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OCTOBER 1982

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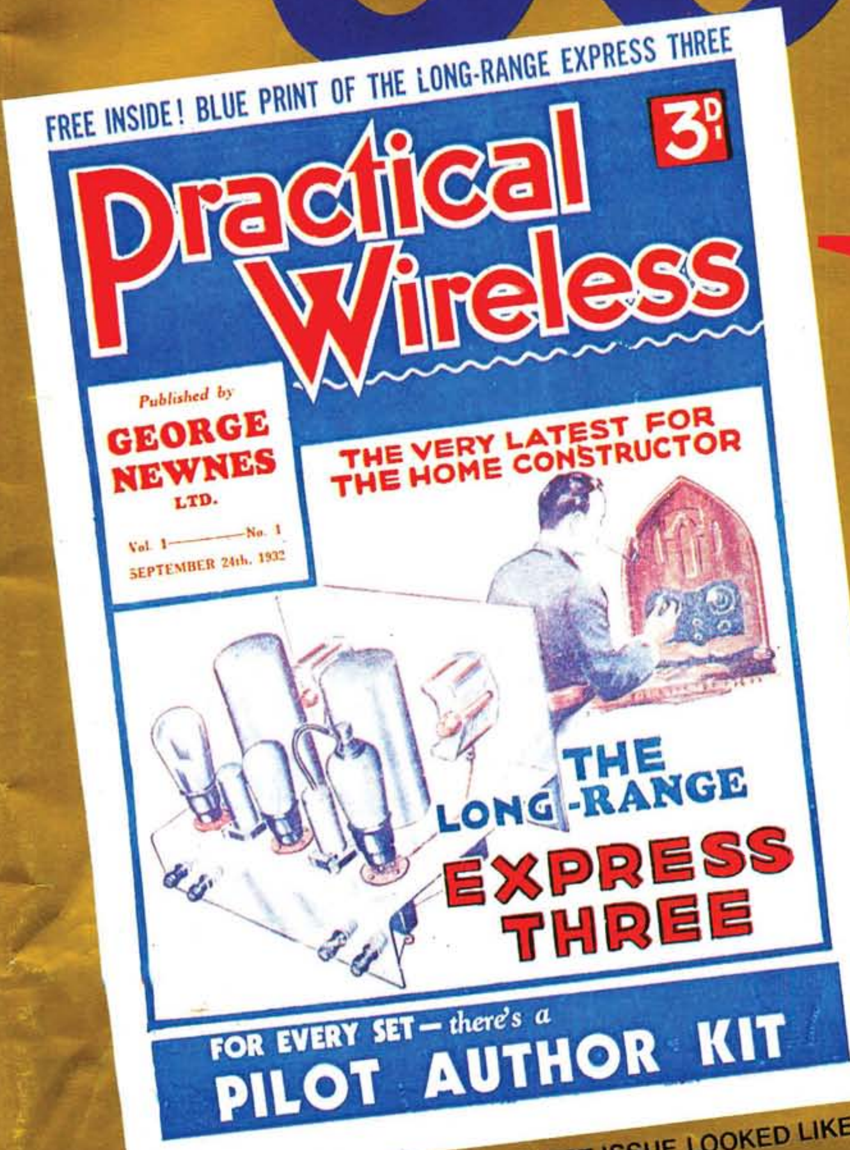
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Vol. 1 — No. 1
SEPTEMBER 24th, 1932

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ADONIS AM503 Compression Mic 1	39.00	(—)
ADONIS AM 802 Compression Mic+Meter 3 O/P	59.00	(—)

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ADONIS AM 202S Clip-on	20.95	(—)
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MOBILE ANTENNAE

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Drae VHF Wavemeter 130-450MHz	24.95	(—)
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MMT432/28S	70cm Transverter for HF Rig	159.95	(—)
MMT432/144R	70cm Transverter for 2M Rig	184.00	(—)
MMT70/28	4M Transverter for HF Rig	119.95	(—)
MMT70/144	4M Transverter for 2M Rig	119.95	(—)
MMT1296/144	23cm Transverter for 2M Rig	184.00	(—)
MML144/30	2M 30W Linear Amp	69.95	(—)
MML144/100S	2M 100W Linear Amp (10W I/P)	139.00	(—)
MML144/100LS	2M 100W Linear Amp (3W I/P)	159.00	(—)
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MML432/50	70cm/50W Linear Amp	109.95	(—)
MML432/100	70cm 10/100W Linear Amp	228.64	(—)
MM2001	RTTY to TV Converter	169.00	(—)
MM4000	RTTY Transceiver	269.00	(—)
MMC50/28	6M Converter to HF Rig	29.90	(—)
MMC70/28	4M Converter to HF Rig	29.90	(—)
MMC144/28	2M Converter to HF Rig	29.90	(—)
MMC432/28S	70cm Converter to HF Rig	37.90	(—)
MMC432/144S	70cm Converter to 2M Rig	37.90	(—)
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ASP/A	Auto RF Speech Clippers (Yaesu Plug)	82.80	(—)
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AD270	Indoor Active Dipole Antenna	47.15	(—)
AD370	Outdoor Active Dipole Antenna	64.40	(—)
MPU1	Mains Power Unit	6.90	(—)
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RFA	Broadband Preamplifier	33.92	(—)
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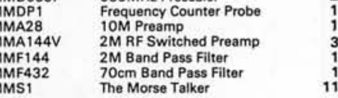
D70 MORSE TUTOR £49.45



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contents

AF606K

DAIWA ALL MODE ACTIVE FILTER £56.50

From Daiwa yet another aid to operating. In addition to the notch, SSB and CW filters, the AF606K is equipped with a PLL tone decoder; when the tone frequency of the CW signal and the free running frequenty of the PLL tone decoder are the same a locked signal is generated. This locked signal keys an audio oscillator which then reproduces the received CW signal. However, there is a tremendous difference between the produced signal and the received one – no noise and, of course, no fading. ANOTHER PIECE OF EQUIPMENT TO ENHANCE YOUR LISTENING.

DK 210

DAIWA ELECTRONIC KEYER £42.00

With so many electronic keys and keyers on the market, it's hard to describe one that is better than the rest. Inevitably it is a matter of "feel", and the feel of the New Daiwa DK210 is superb. Being Daiwa, the quality of design and construction has to be of the best, but it's in use that the DK210 is so impressive. Designed to be used with an external paddle, to give greater personal choice, the DK210 is otherwise self contained, even to being battery powered (PP3). It offers a speed range of 10 to 50 w.p.m., built in sidetone, facilities for semi auto, or fully auto keying, and a tune position for adjusting your transmitter, but the outstanding feature is the adjustable "weight" control. This control gives an amazing improvement in the character of the sending, and completely removes that mechanical sounding "electronic morse" characteristic. Those experienced CW users who have tried out the DK210, have all said how good it sounds – and have usually purchased one. So will you if you try it out.

DK210 from DAIWA – A truly nicer Keyer.

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NOW YOU HAVE A LOWE IN GLASGOW

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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 to144.5, 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 –

the TS 780

£748 inc VAT carr £5.00

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ANTENNAS HF MOBILE

G WHIP

TRIBANDER	Element, 10-15-20M, slide switch	£25.88	1.00
GWBASESTND	Base standard type	£5.75	0.80
LF40	Loading coil 40M	£6.56	0.60
LF80	Loading coil 80M	£6.56	0.60
LF160	Loading coil 160M	£6.56	0.60
LFWHIP	Telescopic whip	£4.26	0.60
MULTIMOBILE	Mast/head 10-15-20M self selecting	£30.48	1.40
GWBASESTND	Base standard type	£5.75	0.80
MM40	Loading coil 40M	£6.56	0.60
MM80	Loading coil 80M	£6.56	0.60
MM160	Loading coil 160M	£6.56	0.60
MMWHIP	Telescopic whip	£4.26	0.60
FLEXIWHIP	Mast/Whip (10M basic)	£18.11	1.00
GWBASESTND	Base standard type	£5.75	0.80
FF15	Loading coil 15M	£6.56	0.60
FF20	Loading coil 20M	£6.56	0.60
FF40	Loading coil 40M	£6.56	0.60
FF80	Loading coil 80M	£6.56	0.60
FF160	Loading coil 160M	£6.56	0.60
THREAD	Thread adaptor G Whip to USA Base	£0.92	0.50
EXTENDAROD	Mast extension 39"	£12.08	0.90
SMC35	Base heavy duty Ball type	£6.32	1.80

HY-GAIN ACCS.

492	Spring mini, whips to 52"	£3.39	0.90
415	Bumper strap, c/w base	£12.42	2.10
498	Body mount split ball 90°	£13.23	1.40
511	Spring heavy duty 3lb 4.5"L	£10.93	1.80
417	Spring medium duty 2lb 4.5"L	£9.78	1.40

SMC

SMCHW/4/A	Antenna (spot f) complete, 2-30MHz	£67.85	2.00
SMCHW/4/A1-2	Coil/Whip (spot f)	£16.10	0.80

SMC-HS

SMC20SE	Ele 20M 1.72M 'fold over' 100W PEP	£15.35	1.80
SMC17SE	Ele 17M 1.915M 'fold over' 200W PEP	£14.20	1.80
SMC15SE	Ele 15M 1.72M 'fold over' 130W PEP	£13.80	1.80
SMC12SE	Ele 12M 1.915M 'fold over' 200W PEP	£13.40	1.80
SMC10SE	Ele 10M 1.72M 'fold over' 200W PEP	£12.65	1.80
SMCSOWM	Adjustable wing mount SO239/SO239M	£3.45	0.72
SMCGCCA	Gutter clip, c/w 4M RG58, PL259	£8.80	1.20
SMCTMCAS	Trunk mount c/w 6M cable	£7.65	0.95
SMCSOCAL	Cable assembly 239M c/w 6M cable PL259	£4.20	0.50
SMCBSD	Bumper + strap deluxe stainless band	£7.71	1.00
SMC35	Mount ball type	£4.89	1.40
THREAD	Thread adaptor fits SMC35 to UK	£0.92	0.50
MX913/M	Dust cover metric fits SMCSOCA	£0.46	0.50

UNITOWER

HT30M	Tower 30ft 10ft lattice	£339.25	Dist
HT40M	Tower 40ft	£437.00	Dist

TELETOWER

TT17	Tower 17m c/w Rig	£391.00	Dist
TT24	Tower 24m c/w Rig	£569.25	Dist
TT30	Tower 30m c/w Rig	£690.00	Dist

MASTS AND TOWERS

VERSATOWER MINI TOWER (10M10 SERIES)

10M10P30	30ft	£388.36	Dist	10M10BP30	30ft	£411.13	Dist
10M10W30	30ft	£373.18	Dist	10M10FB30	30ft	£360.53	Dist

VERSATOWER STANDARD (13M20 SERIES)

13M20P25	25ft	£318.78	Dist	13M40T120	120ft	£1960.75	Dist
13M20P40	40ft	£436.43	Dist	13M20BP25	25ft	£373.18	Dist
13M20P60	60ft	£533.83	Dist	13M20BP40	40ft	£492.09	Dist
13M20P80	80ft	£1018.33	Dist	13M20BP60	60ft	£586.96	Dist
13M20SP25	25ft	£371.80	Dist	13M20BP80	80ft	£1071.46	Dist
13M20SP40	40ft	£488.29	Dist	13M20W25	25ft	£256.80	Dist
13M20SP60	60ft	£586.96	Dist	13M20W40	40ft	£374.44	Dist
13M20SP80	80ft	£1071.46	Dist	13M20W60	60ft	£471.85	Dist
13M20M25	25ft	£1715.34	Dist	7M20FB	25ft	£179.00	Dist
13M20M40	40ft	£1877.26	Dist	13M20FB25	25ft	£237.82	Dist
13M20M60	60ft	£1993.64	Dist	13M20FB40	40ft	£354.20	Dist
13M20M80	80ft	£2527.47	Dist	13M20FB60	60ft	£451.61	Dist
13M40T85	85ft	£1435.78	Dist	13M20FB80	80ft	£934.84	Dist

VERSATOWER HEAVY DUTY (16M20 SERIES)

16M20P40	40ft	£650.21	Dist	16M20SP100	100ft	£1414.27	Dist
16M20P60	60ft	£738.76	Dist	16M20M40	40ft	£2179.60	Dist
16M20P80	80ft	£1113.20	Dist	16M20M60	60ft	£2306.10	Dist
16M20P100	100ft	£1342.17	Dist	16M20M80	80ft	£2834.87	Dist
16M20FB40	40ft	£511.06	Dist	16M20M100	100ft	£2929.74	Dist
16M20FB60	60ft	£604.67	Dist	16M20BP40	40ft	£662.86	Dist
16M20FB80	80ft	£951.28	Dist	16M20BP60	60ft	£766.59	Dist
16M20FB100	100ft	£1163.80	Dist	16M20BP80	80ft	£1141.03	Dist
16M20SP40	40ft	£705.87	Dist	16M20BP100	100ft	£1370.00	Dist
16M20SP60	60ft	£809.60	Dist	16M20W40	40ft	£521.18	Dist
16M20SP80	80ft	£1185.31	Dist	16M20W60	60ft	£611.00	Dist

ANTENNAS VHF/UHF FIXED

JAYBEAM

4Y/4M	Yagi 4 ele	7.5'B	7dBd	£22.43	2.20
PMH2/4M	Harness 2 way			£13.23	1.70
HO/2M	Halo head only	1' sq	ϕdBd	£5.18	0.70
HM/2M	Halo with 24" mast	1' sq	ϕdBd	£5.75	0.95
UGP/2M	Ground plane	1.7'	ϕdBd	£10.93	2.20
C5/2M	Colinear	13.1'	7.1lb 4.8dBd	£47.73	2.20
5Y/2M	Yagi 5 ele	5.2'	7.8dBd	£12.08	2.20
8Y/2M	Yagi 8 ele	9.2'	9.5dBd	£15.53	2.20
10Y/2M	Long Yagi 10 ele	14.4'	11.4dBd	£33.35	2.20
14Y/2M	Long Yagi 14 ele	17.5'	12.8dBd	£36.23	2.20
D5/2M	Yagi 5 over 5 slot	5.2'	10.6dBd	£21.85	2.20
D8/2M	Yagi 8 over 8 slot	9.2'	12.3dBd	£29.33	2.20
PBM10/2M	10 ele parabeam	12.9'	11.7dBd	£39.68	2.20
PBM14/2M	14 ele parabeam	19.5'	13.7dBd	£48.30	2.20
Q4/2M	Quad 4 ele	4.9'	9.5dBd	£25.88	2.20
Q6/2M	Quad 6 ele	8.7'	12dBd	£33.93	2.20
Q8/2M	8 ele quad	11.6'	13.8dBd	£39.10	2.20
5XY/2M	Yagi 5 ele cross	5.5'	7.8dBd	£24.73	2.20
8XY/2M	Yagi 8 ele cross	9.2'	9.5dBd	£31.05	2.20
10XY/2M	Yagi 10 ele cross	11.8'	10.8dBd	£40.83	2.20
PMH2/C	Circular polarisation harness			£8.05	1.20
PMH2/2M	Harness 2 way			£10.93	1.20
PMH4/2M	Harness 4 way			£25.30	1.20
X6/X12	6 ele 2, 12 ele 70	7.2'	8.5/12	£41.40	2.20
C8/70	Colinear	10.5'	6dBd	£54.05	2.20
D8/70	Yagi 8 over 8 slot	3.6'	12.3dBd	£22.43	2.20
PBM18/70	Parabeam 18 element	9.2'	14.0dBd	£27.60	2.20
PBM24/70	Parabeam 24 element	14.8'	15.1dBd	£36.80	2.20
MBM28/70	28 ele multibeam rear mount		12.5dBd	£18.40	2.20
MBM48/70	Multibeam 48 ele	6.0'	14.5dBd	£31.05	2.20
MBM88/70	Multibeam 88 ele	13.1'	16.3dBd	£42.55	2.20
8XY/70	Yagi 8 ele crossed	8.5'	10dBd	£36.80	2.20
12XY/70	Yagi 12 ele crossed	8.5'	12dBd	£46.00	2.20
PMH2/70	Harness 2 way			£9.20	1.00
PMH4/70	Harness 4 way			£19.55	1.50
D15/23	15 over 15 slot length 2.8'		15dBd	36.80	2.20
CR/23	Corner reflector		14.8dBd	£35.08	2.20
SBM4	Yagi 4 ele Band 2			£16.45	2.20
SBM6	Yagi 6 ele Band 2			£24.04	2.20

SMC

GP2U	Ground Plane: folded radiator	1.7'	£5.75	1.70

SMC-HS

GDXA	Discone 100-440MHz		£34.90	2.20
SMCGDX1	Discone 80-480MHz 3dB$\frac{1}{2}$	3.3'	£41.40	2.20
SMCGDX2	Discone 50-480MHz 3dB$\frac{1}{2}$	6.2'	£47.95	2.20
SMCVHFL	Discone 65-520MHz, Rx only	5.0'	£16.85	2.20
SMCGP144W	Colinear 2M, $\frac{5}{8}\lambda$, 6.5dB$\frac{1}{2}$	10.2'	£24.90	2.20
SMCGP2M	$\frac{5}{8}\lambda$, 2M ground plane, 3.4dB$\frac{1}{2}$	4.6'	£15.70	2.20
SMCSQ144	2M Swiss Quad vertical		£52.90	2.20
SMCGP432X	Colinear 70cm, $3\times\frac{5}{8}\lambda$, 6.8dB$\frac{1}{2}$	5.6'	£25.70	1.70
SMC70N2V	Vert. 2.8dB$\frac{1}{2}$ 2M, 5.7dB$\frac{1}{2}$ 70cm	3.6'	£25.70	2.20
SMC2HB6	6M, 2ele, HB9CV Beam		£19.95	2.20

TELEWAND

TW435D	Discone 400-1200MHz	1.2'	£26.45	0.85

ANTENNA ROTATORS

KR500	Kenpro, elevation Meter calb ± 90°		£86.25	Free
KR400	Kenpro bell, box as KR500		£86.25	Free
RLD3	SMC, Bell	Auto control	£38.53	Free
AR30	CDE, Offset	Turn and Push	£51.75	Free
9508	Channel Master, offset		£74.75	Free
9502B	Channel Master, offset		£54.63	Free
KR250	Kenpro, Bell	Twist Switch	£44.85	Free
AR40	CDE	Turn and Push	£65.55	Free
KR400RC	Kenpro	Round meter 360°	£90.85	Free
AR50	CDE	5 position pre-selector	£113.85	Free
CD45	CDE	8 × 4cm meter readout	£113.85	Free
KR600RC	Kenpro	Round meter 360°	£132.25	Free
Ham IV	CDE	8 × 4cm meter readout	£189.75	Free
KR2000RC	Kenpro	Heavy Duty 360° meter	£241.50	Free
T2X	CDE	8 × 4cm meter readout	£270.25	Free
H300	Hy Gain	Digital readout	£451.95	Free

ROTOR ACCESSORIES

CD562	Bearing CDE AR30 etc.		£7.76	1.25
AK 121	Adaptor Kit, CDE Bell to plate		£4.60	0.90
50425	Clamps/U Bolts ST CDE AR40 etc		£4.95	1.25
50463	Clamps/U Bolts HD CDE CD45 HAM4		£7.36	1.85
51472	Mast Mount Kit ST CDE HAM4 etc.		£12.08	2.10
51467	Mast Mount Kit HD CDE T2X etc.		£24.15	2.10
9523	Support Bearing Channel Master		£14.38	1.70
9525	Rotary Bearing Channel Master		£14.38	1.20
KS050	Rotary Bearing 1$\frac{3}{8}$" Kenpro		£12.25	1.40
KS065	Rotary Bearing 2" Kenpro		£17.65	1.85
KC038	Lower Mast Clamp KR400, KR600		£9.95	1.70
RC5W	5 Way AR30 AR40 KR400RC	p/m	£0.35	
RC6W	6 Way KR250/400/500/600RC	p/m	£0.48	
RC8W	8 Way CD45 Ham 4 T2X KR2000RC	p/m	£0.52	

ANTENNA/MAST FITTINGS

CABLE GRIPS

CG5	Bulldog Grip 5mmD (0.1875") Galv.		£0.17	0.55
CG6	Bulldog Grip 6mmD (0.125") Galv.		£0.18	0.55
HD9	Brass Line Clamp for copper wire		£0.55	0.55

WALL BRACKETS (STAND OFF'S)

W12	12" c/w 2" U Bolts T Section	Pr	T.O.S.	2.60
W18	18" c/w 2" U Bolts T Section	Pr	£10.06	2.60
W21	21" c/w 2" U Bolts T Section	Pr	£10.92	2.60
W21HD	21" HD c/w 2" U Bolts D with Brace	Pr	£12.92	2.10
W24	24" c/w 2" U Bolts T Section	Pr	£13.23	2.80
W24HD	24" HD c/w 2" U Bolts with Brace	Pr	£15.48	2.80

D SHACKLE (PIN SIZE)

DS6	6mm ($\frac{1}{4}$ins)		£0.32	0.55
DS8	8mm ($\frac{5}{16}$ins)		£0.37	0.55
DS10	10mm ($\frac{3}{8}$ins)		£0.47	0.55
DS11	11mm ($\frac{7}{16}$ins)		£0.75	0.55

GUY ROPES

HTS3	HT Steel 3mmD 1×19 BS 720Kg	p/m	£0.26	
HTS4	HT Steel 4mmD 1×19 BS 1285Kg	p/m	£0.32	
HTS5	HT Steel 5mmD 1×19 BS 2000Kg	p/m	£0.25	
HTS6	HT Steel 6mmD 1×19 BS 2875Kg	p/m	£0.48	
X150	Rustproof 3mmD Multistrand	150m	£20.59	2.60
FE7X18G100	Galvanised 7 by 18 Gauge	100'	£6.90	2.80
FE7X18G300	Galvanised 7 by 18 Gauge	300'	£20.13	4.20
TPS3	Terylene 3mmD BS 70Kg	p/m	£0.10	
TPS4	Terylene 4mmD BS 295Kg	p/m	£0.15	
TPS6	Terylene 6mmD BS 570Kg	p/m	£0.22	
TPS8	Terylene 8mmD BS 1110Kg	p/m	£0.37	

GUY STAKES

GS18	18" 'T' section 38×38×5mm Galv.		£4.08	2.10
GS27	27" 'T' section 38×38×5mm Galv.		£5.64	2.50
GS36	36" 'T' section 51×51×6mm Galv.		£10.64	3.70

GUY TENSIONERS

TPR933	Turnbuckle 115×8mm, 4.5"		£2.70	0.90
RS150X10	Turnbuckle 150×10mm, 6"		£5.12	1.30

MAST FITTINGS (2" MASTS)

SMCMP3	Guy Plate 3 hole		£1.38	0.75
SMCMP4	Guy Plate 4 hole		£2.19	0.75
SMCMB3	Guy Band 3 hook		£1.61	0.85
SMCMB4	Guy Band 4 hook		£2.24	1.05
SMCMC1	Cap. Cast Alloy		£3.74	0.80
SMCMBP1	Base Plate Alloy Shoe		£5.58	0.95

THIMBLES

THIM30	Galv. 30mm OA (1.25") for Wire		£0.18	0.50
THIM38	Galv. 38mm OA (1.5") for Wire		£0.21	0.50
THIM44	Galv. 44mm OA (1.75") for Wire		£0.23	0.50
THIM51	Galv. 51mm OA (2.0") for Wire		£0.28	0.50
F1235	Nylon 30mm OA (1.25") for Terylene		£0.20	0.50
F985	Nylon 38mm OA (1.5") for Terylene		£0.24	0.50

MASTING

AL32X16G	Aluminium 1.25" 16 Gauge	p/m	£1.83	
AL38X16G	Aluminium 1.50" 16 Gauge	p/m	£2.21	
AL49X7G	Aluminium Nom 2" 7 Gauge	p/m	£4.54	

MISCELLANEOUS HARDWARE

RB6	Rawlbolt 6mm Bolt		£0.32	0.50
RBD20	Rawlbolt 8mm Bolt		£0.51	0.50
RBE19	Rawlbolt 10mm Bolt		£0.61	0.60
RBG20	Rawlbolt 12mm Bolt		£1.08	0.70
RB16	Rawlbolt 16mm Bolt		£2.66	1.30
PSS25	Pulley 25mm winch		£0.76	0.50
PSS38	Pulley 38mm winch		£0.94	0.50
55904	Cable clip 10-14mm		£0.10	0.50
55903	Cable clip 7-10mm		£0.08	1.10
SMC53	Mast to boom clamp 1-2" to 1"		£1.73	1.40
SMC63	Mast to boom clamp 1-2" to 1-1.25"		£2.19	2.10
SMC73	Mast to boom clamp 1-2" to 1" H.D.		£2.82	2.10
SMC59/15	Mast sleeve 15" for 2"		£6.61	2.10
SH63	Shap hook 63mm O/A		£0.99	0.50
UBOLT2	'U' Bolt 2" Centre 9mm Galv.		£0.46	0.60
ER4	Earth rod copperweld 4', c/w Clamp		£6.15	2.10
SMC2LK	Double lashing kit		£13.80	2.50
SMCCP1	Cross over plate 5"×5"×$\frac{1}{4}$"		£4.77	1.90

CARRIAGE

Carriage charges (shown after the item price) are for the mainland only (excluding post) and the rates shown are for one off of the item. Where more than one article is ordered, total freight charge is likely to be *much* lower than the sum of the individual charges.

Cables, ropes and masting are normally despatched by Roadline. Carriage is £2.00 to 7Kg thereafter add an extra £0.15 per Kg. (Mainland.)

Where Securicor delivery on an item, or any number of items combined, is possible (i.e., less than 25Kg/55lbs and 5'6" long) it is charged at £4.49 per lot.

If in doubt of carriage send a cheque crossed, "not more than £ . . . ."

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SMC AGENTS

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Bangor	John	GI3KDR	(0247) 55162
Tandragee	Mervyn	GI3WWY	(0762) 840656
Edinburgh	Jack	GM8GEC	(031657) 2430 Day, (031665) 240 Eve
Jersey	Geoff	GJ4ICD	(0534) 26788

double act

Thanet ICOM Thanet ICOM

The World's most popular portables IC-2E £159. IC4E £199.inc.

and now the marine version IC-M12 £199+VAT.

Nearly everybody has an IC-2E, 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 400 5KHz steps. (430-439.99 4E). **Power output** – 1.5W. **BNC antenna** output socket. **Send/Battery indicator. Frequency selection** – by thumbwheel switches, indicating the frequency. 5KHz switch-adds 5KHz to the indicated frequency. **Duplex Simplex switch** – gives simplex or plus 600KHz or minus 600KHz transmit (1.6MHz and listen input on 4E). **Hi-Low switch** – 1.5W or 150mW. **External microphone jack. External speaker jack.**

The IC-4E is revolutionising 70cm!

Multimode Mobiles IC-290E £366. IC-490E £445.inc.

290E-144-146 MHz/490E-430-440 MHz. 10 W RF output on SSB, CW and FM. Standard and non-standard repeater shifts. 5 memories and priority channel.

Memory scan and band scan, controlled at front panel or microphone. Two VFO's. LED S-meter. 25KHz and 1KHz on FM – 1KHz and 100KHz tuning steps on SSB. Instant listen for repeaters.

IC-720A Possibly the best choice in HF. £883.inc.

One way of keeping up with rapidly advancing technology is to look at what the IC-720A offers in it's BASIC form. How many of it's competitors have two VFO's as standard, or a memory which can be recalled, even when on a different band to the one in use, and result in instant retuning AND BANDCHANGING of the transceiver? How many include really excellent general coverage receiver covering all the way from 100KHz to 30MHz? How many need no tuning or loading whatsoever? and take care of your PA, should you have a rotten antenna. How many have an automatic RIT which cancels itself when the main tuning dial is moved? How many will run full power out for long periods without overheating? How many have band data output to automatically change bands on a solid state linear AND an automatic antenna tuner unit?

The IC-720A may be just a little more expensive than some, but it's better than most! Make your choice an IC-720A.

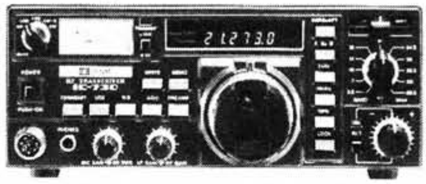
IC-PS15 Mains PSU £99.

Tono RTTY and CW computers 7000E £500. 9000E £650.inc.

The TONO range of communication computers take a lot of beating when it comes to trying to read RTTY and CW in the noise. Others don't always quite make it!

Check the many facilities offered before you buy – especially look at the 9000E which also throws in a Word Processor. Previous ads have told you quite a lot about these products – but why not call us for further information and a brochure?

IC-730 The best for mobile or economy base station £586.inc.



ICOM's answer to your HF mobile problems – the IC-730. This new 80m–10m, 8 band transceiver offers 100W output on SSB, AM and CW. Outstanding receiver performance is achieved by an up-conversion system using a high IF of 39MHz offering excellent image and IF interference rejection, high sensitivity and above all, wide dynamic range. Built in Pass Band Shift allows you to continuously adjust the centre frequency of the IF pass band virtually eliminating close channel interference. Dual VFO's with 10Hz, 100Hz and 1kHz steps allows effortless tuning and what's more a memory is provided for one channel per hand. Further convenience circuits are provided such as Noise Blanker, Vox, CW Monitor APC and SWR Detector to name a few. A built in Speech Processor boosts talk power on transmit and a switchable RF Pre-Amp is a boon on today's crowded bands.

Great base stations IC-251 £499. IC-451 £569.inc.

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 for your 2 Meter station and the 451E for 70 cms. Mains or 12 volt supply. SSB, CW and FM.

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AMATEUR RADIO EXCHANGE

Full details and prices in this issue of the exciting new-generation scanning receivers which we previewed last month... all synthesised and all with digital readout.

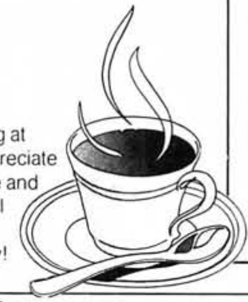
First, our scanning receivers, and to lead off, the **MAXIMAL MK-4000** (right) with FM coverage of 70-87.9875MHz and 140-175.9875MHz in 12.5kc steps on both bands. Sensitivity is 0.5µv S/N 20dB, and selectivity ±15KHz at –50dB, and its AF output is more than 1.3W. All that, plus a built-in digital clock, for just **£99.00.**

Next, two really first-class digital-readout scanning receivers, the **CORONA CD-3000** and **CD-4000** (pictured). Their identical format presentation conceals totally different specifications as follows.

CD-3000 Professional-standard air-band receiver covering 110-139.995MHz on AM in 5kc steps. With sensitivity of 0.5µv S/N 10dB, this is tremendous value at **£89.00.**

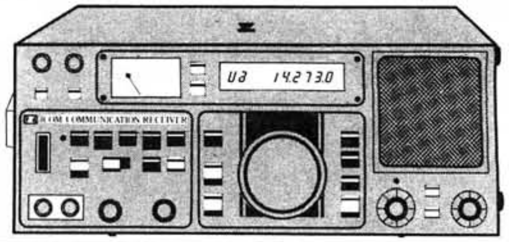
CD-4000 (left) For full coverage of public services, amateur and marine bands between 140 and 159.995MHz on FM at a price of only **£69.00.**

Finally, the **FAIRMATE AS-10960** (below), which covers VHF from 140 to 175.995MHz and UHF from 275 to 410MHz and is programmable to 10 selected frequencies in 5kc increments. Also featuring memory and priority channels, it is tremendous value at **£95.00.**



Reading specifications and looking at pictures are all very well, but the best way to appreciate the quality of these exclusive imports is to come and hear them if at all possible... and that way you'll get a cup of Brenda's coffee too while you're making up your mind which one (ones?) to buy!

Another item seen on our trip to Japan... the new ICOM general coverage receiver. Having tried it, we are convinced that this could well become the market leader in its field. With features like these, everyone who wants the best in today's receiver technology will now be asking for ICOM.



ICR-70
- **Tunable from 100kc to 30MHz**
- **AM/SSB/FM right across the range**
- **Pass band tuning • Scan facility**
- **Notch filter • Two VFO's**

Whether you want to buy outright or part-exchange your existing receiver, phone or call in without delay and be one of the first to enjoy a remarkable new experience in general coverage radio reception.

Ever wanted to decipher all those funny morse code (CW) and radio teletype (RTTY) noises you hear on your communications receiver? Well, now you can – with the new TASCO Morsemaster CWR-600.

Simply connect the input side of the Morsemaster to your receiver or transceiver, and the output either to a domestic TV (UHF) or to a proper VDU which we can also supply. RTTY and CW will be automatically demodulated and displayed on the screen, CW at speeds of up to 250 characters per minute, RTTY between 45.5 and 110 Bauds.

£189

LICENSED CREDIT BROKERS ✻ Ask for written quotation on HP terms. Also interest-free terms with 50% deposit.

BARCLAYCARD VISA

Prices are correct as we go to press, but we reserve the right to vary them if forced to do so by the time this advertisement appears.

YAESU

FT 102	160-10M 9-Band Trans. **NEW**	699.00
FT-ONE	Gen. Coverage Trans. **NEW**	1295.00
FT 790R	70cm all-mode portable **NEW**	295.00
FT 101ZFM	160-10m 9-Band Transceiver	590.00
FT 101ZDFM	160-10m 9-Band Transceiver	P.O.A.
DIGT 101Z	Digital unit	90.00
DCT 101Z	DC Adaptor	42.50
FV 101Z	Remote vfo	112.00
FT 902DM	9-Band AM/FM Transceiver	885.00
FC 902	9-Band atu, swr/pwr etc.	135.00
FTV 901R	Transverter fitted 2m module	285.00
430TV	70cm module for above	185.00
144TV	2m module for Transverter	100.00
70TV	4m module for Transverter	80.00
FV 901DM	Remote vfo for 901	260.00
SP 901	External speaker	31.00
FL 2100Z	9-Band 1200W linear	425.00
FT 107	9-Band 100W solid state	699.00
FT 107DMS	As above with memory	779.00
DMST 107	Memory unit	92.75
FV 107G	Remote VFO for above	98.50
SP 107G	External speaker	29.90
FC 107G	Aerial tuning unit	112.70
FP 107	230V AC power module	101.95
FP 107tG	Cased PSU with speaker	113.00
FT 707	8-Band solid state 100W	545.00
FP 707	230 volts AC power supply	125.00
FC 707	Aerial tuner (unbalanced only)	85.00
MR 7	Metal rack for above	15.70
MMB 2	Mobile mounting bracket	16.00
FRG 7	0.5-30MHz receiver	199.00
FRG 7700	SSB/AM/FM recvr. dig. readout	299.00
MEM 7700	Memory unit for above	90.00

CONVERTERS FOR ABOVE

FRV 770A	118-150MHz	69.75
FRV 7700B	50-60MHz & 118-150MHz	75.50
FRV 7700C	140-170MHz	65.95
FRV 7700D	70-80MHz & 118-150MHz	72.45
FRT 7700	Receiver aerial tuner	37.85
FF 5	LF filter for above	9.95
FT 480R	2m all-mode transceiver	365.00
FP 80A	230V AC power supply	63.00
FT 780R	70cm all-mode transceiver	449.00
FT 290RM	**SPECIAL** 2m all-mode portable with ARE mods	249.00
NC 11C	AC charger	8.00
CSI-1	Carrying Case	3.45
MMB-11	Mobile mounting bracket	22.25
FT 208R	2m synthesized portable FM	199.00
NC 9C	AC charger	8.00
FT 708R	70cm hand-held	209.00

TRIO-KENWOOD

TS 930	Gen. coverage trans. **NEW**	999.00
TS 830S	160-10m transceiver 9 bands	650.00
AT 230	All-band ATU power meter	110.00
YK 88C	500Hz CW filter	29.60
YK 88CN	270 Hz CW filter	32.60
TS 530S	160-10m trans. 200W pep digital	475.00
TS 130S	8-band 200W pep	499.00
TS 130V	8-band 20W pep	445.00
AT 130	100W antenna tuner	79.00
TR 2300	2m FM synthesised portable	166.75
TR 2500	2m FM synthesised handheld	207.00
HC 10	Digital desk World 58.75	
DM 801	Dip meter	60.00
TR 7730	New 25W FM transceiver	247.00
R 600	Gen. Coverage Receiver	199.00

ICOM

IC 740	Multimode H.F. trans. **NEW**	P.O.A.
ICR 70	New multimode receiver	P.O.A.
IC 730	HF mobile transceiver 8-band	586.00
IC 720A	HF trans. and gen. cov. receiver	795.00
PS 15	Power suply for 720A	99.00
IC 251E	2m multimode base station	499.00
IC 25E	2m synth. compact 25W mobile	259.00
IC 290E	2m multimode mobile	366.00
IC 24G	2m FM mobile 10W	169.00
IC 2E	2m FM synthesised handheld	159.00
IC 4E	70cm handheld	199.00
IC L1/2/3	Soft cases	3.50
IC HM9	Speaker/microphone	12.00
IC CP1	Car charging lead	3.20
IC BP2	6V Nicad p-ack for IC 2E	22.00
IC BP3	9V Nicad pack for IC 2E	17.70
IC BP4	Empty case for 6 X AA Nicads	5.80
IC BP5	11.5V Nicad pack for IC 2E	30.50
IC DC1	12V adaptor pack for IC 2E	8.40

MICROWAVE MODULES

MMT 144/28	2m Transverter for HF Rig	99.00
MMT 432/28S	70cm Transverter for HF Rig	149.00
MMT 432/144R	70cm Transverter for 2m Rig	184.00
MMT 70/28	4m Transverter for HF Rig	115.00
MMT 70/144	23cm Transverter for 2m Rig	184.00
MML 144/30LS	2m 30W lin. Amp (3W1/P)	65.00
MML 144/40	2m 40W lin. Amp (10W1/P)	77.00
MML 144/100S	2m 100W lin. Amp (10W1/P)	129.00
MML 144/100LS	2m 100W linears (1/3W1/P)	145.00
MML 432/20	70cm 20W linear Amp (3W1/P)	77.00
MML 432/50	70cm 50W linear Amp	119.00
MML 432/100	70cm 10/100W linear Amp	228.64
MM 200/1	RTTY to TV converter	169.00
MM 400/1	RTTY transceiver	269.00
MMC 50/28	6m converter to HF Rig	27.90
MMC 70/28	4m converter to HF Rig	27.90
MMC 114/28	2m converter to HF Rig	27.90
MMC 432/28S	7cm converter to HF Rig	34.90
MMC 432/144S	70cm converter to 2m Rig	34.90
MMC 435/600	70cm ATV converter	27.90
MMK 1296/144	23cm converter to 2m Rig	59.80
MMD 050 500	500MHz dig. frequency meter	69.00
MMD 600P	600MHz prescaler	23.00
MMDP 1	Frequency counter probe	11.50
MMA 28	10 meter pre amp	14.95
MMA 144V	2m RF switched pre amp	34.90
MMF 144	2m band pass filter	9.90
MMF 432	70cm band pass filter	9.90
MMS 1	The morse talker	115.00

DATONG

PC 1	Gen. Cov. Converter HF on 2m	120.75
VLF	Ver Low Frequency Converter	25.30
FL 1	Frequency Agile Converter	67.95
FL 2	Multi-mode Audio Filter	89.70
ASP	Auto R.F. Speech Clipper (Trio or Yaesu plug)	79.35
D 75	Manually controlled R.F. Speech clipper	56.35
RFC/M	R.F. Speech Clipper Module	26.45
D 70	Morse Tutor	49.45
AD 0300	Indoor Active Filter (inc. PSU)	42.55
AD 370	Outdoor Active Filter (inc. PSU)	56.35
MK	Keyboard morse sender	129.00
Codecall	Selective calling device (Link or Switch prog.)	29.32
HFA	Wideband preamplifier	27.60
MPU	Mains Power Unit	6.90

MORSE EQUIPMENT

MK 704	Squeeze paddle	10.50
HK 707	Up/Down key	10.50
EKM 1A	Practise Oscillator	8.75
EK 121	E,bug	29.95
EK 1MA	Matching side tone monitor	10.95
EK 150	Electronic Keyer	74.00

ROTATORS

KR 250	Kenpro Lightweight 1-1½" mast	44.95
9502B	Colorotor (Med. VHF)	55.00
KR 400RC	Kenpro – inc. lower clamps	99.95
KR 600RC	Kenpro – inc. lower clamps	139.95

BENCHER

BY 1	Keyer Paddle (black base)	28.75
BY 2	Keyer Paddle (chrome base)	37.95
BY 3	Keyer Paddle (gold plated)	92.00
ZA 1A	Balun 3.5-30MHz for dipoles	12.65
ZA 2A	Balun 14-30MHz for beam antennas	13.80

TONO

THETA 9000E RTTY/CW/ASC11	650.00
THETA 7000E RTTY/CW/ASC11 Receive only	550.00
THETA 350 As above, basic unit	259.00

AMPLIFIERS

UC 70	430MHz 55W + preamp	149.00
2M-50W	144MHz 30-50W	65.00
2M-100W	144MHz 100W + preamp	115.00
MR 150W	144MHz 130-150W + preamp	159.00
MR 250W	144MHz 250W + preamp	259.00

TASCO

TeleReader CWR 685A RTTY/CW/ASC11	699.00
TeleReader CWR 670E As above RX only	259.00
MorseMaster CWR 600 As above basic unit	189.00

WELZ

SP 200	1.8-160MHz 20W-200W-1KW	59.00
SP 300	1.8-500MHz 20W-200W-1KW	79.00
SP 400	130-500MHz-5W-20W-150W	59.00
SP 15M	1.8-150MHz 0-2.5-20-200W	29.00
AC 38M	8-band ATU 400W	59.95
CT-15A	DC-450MHz dummy load	6.95
CT-15N	As above N-type socket	11.75
CH 20A	DC-450MHz coax switch SO239	15.95
CH 20N	As above – N-type sockets	23.95

DESK MICROPHONES

SHURE 444D	Dual Impedance	49.00
SHURE 526	MK II Power Microphone	57.60
ADONIS AM 502	Compression Mic 1 O/P	39.00
ADONIS AM 601	Comp. Mic + Meter 1 O/P	49.00
ADONIS AM 802	Comp. Mic + Meter 3 O/P	59.00

MOBILE SAFETY MICROPHONES

ADONIS AM 202S	Clip on	20.95
ADONIS AM 202F	S/neck + up/down btns.	30.00
ADONIS AM 202H	H/Band + up/down btns.	30.95

DRAE

FULLY PROTECTED POWER SUPPLIES

4 amp	27.95	6 amp	44.95
12 amp	69.00	24 amp	99.00

VHF Wavemeter 130-450MHz	24.95
Morse Tutor	47.00

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MICROWAVE MODULES LTD

THEY'RE ALL NEW . . . AND FIRST CLASS!

MM2001

RTTY TO TV CONVERTER

NOW WITH EXTRA FACILITIES! – SUITABLE FOR UOSAT

This converter, MM2001, contains a terminal unit, and a microprocessor controlled TV interface, and requires only an audio input from a receiver and a 12 volt DC supply to enable a live display of "off-air" RTTY and ASC11 on any standard domestic UHF TV set. **The MM2001 will decode these speeds:** RTTY: 45.5, 50, 75, 100 baud; ASC11: 110, 300, 600, 1200 baud. A printer output (Centronics compatible) allows hard copy of received signals. This unit is compatible with amateur and commercial transmissions.

