FOR THE RADIO ENTHUSIAST ...

Practical Wireless

JULY 1983

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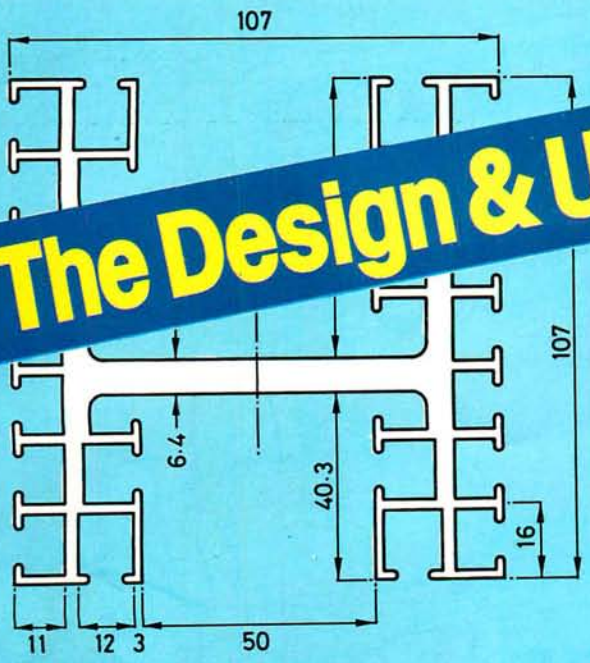

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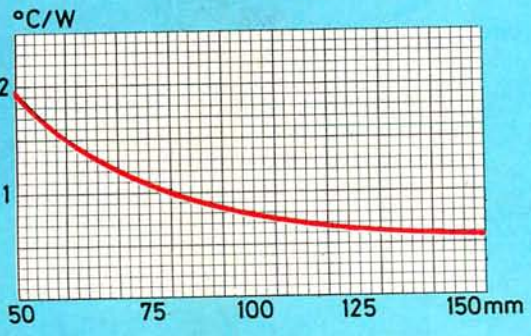

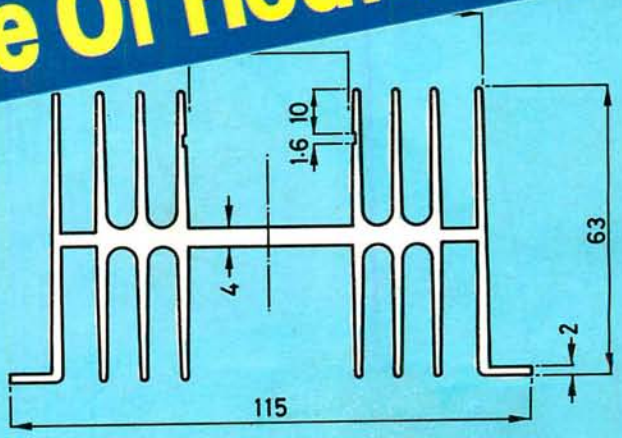

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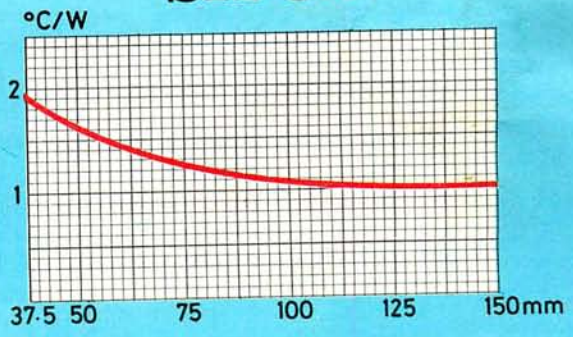

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Practical Wireless

FOR THE Radio ENTHUSIAST ...

JULY 1983 VOL. 59 NO. 7 ISSUE 916

Sorry—the final part of "Are the Voltages Correct?" has had to be held over until next month

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for the HF man, the **TS430S**

£736.00 inc vat carriage £5.00

A new HF transceiver, taking into account the outstanding performance of the previous Trio rigs you could be forgiven for thinking that it would be impossible for them to improve on existing models and specifications. Alternatively of course, you might be of the opinion that engineers with the talents as displayed by the designers of such rigs as the TS830S, TS130V and TR2500 etc. would have no trouble in pushing forward the frontiers of transceiver technology s we know it today.

The new HF transceiver from Trio is the TS430S. Those who have seen it and the fortunate ones who have used it on the air are all agreed that here we have a major advance for the enthusiastic operator on todays busy bands. Not only does the transceiver have full amateur band coverage from 160 to 10 metres (including the three new bands) but it also incorporates a general coverage receiver (150 kHz to 30 MHz). The new transceivers features are many; USB, LSB, CW, and AM with FM available (optional FM430 board), compact size 270mm wide/96mm high/275mm deep, continuous tuning over the entire frequency range, two separate VFO's and an up/down scan mode using the optional MC42S microphone. Eight memories, each of which can be used as a separate VFO are provided and frequency scan is programable between the two frequencies held in memory channels six and seven. Not only does the memory remember frequency but also the mode of operation, thus short wave DX and Broadcast stations can be stored alongside a SSB net channel and complete sense made as the frequencies are scanned. The by now normal Trio features are all included, IF shift, notch filter, speech processor and narrow/wide filter selection on CW, SSB and AM modes.

The TS430S, Trio's rig for todays operator.

for the SWL who deserves the best, the **R2000**

£398.82 inc vat carriage £5.00

Now from Trio, the R2000 general coverage receiver. By taking all the superb features of the R1000 and combining them with the latest in microprocessor control Trio have, in one step, completely revised the standard by which short wave receivers are judged. Among the many features provided for the discerning listener are programmable scan, memory scan, memory retention of the mode set for a particular frequency and last, but not least, Trio have included an FM mode – why FM after all this time and our repeated comment that for a shortwave broadcast receiver FM is not really necessary. Take a look at the rear panel of the R2000: a socket marked VHF converter. Wouldn't it be superb if Trio produced a VHF converter covering from 118 to 174 MHz – then you would require FM, you would also require AM. Study the features and I am sure you will agree the Trio R2000 is the receiver for you.

Continuous Coverage from 150 KHz to 30 MHz
Use of an innovative up conversion digitally controlled PLL circuit provides maximum ease of operation and superb receiver performance. Front panel up/down band switches allow easy selection within the full coverage of the receiver. The VFO is continually tunable throughout the full 150 KHz-30 MHz range.

Ten Memories Store Frequency, Band and Mode Data
Each of the ten memories can be tuned by the VFO, thus operating as ten built in digital VFO's. The original memory frequency can be recalled by simply pressing the appropriate memory channel key. All information on frequency, band, and mode is stored in the selected memory. The "auto M" switch allows two types of memory storage: when the "auto M" switch is off, data is memorized by pressing the "M in" switch; when the "auto M" switch is on the frequency being used at that time is automatically memorized.

Memory Scan
Scans all memory channels or may be user programmed to scan specific channels. Frequency, band and mode are automatically selected in accordance with the memory channel being scanned.

Programmable Band Scan
Scans automatically within the programmed bandwidth. Memory channels 9 and 0 establish the scan limit frequencies. The hold switch interrupts the scanning process. However, the frequency may be adjusted using the tuning knob whilst in the scan hold position.

Three Built In Filters with Narrow/Wide Selector
In the AM mode 6 KHz wide or 2.7 KHz narrow may be selected. In the SSB mode 2.7 KHz is automatically selected. In the CW mode 2.7 KHz is again chosen and if the optional YG455C filter is installed then 500 Hz in the narrow position. In the FM mode 15 KHz bandwidth is automatically selected.
Other important features are: squelch on all modes, noise blanker, a large 4 inch front mounted speaker, tone control, RF attenuator, AGC switch, high and low impedance antenna terminals, optional 13.8V DC operation, record jack and, of course, provision for a VHF converter.
All in all, a truly remarkable receiver.

and later in the year for the **R2000** a 118 to 174 MHz internal vhf converter.

LOWE IN LONDON, Open monday to saturday, six days a week
lower sales floor, Hepworths, Pentonville Rd, London. telephone 01.837.6702
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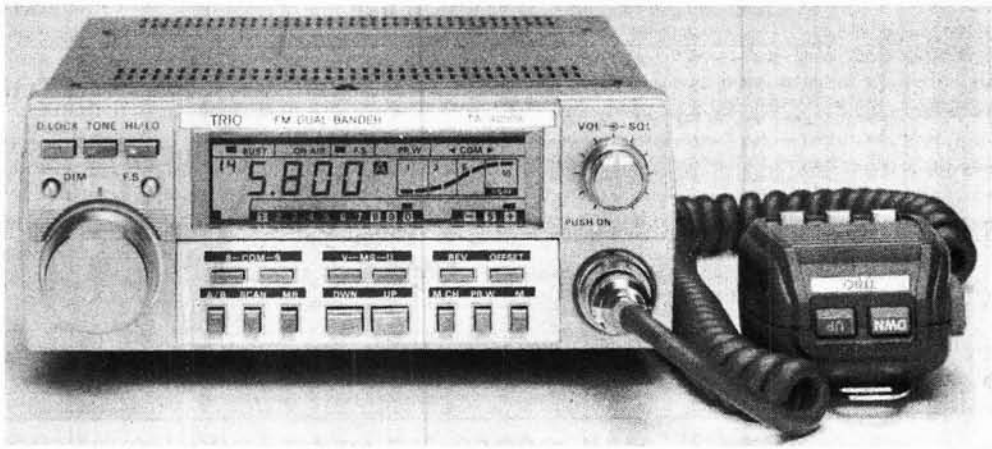
a **NEW** trio transceiver, not just another new model but a new concept, two metres and seventy centimetres fm in a single mobile rig, the **NEW** trio **TW4000A**, a V-UHF fm mobile transceiver

This is the rig I have been waiting for – the new dual bander FM transceiver from Trio. Having had much pleasure from the developing generations of Trio 2 metre mobile equipment, it seemed to me only a matter of time before Trio combined both 2 metres and 70 centimetres FM operation into one unit. They have and the transceiver is called the TW4000A. 25 watts output on both 2 metres and 70 centimetres, dual VFO's, memory channels, memory scan, a green backlit liquid crystal multiple information display, repeater shift and, of course, reverse repeater, the TW4000A dual band FM transceiver from Trio.

You may ask why so much enthusiasm for a dual band FM mobile transceiver – let me explain. Two metres has, for a long time, provided good communication between radio amateurs, either Simplex or Repeater. There are now some 51 2 metre repeaters dotted up and down the country. There are also some 154 70 centimetre repeaters also to be found as one journeys around. In olden times it was no problem to find a clear Simplex frequency when QSYing of the calling channel. Today things are not quite so simple. With the rapid expansion of amateur radio that clear channel is harder to find and more and more amateurs are QSYing to 70 centimetres. Of course you could run two rigs, one for each band, but you would have to own a Mercedes Hearse. In the normal family car room to position one rig can be found, two not so easily. With this in mind Trio have produced the TW4000A. Compact and giving all the operating features that are required in such a rig.

A word of warning: the home market Japanese models are not compatible with our band plan. They do not have 2 metre repeater shift and they are limited to 10 watts output. So buy carefully – don't rush out to your "Kenwood" stockist. The equipment may look identical it may even have been partially brought up to specification by a backroom 'bodger', but it is not the real thing. Take care.

So the next time you want more space for communication or the guy you are working suggests you QSY to 70 centimetres, then remember Trio – the TW4000A dual band FM mobile transceiver.



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- ★ All modes AM, CW, LSB, USB, AFSK & FM (inc.)
- ★ IF shift & variable bandwidth 2.6 kHz→ 300 Hz.
- ★ Inbuilt keyboard operation + scanning.
- ★ Switchable attenuator 10, 20, 30 dB.
- ★ Audio peak + notch filter −40 dB.
- ★ RF processor and Auto mic gain control.
- ★ 3rd order IMD −40dB at 100W PEP.
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- ★ Optional computer interface available.
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- ★ Comprehensive twin meter metering.
- ★ Memory retains mode information.

FT77 £515 inc. VAT @ 15% & SECURICOR

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- ★ No tune design – inbuilt SWR meter.
- ★ Only 3¼" × 9½" – Less than a foot deep!
- ★ Dual selectable pulse width noise blanker.

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- ★ Variable bandwidth 2.7KHz—500Hz *and* IF Shift.
- ★ Fixed bandwidth filters, parallel or cascade configurations.
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- ★ 10 VFO's!!! Any Tx-Rx split within coverage.
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- ★ Main dial, velvet smooth, 10Hz resolution.
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- ★ Receiver dynamic range up to 100dB!!!
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		*option
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SAT726	Full duplex unit	£90.00

KDK FM2030 £199 inc. VAT @ 15% & SECURICOR

★ 2M. 12V DC compact 2⅞" × 6⅞" × 7⅞" transceiver.
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★ 10 "year long" memories for "crystal control". Case.
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402BA	2 Ele Yagi 40 metres 43.0'LE 16.0'B	247.25 6.50
DB10/15A	3 Ele Yagi 10-15M 23.0'LE 13.0'B	198.95 4.80
TH3JNR	3 Ele Yagi 10-15-20M 24.2'LE 12.0'B	202.40 3.50
TH2MK3	2 Ele Yagi 10-15-20M 27.3'LE 6.0'B	169.05 3.50
TH3MK3	3 Ele Yagi 10-15-20M 27.0'LE 14.0'B	274.85 5.30
TH5DXX	"Thunderbird" 5 Ele 31.0'LE 18.0'B	419.75 6.70
TH6DXX	"Thunderbird" 6 Ele 31.1'LE 24.0'B	396.75 8.50
TH7DXX	"Thunderbird" 7 Ele 31.0'LE 20'TR	511.75 8.75
HYQUAD	2 Ele Quad 10, 15, 20M 13.5'TR 8.0'B	354.20 6.00
18TD	Dipole Tape 10, 15, 20, 40, 40, 80M 132	121.90 2.80
JAYBEAM		
VR3	Vertical 10-15-20M. DC Short 6 lb 13.5'H	46.00 2.50
TB3	3 Ele Yagi 10-15-20M 14.6'TR 14.1'B	189.75 5.40
MINI BEAM		
C4	Vertical Miniature 10-15-20M 8 lb 11.5'H	59.00 2.50
HQ1	"Mini" Quad beam 10-15-20M 11.0'LE 4.5'B	139.00 4.00
G4MH MINI BEAM		
	Mini Beam 10-15-20M	82.50 4.00
SMC TRAPPED DIPOLE	10-80M 119' Potted Traps.	
SMCTD/HP	14SWG H/D cμ traps 1000W PEP	43.41 2.50
SMCTD/P	Portable cμ/terylene 75' coax	59.80 2.50
SMCHPT	High Power 7MHz 1000W Per pair	15.52 1.80
SMC-HS ANTENNA		
SMCHF5V	Vertical 10, 15, 20, 40, 80M 15.7'	54.80 2.50
SMCHF5R	Radial kit loaded 6.5'-7.3'	34.90 2.50
SMCHF3VNB	Vertical 10-18-24M 1000W PEP 16.0'H	51.35 2.50

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Than E.T.

YOU'LL MEET THE MOST INTERESTING PEOPLE

IC-720A

The main problem that the amateur of today has to deal with is deciding just which rig out of the many excellent products available he is going to choose. Technology is advancing at such a rapid rate that many cannot hope to keep up. Some go too far!

Perhaps one way of dealing with the problem is to look at just What each model offers in its basic form without having to lay out even more hard earned cash on "extras". The IC-720A scores very highly when looked at in this light. How many of its competitors have two VFOs as standard or a memory which can be recalled, even when on a different band to the one in use, and result in instant returning AND BANDCHANGING of the transceiver? How many include a really excellent general coverage receiver covering all the way from 100KHz to 30MHz (with provision to transmit there also if you have the correct licence)? How many need no tuning or loading whatsoever and take great care of your PA, should you have a rotten antenna, by cutting the power back to the safe level? 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 getting hot enough to boil an egg? How many have band data output to automatically change bands on a solid state linear AND an automatic antenna tuner unit when you are able to add these to your station?

Well you will have to do quite a bit of hunting through the pages of this magazine to find anything to approach the IC-720A. It may be just a little more expensive than some of the others – but when you remember just how good it is, and of course the excellent reputation for keeping their secondhand value you will see why your choice will have to be an IC-720A!

trap dipole £49.50.inc.

The MT-240X Multi-band trap dipole antenna (80m – 10m) is a superbly constructed antenna with its own Balun incorporated in the centre insulator with an SO239 connector. Separate elements of multi-stranded heavy duty copper wire are used for 80-40-15 and 20-10 Metres. Really one up on its competitors

IC-730

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. Full metering WWV reception and connections for transverter and linear control almost completes the IC-730's impressive facilities.

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM

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IC-AT500

It was only when we started to use the new fully automatic antenna tuners from ICOM that we realised just how far ahead of their competitors they are! The very fast tune up time and simplicity of use make them a real worthwhile addition to any station even if the rest of your station isn't ICOM. If it is, then you have the added advantage of fully automatic band selection so that you can virtually hide it away in a cupboard if you want (though we think you will want to show it off).

Apart from its very rapid action and auto band selection facilities it will select the correct antenna for the band (up to four)

Dual accessory sockets are supplied so that you can easily chain your IC-720A, (or IC-701 or IC-730) together with the IC-2KL and AT-500 to produce what must be one of the most advanced automatic stations available.

IC-2KL

To compliment the excellent IC-720A HF Transceiver, ICOM have produced the IC-2KL linear amplifier. It is of a similar size and matches the IC-720A perfectly. It produces 500W output on SSB, CW, AM and RTTY needing 80-100W of drive. As with the IC-720A it will operate from 1.6MHz to 30MHz continuously at full output power, but you still need an antenna that matches. It will follow the IC-720A automatically changing bands WITH NO TUNING – the operating is done from the prime-mover.

And remember we also sell **Yaesu, Jaybeam, Datong, Welz, G-Whip, Western, TAL, Bearcat, Versatower** and **RSGB** publications from our shop and showroom at the address below.

Come in for a demonstration or just a chat, our qualified sales staff and technicians will be glad to assist you.

Listed below are other sets available from Thanet Electronics, a more detailed specification of these will appear in future advertisements. IC-740 PSU for 740 IC-SP3 IC-451 IC-4E IC-740 IC-505 IC-PS20 IC-551 IC-45E IC-R70 IC-ML1 IC-251 IC-PS15 IC-290H IC-AT100 IC490E IC-2E IC-25E TONO: MR250 9000E 550 TELEREADER: CWR-670 -685E -610E

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CUE DEE antennas

The BEST in recent tests and really well made too. Send for a catalogue of these DX antennas. Here's part of the range:-

4el 2m yagi VHF	4144A	8 dBd	£24.93
10el 2m yagi VHF	10144	11.4 dBd	£45.16
15el 2m yagi VHF	15144	14 dBd	£63.00
17el 70cm yagi UHF	17432	14.5 dBd	£48.00
4/5el HF Beam	DUO 2	(14/21 MHz) 9/8 dBd	£356.71

All matching cables, clamps and booms available for stacking 10 and 15 element yagis.

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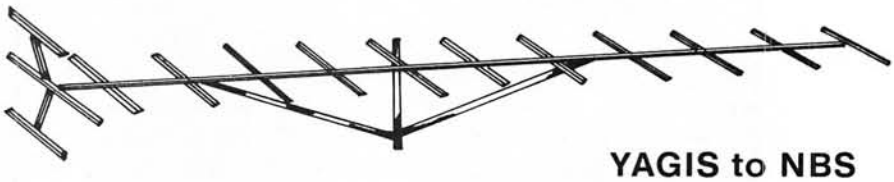

YAGIS to NBS

WHAT IS N.B.S.?

In 1976 the U.S. National Bureau of Standards published a report under the authorship of Peter P. Viezbicke detailing some nine man-years of work undertaken in the optimisation of Yagi design.

Investigation took place on the N.B.S. antenna ranges at Sterling, Virginia and Table Mountain, Colorado into the interreleationship between director and reflector lengths, spacing and diameters as well as the effect of the metal supporting boom, in order to achieve maximum possible forward gain.

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432/17X	17 Ele crossed	2.2 m	13.4 dBd	£46.83
432/17T	17 Ele long	2.9 m	15 dBd	£37.33
2 M				
144/7T	7 Ele	1.6 m	10 dBd	£19.99
144/8T	8 Ele long	2.45 m	11 dBd	£31.26
144/14T	14 Ele	4.5 m	13 dBd	£44.49
144/19T	19 Ele	6.57 m	14.2 dBd	£53.22
144/6X	6 Ele crossed	2.5 m	10.2 dBd	£37.86
144/12X	12 Ele crossed	4.57 m	12.2 dBd	£54.95
4 M				
70/3	3 Ele	1.7 m	7.1 dBd	£28.69
70/5	5 Ele	3.45 m	9.2 dBd	£43.56

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YAESU MUSEN CO. LTD

A message from the President – Sako Hasegawa – JA1MP

The YAESU MUSEN Co Ltd., which has been established over a quarter of a century, has now grown to be the largest single manufacturer of amateur communications equipment in the world.

This has been achieved to no small degree by the dedication and expertise of the YAESU engineering staff, among whose numbers are to be found nearly 400 active licensed operators, and it is this factor, as much as anything, that has enabled YAESU to sense the needs of the market and produce so many truly innovative equipments.

Quite apart from this important human aspect, we have one of the most efficient production units in the industry world-wide. By utilizing the very latest computer aided design and manufacturing techniques we ensure that you, our valued customer, is provided with the very latest state-of-the-art product. Finally, intensive environmental and computer-aided electronic test procedures guarantee you maximum reliability.

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Best 73 and good DX!

Sako Hasegawa
President
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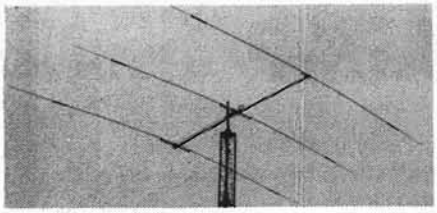

AX210N	10 ele. yagi for 2m crossed	74.95	(n/c)
HB10F2T	2 ele. 10m mono band beam	51.50	(n/c)
HB10F3T	3 ele. 10m mono band beam	74.95	(n/c)
HB15F2T	2 ele. 15m mono band beam	60.66	(n/c)
HB15F3T	3 ele. 15m mono band beam	93.46	(n/c)
HB15M25P	VP mini size 15m 2 ele.	69.50	(n/c)
HB15M35P	VP mini size 15m 3 ele.	102.30	(n/c)
HB34D	4 ele. tri band beam 10/15/20m	222.90	(n/c)
HB33SP	3 ele. tri band beam 10/15/20m	192.50	(n/c)
HB35C	Tri band array 10/15/20m	283.95	(n/c)
HB35T	5 ele. 10/15/20m	278.50	(n/c)
MV3BH	Vertical for 10/15/20m	37.99	(n/c)
MV4BH	Vertical for 10/15/20/40m	48.90	(n/c)
MV5BH	Vertical for 10/15/20/40/80m	63.95	(n/c)
MLA4	Loop antenna 10/15/40/80	105.60	(n/c)
SQ22	Phased 2 ele. swiss quad 2m	58.95	(n/c)
SQY06	6 ele. quagi 2m	45.75	(n/c)
SQY08	8 ele. quagi 2m	52.75	(n/c)
HB210S	10 ele. dual driven yagi 2m	47.99	(n/c)
TE214	14 ele. long yagi 2m	74.40	(n/c)
SSL720	9 x 2 ele. (18) slot fed 70cm	77.20	(n/c)
HB23SP	2 ele. tri band beam 10/15/20m	135.60	(n/c)
SSL218	9 x 2 ele. (18) slot fed 2m	144.79	(n/c)
TPH2	Phasing harness 2m	17.25	(n/c)
QYU10	10 ele. quagi 70cm	67.90	(n/c)
SQ007	70cm 2 ele. phased swiss quad	66.99	(n/c)
SQ10	Swiss quad 10m	97.50	(n/c)
SQ15	Swiss quad 15m	106.90	(n/c)

YAESU ANTENNAS

Base			
RSL145GP	½ wave base ant. 2m	21.20	(1.50)
RSL435GP	½ wave co-linear 70cm	31.60	(1.50)
HF Mobile			
RSL3.5	3.5MHz resonator & whip	12.21	(0.50)
RSL7.0	7.0MHz resonator & whip	11.80	(0.50)
RSL14.0	14.0MHz resonator & whip	11.45	(0.50)
RSL21.0	21.0MHz resonator & whip	11.20	(0.50)
RSL28.0	28.0MHz resonator & whip	11.00	(0.50)
RSL2A	Mast to suit above	5.00	(0.50)
RSM2	Gutter mount/Feeder/PL259 suit above	10.94	(0.75)
VHF Mobile			
RSL145	2m ¼ wave fibreglass whip	12.10	(0.50)
RSL145S	2m ¼ wave steel whip foldover	9.25	(0.50)
RSL150SS	2m ¼ wave PL259 shock spring	3.90	(0.50)
RSM2	Gutter mount/Feeder/PL259 (RSL145)	10.94	(0.75)
RSM4M	Heavy duty mag/Feeder/PL259	13.25	(1.00)
UHF Mobile			
RSL453S	½ wave antenna	15.50	(0.50)

ANTIFERENCE ANTENNAS

VHF Mobile			
TAP3009	½ wave 3db snap-in hinged whip	11.42	(3.00)
TAP3677	½ wave 3db snap-in shock coil	15.64	(3.00)
TAP3002	¼ wave unity gain snap-in hinged whip	8.81	(3.00)
UHF Mobile			
TAP3462	½ over ½ wave 3db	9.89	(3.00)
TAP3697	½ over ½ wave 5db	18.40	(3.00)
K220	Mag mount/Feeder to suit above	10.73	(2.00)

Antennas Various/Accessories

HQ1	Mini beam 10/15/20m 2 ele. 1kW	TBA	(4.00)
C4	Vertical 10/15/20m	48.50	(3.00)
G4MH	Mini beam 10/15/20	85.00	(4.00)
KTLM-4	Gutter mount/Cable assy. SO239	6.90	(0.50)

DATONG PRODUCTS

PC1	50KHz to 30MHz receive converter	137.42	(0.50)
VLF	Very low freq. converter	29.90	(0.50)
FL1	Frequency agile audio filter	79.35	(0.50)
FL2	Multimode audio filter	89.70	(0.50)
ASP/A	Auto RF speech clipper (YAESU)	82.80	(0.50)
ASP/B	Auto RF speech clipper (TRIO)	89.70	(0.50)
D75	Manual RF speech clipper	56.35	(0.50)
RFC/M	RF speech clipper module	29.90	(0.50)
D70	Morse tutor	56.35	(0.50)
AD270	Active dipole RX ant. (indoor)	47.15	(0.50)
AD370	Active dipole RX ant. (outdoor)	64.40	(0.50)
MK	Morse keyboard	137.42	(0.50)
DC144/28	2m converter	39.67	(0.50)
RFA	Broadband preamplifier	33.92	(0.50)
MPU	Mains power unit	6.90	(0.50)

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Transverters			
MMT28/144	10m transverter	109.95	(2.50)
MMT70/144	4m transverter	119.95	(2.50)
MMT432/144R	70cm transverter	184.00	(2.50)
MMT1296/144	23cm transverter	184.00	(3.00)
MMT70/28	4m transverter	119.95	(2.50)
MMT144/28	2m transverter	109.95	(2.50)
MMT432/28S	70cm transverter	159.95	(2.50)
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MML28/100S	10m 100W linear amp.	129.95	(3.00)
MML70/50S	4m 50W linear amp.	85.00	(2.50)
MML70/100S	4m 100W linear amp.	139.95	(3.00)
MML144/30LS	2m 30W linear amp. 1-3W in	69.95	(2.50)
MML144/50S	2m 50W linear amp.	85.00	(2.50)
MML144/100LS	2m 100W linear 1-3W in	159.95	(3.00)
MML144/100S	2m 100W linear 10W in	139.95	(3.00)
MML432/50	70cm 50W linear amp.	109.95	(3.00)
MML432/100	70cm 100W linear amp.	228.65	(4.00)
MML1296/10	23cm 10W linear amp.	199.00	(2.50)
MML432/30	70cm 30W linear amp. 1-3W in	99.00	(3.00)
Converters			
MM1000KB	ASC11 morse converter with keyboard	99.95	(3.00)
MM4001	RTTY to TV converter	189.00	(2.50)
MM4001KB	RTTY transceiver	269.00	(2.50)
MM4000KB	RTTY transceiver with keyboard	299.00	(4.00)
MMC28/144	10m to 2m converter	29.90	(1.00)
MMC50/28	6m to 10m converter	29.90	(1.00)
MMC70/28	4m to 10m converter	29.90	(1.00)
MMC70/28LO	4m to 10m with LO	32.90	(1.00)
MMC432/28S	70cm to 10m converter	37.90	(1.00)
MMC432/144S	70cm to 2m converter	37.90	(1.00)
MMC435/600	UHF ATV converter	27.90	(1.00)
MMC1296/28	23cm to 10m converter	34.90	(1.00)
MMC1296/144	1296MHz low noise converter	69.95	(1.00)
MMK1691/137.5	1691MHz meteosat converter	129.95	(2.50)
Morse Talkers			
MMS1	Morse tutor 2-20WPM Side tone	115.00	(2.50)
MMS2	Morse tutor (advanced) 6-32WPM + speak back	169.00	(2.50)
Amateur TV			
MTV435	70cm 20W (PSP) transmitter	149.00	(2.50)
MMC435/600	Converter ATV UHF output	27.90	(1.00)
Preamplifiers			
MMA144V	2m preamp RF switched	34.90	(1.00)
MMA28	10m preamp	16.95	(1.00)
MMA1296	23cm preamp	34.90	(1.00)
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MMD650/500	500MHz digital meter	75.00	(1.00)
MMD600P	600MHz pre scaler	29.90	(1.00)
MMDP-1	Probe	14.90	(0.50)
Filters			
MMF144	2m band pass 40W max.	11.90	(1.00)
MMF452	70cm band pass 40W max.	11.90	(1.00)
Various			
MMS384	384MHz signal source	29.90	(1.00)
MMR15/10	15db 10W attenuator	11.90	(1.00)

HI-MOUND MORSE KEYS

HK702	Up down keyer marble base	24.50	(0.50)
HK704	Up down keyer	16.68	(0.50)
HK705	Up down keyer	12.50	(0.50)
HK706	Up down keyer	13.75	(0.50)
HK708	Up down keyer	11.96	(0.50)
HK808	Up down keyer marble base	39.57	(0.50)
MK704	Twin paddle keyer	10.95	(0.50)
MK705	Twin paddle keyer marble base	22.00	(0.50)

MOULDINGS

IK	Iambic keyer	19.95	(0.50)

TOKYO HY POWER

HC150	HF ATU SWR/Power meter 200W PEP	62.50	(n/c)
HC2000	HF 2kW ATU SWR/Power meter 6 POS ant. switch. 6 to 1 vernier high Q coils 2kW peak 1kW continuous	276.55	(n/c)

Antenna Rotators & Accessories

9502	Channel master med duty up to 8 ele.	57.00	(3.50)
9523	Alignment bearing for 9502	15.81	(1.25)
KR400	Med/Heavy duty 180° meter (inc. lower casting)	90.85	(3.50)
KR400RC	Med/Heavy duty 360° meter Load 200Kg 1¼"-2" masts	114.94	(3.50)
CASTING	Lower casting set (400RC)	15.00	(1.25)
KR600RC	Heavy duty 360° meter Load 200Kg Rot600Kg/cm Brake 4000Kg/cm 1¼"-2"masts	163.30	(3.50)

Antenna Switches

SA450	SO239 connectors 1 in 2 out	9.75	(0.50)
SA450N	"N" type connectors 1 in 2 out	12.75	(0.50)

Baluns

BL50A	RAK 50 ohm ferrite BALUN 1:1 1.8-38MHz 1kW	12.88	(1.50)
BL-40X	Balun 2K PEP 1.1	11.52	(1.50)

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T30	30W DC 500MHz PL259	6.61	(0.50)
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T200	200W DC 500MHz SO239	31.36	(1.50)
T210	Wide band 10W 1.2G-2.4G	24.50	(0.75)
AW05	Pocket RF wattmeter 5W up to 500MHz BNC	19.75	(1.00)

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FL2100Z	HF warc 1200w PEP, SSB 1kW CW, 400W AM/FM/FSK	449.00	(n/c)
FL2010	2m VHF 10W linear	54.00	(n/c)
FL2050	2m VHF 50W linear 10W drive	115.00	(n/c)
FL7010	70cm UHF 10W linear	91.00	(n/c)

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HL160V	VHF linear preamp output meter 1-10W in 160W+ out	242.40	(n/c)
HL45U	UHF linear preamp 2-15W in 10-45W out	119.75	(n/c)

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MM202S	Mobile safety mic. (non scanning)	23.00	(1.00)
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AM502	Desk mic. (compressor selectable)	45.94	(1.00)

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Mutec

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RPCB	144UB FT221/225 front end board	64.50	(1.25)

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AA	AA size Ni-cad	1.00	(0.20)
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Additional controls include IF Width and Shift on concentric controls, AMGC (Automatic Mic Gain Control) to set microphone input threshold, RF Speech Processor, ALC Meter Hold function, IF Notch and Audio Peak filters, Transmit Monitor, Noise Blanker and CW Full Break-in. Controls are also provided for FM Squelch and CW Keyer Speed when the optional FM and Keyer Units are installed.

The most important feature of the FT-980 is that practically all of the above features can be controlled by the user's separate personal computer, when connected through an optional Interface, also available from Yaesu. Where up to now the few amateur transceivers that offered any kind of computer interfacing at all permitted only frequency control, the FT-980 permits almost total control of all functions from a separate microcomputer, including Mode; IF Width and Shift; Scanner Step, Speed and Limits; and switching of most other functions. (Microcomputers are not available from Yaesu.)

FT-77 THRIFTY HF TRANSCEIVER

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Simple

The front panel control layout and operation are actually simpler than some VHF FM transceivers, with only essential operating controls; while the simple circuit design leaves fewer parts that could cause problems. Nevertheless, all of the essential modern operating features for HF SSB and CW are included, along with extras such as dual selectable noise blanker pulse widths (designed to blank woodpecker or common impulse noise), full SWR metering, and capabilities for an optional internal fixed-frequency channel crystal, narrow CW filter and FM Unit.

Reliable

Computer-aided design of the circuit boards in the FT-77 ensures the most efficient component layout possible in the smallest space, while automatic parts insertion and soldering greatly diminish the chance for human error. Reliability and quality control are thus improved and simplified beyond the degree previously attainable in amateur equipment. This means longer equipment life with less chance of breakdown.

Expandable

The extremely compact size and simple control layout make the FT-77 ideal for mobile operation, or as the heart of a complete base station with the optional FP-700 AC Power Supply, FV-700DM Digital Scanning VFO and Memory System, FTV-700 V/UHF Transverter and the FC-700 Antenna Tuner. The competitive price of the FT-77, coupled with the expansion capabilities presented by these accessories, make this transceiver the perfect choice for those new to amateur HF communication, or as a practical second rig for old-timers.

*Computer Aided Design/Computer Aided Manufacture

FT-726R VHF/UHF Multi-bander

Combining all of the best features from Yaesu HF and V/UHF transceivers, the FT-726R opens a new world of operating ease and flexibility for FM, SSB and CW on the 50*, 144 and 430/440 MHz amateur bands. The design of the FT-726R integrates the individual operating requirements of each of the three operating modes into one unit, and the user can then select which of the optional plug-in band modules he desires.

The VFO-A/B scheme has ten programmable memories, and can be tuned in 20Hz steps for CW and SSB operation, or in selectable steps for FM. FM tuning is accomplished by an indented tuning knob. IF Width and Shift controls are provided for CW and SSB operation, while both preset standard and user programmable repeater offsets can be selected for all modes. An optional Satellite Unit makes the FT-726R into a full duplex cross-band satellite transceiver.

*144 MHz Unit installed, other Units available as options according to local regulations.

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BC150FB	10 channel memory, synthesised	144.90
BC2020	20 channel memory, AM/FM, synthesised	269.00
BC250FB	50 channel memory, synthesised	249.00

TONO

THETA 9000E	RTTY/CW/ASCII, Tx/Rx	669.00
THETA 550	RX only	299.00
	AMPLIFIERS	
UC70	430MHz 55W + preamp	159.00
2M 50W	144MHz 30-50W	69.00
2M 100W	144MHz 100W + preamp	129.00
MR 150W	144MHz 130-150W + preamp	169.00
MR 250W	144MHz 250W + preamp	325.00

TASCO

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

TOKYO HY-POWER

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

HI-MOUND MORSE KEYS

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

BNOS ELECTRONICS

12/6A	Power supply, 13.8V.6 amp fully protected	48.30
12/12A	Power supply, 13.8V.12 amp, fully protected	86.40
12/24A	Power supply, 13.8V.25 amp, fully protected	125.45
12/40A	Power supply, 13.8V.40 amp, fully protected	225.40

DRAE

FULLY PROTECTED POWER SUPPLIES

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

VHF Wavemeter 130/450MHz	27.50
Morse Tutor	49.00

ALINCO

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

TET ANTENNAS

AX210N	10 ele. yagi for 2m crossed	74.95
HB10F2T	2 ele. 10m mono band beam	51.50
HB10F3T	3 ele. 10m mono band beam	74.95
HB15F2T	2 ele. 15m mono band beam	60.66
HB15FT	3 ele. 15m mono band beam	93.46
HB15M25P	VP mini size 15m 2 ele.	69.50
HB15M35P	VP mini size 15m 3 ele.	102.30
HB34D	4 ele. tri band beam 10/15/20m	222.90
HB33SP	3 ele. tri band beam 10/15/20m	192.50
HB35C	Tri band array 10/15/20m	283.95
HB35T	5 ele. 10/15/20m	278.50
MV3BH	Vertical for 10/15/20m	37.99
MV4BH	Vertical for 10/15/40m	48.90
MV5BH	Vertical for 10/15/20/40/80m	63.95
MLA4	Loop antenna 10/15/40/80	105.60
SQ22	Phased 2 ele. swiss quad 2m	58.95
SQY06	6 ele. quagi 2m	45.75
SQY08	8 ele. quagi 2m	52.75
HB210S	10 ele. dual driven yagi 2m	47.99
TE214	14 ele. long yagi 2m	74.40
SSL720	9 × 2 ele. (18) slot fed 70cm	77.20
HB23SP	2 ele. tri band beam 10/15/20m	135.60
SSL218	9 × 2 ele. (18) slot fed 2m	144.79
TPH2	Phasing harness 2m	17.25
QYU10	10 ele. quagi 70cm	67.90
SQ007	70cm 2 ele. phased swiss quad	66.99
SQ10	Swiss quad 10m	97.50
SQ15	Swiss quad 15m	106.90

ANTENNA SWITCHES

SA450	SO239 connectors, 1 in, 2 out	9.75
SA450N	N-type connectors, 1 in, 2 out	12.75

ROTATORS

KR250	Kenpro Lightweight 1·1½" mast	48.00
9502B	Colorotor (Med. VHF)	56.60
KR 400RC	Kenpro – inc. lower clamps	P.O.A.
KR 600RC	Kenpro – inc. lower clamps	P.O.A.

BENCHER

BY1	Keyer Paddle (black base)	35.84
BY2	Keyer Paddle (chrome base)	43.72
BY3	Keyer Paddle (gold plated)	92.00
ZA 1A	Balun 3·5-30MHz for dipoles	15.00
ZA 2A	Balun 14-30MHz for beam ant	17.25

ADONIS MICROPHONES

202HD	Head set mic with control box and fet head	29.00
202HM	Headphones unit, fet mic with control box	39.50
MS10	Mobile speaker and message pad, visor mount	16.25

WELZ PRODUCTS

SP200	1.8-160MHz 20-200W 1kW PWR/SWR Meter	69.95
SP300	1.8-150MHz 20-200W 1kW PWR/SWR Meter	97.00
SP400	130-500MHz 5-20-150W PWR/SWR Meter	69.95
SP600	1.8-500MHz 20-100-2kW PWR/SWR Meter	97.00
SP15M	1.8-160MHz 5-20-200WW PWR/SWR Meter	35.00
SP45M	130MHz-470MHz POWER/SWR Meter	51.00
SP-10X	Compact version of SP15M	24.45
SP250	1.8-60MHz 20-200-2kW	49.50
SP350	1.8-500MHz 5-20-2kW	59.95
SP380	Compact version of SP300 (200 watts max)	49.00
AC38	3.5-30MHz ATU 400W PEP (8 bands)	65.00
CT15A	15-50w dummy load. (PL259)	7.95
CT15N	15-50w dummy load. ('N' plug)	13.95
CT150	150/400w dummy load. Rated 250MHz (SO239)	35.50
CT300	300/1kW dummy load 250MHz (SO239)	49.50
CT03N	3W dummy load 1.3GHz ('N' socket)	30.00
CH20A	2 way coax switch 1kW 900MHz (SO239)	17.95
CH20N	2 way coax switch 1kW 1.3GHz ('N' socket)	31.95
TP05X	50-500MHz power meter with load	13.95
TP25A	50-500MHz 25W power meter with load	17.50
TP20G	30-1500MHz power meter with load	139.00
CA35A	Static discharge protector. DC 500MHz 300w SO239	10.75
CA23N	Static discharge protector. DC 1500MHz 300w 'N'	12.60

MICROWAVE MODULES

MMT 144/28	2M Transverter for HF Rig	109.95
MMT 432/28S	70cm Transverter for HF Rig	159.95
MMT 432/144R	70cm Transverter for 2m Rig	184.00
MMT 70/28	4m Transverter for HF Rig	115.00
MMT 1296/144	23cm Transverter for 2m Rig	184.00
MML 144/30LS	2m 30W linear Amp (3W1/P)	69.95
MML 144/50S	2m 50W linear Amp (10W1/P)	85.00
MML 144/100S	2m 100W linear Amp (10W1/P)	139.95
MML 432/20	70cm 20W linear Amp (3W1/P)	85.00
MML 432/50	70cm 50W linear Amp	109.95
MML 432/100	70cm 10/100W linear Amp	228.65
MM 2001	RTTY to TV converter	189.00
MM 4001	RTTY transceiver	269.00
MM 400KB	RTTY transceiver with keyboard	299.00
MMC 50/28	6m converter to HF Rig	29.90
MMC 70/28	4m converter to HF Rig	29.90
MMC 144/28	2m converter to HF Rig	29.90
MMC 432/28S	7cm converter to HF Rig	37.90
MMC 432/144S	70cm converter to 2m Rig	37.90
MMC 435/600	70cm ATV converter	27.90
MMK 1296/144	23cm converter to 2m Rig	69.95
MMD 050/500	500MHz dig. frequency meter	75.00
MMD 600P	600MHz prescaler	29.90
MMDP 1	Frequency counter probe	14.90
MMA 28	10 meter pre amp	16.95
MMA 144V	2m RF switched pre amp	34.90
MMF 144	2m band pass filter	11.90
MMF 432	70cm band pass filter	11.90
MMS 1	The morse talker	115.00
MMS 2	Advanced morse trainer	169.00

DATONG

PC1	Gen. Cov. Converter HF on 2m	137.42
VLF	Very Low Frequency Converter	29.90
FL1	Frequency Agile Converter	79.35
FL2	Multi-mode Audio Filter	89.70
FL3	FL2 with auto notch	NEW 129.37
ASP	Auto R.F. Speech Clipper (Trio or Yaesu plug)	82.90/89.70
D75	Manually controlled R.F. Speech clipper	56.35
RFC/M	R.F. Speech Clipper Module	29.90
D70	Morse Tutor	56.35
AD 270	Indoor Active Filter (inc. PSU)	54.05
AD 370	Outdoor Active Filter (inc. PSU)	71.30
MK	Keyboard morse sender	137.42
PTS1	Programmable tone squelch systemm (two units)	45.99
RFA	Wideband preamplifier	33.92
MPU	Mains Power Unit	6.90

muTek

SLNA 70s	70MHz switched preamp	33.90
SLNA 70u	70MHz unswitched preamp	20.38
SLNA 70ub	Unboxed SLNA 70u	12.41
SLNA 144s	144MHz switched preamp (now 0·9dB nf typical!)	33.90
SLNA 144u	144MHz unswitched preamp	20.38
SLNA 144ub	Unboxed SLNA 144u	12.41
SLNA 145sb	Optimised preamp for FT290RD	NEW 24.90
BLNA 432ub	1.3dB nf sub-min 432MHz preamp	12.43
TLNA 432s	432MHz bipolar switched preamp	54.90
TLNA 432u	432MHz bipolar unswitched preamp	26.40
TLNA 423ub	Unboxed TLNA 432u	18.50
GLNA 432u·1	432MHz gasfet unswitched preamp 0.8dB nf/13dB gain	46.90
GLNA 432u·2	432MHz gasfet unswitched preamp 0.65dB nf/13dB gain	56.90
BLNA 129ub	1.3GHz bipolar unswitched preamp 1.8dB nf/12dB gain	24.50
GLNA 1296u	1.3GHz two stage ultra-low noise gasfet unswitched preamp 20dB gain	82.25
HDRA 95u·1	1.5dB nf/8.5dB gains high dynamic range band II preamp (input intercept + 22dBM)	29.90
HDRA 95u·2	11.5dB gain variant (input intercept + 16dBm)	29.90
BBBA 500u	20-500MHz broadband high dynamic range preamp	26.40
BBA 860u	250-860MHz broadband low noise preamp	20.50
XBPF 700ub	Band IV-V bandpass tvi filter	2.95
PPSU 012	12v (nominal) mains psu for BBBA 500u and BBBA 860u	6.95
RPCB 144ub	FT221/225 replacement front end board	64.50
RPCB 251ub	IC211/251E replacement front end board	69.90

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Bredhurst electronics

TRIO TS430

YAESU

		£	c&p
FT1	Superb H.F. Transceiver	1450.00	(–)
FT102	AM Band Transceiver	839.00	(–)
SP102	Matching Speaker	49.00	(2.00)
FC102	Matching A.T.U.	225.00	(2.50)
FT101Z	160-10m 9 Band Transceiver (FM)	590.00	(–)
FT101ZD	160-10m 9 Band Transceiver (FM) Dig	665.00	(–)
FC902	All Band A.T.U.	135.00	(1.50)
SP901	External Speaker	31.00	(1.50)
DCT101Z	DC/DC Power Pack	46.75	(1.50)
FAN101Z	Cooling Fan for 101Z/ZD	14.20	(0.75)
FT707	8 Band Transceiver 2000W Pep	515.00	(–)
FP707	Matching Power Supply	110.00	(5.00)
FC707	Matching A.T.U./Power Meter	88.00	(1.00)
MMB2	Mobile Mounting Bracket for FT707	17.25	(1.00)
FT77	Economy H.F. transceiver	515.00	(–)
FRG7	General Coverage Receiver	199.00	(–)
FRG7700	200KHz-30MHz Gen. Coverage Receiver	335.00	(–)
FRG7700M	As above but with Memories	399.00	(–)
FRT7700	Antenna Tuning Unit	42.55	(1.00)
FT208R	2M FM Synthesised Handheld	199.00	(–)
FT708R	70cm FM Synthesised Handheld	229.00	(–)
NC7	Base Trickle Charger	30.65	(1.30)
NC8	Base Fast/Trickle Charger	50.60	(1.50)
NC9C	Compact Trickle Charger	8.00	(0.75)
FNB2	Spare Battery Pack	19.95	(0.75)
PA3	12V DC Adaptor	14.20	(0.75)
FT480R	2M Synthesised Multimode	369.00	(–)
FT780R	70cm Synthesised Multimode (1-6MHz Shift)	399.00	(–)
FT790R	70cm Portable multimode	349.00	(–)
FT290R	2M Portable Multimode	285.00	(–)
MMB11	Mobile Mounting Bracket	24.90	(1.00)
CSC1	Soft Carrying Case	3.85	(0.75)
NC11C	240V AC Trickle Charger	8.80	(0.75)
FL2010	Matching 10W Linear FT290R	59.00	(1.20)
Nicads	2·2 amp HR Nicads Each	2.50	(–)
FF501DX	HF Low Pass Filter 1kW	25.70	(1.00)
FSP1	Mobile External Speaker 8 ohm 6W	9.95	(0.75)
YH55	Headphones 8 ohm	9.95	(0.75)
YH77	Lightweight Headphones 8 ohm	9.95	(0.75)
QTR24D	World Clock (Quartz)	31.45	(0.75)
YM24A	Speaker/Mic 207/208/708	18.40	(0.75)
YD148	Stand Mic Dual IMP 4 Pin Plug	22.60	(1.50)
YM38	Stand Mic dual imp 8 pin	27.20	(1.50)

ICOM

IC740	H.F. 9 Band Transceiver	769.00	(–)
IC720A	H.F. Tx + Gen. Cob. Rx	949.00	(–)
IC-PS20	P.S.U. for above with Speaker	155.00	(–)
IC-PS15	P.S.U.	119.00	(–)
IC2KL	H.F. Linear 500 Watts O/P	915.00	(–)
IC2KLPS	P.S.U. for above	256.00	(–)
ICAT500	1.8-30MHz Auto A.T.U.	349.00	(–)
ICAT100	3.5-30MHz Auto A.T.U.	249.00	(–)
IC251E	2M Multimode Base Station	559.00	(–)
IC290E	2M Multimode Mobile	379.00	(–)
IC25E	2M FM Mobile 25W	269.00	(–)
IC2E	2M Handheld	179.00	(–)
IC4E	70cm Handheld	199.00	(–)
ICBC30	Base Charger	45.00	(1.50)
ICHM9	Speaker – Microphone	12.00	(1.00)
ICML1	10 Watt 2M Booster IC2E	59.00	(1.00)
ICSM5	Desk Mic (8 pin for Icom only)	29.00	(1.00)
ICR70	General Cov. Receiver	499.00	(–)

F D K

Multi 700AX	2M FM Mobile 25W	215.00	(–)
Multi 750X	2M Multimode	315.00	(–)
Expander	70cm transverter for 750X	199.00	(–)

