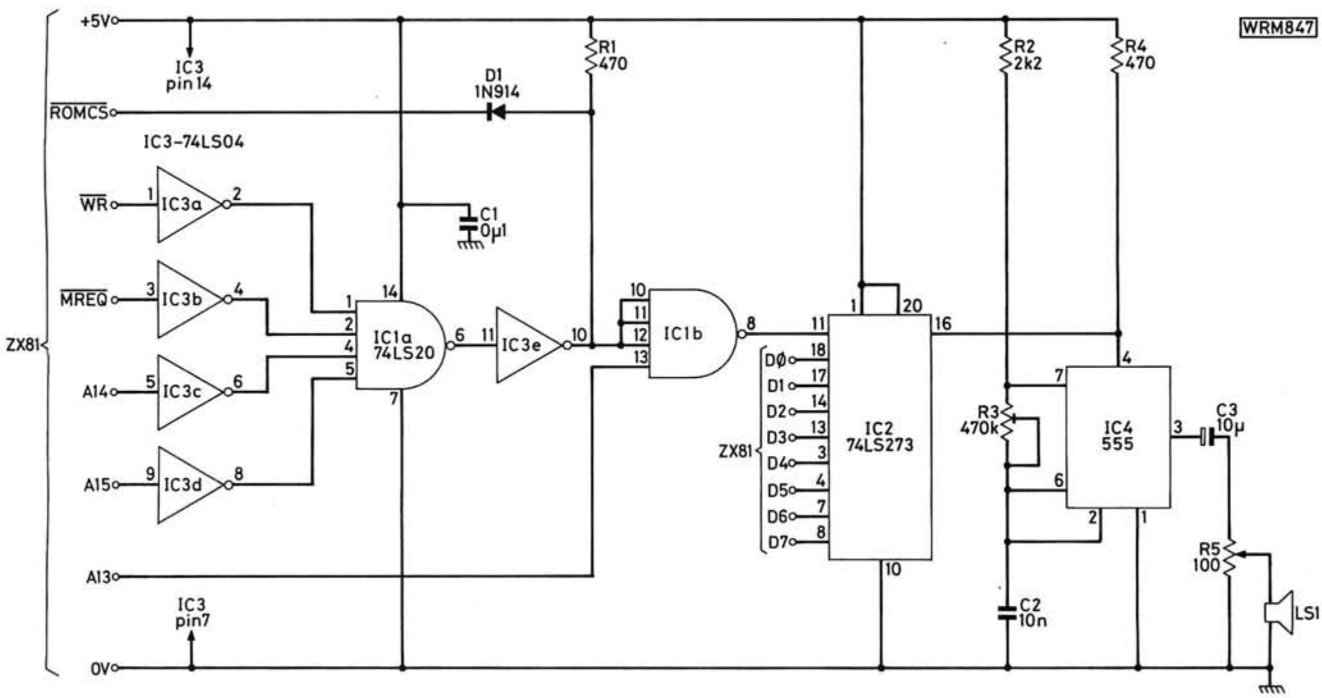


Fig. 1: This simple input port and Morse practice oscillator can be used with the ZX81. The port and oscillator can be tested by POKE 8192,2. The circuit is simply built using Veroboard, no details of the layout are given as most of the "components" on the board will be wire links between the i.c.s. The oscillator can be used with a key for sending practice by connecting the back-contacts between IC4 pin 4 and 0V and disconnecting the link between IC2 pin 16 and IC4 pin 4

push the brain hard and reduce the reaction time between hearing the character and converting that sound into a written character on paper. Using 5 letter groups removes the anticipation factor and keeps the brain hard at it all the time, keeping the learning curve going upwards.

The Output Port

As it stands, the ZX81 will not drive an oscillator or sidetone of a transmitter without some form of interface. The MIC socket output of the computer could have been used but this was rejected on the grounds of poor audio quality and low output level. The use of a more conventional output port has other advantages if you want to use the ZX81 as a Morse sender for meteor scatter etc.

A simple and cheap output port is shown in Fig. 1, and this can be built on a piece of Veroboard. It could be hardwired into the RAM pack edge connector or a mother board could be used to allow it to be plugged into the ZX81 edge connector. The oscillator uses a 555 timer chip driving a small telephone earpiece as a speaker.

Any other output port for the ZX81 may be used so long as its output goes high (1) for address 8192,2.

A cassette with this program on it is available from Practical Wireless Cassette Tape Offer, Dept PWC1, Rochester X, Kent ME99 1AA, price £5.75 inc. postage and VAT. See this page for details.

Timing Errors

To all intents and purposes the correct ratio of pauses for a character speed of 12w.p.m. have been set up in the program. However, not all ZX81s are identical in their internal timing and in some instances the internal clock accuracy may not be tight enough to ensure that the 12w.p.m. practice speed is in fact 12w.p.m.

To ensure that this is so, some form of calibration is needed and the following procedure should be used after loading the program into the computer for the first time.

1) LOAD and RUN the program from the cassette
2) Select *Program 8*
3) On demand enter "1" letters
4) On demand enter "12" groups
5) On demand enter "12" w.p.m.
6) On demand press any key (except BREAK)
7) On the advice "Groups loaded and ready to send" press any key **and at the same time** start a stop-watch going.
8) Time the sending of the 12 groups. This should be 1min 1s (61s). (The extra 1 second is the pause between pressing the key and the ZX81 starting to send the first character.)

If the average time of, say, four timing tests is over 61s the program is slow, if it is under 61s then the program is fast. Correction can be applied as follows:

```
1610 POKE 16605,[1600]/ 12
```

The boxed part [1600] needs changing by 10 up or down until the correct average time is achieved. Changing down increases the speed, up decreases it. If the timing tests give an average time of ±3s of the correct time do not bother to change the timing. ●

Mods

►►►*continued from page 19*

Mods No. 19 (20)—Feb 1983

This month's Mods managed to get mis-numbered in the process of being printed. **Yaesu FT-290R:** Automatic pip-tone on s.s.b. was described and it was suggested that the 3SK88 front-end mod should not be carried out.

Mods No. 21—April 1983

Yaesu FT-290R: Three ways of achieving semi-reverse repeater were described.

Mods No. 22—May 1983

This page was devoted to readers' requests for help.

Mods No. 23—July 1983

IC-25E: Curing the synthesiser hum.

Pass it on...

If you have a mod that you would like to pass on or if you have a request for a mod that you would like to carry out, please write to me at this address: R. S. Hall, Practical Wireless, Room 204B, Hatfield House, Stamford Street, London SE1 9LS.

Uncle Ed

CURRENTS—1

A couple of hundred years ago, when they first realised that there was some sort of current flow involved in the use of electric power, they were a bit in the dark (sorry!). The effects of electric current could be demonstrated—chemical, heating, and (later) magnetic effects—but they didn't know what the current flow was made up of, or which direction it went.

In investigating electrostatics (the science of static electricity, the sort that makes nylon clothes crackle when you take them off on dry, frosty days) it had already been decided that there were two sorts of electricity. These were the charge which was built up on a glass rod rubbed with a piece of dry silk, they called this "positive electricity", and the charge built up on an ebonite rod rubbed with fur, which they called "negative electricity".

When it came to the discovery of the first battery, the voltaic cell (named after its inventor, the Italian scientist Volta), the same names were adopted for the two plates, the copper one was called positive, and the zinc one was called negative (Fig. 1). In talking about this mysterious current flow I mentioned just now, they sometimes found it was necessary to say which direction the flow was going in, and they chose to say it flowed around the circuit from the positive terminal of the battery to the negative terminal.

A century later, the electron was discovered, and it was realised that current in metal conductors was made up of these negatively-charged electrons which flowed from the negative terminal of the battery around the circuit to the positive terminal.

Oh dear! They'd guessed wrong when they made the original choice, but unfortunately one or two conventions had been established with the old system which couldn't just be "turned round" without causing utter confusion. So we finished up with two ways of describing currrent flow, the original way (positive to negative) which they called "conventional current", and the new way (negative to positive) which they called "electron flow".

As long-time readers of this feature will know, I'm very firmly an "electron flow" man. I was taught that way at radio college, and I find it a great help to picture those electrons all rushing round the circuit towards the positive battery terminal (attraction of opposites). If there's a capacitor in the circuit, I can imagine the burst of current which carries the electrons away from one plate, leaving it with a positive charge, and piles them up on the other plate, giving it a negative charge (Fig. 2).

Something that worries beginners very often, is what happens to the electrons after they arrive at the positive terminal of the battery (Fig. 3). Textbooks tell us that the current leaving any point in the circuit must be equal to the current arriving at that point. That means that **inside** the battery, the electrons must flow from the positive to the negative terminal—how come? The answer is that a chemical action inside the battery drives the current through it, and the current in the battery consists of positively and negatively charged ions, rather than electrons. It's really best to ignore what happens inside the battery, and simply to accept the fact that it can cause that flow of electrons around the external circuit.

Although, as I say, my vote goes to "electron flow", I know that I can't avoid finding descriptions in magazines and textbooks based on "conventional current". It's a case of looking at the description and the circuit diagram to decide which system they're using, and reversing your thought process if necessary. If you're dealing with circuits using valves, you have to accept the fact that conventional current flows from anode to cathode, even though the valve really works by the electrons given off by the heated cathode being attracted to the anode which has a positive potential applied to it.

If you're dealing with semiconductor diodes, then on the circuit diagram, the arrow-head which forms the anode part of the circuit symbol is pointing in the direction of conventional current flow (Fig. 4). And in transistors, the same applies (Fig. 5).

I always think it makes understanding a circuit diagram a lot easier if the positive rail of the power supply is at the top and the negative rail at the bottom. Sometimes the negative rail will be the earthy side of the supply, in which case it's convenient to call it "0V", meaning "nought volts" or "zero volts". Sometimes though, the negative rail will be below earth potential, and there may well be a "0V" rail somewhere in between. Roger Lancaster explained this very clearly in Part 1 of his series *"Are the Voltages Correct?"*. No matter how many power supply rails there are, having the most positive at the top and the most negative at the bottom of the circuit diagram means that electron flow will be generally in the direction up the page. Luckily, most circuit diagrams nowadays do follow this convention, though there are exceptions, particularly in American publications.

When I mentioned semiconductors, you no doubt expected me to start talking about "holes". Well, I shall be, but I've unfortunately used up my allotted space, so it will have to be next month. See you then.

Fig 1

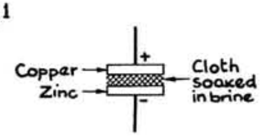


Fig 2

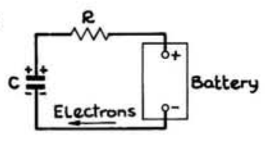


Fig 3

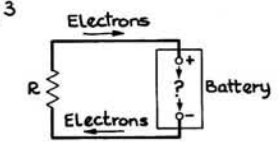


Fig 4

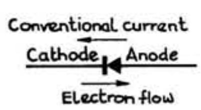
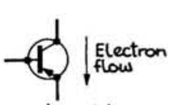
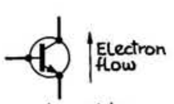


Fig 5(a)



WRM844 pnp transistor

Fig 5(b)



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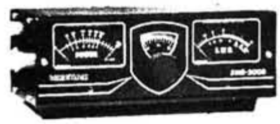

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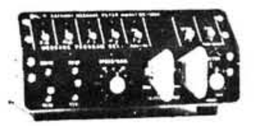

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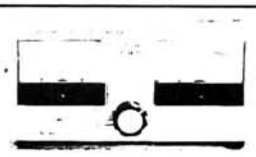

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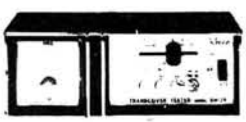

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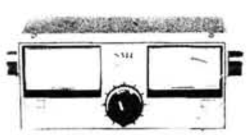

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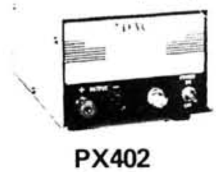

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1·5GHz PRE~SCALER

D.S. POWIS G4HUP Part 2

The construction and operation of this invaluable piece of test equipment was detailed in Part 1 of this article

Setting-up the Pre-scaler

There is very little involved in the setting-up, simply ensuring that the supply voltage for IC2 is correct. Before applying any power to the pre-scaler module, set R6 to the earthy end of its travel. This sets minimum voltage out of the regulator. Connect a voltmeter, set to measure up to 10 volts, between Pin 14 of IC2 and ground, and adjust R6 to give 6·8V (5·2V SP8611B) at this point. The pre-scaler can then be clipped into position and the case screwed up—your pre-scaler is ready for operational testing!

Using the Pre-scaler

Connect the output of the pre-scaler to the input of your frequency counter and switch both units on. With no input to the pre-scaler there should be no count displayed. If your counter has an amplifier input as the *PW* Cranborne does, the use of an attenuator between the two units is advisable—it is essential if measurements below about 800MHz are to be made, as the pre-scaler output will overdrive the counter input. A 20dB loss is sufficient, and either a proprietary BNC unit (such as the RS code 456-144), or a home made unit, as shown in Fig. 2.1 may be used. If the pre-scaler is to be used permanently with one particular counter, as will be the case for most amateurs, then the attenuator can be built on the back of the output BNC socket.

Now apply an input to the pre-scaler. Provided that this is higher than about 300MHz there should be a display, either of the true frequency, if you are using the Cranborne and have the divide by four function selected on the front panel, or of $\frac{1}{4}$ frequency if you have yet to make the counter timebase modifications. Increase the input frequency and note that the indicated frequency increases accordingly.

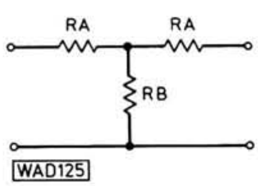


Table 1

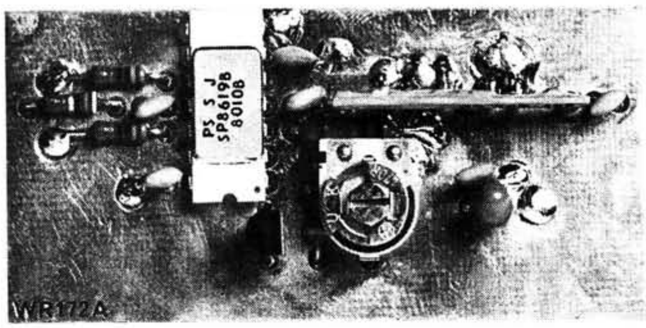
	RA	RB
3dB	10	150
6dB	18	68
10dB	27	33
20dB	39	10

Fig. 2.1: Output attenuator information. Resistors are nearest preferred values in ohms

The signal level is not critical, provided that it is more than a couple of mV (up to about 1GHz) and not greater than 300mV. More information on this is contained in the section on performance.

Variations

There are a number of pre-scaler i.c.s by Plessey Semiconductors that can be used with slight modifications in this design. Table 1 details these devices, their maximum guaranteed frequency and the supply voltage required.



Photograph of the assembled pre-scaler p.c.b.

To provide a 5V supply rail for the i.c., rather than the 6·8V rail, is simply a matter of omitting R5 and R6, and earthing the ground connection of the regulator, IC3.

In the opinion of the author the most cost effective i.c. to use is the SP8617 (see Buying Box Guide in Part 1). For around half the cost of a divide by ten function a system can be built with performance guaranteed to 1·3GHz and in practice measurement capability up to approximately 1·6GHz. The next best solution is to use the SP8611B, if it is felt that the extra 100MHz or so is worth £4 more! It should be borne in mind at this stage that the performance of the OM361 is becoming the limiting factor at about 1·6GHz, so there is little point in spending a lot more on the pre-scaler i.c. Only the SP8617 and SP8619 have been evaluated by the author. The SP8668 is included in Table 1 to indicate the difference in price range between divide by four and divide by ten devices.

Pre-scaler Performance

Measurements made on the unit, using both variants of the pre-scaler i.c., have revealed a very high standard of performance. The input sensitivity is better than 5mV up to over 1·4GHz (1·3GHz for the 8617) and better than 20mV at 1·5GHz (1·4GHz for 8617). The maximum frequency at which a reliable count could be obtained, regardless of signal level, was over 1·75GHz (1·6GHz for 8617). Both in terms of sensitivity and maximum fre-

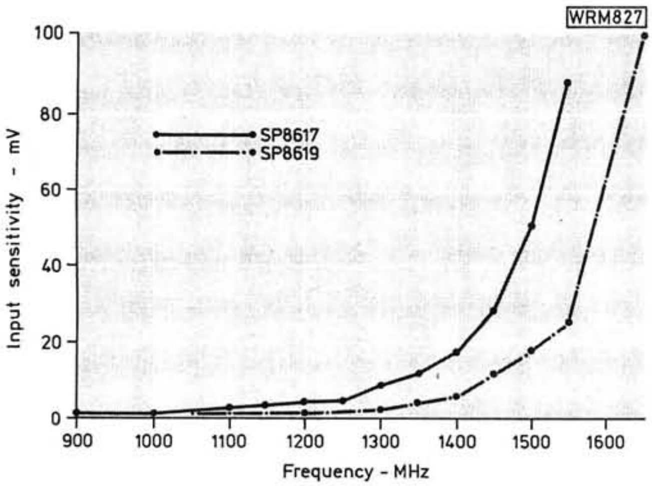


Fig. 2.2: Graph showing input sensitivity against frequency for the 1·5GHz pre-scaler

quency this is considerably better than the author expected when the project was undertaken. Indeed, the degree of sensitivity could prove to be an embarrassment on occasions and it is suggested that a selection of attenuators be constructed, or bought, which can be used in front of the counter. The maximum signal level which the unit would accept was higher than 300mV at all frequencies. The input sensitivity against frequency for the two versions is shown in Fig. 2.2. Minimum frequency of operation was 300MHz. Below this the unit becomes critical of input level and below about 200MHz the slew rate of the signal is too slow.

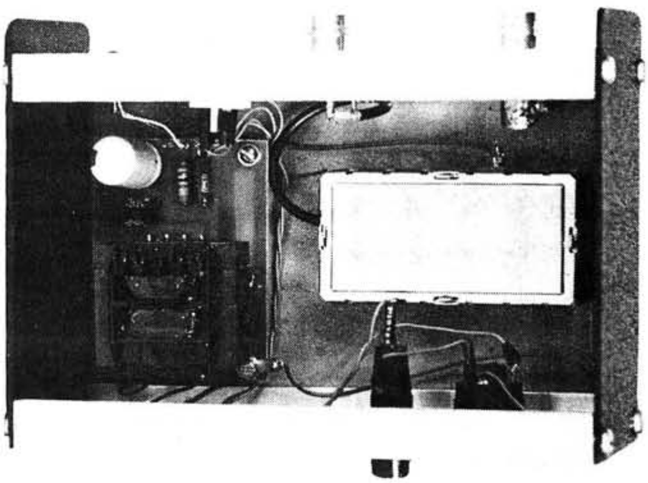
Table 1

Pre-scaler IC	Division Ratio	Max Freq. GHz	Vcc	Approx. Cost £
SP8610	4	1·0	5·0	15
SP8611B	4	1·5	5·0	18
SP8612	4	1·8	6·8	50
SP8617	4	1·3	6·8	17
SP8619	4	1·5	6·8	24
SP8668*	10	1·5		36

*See text

Summary

This unit is a high performance accessory to the *PW* Cranborne, or indeed any other suitable frequency counter, and extends the counter's usefulness considerably. Although a reasonably expensive item to construct the equivalent item commercially is much more expensive. Due to the use of integrated components there are very few things that can go wrong in the construction of this unit.



An internal view showing the general layout of the pre-scaler unit

Acknowledgments

The author is deeply indebted to Ian Strachan of Plessey Semiconductors Limited for device information, Stephen Ibbs for advance information on the *PW* Cranborne, Sam Jewell for background information on u.h.f. pre-scalers, and to various other colleagues and associates for advice and encouragement. ●

New Books

COMPLETE GUIDE TO VIDEO CASSETTE RECORDER-OPERATING AND SERVICING
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Chapter 1 covers the basics of video recorders and the operation of both Beta and VHS equipment. Chapter 2 describes the test equipment and tools required for servicing videos. Chapter 3 deals with typical Beta circuits which should enable the reader to understand the diagrams of similar Beta videos. Chapter 4 deals with VHS videos in a similar manner. Chapter 5 describes the mechanical operation of typical units. Chapter 6 covers typical adjustments, cleaning, lubrication and maintenance procedures, and where it may not be obvious it describes the purpose of the procedure. Chapter 7 deals with trouble-shooting, and also includes service notes for a cross section of videos, both Beta and VHS.

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ANTENNAS PART 7

F.C.JUDD G2BCX

Part 6 of this series considered how antenna performance related to environmental influences. This topic is concluded here together with an examination of earthing arrangements

HF Antennas—Radiation at Vertical Angles

Radiation patterns for h.f. band open wire antennas of various lengths, including the single λ/2, were given in Part 5 but these showed only the relative intensity of radiation in different **horizontal** directions around the antenna. For h.f. band operation it is also important to know the **vertical** angles of maximum intensity, which vary with the height of the antenna above ground and the frequency of operation.

The patterns shown in Figs. 7.1, 7.2, 7.3 and 7.4 are classical and apply to virtually all horizontal antennas which may be a single λ/2 or a number of half-waves operated in-phase (colinear) or out-of-phase (open long wire). These patterns illustrate the lobe formations and their respective vertical angles, which, if the radiation were visible would be seen when looking along the antenna from one end.

If we take Fig. 7.1, it can be seen that maximum radiation in the vertical plane is at high angles when the antenna height is λ/4 above ground. This would be acceptable for operating fairly short skip on say 3·5MHz although the actual height of the antenna would be about 20m too high

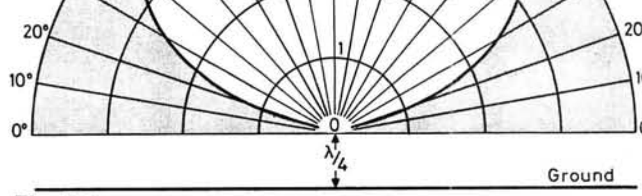

Fig. 7.1

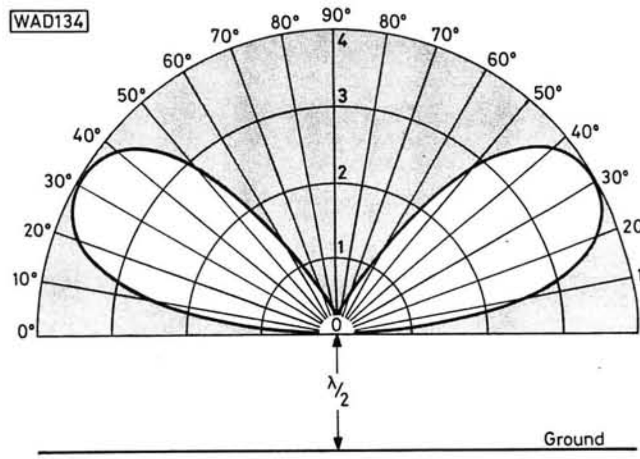

Fig. 7.2

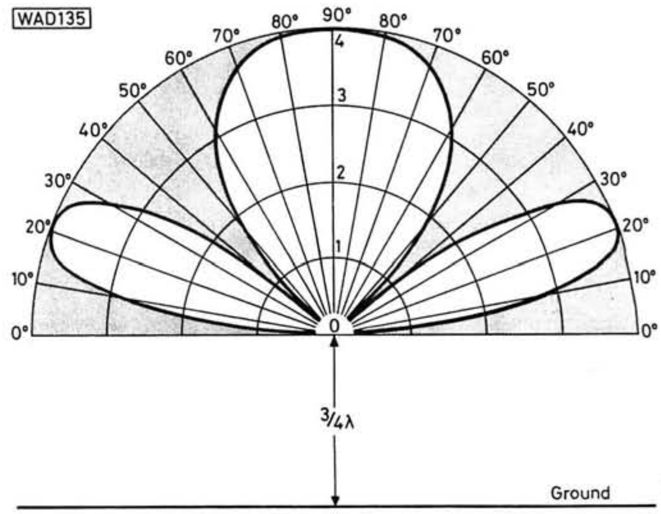

Fig. 7.3

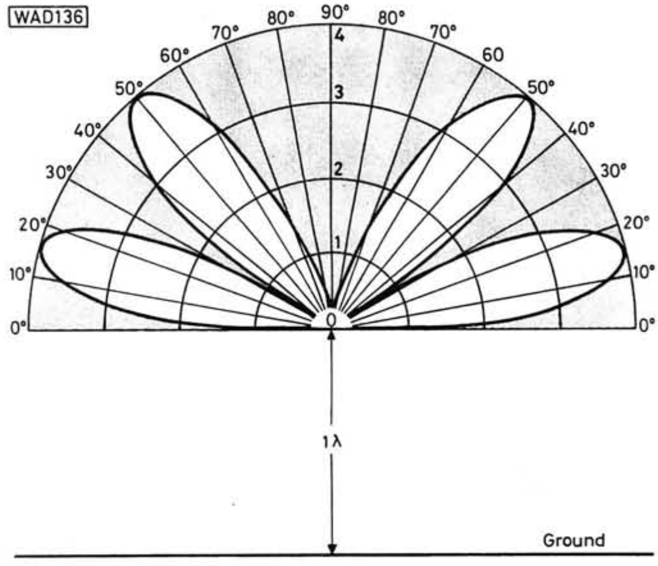

Fig. 7.4

for some. A more practical height would be between say 9 and 12m but the vertical angle of maximum radiation would still be high.

As another example consider a λ/2 on say 14MHz (or a long wire) at a height of λ/2 at the frequency of operation. This means an antenna height of approximately 9m, or a little over, which produces the dual lobes each at the acceptably low angle of 30 degrees and with no wasted radiation in secondary lobes as shown in Fig. 7.2. A better angle for DX working would be about 15 to 20 degrees which would mean raising the height of an antenna for 14MHz to 13·7m, or approximately 3λ/4, as in Fig. 7.3, or alternatively to the whole wavelength (18·3–20·1m) as in Fig. 7.4. The former would mean a large amount of radiation going straight up and consequently wasted, whilst the latter at one wavelength above ground provides four main lobes of more or less equal amplitude at approximately 15 and 50 degrees respectively.

It should be remembered that the angles of vertical radiation and their amplitude can vary somewhat depending on the conductivity of the ground beneath.

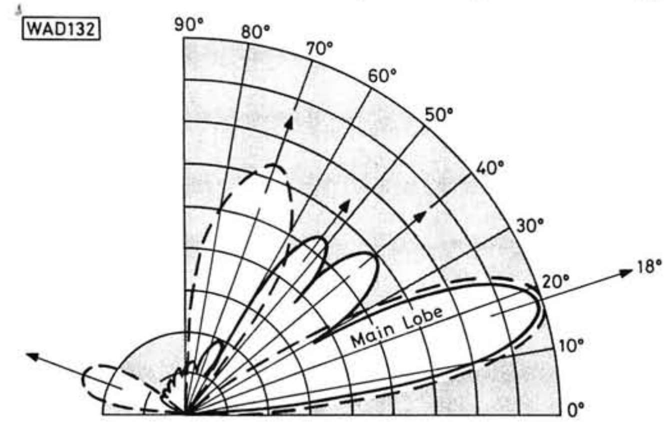

Fig. 7.5: Vertical angle radiation pattern from a two-element h.f. quad. The dotted line pattern with antenna at 5λ/8 above ground. Solid line pattern with antenna at λ above ground

Such patterns do however show the need to consider and if possible experiment with different heights. A good example of variation from the theoretical is illustrated by the vertical angle radiation patterns from a two-element quad antenna, as shown in Fig. 7.5. When operated at two different heights the only significant variation is in the angle and amplitude of the secondary lobes. The main lobe angle remains at 18 degrees and is about right for average DX working on h.f. bands such as 21 and 28MHz.

Earthing Influences

The relatively close proximity to earth of all antennas designed for operation at frequencies ranging from those used for l.w. and m.w. broadcasting up to at least 30MHz, including the amateur h.f. bands, plays a very important part in the **vertical angle** radiation, regardless of whether the antennas are horizontal or vertical.

Ground Reflection

For the purely theoretical explanations we need to assume that the earth occupying a large area around the antenna is a flat plane and has perfect conductivity. Earth reflected waves from an antenna combine with waves radiated at angles above the horizontal plane and do so in various ways depending on the orientation and length of the antenna and its actual height above the surface of the

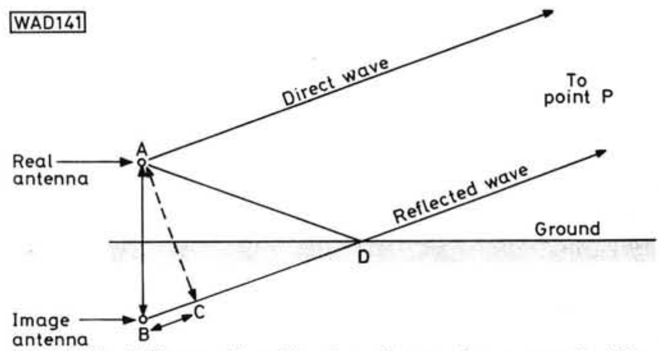

Fig. 7.6: Effect of reflection from the ground. The reflected wave travels a greater distance (B-C) than the direct wave

earth. In practice the electrical characteristics of the earth itself, mainly its conductivity and dielectric constant, have considerable influence on antenna performance.

Radiation from an antenna at angles lower than horizontal (parallel to ground) i.e. directly from the antenna toward earth, is reflected upward again just as light waves are by a mirror. The angle of reflection is the same as the angle of incidence which means that a wave meeting the surface of the earth at an angle of say 20 degrees, would be reflected upward at the same angle. At some vertical angles above the horizontal the direct and reflected waves may both be exactly *in phase,* in which case the resultant field strength will be equal to the sum of the amplitudes of both fields. At other vertical angles the waves may be *out of phase,* the resultant field strength being determined by the amount of phase difference, e.g. complete phase opposition results in a zero amplitude field.

The overall effect on antennas relatively close to the ground is therefore an increase in radiation at some angles and a decrease, or even no radiation at all, at others. The function of ground reflection is illustrated in Fig. 7.6.

At a relatively long distance from the antenna the two waves, one direct and one reflected and meeting at a distant point (P), may be considered to be parallel, but the reflected wave has to travel a greater distance (B-C) to reach (P). It is this difference in path length that accounts for the phase effect described previously.

What is generally known as the *image* antenna is also used to illustrate the effect of reflection. As shown in Fig. 7.6, the reflected wave would have the same path length (AD = BD) if it originated from an antenna with the same electrical characteristics as the real antenna, but is otherwise located below the ground to a depth equal to the height of the real antenna above the ground. Like an image seen in a mirror, the reflected antenna is in reverse as shown in Fig. 7.7. If the real antenna is a horizontal dipole situated half a wavelength above the ground then its instantaneous charge during one half cycle is also reflected but the image antenna assumes *its* instantaneous charge in *opposite* polarity.

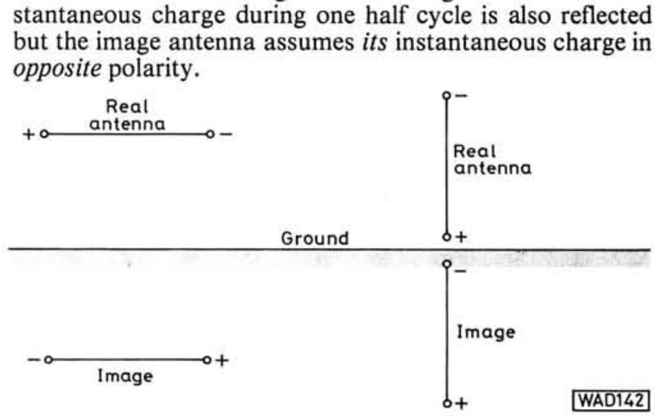

Fig. 7.7: Horizontal and vertical half antennas and their ground images

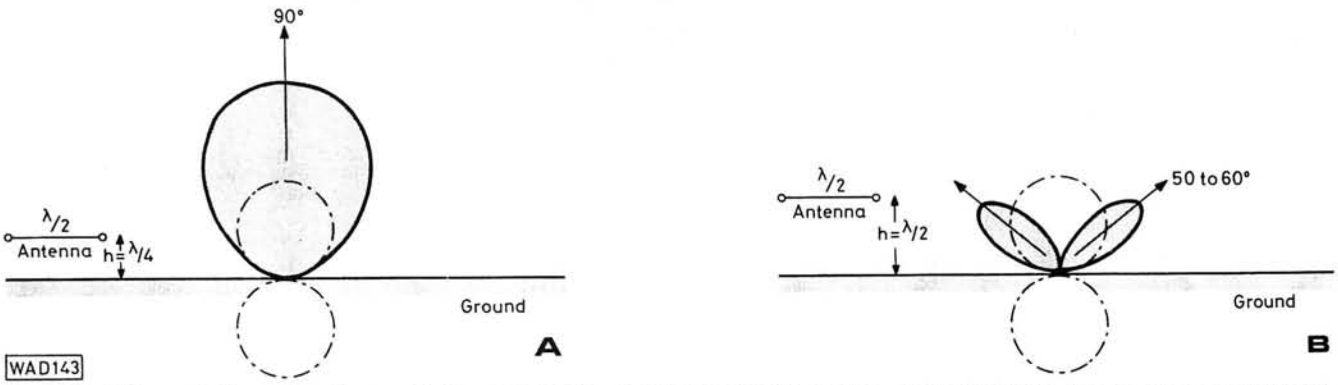

Fig. 7.8: Effect of the ground on radiation from a horizontal half-wave antenna for heights of a quarter-wavelength (a) and a half-wavelength (b). Dotted lines show what would be the normal "free-space" patterns

If on the other hand the real antenna is a λ/2 vertical with one end close to ground, with an instantaneous positive charge at that end for example, then the end of the *image* antenna nearest the surface of the ground will be charged negatively. In the foregoing examples the currents in the *horizontal* antenna are 180 degrees *out of phase* but the currents in the *vertical* antenna and its image are *in phase*.

The overall effect of reflection from the ground, although different for horizontal and vertical antennas, is such that the resultant vertical angle radiation patterns from either are really modifications of the normal free-space patterns. The case for a horizontal λ/2 dipole at two different heights above ground is shown in Fig. 7.8.

Ground Characteristics

Normal ground is far from being a perfect conductor of electrical current but its behaviour with regard to radio waves depends largely on the frequency used for transmitting.

At low frequencies (standard broadcast long and medium waves) the ground generally acts as a fairly good conductor, allowing radiation to penetrate to a considerable depth and thus frequently find a large sub-ground area in which current will flow. The ground resistance will also be fairly low if the area cross-section is large enough. This characteristic is still fairly good even at frequencies as high as 3·5MHz. At higher frequencies however, the penetration of radiation decreases and the ground may even behave as a lossy dielectric causing radiation from the antenna into the ground to become more absorbed as the frequency increases; e.g. from about 7 to 21MHz. This applies to both vertical and horizontal antennas.