£189.00 inc. VAT (P+P £2.50)

MML144/30-LS

144MHz 30 WATT LINEAR & RX PREAMP

FEATURES:
- 30 WATTS OUTPUT POWER
- SUITABLE FOR 1 OR 3 WATT TRANSCEIVERS
- LINEAR ALL MODE OPERATION
- STRAIGHT THROUGH MODE WHEN TURNED OFF
- ULTRA LOW NOISE RECEIVE PREAMP (3SK88)
- EQUIPPED WITH RFVOX

This new product has been developed from our highly successful MML144/25. It is suitable for use with 1 watt or 3 watt transceivers and the input level is switch selectable from the front panel. Other front panel mounted switches controlling the switching circuitry allow the unit to be left in circuit at all times. The linear amplifier and the ultra low noise receive preamp can both be independently switched in and out of circuit. In this way maximum versatility is afforded. Use this new amplifier with your FT290R, C58, TR2300 etc. and have mobile or base station performance at a realistic cost!

£69.95 inc. VAT (P+P £2.50)

MML144/100-LS

144MHz 100 WATT LINEAR & RX PREAMP

(Appearance as 30 watt model)

100 WATTS OUT FOR 1 OR 3 WATTS INPUT ON 144MHz

FEATURES:
- 100 WATTS RF OUTPUT SUITABLE FOR 1 WATT OR 3 WATT TRANSCEIVERS
- STRAIGHT THROUGH MODE WHEN TURNED OFF
- ULTRA LOW NOISE RECEIVE PREAMP (3SK88)
- EQUIPPED WITH RFVOX
- SUPPLIED WITH ALL CONNECTORS

This new two stage 144MHz solid-state linear amplifier has been introduced as a result of the large number of low power transceivers currently available. When used in conjunction with such transceivers this unit will provide an output of 100 watts.

Several front panel mounted switches controlling the switching circuitry allow the unit to be left in circuit at all times. The linear amplifier and the ultra low-noise receive preamp can both be independently switched in and out of circuit. In this way maximum versatility and flexibility is available to the user at the flick of a switch. Use this new amplifier with your FT90R, C58, TR2300 etc. and have mobile or base station performance.

£159.95 inc. VAT (P+P £3)

MTV435

435MHz TELEVISION TRANSMITTER

FEATURES:
- 20 WATTS PSP OUTPUT POWER
- BUILT IN WAVEFORM TEST GENERATOR
- TWO VIDEO INPUTS
- AERIAL CHANGEOVER FOR RX CONVERTER
- TWO CHANNEL USING PLUG-IN CRYSTALS

This high performance ATV transmitter consists of a two channel exciter, video modulator and a two stage 20 watt linear amplifier. The unit will accept both colour and monochrome signals, and a sync pulse clamp is incorporated to ensure maximum output. An internal pin diode aerial c/o switch allows connection of the aerial to a suitable receive converter when in the receive mode. **(MMC435/600 – £27.90).** Full transmit/receive switching is included together with an internal waveform test generator which will assist the user in adjusting the gain and black level controls.

£149 inc. VAT (P+P £3)

SPACE PERMITS ONLY A BRIEF DESCRIPTION OF THESE NEW PRODUCTS. HOWEVER A FULL DATA SHEET IS AVAILABLE FREE ON REQUEST. OTHER NEW PRODUCTS AVAILABLE INCLUDE:–

MMS2	– ADVANCED MORSE TRAINER	– £169 inc. VAT (P+P £2.50)
MML28/100-S	– 10 METER 100 WATT LINEAR/RX PREAMP	– £129.95 inc. VAT (P+P £3)
MMK1691/137.5	– 1691MHz WEATHER SATELLITE CONVERTER	– £129.95 inc. VAT (P+P £2.50)

OUR ENTIRE RANGE OF PRODUCTS WILL BE EXHIBITED AND ON SALE AT MOST OF THE 1982 MOBILE RALLIES BY OUR SALES TEAM. SEE YOU THERE . . .

ALL MICROWAVE MODULES' PRODUCTS ARE FULLY GUARANTEED FOR 12 MONTHS (Including PA Transistors)

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PCB's FOR PW PROJECTS

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WRO68	AF Speech Processor	£2.68
WRO67	Wideband RF Pre Amp	£1.05
WRO 73	Nimbus Transceiver	£5.50
WAD 634	Beginners 2m Convert or	£1.38
WAD 927	SWR Warning Indicator	£1.40
WR 121	HF Converter	£2.40
WR 103	70/cm 2 Meter Converter	£3.70
WR 140		
WR 141	3-Band Short Wave	£5.40
WR142	Converter	per set
WR 131	Audible Field Strength Meter	£2.50

We also supply kits for the most popular boards. Everything we have in stock has a 24 hour turnover.

We are agents for R. S. Components and stockists of VARELCO products. Please 'phone for a quote.

For full list of boards send a 10 x 8 envelope and stamp.

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Made in U.S.A. **Explore a new world of short wave listening pleasure with the:–**

A.E.A. MBA-RO
MORSE/RTTY/ ASCII READER

- SIMPLE CONNECTION TO YOUR RECEIVER VIA SPEAKER OUTPUT.
- 32 CHARACTER FLUORESCENT DISPLAY (NO SEPARATE TV DISPLAY NEEDED).
- AUTOMATIC TRACKING AND DISPLAY OF MORSE SPEEDS TO 99 W.P.M.
- WIDE AND NARROW RTTY SHIFTS.
- 12V D.C. POWER INPUT.
- WELL PROVEN DESIGN – MANY THOUSANDS IN USE.

PRICE **£175** inc. (P&P & ins £2.50)

A.E.A. ADVANCED MORSE KEYERS

Microprocessor controlled – multiple message memories – beacon mode for VHF use – automatic contest serial number generation – programmable speeds – random character training program – SIMPLY THE WORLDS BEST!!

Prices as follows:

KT-2 Keyer/Trainer	**£89.00** inc.
CK-2 "Contester" Memory Keyer	**£99.00** inc.
MM-2 Morsematic Keyer	**£119.00** inc.

(Post and packing £2)

The MM-2 includes all features listed. The KT-2 and CK-2 include subsets.

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Tel: 024 365 590
Please allow 7 days for Delivery

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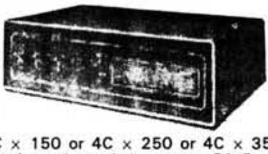
D70c to 70cm		£499.00
D200C	•150FM 300W SSB	£300.00
D200	•300FM 600W SSB	£499.00
D200S	•500FM 1kW	£600.00



EXCLUSIVE TO US

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

GASFET MASTHEAD PREAMPS

VV70GAAS	£75.00
VV2GAAS	£40.00
VV200GAS	£69.00
VV200GAS	£75.00

Powered by the linear or with separate ST200 .9dB signal to noise; .2dB insertion loss; 3SK97 GASFET.

ICOM PORTABLES

IC2E FM 2m £159.00
IC4E 70cm £199.00
IC202 SSB £169.00
IC402 70cm £242.00
All accessories available – see below

ICOM MULTIMODES

IC251 2m	£495.00
IC451 70cm	
IC290 2m	£366.00

ICOM FM MOBILES

IC24G	£165.00
IC25E	£259.00

ICOM HF TRANSCEIVERS

IC2KL 500W linear	£839.00
IC2KLPS Power supply	£211.00
A.T. 100 A.T.U.	£249.00
A.T. 500 Auto A.T.U.	£299.00

ICOM 720A G/C

GENERAL COVERAGE TX ALL BANDS

IC720A 200W	£883.00
PS15 Power Supply	£99.00
PS20 P/S with speaker	£130.00
IC730 200W HF	£586.00

MANY ACCESSORIES FOR ABOVE AVAILABLE

ICOM ACCESSORIES

BP5 IIV Pack	£30.50
BP4 Empty case for 6XAA	£5.80
BP3 STA Noard Pk	£15.50
BP2 6V Pack	£22.00
BC30 Base charger	£39.00
DC1 12V adaptor	£8.40
WM9 Mic speaker	£12.00
CP1 Mobile Charging load	£3.20
LC1/2/3 cases	£3.50
ICMLI 10W Mobile booster for 2E	£49.00
BC30 Base charger	£39.00
MML1 10W Booster	£49.00

JAYBEAM ANTENNAS

8Y/2M 8 ELE YAGI	£15.50
10Y/2M 10 ELE YAGI	£33.00
PBM 10/2M 10 ELEMENT PARABEAM	£39.00
8XY/2M 8 ELE X YAGI	£31.00
X6/2M/X12/70CM DUAL BAND CROSSED	£41.40

MANY OTHERS IN STOCK

TRIO/KENWOOD

TS830S HF Transceiver	£690.00
TS130S HF Transceiver	£520.00
TR8400 UHF Mobile	£320.00
TR9500 UHF Multimode	£445.00
TR7800 VHF mobile	£285.00
TR7850 HP FM 2m	£295.00
TR7730 2m FM	£235.00
TR9000	£370.00
TR2500 Portable Due In	£200.00
PS30 20 1 amp PSU	£85.00

Many Trio/Kenwood accessories available

LARGE DISCOUNTS ON ALL YAESU EQUIPMENT

YAESU/SOMMERKAMP

FT1	POA
FT902DM	POA
FT1012	POA
FT101ZDFM	POA
FT101ZDAM	POA
FT707 200W PEP	POA
FP707 PSU	POA
FL707 ATU	POA
FV707DM VFO FC + FT	POA
(FT707 + FI707 + FL707 SPECIAL PRICE POA)	
FT277ZD Soko all extras inc.	£710.00
FT7670X Soko all extras inc.	£559.00
FT902DM Soko	£935.00
FC902 ATU	POA
FV901DM VFO	POA
SP901 Speaker	POA
Y0901P Scope	POA
FTV901 Transvertor	POA
FT208 VHF	POA
FT708 UHF	POA
FT290 Multimode	POA
FRG7700+ Opt memory	POA

All accessories available

MICROWAVE MODULES

MMA 144V 2m Preamp	£34.90
MML 144/25 RF AMP	£59.00
MML 144/40	£77.00
MML 144/100S New with Preamp	£129.95
MMT 432/144 2-70 Transverter	£184.00
MMT 28/144 10m Transverter	£99.00
MM2000 RTTY Receiver	£169.00
MMI Morse Talker	£115.00

MM 4000 RTTY
SEE IT WORKING AT OUR SHOP
£269.00 + keyboard.
Full range stocked.

STANDARD

C8800 2 mtr mobile	£250.00
C7800 70cm mobile	£270.00
C78 70cm portable	£219.00
C58 2 mtr port. SSB/FM	£239.00
CMB8 Mounting tray	£19.95
CL8 Carry case	£6.95
Battery charger	£7.95
Set Nicads	£11.00
CBP 58 25W linear	
CBP 78 10W linear	

Due in soon, new standard mobile 2 mtr Multimode.

ROTATORS ETC

DIAWA

DR7600X	£135.00
DR7600R	£144.00
DR7500R	£105.00
CN620 1·8 150MHz Pwr/swr	£52.00
CN2002 2·5 kW PEP auto ATU	£190.00

KENPRO

KR250	£44.85
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Progress

THIS ISSUE marks the 50th birthday of *Practical Wireless*, which we commemorate with a special supplement in our centre pages. Looking back through our archives to select some of the advertisements and editorial that most seem to give the flavour of their era, we've been struck by the continual flow of developments, throughout those years.

It's not always the big things that capture the imagination, and that's as true today as it's ever been. Two recent developments that have appealed to me are small but effective. The first is in the sound channel of TV receivers, a neglected area, where we still put up with mono sound when in hi-fi, in-car-entertainment, and even portable radios and cassette players, we have grown accustomed to stereo all the way (almost). We're not likely to have stereo sound on the conventional TV system in the foreseeable future in the UK, but satellite TV will have the facility as standard. Several TV set makers have started putting stereo sound channels into their newest models in readiness, but how do they persuade the purchaser to part with the extra money when the service isn't there yet?

Ferguson have got round it in their new TX range by adding a pseudo-stereo circuit, called "Supersound", comprising an all-pass filter based on three transistors which delays the right-hand channel content by about 500µs. Not one for the purists perhaps, but it gives a really spacious feeling to some types of mono programme material. One thing that worried Ferguson was the lack of visual stereo indication—no sub-carrier, so no stereo beacon. So they devised another natty circuit which looks at the content of the two audio channels, and if it finds that one differs from the other over a certain minimum period, concludes it must be "stereo" (pseudo or otherwise) and lights an l.e.d.

The other item that caught my eye was the "talking" transceiver which announced what channel it was set to. This was a CB rig, but there is no reason why the same principle shouldn't be applied to amateur mobile sets. Trying to snatch a quick glance at the channel or frequency indicator, or counting the number of clicks as you move the selector, is always a hairy business when driving. Though I hope they can do something about the voice, I'm sure that the talking rig could be a major contribution to road safety. (Where have I heard that phrase before?)

Geoff Arnold

services

QUERIES

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

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

PROJECT COST

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

CONSTRUCTION RATING

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

Beginner

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

Intermediate

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

Advanced

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

SUBSCRIPTIONS

Subscriptions are available to both home and overseas addresses at £13 per annum, from **"Practical Wireless" Subscription Department, Room 2613, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

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

Binders are available (Price £5.00 to UK addresses, £5.25 overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

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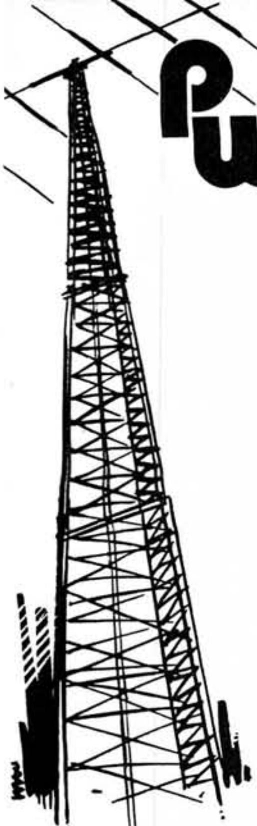
Turn to the following page for details of the PW Radio Users Insurance Scheme, exclusive to our readers.



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B. A. Laymond & Partners Limited, Practical Wireless and the Underwriters wish to make it clear that it is an offence to install or use an unlicensed radio transmitter in the United Kingdom and it is not their deliberate intention to encourage or condone the illegal use of any radio communications equipment.

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5	Antennas (Aerials), s.w.r. meters, etc.				

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

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* If you have, please give details on a separate sheet.

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DELAY IN ARRANGING COVER COULD COST YOU A GREAT DEAL OF MONEY. COMPLETE THIS APPLICATION AND POST WITH YOUR PREMIUM MADE PAYABLE TO "LAYMOND'S" NOW. ADDRESS TO: PRACTICAL WIRELESS (INSURANCE), B. A. LAYMOND & PARTNERS LTD., 562 NORTH CIRCULAR ROAD, LONDON NW2 7QZ. TELEPHONE: 01-452 6611.

introducing PW 'RUIS'

Over the past year, the amount of theft and vandalism of amateur and CB radio equipment and antennas has been steadily rising. Hardly a day passes without news reaching us of yet another incident, particularly affecting mobile installations.

Although some household contents and motor vehicle insurance policies can be extended to cover base station or mobile radio communications equipment, the rates quoted are not usually very attractive. Also, household policies do not generally cover "all risks", and on a motor vehicle policy a claim can affect your no-claims bonus.

It has seemed for some time to us on *PW* that there was a need for a competitively priced policy to cover radio communications equipment for the amateur, s.w.l. and CBer, and we have now negotiated a scheme which represents good value to any users of such equipment, and which is also available to radio clubs or to companies using private mobile radio systems.

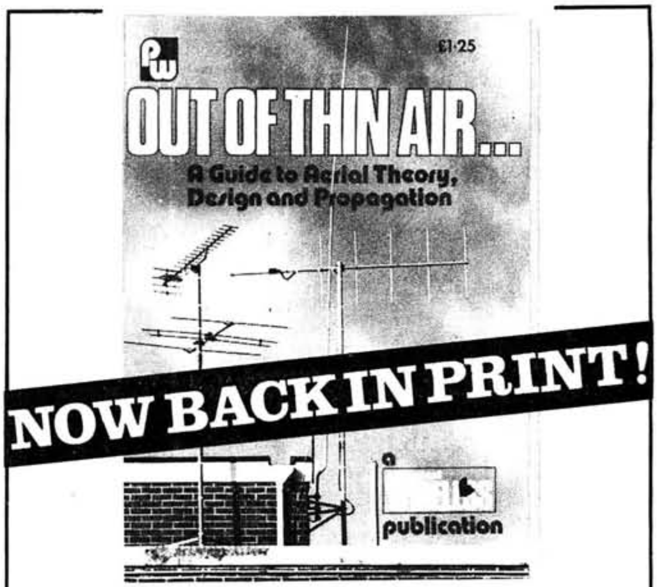
The *PW* RADIO USERS INSURANCE SCHEME's principal features are outlined on the opposite page. The policy covers loss or damage to the insured equipment, which can include: receivers; base station, portable or mobile rigs; antennas except for suction or magnetic mount mobile types; masts; radio-related test equipment. It does not cover the use of 27MHz a.m., s.s.b. or multi-mode CB equipment. Property seized by the Police or any other authority is not insured. Settlement of any claim following total loss or destruction will be the cost of replacement at the date of the loss (after deduction of the Policy Excess), in a condition equal to but not better than its condition when new. The sum insured shall at all times represent the cost of replacement of all the insured property. The policy is index-linked annually to combat inflation, in accordance with the Durable Household Goods Section of the General Index of Retail Prices published by HMSO.

The scheme also covers legal costs and expenses involved in the pursuit of legal rights, in or out of court, relating to any criminal prosecution brought under the Wireless Telegraphy Act 1949 and subsequent Acts and Amendments, or in an appeal against the decision of an official or administration to revoke, suspend, or curtail an existing radio licence. Providing that the insured person holds a valid radio licence or is authorised to operate the equipment under the terms of the licence. Claims are subject to a limit of £500 per incident. Prosecution shall not be deliberately or intentionally sought.

The full policy details may be inspected during normal office hours at the offices of:

1. B. A. Laymond & Partners, Ltd., 562 North Circular Road, London NW2 7QZ, telephone 01-452 6611.
2. Practical Wireless, Westover House, West Quay Road, Poole, Dorset BH15 1JG, telephone Poole (0202) 671191.

In introducing *PW* RUIS, we are reviving an old publishing custom of offering insurance to readers, and we hope that you will find it an attractive scheme.



Aerials and aerial accessories are very definitely among the most popular topics covered in *Practical Wireless*. In response to requests from readers, we've reprinted a selection of articles from the past three years, plus two new features—one by Ron Ham on v.h.f. propagation, the other describing the "Ultra-Slim Jim", a new version of that most popular 2-metre aerial design by Fred Judd.

***Out of Thin Air* has 80 pages, 295 × 216mm, and is available from Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF, price £1.50 including postage and packing to UK addresses, or £1.80 by surface mail overseas. Please ensure that your name and address are clearly legible.**

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CB OPERATING IMPRESSIONS Part 2

Gordon J. KING

Following the theoretical discussion of propagation in Part 1 we conclude with an explanation of the HO Information Sheet on CB antennas.

Signal Attenuation

Some idea now of how a normally propagated space wave is attenuated with distance will be of interest. Fig. 6 shows that a receiving antenna of height h_r receives the signal by two paths from transmitting antenna of height h_t. One path is direct, while the other path is via a reflection from earth. The two components add to give the net signal field at the receiving antenna. If they were in phase opposition, and of equal strength, of course, the net signal would be zero; but this is not the case at normal reception points because the path lengths are substantially different. The strength of the direct signal falls inversely with distance d (e.g., 1/d). However, the reflected signal has a destructive influence on the net signal depending on the phase difference between the direct and reflected signals, which introduces another function of 1/d. Normally, of course, d would be large compared with h_t and h_r, but because of the second 1/d the net signal falls inversely with the square of the distance. In fact, the signal field at the receiving antenna can be expressed by:

$$\frac{4\, h_t\, h_r\, E_o}{d^2}$$

where E_o is the strength of the direct signal a unit distance from the transmitting antenna and the wavelength of the signal (e.g., wavelength in metres equals 300/frequency in MHz).

Antenna Height and Power

The previous expression is very interesting because it shows that the signal field at the receiving point rises in direct proportion to the heights of the transmitting and receiving antennas. On the other hand, the signal strength rises only as the square root of a power increase. Thus a power increase of, say, four times, which is quite a lot, would only double the signal field. This is why CBers often wonder why it is that reception copy does not deteriorate as much as they might expect when the other end drops his power from 4 watts to 0·4 watt or, indeed, why the increase in received strength is not as dramatic as expected when a linear amplifier is switched in! The proportional increase in signal field with antenna height, though, shows why it is that the Home Office have specified a maximum height of 7 metres for the antenna when the transmitter is operated at the legal maximum of 4 watts.

You can, incidentally, start to increase distant signal field above that given when the transmitter is operated at 4 watts and the antenna elevated to the legal 7 metres above local terrain at that power by increasing the antenna height above about 22 metres and dropping *the power to* 0·4 watts as required by law.

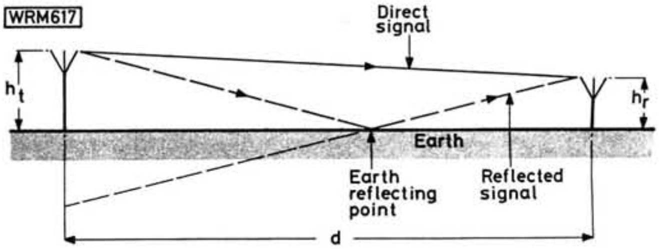


Fig. 6: A receiving antenna responds to two signals over a direct and reflected path, the net signal then falling as a function of the inverse square of the distance

Tropospheric DXing

During May of this year many CBers delighted in communicating with breakers over abnormally long distances presumably some by way of tropospheric ducting. From my Brixham QTH I was personally in strong signal contact with many stations in the Scottish Highlands, at Glasgow, the Orkneys, Shetland Isles, Cumbria, Norfolk and London. The activity was remarkably strong and was thought to be caused by discontinuity of the normal

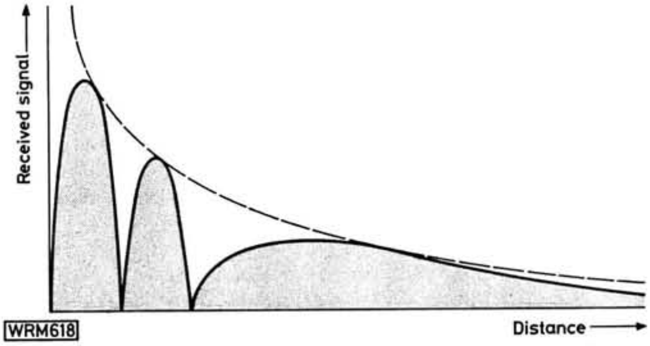


Fig. 7: Showing how the received signal varies with distance from the transmitting antenna

tropospheric temperature gradient, possibly encouraged by my part of the country being abnormally warm for the time of year and other parts suffering snow!

The station was operated under perfectly legal conditions. Transceiver was a Cybernet Beta 3000 and the antenna a Wot Pole mounted at a height not exceeding 7 metres from the bottom of the upper 1·5m element loading coil to ground level (Fig. 8). The antenna was set off from a metal pole secured by brackets to the wall of my studio and was coupled to the transceiver through low-loss 50Ω coaxial cable. The standing wave ratio was 1·3:1 on channel 36, the channel which I monitor for tropospheric and ionospheric activity at my Brixham QTH.

HO Antenna Data

It is interesting to note that the March 1982 issue by the Home Office Radio Regulatory Department of Information Sheet No. 5 dealing with Citizens' Band radio clarifies a number of points concerning antennas which have hitherto been somewhat hazy. For example, the HO interpretation of the ground plane has been brought into the open. It is stated that for a home base the ground plane can be: ". . . a sheet of metal, or wires or rods which are usually horizontal, drooping or downward sloping . . .". Further: "The arrangement of the metal sheet, wires or rods and the size of the ground plane is left to individual preference". This, so far as I can judge, removes any doubt regarding the legality of the Wot Pole or other CB antenna of similar configuration—always assuming, of course, that the upper element connected to the inner conductor of the coaxial cable does not exceed 1·5m in length and is resonated by an inductance at the bottom end.

I was also interested to read regarding effective radiated power that: "For sets with a socket for connecting an external antenna there is no limit on e.r.p. . . .". There is, of course, the 4 watt transmitter r.f. limit so with the 1·5m restriction on the base-loaded top element it would be a bit of a job to get an e.r.p. up to 4 watts or more(!); but the preferential treatment of the ground plane (as defined by the HO) certainly gives food for thought in this area. Anyway, the HO go on to say that an e.r.p. of around 2 watts can be easily achieved, and I would certainly agree with this.

Antenna Efficiency

Indeed, field stength tests that I have made would indicate that most well-designed car-type ground plane antennas are capable of radiating at least 2 watts assuming a loading coil of low dynamic resistance (R_d), that the antenna is accurately resonated and that the ground plane efficiency is high. A 1·5m antenna working on 27MHz has a radiation resistance around 7·5Ω. Thus, assuming a R_d of 4Ω and an earth plane resistance of 2Ω the e.r.p. with 4 watts r.f. (assuming little or no loss in the coaxial cable) can be calculated from:

$$\frac{R_r \times W_t}{R_r + R_d + R_e}$$

where R_r is the radiation resistance of the shortened quarter-wave monopole, W_t the r.f. watts from the transmitter and R_e the resistance of the earth plane. Substituting the figures given we get:

$$\text{Radiated power} = \frac{7{\cdot}5 \times 4}{7{\cdot}5 + 4 + 2} = 2{\cdot}2\text{W}$$

The losses produced by the other elements can be calculated proportionally.

The radiated power so calculated may appear to be optimistically high, and it would certainly be that much lower

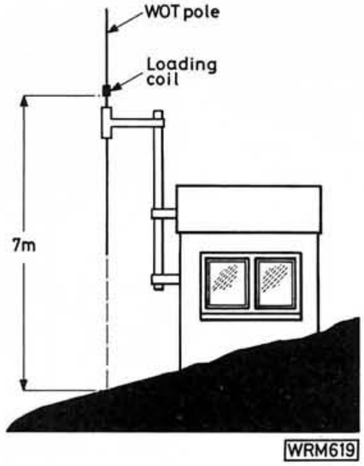


Fig. 8: The antenna height definition of the HO. A height in excess of 7m requires the r.f. power from the transmitter to be reduced to 0·4 watt

with lower R_r and higher R_d and R_e but, as suggested by the HO, 2 watts e.r.p. should not be difficult to achieve from the car-mounted earth plane type of antenna.

It is also interesting to note that with a quarter-wave monopole the bottom part of the radiation is concentrated into a hemisphere above the earth plane thereby increasing the radiation intensity over that of a freely radiating half-wave dipole, but when the monopole is reduced in length to conform to the legal requirement the radiation intensity is reduced as we have seen.

Antenna Tests

I have measured surprisingly low values of R_d, and one of the lowest loss loading coils is that fitted to the American Avanti Moonraker car antenna. Another is that of the K40 antenna. These antennas and those of similar low-loss make-up work quite efficiently. As already noted, signal launching and, seemingly, ground plane efficiency are increased at water level; at water level, with cliff backing, copy over sea can be outstandingly extended—the cliff presumably working as a kind of "reflector" and the sea aiding diffraction. Transmission from the car ferry on the river Dart (between Kingswear and Dartmouth) gives far better copy at my Brixham QTH than when the transmission is from the river bank either side. Indeed, I have measured as much as a 6dB increase in received signal field when the ferried transmitter lies at river centre. I and a colleague have also noted the high incidence of distance copy emanating from stations sited close to water.

I have also been checking the loading coil used in the design of a "portable" type of CB antenna called the Hot Wire which has been designed and is being marketed by a Paignton firm called Link Up South West. This, again, was found to have low R_d and is in the form of two flexible elements, a 1·5m top section and a longer bottom section ("ground plane") which, like the Wot Pole, constitutes a form of "asymmetrical dipole". Radiation efficiency would seem to be on par with a well-designed Wot Pole, suggesting an approach to at least 50 per cent when properly installed and s.w.r.ed. The wire elements can be coiled up for transportation in the glove pocket of a car, for example, the antenna then being available for field use or DX-trials from a car CB set. I do know that there is at least one CBer at Portland (others, too, I understand) using such an antenna at home base and with whom I am in

continued on page 29▶▶▶

swap spot

Have Tektronix type 551 double beam working oscilloscope with supply. No manual, probes, mains cable. Would exchange for working Eddystone v.h.f./u.h.f. receiver 770U or 770R. A. Thomson GM3VOX, 108 Tannahill Drive, Calderwood 12, East Kilbride, Glasgow, G74 3HT. Tel: 41329. *P83*

Have SG711 marine transceiver, 100W p.e.p., programmable as simplex or semi-duplex on A3A, A3H or A3J, 11 channel 1·6–9 MHz, built-in a.t.u., 13·6V d.c. Would exchange for FRG-7700 or FRG-7700M. Tel: Gara Bridge 281. *P93*

Have a Murphy B40 communications receiver. Would exchange or part exchange for any 2m or 70cm transceiver. T.J. Meloughlin, 214 Artic Rd., Cowes, IOW. Tel: Cowes 292612 (evenings). *P95*

Have Uniace 100 CB mobile transceiver with bracket. 13·8V 3/5A power supply. Loft antenna with ground plane radials and coaxial cable. Also v.s.w.r./power meter and patch cord. Would exchange for Sony ICF2001 receiver. J.W. Jemmison, 18 Fanshawe Rd., Bristol. Tel: 0272 832996. *P96*

Have 2m Storno (12 channel, xtal) boot mount and 2m Pye (6 channel, xtal) boot mount. Both fully operational, xtals included. Would exchange for Marconi TF–8334 convertor (50–600MHz) or similar for TF–2401A counter, and/or TF–995A signal generator. Reasonable or repairable condition please. A. Digby. Tel: Hitchin (0462) 700178. *P122*

Have Praktica MTL3 camera plus electronic autoflash unit and fitting bracket. Would exchange for Morse tutor or wavemeter. Miller, 12 Ashmead House, Barton Hill, Bristol BS5 9SS. *P129*

Have Trio TR–7800 2m f.m. mobile transceiver, Daiwa SW110A s.w.r. and power meter also 2m GPV–5 5/8 wave colinear ground plane antenna and a mobile 5/8 antenna. Would exchange for a good general coverage receiver. D. Russell. Tel: Sheffield 484679. *P137*

Have Canon Electronic 1014 fully automatic zoom Super 8 cine camera also Eumig TV type sound projector/recorder and camera tripod. Would exchange for Trio TR–9000; PS20; BO9. N. Park. Tel: 0533 600246 (day), 0533 609538 (evenings). *P152*

Have three 24in monochrome video monitors with sound. Would exchange for two 9in or 12in monitors and Pye Lynx video camera (will separate). Andie Wilkes G4NTV, 34 Tideswell Road, Great Barr, Birmingham B42 2DT. Tel: 021-525 5445 (office hours). *P157*

Have Sony three-head stereo tape recorder, type TC–399 reel-to-reel upright operation also 35 × 50 Mark Scheffel binoculars. Would exchange for SX200N, FT–221R, FT–290R, C–58 or any 2m portable. P. H. Drysdale, 121 Chapelle Crescent, Tillicoultry, Scotland FK13 6NL. Tel: 0259 50465. *P175*

Have Himound HK706 Morse keyer as brand new, plus monitor EKM1 oscillator (used) perfect match. Would exchange for clean 1982 *World Radio and TV Handbook* or world time clock. Lane, 6 George V Avenue, Margate, Kent. *P177*

Have 1956 Ekco TMB272 9in Radio TV (portable) and service sheets. Would exchange for v.h.f. and u.h.f. scanner. T. A. Cooper, 117 Love Lane, Burnham-on-Sea, Somerset TA8 1EZ. *P186*

Have Yaesu s.s.b. transceiver FT–7 mint. Would exchange for scanner receiver SX200 or Bearcat. V. Willmott, 18 Mill Lane, Carbrooke, Thetford, Norfolk IP25 6TD. *P187*

Have Ring 22 stamp album. World stamps, majority mint, mounted; fish, animals, aircraft, birds. Viscount Springback album, interplanetaries hinged—World Cup stamp also World Catalogue. Would exchange for modern general coverage receiver Eddystone or USA. Morgan, 17 St. Marys Place, London W5 5HA. *P217*

Have 2m base station, includes Trio Kenwood f.m. transceiver 25 watts (TR–7400A), 15A power supply, CN620A crossed needle s.w.r. and power meter, rotator, 4-element quad antenna. Would exchange for dual beam 15MHz oscilloscope. Tel: Daventry (03272) 76542. *P223*

Have 2GHz slotted line with probe and connectors. Slot length 120mm also piston attenuator, rack and pinion control, piston sweep 130 × 750mm. Would exchange for frequency counter. Critchley, 16 Finch Mill Avenue, Appley Bridge, Wigan WN6 9DF. *P224*

Have vintage Philips B5G 64A receiver, needs new string for indicator only, otherwise good. Also HAC 2-valve s.w. receiver and phones. Would exchange for grid dip oscillator with coils. J. Sawley, 81 London Road, Newark, Notts. Tel: 0636 73265. *P239*

Have Amplion horn loud speaker 16 × 6 × 6in, collectors piece, circa 1928. Would exchange for an oscilloscope with cash adjustments. Lucking, 62 Ember Farm Way, East Molesey. Tel: 01-398 3603. *P245*

Have first ten volumes of *Electronics Today International* complete and in very good condition. Would exchange for s.w. receiver or legal f.m. CB transceiver with 40 channels. G. Watkin, 16 Clovelly Way, Orpington, Kent BR6 0WD. Tel: Orpington 37431. *P254*

Have Codar Radio Co. AT5—12 watt mini transmitter with T28 receiver and T250 p.s.u. paddle Morse Key and headphones with mic. Amateur bands 1·8–2·0MHz and 3·5–4·0MHz, 10 watts a.m., 14 watts c.w., v.f.o. Would exchange for w.h.y.—interests movie films 16mm and 8mm. Les Taylor, Kilconnell, Ballinasloe, Eire. *P255*

Have Grundig Satellit 3400 s.w. radio four months old. Would exchange for SX200N scanner. Mr Bannister, 3 Eastbourne Walk, Liverpool 6. Tel: 051-263 6724. *P277*

Have Labgear Televerta CM6022/RA perfect & Labgear wide-band pre-amp (unused) model CM7065. Would exchange for a Band III pre-amplifier, 12V without power unit such as MOSFET, etc. James. Lawrenny, Llanon, Dyfed SY23 5HW. *P286*

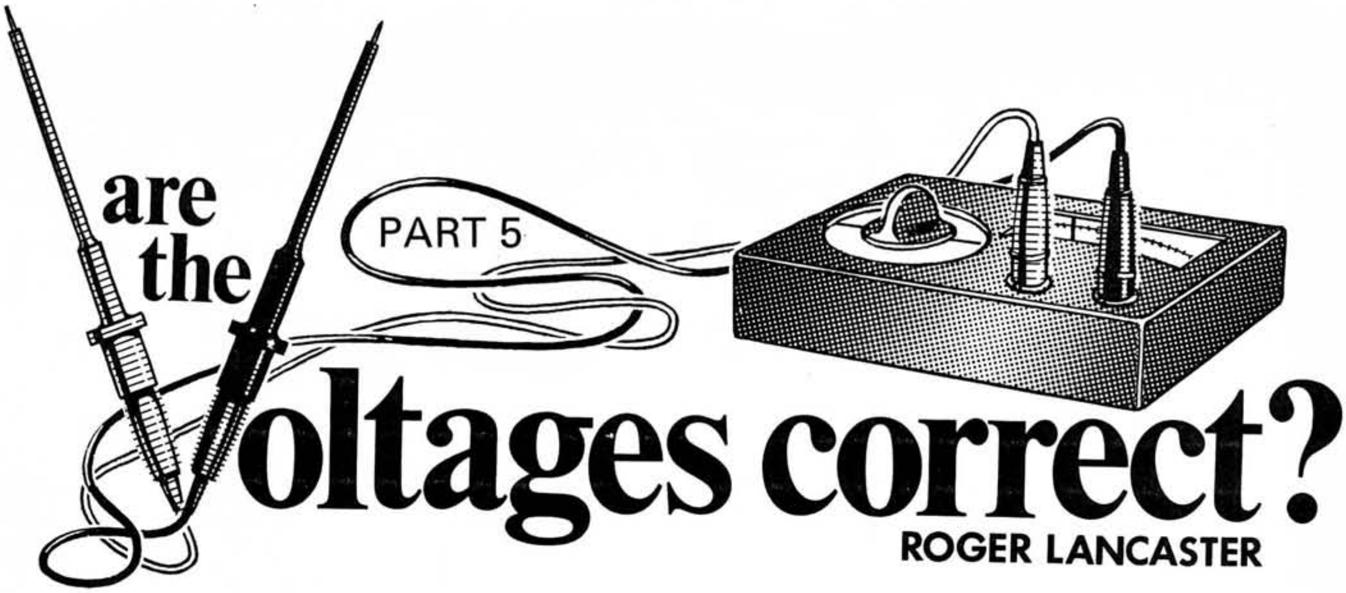
Have new Eumig Super 8mm sound camera still in box. Would exchange for good 2m transceiver or good receiver. J. Wardle, 37 Cornwall Road, Barry, Glam. Tel: 746507. *P287*

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.



are the Voltages correct?

PART 5

ROGER LANCASTER

Solutions to last month's problems: The circuit is reproduced here in Fig. 5.1.

No. 1: To calculate the potentials at "A", "B" and "C" with respect to earth; R1 is shorted out by L1 so "A" is effectively connected to the +6V line. Capacitor C1 can be ignored from a d.c. point of view. Resistor R2 in parallel with R3 simplified to $50/15 = 3{\cdot}33\text{k}\Omega$. So the circuit simplifies to the equivalent one of Fig. 5.2.

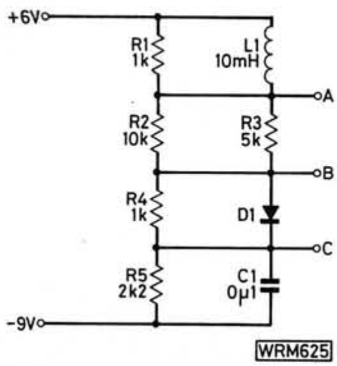


Fig. 5.1

Immediately, we see the potential at "A" is **+6V.**

The total supply voltage is $6 + 9 = 15\text{V}$. Diode D1 appears to be forward biased. Checking; its open-circuit voltage would be

$$\frac{1 \times 15}{(3{\cdot}33 + 1 + 2{\cdot}2)} = \frac{15}{6{\cdot}53} = 2{\cdot}3\text{V}$$

so it is indeed forward biased and therefore the voltage across D1/R4 is 0·6V. By Kirchhoff's Second Law there must be $(15 - 0{\cdot}6) = 14{\cdot}4\text{V}$ distributed between R2/R3 and R5. So the voltage across R5 is given by

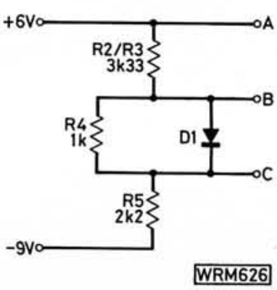


Fig. 5.2

$$\frac{2{\cdot}2 \times 14{\cdot}4}{2{\cdot}2 + 3{\cdot}33} = \frac{2{\cdot}2 \times 14{\cdot}4}{5{\cdot}53} = 5{\cdot}73\text{V}.$$

Thus the potential at "C" is $-9 + 5{\cdot}73 =$ **−3·27V** and that at "B" is $-3{\cdot}27 + 0{\cdot}6 =$ **−2·67V.**

No. 2: With diode connections reversed, D1 will be reverse biased and such a high resistance that we can ignore it. The equivalent circuit will therefore be the same as in Fig. 5.2, but with D1 omitted.

Total resistance $= 3{\cdot}33 + 1 + 2{\cdot}2 = 6{\cdot}53\text{k}\Omega$

$$V_{R2/R3} = \frac{3{\cdot}33}{6{\cdot}53} \times 15 = 7{\cdot}65\text{V}$$

Therefore, potential at "B" $= +6 - 7{\cdot}65 =$ **−1·65V**

$$V_{R5} = \frac{2{\cdot}2}{6{\cdot}53} \times 15 = 5{\cdot}05\text{V}$$

Therefore, potential at "C" $= -9 + 5{\cdot}05 =$ **−3·95V.**

When diodes fail they can become short-circuit, open-circuit or resistive, each of these possibilities being quite common.

If the voltages measured indicate that a diode is probably faulty, it must be removed (or at least one of its connections unsoldered) for checking by ohmmeter. The checks to be made are illustrated in Fig. 5.3(a) and (b).

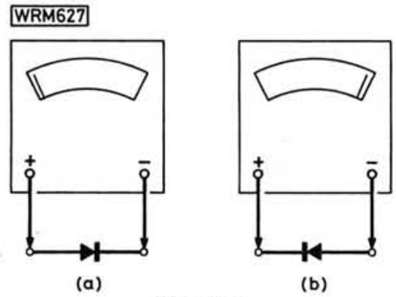


Fig. 5.3

A multimeter's terminals are labelled with the correct polarity for measuring d.c. **voltage.** When the meter is used on its resistance ranges, however, the internal battery provides a voltage across the meter terminals of **opposite** polarity, i.e. the "positive" terminal is at a **negative** potential with respect to the "negative" terminal. This is not the result of meter manufacturers' attempts to confuse everybody, but because the equivalent circuit of the meter on the ohms range is as shown in Fig. 5.4. The polarity of the battery shown being necessary, when a circuit is completed, to provide the required forward movement of the needle. This must be borne in mind when testing semiconductors.

The ohmmeter test of Fig. 5.3(a) therefore means the diode is reversed biased and a high resistance should be indicated (the needle will probably not move off the back stop on the "ohms" range). The test of Fig. 5.3(b) should show a low resistance reading, usually between 500Ω and

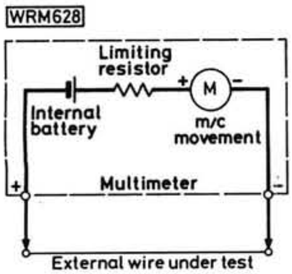


Fig. 5.4

2kΩ (depending upon the types of diode and meter) because the diode is now forward biased. It is not the meter polarity nor the actual readings obtained which are important, however, but the **difference** between the two readings, usually expressed as a ratio and commonly called the "back-to-front" ratio. This ratio of:

$$\frac{\text{reverse biased resistance}}{\text{forward biased resistance}}$$

must be high.

It is also advisable that the meter is used **only** on its "ohms" range. If used on its "ohms × 100" range the internal battery voltage is increased and the resulting forward current delivered to the diode could be excessive. If used on the "ohms ÷ 100" range the limiting resistor is very low and high diode forward current could again result.

When replacing a diode, ensure that it is connected back into circuit the right way round, as shown in last month's article.

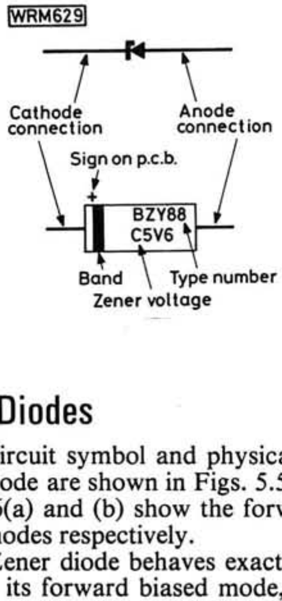


Fig. 5.5(a)

Fig. 5.5(b)

Zener Diodes

The circuit symbol and physical markings of a typical Zener diode are shown in Figs. 5.5(a) and (b) respectively. Figs. 5.6(a) and (b) show the forward biased and reverse biased modes respectively.

The Zener diode behaves exactly like a silicon junction diode in its forward biased mode, so in Fig. 5.6(a), since its open-circuit voltage would be 9V, it conducts with 0·6V across it and the potential at "A" is +0·6V.

