

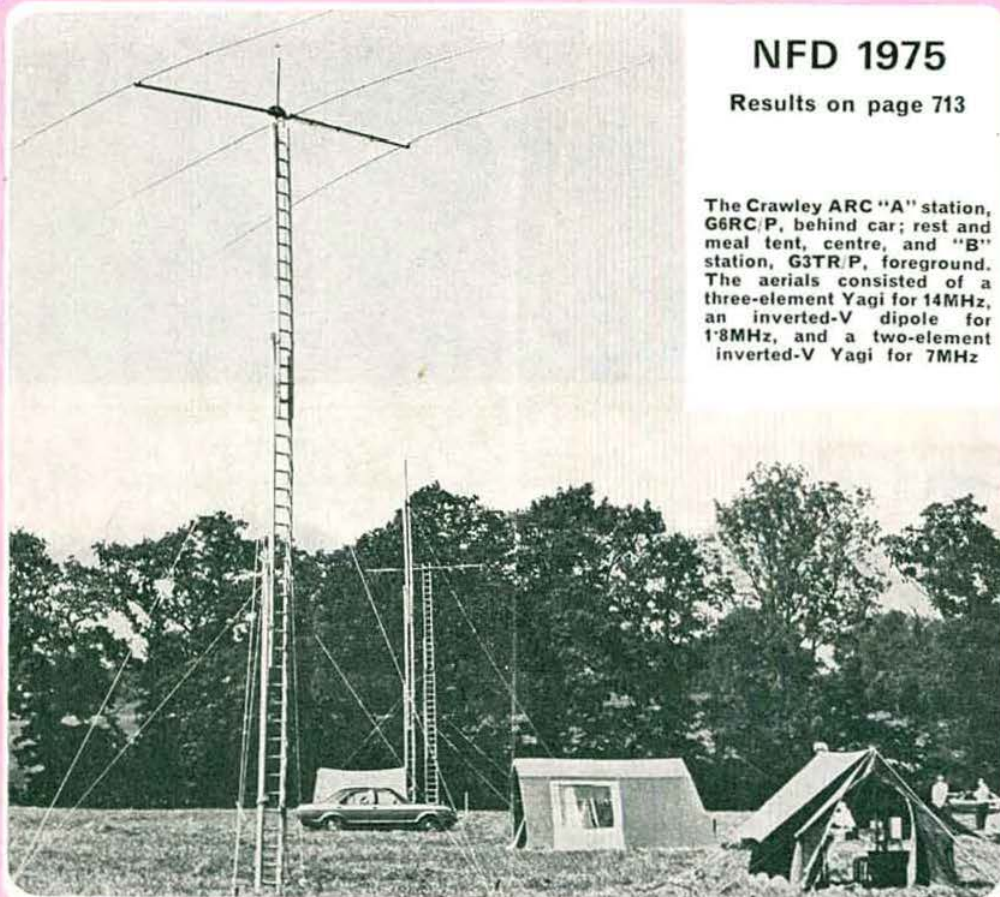
# radio communication

September 1975

## NFD 1975

Results on page 713

The Crawley ARC "A" station, G6RC/P, behind car; rest and meal tent, centre, and "B" station, G3TR/P, foreground. The aerials consisted of a three-element Yagi for 14MHz, an inverted-V dipole for 1.8MHz, and a two-element inverted-V Yagi for 7MHz.



journal of the Radio Society of Great Britain



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# radio communication

Volume 51 No 9

September 1975

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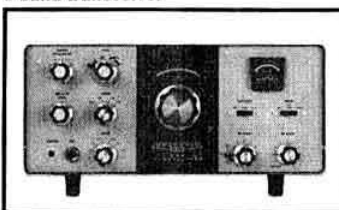
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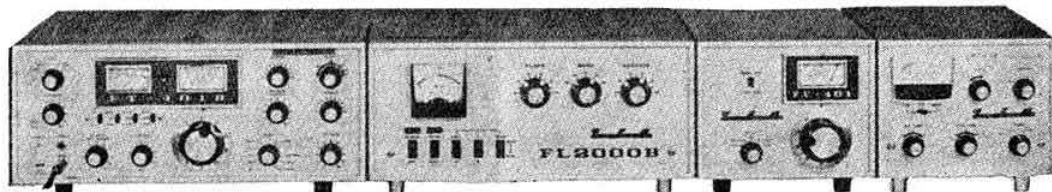
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FV200 VFO for FT200	£42.00