Since the effective reflecting portion of the ground rarely coincides with the actual surface and is usually to be found at a few metres below, there will be some influence on the "electrical" height of the antenna[1].

Ground Screens

The effect of perfectly conducting ground can of course be simulated by providing a circular (or square) screen of meshed wire (chicken wire or similar). Alternatively a large number of copper wire radials (certainly more than 50 equally spaced) just beneath the surface or even on top. The screen or radials should extend in every direction from the base of the antenna, if vertical, for a distance of at least one wavelength at the frequency of operation, or from beneath the centre point of the antenna if this is horizontal. An artificial earth of this nature will tend to re-establish

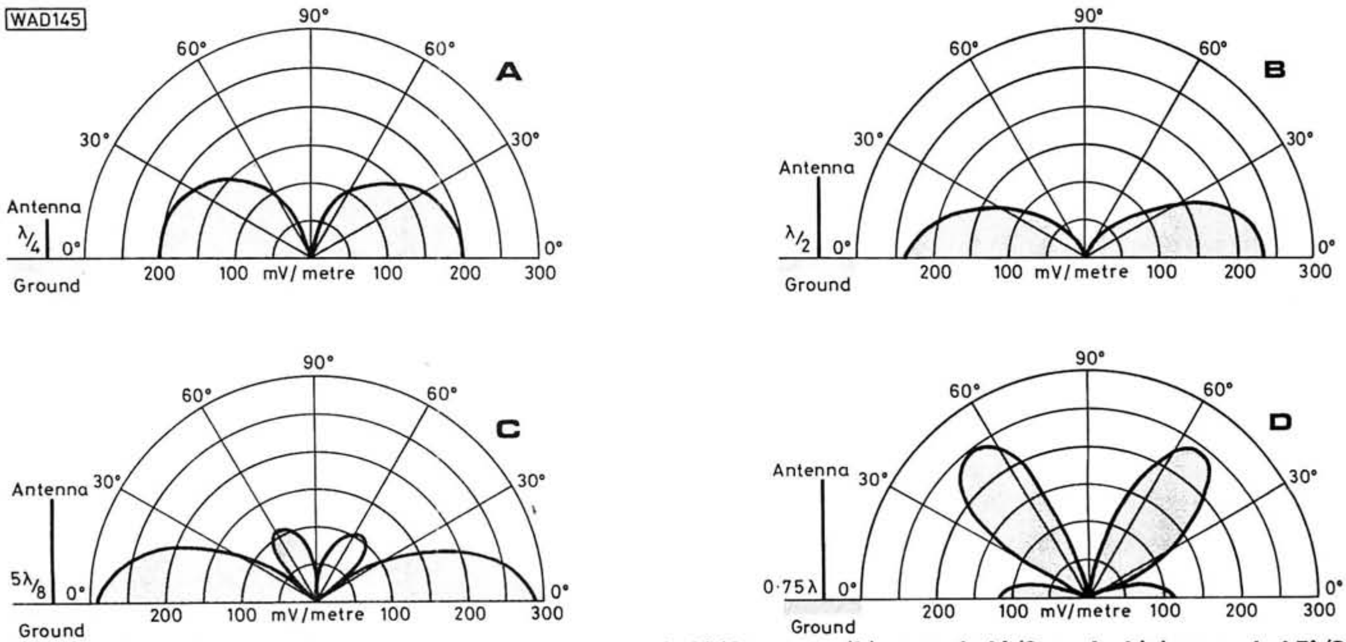

Fig. 7.9: Vertical angle radiation patterns from (a) grounded λ/4 antenna (b) grounded λ/2 vertical (c) grounded 5λ/8 vertical (d) grounded 3λ/4 vertical. Note that these antennas are otherwise omni-directional; some gain is available from the 1/2 and 5λ/8 antennas but only when operated against an infinite ground area with perfect conductivity

the electrical height of the antenna and restore its radiation resistance to something like the true value.

Of course this is fine for broadcast stations, who have large areas of ground at their disposal, but is not very practical for the radio amateur, even one with a fairly large garden, or even a couple of acres of ground. For most h.f. band applications a good direct connection to earth will help considerably and a long piece of copper pipe, of as large a diameter as possible, buried to a depth where the soil is likely to remain moist and therefore fairly conductive, is about the best one can do as an alternative to a buried radial system. Use a heavy gauge copper wire to connect back to the transmitting equipment. Incidentally, although the transmitting/receiving equipment may be "earthed" via a mains socket earth connection, this does not make a good r.f. earth and can lead to BCI and TVI problems due to r.f. circulating around all the earthing lines of the household mains supply wiring.

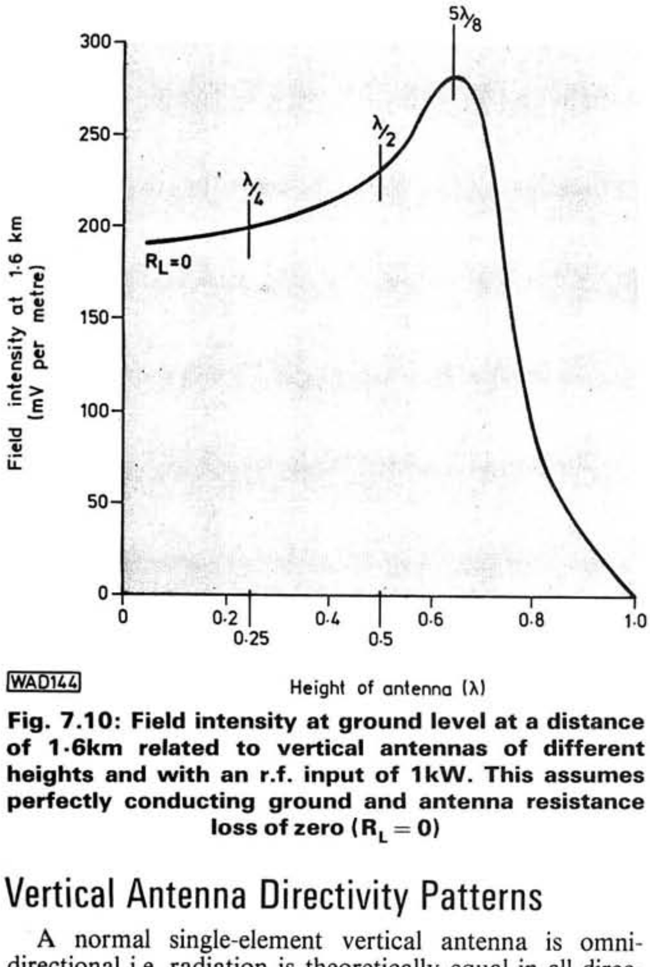

Fig. 7.10: Field intensity at ground level at a distance of 1·6km related to vertical antennas of different heights and with an r.f. input of 1kW. This assumes perfectly conducting ground and antenna resistance loss of zero ($R_L = 0$)

Vertical Antenna Directivity Patterns

A normal single-element vertical antenna is omnidirectional i.e. radiation is theoretically equal in all directions around the antenna. However, it is helpful to have some understanding of the vertical angle radiation directivity for vertical antennas of different heights *but with the base at ground level.*

Such antennas are commonly used for broadcast stations in conjunction with a large area artificial ground screen or radial system. The field intensity from vertical antennas of various heights is shown by the graph, Fig. 7.10. Note that a vertical antenna with a physical height of about 0·64λ yields the greatest field intensity. Its performance and electrical function bear a close resemblance to that of the 5λ/8 antenna used with a ground-plane for v.h.f. application. Both configurations may have stemmed from an antenna known as the double extended Zepp[2]. Classical vertical angle radiation patterns are given in Fig. 7.9.

Fortunate indeed would be any radio amateur able to set up vertical antennas for say 3·5 or 7MHz at a height of approximately λ/2. Even a full λ/4 vertical for 3·5MHz would be some 20m high and a 5λ/8 vertical for 7MHz would be approximately 25m high. All this is apart from providing a large area earth radial system as described earlier in order to ensure the requisite low angle radiation. Hence the inductively loaded multi-band vertical has become popular for h.f. bands operation because of its low physical height and the use of either a relatively small resonant radial system or direct earth connection.

This form of antenna will be dealt with next month.

References

(1) *Antenna Theory and Design.* Vol. 2. H. P. Williams PhD. Published by Sir Isaac Pitman and Sons Ltd.

(2) *The ARRL Antenna Handbook.* US publication. American Radio Relay League.

Further Reading

The Services Textbook of Radio Vol. 5. Transmission and Propagation. HMSO 1958.

Practical Aerial Measurements. F. C. Judd. Wireless World, December 1960.

Out of Thin Air. Practical Wireless IPC Magazines.

The Beam Antenna Handbook. W. I. Orr. Radio Publication Inc. USA. Available from the RSGB book dept.

All About Cubical Quad Antennas. W. I. Orr. Radio Publications Inc. USA. Available from the RSGB book dept.

The Radio Amateur VHF Manual. ARRL. Available from the RSGB book dept.

Letters

RAE Problems?

Sir: I wonder if other readers experienced similar problems with the recent radio amateurs examination. My wife is not of a scientific bent and put in a great deal of hard work before the examination on May 16 at the Camden Centre. I also put in a lot of hard work teaching her!

Like most people we based our work on the RSGB Examination Manual containing the two sample papers. When I took the exam in December 1979 the questions covered very similar subjects to those in the sample papers.

It was with a dawning sense of horror that my wife realised that in the recent exam, Part 2 of the paper bore very little relation to the types of questions and subjects covered in the sample papers. Because you cannot bring out the paper she had to rely on memory but we believe that there were no questions at all on the following important subjects which had been covered in the sample papers: Q codes, RST codes, quotation of formula or calculations on reactances and resonant frequency, transformer calculations, recognition and basic functions of solid state devices, receiver block diagrams, advantages of superhets, types and impedances of the common antenna systems and polar diagrams, and shunt and series resistors used with moving coil meters. Even where some of the subjects with which one was familiar were covered the questions seemed to be phrased in a rather contorted fashion to confuse rather than examine fairly.

I wonder whether other examinees felt unfairly treated in this way and might I be allowed to ask for their views through the Readers' Letters feature in your magazine.

R. M. Rumbelow G8UYL,
Oxshott, Surrey

Special Event Stations

The Southampton Amateur Radio Club will be running two special event stations during July.

First, aboard HMS Cavalier, a destroyer permanently berthed as a museum in the City of Southampton, between 1 and 28 July inclusive, using the callsigns GB2CAV and GB8CAV.

The second station will be sited at the Southampton Show, held annually on The Common, between 8 and 10 July, using the callsigns GB2SOU and GB8SOU.

Special QSL cards will be issued for each event. Further details from: *R. W. F. Stanley G6LOB, 22 Creighton Road, Millbrook, Southampton, Hants. SO1 4JF. Tel: (0703) 771251.*

Also in Southampton on Saturday 20 August, Itchen Valley Amateur Radio Club will be running a special event station in a large departmental store.

They will be using the special callsign GB2DEB (no prizes for guessing the location) and should be operating on most of the h.f. bands and also the v.h.f. band.

Interference permitting they will also be operating a microwave link within the store, along with RTTY and AMTOR as well as slow scan TV. They even hope to get a few club members operating a Morse Key.

Further details of this event and the club's activities are available from: *Steve Bone G4PPJ, 19 Tickner Close, Botley, Hants. SO2 2SW. Tel: (048 92) 3312.*

McMichael Mobile Rally

The McMichael Amateur Radio Society, in conjunction with the Burnham Beeches ARS, the Home Counties ATV Group and the Maidenhead and District ARC are staging a Mobile Rally at the McMichael Sports and Social Club, Bells Hill, Stoke Poges, Bucks. The date is Sunday 24 July, and the doors will open at 11.00am.

All the regular rally attractions will be there and a large attendance is expected.

New Catalogue

The latest 80-page catalogue from Bi-Pak Semiconductors is now available.

The catalogue which lists a host of components of interest to the electronics enthusiast costs only 75p plus 25p p&p, and is obtainable direct from: *Bi-Pak Semiconductors, The Maltings, 63a High Street, Ware, Herts. SG12 9AD. Tel: (0920) 3442 and 3182.*

Interference

On the subject of interference, a strange thing happened recently close to the editorial offices in Poole. Over a period of some three weeks signals were popping up on 145·500MHz (S20) consisting of short bursts of digital telemetry and at times speech. Being the mobile calling channel this did arouse the curiosity of the local amateur community who, being unable to evoke any response from this unidentified "intruder", felt obliged to investigate. Short bursts of signal occurring at times between 7am and 11pm do not always lend themselves to rapid DFing. However after a particularly long burst of activity, with signal strengths peaking to well in excess of the normally recognised 5/9+, the source of the mysterious transmissions was located. Incidentally signal reports were received from stations as far apart as Southampton and Exeter—fair DX from this part of the world!

The upshot of all this is that the signals were emanating from the premises of a local r.f. design contractor who was finalising the control system for a remote surveillance system believed, but as yet not confirmed, to have been for the MOD. What made matters even more interesting was the fact that the contractor had, it is understood, been supplied with the crystals for the 15W TX and antennas (ground plane and multi-element Yagi) by the same authority. On being informed of the existence of the 144MHz amateur band the contractor was *most* apologetic and agreed to cease transmisstions on the spot.

We have since been reassured by the HO that the amateur service in the UK is still the sole primary user of the band 144–146MHz and incidentally any non-amateur transmissions should be notified to them.

On the Move

Lascar Electronics, the UK manufacturer of Digital Panel Instruments, have moved from their two locations in Essex to a single factory in Wiltshire. The new premises are located at Whiteparish near Salisbury, in extensive grounds that will allow for many years of expansion.

Lascar Electronics new catalogue, which lists all existing and new products, is now available. Their full address is: *Module House, Whiteparish, Salisbury, Wilts. SP5 2SJ. Tel: Whiteparish (07948) 567.*

Mold

From a usually reliable source in the "north-west".

The fungi marches on! As confirmed by the RSGB v.h.f. committee in our last issue the Radio Amateur service in the UK remains on a secondary basis in the band 430–440MHz. However propagation of r.f. is not usually restrained by national boundaries—so what I hear you mumble. Well over the chilly reaches of the North Sea an enlightened administration in Holland has confirmed that the amateur service is a primary user of the aforementioned frequency block. It will presumably be only a matter of time before signals emanating from several of the "prime" UK sites now sporting 500W vertically polarised MOD repeater transmitters, start to infiltrate the Dutch 432MHz repeater network. For a system that would appear to be designed as a standby national communications network, presumably of fairly high strategic importance, the decision to locate within what is already a crowded part of the UK spectrum, let alone one that is extensively used by legitimate external services, does seem rather odd. Will the Syledis navigational system operator drilling holes in the Irish Sea, the Penrith Police and the Council roadworks people in Dumfries, not to mention the mobiles in Market Harborough (Leics), who have all reported interference/reception of the Winter Hill unit(s), have any right of complaint?

Club News

Kidderminster and District Amateur Radio Society, G4GXP G6KRC, meets fortnightly on Tuesday evenings at 2000hrs. Their venue is the Aggborough Community Centre, Hoo Road, Kidderminster, Worcestershire.

In addition to their very full schedule of activities they also run a Morse class on Wednesday evenings.

All visitors will be made really welcome at any time, and further details are available from: *The Secretary, Tony Hartland G8WOX, tel: (0562) 751584.*

Denco Coils

Readers may be interested to know that Denco are no longer manufacturing their Maxi Q range of plug in coils. Their manufacture has however been taken over by G. W. Powles, 8 Brunnel Units, Brunnel Road, Gorse Lane Industrial Estate, Clacton-on-Sea. Tel: 0255 424152.

Thanks to *PW* reader Mr E. C. Demeza for the information.

Meet PW at these Events

The Sussex Mobile Rally on 17 July at the Racecourse, Brighton, has over 20 000 square feet of exhibition area undercover, and free car parking for 4 000 cars.

The rally caters for the whole family with free mini bus rides to and from the sea front, many other attractions at the site and excellent catering facilities.

One of the most popular features of this rally is in the huge bring-and-buy stall, plus all the usual attractions and trade stands.

Open between 10.30am and 5.00pm, admission is £1.00 excepting children and the disabled who will be admitted free of charge. Talk-in will be available on S22 and the 3·5MHz band.

Advance tickets for clubs can be obtained at 80p from: *Miss W. Firmager, Flat 2, 23 Chatham Place, Brighton, Sussex.*

A major new mobile rally has been organised in the South of England this year at the Flight Refuelling Sports and Social Club at Merley, near Wimborne, Dorset, on Sunday 21 August, 1983. Starting at 11.00am until 5.00pm, the venue is easily accessible from the A31, Wimborne bypass.

Bournemouth and District RAIBC will be promoting the event at the kind invitation of the Flight Refuelling ARS, and a full programme for the day is forecast. The RAIBC Committee will be holding their AGM at the event and a large number of national and local traders will be present. There will also be side shows, displays and stalls to cater for the radio amateur and his family, and a special demonstration station will be operating showing all aspects of amateur radio in use, plus talk-in will be available on the v.h.f. and u.h.f. bands, under the callsign GB2FRH (Flight Refuelling Hamfest).

Further details from *Bob Burrows G6DUN, 40 Fairmile Road, Christchurch, Dorset BH23 2LL.*

Readers may be interested to know that on the *PW* stand at these events we will have for sale: parabolic dishes (£10 each), *PW Radio Programs-1* cassette tapes, plus copies of *Out of Thin Air, Passport to Amateur Radio* and recent issues of *Practical Wireless.*

Book Search Services

If you have ever tried to obtain a book and been told, Sorry it's out of print or no longer available, you will certainly be interested in the "Out of Print Book Service".

The way the service works is, the client fills in an application form with details of the book required, the firm then, on a weekly basis, distributes throughout the secondhand book trade a list of books wanted by clients. If successful, full details of price, condition etc. will be sent to the client; the book is forwarded only after the client confirms the order at the price quoted. The firm make no charge for the search service.

For further details and an application form, write enclosing an s.a.e. to: *Out of Print Book Service, 17 Fairwater Grove East, Fairwater, Cardiff CF5 2JS. Tel: (0222) 569488.*

Licence Fee Changes

Regulations which came into force on 1 June, 1983, will amend the fees charged for a number of wireless telegraphy licences, including those for amateurs, ships, aircraft, private mobile radio and radiomicrophones, and radio paging.

Some fees will increase—you got it! The amateur licence goes up from £8 to £12. Some fees go down and some fees do not change—among the no changers are TV and CB licences.

Satellite TV

Those enterprising individuals who are able to receive transmissions from the Russian Gorizont DBS should take note of the following.

We understand from a reliable source that written permission from the Russian authorities is required by the Home Office before the reception of Gorizont TV signals is authorised in the UK.

The Gorizont satellite system is not strictly speaking considered to be a true DBS service by our HO, hence their insistence on proof of permission to view.

Over to you comrade!

Repeater News

The Good News: Two items this month for starters. Those following the site rental saga will remember that three groups GB3TY (Tyne Valley) HG (North Yorks) and WD (West Devon) have been faced with the prospect of finding the cost of site rental fees for use of BBC transmitter site locations. The RSGB have now concluded an agreement with the BBC, in recognition of previous verbal permissions before the rental fees dramatically increased, to allow all three groups permission to use their masts at a nominal rental. This generous concession by the BBC will now hopefully allow an early start of operations by the groups, but potential users should not forget that each group must still find funds to cover the costs of professional antenna installers, together with the considerable costs of feeder to the well-sited antenna systems. Your support is needed now more than ever.

Future low rental will only be granted by the BBC for installations that in their eyes further the development of amateur technology/state of the art. Such schemes are thought to encompass microwave and/or beacon sytems.

In a similar vein the RGSB has negotiated an ongoing arrangement for installations co-sited on masts maintained by Pye Telecommunications—a formalisation of existing verbal agreements being necessary in respect of site security measures. Groups wishing to consider the use of a Pye mast should apply to RSGB HQ in the first instance.

Two new u.h.f. repeaters have come on air during the last two weeks, GB3HB—Mid Cornwall RB15 and GB3VS—Bridgwater RB13. One new v.h.f. repeater GB3PW, no not ours but this one's Powys Wales on R3. Reports please to G3VQH or GW4NQJ.

The Dutch Society Veron (=RSGB) have decided to adopt the UK u.h.f. RB repeater system (1·6MHz shift with inputs high). It is understood that Denmark is to adopt the IARU Region 1 RU system (1·6MHz shift with inputs low) and will authorise groups to use channels that coincide with their inverse in the UK and other countries using the RB system. This could, under "lift" conditions, lead to some traumatic "lock-ups". It is further understood that Denmark has proposed universal adoption of the IARU RU system within Region 1, which will be considered at the next conference in Sicily, next year. The RSGB are to propose adoption of our own RB system at this same meeting.

Much comment still abounds about interference on 432MHz between repeaters and ATV enthusiasts. At the time of writing the RSGB has not received any complaints but advise that they will investigate any reports.

Extracts from The RSGB Council Letter Vol. 6 Issue 4

IARU Region 1: The second meeting of the h.f. working group was held in Salzburg on 19/20 March 1983. LA5QK was appointed Region 1 Contest Co-ordinator. His first task is to resolve how the number of contests could be *reduced.*

The group also agreed not to encourage channelisation on the 28MHz band and to encourage use during the sunspot minima by various means. With the prospect of 29MHz repeater proposals within Europe these points of view may be in conflict.

New Books

AN INTRODUCTION TO VIDEO
by D. K. Matthewson
Published by Bernard Babani (publishing) Ltd.
96 pages, 110 × 180mm. Price £1.95

Covering most of the practical aspects of video recording this book should help anyone just about to buy or rent some video equipment, but is not sure what it is all about.

No knowledge of electronics is needed to understand the book as it has been written in as non-technical a way as possible. It covers such topics as how to get the best of the video and its accessories, and discusses the pros and cons of the various formats.

BEGINNER'S GUIDE TO TELEVISION, 6th EDITION
by Gordon J. King, revised by E. Trundle
Published by Newnes Technical Books
227 pages, 122 × 184mm. Price £4.35

The reader is taken step-by-step through all the stages of a modern TV receiver, followed by such items as colour TV, closed-circuit TV, video tape recording, digital TV including Teletext and Prestel.

The revised 6th edition gives a lot of practical information on setting-up TV equipment using test cards, and there is a series of off-screen photographs to illustrate this.

It should prove useful to dealers, salesmen and anyone who is seeking a clear, concise and fairly non-technical explanation of the subject (using little or no mathematics).

CB PROJECTS
by R. A. Penfold
Published by Bernard Babani (publishing) Ltd.
96 pages, 108 × 178mm. Price £1.95

To use a CB rig you need have no technical knowledge, but for anyone who enjoys electronics as a hobby it is possible to get more from the hobby by constructing some items of equipment yourself.

All the projects are suitable for hobbyists with limited experience and each of the ten projects is described complete with layout details.

AERIAL PROJECTS
by R. A. Penfold
Published by Bernard Babani (publishing) Ltd.
96 pages, 111 × 177mm. Price £1.95

The ultimate performance of any receiver, whether home-brew or commercial, will depend on the antenna (aerial) you connect to the set. In this book practical antennas have been considered, those that give good performance and are relatively simple and inexpensive to build.

The book also gives constructional details for some antenna accessories. It is written for both the experimenter and beginner who needs guidance alike.

VHF/UHF MANUAL—Fourth Edition
Edited by G. R. Jessop G6JP
Published by the Radio Society of Great Britain
528 pages, 255 × 190mm. Price (UK) £8.50

It may seem surprising that seven years have elapsed since the third edition of the v.h.f./u.h.f. Manual with much of the previous material remaining intact and as valuable as it was then. Without doubt, this book is virtually an essential source of reference to anyone interested in the theory and practices in the v.h.f. to microwave regions.

This latest edition builds on the previous by the addition of selected reprints of *Radio Communication* articles together with items from *Ham Radio,* VHF *Communications* and *Practical Wireless.* Such new material includes constructional details of 144MHz frequency synthesisers, a 432MHz low-noise Gasfet pre-amplifier and the highly recommended "Microwave Committee" local oscillator source for the microwave bands.

The eleven individual chapters take the reader from the historical experiments conducted above 30MHz through to space communications, encompassing transmitting and receiving equipment together with antenna systems, both simple and elaborate, en-route.

MICROCOMPUTERS IN AMATEUR RADIO
by Joe Kasser G3ZCZ
Published by Tab Books Inc. Available from W. Foulsham, Yeovil Rd, Slough SL1 4JH. (or technical book shops)
308 pages, 128 × 208mm.
Price £8.95 plus £0.90 p & p.

In the fifteen chapters of this book it is shown how computers and amateur radio fit together. Even the reader with very little knowledge of computers is catered for, from buying or building a computer to programming one.

The book includes eight program listings in the appendices covering such wide subjects as Morse code, OSCAR orbit calculator, RTTY and contest logging. Details of programming techniques, flow charts, debugging, assembly language techniques and printing numbers are just some of the topics covered in this book. It even covers how to interface each part of the system and how to interface the computer to your existing station equipment.

30 SOLDERLESS BREADBOARD PROJECTS—BOOK 1
by R. A. Penfold
Published by Bernard Babani (publishing) Ltd.
160 pages, 112 × 177mm. Price £2.25

Each project has a brief circuit description, circuit diagram, components list and notes on construction and use where necessary. Chapter 1 deals with using Breadboard, with details of the most common components you are likely to use. Chapter 2 deals with the 30 projects which cover a wide range of subjects.

SOLID STATE HIGH-FREQUENCY POWER
By Irving M. Gottlieb
Published by Prentice/Hall International
246 pages, 235 × 150mm. Price £15.95

If your interests extend to the design and implementation of r.f. power amplifiers covering h.f. through to the low microwaves the seven chapters of this book will be found to contain plenty of valuable information. The author has drawn from the experiences of most users of the r.f. spectrum from industrial to amateur and produced a book that combines both theoretical and practical aspects of power amplifier practice. The approach chosen does not assume that the reader is a mathematical genius and time is taken to develop from first principles many of the traditional and more "state of the art" elements of circuit design.

Chapters are devoted to comparisons between transistors (bipolar, f.e.t., m.o.s.f.e.t., v.m.o.s.) and valves, considering the advantages/disadvantages from all points of view including matching, dissipation and cost—the results will probably please both the low power (100W and below) solid state person and the higher power valve adherents. The sections devoted to impedance-matching networks and transmission line elements provide a valuable reference source for the designer and constructor alike.

BOOK LABORATORY

(reviewed in this issue)

Please send your order and remittance to:

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Antenna Spreader System

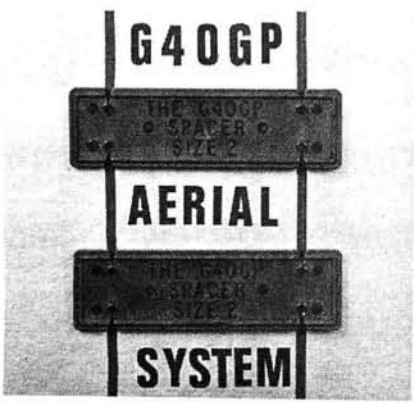
Connecting symmetrical (balanced) antenna systems to rigs via open feeder is generally recognised by amateurs and s.w.l.s alike as the most efficient way of getting the maximum amount of r.f. into and out of the radiating system, with the further benefits of removing the effects of direct radiation and reverse TVI. Also feeders of this type provide virtually zero line loss.

However, the construction of such a feeder system has usually been accomplished by assembling many costly glass or ceramic spacers or the traditional time consuming process of drilling, threading, soldering and finally varnishing dowels to finish the feeder.

A useful component for constructing a 300 to 600Ω balanced feeder has recently been introduced by G4OGP. It is a spacer moulded from ultra-violet stabilised co-polymer polypropylene and features an effective clip-on wire retaining arrangement. It is not only very light but presents minimal wind resistance, additionally individual spacers can be re-arranged or replaced **without** disturbing the complete run of feeder.

Construction is simplicity itself; the first spacer is clipped onto the two wires to be used, an arms length of both wires is then unwound and another spacer clipped on—check for equal tension, and then repeat the operation until the required feeder length is reached. It is recommended that the completed feeder is sprayed or coated with silicone wax or grease to form a barrier against soot build-up and prevent flashover, and the nominal pitch between spacers should be 1·5m.

The inclusive price per pack of 20 spacers is £10.00, plus 99p p&p and are available from: *G4OGP Electronics, 116 Darlington Street East, Wigan, Lancs.*



Yaesu's New Mini HF Transceiver

Here it is, the FT-757GX, Yaesu's latest baby h.f. transceiver, that's been born with all the good looks and capabilities of its bigger and older brothers.

Basically, the FT-757GX can transmit on all amateur h.f. bands and has general coverage on receive. Modes provided as standard are: LSB, USB, CW-W, CW-N, FM (100W p.e.p./d.c.) and AM (25W carrier). Power requirement 13·4V d.c., 2A on receive, 19A (100W).

Other features include dual v.f.o.s and eight memories with programmable memory scanning. Just about every item normally sold as an extra is provided as standard, including a 600Hz narrow bandwidth c.w. filter, iambic keyer with dot-dash memory, 25kHz marker generator, i.f. shift and width filters, effective noise blanker and a.f. speech processor. About the only option is the CAT Interface Unit (Computer Aided Transceiver System) which provides for external computer control.

Next month in *Products* I will feature the FT-757GX in greater detail. No prices are yet available and retail stocks should be in the UK during August.

Many thanks for the photograph and advance information to: *Amateur Electronics UK, 504-516 Alum Rock Road, Birmingham 8. Tel: 021-327 1497 or 6313.*

Antenna for 6m (50MHz)

With the availability of the 6m (50MHz) band to radio amateurs, albeit on an experimental basis, South West Aerial Systems inform me that they can supply a 2-element beam antenna based on 50 to 52MHz or a wider band model based on 50 to 54MHz, both at 50Ω nominal (75Ω versions are available).

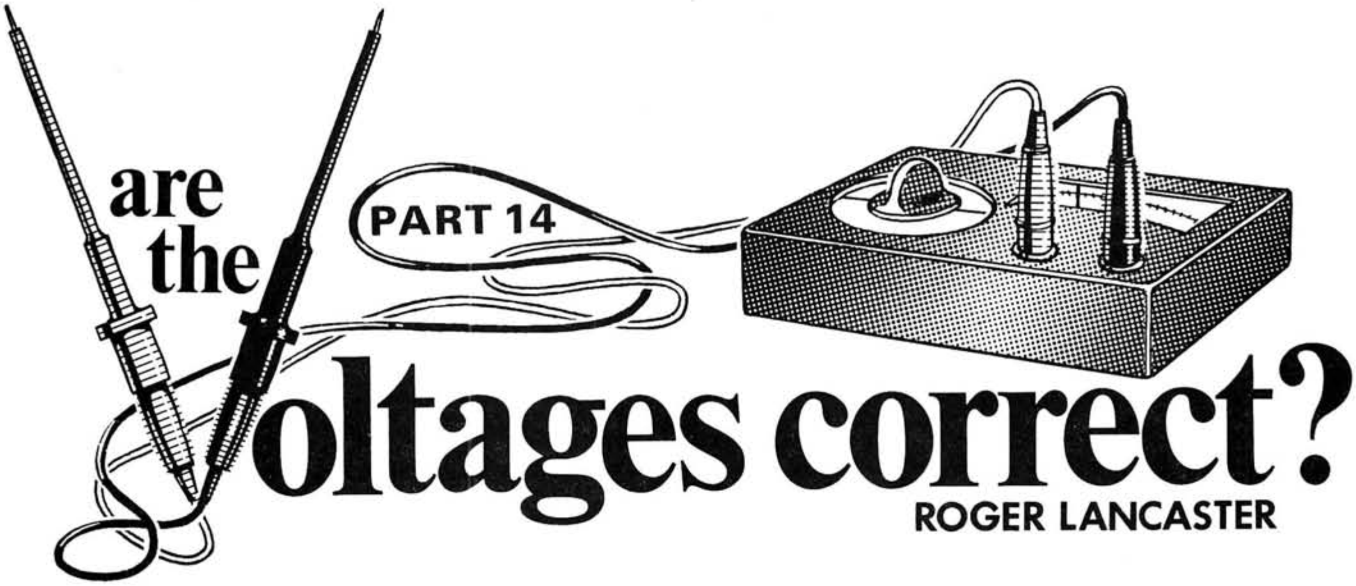
Performance of the antenna shows a midband gain of 4·7dBD and the front-to-back ratio is 8 to 9dB.

The antenna is constructed of hard drawn seamless aluminium tube, the 1·45m long boom is of 25mm o.d. material and the elements of 12·5mm o.d. the longest of which is 2·9m. All tube ends are polythene plugged and the nuts, bolts, washers etc. are bright zinc plated.

Designated NB52 (50–52MHz) and NB54 (50–54MHz) the antenna costs £22.75, which includes VAT, Securicor carriage and the mast clamp. When ordering please state the type number and also whether the 50 or 75Ω version is required.

South West Aerial Systems, 10 Old Boundary Road, Shaftesbury, North Dorset. Tel: (0747) 4370.

More on page 51



are the Voltages correct?

PART 14

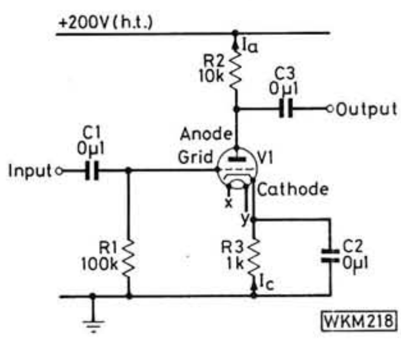
ROGER LANCASTER

This month the series concludes with a look at some representative valve amplifier and oscillator circuits.

Valve Amplifiers

The circuit of a simple triode valve audio amplifier is shown in Fig. 14.1. The wiring which connects the heaters to the heater winding of the mains transformer is usually omitted from circuit diagrams in the interests of clarity, the secondary winding terminals simply being lettered in the same way as the heater leads shown in the diagram. Where a series heater chain is involved, a separate diagram is often drawn to show the heater arrangements.

Fig. 14.1



The relationship between the triode's d.c. voltages and currents is not unlike that of the *n*-channel JUGFET, although the values will be much higher. If the bias between grid and cathode were zero the valve would conduct heavily from cathode to anode. This would cause the valve to overheat and would likely result in damage. It is therefore operated with some reverse bias (grid bias) between cathode (+) and grid (–), usually derived from the cathode current flowing through a resistor in the cathode line (R3 here). This makes the cathode positive with respect to earth by several volts, while the grid is at earth potential (no grid current flowing through R1) and therefore negative with respect to cathode.