WELZ

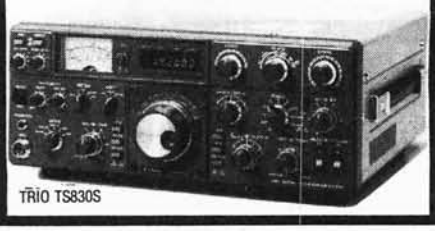
		£	c&p
SP15M	SWR PWR Meter HF/200W	35.00	(1.00)
SP45M	SWR PWR Meter 2M/70cm 100W	51.00	(1.00)
SP200	SWR PWR Meter H.F./2M 1KW	69.95	(1.50)
SP300	SWR PWR Meter H.F./2M/70cm	97.00	(1.50)
SP400	SWR PWR Meter 2M/70cm 150W	69.95	(1.50)
SP600	SWR PWR Meter H.F./2M/2KW	97.00	(2.00)
SP10X	SWR PWR Meter H.F./2M	24.45	(0.75)
SP350	SWR PWR Meter H.F./2M/70 200W	59.95	(1.50)
SP380	SWR PWR Meter H.F./2M/70cm	49.00	(1.00)
AC38	A.T.U. 3.5 to 30MHz 400W PEP	65.00	(1.00)
CT15A	15/50W Dummy Load (PL259)	7.95	(0.75)
CT15N	15/50W Dummy Load (N type plug)	13.95	(0.75)
CT300	300/1kW Dummy Load 250MHz (SO239)	49.50	(2.00)

COAXIAL SWITCHES

–	2 Way Toggle Switch (H.F./2M)	6.00	(0.50)
SA450	2 Way Diecast - SO239 (500MHz)	10.00	(0.75)
SA450N	2 Way Diecast - N plugs (500MHz)	12.95	(0.75)
CH20A	2 Way WELZ - SO239 (900MHz)	17.95	(1.00)
CH20N	2 Way WELZ - N plugs (900MHz)	31.95	(1.00)
–	5 Way Western Rotary (H.F.)	13.95	(1.00)
–	3 Way LAR Rotary (H.F.)	16.95	(1.25)

TRIO

TS930S	9 Band TX General Cov Rx	1216.00	(–)
TS830S	160-10m Transceiver 9 Bands	697.00	(–)
VFO230	Digital V.F.O. with Memories	243.00	(2.00)
AT230	All Band ATU/Power Meter	135.00	(2.00)
SP230	External Speaker Unit	41.00	(1.50)
TS430	160-10m Transceiver	736.00	(–)
PS430	Matching Power Supply	112.00	(3.00)
SP430	Matching Speaker	29.44	(1.50)
MB430	Mobile Mounting Bracket	11.27	(1.50)
FM430	FM Board for TS430	34.50	(1.00)
TS130S	8 Band 200W Pep Transceiver	559.00	(–)
TS130V	8 Band 20W Pep Transceiver	456.00	(–)
VFO120	External VFO	98.00	(1.50)
TL120	200W Pep Linear for TS120V	167.00	(1.50)
MB100	Mobile Mount for TS130/120	18.60	(1.50)
SP120	Base Station External Speaker	26.40	(1.50)
AT130	100W Antenna Tuner	93.00	(1.50)
PS20	AC Power Supply – TS130V	57.96	(2.50)
MC50	Dual Impedance Desk Microphone	30.80	(1.50)
MC35S	Fist Microphone 50K ohm IMP	14.70	(0.75)
MC30S	Fist Microphone 500 ohm IMP	14.70	(0.75)
LF30A	HF Low Pass Filter 1kW	21.00	(1.00)
TR9130	2M Multimode	433.00	(–)
TS9500	70cm Multimode	450.00	(–)
B09A	Bass Plinth for TR9130	39.30	(0.50)
TR7800	2M FM Mobile 25W	257.00	(–)
TR7730	2M FM Compact Mobile 25W	199.00	(–)
TR2300	FM Portable	152.00	(–)
VB2300	10W Amplifier for TR2300	65.70	(1.50)
MB2	Mobile Mount for TR2300	21.00	(1.50)
TR3500	70cm Handheld	250.00	(–)
TR2500	2M Synthesised Handheld	232.00	(–)
ST2	Base Stand	51.90	(1.50)
SC4	Soft Case	13.80	(0.50)
SMC25	Speaker Mic	16.10	(1.00)
PB25	Spare Battery Pack	25.00	(1.00)
MS1	Mobile Stand	31.90	(1.00)
TR8400	70cm FM Mobile Transceiver inc. PS10	299.00	(–)
PS10	Base Station Power Supply for TR8400	64.00	(2.00)
R600	General Coverage Rec	257.00	(–)
R2000	Synthesised 200KHz-30MHz Rec	398.00	(–)
HC10	Digital Station World Time Clock	67.60	(1.50)
HS5	Deluxe Headphones	23.00	(1.00)
HS4	Economy Headphones	11.27	(1.00)
SP40	Mobile External Speaker	14.26	(1.00)



TRIO TS830S

TRIO R2000

DATONG PRODUCTS

		£	c&p
PC1	Gen. Coverage Converter HF on 2M	137.42	(–)
VLF	Very Low Frequency Converter	29.90	(–)
FL1	Frequency Agile Converter	79.35	(–)
FL2	Multi-mode Audio Filter	89.70	(–)
FL3	Audio Filter & Notch	129.37	(–)
ASP	Auto RF Speech Clipper (Trio or Yaesu 4 pin Plug)	82.80	(–)
D75	Manually controlled RF Speech Clipper	56.35	(–)
RFC/M	RF Speech Clipper Module	29.90	(–)
D70	Morse Tutor	56.35	(–)
AD270	Indoor Active Antenna	47.15	(–)
AD370	Outdoor Active Antenna	64.40	(–)
MK	Keyboard Morse Sender	137.42	(–)
Codecall	Selective Calling Device (Link prog)	32.20	(–)
Codecall	Selective Calling Device (Switch prog)	33.92	(–)
RFA	Wideband Preamplifier	33.92	(–)
DC 144/28	2 Metre to 28MHz converter	39.67	(–)
MPU	Mains Power Unit	6.90	(–)

SWR – POWER METRES

Model 110	H.F./2M Calibrated Power Reading	11.50	(0.50)
YW-3	H.F./2M Twin Meter	11.95	(0.50)
UH-74	2M/70cm	14.30	(0.75)
SP 15M	Welz H.F./2M 200W	35.00	(1.00)
SP 45M	Welz 2M/70 100W	51.00	(1.00)
SP 200	Welz H.F./2M 1KW	69.95	(1.50)
SP 300	Welz H.F./2M/70	97.00	(1.50)
SP 400	Welz 2M/70 150W	69.95	(1.50)
SP 600	Welz H.F./2M/70 2KW max.	97.00	(1.50)
SP 10X	Welz H.F./2M Handheld	24.45	(0.75)
SP 380	Welz H.F./2M/70 Compact	49.00	(1.00)
T 435N	2M/70CM Twin Meter N plug 120W	37.00	(1.50)
CN 620A	Daiwa H.F./2M Crosspointer	57.00	(1.00)
CN 630	Daiwa 2M/70 Crosspointer	85.00	(1.00)

TELEREADERS (CW & RTTY)

TASCO CWR 610		189.00	(–)
TONO 550		299.00	(–)
TONO 9000		669.00	(–)

DRAE PRODUCTS

4 AMP	30.75	(1.50)	12AMP	74.00	(2.00)
6 AMP	49.00	(2.00)	24 AMP	105.00	(3.00)
VHF	Wavemaster 130-450MHz			27.50	(–)

ROTATORS

Hirschman	RO250 VHF Rotor	45.00	(2.00)
9502B	Colorotor (Med. VHF)	56.95	(2.00)
EMR400	Alinco	89.95	(2.50)
KR400RC	Kenpro – inc lower clamps	125.00	(2.50)
KR600RC	Kenpro – inc lower clamps	175.00	(3.00)

DESK MICROPHONES

SHURE 444D Dual Impedance	43.95	(1.50)
SHURE 526T Mk II Power Microphone	56.00	(1.50)
ADONIS AM 303 Preamp Mic. Wide Imp.	29.00	(–)
ADONIS AM 503 Compression Mic 1	39.00	(–)

TEST EQUIPMENT

Drae VHF Wavemeter 130-450MHz	27.50	(–)
DM81 Trio Dip Meter	71.00	(0.75)
MMD50/500 Dig. Frequency meter (500MHz)	75.00	(–)

MOBILE SAFETY MICROPHONES

ADONIS AM 2025 Clip-on	24.50	(–)
ADONIS AM 202H Head Band + Up/Down Buttons	34.50	(–)
ADONIS AM 202F Swan Neck + Up/Down Buttons	37.00	(–)

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Syledis

The Editor recently received further information from Malcolm Appleby G3ZNU, chairman of the RSGB VHF Committee, concerning the Syledis navigation system.

The letter reads as follows: "The Syledis navigation system, used mainly in the North Sea by the oil exploration business, has caused problems to UK amateurs using the 432MHz band for some time. Initially Syledis chains were set up temporarily where and when required, but subsequently installations became permanently established. These permanent chains do not transmit continuously, but are switched on automatically by a mobile unit requiring a navigational fix.

Unfortunately for the amateur population, the 430–440MHz band is allocated on a primary basis in the UK to radio location, with amateurs having only secondary status. The amateur population has therefore no right to demand that interference from Syledis cease. What is unfortunate is that the frequencies of operation chosen by the manufacturer of the equipment, and subsequently allocated by the Home Office, coincide with part of the 'DX Communication' end of the 432MHz band.

A paper presented at the 'Electronics in Oil' Conference, held towards the end of last year in London, gave some details of the system, and indicated the frequencies used by the service. The frequencies mentioned are 432·563MHz, 432·513MHz and 432·463MHz for the Primary Group, and 432·383 MHz, 432·303MHz and 432·144MHz for the Secondary Group.

Although the Home Office has been approached about the situation, at present they are not prepared to alter the status of amateurs on 432MHz. So for the time being, UK amateurs are, by the terms of their licences, obliged to avoid these frequencies, so as not to cause interference with the primary service."

News from the RSGB

RSGB HQ hopes to have its first Beacon Station operational later this year on 50MHz, using the callsign GB3NHQ. Initially the beacon will operate outside TV hours, but in 1984 it is expected that it will become operational on a 24 hours a day basis.

The 4th edition of the *VHF/UHF Manual,* published by the RSGB, is now available. The book is an invaluable source of reference for those interested in experimentation above 30MHz and is priced at £10.31 to non-members and £9.29 to members, which includes VAT and carriage.

Orders should be sent, with payment, to: *RSGB Publications (Sales), Alma House, Cranborne Road, Potters Bar, Herts. EN6 3JW.*

RAE Course

A course to prepare students for the Radio Amateurs Examination (City and Guilds 765) will be available at: *Mid-Warwickshire College of Further Education, Warwick New Road, Leamington Spa CV32 5JE. Tel: (0926) 311711.*

The course will be held on Thursday evenings between 1900 and 2100, commencing on Thursday 22 September 1983. Enrolment dates are 8 and 9 September, and further details are available from the college.

QUERIES

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

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

PROJECT COST

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

INSURANCE

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

CONSTRUCTION RATING

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

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

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

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

SUBSCRIPTIONS

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

BACK NUMBERS AND BINDERS

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

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

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

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

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PW RADIO USERS INSURANCE SCHEME

Practical Wireless Radio Users Insurance Scheme was devised by Registered Insurance Brokers B. A. LAYMOND & PARTNERS LIMITED following consultation with PRACTICAL WIRELESS to formulate an exclusive scheme designed to meet the needs and requirements of: Amateur Radio Enthusiasts ● CB Radio Users ● Taxi Companies and Fleet Users with Radio Telephones. A copy of the Policy can be inspected at the offices of B. A. Laymond & Partners Ltd., or of Practical Wireless in Poole.

SPECIAL FEATURES

● All Risks Cover ● "New Lamps for Old" Cover (as defined in policy) ● Index Linked Cover to combat inflation ● Includes Personal Liability cover against damages payments of up to £500000 to members of the public ● Licence protection—covers legal costs arising from any breach of your licence conditions ● Equipment covered anywhere in the UK, Channel Islands and Isle of Man, but not Northern Ireland and Eire ● Fixed Antennas (Aerials) covered ● Frequency, Power and SWR Meters and similar radio-related test equipment covered ● 30 days cover on Western Europe included Free of Charge ● Absolute Security as this scheme is underwritten by a leading member of the British Insurance Association on the London Insurance Market ● Practical Wireless radio receiver and transmitter projects covered (when stated in feature) ● Available to Clubs and Organisations† ● Available to Companies†

†Write directly to B. A. LAYMOND & PARTNERS LTD, for a special application form and full details enclosing the coupon below.

B. A. Laymond & Partners Ltd., Practical Wireless and the Underwriters wish to make it clear that it is an offence to instal or use a radio transmitter in the UK except under the authority of a licence granted by the Secretary of State and it is not their intention to provide cover for or to encourage or condone the illegal use of CB and/or other communications equipment.

MOBILE/PORTABLE EQUIPMENT

Cover for property contained in vehicles is subject to a Limit of Liability of £250, increased to £750 where the vehicle is protected by a reputable audible alarm, correctly set and operational.

When the vehicle is unattended, mobile equipment secured so that tools or a key are required to remove it must be disguised or concealed from view. Portable and mobile equipment not so secured must be placed in a locked boot or otherwise concealed from view, or removed from the vehicle entirely. Equipment not in a secure building or vehicle must not be left unattended.

How Much Will It Cost?

Sum to Insure	£1000	£3000	£5000
Annual Premium	£20	£35	£45

The premium is charged on sums insured in pre-selected bands. Thus equipment totalling £3750 would be in the band up to £5000, and the premium would be £45. Quotations for larger sums available on application.

Claims will be settled after deduction of an excess in the following manner:

Type of Loss		Excess
From saloon cars and hatchbacks with fully concealed luggage compartments		15% of claim (minimum £25)
From estate cars, vans and hatchbacks without concealed luggage compartments		25% of claim (minimum £25)
All others:	Sums insured up to £3000	£25
	Sums insured up to £5000	£50

How To Insure

Complete the application form below to obtain immediate insurance cover. Photocopies will not be accepted

APPLICATION FOR PRACTICAL WIRELESS RADIO USERS INSURANCE SCHEME PW7/83

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

Address

Post Code

Occupation Age Phone No. (Home) (Work)

I/We hereby apply to insure the equipment detailed below

BLOCK LETTERS

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

Please continue list of equipment on a separate sheet if necessary

TOTAL SUM TO INSURE £

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

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

Date Signed

Rush us details of PW Club Insurance ☐
PW Company Insurance ☐

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.

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AMSAT News

AMSAT OSCAR 8 operations manager, W9KDR, has announced a revised schedule for AO-8 to take effect immediately. Under the new schedule, Mode A will be operational on Sundays, Mondays and Tuesdays with Mode J on Thursdays, Fridays and Saturdays. Wednesdays will be reserved for recharge mode with even the beacon turned off to achieve a better charge rate. AO-8 was five years old on 5 March, 1983 (25,000 orbits to date!)

The March 1983 edition of *OSCAR News,* the official journal of AMSAT-UK, contains many interesting articles relating to space and radio matters. One particular article entitled "Satellite Communication for the 'simple' man" by Dave Lane G3VOM included the fact that he had often used a Slim Jim antenna for the 144MHz up-link. As Dave says "Using nothing but the Slim Jim as the up-link antenna plus 10 watts of c.w.—the results were gratifying to say the least. The majority of stations replied with 579 reports, but there was the odd 449—they must have had poor receivers!" It may take some believing, but with this set-up both New Mexico and Alberta were worked. Any other claims for better DX on the magic trombone slide?

On a more serious note, OSCAR 9 (UOSAT) was described, on 25 April 1983, as being in a complex spin in an attempt to release the tip-mass cable. Hopefully, this problem will be clearable and allow full deployment of the stabilisation boom, activation of the h.f. beacons and the c.c.d. camera experiment.

JAMSAT, AMSAT's Japanese arm, has recently received approval for the JAS-1 spacecraft project, Japan's first national amateur radio spacecraft. JAS-1 will be placed into a 1500km circular orbit at an inclination of 50° by a Japanese H1 launcher. The anticipated payload includes a Mode J linear transponder and PACSAT digital transponder.

The Phase IIIB satellite left its assembly point in Germany two weeks ahead of schedule and was thought to be on target for a launch from Karu on 3 June, 1983. However, due to problems with the same engine component which caused the loss of the Phase IIIA satellite, it is anticipated that the launch will be delayed for between one to five weeks.

Callsign Prefixes

With the number of RAE and Morse test passes increasing, the Home Office has decided on the next callsign prefix numbers.

For Class B licences the G6--- prefix is likely to run out this summer, and will be superseded by G1--- (Golf-One). The Class A prefix G4--- is expected to last until early next year when the prefix G0--- (Golf-Zero) will be introduced.

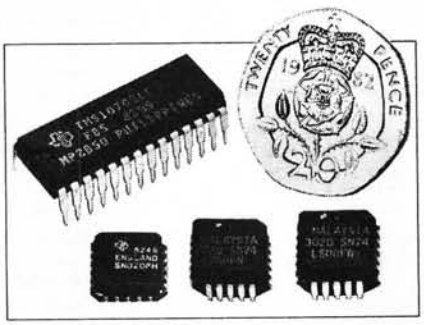
No doubt when the new series are introduced it will open up a whole new world for the ardent QSL card designer!

Texas Chip Carriers

Semiconductor Specialists (UK) Ltd. are pleased to announce that they have now signed a Franchise Agreement with Texas Instruments to supply T.I. devices in chip carriers.

Chip carriers are constructed using similar methods to dual-in-line packages but without the pins and excess packaging materials. Connections are made using contacts on all four sides of the square or rectangular package and this format is suitable for all T.I.'s i.c. technologies from simple gates to microprocessors. Other advantages with chip carriers include reliability, small size, low weight and reduced system costs.

T.I.'s chip carriers are designed to be tomorrow's v.l.s.i. package, and both Semi Specs and T.I. consider that by the end of the decade between 50 and 60 per cent of their customers, currently using conventional d.i.l. packages, will have converted to surface mounting techniques. Already most of



T.I.'s range of digital, MOS and linear devices are available in leaded plastic or leadless ceramic chip carriers.

Readers will be interested to know that Semi Specs have told us that they are able to supply Plessey devices and many other often hard to obtain types, such as those used in the *PW Cranborne.*

Further information from: *Semiconductor Specialists (UK) Ltd., Carroll House, 159 High Street, Yiewsley, West Drayton, Middlesex UB7 7XB. Tel.: (08954) 45522/46415.*

New Source of Components

Emos Ltd., the newly formed member of the Grenson Electronics Group, has recently opened a large warehouse in Daventry, dedicated to the sale of components to all types of electronic hobbyists.

The company's policy is to buy high quality components and resell at extremely competitive prices. Already in stock is over 5000 different types of component, with a value approaching £500 000.

The warehouse, which is open between 9am and 4pm Monday to Saturday, complements the Emos mail order operation that has been operating successfully over the last eight months. Most of the stock is housed in the 5000 square feet warehouse, which has the front section laid out as a large "walk-round" area where customers can browse through the large number of components and test gear etc.

To obtain a copy of the free Emos catalogue, send an s.a.e. to: *Emos Ltd., High March, Daventry, Northants NN1 4HQ. Tel: (03272) 5523.*

Special Event Stations

The Bromsgrove and District Amateur Radio Club will be operating a special 24-hour radio station on 21 June, 1983, at the Foxlydiate Hotel, Tardebigge, on the A448 between Redditch and Bromsgrove. The station will operate on all bands and will have world-wide coverage.

The station has been organised to celebrate the first birthday of HRH Prince William and in recognition of that has been issued with the very special callsign GB1BOY—the first time the GB1 prefix has been issued to an amateur radio club.

In addition to QSL cards for all stations contacted, colour certificates will be issued to those who request them.

Further information from: *Mrs J. Lawther G6JAN, Publicity Officer, 15 Fulton Close, Bromsgrove, West Midlands B60 2HA.*

A special event station using the callsigns GB4FES and G8FES will be operating between 23 and 30 July 1983, as part of "Festival 83", a Christian festival to be held at the County Showground, Stafford. Operation will be via c.w. and s.s.b. on the h.f. bands, plus c.w., s.s.b. and f.m. on the v.h.f. band.

Further details from: *G6CZM or G4LOF, both QTHR.*

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News

Repeater News

u.h.f.: GB3PU Perth on RB0 became operational over the Easter holiday. The group installing the repeater in the windowless hilltop bunker site were quite unaware of weather conditions outside. However, when they did re-emerge they were astounded to find themselves knee-deep in snow!

GB3VS, which was to be located at Glastonbury, is now awaiting site change clearance and will then become operational from Bridgwater in Somerset on RB13.

A proposal has been received, and is under consideration by the RWG, to establish a u.h.f. repeater to cover Omagh, Northern Ireland. The plan is to co-site the device with GB3WT.

It has been proposed that an RTTY repeater, on RB12, be installed at Leighton Buzzard. This will be passed to the Home Office (if agreed) under u.h.f. phase 7/8.

The following u.h.f. repeaters are temporarily off-air: GB3BN at Bracknell (23 months); GB3CK at Fife (13 months) will be back later this year after overhaul; GB3HC at Hereford (25 months) back soon from a new site; GB3LN at Greenwich, SE London (7 months) has been rebuilt; GB3NT at Newcastle (31 months) has a site change pending; GB3SK at Folkestone (3 months) this repeater may change site and local help is required.

The RSGB v.h.f. Committee have reached agreement with the BARTG on a plan to avoid mutual interference on 432MHz. The joint recommendation is to use 433·600MHz for AFSK simplex RTTY instead of 433·300MHz, thus leaving RB12 free of non-repeater traffic.

1·3GHz: GB3MC at Winter Hill is currently operational with test transmissions in beacon mode to allow coverage and equipment assessments to be made. No comments have yet been received from the HO concerning the 1·3GHz ATV repeater proposals currently lodged with them.

144MHz: The Reading repeater, GB3RD on R3, became operational on 19 March, 1983. Reports suggest that the machine is currently running QRP.

The two new Birmingham repeaters (GB3AM and GB3BX) have helped to reduce the overload situation on the original GB3BM. An antenna change is on the cards to avoid co-channel interference on R6.

29MHz: Yes 29MHz, that's not a misprint! Hardly had we put the June issue of *PW* "to bed", when we learnt that two proposals to establish 29MHz in-band repeaters had been lodged with the RSGB. It is understood that the basic principle of having repeaters on 29MHz in the UK will first have to be agreed by the RSGB h.f. Committee before they can be considered on technical merit by the RWG. Proposed locations are at Daventry (GB3XX group) and Leicester.

General news: Bob Leggitt G6KMM has been appointed as a corresponding member of the RWG to advise on band plans and specifications for RTTY and data repeaters. Bob is a full-time BARTG committee member.

Exhibition

The British Amateur Electronics Club will be holding their 18th annual amateur electronics exhibition at the Shelter, the centre of the Esplanade, Penarth, South Glamorgan, from Saturday 16 July until Sunday 24 July, 1983.

Further details from: *Cyril Bogod, "Dickens", 26 Forrest Road, Penarth, S. Glam. Tel.: (0222) 707813.*

Products

New-look Dual-band Transceiver from Trio/Kenwood

I have just received information, via a photograph and specification sheet printed in Japanese, details of the very latest new-look rig from the Trio/Kenwood stable.

Entitled the TW–4000D, it is a dual-band mobile f.m. transceiver covering both the 144MHz (2m) and 432MHz (70cm) bands.

The full frequency ranges covered are 144·000 to 145·995MHz and 430·000 to 439·995MHz. Separate antenna sockets are fitted and r.f. power out is 25W or 5W, on both bands, selected by the Hi/Lo switch. The rig requires a 13·8V d.c. power source.

Other main features include: ten memory channels on each band; two priority channels, one for each band; dial lock; tone burst; reverse repeater; full band and memory scan that may be operated from the microphone; and a novel cross-band working facility, that is once again controllable from the microphone.

The large display is unusual, in that it is a liquid crystal display with a green backlight and the S/RF meter is in the form of a graph that rises in a gentle curve as the signal strength increases.

The receiver section appears to comprise a double conversion superhet with the 1st i.f. at 30·865MHz and the 2nd i.f. at 455kHz. Sensitivity is 0·17μV for 12dB SINAD and the audio output is 2W into 8Ω.

A voice synthesiser that provides frequency information will be available as an optional extra later this year. Owners of Leyland *Maestros* take note!

Priced at £395, which includes VAT, the TW–4000D dual-band transceiver is available from: *Amateur Radio Exchange, 373 Uxbridge Road, Acton, London W3 9RH. Tel: 01-992 5765/6/7.*

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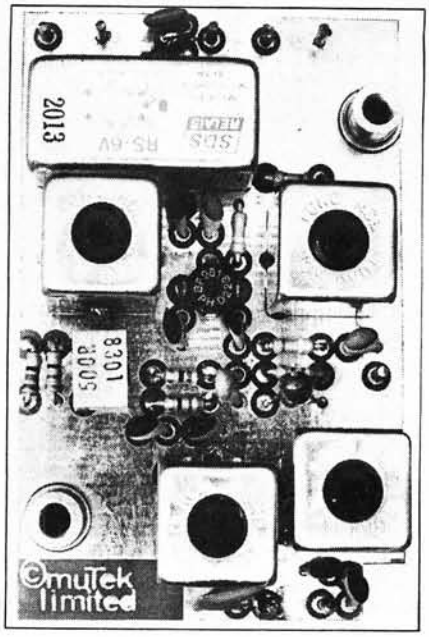
FT290R—The Final Solution?

Since its introduction the FT290R, 144MHz multimode transceiver, has often attracted criticism for an apparent deficiency in receiver sensitivity, in many instances this has been as a direct result of using this erstwhile portable rig in conjunction with QRO outboard linear amplifiers of up to full legal output power.

In an effort to redress the inbalance muTek Ltd. has introduced the SLNA 145sb Transceiver Optimised Preamplifier, which has been designed specifically for incorporation in the FT290R. The unit will, however, complement other 144MHz transceivers for which no complete front-end modification is available.

The pre-amplifier has been engineered to fit neatly within the transceiver and provide a sensitivity improvement sufficient to ensure that external noise is the limiting factor, whilst minimising dynamic range degradation.

Additional benefits include much improved front-end selectivity, and an onboard low-loss nitrogen-filled antenna transfer relay to eliminate the losses in-



herent with diode switching. This is followed by a BF981 in an input noise-matched, output conjugately matched configuration for a very low noise figure and optimum dynamic performance. After an on-board attenuator stage, a properly designed Butterworth band-pass filter provides substantial rejection of out-of-band signals.

The SLNA 145sb pre-amplifier is assembled on a double-sided plated-through-hole epoxy glassfibre p.c.b. and bushed mountings are provided for fitting in the FT290R. A cable kit utilising high quality ptfe dielectric cables is also provided.

Finally, typical specifications of the SLNA 145sb are as follows: Noise figure, 1dB typical; Transducer gain, variable 0 to 15dB; Input third order intercept, +2dBm; Input 1dB compression point, −14dBm; 1dB bandwidth, 4MHz; 20dB bandwidth, 12MHz; Antenna relay power handling, 40W (v.s.w.r. <2·00 : 1); and the overall size is 53 × 35 × 15mm.

Priced at £24.90, which includes VAT, the SLNA 145sb is obtainable from: *muTek Ltd., Bradworthy, Holsworthy, Devon EX22 7TU. Tel: (0409 24) 543.*

If you please

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

It's Legal

Britain's first legal cordless telephone unit has been launched by Fidelity Radio PLC. Called the Fidelity Wanderer, it has a handset to base-unit range of up to 200 metres. Eight duplex channels are available in the band 1·642–1·782MHz from base to handset and 47·46–47·54MHz from handset to base, using telescopic and tuned wire antennas in the base unit and telescopic and ferrite rod antennas in the handset.

To overcome the problem experienced by users of the many illegal cordless phones, of other callers making calls on your line (and inflating your telephone bill), the Wanderer incorporates a digital coding security system with over 16 000 combinations per channel.

The Wanderer's base unit plugs into the a.c. mains supply and a British Telecom telephone socket. The handset is powered from internal Ni-Cad batteries giving up to five hours' continuous use, and recharged whenever the handset is replaced on the base unit. Telephone numbers are called up using a standard keypad on the handset, with a Redial button which automatically redials the last number called, and a Memory (Scratch Pad) facility, which lets you store a number entered whilst making a call, ready for use when that call ends. Ideal for Directory Enquiries and the like.

The handset measures 215 × 74 × 40mm and weighs 334g. It has switches for standby/talk and off/on/high volume, plus l.e.d. indicators for talk and low battery, and has a removable clip to attach it to your belt. The handset telescopic antenna can be retracted when in the standby listening mode. The base unit measures 224 × 183 × 86mm and weighs 934g. It has indicators for power on, in use, and charge, plus a button to call the handset—useful for local messages like "Your tea's ready".

The Fidelity Wanderer is available in one colour only—beige. It carries the British Telecom green circle of approval for connection to the public telephone system, and is approved by the Home Office. No licence is necessary. Made entirely in the UK, the Wanderer is expected to be widely available at around £170.

British Telecom has also launched its own legal, cordless telephone, known as the Hawk, and also manufactured by Fidelity. It uses a helical "rubber-duck" type of antenna in place of the telescopic whip on the handset, but otherwide appears to differ only in minor cosmetic detail.

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FREQUENCY MEASUREMENT—3

I'm sure that you've all worked out that dividing (or pre-scaling, to use the jargon) the input signal frequency by 10 or 100 will do the same thing to the offset. So, a d.f.m. chip with its programming inputs set up for an offset of 10·7MHz on v.h.f. Band II (88–108MHz) **really** has an offset of 107kHz, which is 10·7MHz divided by 100. Looked at the other way round, the pre-scaler chip is multiplying the offset on the d.f.m. chip by 100 before presenting it to the outside world. If you've got one of the d.f.m. chips that covers the h.f. bands up to 30MHz with a ÷ 10 pre-scaler and a receiver i.f. offset of 455kHz, the chip offset is really only 45·5kHz (455 ÷ 10).

Obviously these facts don't matter when you're using the d.f.m. chip with a pre-scaler as the manufacturer intended; it's the end result that counts, if you'll excuse the pun! It does mean, though, that you can't use this standard receiver d.f.m. chip with an h.f. bands receiver with a 10·7MHz i.f. for example. For any of these "non-standard" offsets, you're back to designing your own. Similarly with s.s.b., suppressed carrier transmitters, which I mentioned earlier. The fact that there is virtually no carrier frequency component at the antenna terminal means you have to go back in the circuit to somewhere before the balanced modulator, which is where the carrier is removed. This usually means going right back to the v.f.o., but the problem is that the signal from there will go through one or two mixing processes on its way to the transmitter antenna terminal. To work out how the v.f.o. output frequency relates to the transmitter output carrier frequency you need to know what mixing system the transmitter uses, and what band it's operating on. The d.f.m. in the transmitter has got to do a similar sum to display the carrier frequency, so it's a "design-your-own" situation again.

Finally, I want to talk about accuracy and resolution in digital frequency meters. The specification for a d.f.m. will quote accuracy in two parts. The first part will be a tolerance given either as a percentage or as so many parts per million, which are two ways of saying the same thing. This tolerance relates to the accuracy of the frequency standard used for the time reference I mentioned in Part 1 of this series. Suppose you have a d.f.m. with an accuracy of ±10 parts per million, which you might find written as "±10 p.p.m.", or as "10 parts in 10^6", or even as "$\pm 10 \times 10^{-6}$". All of these are equivalent to ±0·001%. That 10 p.p.m. can make a bit more sense if you realise it means 10Hz per megahertz, so that when measuring a frequency in the 14MHz band, the reading could be up to 14 × 10 = 140Hz in error.

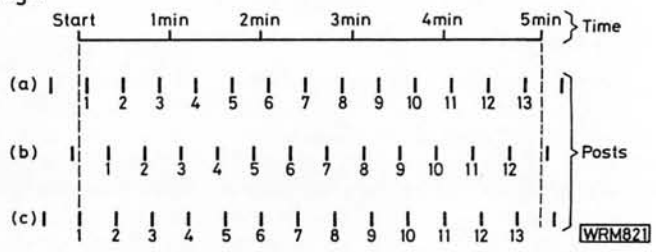
Using that same d.f.m. to read audio freqencies is a different story though. At 3kHz, the error due to the inaccuracy of the frequency standard would be not more than ±0·03Hz, but this would be completely swamped by the ±1 digit uncertainty of the readout.

When the second part of the specification says "±1 digit", meaning plus or minus one digit, the digit they're talking about is the least significant one—the right-hand one on the readout. To explain why there's always that one-digit uncertainty, let's go back to that train journey I talked about in Part 1.

Because you had a stopwatch, you could start timing when you actually passed a ¼-mile post. But suppose you only had an ordinary watch. You could tackle the job in two ways. The first would be to notice the time when passing a post, let's say 10.22 and 17 seconds, and then count posts until 10.27 and 17 seconds came up. If you're anything like me, long before 10.27 had arrived, you'd have forgotten what the time was when you started.

The second way is to wait until some easily-remembered time was reached, say 10.25 and 00 seconds, and count posts passing until 10.30 and 00 seconds came up. The problem now is that a post might come along very soon after you started timing (Fig. 4(a)), or one might have gone past just before you started so that you had a longish wait for the first one to be counted (Fig. 4(b)). Or you might be really lucky and have a post flash past you just as the watch shows 10.25 and 00 seconds (Fig. 4(c)), which gives us 13·6 posts (can you have 0·6 of a post?). I leave it to you to work out the speed, but don't forget to subtract one from the 13·6 before you start, because the first post should have been called "zero", like the first mark on a ruler.

Fig 4



If you ignore the "part-posts", the count you got at (a) is the same as that at (c). But if the posts had come up like (b), you'd have counted only 12. So the count depended on the relative timing between your watch indicating 10.25.00 and the passing of the posts. In the same way, the d.f.m.'s count depends on the relative timing or phasing between the cycles of the incoming signal and the cycles of the oscillator controlling the gate. So the count could be either one less or one more than it would be if the gate-opening coincided exactly with the trigger-point on a cycle of incoming signal, and indeed the last digit on the d.f.m. readout will be constantly changing to indicate this fact, even if the incoming signal is completely stable. Hence the ±1 digit bit!

That flickering last digit can be eliminated for most of the time by simply not displaying it. For example you could count in 1Hz steps but only display the reading down to the 10Hz steps. You will get flicker when the 1Hz count is changing between 9 and 0, but otherwise the final "tens of hertz" digit should remain steady when the input signal frequency is stable.

Modern Amateur-band transceivers usually display frequency to the nearest 100Hz, though some (like the TS-430S reviewed this month) have the capability of finer resolution. ●

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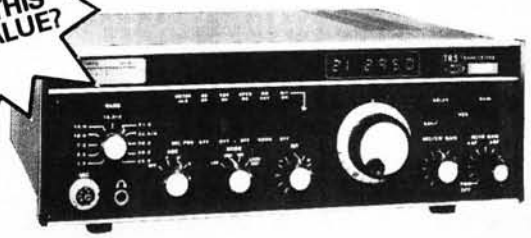

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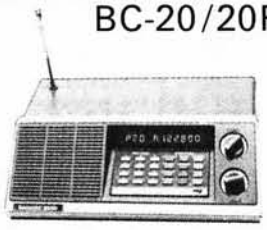

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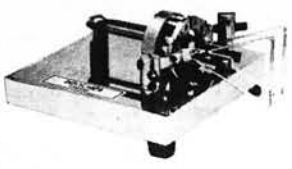

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E82CC	3.50	EF91	1.25	M8083	3.25	QS1200	3.95	6BW6	5.35	150B2	3.95
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	1.10	EL519	6.95	PCF808	1.25	5Y4G	0.85	6V6GT	0.80	7027A	4.65
ECC83	0.65	EM80	0.70	PCH200	1.10	6AB7	0.60	6X5GT	0.50	7199	3.20
ECC85	0.60	EM81	0.70	PCL82	0.80	6AB8	0.66	7B7	1.40	7247	2.00
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AC141K	0.34	BC173B	0.10	BF258	0.28	TIP41C	0.45
AC176	0.22	BC182	0.10	BF259	0.28	TIP42C	0.47
AC176K	0.31	BC183	0.10	BF336	0.34	TIP47	0.65
AC187	0.25	BC184LA	0.09	BFX29	0.30	TIP2955	0.80
AC187K	0.28	BC212	0.09	BFX84	0.26	TIP3055	0.55
AC188	0.25	BC212L	0.09	BFX85	0.32	TIS91	0.20
AD149	0.70	BC213	0.09	BFX86	0.30	2N3054	0.59
AD161	0.39	BC213L	0.09	BFX88	0.25	2N3055	0.52
AD161/2	0.90	BC237	0.10	BFY50	0.21	2N3702	0.12
AD162	0.39	BC238	0.09	BFY51	0.21	2N3704	0.12
AF124	0.34	BC307	0.09	BFY52	0.25	2N3705	0.12
AF125	0.35	BC327	0.10	BFY90	0.77	2N3708	0.12
AF126	0.32	BC461	0.35	BT106	1.22	2N5294	0.42
AF127	0.32	BC478	0.20	BT108	1.22	2N5296	0.48
AF139	0.40	BC547	0.10	BT116	1.20	2N5496	0.65
AF239	0.42	BC548	0.10	BU105	1.22	2SA715	0.95
AU106	2.00	BC549A	0.08	BU108	1.69	2SC495	0.80
AU107	1.75	BC557	0.08	BU124	1.00	2SC496	0.80
AU110	2.00	BC558	0.10	BU126	1.60	2SC1096	0.80
AU113	2.95	BD131	0.32	BU205	1.30	2SC1173	1.15
BC107	0.10	BD132	0.35	BU208	1.39	2SC1306	1.00
BC108	0.10	BD133	0.40	BU208A	1.52	2SC1307	1.50
BC109B	0.12	BD135	0.30	BU326A	1.42	2SC1449	0.80
BC140	0.31	BD136	0.30	BU526	1.90	2SC1678	1.25
BC141	0.25	BD137	0.32	MRF450A		2SC1945	2.10
BC142	0.21	BD138	0.30		11.50	2SC1953	0.95
BC143	0.24	BD139	0.32	MRF453	15.50	2SC1957	0.80
BC147	0.09	BD140	0.30	MRF454	23.50	2SC1969	1.95
BC148	0.09	BF179	0.34	MRF475	2.50	2SC2028	1.15
BC149	0.09	BF180	0.29	MRF477	10.00	2SC2029	1.95
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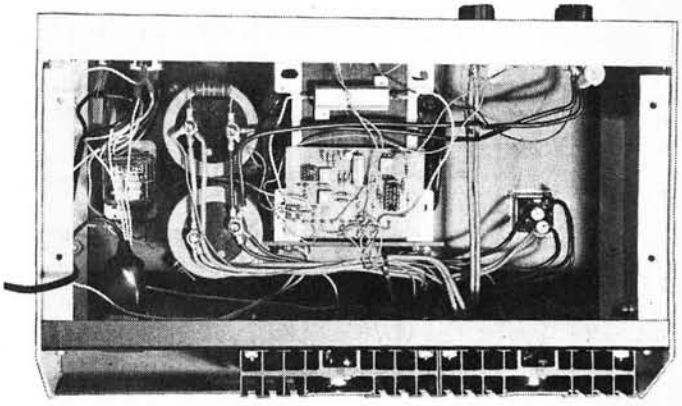
PW 'MARCHWOOD' 30A POWER SUPPLY UNIT part 2

by Nick Allen-Rowlandson BSc G4JET

In the first part we looked at the theory behind the design of a high-current power supply and its protection circuits. In this part the construction of the unit will be outlined. As this project is intended for the more advanced constructor detailed instructions will not be given, indeed since a specially designed cabinet is available ready punched to accept all the specified components such instructions are not really needed.

The control and overvoltage circuits are built on a simple printed circuit board which is bolted on spacers above the mains transformer. The wiring to this p.c.b. can be relatively small in size since only quite small currents are handled.



Casework

The case has been specially designed for this project by Newrad and is available from them ready drilled and formed but in "knocked down" form. Assembly is straightforward and should present no problems. The mains transformer is bolted to the base and front panel to increase the overall rigidity. With the mains transformer in place the unit is heavy and care must be taken when moving it around the bench not to trap your fingers under the sides.

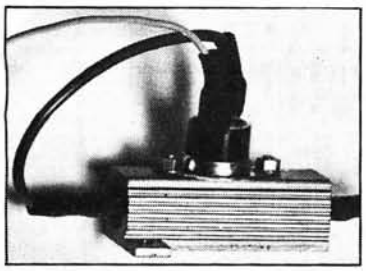
The two smoothing capacitors are mounted in clips bolted to the floor along with the bridge rectifier, which should be fitted with heatsink compound to help get rid of the heat to the case. The relay is also mounted in a plug-in base screwed to the floor.

Heatsink

The output transistors need to be properly mounted onto an efficient heatsink to ensure reliable continuous operation at anything approaching maximum current. The prototype used the TO3 metal cased 2N3055 transistors and these are shown in the photographs and drawings. The plastic cased TIP3055s can also be used and are mounted on the same side of the heatsink as the current sharing resistors. Mica washers are used for both types.

The drawing, Fig. 2.1, shows the method of assembling the heatsink and output transistors together with the resistors and thermal switch. Heatsink compound must be used to ensure good thermal contact between the heatsink and transistor bodies through the insulating washers.

The heatsink extrusion used is available in different lengths and may need cutting to the required lengths to fit



The method of mounting the thermal protection switch onto the soft start resistor

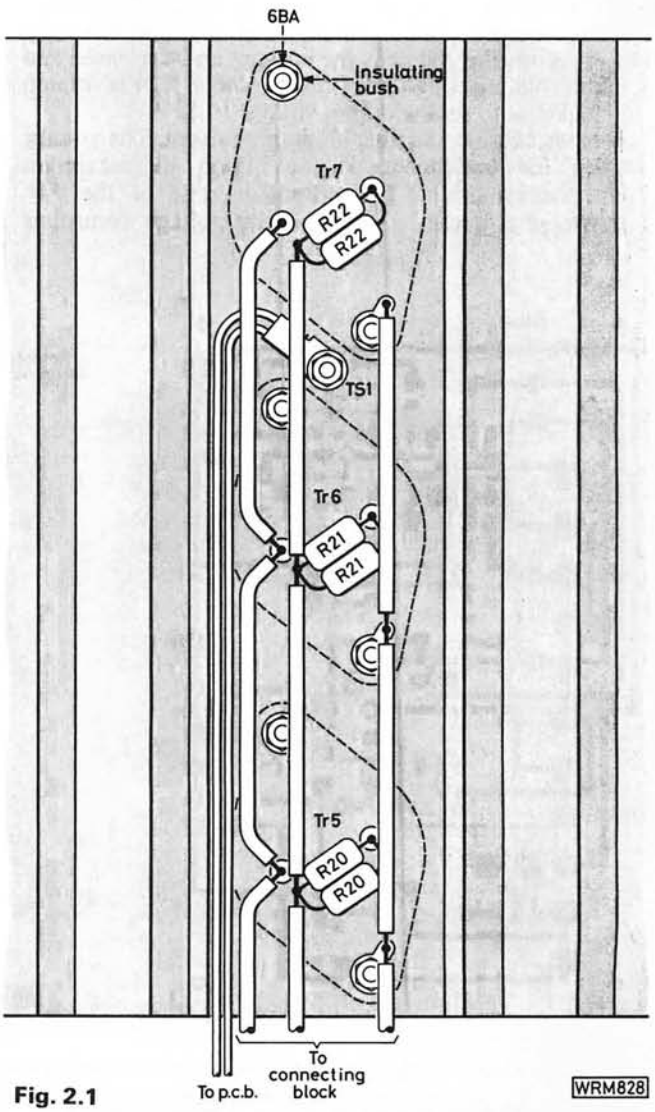


Fig. 2.1

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the case. The heatsink extrusions must not cover the slot in the back of the case but are mounted just above the slot. Air is then forced out of the case by the fan and up over the heatsink fins.

The fan is mains driven and is mounted in the roof of the cabinet together with an air filter. Air is drawn down into the cabinet by the fan and, as the only exit is via the horizontal slot under the heatsinks, the air is forced up over the fins to cool the output transistors.

Power Cabling

The main high-current wiring inside the unit **must** be carried out in a suitable gauge of wire. At least 4mm² pvc insulated cable should be used and this can be obtained most easily from 4mm² twin and earth mains cable. Suitable tags should be used to connect this cable to the capacitor terminals and it is also best to bind joints with thin tinned copper wire before soldering them.

Testing

Before switching on check and double check all your wiring and assembly work. With the current capability of the supply any fault is likely to be catastrophic, not to mention spectacular!

Set R13, R24 and R28 fully clockwise, ensure that the REMOTE SENSE terminals are linked to the OUTPUT terminals, fit a 3A fuse into the mains fuse holder and switch on. No output voltage should appear at the terminals until the PUSH TO START button is pressed when the voltage across the capacitor bank should slowly rise until the relay pulls in. When this happens the button can be released and the output voltage checked. Preset resistor R24 is rotated anti-clockwise to set the output voltage to 13·4V.

Here we come up against a minor problem. The voltage specified for equipment depends upon its maximum current consumption. The output voltage of the *PW* Marchwood is preset, so, unless the voltage control is taken to a potentiometer mounted so as to be accessible from the front panel a decision has to be taken as to whether to set the voltage low or high or somewhere in between. The specified voltage for different current consumptions is given in the table.

Load current (A)	Stabilised voltage (V)
Less than 6	13·8
6 to 16	13·6
16 to 36	13·4
36 to 50	13·2
Greater than 50	13·0

BS6160:Pt 1:1981 and IEC 489–1–1976
Measurement for Radio Equipment used in the mobile services, Pt. 1.

Overvoltage Trip

To set the overvoltage trip the output voltage needs to be temporarily increased to the level at which the trip is required to operate, usually about 15V. So increase the output voltage using R24. Now slowly adjust R28 until the overvoltage trip fires and the relay drops out. Reduce the output voltage, restart the supply and slowly increase the output voltage until the trip again fires. Check the output voltage when this happens and readjust R28 if it is not 15V. Reset the output to 13·4V using R24.

Current Limit

The supply can now be tested on load. To do this properly you will need some form of resistive load which can be varied easily and is capable of loading the output to 30A at 13·4V. In other words a total resistance of 0·44Ω at 400W! The prototype was tested with a combination of resistive mats and an Avo Model 8 with a specially made and calibrated high current shunt. The shunt consisted of a length of 16s.w.g. copper wire the length of which was adjusted to reduce the meter deflection, with 10A flowing on

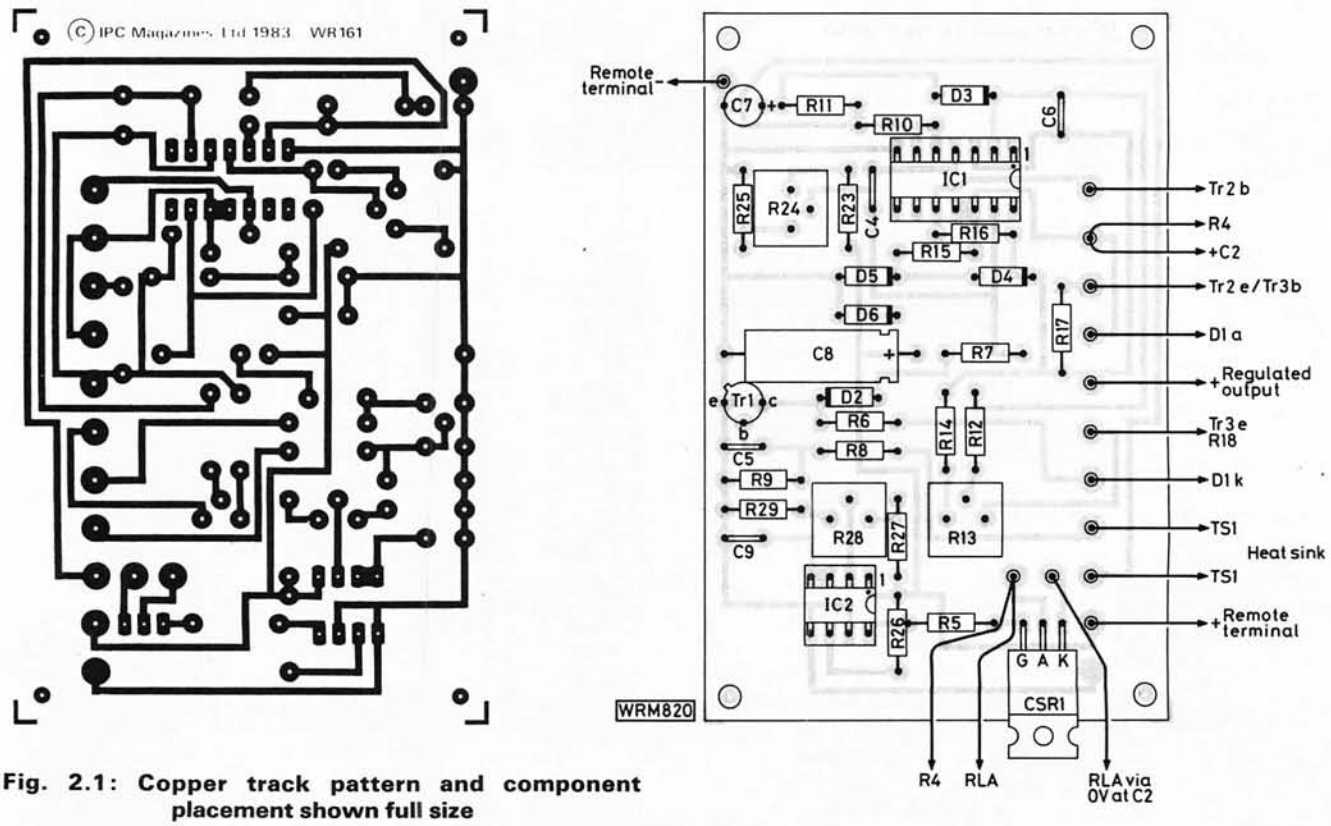

Fig. 2.1: Copper track pattern and component placement shown full size

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★ components

Resistors

Carbon Film ¼W 5%

2·2Ω	1	R5
100Ω	1	R17
220Ω	1	R14
330Ω	1	R9
470Ω	1	R16
1kΩ	9	R6, 7, 8, 10, 11, 12, 15, 23, 30
1·8kΩ	3	R25, 26, 29
10kΩ	2	R3, 27

2·5W Wirewound

0·22Ω	10	R18, 19, 20, 21, 22 (Paralleled pairs)
10Ω	2	R31, 32

25W Aluminium-clad wirewound

2·2Ω	1	R4

50W Aluminium-clad wirewound

47Ω	1	R2

Top-adjusting cermet preset

100Ω	1	R13
1kΩ	2	R24, 28

Capacitors

Resin dipped ceramic

10nF	6	C5, 6, 10, 11, 12, 13
22nF	1	C4
0·1µF	1	C9

Tantalum bead

10µF 35V	1	C7

Electrolytic axial lead

220µF 25V	1	C8

Electrolytic, computer grade, high-ripple (23A)

33000µF 40V	2	C2, 3 (RS 103-137)

Semiconductors

Diodes

1N914	3	D2, 3, 4
1N4002	2	D6, 7
Red l.e.d.	1	D1
Green l.e.d.	1	D8
BZX61C10V	1	D5
Bridge 35A 200V	1	BR1

Thyristors

BT152	1	CSR1

Transistors

BC109	1	Tr1
2N3055	6	Tr2, 3, 4, 5, 6, 7 (see text)

Integrated circuits

LM723	1	IC1
MC3423	1	IC2 (RS 307-890)

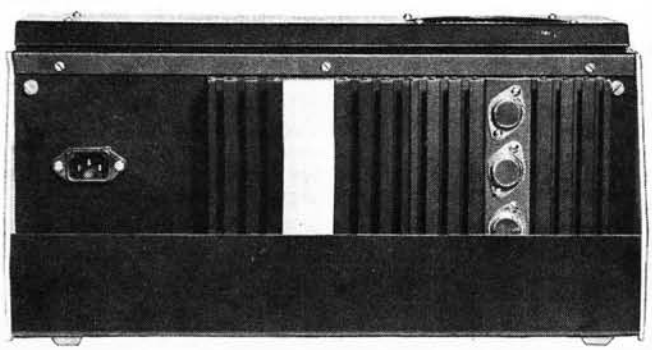
Miscellaneous

Transformer 16V r.m.s. 43A r.m.s. (see text); Heatsinks 1·1°C/W 152 × 130 × 32mm (2); T03 mounting kits (6); Heatsink compound; IEC 6A mains filter plug; Illuminated mains rocker switch d.p.d.t.; Mains push button switch s.p.s.t. 3A alternative action; Mains push button switch s.p.s.t. 3A momentary action; Fuse holder 20mm panel mounting; 6A 20mm quick-blow fuse; Insulated terminals 4mm black (1), red (1); Insulated terminals 30A black (1), red (1); Fan 120mm dia 240V a.c. (RS 509-226) with filter pads to match; Contact suppressor 250V a.c. (R1/C1) RS 238-463; Relay Octal plug-in, 24V d.c. 475Ω (RS 348-784); Compact screw base for relay (RS 402-355); Printed circuit board; Case (see text); 4mm² copper wire pvc covered (see text).