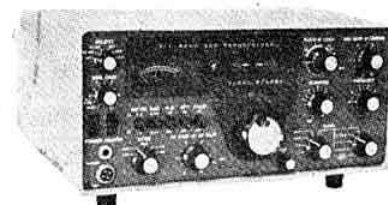
#### ACCESSORIES

SP101 & SP401 ext speakers	£13.00
SP401PB Phone patch	£29.00
XF30A AM filter	£16.00
XF30C CW filter	£16.00
XF30P FM filter	£16.00
MMB101 mobile MT	£10.00
MMB200R MMB Auto 80 mobile MT	£6.50



The FT401B and its accessories are shown above, and provide an uncompromising approach to the home station. The FT401B itself runs 500W P.I.P., but when throttled back to drive the FL2000B and coupled with the FV401 external V.F.O. provides the base stations with ultimate DX appeal.

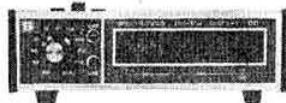
The unit nestling on the end is the FTV650, a 6m transverter which we can provide electrically modified for 70MHz, 100W P.I.P., 50W CW, 40W FM/AM £80.00.



#### FT201

The newest of the Yaesu transceiver on offer the FT201. The FT201 features 80-10m operation and the ability to run from the mains or a 12V supply. It is constructed using plug-in modules as made famous in the FT101. Of special interest to those contemplating using the 201 as a prime mover for VHF use, is the use of 9MHz as the IF frequency and that full AM operation is possible (the optional AM filter being available). For the CW enthusiasts a 600Hz filter is available with AGC characteristics to suit the mode. Write for full specifications.

**NEW at last DIGITAL READOUT UNIT for use with FT101, FT401 etc:** sits neatly on top 8 1/2" x 2 1/2" x 8", a worthwhile accessory, readout to  $\pm 100$ Hz, 21IC's, 76 diodes type DDI £110.00 + VAT.



#### SIGMA 80 R

80 channel synthesized FM transceiver offering complete simplex and duplex coverage of two metres in 10kHz increments. A 600kHz transmitter offset oscillator gives complete flexibility when coupled with the built-in tone burst. A priority channel may be present for instant selection of net or RAEN channels. Automatic final protection, 10W of R.F. and a generous 2 watt of audio for mobile use with a battery drain of only 2.2A on transmit. The unit may be run as a base station with the FP2AC regulated power supply and battery charger.

**FREE STOCK PRICE LIST & SECONDHAND LIST SEND S.A.E. SEE PAGE 664 FOR SELECTION OF MASTS/ANTENNAS**



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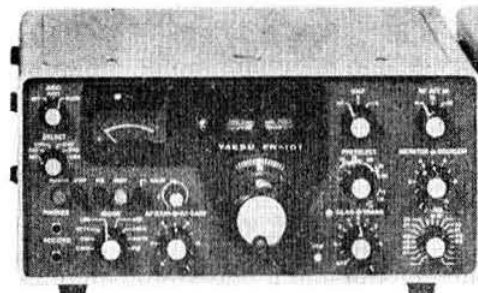


The FT224 is an advanced Solid State transceiver featuring 10W output with a 23 channel flexibility (excluding priority channel) all on one complete package. The FT224 includes a built-in tone burst for repeater actuation. Automatic high VSWR protection of the final transistor and reverse power line polarity protection are included. The wireless comes complete with built-in speaker, mobile mounting brackets and dynamic microphone.