Virtually all the cathode current flows to the anode and through R2, i.e., $I_c = I_a$. So if either the anode or the cathode potential is measured then the other potential can be calculated. For example, if cathode potential is measured as +8V, then

$$I_c = \frac{V_{R3}}{R3} = \frac{8}{1} = 8\text{mA}$$

This flows through R2, developing a p.d. across R2 of

$$I_aR2 = 8 \times 10 = 80\text{V}$$

leaving the anode at a potential of +200 –80 = **+120V.**

In order to obtain further clues to any trouble, the valve can be removed and the potentials of the anode, grid and cathode valveholder pins measured. In this example these should be:

$V_a = +200\text{V}$
$V_g = 0\text{V}$
$V_c = 0\text{V}$

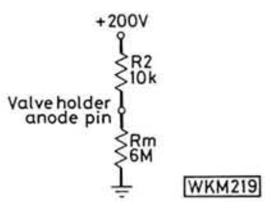
So if V_a measures correctly then there is nothing wrong with R2 or the h.t. voltage line. However, we would still measure 0V on the grid pin if R1 was open-circuit and we would still measure 0V on the cathode pin if R3 was open-circuit. To test these parts of the circuit, measure the same points but with respect to the h.t. line, still with the valve out. These should be:

$V_a = 0\text{V}$
$V_g = -200\text{V}$
$V_c = -200\text{V}$

If anything less than 200V is measured at V_a in the first test, or at V_g or V_c in the second test, then there is a strong possibility that the resistor has gone high in value and a closer investigation—taking the meter resistance into account—should be made. For example, if a 20 000 ohms-per-volt meter on its 300V range is used to measure between the anode pin of the valveholder and earth (see Fig. 14.2), meter resistance $R_m = 20\,000 \times 300 = 6\text{M}\Omega$, and the meter should read

$$\frac{6000\text{k}\Omega}{6010\text{k}\Omega} \times 200 = \mathbf{199{\cdot}7V}$$

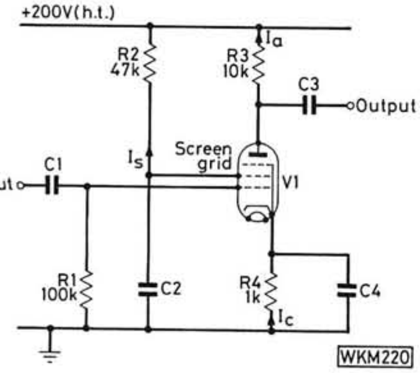
Fig. 14.2



Anything less than this would mean that R2 had gone high in value (provided the h.t. line was indeed +200V).

Tetrodes and pentodes have a screen grid in addition to the control grid of the triode. The screen grid improves the valve characteristics and has to be held at a high potential like the anode (see the pentode in Fig. 14.3). If the high screen potential is not present, no screen current will flow, as you might expect; but, not so obviously, without the screen potential **no anode current will flow either.** The cathode current splits up within the valve, some flowing via screen grid and R2 and the remainder via anode and R3, according to the relationship $I_c = I_s + I_a$. It is no longer possible to be sure about the relationship between cathode, anode and screen potentials with the valve plugged in as we are not likely to know what **proportion** of the cathode current flows to anode or screen. The only test we can make is to measure two of the voltages and then estimate the third by using the current relationship quoted above: not very satisfactory.

Fig. 14.3



To be more sure of where the fault probably lies we can remove the valve and check valveholder pin potentials. These should be (with respect to earth):

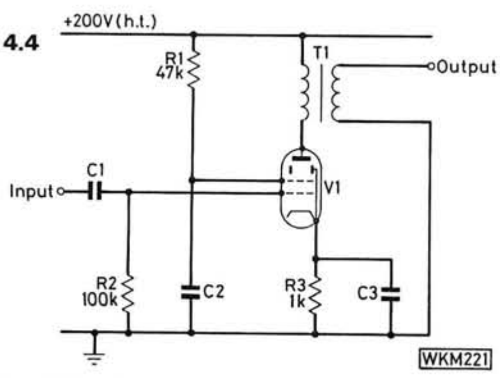
$V_c = 0V$
$V_g = 0V$
$V_s = +200V$
$V_a = +200V$

or, with respect to the h.t. line:

$V_c = -200V$
$V_g = -200V$
$V_s = 0V$
$V_a = 0V$

The beam tetrode circuit of Fig. 14.4 employs a transformer anode load. We cannot estimate anode current here (without breaking the circuit and measuring it) as there is no resistor through which anode current flows. The anode potential should be +200V but screen and cathode potentials cannot be estimated with the limited information available. Once again, removing the valve will provide the best conditions for voltage measurements to verify the condition of the wiring and the passive components (i.e., excluding the valve itself). If these check out satisfactorily, the valve itself is the chief suspect, but it is worth remembering that valveholders can give trouble so don't rule out poor connections between wiring and valve.

Fig. 14.4



The presence of signal voltages can change the value of the measured d.c. potential in exactly the same way as in transistor amplifiers, as described in Part 7, so it is best to eliminate signals for our purposes.

The circuit of a Class C amplifier which might form the p.a. stage of a transmitter is shown in Fig. 14.5. The reverse (negative) bias on the grid of a Class C amplifier is sufficient to maintain the valve current cut off completely in its quiescent state (i.e., before an input signal is applied). In the example shown here, the cathode is at 0V while the grid is at −100V and the anode at +500V. The screen will also be at +500V since with the cathode current zero, no screen current can flow through R1.

When an input ("drive") is applied, the positive peaks will cause the valve to conduct. Average grid potential will rise and average screen potential will fall, though it is impractical to attempt to estimate their values in these circumstances. Average anode potential is likely to change too, because the signal at the anode will almost certainly be distorted, with results as described in Part 7.

There is another reason why voltage readings taken around a high-power r.f. oscillator are misleading. The meter leads can pick-up r.f. energy by induction and the meter can rectify this to produce meter readings which are often fantastically high. Even if the meter leads are removed from the circuit and connected together, readings of thousands of volts can be obtained purely because of r.f. induced into the leads.

If we are to take meaningful voltage readings in a case like this, therefore, it is even more important that signals should be suppressed. It is not necessary to remove the valve if signals are suppressed, because it will not conduct anyway and readings will be as with it removed.

A simple way of suppressing signals in an **amplifier** stage is to short-circuit the coil of a tuned circuit across which the signals are normally developed. This has the advantage of leaving the quiescent d.c. conditions of the amplifier circuit unaffected.

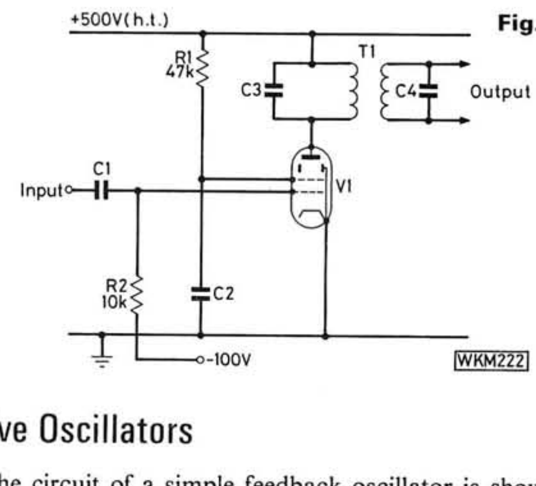


Fig. 14.5

Valve Oscillators

The circuit of a simple feedback oscillator is shown in Fig. 14.6. The frequency is determined by L2 and C2 and the necessary feedback between output and input is via L1 (coupled to L2).

Initially the valve has zero grid bias and will conduct heavily. However, positive half-cycles fed back to the grid will cause grid current to flow and C1 to charge (bottom plate negative). The voltage to which C1 charges will provide grid bias, since C1 is connected between grid and cathode (earth). During the remainder of the grid cycle, the charge on C1 will partially leak away via the grid leak resistor, R1, and a state of equilibrium will soon be reached where a certain value of grid bias is produced. This arrangement is called automatic bias and is usual in valve oscillators. In the Pierce oscillator of Fig. 14.7, the capacitance of the crystal itself (XL1) takes the place of the C1 of Fig. 14.6.

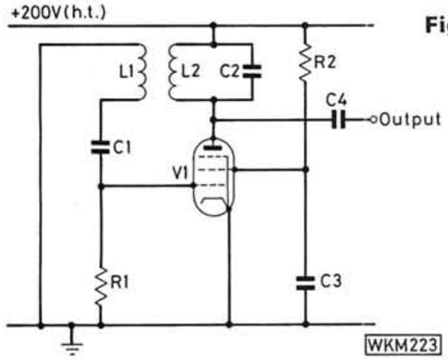


Fig. 14.6

Once again the presence of oscillatory voltages on grid and anode will render d.c. estimations unreliable. It is unadvisable to suppress the oscillations at the oscillator stage itself, however: because of the automatic bias this would leave the valve with zero grid bias, it would conduct heavily, overheat and permanent damage might result.

So we revert to the old standby of valve removal for our voltage measurements.

One circumstance in which valve removal presents difficulty is when the valve heaters are in series. Removal of one valve cuts off heater current to **all** the valves, probably including the rectifier which produces the h.t. supply voltage. If the heater voltage and current rating can be found, a way around this is to insert a resistor in place of the removed valve's heater. If the heater ratings are V_h and I_h then the resistor value should be

$$R = \frac{V_h}{I_h}$$

and its wattage should be greater than $V_h \times I_h$. Taking typical values of $V_h = 6{\cdot}3V$ and $I_h = 0{\cdot}3A$, this would mean a resistor of 21Ω and of some 2W or more, i.e., a 22Ω, 2W resistor in practice.

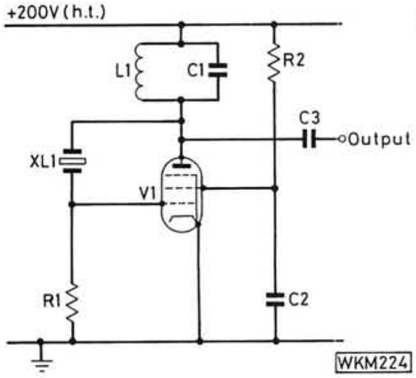


Fig. 14.7

Old valve TV sets used to employ series heater chains of which the heaters were mostly of equal rating and used the same valveholder pin numbers. It is possible in such circumstances to take a representative valve with a good heater (but probably faulty in some other respect), cut off all the pins other than the heater pins, tape over the severed pins and use it as a general plug-in heater, taking extra care to ensure that the two remaining pins are plugged only into the correct valveholder socket holes.

Some valves are multi-functional types, in which two or more valves share the same glass envelope and the same heater. We have already seen one of these—the double diode of the full-wave rectifier circuit in Part 13. Two more examples are shown in the triode-hexode of Fig. 14.8 and the double-diode-triode of Fig. 14.9. These are common in old valve receivers.

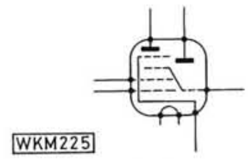


Fig. 14.8

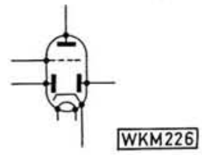


Fig. 14.9

The hexode part of the triode-hexode usually forms an r.f. amplifier while the triode part forms the local oscillator whose output modulates the current of the hexode part, the combination thus performing the frequency-changing (mixing) operation. The triode part of the double-diode-triode is usually an a.f. amplifier preceding the audio output power amplifier stage, while the two diodes assume the roles of signal demodulator and a.g.c. rectifier. In multi-function valves it must be remembered that cathode current will be the sum of all the anode and screen currents of all the valves in the envelope.

Conclusion

I hope that those readers who have been following this series now feel more confident in tackling fault finding down to component level.

As far as your own equipment is concerned, you can make fault finding easier for yourself by making a note of all the important voltage measurements taken while the equipment is working properly (**before** a fault occurs)—this avoids the necessity for most of the calculations when trouble does arise.

Two final reminders: (i) make sure that when you connect your meter to a circuit with the power switched on that you do not inadvertently short-out two points of the circuit, as this could itself create a fault where none existed previously, and (ii) when handling high voltage equipment, such as the valve circuit dealt with, observe all the safety precautions described in Part 13.

Good luck with your trouble-shooting! ●

the things people say

"Yes, you are a very good signal into the 'box', until you time-out, then I can't seem to hear you anymore."
. . . heard on GB3DA by G8VVU

"Can you tell me the 'time-out' on this channel, only it is the first time I've worked through S19."
. . . heard by G8VVU

YAESU FT~77 HF TRANSCEIVER

The FT-77, christened the thrifty h.f. transceiver by Yaesu Musen, is intended to replace the popular FT-7B, which we reviewed in our March/April 1980 issues. The FT-77 covers all the h.f. amateur bands from 3·5 to 30MHz, and has been designed and manufactured using Yaesu's new CAD/CAM (computer aided design/computer aided manufacturing) system. This is claimed to give high reliability in the smallest possible space by using computer-designed circuit board layouts, plus improved quality control and lower costs by using automatic (robot) parts insertion and soldering.

The front panel layout is neat and uncluttered, and features the following controls and facilities. Rotary controls for s.s.b. drive and c.w./f.m. carrier level, clarifier (r.i.t.) and a.f. gain and f.m. squelch (concentric). Rotary switches for band selection (the 28MHz band is divided into four 500kHz sub-bands) and mode. The mode switch includes positions for the optional narrow c.w. filter (not tested) and the optional f.m. unit.

The power on/off switch is a push-button type, and a row of six further push-buttons control the r.f. attenuator, the noise blanker, fast/slow a.g.c. time constants, optional fixed frequency (crystal controlled) operation, a 25kHz calibration check oscillator and the clarifier. More details of some of these features in a moment. Warning l.e.d.s show when the attenuator or clarifier have been switched in.

The main tuning control, which has a rate of about 19kHz per revolution, uses the traditional Yaesu design of knob, but a new feature is that it is coated overall in soft rubber to give a better grip, rather like lens focus rings on modern Japanese cameras. Around the outside of the knob it's quite a good idea, but I can't say that I particularly like the front of the knob, including the finger recess, being coated as well. It's definitely rather rough on the finger-tip!

The "S" meter can be switched to read a.l.c., forward power output, or reflected power when on transmit, by

★ specifications

TRANSMITTER

Types of emission:	A1A (c.w.), J3E (u.s.b./l.s.b.), F3E (f.m.)*
Power input:	240W d.c. for nominal 100W output (85W on 28MHz band)
Carrier suppression:	Better than 40dB
Unwanted sideband:	Better than −50dB (1kHz mod.)
Spurious radiation:	Better than −40dB
Audio response:	350–2700Hz (−6dB)
Frequency stability:	(After 10 min. warm-up) Less than 300Hz drift in first 30 min., less than 100Hz drift every 30 min. thereafter
Antenna impedance:	50Ω unbalanced
Microphone impedance:	500–600Ω

RECEIVER

Sensitivity:	0·3μV for 10dB (S + N)/N 0·15μV for 10dB (S + N)/N with narrow c.w. filter* 0·7μV for 12dB SINAD on f.m.*
Clarifier range:	±2·5kHz approx.
Image rejection:	Better than 70dB
I.F. rejection:	Better than 50dB

Selectivity:

Mode (B/W)	−6dB	−60dB
J3E/A1A(W)	2·4kHz	5kHz
A1A (N)*	600Hz	1300Hz
F3E*	12kHz	24kHz

Frequency marker:	25kHz intervals*
Input attenuator:	20dB approx.
Audio output:	3W into 4Ω at 10% t.h.d.
External speaker:	4–16Ω
Recorder output:	70mV 50kΩ

GENERAL

Frequency coverage:	3·5–4MHz (80m) 7·0–7·5MHz (40m) 10·0–10·5MHz (30m) 14·0–14·5MHz (20m) 18·0–18·5MHz (17m) 21·0–21·5MHz (15m) 24·5–25·0MHz (12m) 28·0–30·0MHz (10m)
Power requirements:	13·5V d.c., negative ground, 1A receive, 20A transmit
Dimensions:	95 × 240 × 300mm incl. heatsink
Weight:	6kg

*Option

★ test measurements

TRANSMITTER

Outputs in A1A mode:

Freq. Output (MHz)	Max. Output (W)	Harmonic outputs (dBc) 2nd	3rd	4th	5th	7th
3·51	110	—	−60	—	−54	−61
7·01	110	—	−54	—	—	−62
10·11	110	−50	−60	—	—	—
14·01	115	—	−57	—	—	—
18·11	115	—	−52	—	—	—
21·01	115	—	—	—	—	—
24·91	115	−67	−64	—	—	—
28·01	90	−65	—	—	—	—
29·01	90	−64	—	—	—	—

Notes: dBc = dB relative to carrier (fundamental) output.
— = output −70dBc or lower.

Carrier suppression: 60dB relative to p.e.p.
Unwanted sideband suppression: On u.s.b.: better than 70dB
On l.s.b.: 64dB
3rd Order i.m.d.: 32dB below p.e.p.
Spurious radiation: −54dBc at (carrier ±i.f.) on 28MHz band
−48dBc at (carrier ±3MHz) on 28MHz band if overdriven
Frequency stability: Drift 50Hz during first hour after 10 min. warm-up (14·1MHz)
Maximum deviation (F3E): ±5kHz
Audio response: 300–2750Hz (−6dB)

Test equipment used:
2017 and 2019 signal generators, TF2370/TK2373 spectrum analyser, 2435 frequency meter, TF2304 modulation meter, TF2337A distortion meter, TF2005R two-tone generator, TF893A power meter, all by Marconi Instruments; Bird Model 43 r.f. power meter; Tektronix 2215 oscilloscope.

RECEIVER

Sensitivity:

Freq. (MHz)	Input e.m.f. (μV) for 10dB (S + N)/N A1A/J3E	for S9 J3E
3·51	0·23	77
7·01	0·29	74
10·11	0·23	109
14·01	0·31	149
18·11	0·29	141
21·01	0·29	120
24·91	0·32	112
28·01	0·40	114
29·01	0·35	132

FM sensitivity: 0·85μV e.m.f. input (±5kHz deviation at 1kHz) for 12dB SINAD at 29MHz

"S" Meter calibration: (at 14·01MHz u.s.b.)

Reading	Input μV e.m.f.	dBμV
S1	2·75	9
S2	4·4	13
S3	6	16
S4	10	20
S5	17	25
S6	28	29
S7	51	34
S8	83	38
S9	150	44
+20	2·15mV	67
+40	25mV	88
+60	237mV	108

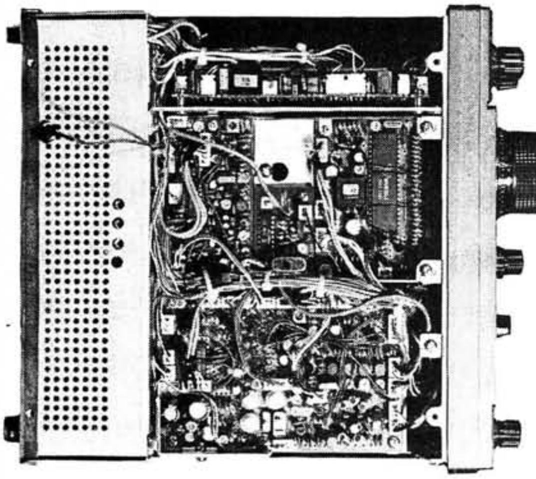
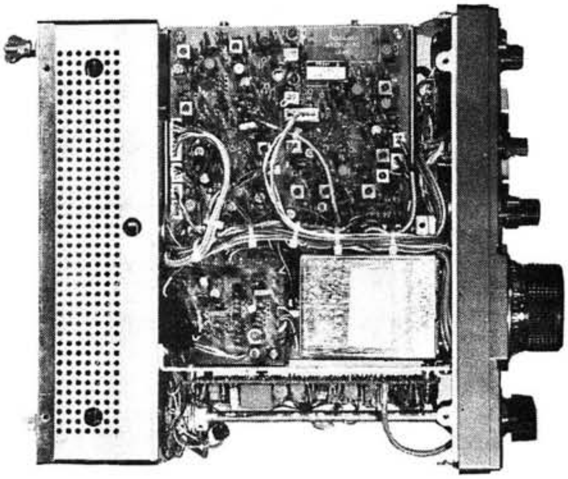
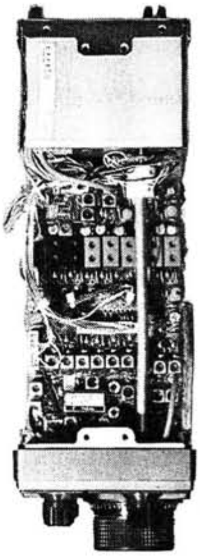
Image rejection: Better than 80dB
I.F. rejection: Better than 70dB
Selectivity: Bandwidths 6/60dB:
A1A and J3E: 2·5/6·3kHz
F3E: 13/22kHz
Clarifier range: −3·5kHz to +3·9kHz
AGC: Output change for 120dB input change, relative to 4μV threshold: 1dB
RF attenuator: 20dB at 3·5MHz, 18dB at 29MHz
FM squelch threshold: 1·25–4μV at 29MHz
Audio output: Distortion 3% for 3W into 4Ω

means of a switch concealed under a little door in the top of the transceiver. A 6-digit blue fluorescent display indicates operating frequency with a resolution of 100Hz. In all cases the displayed frequency is that of the carrier (or suppressed carrier). Alongside the frequency readout are three small displays which show the source of the frequency control. These are VFO.A (normal internal v.f.o.), VFO.B (optional external v.f.o., such as the digital FV-700DM) or F (fixed-frequency, crystal-controlled operation).

As well as the ALC–REF–FWD switch already mentioned, the top-panel door also gives access to the crystal socket for fixed-frequency operation (with associated trimmer), a control to set meter f.s.d. on forward power for direct s.w.r. measurement, c.w. sidetone level, delay for semi break-in c.w. operation, and noise-blanker wide/narrow selection. The noise blanker pulse-widths have been selected for optimum rejection of automobile ignition noise and similar short pulses in the narrow position, and of the "Woodpecker" over-the-horizon radar in the wide position. It makes quite a reasonable job of both of these, judging from the results of our tests.

Moving around to the back panel, we find a large p.a.

Radio SPECIAL PRODUCT REPORT

Internal views of the Yaesu FT-77 showing, from left to right, the top, bottom and right-hand side

heatsink which incorporates a thermostatically-controlled fan. Down one side are ranged sockets for the Morse key ($\frac{1}{4}$in jack), antenna (SO239M) and 8V d.c. output to light the meter and l.e.d. indicators on the optional FC-700 antenna tuner. There is also a wing-nut terminal for the ground (earth) connection.

On the other side of the heatsink are sockets for r.f. output to a transverter (220mV r.m.s. at 50Ω), switching and a.l.c. for a linear amplifier, power and controls for an external v.f.o. including up/down scanning control, and extension loudspeaker. Plus, of course, the d.c. power input connector.

For base-station operation, hinged drop-down legs let you raise the front panel to a comfortable operating angle, and for mobile operation, the case includes fixing points for the optional MMB-16 mobile mounting bracket, which will also accommodate the FV-700DM external scanning v.f.o. and the FC-700 antenna tuner, if desired.

Unlike most recent amateur transceivers, the FT-77 does not use a synthesiser in its frequency generation process. The s.s.b.-suppressed-carrier or c.w. signal is produced in a nominal 9MHz i.f. strip in conventional fashion. The other input to the final mixer (on transmit) is derived in a somewhat unusual way. As in the FT-7B and many other earlier sets, a crystal-controlled band oscillator and a capacitance-tuned v.f.o. covering 5·0 to 5·5MHz are employed, but instead of combining them in a pre-mixer, they are used to phase-lock a voltage-controlled oscillator. The simplified block diagram Fig. 1 shows the basic principle. The band oscillator operating frequencies range from 17·9845MHz for the 3·5MHz band to 43·9875MHz for the 29·5MHz sub-band.

When operating on f.m. (optional f.m. unit installed), the FT-77 becomes a double superhet, with a second i.f. of 455kHz.

The FT-77 is very straightforward to operate, and produces complimentary signal reports in all modes. I would personally have preferred a slightly smaller clarifier range, to give improved resolution for s.s.b. tuning, but accurate tuning is not too difficult. The lack of an r.f. gain control is a slight disadvantage, but the 20dB front-end attenuator is useful in quietening down the powerful broadcast station intruders in the 7MHz amateur band.

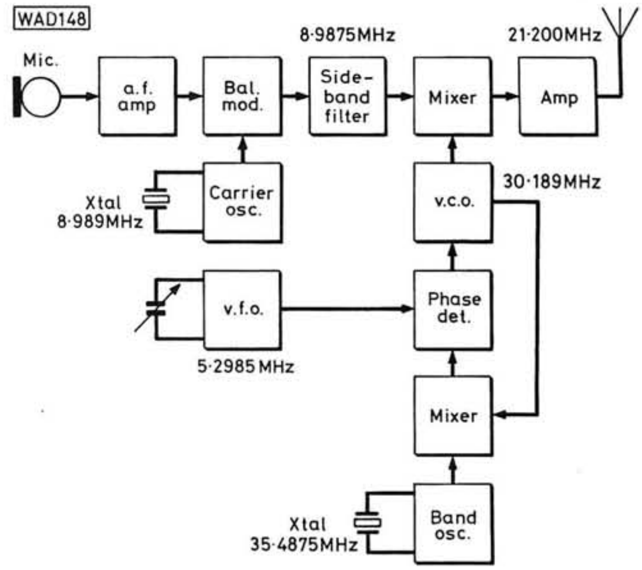


Fig. 1: Frequency generation system of the FT-77 operating on 21·200MHz upper sideband

The standard of construction of the FT-77 is good. Some thought has obviously been given to easy access for economical servicing.

The Instruction Manual is good, with clear operating and installation instructions, block and circuit diagrams with a comprehensive circuit description, plus a 9-page section on alignment with p.c.b. component layouts. Full component lists are provided for all boards, etc. In each case, details of all the available options are included.

Accessories provided are a 3m-long d.c. power cord, incorporating an in-line fuse-holder at the supply end of the positive core, a spare 20A fuse, plus a pair of long legs to provide a greater tilt to the front panel if required, and a set of non-slip pads for the feet.

Radio SPECIAL PRODUCT REPORT

The review FT-77 was powered from a.c. mains via an FP-700 power supply, which incorporates a front-facing extension loudspeaker. Also provided for test was an FC-700 antenna tuning unit, covering the same bands as the FT-77, and capable of transforming an antenna impedance of 10–250Ω to 50Ω for correct loading of the transceiver. The FC-700 includes forward and reverse power metering with ranges of 15 and 150W full scale, s.w.r. indication, and a 50Ω 100W dummy load. The FP-700 and FC-700 appear to be similar to the FP-707 and FC-707, which complemented the FT-707 transceiver.

Current VAT-inclusive prices for the equipment mentioned are £515 for the FT-77 with MH-1B8 hand microphone, plus £25.30 for the f.m. unit, and £9.60 for the marker unit. The FP-700 power supply is £110, and the FC-700 antenna tuner £99.65. A lower-power version of the FT-77, the FT-77S, gives 10W output and costs £435.

Our thanks to **South Midlands Communications Ltd., SM House, Rumbridge Street, Totton, Southampton, Hants SO4 4DP, telephone 0703 867333,** for the loan of the review equipment.

Geoff Arnold

The FP-700 p.s.u., the FT-77 and the FC-700 antenna tuner/power and s.w.r. meter

Over-the-Horizon Radar Systems-
BEYOND THE BLUE HORIZON
by F.C. Judd - Part 1

Over the horizon radar (OTHR) has been with us for some time now as all h.f. band amateur radio operators know (or do now) from the characteristic "tock – tock – tock" QRM called the "Woodpecker", because that is what those signals are. They are very definitely **not** used to control the weather, or to induce some kind of psychological effect on people as suggested by some of the less well informed media. However, it has been established that there are at least four Russian OTHR stations in operation using transmitters with a pulse power output in the region of 20 to 40 megawatts. If the antennas employed are highly directional narrow beam systems, similar to those used in other countries for OTHRs, the effective radiated power could be as high as 200 to 400 megawatts.(1) The **experimental** American CONUS–B OTHR rates an e.r.p. of 100 megawatts which is considered as relatively low power.

Development and Function of OTHR

The idea of OTH radar may have stemmed from experimental high power (CH)(2) World War II h.f. radar although serious research on its possibility did not begin until about 1950. OTHR systems use the ionosphere virtually as a mirror to "see" around the natural curvature of the earth and although the Russian system has been fully operational for a number of years the United States of America have also been experimenting with radar systems of this nature for a very considerable time.

OTHR is operated on almost any suitable frequency (determined by ionospheric conditions) within the range 6 to 30MHz and not always with regard to other services using specific frequencies in that portion of the radio spectrum, e.g. broadcast and amateur radio stations. It must be emphasised that the Russians are most guilty of this practice whilst the Americans have so far shown consideration for others operating in the h.f. band region necessary for OTHR.

Although not too much is known about the Russian OTHR stations at present in operation, quite detailed information has recently been made available describing the function of the latest American OTHR system known as CONUS OTH–B (B for back scatter) and which may throw some light on the function of OTHRs now being used in Russia and other countries. (CONUS stands for Continental United States.) The American CONUS OTH–B radar station is located near the town of Bangor in the State of Maine on the North East American coast. Later there will be others operating, one on the East coast and one on the West coast. One system known as a **forward scatter** h.f. radar has been operating for some time in the Far East with facilities for reception at sites located in Western Europe. The Australians have also been testing a prototype OTHR.

Although an OTHR has certain disadvantages, it has other special fundamental advantages, e.g. it can cover an enormous area by comparison with normal line-of-sight radar and is estimated to be about ten times less expensive than a space orbiting radar system. OTHR can track aircraft and missiles both from and to ground level and so can be used to detect a missile launch. It can also be used to provide warning of regions of high winds and waves, the location of weather fronts and for tracking the eye of hurricanes over water, as well as the movement and courses of ships at sea.

Why American OTHR Has Taken So Long To Develop

Firstly it has taken a number of years to consider environmental problems such as potential electro-magnetic interference and possible material damage, for example. Another consideration is the physical hazards to persons in close proximity to the transmitters the e.r.p. of which, even for initial experiments, has been around 100 megawatts. Delay has also been due to lack of suitable processing technology, i.e. waiting for computer techniques to catch up.(3)

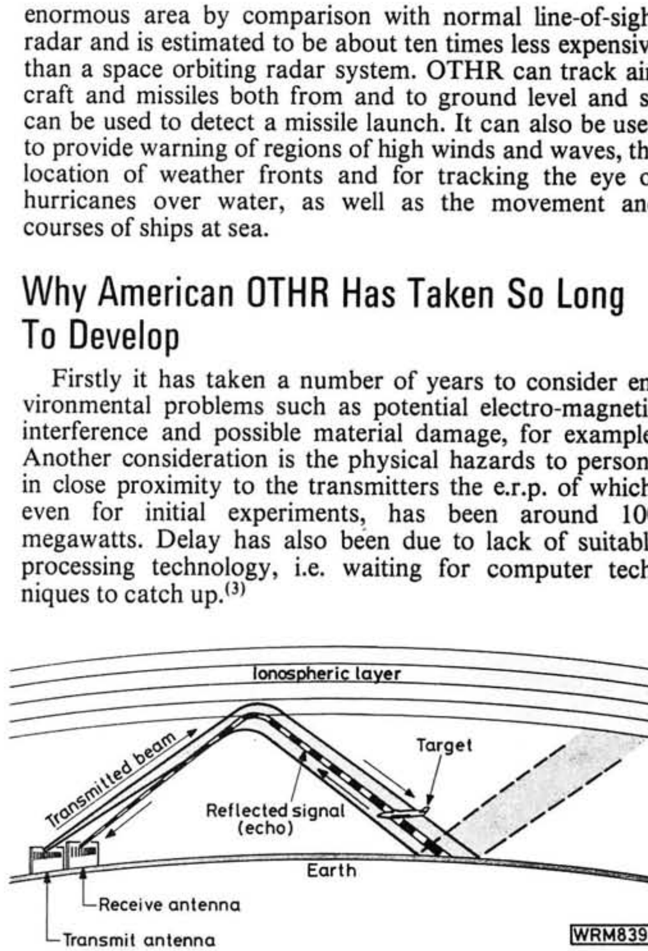


Fig. 1.1: Basic principle of OTH radar

How Does OTH Radar Function?

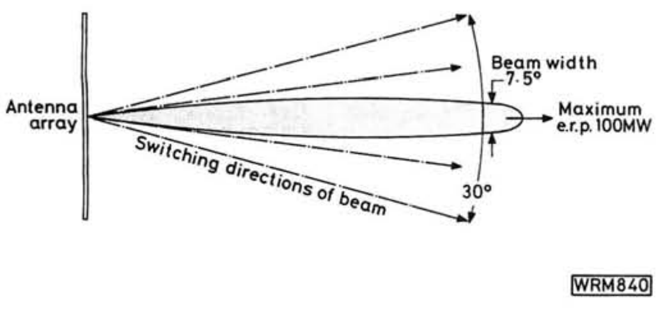
This form of radar depends entirely on the special properties of electro-magnetic radiation in the high frequency part of the radio spectrum, namely 3 to 30MHz (100 metres to 10 metres in wavelength) and on the behaviour of the ionosphere which consists of several electrically charged (ionised) layers of rarefied air. These layers have free electron densities which vary from layer to layer according to the time, day or night, the season of the year and the sunspot activity. They occupy a space some 60 to 350km (32 to 189 nautical miles) above the earth's surface.

Microwave radiation normally used for line-of-sight radar systems passes virtually unimpeded through the ionospheric layers but a significant portion of much lower frequency (h.f.) radiation is reflected back towards the surface of the earth to arrive at distances well beyond the visual horizon. However, enough reflected radiation is returned as **back scatter** on a reciprocal path, i.e. to the ionosphere and thence to its point of origin as in Fig. 1.1. Most of the returned signal consists of ground or sea clutter but solid bodies such as aircraft and ships that are in motion generate discrete echoes which, with Doppler processing, can be separated from the clutter.

Some of the transmitted energy is not "back scattered" but reflected further on by another earth-ionosphere-earth hop. Whilst this could be used to extend the range of OTHR to around 6670km (3600 nautical miles) the detection of objects at that range is not considered reliable.

The CONUS OTH–B Radar in Practice

The main function of the CONUS–B system located in Maine is long range detection of airborne strategic bombers and cruise missiles likely to be directed toward the North American mainland. Existing radars such as BMEWS (Ballistic Missile Early Warning System), supplemented by space systems, can only provide warning time of an ICBM (intercontinental ballistic missile) strike of 24 to 35 minutes. The time limit with line-of-sight radars of a manned bomber-missile carrier, or cruise missile attack, is about 10 minutes; even less if approach is made at low level. The CONUS–B radar allows a greatly increased time for state of readiness, e.g. about 3·3 hours warning for subsonic attacks and 1·2 hours for approach at supersonic speeds. The effective detection range is in the region of 3336km (1800 nautical miles). It is quite possible that the Russian OTHR (Woodpecker) operates on a similar principle.