The case is available direct from Newrad Instrument Cases Ltd., Tiptoe Road, Wootton, New Milton, BH25 5SG. Tel: New Milton 615774. Price £21.00 inclusive. The mains transformer can be obtained from Hilton Transformers, North Causeway, Wareham, Dorset. Tel: Wareham 51646. Price £21·50 inclusive. A kit of semiconductors together with a p.c.b. is available from the author at 19 Kings Avenue, Christchurch, Dorset. Price £20.00 inclusive.

the 10A range, to about one-third of full scale (3A). Remember to multiply the meter readings by the scaling factor of your shunt and do not allow high currents to pass for longer than is necessary to take test measurements.

With the supply loaded to just 30A adjust R13 until the output current drops back to 30A. This sets the current limit level.



Rear view of the case showing the filtered mains plug and heat sinks. The cover over the right-hand transistors has been removed

When running the *PW* Marchwood at currents over about 5A the fan should be used and to prevent the surge from the fan tripping the protection circuits the fan should be switched on before starting up the supply.

Electro-magnetic Compatibility

The *PW* Marchwood has been thoroughly tested including e.m.c. investigation and for this we would like to thank G8MCQ who is professionally involved with this type of testing. The results of these tests were as follows:

1V r.f. 0·5 to 500MHz injected into mains input	No effects
5V r.f. 0·5 to 150MHz injected into d.c. output	No effects
1kV pulses, 1µs rise, 10µs fall, injected into mains input	No problems

Since its construction the prototype has been used extensively with full legal power capability h.f. transceivers with no evidence of any regulation or tripping problems. The supply has also been used to power v.h.f. and u.h.f. equipment again with complete freedom from problems. ●

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"In this World of darkness we must shine,
You in your small corner and I in mine."

In the winter of 1980 the visually handicapped radio amateurs and shortwave listeners of the UK had little or no access to the kind of written information which sighted amateurs could pick up in their local shops. If they were lucky they might have a wife or friend to read to them, but because of the technical nature of the hobby this often led to the reader becoming bored or confusing the amateur.

Following a visit by G4MRB John Feeley to G3DRE Peter Jones and arising from the germ of an idea sown by G3KFE Paul Essery in the pages of the *Shortwave Magazine*, the first few editions of *QTI (Questions of Technical Interest)* were recorded. Late last year at the Granby Hall Exhibition it became a proper charity association and is now in the process of registering with the Charity Commission. *QTI* takes the form of three hours of readings from the technical pages of *Practical Wireless, Wireless World, Shortwave Magazine, Radio and Electronics World, Ham Radio Today, Amateur Radio, Hobby Electronics* and *Sprat*—the journal of the GQRP club, the editors of these magazines having given permission for us to present their material in tape form without charge and in many cases giving free subscriptions.

The main emphasis is on the new and most interesting in equipment and electronic design ideas. Text and adverts are scanned and anything of use to the blind picked out for special mention. Circuits and projects are described by the point-to-point method, many of which have been constructed using the Vero wirewrap system by our "readers". We also visit the shows.

No charge is made for this service which operates from the spare bedroom of G4MRB. Every two weeks the members send two C90 cassettes in a post free pouch to *QTI* at 79 Narrow Lane, North Anston, Sheffield S31 7BJ. When the tapes arrive they are placed in a fast duplicating machine and copies made from prepared master tapes before posting back to members. No charge is made for this service if a letter is sent to state that the "reader" is registered blind when they first send tapes.

The bulk of UK tapes are recorded on our behalf by the Rotherham Talking News team while overseas fast copying is done at the home base. This is due to our outgrowing our copying capability.

Our present UK membership is over 70 and via our agents in Australia (VK3BTL) and the USA (W4GH) we serve about 35 more overseas. Some overseas members prefer to send tapes to us direct to receive our "international" service (2 C90 each month). The "readers" are a mixed bunch of longtime s.w.l.s, newly licensed stations, some who have been blind from birth, and a few older amateurs whose sight has dimmed with the passage of time. Others have lost their sight in accidents. The service is also open to the physically handicapped but they must provide return postage.

The master tapes are prepared each fortnight from a mixture of studio recordings, show recordings and contributions sent in on tape. We have expanded to use two studios (bedrooms) now and the recording weekends make social gatherings for a good number of local amateurs who read from magazines, drink tea and eat G6DIZ's soup (famed all over South Yorkshire).

Finance is a problem for all talking newspapers and ours is no different from the rest. We have to cover our share of the costs of Rotherham Talking Newspaper's equipment while postage and masters present a constant drain on funds. Having said this, we are very warmed by the response we have had from the amateur radio club member and traders who have provided in the past two years no less than four top quality tape decks and a £400 fast copier. The existence of *QTI* owes much to the Electronics Industry and the generosity of many individual amateurs and clubs. We should like to end by thanking the people we have "touched" in the past and those we will "touch" in the future.

QTI is QRT 73
Diz and John Feeley (G6DIZ & G4MRB).

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Frequency:	144 – 146MHz
Frequency Steps:	25/5 KHz
Size:	65 × 167 × 32mm
Weight with battery:	420gm
Operation Voltage:	5.5 – 11VDC
Batteries:	AA Drycell/AA Nicads or Nicad Pack CNB110
Power Consumption:	20mA standby Max: 650mA Transmit

Receiver

Sensitivity:	–6dB at 20dB S/N –8dB at 12dB SINAD
Squelch sensitivity:	–12dB
Audio Output:	600mW

Transmit

Low Power	150mW
High Power	See chart

Type of Battery	RF Output
6-AA Duracells	2.5w
6-AA Dry Cells	2.2w
6-AA Nicads	2 w
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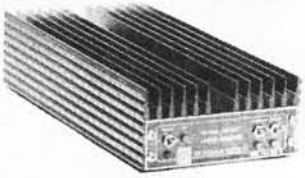

MML144/100-S

INPUT POWER	OUTPUT POWER (R.M.S.)	MODES OF OPERATION	PRODUCT	PREAMPLIFIER GAIN	PREAMPLIFIER N.F.	POWER REQUIREMENTS	R.F. VOX	CONNECTORS
1 or 3W	30W	SSB	**MML144/30-LS**	12dB	< 1·5dB	13·8V @ 4A	√	SO239
10W	50W	FM	**MML144/50-S**			13·8V @ 6A	√	SO239
10W	100W	AM	**MML144/100-S**			13·8V @ 12A	√	SO239
1 or 3W	100W	CW	**MML144/100-LS**			13·8V @ 14A	√	SO239

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MML144/100-LS: £159.95 (p+p £3.00)
MML432/30-L : £99.00 (p+p £3.00)
MML432/50 : £109.95 (p+p £3.00)
MML432/100 : £228.65 (p+p £4.00)

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3 Does the amplifier you are considering have a "realistic" power output specification? Be sure to check if the power rating is RMS or PEP!
4 Is the product fully guaranteed for 12 months – INCLUDING PA DEVICES?

If the answer to any of these questions is No, then you should telephone us immediately for help!

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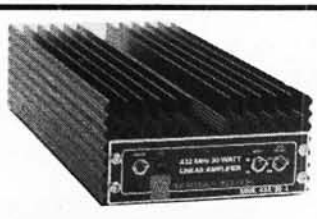
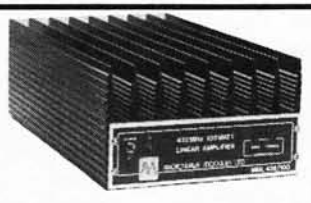
1 or 3W	30W	SSB FM SSTV AM CW	**MML432/30-L**	12dB	< 2dB	13·8V @ 6A	√	INPUT-BNC OUTPUT-BNC
10W	50W		**MML432/50**	12dB	< 2dB	13·8V @ 8A	√	INPUT-BNC OUTPUT-N
10W	100W		**MML432/100**	—	—	13·8V @ 20A	√	INPUT-BNC OUTPUT-N

MML144/100-LS



MML432/30-L



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TRIO TS-430S HF TRANSCEIVER

When I saw the TS-430S advertised, I thought it was a lot bigger than it really is—photographs can be deceptive. It turns out to be a very nice little transceiver which has all the really useful features of a home-station rig built into a box small enough to use portable or mobile.

The transmitter covers the amateur bands from 1·8 to 29·7MHz, whilst the general coverage receiver tunes continuously from 150kHz to 30MHz with the option of band-changing in 1MHz steps or from one amateur band to the next. Two v.f.o.s with band/mode memory allow split-frequency or cross-band operation. The tuning rate is 10kHz per revolution of the main tuning knob with 10Hz steps, or 100kHz per revolution with 100Hz steps for rapid tuning. The 7mm-high blue fluorescent readout indicates true operating frequency in all modes with 100Hz resolution. Snipping an internal link can change this to 10Hz if required. The dial frequency can be locked at the touch of a button.

An 8-channel memory remembers band and mode and gives a comprehensive range of facilities. These include: 1. recall channel with frequency/mode locked; 2. Recall channel as starting-point for tuning, with frequency/mode variable without changing memory contents; 3. Scan memorised channels in turn at a rate of about 1·8s per channel; 4. Scan the frequency band between limits set by the contents of memory channels 6 and 7; 5. Channel 8 has separate transmit and receive memories and can be used for split-frequency or cross-band working. A lithium battery gives about 5 years continuous memory back-up.

When using either of the scan modes, the scan does not stop on receipt of a signal. You have to press a HOLD button to stop the scan, and on the band-scan mode the tuning can then be adjusted by means of the main dial.

The TS-430S incorporates the usual Trio IF SHIFT control, which is a great help in suppressing interfering signals from adjacent channels. There is also a very useful audio notch filter which to my mind has just about the right characteristics. Many audio notch filters are so sharp that it's difficult to adjust them onto the interfering signal. An unusual feature is the SQUELCH control, operative on all modes, and great for a quiet life when standing by for a sked!

Running quickly through the other features, starting at the left-hand side of the front panel, there is provision for a scanning microphone, and low-impedance headphones with either mono or stereo jackplug fitted. Manual and VOX send-receive switching is provided for voice and c.w. modes, with VOX gain, delay and anti-VOX presets recessed into the transceiver top panel. An a.f. speech processor with fixed

Trio's attractive new styling incorporates "S" meter, frequency and memory channel indicators within a single window

level gives a reportedly worthwhile increase in "punch" on DX contacts without too badly affecting speech naturalness.

The "S" meter can be switched to monitor either p.a. stage current or a.l.c. operation when on transmit. The a.l.c. is very effective, limiting the output level to a safe maximum without generating nasty spurii even if you grossly over-modulate or turn up the carrier level too far on c.w.

The NAR/WIDE switch can select different i.f. filters, which are available as options. These include 500Hz or 270Hz filters for c.w., and a 1·8kHz filter for s.s.b. There is also a 6kHz filter option for a.m. but this is not switchable. The transceiver tested had only the standard 2·4kHz filter fitted for all modes. In conjunction with the IF SHIFT control this basic configuration is adequate for c.w. and s.s.b., though the serious c.w. operator would want to try one of the narrow filters. On a.m. it's a different story, and if you want your TS-430S to double as a broadcast-band DX receiver you'll certainly need the 6kHz filter. All bandwidths are —6dB, incidentally.

Below the frequency readouts are l.e.d. indicators for ON AIR, F. LOCK, F. STEP, RIT and NOTCH, and flanking the readout are v.f.o. indicator lights and a display of memory channel selected.

The only other front panel item not already mentioned is the noise-blanker. This is quite effective on impulse noise like passing motor-bikes, but not generally much help with the "Woodpecker". One control on the top panel I forgot to mention is a speed adjustment for the band-scan function.

On the back panel is a large heatsink with a reasonably quiet, thermostatically controlled fan. The power lead sup-

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★ test measurements

TRANSMITTER

Outputs in A1A mode: (13·8V supply)

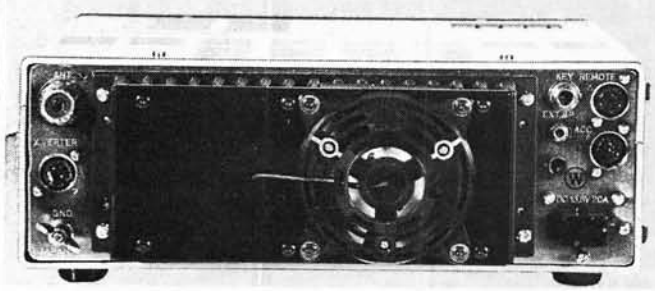
Freq. (MHz)	Max. Output (W)	F.S. Ic (A)	Harmonic Outputs (dBc) 2nd	3rd	4th	5th	Spurious Outputs (dBc)
1·81	95	15	−47	−57	—	−45	−62
3·51	105	14	−46	−55	−46	−63	−60
7·01	110	15	−47	−57	−67	—	−54
10·11	110	12	−62	−44	—	−69	−55
14·01	110	12	−65	−41	—	—	−50
18·11	105	12	−48	−56	—	—	−55
21·01	105	13	−52	−63	—	—	−61
24·91	100	14	−53	−65	−66	—	−52
28·01	95	12	−62	−66	−70	—	−59
29·01	95	12	−61	−61	—	—	−54

Maximum output at 14·1MHz:

Mode	Final Stage Ic (A)	Power Out (W)
A1A	12	110
J3E	12	110
A3E	8	50

Carrier suppression: 65dB relative p.e.p.
Unwanted sideband suppression: 70dB (1kHz tone at 14MHz)
3rd Order i.m.d.: 33dB below p.e.p.
Frequency stability: Within 50Hz during first 3 hours
Frequency setting accuracy: ±4 parts in 10^6
Speech processor compression: 20dB max.

Test equipment used:
2017 and 2019 signal generators, 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; Tektronix 2215 oscilloscope.



RECEIVER

Sensitivity:

Freq. (MHz)	Input e.m.f. (μV) for 10dB (S + N)/N A1A/J3E	A3E	Input e.m.f. (μV) for S9 (J3E)
1·81	0·23	0·28	85
3·51	0·25	0·26	100
7·01	0·27	0·31	120
10·11	0·20	0·25	80
14·01	0·21	0·24	80
18·11	0·25	0·26	105
21·01	0·24	0·26	110
24·91	0·31	0·35	150
28·01	0·30	0·35	150
29·01	0·24	0·28	110

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

Reading	Input required μV e.m.f.	dBμV
S1	3·5	11
S2	5·5	15
S3	8	18
S4	11	21
S5	16	24
S6	22	27
S7	35	31
S8	50	34
S9	80	38
+20dB	340	50
+40dB	2·6mV	68
+60dB	20mV	86

Image rejection: Better than 85dB

I.F. rejection:

Receiver tuned to (MHz)	Input Signal (MHz)	I.F. rejection (dB)
29·700	48·055 (1st i.f.)	86
8·820	8·830 (2nd i.f.)	70
8·825	8·830 (2nd i.f.)	66
8·900	8·830 (2nd i.f.)	102

Selectivity: IF SHIFT control centred, MODE A1A: 2·6kHz (−6dB); 6kHz (−60dB)
RIT: −1·2kHz/+1·5kHz
AGC: Output change for 115dB input change, relative to 8μV threshold: 0·5dB
RF attenuator: 21dB at 1·8MHz, 19dB at 29MHz
Audio notch filter: 18dB approx. at 1kHz. Tunable 300Hz—2·6kHz
Audio output: 1·5W into 8Ω with 9% t.h.d. for 1·25μV input at 14MHz

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★ specifications

TRANSMITTER

Frequency coverage:	1·8, 3·5, 7, 10·1, 14, 18·07, 21, 24·89 and 28MHz (160, 80, 40, 30, 20, 17, 15, 12 and 10m) amateur bands
Types of emission:	A1A (c.w.), J3E (u.s.b./l.s.b.), A3E (a.m.), F3E (f.m.)*
Power input (final):	A1A: 200W d.c., J3E: 250W p.e.p., A3E: 60W
Carrier suppression:	Better than 40dB
Unwanted sideband:	Better than −50dB
Harmonic radiation:	Better than −40dB
Maximum deviation (F3E):	±5kHz
Antenna impedance:	50Ω unbalanced
Microphone impedance:	500Ω–5kΩ

GENERAL

Power requirements:	13·8V d.c. ±15% negative ground. 1·2A receive, 20A transmit (approx.)
Dimensions:	96×270×275mm
Weight:	6·5kg

RECEIVER

Frequency coverage:	150kHz–30MHz
RIT range:	More than ±1kHz

Sensitivity (min):

Mode	Input for 10dB (S + N)/N		
	< 500 kHz	0·5–1·8 MHz	>1·8MHz
A1A/J3E	1µV	4µV	0·25µV
A3E	13µV	40µV	2·5µV
F3E*	—	—	0·4µV (12dB SINAD)

Image rejection:	Better than 70dB (>1·8MHz)
I.F. rejection:	Better than 70dB (>1·8MHz)

Selectivity:

Mode	−6dB	−60dB
A1A/J3E/A3E†	2·4kHz	4·4kHz
F3E*	15kHz	32kHz

† Narrower filters for A1A or J3E, and a wider filter for A3E, are available as options.
*Option.

Frequency stability:	(After 1 min. warm-up) Within ±200Hz in first 60 min. Within ±30Hz every 30 min. thereafter. Better than ±30 parts in 10^6 from 0° to +50°C.
Frequency accuracy:	Better than 10 parts in 10^6
Audio output:	More than 1·5W into 8Ω for 10% t.h.d. (Permissible load 4–16Ω).

plied with the equipment is a heavy 4-core with leads paralleled at each end and a 20A fuse in the positive line at the supply end. Despite its substantial construction the 2·4m lead drops half a volt at full load, a point to be remembered when operating mobile from a nominal 12V battery off-charge.

Besides the usual antenna, earth, key and external l.s. connectors, there are DIN sockets for v.h.f./u.h.f. transverter, linear amplifier, and remote operation which allows use with a second receiver or a separate receiver antenna, or as a second receiver. Details of how to use these facilities, plus connections for a.f.s.k. or SSTV operation, are given in the instruction manual.

Apart from the options mentioned already, there is an f.m. unit available for use on the 28MHz band or with transverters. We were not able to test one of these.

A tilt-bail foot is fitted which can raise the front of the transceiver for a more convenient operating angle in the desk-mounted mode. For mobile use an optional mounting kit for under-dash or tunnel fitting is available.

Final Impressions

The TS-430S has proved very easy to use, the only feature needing serious handbook reading being the memories. Reports from distant stations have all been complimentary. Receive performance is good (apart from the very limited a.m. bandwidth mentioned previously). The instruction manual is a bit fragmented, with how-to-use-it information split between the "Controls" and "Operation" sections, but it also includes installation recommendations and a full set of circuit diagrams, together with photographs identifying the main units. Components are labelled on the p.c.b.s.

The Trio TS-430S in its basic form as tested costs approximately £740 including VAT. It is available from **Lowe Electronics, Chesterfield Road, Matlock, Derbyshire, DE4 5LE, telephone Matlock (0629) 2817** etc., to whom our thanks go for the loan of the review model, and from their branches and agents in the UK.

Geoff Arnold

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PW 'Severn'

QRP 7MHz Transceiver

PART 3

Rev. G.C. DOBBS G3RJV

We have looked at the construction of a direct conversion receiver with a v.f.o. on the 7MHz band. Such receivers have the advantage of being easily convertable to transceivers because the same oscillator can be used to excite the transmitter chain. My general view of transceiver construction is that when the receiver is built and working well . . . "You've cracked it". The addition of the transmit circuitry is simple compared with the task of producing a worthwhile receiver on the amateur bands.

There are many "myths and legends" and not a few hard luck stories about attempting to build a solid state transmitter. Some constructors spend hours studying the theory of r.f. techniques, others build the boards with their fingers crossed—not easy. But no amount of studying, whether it be of the latest learned text or the entrails of a small mammal, can beat finding a tidy little circuit which works well and sticking with it. The circuit I offer for the transmitter section of the *PW* 'Severn' is just that sort of circuit. I have used it in several transmitters and transceivers (such as Ben: The Little Transceiver for 10MHz, *Short Wave Magazine* Jan–Feb, 1982), with success in every case.

The transmit section of the *PW* 'Severn' is genuine QRP in that it runs about 2 watts d.c. input which can be surprisingly effective on the band. The p.a. transistor is uncritical with several types of inexpensive devices offered as alternatives. For the Radio Amateur who wishes to sample QRP operation but use his existing receiver, the transmit board from this section, with the v.f.o. from Part 2, could make a useful first QRP transmitter. A simple method of doing this is discussed at the end of the article. An operator using just a couple of watts of homebrewed r.f. power can command great respect from his fellow amateurs on the band. Why not try it?

The Transmit Board

The transmit board is shown in Fig. 3.1. It is a three stage tuned power amplifier running some 2 watts d.c. input to the final stage. The pre-driver, Tr10, and driver stage, Tr11 are both keyed in a common 12 volt line. The final amplifier is capacitive coupled, via C38 into a fixed pi-network. This output circuit is something of a compromise but with Tr12 at about 2 watts input the L9/C39/C40 network is near enough to 50 ohms impedance in and out. The network could be tunable but over the 100kHz excursion of the 7MHz band the bandwidth is adequate and the output appeared flat over the whole c.w. section of the band. Several devices could be used for Tr12 and the individual constructor may find access to several reasonably or lowly priced transistors for the p.a. A whole variety of devices were tried in the prototype, perhaps the best being a completely unknown surplus type. Excellent results were had from the following: 2N3553, BLY33, 2N4427 and BSX61. Slightly less output was obtained from: 2N3866, BFY51 and some examples of the 2N3053.

Both the pre-driver and driver stages are operated in Class A. It would be quite possible to use one higher gain stage but this method has several advantages. Less gain per stage seems to ensure stability for the little extra cost involved. The additional linearity is also useful, for although the transmitter is for c.w. a driver run at saturation still appears to behave in a linear fashion for spurious products and all the "nasties" slip through with relative ease. Two lower gain stages which are tuned also make a single pi-network acceptable in the output of the p.a.

The p.c.b. layout and component layout are shown in Fig. 3.4. The board is compact but no problems appeared with this layout. The method of construction was the old faithful of building the board a stage at a time and testing as the work progressed. The only test equipment that is essential is a simple r.f. probe which can be used with a multimeter. The circuit for the r.f. probe is shown in Fig. 3.2. This can be built on a piece of scrap p.c.b. or Veroboard. Ideally, it should be in a screened case although this is not vital if the leads to the meter are screened. The probe may be a short length of stiff copper wire. If the constructor does not already have an r.f. probe it is probably a good idea to spend a little time and build it up as a respectable unit. Such probes can make a very useful addition to any amateur workshop. The probe is

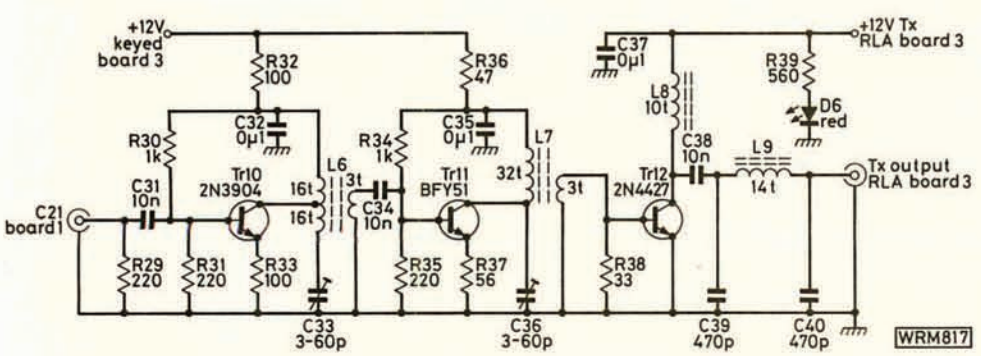

Fig. 3.1: Circuit diagram of the transmit section of the *PW* 'Severn'

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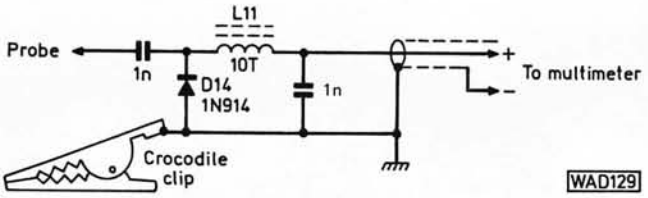

Fig. 3.2: A simple r.f. probe suitable for use in aligning the transmitter board

plugged into a multimeter which is then used on a low voltage scale, or in cases of very low r.f. measurements a d.c. current range may be used. The reading is of the peak r.f. voltage present at the probe tip. Lack of screened leads to the meter can give spurious readings through r.f. pickup in the meter leads.

The first stage, Tr10, is built as shown in Fig. 3.4. The output tuned circuit, L6 and C33, should tune the 7MHz band without problems. L6 is wound on a Neosid 28-511-35 toroid with the main, centre tapped, winding taking up almost the entire length of the toroid. These are available from Neosid Small Orders, PO Box 86, Welwyn Garden City, Herts, AL7 1AS, who can also supply the other wound components as a kit costing £4 inclusive. Although not really variable the inductance of coils wound on toroids can, in practice, be altered a little by opening or closing the spacings between the turns. C33 is a Mullard type semi-airspaced trimmer.

The stage can be tested by running a screened lead from the v.f.o. (Part 2) to the input of the board and applying the 12 volts required for Tr10. The r.f. probe is connected to the output link winding of L6. It should be possible to peak the r.f. output from L6 using the trimmer C33. Tune the v.f.o. to somewhere in the centre of the c.w. sector of the band. If C33 fails to give a peak then the tuned circuit is probably not on frequency and could be amended by altering the number of turns on the main winding of L6. This should not be necessary with the values as given in the Table.

The driver stage, Tr11, is then built and tested as above with the r.f. probe on the output of L7. The p.a. stage is very simple with a homemade r.f. choke providing the collector load. The fastidious could even buy a 100µH r.f. choke. The only critical capacitors in the transmit board are those used in the pi-network. C39 and C40 ought to be good quality silver mica types. There is little point in generating a little decent r.f. to lose it in the output filter. The miniature dipped ceramic capacitors, very attractive though they look, usually give problems even with the small amount of r.f. power used in this type of circuit.

The p.a. stage needs a load on the output before it is tested. Small transistor p.a. stages are not the destructive test beds for devices that some believe, but Tr12 does require a small heatsink and a 50 ohm termination. For test purposes a couple of 1 watt 100 ohm carbon resistors in parallel will do the job. The r.f. probe can then be used to test the output of the whole board. If the constructor has an r.f. power meter which incorporates a 50 ohm load the actual r.f. power can be measured.

There are many myths about the instability found in transistor p.a. circuits. This little board gave no such trouble. Some constructors slip little ferrite beads onto the transistor base lead; not only was that not required for this board but the prototype was built with a bulky transistor holder for Tr12 so that various devices could be tried and it still behaved itself. Note that the p.a. is switched on the whole time during transmit with the driver stages being keyed. If the p.a. gives r.f. output with the driver stages keyed off, then you have got problems . . . I have used this circuit, or ones like it, in several transmitters and found it most forgiving.

★ components

Resistors

Carbon Film ¼W 5%

33Ω	1	R38
47Ω	1	R36
56Ω	1	R37
100Ω	2	R32,33
220Ω	3	R29,31,35
330Ω	1	R46
560Ω	1	R39
820Ω	1	R42
1kΩ	3	R30,34,41
2·2kΩ	3	R44,45,49
3·3kΩ	1	R40
10kΩ	1	R47
82kΩ	1	R43

Semiconductors

Diodes

1N914	8	D7,8,9,10,11,12,13,14
Red l.e.d.	1	D6

Transistors

BCY71	2	Tr14,15
BFY51	2	Tr11,16
TIS43	1	Tr13
2N3904	1	Tr10
2N4427	1	Tr12

Potentiometers

Min. Horizontal Presets

10kΩ	1	R48

Capacitors

Silver Mica

25pF	1	C48
47pF	1	Fig. 3.7 (see text)
470pF	2	C39,40

Polyester

0·1µF	6	C32,35,37,41,42,43

Disc Ceramic

10nF	3	C44,45,46

Tantalum Bead

68µF 16V	1	C47

Feed-through

1nF	1	C49

Miniature Trimmers

3–60pF	2	C33,36

Miscellaneous

Relay 12V d.p.c.o. (RS 349–658); Toroids (see text); TO5 heatsink; Printed circuit boards (2); Case (see text); Phono sockets (3); ¼inch Jack socket.

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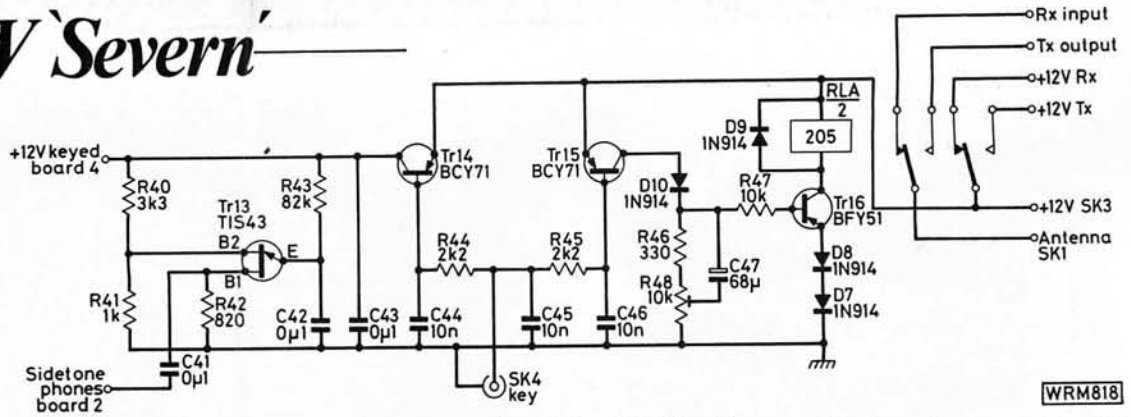

Fig. 3.3: Circuit diagram of the change-over and sidetone generator

The Change-Over and Sidetone Board

The control functions for the *PW* 'Severn' are performed by the circuitry shown in Fig. 3.3. The key controls two d.c. switching transistors, Tr14 and Tr15. These are *pnp* devices and in fact any suitable silicon transistor capable of handling the current to the driver stages on the transmit board could be used. As the driver stages are keyed in the 12 volt line, Tr14 provides the required 12 volts switched on and off by the key. The 12 volt line could be keyed directly but that would result in a key "live" on both sides. Transistor Tr14 allows the more conventional approach with one side of the key connected to ground. Tr15 switches Tr16 via a time delay circuit controlled by R46/48 and C47. When the key is closed Tr15 actuates Tr16 to switch the relay RLA. On releasing the key the relay is held in for a time, governed by the decay of C47. This time can be adjusted with R48. The slight delay in RLA returning from the transmit to the receive position ensures that RLA does not clatter in and out with the keying action, but when a pause in keying occurs, it returns to the receive state. This provides "semi-break in" so that when a pause occurs in the keying, depending upon the setting of R48, the transceiver returns to the receive mode.

Resistors R44 and R45 with C44, 45 and 46 provide a degree of shaping to the keying action to round off what could be a very sharp and click prone switching action. The diodes D7 and D8 hold the emitter up from ground by around 1·4 volts as a safeguard against any leakage current in Tr16 holding in the relay when Tr16 is switched off. Diode D9 acts as a spike suppressor when the field in the relay coil collapses—remember the old induction coil at school?

The relay RLA may be any small relay capable of reliable hold-in with 12 volts d.c. and having two sets of change over contacts. The prototype used a small plug in relay bought on the surplus market with a coil resistance of 185 ohms. A suitable type is made by RS Components with a coil resistance of 205 ohms designed for p.c.b. mounting. The relay switches over the antenna from transmit to receive and switches in a 12 volt transmit and a 12 volt receive line for circuit board control.

Most c.w. operators do not enjoy "deaf keying" and like to hear their Morse as it is being sent. The simplest method is to key an audio oscillator to follow the transmitter, usually called the sidetone. The sidetone circuit is shown in Fig. 3.3 as the circuitry around Tr13. Any simple audio oscillator will serve the purpose, this one being a unijunction relaxation oscillator. What a lovely little device the unijunction is for such applications; normally used in pulse circuits, it just loves to oscillate! The circuit around Tr13 is the basic unijunction sawtooth oscillator with R43 and C42 providing the time constants which govern the frequency of oscillation. Their values were chosen to give a note of some 800Hz with a typical TIS43. This may vary with some examples of the device but the desired note can be adjusted with variation of R43 and C42. The output is developed across R42 and fed directly to the phones socket on the receiver via C41. The level can be adjusted with variation of R42. A whole range of unijunctions could be used for Tr13. The UT46 and E5557 directly replace the TIS43 but the 2N2646, 2N4891 and 2N4871 could all be used although they have different lead connections.

The p.c.b. and layout for the Control Board is shown in Fig. 3.5. In the prototype the relay was omitted from the board. This was to allow a range of relays to be used, as these are probably best bought as surplus items and may differ in mounting detail. In the prototype the relay was simply attached to the bottom of the case, close to the board, and held in place with Blu-tack. We amateurs can be a sophisticated lot. The board layout allows for C47 being a tantalum bead type and R48 an horizontal preset but doubtless a small electrolytic would fit the C47 space and a vertical type could be used for R48 with leads to mate it to the board.

The two d.c. switches, Tr14 and Tr15, are best built first and tested to see if keying does put 12 volts onto their collectors. The relay control circuitry around Tr16 can be added and tested. R48 should give a fair degree of control in the rate of fallout for RLA. The sidetone oscillator, Tr13, is then built and may be tested by connecting a pair of headphones between the output of C41 and ground. Any required adjustments of the pitch of the note can be made using R43 and C42.

The Metalwork

As with any amateur radio project almost any type of housing can be used and the constructors' own ingenuity can come to the fore in the casework. But, if like me, you are reduced to a vice, a power drill and a few files when case making, it is easier to use a ready-made housing. The author's prototype was built in a ready-made case as shown in the photographs. This measured some 127 × 102 × 171mm and was obtained from Minfford's of Sun Street, Ffestiniog, Gwynedd, LL41 4NE. Minffords stock a whole range of inexpensive cabinets and cases for amateur use and will supply their cases by post. The photo in Part 1 showed the front panel layout which includes the r.i.t. control and s.w.r. meter which are discussed in the final part of this article.

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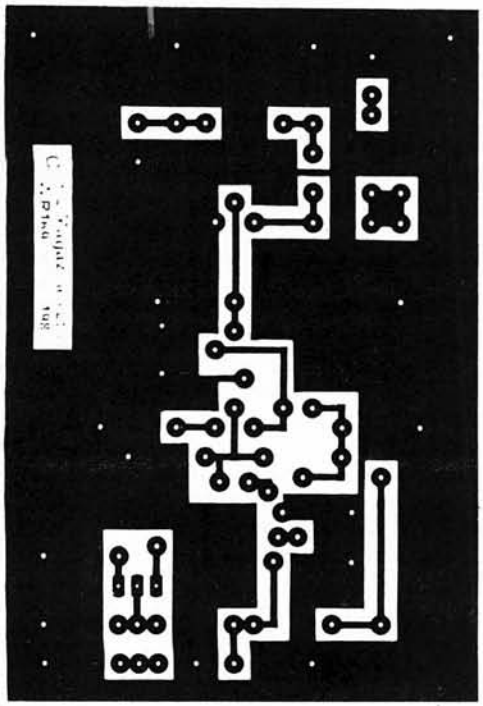


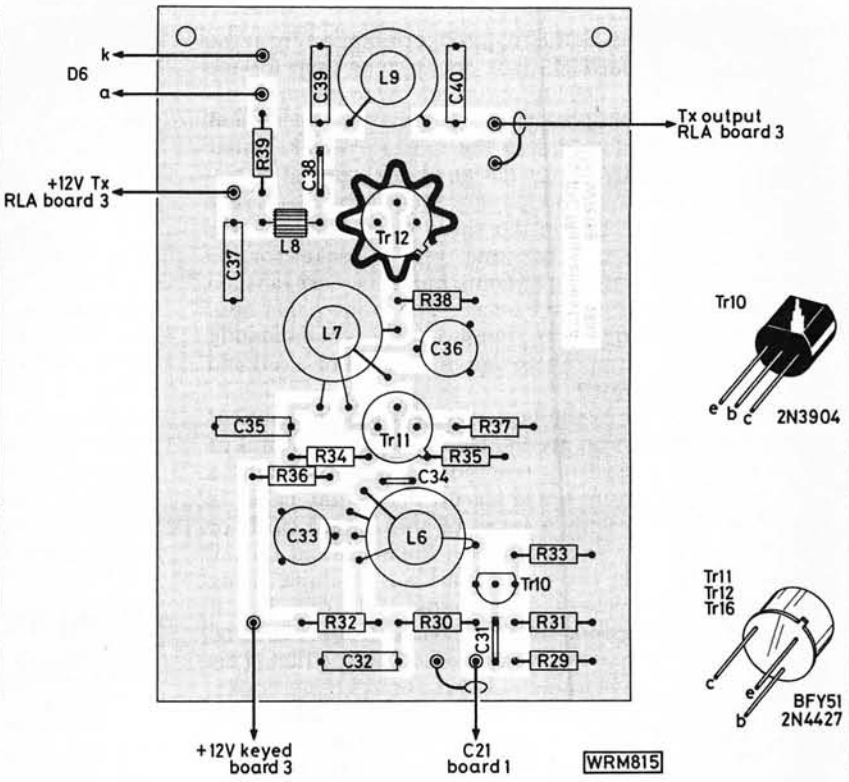
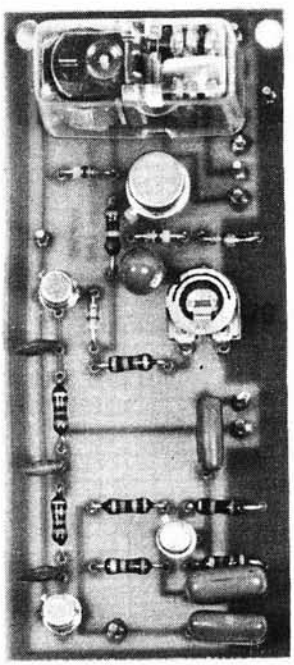
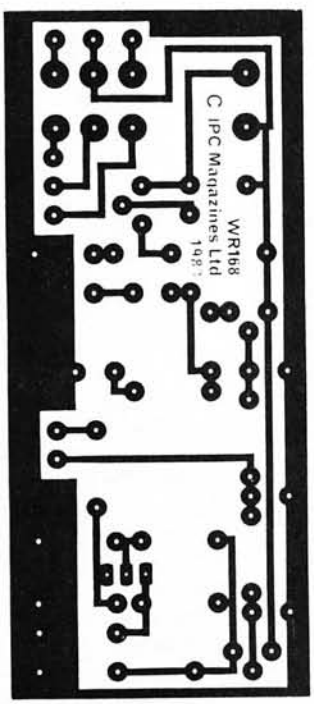
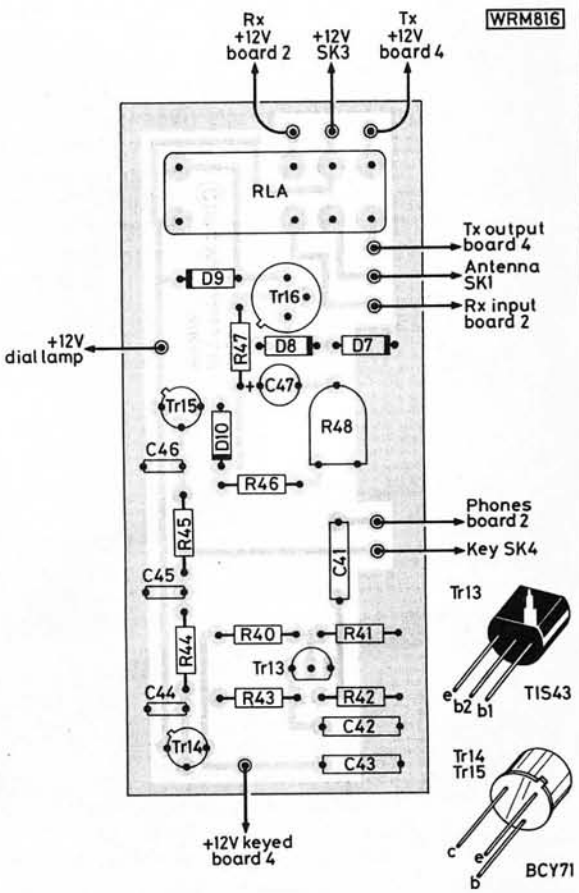


Fig. 3.4: (Above) copper track pattern and component placement for the transmit board shown full size.
Fig. 3.5: (Below) the copper track pattern and component placement for the changeover and sidetone board shown full size. The photograph shows a completed sidetone and changeover board







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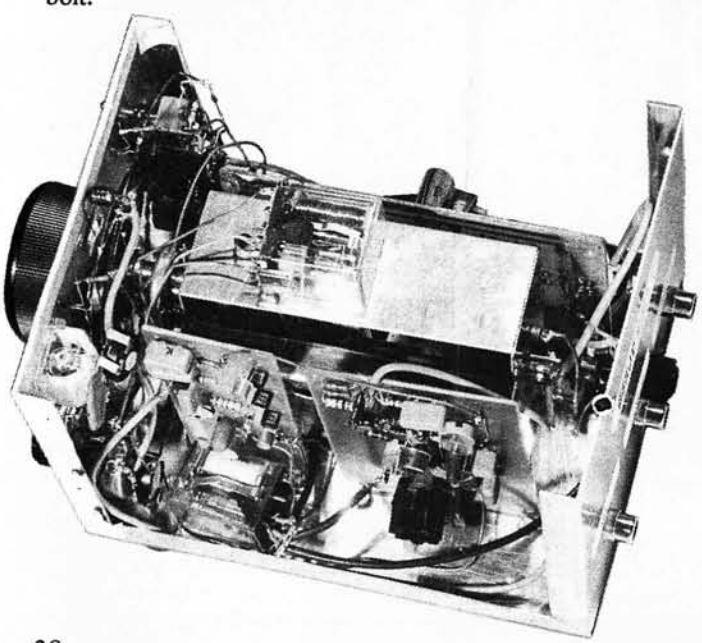
The back panel shows the required termination from the transceiver. A standard ¼in jack socket was used for the headphones and the other terminations were all made using the inexpensive phono sockets. These are so cheap that they have become standard in the G3RJV shack. Other connectors, especially those designed for coaxial cable, can be very expensive and phono sockets perform very well at low levels of r.f. on the short wave bands. Some may think it odd to use the same type of socket for the supply line, the key and the antenna but if they are labelled clearly, no accidents should occur. The front panel contains all the controls plus small l.e.d.s for indicating TRANSMIT and RECEIVE. These can be labelled or a red and a green type can be fitted.

Opinions vary as to the best methods for the amateur constructor to obtain an acceptable front panel finish. For the *PW* 'Severn' I used my common method of adding a false front made from tinted card. When the panel is drilled it is covered with a layer of thin tinted card, or white if you wish. A sharp marking knife will cut out all the holes required in the card. Marking is simple using Letraset rub down letters or perhaps a Rotring Pen if available. To give the final finish the whole front is covered with a layer of transparent sticky backed plastic film. This is commonly sold in stationery stores for covering books. The controls are then added. This method produces a neat front which will wipe clean and does not have the problems of coverage and chipping found with the commonly used car paint sprays.

The method of mounting the circuit boards in the case is seen in the photos. The v.f.o. is housed in a small screened box and this is mounted on its side in the centre of the case. As the tuning knob is placed in the centre of the front panel, some small standoffs will be required to raise the box to the correct height. These need to be very sturdy and four are required so that the box is rigid in use. The receiver board is mounted vertically to the left of the v.f.o. box, with the optional a.f. filter coil glued to the bottom of the case. The transmit board and control board are also mounted vertically. They are to the right of the v.f.o. box mounted longside up. Small angle brackets are required to give this vertical fixing although it is possible to solder large solder tags to the ground plane portions of the p.c.b., bend the tags 90 degrees and use these with a 6BA bolt.



The tuning rate of the v.f.o. is controlled by a small in-line epicyclic drive. The method of fixing this is shown in the picture. The drive mates to the tuning capacitor shaft leaving the v.f.o. box. Such drives have one or two lugs which fix the drive rigid to the v.f.o. box. The bolts required for this will have to be quite long and are best run through standoffs for rigidity. A circular scale is added to the reduced speed collar which is the front of the main body of the drive. Any stiff material will serve the purpose: tinplate, plastic or even stiff card. Some drives have a mounting plate for a scale but if not, the scale can be Superglued to the collar. I have mounted such scales using a Terry Clip fastened to the back of the scale, which is a tight fit on the collar. Once mounted the scale can be calibrated through the little front panel window with faint pencil marks, listening for the v.f.o. on an existing receiver. The whole lot is then dismantled and the scale properly marked, perhaps with Letraset. It is worthwhile spending time on an attractive scale which can make all the difference to the finished transceiver. The window can have a Perspex cover. Notice that the prototype has different sized mounting feet on the front and back to give the tilted back effect so popular in modern equipment.

Using the Transmitter With an Existing Receiver

Some constructors may prefer to build the transmitter alone and use it with the station receiver or the receive portion of an existing transceiver. In which case the control board need not be built. The main problem is that the v.f.o. in the *PW* 'Severn' remains on the whole time and it is not a good idea to switch it off when on receive. This will certainly result in instability. Leaving the v.f.o. on the same frequency as the receiver will result in a signal being present the whole time, so the easiest way to overcome this is to shift the frequency of the v.f.o. each time the receive state is required.

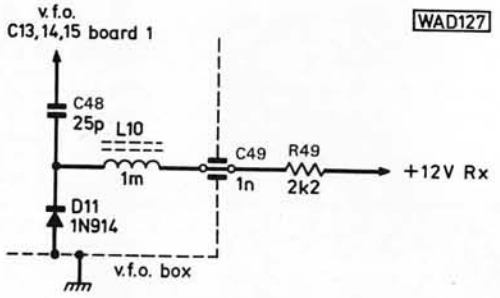


Fig. 3.6: The small offset circuit

A small offset circuit that will do just that is shown in Fig. 3.6. A capacitor and diode are mounted inside the v.f.o. box across the tuned circuit of the oscillator stage. When 12 volts is applied to the circuit the frequency of the v.f.o. will move out of the range of the receiver. This addition must be done with care to maintain v.f.o. stability, but rigidly mounted and decoupled with the r.f. choke and a leadthrough capacitor as shown, stability should remain. Now the transmitter can be used and when the receiver comes into operation the 12 volts applied to this circuit puts it out of the bandpass. Should the note still be heard then C48 can be increased. Arrangements will have to be made to enable the receiver to come on without the offset when the transmitter is being netted to a station.

A changeover manual switch could be used for this method of operation, but a simple electronic changeover is much better.