In its reverse biased mode, however, the Zener diode also conducts, provided its open-circuit voltage exceeds its "Zener voltage", which in this example is 5·6V. In Fig. 5·6(b) the open-circuit voltage would be 9V, so the Zener conducts and when this happens in the reverse biased mode the voltage across the Zener diode will be equal to (or very close to) its "Zener voltage". So in this example the potential at "A" will be +5·6V. If the open-circuit voltage was lower than the Zener diode voltage the diode would not conduct and would have to be treated as an open-circuit.

The Zener voltage is usually shown on the body of the device as illustrated in Fig. 5.5(b). The figure following the C shows the number of volts and the figure following the V shows the tenths of volts. Note the C means ±5 per cent tolerance on the voltage. Zener voltages range from about 3·3V (C3V3) up to 200V (C200). Unfortunately, not all Zener diodes are marked with their Zener voltage and reference may have to be made to manufacturers' data if this information is required.

The Zener diode is usually employed as a voltage stabiliser, as in the circuit of Fig. 5.6(b). The potential at "A" will remain constant at +5·6V even if the supply voltage varies and even if any load resistance between "A" and earth changes, although **always with the proviso that the diode open-circuit voltage would exceed its Zener voltage.**

Ohmmeter tests on a Zener diode are the same as for a junction diode, but the real test for a Zener diode is whether its Zener voltage is developed across it when it is connected into a circuit such as that of Fig. 5.6(b).

As with other diodes, faulty Zener diodes can be open-circuit, short-circuit or resistive.

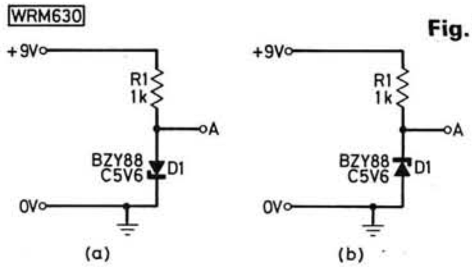


Fig. 5.6

Bipolar Transistors

Like diodes, common bipolar transistors can be of silicon or germanium type, the former being by far the most common, germanium types generally being found in older equipment. Differences in these two types are minor, so unless otherwise stated the writer will refer to silicon transistors.

A much more significant classification of transistors is into *pnp* and *npn* types, the circuit symbols for these being shown in Fig. 5.7(a) and (b) respectively. The electrode names are not part of the symbol. It is useful to remember that the arrow always points to an *n*-type electrode.

Again like the diode, the transistor has two basic modes, conducting and non-conducting. Indeed, the base-emitter junction of a transistor is exactly like a diode, with *p*-type electrodes behaving like anodes and *n*-type electrodes like cathodes. Thus, when the base of a *pnp* transistor is negative with respect to its emitter by something greater than 0·5V, the transistor is in its conducting mode and base-emitter potential lies between 0·5V and 1V (0·2V to 1V for germanium types). If this forward bias voltage is less than 0·5V or if its polarity is reversed to make it reverse bias, the transistor will be in its non-conducting mode (or cut off). Incidentally, the easiest way to cut off a transistor is to make its base-emitter p.d. zero, e.g. by shorting base and emitter together. The *npn* transistor behaves exactly the same but with polarities reversed, i.e. base positive with respect to emitter for forward bias.

WRM631

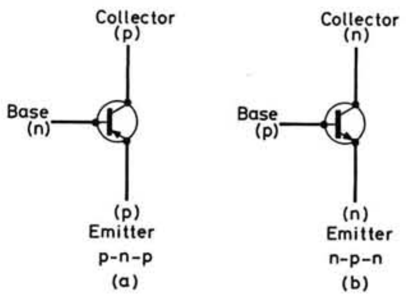


Fig. 5.7

So the base-emitter potentials we can expect to measure are exactly the same as for the junction diode and, if suspect, the base-emitter junction can be tested by ohmmeter in exactly the same way as the diode.

Estimation of the collector potential of the transistor is much less straightforward, as this will depend not only on the degree of conduction of the transistor but also the supply potential and the components associated with the transistor in the circuit.

The transistor is basically a current-operated device and it is the currents flowing in the transistor to which we must turn for clues. Three currents are involved, as illustrated in Fig. 5.8. They are related by the equation:

WRM632

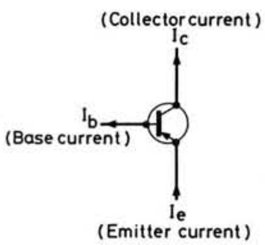


Fig. 5.8

$I_e = I_b + I_c$

Furthermore, I_c is much greater than I_b (typically, $I_c = 100 \times I_b$), so that we can usefully approximate by saying that $I_e = I_c$ for the purposes of estimating collector potential.

When the transistor is cut off, all these currents are zero (neglecting "leakage" currents, as these are insignificant in our voltage measurements). In the event, the circuit can be treated as if the transistor was not connected.

When the transistor is forward biased, however, we have to look at the whole circuit, bearing in mind the current relationship quoted above.

See Fig. 5.9 for an example. This is the circuit of a simple transistor audio amplifier stage.

WRM633

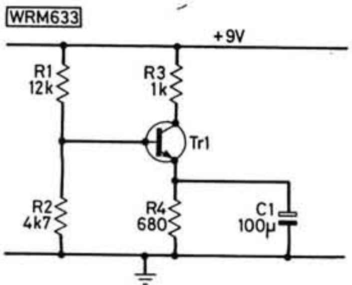


Fig. 5.9

If we ignore base current, the base potential will be $\frac{4 \cdot 7}{16 \cdot 7} \times 9 = \mathbf{+2 \cdot 53V}$.

This would then be the open-circuit voltage between base and emitter, so the transistor conducts and base-emitter p.d. becomes (say) 0·6V. Thus, emitter potential is $+2 \cdot 53 - 0 \cdot 6 = \mathbf{+1 \cdot 93V}$. Emitter current flows through R4 so this will be given by

$I_e = \frac{V_{R4}}{R4} = \frac{1 \cdot 93}{680}$ A $= 2 \cdot 84$mA. Assuming $I_e = I_c$, this current will also flow through R3 and so

$V_{R3} = I_c R3 = \frac{2 \cdot 84}{1000} \times 1000 = 2 \cdot 84$V.

Thus the potential at the collector will be $+9V - 2 \cdot 84 = \mathbf{+6 \cdot 16V}$.

In any transistor circuit, these potentials of emitter, base and collector of each transistor stage are the most useful in fault-finding.

We shall not measure the voltage calculated exactly, however, because we have ignored base current. So we will look into this example further in next month's issue.

WRM634

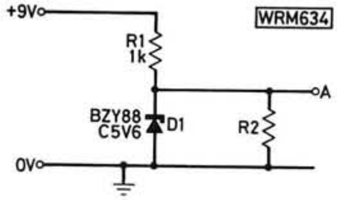


Fig. 5.10

Now for this month's problem. See Fig. 5.10. Calculate the potential at "A"

(i) when $R2 = 2 \cdot 2k\Omega$

(ii) when $R2 = 680\Omega$

CB OPERATING

▶▶▶ *continued from page 23*

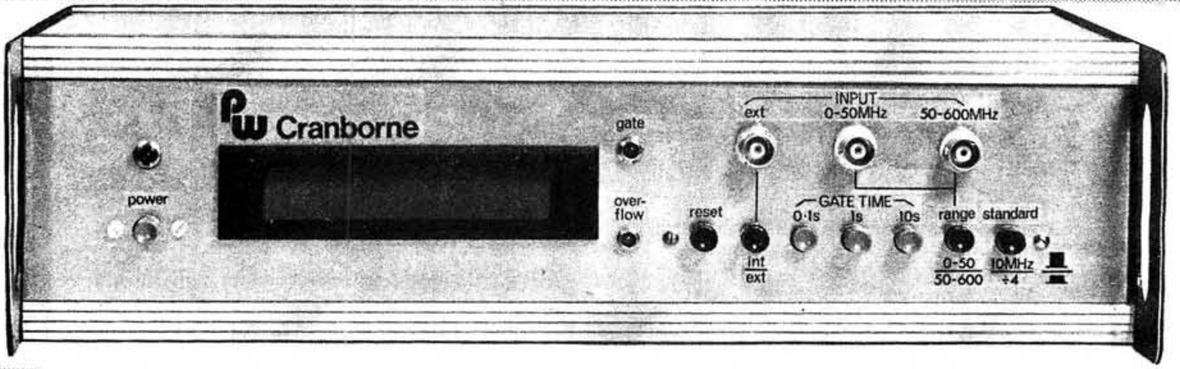
fairly regular contact from Brixham (about 80km distance over sea). This sort of antenna would appear to have an angle of radiation which, although slightly higher than a true half-wave dipole, is lower than that of a shortened quarter-wave monopole mounted on a flat ground plane (e.g., the roof of a car).

To summarise, therefore, the use of 27MHz for high density CB traffic is certainly bringing to light some curios with respect to propagation at that frequency. Interference is far less troublesome now that f.m. is the order of the day; but I cannot reconcile the HO insistence on the use of a shortened antenna when easier matching can be achieved with a full length antenna leading, possibly, to less TVI—particularly chroma suck-out. My experience is that poorly matched shortened antennas have a greater interference potential than a well-designed quarter-wave monopole or even a full half-wave dipole! Looking around the country one can detect no mean number of half-wave CB antennas anyway, some of which appear not to be radiating as successfully as a "peaked up" legal antenna.

One sign of the onset of tropospheric propagation is a sudden drop in barometric pressure following an extended anticyclonic spell. Another is the development of a low-pressure weather front moving in the direction of the DXing QTH.

In conclusion, I would like to thank the very many friendly CBers whom I have quizzed over the channels for their help and observations. My thanks go in particular to George (The Prospector) to whom I (Quicksilver) wish the very best of luck with his projected RAE. ●

PW Cranborne



600MHz FREQUENCY METER

Part 2

Stephen IBBS G4LBW

This month we conclude the basic two-range 600MHz frequency meter project with full constructional information and optional variation details.

Construction

A p.c.b. is used and this is shown in Fig. 8. Insert the wire links and single-sided Veropins. It was decided that links and cable connections were easier, and therefore preferable, to trying to make a double-sided p.c.b. with its inherent problem of matching the two sides together. (This is not, however, a problem with the pre-scaler p.c.b.) Sockets were used for all the i.c.s and these were inserted along with the other components. The switch bank uses a 7-way bracket and the switches are placed into this before being soldered to the board. S1 is an "interlocking" type switch but because it has no latchbar associated with it, it acts as a push-to-make switch for the reset function. S2, 6 and 7 are all "push-push" type switches and like the RESET switch are easy to insert. However, S3, 4 and 5—being interlocked—must have the 3-way latchbar and spring included in the assembly before soldering to the p.c.b. (Fig. 9).

If constructors do not want to extend the range of the meter to 1·3GHz, then S7 and D2 can be omitted. The transformer, being p.c.b. mounted, makes for easy mains connections, and this section was tested before any i.c.s were inserted in their sockets.

Pre-scaler

A double-sided p.c.b. should be used for the 600MHz pre-amp. module—a suggested design for which was given in Fig. 1. For those who have not made one before, the easiest way is to prepare the track side as normal, with etch-resist pen or transfers, and then cover the component side either with etch-resist or with insulating tape, overlapping the strips. When etched and cleaned, drill out the holes from the track side and then from the component side counterbore all non-earth holes with a Verocutter or 3mm drill bit.

Solder in the components, using leads as short as possible and the smallest capacitors available, making sure the i.c.s are inserted the right way around. Component leads going to earth are soldered on both sides of the board and i.c.s soldered in this way are nightmares to remove if inserted the wrong way around.

Mount the board in a die-cast box, already drilled to accept the BNC sockets and supply leads.

The case is connected to earth and the positive lead goes via L1, 2 turns of 28 s.w.g. on a ferrite bead and feedthrough capacitor C29 to the positive supply pin on the main p.c.b. The earth lead is also connected to the main p.c.b.

The front panel was drilled and cut out to take the display, switches, sockets and l.e.d.s and care must be given to the position of the switch bank holes because the p.c.b. must be mounted in such a way as to make the switches operate through the holes drilled. It is because the p.c.b. is mounted only some 10mm away from the front panel that a section is cut away to make room for the display bezel p.c.b.

The prototype had extra holes drilled for the bracket mounting bolts but these have proved to be totally superfluous and can be ignored. The display bezel was mounted behind the front panel, with ribbon cable used to make the 61 connections to the main board by way of the Veropins by IC5 and 6. The rows nearest the i.c.s go to the bottom row of pads on the bezel (and were, in fact, soldered to the underneath of the board in the prototype) and the outer rows go to the top row of pads on the bezel. Fig. 11 shows which segment pin goes to which segment pad. Four wires also go to IC10, the decimal point driver, and a final wire connects the backplane from IC8 and 9 to the display (pin 1). All possible wire links were made on the track side in the prototype to improve the appearance.

★ components

Resistors

¼W 5% Carbon film

51Ω	2	R15,16
120Ω	1	R22
180Ω	1	R21
270Ω	2	R1,24
330Ω	3	R13,14,20 (see text)
680Ω	1	R23
2·2kΩ	1	R17
4·7kΩ	4	R2,3,4,5
10kΩ	3	R6,7,8
27kΩ	1	R11
100kΩ	6	R10,12,26,27,28,29
150kΩ	1	R19
1MΩ	1	R18
22MΩ	1	R9

Potentiometers

Min. skeleton pre-set

1kΩ	1	R25

Capacitors

Ceramic

15pF	1	C6
10pF	1	C26
68pF	4	C1,2,3,5
1nF	14	C11 to 24
10nF	2	C27,28
0·1μF	2	C10,25

Polyester

0·22μF	1	C8

Electrolytic 16V Radial

1000μF	1	C9
2200μF	1	C7

Min. trimmer

5–65pF	1	C4

Feed-through

1nF	1	C29

Semiconductors

Diodes

1N4148	2	D1,2
Red l.e.d.	3	D3,4,5
1A Bridge	1	D6

Transistors

BF375	2	Tr3,4
TIS88A	1	Tr2
2N3702	1	Tr1

Integrated circuits

4070	1	IC10
74LS74	1	IC12 (see text)
74LS132	1	IC6
74LS196	1	IC5
74LS00	1	IC4
7805	1	IC11
ICM7211A	2	IC8,9
ICM7226A	1	IC7
SL952 or SL565	1	IC1
SP8630B	1	IC2 (see text)
SP8660	1	IC3

Switches

Push-button (Ambit SUE series)

2p interlocking	4	S1,3,4,5
2p push-push	4	S2,7,9,10
6p push-push	1	S6
5A mains	1	S8

7w bracket 15mm; 2w bracket 15mm; 3w latch bar and spring 15mm; knobs (10).

Miscellaneous

Mains transformer 6V, 6V 3VA p.c.b. mounting; 10MHz crystal HC18U; Mains socket and filter IEC type; Fuse holder, panel mounting; BNC 50Ω round sockets (4); 8-digit liquid crystal display (RS587-333); Bezel (RS587-462); Ferrite bead; 28 s.w.g. enamelled copper wire; Printed circuit boards; Die-cast box 114 × 64 × 30mm; Case, Centurion EX3H (325 × 187 × 90mm); Sockets for i.c.s 40-pin (3), 14-pin (6).

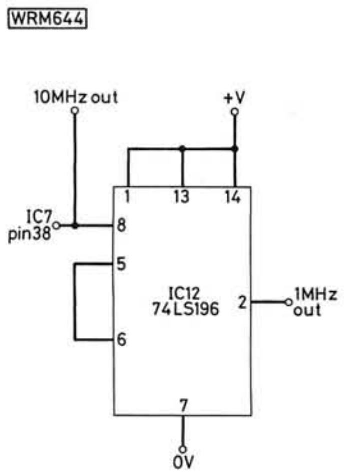


Fig. 6: Circuit details of the optional divider stage to provide a 1MHz calibration signal. The p.c.b. track will require modification

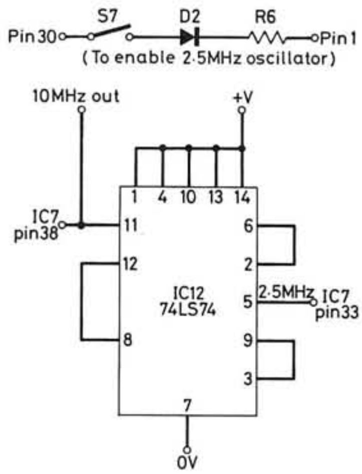


Fig. 7: Circuit details of the external oscillator divider and enabling switch to allow range extension up to 1·3GHz

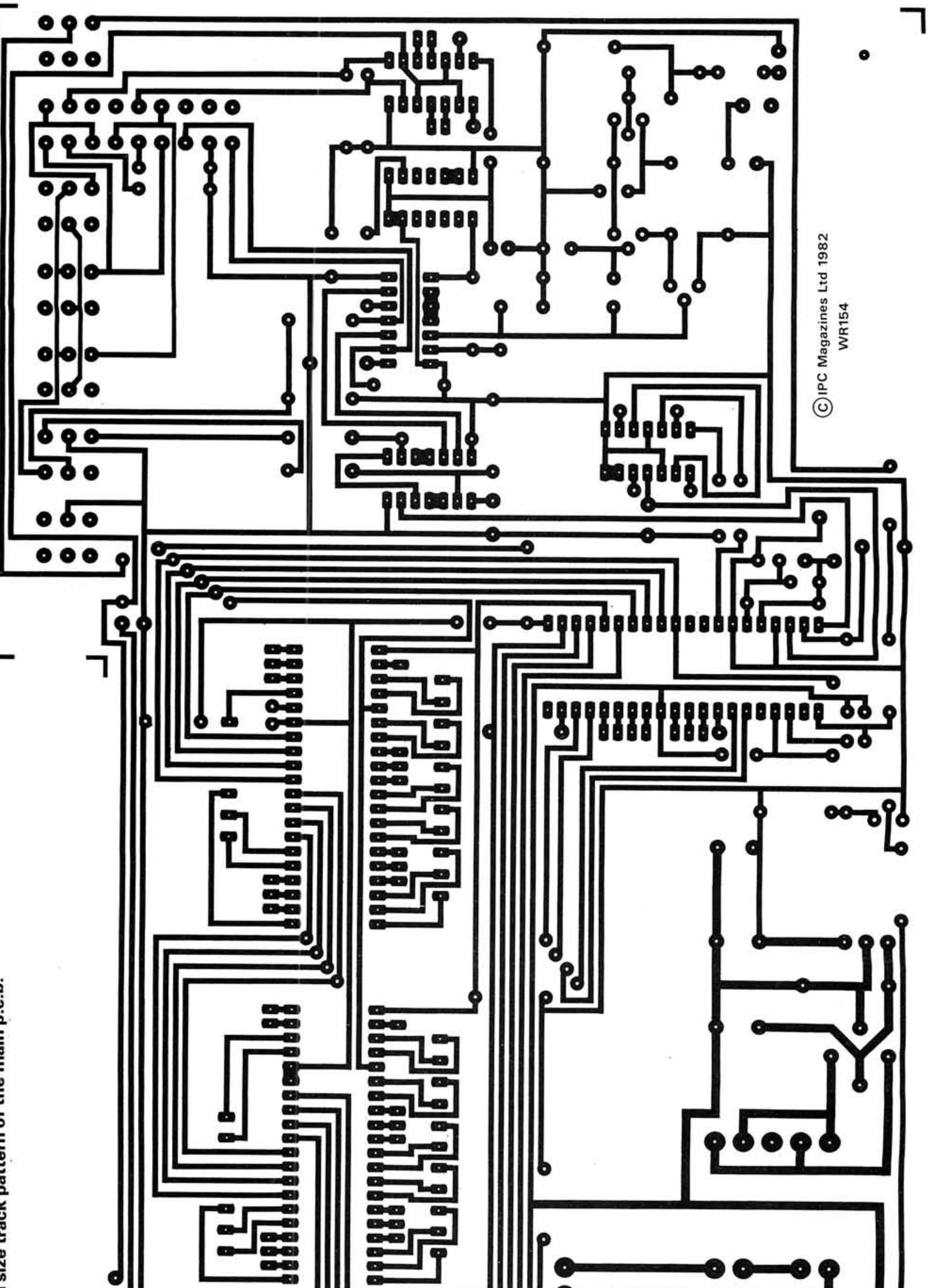
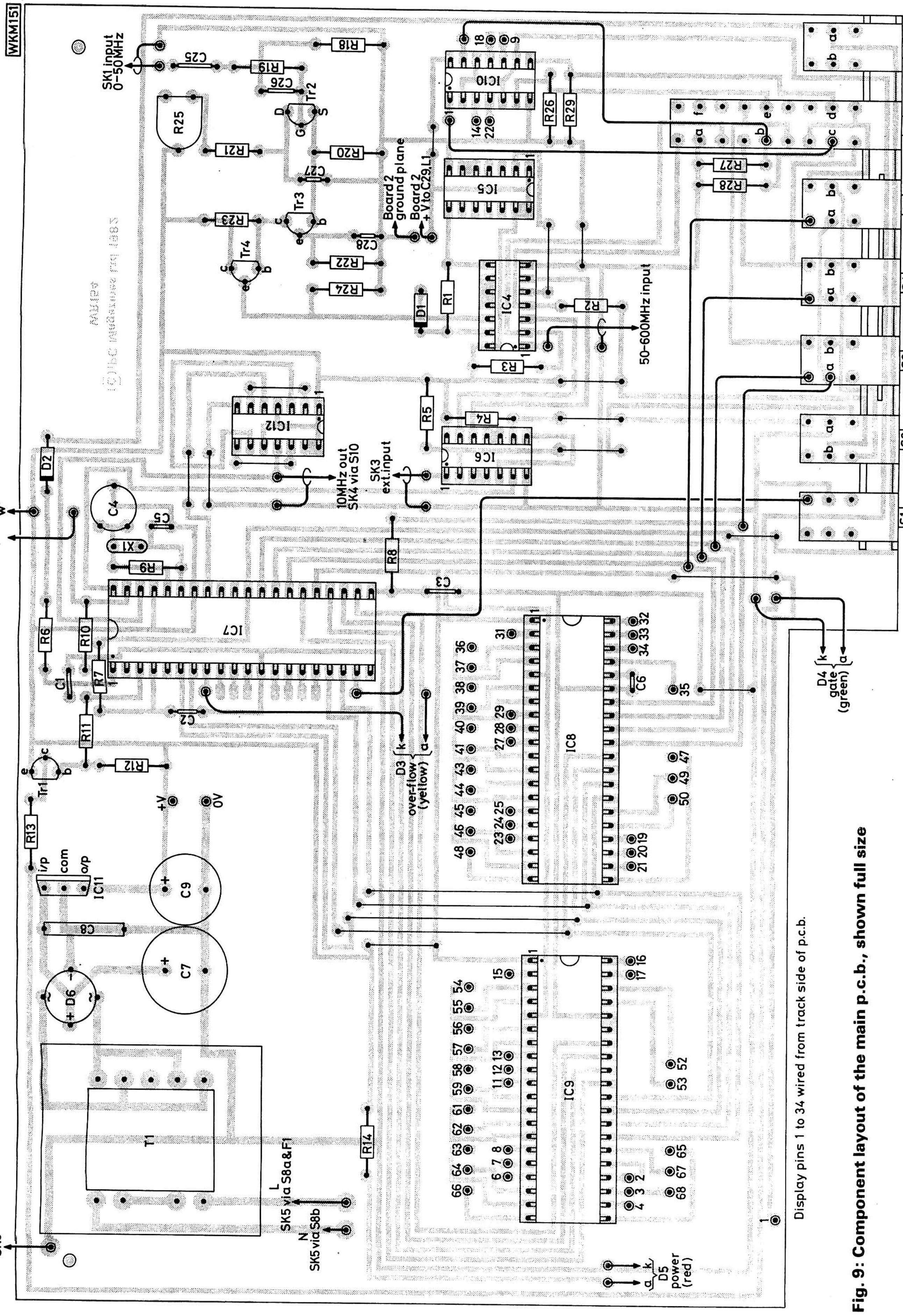
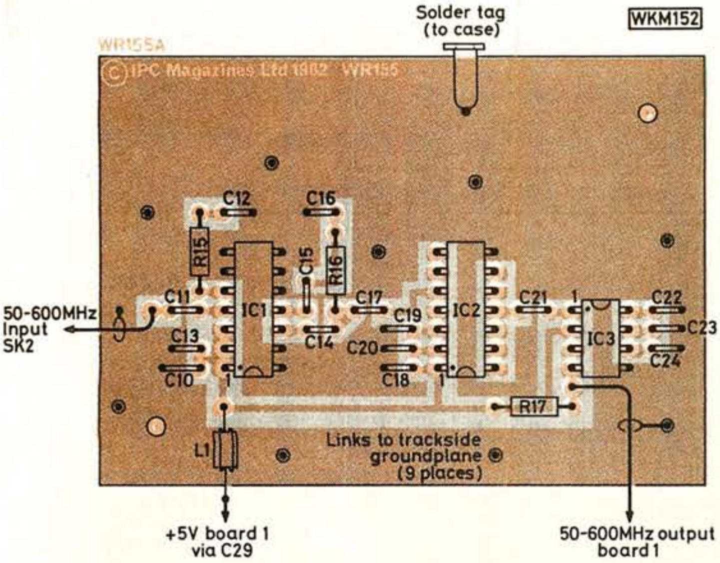


Fig. 8: Full size track pattern of the main p.c.b.



Display pins 1 to 34 wired from track side of p.c.b.

Fig. 9: Component layout of the main p.c.b., shown full size



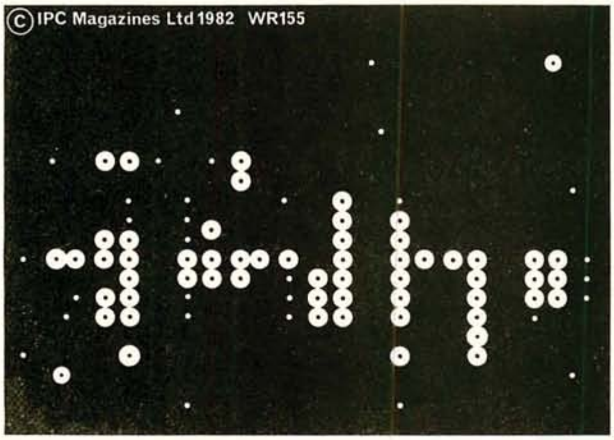
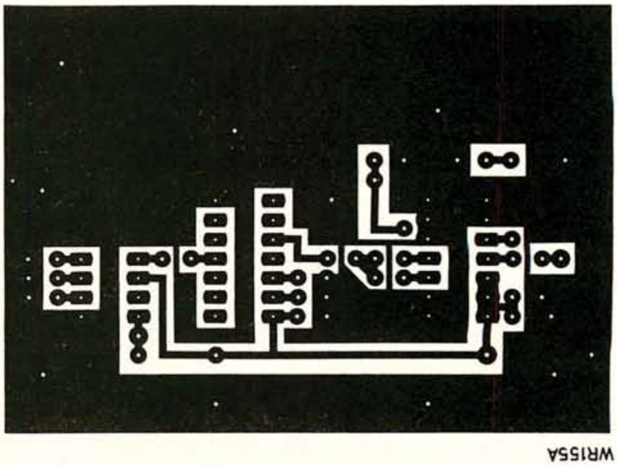


Fig. 10: (Top) Component layout of the 600MHz pre-scaler board. (Above) Component side ground plane, shown full size. (Top right) Non-component side p.c.b. track pattern

The rear panel was drilled for the mains socket, fuse and, if desired, the CALIBRATION OUT socket and switches. The 10MHz and 1MHz (if used) switch and HOLD switch were inserted using a two-way bracket.

Mount the p.c.b. in the case using nuts, bolts and spacers to position it correctly behind the switch bank holes. The die-cast 600MHz module was secured to the front panel by the BNC socket and a lead run from the centre of the output BNC socket to the relevant position on the board. This arrangement made the module relatively easy to remove should it be needed elsewhere.



Alignment

0–50MHz pre-amplifier

Before applying an input signal, the operating point of the f.e.t. must be set. This is done by connecting a d.c. voltmeter to pin 8 of IC4 and rotating R25. At some point, the voltage should switch from low (around 0·5V) to high (around 4·5V) or vice versa. If this does not happen, the value of R20 needs to be changed. Whilst 330 ohms is specified, some f.e.t.s needed 220 ohms, others 470 ohms and, to facilitate this selection, it might be easier to insert two Veropins in the R20 position and then try different value resistors until a suitable one is found. Until this switching action is obtained, it is pointless to try to pass a signal through the amplifier.

Feed a signal of about 25MHz and 200mV r.m.s. into the input and a reading should be obtained. Steadily increase the signal and adjust R25 to maintain a stable display and it should be found that typically 60MHz can be counted accurately. If a signal generator is not available, use a "sniffer" probe made from a coaxial cable terminated in a couple of turns of 20 s.w.g. wire. Obtain a stable display from a transmitter oscillator stage and gradually move the "sniffer" away—adjusting R25 until no more sensitivity can be achieved. If a 144MHz transmitter is available, try measuring at the multiplier stages.

50–600MHz pre-amplifier

No adjustment is necessary on this range and the operation of a transmitter some distance away should trigger the counter with no problem at all.

It will be found that the circuit will self-oscillate in the absence of a signal and the Plessey data sheet does warn of this. The author chose to accept this because to "cure" it involved damping the inputs of the i.c.s, reducing the sensitivity.

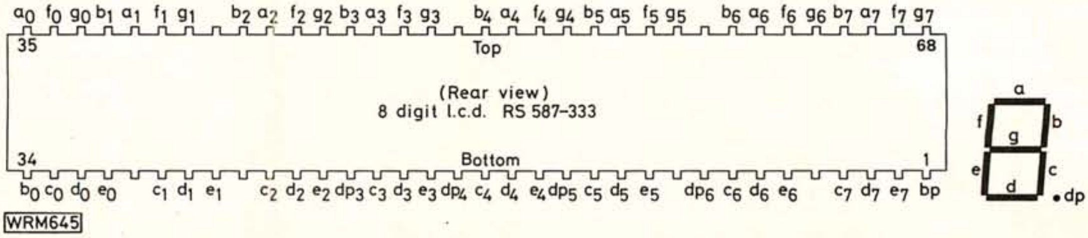
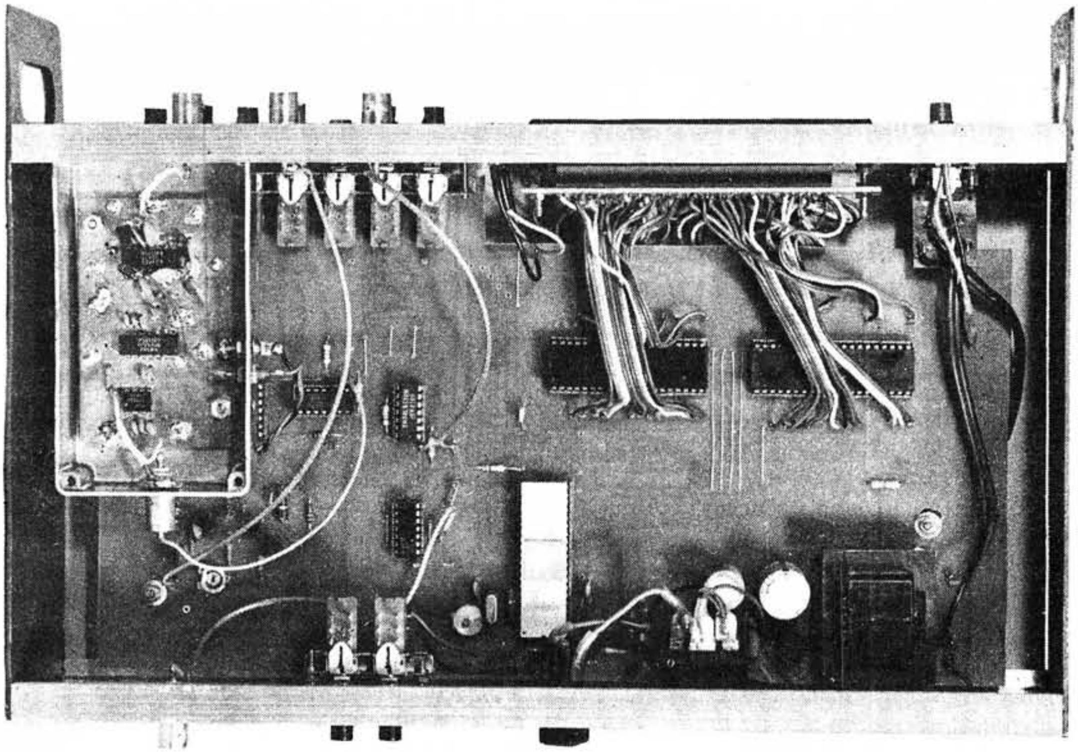


Fig. 11: Connection details of the l.c.d. display together with segment notation. Non-notated pins are left unconnected



Photograph of the author's prototype 600MHz frequency meter. The approximate cost to construct this version would be £100

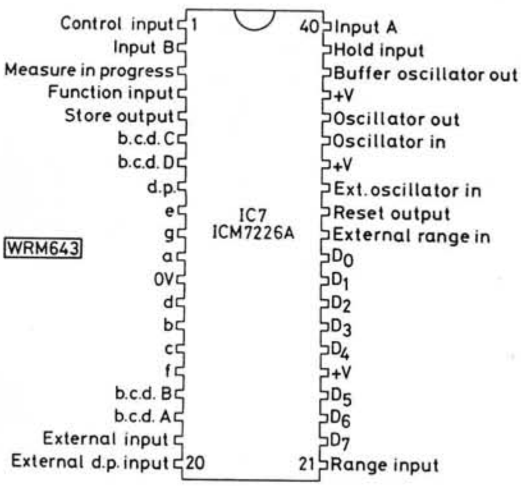


Fig. 12: Pin-out details of the ICM 7226A device

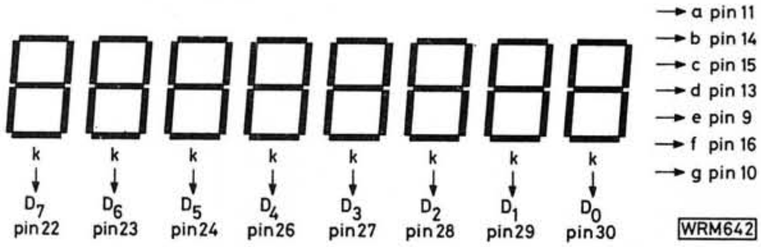


Fig. 13: Connection details of the alternative l.e.d. display. All segment anodes are paralleled, cathodes connect to appropriate pins on IC7

If constructors wish to prevent this self-oscillation, Plessey advise the insertion of a 39kΩ resistor between pin 8 (the differential input) of IC3 and earth—and a 15kΩ resistor between pin 10 of IC2 and earth. It may also be necessary to damp the input of the SL952.

Check that the decimal points have been connected and illuminate when the appropriate range and gate times have been selected. The RESET switch should give a reading of noughts, as the whole counter begins its cycle all over again. The HOLD switch will freeze the display with the last measurement shown.

To trim capacitor C4 either of the following procedures can be adopted. Feed a known accurate signal into the meter and adjust until the correct reading is displayed, or place the meter next to a receiver tuned to WWV (10MHz). The signals will beat together and the trimmer is adjusted for zero beat. The Intersil data actually specifies a 39pF capacitor and trimmer but these were found to be insufficient. If the adjustment is too coarse, then altering the values of C4 and C5 will help.

Conclusion

By building this project as described, readers should end up with a highly sensitive meter, challenging many commercial units in terms of performance and value for money. However, constructors have several options open to them: principally, whether to extend the meter to 1·3GHz; whether to have a liquid crystal or l.e.d. display; whether to have the 1MHz calibration out signal; the extra gate, etc. As an alternative to a mains power supply, rechargeable batteries could be used, with a charging socket on the rear panel. Please note that the EXTERNAL OSCILLATOR OUT pin will drive one low-power Schottky TTL device, so buffering is needed in the 10MHz out signal if either a 74LS196 or 74LS74 is placed in the IC11 position. Future additions to be published will include a high-stability ovened crystal oscillator and a 1·3GHz pre-amplifier stage. ●

Errata

Please note that in Part 1, in Fig. 2, C7 should be 2200µF, under the heading "LED Display" on page 46, the digit strobe lines should be identified as "D_0 (least significant digit, on the right looking from the front) to D_7 (most significant digit)."

In Fig. 4, the top left-hand circuit block should be labelled "1·3GHz", not 1–3GHz as shown.

JFET CRYSTAL OSCILLATORS

M.J. DARBY

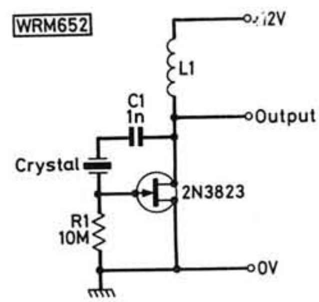


Fig. 1: A simple Pierce oscillator circuit

The crystal oscillator still offers the ultimate in frequency stability for the home constructor, having done so since the early days of radio. Crystal oscillators provide Q factors of the order of tens of thousands — far higher than could be obtained by the use of an inductance-capacitance tuned circuit. Ceramic resonators are intermediate in stability between crystal oscillators and ordinary tuned circuits, but are cheaper than crystals and normally smaller. The stability of crystals can be improved by placing the crystal element in an "oven" which is kept at a constant temperature, but this is not normally necessary in home constructor work.

One important use of the crystal oscillator is in receiver calibration. A low power crystal oscillator operating at, say 1MHz, will provide signals which can be detected by the receiver not only at 1MHz, but also at all the harmonics (or multiples of this frequency) up to perhaps 30MHz. The amplitude of the harmonics fall with increasing frequency. Thus a 1MHz low-power oscillator placed near the receiver antenna will provide marker points at 1MHz intervals. If the 1MHz crystal is replaced by a 500kHz crystal, intermediate marker points are obtained and one can thus calibrate the receiver dial with accurate frequency markings.

It is convenient to employ devices with a high impedance in crystal oscillator circuits so that as little loading as possible is placed on the crystal circuit. In the early days of radio, thermionic valves were used to obtain the high input impedance, but now field effect transistors (f.e.t.s) are commonly employed in crystal oscillator circuits.

Two examples of oscillator circuits employing junction field effect transistors (j.f.e.t.s) are given in this article, one being similar to the Pierce oscillator originally used with thermionic valves and the other being based on the Colpitts circuit as used with inductance-capacitance tuned circuits.

Pierce Oscillator

The Pierce oscillator circuit (Fig. 1) can be employed with various crystals over a relatively wide frequency range. No circuit modifications are required when one changes from a crystal of one frequency to one of another frequency provided that the high frequency choke L1 has a reasonably high impedance at the frequency of each crystal used.

The high impedance of the reverse biased f.e.t. gate electrode permits the use of a high value for R1 and the loading on the crystal can therefore be very small. This ensures that the Q factor and the frequency stability are high.

The type of f.e.t. employed is not at all critical, but naturally an n-channel junction type must be selected for the particular circuit configuration shown. Some variation in the excitation level (the amplitude of oscillation) can be made by varying the supply voltage or by connecting a small capacitor from the gate electrode to ground.

Colpitts Circuit

The Colpitts circuit (Fig. 2) is rather more suitable for use with low frequency crystals than the Pierce circuit, since no choke is required in the Colpitts circuit. Chokes for relatively low frequencies tend to be rather large and somewhat inefficient – apart from being more expensive.

First class frequency stability is again obtainable, since the load imposed by the f.e.t. on the crystal is very small and does not vary appreciably with temperature. The type of j.f.e.t. used is again not at all critical, although it must be an n-channel type for the circuit shown.

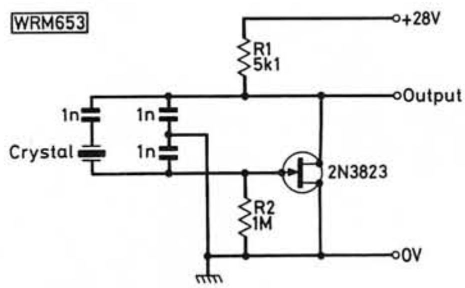


Fig. 2: A Colpitts crystal oscillator circuit

P-channel Devices

P-channel j.f.e.t. devices can be employed in exactly the same type of circuits as those shown provided that the positive power supply voltages shown are replaced with negative supplies of a similar value connected to the same point in the circuit concerned.

However, n-channel f.e.t. devices are more readily obtainable and tend to have a better performance owing to the higher mobility of the electrons in the n-channel material than the holes which carry the current in the channel of p-channel devices.

Try one of these simple circuits next time you need an oscillator circuit of a stable and known frequency or when you wish to calibrate a receiver using oscillator harmonics. If the output is used to trigger a bistable circuit, much higher levels of harmonics can be obtained, since square waves from the bistable circuit have a much higher harmonic content than the relatively pure sinewaves supplied by the simple circuits shown. ●

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0.45Kg	1x012	12+12	1.25	+VAT £0.92
Regulation	1x013	15+15	1.00	TOTAL £7.08
18%	1x014	18+18	0.83	
	1x015	22+22	0.68	
	1x016	25+25	0.60	
	1x017	30+30	0.50	
50 VA	2x010	6+6	4.16	**£5.70**
80×35mm	2x011	9+9	2.77	+p/p £1.30
0.9Kg	2x012	12+12	2.08	+VAT £1.05
Regulation	2x013	15+15	1.66	TOTAL £8.05
13%	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	
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1Kg	3x012	12+12	3.33	+VAT £1.16
Regulation	3x013	15+15	2.66	TOTAL £8.91
12%	3x014	18+18	2.22	
	3x015	22+22	1.81	
	3x016	25+25	1.60	
	3x017	30+30	1.33	
	3x028	110	0.72	
	3x029	220	0.36	
	3x030	240	0.33	
120 VA	4x010	6+6	10.00	**£6.90**
90×40mm	4x011	9+9	6.66	+p/p £1.67
1.2Kg	4x012	12+12	5.00	+VAT £1.29
Regulation	4x013	15+15	4.00	TOTAL £9.86
11%	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	5x011	9+9	8.89	**£7.91**
110×40mm	5x012	12+12	6.66	+p/p £1.67
1.8Kg	5x013	15+15	5.33	+VAT £1.44
Regulation	5x014	18+18	4.44	TOTAL £11.02
8%	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	

TYPE	SERIES No	SECONDARY Volts	RMS Current	PRICE
225 VA	6x012	12+12	9.38	
110×45mm	6x013	15+15	7.50	
2.2Kg	6x014	18+18	6.25	
Regulation	6x015	22+22	5.11	**£9.20**
7%	6x016	25+25	4.50	
	6x017	30+30	3.75	+p/p £2.00
	6x018	35+35	3.21	+VAT £1.68
	6x026	40+40	2.81	TOTAL £12.88
	6x025	45+45	2.50	
	6x033	50+50	2.25	
	6x028	110	2.04	
	6x029	220	1.02	
	6x030	240	0.93	
300 VA	7x013	15+15	10.00	
110×50mm	7x014	18+18	8.33	
2.6Kg	7x015	22+22	6.82	**£10.17**
Regulation	7x016	25+25	6.00	
6%	7x017	30+30	5.00	+p/p £2.00
	7x018	35+35	4.28	+VAT £1.83
	7x026	40+40	3.75	TOTAL £14.00
	7x025	45+45	3.33	
	7x033	50+50	3.00	
	7x028	110	2.72	
	7x029	220	1.36	
	7x030	240	1.25	
500 VA	8x016	25+25	10.00	
140×60mm	8x017	30+30	8.33	**£13.53**
4Kg	8x018	35+35	7.14	
Regulation	8x026	40+40	6.25	+p/p £2.35
4%	8x025	45+45	5.55	+VAT £2.38
	8x033	50+50	5.00	TOTAL £18.26
	8x042	55+55	4.54	
	8x028	110	4.54	
	8x029	220	2.27	
	8x030	240	2.08	
625 VA	9x017	30+30	10.41	
140×75mm	9x018	35+35	8.92	**£16.13**
5Kg	9x026	40+40	7.81	
Regulation	9x025	45+45	6.94	+p/p £2.50
4%	9x033	50+50	6.25	+VAT £2.79
	9x042	55+55	5.68	TOTAL £21.42
	9x028	110	5.68	
	9x029	220	2.84	
	9x030	240	2.60	

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Centre frequency 145MHz.
Supply voltage 13.8 Volts.
Supply current (Drive APP) 3 Amps.
Supply current (Quiescent) 30mA nominal @ 13.8 volts.
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R.F. Power input 0.5 Watts — 3 Watts.