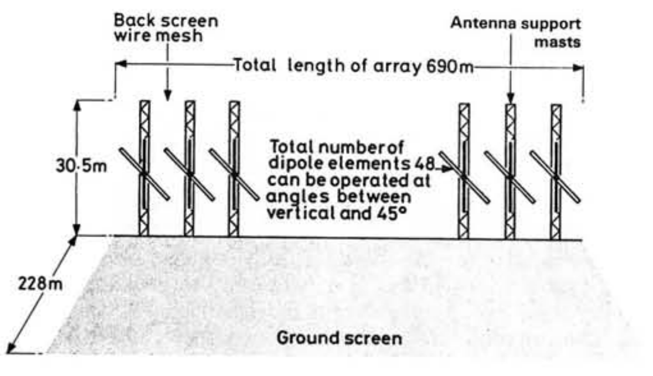


Fig. 1.2: General arrangement of OTH radar transmitting antennas

The CONUS–B over the horizon radar has been operating in Maine USA since towards the end of 1982 and consists of separate static transmitting and receiving sites about 204km (110 nautical miles) apart. The transmitting antenna as illustrated in Fig. 1.2 consists of four separate 12-element sub-arrays with a gain in the

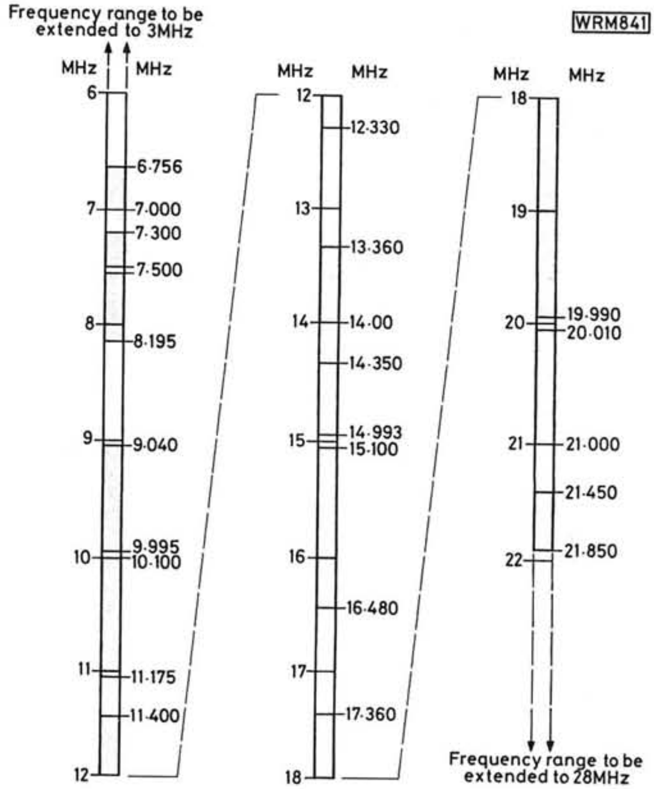


Fig. 1.3: The shaded sections of the frequency range 6 to 22MHz are those expected to be used on a non-interference basis. The range may be extended later down to 3MHz and up to 28MHz

region of 20dB. The dipole elements vary in length and are chosen to cover specific bands of frequencies between 6·74 and 22·25MHz as shown in the allocation chart, Fig. 1.3, and occupying **all the shaded areas.** Until now they have taken care to avoid interference to other vital services and amateur radio.[4] However, the transmitting antenna system will later be extended to provide an azimuthal coverage of 180 degrees and two extra frequency bands will be included to provide coverage between 5 and 28MHz. As already mentioned, the e.r.p. from the present system is approximately 100 megawatts and the switchable antenna beam width is 7·5 degrees although the total present arc of coverage is 60 degrees as shown in Fig. 1.4. The fully operational system will cover an azimuth of 180 degrees.

The receiving and operations centre is located at Columbus in Maine but this may later be transferred to another site. The receiving antenna array is illustrated in Fig. 1.5, which in (a) shows the general arrangement of wide band triangular elements (137 in all) operated against a back screen reflector some 15m high and 1·19km in length with a ground screen projected outwards from the array for a distance of 228m as in diagram (b). The beam width is approximately 2·75 degrees and steerable.

General Function

Radiation from the transmitter in Maine is reflected from the ionosphere to illuminate sections of the North Atlantic, each 926km (500 nautical miles) long (including a large portion of South Greenland) and out to a range of 3336km (1800 nautical miles) as in Fig. 1.6. The normal surveillance mode with the experimental system now in operation is for the 7·5 degree transmit beam to step-scan four adjacent sections (1, 2, 3, and 4) successively to

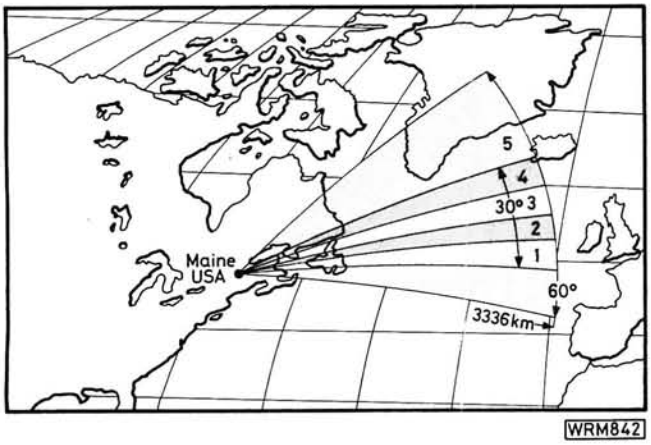


Fig. 1.4: The experimental OTH–B radar system has an interrogate mode (area 5) to provide data on areas of interest within the total coverage of 3336km (1800 nautical miles) by 60 degrees

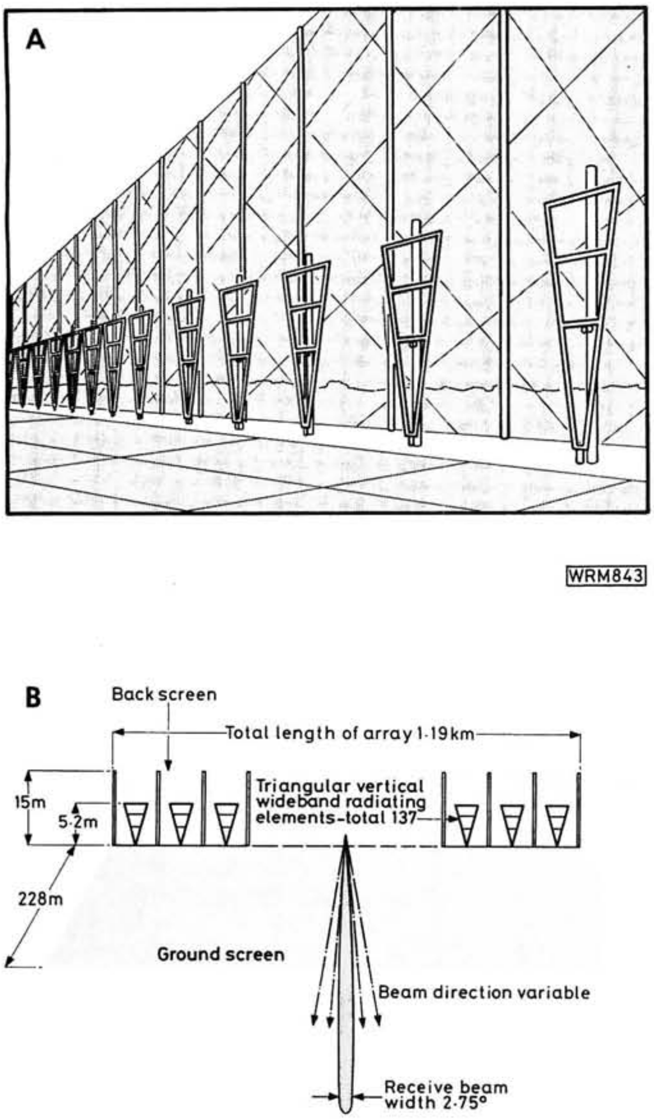


Fig. 1.5: The OTH–B radar receiving antenna, (a) Impression of the antenna; (b) Dimensional schematic

provide a total azimuth coverage of 30 degrees in width at any one time. Within each section the switched 2·5 degree receive beam picks up energy reflected from targets (see also Fig. 1).

The received signals are digitised and then processed so that each is resolved into 4096 time delay (range information) and Doppler frequency (radial velocity) cells. The processing function also takes care of interference, clutter blanking, peak detection and integration. Target contacts are fed to an operations processor which, in turn, provides and maintains the tracks together with geographical coordinates. All information is then formulated for display. The displays for OTH–B radar are called **Detection-Tracking Consoles** and give information graphically and in alphanumerics. These operate in conjunction with a **Senior Director alphanumeric terminal and identification console** for determining the tracks related to flights of commercial aircraft and friendly military aircraft.

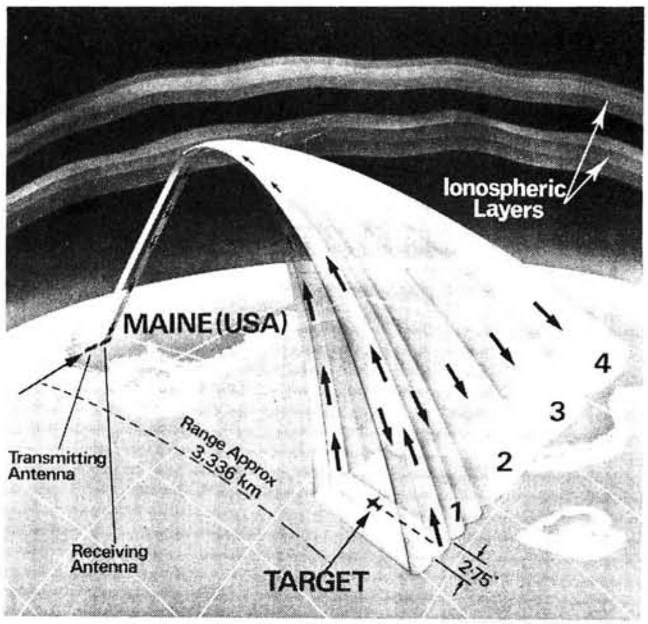


Fig. 1.6: Radiation from the CONUS–B OTH radar in Maine

Part 2 will deal with other aspects of OTH radar, the necessity of ionospheric sounding and analysis of the Russian OTHR signals known to radio amateurs the world over as "the Woodpecker".

References

(1) *Back Scatter Ionospheric Sounding.* Kabanov and Osetrov. The Soviet Press 1965.
(2) Chain Home—a chain of fully operational coastal radar stations installed at strategic positions between Ventnor on the IOW and the Firth of Tay in 1939. The original Chain Home stations operated in the frequency band 20–55MHz.
(3) *Beyond the Far Horizon, USAF Ionosphere Radar.* G. Bulloch. Interavia. December, 1982.
(4) *Over the Horizon—Ionospheric Radar. QST* April, 1980.

Source of Information

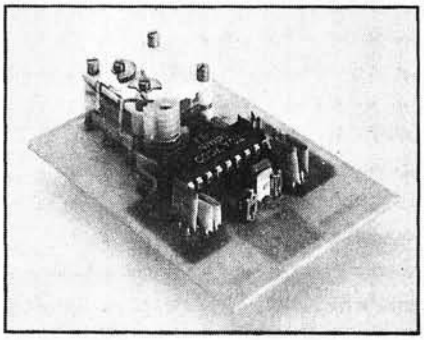
OTH Radar Office.
U.S. Air Force Electronic Systems Division.
Code OCUE, Hanscom AFB.MAO1731. USA.

New f.m. Radio Chip

By the time this issue of *Practical Wireless* is published, Philips Electronic Components and Material Division (Elcoma) will have announced the names of agents stocking a unique new integrated circuit containing most of the essential circuitry of a wide-band f.m. radio receiver.

Designated the TDA7000, the circuit integrates a complete mono f.m. radio from the antenna input terminals to the loudspeaker pins. The only other peripheral components required are one tunable *LC* circuit for the local oscillator, a single resistor, a few inexpensive miniature ceramic plate capacitors and, of course, a d.c. power source.

Prior to the development of this device, it has not been possible to integrate an f.m. radio, principally because of the need for *LC* tuned circuits in the r.f., i.f., local oscillator and demodulator stages. In order that the coils in the i.f. stage can be eliminated, it is essential that the normal f.m. receiver i.f. of 10·7MHz is reduced to a frequency that can be processed by active filters, thus enabling the op-amps and resistors of the active filters to be integrated. It would therefore seem that if an i.f. of zero were achieved, it would be ideal, allowing the elimination of spurious signals such as repeat spots and image response. Unfortunately, with an i.f. of zero the i.f. signal could not then be limited prior to demodulation, resulting in poor S/N ratio and no a.m. suppression. An i.f. of 70kHz would overcome these problems and position the image frequency about halfway between the desired signal and the centre of the adjacent channel. As with all conventional f.m. receivers, there remains a need to suppress excessive noise when the receiver is not tuned to a station or is tuned to a weak signal, spurious responses above and below the centre frequency of the desired station (side tuning), and harmonic distortion due to very inaccurate tuning.



The photograph shows a laboratory model of the TDA7000 in a complete f.m. radio

Philips TDA7000 therefore represents a totally integrated, revolutionary mono f.m. radio that utilises an active 70kHz i.f. filter and also has a unique correlation muting circuit to suppress side responses caused by the flanks of the demodulator S-curve. With such a low i.f., distortion would occur with the usual $\pm$75kHz i.f. swing with maximum modulation. The maximum i.f. swing is therefore limited to $\pm$15kHz by negative feedback from the demodulator output to the local-oscillator in a frequency-locked-loop (f.l.l.). This results in distortion of only two percent with $\Delta f_{mod}=\pm 75$kHz. The combined action of the mute system and the f.l.l. also suppresses image response.

Applications for the TDA7000 are obvious, however, for all classes of f.m. radio the small size, lack of coils, easy assembly, low power consumption and the total elimination of pre-set tuned circuit alignment are not the only attractive features, the unique correlation muting system and the f.l.l. make it very easy to tune, even when using a tiny tuning knob. For higher-performance systems, station presetting facilities using varicap diodes may be utilised.

Brief data on the TDA7000 is as follows: Typical supply voltage, 4·5V d.c.; Typical supply current, 8mA; Input frequency range, 1·5 to 110MHz; Sensitivity for −3dB limiting e.m.f. with $Z_s=75\Omega$—mute disabled, 1·5µV; Maximum signal input for t.h.d. <10%, $\Delta f=\pm 75$kHz e.m.f. with $Z_s=75\Omega$, 200mV; Audio output (r.m.s.) with $R_L=22k\Omega$, 90mV.

The TDA7000 will be available in either an 18-lead plastic d.i.l. package, or in a 16-pin SO package (TDA7010T). Future developments will include reducing the present supply voltage (4·5V typ.), and the introduction of f.m. stereo and a.m./f.m. versions.

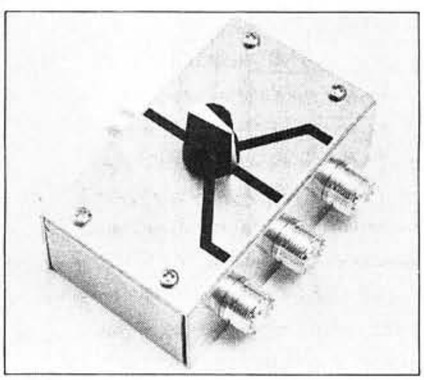
The information on this device was supplied via *Electronic Components & Applications* which is published by *Philips Electronic Components and Materials Division (Elcoma), the Netherlands, in co-operation with associated companies such as Mullard Ltd. in England and Valvo in Germany.*

3-way v.h.f. Antenna Switch

The Drae 3-way v.h.f. antenna switch recently introduced by Davtrend Ltd., manufacturers of amateur radio products, has less than 0·3dB insertion loss at v.h.f. and less than 1dB loss at frequencies up to 500MHz.

The single-pole, three-way switch has silver-plated brass contacts that are terminated via a double-sided p.c.b. transmission line to S0239 connectors. Power rating is 250W r.m.s. at 50Ω impedance.

All the unused switch positions are connected to ground via a high impedance resistor to prevent static build-up on the unconnected antennas. The manufacturer warns users that the



switch is rated for 250W carrying capacity NOT switching capacity, so do not transmit when switching antennas, also when tuning high v.s.w.r. antennas, take care not to exceed the maximum voltage rating of the switch, which is 1kV.

The v.s.w.r. figures quoted range between 1·1:1 at 30MHz to 1·5:1 at 440MHz.

Housed in an attractive aluminium case the antenna switch costs £15.40, which includes VAT, and is available from Drae stockists throughout the country, or direct from the manufacturers: *Davtrend Ltd., The Sanderson Centre, Lees Lane, Gosport, Hants. PO12 3UL. Tel: (070 17) 20141.*

If you please

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

The Design And Use Of HEATSINKS Part 2

by E.A. Rule

Part 1 of this article described how to calculate which type of heat sink you require for your project. In this part we look at the more practical points for choosing the right heat sink for the job.

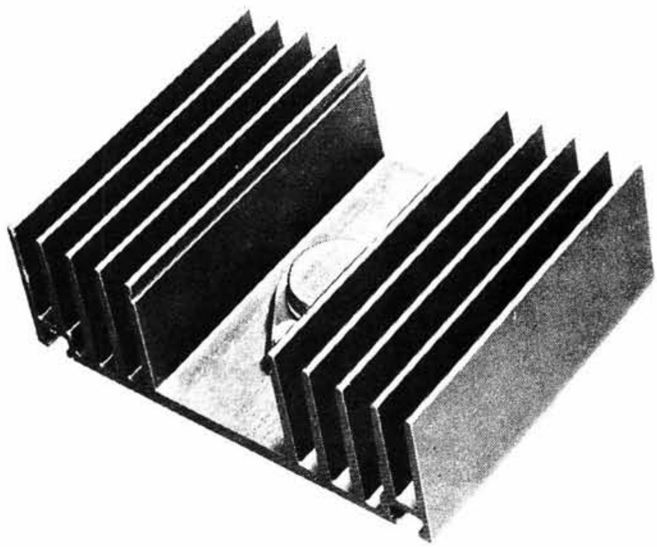
Heat sinks should always be mounted with any fins in the vertical position and the air flow across these fins must be unrestricted if the specified thermal resistance values are to be obtained in practice. Mounting a heat sink under a shelf or inside a cabinet will **greatly** reduce its effectiveness. For example if the fins are not vertical it could be up to 20 per cent less effective. Heat sinks should be painted matt black, or better still, black anodised; bare metal will reduce the effectiveness about 15 per cent. If you mount your heat sink in an unventilated cabinet you could reduce its effectiveness to zero. Whenever possible always mount your heat sink where it will receive the maximum amount of air flow, normally this will be along the rear of the equipment, but be sure to leave a small gap between the bottom of the sink and any chassis or cabinet to allow air to circulate.

Of course it is possible to make your own heat sinks out of aluminium and some details of these will now be given along with the expected thermal resistance figures. Table 1 gives some typical thermal resistance figures for flat plates with a single device mounted in the centre. For example a flat plate of 16 s.w.g. aluminium and 255mm square will have a thermal resistance of around 1°C per watt or one of 110mm square about 5°C per watt. The figures shown in the table can be improved by bending the plates to form fins or ducts as shown in Fig. 2.1. Additional fins may be added as shown in Fig. 2.2.

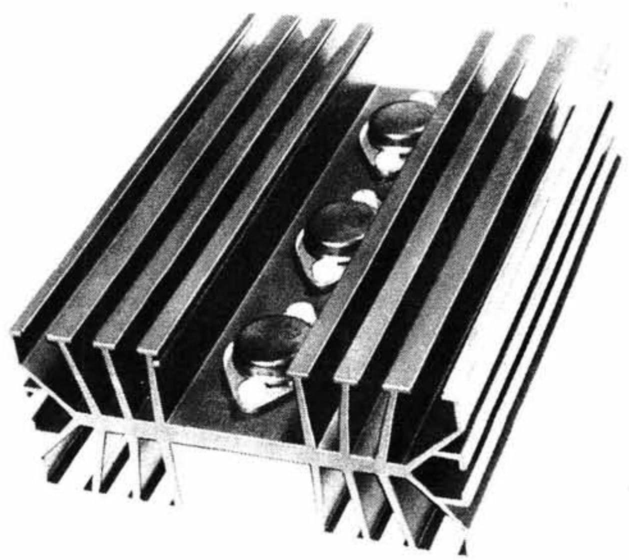
Size in mm	Thermal resistance
300 × 300	0·8°C per watt
255 × 255	1·0°C " "
110 × 110	5·0°C " "
60 × 45	14·0°C " "
50 × 30	20·0°C " "

Table 1

It is possible to calculate the thermal resistance of any particular heat sink after doing a simple test. After building your heat sink, mount on it a suitable high wattage resistor and adjust the current and voltage applied so that it dissipates a known wattage, say 25 watts. Note the ambient temperature before starting the test and then measure the temperature of the heat sink after the temperature has stabilised. Subtract the ambient temperature from the final temperature and divide by the wattage. The answer is the °C per watt for your sink.



Redpoint type MB — 51mm length rated at 2·09°C per watt. 152mm length rated at 1·22°C per watt



Redpoint type L — 51mm length rated at 1·75°C per watt. 152mm length rated at 1·03°C per watt

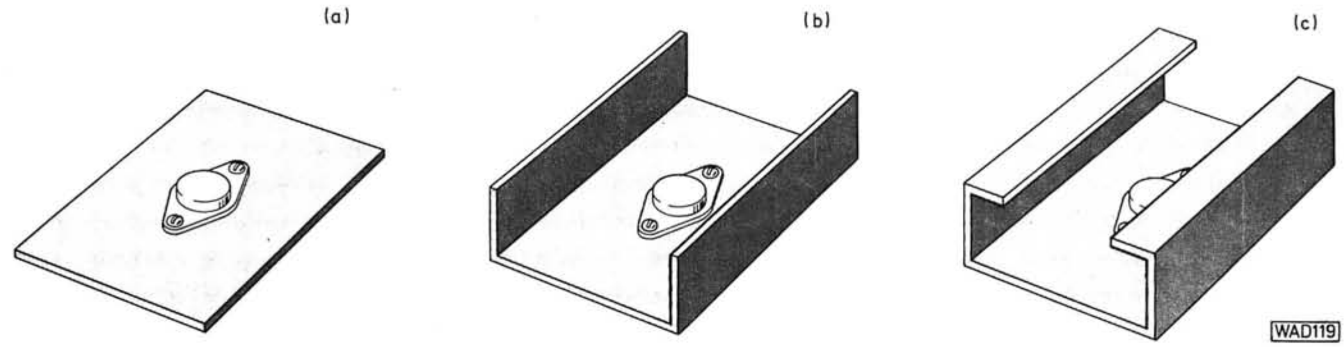


Fig. 2.1: Stages in improving the thermal resistance of a heat sink (a) flat plate, (b) fins added to increase the area, (c) extra bends so that the heat sink is in the shape of a duct — this greatly increases the air flow. All types should be mounted in a vertical position

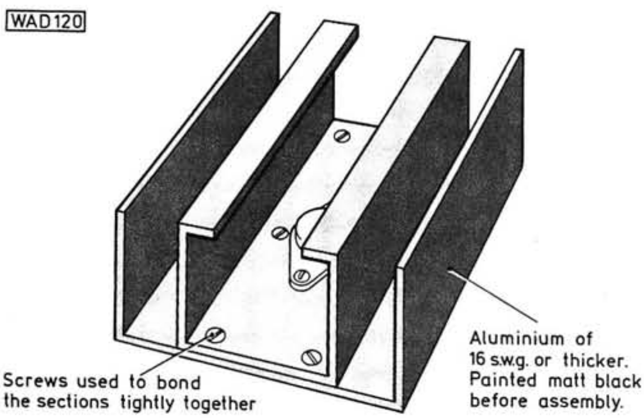
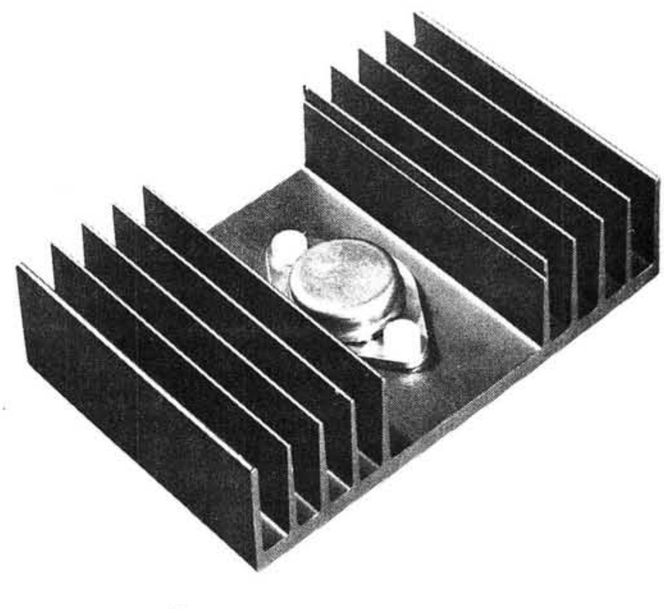


Fig. 2.2: Extra fins and/or ducts may be added to improve the thermal resistance of a heat sink. Silicone grease must be used between all surfaces which should be flat and free from burrs. The various sections should also be firmly bolted together for maximum heat transfer between them



Redpoint type MA — 51mm length rated at 2·35°C per watt. 152mm length rated at 1·50°C per watt

Example:
25 watts dissipation. Ambient 20°C.

Final temperature 180°C.

$180° - 20° = 160°C.$

$\frac{160°}{25W} = 6{\cdot}4°C$ per watt.

The effects of adding fins, painting black etc., can quickly be measured by this method and a few samples will enable you to get the hang of how to decide on the size of the heat sink for any particular project. Remember, the lower the final case temperature of your semiconductors the greater the reliability will be. Always calculate for the worst possible conditions likely to be encountered in practice. It is possible to mount more than one device on one heat sink and in this case you add the total combined dissipation for the power and take the lower of any operating temperatures given for the devices.

Heat sinks range from the small clip-on type for small signal transistors through to fan-cooled and liquid-cooled types produced by manufacturers such as Redpoint. Commercial heat sinks cover a thermal resistance range of from 100°C per watt down to as low as 0·01°C per watt for the liquid-cooled types. However, it is unlikely that the average *PW* reader will have a need for these!

The author is indebted to Redpoint Limited for much of the information presented in this article. ●

the things people say

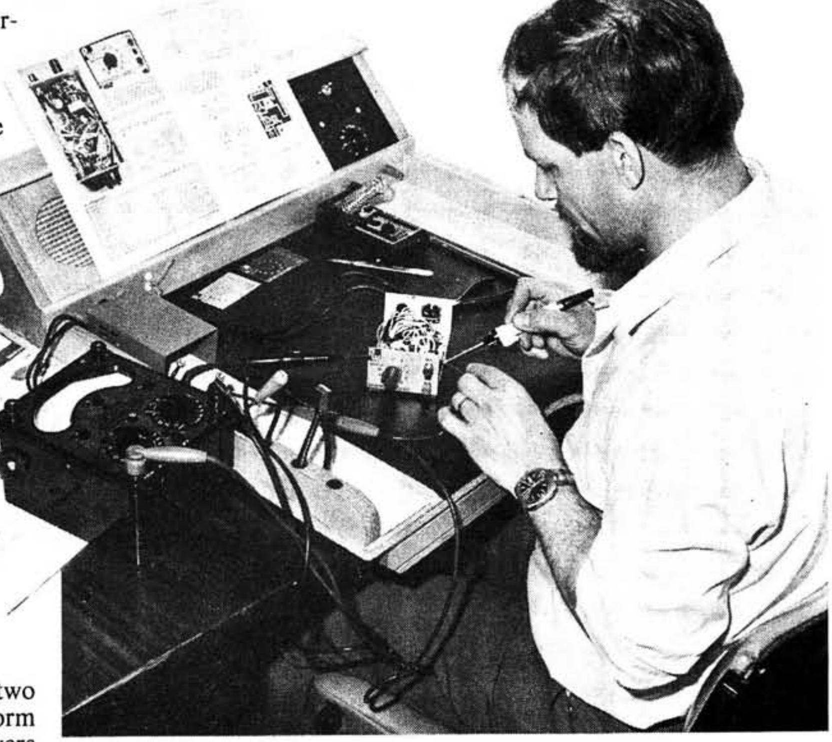
"... Yes, I find take-off to the North, West and East from this QTH is fine, but to the South the Pennines are usually in the way!" (You know what they say about faith moving mountains!)

... heard by G6KND

Have you heard any (printable) comments, funny peculiar or funny ha-ha? If so, why not send them in to our Editorial offices at Poole. We will pay for every one published.

TABLE-TOP WORKBENCH

by A. SPROXTON



Several years ago *Practical Wireless* reviewed a commercially produced table-top workbench designed and sold by Home Radio. Unfortunately both Home Radio and the workbench have since fallen by the wayside.

As this concept proved to be very useful for the home constructor who has to work on the dining room table we are presenting the details of a modified workbench suitable for home construction.

The pictures show all the basic details of the construction of the workbench and together with the notes below should enable even the world's worst carpenter to make a success.

Part A Made from a piece of 12mm thick blockboard or chipboard 660 × 660mm, the blockboard being possibly the best material.

Part B This doubles as a carrying handle and a stop to prevent the workbench from being pushed further onto the table. The slot should be cut by drilling large holes at each end and then removing the rest of the material with a jigsaw. The material is 6mm thick plywood 660 × 28mm and is held to the base (A) with 10mm square strips of wood glued and screwed for extra strength.

Part C There are two of these each made from two pieces of 4·5mm ply with pieces of 6mm ply cut to form the slots to hold tools. Glue and pin the three layers together before rounding the front edge.

Part D A plain strip of 6mm thick plywood 660 × 45mm glued and pinned to the two side pieces (C).

Part E The two sides are made from 15mm thick ply or blockboard with the large cut-outs for the 13A mains sockets cut with a jigsaw. (If preferred surface mounting mains sockets could be fitted but could get in the way when "parking" the bench).

Part F These are similar to the ends (E) but have no cut-outs.

Part G The top is a plain piece of 10mm plywood 660 × 50mm. It should be glued and pinned in place after the sloping front panels have been fitted as it extends forward over these panels.

Part H The hinged toolbox lid made from 6mm plywood cut to fit the opening. A lock could be fitted if needed.

Part I The back panel is a piece of 6mm plywood 660 × 172mm glued and pinned to the sides and base.

Refinements

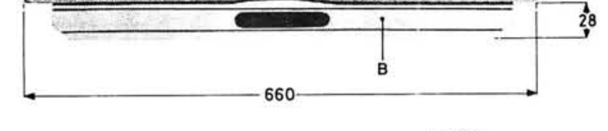
The bottom should have four rubber feet fitted to prevent scratching the wife's best tabletop, while four more feet should be fitted to the back panel for "parking" purposes.

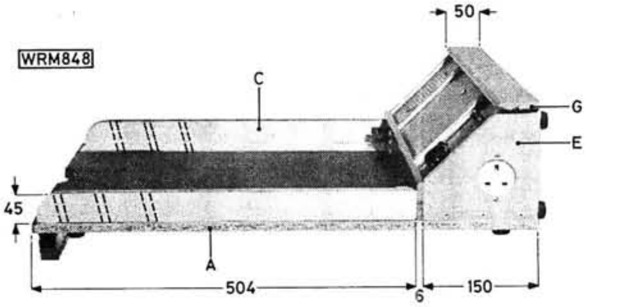
The solder and wire reels are carried on a piece of dowel fitted inside the tool box with the solder and wire emerging from the depths through grommetted holes in Part D. Also on this part are the terminals for the speaker and power supply. If an amplifier is fitted the volume control would be fitted on the loudspeaker panel.

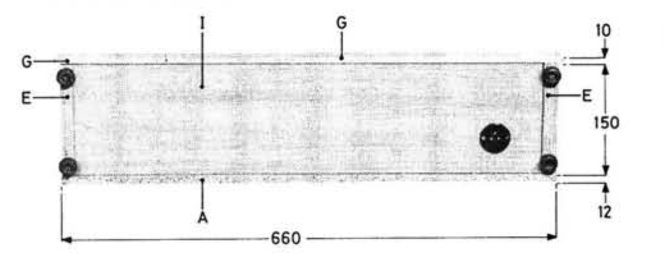
To make the work area better for electronic work a strip of black industrial rubber 3mm thick is fitted between two thin wood strips and the outer sections covered with Formica.

The mains supply for the power unit is fed into the

All dimensions in mm.







bench through a standard IEC three pin mains plug and socket of the recessed type. The mains lead can be stored in the tool box when not in use. The recessed plug is fitted into the back panel.

The power supply could be as simple or complex as desired. A regulated variable supply of, say, 0 to 15V at 1A could be useful and with modern regulator i.c.s would be cheap and easy to build. In the same vein a low-cost audio amplifier feeding the loudspeaker would also be useful. Suitable design appeared in the March 1981 and June 1982 issues of *PW*. (See also the *Computing Supplement* in the December 1982 issue.)

The two panels carrying the speaker and the power supply controls can be made from 6mm ply, screwed into place to allow easy removal in case of trouble with the amplifier or power supply. Both of these panels are best cut to size after the bench is assembled to ensure that you get a good fit.

A small vice can be fitted to the bench if required and there are many different types available which are suitable.

Your local d.i.y. shop should be able to supply most of the structural parts for the project and, of course, you could alter the dimensions if desired to suit material to hand.

The industrial rubber sheet can be obtained from Cloughs (Croydon) Ltd., 85 Manor Road, Wallington, Surrey.

The electrical fittings are stocked by good d.i.y. stores or electrical shops but please only use good quality parts here.

BANDSCAN

An Occasional Look At The International Broadcasting Scene by Peter Laughton

Next year telecommunications representatives will meet in Geneva, Switzerland for what is being termed a "mini" World Administrative Radio Conference. Actually the problems this meeting has to solve are a bit more major than the title implies. The main WARC conference back in 1979 was a bit of a disappointment as far as international broadcasting was concerned. Some expansion of the present "official" short wave broadcasting spectrum was agreed upon, with an eye on 1989 as the year for its implementation. In reality, some international broadcasters are already jumping into the new bands, either because of lack of space in existing "official" bands, or because they believe in the old practice that if you use a channel for a while, you can claim it's "yours".

The 1984 WARC has to try and sort out some of the political arguments that appeared in 1979, in what (in theory) should be a purely technical conference. Long established broadcasters complain of interference, whilst developing countries point out that they have no spot on the dial to go to. The East complains when USA, West Germany and the UK use 10 or more frequencies to beam a programme into one country, whilst the West responds with facts that their broadcasts are jammed, and that East Bloc stations use more than a few channels as well!