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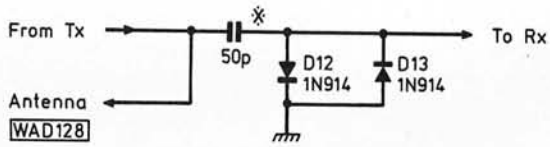
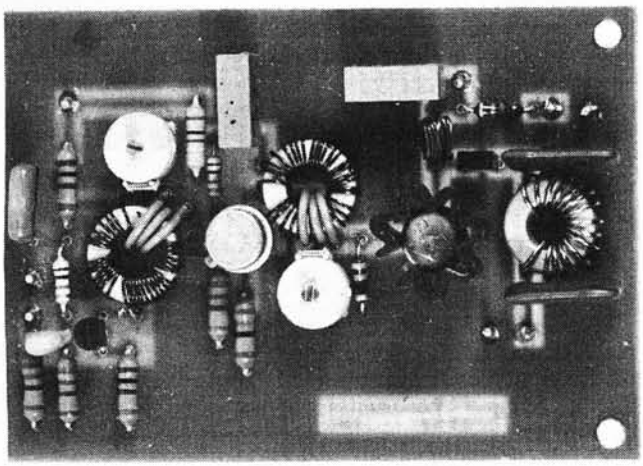


Fig. 3.7: Electronic changeover circuit

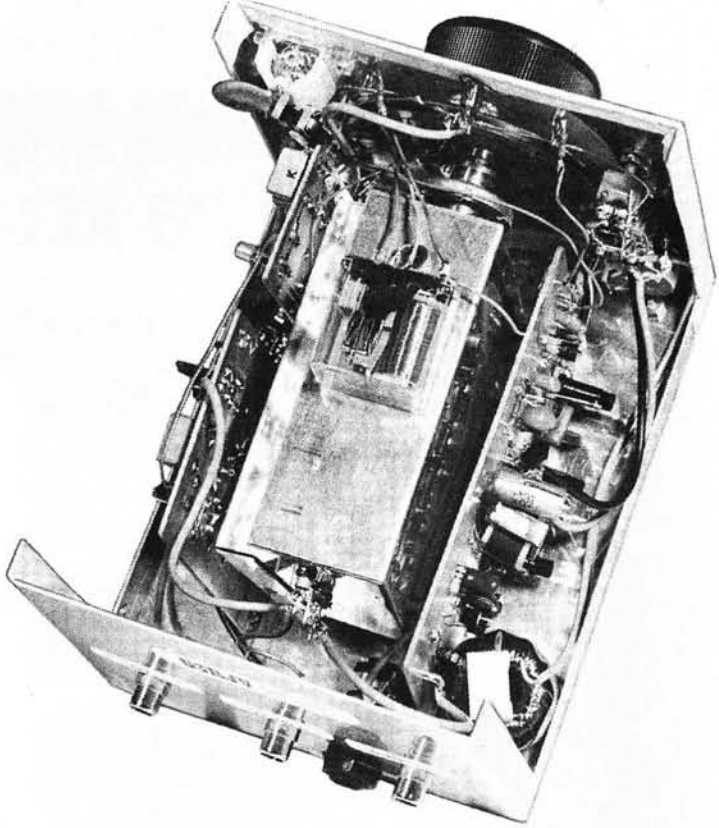
The circuit shown in Fig. 3.7 represents about the simplest possible electronic method of interfacing a transmitter and receiver without a mechanical switch. It originally appeared in *SPRAT, The Journal of the G QRP Club*. The transmitter and antenna are directly connected, with the receiver connected to the antenna via a small capacitor. Two diodes protect the receiver front end by limiting the amount of r.f. that can pass to the receiver. So simple yet quite effective. The capacitor may require adjustment as it needs to be a small value. Ideally it should be just high enough not to impair the sensitivity of the receiver and not so high as to cause too much r.f. leakage from the output to the receive on transmit. Obviously this does not mute the receiver and the signal will be very loud, but it is a simple matter to turn down the receiver audio gain control and use a reduced audio output to monitor the keying.

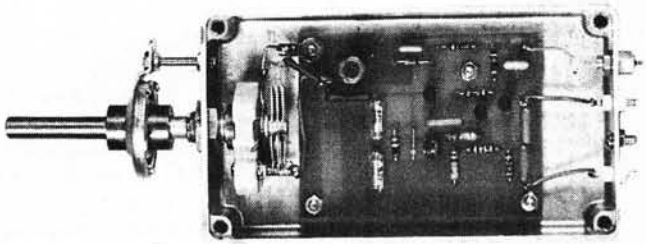


A completed transmit board is shown above. The mechanical construction is shown at the top of the next column with a completed v.f.o. below

Coil	Turns	Wire s.w.g.	Former
L6	16+16 3	28 24 (pvc)	Amidon T50-2
L7	32 3	28 24 (pvc)	or Neosid
L9	14	22	28-511-35
L8,11	10	32	Ferrite bead

Readers who intend to operate the *PW* 'Severn' should be in possession of the appropriate licence issued by the Home Office to those who have passed the City and Guilds Radio Amateurs' Examination. Details may be obtained from: The Home Office, Radio Regulatory Department, Amateur Licensing Section, Waterloo Bridge House, Waterloo Road, London SE1 8UA.





The *PW* 'Severn' is now complete in its basic form and a useful little transceiver it is too. The final part of this article will describe some extras for the project and say something of the techniques of low power operation with such a transceiver.

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IC of the month

Brian DANCE M Sc

Plessey Semiconductors SL6700—Part 2

We continue with more applications for the SL6700

CW Only

If the SL6700C is required for c.w. only reception, the circuit of Fig. 5 may be used which avoids the use of the SL1621.

Broadcast Receiver

The SL6700C may also be used as the signal frequency and i.f. stages of a broadcast station receiver, a typical circuit being shown in Fig. 6.

Capacitors C7 and C15 form the tuning capacitance, L1 normally being a ferrite rod antenna, although an external antenna wire could be used if desired.

The components which determine the oscillator frequency, L2/C15, trimmer C14 and series padder capacitor C13, must have values selected such that the oscillator circuit resonant frequency tracks reasonably closely to that of the antenna circuit. In other words, the l.o. frequency must always exceed the antenna circuit resonant frequency by approximately 455kHz (i.e. by the i.f.). Standard coil systems are available which provide this tracking with suitable tuning capacitor values.

An extra transistor, Tr1, is required for the oscillator circuit, but this can be almost any small signal *npn* type such as a BC107, BC108, etc. If desired for circuit simplicity and economy, the filter FL2 may be replaced with a 100pF capacitor, but there will be some degradation in the adjacent channel selectivity. If a well-filtered +5V supply line is available (possibly from a voltage regulator device), the components R3 and C11 may be omitted.

It may be noted that the input signal from L1 and the l.o. signal are both fed to the double balanced modulator block. The output from this block at pin 8 is fed through FL1 to the input of AMP 1 (Fig. 1) at pin 18, before passing through FL2 to the input of AMP 2 and then from pin 6 through FL3 to the demodulator input at pin 13. The audio output is taken from the demodulator output at pin 15 through d.c. blocking capacitor C5.

Plessey Semiconductors state that the SL6700C is especially suitable for broadcast reception applications, since its high linearity and low distortion permit high quality audio signals to be obtained—although a.m. signals can never be expected to rival f.m. reception as regards quality of reproduction. The circuit also offers the advantage of requiring a relatively small number of components and can be constructed in a very small enclosure at low cost. Obviously the output from the circuit of Fig. 6 must be fed to a power amplifier stage or at least an earphone amplifier.

The delayed a.g.c. system is not employed in this receiver and is left disconnected. If it is wished to extend the frequency coverage to the h.f. bands, Plessey Semiconductors suggest the addition of an SL1610C signal frequency amplifier, placed between the antenna and the input to the SL6700C at pin 7. This extra stage will not only improve the sensitivity by a useful amount, but the extra tuned circuit used to couple it to the SL6700C will provide extra image frequency rejection. In such a circuit resistor R1, from pin 1 to ground, should be omitted and a 1kΩ potentiometer connected between pins 1 and 2, retaining C1 between pin 1 and ground. Alternatively a 330Ω resistor may be used instead of a variable resistor between pins 1 and 2.

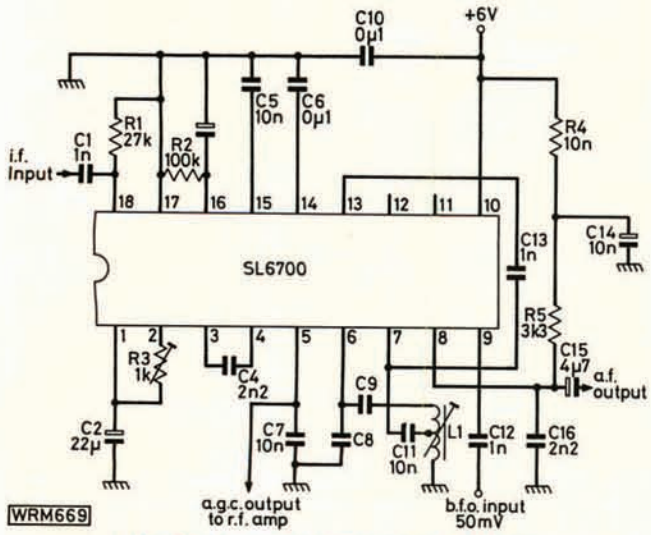

Fig. 5: A c.w. only receiver i.f. strip

TABLE 2

Parameter	455kHz	1·4MHz	Notes
Carrier Suppression	50dB	46dB	Relative p.e.p.
3rd order i.m.d.	−40dB	−40dB	Relative to each tone of a 2 tone signal, with separations down to 50Hz
2nd order i.m.d.	−43dB	−38dB	as 3rd order
Output Level	200mV p−p	200mV p−p	in 600Ω load
Carrier Level	50mV	50mV	r.m.s.
Audio Level	30mV	30mV	r.m.s. input to SL6700 pin 7

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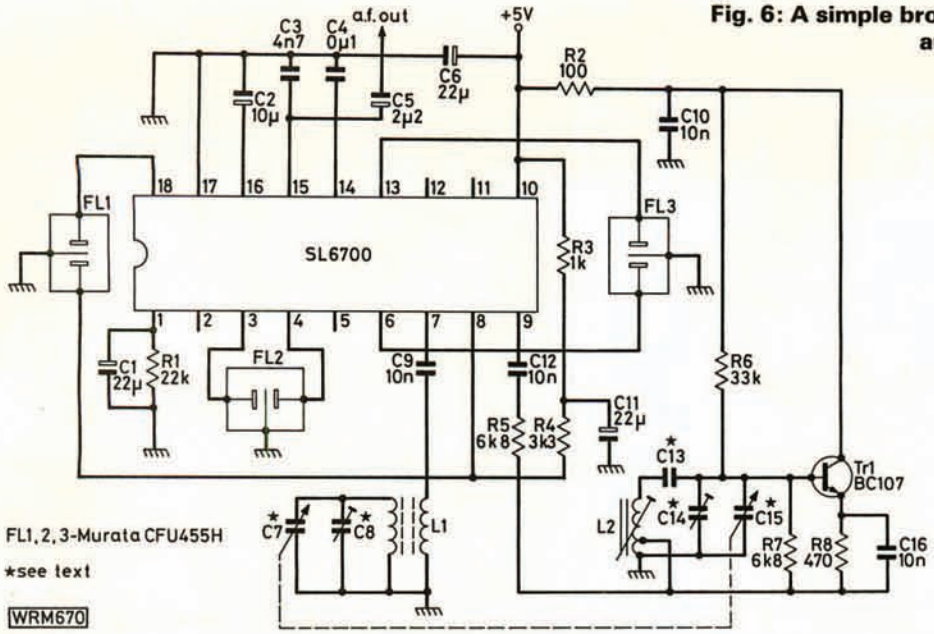


Fig. 6: A simple broadcast station receiver without the audio output stage

Remote Control

The circuit of Fig. 7 has been designed for remote control applications in which a signal from a remote control hand-held or other transmitter is picked up by the coil L1, amplified, coupled to the second amplifier by C8 and then passes into the double balanced modulator input at pin 7.

A third overtone 27MHz crystal controlled oscillator signal is fed to pin 9 of the double balanced modulator. Transistor Tr4 may be any small signal *npn* transistor. The signal difference frequency from pin 8 is fed to the demodulator at pin 13 through the 455kHz i.f. filter FL1. The output from pin 15 is amplified by the transistor network at the top of Fig. 7 to provide an output suitable for performing whatever function is required in the equipment or toy being controlled.

SSB Generator

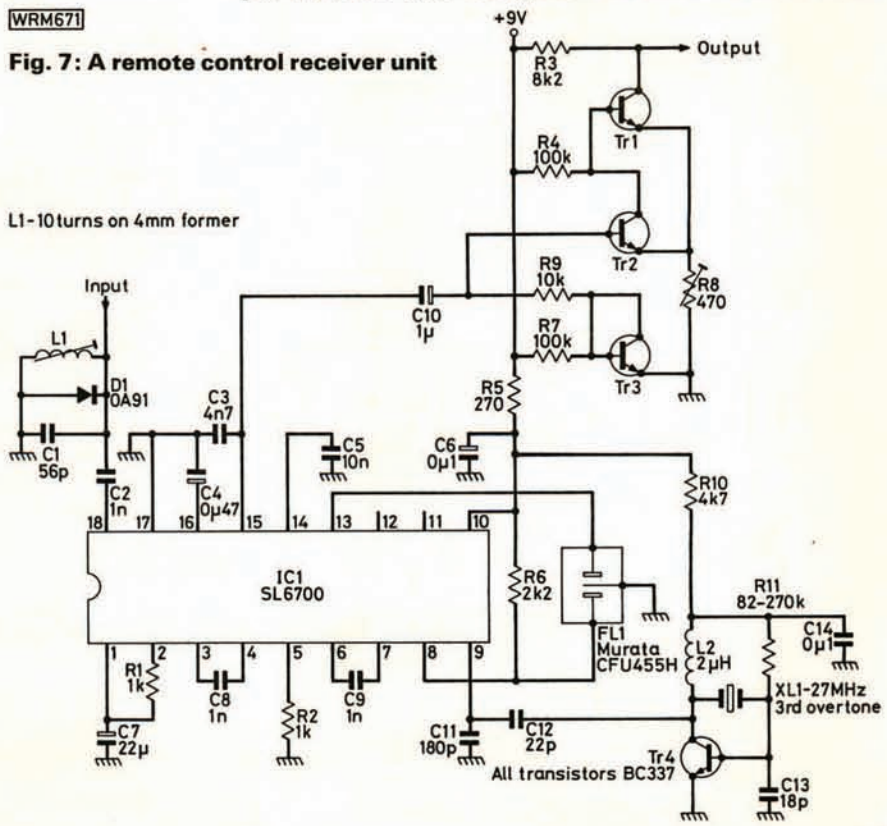
The simple circuit of Fig. 8 can be used to convert a microphone input signal into a s.s.b. signal for the operation of a transmitter. One of the particular advantages of this simple circuit is that no time-consuming adjustments are needed. The SL6270 device shown on the left-hand-side is a Voice Operated Gain Adjusting Device (VOGAD), which maintains a constant output level for a wide variation of input signal amplitudes.

Output from the VOGAD device is fed into pin 7 of the double balanced modulator section of the SL6700C device. Use of this balanced modulator as a mixer provides some 20dB of carrier frequency suppression. The s.s.b. filter provides a further 20 to 25dB suppression so that an acceptable s.s.b. signal is produced (Table 2). The components marked R_t and C_t should be selected so as to suitably match the needs of the filter employed. Impedances in the range 1 to 4kΩ are to be preferred. Filters for s.s.b. such as the Collins 526-9939-010 with R_t 2·7kΩ and C_t 360pF have been reported to give good results. Stray capacities result in a greater leakage of the carrier frequency at 1·4MHz, but can be used. The Cathodeon BP4707/BP4708 filters are suitable for use at this frequency with R_t 1kΩ and C_t 15pF. At 1·4MHz it is suggested that it may be helpful to connect a 6·8kΩ resistor in series with pin 18 of the SL6700C to improve carrier suppression.

The value of R4 should be set during the circuit design; it controls the input to the demodulator stage and thus the amount of a.g.c., therefore setting the gain of the first amplifier. The value of this resistor sets the a.l.c. threshold, its value varying from 47kΩ at 1·4MHz to 120kΩ at 455kHz, depending on the desired output and the amount of a.l.c. required. An additional a.l.c. input is available at pin 13; if the a.l.c. voltage derived from the latter is fed

WRM671

Fig. 7: A remote control receiver unit



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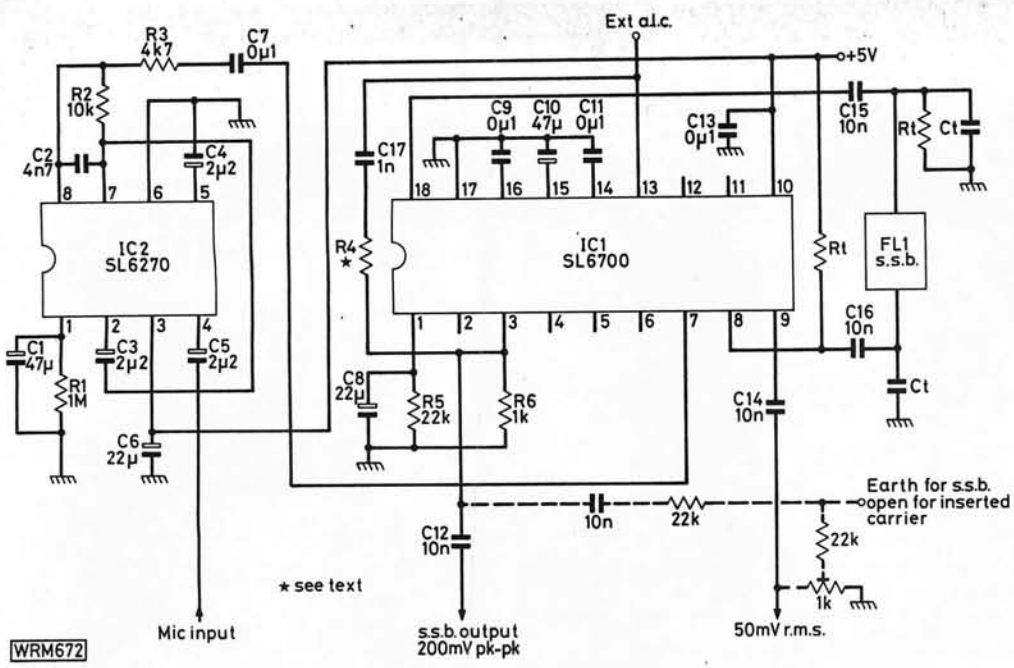


Fig. 8: An s.s.b. generator

into the transmitter via a suitable resistor, multiple level a.l.c. action can be obtained. The 47µF capacitor in the pin 15 circuit sets the a.l.c. time constant. If a component with a smaller value is employed, distortion may be introduced. The 1kΩ resistor from pin 3 to ground increases the current through the emitter follower driving this output and enables an undistorted output to be obtained with an impedance as low as 50Ω.

If the circuit of Fig. 8 is to be employed in an s.s.b. transceiver, it is suggested that separate SL6700C devices are employed, since switching of a single device between the transmitter (for s.s.b. generation) and the receiver (as an i.f. unit) would be too complex.

Components shown dotted in Fig. 8 can be employed for re-inserting the carrier for A1A, H2A, R3E or H3E operation. The level of the carrier is set by the 1kΩ potentiometer and care should be taken in the setting of this level.

Plessey Semiconductors suggest that this circuit may (with very careful layout and design) be usable at frequencies of up to 12MHz or so, but at frequencies above about 1·6MHz care is needed as the balance of the modulator degrades and the a.l.c. detector sensitivity falls.

Plessey Semiconductors have also designed a very simple s.s.b. generator in which one of the unused amplifiers of the SL6700C is used as a VOGAD device, but the input signal range of this circuit is limited. However, this other simple circuit shown in Fig. 9, can produce very effective results for simple, low-power s.s.b. generation and will operate from power levels of the order of 50mW, making it attractive for hand-held equipment operating from small batteries.

The SL6700C is one of the most versatile a.m. i.c. devices that has yet come on to the market and experimenters will doubtless devise other new applications for its use. ●

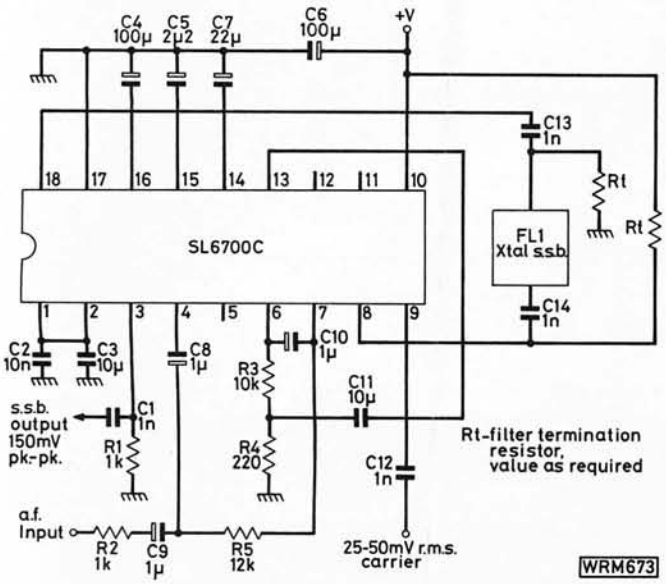
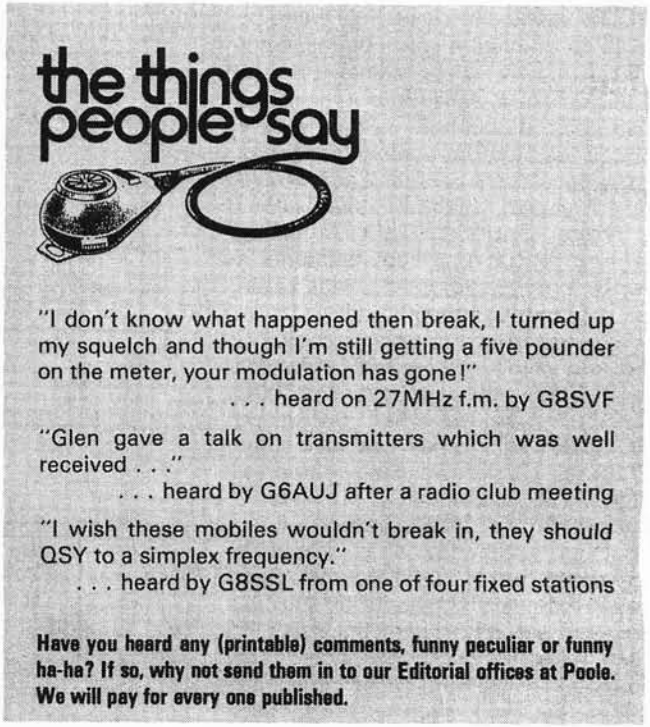


Fig. 9: A very simple s.s.b. generator



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UM80	0.90	6/30L2	0.90	6GA8	1.95	12AX7	0.65	75C1	1.70
UM84	0.70	6AB7	0.70	6GH8A	0.95	12BA6	0.90	76	0.95
UY82	0.70	6AC7	1.15	6H6	1.60	12BE6	1.25	78	0.95
UY85	0.85	6AG5	0.60	6J4	1.35	12BH7	1.95	80	1.70
VR105/30	1.25	6AH6	1.15	6J4WA	2.00	12BY7A	2.30	85A2	1.40
VR150/30	1.35	6AK5	0.65	6J5	2.30	12C8	0.65		2.55*
X66	0.95	6AK8	0.60	6J5GT	0.90	12E1	18.95	807	1.25
X61M	1.70	6AL5	0.60	6J6	0.65	12J5GT	0.55		1.90*
XR1-6400A	125.00	6AL5W	0.85	6J6W	0.90	12K7GT	0.70	813	19.32
Z759	19.00	6AM5	4.20	6JE6C	2.95	12K8GT	0.80		88.50*
Z749	0.75	6AM6	1.50	6JS6C	2.95	12Q7GT	0.60	829B	14.00
Z800U	3.45	6ANBA	2.50	6JU6	5.85	12SC7	0.65	832A	8.90
Z801U	3.75	6AQ4	3.40	6K7	0.80	12SH7	0.65	866A	3.80
Z803U	16.00	6AQ5	1.00	6KD6	4.50	12SJ7	0.70	866E	6.25
Z900T	2.45	6AQ5W	1.80	6L6M	2.80	12SQ7	1.45	931A	13.80
		6AS6	1.15	6L6G	2.50	12SQ7GT	0.85	954	0.60
		6AT6	0.90	6L6GC	2.65	12Y4	0.70	955	1.20
		6AU6	0.60	6L6GT	1.25	13D3	0.70	956	0.60
				6L7G	0.65	13D5	0.90	957	1.05
				6L18	0.70	13D6	0.80	1625	1.80
				6LQ6	2.95	14S7	1.15	1629	1.85

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The Design And Use Of HEATSINKS Part 1

by E.A.Rule

With electronic circuits using semiconductors heat can reduce their reliability by as much as 50 per cent for every 10°C rise in temperature above 50°C. This is because each time the semiconductor is heated up and cooled down (thermal cycle) stresses are set up in the junction and internal connections which eventually cause failure. It follows from this that if the limits of these temperature excursions can be reduced the overall reliability will greatly improve. The use of a correctly designed heat sink is a major factor in achieving this.

Like all components used in the electronics industry, the heat sink has specified parameters which should be understood if the best type for any particular job is to be used. In this article we shall be taking a detailed look at these parameters and what they mean in practice. We will also go into the calculations required in order to choose the most suitable type. The basic idea of the heat sink is to remove the heat generated in the semiconductor devices so that their maximum dissipation ratings are not exceeded; regretfully, many constructors simply fit a piece of metal without knowing if it's suitable or not, in the hope that it will do the job only to find that after the project is finished it wasn't suitable and that there isn't any space left to fit one that is. A study of this article should avoid this situation and enable much higher reliability to be obtained.

All semiconductors generate heat at their junctions and this heat must be removed so that the junction temperature does not exceed certain maxima. For silicon the normal maximum **working** junction temperature is specified as 150°C and for germanium 90°C. A power dissipation curve for a typical silicon semiconductor is shown in Fig. 1.1, and it can be seen that the absolute maximum junction temperature is 200°C, but at this temperature the

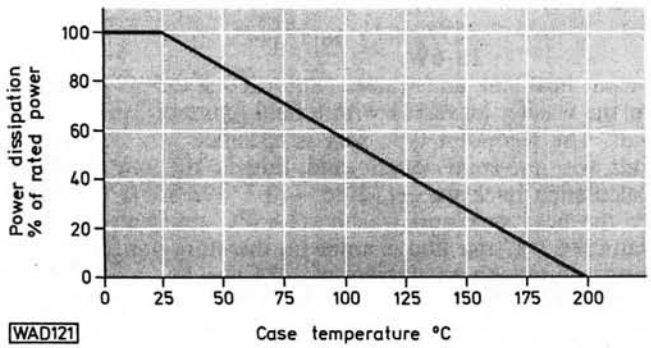

Fig. 1.1: Typical power derating curve for silicon semiconductors

power dissipation is reduced to **zero.** The normal power rating for a semiconductor is specified for a **working** case temperature of 25°C and if the case temperature is higher than this the power rating is reduced in a linear manner to zero at 200°C. We can see from this that if we want to use a device at its maximum power rating we must keep the case temperature down to less than 25°C. Note that this is the **working** temperature **not** the rise above ambient. In many applications the ambient temperature could be higher than 25°C and in these cases the semiconductor must never be used at its full power rating. Two temperatures are involved, one is the **absolute** maximum temperature and the other is the temperature **rise above ambient** and it is important to know which one is being referred to at any particular time. The absolute temperature is maximum temperature of the device which must never be exceeded under any conditions (even during storage). The temperature rise above ambient is the amount the temperature rises due to heat generated within the device and it is this heat which is normally transferred to the surrounding air by the use of a heat sink. In the case of silicon the absolute maximum temperature is 200°C and for germanium is 150°C. Do not confuse this absolute maximum temperature with the maximum **working** temperature.

For our example we shall use the parameters of the popular 2N3055 and consider this device in an application although of course the calculations can be used for any type of device. The parameter we are interested in is the Thermal Resistance (θ) and this is specified in °C per watt. Looking at the 2N3055 data we find that this thermal resistance is specified as 1·5°C per watt for the junction to case. This means that for every watt dissipated in the device the junction temperature will rise 1·5°C **above the case temperature.** We also need to know the thermal resistance of the case to air, but this will depend on the type of heat sink used and will be dealt with in detail later. For the moment let us only consider the actual transistor case to air thermal resistance, in other words, assume that the device is being used without a heat sink. The thermal resistance of the case to air is not specified in the data but in practice will be around 25°C per watt, which means that the case temperature will rise 25°C **above the air temperature** for every watt dissipated within the device.

Let us now consider a practical example, the circuit given in Fig. 1.2 shows the basic arrangement of a stabilised power supply which uses the 2N3055 as the "pass" transistor. Assume that this power supply is

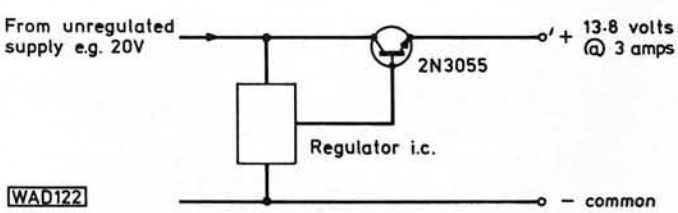

Fig. 1.2: Basic circuit of stabilised power supply using a 2N3055 as the "pass" transistor

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specified at 13·8V and 3 amps current. On full load, if we measure the voltage on the collector we may find, for example, 20V. We know that the emitter is fixed at 13·8V and the difference between the two will appear across the 2N3055 and will be 6·2V. As the maximum load current is 3 amps, 3 × 6·2 = a dissipation of 18·6 watts within the device. We know that the thermal resistance between the case and the air is 25°C per watt which gives us a final case temperature which equals (in theory) 465°C with a junction temperature of 1·5 × 18·6 = 27·9°C above this, a final junction temperature of 492·9°C above ambient!

Clearly the device would fail long before these temperatures could be reached. Yet, if we ignore the thermal resistance and temperature ratings the device would appear to be safe; after all, we are only dissipating 18·6 watts in a device rated at 115 watts, plenty in hand surely! In fact if we refer back to Fig. 1.1, we find that for a dissipation of 18·6 watts (16·1 per cent of maximum rating) the case temperature must not exceed 160°C so a heat sink must be used if the device is to operate within its maximum ratings. As a matter of interest, if the 2N3055 is used without a heat sink the maximum dissipation is limited to around 4 watts for a case temperature rise of 100°C above ambient. For example if the ambient is 33°C the case would reach 133°C and the junction would be 4 × 1·5 = 6°C above, making a final **working** junction temperature of 139°C, just below the recommended maximum operating temperature.

Referring back to Fig. 1.1 again, we see that at 18·6 watts dissipation the case temperature must be limited to not more than 160°C. Now assuming an ambient of 33°C as the worst case we must subtract this from the case temperature which gives us 160 − 33 = 127°C. If we now divide this figure by the dissipation in watts we get

$$\frac{127^\circ}{18{\cdot}6\text{W}} = 6{\cdot}83^\circ\text{C per watt}$$

this is the wanted thermal resistance of the heat sink to maintain the device within its ratings. Another factor must now be considered and that is the method of mounting the transistor on the heat sink. In most cases the heat sink will be at earth potential and the transistor will have to be insulated from the sink by a washer. The most commonly used type is made of mica and this will **add** around 0·5°C per watt and this must be **subtracted** from the calculated figure for the heat sink giving us a final figure of 6·83 − 0·5 = 6·33°C per watt for our sink. This assumes that the mica washer is coated each side with a silicone grease or equivalent. If it is used "dry" it will add 1·5°C per watt and not 0·5°C per watt, making our final requirement 5·33°C per watt instead of 6·33°C per watt. This use of thermal grease becomes very important at higher power dissipations. Consider the case where we are dissipating 75 watts. The maximum case temperature is now limited to 80°C and if we subtract our ambient of 33°C we get 47°C. Therefore:

$$\frac{47^\circ}{75\text{W}} = 0{\cdot}62^\circ\text{C per watt}$$

for our combined heat sink and washer. If our washer is used with silicone grease both sides it adds 0·5°C per watt making our final heat sink requirement 0·12°C per watt, which is a very large heat sink indeed. Now if we tried to use the mica washer "dry" it would add 1·5°C per watt which would make our final heat sink requirement MINUS 0·88°C per watt, a negative value and clearly impossible. From this we can see that where we have a very high dissipation the type of washer used and the way it is used make a very large difference to the final size of heat sink required, because the thermal resistance of the washer is comparable with that of the heat sink. In the above example the silicone coated washer amounts to 80 per cent of the total thermal resistance! All the individual thermal resistances are added together to find the total and this is then used in the calculations to determine the size of heat sink required.

$$P_{tot}\,\text{Max} = \frac{T_j\,\text{Max} - T\,\text{Ambient}}{\theta\,\text{junction to case} + \theta\,\text{case to sink} + \theta\,\text{sink to air}}$$

θ = °C per watt.

$\theta_{j\text{-}c}$ will depend on the type of semiconductor used and is found from the manufacturer's data.

$\theta_{c\text{-}s}$ is dependent on the interface used between the semiconductor and heat sink.

$\theta_{s\text{-}a}$ will vary depending on the type of heat sink used.

A useful variation of the above equation is:

$$\theta_{s\text{-}a} = \frac{T_j\,\text{Max} - T\,\text{Ambient}}{P_{tot}} - (\theta_{j\text{-}c} + \theta_{c\text{-}s})$$

Typical values for $\theta_{c\text{-}s}$ are:

Semiconductor direct onto sink (with silicone grease), 0·1 to 0·2°C per watt.

Semiconductor onto mica washer, 0·5°C per watt.

Semiconductor onto beryllia washer, 0·2°C per watt.

Semiconductor onto "dry" mica washer, 1·5°C per watt.

Fortunately for us some heat sink manufacturers have made things easy by specifying their heat sinks in degrees temperature rise above ambient for watts dissipation; this makes it a simple job to select the correct type of heat sink. One such firm is Redpoint Limited. This company was in fact the first manufacturer to produce commercial heat sinks in Europe way back in 1959 and today offers what is probably the largest range of different types available from one manufacturer. Some examples of these are shown in the photographs. For example their "L" type is specified at 1·75°C per watt for a 51mm length and 1·03°C per watt for a 152mm length. From figures like these it becomes an easy matter to decide on the best type for a particular job.

Taking our original example we found that we required a heat sink (including washer) with a thermal resistance of 6·33°C per watt for a final case temperature of 160°C; however, although this is within the rating for the device, this temperature would be considered too high. It is desirable to limit the final case temperature to around 90°C if reliable operation is to be obtained and using our example in Fig. 1.2 we get 90°C − 33°C = 57°C rise. Therefore:

$$\frac{57^\circ}{18{\cdot}6\text{W}} = 3{\cdot}06^\circ\text{C per watt}$$

for our heat sink and washer. Subtracting 0·5°C per watt for the washer leaves us with a final figure of 2·56°C per watt. The Redpoint type MA is specified at 2·35°C per watt for a 51mm length and this is the one to use. Calculating back we get, 2·35 + 0·5 = 2·85°C per watt for the heat sink and washer. 2·85°C per watt × 18·6 watts = 53°C rise above ambient, therefore our final case temperature with an ambient of 33°C will be 53° + 33° = 86°C. Because we have gone into this in some detail it may now all seem a bit complicated but we can bring it down to basic steps.

1: Decide what the power dissipation is for the device in use under its worst operating conditions.

2: From the manufacturer's data find out the case temperature permitted.

3: Subtract the maximum likely ambient temperature from the case temperature permitted at the power dissipation in use.

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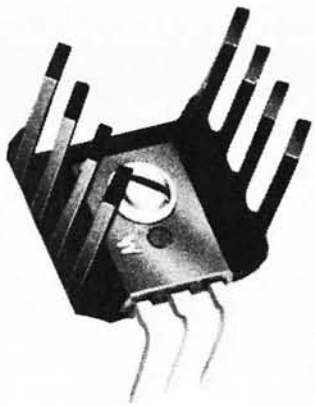
4: Divide this difference in temperature by the watts dissipation to obtain the degrees per watt figure for the heat sink and washer combined.

5: Subtract an allowance for the washer or other mounting arrangement and select the heat sink with the next lower figure of thermal resistance.

Redpoint type EB — 51mm length rated at 2·5°C per watt. 152mm length rated at 1·09°C per watt



Redpoint type TV — 4 — rated at 17°C per watt

Example:

1: 25 watt dissipation.

2: (Say) 145°.

3: $145 - 33 = 112°$.

4: $\frac{112°}{25W} = 4{\cdot}48°C$ per watt.

5: $4{\cdot}48 - 0{\cdot}5 = 3{\cdot}98°C$ per watt for required heat sink.

Use Redpoint type P 50mm length rated at 3·4°C per watt, or type M 76mm length rated at 3·2°C per watt.

The heatsink drawings on our front cover are reproduced from the Fischer Elektronik catalogue, by kind permission.

Part 2 will deal with making your own heat sinks and calculating their necessary size.

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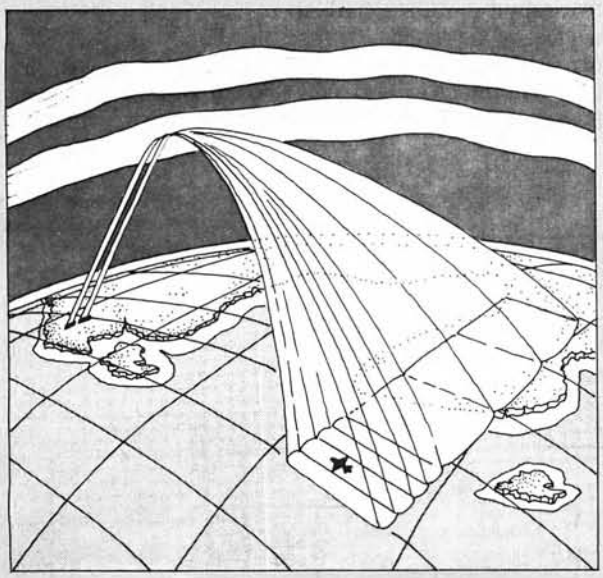

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1·5GHz PRE-SCALER

D.S. POWIS G4HUP Part 1

This article describes the construction and use of a pre-scaler module enabling frequencies in excess of 1·5GHz to be measured with a frequency counter covering 500MHz. It may be constructed as a complete, self-powered unit, or as an add-on accessory, powered from an existing supply source.

When working with frequencies in the u.h.f. range it can be very difficult to be precise about frequency; often the only measurement that can be made is with an r.f. detector, to show that some signal is being produced, the frequency of that signal being left to luck. This is frequently the point where it becomes apparent that all may not be well and another project is relegated to the junk box for want of a piece of test equipment!

The pre-scaler detailed here is extremely useful when working with any u.h.f. project. The author has suffered from the problems mentioned above, and some time ago constructed a 500MHz counter system. It was only when this was in regular use that the full potential of the counter as a piece of test equipment was realised. The limitations of not having access to frequency counting equipment came as a sharp reminder when a project was started which involved frequencies over 500MHz.

With the advent of the Phase 3B amateur satellite and the imminent appearance of satellite TV there is great interest in the home construction of equipment for the 1·3GHz (23cm) band and for DBSTV reception. The proposed i.f. for DBSTV is in the range 900–1300MHz. This design is therefore offered hopefully in time to prevent even more u.h.f. projects ending their days in the junk box!

Design Considerations

There are a large number of 500MHz frequency counters available, either as designs for home construction or as moderately priced built units, based around the Intersil ICM7216 and 7226 series of frequency counter i.c.s. The most recent of the published designs is the *PW* Cranborne and this unit is offered as a companion to it.

In order to extend the coverage of these units up to 1·5GHz a divide by four ratio is adequate. Devices which will do this are noticeably cheaper than divide by ten circuits—around 50 per cent of the price. The disadvantage of these is that the frequency display no longer gives direct readout, and as most users find it inconvenient to be constantly performing mental arithmetic this is not an acceptable solution to the problem.

However, there is an approach which enables the cheaper divide by four devices to be used. If the reference frequency used by the counter is also divided by four then the frequency readout becomes correct.

This may at first seem a cumbersome approach, but the design of the Intersil counter chips makes it straightforward. The 7226 has provision for feeding the internal reference out, by dividing this by four and feeding it back to the reference input; very little external circuitry is required. In the case of the *PW* Cranborne this information was published in the original article.

The pre-scaler i.c. used in this project is the Plessey Semiconductors SP8619 which is a 1·5GHz divide by four device. It is capable of working to frequencies in excess of 1·5GHz, as the quoted maximum frequencies are measured by the manufacturer with the device mounted in an i.c. socket. Considerably better performance can be obtained when the device is mounted directly onto a properly laid out p.c.b. The author has also used the SP8617, a 1·3GHz divide by four device, and this will measure up to 1·6GHz. Both the 8617 and 8619 are considerably cheaper than the divide by ten SP8668.

There are a number of other, often much cheaper, pre-scalers which will work to frequencies in excess of 1GHz. Typical of these is the Telefunken U264, which will work to around 1·3GHz and costs only a few pounds. The device is designed for use in the synthesisers of TV receiver local oscillators, and whilst the very low price is tempting the drawback is that the division ratio is 64. The reference clock requirements of the Intersil counter i.c.s

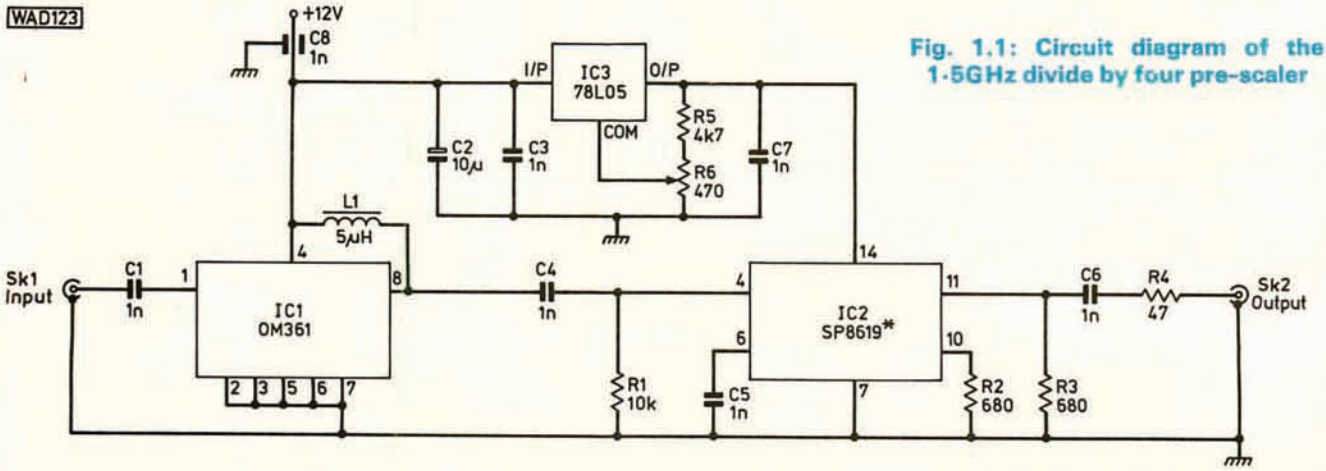

Fig. 1.1: Circuit diagram of the 1·5GHz divide by four pre-scaler

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are such that they will not operate correctly with the input divided by 64, which means that a comparatively large amount of external circuitry would be required to obtain a true frequency readout.

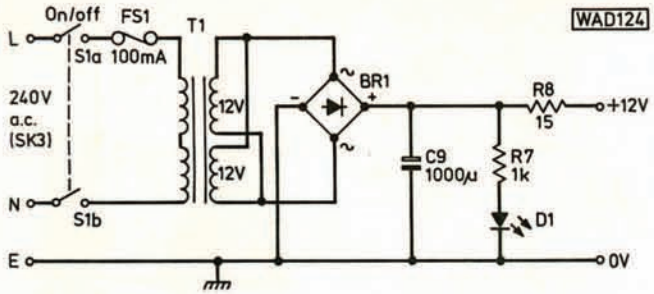

Fig. 1.2: Circuit diagram of the optional p.s.u.

With the exception of the TV pre-scalers, all of the other available devices are fairly insensitive, needing approximately 400-600mV of r.f. input for correct counting. This figure is not good enough for frequency counter use, 10-40mV being a much more acceptable signal range. This is achieved in this design by the use of a hybrid thick film wide-band amplifier module, the Mullard OM361, which although designed for TV distribution amplifier use gives useful gain to over 1·5GHz when running from a 12V supply. It is housed in a single in-line package, and although a broadband amplifier from discrete components may be slightly cheaper the convenience of this device, its repeatability and its small size, make it well worth using.

Circuit Description

The OM361 is a three-stage device with an open-collector output. The input is applied via a 1nF capacitor, and the output must also be capacitively coupled by 1nF. These capacitors should ideally be chip or leadless types, but due to the difficulty in obtaining such types ordinary miniature ceramic ones have been used with no obvious sign of degraded performance. The leads of all capacitors must be kept as short as possible to reduce their inductive effect.

The choke, L1, forms the collector load of the output stage of the OM361 and its value is non-critical, but should be in the range 1-10µH. Supply decoupling is provided by C2 and C3 for the amplifier, and by the feed-through capacitor C8, at the supply input. The full circuit diagram of the pre-scaler module is given in Fig. 1.1.

A 10kΩ resistor R1 at the input to the pre-scaler, IC2, prevents spurious counts appearing. It does have the effect of reducing the input sensitivity, although this does not matter in this case as an amplifier is used in this application of the i.c.; there is however nothing worse than a counter displaying random counts with no input connected. The output of IC2 is differential, i.e. there are two output pins on the i.c., and they are in anti-phase. A single-ended output is required, but due to the internal design of the i.c. both outputs should be terminated in the same manner. Resistors R2 and R3, on pins 10 and 11 of IC2, achieve this, the output to the counter being taken from R3 via C6 and R4.

In order to achieve the necessary speed of operation IC2 employs e.c.l. (emitter coupled logic). Devices of this sort are intended to operate from a negative supply, i.e. with Vcc at ground and a negative 6V supply rail. This is incompatible with the amplifier used here, so the supply arrangements used are those devised by J. Grimm DJ6PH in an article in *VHF Communications* March 1981. To obtain a +6V rail a 78L05 regulator, IC3, is used with R5 and R6 providing a pedestal for the ground connection of the i.c.

The power supply requirements are quite straightforward: 12V with a current capability of 200mA. This may be available from the counter the unit is to be used in conjunction with, or from a bench supply. For those who wish to build a dedicated supply, Fig. 1.2 gives the circuit diagram of the simple p.s.u. used in the author's prototype.

Construction

It is advisable to use a printed circuit for this project and to adhere closely to the layout shown. Other layouts will no doubt be possible, but no guarantee can be made as to their performance.

The p.c.b. layout and component placement used by the author are shown in Figs. 1.3 and 1.4 respectively. The board was designed to fit the medium size Astec type modulator box available from Ambit, as these make ideal screening enclosures for r.f. units. Drilling dimensions for the box are also detailed in Fig. 1.3.

Mount IC1 first, noting that the ground connections are made to the top surface of the p.c.b. Carefully bend all the ground pins of IC1 at right angles to the body and push the remaining three pins through the p.c.b. Next mount all the components associated with IC3, i.e. R5, R6 and IC3. Integrated circuit IC2 and the capacitors and resistors can then be mounted. Note that L1 is mounted on the underside of the board, between the supply and output pins of IC1.

When the p.c.b. is completed it may be mounted into the box. There are indentations in the sides of the box for the p.c.b. to sit on, and when satisfied that it is seating correctly the p.c.b. should be soldered to the box, all round the edges of both upper and lower board surfaces. This leaves the input, output and supply to be connected. Carefully solder the feed-through capacitor C8 into position, and connect the inner end to the p.c.b. track. This is best done by using a short link wire, rather than trying to bend the end of the feed-through, as there is a danger of fracturing the body.

Connectors have not been used on the input and output of the pre-scaler module itself, as good quality miniature

CONSTRUCTION RATING Intermediate

BUYING GUIDE

Since this article was prepared we have been advised by Plessey Semiconductors that the availability of the SP8617/9 in the UK is severely limited. However, the SP8611B is readily available at £23.29 incl. from Semiconductor Specialists (UK) Limited, Carroll House, 159 High Street, Yiewsley, West Drayton, Middlesex. Tel: (08954) 45522. This will fit the p.c.b. but please see the note headed Important. The OM361 is available from RS Components stockists or ECCS, Alexandra Road, Wellington, Telford, Shropshire. Tel: (0952) 54161.

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Fig. 1.3: Component placement and double-sided p.c.b. track patterns, shown full size. Note that r.f. choke L1 is located on the non-ground plane side of the board

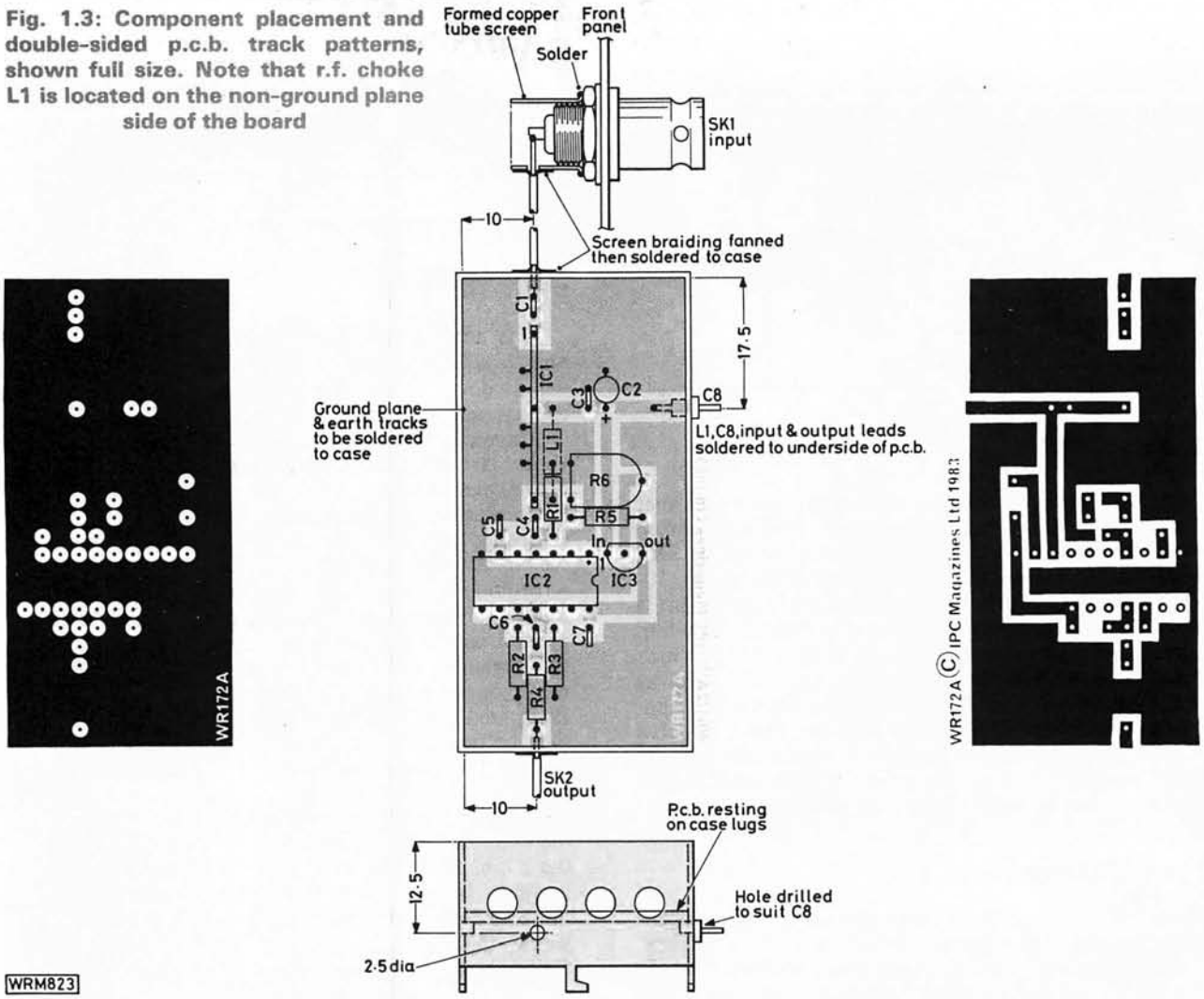

Fig. 1.4: Component placement and p.c.b. track pattern of the p.s.u. module

r.f. connectors are very expensive. Instead, direct termination of the coaxial leads from the front panel sockets SK1 and 2 was used in the prototype, with satisfactory results. The method of termination is shown in Fig. 1.3; note that the braiding of the miniature coaxial cable is not twisted up before soldering, but is fanned out. This method of termination will not stand up to repeated movement, but where the unit is to be mounted inside another case it is perfectly adequate.