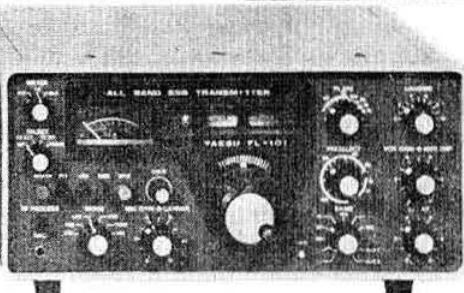
S.M.C. models come fitted with 145.00, 145.50 and 145.55MHz as standard

FT224 £130

Ex-Stock



The FR101 is an advanced receiver offering in the deluxe version, coverage from 1.5MHz including all SW broadcast and HF amateur bands (23 in all) to 144MHz. AM, FM, SSB CW are catered for, each with a separate crystal filter. Transceiver operation with the FL or FT101. Also Digital versions available.



FL101 £265

FR101S £245

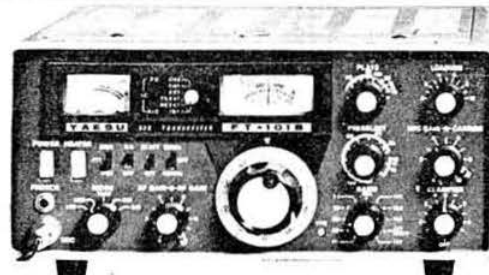
FR101D £330

Ex-Stock

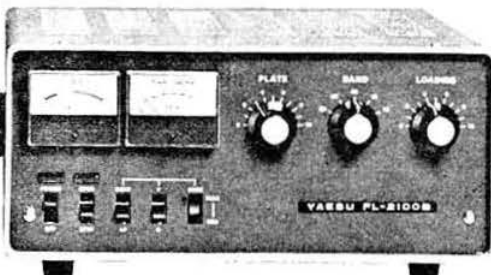
FR101SD £330

FR101DD £430

The FL101 is the ideal companion to the FR101 thus forming a superb base station. Operation on 160 through 10m using SSB, AM, CW or RSK is offered, with the added bonus of an option inbuilt RF speech processor being available at moderate cost.



The FT101B is except for driver and PA, fully solid state using reliable and serviceable "computer type" plug-in modules. All that is needed for instant "on the air" operation from 160 through 10m is either 12V DC or 234V AC and, of course, an antenna.



FT101B

£330

FL2100B

£195

Ex-Stock in

Totton

The FL2100B features operation 80 through to 10m using two rugged 572B carbon plate tubes in class "B" grounded grid circuits with individually tuned input coils for each band, and Bifilar wound ferrite filament chokes.



£170 (+ 25% VAT)

YD844

FV200

FT200

FP200

FT200

Value for

Money Still

Only £170 +

PSU £44

The FT200 is still without doubt one of the "best buys" available. Compare its features with similarly priced units. SPECIFICATION: 260W, P.I.P. SSB/CW 75W AM 1kHz readout on all bands 3.5-28.5-29MHz (3 optional 10m crystals available). Stability: 100Hz 30 min. after warm up. Sensitivity: 0.5µV 10dB/S + N. Selectivity 2.3kHz (6dB) 4kHz (60dB). Solid state FET VFO with excellent linearity (like all Yaesu VFO's). Xtal calibrator. VOX/PTT. Clarifier—5kHz. Break in CW keying. Extra crystals from SMC only £2.20 (+ VAT).

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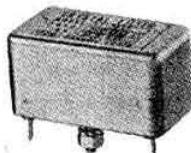


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individually supplied with  $\pm 6$ dB, (25dB,) 60dB bandwidths, ripple factor and insertion loss.