Diminishing Coverage

The mood in the frequency departments of international short wave stations is somewhat gloomy at the moment. Sunspot activity is declining, with the result that the higher frequency short wave bands (e.g. 25 and 21MHz) become impossible to use to certain targets. So everyone has to move down in frequency. It was the same situation 11 years ago, of course, during the last sunspot cycle, but since then many more high power transmitters have joined the airwaves. And so telex messages fly from one station to another, requesting in the most polite diplomatic language that the other station should get off their channel and pester someone else. Even optimists say the chance that issues such as jamming and a better use of the spectrum are sorted out in the next few years, is just a dream. The alternatives are proving expensive.

Traditional multi-hop paths are getting very difficult. Radio Australia no longer has the reliable reception in Europe it enjoyed in the seventies. Indeed, during the bush fires in February, the BBC offered Radio Australia a few minutes of airtime on six of its transmitters, to keep listeners in Europe informed as to the state of the problem.

The service lasted a few days, but the idea of sharing facilities is becoming more and more popular. It's nothing new, though, since the Dutch station in Eindhoven, PCJ, relayed programmes from the UK directed to British colonies until the BBC set up G5SW, by arrangement with Marconi's Wireless Telegraph Company. That was for a short period ending in November 1927. Today, in order to be able to serve a distant continent satisfactorily, relay stations are essential. In this respect, countries such as Sri Lanka have become populated with transmitters carrying the programmes from the religious organisation Trans World Radio and Voice of America. The VOA is rebuilding its facilities to increase the present two 35kW transmitters, whilst Deutsche Welle, the Voice of Germany, is constructing a relay station too.

Short Wave, via Satellite?

The People's Republic of China is a popular target at the moment, especially since the Chinese started writing in their thousands to stations with a Chinese service a few years ago. Radio Australia boasts a bumper postbag, whilst the BBC would like to build facilities in Hong Kong to improve its reception if it can raise the funds. Religious station WYFR, with headquarters in Oakland, California, has opted for another alternative. It needed to reach the People's Republic, and it became aware that the Voice of Free China, Taipei, Taiwan wanted to reach North America. So as from January 1982 the two stations made a programme swap, part by tape, part via satellite, with WYFR putting out VOFC programmes and vice-versa. Starting at a time when the US wanted to improve relations with the government in Peking, this was an interesting development which escaped the attention of politicians, and even the FCC for a few weeks. After a year, WYFR says the agreement is a success and will continue.

Radio Peking, which since the 1st January 1983 has started calling itself Radio Beijing, is also looking around for friendly countries. It used to have a relay from facilities in Tirana, Albania, as the Chinese helped this country to build its transmitters. But the relationship has since gone sour and the relays discontinued. At one time Radio Peking was logged in English, Italian and Russian running programmes backwards with no explanation. The frequent occurrence of this ruled out a mistake, and a theory was put forward that this was a simple way for Peking to feed its Albanian relay base. The technician in Tirana simply had to turn over the tape, without rewinding, for the broadcast. No one ever received an official explanation, though backwards Russian is still heard from time to time by listeners scanning the band in Europe. The Chinese are now assisting Tanzania with short-wave transmitters. Radio Havana Cuba uses transmitters in the USSR for some of its European programmes (e.g. in English) but it says it doesn't relay Radio Moscow in return. A brief spell of a medium wave Radio Moscow service to the USA was the result of consultations with other Cuban stations.

The Japanese appear pleased with their satellite fed relay via Radio Trans Europe in Sines, Portugal and have been looking at other ways to relay Radio Japan's signals to other important target areas. Some years ago the BBC co-operated with Deutsche Welle to build a successful relay in Antigua, whilst the French went to Gabon to help finance a station called "Africa Number One". Due to propagation anomalies in the equatorial regions, the Gabon station, which was designed with the idea of relaying Radio France Internationale to Africa for part of the time, hasn't proved to be the solution they were hoping for. But RFI will have a relay station in French Guiana quite shortly, and there is talk of a Pacific relay too, if they don't run out of money.

Relay stations are increasingly fed via satellite, instead of s.s.b. short wave, to improve the audio quality. Deutsche Welle, VOA and Radio Netherlands have done this for some years, whilst the BBC is rapidly catching up with satellite feeds to its relay bases. To save money, the majority of the stations don't hire a studio line on the satellite, but simply two telephone lines. The studio signal is split into two components at the station, fed over the telephone circuits via the satellite and recombined at the relay station into a studio signal with a bandwidth of about 5·5kHz, more than enough for short wave fidelity, yet noticeably better than using an ordinary telephone line.

Politics in Radio

For those without the possibility of a relay station, there is always hope that transmitter time may become available on a relay base. But here politics plays a role, as the relationship between the host country and the station operating the relay base is usually more than hiring a plot of land. Agreements often include the use of local labour, the need for training programmes, development aid, and, in some cases, the right of the host country to censor transmissions. Not surprisingly then, both station and host country are reluctant to involve a third party. Those with relay stations got a reminder of what could happen when Malta passed a law in September 1982 which prohibited Deutsche Welle from operating their relay station. It took 2 months of negotiations before it returned to the air, and with some considerable changes to the original agreement. DW now have to hand over the entire facilities to the Maltese in 1990, and use of airtime by the Maltese government has been adjusted to allow the expansion of Radio Mediterranean to a three hour daily service. This is a joint project between Algeria and Malta, with the aim of serving the Mediterranean area and other parts of Europe.

With the problems at the conference table in Geneva still unsolved, the programme swap and expansion of relay facilities (where possible) will no doubt increase. And with the state of global policies, watching who teams up with who will doubtless lead to some surprises.

Benny

Swap Spot

Have full coverage receiver, digital readout plus Hy-Gain 3·5—28MHz trapped vertical, cost £399. Would exchange for BBC Micro or Dragon plus tape recorder and software. Possibly could deliver. Tel: 0472 751636 for further details. *S136*

Have Heathkit Cointrac metal locator model Gd1190, new and unused, complete with NiCads and manual. Would exchange for legal CB rig. Pye. Tel: Norwich 57725. *S152*

Have Fender precision bass guitar, black with case, v.g.c. value £200. Would exchange for modern good quality communications receiver in similar condition. P. Wilson, Alfreton, Derbyshire. Tel: 831490. *S169*

Have RCA AR88D in really excellent condition, unmarked cabinet with spare set of valves and manual. Would exchange for any type of h.f. transceiver or Icom v.h.f. rig etc. Trevor Wood, 47 Marsh View, Beccles, Suffolk. Tel: Lowestoft 716292. *S170*

Have Trio TS130s v.g.c. Would exchange for 144MHz home base multimode. J. W. Stokes, 47 River Avenue, Somercotes, Derbyshire. Tel: Leabrooks 604965 (day) or Ambergate 6159 (evenings). *S171*

Have Yaesu transverter 144MHz suitable for FT101/T-T201, FL101/FR101. Would exchange for good receiver, cash adjustment if necessary. P. Haughey G3JXR. Tel: 0908 642398 (Bletchley). *S172*

Have Practika-L with Oreston 1·8/50 and case, Photax f400mm with case and rifle-butt holder, exposure meter, lens hood, Braun flash and two gadget cases, in excellent condition. Would exchange for SX200N in good condition. Mills, Malpas, Truro. Tel: 3769. *S174*

Have set of 12 solid silver ingots (mirror finish), embossed with Royal Castles in presentation case. Good investment, approximate value £300. Would exchange for h.f. transceiver or 144MHz multimode, FT-480R, IC290E etc. Tel: 0633 214541 (Newport, Gwent). *S182*

Have Tektronix 454A twin beam d.c.—150MHz 'scope, Eddystone 770R 19-165MHz a.m., c.w., f.m., CR100 50kHz-30MHz a.m., s.s.b. Would exchange for FT707S any condition. Tel: Chesham 782206. *S211*

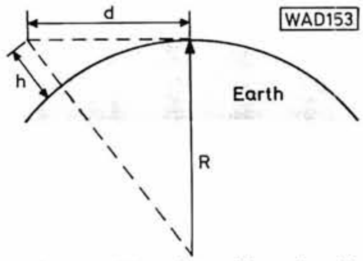
Radio Range~Height Calculations

By R.T. Irish

Being born and bred at the seaside, I have often stood on the beach and wondered just how far away the horizon really was and to what extent this visual distance increased when the top of a ship's mast appeared above it.

Attention was recently drawn to this same problem when determining the maximum range of a v.h.f. transmitter/receiver system as the elements of the system start to drop below the horizon "line of sight", assuming no intervening obstacles such as hills, etc.

Fig. 1



This interesting problem is easily solved by considering the geometry, shown in Fig. 1. Here, h is the height of the transmitter (or receiver) antenna, d is the distance to the horizon and R is the earth's radius. Using our well-tried friend, Pythagoras, on the triangle formed:

$$(R + h)^2 = d^2 + R^2$$
$$\text{or } d^2 = 2Rh + h^2$$

and since 2Rh is much greater than h^2 for usual values of h, this becomes:

$$d = \sqrt{2Rh}$$

In useful units, R = 6400 km and if h is expressed in metres then this formula becomes: $d = \sqrt{13h}$—as nearly as makes no difference.

For a transmitter, height h_1 and a receiver at height h_2, just on the limit of visibility, the ray path is tangential to the earth's surface—as shown in the diagram at the top of Fig. 2. The maximum range may thus be found by adding the distance of each from the horizon. The nomogram, Fig. 2, displays this range as the left-hand central scale marked "optical".

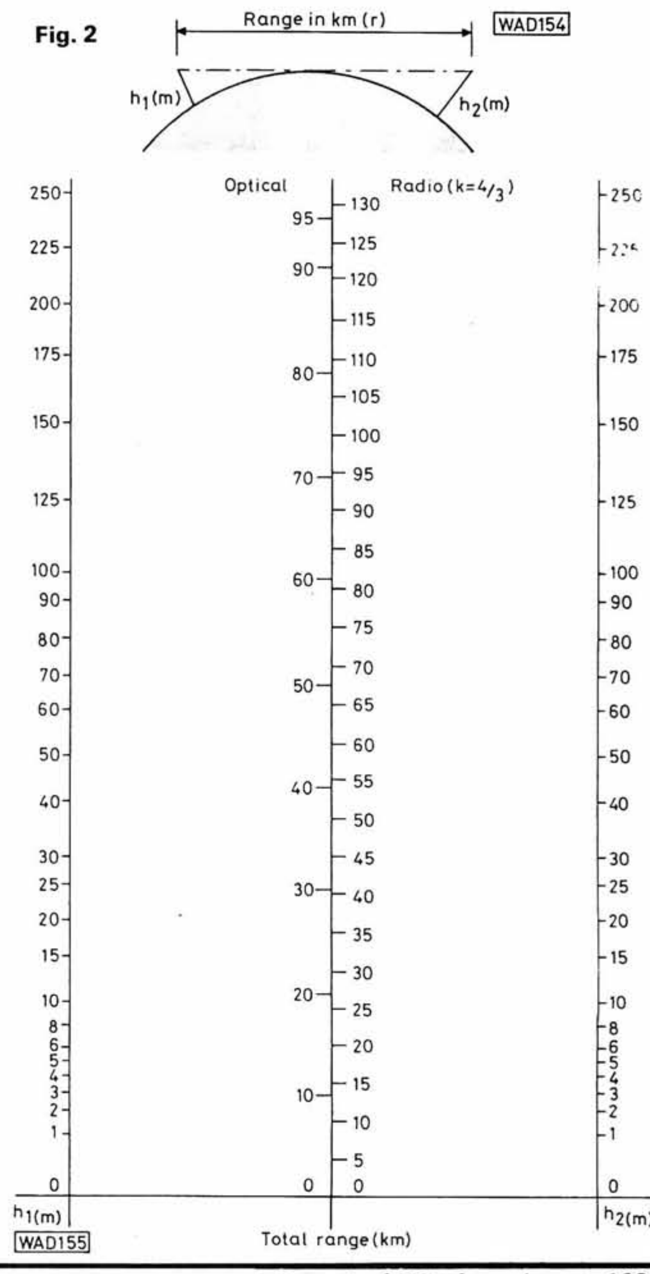
As radio enthusiasts are aware, the atmosphere is denser nearer the earth's surface than it is at higher levels. As a result, radio waves travelling in this density-graded atmosphere are bent downwards somewhat and the true ray path extends beyond the simple geometric limit. This may be very simply taken into account by multiplying the earth's radius by factor k and using the modified radius in the formulae instead. Experimental results show the best value of k to be 1·333 for a so-called "standard atmosphere". With this in mind, the practical formula now becomes:

$$d = \sqrt{17h}$$

and the results for the more practical value of maximum range are given on the "radio range" scale on the nomogram.

As an example, if your receiving antenna is at 50m and the transmitting station 100m then, in the absence of intervening obstacles, the maximum radio range can be expected to be about 70km. ●

Fig. 2



SUPPORT YOUR LOCAL RADIO CLUB

by D.O.White G3ZPA

What is it like at your Radio Club Meetings these days? Is it getting boring, attendances falling off, are people tired of the same old dreary programme—is this how it is at your Club?

Now is the time to do something about it, time for the committee to invigorate things and get new members as well.

You could start off with the obvious and remind members to attend meetings and the secretary could mail a programme of events to irregular attending members. Meeting announcements can also be sent to your local newspapers and radio station and a committee member should be appointed to give information over the club v.h.f. net, assuming you have one. If you do not, why not start one up as they are a big help in holding clubs together? It is a good idea to duplicate a list of all meetings and events together with net night schedules for the year and distribute to all members so they can keep it in their shack.

Club Meetings

Once everyone, including former members, knows the night and programme of meetings, you now have to keep them coming to meetings. A well organised meeting is a good part of the answer.

One good way to arrange club meetings is to split them up into three parts: the main activity or lecture, coffee break, the business part of the meeting and distribution of the Newsletter. Once again if the club has no Newsletter a committee member should be appointed to organise one, even if it is only a single copy that has to be passed around at the meeting.

A good committee is essential and a chairman should be selected who is both forceful and dynamic and who generates enthusiasm. He should also have a big "gavel to bang" and use it too! Choose him carefully for he might be the most important member of your club.

The committee should now get together and thrash out a programme of events which could go something like this:

Winter Activities

1.1 A visit to the electronics department of a local industry.
1.2 Display of different types of receivers, both old and new with working demonstrations and a discussion of the merits or failings of each one. (This would keep the s.w.l. element of the club happy.)
1.3 An auction or bring-and-buy (junk) sale with about five per cent (or more) commission for the club to help funds.
1.4 Movies and slides of the previous summer's activities, such as field day or the DF hunt.
1.5 Test equipment display and demonstration of how each piece of equipment is used.
1.6 Faulty equipment night where members bring along that piece of equipment that has failed and where the more knowledgeable members assist or advise on repairs.
1.7 Christmas party where members can bring along their respective "better halves" and use up some of those surplus funds for a good "fling".
1.8 Club operating contest where a trophy should be purchased and awarded annually to a club member for the best item of home brew equipment.
1.9 Invite speakers from other nearby clubs.
1.10 Purchase an episcope projector. This is a worthwhile item to spend some of those club funds on as it can be used to make lectures far more interesting by showing photographs, maps, drawings, circuits etc.

Summer Activities

2.1 Visit to another club and see how their activities compare with yours.
2.2 Organise at least two direction finding contests (Foxhunts) for the summer as these are really great fun and can be followed-up by a picnic afterwards.
2.3 Appoint a sub-committee to organise a field day event which can last a whole weekend.
2.4 Have an antenna gain measuring day out in the field using a switched attenuator and a reference antenna. This could also be done jointly with another club(s) and followed up by a barbecue.

The foregoing is just a sample of how the author's local club runs its events, so that's it folks, careful planning and plenty of publicity is the secret of success here.

Try to put a little life into your club and you will watch it grow and prosper and maybe you will even have some fun doing it! ●

Kindly Note

RTTY with the ZX81—1, June 1983
On P.62 Fig. 1.2, the designations and values of C6, 7 and 8 were unfortunately omitted from the circuit diagram. Capacitor C6 (IC2 pin 6) should be 0μ1; C7 (IC2 pin 2) 1μ; C8 (IC2 pin 1) 2μ2. C15 should be a 10nF polystyrene capacitor not disc ceramic as specified in the components list.

***PW* "Marchwood"—2, July 1983**
Please note that the thermal protection devices, S4 and TS1, were left off the Components List. They are RS Components order code references 339–308 and 307–935 respectively.

Swap Spot

Have Grundig Satellit 1400 professional RX, nice working order, digital readout, all bands l.w.—30MHz, b.f.o., s.s.b. u.s.b./l.s.b., very slow tune rate. Would exchange for FRG-7 or SRX30D. J. Walker, 16 Himley Road, Clayton, Manchester, M11 4JF. Tel: 061 688 5570. *S007*

Have Faradic electronic exerciser "Slendertone" 8 pads, in smart executive lock-up case. Would exchange for anything in amateur radio w.h.y.—just started. Wingrove, 34 Millhouses Street, Hoyland, Barnsley, S. Yorks. *S047*

Have Fidelity 3000 base station f.m. CB, as new. Would exchange for 144MHz (2m) transceiver, or FRG-7 or Trio communications receiver. G. Stubbings, 47 Haverhill Crescent, Rise Park, Nottingham. *S048*

Have Futaba 4 + 2 radio control equipment complete, as new, plus many extras. Also Realistic DX160 receiver and SP150. Would exchange for 144MHz base rig or MM transverter and oscilloscope for radio/electronic work. B. P. Keegan. Tel: 0253 854000 (Cleveleys). *S049*

Have colour TV, new tube recently fitted. Would exchange for TH33 or Thunder Bird beam. Tel: Harlow 31973. *S050*

Have mint FRG-7700 with *R & EW* modules, s.s.b., buffer, mixer, c.w. and control unit, only needs f.m. board and p.a. to make RX into 1-30MHz all mode TX-RX. Would exchange for FT101ZD, FT707 etc. Tel: Southend 218646 after 6.00pm. *S051*

Have approximately 400 magazines, *PW, EE* etc. Would exchange or part-exchange for any 144MHz rig (working or not). All postage paid for. Tel: Fawley 897338. *S052*

Have Bolex sound camera with Marco zoom and Eumig sound projector—both as new. Would exchange for h.f. linear or 101ZD accessories. T. Thompson, 28 Josephine Avenue, Limavody, N. Ireland. Tel: 0504 72 3396. *S060*

Have RTTY interface board for ZX81 plus tape and instructions. Would exchange for 10 × 50 binoculars or cassette recorder used for computer purposes. Tel: 061 969 0785 or write 77 Rook Field Avenue, Sale, Cheshire. *S061*

Have Sony AVC400 Viewfinder studio camera, 625 line, less lens, plus camera cable, Tamron 50-75 zoom lens "C" mount. Would exchange for a good h.f. receiver or 144MHz/432MHz gear or good reel-reel stereo tape recorder. G6TSL, 7 Willowbrook, Greytree, Ross-on-Wye, HR9 7HN. *S071*

Have computer 16K Video Genie, one year old in v.g.c. Would exchange for a 150W + 144MHz linear (not home brew). Tel: Dover 820031. *S072*

Have Casio FX202P programmable scientific calculator, as new, with manuals value £85. Would exchange for any 144MHz transceiver i.e. 2200, w.h.y. G8XKZ, QTHR. Tel: 01 361 1666. *S088*

Have model railway equipment. Would exchange for 144MHz transceiver, v.h.f. scanner, Spectrum or Dragon computer. Jim. Tel: 0504 59634 (N. Ireland). *S101*

Have TRS-80 computer, level 2, model 1, 48K with monitor and extensive software. Would exchange for 432MHz multimode or h.f. transceiver. Tel: 061 480 1472 (Manchester). *S114*

Have Walkman type Aiwa model CS-J1 f.m. stereo radio/cassette recorder/player, cost £100, as new, complete with earphones etc. (top of the range model). Would exchange for ZX81 with 16K RAM pack. Tel: Graham, 061 740 4126 (Manchester). *S118*

Have Hartley model 13 double beam 'scope, needs repair, with manual, spare valves and c.r.t. Would exchange for any 144MHz mobile of any age or 432MHz gear. G8XCL. NOT QTHR. Tel: Lydd (Kent) 20954. *S119*

Have LCL f.m. CB, boxed (easily converted amateur 28MHz f.m.) plus s.w.r./Power meter and trunk lip antenna. Would exchange for (elderly but operational) general coverage receiver, RAE student. Louis. Tel: Ringwood 77738. *S222*

Have SU8 crystals for Trio TR3200/8300 transceivers. Would exchange for RB0 crystals for same. Also Philips valved CCTV system. Would exchange for u.h.f. or microwave equipment. GW6AYM, QTHR. Tel: 0792 204146 (Swansea). *S250*

Have Labgear Televerta model CM6022/RA. Would exchange for test gear or hard/soft ware for Spectrum computer or w.h.y. Tel: 0823 432909 (Taunton). *S251*

Have W/S No. 19 with mains p.s.u. built into Rotary p.s.u. case, with v.h.f. section. Also large 52 set a.t.u. Would exchange for R1155 receiver or 62 set or CB rig with mains p.s.u. Heslop, 75 Alder Park, Brandon, Durham. *S289*

Have National Panasonic receiver RF 3100L, 29 shortwave bands, digital readout and b.f.o. Also Grundig Satellit 2000, 10 shortwave bands. Would exchange for $3\frac{1}{2}$in lathe, any condition, with screw cutting facility. Tel: Southport 77227. *S290*

Have Binatone 5-star f.m. CB rig plus accessories. Would exchange for 432MHz ATV converter plus 432MHz ATV beam, or reasonable offers. J. G. Bolland, 23 Kingsley Street, Claughton, Birkenhead. Tel: 051 653 4853. *S308*

Have Midland 2001 CB transceiver. Would exchange for general coverage h.f. receiver or 144MHz receiver or w.h.y. Tel: Cambridge 834263 evenings or weekends. *S309*

Have ZX81 within fully enclosed keyboard, with 64K RAM, many books and game cassettes. Would exchange for FRG-7700 memory unit. Tel: 01 385 5403. *S326*

Have scale model tugboard, 47in o/a, Futaba 2-channel r/c, Decaperm 6V motor and accumulator. Superb construction. Exhibition standard. Would exchange for good general coverage receiver. Lane, 19 Smuggler's Way, Birchington, Kent. *S338*

Have Avo valve tester without manual, also quantity of channelised v.h.f. Band I and III amplifiers. Would exchange for multiband scanner working or not, good legal CB and accessories or Chinon CE4 camera. Mr. Darby. Tel: 0604 811438 after 6 pm or weekends (Earls Barton). *S344*

Have one pair of 40 DCOE Weber carburettors. Would exchange for anything for h.f. or a ZX81 with 16K RAM. Tel: 03683 410 (Cockburnspath). *S358*

Have Admiralty receiver 60kHz–30MHz, excellent condition, with p.s.u. Would exchange for KW Supermatch or similar a.t.u. Tel: 0495 270900 (Cross Keys). *S365*

Have Skipmaster base mic, Amstrad 901 CB, 7 amp p.s.u., s.w.r./power meter, Wotpole—complete station eight weeks old in original boxes. Would exchange for a shortwave receiver in good order—HRO, CR100, Trio, w.h.y. Tel: 0438 50310 (Stevenage). *S370*

Have Pioneer CTF6161 cassette desk, 5XY 144MHz antenna (has been repaired), eighty 78 r.p.m. records (all pre-rock 'n' roll). Would exchange for anything radiowise. M. Hahn G4JRB, 21 Stanley Road South, Rainham, Essex, RM13 8AJ. *S371*

Have Halina binoculars, hard coated lenses, 12 x 50, c/w leather case, ex-game spotting Uganda, perfect condition. Would exchange for communications receiver, AR88 or Eddystone similar type and perfect condition. Tel: Bovey Tracey (Devon) 832455 (evenings). *S374*

Swap Spot

Have Realistic DX–302 communications receiver, digital frequency readout, c.w., a.m. and s.s.b. Heath HX–1681 c.w. transmitter, 100W with PS23 p.s.u. Heath SA–2040 a.t.u. 3·5–28MHz and Heath r.f. s.w.r./power meter HM–102. Would exchange for a reasonably good, non-valve, dual trace oscilloscope. WO1 (F of S) C. W. Payne, Technical Maintenance Troop, 16 Signal Regiment, BRPO 35. *S389*

Have Solartron CD711S.2 double-beam 'scope (with service manual)—needs new transformer—repairing would make good club project. Would exchange for anything small (about £5 worth). Tel: 01-399 0707 (Surbiton). *S399*

Have approximately twenty-seven 40-piece socket sets ¼in and ⅜in drive. Would exchange for SX200N scanning receiver (exchanger must collect). Tel: 01-203 3577 after 5.30 pm or weekends (Hendon). *S417*

Have York JCB 863 f.m. CB, 5 amp p.s.u., K40 antenna, s.w.r. meter and an a.t.u. Would exchange for a general coverage receiver. W. Francis, 55 Clark St., Treorchy, Rhondda, Mid Glam. *S418*

Have Avo CT378A signal generator 2–250MHz, harmonic range 500–170MHz, sine and square wave switches, with instruction manual. Receive converter 46–220MHz, 440–870MHz, i.f. 28–30MHz. Would exchange for reasonable h.f. transceiver. Tel: 051-334 6859 evenings (East Bebington). *S420*

Have IC202 with "C" type NiCads (2Ah). Would exchange for any 432MHz handheld. Please collect and deliver. P. Martin G6EON, 24 Wolsdon St., North Road West, Plymouth, Devon. *S421*

Have Eddystone 730/1 receiver, revalved and realigned last year, manufacturer's data sheets and circuit, worth £140. Would exchange for MW2001 colour portable TV or w.h.y. Can deliver reasonable distance. Tel: Bacup 4928 after 8 pm. *S422*

Have Grundig video 4000, good condition, two blank tapes and just serviced by Grundig. Would exchange for h.f. transceiver or FRG-7700. Tel: Harpenden 64349 after 8 pm. *S423*

Have 4600 synth (value about £500). Would exchange for w.h.y. radio wise. Tel: 0543 77016 (Heath Hayes). *S424*

Have FAL system 50 disco unit, comprising double decks, light units, speakers, microphone etc. Would exchange for any 144MHz mobile e.g. FT–227R or w.h.y. G4RKV (QTHR G6HLB) Tel: Bordon (Hants) 4111 or 4664. *S455*

Have Liner 2 s.s.b. TX/RX working on 28MHz and 144MHz. Would exchange for one of the following, h.f. valve or transistor linear amplifier, Trio VFO120, SEM h.f. a.t.u. or w.h.y. Tel: 0983 86 6687 (Shanklin). *S456*

Have communications receivers BRT400 and HRO, with coils, p.s.u., valves, new and ex-equipment transistors, resistors, capacitors etc. Also stamps, First Day Covers, Presentation Sets—mainly GB and Commonwealth. Would exchange for 144MHz equipment with v.f.o. H. S. Martin, 22 Glebe Road, Wickford. Tel: 03744 4184. *S464*

Have Pye NI700 VCR video recorder plus 16hrs tapes, leads, in mint condition. Would exchange for Bearcat 220FB scanner, an oscilloscope or w.h.y. Also have Yashica SLR camera plus extras, darkroom outfit complete. Would exchange for reasonable 432MHz gear or w.h.y. Dave GW6UGD. Tel: 0222 733885. *S484*

Have excellent condition homebase/mobile CB station Transom GBX4000, with many extras, almost everything you would ever need for a complete station. Would exchange for Sinclair ZX Spectrum 48K RAM or similar. Tel: Romford 46538 after 6pm. *S487*

Have FT-790 including NiCads, charger, carrying bag, whip antenna, 3 x 5/8 colinear, all new in February. Also Tono 150 watt 144MHz linear, new December—G4 coming. Would exchange for h.f. gear, windsurfing board or w.h.y. A. Whittam. Tel: 061 330 3082 (daytime only). *S488*

Have Ambassador RC502 radio cassette recorder, modified to s.w. receiver, a.c. and d.c. operation. Would exchange for any s.w.l./amateur radio (d.c.) equipment. Write to arrange suitable time for exchange 98 Shakespear Road, SE24 0QQ. *S489*

Have Microwave Modules MML 144/25 linear, mint condition, reason for sale QRO, suit FT290R etc. Would exchange for Audio notch filter or variable attenuator—20dB. Any gear considered. Tel: Dean G6RBY 01-247 6097 (day) or 01-446 4932 (evenings). *S503*

Have Datong multimode filter FL2 (cost £89), Amtech 300 a.t.u. (cost £38), Scopex 4D10 oscilloscope (cost £185), Practical Wireless 1970-1978, Practical Electronics 1964-1978 and Everyday Electronics 1971-1978, all bound volumes. Would exchange for FP707 and FC707. Tel: Uxbridge 54116. *S551*

Have Binks Bullows Professional spray gun, 1 ltr suction feed perfect condition. York Automotive compressor approximately 2½ c.f.m. Single phase ½h.p. electric motor v.g.c. Vehicle test meters by Vane or Enghand. Complete B & W dark room including Gnome Enlarger, masking frame, dishes, developer tank, tongs, film clips, safe lamp, chemicals, paper etc. Would exchange for any good amateur h.f., v.h.f. RX/TX, scanner w.h.y. Pete 29 Chessel Cres, Bitterne, Southampton. Tel: 0703 25679 (evenings). *S562*

Have Yaesu 7700, BC348, HRO and Trio 9R59DS. Would exchange for v.h.f./u.h.f. receivers, Eddystone or Hallicrafters or similar. Tel: Milton Keynes 0908 566222 ext 35 (9am-2pm only). *S563*

Have Tandy TR580 MI, LII (mint), includes c.p.u., monitor, cassette, p.s.u., editor/assembler, books. Would exchange for FT101 series h.f. transceiver (or similar). Tel: 061 338 7016 (evenings) (Dukinfield). *S569*

Have new valves, c.r.t., 50 HB1, 2 KT66, 4 TT22, 2 6146A, 2 A2426. Would exchange for h.f. transceiver preferably running, not too old, for new licence (wishing to specialise in c.w.). Robin Phillips. Tel: Hull 899167. *S570*

Have quality Tandberg reel recorder, with Tudor panel. Ideal for radio club, Morse sessions, Language lab. Also good Ferguson reel-to-reel. Would exchange either/both for h.f. or v.h.f. gear, u/s OK. Cain. Tel: Alnwick 602487. *S571*

Have 6in refracting telescope, lacks mounting. Would exchange for FRG-7700 receiver or similar. D. Butler. Tel: Chelmsford 357055. *S589*

PW "SWAP SPOT"

Got a camera, want a receiver? Got a v.h.f. rig, want some h.f. gear to go with your new G4? In fact, have you got anything to trade radio-wise?

If so, why not advertise it FREE in our new feature SWAP SPOT. Send details, including what equipment you're looking for, to "SWAP SPOT", *Practical Wireless*, Westover House, West Quay Road, Poole, Dorset BH15 1JG, for inclusion in the first available issue of the magazine.

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

PW 'Severn'
QRP 7MHz Transceiver

PART 4

Rev. G.C. DOBBS G3RJV

Very often the home constructor in amateur radio these days is a "bits and pieces" man. He builds power supplies, station accessories and small modifications to his commercial equipment. All very satisfactory as far as it goes but the real satisfaction comes from building a complete item of station equipment like a transmitter or a receiver and telling the station at the other end of a QSO that you are homebrew. The first three parts of this series described the building of a low power (QRP) transceiver for the 7MHz amateur band to a design simple enough for the relative newcomer. By now the transceiver, or perhaps just the transmitter or the receiver portion, may have been built. This final part deals with some of the extras that go towards making the *PW* 'Severn' even more of a viable amateur radio station.

SWR Bridge

The *PW* 'Severn' transmitter has a fixed pi-network output designed to feed into a load of 50 ohms impedance. This is common practice in amateur radio circles and true of many modern transceivers. Some antennas are bought or built to match such an output but many amateurs using "bits of wire" or multiband antennas have to put an antenna tuning unit (a.t.u.) between the transmitter and the antenna. This matches the impedance of the antenna to the characteristic impedance of the transmitter output. "You want to see 50 ohms, my boy, I'll arrange it for you!" The simplest way to ensure that the a.t.u. is correctly adjusted to present the 50 ohms required to the transmitter is to use some form of standing wave indicator. The standing wave ratio bridge (s.w.r. bridge) measures the forward and reverse current passing along the feeder line from the transmitter to the antenna via the a.t.u. Want to know more about s.w.r.? It would take more than the space here to do it justice, try one of the many amateur radio text books. It is also worth reading some of the articles which

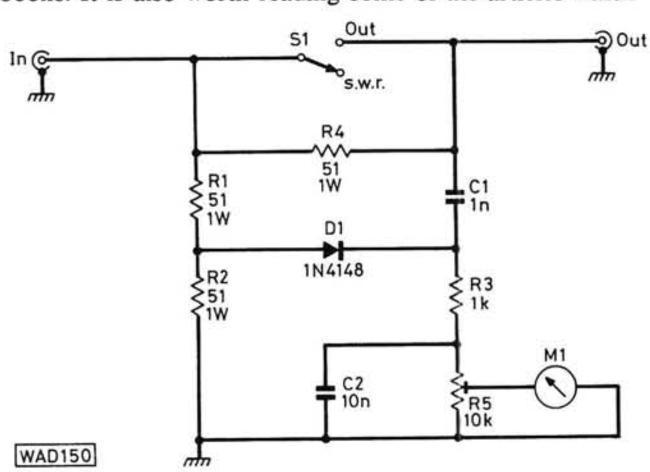


Fig. 4.1: Simple resistive s.w.r. bridge

debunk the importance that s.w.r. has achieved in modern radio. It might not be everything some claim but measuring the s.w.r. is the easiest way to tune up the little *PW* 'Severn' via an a.t.u.

About the easiest way to check the s.w.r. of a low power transmitter is to use a resistive bridge. A suitable circuit is shown in Fig. 4.1. This might more accurately be called an impedance matching bridge. Remember the Wheatstone Bridge in school physics . . . who doesn't! This circuit is based upon the same principle. R1, R2 and R4 form three arms of the bridge, the fourth being the load offered by the antenna, or antenna via the a.t.u. When all four impedances are equal there should be a null across the bridge. The reading across the bridge is indicated by the meter, M1, as a d.c. current after being rectified by D1. It is very simple to use as all that is required is to adjust the antenna or a.t.u. until M1 gives the lowest reading. Naturally, as with all such measurements, the bridge comes between the transmitter and the a.t.u.

This circuit has the obvious merit of only requiring a few cheap components and a meter. It also has the added advantage that because the bridge offers a load across the output of the transmitter, during loading up the transmitter never sees a really bad mismatch. This can be quite a saving in transistor p.a. stages which tend to die in severe mismatch conditions. The slight disadvantage is that this load offered by the bridge must be switched out during transmission or some of the precious r.f. will be dissipated in the bridge. A switch S1 cuts out the bridge in this circuit.