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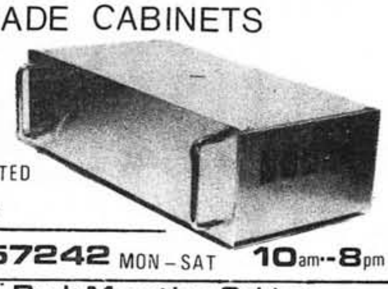

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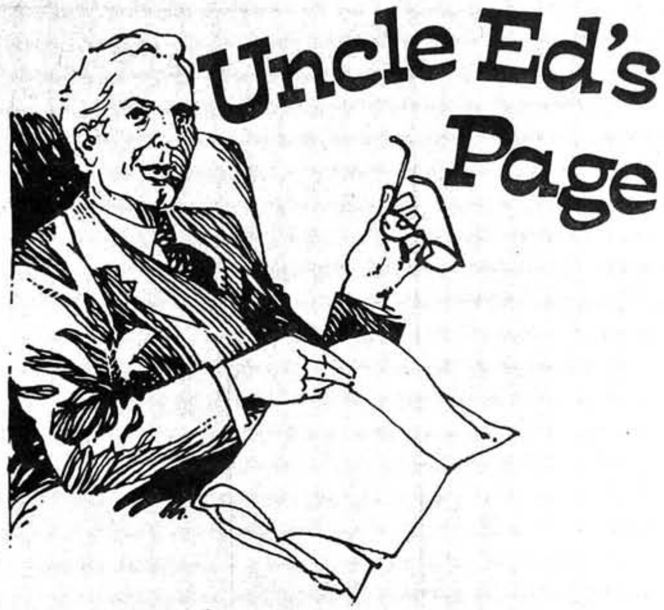


Uncle Ed's Page

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

TRANSMITTER POWER—2

Last month I looked at carrier power and mean power. This month it's the turn of peak envelope power (p.e.p.), defined in the *Radio Regulations* thus:

Peak Envelope Power (of a radio transmitter): *The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions.*

The "peak" bit of the title is in some ways an unfortunate choice of word since, as the definition says, it's talking about an average power. Actually, the "peak" ties up with the "crest" of the definition.

In the Amateur Service, p.e.p. is only specified in connection with single-sideband transmissions, but it can in fact be applied to other modes too. One of these, double-sideband amplitude modulation (d.s.b. a.m.), actually forms a good starting point for understanding p.e.p.

In Fig. 3, I've shown the display you'd see on the screen of an oscilloscope monitoring the output of a d.s.b. a.m. transmitter. In Fig. 3(a) there's just an unmodulated carrier (p.t.t. button pressed but no audio input), with a constant peak amplitude of V volts (an oscilloscope display normally indicates voltage). The r.m.s. amplitude is $0{\cdot}707 \times 1V = 0{\cdot}707V$ volts. In Fig. 3(b), 100 per cent sinusoidal modulation has been applied to the carrier and the peak amplitude of the carrier wave now varies between $2V$ volts and zero. At the modulation peak, the r.m.s. amplitude is $0{\cdot}707 \times 2V = 1{\cdot}414V$ volts.

To relate the voltages to power levels, which is what we're interested in, we are back to our old friend—power is proportional to voltage squared. For Fig. 3(a), $0{\cdot}707^2 = 0{\cdot}5$. For Fig. 3(b), $1{\cdot}414^2 = 2$. Therefore, the p.e.p. of a carrier modulated 100 per cent by a single sinusoidal tone is four times the unmodulated carrier power ($2 = 4 \times 0{\cdot}5$).

When we move on to a single-sideband, suppressed carrier transmission, things become a little more complicated. If we consider an s.s.b. transmitter driven by a single tone, then the output viewed on an oscilloscope has a constant amplitude (again I've called it V volts), and looks just like an unmodulated carrier. In this case, the mean power and p.e.p. are exactly the same (Fig. 4), because the "modulation peak" effectively lasts for ever. Why does the output of an s.s.b. transmitter modulated by a single tone look like carrier wave, so much so that a distant receiver couldn't tell the difference?

If you've got *PW* for March and April 1981 you'll find an explanation there in *Uncle Ed.* One way of looking at it is to consider an s.s.b. transmitter as a frequency translator, taking in an audio frequency tone and producing a radio frequency output from it. Say you have an s.s.b. transmitter with a carrier frequency of 14 100kHz (except that the carrier is suppressed, so that there is virtually no output at that frequency), and a 1kHz modulating tone applied to it. The transmitter will be operating on upper sideband (u.s.b.) so an r.f. output will be produced at 14 100 + 1 = 14 101kHz. The amplitude of the r.f. output from the transmitter will be proportional to the amplitude of the modulating tone input. So far as the distant receiver is concerned, it will be unable to tell the difference from a c.w. transmitter on 14 101kHz with the key held down.

If we add to the modulation another tone, of the same amplitude as the first but not harmonically related to it, on 1·6kHz for example, the transmitter will produce two r.f. outputs, the one on 14 101kHz plus a new one on 14 101·6kHz. These will beat together, running in and out of phase to produce the waveform of Fig. 5.

I've already said that the r.f. output amplitude is proportional to the amplitude of the modulating tone, and the same applies if more than one tone is applied at the same time. So, if the two tones have the same amplitude, the two r.f.

Fig 3

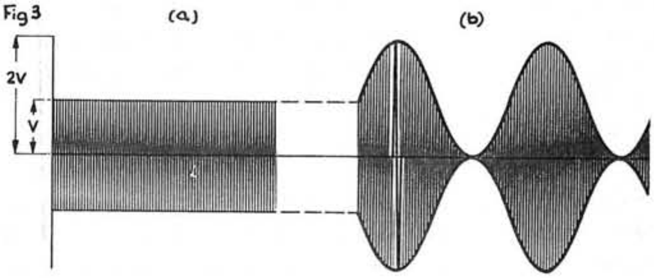


Fig 4

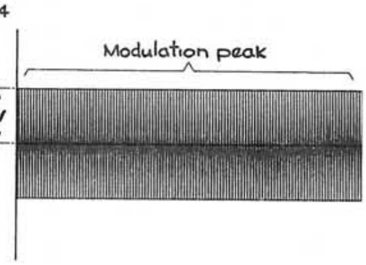
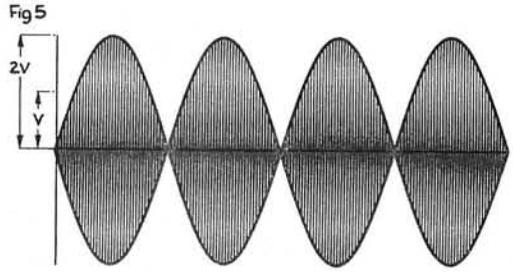


Fig 5



WRM654

continued on page 47▶▶▶

SPACE SHUTTLE COMMUNICATIONS

Part 1

Brian DANCE

The launching of the Space Shuttle on its first manned orbital flight on Sunday, April 12th 1981 and its safe return from orbit, was watched by many hundreds of millions of television viewers throughout the world. Such world-wide TV links involve the use of satellites above the Atlantic, Indian and Pacific oceans in geostationary orbits some 36 000km above the equator. One of the most important tasks of the Space Shuttle will be to lift such communication satellites into earth orbit from where they can be cheaply boosted into the required geostationary orbits.

The demand for economical international telecommunications is increasing at a phenomenal rate, not only for the transmission of TV signals throughout the world, but also for international telephone, telex and military communications. In addition, direct broadcasting of TV (DBS) and sound radio signals from satellites in geostationary orbits over the equator to individual homes is planned for Britain and other countries within the next few years. Powerful, and therefore relatively heavy, satellites must be made available for such applications able to handle information at high rates.

It is confidently anticipated that the availability of the Space Shuttle facilities will enable us not only to launch satellites, but to construct huge antennas and associated facilities in space. Some of these antennas may be many square km in area and be put together by men working in earth orbit. The availability of such antennas will result in enormous advances in the field of space communications, including the wide use of electronic mail, facsimile transmission and perhaps even the provision of time signals for automatically setting, with great accuracy, your wrist watch.

On its sixth operational flight, it is planned to use the Space Shuttle to launch the first in the series of American Tracking and Data Relay Satellites (TDRS). The primary communications channel between the Shuttle and the earth in subsequent flights will involve the use of these powerful relay satellites. Although the use of the Space Shuttle for Spacelab type activities has received great publicity in the past few years, its use in the field of communications is equally important and will probably have a greater impact on the lives of ordinary people.

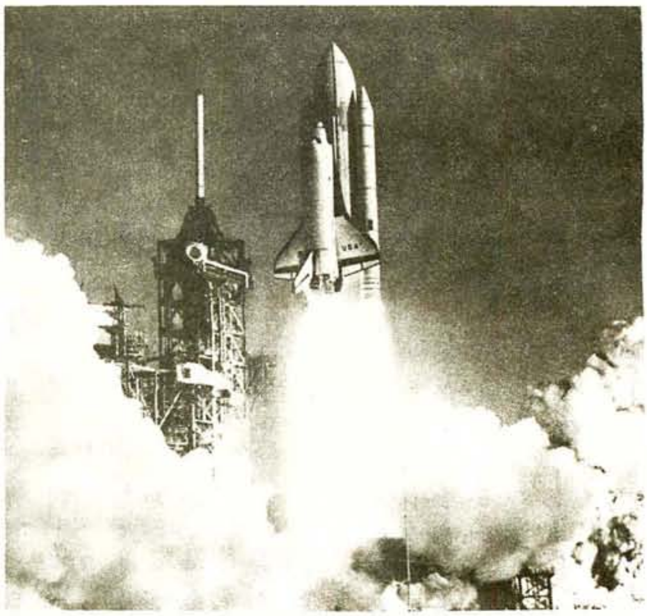
This article covers the communications, radar and tracking systems of the Space Shuttle itself, which are needed to enable it to operate safely and efficiently not only in earth orbit, but also in outer space and the intermediate regions of the upper atmosphere. The Shuttle Orbiter vehicle contains a mass of electronic equipment, including five computers with communications and radar equipment, which will enable these functions to be performed; indeed, it is the requirement for automatic or manual flight control in such very different regions that necessitates the use of such complex and diverse equipment.

Communications Systems

The Orbiter vehicle has about 20 communication antennas, mounted flush with the surface of the forward fuselage. Throughout each mission the communications systems will provide direct voice, command, telemetry and TV communications with the ground staff, crewmen on extra-vehicular activity (EVA) work and with payloads that have been detached from the Orbiter.

Main communications and tracking links for use in orbit are shown in Fig. 1.[1] The whole system has been designed so that it has sufficient flexibility to accommodate the requirements of most types of payload and few changes will thus be required for special missions. The communications and tracking system in the Orbiter supports Orbiter-to-payload communications in addition to the transfer of payload telemetry, uplink data commands and voice signals to and from the space network ground stations.

The data processing and software sub-system furnishes the on-board digital computation required to support payload



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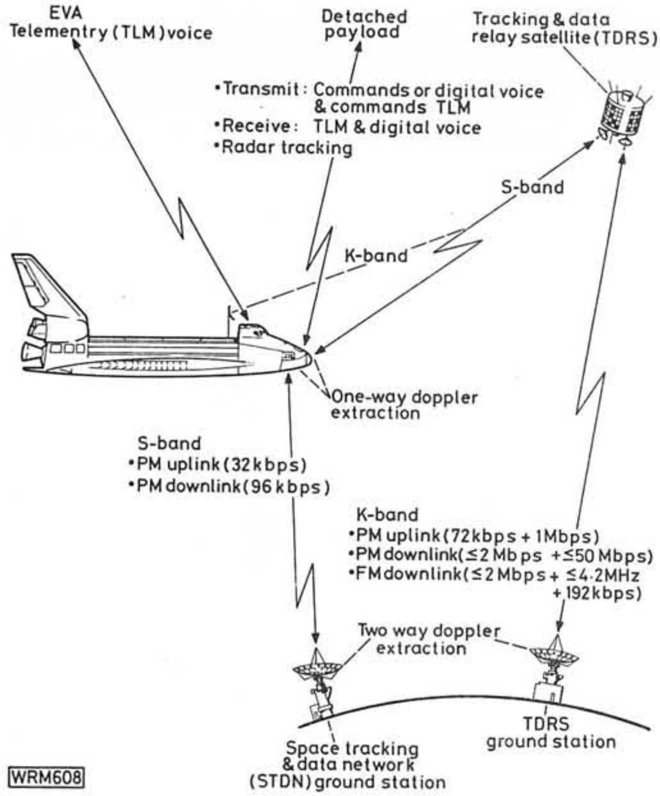


Fig. 1: Communications links associated with Space Shuttle flights

management and handling. Functions in the computer are controlled by the crew through main memory loads from the tape memory. Flight deck stations for payload management and handling are equipped with data displays, cathode ray tubes and keyboards for monitoring by the crew and for controlling payload operations on a flight-by-flight basis using equipment supplied as part of the payload.(1)

Orbiter radio frequency systems include an S-band phase modulation (p.m.) transmitter-receiver for direct communication with the ground tracking and data network stations, a K-band transmitter/receiver integrated radar and communications sub-system, two independent S-band frequency modulation transmitters, and an S-band payload interrogator transmitter-receiver system. Table 1 gives further details of these systems.(2)

S-band PM System

The S-band p.m. equipment on the Orbiter can work directly with a tracking and data earth station or alternatively through a tracking and data relay satellite and its ground station. Four selectable omni-directional antennas are available for use with this system, one of these antennas being located in each quadrant of the Orbiter craft behind the cockpit. This S-band p.m. system can be used in all parts of all Orbiter flights, normally phase-locked to the up-link carrier, on either of the two frequencies shown in Table 1.

Table 1 shows that the Orbiter receiver can accept one command and two voice channels at its high data rate, or one channel of each type at the low data rate. Similarly the transmitter can send either two voice channels and one telemetry signal at the high data rate or one channel of each type at its low data rate. All of these signals may be sent directly to an earth station or alternatively through the TDRSS.

In addition, the S-band p.m. system provides a ranging capability by modulation of multiple tones on a 1·7MHz sub-carrier in the signal received from the ground Space Tracking and Data Network station. The modulated sub-carrier is then sent through the Orbiter transmitter back to the ground station. This ranging facility is not available for transmissions routed via the TDRSS. The range measurement together with the time, the earth station antenna angles and two-way Doppler derived from the coherent system provides the S-band metric data.

Payload Interrogator

In the later parts of the orbital flight test programme, a transmitter-receiver system known as the "payload interrogator" will be available for communications with detached payloads in space. It will be able to receive any one of 825 selectable channels with data rates of up to 16kb/s on a 1·024MHz sub-carrier, whilst in the "bent-pipe" mode the maximum bandwidth is 4·5MHz. The 1·024MHz sub-carrier is routed to the Orbiter processors, whilst bent-pipe data is routed to the K-band transmitter.

The transmitter of the interrogator operates on any of 825 selectable channels and can convey command data to the payload at data rates of up to 2kb/s. The S-band frequencies are shown in Table 1.

S-band FM

In addition to the S-band p.m. link direct with the ground station shown in Fig. 1, a single wide-band data channel is provided by the S-band f.m. transmitter using one of the two omni-directional antennas located on the upper and lower hemispheres of the Orbiter. The frequency and the type of data are shown in Table 1.

S-band DFI

A further S-band transmitter provides the facility for sending development flight instrumentation (DFI) data in real time to the ground station. The transmitter employs the same antenna as that used by the f.m. S-band transmitter, a multiplexer antenna coupling being used.

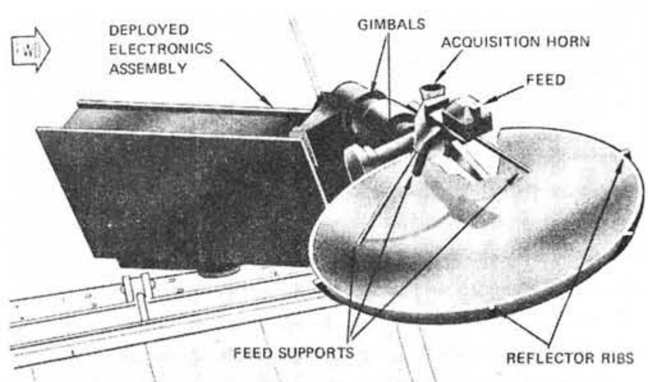
K-band Communications

The Orbiter vehicle is equipped with an integrated radar and communications sub-system, manufactured by the Hughes Aircraft Company, which operates in the K-band. It can provide duplex communications between the Orbiter and the Mission Control Centre by the use of the TDRSS when the Orbiter is in direct line-of-sight with the satellite. This communications system employs a high-gain deployable antenna normally stored inside the payload bay and is thus only available when in orbit and when the payload bay doors are open.

The K-band transmitter accepts data in either of the two modes shown in Table 1, with three data channels in each mode. The K-band receive link provides the same 192kb/s communications facilities as the high data rate S-band link and, in addition, incorporates a 144kb/s text and graphics channel, the total data rate being 216kb/s.

The K-band communications system shares its antenna and front-end electronics with the K-band rendezvous radar system. However, a second K-band communications antenna can be installed for missions which require greater communications capacity.

Before the K-band communications system can be used, an S-band signal is transmitted by the Orbiter to the TDRSS satellite as a broad beam. This conveys command signals which cause



Shuttle Integrated Radar and Communications sub-system for K-band use

(Hughes Aircraft Co. California)

TABLE 1
Orbiter RF Systems and Services

System and frequency	Data Services
S-band (p.m.):	
Transmitter— Coherent— 240/221 times received frequency Auxiliary oscillator— 2287·5 or 2215·5 MHz	High data rate at 192kb/s: 2 voice at 32kb/s each 1 telemetry at 128kb/s Low data rate at 96kb/s: 1 voice at 32kb/s 1 telemetry at 64kb/s Ranging: Turned-around composite signal on 1·7MHz sub-carrier
Receiver— 2106·406300 or 2041·947900 MHz	High data rate at 72kb/s: 2 voice at 32kb/s each 1 command at 8kb/s Low data rate at 32kb/s: 1 voice at 24kb/s 1 command at 8kb/s Ranging: Composite signal on 1·7MHz sub-carrier
K-band:	
Transmitter— 15·0034GHz	Mode 1 (p.m.): 192kb/s operational data 16kb/s to 2Mb/s payload data or 60 to 1024kb/s operational playback data 4 to 50Mb/s payload data convolution-encoded at 1/2 Mode 2 (f.m.): 192kb/s operational data 16kb/s to 2Mb/s payload data or 60 to 1024kb/s operational playback data 16kb/s to 4Mb/s (p.c.m.) data or 3Hz to 4·5MHz analog data
Receiver— 13·7750GHz	High data rate at 216kb/s: 1 command at 8kb/s 2 voice at 32kb/s each 1 text/graphics at 144kb/s
K-band rendezvous radar	Co-operative or passive mode outputs: Range, Range rate, Angle, Angle rate
S-band payload interrogator:	
Transmitter— 2025·0 to 2120·0MHz	825 channels: 2kb/s maximum
Receiver— 2200·0 to 2300·0MHz	825 channels: 16kb/s maximum to payload data interleaver Bent-pipe 4·5MHz maximum
S-band f.m. transmitter:	
Transmitter 1— 2250·0MHz	Wideband data for one of following: Real-time engine data—3 channels at 60kb/s each Real-time TV Real-time attached payload data up to 4MHz (analog) or 5Mb/s (digital) 1 main-engine data dump at 60kb/s (four rates: 1:1, 2:1, 3·5:1, and 16:1) 1 p.c.m. telemetry dump at 128kb/s (four rates: 0·5:1, 1:1, 1·6:1, and 8:1) 1 p.c.m. telemetry dump at 192kb/s (four rates: 0·325:1, 0·625:1, 1:1, and 5:1)
Transmitter 2 (DFI)— 2205·0MHz	Real-time p.c.m. development flight instrumentation at 128kb/s Real-time 15 sub-carrier channels

the high gain K-band satellite antenna to be pointed towards the Orbiter. The computing system of the Orbiter feeds the approximate location of the satellite to the K-band sub-system and the K-band antenna of the Orbiter then commences an eight degree spiral conical scan, which is automatically expanded to 20° if the signal from the satellite is not found. The scanning stops when the increase in signal level is detected, the maximum time for acquisition being 2 minutes. The Orbiter K-band antenna then automatically tracks the signal from the satellite.

Rendezvous Radar

The K-band rendezvous radar carried by the Orbiter vehicle greatly facilitates the ability of the Orbiter to rendezvous or to dock with other orbital vehicles, in either the co-operative or passive mode. A target equipped with a transponder is employed in the co-operative mode so that detection and tracking of the target at a maximum range of 560km is possible, whereas the maximum range in the passive mode, without a transponder, is in the order of 19km. Minimum range in this mode is 30m. The radar supplies four outputs to display the range, range rate, angle and the angle rate. In the passive mode optical angle tracking using the Orbiter star tracker can be employed to improve the radar performance.

Ground station contact using the wide frequency band of the K-band system is not required during rendezvous operations, so the radar system components can be shared with the communications system components. This permits maximum economy in weight, space and cost.

The rendezvous radar has many uses. For example, if a satellite is not operating correctly, the Orbiter could rendezvous with it and the crew could either repair the satellite in space using EVA techniques or the satellite could be loaded into the cargo bay and brought back to earth for checking and repair.

K-band Down Converter

The front-end of the K-band receiver raised many design problems(3), but "state-of-the-art" GaAs f.e.t. devices have been employed by Avantek Inc. to construct a circuit of the form shown in Fig. 2. The complete circuit is mounted in a sealed aluminium box of outside dimensions 82·5 × 36·2 × 15·7mm, weighing about 0·113kg.

Thin film hybrid circuitry was selected for this application because it can withstand shock, vibration and temperature cycling. In addition, thin film circuitry enables a consistent performance to be obtained because tolerances of thin film conductors can be held to within a few μm by the use of precision photolithographic techniques. The circuitry is protected by filling the box with dry nitrogen and hermetically sealing it, using a tungsten inert gas welding technique. Hermetic sealing is used to prevent gas leakage at any of the openings. The circuit has been designed for a mean-time-between-failures of more than 40 000 hours under any combination of environmental parameters which occur naturally.

The circuit selected for the down converter includes three stages of balanced GaAs f.e.t. amplification at the incoming signal frequency, followed by a Chebyshev K-band bandpass filter to reject image frequencies. The filter is followed by an unusual type of single-balanced mixer, a single stage of i.f. gain in the 650MHz band and a temperature controlled attenuator. Two monolithic i.c. voltage regulator devices are also employed.

Each functional stage, such as a single amplifier, is fabricated with thin-film gold conductors and tantalum nitride resistors are deposited on the aluminium oxide ceramic substrate which is bonded to a metal carrier. Each complete functional module is screwed to the metal case and the module interconnections are made with gold ribbon or wire.

The Avantek GaAs f.e.t. device(4) selected for this application have a 0·5μm gate length and are used in balanced pairs so that each amplifier can be assembled aligned and tested as a separate unit, with the additional advantage of an increased dynamic range. Quadrature hybrid couplers are used at both the input and output. Each amplifier stage is bonded to a carrier with an area of approximately 6·3 × 6·3mm.

The image filter was required to provide a rejection of over 20dB of noise power in the 12·481 to 12·685GHz range. Various Chebyshev edge-coupled filters with four to six poles and 0·01dB ripple were tried, but the simple four pole filter was selected because it gave the required image rejection, with less insertion loss, than the more complex filters. This four pole filter is fabricated on a 19·0 × 6·3mm substrate. The insertion loss is 1·5 to 1·6dB, the v.s.w.r. less than 1·3:1 at both input and output and the phase deviation is ±0·25°.

The mixer stage employs Schottky barrier mixer diodes in their unpackaged chip form. These diodes are selected under expected operating conditions on an automatic network analyser. The use of a bandpass filter at the input of the mixer does create design problems, since the filter presents a varying out-of-passband source impedance.

Testing of the mixer and filter is done with these components connected together to minimise problems due to their interaction. The overall conversion loss of the mixer and filter is some 6dB.

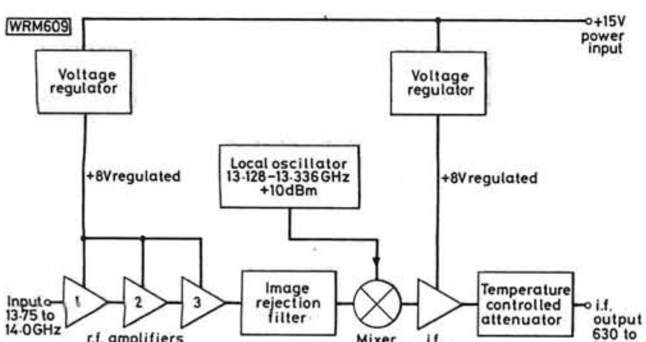


Fig. 2: Schematic diagram of the K-band down converter

STDN ground station provides communications with the Orbiter during launch and landing *(NASA)*

Large capacitors, normally used in a 650MHz i.f. amplifier, have been replaced by small value m.o.s. chips in order to obtain the good pulse recovery characteristics required for quick recovery after a transmitted radar pulse. A unique temperature controlled attenuator is employed to compensate for the additional gain of the GaAs f.e.t. stages at lower temperatures; it employs a fairly conventional pi-type attenuator with a glass bead thermistor as part of the series resistance leg. The gain variation with temperature is thus limited to 4dB.

Atmospheric Aids

In additon to the communications systems already described for use in orbit, the Orbiter also possesses various systems to assist its flight through the earth's atmosphere. They include v.h.f. voice communications equipment, radar altimeter, tactical air navigational system (TACAN) and a multi-scanning beam landing system.

The microwave scanning beam landing system is one of the most important items of equipment on board the Orbiter vehicle. After a mission has been completed, the orbital manoeuvring system engines are used to cause the Orbiter vehicle to enter the atmosphere. During re-entry friction causes the lower surface of the Orbiter to glow at temperatures up to 1250°C. Unlike an aircraft, the Orbiter has no engines to alter its path once the landing operation has commenced. The microwave beam landing system is therefore used to provide three dimensional information to the Orbiter, which allows its computers to steer the vehicle along the best landing path. The Orbiter has three independent K-band microwave beam landing systems which commence to operate about 13km from the landing site.

Additional Orbiter Systems

Apart from the actual transmitters and receivers themselves, the Orbiter must carry suitable additional equipment to interface with these transmitters and receivers. For example, a TV system is required to provide the Orbiter crew with a better image of space objects and to provide such information to people on the earth. The system currently planned can accept inputs from up to 10 TV cameras, but at some later date a video tape recorder may be added. The camera outputs may be switched to two onboard monitor screens and can be transmitted to earth by S-band f.m. or K-band links. The basic cameras are monochrome equipped with changeable lens configurations including a field sequential colour wheel system.

The p.c.m. master unit will accept data from payloads (attached or detached from the Orbiter), the Orbiter itself, or its computers and provides outputs or operational telemetry at both the 64kb/s and 128kb/s rates. These outputs may be fed to the network signal processor (which also accepts analogue voice data signals and converts them into digital signals). The signals are suitably multiplexed and the outputs fed to the S-band p.m. transmitter, the K-band signal processor, or the recording system. The network signal processor also accepts command and voice signals received by the Orbiter systems, separates the multiplexed signals, converts voice signals into the analogue form, and then routes all signals to the appropriate destination.

The f.m. signal processor and the K-band signal processor accept suitable input signals and route them to the appropriate transmitter. Other interface circuits are used in connection with payloads.

The concluding part of this article examines the role of the Tracking and Data Relay Satellite System

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

Letters

The RSGB—A Good Buy?

Sir: There is firm evidence to suggest that all is not well, and indications are that matters are worsening, in the relationship between the ordinary membership of the RSGB and its governing Council. The latter consist of 18 men and 1 token woman who together form the decision-making and policy implementation arm of the Society. From these people flow directives that steer the course of the RSGB, but in the process they fail to take on board much of the constructive advice and innovatory remarks made by the paid-up crew numbering well over 30 000 people. Hence it is quite common, as one spins the dial through 80 and 40 metres, to hear the malcontentment being voiced against what some cynics refer to as the London Wireless Society. Letters of justified heartfelt criticism appear regularly in periodicals embracing radio amateurs among their readers. In essence, what people in the main are complaining about, as we fast approach the 21st century, is the inability or unwillingness of the Council to accept change. Change of a nature that is designed both to improve services to subscribers and give them more say in the Council's affairs.

Certainly, many object to the steadily rising cost of membership—£14.50 for being a corporate member, who form the bulk—to give the Society an income well towards £$\frac{3}{4}$ million in this financial year. Much of the money is spent in the maintenance of 35 Doughty Street, and on the salaries of a growing number of full-time staff. Some years ago it was argued that the headquarters should be moved to the Birmingham area, an easier place to reach by rail and road with cheaper overnight accommodation plus the high probability of buying larger premises, perhaps to include our own exhibition hall. To contemplate such a move now would probably necessitate expensive redundancy payments, though rumour has it that the Council are currently negotiating for fresh premises but still to be located in the Great Wen. Until recently it might have been argued that being within consulting distance of the Radio Regulatory Department of the Home Office was a sound major reason for remaining in the nation's capital. However, the recent farce in the *London Gazette* re the new licence conditions glaringly shows this claim lacks substance, like the reputed excellent rapport twixt its civil servants and the RSBG officials. That's why new licensees are receiving their callsigns by return post.

Tied inextricably to money matters is the shape of the total package of practical information available over such enquiries as planning permission for antennas, Sunday news broadcasts, listing stolen equipment, etc. Whilst generally there is minimal dispute over their appropriateness and efficiency, maybe the up-to-date amateur radio news via the land-line is rather an elaborate gimmick. True it is a service, so too could 24-hour marriage guidance counselling be merited as an even more valuable provision for members snuggling up cold to the XYL at 3 a.m. after DX chasing. At a time when large numbers of members are placed on short-time working or retire, an effort should be made to stabilise the subscription rate for at least the next few years. Some savings surely could be made by stringent examination of the necessity to call so many Council meetings and of its members' subsistence and travelling expenses at home and frequently abroad on official business. Indeed, what is admittedly a token gesture would be the Council reversing their latest decision to give themselves free copies of every RSGB publication, or refusing to accept the none-too-cheap plaques commemorating their term of office. True altruism has no tangible rewards.

Next, whilst it is neither sound nor good journalistic practice for *Practical Wireless* to openly knock another publication, what follows may be excused on the grounds that first and foremost it is published for commercial reasons as purchasers are well aware. *RADio COMmunication,* in sharp contrast, is primarily supposed to be directed towards sustaining members' amateur radio welfare. It definitely does this judging by the thick wad of advertisements at the beginning and end of each issue. In the middle, readers are offered a very mixed diet. At times, state-of-the-art papers are printed, but copy more often contains material filched from other publications and bland descriptive reviews of factory-made equipment that say little more than its handbook. Even the merest hint of pointing out a product's shortcomings is skilfully avoided; the income from adverts precludes *RAD COM* from entering into meaningful debate over the vast price increase and the dealers' attendant cartel on its adherence regarding imported transceivers. Through a policy of selection and exclusion, articles and letters fault-finding the RSGB are never printed. To all intents and purposes the members are one big happy family. But of late, newcomers last three years before quitting; they want value for money.

Finally, what other paramount changes should the Council ideally consider initiating? One should be that no Council member should serve more than 2 years in any 12-year period, thereby avoiding the notion of the self-perpetuating clique and admitting no one is irreplaceable. Power groups within the cabal would also be dissipated or at least neutralised. Also candidates for Council vacancies should be positively encouraged to send substantial election manifestoes to members, to include canvassing on the air waves. The obligatory participation of a Council member at the local annual major rally in open forum would offer members a valuable democratic opportunity to exchange their opinions with their representative about the hobby's future directions. Furthermore, at the same time recruitment to the various sub-committees could be publicly handled. Sadly, being offered a place is now based 'on who you know'. The biggest example of the phenomenon is the election of the President of the RSGB by a handful of people who claim the gift of wisdom in selecting one from their number. In certain instances the accolade has blessed the same person more than once. What a thick lot the rest of us must be.

To conclude, it cannot be denied that British radio amateurs need a national organisation similar to the RSGB in order to protect our hard-won privileges. What is obviously not being offered is a willingness to pay attention to, and occasionally follow, grassroot opinion. Ironical failure in a way, since the hobby is all about communication.

A. Harada G4INX
Chester

The RSGB Replies

Sir: Mr Harada has raised in his letter a large number of points, the majority of which have been voiced by others at one time or another but with considerably more grace. He, as a responsible member of RSGB, should already know the answers to most of them—or at least have been able to find out after a little homework. My reply, therefore, is directed at readers who are **not** members of RSGB and who may be misled by some of the statements made in his letter. I am grateful to the Editor of *Practical Wireless* for sending me a copy of Mr Harada's letter and for the space to reply. Because of the complexity of a Society such as RSGB, I regret that the answers will need to go into some detail.

Structure of the Society

Mr Harada presents a picture of the Society as an autocratic Council, divided from an informed and constructive ordinary membership. He tries to erect the classic "them-and-us" situation, with the "them" being the RSGB hierarchy and the "us" being the "grass roots" of the Society. Unfortunately for Mr Harada, in amateur radio the situation is not quite so simple: this is firstly because the hierarchical "them" also happen to be very ordinary amateurs practising their hobby in the same way as everyone else and secondly, because a remarkable number of the "us" play a vital role in the running of **their** (not **the**) Society. RSGB in fact has an unusually broad base compared with other Societies as the following will illustrate.

The RSGB functions as the result of the combined efforts of three bodies: its representative system, its non-elected volunteer effort and, by no means least, its professional administration. Considering each in turn:

Representative System

The RSGB Council consists of 18 members (not 19!), all of whom, with the exception of the Honorary Treasurer and sometimes the President, have been elected to Council by members of the Society. Seven of the members of Council, Zonal Members, are elected by only those members who live in one of the seven zones covering the whole of the UK, and their **primary** responsibility is to the general supervision of Society affairs in their zone.

The current practice is for Council to hold about seven meetings per year, each of which lasts typically seven hours. During some 1000 man-hours per year, it has to review all the activities of the Society, especially the work of its HQ, its 15 committees and all its honorary officers and managers, and also to consider future policies. Needless to say, there is never sufficient time in practice, and there are as many opinions on what changes need to be made—such as whether to hold more frequent Council meetings, as was past practice, or to circulate more paperwork—as there are Council members. There is no easy answer; indeed, with the growing complexity of amateur radio, the problem predictably will get worse.

The UK is further divided into twenty regions, each of which is the responsibility of a Regional Representative who is also elected directly by only those members who reside in the region. The names of all Regional Representatives, Council Members and Honorary Officers are published every month in the Society's journal *Radio Communication*. In addition, members in any sizeable area may nominate Area Representatives to act as links with the Society at the local level: these number over 100.

Non-Elected Volunteer Effort

One feature of RSGB is the way in which the effort of a large number of volunteers is integrated directly into its organisation. Their main use is in the 15 specialist committees and subsidiary working groups of Council, each of which has specific tasks dictated by its terms of reference. Each committee has the responsibility to design its own membership to best deal with its duties. In some cases, this requires the committee to have a representational basis. The Membership and Representation Committee is **the** classic example: it includes all Zonal Members of Council and some Regional Representatives. However, most committees are—and should be—made up by people who not only have the specialist and general knowledge appropriate to the work of the committee, but must also be able to engender a sense of team work. This is essential to the operation of all successful committees. For most committees, being "representative", geographically speaking, is not normally relevant; nevertheless, a large number of committee members live at a distance and are still prepared to participate despite the burden of travelling. In practice, approximately 138 volunteers occupy the present 200 committee places; some people occupy more than one position for obvious liaison purposes.

Committee members represent a large resource of effort and expertise, on which RSGB capitalises to an extent that is unique amongst radio societies throughout the world. Not only do they contribute to the organisation itself, but they also provide yet another set of links between RSGB and its membership. We are indeed fortunate that the Society can attract and be subsidised by this volunteer effort—there is no way it could afford the several thousand man-hours of effort each year at anything approaching normal rates.

In addition to the above committee effort, volunteers provide invaluable service in other areas: the scale of this can be judged from the summary given in the Annual Report for the year ending 30 June 1981 which Mr Harada, like all members, received with their November 1981 *Radio Communication*.

11	Honorary Officers
12	Intruder Watchers
14	BREMA/CCIR/BSI/IERE Liaison Members
16	Planning Panel Members
18	Council Members
20	Regional Representatives
20	Amateur Radio Observation Service Listeners
31	Beacon Keepers
43	QSL Bureau Sub-Managers
39	Slow-Morse Transmitters
80	Newsreaders and Reserves
100+	Area Representatives
133	Repeater Keepers
162	Raynet Controllers
175	Committee Members

Professional Effort

The main brunt of Society administrative work is borne by its Headquarters staff; the 20 or so full-time staff represent approximately 50 000 man-hours of effort per year. While a proportion of this necessarily is concerned with the routine administration associated with any company (which is what we are), a large and increasing proportion is devoted to the development of amateur radio itself. The thousand or so letters received each day represent a very direct "grass roots" contact with the membership. Each letter may take anything from one minute to several hours to answer: this reply is an example of the latter. Telephone calls, and the presence of the HQ staff at exhibitions, rallies and meetings provide further direct links with members. HQ staff frequently give talks to affiliated clubs; during the last three weeks I have personally spoken about the Society's work at three clubs, at Brighton, Burnham Beeches and Shrewsbury.

Viewed as a whole, the above represents a comprehensive structure in which a large number of members participate directly and which provides a multiplicity of links at many levels with the membership at large. It is a far cry from the simplistic picture which Mr Harada attempts to paint. Nevertheless, while much of this organisation works reasonably well, it is not fully exploited. Improvements will continue to be made as part of the normal development of the Society.

Cost of Membership

Mr Harada complains about the cost of membership of RSGB and suggests that subscriptions alone give the Society an income well towards £$\frac{3}{4}$ million in this financial year. If he had referred to his copy of the 1980/81 Accounts, he would have seen that this figure was the rather smaller one of £264 084.

Being a member of RSGB implies that you believe in amateur radio, you feel that it is worth defending, you are prepared to help others to enjoy what you enjoy, and you see it as a means of repaying some of the effort that others have put in to amateur radio and from which you have derived much benefit—and you are prepared to back your beliefs with a positive commitment. You also receive many benefits in the way of services.

To put the £14.50 subscription into perspective: (a) this still represents less than 4p per day; (b) taking into account the effect of inflation, the subscription is lower in absolute terms than in the past; (c) it compares with the "subscription rates" of other magazines which have some amateur radio content, while in the case of RSGB, its journal is devoted entirely to amateur radio and represents only one of a large number of services to members.

Headquarters

Mr Harada again is quite wrong when he suggests that the number of full-time staff employed in its Headquarters is growing. In fact, the number has remained substantially constant over the last five years, during which time the membership has increased by over 50 per cent and services to members have expanded considerably. This has been achieved by greatly improving the effectiveness of staff effort by the exploitation of modern data processing techniques—one of the major innovatory changes in the Society that Mr Harada has chosen to ignore.

If Mr Harada cares to study the Annual Report that he will have received, he will realise that this effectiveness is reflected in the relatively low staffing costs in terms of cost per head of staff compared with other institutions. At this time, the main Headquarters problem is the urgent need to employ **more** staff, not fewer. This will be done as soon as larger headquarters premises have been obtained.

Home Office

In recent years, links between the Home Office and RSGB have grown closer and stronger. One outcome has been that RSGB has been able to take over some of the responsibility for the day-to-day control of amateur radio. This, in general terms, is to be welcomed. There is little doubt that, had RSGB not accepted the task of the initial vetting of proposals for services such as beacons, repeaters and special event callsigns, the expansion of these services to radio amateurs would have been curtailed.

However, not all Home Office matters have gone so smoothly. Many readers will be aware of the problems associated with the issuing of a new licence schedule earlier this year. The reason for this was that the newly appointed Home Office staff did not fully appreciate the intricacies and implications of the schedule modifications put forward by their own technical department following the World Administrative Radio Conference in 1979 (WARC '79), and therefore did not see the need to trouble RSGB: the situation was made worse by printing errors in the *London Gazette*. RSGB did much to get the major errors corrected in order to establish the present temporary schedule. Negotiations will continue with a view to producing a final version which includes all the modifications pending from WARC '79.

The delays in issuing amateur licences are due to two reasons: the problems with the schedule which are described above, and the effects of staff cut-backs at the Home Office at the same time as a huge increase in the numbers applying. In the case of the schedule problem, the RSGB **was** able to provide direct help: however, in the case of licensing delays, RSGB can do little other than make the Home Office fully aware of the frustration and heartbreak that these delays cause to those who have worked hard to pass their exams.

Communication

Mr Harada in his letter seems to welcome various services and modes of communication with members, but singles out the Headline News Service, on 01-837 4118, as a gimmick. The 600–800 calls received each week suggest otherwise.

Books

Books represent one of the most important services RSGB provide to radio amateurs throughout the world. It is a service to be proud of and represents annual sales approaching £$\frac{1}{4}$ million. Council members need to have a clear and up-to-date picture of our publishing programme; to issue copies of each new edition to them is a sensible way of achieving this.

Radio Communication

Because this journal is circulated to all members who, by definition, have an interest in amateur radio, the Society is able to attract considerable advertising revenue. The advertisements are of direct interest to most members and therefore this can be regarded as a service in itself. What they do **not** do is to take pages away from that part of the magazine devoted to articles, features and news. On the contrary, by off-setting some of the production costs, they enable the journal to be expanded.

Mr Harada's assertion that much material is "filched" from other publications is ridiculous. There is an agreement between national radio societies that articles may be reproduced—with due acknowledgements, of course. RSGB **does** reproduce exceptional articles: it would be failing its members if it did not. A rather higher number of RSGB articles are published in other journals than vice versa.

Technical reviews of equipment are appreciated by the majority of amateurs. However, it is not easy to produce a review that, in one article, provides a technically accurate description of the effectiveness of an equipment relative to its specification and in a form which is both comprehensive and interesting to a readership which covers the widest possible range of technical background. A second difficulty arises from the fact that technical quality and features, like beauty, are very much in the eye of the beholder. A particular feature that one amateur may regard as essential and its omission a serious deficiency, may to another amateur, be seen as an unnecessary extravagance, a complication and a potential source of unserviceability. *The best* that can be done, surely, is to present a fair and accurate description in terms of its specification and to leave it to the reader to judge its value-for-money in terms of his particular requirements.

Regarding the suggested conflict of interest between the advertising and reviewing of equipment, this cannot be the case as on a day-to-day basis they are entirely separate operations. Advertising is essentially a commercial activity which is dealt with by HQ staff, whereas technical reviews are the responsibility of the volunteer members of the Technical & Publication Committee.

As regards the cost of equipment in this country, RSGB have attempted to determine the justification for UK prices. However, the situation is by no means stable: I understand that Americans can now buy certain equipment at a lower price in the UK than in the USA.