	9MHz	
YF90M600	600Hz	£13.00
YF90F2-4	2-4kHz	£11.00
YF90F12	12kHz	£13.00
Carrier crystals HC18/U	each	£1.50

	10-7MHz	
YF107M600	600Hz	£13.00
YF107M2-4	2-4kHz	£12.00
YF107M12	12kHz	£12.00
Carrier crystals HC18/U	each	£1.50

**FT2F** (52MHz Rx 6 MHz Tx), £3.50 pair,  
£2 each  
144 (-15, -25, -36, -40, -48, -60R, -70, -80R)  
145 (-08, -09, -68R, -90)

### Simplex

S (0, 12, 16, 20, (21), (22), 23, 24)

### Duplex

R0, R2, R3, R4, R5, R6, R7, R8

**Duplex** (normal repeaters)

R (0, 1, 2, 3, 4, 5, 6, (7), (8), 9)

### Inverse Repeaters

IR (0, 1, 2, 3, 4, 5, 6, (7), 8, 9) RX

IR (0, 1, 2, 3, 4, 5, 6, (7), 8, 9) TX

IR0R, IR2R, IR4R, IR5R, IR6T, IR8T

**FT220** Channel crystals £2.20 each  
B (00, 125, 150, 175, 225, 250, 275, 50, 575)  
**FT2FB** (14MHz Rx, 18MHz Tx), £3.50 pair,  
£2 each

144 (-15, -20, -30, -36, -40, -50, -60)

145 (-09, -32, -44T, -51, -84, -90)

### Simplex

S (0, 16T, (20), 21, (22), 23, 24)

### Duplex

R (0, 1, 2, 3, 4, (5), 6, (7), 8T, (9))

**Inverse Repeater**

IR (0, 1, 2, (3), 4, 5, 6, 7, 8, 9) RX

IR (0, 1, 2, (3), 4, 5, 6, 7, 8, 9) TX

**C146A & C825MB**, £3.50 pair, £2 each

S20, S21, S22T, S23, S24

### Special Offer (for MORSE MEN)

145.125T 12MHz HC25/U, only £1

**FT200**, £2.20 each

10A, 10C, 10D (Insured P & P 37p.

VAT 25%)

8MHz HC25/U, £2 each

144.48, S20, S21, S23, S24

12MHz HC25/U (£2.20) HC25/U (£2)

144.48, S20, S21, S22, S23

**C430 ONLY** £3.50 pair

433 (-10, -15, -20)

**Pye Pocket Phones**

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**CONVERTER CRYSTALS**, £2 each

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12AVQ 10-20m. Trapped Vertical	£25.00	TH3 Mk III 10-20m, 3 element	£99.90	402BA 40m 2 element	£121.00
14AVQ 10-40m. Trapped Vertical	£36.00	TH6DXX 10-20m, 6 element total	£109.00	204BA 20m 4 element	£96.00
18AVT 10-80m. Trapped Vertical	£52.00	HY QUAD 10-20m, 3 element	£99.60	203BA 20m 3 element	£80.00
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Trap dipole standard 10-80m .. (S) £16.85

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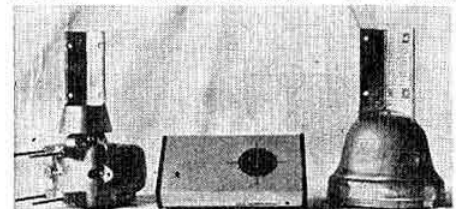
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THE NEW SILENT CONTROL UNIT WITH AN AR30 and 40

THE NEW CONTROL UNIT FOR THE CD44 AND HAM 2

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ATLAS 210,		
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215	Transceiver	£373.75
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ATLAS 180	SSB Transceiver	£325.00
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MT-1	Mobile antenna matching transformer. Broadband design, transforms base impedance to 50 ohms	

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telescopic whip for above coils		£1.53
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XCR	30	£112.50
SONY	CRF-5090	£125.00
DRAKE	T-4XB	£250.00
HEATHKIT	SB-401	£160.00
KW	Atlanta & PSU	£187.50
HEATHKIT	SB-600 Speaker	£12.50
HAMMARLUND	Speaker	£12.50
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IC-201  
IS HERE!!**

**PRICE £300 + VAT** (at the time of going to press and providing the pound doesn't go too far down the drain!)

The first stocks of this wonderful new rig from INOUE are now in the country and our order book is growing. The supply situation has improved somewhat, however. If you want to own one then get in touch with us or one of our agents NOW before the list gets too long. You can see demonstration models at Herne Bay, Barnsley, London and Crayford by telephoned appointment and they will be on show, together with most of the ICOM range, at Leicester and most of the popular rallies.