No special or expensive components are required. The resistors R1, R2 and R4 can be made up from two 100 ohm resistors in parallel. The meter, M1, may be one of the many surplus tape recorder meters that appear on the market at low prices. The prototype used a small square one which seemed to have a full scale deflection of around 150µA. Almost any meter under 1mA would serve as the preset, R5, controls the meter sensitivity. No layout is shown for the bridge as it is easily built "ugly style" using the leads as supports for the various components. All leads should be kept as short as possible. The bridge can easily be suspended near the output socket for the antenna on the back of the case. The meter and the switch are front panel mounted using the layout shown in Part 2 of this article. If S1 is on the front panel screened leads must be used for the wires to the switch. Some constructors may prefer to have the switch on the back panel near the socket and bridge.

Alternative SWR Bridge

Some constructors do not like resistive bridges because they have to be switched out when the transmitter is in use and give no indication of r.f. going to the antenna. For the "dancing needle fan" there is no real problem. Low power permits very simple versions of the classical Bruene

Bridge. A suitable circuit is shown in Fig. 4.2. The signal passes through the small winding in the r.f. transformer, T1. The larger winding samples the r.f. and two signals appear at either ends of the winding at R1 and R2, 90 degrees out of phase. These signals across the resistors R1 and R2 represent the forward and reverse currents in the feeder line. Switch S1 enables either side to be selected. The signal is rectified by D1 and indicated on the meter, M1, which has a sensitivity control, R3. T1 is wound on a toroid former, the "polo mint" type cores which were used earlier in the transmitter section. The sampling winding occupies most of the circumference of the core and the signal winding is just three turns of pvc covered hookup wire around the centre of the main winding. If the circuit designations for Forward and Reverse are to apply, the two windings must be the same way round. Once again M1 is a cheap tape recorder meter. The choke, RFC1, is a 1μH r.f. choke but any similar value will do the job.

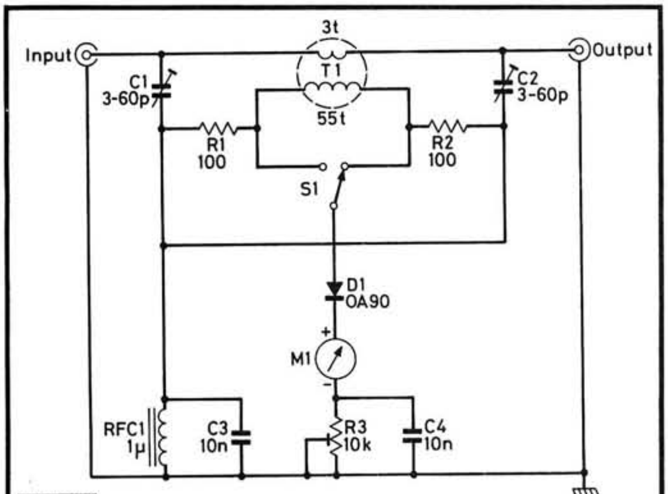
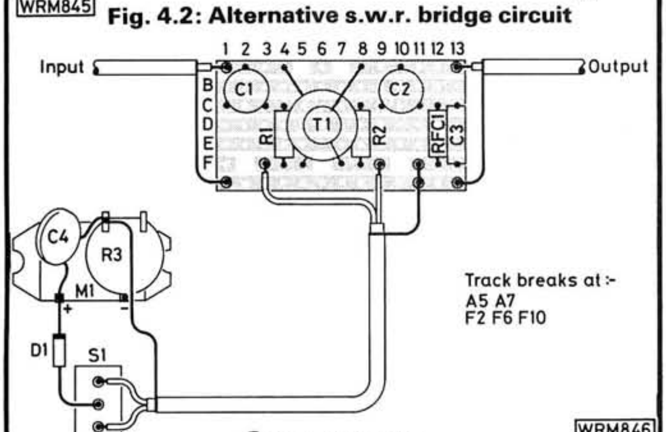


Fig. 4.2: Alternative s.w.r. bridge circuit



Components

Linear preset potentiometer		*Moulded choke*	
10kΩ	1 R3	1μH	1 RFC1
Resistors ¼W 5%		*Germanium diode*	
100Ω	2 R1,2	OA90	1 D1
Foil trimmer capacitors		See text for other components	
3-60pF	2 C1,2		

Winding details for T1

55 turns 28s.w.g. enam. wire

3 turns pvc covered wire on Amidon T-68-6 toroid

Fig. 4.3: Veroboard layout of the alternative s.w.r. meter. This layout was originally designed for 0·15inch matrix board which is becoming increasingly difficult to obtain in small pieces. 0·1inch matrix can be used but it will probably be necessary to add an extra track between tracks A and B and also to add a couple of extra holes onto the length to fit the two trimmer capacitors

The layout in Fig. 4.3 shows the bridge built up onto Veroboard. I do not favour Veroboard for r.f. work, but this little circuit lends itself well to the method.

Twin screened lead takes the signal from the board to the switch and meter portion of the circuit. When this circuit was tried with the prototype the board was fastened with its single screw fixing to the back panel near the antenna socket and the switch, meter and associated components were on the front panel. The circuit is symmetrical and can be used either way round, in fact this is the way to set it up using C1 and C2. It can be nulled with a non-inductive dummy load of 50 ohms using C1 and C2 and then reversed and nulled again.

Receiver Incremental Tuning

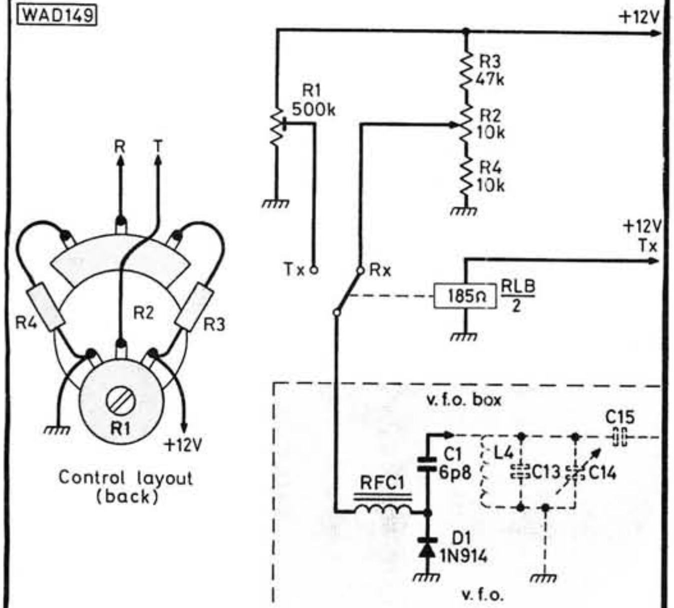
Many operators like to have some form of independent tuning of the receiver section of a transceiver which enables a small degree of offset tuning on receive without affecting the frequency of transmission. On c.w. this allows the signal to be adjusted to a comfortable listening pitch without material alteration of the transmission frequency. This is particularly useful in direct conversion transceivers, like this one, where the same v.f.o. is used for transmit and receive functions. This means, in theory, one transmits and receives on the same frequency, but ideally the receiver should be offset slightly to obtain the beatnote. It is possible to judge this to be near enough netted to the other station for practical working but receiver offset tuning is a great aid. Usually this facility is called Receiver Incremental Tuning (r.i.t.) or in some usage, especially CB, a clarifier control (ugh!).

The principle is to be able to tune the v.f.o. slightly off frequency during receive only and return to the original frequency during transmit. Fig. 4.4 shows a simple circuit that will do just that. A diode and a capacitor, C1 and D1, are placed across the v.f.o. tuned circuit. These form a varicap circuit such that small voltage changes across the diode will alter slightly the capacitance across the tuned circuit. So D1 and C1 are added to the v.f.o. circuit and taken via RFC1 to a control voltage. This voltage is controlled by R2 on receive and by R1 on transmit through the action of a relay changeover. R1 is preset so that the v.f.o. is at the same frequency when R2 is in the middle of its travel. This enables R2 to control the frequency either side of the transmitted frequency.

A word of warning at this stage—v.f.o. circuits are not to be trifled with and the r.i.t. circuitry built inside the v.f.o. box must be firm and directly wired with short leads. Some decoupling is provided by RFC1 but this is still playing about with the most sensitive part of the transceiver. RFC1 is simply a couple of small ferrite beads slipped onto the lead from D1 and C1 inside the v.f.o. box. The values given gave about a 1kHz offset either side of the transmitter frequency in the prototype, but the values of the receiver voltage divider, R2, R3 and R4, may require individual adjustment with other examples of the *PW* 'Severn'.

The relay is a small 12 volt changeover relay of any type and ought to be mounted on top of the v.f.o. box close to the point where the lead is led through the box. I stuck mine on with Blutack. This should be as close as possible to the tuned circuit. The relay is energised by the 12 volt transmit line. R1, R2, R3 and R4 are all mounted around the front panel placing for R2, the r.i.t. control. Short, direct leads should take the transmit and receive voltage to the relay. The metal case of R2 ought to be earthed and short wiring used throughout. A layout for the back of the r.i.t. control is shown.

The best way to set up the r.i.t. is to listen to the v.f.o. signal on another receiver and adjust R1 until it is at the



Components

See text for components.

Fig. 4.4: The r.i.t. circuit diagram for the *PW* 'Severn'

same frequency as R2 when R2 is set towards the centre of its travel. Ideally the operator should know where to set R2 to listen at comfortable pitch to a signal on the same frequency as the transmitted signal. This can be done with another signal used in conjunction with the v.f.o. and second receiver. This signal could be from a crystal oscillator or a signal generator. This signal is zero beated with the v.f.o. signal on the spare receiver and then R2 is adjusted until that signal can be heard at a comfortable listening pitch. This may require a little trial and error with R1 and R2 to get the setting on R2 in about the centre of the control travel. A mark can be made on the front panel to give the setting that enables the receiver portion to give a signal which is comfortable listening and gives a transmission that is zero beat. Remember that it is usual to tune from the low frequency end of the band when working on the 7MHz band. It is fiddly but worth it in terms of being assured that the *PW* 'Severn' transmits on the same frequency as the station to be called. The r.i.t. control must be returned to the marker at the beginning of every new QSO.

Power Supply

The *PW* 'Severn' works from a 12 volt supply and storage batteries of reasonable size will provide suitable power. However, most people prefer, at least for home station working, to use a mains supply. Although the v.f.o. has a built-in stabilised line it is important to use the *PW* 'Severn' on a stable supply. Many amateurs have such supplies as a standard part of their station setup but in case this is lacking the circuit in Fig. 4.5 shows a suitable supply. The circuit uses one of the three pin regulator integrated circuits which can handle just over one amp. They are quite inexpensive and this current rating is more than adequate for our QRP transceiver.

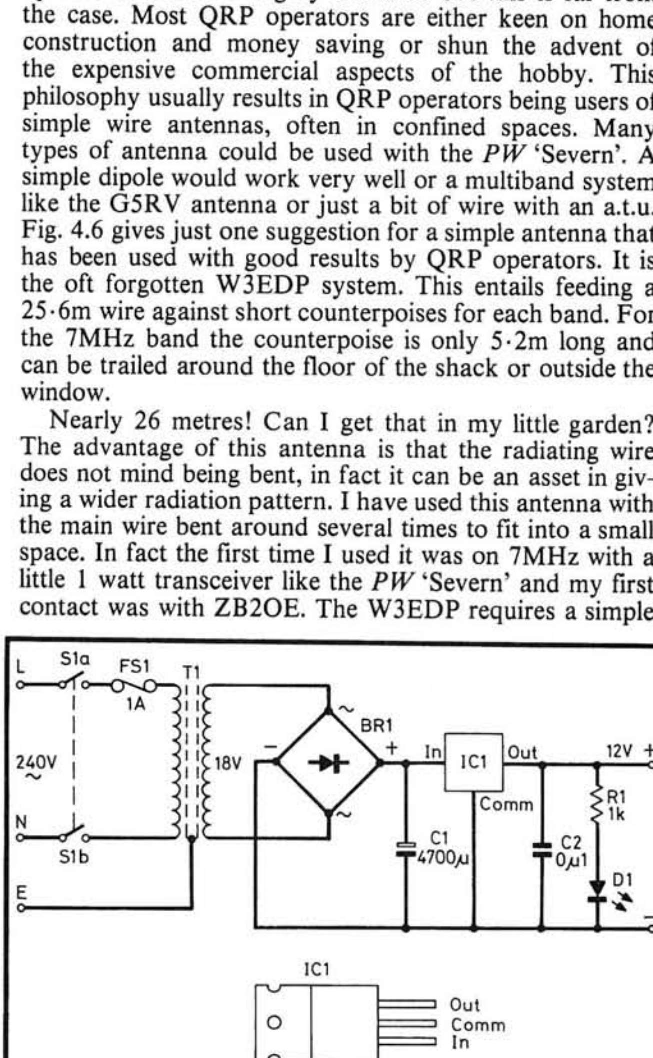
The circuit explains itself and can be built in almost any type of housing. A good degree of smoothing is essential for this transceiver as all direct conversion transceivers are very prone to hum pickup from supply lines. They can be a good test for a 12 volt bench supply. IC1 ought to have a small heatsink and C2 should be mounted as close to the output pin as possible. R1 and the l.e.d. indicate that the supply is on.

The supply should present no problems even to the beginner in construction. Although a bench supply is useful, don't overlook the use of batteries. A small motorcycle 12 volt lead-acid battery or the Dryfit lead-acid batteries would be very suitable for the low current demands of the *PW* 'Severn'. This also enables the transceiver to be used as a portable unit or as a second station in another part of the house.

What About Antennas?

It is a widely held belief that successful low power operators must use mighty antennas but this is far from the case. Most QRP operators are either keen on home construction and money saving or shun the advent of the expensive commercial aspects of the hobby. This philosophy usually results in QRP operators being users of simple wire antennas, often in confined spaces. Many types of antenna could be used with the *PW* 'Severn'. A simple dipole would work very well or a multiband system like the G5RV antenna or just a bit of wire with an a.t.u. Fig. 4.6 gives just one suggestion for a simple antenna that has been used with good results by QRP operators. It is the oft forgotten W3EDP system. This entails feeding a 25·6m wire against short counterpoises for each band. For the 7MHz band the counterpoise is only 5·2m long and can be trailed around the floor of the shack or outside the window.

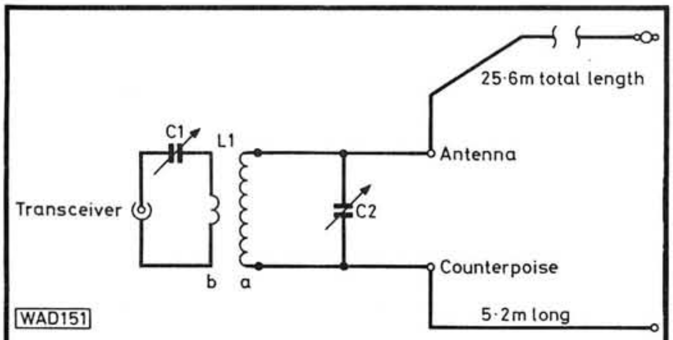
Nearly 26 metres! Can I get that in my little garden? The advantage of this antenna is that the radiating wire does not mind being bent, in fact it can be an asset in giving a wider radiation pattern. I have used this antenna with the main wire bent around several times to fit into a small space. In fact the first time I used it was on 7MHz with a little 1 watt transceiver like the *PW* 'Severn' and my first contact was with ZB2OE. The W3EDP requires a simple



Components WAD152

Mains transformer		
9+9V 20VA	1	T1
Bridge rectifier		
50V, 1A	1	BR1
Integrated circuits		
7812	1	IC1

Fig. 4.5: A suitable and simple regulated power supply for use with the *PW* 'Severn'



Winding details

L1a 10 turns 24s.w.g. pvc covered wire on 25mm dia. former
L1b 2 turns 24 s.w.g. pvc covered wire over centre of L1a
See text for details of C1,2

Fig. 4.6: Simple a.t.u. for use with the *PW* 'Severn' transceiver and the W3EDP antenna

a.t.u. of the type that is normally used for an open wire feeder antenna. It is useful in that it can be used from upstairs rooms without problems, being a balanced system.

The a.t.u. is simple and can be built quite small using junk components. Remember this is QRP so a lot of the a.t.u. building problems just disappear. L1 is a conventional coil wound onto any 25mm diameter former. C1 and C2 are both polycon variable capacitors of the type used in cheap transistor a.m. radios for the main tuning control. These are usually two gang controls of some 200pF per section. One section only is used for C2 and both sections are paralleled for C1. Cheap polycons for an a.t.u.? Well, at these power levels they seem to perform adequately and can cost nothing if culled from scrapped oriental a.m. radios. Look for the ones with longer shafts so that a control knob can be used.

The a.t.u. is very simple to use. C2 is tuned to get the best dip on reversed current on an s.w.r. bridge and C1 is adjusted for optimum output with lowest s.w.r. The method of setting up soon becomes clear in use. Try a W3EDP—you might like it and it can cost nothing.

Using the *PW* 'Severn'

QRP operation is a viable proposition on today's amateur bands as many radio amateurs prove daily the world over. It calls for all the skill and cunning which every good operator should use to gain QSOs. Remember that the signal will probably be some 3 "S" points down on the average station. Calling CQ is wasteful on time, except perhaps from time to time on the International QRP Calling Frequency of 7030kHz. Look for stations who are calling CQ and call them. Check which stations are working stations known to be relatively close, what reports are they getting? Who is working who? Listen around for a while before beginning to transmit. In fact, do all the things any good operator would do.

Tail ending is another good way to make QSOs. Wait until a QSO is finished. Allow time for that little extra exchange of dits or 73 at the end, and call the station from the two that you wish to work. It is great fun, other operators will be pleased to work a homebuilt low powered station. Another useful tip is to avoid saying you are QRP until after the other station has given his report . . . it makes a surprising difference! Be bold, enjoy yourself. The satisfaction of QSOs using low powered homemade equipment has to be experienced. ●

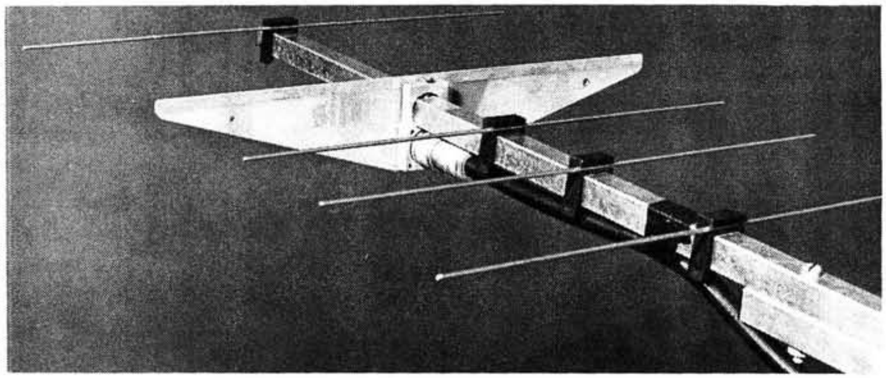
SILVER 70 432MHz Antenna

Commercial antennas for amateur use are increasingly being imported from abroad so it is pleasant to be able to evaluate a genuine UK product for a change.

The Ant Products Silver 70 432MHz band Yagi was unveiled during 1982 and we here at *PW* have been recently evaluating an early sample. As the photographs show the antenna follows the traditional Yagi layout but has design features specifically incorporated for the demands imposed by amateur users. Prominent amongst these is the construction of the driven element which consists of a 1·5mm silver-plated (hence the name) double-sided glass fibre board arranged to form an effective gamma/delta matched dipole. Bolted to this driven element is a silver plated 50Ω N type socket for feeder connection. This arrangement results in a very good v.s.w.r./power transfer across the complete 10MHz of the 432MHz band—the significance of this will no doubt be most apparent to the mushrooming number of ATV enthusiasts.

With low noise pre-amplifiers now available, both bipolar and GaAs f.e.t., even greater attention is being given to the noise contribution from the antenna structure itself. In this respect the Silver 70 uses fully insulated 2mm diameter stainless steel directors (12) and reflector element. By doing so, both galvanic and electrolytic corrosive action is prevented. Designs using direct metal to metal and dissimilar metallic combinations must ultimately deteriorate and introduce noise at the effective "front end" of the receiving system.

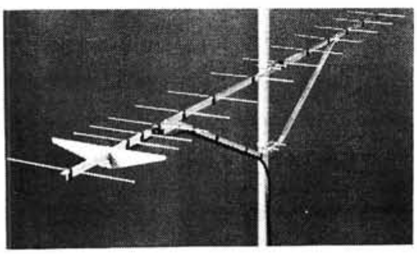
A further, often not appreciated, fact is that having the directive elements insulated from the boom lessens the effects of non-symmetrical current distribution, and consequent polar



A view of the gamma/delta matched p.c.b. driven element of the Silver 70 Yagi, which has an all-up weight of 1·1kg

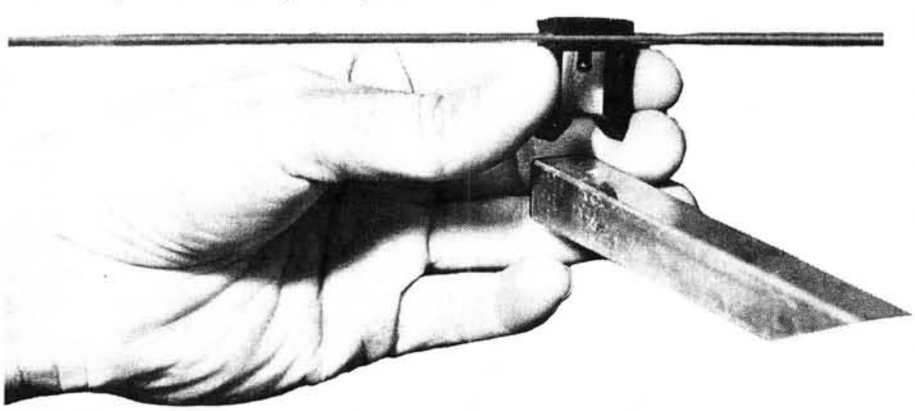
response distortion, due to elements being located or becoming off-centre.

Once again back to the silver-plating which is certainly not a cosmetic sales gimmick! Maintaining the antenna parameters within the limits imposed by the manufacturer is difficult, especially in industrial areas where each shower brings along a fair dose of acidic rain. The oxide of silver is one of those rare cases where the oxidised



metal has a lower resistance than the base metal and hence good long term stability.

Performance wise the manufacturer's quoted figures for gain are 16dBd with a 3dB beamwidth in the E plane of approximately 22 degrees. Side lobe responses are estimated to be 10–16dB below peak with a nominal front-to-back ratio of 20dB.



The antenna is supplied in "knocked down" form and took this reviewer 45 minutes to assemble, including a *careful* readthrough of the illustrated assembly instructions. No problems or departures from the information provided were encountered and a favourable impression of the mechanical aspects of the antenna formed. This would make a very readily deployable /P antenna as well as a compact (2·7m long with central joint) base station installation.

Since its installation the Silver 70 has performed favourably for 432MHz s.s.b. and ATV use, both modes using of course horizontal polarisation. If vertical mounting is required Ant Products can supply additional mast-decoupling hardware. Arrays using two, four or more antennas can be constructed without heavy investment in substantial rotators and guyed masts. Also available are two- and four-way microstrip based low-loss hybrid combining networks, supplied with N type or other connectors to order. Alternative frequency versions are available and currently in use for other services.

The Silver 70 antenna is supplied complete with all parts, including boom brace, connector shroud, mounting clamps (50mm mast max) and even a roll of self-adhesive vinyl tape, for £31.95 (£35.95 including delivery by Securicor).

Our thanks go to **Ant Products, All Saints Industrial Estate, Baghill Lane, Pontefract, West Yorkshire. Tel: (0977) 700949** for the loan of the review sample.

John M. Fell

AIR TEST

USER REPORTS ON SETS AND SUNDRIES

LECTRON Book Laboratory

The Lectron Book Laboratory has a bold notice on the front cover, ". . . for young people (from the age of 10) and for parents who are interested". As no previous knowledge is assumed anyone who has just started looking at basic electronic principles (perhaps en route to the RAE) could find this kit very helpful.

With no tools or soldering equipment necessary and only a 9V battery required the kit is "safe" for children to use. It is a relatively "cheap" way of finding out if children are interested in learning more about electronics, or of teaching yourself the building blocks of radio and electronics.

The set is supplied in a pvc covered folder which has a side fastener, therefore stopping the bits falling out when in use on a car or train journey (unless you are driving!). It includes 11 magnetic circuit blocks, assorted components, an earpiece, bulb, metallic base plate and instruction manual.

The 52 experiments in the book are illustrated using full-size photographs and very detailed instructions. Throughout the book some 47 questions are asked, with the answers tucked away at the end. The questions seem designed to show whether the student has understood the subject fully or not.

There are nine chapters ranging from "All about electric circuits" to "Merry electronics: Croaks squeaks and all kinds of odd noises". When the kit was tried out "odd noises" was a very apt description! All the circuits did work first time, although one or two do take a few seconds to build up "steam".

Proving that they really mean no previous knowledge required the first experiment is lighting a bulb using a battery, bulb and coin. The following few chapters deal with resistors, capacitors and diodes in turn, explaining how they work and what you can make them do in a circuit in each case.

The instruction book then goes on to deal with the transistor, again going into detail on how it works. Using various experiments the principles of tape recorders and simple radio receivers are illustrated. All through the book very simple cartoons are used to help understand certain points.

From here on the book makes learning about electronics fun with projects that "do" things (often noisily!). Most use a two transistor block (the largest in the kit) to build "real" circuits.

Signal generators (for Morse code oscillators—prospective Class "A"s note!), amplifiers, logic circuits and computer basics are all dealt with. All the various logic gates are explained using simple circuits and truth tables.

The final chapter turned out to be the favourite and most interesting, producing noises from the circuits. Electronic "bullfrogs", "sparrows" and "rattling bones" are shown, but there are many more that can be constructed without too much difficulty.

The book finishes by saying ". . . these experiments do not exhaust the possibilities of having fun with electronics . . ." at least this project kit provides an easy stepping stone into a very interesting subject.

The kit is available for £19.90 from **Artec (I for E) Ltd., Salewheel House, Ribchester, Preston, Lancs PR3 3XU** to whom we offer our thanks for the review kit.

Elaine Howard

Letters

Correct Voltages?

Sir: In reply to the question "Are the Voltages Correct?" on page 33 of your May issue, the answer is "No!"

For No. 1 (a) part (iii) the "–" input will be about –1·4V, not zero volts as stated. This is because, as stated in the answer, the output has limited. Indeed one way of checking whether a high gain amplifier is clipping is to check the differential input voltage.

Simon Richards G4HSQ
Cambridge

Roger Lancaster replies: Simon is quite correct. While the differential input voltage is insignificant up to that which produces limiting, it can of course exceed this value and in a case such as the widely overdriven op. amp. in the example the voltage at the "–" input is certainly not insignificant.

V_0 is at +11V and the input is at –2V, so there is 13V across R1 and R2. Assuming infinite input impedance of the op. amp. this means a p.d. across R2 of

$$\frac{50}{1050} \times 13 = 0{\cdot}62V$$

This would leave the "–" input at $-2 + 0{\cdot}62 = -1{\cdot}38V$, just as Mr Richards says. So sorry I overlooked this one.

Long Time SWL

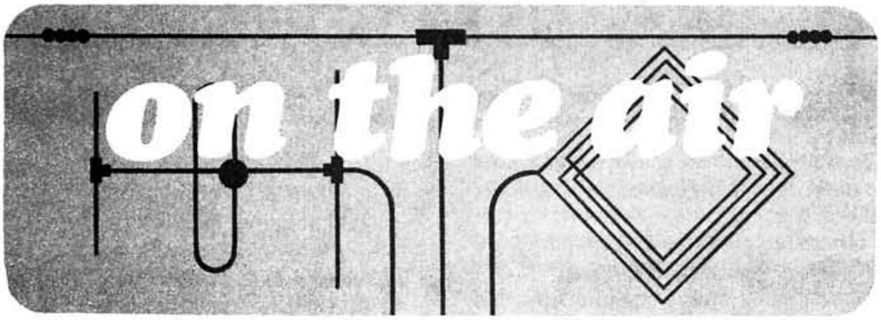
Sir: I am now 64 years old and have been interested in s.w. radio for 50 years. During much of this time I have been a reader of PW.

In the old days neighbours came in to hear such stations as W2XAD, W2XAF and on some occasions Japan, South America etc. I still have one or two QSL cards from that era but, unfortunately, the bulk of them have been lost.

Last year I did find my badge from the British Long Distance Listeners Club sponsored by your magazine well over 40 years ago. I also had a certificate to put on the wall of my room, but that has long since gone—I think it was around 1936.

It would be interesting to know how many of the Club Listeners are still alive, I doubt if many have still got their badges though.

A. J. Jenkins
West Molesey, Surrey



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.

Decibels are funny things. A term of measurement used widely in electronics and acoustics and frequently bandied about in conversation on the amateur bands, usually with reference to the performance of antenna systems. The decibel is still not as fully understood as it ought to be. In fact, to some, it still has an air of mystery which they are not prepared to penetrate in order to understand it properly—which is a pity as it is not all that difficult and can be very useful in amateur radio work.

The trouble with the decibel is that it is not a linear measurement like the volt, ohm or ampere. If you add 100 ohms in series with 100 ohms we get 200 ohms, very easy. If you apply 10V to a circuit and get a certain current then if 20V is applied the current will be double, all simple and linear. But add nine decibels (9dB) to nine decibels and the answer is 18dB, numerically speaking, but the effect will not be double whatever it is we are talking about. In fact the poor old decibel is **not a unit** as we understand it but a **ratio** of two or more numbers measured in the same units. Now comes the complication as the ratio is measured logarithmically. Hang on, don't go away!

Decibels descend from the science of acoustics or sound and are used to measure sound levels, as well as antenna gain. Unlikely as it may seem the good old human ear is the source of all the confusion because it is not linear in its apparent sensitivity to different sound pressures. If one sound pressure is twice that of another it doesn't sound twice as loud to the human ear; it will sound somewhat less than double. The effect is logarithmic as shown in Fig. 1. The horizontal scale is logarithmic. What's logarithmic, you may well ask. Take the number 100 which we know is the same as 10 squared, or 10^2 or we can say 1×10^2. The number 1000 is also 1×10^3, and 10 000 is 1×10^4, and so on. From this we can see that a number like 450 must lie between 1×10^2 and 1×10^3 and if we look up 45 (only the significant figures) in a table of logarithms we get 6532, called the *mantissa*, to which we add our 2 (from the index of the 10 as $450 = 4{\cdot}5 \times 10^2$) the *characteristic*, getting 2·6532 which is the equivalent of saying $10^{2\cdot6532}$ or "ten raised to the power of 2·6532".

So, to compare two values in terms of decibels we have to use log tables. In practice other tables are readily available which give all the information we normally want without in fact needing to know much about logs. But it is nice to know how it all happens. Without going into detail we should remember just two easy formulae, one when we are dealing with voltages or currents and the other for power, but as always the units being compared must both be the same. For example volts and volts, not volts and millivolts. If necessary change one unit to agree with the other.

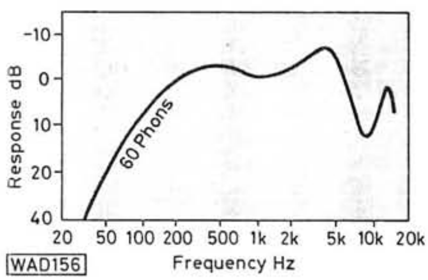


Fig. 1: Contrary to popular belief the frequency response of the human ear is anything but flat, as shown here. Individuals' responses vary enormously as we all know and our own pair of ears are seldom balanced in terms of sensitivity or frequency response

Note that the decibel is one tenth of the basic unit used in sound pressure measurements, the Bel, and is written dB, not Db or DB as is so often seen in ads. The formulae are $dB = 10 \log_{10} P1/P2$ for power measurements, and $20 \log_{10} V1/V2$ for voltage measurements (or I1/I2 for current), with the important proviso that the input and output impedances involved are the same. In practice they seldom are! Some dB ratios likely to be encountered in practice are given in Table 1.

Just to check the validity of the formulae take an amplifier with a gain of 60dB, or a voltage output/input ratio of 1000. Even without a table of logs we can say that $dB = 20 \log_{10} Vout/Vin$ equals $20 \log_{10} 1000/1$. We know that 1000 is the same as 10^3 so the log of the ratio is 3. Hence $20 \times 3 = 60$ or 60dB. Don't forget that there are some applications where there is a loss in the circuit instead of gain and the decibel figure becomes a negative value but the method of working out ratios in decibels is the same.

A knowledge of decibels and how to use them comes in very handy when considering the ads in various magazines for amateur band antennas but beware! Antenna gain is oft quoted without giving the reference level, which is then quite misleading and one can easily believe that it is done purposely to deceive. The article by Fred Judd G2BCX on *Antennas—Part 4* in the May issue of *PW* is essential reading if the real gain of an antenna system is to be estimated with any degree of reality. Note the two possible datum levels quoted.

Current or Voltage Ratio		Power Ratio	
Acoustic pressure	dB	Acoustic pressure	dB
1	0	1	0
2	6	2	3
4	12	4	6
10	20	10	10
100	40	100	20
1000	60	1000	30
10 000	80	10 000	40
100 000	100	100 000	50

Table 1: Table showing some values in decibels for various ratios of electrical voltage/current or sound pressure, left, and for electrical power and sound power, right

Reverting to Fig. 1 note the peak in the response around 500Hz, which can be a boon to the c.w. addict. If the audio filter in use is tuned to around this frequency and the beat note is also set to the same frequency the apparent selectivity will be increased considerably. As has oft been remarked, the ears plus the brain can often prove more selective in practice than any filter, i.f. or audio.

General Chat

Last December **Sydney Cook** of Durham passed his RAE and having booked the call G6SYD was duly licensed. Realising that with a bit of effort as far as the code test was concerned Syd set to and passed the test and asked for the call G4SYD which he duly received in April. The question Syd asks is "has this happened before". I believe it is not very common but I'm quite sure it has occurred before, and would not be too difficult to organise while keeping an eye on the licences being issued. If the likely interval is going to be only a matter of a few months it is rather an expensive operation and somewhat pointless, especially now that the licence fee has gone up 50 per cent to £12!

Talking of licences would you believe that the radio station licence for a UK-registered aircraft is just £15, and was previously the same as an amateur

Voltage ratio out/in	Gain (dB)	Voltage ratio out/in	Gain (dB)
1	0	100	40
2	6	200	46
4	12	800	58
10	20	1000	60
20	26	10 000	80
40	32	100 000	100

Table 2: Typical voltage amplifier gain figures. Note that if the gain is doubled, represented by 6dB, the decibel numbers are added together so that a gain of x4 is 6dB + 6dB, or 12dB. But, when doubled from, say, 100 (40dB) to 200 times the added 6dB makes it 46dB and not 80dB as one might think

licence. One feels we amateurs are being ripped off, again! About the only users of the radio waves who have not suffered an increase recently are CBers and users of radio microphones!