A p.c.b. track pattern and component layout for the power supply is given in Fig. 1.4; this is straightforward and requires no further comment.

The case used on the prototype is the Centurion DX1 from Ambit, to match the *PW* Cranborne. The drilling dimensions for this case are shown in Part 2, and Fig. 3 shows the method of terminating the input BNC socket, by using a small piece of copper foil to project the skirt of the socket and provide a better earthing arrangement. The pre-scaler module is mounted by securing one of the clip-on lids of the Astec box to the base of the DX1 case. The module itself can then be removed and replaced as required without undoing any screws.

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★ components

Resistors

¼W 1% Metal Film

47Ω	1	R4
680Ω	2	R2, 3
4·7kΩ	1	R5
10kΩ	1	R1

(See note)

Miniature Cermet Horizontal Pre-set

470Ω	1	R6

Capacitors

Miniature Plate Ceramic

1nF	6	C1, 3-7

Tantalum Electrolytic—16V

10µF	1	C2

Semiconductors

Integrated Circuits

OM361	1	IC1 (RS302-485)
SP8617/9	1	IC2 (See note)
78L05	1	IC3

Miscellaneous

5µH r.f. choke (Ambit Code 35-71472); Astec modulator box, 71 x 37 x 20mm (Ambit Code 21-06053); miniature 50Ω coaxial cable (RG174); p.c.b.

PSU and Case

Resistors

¼W 5% Carbon Film

1kΩ	1	R7

2W Vitreous Wirewound

15Ω	1	R8

Capacitors

Single-ended p.c.b. Mounting—16V

1000µF	1	C9

Semiconductors

0·9A d.i.l. bridge	1	BR1 (RS 262-090)
Red l.e.d.	1	D1

Miscellaneous

12V 3VA transformer (RS207-835); case, Centurion DX1 (Ambit Code 21-06010); 20mm fuse holder with 100mA fuse; miniature mains rocker switch (1); 50Ω BNC single hole mounting sockets (2); 1·5A mains connector; p.c.b.

IMPORTANT!

Since preparing this article and immediately before going to press we were informed by Plessey Semiconductors Ltd. that the SP8617 and SP8619 devices are no longer readily available in the UK. We have been advised that the SP8611B is pin compatible but the following minor component value changes must be made.

Resistors R2/3 should be 430Ω and R1 selected to achieve the best input sensitivity consistent with spurious count suppression. Potentiometer R6 should be adjusted to provide 5·2V at pin 14 of IC2.

The concluding part of this article provides full setting-up and performance details.

WOOD & DOUGLAS

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NEW PRODUCTS for the exhibition season from our new factory facility.

144LIN25B 25W VHF LINEAR – A single stage higher power version of our popular 144LIN10B designed for the 2-3W output level FM or SSB equipments. The board retains the straight through mode in receive or when the power supply is disconnected and fits neatly into a small diecast box. Ideal for the FT290.
Price details: **£29.95** in kit, **£40.25** as an assembled module.

6RX2 6M CONVERTER – You may not be one of the priveleged 40 but you can at least listen on this compact high performance converter for 6M. It allows reception on the 2M band. The board has options for local oscillator output and r.f. gain adjustment.
Price details: **£19.95** in kit, **£27.60** as an assembled module.

MPA2 MICROPHONE PRE-AMPLIFIER – A buffered output version of the MPA1. The board will now interface with low input impedance equipment without degrading the response.
Price details: **£3.45** in kit, **£5.95** as an assembled module.

TVMOD1 Ch 36 MODULATOR – An alternative to imported UHF modulators giving adjustable frequency over the range 400 to 600 MHz. This enables system checks at 70cms or directly into your TV set in Band IV. The board has video gain and modulation preset adjustable. The output oscillator runs at 200-300MHz so it could be adapted to Band III.
Price details: **£6.95** in kit form, **£10.15** as an assembled module.

Impressive new products but the best is yet to come . . .

In May a new design for a 50W h.f. transceiver will appear in Radio Communications. While it is a departure from our normal policy of marketing only our own designs we were so impressed by George Fare's (G30GQ) write up that we have offered to back the project with component kits. This will include PCB's and all components per our normal policy. Full price details are not yet available but a full kit should market for approximately £250 inc. VAT. Some provisional technical details are available, please ask.

When you purchase one of our products you are guaranteed success because we offer full back up and servicing on any item no matter how small. The confidence we have in the product is reflected in the range available and the low service return rate incurred.
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Aldermaston, Reading RG7 4PQ
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ANTENNAS PART 6

F.C. JUDD G2BCX

It is appreciated that few radio amateurs have either the means or opportunity of setting up **an ideal antenna system in an ideal location** (if such exists). Yet, having spent perhaps several hundred pounds on a highly sophisticated transmitter/receiver it is surprising to find the potential of such equipment totally spoiled by the use of an inefficient and often badly sited antenna.

For example, a random length of wire with one end hung in a tree, then draped over a rooftop and run halfway through the house, is hardly likely to justify the usually excellent performance of a modern h.f. band set.

Before being shouted down with comments about lack of available space, local planning requirements, objections from family or neighbours to "unsightly" masts and antennas etc., let me say that these reasons are fully appreciated and sympathy is extended to those with such problems. Whilst these limitations may be frustrating, a little serious thought could well result in a solution satisfactory to all concerned.

It is not within the scope of this article to provide answers to individual problems of this nature; there are numerous books available with at least one chapter devoted to antennas designed for use in otherwise difficult situations and especially where space is limited. Investment in such a book could well result in worthwhile dividends in terms of finding an antenna design best suited to meet whatever circumstances may prevail.

Antenna Performance and Environment

The performance of an antenna in its chosen location may well be different to that specified by the manufacturer and/or not in accordance with its theoretical function. The height of an antenna above ground, its proximity to other antennas or other conductors such as overhead telephone and power cables, conductivity of the ground beneath, other buildings in the vicinity, large trees or groups of trees etc., can all affect performance in some way or other. Performance can of course be affected by not following the manufacturer's instructions, or in the case of published d.i.y. antenna projects by not using the designer's specified materials, dimensions and other recommendations for obtaining optimum performance—including the use of suitable feed cable of the correct impedance.

In this article only a few ways in which the performance of antennas can be affected are illustrated, mostly by polar patterns, plotted under what might be termed normal environmental conditions. The photograph of Fig. 6.1 shows some of the antennas used at the author's QTH and which are sufficiently separated to avoid any significant deviation from expected performance, except in the case of the 12-element v.h.f. beam antenna directly above the 28MHz beam. The v.h.f. antenna suffers a slight rise in v.s.w.r. when in the horizontal mode owing to its close proximity to the beam below it. In the vertical mode it is unaffected. Note: The v.h.f. beam can be electro-mechanically rotated from horizontal to vertical and back. However, because of a large building consisting of **four metal lined sugarbeet silos, each about 55m high and located 1km away,** reflections from these at v.h.f. are strong enough to cause apparent distortion of the radiation pattern of the v.h.f. beam when operating in vertical mode, as shown in Fig. 6.2(a)—the solid line. This is a typical case where an antenna with an otherwise quite symmetrical polar pattern appears to behave in a curious manner in certain directions. The nominal pattern is shown in Fig. 6.2(b) with a dotted line for comparison.

But this is nothing new. In 1916 Marconi and his assistant C. S. Franklin found in the course of experimental work, **using a wavelength of two metres,** that the transmitted signals were reflected from objects in the path of the radiated wave. Marconi concluded from this that a form of what he called "wireless detection" (of objects) seemed possible but he did not pursue the idea. It was the result of a similar experiment by R. Watson-Watt in 1935 that quickly led to the development of "radar" using the pulse/echo principle.

Phase and Anti-Phase at VHF

Signal "flutter" from mobile transmitters operating on v.h.f. and u.h.f. is of course well known. There are two principal causes, the first one being due to shielding in the path of the transmitted signal due to buildings, roadside lamp standards and overhead telephone wire etc. The second can be due to a dual path being taken by the signal, direct and reflected from ground or other obstacles. This means that in effect two signals of the same origin arrive at the receiving antenna either **in** or **out** of phase. In-phase the signals add but when out of phase, they cancel each other.

It is quite possible for this phase difference to occur with signals between two *fixed stations,* perhaps only a few km apart, resulting in comments of the nature: *"OK on your new antenna OM but your signals are way down; nothing like the strength they were before with the old antenna."* Then the reply: *"Well I can't understand that, the new antenna is on a different mast and much higher and I'm getting very good reports from other stations. Must be something wrong your end OM."* The reason is that the signal is taking two paths and arriving **out-of-phase.** So, never rely on signal reports from one station only when trying out a new antenna.

However, the idea adopted by the author and illustrated in Figs. 6.3 and 6.4 might prove useful to those who use a beam antenna mounted on a rotator. By mounting a v.h.f. omni-directional vertical antenna on the end of an arm approximately 480mm out from the mast section above the rotator and above the beam, the v.h.f. omni' can be turned

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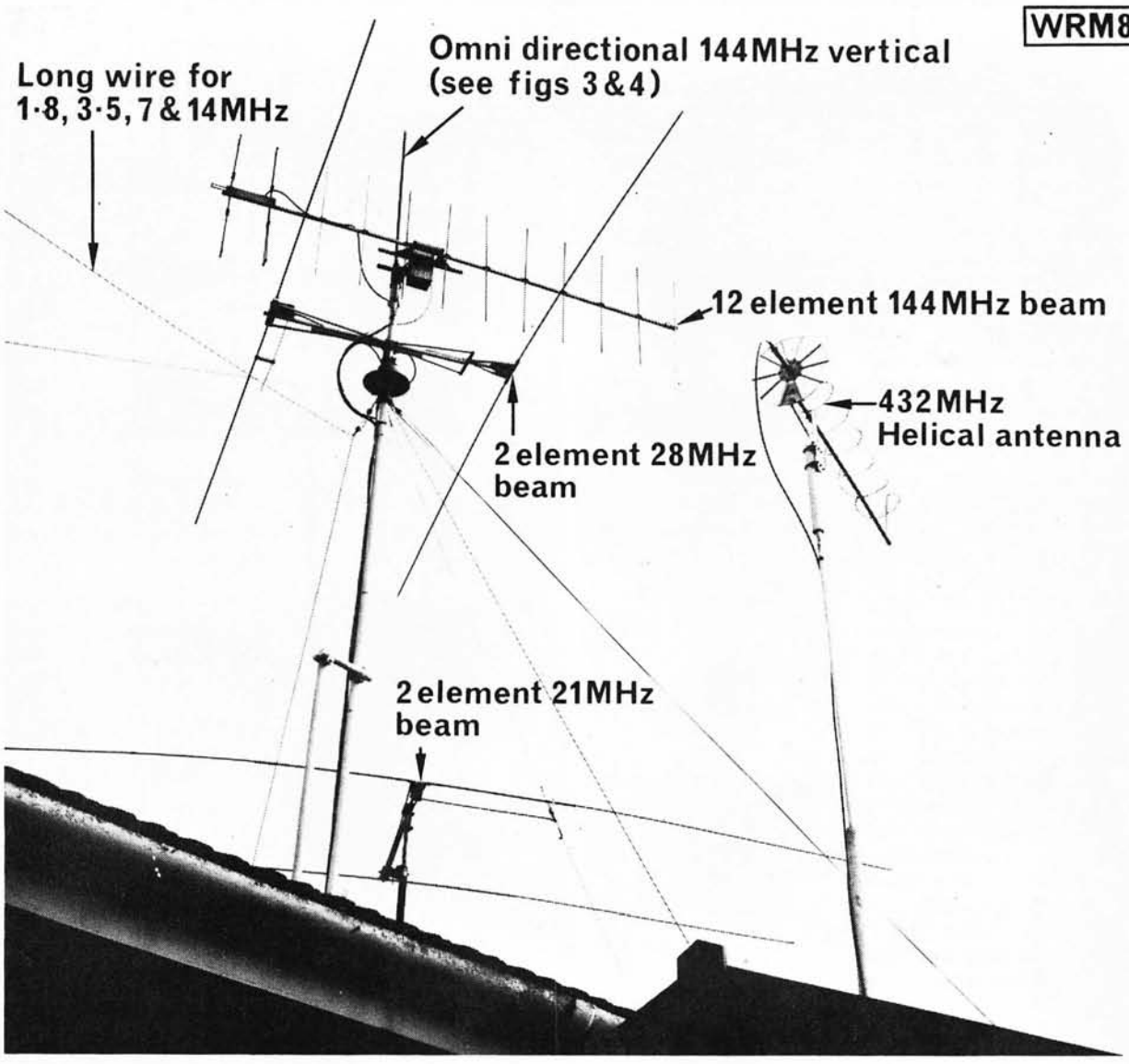

Fig. 6.1: Some of the antennas used by the author

through a circle of the same radius. This will allow the antenna to be positioned toward or away from the station being worked by $\pm\lambda/4$. This arrangement has been found to be very effective as Fig. 6.4 shows. The chart recording signal level variations from a station 40km distant is shown relative to the position of the antenna when turned through 360 degrees.

Attenuation and Polarisation Changes at VHF and UHF

Wave propagation at v.h.f. and u.h.f. is largely "line-of-sight" and ideally antennas for these bands should be installed high enough so that radiation, which is normally parallel to the ground, is directed well above buildings, trees and conductors such as overhead telephone wires etc., in the vicinity. Attenuation due to large buildings with steel frames or other metallic reinforcement, can be higher than is generally realised and tests have revealed as much as 25dB. At v.h.f. and u.h.f. attenuation is usually greatest with vertically polarised waves, which is not surprising when you think of all the vertical conductive obstacles that may lie in the path of waves travelling near to the ground.

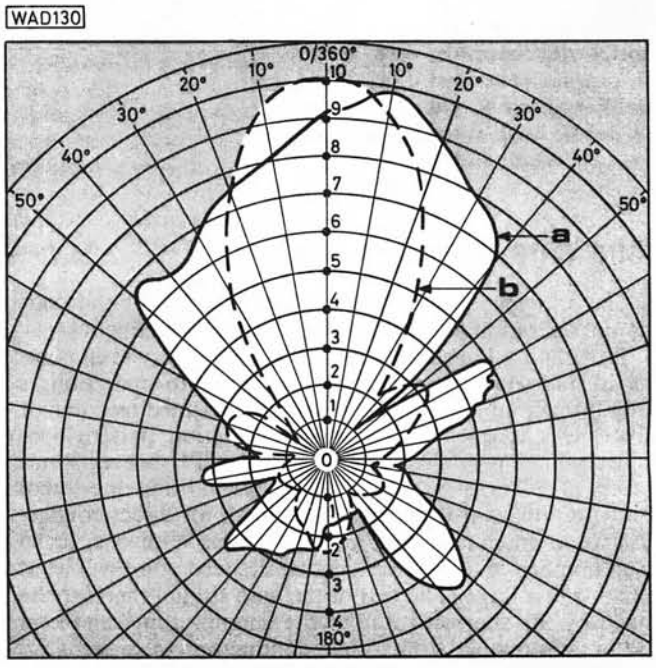

Fig. 6.2: The distortion of the radiation pattern due to the four silos

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Values of attenuation for vertically polarised signals due to trees and especially large numbers of trees together have been assessed as 3dB at 30MHz rising to more than 10dB at frequencies above 100MHz. The average attenuation figure at v.h.f. for horizontally polarised waves is approximately 3dB. Normal brick walls and slate or tiled roofs can account for an attenuation of 6dB at v.h.f. and u.h.f. which means that radiation from indoor antennas will suffer some loss and more so when rooftops and walls are wet.

Other tests carried out with regard to the effect of terrain revealed that diffraction and reflection from the ground, buildings and other conducting objects can result in the polarisation of a v.h.f. signal becoming twisted. Observations have shown that vertically polarised signals arriving from distances of 48 to 64km can become reorientated to such an extent that an increase in received signal strength of 6dB or more could be obtained by slanting the receiving antenna to meet the polarisation change. Instances have even been recorded where wave polarisation at v.h.f. over a long path (60–100km) has been changed completely from vertical to horizontal.

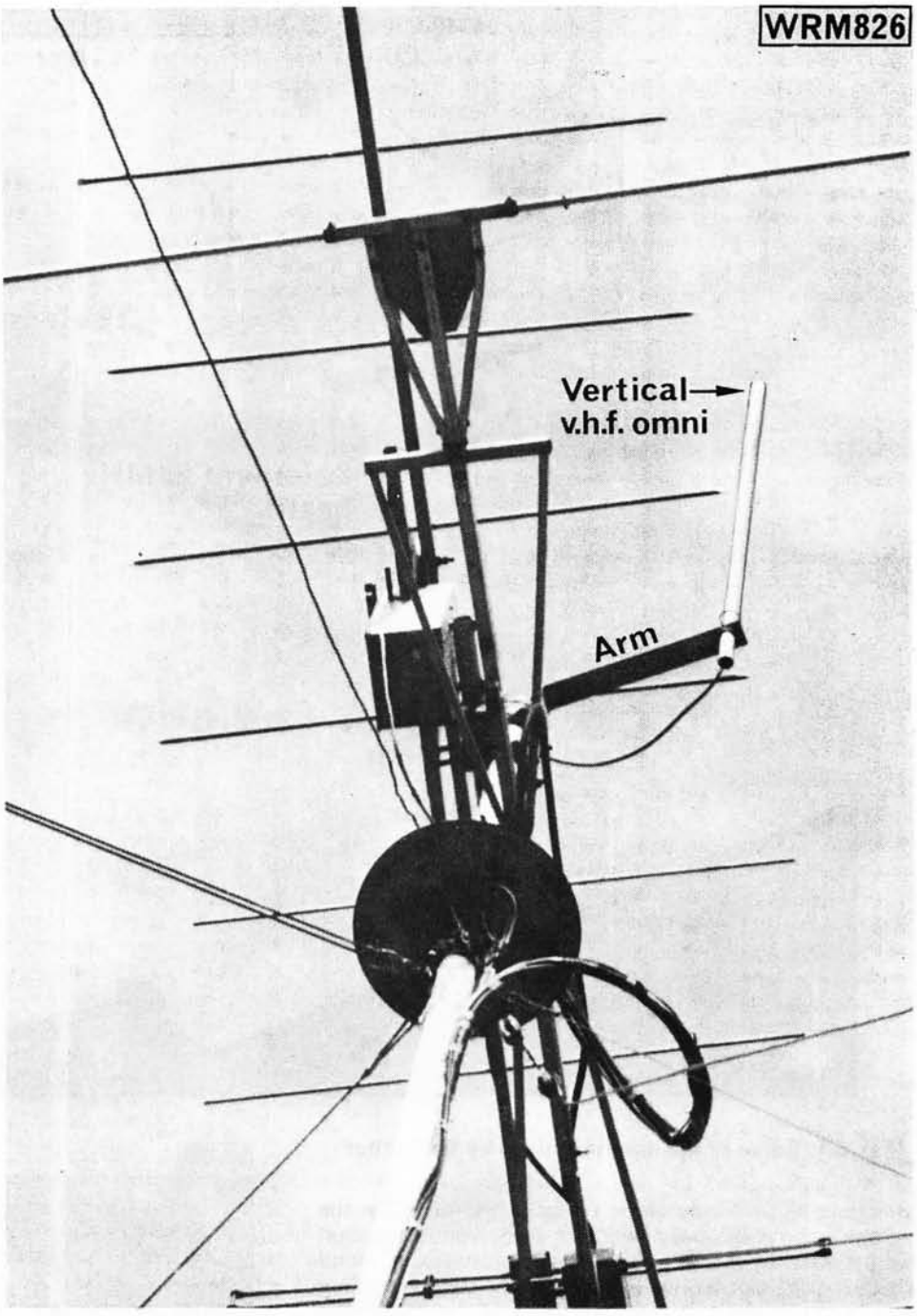

Fig. 6.3: Use of extending horizontal support arm with an omni-directional v.h.f. vertical antenna for rotation through 360 degrees on a radius of λ/4

Long Wire Antennas—HF

The principle of long wire antennas for multi-band (harmonic) operation was dealt with in Part 5 of this series.

Providing a long wire consists of one or any even number of half-wave lengths at the frequency of operation, is fully horizontal and fed at one end via a tuned feed line or other matching system, then the radiation patterns obtained will be very close to the theoretical. However, it has been and still is fairly common practice to bring one end of the wire downwards and into the shack for direct connection to an antenna tuning/matching unit. With one, or an even number of half-wave lengths, the feed point will be at a high r.f. voltage. The end of the wire should therefore be taken by the shortest route to the antenna tuner and kept as far as possible from other conductors to prevent r.f. power loss. This method of feeding a long wire can also distort the otherwise normal radiation patterns that would be obtained. Radiation from the downward portion of wire will normally be almost vertically polarised and this can result in some cancellation of power from one of the main lobes, whilst causing an increase in power from the others.

End feeding also causes "tilting" or a shift in the angle of the main lobes with respect to the wire. The shaded polar pattern with the dotted outline as in Fig. 6.5(a) shows what can happen. In this example the antenna is approximately 40m long (total) and naturally resonant as a half-wave on 3·5MHz, but being operated as a **full-wave** on 7MHz. If the whole length of wire was horizontal and coupled to the transmitter via a matched line at one end it would produce the symmetrical pattern of four lobes, each having the same amplitude and at an angle of about 54 degrees to the line of the wire, as Fig. 6.5(b) shows. Note how the result of direct feeding at one end has, in this example, greatly diminished the amplitude of the lobe lying in the Southerly direction.

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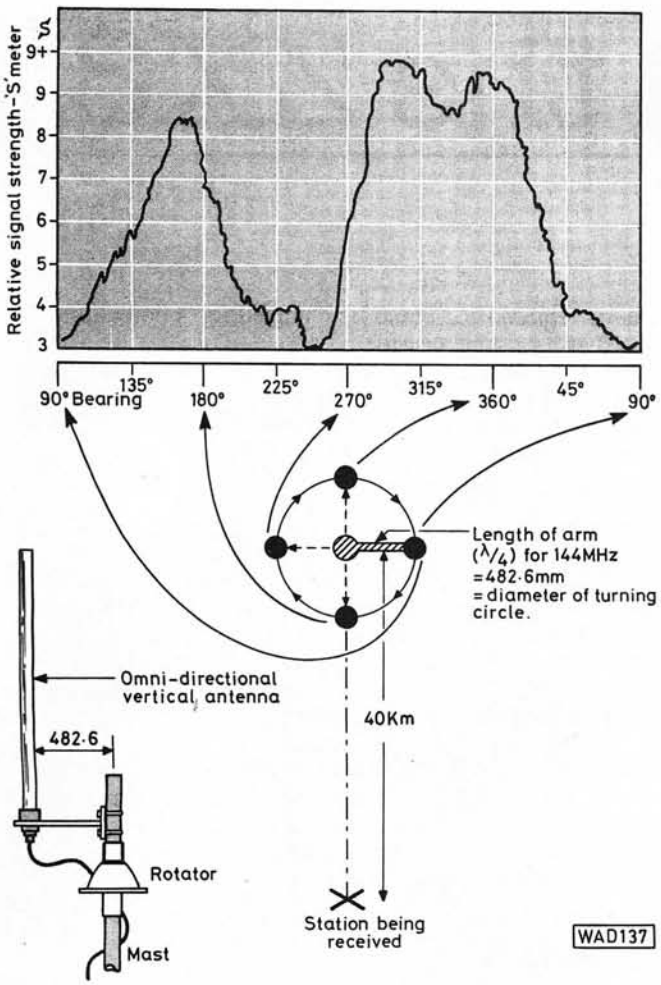

Fig. 6.4: Showing the pen chart recording of v.h.f. signal variation due to phase effects, also the rotation of the v.h.f. vertical antenna on a radius of λ/4

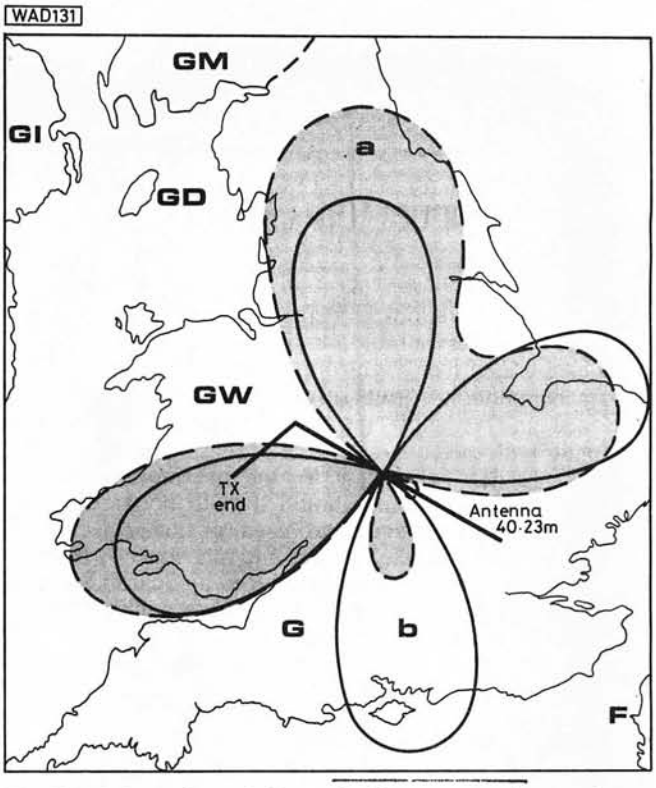

Fig. 6.5: Distortion of the radiation pattern from a long wire antenna operated on the h.f. bands

NEXT MONTH

In Part 7 we will consider radiation at vertical angles for h.f. antennas and also the effects of ground proximity

Swap Spot

Have remote control 22in colour television (Hitachi) excellent condition. Would exchange for a good general coverage receiver or 144MHz transceiver. "Exchanger" to collect (no rubbish please). R. G. Jones, 1 Southampton House, Avon Road, Tidworth, Hants, SP9 7RT. Tel: Stonehenge 46374 (not after 7.00pm). *R991*

Have complete camera outfit, mint condition, Canon A1, AE1 programme, 50mm, 200mm, 300mm Canon FD lenses, winder, Sunpack auto zoom, 3600 flash, filters, straps and aluminium case. Would exchange for 144MHz or h.f. rig. P. Deighton, 3 Prickett Road, Bridlington, E. Yorks. *R992*

Have JVC S100E colour video camera etc., 10X zoom lens, mint condition, 2 months old. Would exchange for good 144MHz and h.f. transceivers with possible cash adjustment. K. White, 95 Burstall Hill, Bridlington, E. Yorks. *R993*

Have Eddystone 770R v.h.f. communications receiver in good condition. Would exchange for 144MHz (2m) f.m. mobile. Tel: 0376 40502 (Braintree, Essex). *R994*

Have FT-290 plus cash, still under warranty, NiCads & charger. Would exchange for TR-9000 or FT-480, 100W linear 10W drive. GM6LJG Eric. Tel: 0397 2992 (Fort William). *R995*

PW "SWAP SPOT"

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

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

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

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RTTY with the ZX81

by Dick Ganderton G8VFH

Part 2

In the first part we looked at the design and construction of a terminal unit suitable for use with a microcomputer such as the ZX81 or Spectrum. Before we can use the t.u. with a computer we need some form of serial to parallel interface unit to allow the t.u. to conduct its two-way 'dialogue' with the computer.

Those readers who want to find out more about the theory behind interfacing should turn to books covering the subject. The interface board used for this project is the one designed by Scarab Systems and marketed by them as a kit of parts. The board was produced by Scarab Systems for use with their ZX81 RTTY software package and is simple, effective and easy to build.

Interface Construction

The interface is shown in the circuit diagram (Fig. 2.1) and uses the well-known 8251A programmable communications interface chip. It could be built on Veroboard if desired to keep the costs as low as possible. However the recommended method of construction is on the double-sided p.c.b. as shown in Fig. 2.2. This p.c.b. is available from Scarab Systems along with the RTTY software cassette.

Construction is started with the 23 through-board links and the TEST pin. Note that these must be soldered on both sides of the board. When you are satisfied that you have fitted all the links the i.c. holders can be fitted. If you want to save costs then these holders can be left out and the i.c.s soldered directly to the board although in the case of IC3 a holder is recommended.

The remaining components are then soldered in place taking care to solder both sides of the board where pads are provided. If a means of remotely changing the baud rate is required R2 could be changed for a potentiometer wired as a variable resistor.

Connections to the ZX81 are made with ribbon cable which can be soldered directly to the RAM pack or to the ZX81 p.c.b. depending on what you decide to do about re-housing the ZX81.

Setting Up

When you are satisfied that all connections have been properly made the baud rate can be set up. With S1 open, adjust R1 to obtain 2908Hz at the TEST point. Close S1 and adjust R3 to obtain 3200Hz at the TEST point. For other baud rates the frequency required at the TEST point is found from the following equation

$$f = 64 \times \text{baud rate}$$

If R2 has been changed to a variable resistor the baud rate should be set with it at mid-range to give a swing both above and below the nominal baud rate. You could, of course, calibrate the control and adjust it from the front panel of the computer keyboard.

Software

The program chosen for this project is the Scarab Systems ZX-RTTY program as this is readily available, proven and reasonably priced. The program offers six programmable memories, one of which transmits up to 255 RYs for tuning purposes while the other five can transmit individual messages, such as a CQ call, station details, test messages, etc. each containing up to 255 characters. Transmitted information is displayed on the v.d.u. screen in inverse format to distinguish it from received information.

The re-housed ZX81 with the Maplin keyboard. The diecast box houses the mains power supply, mains filter, ZX81, Ground Control 16K RAM board, Scarab interface board together with the various input and output sockets. The Maplin keyboard is a great improvement over the original ZX81 pressure-sensitive one

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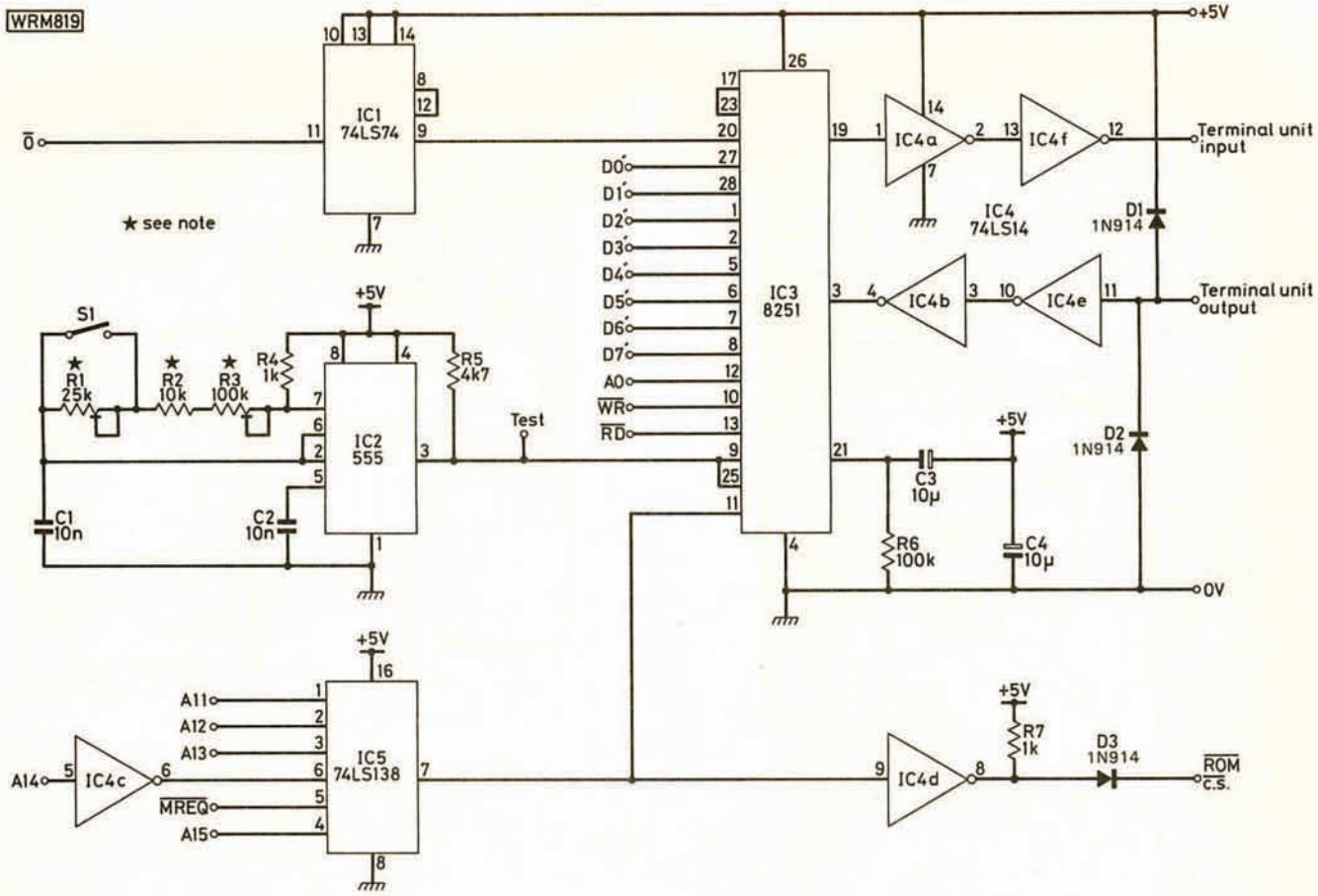

Fig. 2.1: Circuit diagram of the Scarab Systems interface. Resistor R2 can be replaced with a variable resistor to give a fine baud rate control if required.

CONSTRUCTION RATING Intermediate

BUYING GUIDE

The Scarab Systems software used in this project is available on a cassette from Scarab Systems, 141 Nelson Road, Gillingham, Kent ME7 4LT, Tel: 0634 575778. Price £9.75 incl. VAT and postage. The cassette with p.c.b. is also available from Scarab at £13.45 while the complete package including components is £25.15. The 16K RAM board used is available, cased, from Ground Control, Alfreda Avenue, Hullbridge, Essex SS5 6LT, Tel: 0702 230324. Price £19.95 inclusive. Ground Control can also supply their 16K RAM and IO board (p.c.b. only) together with full instructions at a special price for *PW* readers of £7.75. The keyboard used is from Maplin Electronics and is their LW72P at £19.95 in kit form. The case is their XG17T at £4.95.

The quoted price does not include re-housing the ZX81.

APPROXIMATE COST £26

★ components

Resistors

Carbon film ¼W 5%

1kΩ	2	R4, 7
4·7kΩ	1	R5
10kΩ	1	R2 (see text)
100kΩ	1	R6

Potentiometers

Min. horizontal presets

25kΩ	1	R1
100kΩ	1	R3

Capacitors

Polyester

10nF	2	C1, 2

Tantalum bead

10µF 16V	2	C3, 4

Semiconductors

Diodes

1N914	3	D1, 2, 3

Integrated circuits

NE555	1	IC2
8251A	1	IC3
74LS14	1	IC4
74LS74	1	IC1
74LS138	1	IC5

Miscellaneous

Min. toggle switch s.p.s.t.; Integrated circuit holders 8 pin d.i.l. (1), 14 pin (3), 28 pin (1); Printed circuit board (Scarab Systems); Through-board links, wire, ribbon cable etc.

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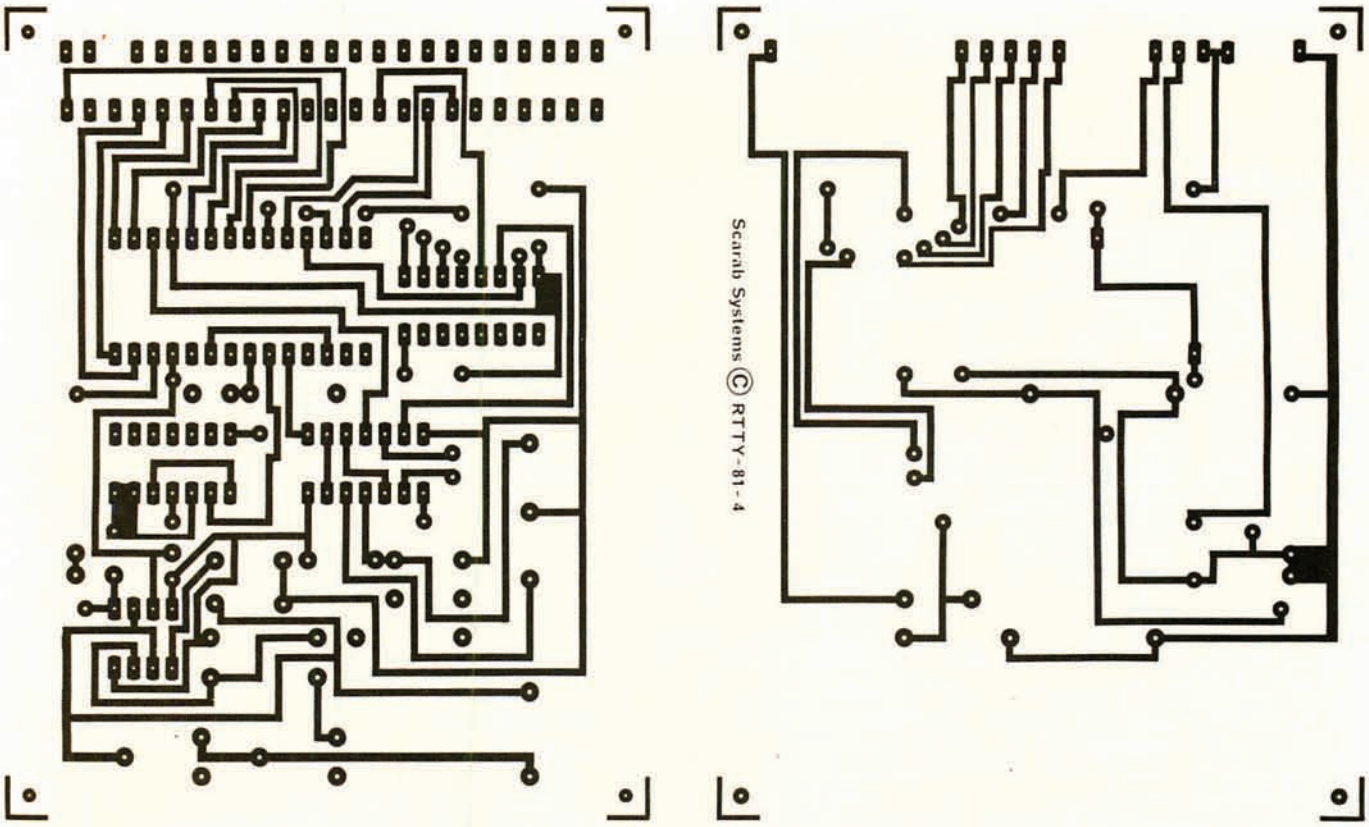
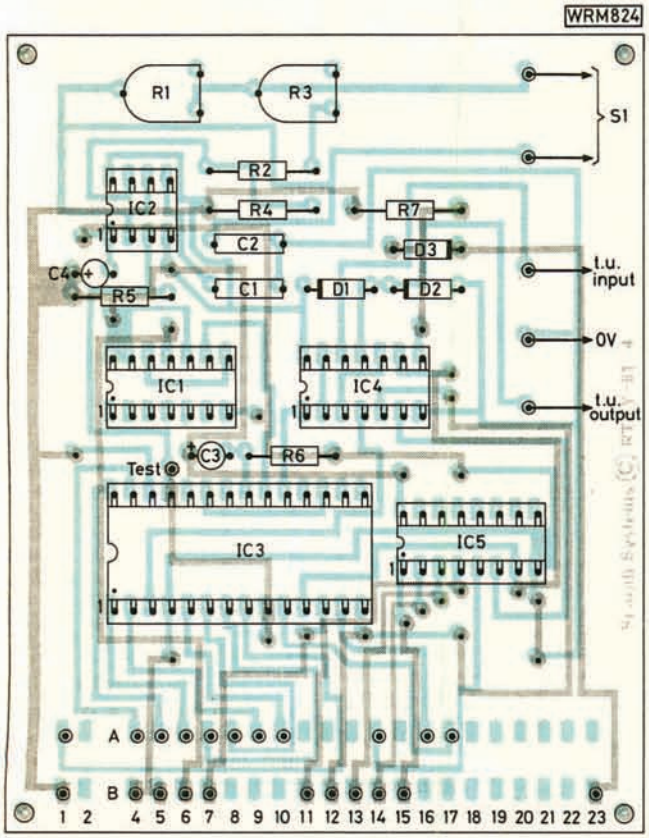
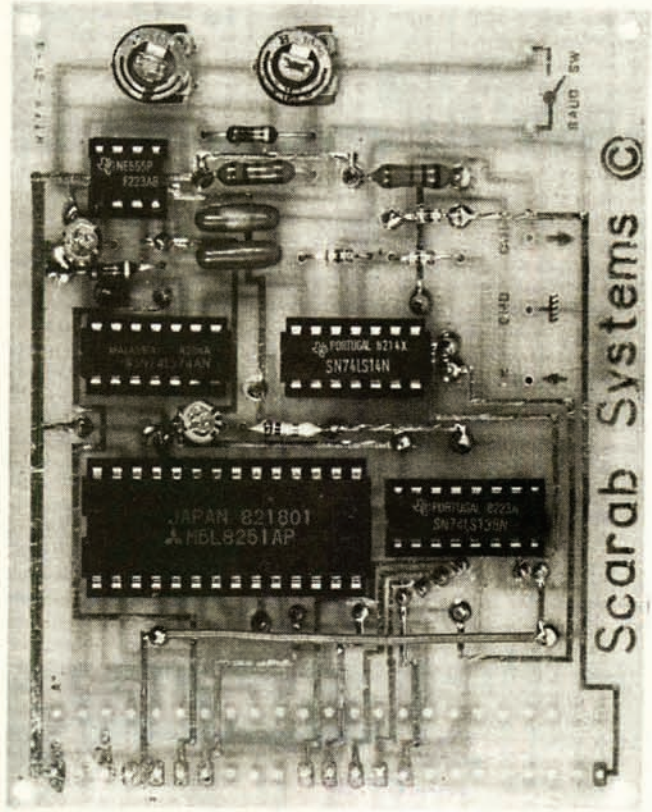


Fig. 2.2: Full-size copper track patterns and component placement for the Scarab Systems interface board





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RTTY with the ZX81

Carriage return, line feed codes are automatically inserted during transmission after every 64 characters and text is written at the bottom of the screen and automatically scrolls upwards. All that remains to be done is to connect the interface board to your ZX81 and terminal unit, connect the t.u. to your transceiver, load the Scarab Systems RTTY program into the ZX81 and away you go.

QRM and Other Problems

All microcomputers produce some degree of QRM and the ZX81 is no exception. In some cases it is so bad that it completely swamps the transceiver while in other instances it is no problem at all!

It is well worth while, however, completely stripping the ZX81 out of its case and treating it as a plain p.c.b. which can be mounted into a screened metal enclosure together with a mains power supply, properly filtered, the RTTY interface board and the RAM pack.

While this is being done a better keyboard can be added, and this really is a must for RTTY operation. Also the various parts of the computer can be hardwired together for greater reliability.

I opted to use the Maplin keyboard which is reasonably priced in kit form, and has several useful features such as a SHIFTLOCK key, FUNCTION key and GRAPHICS 2 key to make life easier when loading or editing programs. The keyboard is connected to the computer via a ribbon cable and I used a 25-way plug and socket for this although it is not essential and the ribbon cable could be fed into the metal enclosure through a small slot.

The complete ZX81 with p.s.u. and RAM pack, etc. can be fitted into a large diecast box although this is a squeeze. The RAM pack used is the Ground Control 16K unit removed from its case and the edge connector unsoldered. The board is then connected directly to the ZX81 p.c.b. using either ribbon cable or a mixture of ribbon cable and rigid tinned copper wire to support the RAM pack board above the ZX81 board. To allow a printer or other peripherals to be fitted to the computer a slot is cut in the side of the box to allow access to the edge connector on the ZX81 p.c.b. For extra reliability I fitted a gold-plated edge connector to the board but this is an expensive luxury, and not really necessary.

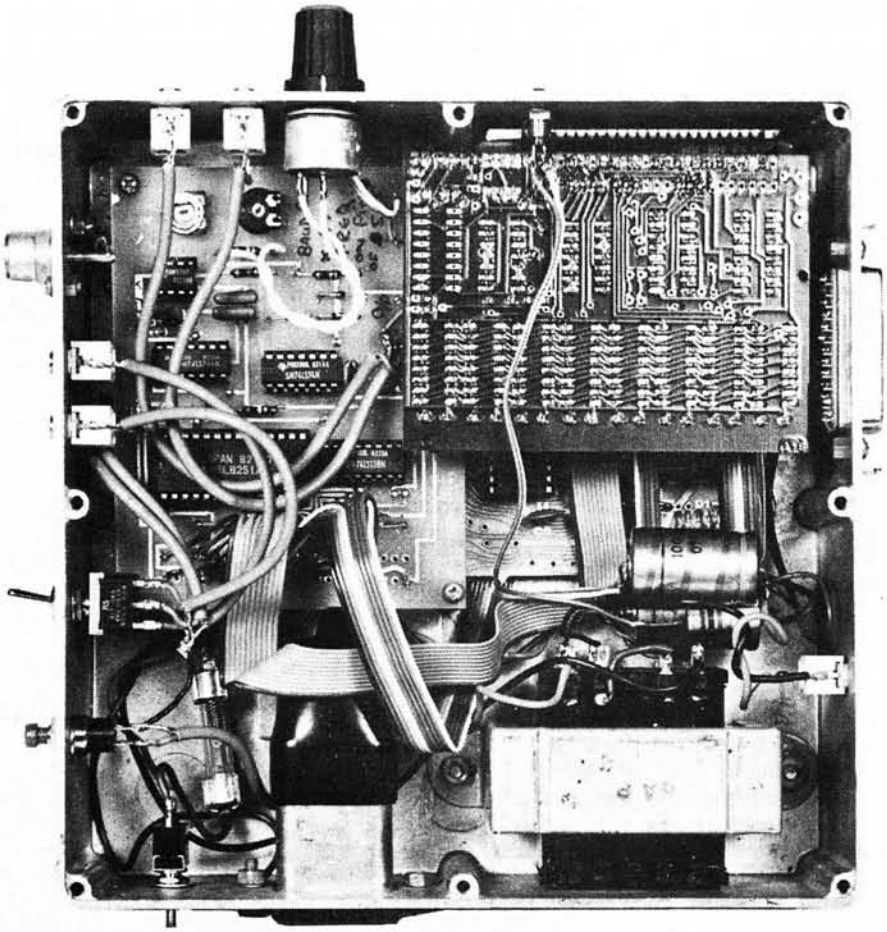
The ZX81 p.c.b. is attached to the box floor by two plastic pillars and the ZX81 heatsink which is joggled downwards and screwed to the box floor with some heatsink compound and a 6BA nut and bolt through a hole drilled in the centre of the heatsink.

Any metal enclosure could be used so long as it has a close fitting lid to keep it reasonably r.f. tight.

The mains p.s.u. could be the original Sinclair one, as long as it is the larger version capable of driving the printer as well as the computer, or it could be a new one built from a 9V 20VA transformer feeding a bridge rectifier with adequate smoothing. The mains input must be filtered as well as switched and fused.

Eliminating the problems created by the Sinclair edge connector by hardwiring, improving the heatsinking and screening the whole lot in a metal box improves the overall reliability and the computer can still be used by the kids to play games. The QRM is now low enough to be lived with and the Scarab Systems RTTY program works very well.

Scarab also produce an interface board and software for RTTY with the ZX Spectrum and the t.u. described in Part 1 is suitable for this. ●



The complete 16K ZX81 fitted into a large diecast box. The Scarab Systems RTTY interface board is fitted at the top left of the box while the Ground Control 16K RAM board, taken out of its plastics case is mounted directly above the ZX81 board in the top right corner. The mains power supply is in the bottom right of the box with the mains filtered plug centre bottom

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Mods

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

No. 23
Roger Hall G8TNT (Sam)

Mods 22 in the May issue of *PW* was devoted to readers' requests and we are now almost up to date with them. This month I will explain how to extend the frequency range of some 144MHz rigs.

Frequency extension these days is a basic mod that is quite easy to carry out on most Japanese sets because they are usually made to be sold throughout the world. Instead of making different sets for each part of the world, with their own specific frequency allocations, the Japanese make one model that can be easily modified to work within the appropriate band edges.