Period of Service on Council

If Mr Harada is serious in suggesting that Council members should serve only two years in any 12 year period, then he clearly has no concept of the level at which an organisation, the size and complexity of RSGB, has to work. The biggest task facing Council members is to ensure that, in making decisions, **all** the factors affecting the problem and **all** the implications that inevitably impinge on other areas are understood. It is my opinion, and that of other experienced people, that it can take many years' close involvement before one begins to understand the conflicting demands placed upon our resource of effort and money. Even then, this experience does not guarantee the wisdom necessary to judge the conflicting and other intangible factors involved. However, having served this long apprenticeship, people **do** expect to be better placed to make decisions about Presidents.

Even within the space of this extended letter, I have only been able to deal with some of the points raised by Mr Harada. The involvement of members is crucial to the Society and it is appreciated that Mr Harada shows such concern in its operation. However, we believe that vituperative and destructive criticism is counter-productive, and alien to the spirit which permeates amateur radio and which is, in fact, its driving force. The RSGB clearly **is** responsive to the amateur spirit emanating from its members in so many ways.

If readers would like any further information, or details of how to become a member of RSGB, please will they write directly to me at 35 Doughty Street, London WC1N 2AE.

David Evans
General Manager/Secretary, RSGB

Uncle Ed's Page

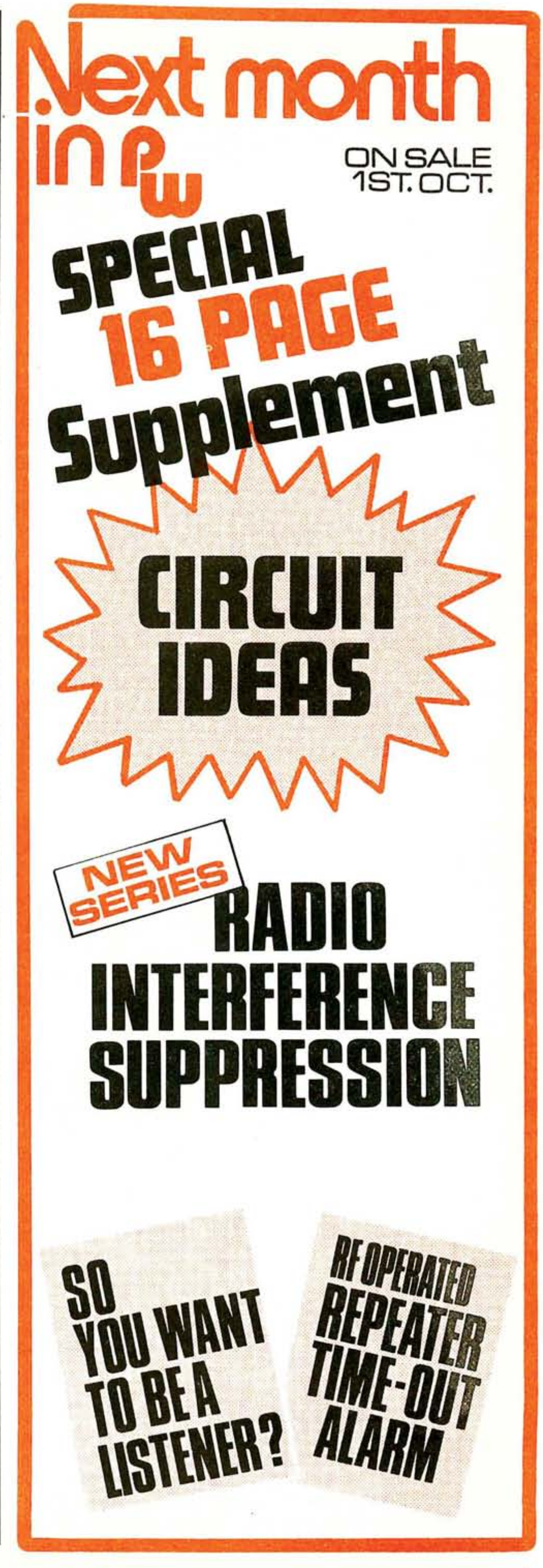
▶▶▶*continued from page 39*

outputs will have the same amplitude too, and they will each have the same average power. The two-tone output shown in Fig. 5 will therefore have twice the average power of the output due to either tone on its own.

When it comes to talking about peak envelope power of the two-tone output, you will note that the peaks have got an amplitude of $2V$ volts. I'm sure you won't need me to tell you that this means that the p.e.p. of the two-tone output will be four times the average power due to either tone on its own, or twice the average power due to the two tones together.

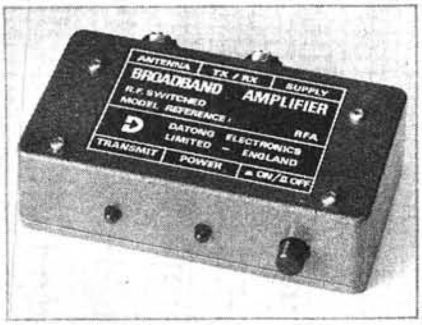
So, for a 100 per cent tone-modulated d.s.b. transmission, p.e.p. $= 4 \times P_c$ (P_c is unmodulated carrier power), and for a two-tone modulated s.s.b. transmission, p.e.p. $= 2 \times P_m$ (P_m is mean power). If you compare the waveforms of Fig. 3(b) and Fig. 5, you'll see that they have quite a different shape, especially near the centre line.

If the modulation input level is turned up too far, the amplitude of the r.f. output signal is no longer proportional to the input signal level. In other words, the output becomes distorted. The power level at which the acceptable distortion level is just reached is the rated output p.e.p. of the transmitter (see *Understanding Transmitter Parameters, PW* June 1982, for further details), which is the same whether it's putting out the two-tone test signal or the more useful speech signals, but see also next month's discussion on transmitter ratings for various modes, and how they relate to each other.



PRODUCTION LINES

ALAN MARTIN G8ZPW



Broadband Pre-amplifier

One of the latest additions to the Datong Electronics product range is a broadband r.f. switched pre-amplifier, called the RFA.

Typical applications for the RFA include: weak signal reception of all amateur bands between 5MHz and 200MHz; long distance reception of v.h.f. f.m. broadcasts and v.h.f. TV signals; CB transceivers; private mobile v.h.f. radio transceivers; reception of marine and aeronautical bands; v.h.f. scanner receivers; and compensating for signal loss in long antenna feeders. The wide bandwidth of the unit makes it particularly suitable for use with broadband antennas.

The RFA is intended for indoor use and is very simply installed between the antenna and receiver/transceiver. Send/receive switching is automatic, using r.f. sensing and internal bypass relay. Also the unit features excellent large-signal handling (intercept point +20dBm) and is suitable for use with transceivers with a maximum transmitter power out of up to 30 watts.

Other technical parameters are: frequency range 5 to 200MHz; noise figure better than 3dB; overall gain 9dB; input and output impedance 50Ω, via standard SO239 u.h.f. connectors.

An aluminium diecast case, measuring 113 × 62 × 31mm, houses the unit. Two l.e.d.s indicate power on and transmit, and an external power supply of 10 to 14V d.c. at 40mA is required.

Costing £33.92, which includes VAT and carriage, the model RFA plus optional mains power supply unit and coaxial jumper lead are available from: *Datong Electronics Ltd., Spence Mills, Mill Lane, Bramley, Leeds LS13 3HE. Tel: (0532) 552461.*

Scientific Calculator with a Difference

Dorman Smith Instrumentation have introduced a well equipped scientific calculator capable of complex calculations and have combined it with a digital multimeter.

Called the Hioki 3208, the unit provides a versatile, pocket-sized, go-anywhere electrical or electronic tester/calculator facility, and is housed in a case measuring only 170 × 76 × 20mm. It is claimed that the internal battery will power the unit for 100 hours of continuous working.

A single function key immediately converts d.m.m. data to scientific notation on the calculator display with the d.m.m. ranges covering d.c. volts, a.c. volts, two current ranges, ohms and low power ohms for in-circuit resistance.

The 3208 is supplied complete with battery and test probes, costs £75.00 plus £3.00 p&p and is available mail order direct from: *Dorman Smith Instrumentation, Blackpool Road, Preston PR2 2DQ. Tel: (0772) 728271.*

Low-cost Digital Multimeters

Recently introduced by Armon Electronics Ltd. are two digital multimeters, called the model 6010 and model 7030. Specifications for both the instruments are the same excepting for the d.c. accuracy figure, on the model 6010 it is 0·5% and on the model 7030 0·1%.

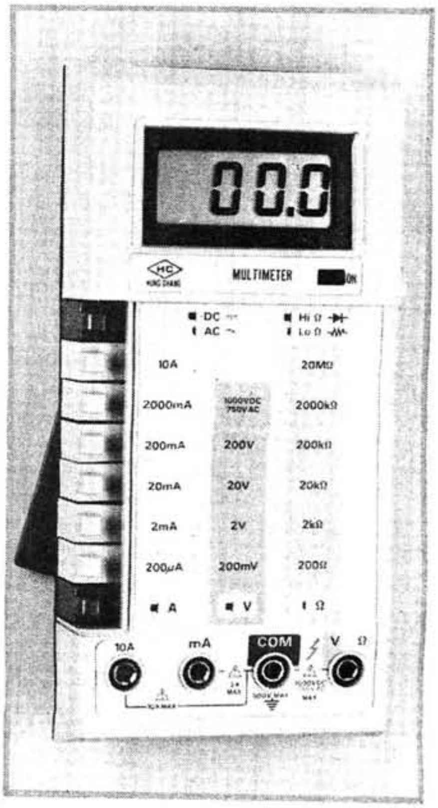
Specification for both units is as follows: a.c. volts—200mV to 750V over five ranges; d.c. volts—200mV to 1000V over six ranges; resistance—200Ω to 20MΩ over six ranges; a.c. and d.c. current—200μA to 10A over six ranges; input impedance—10MΩ and full overload protection is provided over all the ranges.

Measurements are indicated on a $3\frac{1}{2}$ digit, 13mm high l.c.d. display and the instruments are powered by a single 9V battery (alkaline) with an estimated operating life of 200 hours.

Other features include, auto polarity, auto zero, battery-low indicator, and the unit is housed in an ABS plastic case with fitted tilt stand. Test leads are supplied and the only optional accessory is a soft carrying case.

The model 6010 costs £29.95 plus VAT and the model 7030 £35.95 plus VAT, post and packing is free of charge.

Both the instruments are available from: *Armon Electronics Ltd., Cottrell House, 53–63 Wembley Hill Road, Wembley, Middlesex HA9 8BH. Tel: 01-902 4321 (3 lines).*



WORKING DX

Jeff MAYNARD G4EJA

It has been said that information is power; witness the establishment of computer-controlled data banks by Government and security agencies throughout the world. You might be forgiven for wondering what relevance this statement has to improved DX working, or to any other aspect of amateur radio. My experience of operating phone, c.w. and RTTY on the h.f. bands leads me to conclude that we can regard information as being equivalent to power (in the transmitted sense, as you will see).

My proposals outlined in this article are primarily of use to the transmitting amateur; however the amateur and broadcast bands s.w.l. might find some useful tips on log-keeping, operating procedures and so on.

The major problems in working DX, apart from finding it (but more of that later), seems to be static or other QRM and the inevitable pile-up, more often than not from multi-kilowatt Mediterranean stations. Both *can* be overcome by increasing the amount of r.f. transmitted. Easy, then, to work DX—all that is needed is a kilowatt linear amplifier and a TH6DX at 30 metres a.g.l. The main obstacles will be the XYL and the Home Office!

Apart from the enormous cost of such equipment there may be one or two objections raised on aesthetic grounds to a 30 metre high tower in the middle of the lawn; the argument that the guy ropes can be used to hang washing from is not, in my experience, acceptable. The practical solution is therefore to make the most of the equipment available.

Equipment and Station Layout

I believe that a well organised shack can contribute to success in DXing.

Before looking at the methods (essentially administrative) a word or two about equipment and layout. The equipment in use at G4EJA comprises the following:

Rigs:	Yaesu FT-101B transceiver and remote v.f.o.
	Europa B transverter 144 MHz (2m) band
	Trio 2200GX, 144–146MHz f.m. transceiver
	Atlas 210 h.f. transceiver
	Trio R-1000 general coverage h.f. receiver
Antenna Systems:	2-element triband Yagi for h.f. } Mounted on a 12m tower
	14-element Yagi for 144MHz (2m) band } Mounted on a 12m tower
	Inverted "V" for 3·8MHz (80m) band
	Dipole for 7·0MHz (40m) band
	Ground plane for 144MHz
RTTY:	Home made terminal unit (see the recent *PW* series *Introducing RTTY),* v.d.u. and printer together with a big fan (needed to cool the Atlas heat sink!)
Miscellaneous:	Xitex Morse transceiver, 150MHz digital frequency meter, s.w.r. bridges covering the h.f. and v.h.f. bands
	Low-pass filter (on the h.f. beam)
	Datong active filter
	Tape recorder
	Speech processor (G3LLL type)

I have tried to arrange this equipment for ease of use, grouping together items used together. For example, the RTTY equipment is located at one end of the operating table next to the Atlas transceiver. Similarly the kit used for phone operations is also grouped together.

The equipment is arranged into two levels. On top, at eye level, are the miscellaneous items—s.w.r. bridges, filters, antenna rotator controller and so on. Desk-level space is reserved for rigs and the station log-book. The two transceivers are arranged symmetrically about the centre of the operating area and inclined inwards. The station log-book and notepaper can then be conveniently situated in the middle (don't forget a supply of pens and scribbling paper).

Audio from all the receivers is brought to a jackfield together with input and output connections for filters, terminal units, speakers, tape recorder and so on. It is then a very simple matter to cross-connect between items. Any such connection can be made without having to delve behind the rigs or search for a particular type of connecting lead. In the same way that audio connections are standardised on PO style 3-pole jacks, so antenna connections are all of the PL-259 variety (rigs have sockets, leads have plugs and a supply of back-to-back sockets is to hand).

The shack is laid out as shown in Figs. 1 and 2, in accordance with simple ergonomics with all connectors and interfaces being standardised.

So far, we have only made the shack comfortable to operate in and have minimised the effort required to change to any desired operating configuration.

No shack can be considered complete without a 24-hour clock. Not only must the operator be aware of his own time of day, for log-keeping purposes, but he must also know the time of day at the location of the station he is attempting to work or listen for.

On the wall above my operating table is a time zone map which indicates the difference between local time and GMT for the various areas of the world. The simplest use of this valuable operating aid is to decide whether to say "good morning" or "good evening" when eventually contact is made.

More important is the relationship between the time of day and propagation. Forecasts for amateur h.f. band propagation are given in *Radio Communication* each month and—in more general terms—can be found in the RSGB publication *Amateur Radio Operating Manual.* Although these forecasts are only a guide it is usually a waste of time to call CQ in a direction for which no propagation is forecast.

Another possible timewaster is to call, say, "CQ Australia" just after tea, because most of our antipodean cousins will be tucked up in bed. Any Australian amateur station on the air at that time will probably be at the other end of a pile-up anyway.

Having selected a direction in which to point the beam, and a time of day when you and some DX are likely to be awake, you can then scan the dials. This is probably the most widely practised method but can be improved on.

Experience has shown that far more DX is on the air during a contest than on an average weekend (and weekends in general are busier than weekdays). Contest operating is almost a subject in itself and benefits from advance planning.

Incidentally, DX need not necessarily mean long distance, even though the term originally meant just that for c.w. operating. A station that is rare or in some way unusual can be classed as DX. For example, I once tried for two hours before finally working an RTTY station located on Aaland Island—OH0, off the coast of Finland.

Contests

Contests are of many types including single-operator, multi-operator, multi-band and so on, covering in the course of a year all the main modes of transmission (c.w., phone, RTTY and SSTV). Contests are held for bands right up into the microwave regions, although it is the h.f. contests that are primarily of interest for our current discussion.

A number of contests have become well established in the amateur calendar and attract a tremendous interest throughout the world—including that of DXpeditions, about which more later. These include the following:

ARRL DX Contest: held in the spring when the rest of the world work stations in North America. Very useful for the collection of US States and Counties.

RSGB Commonwealth Contest: also takes place in the spring and requires contacts with current or one-time members of the British Commonwealth.

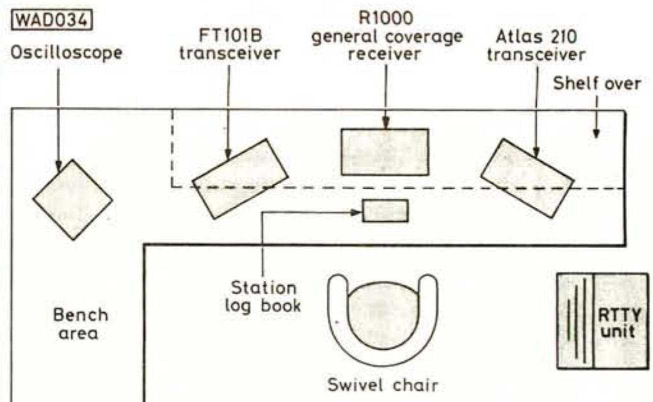


Fig. 1: Plan view of the operating area

WPX contest: run by the US Magazine *CQ* is also held in the spring and requires contacts with different prefixes.

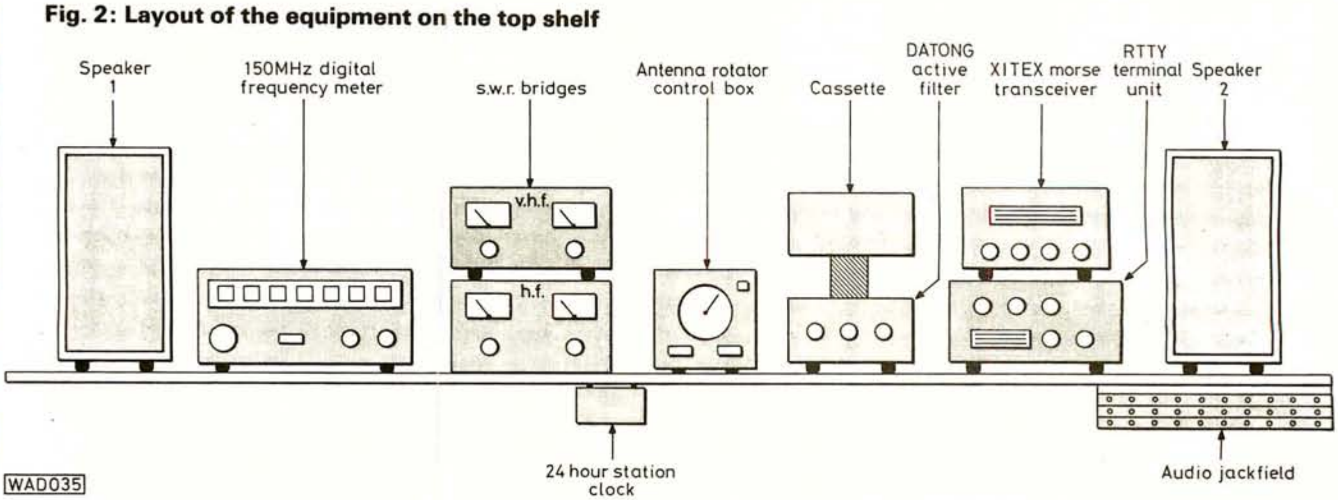
Worked All Europe (WAE): organised by the German amateur body DARC is split into three sections for phone, c.w. and RTTY. An interesting feature of WAE is the use of QTC, or information about previous contest QSOs passed to another participant, for which additional points are earned.

CQ WW DX (*CQ Magazine* World Wide DX). This contest is probably the biggest event of the year (one each for phone and c.w.) where the object is just to work as many other stations as possible.

In addition to those mentioned there are many other contests throughout the year such as the VK–ZL Oceanic Contest, the Bermuda Contest and even the International Police Association Contest! The keen DX'er will keep a diary of important contests from dates and information gleaned from *PW*, *Radio Communication* and other magazines. Incidentally, sending an entry to a contest usually guarantees advance notice from the organisers, by way of post, for that contest for a few years at least.

The foregoing brief list of contests shown gives an indication of the different objectives required. Contests can also require the exchange of different information for a valid contest QSO. The most usual contest exchange is a combined signal report and serial number. Thus in a phone contest exchanges would begin with: 59001, 59002, 59003 and so on up to, perhaps 59364. The first two digits of the exchange give respectively signal readability and signal strength with the final three digits providing the QSO serial number in the contest.

Fig. 2: Layout of the equipment on the top shelf



There are two things to notice about the contest report. First the readability and strength always seems to be "59". This is an anathema to the purists of course, particularly when comments such as the following are heard: "Your report is 59 but I don't copy your callsign or report". Nevertheless, it does save time if all reports are the same; some contest DXpeditions even print 59 as an integral part of their QSL cards! Secondly, the serial number comprises three digits, even for the first few QSOs. This can improve readability in conditions of heavy QRM.

Other information to be added to signal reports for contest exchanges can include: zone number (*CQ* or *ITU*); input power; county; age (YL's allowed 00 for this one!) There may also be restrictions on who to work or when; for example, work only non-Europeans or a specified maximum of 12 hours of continuous operating.

It is most important that the rules for a contest are studied in advance. Sending the wrong information, such as serial number when zone number is required, not only wastes your time it wastes that of a busy DX station who will not thank you for it. Having determined the date and operating detail requirements of a contest there are two approaches to entering; to win and to chase DX.

The first approach, that of entering to win, is really outside the scope of this discussion. However, the main points can be summarised as follows:

Study the rules
Ensure all your gear is fully operational
Study propagation forecasts
Plan an operating schedule band by band
Keep a duplicate log

The main benefit of contest operation to the average amateur is the availability of good DX. This is particularly true for the major contests outlined previously when many special stations are established in otherwise quiet countries. These stations are often operated by amateurs from the US whose willingness to QSL is to be admired.

On a particularly busy contest day it may be difficult to know which DX to chase simply because there is so much. This will be particularly true for a station who is perhaps running QRP and knows that it will take some time to make contact with the DX station through the inevitable pile-up. To maximise operating time it is essential to be certain that a particular station needs to be worked. Many special prefixes appear during contests and it is wasteful, for example, to sit through a pile-up trying to work a station prefixed EE3, only to realise later that this is an EA3 station. A regular contest prefix is ZZ2, who turns out to be PY2, and therefore of less interest from the DX point of view.

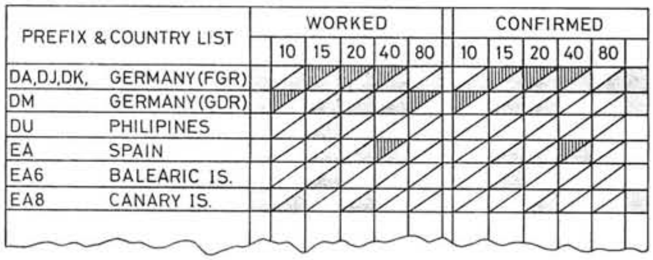
Russian stations also appear with some exotic prefixes such as 4J and EX, which usually turn out to be club stations in Moscow! So, if you are not sure about a prefix, check it. Many books include a list of callsign block allocations as issued by the ITU. The March 1982 *PW* prefix and QTH locator pull-out is also highly recommended. Take care however because these generally do not contain sufficient information. For example, you may hear OH0BB calling CQ contest; a look at the callsign allocation indicates that prefixes OF–OJ belong to Finland. Fine, an easy country that you have worked many times, so you QSY. However, OH0 indicates a station on Aaland Island which, although belonging to Finland, is classed as a separate country and would have been DX worthy.

There are many other and more obscure examples of this problem. A detailed listing of callsigns together with their status for DXCC (organised by the ARRL) is necessary. The best list I know of is that available from *DX News Sheet* publisher Geoff Watts. This lists current and special callsigns, continent, DXCC status, and zone numbers. Russian club station callsigns (those beginning UK) are listed by individual country (for example UK2G—is a club station operating from UQ2, Latvia).

It is not always enough to know the location of a prefix, particularly if your geography is a little rusty, as mine is. For example, knowing that VQ9 is Chagos Island is much more useful if you also know that it is in the Indian Ocean on a beam heading of 108°. So a map, chart, or atlas together with a Great Circle Map, to provide true beam headings, are tools with which no DX seeker's shack should be without.

The next hurdle is to decide if this particular country has been worked on this band and using this mode previously. Fortunately, there is no need to study the station log-book for the last 10 years. The system I use takes only a few seconds to provide answers to these questions.

The "*5 band DXCC Insta-Gress*", from Dick Morley WA1CFT, provides a simple yet effective record book of h.f. band country/mode/band worked and confirmed information. Fig. 3 illustrates a portion of one page of the Insta-Gress system.



WAD036

Fig. 3

Countries are listed in prefix order with cross-referencing from out-dated or duplicated prefixes. Alongside each prefix is a series of columns, one for each h.f. band in the "worked" section with the same "confirmed". Each prefix column entry is split diagonally, the upper portion representing c.w., filled in with a red pencil, the lower representing "phone", filled in with a black or blue pencil.

When a country is worked on a particular mode, the appropriate box is filled in. For example, Fig. 3 shows that the Philippines, prefix DU, has been worked on 15m phone. As QSL cards arrive the corresponding "confirmed" entry is made. Thus, referring to Fig. 3 again, East Germany, prefix DM, has been confirmed on c.w. on 10m.

The Insta-Gress is easy and quick to use and provides valuable information. Suppose that, during a contest, a pile-up is heard for a Canary Islands station, EA8ABC working phone on 20m, a look at the Insta-Gress shows that this country has been confirmed already on this band in this mode. If perhaps you heard the station say he would be on 10m later, the chart would reveal that although already worked, this had not been confirmed. Incidentally, I use the square boxes on the edges of the chart to indicate RTTY worked and confirmed. For example, Spain (EA) has been worked on RTTY but not confirmed, whilst the Canary Islands (EA8) has been both worked and confirmed.

Getting through the pile-up is the next hurdle. And it is this one for which there is very little advice. The DX station will only reply to you if he has your callsign; this does not mean you need to shout or interrupt established QSOs (both practices heard all too often). The following tips might help in making the contact:

1) Don't repeat his callsign, he knows it!
2) Count to ten before attempting to transmit your call.
3) Use only the suffix of your call (unless of course you are a GD, GJ or GU).

4) Speak clearly and confidently.

If all else fails try transmitting a few hundred hertz off frequency.

Another very helpful (and fun to use) trick is to transmit a phrase or two in the DX operator's own language, assuming it is not English of course. This technique is particularly applicable to c.w. and RTTY where there is no problem with pronunciation.

The *Radio Amateurs Conversation Guide* published by OH1BR and OH2BAD lists 147 useful amateur radio phrases in English, German, French, Spanish, Russian (Cyrillic script), Russian (phonetic) and Japanese. Optional add-ons provide less popular languages. In addition to the phrases is a 500 word dictionary covering everything from "absorption to Yagi".

I have found that during RTTY QSOs other stations, particularly Japanese, really appreciate an attempt to use their language. It is often necessary to explain that you are not able to understand a long tract of, say, Japanese in return!

All of these techniques will hopefully contribute towards achieving a DX QSO. That of course is only stage one; the contact cannot be considered complete until the relevant QSL card is received. Since most DX stations only QSL in response to an incoming card, it is necesary for the DX hunter to send his own card.

A particularly rare DX station may make several thousand QSOs over a single weekend and the resulting influx of QSL cards could be enough to give the village postman a heart attack. When operating GT4CDA/A from the Douglas Bay Hotel on the Isle of Man for 3 days in July 1979, some QSL cards were received by post before we closed down!

Faced with an enormous heap of QSL cards the DX operator, or his QSL manager, will more than appreciate neatness and accuracy. Having acted as QSL manager for GT4CDA, GT4EJA/MM and F0EDB, I am amazed at the sloppy nature of some QSL cards even from stations who have sent stamps or money for a prompt reply.

WAD037 TO RADIO W9ABC

confirming our QSO

DATE	TIME	BAND	MODE	REPORT
10 OCT. '80	1320	10M	SSB	57

Fig. 4: The essentials of a QSL card

Fig. 4 shows the *essential* details to be entered on a QSL card. It might seem obvious but a lot of radio amateurs seem unable to work out the time in GMT at their own QTH, and since date and time are essential for locating a QSO in the station log this does not help. Many foreigners including Americans express dates as MM/DD/YY rather than our DD/MM/YY. So 12/06/80 could be the 12th of June or the 6th December. To circumvent this problem write the month as a word—i.e. 12 Jun 80 or 6 Dec 80: Some operators use Roman numerals for the month—12 VI 80 or 6 XII 80. Either way it helps the QSL recipient to find the correct log page. Apart from writing neatly the only other QSL tip is to include the contest number received from the DX station where applicable. Short wave listeners should include other information on their QSL card (including the callsign of the station being worked) as an aid to the DX operator.

A bureau system can be used for the exchange of QSL cards. Members of the RSGB can send all their outgoing cards to the RSGB QSL Manager for distribution abroad and can lodge stamped addressed envelopes with the bureau sub-manager, appropriate to their callsign, for incoming cards. A QSL bureau is also operated by the International Short Wave League.

The drawback of the bureau system is the necessary processing time delay involved. I recently received a card from a UK2 station for a QSO in December 1975! Sending a QSL direct to the DX station is the only way to reduce this time delay, sometimes!

Many DX stations will quote a QSL address over the air, as a PO Box number, or as a manager's callsign. In the latter case, or where no information is given, some recourse to available literature is necessary. Two large volumes list USA and rest of the world names and addresses by callsign and are available from RSGB. A number of QSL manager publications are also published but these tend to get out of date quickly. I keep my own QSL manager update list from information gleaned from magazines, GB2RS news bulletins and heard on the air.

When writing to a DX station or his manager for a QSL make sure you provide the following information and adhere to the rules for writing QSLs already mentioned.

1) Sufficient i.r.c.s (International Reply Coupons); two or three is usually adequate.
2) A self-addressed envelope or sticky label with your address.
3) A postcard of your locality or some other item of interest.

Hopefully after all this effort you will end up with a goodly collection of DX and an equally impressive collection of QSL cards.

Operating Awards

Although nice to decorate the shack wall, QSL cards do generally serve a more practical purpose. This is to demonstrate proof of a QSO for the purpose of obtaining operating awards.

There are many different amateur radio awards available for working, or hearing, a wide range of stations. For example awards can be obtained for:

Working five Nigerian stations
Contacting 100 German large cities
Working 50 cities with international airports
Contacting 300 different prefixes
Working stations in Cheshire (details from the author!)

Some of the more impressive, by virtue of the difficulty in obtaining them or their colourful nature are described.

Worked All Continents, WAC, requires a contact (phone, c.w. or mixed) with each of the six continents, N. America, S. America, Europe, Asia, Africa and Oceania. Administration of the awards is by IARU, HQ in USA. A WAC RTTY award is also available from the *RTTY Journal* published in the USA.

DX Century Club, DXCC, requires contacts with 100 different countries, as defined in the DXCC Countries List available from the sponsors ARRL (American Radio Relay League). The DXCC costs US $5.

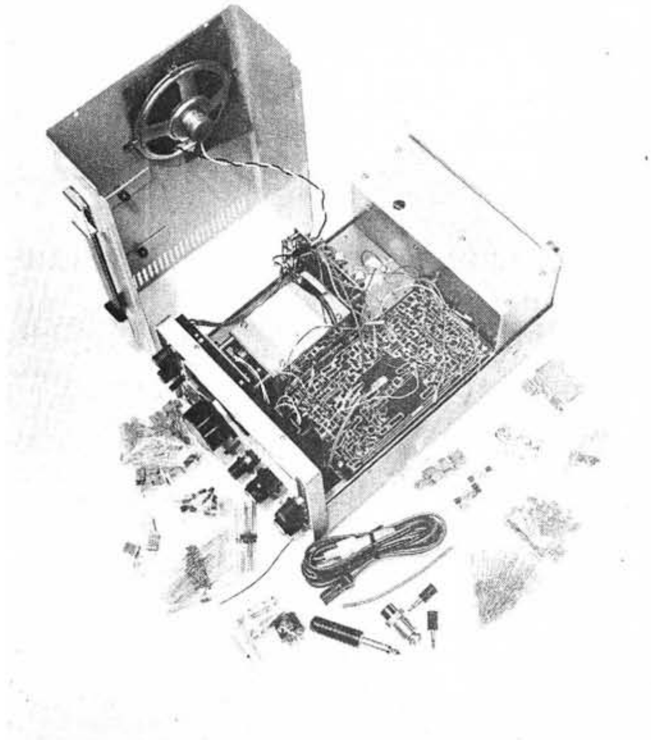
Worked All Zones, WAZ, needs a confirmed contact with each of the 40 worldwide zones as defined by the award administration, *CQ Magazine*.

The Counties Award, CA, for contacting a minimum of 500 US counties, from a total of 3079 at the time of writing. This award is given to the operator rather than the station and QSOs from any location are therefore valid. Application must be made in the special booklet available from the sponsors, *CQ Magazine*.

Award hunting can be quite interesting itself; there are many tips to be passed on and publications available to help the award hunter. But that's another story. ●

SHIMIZU SS–105S SEMI–KIT HF TRANSCEIVER

So far as I know the Shimizu SS-105S is unique, certainly in the UK, being a part-built, part-kit h.f. transceiver. For someone with a reasonable amount of constructional experience, it provides a useful insight into the system design of a multi-mode rig which, though it lacks many of the frills and gadgets which seem to cram every new "black-box" these days, nevertheless provides all the basic requirements for c.w. or s.s.b. operating, and n.b.f.m. too, if you so desire.



The kit as supplied

Circuit Description

The handbook doesn't have a circuit description, so you have to deduce it for yourself from the block diagram, circuit diagram (very difficult to read), and inter-unit wiring diagram.

In outline, the SS-105S is a single-conversion transceiver, with a 9MHz i.f. chain employing a crystal filter. Frequency generation is by a pre-mix system, using a conventional *LC* tuned v.f.o. covering 5–5·5MHz, and crystal-controlled band oscillators running at frequencies between 21·5 and 44MHz.

Transmit a.l.c. is derived from a pre-driver stage, and applied to two 9MHz i.f. and one r.f. amplifier. Receive a.g.c. is applied to three i.f. amplifiers and the r.f. amplifier (this is separate from the optional r.f. a.g.c. described later), which is a 3SK49 driving a balanced first mixer using a pair of 3SK41s.

Separate, switched low-pass filters are provided for each band. These are accessible via a coaxial link on the back panel, and are rated at 100W. The reason behind this is that there is a 100W version of the SS-105 (not available in the UK) which has its final amplifier module mounted externally, and the filters are the same for both versions. Obviously you could insert any suitable linear amplifier into this link. A multi-pole connector is also provided for remote control of a linear amplifier or transverter.

On c.w., sidetone and semi-break-in facilities are included.

Assembly

The SS-105S comes with all the mechanical assembly done, and those p.c.b.s carrying circuits likely to present difficulties in alignment already assembled and lined up. Two p.c.b.s are left for you to assemble and set up, but you need nothing more in the way of test equipment than a multimeter, an r.f. diode probe made up from components supplied as part of the kit, and an h.f. receiver.

The first p.c.b. is the SE-IF module, which carries the transmitter i.f. amplifier, balanced modulator, carrier oscillator, receiver i.f. amplifier and receiver detector. Assembly involves fitting 2 coils, 71 capacitors, 3 potentiometers, 4 trimmer capacitors, 86 resistors, 28 diodes, 13 transistors, a crystal filter and 3 crystals, and 6 i.f. transformers. This took me just $4\frac{3}{4}$ hours. No layout drawing is provided, but the p.c.b. is printed with a full component identification, and there are no problems.

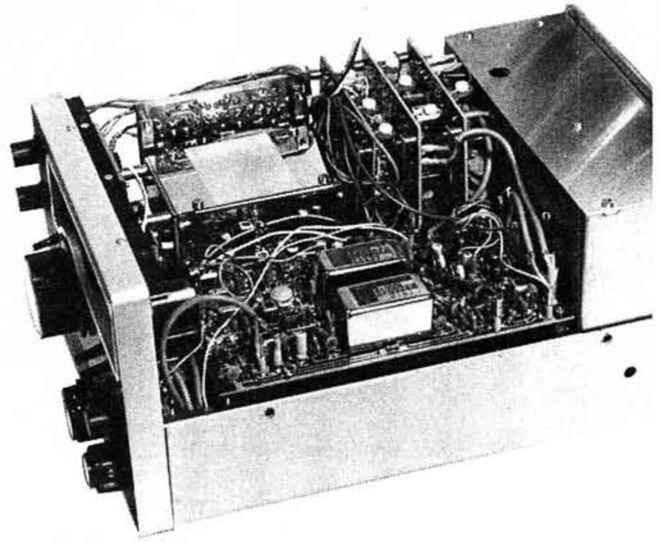
The second p.c.b. is the SE-LO module, which holds the band oscillators and pre-mixer. This board carries 62 capacitors, 9 coils, 60 resistors, 18 diodes, 17 transistors, and holders for up to 8 band crystals. Assembly of this one took slightly under 4 hours.

Fitting and wiring the two boards and going through the lining-up procedure took me around 4 hours. I think this could be reduced if the instructions were clearer, but let me explain the problem.

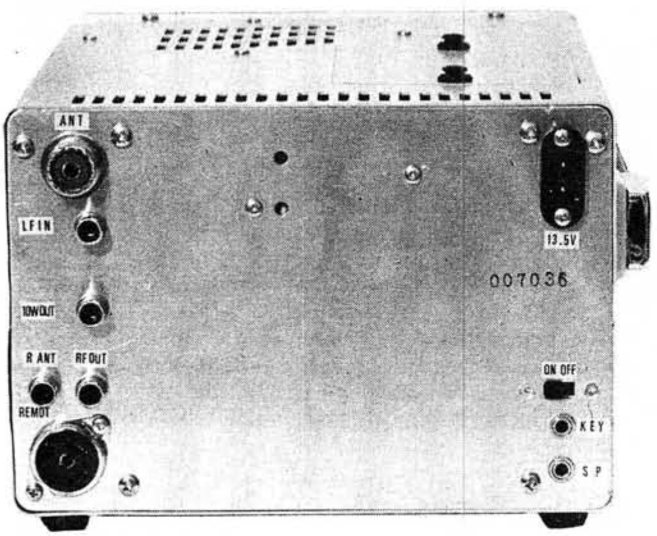
The Shimizu handbook leaves a lot to be desired. The section on assembly has a comprehensive component checklist, with identification drawings which are very helpful. The wiring instructions (everything via push-on connectors) are good too. But the alignment details are very poor, partly due to the excruciating "Japanese English". To try to overcome this, importers Lowe Electronics got G4IDI to assemble several kits for them and write up his own notes on the procedure. These are a great help, but being only notes, you still need to refer to the manufacturer's handbook too, and I found myself getting rather confused in the process. I got there in the end but it was hard work at times.

Radio SPECIAL PRODUCT REPORT

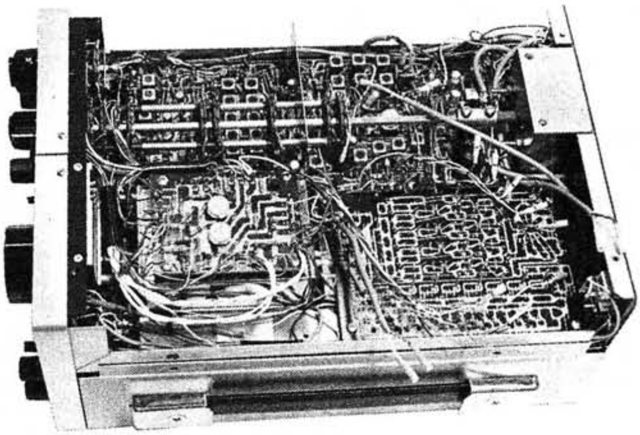
Front and back views of the transceiver



Top view of the completed SS-105S with a full complement of modules installed



Bottom view, with the SE-LO board (bottom right) still to have its components fitted



Operating Impressions

Was it worth all that hard work? My answer to that is an unqualified yes. The receiver is very sensitive, as the test figures bear out, and the transmitter's nominal 10W output has given me QSOs with a whole list of stations without too much effort.

The evening I finished lining the rig up, I put it on the air, called CQ on 21MHz s.s.b., and back came VE3QE near Toronto with a report of R5 and S7–8 and good speech quality, which can't be bad. At that time, I was using a Z-match and long wire antenna, but the following contacts were made using an HF5V trapped vertical mounted on a ground post in a far-from-ideal situation almost surrounded by trees. Prefixes in italics were c.w. stations:

3·5MHz: *DJ4,* G4 (Birmingham). **7MHz:** *G3* (Essex), *YU3, C31* (through the pile-up). **14MHz:** *UA1, PY1, I2,* HB0 (through the pile-up again). **21MHz:** *KA1,* KA3, 8P6. **28MHz:** *OK1,* G6 (Poole — real DX!). And on 29·6MHz f.m., PA0.

The p.a. stage is broad-banded, but there is a TUNE control which peaks up the receiver front-end coils and the transmitter drive as well. It's quite sharp on the higher bands, and if you don't set it carefully, you get little or no received signals and some nasty spurii and harmonics on transmit. It's simple to tune using the meter provided, but be warned.

One thing which put me off the SS-105S before I actually laid hands on one was the lack of a digital frequency readout. How we do become lazy. But in fact, the analogue dial is so good that it's not a problem in operation. The scale is calibrated in kilohertz divisions, each about 2mm wide, and the tracking between the scale and the v.f.o. is so good that there is a maximum error of 2kHz at any 25kHz crystal check-point right across each 500kHz band. The tuning and meter scales ("S" meter on receive, "Power out" or "ALC" on transmit) are both illuminated.

The tuning rate of the main knob is between 15 and 17kHz per revolution, and there is a substantial overlap at

★ specifications

Frequency coverage:	3·5–4·0MHz (80m) 7·0–7·5MHz (40m) 14·0–15·0MHz (20m)* 21·0–21·5MHz (15m) 28·0–30·0MHz (10m)*
Types of emission:	A1A (c.w.), J3E (u.s.b./l.s.b.) F3E (f.m.)*
Power output:	10W
Spurious ratio:	Less than −40dB
Image ratio:	Better than 50dB
Antenna impedance:	50Ω
Receive sensitivity:	J3E 0·25µV for 10dB S/N F3E 0·5µV for 20dB quieting
Frequency stability:	Within ±1kHz from 1 min. to 60 min. after switch on. Then within 100Hz per 30 min.
Microphone impedance:	500Ω–50kΩ
Audio output:	1·5W max. into 8Ω
Power requirements:	13·5V d.c. 3A
Dimensions:	124 × 178 × 272mm
Weight:	5kg

***See text**

★ test measurements

TRANSMITTER

Outputs in A1A (c.w.) mode:

Freq. output (MHz)	Max. output (W)	Harmonic outputs (dBc)			
		2nd	3rd	4th	5th
3·6	12·5	−64	−61	—	−61
7·1	13·1	−54	—	−68	−58
14·1	11·0	−52	−53	—	—
21·1	11·0	−59	−58	−67	−70
28·1	8·5	−69	−59	—	—
28·6	7·0	—	−58	—	—
29·1	7·5	—	−58	—	—
29·6	7·5	—	−58	—	—

Carrier suppression:	42dB relative to full power A1A or p.e.p.
Unwanted sideband suppression:	70dB, operating u.s.b. 60dB, operating l.s.b.
Two-tone intermodulation:	−28dB relative to either tone
Frequency stability:	Drift <200Hz during first hour from switch-on

NOTES

Receiver sensitivity measurements were made for a 10dB (S + N)/N ratio to correspond to the manufacturer's specification. On 14MHz J3E, an identical input level was required to achieve 12dB SINAD.

All measurements were made on the transceiver set up according to instructions given, and without further adjustment.