Peter Hawkes has now moved to a pleasant spot called Triangle, in Zimbabwe, and is Z2-304 as a s.w.l. member of the Zimbabwe ARS and busy when time permits studying for the RAE. He is pleased to report that there is no TV service in his area. "What a pleasure" is his comment. I have asked Peter to let me have a list of the UK stations he is hearing down there, particularly on the l.f. bands, as this could be very useful I feel.

Top to Ten

Too late to tell you of the amateur band operation of HC1JB from the famous Quito s.w. broadcast station HCJB using some of that station's beam antennas, like the 24dB gain 24-element cubical quad on 21MHz or the 24dB gain steerable antenna system for 14MHz! But it was back to a dipole for 7MHz. The operation on June 11/12 last will be pleased to send QSL cards for reports or QSOs on receipt of one IRC, to HC1JB, Casilla 691, Quito, Ecuador.

Glad to see that **Terry Jenner** (RAF Watton) is using his Trio R-2000 to best advantage by tackling several of our bands instead of just sticking to the "easy DX" on the 14MHz band! With a 30m-long wire and homebrew a.t.u. he found VP2VD on 3·5MHz, and AP2SQ, SU1ER, VS5GF, 3A2LF and 9Y4BG on 14MHz. On 21MHz Terry logged DU6JP, VP8AEN on Argentine Island, VS5GA, YC1GJ and 6W8KA.

John Griffiths BRS54142 up in Holyhead, Gwynedd, fills in a few personal details, having spent some time afloat, in the oil business, and had his hands on all sorts of radio equipment. He tried CB for a while but gave it up because of the minority of "irresponsible swearing idiots" who spoil it for everyone. So it's all hands to the pumps studying for the RAE. Good luck OM. On 14MHz only one of interest was TR8JD but he did also catch J6LMT and the inevitable HZ1AB. On 7MHz it was CP1KMH, CX3TU, 5B4HG and HK2YH. John uses an FRG-7700/FRT-7700 with a dipole cut for the band.

A multiband dipole for the 28, 14 and 7MHz bands helped the FRG-7 of **David Price** in Wellington, Somerset, collect Z21GN, CX2AN, S83H, T26FIC and ZS6AAB on 28MHz plus YB2BSF and ZD7CW on 21MHz, and TO5RV/FC on Corsica, KH6FKG and FY7BB. In Prestwick, Manchester, **Dave Shapiro** has a DX200 with various antennas including what looks like a Windom, a 20m-long wire tapped off-centre. He comments on an OE station on 14MHz using 2·5W who was still readable when he had reduced power to 200mW! Dave was very impressed. Dave comments on those stations who seem very numerous these days who do not give their callsigns as frequently as required and then the wrong way round so that he doesn't know which is which. I agree, and this is particularly so on the 3·5MHz band with all the rag-chewing that goes on there. I have a feeling it is often a matter of an ex-CBer who has not yet got used to the ways of the radio amateur and naturally carries on as he used to on the CB band. Only time will tell, I suppose. Anyway DX logged by Dave included SU1XF with QSL plus two IRCs to Box 5661, Cairo, VP2VD and ZD7BW all on s.s.b. on the 3·5MHz band. VP2MCK is the only item on the 7MHz band so on to the 14MHz band and TU2JD, VP8AIB, V3WS, ZD8FX (QSL G3YNB), 9N1MM, with KG4DX, P29NSF, S79ARB, S83H, TR8JD, ZD8BX, 7P8CL, 8Q7AZ, 9J2DS on the 21MHz band. On the 28MHz band it was C53CR, TZ6FIC (QSL F6CRS), VP8WA, ZD7CW and Z22CV. Not a bad log at all this month OM.

An FRG-7700 and a.t.u. with a long wire got some nice ones for **Jim Willett** in Grimsby like ZL4AP at 0545GMT on the 3·5MHz band, then KH6ADC, VS5JS, ZM1BXA all on 14MHz, YS5ZPD, ZP5SC, S79WHW, YC1WS and ZS6BJH on 21MHz.

A note from **David Whittaker** BRS25429, Hillcourt, 57 Green Lane, Harrogate, N. Yorks says he has the results of the White Rose l.f. bands contest held last January. Anyone wanting a copy should send a large s.a.e. to David.

Viv Doidge has done very well indeed in Callington, Cornwall, with his FRG-7700 and a.t.u. fed by a long wire, in spite of trying to concentrate on his RAE studies. On 3·5MHz it was VK6HD for a good catch and then on 7MHz 5T5RR and 9N1MM, followed by C6ANU, FM7CD, FY0GSI, J6LMT (QSL Box 111, Castries), S83H, ST2SS with YL op, probably from the Radio Club in Omdurman, T70A who said a suspicious Box 1, San Marino, TU2IE, VS5GA, YI1BGD of Box 5864 Baghdad, ZD8FX, 4S7PVR all on 14MHz s.s.b. On to 21MHz and HI8GB, J6QP, J73HA, VQ9CI, 4S7EA, 5Z4BP, 9M2FZ and, finally 9X5LR.

Club Round-Up

Acton, Brentford & Chiswick ARC G3IIU A demonstration of amateur test equipment is promised for Tuesday July 19 at 7.30 at the Chiswick Town Hall, London W4, says sec W.G. Dyer G3GEH, 188 Gunnersbury Avenue, Acton, London W3 who assures all visitors a very warm welcome.

Bristol ARC Every Tuesday at 7.30 at the YMCA, Park Road, Kingswood, Bristol with the computer group meeting on the fourth Tuesdays. July 12 is a night on the air with the club's new multimode rig on the 144MHz band plus a transverter for the 432MHz band. The following Saturday is booked for a social event with details in due course. Computer evening July 19 has G4KUQ demonstrating the Sharp MZ3500 business computer system, while the 26th is QRP night for this flourishing section of the club membership, and anyone else interested, come to that. G4KUQ hides the identity of the club's PRO Mark Goodfellow, 99 Somerset Road, Knowle, Bristol who can also be reached on (0272) 716093. There is a new club net on 3·75MHz on Sundays at 1030.

Bury RS Bring plenty of surplus equipment, and cash, along to the meeting on July 19 for junk sale time, at the Mosses Centre, Cecil Street, Bury, at 8pm. The club gathers there every Tuesday but not on July 5 and 12 when the Centre is closed. Get the gear ready for the fox-hunt on Tuesday August 9 when the quarry will be last year's winner G6FUQ. Sec Brian Tyldsley reports he is now G4TBT so congrats OM, but the Publicity Officer who would like to hear from prospective members is Malcolm Pritchard G3VNQ, 56 Shelfield Lane, Norden, Rochdale, Lancs.

Cambridge & District ARC G2XV Interested in computers, amateur TV, satellite communication or plain amateur radio? Then this is the club for you if you're in the Cambridge area. Always active are the v.h.f. and h.f. rigs and many local CBers have succumbed. Meetings during term time on Fridays at 7.30 at the Coleridge College, Radegund Road, off Coleridge Road, in the Visual Arts Room. July 8 is code time and on-the-air night as is the 22nd, with a talk on the 15th. Note that the college is closed on July 29 so it could be an external social event. A note for Sunday August 14 when a DF foxhunt is scheduled on 144MHz. Club sec is Dave Leary G8JKV, 9 Priory Avenue, Swavesey, C'bridge, also Swavesey 31120, or PRO Dave Wilcock G2FKS on Cottenham (0954) 50597.

Crawley ARC From the club newsletter it seems the club meets on the fourth Wednesdays at the Trinity Church Hall, Ifield, Crawley, Sussex, but I can tell you that there is to be a DF Hunt-cum-Bar-B-Q in mid-July. For more info you'll have to ring David Hill G4IQM on Crawley 882641.

Derwentside ARC G4PFQ Spring cleaning is the name of the game at the club's shack in preparation for contest time. Lectures and demos in the pipeline include Computers in Radio, precautions against static charges, and working through the amateur satellites. Details from sec P. Howes G8WEJ, 26

Hadrians Way, Ebchester, Co Durham. The club meets on Monday evenings at the RAFA Club, Sherburn Consett where all are heartily welcome.

Dunstable Downs RC G4ARD G8DDC G4DDC A very sensible and properly printed handout has been issued by the club for the guidance of potential members or anyone expressing an interest in amateur radio. The membership is a modest £6 a year but imagine that can be reduced for those who may be in straightened circumstances these days. Weekly meetings on Fridays at 8 at Chews House, 77 High Street South, Dunstable, Beds. The club is well equipped with gear judging by the calls held and entries are made in most contests from Top Band to microwaves. It's P.G. Seaford G8XTW, 12 Jupiter Drive, Leighton Buzzard, Beds for more info.

Exeter ARS G4ARE G6ARE The second Monday is a formal meeting at the Exeter Community Centre, St Davids Hill, Exeter, with informal gatherings the remaining Mondays at the Scout Hut, Emmanuel Road, St Thomas, Exeter. No dates for July so perhaps it is holiday time but note the constructor's competition in August. It's 7.30 at any meeting says PRO Andy Lake G8YOA, 16 Taddiforde Road, St Davids, Exeter, Devon with a home 'fone (0392) 39597.

Farnborough & District RS Celebrity Louis Varney G5RV talks on "HF Perils" on July 13, the club meeting on the second and fourth Wednesdays at 7.30, Railway Enthusiasts Club, Access Road, off Hawley Lane, Farnborough. If you are lucky and the 100th member to join the club you'll get your first year's subs for free. As a guide the current membership is 81. Chris French G8ZAJ will be glad to take your application at the club or at 26 Wood Street, Ash Vale, near Aldershot or A'shot 29469, as will sec Ivor Ireland G4BJQ, 118 Mytchett Road, Mytchett, near Camberley, Surrey.

Fylde ARS A good programme running into October already organised. Meets at the Kite Club, Blackpool Airport at 7.45 on the first and third Tuesdays with visitors cordially welcome. On July 5 there is an introduction to computers by G6HEA and an informal get-together on the 19th. Must tell you now of a tour of the air traffic control and met facilities at the airport on August 2 with initial assembly at the club with a strict notice that late arrivals will not be accommodated. Even further ahead, in August, when an old friend of mine Eric Lomax G4DGR and ex-5N2ABG talks on working from a DX location. Filler-in of details is H. Fenton G8GG, 5 Cromer Road, St Annes, Lytham St Annes, Lancs.

Horsham ARC G4HRS Nancy Hubbard G4RTZ says the club gets together on the first Thursday at 8, the Girl Guides HQ, Denne Road, Horsham, Sx, but I have no info for July so you'll have to QSO her at 33 Amberley Road, Horsham, Sx I'm afraid, but go along anyway.

Inverness ARC Hope this info is still current but they used to meet on Mondays and Thursdays at the Cameron Boys Club, Planefield Road, Inverness, with RAE course on the Mondays and general chat and construction matters on Thursdays. Try Bob Brown GM8VIZ, The Flat, 21 High Street, Dingwall, Ross-shire, Scotland.

Ipswich RC G4IRC GB2IRC On July 13, a Wednesday, it's DF Hunt time returning to the clubroom to join the less brave. On the 27th Polemark Ltd have a representative talking on the Microdot computer. Interested? Then it's off to the clubroom of the Rose & Crown 77 Norwich Road, Ipswich, Suffolk on the second and last Wednesdays at 8. Hon sec:—Jack Tootill G4IFF, 76 Fircroft Road, Ipswich, or try (0473) 44047.

Leighton Linslade RC The Vandyke Community College, Room A64, Vandyke Road, Leighton Buzzard, Beds, from 7pm. Dates I know about are Saturday July 16 when it's LLRC Family Picnic time and Monday the 18th when G8GIK analyses circuit diagrams. Sunday 31st is a fun-only DF Hunt but could be 144MHz or Top Band, I don't know. Your contact for more info is Peter Brazier G6JFN, Kingsway Farm, Miletree Road, L. Buzzard or you may ring Heath & Reach 270.

Maltby ARS Now six months old the club has gained 50 members and seemingly going strong with frequent talks plus c.w. classes and a talk-in G4SKM on S22. It's every Friday at the Methodist Church Hall, Blyth Road, Maltby at 7. Sec Ian Abel G3ZHI, 52 Hollytree Avenue, Maltby, Rotherham, is on (0709) 814911 and is also the leading light it seems in the campaign to wring a Novice Licence out of the Home Office.

Medway ARTS G5MW G8MWA No. 1 Hall, St Luke's Church, King William Road, Gillingham, Kent, around 7.30 every Friday, says sec Peter Poole G4EVY, 5 River Drive, Strood, Rochester, Kent, otherwise Medway 76463. On July 8 the club is "at home" to members of the South Essex ARS for a social occasion. What a good idea! Get your club to invite other local clubs round for an evening. On July 29 it's film time with one on electromagnetic waves and the other on thin-film microcircuits.

Mid Sussex ARS G3ZMS Meeting at the Marle Place Adult Education Centre, Leylands Road, Burgess Hill, W.Sx. On July 14 there is a constructional contest with the big event, the Sussex Mobile Rally, on the Brighton race course on Sunday July 17. The Centre is closed on the 28th but it is hoped to concoct something for that evening, while during August it is intended to hold meetings on Thursdays at members' homes. Programme sec is Colin Campbell who will be delighted to tell you of his new G4 callsign on Burgess Hill 5211 during office hours, amongst other club details.

Nene Valley RC G4NWZ G6GWZ The club's transmitting activities take place at the 1st St Mary's Scout Hall, Finedon, with other functions at the Dolben Arms, Finedon, club meetings, that is! July 6, a Wednesday, is natter-nite and 8pm would be a good time to arrive. The lecture on the 13th is on Top Band operation in connection with the WAB award, by G3ONT. It's Microcomputers—an insight, by G4NWH on the 27th, with another natter-nite on the 20th. All from Lionel Parker G4PLJ, 128 Northampton Road, Wellingborough, Northants.

North Bristol ARC G4GCT Make for the S.H. Enterprise, 7 Braemar Crescent, Northville, Bristol, around 7pm on a Friday. No dates of events for July known other than participation in VHF FD, so contact Ted Bidmead, 4 Pine Grove, Northville, B'tol, who is also G4EUV.

Northern Heights ARS G2SU It's Wednesdays at the Bradshaw Tavern, Bradshaw, Halifax at 8, at which visitors are most welcome. July 13 is surplus equipment sale night, and on the 27th G4DXA will hold forth on matters of Interference. Unusually, a talk on home winemaking on Aug 10 with advance notice of a visit to Radio Aire in Leeds on the 24th. Your queries please to G. Milner G8NWK, 3 Briggs Villas, Queensbury, Bradford or buzz B'ford 882945.

North Wakefield RC Every Thursday at 8, at the Carr Gate WMC, not forgetting July 7 when G3WGW holds forth on radio and air navigation. Also note Aug 4 with a demo of equipment by a local distributor. More from Steve Thompson G4RCH, 3 Harlington Court, Morley, or buzz (0532) 536633.

Radio Society of Harrow G3EFX It's Fridays at 8, at the Harrow Arts Centre, High Road, Harrow Weald, Middx, in either the Belmont Room or the Roxeth Room depending upon the nature of the meeting. There is access to bar facilities including coffee and biscuits, not to mention free parking. Talk-in on 432MHz on GB3HR. Now, July 8 has a chat on vertical h.f. antennas, 15th is informal, but Sunday the 17th is a Summer Madness DF Hunt and Bar-B-Q. Subject of the talk on the 22nd has yet to be decided upon but on the 29th it's equipment test evening. You might like to know now that all August meetings will be informal with outdoor events etc. The lad to fill you in on the gory details is Chris Friel G4AUF, chairman no less, of 17 Clitheroe Avenue, Harrow, Middx.

St Neots & District ARS Alternate Mondays (ugh!) which seems to be July 11 and 25 as most relevant, at the Horseshoe Inn, Offord Darcy, near Huntingdon, Cambs, but you'll have to contact Steve Foote G4FOH, Whiteknights, 10 Old Farm Close, Needingworth, H'don, for the latest details. He is also on St Ives 68580 which may be quicker.

Shefford & District RS Meets on Thursdays at the Church Hall, Amphill Road, Shefford, Beds, at 8. Apart from a post mortem on the VHF NFD there will be a contest slide show on July 7. Off schedule is a Treasure Hunt for all the family on Sunday July 10 so a good chance to repay the girls for all their patience at other times. The 14th is a junk sale evening with a natter-nite on the 21st. The 28th is devoted to planning for the September SSB FD. Alan Little G4PSO, 41 St Michaels Road, Hitchin, Herts is your intermediary.

Southdown ARS G3WQK Normally the first Monday at the Chaseley Home for Disabled Ex-Servicemen, Southcliff, Eastbourne, Sussex at 7.30. Features of club activity include RAE and code classes. Note August 1 with a discussion of all aspects of amateur radio with a resolution that every member should endeavour to convert a CBer to AR! Sec is T. Rawlance G4MVN, 18 Royal Sussex Crescent, Eastbourne for more gen.

South East Kent (YMCA) ARC G3YMD G8YMD Its over 170 members enjoy meetings on Wednesdays at 7.45 at the Dover YMCA, Godwynehurst, Leyburne Road, Dover, with the club rig available beforehand. On Mondays it's down to work for the RAE with G4EGQ in charge and on Tuesdays G3SVU and G2FLT will help with the code. Club nets on Sundays at 11am on 3·745MHz and 144·395MHz. Club mag *Net* mentions

problem of some members of QRM when using video recorders feeding into the TV set on Channel 36, due to local radar operating on same frequency. As mentioned, the retuning of set and VTR can usually cure this trouble. Ah, yes, "a foot is a third of a meter". Profound thought but METRE please! A common error these days especially in magazine advertisements generally. More on the club's activities from sec Alan Moore G3VSU, 168 Lewisham Road, River, Dover, Kent with the alternatives of (03047) 2738 at home or (0304) 207670 at work.

Stevenage & District ARS Meeting spot is the TS Andromeda, Fairlands Valley Park, Shephall View, Stevenage, Herts, first and third Tuesdays and if you get there about 7.15 you can take advantage of the Morse code class until 8. The club net is on 145·250MHz Sundays at 7pm. The only meeting I know about is not on a Tuesday but Sunday July 17 when it's Sussex Mobile Rally time at Brighton. The new club secretary no doubt would like a bit of publicity for the benefit of all and sundry and it is Cliff Barber G4BGP, 13 The Sycamores, Baldock, Herts or (0462) 89736.

Swale ARC Brian Hancock G4NPM, Leahurst, Augustine Road, Minster, Sheppey, Kent says the club's venue is Nina's Restaurant, 43 High Street, Sittingbourne, every Monday at 7.30. By this time there should be both RAE and Morse code classes going strong.

Thames Valley ARTS You have already been warned of the big event at the club, the lecture by Louis Varney G5RV on July 5, so it is the Thames Ditton Library, Watts Road, Giggshill, Thames Ditton, Surrey at 8. If I don't tell you now it will be too late next month, about the lecture by club President Alan Mears G8SM on August 2 on the 50 years history of the Society, aided by Joe Hill G3JIP. Further information on the club's activities from Julian Axe G4EHN, 65 Ridgway Place, Wimbledon, London SW19 or you can reach him on 01-946 5669.

Torbay ARS G3NJA G8NJA Les Mays G2CWR has relinquished the job of PRO for the club so a word of thanks to him for having been so helpful over the years with regular epistles. Tony Rider G6GLP fills the spot. Meetings still at 7.30 Fridays at the HQ in Bath Lane at the rear of 94 Belgrave Road, Torquay with a general meeting and a lecture usually on the last Saturday of the month. Don't forget the club net from G3NJA on 3·756MHz at 1030am Mons and Weds and at 10am on Sats.

Westmorland RS Now resurrected after some years of inactivity the club has got going again meeting on the second Tuesday of the month at the Strickland Arms, just south of Kendal on the A6, said to be just before the by-pass and to follow the signs for Sizergh Castle. Anyone interested in electronics in any form is warmly invited to go along to a meeting, says Neil Martin G6OPO, Flat 8, Broom Close, Sedbergh Road, Kendal, Westmorland, otherwise (0539) 31476.

Wigston ARC Every Friday at the United Reformed Church in Long Street, Wigston, Leicester, at 7.30 prompt. Next in the series of club constructional projects are a 144MHz beam and a transistor tester. Your contact is sec Alan Faint G6GWH on (0858) 62827.

In answering the many contributions received for the Clubs feature I always point out that the deadline is the 15th of the month and that six weeks' notice is required if an item is to get into the appropriate issue. Unfortunately a lot of information is still received that is too late for publication, wasting time all round as well as postage. Remember also that *PW* comes out around the first Friday of the month which may be the 7th. Club dates before that, 1st to 7th, need 10 weeks' notice to be sure of getting in. However, if they are given well ahead I endeavour to put them in the previous issue. Complicated, isn't it! Cheers for now.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

A letter from a *PW* reader living in Bombay India, which outlined his unsuccessful attempts to obtain regular reception of a 10kW medium wave station some 1000 miles distant, raised some basic points about medium wave propagation that are worth looking at. Medium wave DXers should be aware that DXing is possible only when the path between the transmitter and the receiver is in darkness. Here in Europe, where the band is full of stations, even the casual listener will know that there is a lot more to be heard after dark, usually in the form of interference! Why is this and what can be picked up during the day?

Daytime Propagation

Frequencies in the range 530kHz to 1600kHz, which are known as the Medium Waves or the Broadcast Band, are allocated throughout the world to domestic broadcasting. Apart from a few intruding radio beacons transmitting their identity in slow Morse, this is all you will hear. The daytime propagation is shown in Fig. 1. The earth, for the sake of convenience, is shown flat. The only useful radiation is the ground wave, which, as the name suggests, follows the surface of the earth. Anything else will end up in the lowest region of the ionosphere, which is the D layer, where it will be absorbed. There is no sky wave during the day on the medium waves.

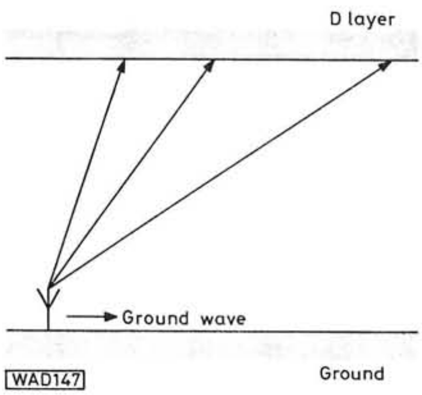


Fig. 1: Daytime Propagation

What happens to the ground wave? As you move away from the transmitter it gets weaker (attenuated). This happens because some of the energy from the passing radio waves is absorbed by the ground. The daytime range of a medium wave station depends on a number of factors. A high power station will cover a larger area than a low power one. Attenuation is greater over land than over sea and at high frequencies than at lower ones. The BBC World Service on 648kHz takes advantage of both factors for its broadcasts to Europe. In Spain, the high power general coverage stations are in the lower frequency half of the band while the low power locals of interest to DXers are in the h.f. end.

Ground Wave Reception

Is there anything that can be done by a listener outside the service area to improve reception? A good outdoor antenna located as high as possible above the ground or buildings should help but if the signal is comparable in strength to the background noise, there is little in practice that can be done. Increasing the receiver selectivity will improve the signal-to-noise ratio but at the expense of audio quality. A directional antenna will certainly help but the ordinary m.w. loop is of limited value. Its pick up is a lot less than a longwire and the direction of maximum pick up is rather broad. What is needed is a directional antenna with a sharp maximum which can be pointed

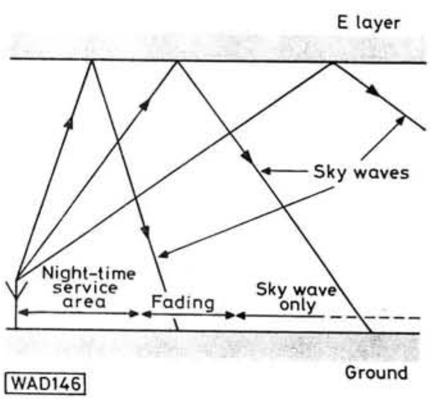
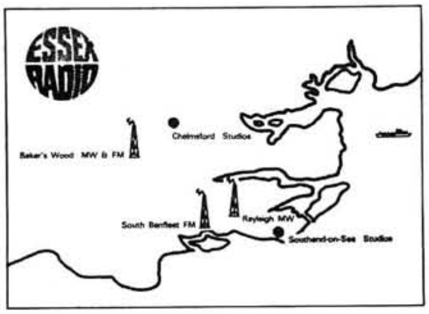


Fig. 2: Night-time Propagation

towards the station while reception of noise from other directions is reduced. The Beverage antenna meets these criteria but unfortunately it is not a practical proposition for most of us. The Beverage is no more than a very long longwire—several wavelengths. Quite remarkable results have been obtained by DXers in the United States and in New Zealand using Beverages but for most of us it can only be a dream.



Radio Essex *(Kevin Lewis)*

Night-time Propagation

The D layer disappears at sunset. Radiation from a transmitter can now reach higher regions of the ionosphere where it is reflected, coming back to the surface of the earth as the skywave, at considerable distances from the transmitter. The sky wave usually is of little interest to the broadcaster who often arranges the antenna so that maximum power goes into low angle radiation.

Strangely, the night-time service area is reduced, see Fig. 2. As distance increases the ground wave weakens, the signal gradually becoming comparable in strength to the sky wave. When this happens the two interfere with each other to produce deep fading, which is at its worst at sunset. The useful range of the transmitter is thus less after dark than during the day.

Further out from the transmitter there is only the sky wave which can be recognised by the slow cyclic fading that occurs when waves arriving from the ionosphere at different angles go in and out of phase. The sky wave is entirely dependent on the ionosphere, reception generally being unreliable and only of interest to DXers.

Region 2 in Summer

ITU Region 2, which covers North, Central and South America, can be heard on the medium waves throughout the year. Even in mid-summer there is a path of darkness across the Atlantic for an hour or so each day and for longer periods further south. The best time for DXing is during the hour before sunrise in the UK when stations gradually peak up before being lost in static, once daylight and the D layer become established at our end of the path.

Only the east coast of North America will be heard, the Atlantic seaboard of Canada being the most likely area. Listen for CBNA in St Anthony on 600kHz, for CBN St John's on 640, CKVO Clarenville on 710, CBGY in Bonavista on 750 and CJYQ in St John's on 930kHz. These stations are in Newfoundland which is only 4 200km from the UK so if the path is open, they should be the first to fade in. Other North Americans to look for are CHNS Halifax Nova Scotia on 960kHz, WMRE in Boston on 1510 and WQXR in New York on 1560kHz.

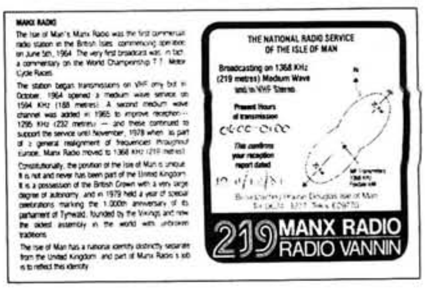
There are a number of stations in the Caribbean that come in regularly in the UK. The Voice of America in Antigua can be heard on 1580kHz, the Caribbean Beacon in Anguilla on out-of-band 1610kHz is usually conspicuous while Radio Caraibes in Dominica on 1210kHz has been coming in well recently.

From Latin America the Portuguese speaking Brasilians are probably the easiest to locate. Listen for Radio Jornal in Rio de Janeiro on 940kHz, Radio Nacional in Brasilia on 900kHz, Radio Globo in Sao Paulo on 1100 and in Rio on 1220, Radio Tupi in Rio on 1280. Broadcasts in Spanish should be investigated. Stations in Venezuela and Colombia are heard regularly and from farther south in Uruguay and Argentina less frequently.

There are signs now that solar activity is decreasing since short wave broadcasters are looking to lower frequencies. The trend will benefit long distance reception on the medium waves so if you do wake up during the small hours this summer, have a tune round the band. You may get a surprise.

Readers' Letters

Australian reader **Harry Capsey** VK2OQ who had a problem with his DX160 communications receiver (April issue) writes to say that he has finally tracked down the cause of the excessive drift. On disconnecting the oscillator section of the three-gang tuning capacitor and substituting temporarily a single-gang variable the trouble disappeared. Some sheets of insulating material between the vanes had come loose which he suspects caused the trouble. In any event a permanent repair was made with a replacement three-gang obtained from Tandy Australia. I had a similar problem with my DX160; this time it was a dry (badly soldered) joint to the oscillator section which caused the set to jump by a few kHz in response to vibration. Intermittent faults are the worst to locate. I think I would prefer to have smoke coming out of the set. At least you would know what was wrong!



Manx Radio *(Kevin Lewis)*

A Panasonic RF1403L portable accompanied **Keith Nockels** of Edinburgh while on a visit to Ipswich last April. With it he pulled in the BBC local radio outlets at Leicester on 837kHz, Medway on 1035, London on 1458 plus the ILR stations Saxon Radio 1251, Hereward Radio 1332, Essex Radio 1359 and 1431 and his new local Radio Orwell on 1170. It is always interesting to bring along a portable when away from home. It provides the opportunity to observe the band from a new location and the incentive to try for some of the new catches on returning home.

Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

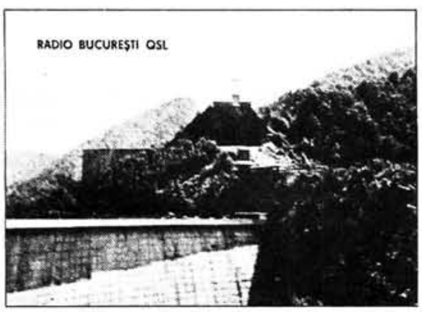
Newcomers to the hobby usually start off with a portable receiver equipped with a telescopic whip antenna. Although this type of set is designed to operate with its whip alone, many users try with varying success to give reception a boost by connecting an additional antenna to the set. Two contrasting letters from readers, both of whom use a Vega 206, outline methods tried and the results obtained when they have attempted to improve reception this way.

Walter Sharland of Mill Hill, London discovered he could peak up weak stations just by placing the receiver on the draining board in the kitchen. The draining board may be acting as an additional antenna or even as a counterpoise earth. Reader **John Dennis Court** of Birmingham, who uses a longwire with his 206, is troubled with QRM from CB operators, which appears all over the short wave bands. He wonders if there is anything he can do to minimise this problem. The antenna is too long for the receiver and is overloading it with strong signals. Spurious responses (spurios) are the result.

My faithful companion on holiday over the years has been a Vega 204 which is an earlier version of the 206. I have tried connecting short antennas to it in a caravan, on a boat, in hotel bedrooms and although the set is really intended for use with its whip and performs very well when used this way, there is no doubt that you can improve reception at times with an additional antenna. You have to be very careful though with the length of the antenna and how you connect it to the set.

Radio Norway *(Simon Hamer)*

A short random wire plugged into the (sw) antenna socket gives good reception. This is the method used inside a caravan where the whip is screened by the metal body. Unplug the antenna and tap it onto the whip and overloading occurs. So if your receiver does not have an antenna socket, which would only couple the antenna very loosely to the set, then do not be tempted to join an antenna to the whip. Instead, wrap the **insulated** antenna lead round the whip several times making sure there is no metallic connection between the two. You can now adjust the amount of energy passing from the antenna to the receiver by varying the number of turns round the whip.

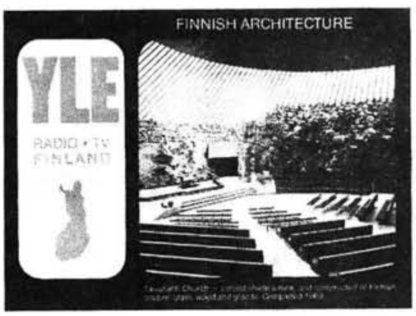


Bucharest *(Adrian Butcher)*

Pitfalls

There are two undesirable effects that may occur if you feed too strong a signal into a portable or if you couple an external antenna too tightly to it. Overloading usually causes stations to spread out and gives the impression that QRM is a lot worse than it really is. In severe cases spurios will occur. The second effect is an increase in images (second channel interference). Every superhet will, if it is allowed, pick up stations at two places on the dial simultaneously. Usually the image is 910kHz higher in frequency than the wanted station. Normally, receiver front-end selectivity will suppress or reduce the strength of an image but if you touch the whip, or connect an antenna to it, you may spoil the selectivity. Then images, often in the form of Morse, are the result. If you are tuned to the 6MHz (49m) band then images from the 7MHz (41m) band may be picked up. Add to this a bit of receiver overloading and the results will be far from attractive. Images may also appear if very strong signals, stronger than the set is designed to handle, are fed to it from an external antenna.

Some readers have asked if they are likely to damage their set by using an external antenna. Unlikely, unless you live next door to a high power broadcaster, so the field is wide open for the experimenter. If the results are unsatisfactory then try something else. If successful let us know what you have done as it will be of interest to others. In the early days of radio even the bedsprings were used as an antenna though I would not recommend them for use with a mains operated receiver.



Radio Finland

On The Bands

Spectrum is the name of a programme for DXers that can be heard direct from Australia on Sundays at 0810 on 9·570MHz in the 9·5MHz (31m) band. This frequency is used from 0700 to 0900 for programmes beamed to Europe and reception is generally good on a portable with whip.

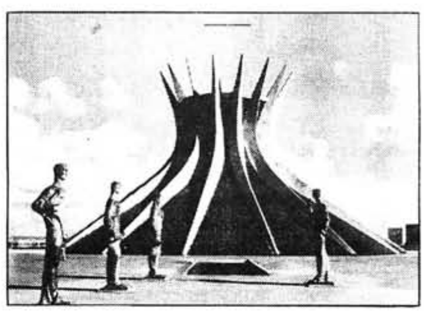
All India Radio broadcasts daily in English from 2045 to 2230 UTC. This transmission is beamed to Europe on three frequencies, the best at my QTH being 11·620MHz which is just outside the low frequency end of the 11MHz (25m) band. It can also be heard with an inferior signal on out-of-band 9·912MHz but it is submerged in QRM on 9·665MHz which lies within the 9MHz (31m) band. Reception may be different in other localities so it is worth trying all three channels. The station does QSL. Send reception reports and comments on the programmes to All India Radio, PO Box 500, New Delhi, India.

Reader **Andrew Hill** (Walsall) reports hearing Radio Bagdad nightly in English on 9·745MHz from 2130 to 2230. A programme schedule plus QSL card was received from the General Establishment of Broadcasting and TV, English Section, Bagdad, Iraq.

When to Send a Reception Report

In the early days of broadcasting, when high power transmitters, beam antennas, relay stations, digital readout, keyboard frequency selection, were all unknown, it was normal practice to send a reception report to any broadcaster on the short waves. In return, the station issued a verification of reception (verie) usually in the form of a QSL card.