Before explaining how to carry out these modifications, I should make it quite clear that sets that operate outside the UK amateur allocation of 144–146MHz can by themselves only be used in those countries that allow such operation. The only other valid reason for a UK amateur wanting to be able to cover a 4MHz range is to drive a transverter for 432, 1296MHz or other microwave bands. Transverting is an acceptable way of getting on to these higher frequencies but great care must be taken to ensure that any leakage of the fundamental signal from the driving rig is maintained at a very low level (normally better than 60dB below the peak output). By way of example when we tried transverting to 1296MHz for a contest, several people came back to us on 144MHz. Despite all our precautions, some of our signal was being radiated on 144MHz and people who returned to our CQ calls on that band did not even realise that we were trying to operate on 1296MHz!

It should also be noted that wanting to listen to services operating above 146MHz is not a good reason for modifying a 144MHz band rig. Contrary to popular belief, we are not allowed to listen to these transmissions provided we do not pass on anything that we may hear—we are not allowed to listen at all. The existing Wireless Telegraphy Act makes it quite clear that without an appropriate licence the general public are **only** allowed to listen to transmissions from radio amateurs and authorised broadcasting stations; nothing else. Holders of an amateur licence (A or B) may additionally monitor transmissions from Standard Time Stations such as WWV and MSF Rugby.

And now for the Mods folks!

Mr C. North G6FHI obviously does not want to use his set for any illicit purposes because he wrote in to tell me how to de-modify an **IC-290.** He bought an American version of this set and then found that it did not have a tone burst and its coverage was 143·800–148·999MHz.

He solved the tone burst problem by buying a ready-made board and fitting it inside the case and then, because he thought that it would be too easy to accidentally transmit out of band, he decided to Anglicise the set. He found that there are three diodes marked 15, 20 and 23 and next to them there are three vacant spaces for diodes. These are marked 16, 31 and 22. He removed the diodes from their original positions and replaced them in the vacant ones. The mod was completed by running a wire from D31 to the unused hole adjacent to J8. This work has to be carried out on the p.l.l. board which should be removed from the rig. This involves removing the top cover, then taking out the sensor board (one edge connector). All the connectors have then to be removed from the logic board and, when the four screws have been removed, this board can be taken out.

Mr North passed on this information with the comment that the circuit board is clearly marked and it should be easy to see where the components should go. He also mentioned that people with the European version of this set can extend their frequency range by simply reversing the procedure.

The Icom **IC-25E** is a tiny 25W mobile rig that is very nice but it does have one annoying fault. It has a tendency to buzz, even when the audio gain control is turned right down. I receive the *Icom Newsletter* from the Users' International Radio Club. This is published by Rob Pohorence N8RT, and it usually contains a wealth of information. A small item in issue 31A mentioned the problem of low frequency hum leaking into the audio output on this model and a modification was suggested that should cure it.

First remove the top and bottom covers and then remove the two screws on each side that hold the front and back panels. Then unsolder the red wire on the power switch which terminates at J8 pin 2 on the driver board. Slip the wire out of the bundle so that it is free to move to the back of the set and then solder it to the cathode of D22. This is located just to the right of the external speaker jack on the heatsink.

The output level of the hum before modification was measured at 1·1mV with the volume control set at zero. After modification the level was 0·5mV—a significant improvement!

While on the subject of the **IC-25E,** I should mention how easy it is to make this model cover a full 10MHz. I have already published this information but it is so easy that I am going to print it again. On the front panel there are three rectangular push-buttons, FULL-SCAN/PROGRAMME-SCAN, SIMPLEX/DUPLEX and NORMAL/REVERSE. If the latter two buttons are pushed in simultaneously they will both latch in the depressed position and the set will then tune between 140·000 and 149·999MHz without any further modification. It couldn't be easier.

Wanted

This column exists to allow readers to exchange information so if you have a mod for any kind of amateur radio equipment, please write in and let me know. I can then pass it on via this page. Under the heading Wanted I can also pass on your requests for mods so write in if you would like to know how to modify your rig. Unfortunately I cannot answer individual queries so please do not enclose any sort of s.a.e. or IRC.

We will soon be publishing an index so that you can see if the mod that you have been looking for has already been printed. If it has, the easiest way to obtain a copy is to contact the Post Sales Department. Their address is at the front of this issue.

The address to write to with a mod, or a request for one, is R. S. Hall, Room 2046, Hatfield House, Stamford Street, LONDON SE1 9LS.

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The R2000 is Trio's latest communications receiver covering the entire spectrum from 150KHz to 30MHz. It boasts a whole host of features that make it probably one of the best buys in radio communications receivers currently available today. Its uncompromising design provides facilities for AM, SSB, CW and FM reception with 3 separate filters automatically switched in. The factory fitted memory module provides for 10 separate frequencies to be programmed in any mode and for automatic scanning of all channels. In addition, pre-programmed segments of the band may also be scanned making it one of the most versatile designs available. As an added feature an internal battery with an estimated life of 5 years retains the memory even when the power is disconnected. The rate of tuning is controlled electronically and has 3 speeds to suit all types of operation. Another novel feature is the squelch control that is effective on all modes for suppressing background noise when no signal is present. Other features include noise blanker, dual AGC, clear digital display down to the nearest 100Hz, dimmer switch, 24 hour quartz clock, front mounted speaker, tone control, RF step attenuator, dual impedance aerial terminals, 230v AC or optional 12v DC operation, built-in timer etc, etc.

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ICOM R70 £499

The R70 is possibly the ultimate in receivers designed for the amateur market. We've tested this thoroughly and are convinced that this receiver offers everything that the enthusiast could ever wish for. If anything can pull the signals in, this one will. Frequency coverage is 100kHz to 30mHz in 30 bands. A 3 stage rate of tuning enables easy tuning for all modes, AM, SSB, CW and FM (the latter requires the optional FM module). The dual VFO enables 2 separate frequencies to be used and the bright digital display gives precise frequency readout down to 100Hz with absolute stability. Great emphasis has been put on selectivity and in addition to independant filters for each mode, there is a separate selectivity control. This enables the bandwidth to be continuously varied down to 500Hz. Another control provides a variable notch filter to prevent hetrodyne interference – now you can really dig deep for those elusive DX signals. Another nice feature on this receiver is its excellent sensitivity even on very modest aerials. This is obtained by the use of a well designed front end incorporating switched pre-amplifier and attenuator. Other features include dual-mode noise blanker, dual AGC action, transmitter monitor, dimmer switch, dial lock, RIT control, squelch control, tone control, FM tuning indicator, forward facing speaker, 230v AC power requirements, etc, etc.

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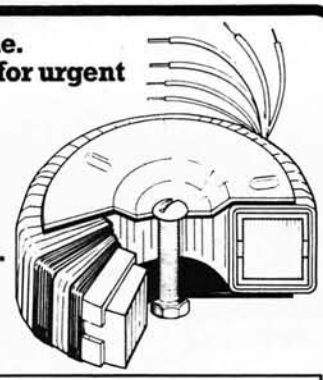

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0.35Kg	0x012	12+12	0.63	**£5.12**
Regulation	0x013	15+15	0.50	+ p & p £0.78
19%	0x014	18+18	0.42	+ VAT £0.89
	0x015	22+22	0.34	TOTAL £6.79
	0x016	25+25	0.30	
	0x017	30+30	0.25	
(encased in ABS plastic)				
30 VA	1x010	6+6	2.50	
70 x 30mm	1x011	9+9	1.66	**£5.49**
0.45Kg	1x012	12+12	1.25	+ p & p £1.10
Regulation	1x013	15+15	1.00	+ VAT £0.99
18%	1x014	18+18	0.83	TOTAL £7.58
	1x015	22+22	0.68	
	1x016	25+25	0.60	
	1x017	30+30	0.50	
50 VA	2x010	6+6	4.16	
80 x 35mm	2x011	9+9	2.77	
0.9Kg	2x012	12+12	2.08	**£6.13**
Regulation	2x013	15+15	1.66	+ p & p £1.35
13%	2x014	18+18	1.38	+ VAT £1.12
	2x015	22+22	1.13	TOTAL £8.60
	2x016	25+25	1.00	
	2x017	30+30	0.83	
	2x028	110	0.45	
	2x029	220	0.22	
	2x030	240	0.20	
80 VA	3x010	6+6	6.64	
90 x 30mm	3x011	9+9	4.44	
1Kg	3x012	12+12	3.33	**£6.66**
Regulation	3x013	15+15	2.66	+ p & p £1.72
12%	3x014	18+18	2.22	+ VAT £1.26
	3x015	22+22	1.81	TOTAL £9.64
	3x016	25+25	1.60	
	3x017	30+30	1.33	
	3x028	110	0.72	
	3x029	220	0.36	
	3x030	240	0.33	

TYPE	SERIES No	SECONDARY Volts	RMS Current	PRICE
120 VA	4x010	6+6	10.00	
90 x 40mm	4x011	9+9	6.66	
1.2Kg	4x012	12+12	5.00	
Regulation	4x013	15+15	4.00	**£7.42**
11%	4x014	18+18	3.33	+ p & p £1.72
	4x015	22+22	2.72	+ VAT £1.37
	4x016	25+25	2.40	TOTAL £10.51
	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	
110 x 40mm	5x012	12+12	6.66	
1.8Kg	5x013	15+15	5.33	
Regulation	5x014	18+18	4.44	**£8.43**
8%	5x015	22+22	3.63	+ p & p £1.72
	5x016	25+25	3.20	+ VAT £1.52
	5x017	30+30	2.66	TOTAL £11.67
	5x018	35+35	2.28	
	5x026	40+40	2.00	
	5x028	110	1.45	
	5x029	220	0.72	
	5x030	240	0.66	
225 VA	6x012	12+12	9.38	
110 x 45mm	6x013	15+15	7.50	
2.2Kg	6x014	18+18	6.25	
Regulation	6x015	22+22	5.11	**£9.81**
7%	6x016	25+25	4.50	+ p & p £2.05
	6x017	30+30	3.75	+ VAT £1.78
	6x018	35+35	3.21	TOTAL £13.64
	6x026	40+40	2.81	
	6x025	45+45	2.50	
	6x033	50+50	2.25	
	6x028	110	2.04	
	6x029	220	1.02	
	6x030	240	0.93	

TYPE	SERIES No	SECONDARY Volts	RMS Current	PRICE
300 VA	7x013	15+15	10.00	
110 x 50mm	7x014	18+18	8.33	
2.6Kg	7x015	22+22	6.82	
Regulation	7x016	25+25	6.00	**£10.88**
6%	7x017	30+30	5.00	+ p & p £2.05
	7x018	35+35	4.28	+ VAT £1.94
	7x026	40+40	3.75	TOTAL £14.87
	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 x 60mm	8x017	30+30	8.33	
4Kg	8x018	35+35	7.14	**£14.38**
Regulation	8x026	40+40	6.25	+ p & p £2.40
4%	8x025	45+45	5.55	+ VAT £2.52
	8x033	50+50	5.00	TOTAL £19.30
	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 x 75mm	9x018	35+35	8.92	
5Kg	9x026	40+40	7.81	**£17.12**
Regulation	9x025	45+45	6.94	+ p & p £2.55
4%	9x033	50+50	6.25	+ VAT £2.95
	9x042	55+55	5.68	TOTAL £22.62
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	9x029	220	2.84	
	9x030	240	2.60	

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AIR TEST

USER REPORTS ON SETS AND SUNDRIES

GSC 3002 Autoranging Capacitance Meter

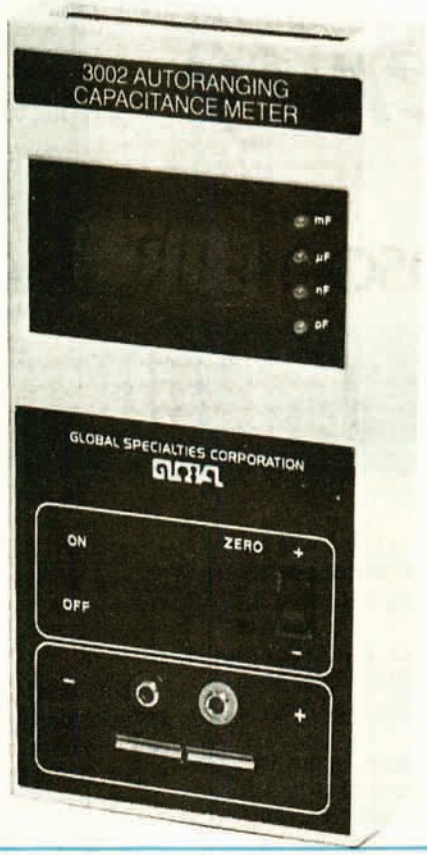
There cannot be many amateurs who have not got a box full of capacitors of unknown or uncertain value just waiting to be incorporated into the next project—just so long as their values can be deciphered.

How useful it would be if you could just plug the capacitor into a couple of terminals and read the value directly and accurately. Global Specialties Corporation's latest instrument allows you to do just that.

Launched a couple of months ago this simple piece of test gear has just two controls. A slide switch to turn the instrument on and a rotary control to set the zero. Nothing else—no range switch or other controls—just the l.c.d. readout, four red l.e.d.s indicating pF, nF, µF or mF and the sockets into which the capacitor leads or test leads can be plugged.

We have been using the instrument to sort out capacitors of dubious marked value, or where the markings have rubbed off. It has also proved of value in confirming that the markings have been correctly "decoded".

The readout is by a $3\frac{1}{2}$ digit l.c.d. which gives readings of capacitance from 1pF up to 19 990µF (19·99mF)



and the instrument automatically selects the most appropriate of the eight ranges. The basic accuracy is claimed to be 0·2 per cent of reading ± 1 count up to 199·9µF and 1 per cent of reading ±1 count up to 19·99mF with a resolution of 0·05 per cent of full scale on all ranges and 1pF on the lowest range.

Powered by six R6 (AA size) batteries the battery life is around 16 hours of continuous use. NiCads can be used instead of dry cells and a small switch in the battery compartment has to be set for the type of battery in use.

The instrument is small enough to be comfortably held in the operator's hand and also has a built-in flip-up leg for use on the bench.

As well as measuring capacitors the unit can be used to determine capacitance in cables, switches and other components. At a price of £166.00 inc. VAT from GSC (UK) Ltd, Freepost—Saffron Walden, Essex CB11 3AQ this instrument will probably be beyond the reach of most amateurs but would make a useful addition to a club's test equipment suitable for loaning or hiring out to members.

Letters

Arabackle Oblifork?

Sir: In Ost Prussia ve haf ze vay of dealink wiz fools like ze. Mein hearink has gone since 1 April 1937 wen I was ein Funker on ze $\sqrt{2}$ frequenz auf Insel Allenstein. I demand kompensation from ze Amateurs of England und ze RSGB ich willen see for zis.

Dr. Herr Megaw sed he was meine freund aber he was nicht so freundlisher. Alles is lost für me; I remember solo ze parasitäre Swingugen; die stehende Welle, und zen Der Kurzschluss. Die Röhren was kaput wen die Britischen Raumwelle gekommen.

Kompensation ist nich genug: ich wohne REVENGE.

Niche Irhre Freunde
NIE EILRACH

Für deutch sehen zie PW Feb und APRIL 1983

Out-dated IRCs

Sir: Many amateurs who work the h.f. bands receive IRCs with a request for a QSL-card, and a surfeit can be quite an embarrassment . . . Arguments have been heard on 3·5MHz (80m) as to whether they have a certain "life-span", but the Post Office Guide clearly states that they are exchangeable irrespective of date of issue.

However, when I presented the attached IRC to the charming young lady in my local GPO, I was told she could not do anything with it, as it was issued "before metrication". Although only just received, the date on it was 2 Feb 1956. Anyone beat that?

Douglas Byrne G3KPO
Ryde, IOW

Practical Wireless, July 1983

www.americanradiohistory.com

Save a Vintage Radio for Posterity

by G.Thompson

Advertisement from
PRACTICAL WIRELESS October 1932

£17.17s

I put together my first crystal set in 1927, when I was ten years old. Later inheriting a tea chest of parts, I spent many ill-informed but happy hours building a succession of transformer coupled multi-valve t.r.f.s. On pocket money of 3d a week my budget for research and development was limited, and my multimeter was a magnetic compass with a few turns of wire round it, and with a variable resistor in series.

I remember, when I was fourteen, a second-hand two valve short-waver on sale for twelve shillings and sixpence. I badly wanted it, but lacked the necessary cash. It so happened that I was just off on a self-catering camping holiday, and I lived exclusively on porridge for a fortnight to save the money. On my return I found that the coveted wireless had already been sold, a possibility which seems not to have occurred to me. I was sick—no doubt partly from disappointment, but probably also from a surfeit of porridge!

Second Childhood?

After the war, in 1945, I became a service engineer. Few domestic radios had been manufactured after 1939, and components were not readily available. The sets brought in for repair were from the late twenties and thirties, and had been doctored in various ways. It was not unusual to find a wad of cotton wool behind the loudspeaker cone, to stop it rattling, and external banks of paper condensers replacing unavailable electrolytics. But supplies did improve with time, and life became a little easier.

What all this is leading up to is that, being now heartily sick of oriental micro-miniature gimmicks, and no doubt also entering my second childhood, I have resumed an interest in vintage radio. On looking around, however, I find that while old bottles and cigarette cards are greatly valued, vintage radios are not. It seems to me that if enough properly restored equipment were made available a public demand could be created. When that happens the economics will become comparable with other sought after memorabilia—well worth while, as well as an absorbing hobby.

How does one come by a vintage wireless? Mostly by asking elderly people living in elderly houses. Large hauls can sometimes be acquired from the kind of old-fashioned village general store which also dabbled in radio, and took sets in part exchange. Other possibilities are a small ad. in your local newspaper or a card in your tobacconist's window, but don't advertise for "vintage wirelesses" or you will be asked to pay antique prices: more sensible would be "old radios wanted for spare parts". Auctions and secondhand dealers can also yield treasure.

Do not despise anything: the dirtiest and rustiest radio can be adequately refurbished if the cabinet is not badly broken, and if the dial and knobs are intact. Of course, some equipment will be damaged beyond repair, but it is still invaluable as a source of spare parts.

Taking Care

A word of warning—old mains sets can be lethal. It is possible to get a shock of the order of a thousand volts from the secondary of a mains transformer, and a.c./d.c. radios can have their chassis live to mains. Other hazards are valve top-caps at h.t. potential, or metal valves with exposed anodes, again at h.t. Many d.c. only radios were made, and these tend to go bang if connected to a.c. mains! The old advice to keep one hand in your trouser pocket is still sound. If you are not certain of your ability to cope with these hazards why not team up with a vintage engineer, or stick to battery sets to begin with. In any event, do nothing irreversible to a valuable radio, someone else may want to do the job properly at a later date.

Information such as the bias voltages and anode loads are to be found in old valve data books, and second-hand bookshops should be investigated. Recommended are the *Wireless World Radio Valve Data* and for general theory

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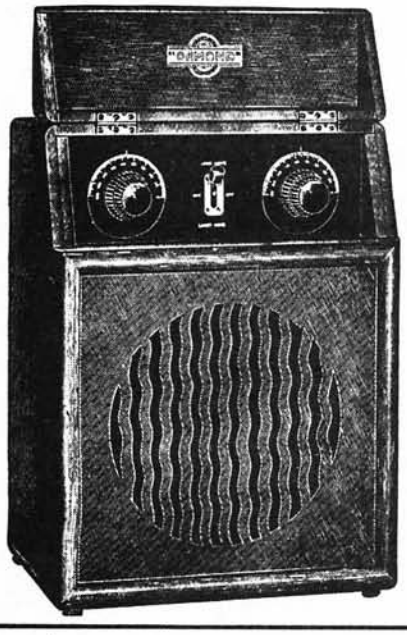
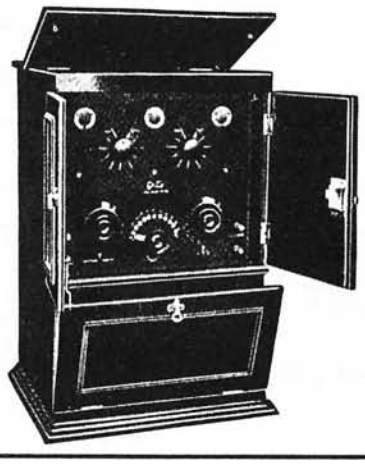
books such as *The Admiralty Handbook of Wireless Telegraphy*, *Foundations of Wireless* by Sowerby and *The Radio Amateurs Handbook* by ARRL.

The performance of most vintage radios is surprisingly good. The earlier t.r.f.s are still suitable for daytime reception of local stations; the later superhets are excellent and most give far better sound than the ubiquitous "trannie". The more advanced models had ten or more valves, variable selectivity i.f.s and automatic frequency control; motorised push-button tuning was not unknown, and cathode ray tuning indicators were common. Many had splendid short-wave performance, with input for a dipole antenna, double-geared tuning and audio roll-off. The question which occurs is—what constitutes, in the absence of original spares, a reasonable restoration? There will be a percentage of radios which are in more or less mint condition, and probably these should be reserved for technical museums. For the remainder, it seems to me, anything which might have been a normal repair during the original life of the receiver is alright today. There may even be a case, economically, where a cabinet is in good condition but the chassis is unrepairable, for putting modern works in an old case. Things like RC coupling of the audio stages because an intervalve transformer is unobtainable seems satisfactory, but the transformer should be left in place in case rewinding becomes desirable later. ●





New Books

PRACTICAL HANDBOOK OF VALVE RADIO REPAIR
by Chas. E. Miller
Published by Newnes Technical Books
230 pages, 185 × 245mm. Price £13.50

A useful book which should fill in any gaps of information, both technical and historical, for those interested in all aspects of vintage radio, where possible original circuit diagrams are reproduced to help illustrate the topic.

The Appendices cover the Intermediate Frequencies of the various receivers, listed alphabetically by the manufacturer's name; Valve Characteristics and Base connections, including many types no longer made—but alternatives can be chosen using the data provided; plus a reproduction of the Radio Handbook—presented free with Popular Wireless, 19 October 1927, price 6d! With the aid of this book almost any old radio could be restored to life.

THE ART OF PROGRAMMING THE ZX SPECTRUM
by M. James
Published by Bernard Babani (publishing) Ltd.
144 pages, 111 × 178mm. Price £2.50

The book is divided into ten chapters and aims to teach the reader the art of effective programming with the ZX Spectrum. Chapter 1 starts with an introduction, Getting to know your Spectrum. The other chapters deal with such topics as, fun at random, high and low resolution graphics, sound, moving graphics, peek and poke, a sense of time, strings and words and graphics.

The result of the book is some very effective and exciting programs from BASIC.

QUESTIONS AND ANSWERS—CB RADIO
by F. C. Judd G2BCX
Published by Newnes Technical Books
102 pages, 111 × 165mm. Price £2.50

This book gives simple and concise answers to many of the questions that puzzle both the beginner and student alike.

It deals with an introduction to CB as well as technical matters, relevant to both 27MHz and 934MHz f.m. CB. Questions on the type of antennas permitted within the bounds of the licence are answered, and propagation is also explained. There is a comprehensive section on operating procedures, and a very useful glossary of technical terms any student is likely to come across whilst looking at the subject of radio—CB in particular.

HOW TO GET YOUR ELECTRONIC PROJECT WORKING
by R. A. Penfold
Published by Bernard Babani (publishing) Ltd.
96 pages, 111 × 177mm. Price £1.95

This book is divided into four sections to aid the reader when trouble shooting. Chapter 1 deals with Mechanical Faults including the construction and use of a continuity tester. Chapter 2 deals with Linear Circuits and also covers the construction and use of a signal injector/tracer to help with fault finding. Chapter 3 is about Component Testing and how to test the more common components use in circuits. Chapter 4 deals with Logic Circuits including t.t.l. and c.m.o.s. In this chapter a pulse generator is described to help with fault-finding.

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Swap Spot

Have a Yaesu FT-227R f.m. 144MHz transceiver, value £120. Would exchange for Sinclair ZX81 or similar with 16K RAM, p.s.u., leads, manuals, programs etc. Tel: Deeside 816435. *R860*

Have Spectrum M8 legal f.m. CB 40 channel. Would exchange for Ex-Army 19 set s.w. RX/TX or one with TX in need of repair or anything similar. S. D. Shaw, 49 Bank Street, Paisley, Nr. Glasgow. Tel: 041 889 0029. *R879*

Have Contax 137MD quartz camera, Zeiss 1·7 plus tele and wide-angle. Cost £400. Would exchange for h.f. transmitter or quality receiver. Mrs. Demkiv, 26 St. Andrews Drive, Axminster, Devon. *R882*

Have new Grundig Satellit 1400. Would exchange for FRG-7, FRG-7000, R1000 or any communications receiver. K. Miller, 15 The Rise, Green Lane, Whitby, Yorks, YO22 4ES. *R883*

Have Maxcom 7E CB mobile/portable f.m. rig, NiCads, 16K ZX81 plus games tapes, CB p.s.u. and Lubitel t.l.r. camera. Would exchange for v.h.f.—u.h.f. scanner receiver, SX200N, Realistic, Bearcat or similar. Write or call (p.m.) R. McAvoy, 71 Grasslot, Maryport, Cumbria. *R884*

Have 7 x 50mm Dixons Binoculars, as new, central focusing, coated lenses, eye cups plus carrying case with shoulder strap. Would exchange for solid state, working s.w. receiver with b.f.o. or regeneration. P. Drinkwater, 5 Mayfield Road, Boldmere, Sutton Coldfield, Birmingham. Tel: 021 354 2168 evenings or weekends. *R898*

Have Sony ICF 6800W receiver boxed and virtually unused. Would exchange for pair of 934MHz CB (with antennas), possibly consider 27MHz Oscar or Lucas. L. Woodley, 5 Brunel Road, High Wycombe, Bucks. Tel: 0494 30065. *R899*

Have a Micronta metal detector. Would exchange for small amateur/communications receiver. 60 Baldock Road, Letchworth, Herts. Tel: 04626 71027. *R900*

Have powerful refracting telescope 60 x 910mm, tripod and accurate cast iron mounting, many lenses and accessories (to 500X magnification) as new. Would exchange for modern 144MHz (2m) multimode base or w.h.y. (will haggle). M. Brooke, 1 Kenmore Way, Cleckheaton, W. Yorkshire, BD19 3EL. Tel: 0924-454339 daytime (Dewsbury). *R938*

Have Marconi Guardian RX 1193A, 3 bands 180kHz—4·65MHz DF working, front end with zero sharpen and sense controls, 240V a.c., with spare valves and manual in v.g.c. Ideal set for multiband DXer. Would exchange for Trio R599D or w.h.y. Hoyland. Tel: Grimsby 49148 (not after 1900 hrs.). *R943*

Have unused 4CX250B in box plus 500-0-500 transformer, also 19in rack case suitable for amplifier. Would exchange for Creed 7ERP or later teleprinter. Rick Keens G8NDN. Tel: 06793 4142 after 6.30pm or weekends (New Romney). *R944*

Have set of welding bottles, hoses, gauges, complete set Victor welding and cutting gear, nozzles etc. in case, Saphire NM250 cutter. Would exchange for 144MHz multimode transceiver or w.h.y. Tel: 0469 75261 (Immingham). *R945*

Have large amount of magazines, *PW* (79/82), *HE, PE, TV, Radio Constructor* (old style) single copies or in years. CB radio magazine, plus hard back books on same (CB). Would exchange for anything useful in DXing, TV or s.w.l.ing. For more details write stating requirements plus s.a.e. to Mike Evans, c/o 185 Fleet Street, London, EC4A 2HS. *R954*

Have Philips N1700 video cassette recorder, v.g.c. and working, but needs service. Would exchange for FRG-7 or similar. E. Adlington. Tel: 0703 437981 (Southampton). *R955*

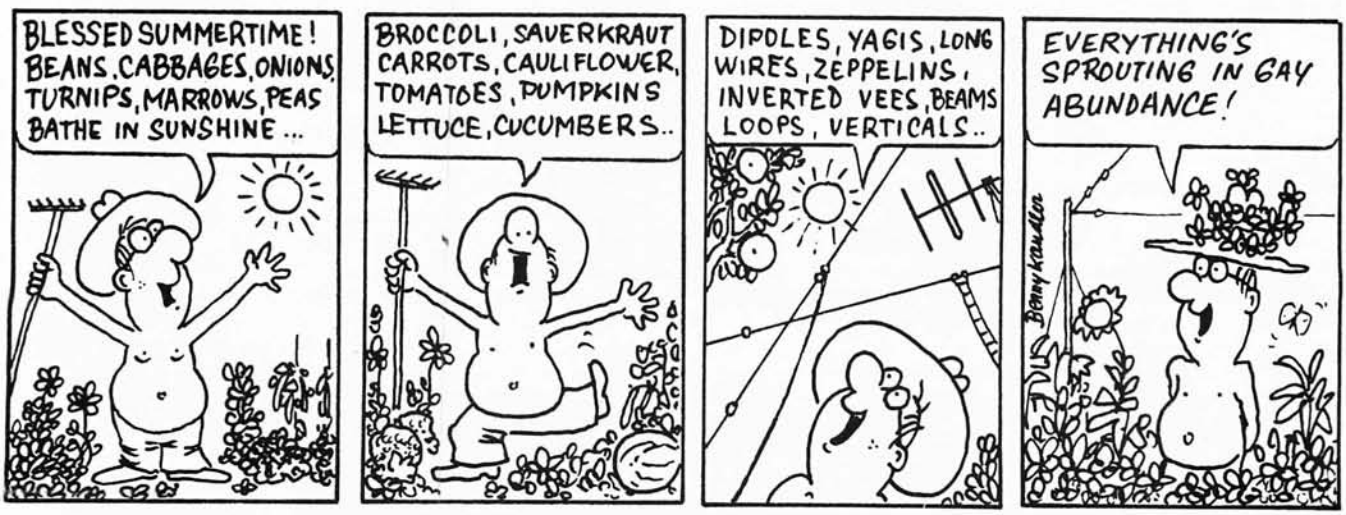
Have Hallicrafters and CR100 receivers, both with *handbooks*. Would exchange for Datong Active Antenna or Avo multimeter, but anything considered. J. P. Wright, 44 Wilmott Way, Basingstoke, Hants, RG23 8AR. Tel: Basingstoke 68649. *R956*

Have Tandy PRO-2001 Scanner. Would exchange with cash adjustment for R-1000 h.f. receiver. GM4DHJ. Tel: 041-889-9010 (Paisley). *R968*

Have Feinwerkbau 300SJ, 177 Match air rifle, cost £205, as new. Would exchange for scanning receiver, Bearcat, Tandy, Sony etc. J. Hellis, Tel: Taunton 83596. *R989*

Have Binatone Long Ranger 12, 4W 12 channel (6-17) f.m. handheld CB transceiver and case, rechargeable batteries and recharging power pack. Would exchange for FRG-7 general coverage receiver in good condition. B. Forde, 45 Staveley Close, Camden Road, London N7 9RS. *R990*

Benny



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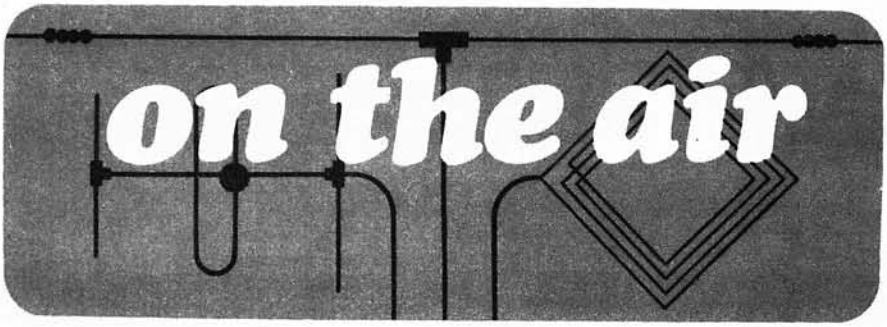

Amateur Bands

by Eric Dowdeswell G4AR

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

With a steady and welcome influx of newcomers into our hobby of amateur radio there is a steady demand for information on how to get started, amply met by the literature on the subject, but when it comes to the critical matter of choosing a suitable receiver matters get a bit confused. Not being exactly cheap, it is very easy to waste good money on a set that may be quite unsuitable for the purpose.

First and foremost, keep away from those portables that claim to cover every band from v.h.f. to the long wave band, always with a hint that one can then be very naughty and eavesdrop on to other bands that are not meant for the public ear. Generally they do not have a beat frequency oscillator which is essential for the reception of single-sideband (s.s.b.) telephony that is virtually universal on the h.f. amateur bands. In no way can this class of set be considered as a communications receiver and is best forgotten for our purposes.

There are two steps that the potential buyer of a good receiver may take initially: first to go along to the local radio club and meet the lads and lasses who will be only too glad to advise on such matters, and secondly, to make up one's mind to spend a little more than originally intended even if it means getting it on some kind of credit scheme. Better this than to find that the receiver is lacking in this or that facility when it is too late.

The choice of communications receiver is, in fact, rather limited and even though the price range is quite wide, say from £200 to well over £1000, the design of the basic receiver is very similar from one set to another. It is the peripherals, such as memories, and often almost unnecessary bits and pieces that put the price up.

Almost all sets have a digital display of frequency using l.e.d.s and, although it does not add to the performance of the receiver, it is worth investigating various displays with respect to l.e.d. size and colour since one is going to spend an awful lot of time in the future looking at them! In particular, make sure that they are large enough. As far as the user is concerned the digital display now provides a vastly more accurate readout of frequency than was ever possible with manual analogue tuning.

Possibly the most important component in a receiver is the filter in the first i.f. stage which, broadly speaking, decides just how well the set is going to sort out one signal from another. Different bandwidths are required for different modes, the widest for a.m. reception and the narrowest for c.w. On the cheap and nasty sets there may be only one ceramic filter, very much a compromise. Conversely, on a good receiver there may be a choice on the front panel of two or more i.f. filters. In some cases it is possible to fit optional filters inside at a later date.

Since it is very likely that the station's h.f. receiver will be used at some time with a v.h.f. or u.h.f. converter it is highly desirable that the set be able to receive f.m. signals or to have an optional f.m. module available. Already there is the American repeater network around 29·6MHz using f.m. that is easily received in the UK and no doubt the cult will spread.

Before spending good money on a set do make every effort to try out a number of receivers either through club members or at a supplier's shop and don't hesitate to ask questions if you are not sure what a particular knob or switch does. As with everything else it comes down to "you get what you pay for". Don't forget that after a period of listening you may very well move on to a transmitting licence and you'll want to sell the receiver in order to buy a transceiver or suchlike. The more expensive receiver is likely to attract a better secondhand price than a cheaper one.

Following on from that, don't be tempted to tamper with or modify the set in any way or the re-sale price will drop dramatically. Don't forget that receivers today are general coverage, usually from 150kHz to 30MHz whereas, with some generally rather expensive exceptions, transceivers are amateur bands only. In the past receivers with amateur bands only were not uncommon, while the single or multi-band transmitter has virtually disappeared.

The "extra" features on a receiver, which may or may not be considered desirable, include a number of memories into which the frequencies of stations may be fed and recalled by pushbutton. The mode, s.s.b., c.w. etc. is also entered automatically. Whole bands may be scanned electronically or any programmed bandwidth as desired. The stations entered in the memory can also be scanned and the required station held. Noise limiters are usually fitted but their value must be seen with some scepticism as, personally speaking, I have never yet come across one that was really effective. If the interference is really that bad then the signal is not worth listening to, anyway.

A clock-timer will show the time on the display on pressing a button and the receiver can be programmed to come on or go off as set on the timer. Again, an accessory that in no way enhances the performance of the set. In general go for a receiver that has all the basic essential features and a minimum of gimmicks which only cost money that is better spent on receiver performance, particularly in respect of extra filters on the i.f. side.

Here and There

There, in particular this month, is Edinburgh where the good news is that **Anne Edmondson,** ex-BRS47285 thank goodness, is now duly licensed as GM4TCW, a nice one since she is especially keen on c.w. operating. So now it is just the small matter of actually getting on the air. Being in the RNARS she suggests semaphore as a first possibility! Good luck on the air Anne, with best wishes from all of us, and congratulations.

They come, they go! Regular correspondent **Dave Ackrill** in West Heath, Birmingham, has forsaken the h.f. bands for 144MHz having become G6VMQ. After finishing college this year Dave will get cracking on the code and get his G4. So, it's congrats OM and nice knowing you. Best wishes and lots of DX.

Now a word of warning. A reader noticed a lot of CBers on the 28MHz band on his receiver and thought the set was at fault and started "fiddling with the cores and trimmers" to get the calibration right again. Needless to say he couldn't since it was OK in the first place and so he is in deep trouble now. Unless one is experienced in receiver alignment and has the necessary test equipment NEVER interfere with any internal adjustments on a receiver, or any other piece of electronic equipment, come to that.

Look at the manual and see what adjustments are permitted by the user and don't do anything else. The CBers could very well have been on the band illegally or it might have been second channel interference or just sheer breakthrough from a nearby CBer, perhaps using high power. They might be using illegal s.s.b., as well as f.m., although f.m. might be a bit difficult to demodulate on an h.f. bands receiver.

John Griffiths BRS54142 of Holyhead, Gwynedd, has joined our hobby with an FRG-7700 and complementary a.t.u. using a half wave dipole for 7MHz and an active antenna FRA-7700. I've suggested that he replace the coaxial feeder on the *dipole* with open feeder into the a.t.u. giving maximum performance on all the bands instead of just one. Then he can throw the active antenna away! John believes in doing his apprenticeship on the bands as a listener

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while getting ready for the RAE and a ticket, in what he calls the "furthest outpost of GW land".

Believe it or not **Bob Salmon** G4LJX was unable to recruit a licensed amateur able to join him, and others, in sailing a yacht from Tortola back to the UK. By the time this appears in print Bob should be on his way back as /MM but while waiting to start off he will use /VP2V. He expects to check in to the UK Maritime Net on 14303kHz some time between 0800 and 1800GMT. He will be happy to QSL contacts or s.w.l. reports direct or via the bureau. What has happened to that old pioneering spirit? I had expected that Bob would have the unhappy task of turning people away!

Reporting the DX

Two lucky lads have departed these shores for Kenya with **Tony Oakley (G4HYD)** becoming 5Z4DJ (QSL to Norman Bedford G4NJP, 39 Hamilton Road, Bridlington, N. Humberside) and **Tony Sherer G3TEU** taking 5Z4DP (QSL to Ian Sherer G8RQH, 18 Malham Avenue, Anlaby High Road, Hull, N. Humberside). DP has taken up permanent residence and his gear will have been installed by now, while DJ is a regular visitor, taking up residence in July with his gear due to arrive in September. Both will be active on RTTY and s.s.b. from 3·5 to 28MHz. The new WARC bands and Top Band are not available in 5Z4-land.

Both operators will be travelling extensively in East Africa and the islands of the Indian Ocean so every opportunity will be taken to activate some of the rare prefixes in these areas. Intriguing, isn't it? What do they do?

On 21MHz **Jim Willett** of Grimsby concentrated on VP2EC, 5B4HF, OA4ML/8, VP2MRA on Montserrat, plus AQ7AZ said to be in Pakistan, all on his FRG-7700 and matching a.t.u. plus a long wire. Jim now tries to tape all his loggings just to make sure he has everything right.

Also using the same set-up but with a 20m long wire and two-element quad on 28MHz **Dave Coggins** up in Knutsford, Cheshire, was pleased to bag a new one for himself in the way of FB8ZP on Amsterdam Island on 28MHz s.s.b., which appeared to be pretty dead otherwise at the time. He also managed

The neat set-up of the Abergavenny & Nevill Hall ARC special event station GB2ABC. Its next outing is on Saturday July 30. Difficult to recognise from this angle but Bob GW6JVB is standing at the left while the three ops are Lloyd GW6JIB, Gerwyn GW4JDE and Roland GW4LEU

VP8ZP (Box 38, Port Stalnley) and TR8JD. On 7MHz came VK2WC on long path at 0750GMT, HI8GB and ZS6BOK. Unusual ones on 3·5MHz were 3A2EE and HZ1AB (QSL via the YASME Foundation). Top Band produced EA3VY, LX1PD and W8LRL all on s.s.b.

Down in deepest Cornwall, in Callington to be precise, **Viv Doidge** also runs an FRG-7700, plus matching a.t.u. need I say, and a 40m long wire. What happened to all those other receivers that were knocking around? Well, Viv has not been hanging about, with 3·5MHz coming up with FM7WS, PJ9EE, SV8CS on Zante Island where PO Box 40 will find him, VP2MQQ, ZP5CDV, 6W8AR and 8P6J. To 7MHz and A92F, DF3NZ/ST2, KP4DEX/V2A, and TG9XLG (QSL KA4SAE). Up to 14MHz starting with C53EY, VS5RB, YI1BGD, YN9WL, 3B9DA on Rodriguez Island, 5T5AP and 9X5MH. Ending with 21MHz we find DF4SU/ST2 who said QSL PO Box 1623, Khartoum, then VP2EC, W0BM/VP2V, 5H3JR, 6Y5LS and 9L1YL. Might have been easier if Viv had told us what he didn't hear!

Ah! a Drake 2C for a change, operated by **David Palmer** of Stowmarket, Suffolk aided by a 30m-long end-fed wire. Despite severe problems with interference which he is in the process of clearing up Dave caught G4GFM/JA, JW5VAA (QSL LA4YW), S79ARB, VP8ANT, VQ9SB, all on 21MHz. Coming to 14MHz it was KX6PP, TR8JD, VP8SB, VR6TC on Pitcairn, 5T5AP and 9Q5JE. Local electrical interference can be a nuisance and it is very easy to just switch off when it occurs rather than trouble to find out the cause. Proceed logically and determine whether it's coming via the mains or the antenna and take it from there. The solution may be a very simple one. Don't forget that great QRM-maker, the hot water system thermostat. Remove it if possible and clean the contacts or, probably better, stick in a new one.

Now, how about a Ferguson TR6 plus an Eagle RAD30 as the external oscillator in order to copy s.s.b.? That's certainly doing it the hard way, by **Donald Stewart** of Hamilton, in GM-land, fed by a dipole or 30m long wire or a homebrew vertical. Sticking to 14MHz he logged ZP5MJO, PZ9AA (QSL Box 20, Paramaribo, Surinam), KL7RA, OY2R, 4S7EA, V2AO on Antigua, 5T5RY, VP5GT, VS5DD, 5B4MM (QSL VE7DLM), and C6ADC (QSL Box 9798 Nassau). Well done, OM and think what you'd do with a real receiver!

In Prestwich, Manchester, **Dave "Shaps" Shapiro** runs a DX200 and homebrew a.t.u. with dipoles for 21 and 14MHz plus a long wire. He confirms that the T42AMC is in Cuba and like other stations with AMC or WCY suffixes is a special event station, being World Communications Year. So to 28MHz and 9K2BE and XE1OE, then to 21 with 5H3DM, 6Y5AM, 7P8BX, and 9X5SL (QSL DL8DF). Up to 14MHz and C31NH, DU7RLC, M1J, VP2MCG, V2AN, 3B8FL, 5T5AP and 8P6CC. For 7MHz the fare is FM7CD (QSL F5VU), HP3FL, VP2MCK (QSL G2ACK) and ZP5CDV. Finally on 3·5MHz FM7WS, HZ1AB, G3ZGC/J8, J6LCV, ZP5CCG, 4X6DK and 5N8ARY. Dave confirms that the M1 and 9A1 prefixes change to T77 by the time this appears.

T. P. Jenner is with the RAF at Honington in Suffolk and writes in for the first time so welcome to the column OM. Present programme calls for a go in the December RAE so good luck there. The R200 receiver is about to be joined by a homebrew a.t.u. fed by a long wire. Logged on 3·5MHz was ZB2EO, ZD9BW, 4Z4AB, CR7EJ, ZP6EM and J6LCV. Not much on 7 except VP2MCK and 5B4MD. On 14MHz VK2BU, VS5GA, VS5DO, 4S7FG and VU2SI were bagged.

Club Time

As a professional journalist I can both appreciate a good, well-produced club magazine and, equally, be appalled by a bad one. But the latter need not be bad given just a little attention to spelling and grammar and a little thought. There is a tendency to write as one speaks and that is not always a good thing. Let a second person read the copy and make any corrections before committing it to print. We all make mistakes, after all.

However the biggest failing is to imagine that the club mag is only read by the club members and to omit details like the full name, address and telephone number of the club secretary, at least. This info plus details of when and where the club meets should be on the first page for all to see, and can be permanent copy until any changes are made. One secretary of a well-known club grumbled because his club never appeared in our listing. In fact there was not one mention of an address of any club official in an otherwise good mag. Plenty of "Fred", "Joe", and callsign suffixes but I just don't have the time to do a Sherlock Holmes turn in such cases.

I do hope that all you good people participating in the Field Days will enjoy fine, warm weather combined with excellent propagation conditions whatever bands you are working on. Till next month.

Acton, Brentford & Chiswick ARC G3IIU
New Members' Forum is the subject for the evening of Tuesday June 21 which, hopefully,

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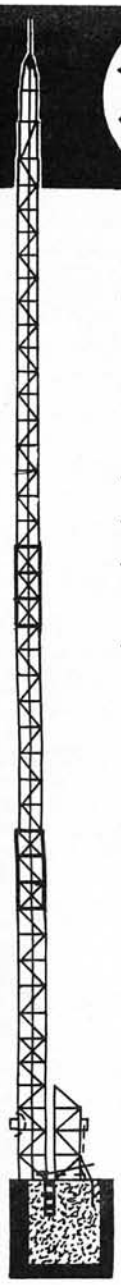

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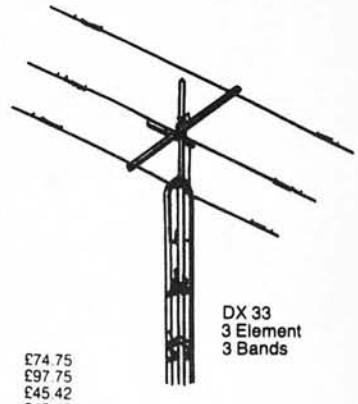
2. G3AAE "This letter is to tell you how pleased I am with the DX-33 antenna . . . On unpacking the DX-33 I was immediately impressed with the quality of the hardware, and in operation it is just as impressive. I have used it on all three bands and have been obtaining excellent reports from DX stations all over the world. I have conducted tests with other stations and these show that the electrical figures included in the DX-33 specification are fully met in practice. Congratulations on a very fine product!"



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DX-34	4-element, 2kW, 10-15-20m	£212.75	TD1/15/80	Trapped dipole, 15,20,40,80m	£45.42
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TS-930S	HF transceiver with gen. cov. receiver	1199.00
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TR-2400	2m FM hand portable transceiver	195.00
FT-290R	2m all mode transceiver, portable	249.00
FT-1012	Transceiver	529.00
FT-1012D	Transceiver, digital	599.00
FT-980	Transceiver//gen. coverage receiver	1059.00
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will bring in some visitors and potential members. It's at 7.30 at the Chiswick Town Hall, High Road, Chiswick, London W4 and all are assured of a warm welcome. If you want to know more of the club's activities drop a line to W. G. Dyer G3GEH, 188 Gunnersbury Avenue, Acton, London W3.

Bangor & District ARS Meets at the Sands at 7.45 on the first Friday usually with a main speaker, followed by a "mini-talk" by a member. Another good idea practised by the club is "shack visits" with members visiting each other's shacks in turn. At least that ensures that the place gets cleaned up now and again! More details from secretary Harry Squance GI4JTF, 24 My Lady's Mile, Holywood, Co Down, NI.

Barry CFE RS GW4BRS GW3VKL Make it at 7 every Thursday at the College Annexe on the B4226 road out of Barry. Don't get lost! Extensive shack repairs and reorganisation are under way with the antennas getting a bit of attention at the same time. New members and visitors equally welcome. Projects include TV and RTTY and there are code and RAE classes. PRO Dennis Egan still lives at 4 Hazel Grove, Longmeadow, Dinas Powis, S. Glam and is GW6HAW, telephone (0222) 512959.

Bolton & District ARS G8WY At the Horwich Leisure Centre at 8pm every Wednesday with activity nights that cover constructional projects, lectures, demonstrations, RAE classes and code instruction, not to mention on-the-air sessions on the club rig on h.f. and v.h.f. Contact Keith Pope G6CGZ, 403 Derby Street, Bolton, Lancs, or ring (0204) 62443.

Brighton & District ARS G4GQR G8OMR Club meets at the Marmion Road YMCA at 7.30 on alternate Wednesdays which turns out to be June 15 when members are invited to tell a story, and June 29 when there is an evening club rally. No meetings seem to be planned for August. Morse code classes are held at the same spot on Mondays and if you want to know more contact Wendy Firmager, Flat 2, 23 Chatham Place, Brighton. Note for July 13 and visit to Sussex Police Comms Centre in Lewes, so book this one early, and a chat on fox-hunting by G3WMU on the 27th.

Bristol ARC A press release from Mark Goodfellow G4KUQ, 99 Somerset Road, Knowle, Bristol (0272) 716093, says the club is alive with new projects with construction a very important part of the club's activities, especially attractive to new members. Members are busy with help for the RSGB's Bristol Group's efforts in organising the Longleat Rally. Computer interest is increasing rapidly with activity over the air. Club meetings at 7.30 every Tuesday with the fourth one devoted to the computer group. Contact Mark for latest info.

Bury RS Every Tuesday at 8, at the Mosses Community Centre, Cecil Street, Bury, with principal meetings tending to be on the second Tuesday, like June 14 when G8XUR tells all in the confessions of a TV repair man. August 9 is fox-hunt time. The centre will be closed on July 12 but on the 19th a surplus gear sale will be held. Newcomers are cordially welcome at any meeting says hon sec Brian Tyldsley G6OKE, 4 Colne Road, Burnley, or B'ley 24254.

Chesham & District ARS Every Wednesday, at 8pm, the Stable Loft, Bury Farm, Pednor Road, Chesham with prospective members and visitors very welcome, says sec John Alldridge G6LKS, 15 Whichcote Gardens, Chesham, Bucks, also Chesham 786935.

Chichester & District ARC Club net on S11 145·275MHz Wednesdays at 7pm, with personal get-togethers at the Green Room, Fernleigh Centre, 40 North Street, C'chester on the first Tuesdays and third Thursdays at 7.30. The event on June 16 is the club barbecue evening on Trundle Hill, Goodwood so don't miss it. An aside—it's Vintage Wireless Day at the Chalk Pits Museum, Amberley on Sunday June 5 run by my v.h.f. associate Ron Ham. Note too the GB2CHI special event station for the Chichester 908 festivities on Fri/Sat July 8/9. More, if any, from T. M. Allen G4ETU, 2 Hillside, West Stoke, C'chester, Sx or West Ashling 463.