RECEIVER

Freq. (MHz)	Input e.m.f. (µV) for 10dB (S + N)/N		Image rejection (dB)	I.F. rejection (dB)
	A1A	J3E		
3·65	0·2	0·24	>100	>80
7·05	0·2	0·2	100	72
14·15	0·14	0·18	68	>80
21·225	0·25	0·25	84	>80
28·85	0·2	0·2	77	>80

FM sensitivity:	0·5µV e.m.f. input to produce 20dB quieting
Bandwidth:	Standard (J3E) filter: 1·75kHz (−3dB) 2·2kHz (−6dB) Narrow (A1A) filter: 500Hz (−3dB)
AGC:	Output change for 94dB input change relative to 2µV threshold: 3dB
Audio output:	Distortion 11·5% for 1·5W into 8Ω Maximum output 1·8W into 8Ω

"S" Meter calibration: (at 14·1MHz, u.s.b.)

Reading	Input	
	µV e.m.f.	dBµV
S1	1·2	+1·5
S3	1·7	+ 5
S5	2·5	+ 8
S7	3·2	+10
S9	5·0	+14
+20dB	17	+24
+40dB	120	+41
+60dB	1·3mV	+62

Test equipment used: TF2008 signal generator, TF2370 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 power meter and load.

the band edges, +115kHz and −75kHz on the review sample.

The RIT operates on a varicap diode across the v.f.o. tuned circuit, and gives a variation in received frequency of ±2 to ±2·5kHz, depending on whereabouts in the band you are.

Options

From the basic kit, you get a c.w./s.s.b. transceiver which operates on the whole of the 3·5, 7, 14 and 21MHz amateur bands, and on 28–28·5MHz, using the standard s.s.b. filter for c.w. reception as well. A 500Hz c.w. filter and band crystals for 14·5–15MHz (for WWV reception) and for the rest of the 28MHz amateur band are available as optional extras. You can also get four more modules, providing additional features as follows.

SE-NB, noise-blanker and r.f. a.g.c. unit. The noise blanker seems very effective on some types of interference but far less so on others. The r.f. a.g.c., applied to the first two stages of the receiver, comes from a separate detector driven via a buffer from the output of the first mixer. It is therefore more broad-banded than the normal a.g.c., derived from the final i.f. amplifier, and is very effective indeed at reducing cross-mod spurii from high-power broadcasters in the 7MHz band. **SE-MK** is a crystal oscillator providing a spectrum of 25kHz markers right up to 30MHz. **SE-FMT** and **SE-FMR** are f.m. modulator and demodulator modules respectively, useful either for the f.m. section of the 28–29·7MHz band, or when using transverters for 144MHz or 432MHz. A special socket is provided on the back panel of the SS-105S, giving a 100mW output to drive up-converters, and there is a switch to turn off the 10W p.a. On f.m., the receiver becomes a double superhet, with a second i.f. of 455kHz.

These four optional modules come ready built, but you do have to do some lining up.

Criticisms

Very few. The main one, as you'll have gathered, is the combined operating and assembly handbook. Really, I think that this transceiver deserves a very much better one, easier to follow in the construction and alignment section, and with at least some sort of circuit description to aid the constructor in understanding what he is doing. And that circuit diagram—Ugh! Having said all that, I should tell you that I like the SS-105S so much I've bought one, so that should be some recommendation.

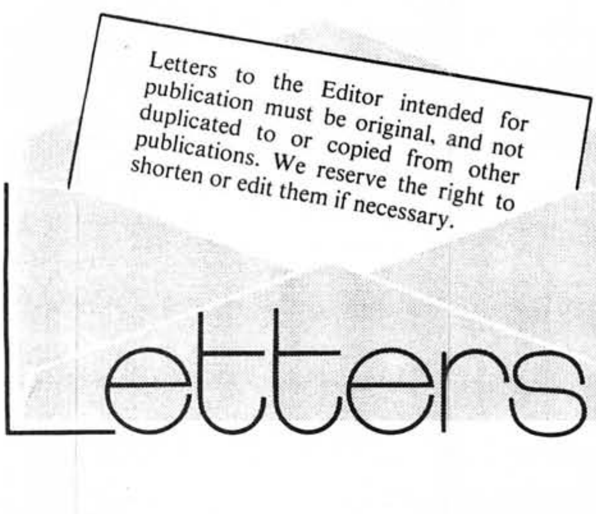
I'll be making two small modifications to mine. One will be to fit a knob with a winding handle to the main tuning. At over 29 revolutions to get from one end of the v.f.o. span to the other, life can get tedious especially on the 28MHz band. The other will be to find some way of bringing the FM SQUELCH control out to the front panel. As designed, it's a preset control accessible, along with the other main level adjustments on the FMT, FMR and AF boards, through a little door in the top of the case. Unless you're operating on an exclusive channel, or the only station you want to hear is very, very much stronger than all the rest on channel (which effectively amounts to the same thing), I've always found preset squelch controls to be an absolute pain.

Oh yes, I'll be fitting an earth terminal on the back panel. It's strange it doesn't come with one.

Prices

The SS-105S is available from **Lowe Electronics Ltd., Chesterfield Road, Matlock, Derbyshire DE4 5LE, telephone 0629 2817.** Prices including VAT are as follows (carriage in brackets): SS-105S semi-kit £275.00 (£5 Securicor); 500Hz c.w. filter £23.50 (50p p. & p.); extra band crystals £3.45 each (25p); SE-NB £11.50 (50p); SE-FMR £25.00 (£1); SE-FMT £14.00 (£1); SE-MK £15.00 (50p).

Geoff Arnold



Can You Help?

We regularly receive letters from readers seeking information, circuit diagrams, sources of spares etc. for a variety of electronic equipment, and where possible we reply directly to them. However, in some instances we are unable to help and would like to ask fellow enthusiasts if they can help. Brief details of some of the requests are listed below:

Hallicrafters Model S120 Communications Receiver, require circuit diagram or service sheet. *J. E. Ware, 40 Stone Park Avenue, Beckenham, Kent BR3 3LX.*

Blaupunkt "Arkansas" Radiogram Type No. 40320/40330, require spares or would consider buying complete set if available. *E. Watson, 20 Warden Road, Rochester, Kent. Tel: Medway 813165.*

Murphy Radio Receiver, similar to Model A92 with the following Nos. stamped on the chassis: 217360, 257926 and 16126, require circuit diagram. *M. Meenagh, 23 Herbert Street, Kihikihi, TE AMAMUTU, New Zealand.*

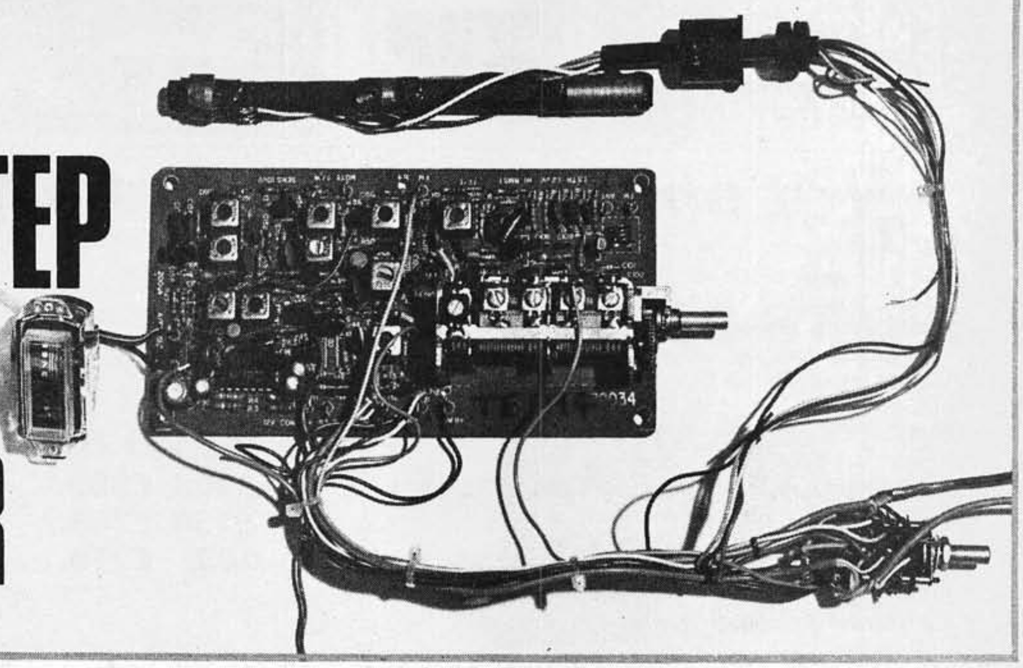
Simon S.P./2 Tape Recorder, require circuit diagram. *C. Challacombe, 8 Old Malvern Road, Powick, Worcs. WR2 4RX.*

Ekco A222 Clock Radio which has four valves and was built around 1950, require circuit diagram or service manual. *Mr Lynch, 17 Ardrossan Gardens, Worcester Park, Surrey. Tel: 01-337 8399.*

Trio R-300 Communications Receiver, require copy of instruction manual. *T. Smith, 49 Stannes Road, Denton, Manchester M34 3DY.*

special offer

TIMESTEP FM4 TUNER



This module contains a complete m.w., l.w. and v.h.f. stereo tuner suitable for use with a d.c. power supply and a stereo audio amplifier.

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1327	SP-230	Speaker to match TS-530S/830S	35.00
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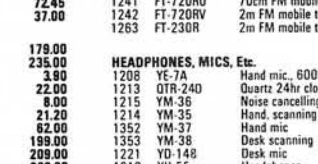

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144 MHz RING-BASE ANTENNA

PART 2 **F.C. JUDD G2BCX**

The electrical theory behind the ring-base antenna was given in Part 1, together with details for construction, on a simplified basis, for either 144MHz base station operation or for the 156MHz marine communications band when suitably tuned.

The designs presented here are for 144MHz, suitable for either mobile or base station operation, but are much more complex with regard to construction. *A lathe and bench drill will be required to turn out most of the parts.* However those constructors who have access to these tools may find that the project is not so difficult as might first appear.

There is no difference between the base station and mobile versions except for the cable connections at the base. Constructional details are given in Fig. 6 which show a PL259 plug at the base so that the antenna can be used for mobile operation and connected to a matching UHF socket fitted on a gutter mount, or directly onto the car body. Ideally, the mobile version should be roof-mounted to achieve maximum height above ground. The omni-directional properties of any v.h.f. antenna can be affected by wing, side or boot mounting.

Construction

The base section to which the PL259 plug is attached and the section for holding the base ring can be turned from brass. The radiator base section or ferrule can be made from 9·5mm diameter aluminium rod drilled through as indicated. Details for the ring base are also given in Fig. 6 and this can easily be formed into a circle by hand if done carefully. For the antenna described here the ring is made from 3mm diameter aluminium or brass rod. The assembly of the finished antenna with a PL259 base connection and set up on a gutter mount is shown in the photograph below. The inductor must, of course, be covered as will be explained later.

Details for the lower section of the base station version are also shown in Fig. 6. The base is turned from brass as is the section attached to it to hold the ring-base. The inductor and the remainder of the antenna are constructed as shown. Assembly and details for a base station mounting bracket are also shown in Fig. 6.

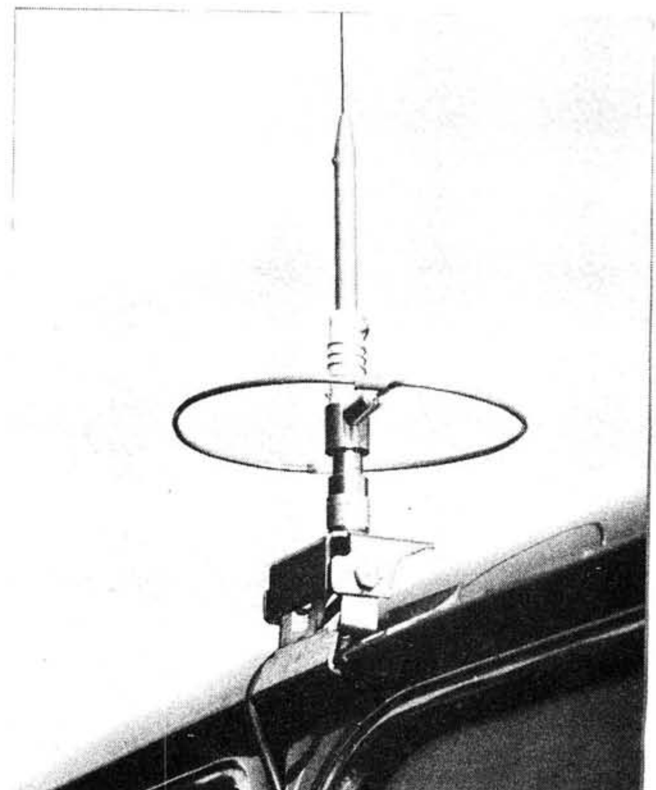
The inductor on either model must be protected against rainwater and is covered with heat-shrink sleeving with a bore diameter of 19mm. When heated, the sleeve will wrap tightly around the inductor and the lower part of the antenna ferrule, as can be seen in the photo. The length of heat shrink sleeve required is 65mm.

The alternative antenna for mobile operation has a coaxial socket built into the base section as shown in Fig. 6. This fitting is suitable for standard magmounts with an ASP type coaxial connector but which would be somewhat difficult to make. The illustration is included however, so that readers may recognize the type of fitting.

All three versions of the ring-base antenna as described will be available in kit form with finished parts for assembly of the complete antenna, and an engineering company has been appointed to supply the kits. For details, see under "Kits".

Assembly and Tuning

For either version of the ring-base antenna the inductor L consists of five turns of 16 s.w.g. tinned copper wire with the turns evenly spaced as shown in the diagram. It is



Gutter-mounted mobile version of the ring-base antenna, fitted with PL259 plug. The inductor has not yet been sleeved

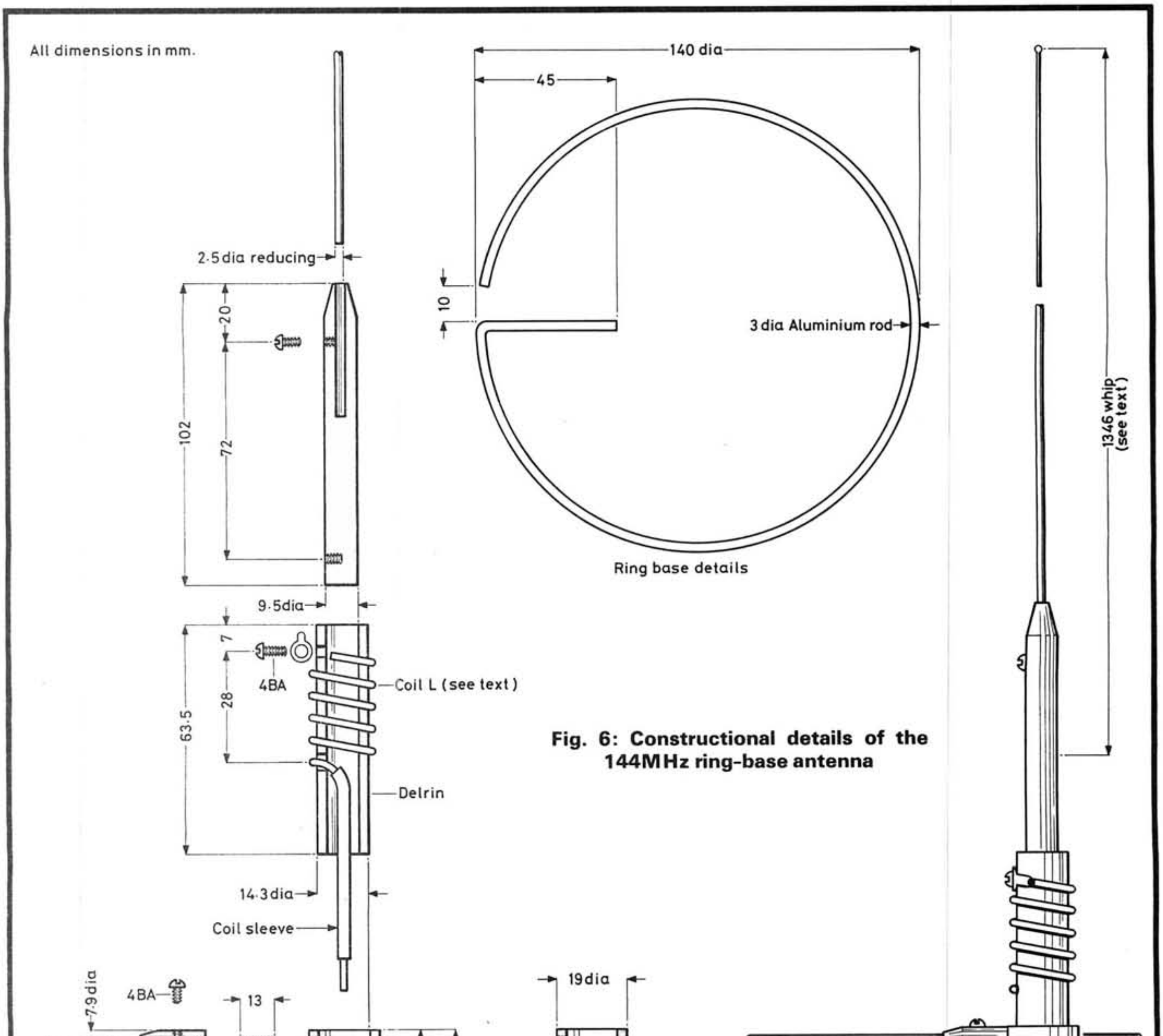
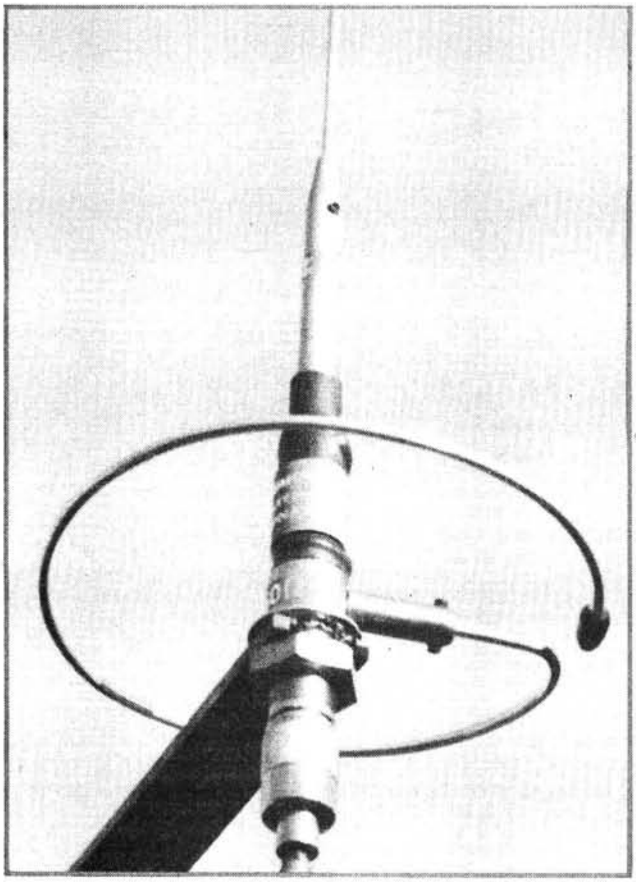
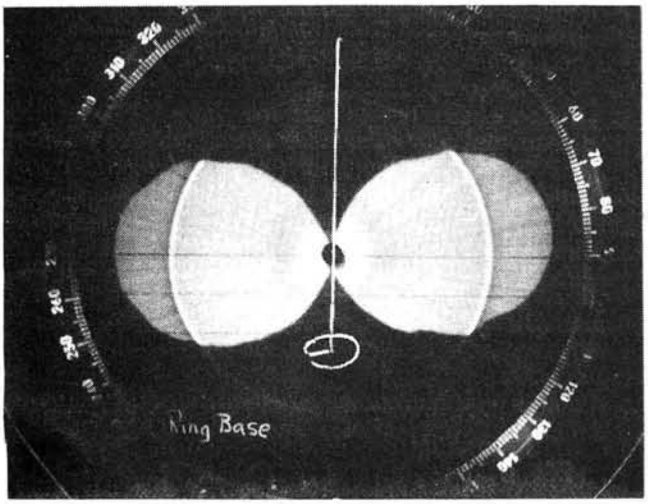


Fig. 6: Constructional details of the 144MHz ring-base antenna



The assembled base station version, showing the mounting bracket and base assembly

advisable not to put the heat shrink sleeve on until the antenna has been checked and a satisfactory v.s.w.r. obtained. The whip section should be approximately the length given (1346mm) although the whip section supplied with the kits is a little longer and will require trimming by 25mm or so depending on whether the antenna is used in a "free space" condition e.g., as a base station antenna, or on a glassfibre vehicle or boat, or on a metal-bodied car. The whip section supplied with the kit of machined parts will be in two sections which are joined with a thin, threaded sleeve supplied with the kit.



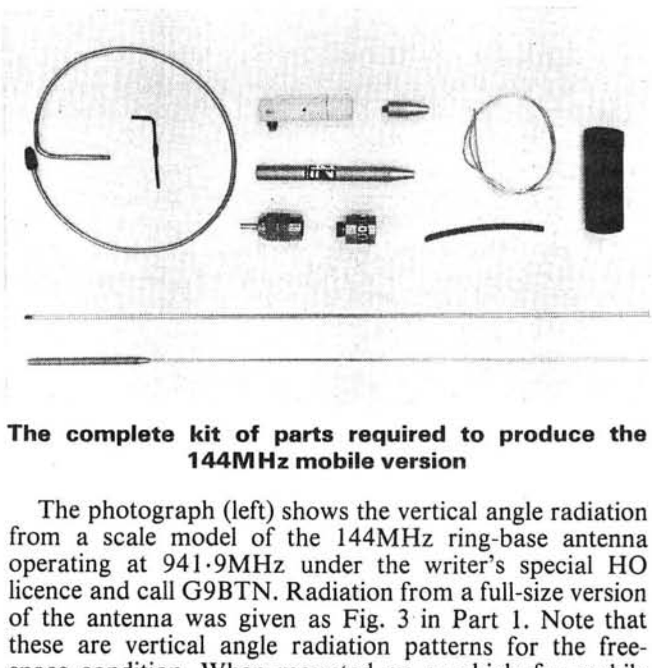
Free-space radiation plot obtained from a 941·9MHz scale model of the ring-base antenna

For v.s.w.r. checking use the centre frequency of the band i.e., 145MHz. First set the bottom end of the whip about half-way down the base ferrule and lock with the set screw. Check v.s.w.r. at band centre and it will almost certainly be fairly high. Note the reading. Now cut about 25mm off the top of the whip and check v.s.w.r. again. If this is now a much lower value then adjust by altering the length within the ferrule at the base. If further trimming of the whip section seems necessary, snip off only 10mm at a time in conjunction with adjustment at the ferrule. If the top section of the whip is accidentally reduced too much in length a new one can be supplied at very minimal cost. The v.s.w.r. curve for the antenna when tuned is shown in Fig. 4 (Part 1).

The final job is to put the heat shrink sleeve on and heat this until it closes tightly around the inductor and lower portion of the antenna as shown in the adjacent photo.

Trials

Prototypes of each version of the ring-base antenna have been tested under all kinds of conditions and in all weathers. The magmount version will remain stable at speed providing a suitable magmount with reasonable magnetic strength is used. The performance of a base station version has not been affected by snow, rain or frost during several months of use but it is advisable to put grease on metal parts, including the whip section and the mounting bracket, and also ensure that the cable connection is absolutely water tight by carefully covering with adhesive PVC tape and then giving the whole a coat of rubberised sealant.



The complete kit of parts required to produce the 144MHz mobile version

The photograph (left) shows the vertical angle radiation from a scale model of the 144MHz ring-base antenna operating at 941·9MHz under the writer's special HO licence and call G9BTN. Radiation from a full-size version of the antenna was given as Fig. 3 in Part 1. Note that these are vertical angle radiation patterns for the free-space condition. When mounted on a vehicle for mobile operation these patterns might be modified slightly depending on the position of the antenna.

Kits

Complete designer approved kits are available for each version of the antenna from **ZL Communications, Cantley, Nr. Norwich, Norfolk, NR13 3RT.**

For identification the kits are coded as follows: *Kit A* mobile, gutter mounting; *Kit B* mobile, for use with ASP type magmount; *Kit C* base station. A zinc-plated mounting bracket and mast clamp is also available for the base station version. ●

NEWS NEWS NEWS

RAE Courses

Courses to prepare students for the Radio Amateurs Examination (City and Guilds 765) will be available at the following locations:—

Canterbury—*Canterbury College of Technology, New Dover Road, Canterbury, tel: (0227) 66081*, commencing 20 September at 18.30hrs, enrolment 13 September between 08.30 and 19.00hrs. Course Tutor G3LCK.

East Devon—*Axe Valley Adult Education Area, St Clare's Centre, Fore Street, Seaton, East Devon*, commencing 7 October at 19.30hrs, enrolment 21 September. Course Tutor is G. R. Smith BSc, C.Eng., MIEE, G8AOJ and further details from D. W. Tinkler, the Warden at the Centre.

Manchester—*North Trafford College of Further Education, Talbot Road, Stretford, tel: 061-872 3731*, to be held on Monday or Thursday evenings between 18.00 and 21.00hrs, enrolment 6, 7 and 8 September. Course Tutor J. T. Beaumont T.Eng (CEI), MIElectIE, MASEE, G3NGD.

Newcastle upon Tyne—*Gosforth Adult Education Association Classes, Gosforth Secondary School, Gosforth, Newcastle upon Tyne*, to be held on Tuesday evenings between 19.00–21.00hrs. Course Tutor D. R. Loveday G3FPE. Further information from either the Principal at the school or telephone (0632) 668439.

Kettering—*Latimer School Adult Education Centre, Castle Way, Barton Seagrave, Kettering NN15 6SW, tel: (053 672) 4219*, commencing 23 September, enrolment, at the centre 6 and 7 September from 19.00 to 20.30hrs, and by post from 8 September. Course Tutor Alan Course and further details available from Ian F. Wibberley at the centre.

Nr Stamford, Lincs.—*Great Casterton Community Centre, Ryhall Road, Great Casterton, Nr Stamford, Lincs.*, commencing 23 September at 19.00hrs, enrolment at the Centre 6 September at 19.00hrs or by post addressed to the Principal. Course Tutor J. M. Tripp G3YWO.

Bracknell — *Bracknell College, Church Road, Bracknell RG12 1DJ. Tel: (0344) 20411*, commencing 21 September between 19.00 and 21.00 hrs. Course Tutor G. Redman and further details from the College.

Crawley, West Sussex—*Sarah Robinson School, Ifield, Crawley, West Sussex*, two courses commencing on either 20 or 23 September between 19.00 and 21.00hrs, enrolment for either course on 6 and 8 September between 19.00 and 21.00hrs. Further details from R. Scrivens G3LNM, tel: (0293) 22540.

Glenrothes, Fife — *Balwaerie Community School, Kirkaldy*, commencing in September, enrolment 20 September between 19.00 and 21.00 hrs. The course is two part with a Morse class on Tuesday evenings and a theory class on Thursday evenings. Further details from John Haliburton GM4AQO. Tel: (0592) 266287.

Redhill, Surrey — *Reigate and Banstead Adult Education Institute, Redstone School, Redhill, Surrey*, enrolment 7 September between 19.00 and 21.00 hrs. Further details from the Course Tutor J. H. Backus. Tel: (073 72) 40574.

Hemel Hempstead—*Dacorum College, Marlowes, Hemel Hempstead HP1 1HD*, commencing 22 September between 18.30 and 21.00hrs, enrolment 6 September. Course Tutor C. B. Burke G3VOZ. Further details from the College, tel: (0442) 63771.

Bath—*All Saints Church Hall, Weston, Bath*, commencing late September. Details from the Course Tutor, Peter Bubb G3UWJ, 58 Greenacres, Bath, tel: (0225) 27467. Alternatively, Peter Bubb runs a five day residential course at the Apsley Garden House Hotel, an elegant and charming building dating back to the times of William IV. Full details of the course are available from Peter Bubb at the address mentioned above.

Morse Course

A Morse course has been arranged at the *Beckenham Adult Education Centre, 28 Beckenham Road, Beckenham, Kent*. Comprising of 28 two hour lessons, the course will start at 19.30hrs on Tuesday 21 September. Further details from the Course Tutor, Steve Palmer, tel: 01-650 1383 or 01-560 4208.

Unfortunately, the RAE course at the centre, mentioned on page 41 of our August issue, has had to be cancelled due to the lack of available space at the centre.

Rallies and Events

Peterborough Radio and Electronics Society, G3DQW, will be holding the Peterborough Mobile Rally on Sunday 19 September in the Wirrina Sports Stadium, Bishops Road, Peterborough. Doors open between 10.30 and 17.00.

Details from: *Rally Secretary, D. T. Wilson G4KSW, 4 Conway Avenue, Peterborough. Tel: (0733) 76238.*

This year's Welsh Amateur Radio Convention will be held at the usual venue—Oakdale Community College, Blackwood, Gwent—on Sunday 26 September. Doors will be open from 10.00hrs and admission will be £1.00. Along with the usual interesting programme of lectures and films will be talk-in on S22 plus refreshments.

Further details from: *R. B. Davies GW3KYA, QTHR. Tel: (0495) 225825.*

The Telford Amateur Radio Rally and Exhibition will be held at Telford New Town Centre Malls, Telford, Shropshire on Sunday, 12 September. Opening at 11.00hrs (10.45 for the disabled, with special parking and access facilities) there will be a talk-in via GB4TRG on 144MHz (S22) and 432MHz (SU8/22), plus all the usual attractions including free parking.

Some seventy stands (including one for *Practical Wireless*) will be laid out in the air-conditioned Malls, with a selection of catering facilities available.

Further details from: *Ken G8DIR (tel: Shrewsbury 64273), Jim G8UGL (tel: Telford 584173) or Martyn G3UKV (tel: Telford 55416). All QTHR.*

Morse Stateside

If you think the UK 12 w.p.m. Morse test is difficult—spare a thought for our friends in the US. A recent exam conducted by the Seattle Office of the FCC resulted in failure by all candidates trying for the 20 w.p.m. extra class licence. The reason? To a man they corrected spelling errors they found within the text. Unfortunately the people from the FCC considered their misspelt words were perfectly valid elements of the text. The moral here is "just copy, don't think!"

As an aside all current classes of US amateur licence require knowledge of Morse, but receive only. A Class B type system is currently under consideration.

News from the RSGB

Emergency Use of Amateur Radio: The RSGB, at a Home Office meeting in April, stated that the Society believes that radio amateurs should have the freedom to act, as appropriate, in an emergency situation where risk to life is apparent. Present licensing conditions, however, do not permit the transmission of any third-party message, other than with the users specified in the UK licence. Whilst the only opportunities to practise procedures and improve user service/RAYNET liaison under practical conditions are restricted to County Shows and similar events, the Society holds the view that there is a need for greater freedom in this area, especially during events such as marathons, charity walks, orienteering, etc. The H.O. agreed to consider this matter and requested further information from the Society, which has since been sent.

Greetings Messages: The RSGB is continuing to press the H.O. to permit, once again, licensed stations to handle short greetings messages to and from non-licensed persons. Having thought about the Society's suggestion, the H.O. expressed the view that some relaxation could soon be considered, and were looking into the international implications of such messages and would advise the RSGB of their conclusions.

70MHz (4m): Although this band is not internationally allocated to the amateur service, it is available to UK amateurs, on a special basis, until further notice. The H.O. would continue to explore the possibility of Class B usage, in the context of how the potential increase in occupancy might affect the use of this portion of the spectrum by the primary users in the UK. The RSGB agreed that it was necessary to proceed cautiously.

Use of Morse by Class B Licensees: The RSGB has put the following statement to the H.O., "As amateur radio is a service of self-training, the Society wishes to explore the concept of permitting Class B licensees to use Morse code, primarily for practice purposes". The H.O. replied that it would consider the proposal prior to any further discussion.

50MHz (6m): The RSGB is continuing in discussions with the H.O. regarding the use of 50MHz for experimentation purposes. The possibility of time-sharing with broadcasters is still under review.

18 and 24MHz (17 and 12m): Under international agreement, primary status of the amateur service would not be achieved until all assignments to the fixed and mobile services have been transferred. This procedure has to be completed not later than 1 July 1989. Until the process is complete, the amateur service has no right to use these frequencies. The H.O. will continue to examine the UK position in respect of other services currently registered on these frequencies.

Novice Licence: For many years, the RSGB has been putting forward the concept of a novice licence to the H.O. Regrettably, the H.O. response has been that, although there were no objections in principle, it has been ruled out purely for administrative reasons. However, when the H.O.'s computerisation system has reached a more advanced stage, it would be possible to consider the matter further.

***PW* Comment:** Nothing exactly positive in the above, but at least the often "swept under the carpet" subjects have had a public airing.

UK DBS News

The Home Secretary has authorised the BBC to begin transmissions via the first UK "Direct Broadcast Satellite" during 1986.

The DBS will be geostationary and basic data is as follows: Longitudinal position—31° West; Angle of elevation from the UK—varies from about 28° (Lands End) to 17° (Shetland); Transmission band—11·7 to 12·1GHz (Channels 1 to 20) and 12·1 to 12·5GHz (Channels 21 to 40); Television broadcast channels allocated to the UK—4, 8, 12, 16 and 20 (two of these will be used for the BBC's services—no plans have been announced for the other channels); Type of modulation—f.m. (27MHz channel width); Polarisation—Circular (right-hand); Minimum power flux density throughout the UK— −103dB (W/m²).

Of the two channels provided, one will be a subscription channel and the other a non-encoded service entitled "Window on the World". Many television programmes on both services will be broadcast with accompanying stereo sound, and in addition to the TV services, it is hoped to provide several radio channels. The BBC would like to use some of these for digital transmission of new high-quality musical services.

Radio Rally

Aberdeen Amateur Radio Society will be holding their radio rally in the Aberdeen University buildings on Saturday 11 September. Following the rally, in the evening, a dinner will be held at the Stackis Royal Dorroch Hotel in Cults.

For further details contact: *Findlay Baxter GM3VEC, tel: (0224) 868263.*

The 1982 Girl Technician Engineer of the Year

The search is on for the 1982 Girl Technician Engineer of the Year. Sponsored by the Caroline Haslett Memorial Trust and the Institute of Electrical and Electronic Incorporated Engineers, the award has already established itself as a worthwhile and successful competition, increasingly well supported by the electrical and electronics industries.

The aim of the award is to focus attention on electrical and electronic engineering as a worthwhile professional career for women by selecting the most outstanding girl technician engineer, who will have undertaken the necessary education and training, and have proved herself capable of holding a responsible job.

Nominations for this award, with its £250 prize, are required no later than 1 October, 1982.

For further details and copies of the 1982 award nomination form, apply to: *The Secretary, IEEIE, 2 Savoy Hill, London WC2R 0BS. Tel: 01-936 3357.*

UOSAT

The July 1982 edition of *Oscar News*, the official journal of AMSAT-UK, includes a brief update on UOSAT, currently troubled by command input desensitisation.

Latest attempts to re-access and re-program the satellite have included utilising the 35dB gain, 46 metre diameter parabolic dish antenna system of K1WHS, together with 3kW of r.f. to feed into it! Yes, if my calculations are correct, that means 9·5MW e.r.p. (M = Mega).

In his progress report No. 9 (June 1982), Dr M. N. Sweeting G3YJO, the UOSAT spacecraft project leader, made reference to the current problem. He said, "it was not possible before launch to achieve as great a degree of isolation from the v.h.f./u.h.f. antenna hybrid as was desired". Notwithstanding these problems, the UOSAT project has proved without doubt, that a small team of highly specialised members, can within a very short timescale, successfully generate and manage the resources necessary to design, build and operate a small spacecraft capable of worthwhile science and engineering contribution.

Can I Help You!

Are you the secretary, organiser or general dog's body of your local radio club or any other group whose functions may interest readers of *PW*? If so, let me know and I will endeavour to publicise your rally, get-together whatever, through this column.

on the air

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.

Until the recent advent of the three new h.f. amateur bands the then existing bands were harmonically related, at least as far as the l.f. ends of the bands were concerned (on Top Band we used to start at 1750kHz!), the bands being of varying widths. This harmonic concept by the Post Office in the early days meant that harmonics of amateur transmissions fell into amateur bands and thus did not interfere with other services. We even had to submit a certificate for the quartz crystal used in the transmitter!

It also meant that frequency doublers and triplers then were fairly simple affairs. Getting on to the new 10, 18 and 24MHz bands is quite a problem if one attempts to modify modern equipment. A pity the new allocations were not on 10·5, 17·5 and 24·5MHz (3·5MHz ×3, ×5 and ×7). What I am really working up to is a realisation that the length of a long wire antenna, if chosen correctly, will enable it to be used on its harmonic frequencies, including the new bands, although it will only be correct on one band but perfectly acceptable on the others.

Taking a wire for Top Band (1·8MHz) this should be about 78m (143/f) for a half-wave but as a long wire on 28MHz where it is 16 half-waves long the length should be about 85m from:

150 (n–0·05)/f (in MHz)

due to what is known as "end effect", and where "n" is the number of half-waves on the wire.

This train of thought was initiated by a reader who, thinking of improving his antenna system by putting up a wire 52m long then proceeded to tear it down because "it wasn't any better". Hardly surprising, since the wire was resonant around 2·75MHz! Need I say that had he used an a.t.u. to resonate the wire on each band he would have had a big increase in signal strengths all round.

What our experimenting reader did not appreciate is that any wire a half-wave long on the lowest band in use has a very high impedance at the receiver end on that band and all harmonically related bands. The antenna input impedance on the average communications receiver is very low, around 50 to 70Ω, hence giving a very bad mismatch and severe reduction in signal levels.

A properly adjusted a.t.u. used with the wire would have converted the high impedance to a low value and should never be omitted in these particular circumstances. The only time an antenna wire can be connected directly to the receiver antenna terminal is when it is a quarter wave long at the frequency concerned, say 41m at 3·5MHz, or with odd multiples of a quarter wave.

While, over short distances, it is usually reckoned that the best signal will be received if both the receiving and transmitting antennas have the same polarisation, horizontal or vertical in practice, it is worth remembering that when a DX signal has been reflected two or three times by the ionosphere the original polarisation may be completely reversed by the time it reaches the receiver. Thus it is highly desirable that one is able to have the choice of polarisation by using two separate antennas, one horizontal and the other vertical, with a changeover switch in the a.t.u. or feeders. Sticking to just one antenna all the time is like tuning in the DX with one hand tied behind the back, it can be done but with difficulty!

On the Bands

From Knutsford, Cheshire, **Dave Coggins** doesn't reckon much of the bands of late although he did find 7MHz open to Asia during the evenings. He's started listening to those f.m. stations on 28MHz and was surprised at the number of Ws there. His FRG-7700 with 2-element Yagi plus 10 metre-long wire caught these on 7MHz (40m): CE3DKZ, JX7FD, UH8EAA and 9H1EU, with EA3VY of sole interest on Top Band.

In Earl Shilton, Leics, our RTTY expert **Dennis Sheppard** is now using an FTDX401 with trapped dipole as an inverted-V covering 28 to 3·5MHz. However it's s.s.b. from A92F, CX5BW, J28DL, VP8NO, Z21GN, 5N3RTF, 7Q7LW and 9J2TY on 28MHz (10m), plus D44BC, S79MC and EL5C on 21MHz (15m). Then comes 7MHz with JW5VAA, JX1CY, TG9WE, and TL8CK. The long wire, or should I say "random length wire" of **Philip Morris** in Llanmorlais, Swansea, plus his CR100 and an a.t.u. got EA8QL on 1·8MHz (160m) and on 14MHz (20m) it was TYA11 (QSL W2TK), K5YY/J8 and 5N3BH. It seemed a bit better on 21MHz with TU2JL, TL8DC, 7P8BY and VQ9CI. Philip's toll of countries on 1·8MHz is now 40 which is not bad going.

Viv Doidge of Callington, in Cornwall, also has an FRG-7700 plus a.t.u. and long wire to capture HL1AHZ, J73PP, VS5PP, YC2CMC, Z21GN, DU1NER, FM7BK and 5N8HEM not to mention 9A2KK in San Marino, not exactly DX in the usual way but not heard all that often, all on 21MHz s.s.b. The 14MHz band came up with DK9VC/DU1, XT2AW, 4S7WP, 6D5VHF (!) in Mexico City, 6Y5SG, VP9CT, VQ9CI and VP2KX, while 7MHz produced CX4PS and OA4OS. From **Brian Patchett** in Sheffield a problem. Does he get an a.t.u. for his Grundig 1400 and EC10 or buy a 144MHz receiver? Problems, problems! Personally speaking I'd junk the two sets and get a decent communications receiver. As for 144MHz, need I say more? Regarding the a.t.u., he should make one, it's not too difficult and much more rewarding. With a loft antenna Brian copied CE2MM, C6ADC, HC5ML, HH5CB (QSL K9WJU), J73CJB, KL7FI, YB2BNJ, VP5RAC, 5N8HEM and 6W8GT all on the 21MHz band with 7Q7LW in the c.w. mode. Little of interest on 14MHz except V2AO and 7X5KWW.

BRS45205 is **Jonathan Kempster** of Berkhamsted, Herts who, having finished his studies for the time being, is now concentrating on the RAE in December but still managed to get V2AO, ZL3MA and C6ANU on 14MHz, with WA7LUU/HB0 and 3A2EE on 7MHz. From Whitehaven, Cumbria, **Paul Williams** expresses disappointment with conditions as found on his Realistic DX100L and 15 metre-long antenna but logged VP2KK, J3ABA, HH2VP (QSL N4XR), 8P6OV, VP5RAC and HI8VAT on 21MHz band. Old faithful 14MHz turned up CM2VG, OJ0AM, 4S7WP, SV0AU, VP9HK, and FM7CF who wants cards through WB3AKI.

Stephen Pearson (Arundel, W. Sx) heard VP8QI who it seems was on his way home from Antarctica via the Falklands when he got caught up in the goings-on, and is now active there. The BC348J and a.t.u. fed from a wire caught VP2MDG, 6W8DB, VP9CI (QSL WA4UPJ), VQ9IB on Diego Garcia, VP5WJR, VS5DP, and VP8QI just mentioned. All that was found on 7MHz was 5H3JR. A first report from **Mike Hunter** in S. Croydon, Surrey, lists DX heard on his HAC Triple-T receiver and a short inside wire which just shows what can be done with simple gear, like JY9RV, VK2XT and 5Z4CX on 21MHz together with A92NH, CX2CS, OA4AX, lots of PYs, VK3AOS, 7X2LK, and 9X5SL who asks for QSLs via DL8DF. A log only from **C. Griffiths** in Northam, N. Devon, says he uses a CR150 with three separate long wires to log quite a lot of stuff on 21MHz such as CT2CR, TR2DX, TU2CL, VS5PP, VQ9PG, VP5JEX, VP2DMG, J73D and VP5WJR, all on s.s.b. of course. Doesn't anyone copy any c.w. DX these days?

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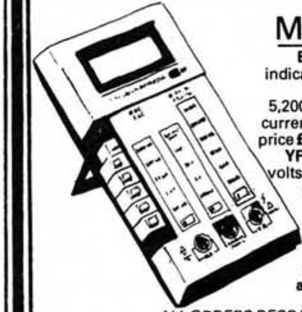

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At the time of writing to me in July, **Jim Dunnett** of Prestatyn, Clwyd, had not got the result of his RAE or a date for his code test. Expect it will all happen at the same time! The FT-101 is all set to go with the G5RV antenna. In the meantime it was logger/tea maker duties in the v.h.f./u.h.f. field day at GW4NLD/P. Ah, a c.w. log at last! Jim found quite a lot of stuff on all the h.f. bands on c.w. like 28MHz where it was A51PN (POB 166 Thimpu), BY1PK (at last) who said QSL POB6106, Beijing which is also Peking, HP1XEK, HV1CN, K5YY/J6, PZ2AA, SV0CJ/SV5 (POB 349, Rhodes), YC2BDJ, ZL1AH, ZS3TL, 3B8FK (QSL POB1080, St Louis), 9V1VB and 9Y4W. On 21MHz s.s.b. Jim caught C53CC, TU2JL, VQ9CI, YB8QD, 8R1RBF. On 14MHz it was CE0DK, CM7RM, OJ0AM, 4N6N (YU-land) and 9U5WR. Now to c.w. on that 10MHz band for FG7BG, DK8CB/HB0, XT2AW and ZL3GQ. The same mode on 7MHz found FM7AZ, JW8MY, DK3GI/HK1 and 4K1D (QSL UA1AFM) with OH6VM/OH0 on s.s.b. The 3·5MHz band found some PYs and LUs plus CN2AQ on c.w., while the only RTTY logged was IZ0USF and 5Z4RT on 14MHz.