Times are changing. DXers are now only a tiny fraction of the audience of major broadcasters, many of whom prefer to spend their funds, often limited, on programmes rather than on staff to check reception reports and issue veries, especially to areas where they know they are being well received. The QSL cards issued by the BBC and the VOA are not veries, being little better than compliments cards. Radio Sweden issues a do-it-yourself card which the listener fills out and returns for confirmation. Radio Canada International only QSLs once a year. Radio Finland has stopped QSLs altogether, replacing them with Listeners Cards which are sent to those commenting on the programme content. This policy is only followed by some major broadcasters who beam or relay their programmes to this country and personally I only send them a report if they ask for one over the air. In all other cases, whether on the international bands or on the Tropical Bands, the traditional type of reception report is appropriate. If in doubt, send a report as well as appraisal of the programme. You may get a QSL as well as a mention in the mailbag or listeners letter programme.



Radiobrás *(Kevin Lewis)*

Readers' Letters

Richard Hunt of Tadcaster says "I thought you might be interested to hear about a radio I bought for £5. It is an Ekco A104 which covers the long, medium and short wavebands—it has an internal antenna in the form of a loop attached to the hardboard rear panel. It is possible to detach this antenna simply by removing a plug from the antenna socket and attaching an external antenna. Can you tell me where I could get a service sheet?" concludes our reader. Try the Vintage Wireless Company, 64 Broad Street, Staple Hill, Bristol BS16 5NL.

Using a 3 metre random wire antenna, Richard picked up the Voice of Nigeria on 15·120MHz and Radio Nacional do Brasil on 15·390MHz. The latter is on the air daily in English with an hour's programme starting at 1800 UTC. The station does verify, the address on the QSL card being Radiobrás, PO Box 04, 0340 Brasilia, DF, Brasil. The transmitter, which has a power of 250kW, is located 55km NW of Brasilia.

Finally, thank you to **Paul Ward** G4RVM for his translation of the Chinese QSL card. It arrived too late for last month.

VHF Bands

by Ron Ham BRS15744

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

Among this month's goodies are an award for Peter Lincoln, a moonbounce QSO by a Dorset club, 50MHz activity at home and abroad, a DXpedition and a batch of QSL cards on Band II and the beginning of the 1983 sporadic-E season as experienced by my readers on the 70, 50 and 28MHz bands.

Solar

Although solar activity is predominantly low, **Cmdr Henry Hatfield,** Sevenoaks, using his spectrohelioscope on May 11, located 3 sunspot groups and two flares which were no doubt responsible for the radio noise storm that he and I recorded at 136 and 143MHz respectively on the 11th, 12th and 13th. As usual this solar storm had some effect on terrestrial communications because during the afternoon of the 13th, the BBC World Service warned their listeners that an ionospheric disturbance could be spoiling their reception.

During his routine optical observations, **Ted Waring,** Bristol, counted 28 sunspots on April 19, 37 on the 27th, 34 on May 9th and 30, plus 6 active areas, on the 14th. Members of the Flight Refuelling Amateur Radio Society directed a pair of vertically polarised 22-element quad loop Yagis, Fig. 1, toward the sun on May 14 and when a noise increase of some 8dB was recorded, they knew that their 432MHz (70cm) receiver was ready for a QSO, via the moon, with K8HUH the following day.

The 50MHz (6m) Band

By May 5 **David Newman** G4GLT, Leicester, had worked 31 of the 39 permit holders direct on 50MHz and 20 non-permit holders by means of crossband. Up to that date, David's best 50MHz tropo contacts were with GI3RXV and GI3ZSL in Northern Ireland and GJ3YHU in the Channel Islands and his longest QSO, about 300 miles, was GM3ZBE in Aberdeen. "Undoubtedly the most interesting aspect of the 50MHz tests carried out so far have been the meteor scatter experiments with several Scottish stations including GM3WOJ, Fort William, GM4FZN, Caithness and GM4IHJ, Saline Fife", writes David. He noted some long bursts of signals from the stations in Northern Ireland, a 50 second burst of hand-speed c.w. from GM4FZH and to his amazement, one lasting 120 seconds during an s.s.b. QSO with GM3WOJ. The prospective excitement of the 1983 sporadic-E season began with David between 1159 and 1300GMT on May 1 when he received a 599 signal from the Gibraltar beacon ZB2VHF on 50·035MHz.

Dave Coggins, Knutsford, heard c.w. signals from G3OHH on April 21, his s.s.b. signals at 0652 on the 26th, c.w. from G4GLT and G3OHH at 0650 and 0701 respectively on May 2 and an s.s.b. QSO between G3OHH and GM3WOJ at 0645 on the 5th.

From Port Elizabeth comes an interesting letter from **Waldie Bartie** ZR2EL, telling me that the band 50 to 54MHz has been allocated to the amateurs in South Africa and about 32 50MHz enthusiasts in King William's Town and Port Elizabeth are busy modifying the Plessey C42, ex-army transceivers for DX contacts on 51·2MHz and the local working on 52·6MHz.

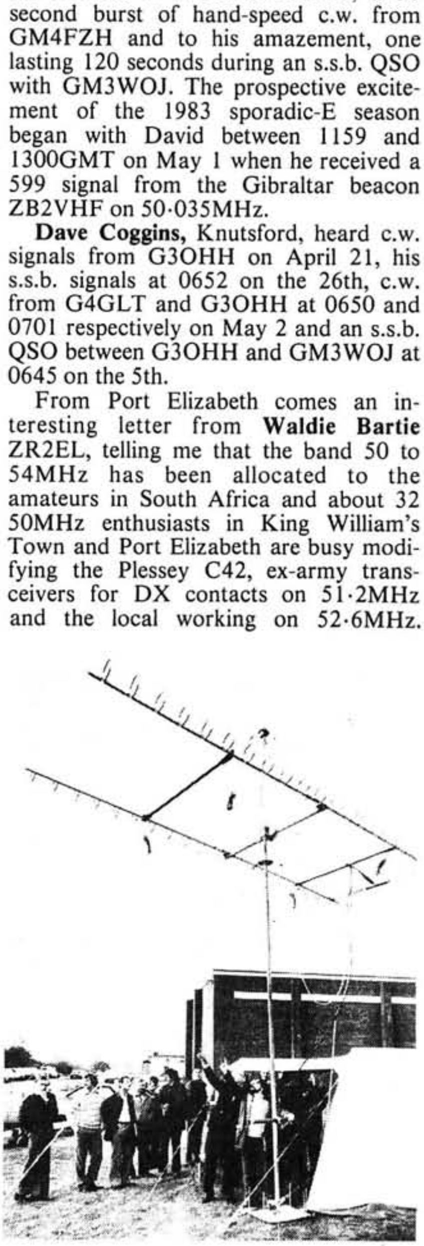


Fig. 1: Flight Refuelling RS (G4RFR) with their antennas for the moonbounce project

These operators use between 3- and 6-element Yagis for DX and their activity has aroused more interest among a group of ZS5s located in the Durban area. "We have a local net each Sunday at 1730 GMT and have as many as 10 or 12 operators on", writes Waldie, who feels that all this interest, especially the modifying of a military set, is all good for the spirit of amateur radio. It sure is Waldie and we will all look forward to hearing more about your 50MHz activities in South Africa.

The 28MHz (10m) Band

A near neighbour of mine, **Fred Pallant** G3RNM, logged signals from ZS5 and ZS6 and noted an opening toward South America around 1700 on April 24. While operating the Chalk Pits Museum station, GB2CPM, on May 2 **Richard Brownlow** G4LCV, heard several Russian stations on the band and at 1345 managed a 349 QSO with UA4AA. Fred logged stations in ZS1, 2 and 6, Z21, 5B4, 5N8, 9K2 and 9L1, between 1400 and 1500 on the 2nd, PY2, ZS1 and 5B4 at 1430 on the 8th and RA6, UA6 and ZS6 at 0920 on the 9th. At 1735 on the 12th, Fred checked the band and found it dead then suddenly it opened and at 1820 he received signals from CX8, LU2, PP2 and PY2 working into the USA.

"Quite a lot of activity, particularly in the afternoons" writes **Norman Hyde** G2AIH, Epsom Downs, who, between April 13 and May 12, either heard or worked stations in Brazil, Cyprus, the Falkland Islands, Germany, Israel, Italy, Jordan, Kenya, Paraguay, South Africa, Uruguay, USA and the USSR. A very impressive list Norman, it certainly pays to keep a watch on the band. In Aldershot, **Peter Lincoln** BRS 42979, logged A71BJ and 5U7WI on April 25, CT3AF, KP4AXC and WP4CPC on the 28th and LU6FGZ, TL8CK, YC2DNT, ZS6AER and Z21EI on May 2.

Dave Coggins reports a good opening to Africa on April 29 and to the Far East on May 5 when he heard signals from JA, VK4 and VK6. Later in the day a good path toward South America with lots of Argentine stations logged. During the sporadic-E conditions on May 1 and 2, Dave heard French, Italian and Spanish stations at good strength in addition to the German beacons DF0AAB, DK0TE and DL0IGI, which always make good short skip indicators.

28MHz Satellites

From Winchester, **John Coulter** sent a list of the stations he logged via the RS and OSCAR satellites between April 15 and May 10 which includes complete QSOs and individual signals from stations in 19 countries, DF, DL, EA, F, G, HB9, HG, LA, OK, ON, OZ, PE, SP, SV, UA, VE, VK4, Ws 1 and 3 and YU, using both c.w. and s.s.b. "It is not always evident which amateurs are working through OSCAR or RS satellites but sometimes they do specify which", writes John.

28MHz Beacons

Between 1400 and 1600 on April 19 and 20, **Bill Kelly,** Belfast, heard a weak c.w. signal which he logged, with difficulty, as "VVV de ZSD5VHF beacon on 28·2025, 50·005 and 144·925MHz. VVV de ZS5VHF beacon QSL to ZS5TR. VVV de ZS5VHF beacon position 29D44M south, 30D30M east, Natal, South Africa". Norman Hyde also heard this beacon on April 23 and May 5.

"I operate the KA1YE/B beacon here in New London County, Connecticut", writes **W. Keith Hibbert** KA1YE and adds, "The beacon is in Groton, on a hill at 46m overlooking Long Island Sound. The transmitter is a converted Hy-Gain CB set running 4 watts output to a vertical antenna". Keith, who would appreciate readers' reports on his beacon sent to him at 25 Hillcrest Rd, Niantic, Connecticut, 06357, USA, has plans to add a horizontal turnstile and a J-pole vertical, fed via a hybrid splitter to the beacon's antenna system.

Don Benham GW3ZFY, Swansea, using a DX302 and a long wire antenna in his attic, heard signals from LU1UG on April 10 and like Bill and Norman logged ZS5VHF on April 23. Both Don and David Newman received signals from VP8ADE on 28·284MHz on the 21st and Norman Hyde heard it on the days indicated on the beacon chart, Fig. 2. Information to make up this chart came from the observations of Dave Coggins, John Coulter, Henry Hatfield, Norman Hyde, David Newman, Ted Waring and myself. Signals from the beacon EA6AU were heard by Norman on April 28, Dave Coggins on May 1 and 4 and Ted on the 9th and on May 2, Dave logged LU1UG and David Newman heard HG2BHA.

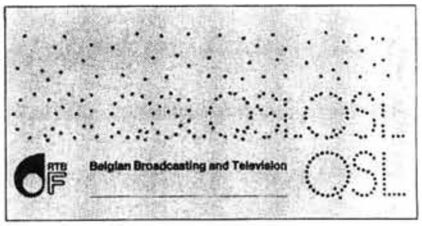


Fig. 3: Received by Michael Welch

Sporadic-E

During a brief sporadic-E disturbance around 1054 on May 12, I received strong signals from 4 east-European f.m. broadcast stations between 66 and 68MHz and by 1337 the number had increased to 14 and the frequency range extended to 73MHz. A similar event occurred on the 13th and at 1138 I counted 16 very strong signals from these stations using my ex-army R216 v.h.f. communications receiver, which can tune from 19 to 157MHz in 5 ranges, a.m. or f.m.


BRITISH FORCES BROADCASTING SERVICE
GERMANY · B.F.P.O 19

Thank you for your reception report concerning our transmission at Bielefeld

on 101.5 *MHz* *dated* 18.2.83

We are pleased to confirm the details supplied and wish you good luck and happy listening.

Main Studio & Offices:
5 KÖLN 51
Parkstrasse 61
W. GERMANY

Transmitters in:
Berlin, Bonn, Drachenberg
Herford, Langenberg, Visselhovede
Werl, Hameln, Hoensbroek, Maastricht

BFBS

BFBS Form 4005

Fig. 4: Received by Michael Welch

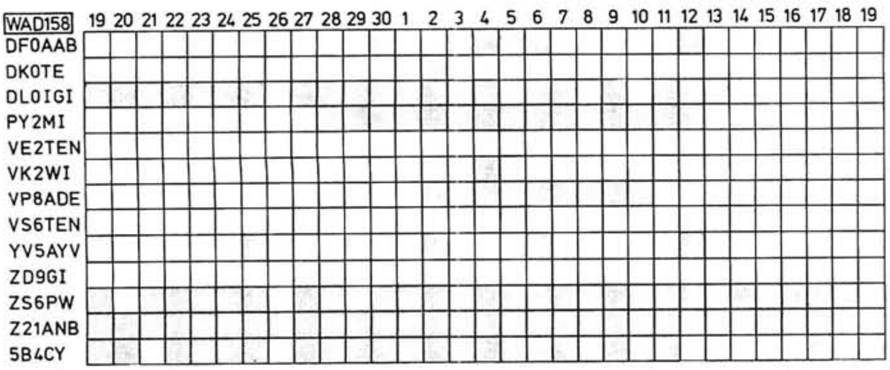


Fig. 2: Distribution of beacon signals

Tropospheric

Apart from a few hours on May 5, the atmospheric pressure, measured at my QTH with a Short and Mason barograph, remained well below 30·0in (1015mb), a minimum requirement for v.h.f. DX, hovering around 29·6 (1002) from April 17 through to May 18.

Band II

Although v.h.f. conditions were below average this did not deter some of my readers from having a go. While on holiday in Ipswich, **Keith Nockels** from Edinburgh, using a Panasonic RF 1403L and a Hitachi stereo tuner, heard the Belgian stations BRT 1 and possibly BRT 2 and 3 and France Culture on April 15 and 16. Around 1638 on April 24, I was 198m a.s.l. on the South Downs and using the f.m. radio section of my Plustron TVR5D. I heard a strong French station around 100MHz mixing with and often obliterating official traffic around that frequency.

Fig. 5: Received by Michael Welch

During a Band II DXpedition to a hill top some 609m a.s.l. near New Radnor on April 17, **Simon Hamer,** Presteigne, heard BBC Radios Barrow-in-Furness relaying *Lakeland Sport,* Radio Carlisle, Radio Lancashire, Radio Leeds transmitting *Sunday Best* and Radio Nottingham previewing *The Elephant Man* in the Nottingham Playhouse. Among the ILR stations Simon identified were Liverpool's Radio City, Nottingham's Trent, Preston and Blackpool's Red Rose, Swansea Sound and Wyvern, plus a song by Kiri te Kanawa from RTE Radio 1.

Between 1600 and 1700 on April 15, **Michael Welch,** London, heard BRT and poor signals from BRT, Egem, at 0730 and BFBS, Bielefeld, at 0745 on May 7th. Just to whet every DXers appetite, Michael has now received QSL cards

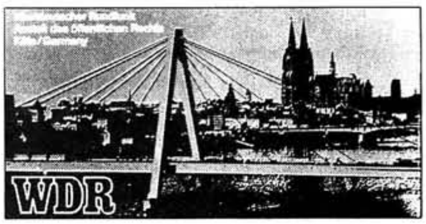


Fig. 6: Received by Michael Welch

from broadcast stations in Belgium RTBF (Fig. 3), Germany BFBS (Fig. 4), BBC Radio Devon (Fig. 5) and Westdeutscher Rundfunk (Fig. 6), acknowledging the reception reports he sent them for their signals in January, February, March and April respectively.

RTTY

Among the visitors to the Chalk Pits Museum radio building on May 2 was **David Foster** G3KQR, Kingston, a keen RTTY operator who has worked over 100 countries with his Collins equipment, half-wave dipole, home brew terminal unit and a Creed 75 teleprinter. David is a great home constructor and enjoys building Morse keys.

"With the 14MHz band staying open late I had a field day with new countries" writes **Peter Lincoln.** He increased his RTTY number of countries received to 106, with 32 confirmed, by copying signals from CX1BBR on April 23, HC1HC on the 21st, H18KW on the 17th, TG9NR on the 12th, TN8CC on May 3rd and T7OA and 9H1E on April 20. "The TG station was asking for medical help from the USA for an amateur in Venezuela" says Peter. Apart from the usual Europeans, Peter also logged stations in CE, EA9, FM, JR, PR, YB, YU, XT and 5T.

"The Icom IC-R70 has got the lot, a super receiver for RTTY as well as the normal DX" writes **Norman Jennings,** Rye, who copied some 22 European countries plus good signals from north and south America, Australia, Indonesia and Japan on 14MHz. Between April 19 and May 18, I copied a large number of Italian stations among the RTTY signals I received from 15 countries, DJ, EA, F, HA, I, IT9, OE, OH, UT, XT, YU, 4X4, 5T5, 5Z4 and Y8, on or around 14·090MHz.

Don't forget that the British Amateur Radio Teleprinter Group are holding a rally for all RTTY enthusiasts at Sandown Park Racecourse, Esher, Surrey, between 1030 and 1700 on August 29, admission 50p. Their secretary, **Ted Batts** G8LWY, says that they hope to make Monday evenings an RTTY Activity Evening in order to assist stations in getting the new awards introduced by the BARTG. Details of Awards, contests and membership from Ted Double G8CDW, 89 Linden Gardens, Enfield, Middx.

Moonbounce

Congratulations to the Flight Refuelling ARS, led by our Technical Editor John Fell G8MCP, for their successful QSO on 432MHz with the West Virginian station K8HUH, via the moon, on May 15. The UK station, which required a great deal of planning, was installed at the club's QTH in Wimborne on the 14th and was operational by 1300. As this was their first attempt at such a QSO they sought the advice of Charlie Suckling G3WDG, the UK e.m.e. coordinator who confirmed that he had heard the American signals as the moon set on the evening of the 13th. The antennas seen, in Fig. 1, were mounted on a Kenpro KR500 elevation rotator at the top of a 5m high mast. Separate feeders were installed for connection between the muTek TLNA 432u, 1·4dB nf, bi-polar pre-amplifier and the receiver down-converter and p.a. stage. The receiver i.f. section comprised various 28MHz devices including a Trio 830S transceiver and a Yaesu 707. The transmitter comprised a Yaesu 790 driving an Elinco 10W 432MHz linear and Microwave Modules MML 432/100 final. A computer tracking programme was developed by Judith Richardson G6JGR and Mervin Staton G4BGT to allow continuous incremental setting of both azimuth and elevation headings of the antenna. Alan Martin G8ZPW, constructed a 600mm diameter 360 degrees protractor which bolted to the base of the vertical mast allowing relatively easy setting to within one degree of azimuth. At 1601, Nick Foot G8MCQ, "pounded the brass" (under G4BGT's supervision) and made the first contact and later at 1845, Chris Pedder G3VBL made the second contact which rounded off the day nicely.

The club have asked me to thank the editor and staff of *Practical Wireless,* Mutek Ltd, South Midlands Communications Ltd and Charlie Suckling G3WDG for their valuable assistance. I am very pleased to say that reports of this fine achievement received full page treatment in their local newspaper and an item on the Independent Local Radio station 2CR.

TV

by Ron Ham BRS15744

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

Many new DXers get confused between the words "Band", "Channel" and "Frequency" when they read about international television transmissions, so, to try to clarify this I suggest that you take a look at 3 books, *Long Distance Television* by Roger Bunney, *Guide to World Wide Television Test Cards* by Keith Hamer and Garry Smith and then, if you take it up seriously, that comprehensive work, *World Radio and TV Handbook.* The TVDXer is mainly concerned with 3 regions of the radio frequency spectrum which are approximately 40 to 70MHz for Band I, 170 to 230MHz for Band III and 470 to 850MHz for Bands IV and V. By International agreement the world's television systems are allocated with channel numbers, such as Ch.R1 49·75MHz, Ch. E8 196·25MHz and Ch. 30 543·25MHz.

Fig. 1: Received by Tim Anderson in August 1982

Sporadic-E

"I never go anywhere without the Plustron TV" writes **Tim Anderson,** Stroud, who was in London on May 2 and saw possibly the first real sporadic-E opening of the 1983 season. "This opening came up very suddenly in London, in a matter of minutes, at about 1319 and lasted to 1430," said Tim. He saw ice hockey, probably from the USSR on Chs. R1 and R2 and then test cards from Austria ORF-FS1 on Ch. E2 (Fig. 1), Czechoslovakia CST (Fig. 2), Poland TVP on Chs. R1 and R2 and East Germany DDR, on Ch. E4.

"I was enthralled to see the Grunten test card on Ch. E2" writes **David Newman,** who, using a Hugh Cocks v.h.f./u.h.f. converter for the first time, also received the test cards from Austria and Czechoslovakia. During this event

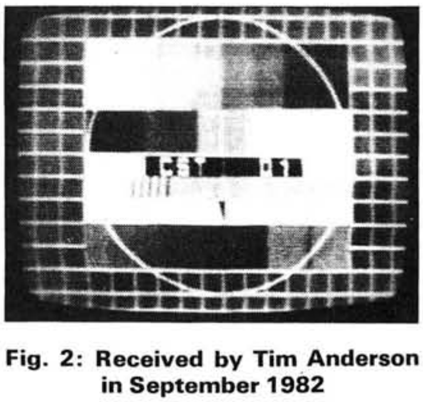


Fig. 2: Received by Tim Anderson in September 1982

Simon Hamer saw both the CST and RS-KH test cards from Czechoslovakia and at 1400GMT, Poland's TP clock caption was showing 1600, two hours ahead of GMT. On the subject of clocks, Tim Anderson sent me a couple of pictures which he received during the 1982 season showing the analogue clock from RAI Italy (Fig. 3), on Ch. 1A 53·75MHz and the digital clock, bottom right, on Spain's

TVE test card (Fig. 4). When pictures are bursting, or during a big event when many stations are swapping places on the screen, keep a sharp eye open for clocks or identification marks such as RAI, TVE and TP which often appear in the corners of new pictures.

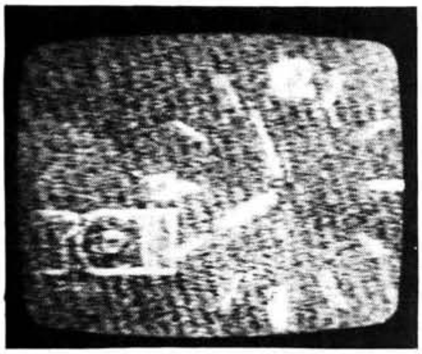


Fig. 3: Italian clock received by Tim Anderson

At 1410 on the 2nd, Simon saw the German ARD/ZDF caption on Chs. E2, 3 and 4. As the disturbance ebbed and flowed he watched ice hockey between Czechoslovakia and Sweden on Chs. R1 and R2, a YL vet inspecting a black bear's paws and a studio discussion with, what looked like Czechoslovakian captions and a few posters showing various lakes, followed by a picture of a stamped addressed envelope.

"The Hugh Cocks MOSFET tuner is certainly a big help," said Simon who received strong pictures on Ch. R2 of what appeared to be another studio discussion at 2010 on May 3. At 0755 on the 12th, I received strong test cards from MTV-1 Budapest and Poland on Ch. R1 and the associated sound on 56·25MHz. Later at 1240, a YL announcer was seen with a digital clock showing 1540, 3 hours ahead of GMT, which puts the transmitter somewhere in the Moscow area. During the morning of the 13th, test cards from Hungary and the USSR came up on Ch. R1 along with a mixture of tone and music on the sound channel. Soon after 1130 the Russian caption Hobocton appeared above a couple of news items shortly before the event finally died away.

There was a path toward Scandinavia around 0732 on the 17th when an analogue clock gradually appeared on Ch. E2 showing 0932 along with the caption NRK to the right and below were the words Nordkaloeemarsj (ofstad) det norske janitsjarorkester. At 0736 the first line changed to Konsertmarsj (sverre bergh) followed at 0744 by a programme list with a digital clock reading 0944.47. These Norwegian pictures did not last long but were strong enough for me to copy the words, letter by letter.

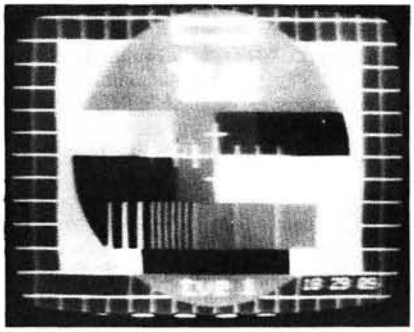


Fig. 4: Test card from Spain received by Tim Anderson

Amateur Television

From Australia, **Wenlock Burton** tells me that the signals from the ATV repeater in Sydney VK2RTK, situated in Lane Cove, are vertically polarised and transmissions are made through it, between 1930 and 2230, on Mondays and Thursdays by the Kenwood Ltd Amateur Radio Club. The club programmes, on such technical subjects as moonbounce and satellites, are in colour and published in Sydney TV guides and further information is available from Bruce Smith VK2ADK, Kenwood Ltd., Lane Cove, Sydney.

Fig. 5: SSTV CQ copied by Peter Lincoln

Fig. 6: Austrian logo sent by Tom Toth

SSTV

"With the 14MHz band staying open late, SSTV pictures have been received from Canada and the USA" writes **Peter Lincoln.** He copied both sides of a QSO between VE2DEN and W5ZR in addition to the usual German (Fig. 5) and Italian stations he regularly sees. Peter also received pictures from EA8AHK and HA5KBM. Among the SSTV countries that Peter already has confirmed are the Azores, Denmark, Finland, West Germany, Hungary and South Africa.

One of the many interesting aspects of writing a regular column is the feed back afterwards and I learnt from Peter Loncoln that his picture of F3RT, which I used in our June issue, was transmitted from the page in *PW,* via SSTV, back to F3RT, by a Midlands G station.

Other Stations

The mystery picture I published in our April issue was certainly no mystery to **Tom Toth,** Southampton, who writes "it's Austrian Radio's logo", ORF, the same as the letters of his callsign G4ORF. Tom also sent a copy of the logo (Fig. 6).

"How do you adapt a 625-line u.h.f. TV to the European system" writes **G. B. Woolton,** a 14-year-old Band II DXer from Egham, Surrey. My short answer is have a chat to one of the firms who advertise v.h.f. to u.h.f. converters or be independent and look around the shops for one of these small screen receivers which tunes through Bands I and V.

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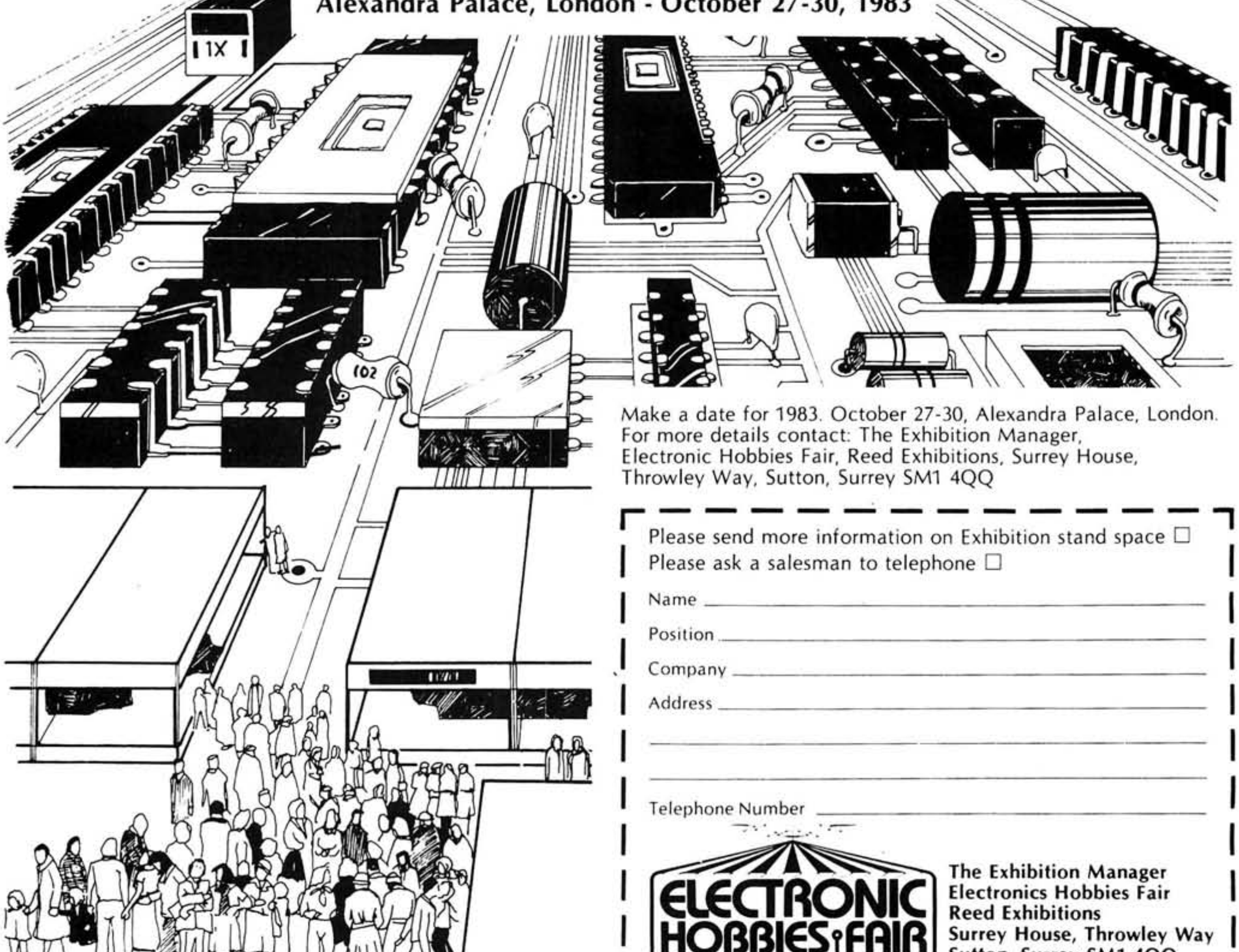

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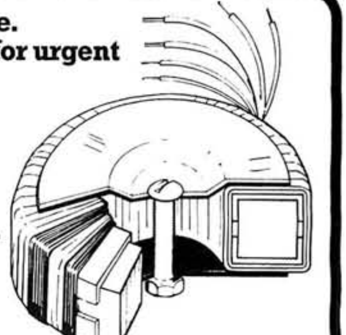

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	0x015	22+22	0.34	
	0x016	25+25	0.30	
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	1x013	15+15	1.00	TOTAL £7.58
	1x014	18+18	0.83	
	1x015	22+22	0.68	
	1x016	25+25	0.60	
	1x017	30+30	0.50	
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	2x012	12+12	2.08	+ VAT £1.12
	2x013	15+15	1.66	TOTAL £8.60
	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 1Kg Regulation 12%	3x010	6+6	6.64	**£6.66**
	3x011	9+9	4.44	+ p & p £1.72
	3x012	12+12	3.33	+ VAT £1.26
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	3x014	18+18	2.22	
	3x015	22+22	1.81	
	3x016	25+25	1.60	
	3x017	30+30	1.33	
	3x028	110	0.72	
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	4x012	12+12	5.00	+ VAT £1.37
	4x013	15+15	4.00	TOTAL £10.51
	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 1.8Kg Regulation 8%	5x011	9+9	8.89	**£8.43**
	5x012	12+12	6.66	+ p & p £1.72
	5x013	15+15	5.33	+ VAT £1.52
	5x014	18+18	4.44	TOTAL £11.67
	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 2.2Kg Regulation 7%	6x012	12+12	9.38	**£9.81**
	6x013	15+15	7.50	+ p & p £2.05
	6x014	18+18	6.25	+ VAT £1.78
	6x015	22+22	5.11	TOTAL £13.64
	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	

TYPE	SERIES No	SECONDARY Volts	RMS Current	PRICE
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	7x015	22+22	6.82	+ VAT £1.94
	7x016	25+25	6.00	TOTAL £14.87
	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 4Kg Regulation 4%	8x016	25+25	10.00	**£14.38**
	8x017	30+30	8.33	+ p & p £2.40
	8x018	35+35	7.14	+ VAT £2.52
	8x026	40+40	6.25	TOTAL £19.30
	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 5Kg Regulation 4%	9x017	30+30	10.41	**£17.12**
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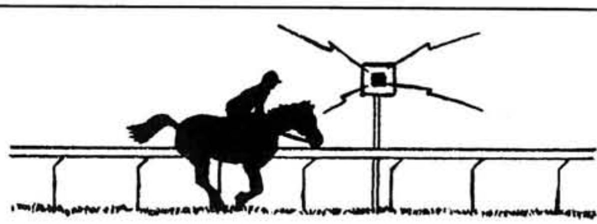

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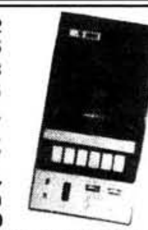

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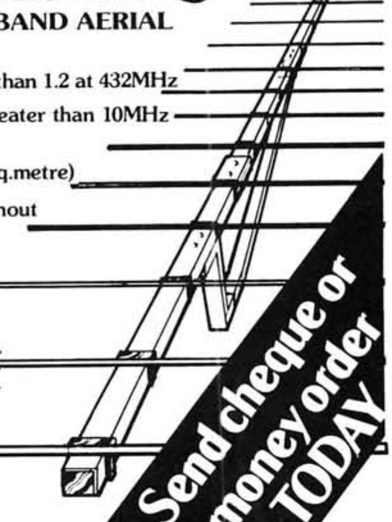

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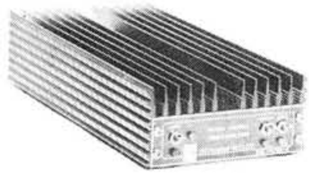

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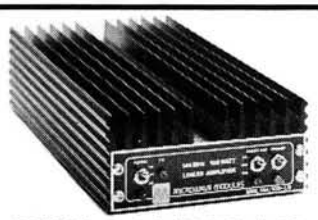

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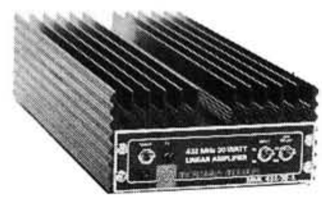

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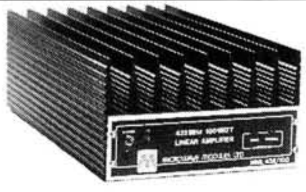

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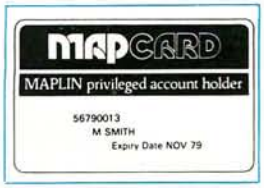

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