Cornish Radio Amateur Club Meets at the SWEB Clubroom, Pool, Redruth, on the first Thursday at 7.30pm, with a computer section getting together on third Mondays. Big event is a coach trip to the Computer Fair at Olympia on Saturday June 18. Reminder of the mobile rally at the Cornwall Tech College on Sunday July 17, at Camborne I believe, starting at 10am. Jack-of-all-trades in the club PRO Simon Rodda is now G4PEM and can be found at the Cliff Hotel, Penzance, Cornwall.

CwmCynon ARS GW3FFE Recently formed club in the Cynon Valley meets on second and fourth Wednesdays at the Cefn Pennar Hotel, Mountain Ash at 7.30. Interests varied including competition operation, talks and lectures, RTTY, TV etc. Potential members or visitors very welcome indeed. So contact hon sec Roy Allwood GW6IRD, 7 Daniel Street, Cwmlach, Aberdare, Mid Glam, otherwise (0685) 879938.

Denby Dale & District ARS G4CDD G8KMK Excitement brewing up with the approach of the DD mobile rally at Shelley High School on Sunday June 19, with the inquest on the 22nd! Just before the rally, on the 11/12th, a special event station will be active from the same place for the Further Education Exhibition. Now is the time to get ready for the "week's activity from caravan or canvas" scheduled for July 23 to 31st. More info from J. Clegg G3FQH, 8 Hillside, Leak Hall Lane, Denby Dale, Huddersfield. Ah! nearly forgot! Louis Varney G5RV on antennas July 13.

Devizes & District ARC A fairly new club so far operating only on 144MHz. Special event station GB8KAT operated on May 30, with a special QSL for working or hearing it on receipt of an SAE and details. Club meets at the Castle Hotel, Devizes, first Thursday at 8pm. More from J. L. Harries-Harris G6PUY, 32 The Street, All Cannings, Devizes, Wilts, or Cannings 393.

Echelford ARS Another fine club mag, forwarded by new hon sec Alfred Othen G8FSZ of 5 Millan Close, New Haw, Weybridge, Surrey, says the club meets the second Monday and last Thursday at 7.30 at The Hall, St Martins Court, Kingston Crescent, Ashford, Middx. Nets operate at 10am on Sundays on 1930kHz and on 144·575MHz f.m. on Wednesdays at 8pm, all welcome to join in. Computerised slow Morse comes from G4NNS on 144·625MHz on Wednesdays at 7pm. An excellent article on building a 3·5/7MHz exciter by G3TDR is in its second part in the mag with full constructional info and p.c.b. data. Curing v.h.f. interference to car radios ought to go down well, too.

Farnborough & District RS Second and fourth Wednesdays at 7.30, the Railway Enthusiasts Club, Access Road, off Hawley Lane, F'boro. Attendance will be large for the visit of G5RV to talk on h.f. antennas, what else? on June 8. The 22nd is devoted to a preview of the VHF Field Day preparations. It's Chris French G8ZAJ, 26 Wood Street, Ash Vale, near Aldershot, Hants, also A'shot 29469.

Fingal Radio Club Each Monday at 8, at the Scout Hall, Ballygall Road East, Dublin 11, with plenty of activity on c.w. and theory classes for the Radio Experimenters' Exam, lectures and films, junk sales, with a QRP project being designed for the autumn season. All visitors very welcome of course. It's G. Birkhead EI9DZ, 103 Roselawn Road, Castleknock, Co Dublin.

Flight Refuelling ARS G4RFR G6SFR Sundays at the FR Sports & Social Club, Wimborne, Dorset, at 7.30. Attractive features to come include Tracking the Moon by Computer, by Judith G6JGR and Mervyn G4BGT on June 5, a newcomer's guide to h.f. bands operation by Jerry G2KV on the 12th, and Technical Ramblings from Nick G8MCQ on all matters r.f. including Constructor's Clinic on the 19th. Nothing doing on June 26 as all off to the Longleat Rally! After much toil, sweat and tears a 12m mast has been recovered from the depths of Wiltshire on behalf of the club. The ground post being in 2·5m of concrete did not help, apparently. Your contact is sec M. Owen G8VFY on Wimborne 882271.

Goole Radio & Electronics Society It's get-together time on Tuesdays at 7.30, the Junior Chamber Premises, 17 Boothferry Road, Goole. The "How to reach us" map in the newsletter is fine but the less said about the rest of the copy the better! I do hope that something better is being produced by now. The club sec is Richard Sugden G8IOH, 8 Kings Road, Swinefleet, Goole, N. Humberside.

Gosport (Rowner & District) ARS Meets on the first and third Mondays at 7.30 at the Hardway & District Community Association, Fieldmore Road, Gosport, Hants, with current activities including an RAE course run by G4NEJ. For more on club events and membership contact the PRO C. Jackson G4NAB on Stubbington which is (0329) 662144.

Greater Peterborough ARC G4EHW It is expected that the meeting on June 23 will be an evening devoted to c.w. matters. That makes it the fourth Thursday at 7.30, at the Southfields Junior School. The club will be active in the VHF NFD on July 3/4. Secretary is Frank Brisley G4NRJ, 27 Lady Lodge Drive, Orton Longueville, P'boro otherwise (0733) 231848.

Horsham ARC G4HRS First Thursdays at 8pm, at the Girl Guides HQ, Denne Road, Horsham, with all the usual club happenings like junk sales and constructional contests. Lots more info from Nancy Hubbard G4RTZ, 33 Amberley Road, Horsham, Sussex.

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Inverness ARC Now going for a few months this new venture meets on Mondays and Thursdays at the Cameron Boys' Club, Planefield Road, Inverness, with RAE classes on the Monday and more general chat and construction time on the Thursday. R. H. Brown GM8VIZ, The Flat, 21 High Street, Dingwall, Ross-shire, Scotland.

Ipswich RC G4IRC Second and last Wednesdays, at 8, at the Club Room of the Rose & Crown, 77 Norwich Road, Ipswich, which, as I never fail to point out, is separate from the public bars. On June 8 it's Treasure Hunt time, while the 22nd sees a postmortem on the East Suffolk Wireless Revival event. Sat/Sunday June 25/26 sees the club running a demonstration station at the Boys' Brigade Centenary celebrations at the Suffolk Showground. Much more on the club from Jack Toothill G4IFF, 76 Fircroft Road, Ipswich, Suffolk or buzz (0473) 44047.

Kidderminster & District ARS G4GXP G6KRC Fortnightly on a Tuesday but the meeting on June 11, when a special event station celebrates the Brinton Bicentenary, is a Saturday. So you have to take June 7 as the datum point, when G3PGQ deals with antenna systems. Morse code classes are held on Wednesday evenings. So it's the Aggborough Community Centre, Hoo Road, Kidderminster, Worcs at 8pm. Tony Hartland G8WOX is sec, at 22 Granville Crest, Offmore Farm, K'minster, Worcs, or K'm 751584.

Leighton Linslade RC It's Room A64, Vandyke Community College, Vandyke Road, Leighton Buzzard, Beds. Looks like the first and third Mondays with June 20 offering a demo of practical s.w.r. measuring techniques by G8BHW. The club seems to be very keen on outdoor operations like field days and DF hunts and the organising of special event stations. You can find out more from Peter Brazier G6JFN, Kingsway Farm, Miletree Road, Heath & Reach, Leighton Buzzard, or H & R 270.

Lincoln SW Club G5FZ G6COL City Engineers Club, Central Depot, Waterside South, Lincoln, at 8, on Wednesdays. On June 8 the Lincolnshire police will be talking on drugs while the following week it is RAE and code classes. The 22nd is on-the-air night with the club transmitters, and back to the classes on the 29th, and again on July 6. Call on Pam Rose G8VRJ ("awaiting G4") at the club or drop a line through the same QTH.

Midland ARS I am not going to attempt to list the activities of this extremely busy club except to say that something is going on every night with contest working popular at weekends. In particular there is a junk sale on Tuesday June 21, plus a note of G4KVC talking on recording methods on Tuesday July 19. The Computer section is now well established with next meeting on Tuesday June 14. The April MARS *Probe* carries a particularly useful feature by G4LLW on lightning protection at the amateur station. The club HQ is 294a Broad Street, Birmingham B1 while "post boy and president" Tom G8GAZ is on 021-357 1924 ready with any further info on the club.

Mid-Sussex ARS G3ZMS From *Mid-Sussex Matters* I learn that no less than Arthur Milne G2MI is to address the club on Thursday June 9 on the subject of amateur radio since the 20's. The place is Marle Place Adult Education Centre, Leylands Road, Burgess Hill, W. Sussex. The newsletter is a bit thin on committee info but I do know that Colin Campbell G6NPY can help you on Burgess Hill 5211 during office hours and he is the programme secretary.

Newark & District ARC Venue is the Palace Theatre, Appleton Gate, Newark on the first Thursday and in June G3PJR will run a quiz, to be followed by a discussion on VHF NFD. Note that the July meet is a DF foxhunt. Your contact is R. Hiscock G4MDV, 17 The Green, Elston, near Newark, Notts, or failing that M. Gaylor G6NMP on Newark 702076 in the evenings.

Northern Heights ARS G2SU Wednesdays at 8, the Bradshaw Tavern, Halifax. On June 15 it's rig alignment and test gear demonstration evening, with an unusual subject on the 29th, G3WGW on radio in light aircraft. Note that there is a junk sale on July 13. I hope that G. Milner G8NWK is still chairman, at 3 Briggs Villas, Queensbury, Bradford or ring him on B'ford 882945.

North Wakefield RC Thursdays, 7.45, Carr Gate Working Men's Club, although on June 23 it is a visit to the Holme Moss TV transmitter site. All the info from Steve Thompson G4RCH, 3 Harlington Court, Morley, or try (0532) 536633.

Reading ARC Meeting place is the Clubroom, The White Horse, Pappard Road, Emmer Green, Reading, Berks, on "alternate Tuesdays" and as I have no datum point you'll have to contact the sec Chris Young G4CCC, 18 Wicroft Road, Caversham, Reading to find out what is going on and when. You may be able to use the talk-in on S13 or RB11 from GB3BK.

Ripon & District ARS RAE and c.w. classes plus coffee and a chat precede activities every Thursday at the St John Ambulance Hall in Ripon, starting at 7. Then may come a demonstration of gear, or a lecture, film or talk. For more specific info contact Peter Fautley G6CUG, Parkside, Thornton-Le-Street, Thirsk, or Thirsk 24945.

Sheffield ARC First and second Mondays at the Firth Park Pavilion plus third Monday at the Sheaf House Hotel, Bramall Lane, mainly informal. Firth Park is a new venue with seemingly good prospects for building into a first class club with every facility. Your contact is Bob Kugler G8VQS, on (0246) 31696, or the chairman of the club George Hancox G8PVM on (0742) 682963.

South Devon RC Every Wednesday at the Devonport Arms Inn, Elmbank Road, Paignton, around 8. CBers and SWLs are counted among the membership although a large percentage steadily move on to becoming licensed radio amateurs. RAE classes are held on Mondays at Brixham Community College, as well as code courses on club nights. "Coming soon" means a club station, newsletter, net and more equipment. PRO Derek Scarr G4PTH, is on Torquay 211065 with more info if you are interested.

Southdown ARS G3WQK First Monday at the Chaseley Home for Disabled Ex-Servicemen, Southcliff, Eastbourne, Sx at 7.30 for 8. On June 6 G5CRD talks of licensing matters in the US. Make a special note of July 4 when it's all out to Butts Brow and an open air meeting involving bangers and beer. If it is really wet then get along to the Chaseley Home. Sec is T. Rawlance G4MVN, 18 Royal Sussex Crescent, E'bourne although Publicity member Peter Henley G8IQO on E'bourne 763123 will also help.

South East Kent ARC At the Dover YMCA, Godwynehurst, Leyburne Road, Dover, Kent, on Wednesdays at 7.45 for general club meetings, Mondays means RAE classes while Tuesdays are Morse tuition periods. Club nets on Sundays at 11am on both 3745kHz and 144·396MHz. Why not try Alan Moore G3VSU, 168 Lewisham Road, River, Dover, or ring (03047) 2738 at his home QTH or (0304) 207670 in office hours.

South Essex ARS Formed in October last the membership of the club now exceeds 100, meeting at the Paddocks Community Centre, Canvey Island at 7pm, every Wednesday, preceded by Morse code classes for half an hour. One current project is to sponsor a station for a local charity, believing that if the CBers can do it so can the amateurs. Pocket-sized club mag *EARS* is yet another top class job with the sense to take ads to offset production costs. Editor D. V. Pritchard G4GVO is to be congratulated. The March issue had article on Top Band DF receiver with all constructional details, personal computer comment, the VK2ABQ beam by the editor plus letters and members' ads. June events include junk sale on the 8th, club field day on the 18/19th and fox-hunt on the 22nd. All go, isn't it? Lastly VHF NFD preparations on the 29th. Previously mentioned G4GVO will take your enquiries at 55 Walker Drive, Leigh-on-Sea, Essex, in lieu of an address for sec Ian Clark.

Southgate ARC Forgathers at St Thomas' Church Hall, Prince George Avenue, London N14 at 7.30, with Stanley Wood talking on Marconi, the Man, on Thursday June 9. An event station will be mounted for the Southgate Carnival on June 11/12 with profits to the muscular dystrophy organisation and similar deserving causes. Note for the diary: BBC talk on the d.b.s. satellite project and cable TV systems, on Thursday July 14. Contact John G8EWG, 16 Kent Drive, Cockfosters, Barnet, Herts.

Stevenage & District ARS G3SAD G8SAD Club newsletter is all that a club mag should be; well printed with everything one could want to know about the club on the first page. It could well be copied by others! Meeting spot is T. S. Andromeda, Fairlands Valley Park, Shephall View, Stevenage, Herts. at 8 on the first and third Tuesdays, preceded by code classes at 7.15. Publicity sec Les Mather G8OKI is stepping down soon due to pressure of exams but you can still get details of the June meetings from him at 63 Woodhall Lane, Welwyn Garden City, Herts.

Stourbridge & District ARS G6OI G6SRS First and third Mondays at The Garibaldi, Cross Street, S'bridge, beginning at 8. No details to hand of June meetings so contact progs sec Bob Taylor G4DST, 122 Birmingham Road, Great Barr, B'ham otherwise 021-357 5171.

Swale ARC Every Monday at 7.30, at Nina's Restaurant, 43 High Street, Sittingbourne, Kent. Hon sec is Brian Hancock G4NPM, Leahurst, Augustine Road, Minster, Sheppey, Kent, and Minster 873147.

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74LS14	30	7409	14
74LS20	12	7410	14
74LS30	12	7413	18
74LS32	14	7414	20
74LS37	14	7420	15
74LS38	15	7430	14
74LS42	28	7440	14
74LS47	56	7442	32
74LS51	14	7443	60
74LS73	18	7444	60
74LS74	18	7447	36
74LS75	22	7448	40
74LS76	19	7450	14
74LS85	48	7451	14
74LS86	20	7453	14
74LS90	27	7454	14
74LS92	32	7460	14
74LS93	24	7470	24
74LS107	40	7472	26
74LS112	22	7473	26
74LS123	38	7474	23
74LS125	29	7475	32
74LS126	27	7476	30
74LS132	40	7480	35
74LS136	25	7482	65
74LS137	110	7483	38
74LS138	30	7485	60
74LS139	35	7486	20
74LS145	70	7489	159
74LS148	89	7490	28
74LS151	40	7491	35
74LS153	40	7492	25
74LS155	38	7493	25
74LS156	36	7494	36
74LS157	30	7495	35
74LS161	37	7496	40
74LS163	36	74100	80
74LS164	43	74104	40
74LS165	60	74107	22
74LS166	90	74121	24
74LS173	55	74123	40
74LS174	45	74125	34
74LS175	40	74126	33
74LS191	50	74141	51
74LS193	40	74151	40
74LS195	39	74154	60
74LS196	48	74155	39
74LS197	60	74156	40
74LS221	51	74157	30
74LS240	55	74190	48
74LS241	55	74192	48
74LS242	75	74193	48
74LS243	75	74393	95
74LS244	60		
74LS245	85	**CMOS**	
74LS251	55	4000	10
74LS253	43	4001	10
74LS257	35	4002	12
74LS259	84	4006	50
74LS266	28	4007	14
74LS273	60	4008	40
74LS279	40	4009	24
74LS299	250	4010	24
74LS367	34	4011	12
74LS368	24	4012	15
74LS373	84	4013	20
74LS374	68	4014	46
74LS378	60	4015	40
74LS393	60	4016	20
		4017	35
		4018	45
		4019	25
		4020	42
		4021	40
		4022	35
		4023	14
		4024	32
		4025	14
		4026	80
		4027	20
		4028	39
		4029	45
		4030	16
		4041	44
		4042	40
		4043	40
		4044	40
		4046	46
		4049	23
		4050	23
		4060	45
		4069	14
		4070	14
		4071	14
		4072	14
		4081	14
		4082	14
		4093	20
		4510	46
		4511	46
		4511	120
		4516	53
		4518	40
		4520	60
		4543	120
		4583	130

All above prices are NET in pence

ANALOGUE

709C5	49	TCA105	120
709C14	44	TCA105B	108
723C14	36	TCA105G	140
741C5	57	TCA250A	185
741C8	18	TCA205K	200
741C14	47	TCA335A	66
747C14	65	TCA345A	109
748C8	35	TCA345W	177
1458C5	62	TCA671	131
1458C14	40	TCA780	211
7106	450N	TCA871	114
7107	500N	TCA955	228
555	23	TCA965K	170
7555	86	TCA971	92
556	45	TCA991	80
CA3046	78	TCA991K	100
CA3080E	86	TDA2002	120
CA3130E	99	TDA2003	126
CA3140E	55	TDA2030	150
LM301AN	26	TDA4050B	144
LM308N	60	TDA4290	169
LM317K	321	TDA4600	184
LM324N	45	TDA4700A	546
LM348N	65	TDA4713A	435
LM380N	75	TFA1001W	252
LM380N8	104	TL071CP	45
LM381N	145	TL072CP	75
LM382N	115	TL074CN	120
LM3900N	50	TL081CP	46
LM3914N	200	UAA170	165
LM3915N	200	UAA170L	152
NE555V	23	UAA180	165
NE556A	45	UAA190	141
NE567N	104	XR2206	520
RC4151NB	80	ZN414	85
S041E	290	ZN424P	99
S041P	121	ZN425E	350
S042E	364		
S042P	138		
S89	11.23		
S178B	31.00		
S187	13.28		
S566B	214		
S576A	235		
S576B	235		
S576C	235		
S576D	225		
S1469	468		
SAB0600	302		
SAB3209	497		
SAB3210	311		
SAB3211	168		
SAB3271	329		
SAB4209	497		
SAB8256C	35.40		
SAD1024	15.50		
SAJ131	238		
SAJ141	224		
SAJ205	810		
SAS231W	260		
SAS251	142		
SAS580	196		
SAS590	196		
SDA5680A			
	15.55		
TAA761	104		
TAA761A	49		
TAA765A	62		
TAA861	103		
TAA865A	59		
TAA2761A	72		
TAA4761A	113		
TAA4765A	120		
TAB1041W	187		
TBA120AS	62		
TBA120U	72		
TBA400	100N		
TBA800	75		
TBA10S	75		
TBA820	75		
TBB1458	62		
TBB1458B	40		

AN EXCITING EV SPECIAL! 'SIPMOS' MOSFET POWER TRANSISTORS BY SIEMENS

Type	Case	V	A	W	PRICE
Buz 10	TO22	50	12	45	**£4.78**
Buz 10A	TO22	50	12	45	**£4.78**
Buz 15	TO3	50	45	125	**£18.70**
Buz 20	TO220	100	12	45	**£6.25**
Buz 23	TO3	100	10	62.5	**£8.82**
Buz 24	TO3	100	32	125	**£16.20**
Buz 30	TO220	200	6.5	0.75	**£5.68**
Buz 32	2*	200	8.8	62.5	**£8.11**
Buz 33	TO3	200	7.2	78	**£8.11**
Buz 35	TO3	200	9.9	78	**£10.52**
Buz 36	TO3	200	22	125	**£23.60**
Buz 41A	TO220	500	4.3	62.5	**£7.77**
Buz 43	TO3	500	2.8	78	**£8.11**
Buz 44A	TO3	500	4.8	78	**£11.57**
Buz 45	TO3	500	9.6	100	**£18.18**
Buz 46	TO3	500	4.2	78	**£9.32**
Buz 48	TO238	500	7.3	83.3	**£23.30**
Buz 50A	TO220	1000	2.3	75	**£10.42**
Buz 54A	TO3	1000	4.6	125	**£20.45**
Buz 60	TO220	400	5.5	62.5	**£8.71**
Buz 64	TO3	400	11.5	100	**£22.69**
Buz 80	TO220	800	2.6	75	**£9.78**
Buz 80A	TO220	800	3	75	**£16.23**
Buz 83	TO3	800	2.9	78	**£14.58**
Buz 83A	TO3	800	3.4	78	**£15.29**
Buz 84	TO3	800	5.3	125	**£26.45**
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Large range of types in stock; also probes, leads, accessories, etc.
PANEL MOUNTING in 50, 100, 500μA; 1, 5, 10, 50, 100, 500mA; 1A either model.

T Range 60 × 45mm **£5.95**

MU Range 50 × 45mm **£2.68**

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NH56A NEW – 20kΩ/V AC/DC/-RES/dB in 23 ranges: 130 × 88 × 37mm **£11.20N**

YN360TR 20kΩ/V: AC/DC/R/dB/Transistor Test: in 21 ranges: 145 × 96 × 45mm **£16.45N**

SWITCHES

Type CK – 1P/12 way, 2P/6 way, 3P/4 way, 4P/3 way **48p**; Min Toggles – S7101 SPDT **57p**; S7201 DPDT **80p**; S7301 3PDT **£1.64**; S7203 DPDT **96p**; PB min. 8531 mk 8533 br **62p**; 8225 DPDT **£1.34**.
DUAL IN LINE ERG colour coded 0.3" × 0.1" format. On/Off single throw 2P SDS2 **54p**; 4P SDS4 **95p**; 6P SDS6 **£1.38**; 8P SDS8 **£1.87**; 10P SDS0 **£2.10**. *Low cost* D-I-L 4P DNS04 **65p**; DNS08 **£1.00**.

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Polystyrene, Siemens 5% Tolerance 160V 5, 7, 10, 12, 15, 18, 22, 27, 33, 39pF **15p**; 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 820pF, 1n, 1n2, 1n5, 1n8, 2n2, 2n7, 3n3, 3n9, 4n7, **10p**; 5n6, 6n8, 8n2, 10n, **13p**.
Ceramic Very small 1.8, 2.2, 2.7 etc. up to 1n, **5p each**. 1n5, 2n2, 3n3, 4n7, 6n8, **5p**; 10n, 22n, **6p**; 33n, 47n, **7p**; 100n, **8p**.
Polyester, Siemens Layer Type 7.5mm lead spacing 100V.
1n, 1n5, 2n2, 3n3m, **6p**; 4n7, 6n8, 8n2, 10n, 12n, 15n, 18n, 22n, 33n, 47n, **7p**; 56n, 68n, **7p**; 82n, 100n, **9p**; 120n, 150n, **15p**; 180n, 220n, **12p**; 270n, 330n, 330n, 390n, 470n, **15p**; 560n, 680n, **24p**; 10mm spacing 1uF **25p**; 15mm spacing 2u2 **35p**; 22.5mm, spacing 1uF 400V **50p**; 3.33uF 100V **69p**; In depth stocks.

ELECTROLYTICS

1/63	10	47/63	17	470/100	73	2.2/35	16
2.2/25	13	47/100	18	1000/10	19	4.7/16	16
2.2/63	10	100/3	03	1000/16	26	4.7/35	18
4.7/63	11	100/10	13	1000/25	36	6.8/16	18
4.7/100	14	100/16	14	1000/40	44	6.8/25	24
6.8/40	10	100/25	15	1000/63	76	10/6.3	16
10/6	13	100/40	15	2200/6	09	10/16	18
10/25	10	100/63	20	2200/16	44	10/25	18
10/40	11	100/100	27	2200/25		22/6.3	18
10/63	14	220/10	16	2200/40	73	22/16	30
10/100	15	220/16	16	4700/16	72	22/25	30
22/10	10	220/25	18	4700/25	90	33/6.3	24
22/25	11	220/40	20			33/10	30
22/40	14	220/28	28	**TANTALUM**		47/6.3	30
22/63	15	220/100	42	**BEARS**		100/10	80
22/100	16	470/10	19	0.1/35	13		
47/3	03	470/16	19	0.22/35	13		
47/10	11	470/25	19	0.47/35	13		
47/25	12	470/40	27	1.0/35	13		
47/40	15	470/63	45	2.2/16	13		

RECHARGEABLE CELLS

AA **99p** C **227p** D (4AH) **376p** PP3 cell (7.2V) **495N**

CHARGERS

For any two pairs AA, C or D No NC1230 **820N**
MW398 for any two pairs of above **£6.75**

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SEMICONDUCTORS

1N914	03	AA118	14	BC213	09	BU124	85
1N914B	10	AA119	13	BC213L	09	BU208	180
1N916	05	AC126	25	BC214	09	BUX26	350N
1N4007	08	AC127	25	BC214L	09	BUX28	545
1N4148	03	AC128	25	BC238C	09	BUX81	744
1N5402	14	AC151R	55	BC239C	09	BUX85	249
1N5407	18	AC153K	20	BC258B	09	BY164	48
2N697	23	AC176	25	BC267B	16	C106D1	45
2N706	18	ACY17	155	BC300	26	C0326	460N4
2N930	20	ACY18	120	BC301	24	C0340	490N4
2N1132	23	ACY19	99	BC303	30	C407	17
2N1302	110	ACY20	90	BC327	16	C0546	126N1
2N1303	58	ACY21	85	BC328	11	C762	40
2N1304	62	ACY39	170	BC337	14	C1406	77
2N1305	62	AD141	10	BC338	11	D4 clip for C1406 and	
2N1306	90	AD136	530	BC413	09	E2506	10
2N1307	67	AD142	90	BC414	09	D1046	88
2N1308	147	AD149	88	BC477	29	E1110	76
2N1309	99	AD161	35	BC546	10	E1210	76
2N1599	100	AD162	35	BC547	09	E2506	154
2N1613	25	AF114	37	BC548	09	EB383	20
2N1711	25	AF115	37	BC549	09	MJ2955	90
2N1893	32	AF116	57	BC550	10	MJE340	55
2N2218A	31	AF117	110	BC556	10	MJE2955	95
2N2219A	25	AF124	AF125 37	BC557	09	MJE3055	70
2N2222A	25	AF126	37	BC558	09	MPF102	40
2N2369A	21	AF127	37	BC559	09	MPS6531	40
2N2484	25	AF200	10	BC560	10	MPS6534	42
2N2646	45	AF239	114	BC879	38	MPSA12	36
2N2904	26	AF279	30	BC880	43	MPSA63	38
2N2904A	25	AFY12	204N	BCY31A	157	NAS206S5	81
2N2905A	25	AFY16	327N	BCY58	18	OA47	12
2N3053	23	AFY180	310N	BCY59	18	OA90	10
2N3054	55	AFY18E615N		BCY70	18	OA91	10
2N3055	48	AFY42	461N	BCY71	18	OA95	DIS
2N3405	64	AU106	240	BCY72	18	OA202	14
2N3663	15	AU111 (use 3702-11	09	BD130	45N	OC28	75
2N3771	180	AU111G)		BD131	48	OC29	75
2N3794	21	AUY22	10.95	BD132	48	OC35	75
2N3819	22	BO140	25N	BD135	27	OC36	90
2N3820	40	BO146	30N	BD136	27	OC44	25
3823	60N	BO226	45N	BD139	30	PM7A2	373
2N3904	15	B1906	38	BD140	32	PN70	10
2N3906	15	BA379	25	BD679	62	PN72	05
2N4036	46	BAS40-03	36	BD680	64	Q4006LT	104
2N4058-62	09	BAS70-03	41	BF115	35	Q4010LT	115
2N4124	25	BAT14-036	11.75	BF167	25	Q4025H	450
2N4126	25	BB409	33	BF173	25	T2700D	189
2N4284	30	BC107A,B	16	BF177	25	T2800D	104
2N4286	18	BC108A,B,C	16	BF178	25	TAG3-400	100
2N4289	23	BC109B,C	18	BF244B	40	TAG209-400	85
2N4291	24	BC121W	30N	BF254	14	TAG209-600	130
2N4292	21	BC122Y	100	BF255	14	TIC106D	48
2N4991	62	BC125	20	BF420	31	TIC106M	55
2N5062	32	BC140	30	BF421	34	TIC126D	64
2N5192	110	BC141	30	BF457	35	TIC126M	54
2N5195	106	BC147A	10	BF458	35	TIC206D	61
2N5457	32	BC149	10	BF459	35	TIC226D	96
2N5458	32	BC154	25	BF597	12N	TIC236D	105
2N5459	36	BC160	30	BF834A	84	TIC246D	36
2N6050	380	BC161	30	BFR39-41	23	TIP31A	36
2N6057	375	BC167A	09	BFR79-81	23	TIP32A	45
6F40	152	BC167B	09	BFT65	119	TIP41A	60
16F40	165	BC168A	09	BFT66	192	TIP42A	45
40HF40	225	BC168B	09	BFX29	24	TIP42C	60
40361DIS		BC169B	09	BFX84	24	TIP150	75
40362	65	BC169C	09	BFX85	24	TIP2955	55
40406	71	BC177B	16	BFX87	28	TIP3055	55
40408	95	BC178B	16	BFX88	26	TIS43	50
40412	108	BC179B	18	BFY50	24	U763	50
40430	100	BC182	09	BFY51	24	VN10KM	55
40594	123	BC182L	09	BFY52	24	VN46AF	93
40595	123	BC183	09	BFY90	143	VN66AF	105
40636	147	BC183L	09	BR34	70	VN88AF	123
40673	145	BC184	09	BR64	110	W02	25
A9903	16	BC184L	09	BRY39	45		
AA113	13	BC202Y	120	BSX20	22		
AA116	13	BC212	09	BSX26	22		
AA117	13	BC212L	09	BSX63	769N		
				BT106	147		
				BT108	136		
				BU105	170		

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L	W	D	ABS	Plain	Stove Gr
50	50	25	—	5001P **90p**	5001 **123p**
100	60	25	2002 **96p**	5002P **117p**	5002 **154p**
113	63	31	2003 **109p**	5003P **143p**	5003 **184p**
121	66	40	2004 **115p**	5004P **162p**	5004 **210p**
152	82	50	2005 **134p**	5005P **216p**	5005 **268p**
192	113	61	2006 **235p**	5006P **314p**	5006 **401p**

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134	90	44	21089	**£7.28N**
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to give a completely professional finish to a much valued project.
ABS, light grey top; dark grey bottom + 2 anodised panels.

L	D	H	TYPE	PRICE
205	140	40	21034	**£4.52**
205	140	75	21035	**£5.02**
205	140	110	21036	**£6.54**
180	120	39	21037	**£4.11**
180	120	65	21038	**£4.40**
180	120	90	21039	**£4.69**
155	85	39	21040	**£3.31**
155	85	60	21041	**£3.31**
155	85	80	21042	**£4.30**
125	65	30	21047	**£2.36**
125	65	39	21048	**£2.99**
125	65	50	21049	**£3.37**

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ANTEX C-240V **£4.60N**; X-25-240V **£5.30N**; CSBP **£5.45N**; XSBP **£5.56N**; ST4 Stand **£1.70N**.
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Because no similar unit is made, it's usefulness is not appreciated until you have used one.

We could not improve its performance, so we improved its appearance.
Clean up the bands by tuning up without transmitting.
Connects in aerial lead, produces S9 + (1 – 170MHz) noise in receiver. Adjust A.T.U. or aerial for minimum noise. You have now put an exact 50 Ohms into your transceiver. Fully protected, you can transmit through it, save your P.A. and stop QRM. SO239s. **£29.50 Ex stock.** P.c.b. + instructions to fit in any A.T.U. **£24 Ex stock.**

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Now feature either POWER AMP alone or PRE-AMP alone or both POWER AND PRE-AMP or STRAIGHT THROU when OFF. Plus a gain control on the PRE-AMP from 0 to 20dB. N.F. around 1dB with a neutralised strip line DUAL GATE MOSFEZT (BF981).

Ultra LINEAR for all modes and R.F. or P.T.T. switched. 13.8V nominal supply. SO239 sockets.

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Swansea Radio Amateur Constructors Club Newly-formed with construction matters firmly in mind with the foundation membership of 30 already being exceeded. A clubroom/workshop is being built in the attic of a building in Swansea's south dock area. Code classes are held over the air from GW4OXB on 144MHz, with RAE classes being conducted by GW4PYK. Much excitement with the delivery of a large quantity of "spare" components from a national electronics company not an awful long way away! More from Trevor Morgan GW4OXB, 1 Jersey Street, Hafod, Swansea.

Thames Valley ARTS Celebrating 25 years of *Technical Topics* in *RadCom* Pat Hawker G3VA could hardly be a more appropriate speaker for a club celebrating its Golden Jubilee this year. On Tuesday June 7 Pat reveals some of the secrets of clandestine radio, at 8pm at the Thames Ditton Library, Watts Road, Giggshill, Thames Ditton, Surrey. Further info from Julian Axe G4EHN, 65 Ridgway Place, Wimbledon, London SW19, also 01-946 5669. Don't go away! Same place, same time, on Tuesday July 5 the subject is h.f. antennas and equipment 1927 to 1983, by an equally famous crowd-puller Louis Varney G5RV/CX5RV.

Torbay ARS G3NJA G8NJA The site for this year's rally has been confirmed once again as the ITT Social Centre, Old Brixham Road, Paignton, and it will take place on Sunday August 28, with light meals, bar and refreshments. Don't forget the TARS nets on Mon/Wed 1030 on 3756 kHz and Sat at 10am. Meetings Fridays at 7.30 and on last Saturdays at Bath Lane, rear of 94 Belgrave Road, Torquay. More from sec Les Mays G2CWR, Atlantis, Clennon Avenue, Paignton.

Vale of White Horse ARS Newsletter says the club gathers at the club room of the White Hart Inn, Harwell Village, at 7.30, on June 7 for example when John Morris G4ANB talks on computing and the amateur. July 5 is AGM time. Club net on Thursdays at 7.30pm on 28·750MHz. More from sec Ian White G3SEK, 52 Abingdon Road, Drayton, Abingdon, Oxon, otherwise (0235) 31559.

West Kent ARS G3WKS Club nets:–Sundays 1100 28·700MHz s.s.b. and 1000 3·510MHz c.w. plus v.h.f. f.m. 2000 S23/145·575MHz on Mondays. Club meets at the Adult Education Centre, Monson Road, Tunbridge Wells, Kent and it seems to be the second and fourth Fridays for formal meetings with informal gatherings on the Tuesday following at the Drill Hall, Victoria Road, T-W. Details from Brian Castle G4DYF on Sevenoaks 456708.

Wigston ARC Every Friday at the United Reform Church in Long Street, Wigston, Leicester, at 7.30. Twelve members participated in a club project, a 30W linear for 144MHz, and all 12 worked! Forthcoming projects include a 144MHz antenna and a transistor tester. Club sec is Alan Faint G6GWH, QTHR if you have a suitable callbook, or (0858) 62827.

Wimbledon & District RS Hon Sec Geoff Mellett G4MVS welcomes visitors to the club meetings on the second and last Fridays at 8pm at 124 Kingston Road, London SW19. On June 10 a video of the work of Tesla, as shown on TV recently, followed by a discussion. June 24 is natter night combined with code practice class. Geoff can be found at 26 Paget Avenue, Sutton, Surrey, or on 01-644 8249.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

An interesting letter from reader **Goff Curtis** of Harrow describes his successful attempt to improve the performance of an old Bush receiver of 1945 vintage. Medium wave reception was poor so our reader decided to replace the internal frame antenna with a new external one. It was not too difficult to do this as the frame antenna was connected to the rest of the receiver by plugs and sockets and the replacement was simply plugged in at this point.

The new antenna consisted of 15 turns of ordinary single wire wrapped round a 150mm diameter former "a plastics tub of my XYLs", with the free ends dangling after being secured. With this set-up Goff picked up Senegal on 765kHz after Switzerland, which is on the same channel, had signed off for the night. "Been looking for Dakar on the short waves for around 15 years" he concludes, obviously satisfied with the result of his efforts.

Frame Antennas and Loops

The frame antenna of old receivers and the internal ferrite rod antenna in modern sets should not be confused with the DXers' medium wave loop. A loop is a self-contained antenna, usually about one metre square, which has its own tuning control. It is connected to the antenna sockets of the receiver via a lead, which comes either from a coupling winding on the loop or from a differential matching amplifier (d.m.a.). My article MW/LW Loop Antennas which gives constructional details for a standard medium wave loop can be found in the *PW* publication *Out of Thin Air,* which is currently available again.

Ferrite Rod Antennas

The internal ferrite rod antenna found in nearly every modern domestic set performs a dual function. It is an antenna and an antenna tuning coil as well. Its predecessor, the frame antenna, was just an overgrown tuning coil (inductor). If you remove or disconnect the ferrite rod antenna then your receiver will not work. You would have to replace it with an antenna tuning coil (r.f. transformer) with two windings. A coupling winding for an external antenna and earth, and a main winding to form a tuned circuit along with the receiver's tuning capacitor. It is far from easy to carry out this modification on a portable receiver. Lack of space, difficulty in finding a suitable component, are the main problems.

Coupling Loop to Portable

Why get rid of the ferrite rod antenna? It prevents the set being used with a m.w. loop. If a loop is connected to a set which has an internal antenna of its own, then both antennas are in use, each feeding signal to the receiver. In order to null out interference you would have to do it in two stages, firstly by rotating one antenna until its null points towards the QRM and then doing the same with the second antenna. In practice this would be very difficult, but it would be interesting to hear from anyone who uses this method.

The answer to the problem is to fix the receiver to the loop in such a way that the nulls of the loop and internal antenna are pointing in the same direction. Loop and receiver are now rotated together. The direction of the null of the receiver's antenna can be found by trial and error. Usually it will be along the direction of the width of the receiver case, which corresponds to the length of the ferrite rod. Minimum pick-up occurs along the length of the rod.

If the receiver is small and the case is not made of metal, then attach it to a small shelf fixed to the centre of the loop (Fig. 1). Tune in a station on the receiver, then adjust the loop tuning control to peak it up. Rotate loop plus receiver to null out QRM. How does it work? Since the loop is not connected to anything—there is no direct connection between loop and receiver—the signal collected will be re-radiated. Some of it will be picked up by the ferrite rod where it adds to the

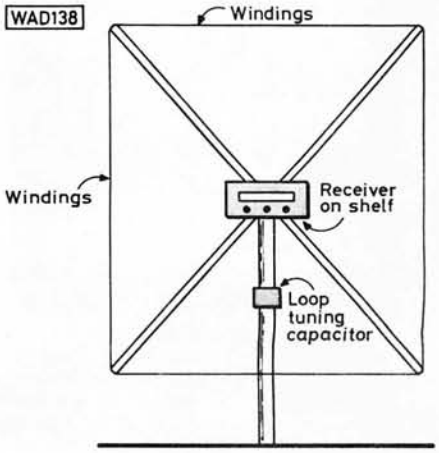

Fig. 1. Receiver attached to loop

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signal picked up direct, to give a boost to reception. When loop with receiver attached is rotated, it will be possible to null out QRM in the ordinary way, providing of course the nulls of the two antennas point in the same direction. This method of coupling a loop to a portable, although a little clumsy, really does work. It provides a way for DXers who do not possess a communications receiver to try the medium waves.

Ramadam

At first sight it should be easy to hear DX from the Arabic speaking world. Many of the countries concerned are grouped round the Mediterranean, being no further away than Newfoundland, but there are problems, mainly as a result of the different time zones. Those we are interested in are either the same or ahead of our own. By the time European QRM starts to subside at 2200 most of the DX will have already signed off for the night. In winter there is a compensating period starting at 0330 when Middle East broadcasting starts up for the day but in summer the path is in daylight at this hour, reception is not possible and we are thwarted again.

DXers then, if no-one else, will welcome the arrival of Ramadam, which starts this year on July 12. During this four week period, broadcasting in Moslem countries continues throughout the night, giving the DXer the chance to make a few interesting catches. Even a domestic portable will pull in a few of the nearer ones. Try for Sfax in Tunisia on 720kHz, Algiers on 891kHz, Tripoli in Libya on 1251 and perhaps even Jeddah on 1512 and Duba 1521, both in Saudi Arabia. On the long waves listen for Radio Mediterranean in Morocco on 173kHz, Azilal Morocco on 209kHz and Tipaza in Algeria on 251kHz. Don't forget to rotate the receiver to make use of its directional antenna. Interference from other stations and sometimes static as well can often be reduced this way. The DXer, with loop and communications receiver, will investigate every weak signal, his problem now being with identification and obtaining suitable material for a reception report.

Radio Finland

The external service of Radio Finland goes out on the medium and long waves daily during the evening. Listen on 963kHz, 558kHz and 254kHz long waves at 1930 and again on 963kHz only from 2100 to 2125 (2255 Saturdays). To quote the station schedule "You'll be surprised how easy it is to tune to Finland on a simple inexpensive radio" and certainly the transmission on 963kHz comes in well at my QTH. The address is Finnish Broadcasting Co, External Service, Box 10, 00241 Helsinki 24 Finland, who will supply a copy of the programme and frequency schedule free of charge. Do not send a reception report as Radio Finland does not QSL, but they are interested in hearing from their listeners. *Audience Response* on Tuesdays reviews comments and criticisms from listeners as well as answering questions about Northern Europe. One of a series of Listeners Cards is sent to anyone asking for a schedule and commenting on the programmes.

Listeners Card from Finland

Readers' Letters

"I overhaul and recondition AR88, CR100, 1155, Eddystones, BRT400, HRO etc, you name it and I can fix it" writes G3EKX who goes on to say "your comments are very harsh regarding the reliability of these old sets—I would rather repair an old set than a modern one." Non-technical owners of these sets who are in trouble, should write to **Norman Birkett** (G3EKX), The Moorings, Halverras Road, Playing Place, Truro, Cornwall, TR3 6HD. There is nothing wrong with any of those receivers while they are working and they really are worth overhauling if you know how to do it. Many thanks for writing Norman.

Reader **Jack Sargent** (G3CMN) of Hastings uses an FRG-7700M with Yaesu a.t.u. connected to a "T" antenna which has a 40m top at a height of 18m running NW–SE. He says he can normally receive 20 or so British local stations at good strength during daylight conditions e.g. Torbay on 954kHz at S9+30 at midday, distance about 210 miles. Shows what a good outdoor antenna can do. DX heard includes Radio Globo in Rio de Janeiro on 1220kHz at 0030 and Caribbean Beacon in Anguilla on 1610kHz.

Sticker from Swansea Sound

Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

"In your article Short Wave Broadcasts you mention a station called HCJB The Voice of the Andes. You go on to say that the station is a good verifier and to send IRCs with the reception report" writes reader **E. E. Bramwell** of Ellesmere Port who goes on to ask "what is an IRC" and "does the reception report need to be in a recognised format?"

Return Postage

While it is easy to enclose an s.a.e. or postage stamps when writing to a broadcaster in the UK, difficulties arise when you attempt to send return postage to stations abroad. The International Reply Coupon (IRC) is the usual answer to the problem. It is obtainable at the stamp counter in main post offices in the UK for 30p and is exchangeable for stamps sufficient for return postage by seamail, in any country belonging to the Universal Postal Union. The IRC, which measures 105mm by 74mm, has a space for the issuing office to date and for the receiving office to cancel. An IRC sent to me by a reader in Australia who obtained it from the Post Office at Chester Hill is shown in Fig. 1. The reverse side of the IRC is interesting as the instructions are printed in six languages which include Arabic, Chinese and Russian.

Since the IRC covers return postage by seamail only, you will have to send more than one if you want a reply by airmail. HCJB asks for two IRCs for an airmail reply, which is typical, while Radio New Zealand asks for four, presumably on account of the higher postal charges from Australasia.

There are a few stations, usually small ones and mainly in Latin America, that are unable to exchange IRCs. Whether this is because the country does not belong to the UPU or that their local post office is unfamiliar with the IRC, is not clear. Try your local stamp dealer (philatelist

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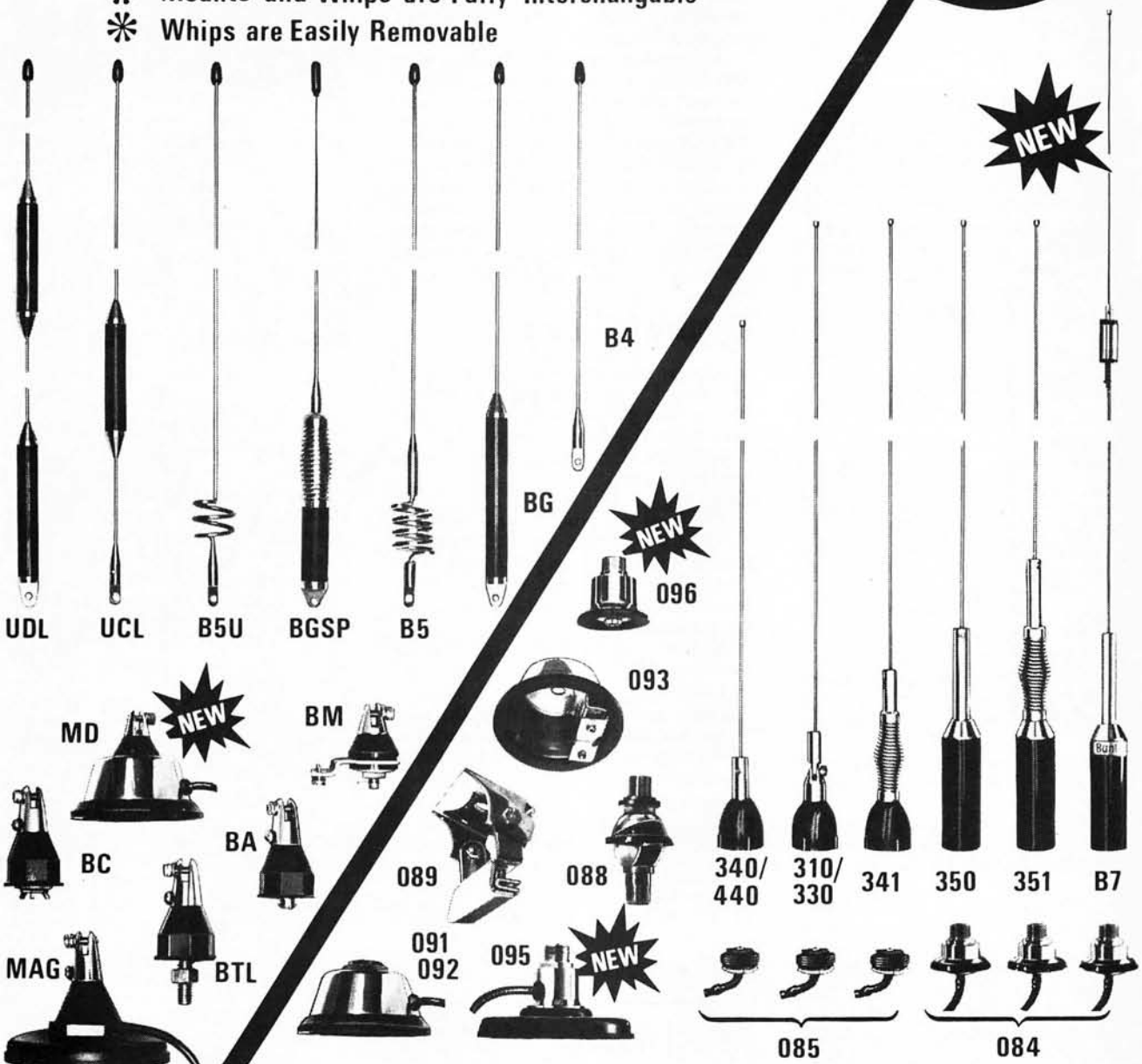

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Fig. 1: IRC (both sides)

shop). Instead of IRCs spend the equivalent amount in stamps of the current definitive issue of the country concerned. Explain why you want them and the dealer will help. Even if you don't know the exact value to purchase the effort will be appreciated by the station who will be put to the minimum inconvenience this way.

IRCs have become something of an international currency to DXers. Sample bulletins and other DX club publications are available for payment in IRCs and even club subscriptions can occasionally be settled by this method rather than by international money order which can be quite expensive in relation to small amounts.

Reception Reports

There is no standard format for a reception report. The listener can please himself how he presents the information he sends to a station but it should contain the following: Date, Time in GMT (not summer time), frequency in MHz (or kHz), name of programme, some details of programme content covering at least 15 minutes of listening. These are the requirements issued by HCJB and if any of them are not met then a QSL card will not be issued.

As well as supplying the above information it is usual to make comment on the quality of the signal and this is done by means of a reporting code such as SINPO. Each letter stands for a separate item. S = Signal Strength, I = Interference (from other stations), N = Atmospheric Noise, P = Propagation (fading), O = Overall Merit and they are measured by the numbers 1 to 5 as follows.

S	I, N, P	O
5 Excellent	5 None	5 Excellent
4 Good	4 Slight	4 Good
3 Fair	3 Moderate	3 Fair
2 Poor	2 Severe	2 Poor
1 Barely Audible	1 Extreme	1 Unusable

For example, a signal of 43433 would mean good signal strength, moderate interference, slight atmospheric noise, moderate fading, fair overall merit.

A simplified version of SINPO called SIO is gradually coming into use. This is the one I use and is the one recommended by some broadcasters such as the BBC or Radio Canada International (RCI). SIO is SINPO with the N (Noise) and P (Fading) left out. This relieves the reporter of the task of making what would probably be a subjective assessment rather than a measurement, of these two items.

Mystery QSL Card

Regular readers will remember the card from China, shown in the May issue. I have received two translations to date from **Soew-Tok Lim** and **Roger Tidy.**

Soew-Tok Lim translated the whole card which reads:

Dear friends;

This card is a proof of your report to us on the reception of our broadcast programme on frequency 4865kHz dated 13.12.82. We shall welcome your future report on the quality of the reception of our programme.

Kangsu people's republic radio broadcasting station

11.01.1983.

Roger goes on to say that the letter was in Standard Chinese—a language he is studying, we wish you all the best with your studies.