By the time this appears in print most readers will have heard about the massive sunspot that was visible to the naked eye (through a proper filter, of course), and which wiped out all communications on the h.f. bands from around 0900 to 1400 hours on July 12th. The 144MHz v.h.f. band was open to Europe and excellent aurora were reported. Predictions had anticipated some activity but not to the extent that finally occurred.

Using a Sony ICF2001 and a long wire antenna, **Tony Pinnell** BRS50886 of Reigate, Surrey has been roving between 3·5 and 28MHz but is still not quite sure what constitutes "DX". Among what I consider DX is EA9FE and PY4LJ on 3·5MHz, then J6LB, 6Y5AG and VK6LK on 7MHz, plus J3AH, J6LB, K5YY/J8, VK9YB, VS6CT and 9L1DR on 14MHz. DX catches on 21MHz included DU6SSB, D44BC, J73PP, S79WHW, TL8CK, TU2IJ, TYA11, VP8QG, VQ9CI and 9X5SL while 28MHz saw TU2IJ, TYA11, 7P8CI and 5N3RTF. DX, as far as this column is concerned, is a mixture of rarity and distance and not distance alone. Tony seems to have done very well in this instance.

Odd Items

An appeal from **Graham Fear** of Whitegates, Bunces Lane, Burghfield Common, near Reading, for info/circuit diagram of the R1155 receiver. Stand by for the deluge OM!

A while ago **D. L. Broadley** of Frome, Somerset, was put in touch with G3DVW of Liverpool by yours truly concerning an HRO. Being in the Liverpool area recently DLB called to see G3DVW who turned out to be an old school chum, last met together some 28 years ago! Nothing too much trouble for *PW*!

Dick Benham-Holman G2DYM of DYM Aerials has asked me to mention a certain "Inverted-V trapped dipole" being sold through a distributor in Merseyside which, in fact, has loading coils but not traps and thus needs an a.t.u. to function on several bands. It seems that this is a matter of misunderstanding the original Italian manufacturer's instruction leaflet, which specifies the need for an a.t.u., rather than deliberate deception. Thought I'd mention it. It is expected that the advertiser will make matters clear in future ads.

Around the Clubs

To assist all concerned I'd like to point out that if club secretaries or PROs care to send in a fixture list for, say, a few months ahead, together with meeting place and dates, there will be no need to write in every month with bits and pieces of information. Apart from the savings in postage all round it might even persuade a few club committees to stir themselves and formulate such a list!

Wirral & District ARC Second and fourth Wednesdays at the new club venue at the Irby Cricket Club. Dates are Sept. 8 for Gordon Adams G3LEQ on Sun, Earth and Radio-Part 1, with second part on Sept. 22. Meetings at 8pm with visitors most welcome, which goes for all clubs, of course. Local club channel is S13, but more from Neil McLaren G4OAR, 596 Woodchurch Road, Oxton, Birkenhead.

Mid Ulster ARC First Sunday at the QTH of GI4BAC in Banbridge at 3pm. Because of the s.s.b. Field Day the AGM will be held on Sept. 12, says Danny Campbell GI4NKD, 109 Drumgor Park, Craigavon, Co. Armagh or (0762) 42620.

Bury RS Second Tuesdays at the Mosses Youth & Community Centre, Cecil Street, Bury. Sept. 14 has G8LIR declaiming on Radiography, and a reminder of the construction competition on October 12. Try D. Hensby G8TKD at the Centre.

Wakefield & District RS Meetings in Room 2 or 3, Holmfield House, Denby Dale Road, Wakefield at 8pm, like Tuesday Sept. 7 for a home-brew equipment evening or the 12th when G4DXA talks on Interference. Early warning of the club project night on October 5 QSO Rick Sterry G4BLT on Wakefield 255515.

Worthing & District ARC Every Tuesday, 7.30, the Amenity Centre, Pond Lane, Durrington with details of club programme, etc., from Joyce Lillywhite, 41 Brendon Road, Worthing, W. Sx. also Worthing 63062.

Abergavenny & Nevill Hall ARC Aiding the handicapped and blind at the Nevill Hall Hospital, Abergavenny, the club meets every Thursday at 7.30 at Pen-y-Fal Hospital, A'gavenny with a club net on S17 Sundays 8pm. RAE courses held starting September until May next. The club location also an official RAE exam centre. Drop a line to Dave Jones GW3SSY at 2 Dalwyn Houses, Llanover Road, Blaenavon, Gwent or buzz (0495) 791617.

Aberdeen ARS New club rooms at 35 Thistle Lane, every Friday at 7.30 with lectures, instruction in RAE and code, junk raffles and sales and so on. All I have on the secretary is Stan on A'deen 691716! Now to the **Scottish AR Convention** on Saturday Sept 11 in the Natural Philosophy Dept of A'deen University in Bedford Road, off St. Machar Drive. Trade stands, Bring and Buy, RSGB stand, and lectures culminating in a grand dinner in the evening. A portable CTV is the big raffle prize. Time 10am to 5pm with dinner at the Royal Darroch Hotel, Cults, at 7.30pm. Convention entrance a mere £1.50. More from Findlay Baxter GM3VEY, 24 Hillview Crescent, Cults, Aberdeen or (0224) 868263.

Farnborough & District RS Second and fourth Wednesdays at 7.30, Railway Enthusiasts Club, Access Road, off Hawley Lane, F'borough, near the M3 bridge. On Sept 8 a pre-AGM get-together with the construction contest on the 22nd, the lucky winner getting a cup. It's sec Ivor Ireland G4BJQ, 118 Mychett Road, near Camberley, Surrey, or F'boro 43036.

Dumfries & Galloway Radio & Electronics Club Big event September 9 to 12 is the Robert Burns World Federation visit with special event station GB4RB from St. Michaels Church Hall in Dumfries. Operation all h.f. bands plus 144MHz with special QSL. Normally meetings held first and third Mondays at 7.30 in the Cargenholm Hotel, New Abbey Road, Dumfries. GM4NNC C. Rodgers, 5 Elder Avenue, Lincluden, Dumfries is waiting to answer all your questions.

Bournemouth RS First and third Fridays at Pelhams Community Centre, Milhams Lane, Kinson, B'mouth but Arthur Bagley G4EKE, 8 Larks Rise, Ferndown, Wimborne will give you all the details. Suffice to say that a talk on Prestel is scheduled for Sept 3 although this may be too early for this issue but on the 17th SMC should be putting on a show of amateur equipment. Must tell you now of the AGM on October 1 with the club social the next evening. Note, too, a talk on October 15 on fast scan TV.

Spen Valley RS To remind you that the new venue is the Old Bank WMC, Old Bank, Mirfield, W. Yorks, with next meetings on September 16 and 30 which makes it every other Thursday at 8pm. Hon sec is Ian Jones G4MLW, 54 Milton Road, Liversedge, Heckmondwike, W. Yorks or H'wike 409739.

Acton, Brentford & Chiswick ARC Oscillators are the subject on Tuesday September 21 at 7.30 at the Chiswick Town Hall, High Road, Chiswick, London W4, delivered by G3IGM, with everybody welcome of course. More from W. Dyer G3GEH, 188 Gunnersbury Avenue, Acton, London W4.

Fareham RC Every Wednesday, 7.30, Room 12, Portchester Community Centre with G3CCB describing a tuned balun for the h.f. bands, on September 8, which

I'd dearly love to hear about! On the 22nd it's demo night with Telecomms of Portsmouth putting on a show of Trio gear. This is always a good idea, getting local retailers to show their products, and very popular. It costs the club nothing and the retailer may make a sale or two with a small percentage to the club funds! Try Brian Davey G4ITG, c/o 31 Somervell Drive, Fareham, Hants or F'ham 234904.

Edgware & District RS Second and fourth Thursdays at 8pm at 145 Orange Hill Road, Burnt Oak, Edgware, Middx, says sec Howard Drury G4HMD, 11 Batchworth Lane, Northwood. Slow Morse at meetings is supplemented by over-the-air stuff on Top Band and 144MHz by G3ASR and there is a club net on 1875kHz Mondays at 10pm.

Radio Society of Harrow Fridays at the Roxeth Room, Harrow Arts Centre, High Road, Harrow Weald, Middx, or opposite the Alma pub if that is how you navigate around! Here are bar facilities or coffee and biscuits and plenty of parking space. Sept 10 is constructional contest night with a surplus equipment sale on the 17th while practical and informal is how Sept 24 is described by Chris Friel G4AUF, 17 Clitheroe Avenue, Harrow, also 01-868 5002. Talk-in if you're lost on GB3HR on RB14.

Echelford ARS Second and last Thursdays at The Hall, St Martins Court, Kingstan Crescent, Ashford, Middx, plus a Sunday net on 1930kHz at 1000 hours. More from Anton Matthews G3VFB, 13a King Street, Twickenham, Middx or dial 01-892 2229.

Cheshunt & District ARC All "go" up there with meets every Wednesday at 8pm Church Room, Church Lane, Wormley, near Cheshunt, Herts, plus RAE course at the East Herts College at Turnford now under way (or should it be "weigh"?) plus a beginners' course in the Morse code. September 8 an open discussion with the theme "Amateur Radio—a very special hobby?" while on the 22nd G6BTQ deals with r.f. measurement techniques. Advance notice of G3YPZ on 28MHz f.m. operation on October 6 in case your *PW* is a bit late arriving. Do contact Jim Sleight G3OJI, 18 Coltsfoot Road, Ware, Herts which is also (0920) 4316.

White Rose ARS New year starts with newly-installed chairman G3KWT and future programme including goodies like G4DZU on moon-bounce, G4OAT "looking into the past" and Datong Ltd dealing with DF matters and other products, and there is to be a constructional contest to round things off. Wednesdays at 7.30, Moortown Rugby Club with clubhouse facilities also available every pm and Sunday lunch time. QSO Peter G3WSZ at the club QTH.

Thames Valley ARTS DX working is the subject to be dealt with by G3TXF and G3SXW, who was EP2IA and YA1R and therefore knows of what he speaks, on September 7 at the Thames Ditton Library, Watts Road, Giggshill, Thames Ditton, Surrey at 8pm. Otherwise it's the first Tuesday of the month. Write or ring Julian Axe G4EHN, 65 Ridgway Place, Wimbledon, London SW19, or 01-946 5669.

Salop ARS Thursdays 8pm Albert Hotel, Smithfield Road, Shrewsbury, with G6AKE Edwin Arnold, 30 Leamore Crescent, Belle Vue, Shrewsbury on S'bury 66969. Several new calls in the club following the May RAE. September events include a station at the Uffington Fete on Saturday Sept 4, talk on sporadic-E by G3USF on the 9th, computers by G6FHM on the 23rd and natter nights in between. Reminder, AGM October 14.

Horsham ARC First Thursdays, 8pm, Girl Guides HQ, Denne Road, Horsham with autumn junk sale on October 7. If you are intending to visit do take your junk along. More from Tony Wadsworth G3NPF QTHR or Nancy Hubbard G6DHH, 33 Amberley Road, Horsham, Sussex.

Sutton Coldfield RS Second and fourth Mondays at 7.30 at the Central Library, Sutton Coldfield, from Derek Turner G8TUR who can be found on 021-353 2061. September 13 will be devoted to welcoming new members and a general natter, but on the 27th it's communicating by satellites as the talk of the evening.

Stevenage & District ARS Being so efficient PRO Les Mather G8OKI is now also editor of the club newsletter! First and third Thursdays at the British Aerospace Dynamics Staff Canteen, Site B, Argyle Way, Stevenage, Herts, at 8pm but get there at 7.15 if you want to join in the code classes. RAE classes start in the autumn and there are DF hunts on the fourth Thursdays normally, meeting at Fairlands Valley Lakes car park at 7.30. Contact Len at 63 Woodhall Lane, Welwyn Garden City, Herts.

Nene Valley RC "A newly-formed club struggling for members and cash" says L. Parker, secretary, of 128 Northampton Road, Wellingborough, Northants (W'boro 79539). How can you resist that appeal, if you live anywhere in the area? So it's Wednesdays 8pm at the Royal pub in Knox Road, W'boro. Soon h.f. and v.h.f. nights begin, so new members and visitors can see what amateur radio is all about, plus a social evening and ladies' night being arranged for Sept 29. A programme to the end of the year has been compiled which includes the RSGB video show on September 22, with G3DOT holding forth on the subject of amateur radio in Norway, on October 6.

North Bristol ARC A new RAE class has now begun, with continuing c.w. classes run by G4FMH. It's every Friday at 7pm at the Self-Help Enterprise Centre, Braemar Crescent, Northville with a series of lectures now starting on the last Fridays. Ted Bidmead G4EUV, 4 Pine Grove, Northville, Bristol is your contact for more info.

Rossendale Valley ARC Meetings at the Bishop Blaize Hotel, Burnley Road, Rawtenstall, Lancs with a full programme of events being finalised, Beyond that I know nowt! However you'll be glad to know that Celia Adams G6GZM, 373 Bury Road, Rawtenstall, Rossendale, Lancs is awaiting calls from potential members and visitors on (0706) 220935. Or you can try Mrs. B. Hughes on R'dale (0706) 212306, her rank in the hierarchy being unknown! Late news! It's Wednesdays at 8pm. Celia's OM is G6GZN with both due to take the code test 'ere long. Good Luck!

Radio Club of Thanet Second and fourth Fridays at 8pm the talk on September 10 being on construction techniques and that on the 24th dealing with RTTY, followed by the AGM on October 1. Meeting spot is the Birchington Village Centre but let Ian Gane G8HLG (or is it G4 now?) of 17 Penshurst Road, Ramsgate, Kent answer your queries on (0843) 54154.

Denby Dale & District ARS News of the four-day "weekend" activity aimed at the members and their families. This was extended to a week this year, July 24 to August 1, but the news was received too late for *PW*. Hope everyone enjoyed themselves, nevertheless. Wednesdays, 8pm, the Pie Hall, Denby Dale, with September 8 on computer programming, the Sat Sept 11 event being the station demo at the Denby Dale Carnival. Following Sat/Sunday will be spent with the Newsome Scouts. Back to normal, more or less, for a junk sale on September 22. I managed to contact sec Jack Clegg G3FQH, 8 Hillside, Leak Hall Lane, Denby Dale, Huddersfield, on 3·5MHz recently and he filled me in on the significance of the Pie Hall.

Hastings Electronics & Radio Club Principal gatherings at West Hill Community Centre, Hastings but the club room at 479 Bexhill Road, St Leonards-on-Sea is open on Mondays and Fridays for computer and socialites respectively. On Tuesdays it's RAE classes at the William Parker School at 7.30. Club mag *Vital Spark* has an ad from a member offering a tunable u.f.o. for sale. That's a new twist. What will the Japs think of next? Don't forget the Churchwood School Fete on Saturday September 11 at 11am. I forgot to mention the G4ITM Morse classes also at 479 Bexhill Road on Tuesdays at 7.30pm. If there is anything else that can be told about the club I suggest you contact George North G2LL, Fontwell Avenue, Little Common, Bexhill-on-Sea, E. Sussex, also Cooden 4645.

Meirion ARS The new club venue at the Nannau Country Club, which is two miles NE of Dolgellau, has been received with general acclaim by the membership evidenced by a doubling in attendance in recent meetings. Much interest has been shown in a 432MHz (70cm) colour TV demonstration with gear constructed by GW8WNB and GW6ARL in co-operation with GW3FDZ who has received reports on his own signals from 100 miles away. Note the RSGB film show on October 2. Normally the club meets the first Thursday at the Club, Llanfachreth. More from the PRO Len

Bridges GW6COM, c/o Tremidris, Llanelltyd, near Dolgellau, Gwynedd, or (0341) 422568.

West Kent ARS QTH is the Adult Education Centre, Monson Road, Tunbridge Wells, Kent, at 8pm alternate Fridays plus Tuesday evenings at the Drill Hall, Victoria Road, with a 144MHz DF foxhunt on September 17 and an Open evening on October 1 when beginners are especially welcome. It would be a good idea to contact Brian Castle G4DYF, 6 Pinewood Avenue, Sevenoaks, Kent for details of some very interesting talks coming up in October and November. A ring on (0732) 456708 will do.

Milton Keynes & District ARS Miss L. Taylor G4FYR tells me that the club meets on the second Monday at 8pm at the Lovat Hall, Silver Street, Newport Pagnell and on the fourth Monday at the Globe, Long Street, Hanslope. However if you want more details and info on the club's activities then it is D. White G3ZPA, Rose Cottage, Shenley Brook End or buzz (0908) 501310.

Aylesbury Vale RS Monthly at Stone Village Hall, Stone, at 8pm with, on September 7, G3RZP gives the lowdown on frequency synthesisers. Must also tell you of G6AGE dealing with British Telecom on October 5. Everybody welcome with coffee and a raffle at every gathering. It is Mike Marsden G8BQH, Hunters Moon, Buckingham Road, Hardwick, Aylesbury, Bucks.

Wimbledon & District RS Following resignation of sec Ted Allen G3DRN the new incumbent is Ken Bailey G3EPU of 32 Strathern Road, Wimbledon Park, London SW19, or 01-946 1390; club meets second and last Friday at St. John Ambulance HQ, 124 Kingston Road, W'don at 8pm with tea and biscuits as an incentive to visitors. Net 144·875 f.m. 9pm Mondays.

North Wakefield RC Carr Gate Working Men's Club, 7.45, Thursdays. Don't just sit there but get along for the junk sale on September 9 with the 23rd devoted to a natternite. Neil G8WWE awaits your calls at 81 Denshaw Grove, Morley, Leeds, W. Yorks.

Now for some news of an RAE course held under the auspices of the Rugeley Evening Institute at the Aelgar Comp School, Taylors Lane, Rugeley, every Thursday at 7pm starting on September 16th. The important info is the enrolment dates, September 6, 7 and 8th between 7 and 8.30pm at the school. Non-examination candidates are very welcome because, in the past, several have gone on to take the RAE. So don't be shy! All this from instructor C. J. Terce G4DBR of 29 Armitage Lane, Brereton, Rugeley, Staffs who welcomes enquiries on the course. He is also Rugeley 2921.

That's it for this time folks.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

It was a past Editor of *Practical Wireless* who suggested, half seriously I think, that it was really the readers who write this column for me. There is a lot of truth in the assertion since it is from readers' letters that most of the stimulus comes. It seems appropriate then, in this anniversary issue of *PW*, to thank all those who have written to this column over the years and more recently, to the short wave section as well.

Loop Amplifiers

Duncan Fraser sends me the sequel to his experiences in New Zealand and the UK using a "straight" loop pre-amplifier (Fig. 2) and mentioned in this column in the July issue. A fellow member of the World DX Club made up a d.m.a. (differential matching amplifier) for Duncan, who now finds that overloading is virtually cured. "I do wonder what is the difference; while the straight one goes between loop and set, the d.m.a. goes across the loop (across the capacitor) which seems odd." This observation goes right to the heart of the way a loop functions so perhaps we'd better start from first principles.

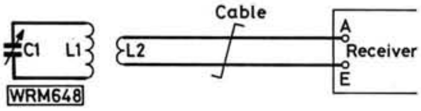


Fig. 1: Ordinary loop

Matching

A loop is really a parallel tuned circuit which can be rotated. Ignore the directional properties for a moment. When we peak a station with the loop's tuning control we adjust its tuned circuit so that it offers a high impedance to that station and a low impedance at other frequencies. The loop gives a boost to the station by developing a voltage across this high impedance and the problem now is to lead this voltage away from the loop and apply it to the receiver. If we joined a piece

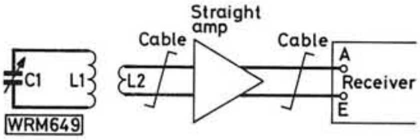


Fig. 2: Ordinary loop with amplifier

of cable across the tuned circuit we would detune it, since the self-capacitance of the cable would be in parallel with the loop's tuner. We would also shunt the high impedance of the tuned loop with the combined impedance of cable and receiver. In short we would damp and detune the loop.

To avoid these problems a single-turn coupling winding is wound on the loop. Fig. 1 shows the arrangement. The tuned circuit is formed by C1 and L1, C1 being the tuner and L1 the main winding, C2 is the coupling winding. Inductors L1 and L2 together form a step-down transformer and providing the coupling is not too tight, we can connect L2 to a cable going to the receiver, without adversely affecting the performance of the loop.

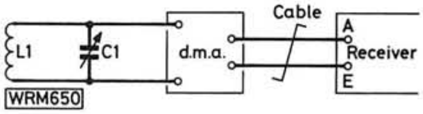


Fig. 3: Loop with d.m.a. but without coupling winding

A coupling winding is really a rather crude solution to the problem. There are bound to be losses and consequent reduction in signal strength. This is where the d.m.a. comes in. It is an amplifier with a high input and a low output impedance. Since the input impedance is high it can, if the leads are kept short, be connected directly to the main winding without loading it. The most convenient way of doing this is to tap across the tuning capacitor C1 (Fig. 3). The output from the d.m.a. is taken by cable to the receiver and the two, receiver and loop, are now isolated from each other.

As the name suggests, the d.m.a. is primarily a matching amplifier, any gain obtained being incidental. Usually this gain is kept low to avoid problems with overloading. Even if the gain of the d.m.a. is unity, i.e. zero, there will still be a boost to signal strength as a result of the elimination of the losses that occur when a coupling winding is used. All the voltage developed across the loop is applied to the d.m.a.

There is a lot more to the tuneable loop antenna than meets the eye. We have not even considered its directional properties! Newcomers to the hobby should not be deterred from constructing the ordinary loop with coupling winding. It works very well indeed and although I possess a d.m.a. it is not often that it is used. For those who are interested in experimenting or who wish to squeeze a few more drops of signal out of the loop, then the d.m.a. is a useful accessory. It is advisable though to build an ordinary loop first just to gain experience with it, before introducing any frills.

Selectivity

"I started DXing on a modern hi-fi and a cheap s.w. portable" writes 17-year-old **Antonio Gomes** from Goodwood in RSA. During the holidays he made enough money to purchase a "shining new FRG-7". There is one snag though. "My FRG-7 is rather unselective. Bandwidth is 6kHz and is wide." Antonio wonders if there is a filter available that would improve selectivity and could be inserted between the receiver and the phones or speaker.

Any filter would have to be inserted in the i.f. stages inside the set. A suitable 2·4kHz bandwidth filter is available from Yaesu distributors South Midland Communications at Totton, or a d.c.-switched module is available from Ambit International. Remember though that installing either of these means attacking the receiver with screwdriver and soldering iron, which will invalidate the guarantee on a new set. The later FRG-7700 has two degrees of selectivity that can be chosen by a switch. **Wide,** gives poor selectivity but good audio quality. **Narrow,** gives improved selectivity but poor audio. Both s.w.l. and DXer are satisfied. A receiver with fixed selectivity will probably lean towards the s.w.l. rather than the DXer and this appears to have occurred with the FRG-7.

Antonio enclosed a mouthwatering log which includes Madeira, with pop music on 1331kHz at 2225 UTC, Malawi on 540 at 2000, Canary Islands 621 at 0055, Reunion, in French on 666 at 1800 and Sao Paulo, Brazil on 1410kHz at 1550. The latter is interesting as this path is supposed to be a difficult one.

DX-160 Communications Receiver

I have just acquired a DX-160. I was really looking for a more powerful portable for the caravanette, when I came across it. Since the DX-160 will operate from a 12 volt car battery and you need an additional antenna anyway when using a portable inside a caravan owing to screening effects, it seemed a good choice.

Regular readers will remember the problems m.w. DXers have had with the DX-160. The original version was a good receiver for m.w. DXing judging from reports from readers and it could be used with a medium wave loop. Then the manufacturer replaced the medium and long wave antenna tuning inductors with a ferrite rod antenna. There were two versions. One had the ferrite rod mounted externally at the rear while the other, which is the one I have, has the rod mounted internally.

The result in each case is the same. You can no longer use a loop! If you null out a station with the loop, you will still pick it up with the ferrite rod antenna.

The rear of the DX-160 is interesting. Only the top half, which is made of hardboard, is removable. The remainder of the cabinet, including the back plate for the tuning scale, is of metal so it can only be through the hardboard panel that signal reaches the ferrite rod. The latter is 10mm in diameter and 120mm in length and is mounted on two plastics brackets fixed to the chassis immediately behind the hardboard panel. It should not be too difficult to screen the ferrite rod either by covering the hardboard panel with earthed metal foil or replacing the panel with a metal one. How well the modified receiver would perform with a loop remains to be seen. I hope to have the answer next time.

Antenna Projects

"Can you recommend any books that cover medium wave DXing?" is a question often asked by readers but one that is not easy to answer. *Media Network,* of Radio Netherlands, produce a useful pamphlet called *Medium Wave What Now,* which is available for the asking but otherwise there was until recently nothing currently in print that covered the subject. The new paperback *Aerial Projects* by R. A. Penfold, published by Babani, is a welcome arrival. Although intended for the short wave hobbyist as well, it does have sections which include constructional data on a conventional loop, an active loop and an unusual differential loop antenna. The remainder of the book applies equally to short wave listening, covering various types of outdoor antenna and antenna accessories such as a preselector, attenuator, antenna tuning unit. *Aerial Projects* (BP105) is available in the UK, price £1.95 from bookshops, or direct from Bernard Babani (publishing) Ltd., The Grampians, Shepherds Bush Road, London W6 7NF (post and packing 25p to UK and 50p to overseas addresses).

Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

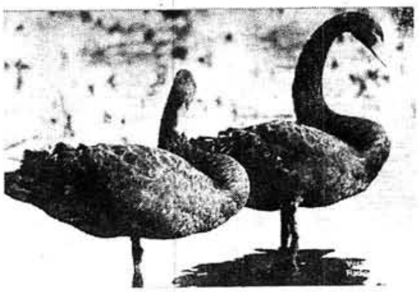
"I am a comparative newcomer to short wave listening" writes reader **L. Hollis** from Brandon in Suffolk, who goes on to say that he followed the advice given in this column some time ago which was to purchase a portable receiver with telescopic antenna in order to gain experience of short wave listening before investing in an expensive receiver. He has now graduated to an FRG-7 which he uses with the Windom antenna and antenna tuning unit described in the Aerial Data Chart presented with the November 1979 edition of *Practical Wireless.* Our reader comments on the amount of jamming on some of the bands these days, in particular on 11MHz, 15MHz and 18MHz. He wonders what, if anything, other readers of the magazine are able to do in an attempt to overcome it.

Jamming

"What if anything" is the operative phrase for it is difficult, though not impossible, to construct a movable directional antenna for those frequencies and this is really what is required. On the medium waves it is easy to null out an unwanted signal simply by rotating the receiver to make use of the directional properties of the internal antenna, if it is a portable, or by using a medium wave loop antenna. I have, on the short waves, tried the whip in a horizontal position and by pointing it in different directions have on occasion, managed to suppress an incoming signal. A rather hit-and-miss procedure but it does work sometimes.

To digress a little, it is interesting to look at some of the technical problems involved both in jamming and its avoidance. The range of the ground wave from a transmitter is inversely proportional to the frequency in use. On the medium waves it is easy to cover a distance of 100 miles with the ground wave. On the higher short wave bands this range may literally be reduced to a few miles. In order to jam a station on the h.f. bands one must either be very close to the listener and use the ground wave or else the sky wave must be employed. Both have their problems.

Ground wave jamming means large numbers of jammers close to the main areas of population. Sky wave jamming means going beyond the skip (dead) zone which at times may extend for a thousand miles around the jamming transmitter. Unless you can transmit from the same



QSL card from Australia

HCJB from Ecuador

direction as the broadcaster you are trying to interfere with, then there are serious problems. Different paths may have different propagation characteristics at any particular time and may not even be in daylight together. This means a number of jamming stations at different localities all on the air at the same time. Sometimes you can hear a jammer on its own, which probably means that the path from the jamming station to us is open, while the path from the station being jammed, is not.

A recent edition of *Media Network,* which is broadcast over Radio Netherlands on a Thursday, had a feature on the local jamming set-up which is common around cities in Eastern Europe. It described a complicated arrangement where a "listener" could order jammers over the telephone to move onto different frequencies as required. In order to assess their effectiveness, each jamming station has its own callsign which is transmitted in Morse so that it can be identified. You can often hear this Morse identifier among short wave jamming and it has occurred to me that it really would be something if you could get a QSL from one of them!

Jamming is a sad reflection on our times but it does exist and the listener has to live with and if possible try to combat it.

Fig. 1: Antenna switching

Lightning Protection

The piece I wrote about lightning protection in the March issue prompted **F. E. Wellstead** (Northampton) to ask if I could give more detailed information, including a diagram, of the antenna switching arrangement at my QTH.

The set-up (Fig. 1) is centred on an antenna switch model CX3 which was obtained from Progressive Radio in Liverpool. The input/outputs at the switch consist of sockets type SO239 and a set of plugs PL259 are required for the connecting cables. The lightning arrestor type LA15, which has a PL259 plug at one end and an SO239 at the other, is inserted into the "input" of the switch as shown. The antenna lead is plugged into the opposite end of LA15. If the antenna lead is a single wire then it can be terminated on a large-size wander plug (4mm pin) which is plugged into the socket end of LA15. Otherwise a PL259 is required.

The leads from outputs 1 and 2 must have a PL259 at one end and whatever terminal is required at the other end to match the antenna socket of the receiver. The lead from output 3 goes to earth as does the terminal attached to the body of LA15. The spark gap inside LA15 protects the receiver when the antenna is in use. When the antenna is not in use, the switch is placed in position 3 which earths the antenna and also isolates it from the receiver.

This arrangement is suitable for use with a random wire, an inverted "L" or any other antenna that has a single wire or coaxial downlead. It is unsuitable for use with an antenna having a twin feeder, which would be connected to the dipole sockets (A1, A2) of the receiver.

Switch CX3, according to its markings, is intended to switch a receiver to any one of three antennas. When used this way, the cable from the receiver would plug into the single socket currently occupied by LA15 while the antenna leads would go to the top sockets (Fig. 1), preferably via an LA15 in each case.

QSLs

"Enclosed are two QSLs I received recently from Taiwan" writes **Alex Stewart** from Carstairs Junction. His receiver is a Satellit 1400 with telescopic rod antenna. "Due to the present QTH an outside antenna is not possible, but as you say the modern portable is a marvellous piece of technology, so the telescopic rod works just fine."

"I am a keen collector of QSLs and treasure them greatly" says **R. N. Carrick** (Barrow-in-Furness) who has trusted me with two of his recent acquisitions. One is from Australia and the other from HCJB, the Voice of the Andes in Ecuador. **Vic Dye** (Carshalton) encloses a QSL just received from Radio New Zealand. This station is still on the air relaying domestic programmes for the time being at any rate. Vic quotes the Pacific Service frequencies which at the moment are 11·96MHz from 1800 to 2105, 17·705MHz from 2115 to 0815 and 15·485MHz from 0825 to 1215 and again from 1800 to 2100. These may change during the autumn but are the only ones available at the moment.

Two beautiful cards from Taiwan

Portable Receivers

Recently retired reader **William Savage** of Warrington writes to say that since he bought his Triumph four-band SRR-3000 portable early this year he has identified approximately 130 stations located in 46 different countries. In an effort to hear a few more, he is using a set-top TV antenna joined to the end of the vertical radio antenna. The quest for even more DX led him to think of installing a loft antenna but he wonders now, from what I have written on the subject recently, whether such a course is desirable.

A total of 46 countries is not bad for a portable with whip antenna and illustrates the point I have been making, that the modern portable receiver is a self-contained unit capable of providing worldwide reception. It will not harm a portable to connect a long wire to it, so one can experiment in safety but you have to proceed warily. As well as picking up weaker stations you may also pick up a lot of electrical interference. If you tune across a busy band such as 6MHz, the stronger stations will overload the receiver giving rise to unpleasant results. On the other hand if you tune across a quiet band, say 15MHz just after dark, and if you live in an electrically quiet locality, then the extra antenna may be useful. It is a question of suck it and see. Readers who are unable or unwilling to put up an antenna should not be deterred from taking up short wave listening though. The modern portable with its telescopic antenna will not disappoint you.

The latest one from New Zealand

Listeners' Letters

"The National Service of Radio Uganda can be heard between 1830 and 2100 on 5·026MHz—a transmitter on this frequency was destroyed in Spring 1981 and seems to have been replaced/repaired" writes **Peter Walker** from Kenton in Middlesex. Reader **Paul Hardy** is on the lookout for a Sony ICF-5900W portable receiver, a model no longer made. Anyone who has one for disposal should write to Paul at 43 Sheridan Avenue, Caversham, Reading, Berks, RG4 7QB.

VHF Bands

by Ron Ham BRS15744

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

When *Practical Wireless* was born in 1932 much of the radio frequency spectrum above 30MHz was unexplored, but now, fifty years later, I have the pleasure of writing about readers who take advantage of such natural disturbances as aurora, sporadic-E and tropospheric scatter for DX QSOs and freely communicate on frequency bands from 28MHz to 10GHz.

Solar

After **Cmdr Henry Hatfield,** Sevenoaks, **Reg Taylor,** Shillington, and I had recorded a few small bursts of solar radio noise, around the 144MHz (2m) band, on June 20 and a noise storm on the 22nd and 23rd the sun remained quiet until July 8, when we recorded a few strong bursts (Fig. 1). During the morning Henry looked at the sun with his spectrohelioscope and saw plages and sprays of gas high on the east limb. At 0835 on the 9th, I heard a massive, 4-minute duration burst at 28 and 50MHz and although the sun, at that time, was well outside the beamwidth of my radio telescope, the burst was recorded by this instrument at 143MHz. Although more individual bursts, similar to Fig. 1, were recorded on the 10th, 11th, 13th and 17th, the big event was the severe noise storm on the 12th which was also heard on 144MHz by **Phil Hodson** G8RBY, Leicester and **George Grzebieniak** G6GGE, London, who said: "The noise was so strong I heard it on the back of my beam". **Ted Waring,** Bristol, observed 48 sunspots on June 25, 6 on the 29th, 4 on July 3, 9 on the 7th and 54 on the 11th, so with all the large amount of solar activity around July 12, I was not surprised when the auroral alert was sounded by members of Phil Hodson's network. A sudden ionospheric disturbance (s.i.d.) upsetting the h.f. bands was reported by **Norman Fitch** G3FPK, Purley on the 12th and an h.f. blackout noted by **Ian Kelly,** Reading, on the 13th.

Aurora

Jim Penny GM4JLY, Aberdeen, worked stations in Germany and Scandinavia on 144MHz (2m) c.w. during an auroral event between 1715 and 1835 on July 11 and suggests that "G" stations should take a look for contacts on the 432MHz band when aurora is present. **Ray Lowes** G4NJW, worked a station in Denmark via aurora around 1900 on the 12th and George Grzebieniak heard tone-A signals from G4DEE and GM6CFN. Also on the 12th, **John Heys** made auroral c.w. contacts with 4 stations in Sweden and 1 in Norway. According to various reports, a major auroral disturbance began around 1800 on July 13, ebbed and flowed with several peaks and waned about 0400 on the 14th. At 1902, **John Cooper** G8NGO, Cowfold, Sussex, worked into Germany and Scotland on 144MHz (2m) s.s.b. and between 0014 and 0300 had contacts in Austria and Sweden, but his real prize came at 0102 when he worked F1CCC, 100km east of Moulins. "A long way south for an auroral QSO", said a delighted John. "Pandemonium" said **Alan Baker** G4GNX, Newhaven, at 0140 while sorting out the auroral c.w. and s.s.b. stations active on 144MHz. This event disturbed a wide range of frequencies, at 1853 I counted 25 signals with auroral burble from broadcast stations between 40 and 73MHz. At 0109 I heard the ghostly auroral whisper from G8RAF in Locking on 144MHz s.s.b. and 55A signals from the 28MHz beacons in Germany DF0AAB and DL0IGI, Norway LA5TEN, UK GB3SX and many tone-A twitters in Band II.

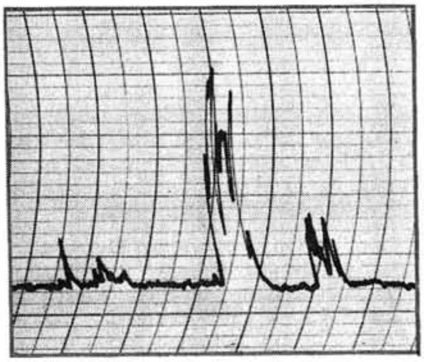


Fig. 1: Solar burst recorded by the author on July 8

The 28MHz Band

"The bands are rather dead lately" writes **Frank Whitfield** BRS 47262, Widnes, on June 30, who concentrates his efforts on the 21 and 28MHz bands and like me, **Harold Brodribb,** St Leonards-on-Sea, heard mainly European stations on 28MHz between June 18 and July 18. During this period **George Coulter,** Dover, heard 9J2NO and 9J2TJ on c.w. and Z21AE on s.s.b. and around midday on July 11 **Gerry Brownlow** G3WMU/P

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at Amberley, Sussex, heard a PY but could not raise him. **Mike Steventon** G4GWH, using a TS120V, linear amplifier and rotatable 28MHz dipole, worked stations in VU and YV from his home in Bognor Regis, first with 100W to establish the QSO and then with only 10W to prove the feasibility of low power on 28MHz. **Susan Beech** RS50969, Dollar, Scotland, is a keen listener on the h.f. bands and has just reached the grand total of 100 countries heard on 14, 21 and 28MHz. Susan is taking the RAE in December and we wish her the best of luck.

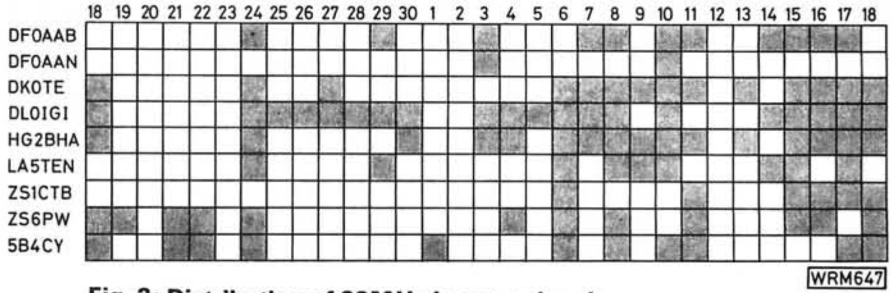


Fig. 2: Distribution of 28MHz beacon signals

28MHz Beacons

Having read Richard Brownlow's report of the "4VHTIAIET" beacon signal in our August issue, **Ian Traynor,** York, using an FRG-7, long wire antenna and a.t.u., phoned me to say that he also heard this signal at 1042 on July 3. There seems to be some doubt about the validity of this callsign because I received letters from **Ted Cawkwell** G8VEL, Aylesbury, **John Coulter,** Winchester, **Mike Matthews,** G3JFF, Portsmouth, **Dave Newman** G4GLT, Leicester, **Tony Usher** G4HZW, Knutsford and Ted Waring all suggesting that this signal was in fact the "space" transmission and not the "mark" of the Cyprus beacon 5B4CY. "He will kick himself as I did when he finds out that this wonderful callsign is the 'spaces' to the f.s.k. mode of 5B4CY. If he tunes to DL0IGI on 28·205MHz he will find not only DL0IGI but the callsign 'FUEEEEKEAA' as I did in 1980," writes Dave Newman. Thanks for your letters lads, I was with Richard when he heard it and I fell into the "space" trap myself, hi, but on the other hand it could have been a signal from one of these beacons which appear for a short time, so I feel that any unusual callsigns are always worth reporting. Early in July, George Coulter heard signals from the beacons in Gough Island ZD9GI and Mauritius 3B8MS, Ted Waring heard DF0THD repeating in a beacon-like mode on June 24 and Dave Newman heard OA4CK at 2012 on July 10, a new beacon from Argentina LU4FM 28·232MHz, at 1355 on July 11 and also VK5WI at 0723. The beacon signals listed in Fig. 2 are mainly due to sporadic-E and compiled from the observations of John Coulter, Dave Newman, Henry Hatfield, Ted Waring, Susan Beech and myself.

The 50MHz (6m) Band

I am told that readers wishing to test a 50MHz converter should look out for the UK beacon in Anglesey GB3SIX on 50·020MHz operational between 0100 and 0830GMT daily. Dave Newman logged the French Guiana beacon FY7THF 50·038MHz, via sporadic-E between 2100 and 2125 on June 17, 1724 and 1822 on the 18th and again during the evenings of July 6, 7 and 9.

During the latter opening, the Gibraltar beacon ZB2VHF 50·035MHz was often heard and the Cyprus beacon 5B4CY 50·501MHz, was logged at 599 around 2215. "The most frustrating part of the opening to FY7 is that 28MHz is invariably closed to south America and the Caribbean thus preventing cross-band operators alerting 50MHz operators to the good conditions" writes Dave. Another strong argument for the UK amateurs to get the 50MHz band. "The Gibraltar beacon was heard in the UK for several hours almost daily throughout June and early July", says Dave who periodically logged 5B4CY at good strength during the same period.

RTTY

Although the h.f. bands were below normal between June 18 and July 18, I managed to log 50 stations in 16 countries, AM, CN, DF, EA, F, G, HB9, I, LA, LX, OE, OH, OZ, SM, SV and W on 14MHz RTTY. At 1907 on June 24, I copied a strong signal from ED5RCB, "Radio Club Burjassot" in Valencia. Phil Hodson is looking for 144MHz RTTY skeds with stations in EI, GI, the Shetlands and QRA squares AK, XK, XM, XN, YJ, YO and YP. Readers interested can contact Phil on 0664-67118. By June 22, Phil had worked 8 countries and 23 QTH locator squares and earlier in the year he received the BARTG No. 1 VHF/UHF Century Award for making more than 100 RTTY contacts on 144MHz. Our congratulations to Phil and also to **Paul Melton** G6AEA, **Gareth Abel** G6EJG and **Shaun Kinton,** who under the Melton Mowbray Amateur Radio Society's call, G4FOX, won the BARTG Spring VHF RTTY Contest for the second year running. Well done lads, what about the hat-trick?, hi.

Microwaves

Both **Ron Allen** G2DSP and **Terry Allen** G4ETU operating their respective 10GHz gear during the contest on June 20 worked the Vectis Wireless Group G3IW on the Isle of Wight, G8MCQ Dorset, G8GKV Sussex and 5 and 9 contacts both ways with F1BHL, F6DCK and F8WN. "Conditions were really good because we could receive signals from the Alderney beacon GB3ALD on open wave-guide" said Ron who has now built a small 10GHz beacon transmitter comprising a Gunn oscillator, horn antenna and a pulsing tone unit which he intends to leave running, repeating his own callsign, beamed towards France during contests. Ron's 10GHz home-brew transceiver has a 760mm dish antenna with a beamwidth of about 3 degrees, a Gunn oscillator in both transmitter and receiver, a 100MHz i.f. strip all beautifully mounted on a tripod and powered by a 12 volt battery. During the third RSGB Cumulative Microwave Contest on July 11, Ron and Terry were portable again on Trundle Hill the old WWII Radar site near Chichester, and individually worked G3IW, G3JHM, G8GKV, F6DCK and F8WN both 18km south of Le Havre and F1BQ in Le Havre. The current joint project between Ron and Terry is equipment for 24GHz.

Sporadic-E

During the more intense sporadic-E disturbances on June 24 and July 3, 7, 8, 10, 11 and 15, I logged a daily average of 33 very strong f.m. signals from east-European broadcast stations between 66 and 73MHz with a peak of 44 stations at 2215 on July 10. Harold Brodribb counted 8 such signals on June 18, 20 on July 8 and 26 on the 10th. Throughout most of these events a variety of continental radiotelephone stations were received between 40 and 46MHz. During a short burst of sporadic on July 7, John Heys G3BDQ, Hastings, worked UB5EDT on 144MHz s.s.b., giving John his best v.h.f. DX at 2414km.

Tropospheric

The atmospheric pressure, measured at my QTH, was mainly below 30·0in. (1015mb) from June 19 until the 30th, when it rose to 30·2 (1022) and fell back again at midday on July 2. A sharp rise to 30·1 (1019) took place on July 4 and pressure varied slightly around this level until 0600 on the 13th, when it fell to 29·9 (1012) and did not return to 30·1 until 1400 on the 16th.

During VHF NFD on July 3/4, George Grzebieniak used his 10W 432MHz gear and 17-element Yagi, some 16km south of Aldershot and worked 81 stations with F1KCP at 375km being best DX. On 1296MHz G6AWM/P, running 1·3W into a 23-element Yagi made 38 QSOs with a best DX of 230km.

On July 4, John Cooper worked GD3KMI; on the 7th DL9MCC near the Austrian border; on the 8th 4U1ITU, HB9, I and OE; and at 2154 on the 12th he worked GM4LBE via tropo during the aurora. Conditions were very good on the 8th because **Elaine Howard** G4LFM had a simplex QSO with G4BCO in Hastings from her car in Bournemouth. On June 6, G6GGE heard EI6AIB and EI8AQB/P; on the 7th GI4GVS, PE, F and DL; on the 8th two GMs; on the 11th 3GUs, and on the 12th worked into Scandinavia for the first time through a pile-up as well as a QSO with GM4LBE in Shetland. Between 1900 and midnight on the 12th, both Phil Hodson and **Julie Rose** G8MKD, Warley, worked into Germany, Scandinavia and Shetland on 144MHz s.s.b. Julie was running 10W and Phil 50W. Around the same time Jim Penny worked stations in LA and OZ. "Tropo conditions favoured a southerly direction, particularly G, on the 13th", writes Jim, who heard and had QSOs through the 144MHz repeaters GB3CE, GY, LE and NM, as well as with many G stations. Jim will have to keep a look out for **Mike Tatham** G3RSY, Fontwell, who operates on 144MHz with a FT-208 from his Reliant Robin car.

Band II

"Using my Grundig Melody Boy, I received signals via sporadic-E in Band II between 2000 and 2015 on June 24, around 1030 on July 3 and 1900 on the 7th", writes **David Hackwell,** Warrington. He counted more than 18 Italian and Spanish stations between 100 and 108MHz on the 7th, as did George Grzebieniak on the 7th and 8th. On July 8, Harold Brodribb heard 22 French stations via tropo in Band II, and at 0700 on the 9th, Ian Kelly received many editions of *Inter* and *Musique and Cultur* from Bologne, Caen, Lille and Rouen and two editions of *Frequence Nord* from Bologne and Lille. At 2200 on July 12, Ian received signals from Hilversum 1 and early on the 13th he heard BBC Radios Bristol, Derby and Northampton.

During the morning of June 20, **Simon Hamer,** Presteigne, also heard the French stations and BRT II from Egem. During the evening of July 6 he received test-tones and announcements from Radio Wyvern in Hereford, the usual French stations and BBC Radios Cambridge, London, Northampton, Solent and Stoke-on-Trent and programmes from stations in Austria, Sweden and Yugoslavia on the 7th.

For most of July 16, while the pressure was rising, I received strong signals from France between 96 and 100MHz, using the radio section of my Plustron TVR5D while mobile in east-Sussex.

During the sporadic-E on June 23rd, George Grzebieniak found the best spots for Italian and Spanish stations are between 87 and 88MHz and 98 and 106MHz. Fourteen-year-old **Alan Beech,** Dollar, received local radio stations in Northern Ireland and Northern England during the good conditions between July 7 and 15.

Special Items

Newly licensed **Albert Vickers** G6IAR, Crawley, uses a FT-480R on 144MHz and has a TS-130S ready for operation on the h.f. bands when he passes the Morse test. As a member of AMSAT UK, Albert uses the TS-130 for listening to OSCAR 8 and the RS satellites on 28MHz and in due course intends to become active in the field of ATV. DXers in the Crawley area wishing to talk to Albert about DXTV or ATV should ring 0293 515 711.

Two members of the Veteran Car Club, **Derek Crossmark** from Hurstpierpoint and **John Tanner** G8AEV from Andover were among the drivers on the veteran car run on July 4. At home, Derek uses a Trio R-1000 and a long wire antenna for 21 and 28MHz and a Bearcat 220FM scanner receiver and dipole for the v.h.f. bands. John, former editor of *CQ-TV,* uses home-brew gear for ATV and a TS 770, and enjoys operating mobile on 144MHz from his 1900 Daimler with "Hot wire ignition" ("no electrics to cause interference" said John), and a big 1904 Berliet.

Also on July 4, members of the Chichester Amateur Radio Society installed 6 radio check-points operating in the 144MHz band to control a sponsored walk on the South Downs and Terry Allen G4ETU, completed the 25km walk, with a hand-held as the back marker.

About 100 people, including representatives from the Horndean, Marconi, Southdown and Worthing Amateur Radio Societies and *Practical Wireless,* attended the Chichester annual mobile rally, on July 5, organised by the Chichester Amateur Radio Society and held near the main grandstand on Goodwood racecourse.

Fig. 3: Commemorative QSL Card

The talk-in station G3ISO/P using a FT290R to a home-brew colinear some 9m a.g.l. made 28 QSOs, including GU6JVM and the talk-in station of the South Down ARS who were holding their annual barbecue at Eastbourne. The majority of visitors sampled the burgers, hot dogs and rolls, cooked by **Charles Nightingale** G3IDX and the ever popular raffle and bring and buy sale.

On July 9 and 10, members of the club laid on an impressive amateur radio exhibition in the 13th-century Priory at Chichester as their contribution to the town's annual festival. Using the callsign GB2CHI (Fig. 3) they had a FT-221R and 10-element Yagi on 144MHz, a FTDX401 and Tribander on the h.f. bands in addition to ATV equipment on 432MHz with a 48-element Multibeam. Club treasurer **John Francis** G8ZTD demonstrated computer log-keeping with his Commodore 4032 and **Tink Shaw** G3NW, exhibited club projects such as a band-edge marker for 144MHz, Morse practice oscillator, wavemeter and c.w. mini-computer which replays your own fist at a variety of speeds.

Among the other exhibits was the microwave gear of G2DSP, RTTY equipment by the club President, **Mike Rowe** G8JVE, a collection of badges and certificates of the late G2NM and a 1920s crystal set with a 2-valve amplifier.

Radio enthusiasts visiting the astronomical exhibition at Herstmonceux Castle, in Sussex, should be sure to see the photographs of the 75m dish at Jodrell Bank, still the world's largest steerable antenna, and of the "Y" configuration of 27 dishes in New Mexico. These are adjustable along some 40km of railway track to get fine detail when the instrument is mapping a celestial radio source. There are also photographs of the Sun taken during the Skylab mission, and a comparison between the optical image, as seen by the 200in telescope at Mount Palomar, and the radio observation at 1480MHz, of the Whirlpool Galaxy.

TV

by Ron Ham BRS15744

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

"Readers have been accustomed, by means of 'wireless', to hear voices which came from hundreds or even thousands of miles away. Television, therefore, is all the more important, as when perfected it will complete the process of hearing by adding wireless vision . . .", said F. J. Camm, our first and very famous Editor in his book *Newnes Wireless Constructor's Encyclopedia* advertised in our first issue on September 24, 1932. I wonder if F. J. Camm could have guessed that television would become world-wide, in fact inter-planetary, and replace the wireless set as the family's main entertainment.

Amateur Television

The Horndean and District Amateur Radio Club have amateur television very much in mind, their Chairman, **Doug Hotchkiss** G4BEQ and Secretary **Dan Bernard** G6GBM have ATV transmitters on the air using a combination of home-brew and Wood and Douglas gear and a large number of their 40 members have receiver boards under construction. The club meets at Merchistoun Hall, Horndean, every second Thursday of the month. Details from Dan on 0705 593429.

Between 2015 and 2215 on July 13, **Jim Penny** GM4JLY, Aberdeen, exchanged pictures with G4AGE, G4DYB and G8RWV, all members of a net in Sheffield. Back in May, Jim worked G6BIA in South Shields (Fig. 1), G8GHH in Margate (Fig. 2) and PE1HTG (Fig. 3). The strangest signal verification recorded by Jim so far is a kilted figure with the words "OCH AYE" written below. I like that, ATV certainly lends itself to good humour.

SSTV

On July 12, Richard Thurlow G3WW, March, exchanged slow scan television pictures with PE1DUP on 144·5MHz giving him his first contact with the UK and Richard his 1766th station worked for the first time. Earlier in the evening, PE1DUP had a two-way QSO with a DL and Richard worked OZ1BEP/P and OZ6FH. Around 1750 on March 17, **Sam Faulkner,** Burton-on-Trent, received pictures on 28·680MHz from FM7CD in Martinique (Fig. 4) while he was working Richard and in April, Sam logged 8P6NC in Barbados calling CQ (Fig. 5) and PY2AJK also calling CQ at 1800 on June 12. During early July, Richard had monochrome QSOs with stations in Denmark, France, Germany, Spain and the USA and colour QSOs with DJ4GL and on several occasions with ZS6BTE. He reached another target during the evening of July 16 when he worked C31JX in Andora giving him his 110th country on SSTV.

Tropospheric

Tim Anderson, Stroud, using a Plustron TVR5D and a 12-element array received pictures in Band III from Radio Telefis Eireann, RTE1 on June 20 and 25 and July 7 and 11. Between 1200 and 1300 on July 7, **Albert Vickers,** Crawley, using a Hugh Cocks converter, a Philips 20in receiver, Fuba antenna and wide-band pre-amp, saw a documentary, captions and a police film from France on Ch. 21. Around 2030, **Brian Renforth,** Chippenham, also received strong pictures from TDF on Ch. 21 in addition to Anglia TV from Sudbury and Channel Television from Fremont Point on Ch. 41. During the evening of the 8th, Brian received pictures from Belgium on Ch. 25, Holland on Chs. 29 and 32, ZDF West Germany on Ch. 35 and test cards scribed "Leglise Canal 60", "Wavre Canal 28" and the ZDF close down caption "Sendeschluss".

Around 1700 on July 16, I used my Plustron TVR5D, about 30m a.s.l. near

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

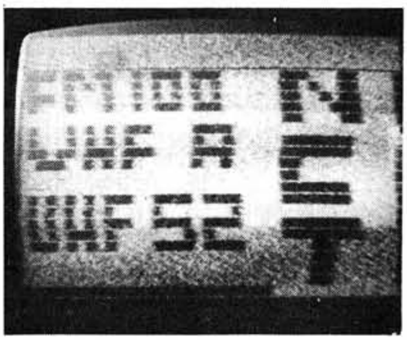


Fig. 6

Fig. 7

Fig. 8

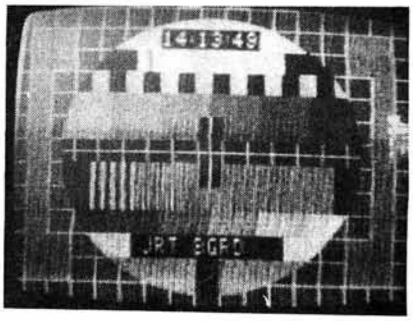


Fig. 9

Herstmonceux Castle and received a strong test card from FR3 on Chs. 55 and 60 and other French pictures such as tennis and test cards on about 7 spots between Chs. 22 and 60. At 1924 I was parked on the north side of the South Downs, with some 152m of hill immediately above me and saw the end of the French news programme *Tele-Journal* and the FR3 caption on Ch. 26.

Sporadic-E

At 1700 on July 8, **David Hackwell** received a caption NCT (Fig. 6) from an Italian private station seen previously by **Dave Cawser,** Burton-on-Trent and Sam Faulkner on June 12. When Sam saw it at 1630 on the 24th the FM100 was missing from the listing. Tim Anderson received the captions EPP on Ch. E4 and UDP on Ch. E3 on July 7, written under what looked to Tim like a globe. Any ideas?

You do not have to be a technical genius to enjoy DXTV, especially during the sporadic-E season, when signals from transmitters within the countries ranging from Iceland to Italy and Scandinavia to the USSR are fighting for predominance on your screen. Although the sound signal from these countries is not always received, my readers are conversant with the test cards, captions, clocks and programmes such as documentaries and news, films often American and British with local sub-titles, sport and scientific from the different countries.

At 1530 on June 26, Brian Renforth watched *The Time Machine* from RTVE Spain on Chs. E2, 3 and 4 and at 1925 on July 3 he saw *Magnum* and London Weekend's *A Fine Romance,* both with sub-titles, from Sweden on Ch. E2. "Spain was very prominent all through the month, the highlight being my first reception of colour signals on the Bradford/Hugh Cocks tuner with the world cup football on Chs. E2, 3 and 4 on June 17 and 23", writes Tim Anderson, who also watched the TVE2 programme *Estudio Abierto* between 2130 and 2200 on July 7.

Between Tim, **David Appleyard,** Sweden, Dave Cawser, Sam Faulkner, **Simon Hamer,** David Hackwell, Nicholas Wythe and Albert Vickers, Band I test cards and pictures were identified from stations in Austria (Figs. 7 and 8), Czechoslovakia, Denmark, Finland, Germany, Hungary, Italy, Iceland, Norway Bagn, Bremanger, Gamlem, Gulen, Hermnes, Melhus, Steigen and Televerket, Poland, Portugal, Spain, Sweden, Switzerland, Yugoslavia (Fig. 9) and the USSR. Among the Spanish captions seen by Dave Cawser were Ailanta, Aragon, Control Central, Lamcila and Tele Murcia.

Kevin Piper G8TGM, Pagham, using a Hugh Cocks converter into a Philips receiver and a Band I dipole added Rumania to the list. Up in Perthshire, **J. Horn**, has installed a 12in Sharp monochrome receiver for DXTV and has seen microcube championships from Budapest, basket ball, bull-fighting and dancing from Spain, and a music and folk festival from Germany. Several football matches in the world cup series in Spain were seen from various countries by **Harold Brodribb,** Dave Cawser and Brian Renforth and among the adverts seen by Dave were Broom Fly Spray, Frigo Ice Cream, Kelloggs Crisps and Timex Watches.

During the period June 18 to July 18, I saw the captions 'dt' and 'TP1' from Poland, HOBOCTON and YL announcer and TB CCCP from the USSR, Praha from Czechoslovakia, TV Hirado and clocks from TP Poland and MTV1 Hungary both 2 hours ahead of GMT.

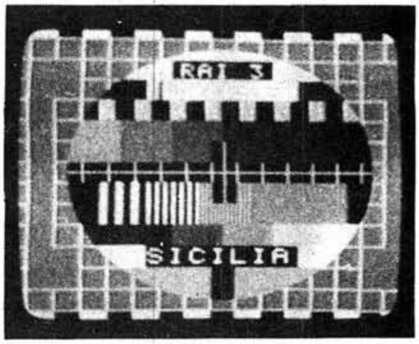
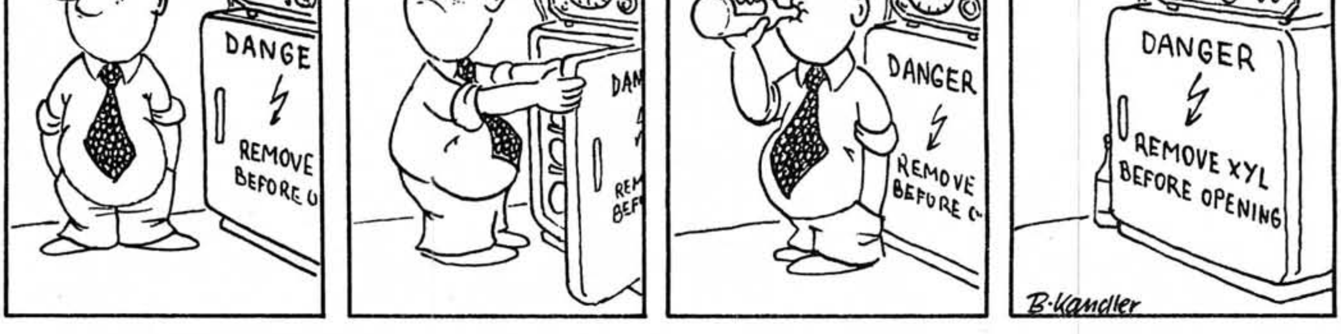


Fig. 10

David Appleyard saw the cartoons *Bratislava Lyra* from Czechoslovakia, *A Small Girl And a Dog* from Austria and a Charlie Chaplin silent movie with a German commentator from West Germany.

On June 18, Harold Brodribb received a weather map of Hungary and at 1800 saw the MTV1 clock showing 2000. On July 9, Harold saw the Spanish captions La Prensa and Espana and the figures 82 in the middle of a large letter "C". Like Simon Hamer, Harold watched plenty of football from Italy and Spain and Simon received a Hungarian YL announcer called Kisk Almar, a circus, an American film featuring truck drivers and CB radio and an advert for Fuji film.

Well known TV-DXers, **Keith Hamer** and **Garry Smith** from Derby sent a photograph (Fig. 10) of the Italian RAI3 test card and Keith said: "DX conditions have been quite good with several sightings of ZTV, Gwelo, using possibly a colour-bar pattern with a grey (or probably red) band at the bottom of the pattern."

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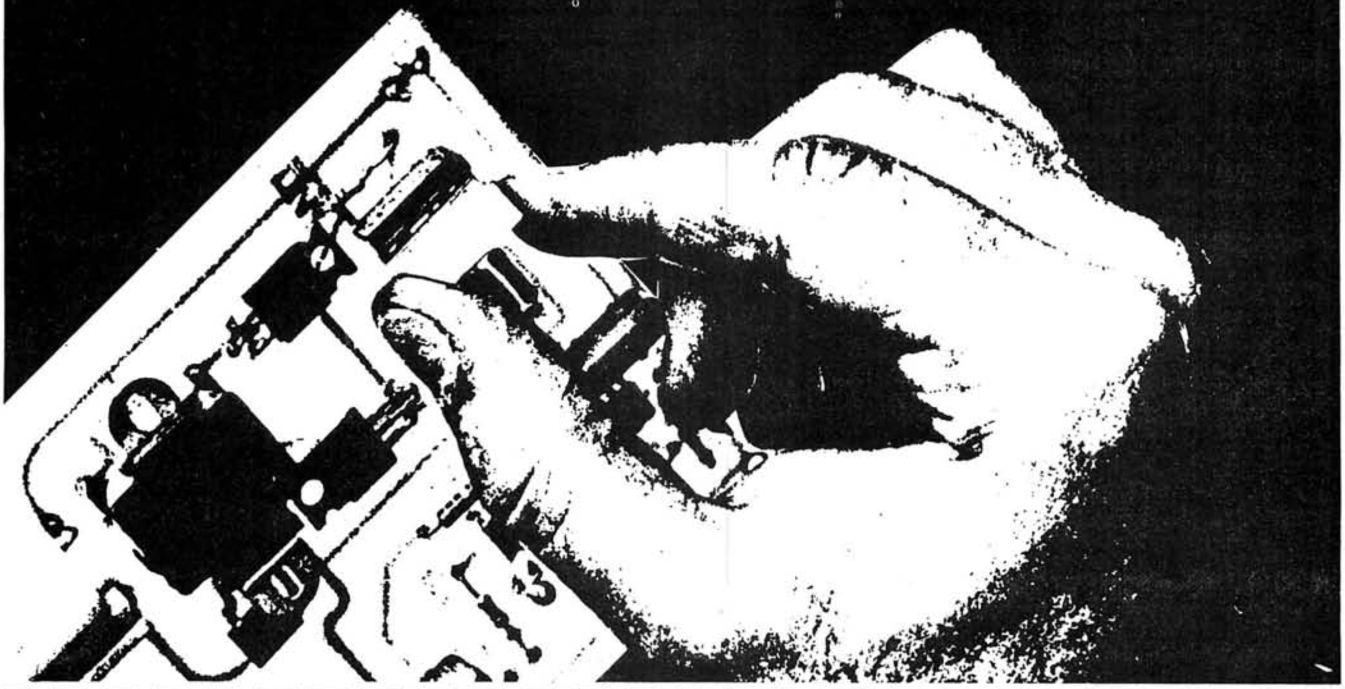

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Whilst prices of goods shown in advertisements are correct at the time of closing for press, readers are advised to check with the advertiser both prices and availability of goods before ordering from non-current issues of the magazine.

Situations Vacant

Radio/ Electronic Technician

London based organisation seeks enthusiastic Radio/Electronic Technician with a broad knowledge of Communication Techniques and associated systems. Applicants should preferably be aged between 25 and 40 with desirable qualifications of City and Guilds Certificate/T.E.C. in Telecommunications or equivalent in experience. Some overseas travel is a possibility in this position.

Salary according to qualifications and experience but not less than £7,300.

Please write with personal and career details to Confidential Reply Service, Ref. BMR 8482, Austin Knight Limited, London, W1A 1DS.

Applications are forwarded to the client concerned, therefore companies in which you are not interested should be listed in a covering letter to the Confidential Reply Supervisor.

Austin Knight Advertising AK LONDON

WATFORD ELECTRONICS

33/35, CARDIFF ROAD, WATFORD, HERTS, ENGLAND
TEL. WATFORD (0923) 40588. TELEX 8956095

ALL DEVICES BRAND NEW. FULL SPEC. AND FULLY GUARANTEED. ORDERS DESPATCHED BY RETURN OF POST. TERMS OF BUSINESS: CASH/CHEQUE/P.O.s OR BANKERS DRAFT WITH ORDER. GOVERNMENT AND EDUCATIONAL INSTITUTIONS OFFICIAL ORDERS ACCEPTED (TELEPHONE ORDERS BY ACCESS NOW ACCEPTED Minimum £10·00 please). TRADE AND EXPORT INQUIRY WELCOME. P & P ADD 50p TO ALL ORDERS UNDER £10·00. (excluding VAT). OVERSEAS ORDERS POSTAGE AT COST.

VAT Export orders no VAT. Applicable to U.K. Customers only. Unless stated otherwise, all prices are exclusive of VAT. Please add 15% to the total cost including p & p.

We stock many more items. It pays to visit us. We are situated behind Watford Football Ground. Nearest Underground/Br. Rail Station: Watford High Street. Open Monday to Saturday 9 a.m.-6 p.m. Ample Free Car Parking space available.

POLYESTER RADIAL LEAD CAPACITORS: 250V; 10n, 15n, 22n, 27n **6p;** 33n, 47n, 68n, 100n **7p;** 150n, 220n **10p;** 330n, 470n **13p;** 680n **19p;** 1µ **23p;** 1µ5 **40p;** 2µ2 **46p.**

ULTRASONIC TRANSDUCERS **325p** per pair.

ELECTROLYTIC CAPACITORS (Values in µF). **500V:** 10 **52p;** 47 **78p; 63V:** 0·47, 1·0, 1·5, 2·2, 3·3, **8p;** 4·7 **9p;** 6·8, 10 **10p;** 15, 22 **12p;** 33 **15p;** 47 **12p;** 100 **19p;** 1000 **70p; 50V:** 47 **12p;** 68 **20p;** 220 **24p;** 470 **32p;** 2200 **90p; 40V:** 4·7, 15, 22, **9p;** 3300 **90p;** 4700 **120p; 25V:** 1·5, 6·8, 10, 22 **8p;** 33 **9p;** 47 **8p;** 100 **11p;** 150 **12p;** 220 **15p;** 330 **22p;** 470 **25p;** 680, 1000 **34p;** 2200 **50p;** 3300 **76p;** 4700 **92p; 16V:** 40, 47, 100 **9p;** 125 **12p;** 220 **13p;** 470 **20p;** 680 **34p;** 1000 **27p;** 1500 **31p;** 2200 **36p;** 3300 **74p;** 4700 **79p.**
TAG-END TYPE: 70V: 4700 **245p; 64V:** 3300 **198p;** 2200 **139p; 50V:** 3300 **154p;** 2200 **110p; 40V:** 4700 **160p; 25V:** 4700 **98p;** 10,000 **320p;** 15,000 **345p.**

TANTALUM BEAD CAPACITORS: **35V:** 0·1µ, 0·22, 0·33 **15p;** 0·47, 0·68, 1·0, 1·5 **16p;** 2·2, 3·3 **18p;** 4·7, 6·8 **22p;** 10 **28p; 16V:** 2·2, 3·3,**16p;** 4·7, 6·8, 10 **18p;** 15 **36p;** 22 **30p;** 33, 47 **40p;** 100 **75p;** 220 **88p; 10V:** 15, 22 **26p;** 33, 47 **35p;** 100 **55p.**

POTENTIOMETERS: Carbon Track
0·25W log & Linear Valves.

470Ω, 680Ω 1K, 2K (Lin only) Single	30p
5KΩ to 2MΩ Single gang	30p
5KΩ to 2MΩ Single with D/P switch	78p
5KΩ to 2MΩ Dual gang	88p
1W Wirewound 50Ω-20K	115p

POLYESTER (MYLAR) CAPACITORS: **100V:** 1nF, 2n, 4n, 4n7, 10n **6p;** 15nF, 22n, 30n, 40, 47 **7p;** 56, 100n, 200 **9p;** **50V:** 470nF **12p.**

SLIDER POTENTIOMETERS
0·25W log and linear values 60mm track

5KΩ 500KΩ Single gang	70p
10KΩ 500KΩ Dual gang	110p
Self-Stick graduated Alum. Bezels	40p

CERAMIC CAPACITORS 50V
Range: 0·5pf to 10nf **4p**
15nF, 22nF, 33nF, 47nF **5p** 100nF **7p**

PRESET POTENTIOMETERS

0·1W 50Ω-2·2M Minl. Vert. & Horiz.	7p
0·25W 100Ω-3·3MΩ Horiz. larger	10p
0·25W 250Ω-4·7MΩ Vert.	10p

POLYSTYRENE CAPACITORS
10pF to 1nF, **8p** 1·5nF to 12nF, **10p.**

RESISTORS—5% carbon, High Stab. Miniature, Low Noise.

	Range	Val.	1-99	100+
0·25W	2Ω2-4M7	E24	2p	1p
0·5W	2Ω2-5M1	E12	2p	1p
1W	2Ω2-10M	E12	5p	3p
2% Metal Film 10Ω-1M		E24	6p	4p
1% 0·5W 51Ω-1M		E24	10p	8p

N.B. 100+ price applies to Resistors of each type not mixed values.

OPTO ELECTRONICS

LEDs plus clip		3½ Digit LCD	495
TIL209 Red 3mm	11	4 Digit LCD	530
TIL211 Grn 3mm	14	OCP71	120
TIL212 Yel 3mm	14	ORP12	86
·2" Red	12	2N5777	45
·2" Green or Yellow	14	(Infra Red Emitter)	
Rectangular LED's		LD271	46
Red, Green, Yellow		TIL32	58
with bezel	29	Detector	
7 Seg. Displays Red		SFH205	119
·3" C Cath	99	TIL78	55
·3" C Anod	99		
·3" ±1 Red or Grn	150		
·5" C Cath	115		
·5" C Anod	115		
·8" Orange	275		
Burgraph 10 seg.	225		

CRYSTALS

100KHz	235
455KHz	370
1MHz	275
1·008M	275
1·6MHz	395

VEROBOARDS: 0·1"

	Clad	Plain
2½×3¾"	80p	65p
2½×5"	91p	—
3¾×3¾"	91p	—
3¾×5"	105p	87p
3¾×17"	360p	232p
4¾×17"	470p	—

Pkt of 100 pins **50p**
Spot face cutter **135p**
Pin insertion tool **178p**

'VQ' Board **150p**
'DIP' Board **330p**
Vero Strip **144p**

PROTO – DECs
Veroblock **375p**
S-DeC **350p**
Eurobreadboard **520p**
Bimboard 1 **550p**
Superstrip SS1 **£13**

COPPER CLAD BOARDS

Fibre Glass	Single-sided	Double-sided	SRBP 9·5"×8·5"
6"×6"	90p	110p	95p
6"×12"	150p	200p	

FERRIC CHLORIDE
1 lb **195p** +50p p&p

DALO ETCH RESIST PEN plus Spare Tip **90p**

SOLDERCON PINS
100 pins **70p;**
500 pins **325p**

VERO WIRING PEN
+ spool **310p**
spare spool **75p;** combs **6p.**

DIL SOCKETS

	Low profile	Wire wrap
8 pin	8p	25p
14 pin	10p	35p
16 pin	10p	42p
18 pin	16p	52p
20 pin	22p	60p
22 pin	25p	70p
24 pin	25p	70p
28 pin	28p	80p
36 pin	—	105p
40 pin	30p	99p

EDGE CONNECTORS

	·1	·156
2 10 way	—	135p
2 15 way	—	140p
2 18 way	180p	145p
2 22 way	199p	200p
2 23 way	210p	—
2 25 way	225p	220p
2 28 way	210p	—
2 30 way	245p	—
2 36 way	295p	—
2 40 way	315p	—
2 43 way	395p	—

DENCO COILS
Dual Purpose 'DP'
VALVE TYPE
Ranges: 1-5 Bl. Yl. Rd. Wht. **122p**
6-7 B, Y, R **110p**
1-5 Green **150p**
'T'-type (Transistor Tuning).
Ranges: 1-5 Bl. Yl. Red, White **150p**

B9A Valve Base	42p
RDT2	145p
RFC 5 chokes	140p
RFC 7 (19mH)	160p
1FT 13/14/15/16 17	120p
1FT 18/1·6	135p
1FT 18/465	152p
TOC1	124p
MW 5FR	122p
MW/LW 5FR	154p

JACKSONS VARIABLE CAPS.

Dielectric 100/300pF	220p
500pF	250p
6:1 Ball Drive 4511/DAF	185p
Dial Drive 4103 6:1/36:1	775p
Drum 54mm	59p
0-1-365pF	350p
00-2-365pF	435p
00-2-650pF	650p
0-2-365pF with slow motion Drive	495p
00-2-208/176	435p
,, ,, with slow motion drive	495p
C804: 5pF; 10	278p
25pF	290p
50pF	290p
100;150pF	350p
'L' 3×310pF	725p
00-3×25pF	575p

TRANSISTORS

AC141/2	30	BD140	40	OC170/1	50	2N3710/11	10
AC176	28	BD144/5	198	OC200	50	2N3771	179
ACY17/18	70	BD205	110	TIP29A	32	2N3772	195
ACY19/20	75	BD214	115	TIP29C	38	2N3773	210
ACY21/22	75	BD245	45	TIP30A	35	2N3819	22
ACY28	75	BD378	70	TIP30C	37	2N3820	38
AD149	79	BD434	55	TIP31A	38	2N3822/3	45
AD161/2	42	BD517	75	TIP31C	37	2N3866	90
AF106	70	BD695A	99	TIP32A	38	2N3903/4	15
AF118	90	BD696A	99	TIP32C	42	2N3905/6	15
AC125	35	BDY56	180	TIP33A	65	2N4037	46
AC126/7	35	BF115	35	TIP33C	78	2N4058	10
AC128	30	BF167	29	TIP34A	74	2N4061/2	10
AF139	40	BF180	38	TIP34C	88	2N4427	80
AF178	75	BF194/5	12	TIP35A	110	2N4859	78
AF239	78	BF196/7	12	TIP35C	128	2N4871	55
BC107	10	BF198/9	16	TIP36A	130	2N5172	18
BC107B	12	BF200	30	TIP36C	140	2N5179	45
BC108	10	BF224	24	TIP41A	50	2N5191	75
BC108B	12	BF244	30	TIP41B	52	2N5305	24
BC108C	12	BF244B	30	TIP42A	55	2N5457	30
BC109	10	BF256	35	TIP42B	58	2N5485	30
BC109B	12	BF257/8	32	TIP120	70	2N5642	750
BC109C	12	BF259	35	TIP121	73	2N5777	45
BC140	30	BF274	42	TIP141	105	2SA636	250
BC141/2	30	BF336	40	TIP142	105	2SA671	250
BC143	30	BF451	35	TIP147	120	2SA715	60
BC147	9	BF594	30	TIP2955	60	2SC495	70
BC147B	10	BF595	39	TIP3055	60	2SC496	70
BC148	9	BFR39	23	TIS43	32	2SC1061	250
BC148B	10	BFR40/41	23	TIS44/5	45	2SC1096	85
BC148C	10	BFR79	23	TIS88A	50	2SC1173	125
BC149	9	BFR80/1	24	TIS90	30	2SC1306	100
BC149C	10	BFR98	105	TIS91	32	2SC1307	150
BC153/4	27	BFX29/84	28	VN10K	55	2SC1449	85
BC157/8	10	BFX85/6	28	VN66	80	2SC1678	140
BC159	11	BFX87/8	28	ZTX107	11	2SC1923	50
BC160	45	BFY51/2	23	ZTX109	12	2SC1945	225
BC167/8	10	BFY56	32	ZTX300	13	2SC1953	90
BC168C	10	BFY64	35	ZTX301/2	16	2SC1957	90
BC169C	10	BFY81	120	ZTX303	25	2SC1969	140
BC170	15	BRY39	40	ZTX304	17	2SC2028	85
BC172/3	11	BSX20	20	ZTX314	25	2SC2029	210
BC177/8	16	BSY95A	25	ZTX326	30	2SC2078	170
BC179/81	20	BU105	170	ZTX341	30	2SC2091	85
BC182/3	10	BU205	190	ZTX500	14	2SC2314	85
BC184	10	BU208	200	ZTX501/2	15	2SC2166	165
BC182L	10	E421	250	ZTX503	18	2SC1679	190
BC183L	10	MD8001	250	ZTX504	25	2N6027	32
BC184L	10	MJ400	150	ZTX531	25	3N128	112
BC187	26	MJ491	175	ZTX550	25	3N140	112
BC212	10	MJ2955	70	2N697	23	40311	60
BC212L	10	MJE340	54	2N698	40	40313	125
BC213	10	MJE370	100	2N699	48	40315	90
BC213L	10	MJE371	100	2N706A	19	40316	85
BC214	10	MJE2955	99	2N708	19	40361	70
BC214L	10	MJE3055	70	2N918	35	40362	70
BC236	10	MPF102	50	2N1131/2	24	40407/8	75
BC237	14	MPF103/4	30	2N1303	60	40411	280
BC307B	15	MPF105	30	2N1304/5	65	40467	95
BC308B	16	MPF106	40	2N1671B	160	40468	60
BC327	15	MPSA05	25	2N2219A	28	40594	90
BC338	15	MPSA06	25	2N2220A	26	40595	98
BC441	34	MPSA12	32	2N2221A	25	40603	90
BC461	34	MPSA55	30	2N2222A	25	40673	85
BC477	40	MPSA56	30	2N2369A	17		
BC516/7	40	MPSA70	25	2N2646	45		
BC547/8	12	MPSU06	55	2N2904/5	28		
BC549C	14	OC28	220	2N2906/7	26		
BC557/8	15	OC35	220	2N2926G	10		
BC559	15	OC36	75	2N3053	26		
BCY70	16	OC41/2	75	2N3054	58		
BCY71/2	20	OC43	55	2N3055	48		
BD131/2	48	OC44	75	2N3442	140		
BD133	60	OC45	40	2N3663	15		
BD135	45	OC70/71	40	2N3702/3	10		
BD136/7	40	OC74/76	50	2N3704/5	10		
BD138/9	40	OC81/82	50	2N3706/7	10		
		OC83/4	40	2N3708/9	10		

74LS (TEXAS)

74LS00	12	LS12	15	LS196	45
LS01	13	LS13	20	LS197	60
LS02	14	LS14	34	LS200	345
LS03	14	LS15	15	LS202	345
LS04	15	LS20	15	LS221	60
LS05	15	LS21	15	LS240	96
LS06	15	LS22	15	LS241	65
LS08	15	LS26	18	LS242	65
LS09	15	LS27	15	LS243	65
LS10	15	LS28	20	LS244	60
LS11	15	LS30	18	LS245	118
		LS32	15	LS247	40
		LS33	16	LS248	
		LS37	16	LS249	68
		LS38	16	LS251	30
		LS40	16	LS253	40
		LS42	28	LS257	48
		LS47	35	LS258	40
		LS48	80	LS259	58
		LS49	60	LS260	22
		LS51	15	LS261	195
		LS54	15	LS266	25
		LS55	30	LS273	60
		LS63	150	LS275	290
		LS73	25	LS279	30
		LS74	25	LS280	130
		LS75	28	LS283	45
		LS76	20	LS290	57
		LS78	24	LS293	46
		LS83	36	LS295	86
		LS85	70	LS298	85
		LS86	16	LS299	190
		LS90	35	LS300	175
		LS91	80	LS302	175
		LS92	36	LS320	270
		LS93	26	LS323	270
		LS95	45	LS324	200
		LS96	120	LS325	320
		LS107	43	LS326	330
		LS109	30	LS327	315
		LS112	26	LS347	150
		LS113	40	LS348	190
		LS114	35	LS365	37
		LS122	36	LS366	37
		LS123	36	LS367	37
		LS124	90	LS368	90
		LS125	24	LS373	75
		LS126	30	LS374	75
		LS132	40	LS375	43
		LS133	35	LS377	90
		LS136	24	LS378	69
		LS138	35	LS379	65
		LS139	38	LS384	250
		LS148	73	LS390	50
		LS151	39	LS393	45
		LS153	39	LS395	199
		LS155	39	LS398	275
		LS156	39	LS399	220
		LS157	26	LS445	140
		LS158	36	LS447	195
		LS160	35	LS490	245
		LS161	35	LS541	135
		LS162	35	LS668	175
		LS163	35	LS670	175
		LS164	40	LS673	550
		LS165	55	LS674	750
		LS166	55		
		LS170	75		
		LS173	72		
		LS174	72		
		LS175	58		
		LS181	95		
		LS183	275		
		LS190	58		
		LS191	58		
		LS192	58		
		LS193	65		
		LS194	35		
		LS195	35		

74S

74S00	60
74S132	138
74S138	240
74S158	240
74S188	210
74S189	158
74S194	360
74S201	620
74S241	540
74S262	850
74S287	325
74S288	210

VOLTAGE REGULATORS
1A +ve 5V, 12V, 15, 18, 24V **40p**
1A −ve **45p**
100mA −ve 5V, 6, 8, 12, 15V **30p**
100mA −ve **65p**

LM309K	135p
LM317K	320p
LM323K	500p
LM723	38p
78H05	550p
78HG05	650p
79HG	685p
TBA625B	75p

BRIDGE RECTIFIERS

1A/50V	18
1A/100V	20
1A/400V	25
2A/50V	34
2A/400V	46
2A/600V	65
6A/100V	83
6A/400V	95
10A/200V	215
10A/600V	298
25A/200V	240
25A/600V	395
BY164	56
VM18 DIL	50

SCRs THYRISTORS

1A/200V	58
5A/100V	32
5A/400V	40
5A/600V	48
8A/300V	60
8A/600V	95
12A/400V	95
12A/800V	188
BT106	150
BT116	180
C106D	38
TIC44	24
TIC47	35
2N4444	130

TRIACS

3A/100V	48
3A/400V	56
3A/800V	85p
8A/100V	60
8A/400V	69
8A/800V	115
12A/100V	78
12A/400V	82
12A/800V	135
16A/400V	105
16A/800V	220
25A/400V	185
25A/800V	295
30A/400V	525
T2800D	120

DIAC
ST2 **25p**

DIODES

AA119	15
BY100	24
BY127	12
CR033	250
OA9	40
OA70	12
OA79	15
OA81	15
OA85	15
OA90	8
OA91	8
OA95	8
OA200	8
OA202	8
1N914	4
1N916	5
1N4001/2	5
1N4003/4	6
1N4005/6	6
1N4007	7
1N4148	4
3A/100V	15
3A/400V	16
3A/600V	17
3A/1000V	19
6A/400V	50
6A/800V	65

NOISE DIODE
Z5J **195**

ZENERS
2V7 to 39V 400mW **8p**
3V3 to 33V 1·3W **15p**

VARICAPS

MVAM2	158
BA102	50
BB104	40
BB105B	40
BB106	40

LINEAR IC's

702	75	LM380	75	TA7310	150	4118-200	400
709C 8 pin	35	LM381N	145	TAA621AX1	295	4164-200	450
710*	48	LM382	115	TAA661A	190	4315 CMOS	795
733	70	LM386	90	TBA120S	70	4334-3	325
741 8 pin	14	LM387	120	TBA641-A12/ BX1 or BX11	290	4816	225
747C 14 pin	65	LM389	95	TBA651	190	4864-3	490
748C 8 pin	36	LM1458	45	TBA800	80	6116-150N	390
753 8 pin	185	LM3900	50	TBA810S	95	6502	325
810	159	LM3909N	85	TBA820	80	6520	115
9400CJ	350	LM3911	125	TBA920Q	200	6521	115
AY-1-0212	675	LM3914	180	TCA965	120	6522	300
AY-1-1320	225	LM3915	200	TDA1004	290	6545	899
AY-1-5050	99	LM13600	125	TDA1008	310	6551	650
AY-3-1270	840	LM3916	220	TDA1022	499	6800	275
AY-3-8910	440	LS7220	280	TDA1024	420	6802	335
AY-5-1230	450	M252AA	625	TDA1490	325	6804	160
AY-5-8100	775	M253AA	1150	TDA2020	320	6805	670
CA3020	186	MB3756	440	TDA2030	320	6807	997
CA3028A	80	MS1513L	230	TL061CP	40	6810	115
CA3043	275	MS1515L	320	TL062CP	60	6820	115
CA3045	365	MC1304P	260	TL064CN	98	6821	115
CA3046	70	MC1310P	150	TL071CP	24	6840	395
CA3048	214	MC1495	350	TL072CP	45	6845	720
CA3059	225	MC1496L	70	TL074CN	100	6847	850
CA3080E	70	MC1596	225	TL081CP	24	6850	135
CA3089E	215	MC3340P	120	TL082CP	45	6852	255
CA3090AQ	375	MC3360P	120	TL083CP	75	8080A	260
CA3130	90	MC3403	75	TL084CN	90	8085A	450
CA3140	40	MC3405	150	UA2240	120	81LS95	85
CA3189	200	MFC6040	97	UAA170	170	81LS96	85
HA1336W	240	MK50398	635	UAA180	170	81LS97	85
ICL7106	750	MM5303	635	UAA1003	935	8224	180
ICL7107	975	MM5307	1275	UPC575	270	8251	320
ICL8038CC	300	MSM5526	820	UPC1025H	375	8253	799
ICM7205	1150	NE543K	225	UPC1156	270	8T26A	99
ICM7215	1050	NE544	210	UPC1182	330	8T28A	140
ICM7216A	1950	NE5534	125	XR2206	350	8T95N	99
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7409	16	104	54	74194	45
7410	14	105	55	74195	45
7411	20	107	20	74196	46
7412	20	109	35	74197	46
7413	24	110	40	74198	84
7414	32	111	55	74199	84
7416	20	112	170	74221	54
7417	20	116	50	74246	150
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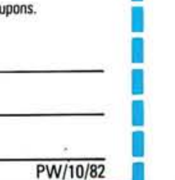

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