Radio Cairo

"Would you please tell me how I can receive Radio Cairo on 17·92MHz at 1215-1230 beamed to South and South East Asia but I can hardly hear it beamed to Europe on 9·805MHz at 2215" asks reader **J. R. Cox** who lives in Treherbert, S. Wales.

Beam is an unfortunate word, as it gives the impression of a searchlight. This is far removed from reality so far as short wave antennas are concerned. A directional antenna will favour some directions more than others, the amount depending on the type, but there will still be some radiation in all directions. This can be significant when a high power transmitter is involved and may be enough to provide good reception off-beam under favourable propagation. It is quite normal on the short waves to pick up a transmission not intended for reception in Europe.

It is a pity that Radio Cairo comes in so poorly in the UK as the English service is worth listening to. I listen now and again, conditions permitting, but it is seldom that it is a strong signal. Europe is a wide area to cover for a station located as near as Egypt and it may be that an

Radio Japan *Christopher Williams*

Voice of Greece *Christopher Williams*

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omni-directional antenna is in use. In any event the choice of frequency/time/antenna is obviously unsuitable for good reception in the UK.

RAI Italy *Christopher Williams*

Readers' Letters

Simon Hamer (New Radnor) has been active with his Grundig S-1400 which is connected to either a 9m or 22m long wire via an antenna tuning unit (a.t.u.). DX on 5MHz band (60m) in the evening included Nigeria on 4·77MHz at 2145, Radio RSA 4·835 at 2151, Radio Juventud Venezuela on 4·9MHz at 2212, Gabon 4·81 at 2220, Radio Lara in Venezuela on 4·8 at 2230 and ELWA in Liberia on 4·765. On the international bands Radio New Zealand was heard at breakfast time on 11·96MHz with a good signal.

An FRG-7700 with G4MH mini-beam picked up the Voice of Greece on 15·050 at 1235 for **David Martin** (London) who would like to know the postal address of the station. It is Greek Radio Television, Director of Technical Services, 16 Mourouzi St, Athens 138.

A useful log of tropical band DX comes from Roger Tidy (London) who uses an R600 receiver. As he lives in a flat he has to use a 6 metre indoor antenna but he still managed to hear China on 4·22, 4·5 and 4·735 after 2300, Radio Mundial Bolivar in Venezuela on 4·77, La Voz del Cinaruco in Colombia signing off on 4·865 at 0355, Radio Bormorema in Brasil on 5·024 at 0230. On 19 metres Radio Free Granada was picked up on 15·045MHz at 0023 sign off when listeners were invited to write in with reception reports and programme comments.

VHF Bands

by Ron Ham BRS15744

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

For most of the period covered this time conditions on the h.f. and v.h.f. bands were generally poor; however, many of my readers still kept tuning and came up with some unexpected DX, which may well have gone by unrecorded had they not persevered.

Solar

Although from the radio point of view the sun was quiet from March 21 to April 17, **Cmdr Henry Hatfield** and I did record a few small bursts of noise at 136 and 143MHz respectively on March 21, 23 and 26 then again on April 3, 5 and 7. There were also slight noise storms on March 22 and April 17. While using his optical equipment **Ted Waring,** Bristol, counted 30 sunspots on the 19th, which would account for the March radio noise, 15 on April 1 and 18 on the 10th.

Aurora

During an auroral event on March 12, **Dave Coggins,** Knutsford, heard tone-A signals from the 28MHz (10m) beacons in Germany DF0AAB and Norway LA5TEN. On the same day **Norman Hyde** G2AIH, Epsom Downs, heard weak auroral signals on 144MHz (2m). Norman also reported a complete fade out on the 12th and 13th and again on April 3. I am always interested in readers' comments about aurora and ionospheric disturbances because it helps to build up a meaningful record for posterity.

The 50MHz Band

At the end of March, GJ3YHU, Jersey, heard 50MHz signals from **David Newman** G4GLT, Leicester and a Guernsey station, GU2HML completed a crossband QSO with David working between 50·100 and 3·718MHz. On April 4 and 6 David made direct 50MHz contacts with GM4DIJ and GM3WCS respectively, the latter peaking 559 with David and both GMs had meteor bursts superimposed on their tropospheric signals. "My most difficult contact so far has been with Peter Turner GW4IIL/A at Tregaron who has an awkward v.h.f. QTH with a large mountain to the east of him" writes David. However with Peter beaming north and David beaming directly to the west, they did manage a QSO after two days of effort. After a week of trying, David made another difficult contact with G4CG in Barnstaple by again working crossband 50 to 3·5MHz.

Paul Johnson ZS1BR, Chairman of the Cape Town branch of the South African Radio League, asks us all to listen out for their beacon, ZS1SIX on 50·945MHz and send reports to ZS1CT, Cape Town branch SARL, P.O. Box 5100, Cape Town 8000, Republic of South Africa. The beacon, which is crystal controlled and has an output of 16W to a vertically polarised ground plane antenna, was built by ZS1BR and ZS1SG and the annual licence fee is sponsored by the Electricity Supply Commission Amateur Radio Club.

The 28MHz Band

"Conditions on h.f. are currently poor and DX very scarce" writes **Bill Kelly,** Belfast; and Dave Coggins said "I found conditions to be largely down due to the low sunspot number". Although **Fred Pallant** G3RNM, Storrington found the band dead on March 19, he did receive signals from EA7 at 1120 and PY2, ZS1,

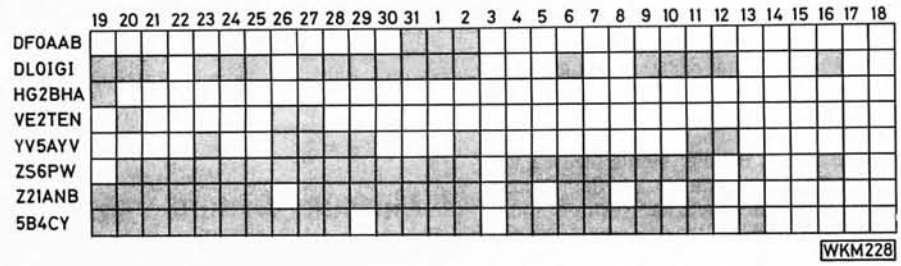

Fig. 1: Distribution of 28MHz beacon signals. A92C, DK0TE, LA5TEN, TY2AMI, VP9BA, VS6TEN and ZS1CTB were not heard this month.

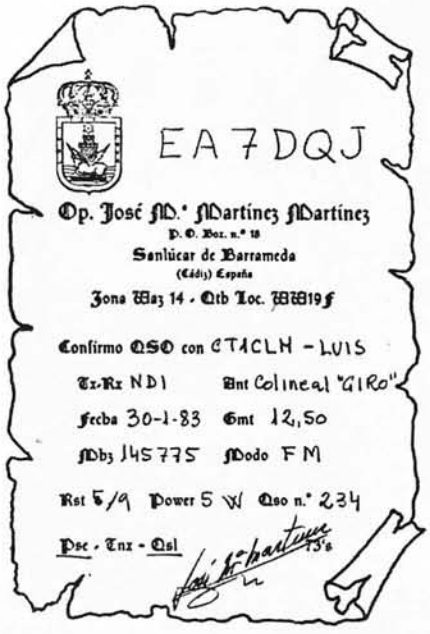

Fig. 2: 144MHz QSL card received by Luis Carbalho

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ZS2 and ZS6 at 1540 on the 20th. Whilst my log confirms the general findings, I did hear CX4 at 1847 on the 23rd and 4X6 and 5B4 at 0938 on the 27th. Despite the poor conditions, Dave kept looking around and heard VP8ZV at 59 on March 28, and then during an opening to South America on April 1 he logged signals from CE, CX, LU, PY and VP8. On April 4, he heard 3B8FK and JY, ZS and 4X and his best catch was FB8ZP on Amsterdam Island.

Over in Winchester, **John Coulter** keeps an ear on the frequency of OSCAR 8 and has logged signals from Dr. A. Gee G2UK, Lowestoft and Pat Gowen G3IOR in Norwich who are both well known in the amateur satellite world.

28MHz Beacons

Both Ted Waring and David Newman heard signals from the Canadian beacon VE3TEN on March 27 and David heard it again at 1700 and 1926 on the 30th. We have heard that a new group of amateurs have taken over this beacon and it is likely that it will QSY from 28·175MHz to a new frequency within the beacon segment of the 28MHz band, 28·2 to 28·3MHz. My log for the period March 19 to April 17 has many entries saying "No beacons heard"; however, at 1847 on March 23, the only beacon about was YV5AYV, fluctuating in strength between 529 and 559 and at 1410 on April 16 another loner was the German beacon DL0IGI. "A very thin beacon log this month" writes Norman Hyde and "The 28MHz band has been very quiet lately, with beacons very few for the time of year" writes Ted Waring, who, along with Dave Coggins, John Coulter, Henry Hatfield, Norman Hyde and I made up the monthly list of beacons heard (Fig. 1).

Band II

Judging from his letters, it is obvious that **Simon Hamer,** New Radnor, enjoys the programme content as well as the DX during an opening and he was again rewarded at 2150 on March 10 when he heard *Goldfinger* by Shirley Bassey and *News in Brief* with Paul Welsh from ILR Centre Radio in Leicester on 97·1MHz.

While using his Academy Radio Recorder at Anstruther Holiday Camp, **Colin Watson** BRS 46598, Cumbernauld, heard BBC Radio Newcastle on 96·2MHz. On Easter Monday, **Peter Lincoln** BRS 42979, Aldershot, heard the new ILR station County Sound commence transmissions on 96·6MHz from their Guildford studios. Simon Hamer logged its test tone at 2030 on March 19 and **Michael Welch,** London, heard Frank Muir introduce the station's regular programme service at 0745 on April 2. "Very good signals in the London area but close proximity to BBC Radio Medway on 96·7MHz" said Michael.

During the Easter weekend, Simon Hamer received signals from the French TDF station at Lille with "flutter fading" and although conditions were poor, Michael logged Belgium's BRT Dutch 2 programme on 102·8MHz at 1955 on April 1 and RTBF French Net 3 on 94·1MHz at 0617 on the 2nd. Michael has now received QSL cards confirming his reception reports from BRT Genk, BFBS Bieleveld, BBC Radio Devon and WDR Teutoburger.

Tropospheric

The atmospheric pressure, measured at my QTH, remained below 30·0in (1015mb) fluctuating between 29·4 (995) and 29·9 (1012) from March 21 to 0200 on April 12, when it crossed the 30·0 line for the first time in 22 days. The pressure then rose sharply to 30·4 (1029) by midday on the 13th, remaining at this level until 1000 on the 15th when it gradually fell to 29·6 (1002) at midday on the 17th.

During the good conditions at the end of January, **Luis Carvalho** CT1CLH, Carcavelds, about 16km from Lisbon, logged the pressure at 30·18 (1021) and on 144MHz f.m. he worked EA7DDT, EA7DQJ (Fig. 2) in Cadiz and EA8ALG and EB8AC (Fig. 3) in Canarias. "I have been working on some special days Spain, Canarias and Marrocos, in the range of the 145MHz repeaters" writes Luis, who tells me that other 144MHz stations in Portugal had worked into Gibraltar and the islands of the Azores and Madeira. At 2330 on March 16,

Fig. 3: 144MHz QSL card from Canaria

Luis, using a Kenwood 9130 on 144MHz f.m. and a vertical Ringo antenna worked CT3AP (Fig. 4) located on the island of Madeira. Congratulations to all concerned Luis, good to hear from you

Bill Kelly, Belfast, seems pleased with the v.h.f. performance of the Discone DX2 antenna which he uses in conjunction with his Bearcat and SX200 receivers and writes, "Big improvement in signal output, all local repeaters were heard and some DX in Dublin at 160km". Although signals from the parts of the UK were disappointing Bill did log a couple of GMs and G8OPS near Lincoln. Conditions on the v.h.f. band improved with the rising pressure and during the afternoon of April 14, **Fraser Lees** G6JIO, Lewes, heard signals through the Leicester repeater GB3CF on R0 and had QSOs on 144MHz s.s.b. with G4LOH in Melton Mowbray and G6ETI in Stoke.

RTTY

"The 14MHz band is beginning to open up in the late evening now and South American RTTY stations are coming through", writes Peter Lincoln on April 9, who has just received the Quarter Century Award from the British Amateur Radio Teleprinter Group (BARTG) for confirmation of 25 different countries received in the RTTY mode. Well done Peter, I bet you will now try for the 50, 75 and 100 countries endorsements. In addition to the usual crop of European RTTY stations Peter logged in March were, CN8AT, FM7CP, FY7BC, HK4CCK, OX3CO, YB2BLI, 4X4KP and 5Z4DA on 14MHz, CE3CBG, DU7RLC, KA6OHJ and 9K2KA on 21MHz and EA8QS and ZS6UY on 28MHz. During March he added four new countries to his score, US6FX and 5R8AI on 21MHz, A22BW on 28MHz and UP2MJL, operating an electronic mail-box on both 14 and 21MHz. Between March 11 and April 11, **Norman Jennings,** Rye, copied RTTY signals from stations in CT, DK, EA, F, G, GM, GW, I, HA, HB, LA, LX, LZ, OE, OH, OK, SM, SV, UB5, UK3, UT5, YO and YU on 14MHz, VP2, ZS6 and 9K2KA on 21MHz and, like Peter, A22BW on 28MHz. Among Norman's outstanding DX was CE3CEW, FY7BC, HK4CCX, OD5GN and 9M2DW. During the period March 19 to April 18, I copied RTTY signals from 16 countries on 14MHz, mostly the same as Norman, extra countries were IT9, K, SL, VK, W and 5T, also a local QSO between two EAs at 0827 on April 1.

More on Band II

Graham Cox, Dudley, wrote to say that the IBA are going to use f.m. from 102·1MHz–104MHz for their ILR service. There will also be a new v.h.f. service for Stoke-on-Trent around 104MHz which will start broadcasting on 5 September.

Museum Visitors

Despite some cold winds, rain, snow, sunshine and cloud, more than 200 people visited the Chalk Pits Museum at Am-

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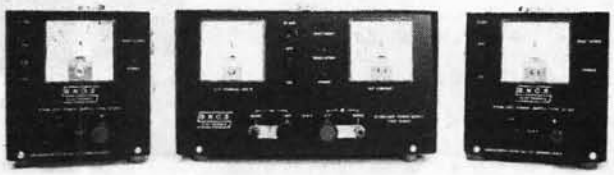

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BU13	SO259 single hole, outside nut	**0.47**
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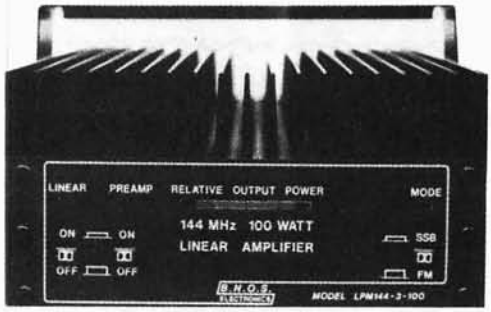

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berley in Sussex over the Easter holiday including many of our readers who made straight for the radio building, one overseas visitor was Jan ten-Have PA0ATH.

International Callbooks

"I also have a 1983 DX Callbook and a 1982 for the USA," writes Norman Jennings who would be pleased to supply readers with information on receipt of an s.a.e. to 64 Udimore Road, Rye, East Sussex or phone 0797 222530.

Fig. 4: 144MHz QSL card from Madeira

Silent Key

It is with deep regret that I have to report the death of Leon Ward GW5NF who spent the latter days of his life, in hospital, working some of his many friends on 144MHz through the Wells repeater GB3WR. Leon was a prominent pioneer of the v.h.f. and u.h.f. bands and was once awarded a gold medal for a DX QSO during a sporadic-E disturbance. Leon will be sadly missed and we send our deepest sympathy to his family.

TV

by Ron Ham BRS15744

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

In my late teens toward the end of the 1940s, I worked for one of the largest and oldest established radio and television dealers in Worthing. At that time Worthing was a highly populated town, on the "wrong" side of the South Downs, and really outside the accepted service area of Alexandra Palace. In those days the BBC transmitted programmes for a couple of hours each evening and sometimes an hour in the afternoon. I remember telling customers "Friday night is newsreel night". At that time, outside of the USA, the BBC transmissions from Alexandra Palace and later Sutton Coldfield must have been among the first few stations in the world with a regular programme schedule.

I think it is fair to say that the technology in the early television receivers was ahead of its time, but with their relatively low sensitivity, coupled with weak signals and much local mains interference, viewing would have been almost impossible but for the dedicated and untiring efforts of the GPO's (now British Telecom) Radio Interference department. I saw first hand how the department's engineers spent untold hours, with much expertise, tracing and curing noise generated by the motors in electric fans, refrigerators etc, which had not bothered anyone before. As the years passed the BBC and later the IBA installed hundreds of new transmitters to meet the demands of millions of new viewers throughout the UK and although the technical advances in receiving antennas and sets has been fantastic, there has and I think always will be a need for an official Radio Interference department and in my view, it will be a mistake to close it down as hinted in an article in the *Daily Mirror* on April 13.

Amateur Television

Having acquired yet another Bush TV183D receiver for his DX work, **Roger Wallis,** Solihull, has re-adjusted one of the tuners for the 432MHz band and writes, "Thanks to G3DFL on March 18, who was busy transmitting to G6IRB and G6FPU, I was able to set up my spare tuner for ATV" (Fig. 1). Roger received signals from all three stations during the Easter weekend and with the aid of his Tandy PRO–2008 scanning receiver he monitored their talk-back. He also received pictures from G3DFL on March 22 and 31 and from G6FPU and G6IRB on the 31st.

The Chichester and District Amateur Radio Club ran a 9 week course to give local scouts a chance to earn a Communicators Badge for which they have to log 50 amateur QSOs. While G6NKM and G6DHU demonstrated 144MHz gear and activity, G8ZTD showed off the Trio 1000 receiver, G8TIF used the 3·5MHz band and Andy Hearn G3UEQ took his ATV gear to the classes to give the lads a chance to log a visual QSO with Eric Clark G6CSX. All good publicity for amateur radio.

No doubt the ATV buffs in Sussex will be out in strength at the Chalk Pits Museum's annual Wireless Day at Amberley on June 5 and at the Sussex Mobile Rally due to be held at Brighton Racecourse on Sunday July 17.

Band I

Between March 19 and April 18, the numbers of bursts of signals on Chs. E2 48·25MHz and R1 49·75MHz gradually increased and at times I positively identified test cards from Austria ORF-FS1 on Ch. E2 and Czechoslovakia RS-KH, Poland and the USSR on Ch. R1. During a short lived sporadic-E disturbance around 1815 on March 25, I saw what looked like OTO-CCCP on Ch. R1 scribed below a YL announcer and later the Russian news caption BPEMR at the right of a male announcer on Ch. R2 59·25MHz. By using a v.h.f. communications receiver in conjunction with the TV sets I was able to hear the sound of Ch. R1 on 56·25MHz and R2 on 65·75MHz. At 0800 on the 26th, **Fraser Lees** G6JIO, Lewes, received a test card from Holland NED-1 on Ch. E4 62·25MHz and at 0830 the same morning I saw a long burst of pictures of a record being played on a turntable on Ch. R1.

Tropospheric

When Bill Giles, a BBC TV weatherman, said, "this high pressure will also mean interference to TV reception tonight and I'm afraid it will last for a while until this high pressure moves away", **George Garden,** Bracknell soon started DXing

Fig. 1: ATV signal *Roger Wallis*

Fig. 2: French Television *Roger Wallis*

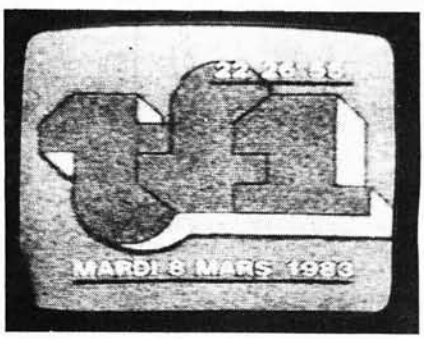

Fig. 3: French TV caption *Roger Wallis*

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Fig. 4: French TF2 *Roger Wallis*

Fig. 5: TF3 picture *Roger Wallis*

Fig. 6: UHF signal *Tim Anderson*

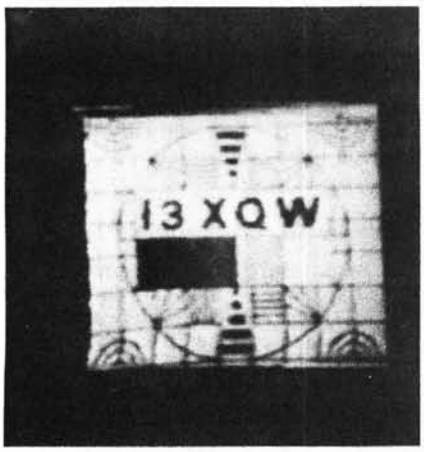

Fig. 7: Italian SSTV signal *Peter Lincoln*

Fig. 8: SSTV caption *Peter Lincoln*

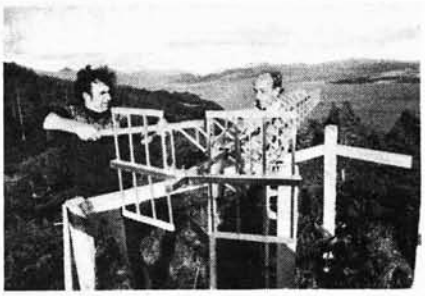

Fig. 9: Alistor Maclaren and a visitor working on the active deflector pointing toward Pennyghael across Loch Scridan

and writes, "This information, although a pest to many, is very useful to us". George proved this on March 8 when he took advantage of this warning and logged strong sound and pictures from TSW Caradon Hill on Ch. 35 and at 0045 on the 9th a strong picture of a male news reader with the words *News from Wales* on his right. George was using the slow motion rotary dial on his Teleton receiver to tune the u.h.f. band and thinks this signal was on Ch. 33.

During the opening on January 23, **Roger Wallis,** using a modified Bush TV183D receiver, watched excellent pictures from France TF2 (Fig. 2), on Ch. E21 and on March 8, TF1 (Fig. 3), TF2 (Fig. 4) and TF3 (Fig. 5) while conditions were good on March 8, on Chs. E22, 25 and 28 respectively. On March 8 and 9, **John Thompson,** Rainham, Kent, using a JVC CX610 receiver and a XG14 rotatable antenna, received pictures from Belgium BRT-2 on Ch. E25, Germany DDR-2 on E27 and WDR on E50. On April 9, he watched such programmes as *Dallas, The Persuaders* and *Nos-Journal* from the Dutch station NED-1, Ch. E29 along with *The Showbiz Quiz* featuring Orville and Keith Harris on NED-2 on Ch. E32. "Both stations excellent signals, even the Teletext was decodeable" said John, who has been busy building a Band III antenna ready to join the wide band 2-element array he built for Band I.

Down in Wales, **Simon Haver** received pictures from Anglia TV's Tacolheston transmitter on Ch. 59, 'Channel 4' from Belmont on Ch. 32 and 'Central TV' from Oxford on Ch. 60 and Waltham on Ch. 61 during the evening of March 12.

On March 8, **Tim Anderson,** Stroud, using a Thorn receiver, a Hugh Cocks tuner and an indoor dipole logged pictures from Radio Telefis Eireann RTE-2 from Mt Leinster on Ch. 1 and with his Sony receiver, 22-element antenna and Labgear pre-amplifier watched TSW from Stockland Hill on Ch. 23 (Fig. 6).

SSTV

"Apart from the usual German and Italian (Fig. 7) stations, the only slow scan DX I could find was 4X4VB (Fig. 8) on 14MHz at the beginning of the month and today I received ZS2OA putting out an unanswered CQ call", writes Peter Lincoln from his QTH in Aldershot on April 9.

Other Stations

My thanks to Tom Toth G4ORF, Adrian Butcher, Washington, David Appleyard, Sweden and E. Rother BRS36149, Manchester for the information that the mystery picture, Fig. 6, Apr *PW,* is from Austria ORF Oster-reichischer Rundfunk on Ch. E2. At present Mr Rother uses a Sinclair Micro-vision receiver for DXTV and is planning to install an outside antenna for it.

Alistor MacLaren and Eugene Andrews are members of a group of enthusiasts who were responsible for the Active Deflector, Fig. 9, installed at Scobull to direct 625-line television signals 6·5km across Loch Scridan so that the inhabitants of the village of Pennyghael in Strathclyde can receive BBC 1 and 2 and ITV pictures. The Wolsey Amethyst and Supa-Nova amplifiers used at the deflector are housed in a large wooden box, along with the 12 volt car batteries used to power the equipment and a 40 day clock which cuts off transmissions between 0200 and 1400 daily to give a battery life of about 14 days. Active Deflectors for television have also been installed by local communities to service Bunessan, Fionnphort and Iona. Many congratulations to all concerned, a fine effort.

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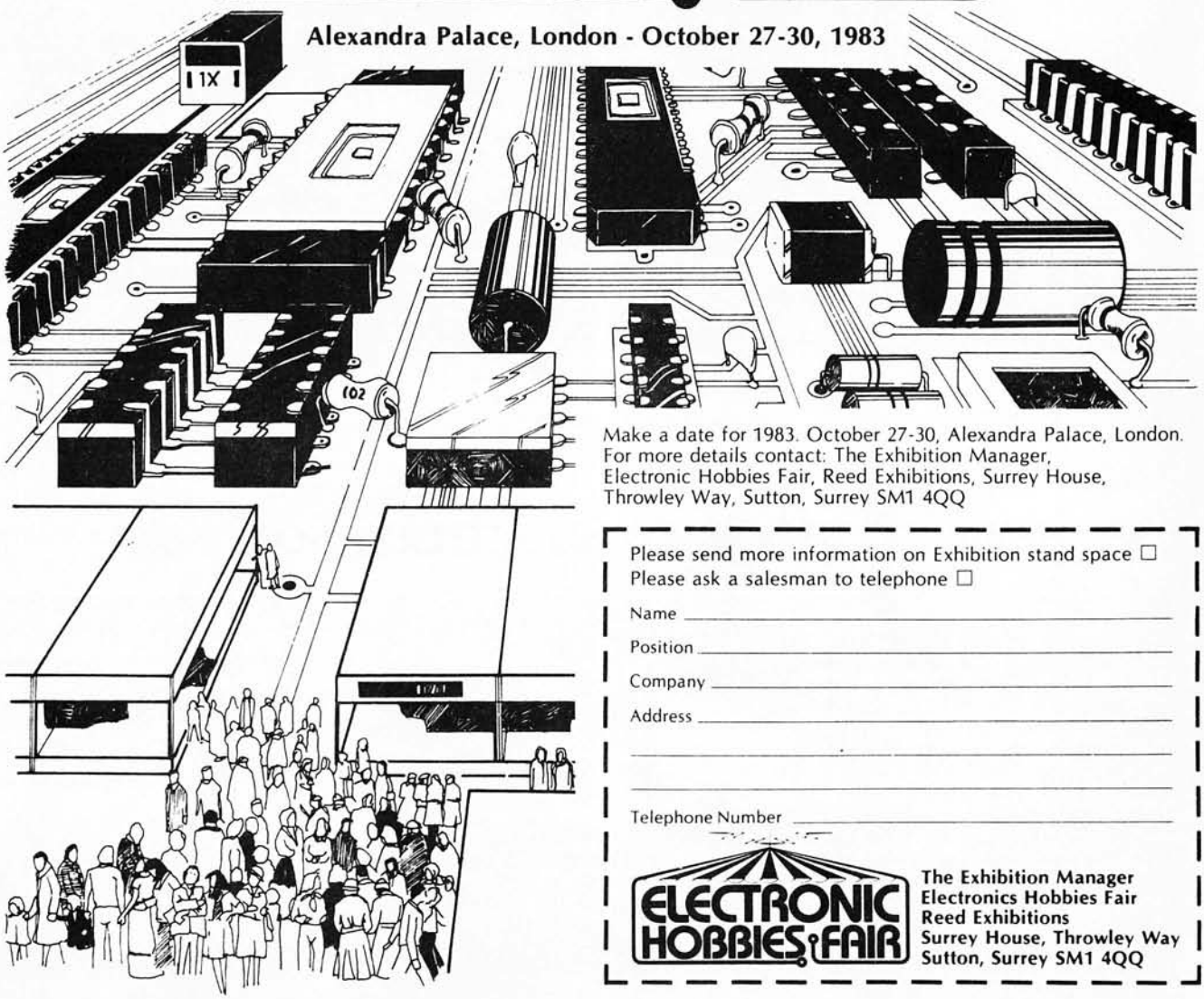

Make a date for 1983. October 27-30, Alexandra Palace, London. For more details contact: The Exhibition Manager, Electronic Hobbies Fair, Reed Exhibitions, Surrey House, Throwley Way, Sutton, Surrey SM1 4QQ

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40163	23 40163	1.05
40174	23 40174	1.05
40175	23 40175	1.05
40192	23 40192	1.08
40193	23 40193	1.08
40195	23 40195	1.08

74LSXX

Type	Stock No	Price
74LS00	31 07400	0.11
74LS01	31 07401	0.11
74LS02	31 07402	0.11
74LS03	31 07403	0.11
74LS04	31 07404	0.14
74LS05	31 07405	0.14
74LS08	31 07408	0.14
74LS09	31 07409	0.14
74LS10	31 07410	0.14
74LS11	31 07411	0.14
74LS12	31 07412	0.14
74LS13	31 07413	0.32
74LS14	31 07414	0.32
74LS15	31 07415	0.14
74LS20	31 07420	0.14
74LS21	31 07421	0.14
74LS22	31 07422	0.14
74LS26	31 07426	0.14
74LS27	31 07427	0.30
74LS28	31 07426	0.18
74LS30	31 07430	0.14
74LS32	31 07432	0.14
74LS33	31 07433	0.14
74LS37	31 07437	0.18
74LS38	31 07438	0.14
74LS40	31 07440	0.18
74LS42	31 07427	0.30
74LS47	31 07447	0.75
74LS48	31 07448	0.40
74LS49	31 07449	0.80
74LS51	31 07451	0.14
74LS54	31 07454	0.14
74LS55	31 07455	0.14
74LS74	31 07474	0.21
74LS75	31 07475	0.21
74LS76	31 07476	0.25
74LS78	31 07478	0.19
74LS83	31 07483	0.33
74LS85	31 07485	0.44
74LS86	31 07486	0.15
74LS90	31 07490	0.24
74LS91	31 07491	0.36
74LS92	31 07492	0.32
74LS93	31 07493	0.24
74LS95	31 07495	0.36
74LS107	31 74107	0.31
74LS109	31 74109	0.25
74LS112	31 74112	0.21
74LS113	31 74113	0.21
74LS114	31 74114	0.21
74LS122	31 74122	0.27
74LS123	31 74123	0.36
74LS125	31 74125	0.27
74LS126	31 74126	0.27
74LS132	31 74132	0.27
74LS133	31 74133	0.24
74LS136	31 74136	0.20
74LS138	31 74138	0.30
74LS139	31 74139	0.30
74LS151	31 74151	0.30
74LS153	31 74153	0.34
74LS155	31 74155	0.30
74LS156	31 74156	0.33
74LS157	31 74157	0.27
74LS158	31 74158	0.27
74LS160	31 74160	0.34
74LS161	31 74161	0.36
74LS162	31 74162	0.36
74LS163	31 74163	0.36
74LS164	31 74164	0.40
74LS165	31 74165	0.80
74LS166	31 74166	0.58
74LS168	31 74168	0.69
74LS170	31 74170	0.83
74LS173	31 74173	0.47
74LS174	31 74174	0.37
74LS175	31 74175	0.40
74LS181	31 74181	0.87
74LS183	31 74183	1.05
74LS190	31 74190	0.39
74LS191	31 74191	0.39
74LS192	31 74192	0.39
74LS193	31 74193	0.39
74LS194	31 74194	0.39
74LS195	31 74196	0.39
74LS196	31 74196	0.39
74LS197	31 74197	0.47
74LS221	31 74221	0.50
74LS240	31 74240	0.80
74LS241	31 74241	0.80
74LS242	31 74242	0.55
74LS243	31 74243	0.55
74LS244	31 74244	0.80
74LS245	31 74245	1.00
74LS251	31 74251	0.36
74LS253	31 74253	0.36
74LS257	31 74257	0.36
74LS258	31 74258	0.36
74LS259	31 74259	0.51
74LS260	31 74260	0.26
74LS266	31 74266	0.20
74LS273	31 74273	0.70
74LS279	31 74279	0.35
74LS283	31 74283	0.40
74LS290	31 74290	0.40
74LS293	31 74293	0.40
74LS298	31 74298	0.54
74LS365	31 74365	0.34
74LS366	31 74366	0.40
74LS367	31 74367	0.30
74LS368	31 74368	0.30
74LS373	31 74373	0.72
74LS374	31 74374	0.72
74LS375	31 74375	0.31
74LS377	31 74377	0.60
74LS378	31 74378	0.44
74LS379	31 74379	0.44
74LS385	31 74385	1.30
74LS386	31 74386	0.27
74LS390	31 74390	0.51
74LS393	31 74393	0.48
74LS398	31 74398	0.80
74LS399	31 74399	0.65
74LS490	31 74490	0.60
74LS670	31 74670	1.15

74CXX

Type	Stock No	Price
74C00	29 07400	0.35
74C02	29 07402	0.35
74C04	4069C	
74C08	29 07408	0.35
74C10	29 07410	0.35
74C14	4584C	
74C20	29 07420	0.35
74C30	29 07430	0.35
74C32	29 07432	0.35
74C42	29 07442	1.05
74C48	29 07448	1.50
74C73	29 07473	0.75
74C74	29 07474	0.75
74C76	29 07476	0.60
74C83	29 07483	1.30
74C85	29 07485	1.30
74C86	29 07485	1.30
74C89	29 07489	3.80
74C90	29 07490	1.05
74C93	29 07493	1.05
74C95	29 07495	1.25
74C107	29 74107	0.60
74C151	29 74151	2.10
74C154	29 74154	3.05
74C157	29 74157	2.10
74C160	40160	
74C1610	40161CM	
74C1620	40162CM	
74C1630	40163CM	
74C164	29 74164	1.05
74C165	29 74165	1.10
74C173	4076C	
74C1740	40174CM	
74C1750	40175CM	
74C1920	40192CM	
74C1930	40193CM	
74C1950	40195CM	
74C200	29 74200	6.50
74C221	29 74221	1.55
74C901	29 74901	0.55
74C902	29 74902	0.55
74C903	29 74903	0.55
74C904	29 74904	0.55
74C905	29 74905	6.50
74C906	29 74906	0.55
74C907	29 74907	0.55
74C908	29 74908	1.10
74C909	29 74909	2.10
74C910	29 74910	5.00
74C914	29 74914	1.10
74C918	29 74918	1.30
74C925	29 74925	6.00
74C926	29 74926	6.00
74C927	29 74927	6.00

74HCXX

Type	Stock No	Price
74HC00	30 07400	0.56
74HC02	30 07402	0.56
74HC04	30 07404	0.68
74HC10	30 07410	0.58
74HC20	30 07420	0.56
74HC86	30 07486	0.74
74HC132	30 74132	1.26
74HC266	30 74266	0.81
74HC4002	30 04002	0.56
74HC4075	30 04075	0.56
74HC242	30 74242	2.00
74HC243	30 74243	2.00
74HC74	30 07474	0.74
74HC109	30 74109	0.88
74HC175	30 74175	1.08
74HC373	30 74373	2.40
74HC374	30 74374	2.40
74HC533	30 74533	2.40
74HC534	30 74534	2.40
74HC165	30 74165	1.98
74HC173	30 74173	1.20
74HC160	30 74160	1.33
74HC161	30 74161	1.33
74HC162	30 74162	1.33
74HC163	30 74163	1.33
74HC4538	30 74538	2.10
74HC85	30 74280	2.95
74HC280	30 74280	2.95
74HC42	30 07442	1.00
74HC138	30 74138	1.08
74HC139	30 74139	1.08
74HC4514	30 04514	3.40
74HC4543	30 04543	2.75
74HC157	30 74157	0.92
74HC158	30 74158	0.90
74HC257	30 74257	0.90

SMALL SIGNAL AUDIO

Device	Stock No	Price
BC182	58 00182	0.10
BC212	58 00212	0.10
BC237	58 00237	0.08
BC238	58 00238	0.08
BC239	58 00239	0.08
BC307	58 00307	0.08
BC308	58 00308	0.08
BC309	58 00309	0.08
BC327	58 00327	0.13
BC337	58 00337	0.13
BC413	58 00413	0.10
BC414	58 00414	0.11
BC415	58 00415	0.10
BC416	58 00416	0.11
BC546	58 00546	0.12
BC550	58 00550	0.12
BC556	58 00556	0.12
BC560	58 00560	0.12
BC639	58 00639	0.22
BC640	58 00640	0.22
MPSA13	58 04013	0.30
MPSA63	58 04063	0.30
ZTX108	58 01108	0.10
ZTX212	58 01212	0.10
ZTX653	58 01653	0.20
ZTX753	58 01753	0.20
2N2904	58 02904	0.25
2N2905	58 02905	0.25
2N3905	58 03905	0.10
2SB646A	58 03646	0.30
2SB648A	58 03648	0.40
2SD666A	58 03666	0.30
2SD668A	58 03668	0.40
2SA872A	58 02872	0.19
2SA1084E	58 01084	0.25
2SA1085E	58 01085	0.25
2SC1775A	58 01775	0.19
2SC2546E	58 02546	0.24
2SC2547E	58 02547	0.24

AUDIO POWER

Device	Stock No	Price
BD139	58 15139	0.29
BD140	58 15140	0.31
BD165	58 15165	0.46
BD166	58 15166	0.40
BD179	58 15179	0.38
BD180	58 15180	0.41
TIP31A	58 15031	0.35
TIP32A	58 15032	0.35
MJ2955	58 12955	0.88
2N3055	58 13099	0.58
2SB720	58 15720	0.60
2SD760	58 17600	0.60
2SJ49	60 01049	3.10
2SJ50	60 01050	4.25
2SJ83	60 01083	3.55
2SK134	60 00134	3.10
2SK135	60 00135	4.25
2SK227	60 00227	3.55
2SD753	58 03753	2.34

SMALL SIGNAL RF

Device	Stock No	Price
BFY50	58 06500	0.22
BF241	58 06241	0.18
BF273	58 06273	0.18
BF274	58 06274	0.20
BF362	58 06362	0.49
BF440	58 06440	0.21
BF441	58 06441	0.21
BF479	58 06479	0.66
BF679S	58 06879	0.55
BFR91	58 07091	1.33
BFT95	58 10095	0.99
BFW92	58 08092	0.60
BFY90	58 09090	0.90
NE21936	58 21936	5.00
ZTX323	58 06232	0.60
2N2369A	58 02369	0.38

RF POWER

Type	Stock No	Price
BFW16A	58 08016	0.65
MRF237	58 14237	3.20
MRF238	58 14238	16.50
MRF245	58 14245	40.00
MRF449A	58 14449	16.50
MRF472	58 14472	1.25
MRF475	58 14475	4.60
MRF629	58 14629	4.99
PT8811	58 18811	8.50
TP2320	58 12320	10.24
VN66AF	60 02066	0.95
ZTX3866	58 03866	0.45
2N3866	58 13866	1.20

SMALL SIGNAL FET

Type	Stock No	Price
BF256	59 00256	0.38
BF960	60 06960	0.99
BF961	60 06961	0.70
BF963	60 06963	0.99
J310	59 22310	0.88
J176	59 22176	0.65
2SK55	59 01055	0.32
2SK168	59 01168	0.37
3SK45	60 04045	0.49
3SK51	60 04051	0.54
3SK60	60 04060	0.58
3SK88	60 04088	0.99
40673 see 3SK51		
40822 see 3SK51		
40823	60 03823	0.65
3SK112	60 04112	4.60

DIODES

Type	Stock No	Price
AA112	12 01126	0.25
BA244	12 02447	0.17
BA379	12 03797	0.35
ND4981 7E	12 49817	0.51
OA91	12 00916	0.07
OA47	12 00476	0.10
PW02	12 62006	0.75
SD4	12 24006	0.45
W005	12 10506	0.28
1N4001	12 40016	0.06
1N4002	12 40026	0.07
1N4004	12 40046	0.07
1N4148	12 41486	0.05
1N5404	12 54046	0.16
1N6263	12 62637	0.62

VARICAPS

Type	Stock No	Price
BA102	12 01025	0.30
BA121	12 01215	0.30
BB105B	12 01055	0.30
BB109B	12 01095	0.27
BB204B	12 02045	0.36
BB212	12 02125	1.95
ITT210	12 02105	0.30
MVAM115 see KV1236		
MVAM125 see KV1225		
KV1210	12 12105	2.45
KV1211 see KV1236		
KV1225	12 12255	2.75
KV1235	12 12355	2.75
KV1236	12 12365	2.55
KV1310	12 13105	0.40
KV1310	12 13205	0.40

ZENER DIODES

BZY88C 400mW 5%

Type	Stock No	Price
2V7	12 00278	0.10
3V3	12 00338	0.10
3V9	12 00398	0.10
4V7	12 00478	0.10
5V1	12 00518	0.10
5V6	12 00568	0.10
6V8	12 00688	0.10
8V2	12 00828	0.10
9V1	12 00918	0.10
10	12 01008	0.10
11	12 01108	0.10
12	12 01208	0.10
15	12 01508	0.10
18	12 01808	0.10
22	12 02208	0.10
27	12 02708	0.10
33	12 03308	0.10

SCRS TRIACS

Type	Stock No	Price
BRY55 100	52 55100	0.50
C106D1	52 00106	0.70
C122D1	52 00122	1.45
2N6403	52 06403	2.22
2N6073A	56 06073	0.98

BALANCED MIXERS

Type	Stock No	Price
SBL1	12 00003	4.98
SBL1 8	12 00013	5.00
SBL1 X	12 00023	6.33
SRA1	12 00033	10.80
SRA1 1	12 00043	12.77
SRA1H	12 00053	18.34
SRA3	12 00063	15.35

LEDs

Standard 5mm DIA LEDs

Type	Stock No	Price
CQY40L Red	15 10400	0.12
CQY72L Green	15 10720	0.15
CQY74L Yellow	15 10740	0.15
CQX38A Grid	15 20380	0.20
CQX39B Grid	15 20390	0.29

LINEAR ICs

Type	Stock No	Price
LM10CN	61 00010	3.88
MF10	61 00011	5.05
L149	61 00149	1.88
ZNA234	61 02340	8.50
U237B	61 00237	1.28
U247B	61 00247	1.28
U257B	61 00257	1.28
U267B	61 00267	1.28
LM301AH	61 03010	0.67
LM301AN	61 03011	0.27
LM308H	61 03080	0.70
LM308CN	61 03081	0.65
LM324	61 03240	0.45
LM339N	61 03390	0.66
LF347	61 00347	1.60
LM348	61 03480	0.90
LF351	61 03510	0.49
LF353	61 03530	0.76
LM380N	61 00380	1.00
LM381	61 00381	1.81
LM382	61 00382	1.81
2N419CE	61 00419	1.98
ZNA423	61 04230	1.00
ZN425E 8	61 04250	3.50
ZN426E 8	61 04260	3.00
ZN427E 8	61 04270	6.28
ZN428E 8	61 04280	4.78
ZN429E 8	61 04290	2.10
ZN432CJ10	61 04320	28.05
ZN433CJ10	61 04330	22.59
ZN440J	61 04400	0.80
ZN450E	61 04500	7.61
NE542	61 05420	1.20
NE544	61 00544	1.80
NE555N	61 05550	0.22
NE556N	61 05560	0.50
SL560C	61 05600	1.98
NE562	61 00562	4.05
NE564	61 00564	4.29
NE565	61 00565	1.00
NE566	61 00566	1.30
NE567	61 00567	1.30
NE570N	61 00570	3.85
SL624	61 00624	3.28
uA709HC	61 07090	0.64
uA709PC	61 07091	0.36
uA710HC	61 07100	0.64
uA710PC	61 07101	0.59
uA711CN	61 07110	0.85
uA733CN	61 07330	0.80
uA741CH	61 07410	0.66
uA741CN	61 07411	0.20
uA747CN	61 07470	0.70
uA748CN	61 04780	0.30
uA758	61 00758	2.35
TBA820M	61 00820	0.78
TDA1028	61 01028	2.11
TDA1029	61 01029	2.11
ZNA1034	61 01034	2.10
LM1035	61 01034	2.10
TDA1054M	61 01054	1.45
TDA1062	61 01062	1.95
TDA1072	61 01072	2.69
TDA1074A	61 01074	5.04
TDA1083	61 01083	1.95
TDA1090	61 01090	3.05
HA1137	61 12411	1.20
HA1196	61 01196	2.00
HA1197	61 01197	1.00
TDA1220	61 01220	1.40
LM1303	61 01303	0.99
LM1307	61 01307	1.55
MC1310P	61 01310	1.90
MC1330	61 01330	1.20
MC1350	61 01350	1.20
HA1370	61 11370	1.90
HA1388	61 01388	2.75
LM1458N	61 14580	0.45
MC1496P	61 01496	1.25
SL1610	61 01610	1.92
SL1611	61 01611	1.60
SL1612	61 01612	1.60
SL1613	61 01613	2.06
SL1620	61 01620	2.50
SL1621	61 01621	2.50
SL1623	61 01623	2.44
SL1625	61 01625	2.50
SL1626	(SL6270)	
SL1630	61 01630	1.62
SL1640	61 01640	2.25
SL1641	61 01641	2.25
MC1648	61 01648	3.25
TDA2002	61 02002	1.25
ULN2240	61 02240	3.25
ULN2242	61 01090	3.05
ULN2283	61 02283	1.00
CA3080	61 03080	0.70
CA3089	61 03089	1.84
CA3123	61 03123	1.40
CA3130E	61 31300	0.80
CA3130T	61 31301	0.90
CA3140E	61 31400	0.46
CA3189E	61 03189	2.20
CA3240E	61 32400	1.27
MC3357	61 03357	2.85
MC3359 (see ULN3859)		
ULN3859	61 03859	2.95
KM3701	61 03701	85.53
KM3702	61 03702	74.84
LM3900	61 39000	0.60
LM3909N	61 39090	0.68
LM3914N	61 03914	2.80
LM3915N	61 03915	2.80
KB4400	61 04400	0.80
KB4412	61 04412	1.95
KB4413	61 04413	1.95
KB4417	61 04417	1.80
KB4420B	61 04420	1.09
TDA4420	61 14420	2.85
TDA4421	61 14421	2.65
KB4423	61 04423	2.30
KB4424	61 04424	1.65
KB4430	61 04430	2.30
KB4431	61 04431	1.95
KB4432	61 04432	1.95
KB4433	61 04433	1.52
KB4436	61 04436	2.53
KB4437	61 04437	1.75
KB4438	61 04438	2.22
KB4441	61 04441	1.35
KB4445	61 04445	1.29
KB4446	61 04446	2.75
KB4448	61 04448	1.65
NE5044	61 05044	2.26
MC5229	61 05229	9.60
NE5532	61 55320	1.85
KM5624	61 05624	4.35
SD6000	61 06000	3.75
SL6270	61 06270	2.03
SL6310	61 06310	2.45
SL6440	61 06440	3.38
SL6600	61 06600	3.75
SAS6610	61 06610	1.48
SL6640	61 06640	2.75
SL6690	61 06690	3.75
SL6700	61 06700	2.75
SAS6710	61 06710	1.48
LS7225	61 07225	3.65
ICM7555	61 75550	0.80
CL8038CC	61 08038	4.50
MSL9362	61 09362	1.75
MSL9363	61 09363	1.75
K10170	61 10170	1.87
TK10321	61 10321	2.75
HA11223	61 11223	2.15
HA11225	61 11225	1.45
HA12002	61 12002	1.22
HA12017	61 12017	0.80
HA12402	61 12402	1.95
HA12411	61 12411	1.20
HA12412	61 12412	1.55
LF13741	61 13741	0.33
MK50366	61 50366	3.35
MK50375	61 50375	3.85
MM53200	61 53200	3.90

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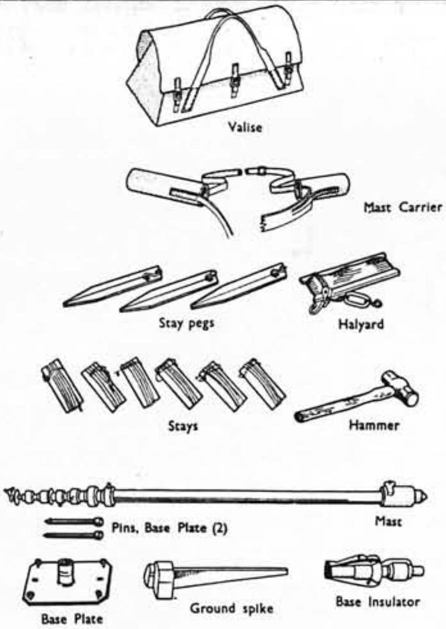

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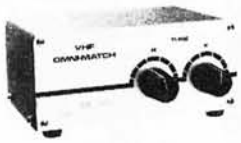

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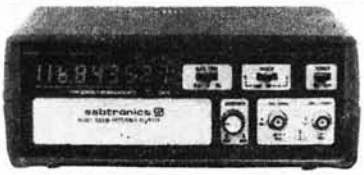

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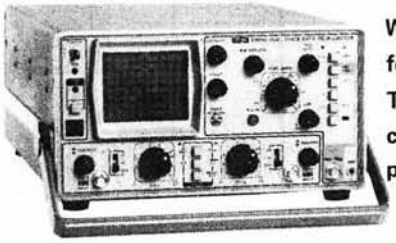

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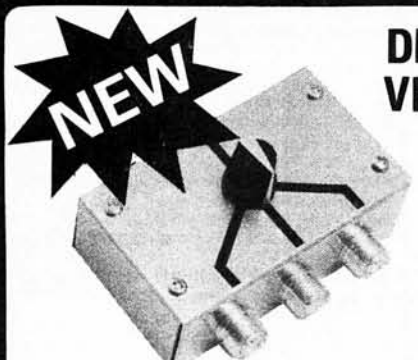

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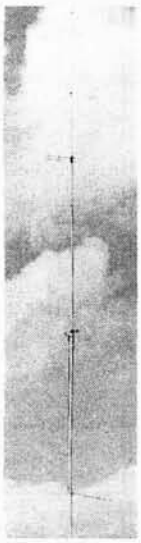

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