Compare these features with other multi-mode rigs:

**Centre-Zero** meter on FM

**Narrow filter** on FM for 25kHz channel spacing

Good, well-limited FM

600kHz shift of Tx. using **Duplex** for working repeaters

**Automatic** tone-burst introduced on **Duplex**

4 Crystal positions for net and repeater frequencies

**Two-speed** gearbox giving easy rapid tuning

**Crystal Calibrator**—500kHz

**ACCESSORIES:** microphone, DC power cord with plug, spare fuses, plug for CW key.

**Vox.** Fully adjustable (works on FM if you really want it)

**CW** side-tone

Full **break-in** on CW (separate VOX relay controls for CW and SSB)

**RF** gain control by adjusting the coupling of two helical filters

**Excellent** noise blanker

**R.I.T.**

**Mic** gain control on front panel

**Dial-readout** to 1kHz—accurate to 2kHz or better

Specification	
Transistors	53
FET	16
IC	10
Diodes	66
Frequency Range	144-146MHz
Weight	5.4kg
Dial accuracy	(-10°C to 60°C) ± 2kHz
Modes SSB (usb or lsb), CW and FM	
Ant. Impedance	50ohms
Operating Voltage	DC 13.8v ± 15% AC 230v
Size	111mm × 230mm × 260mm deep

### Receiver

I.F. Frequencies A3J, A1 10.7MHz  
F3 10.7MHz and 455kHz

Sensitivity A3J, A1 0.5µV for 10dB S + N/N

FM 0.4 µV for 20dB quieting  
Squelch sensitivity (FM)

-8dB (µV) or less

Bandwidth  
SSB, CW ±1.2kHz -6dB points  
±2.4kHz -60dB points

FM  
±8kHz -6dB  
±16kHz -60dB

Audio output  
Speaker 2W  
8ohms

### Transmitter

Power Output A3J 10W pep  
A1, F3 10W

Carrier Suppression (SSB) > 40dB

Unwanted sideband suppn. > 40dB

Spurious radiation -60dB

Deviation FM set to 4.5kHz

Mic. Impedance 500ohm

Operation PTT or VOX

These details are accurate to the best of our knowledge at the time of going to press, but there could be variations.

**FREE SECURICOR DELIVERY ON ALL TRANSCEIVERS**



## THANET ELECTRONICS

**NOTE OUR NEW ADDRESS DURING EXTENSIONS TO OUR  
WHITSTABLE PREMISES**

**34 Cliff Avenue, Herne Bay, Kent CT6 6LZ**



**Tel. (02273) 63846**

## VHF AND UHF



## WHAT'S THIS!

A CALL BUTTON on the IC-22A!—after all we have said about our tone-bursts being AUTOMATIC and only inserted on repeater channels! Have no fear, you don't have to press that button with your third hand to work a repeater, while holding the mike, and driving the car, and anything else you might be trying to do as well. The button is not connected internally—but of course you could employ it to do something else, such as opening the garage door or ejecting unwanted passengers—or anything. At £125 + VAT for the version with 8 channels or £115 if you only want 5 it is still one of the best rigs you can get for either simplex or repeater working.

5 channel version: 145 00, S20, S21, S22, S23 .. .. . £115  
8 channel version: above plus S24 and 2 repeaters of plus 3 repeaters £125

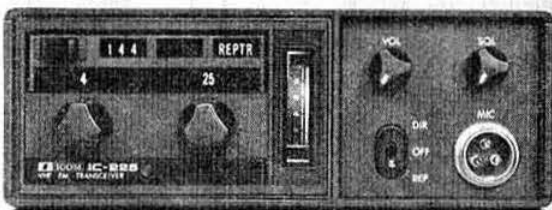
See the June and July adverts or contact us for specifications.

IC-3PA matching power supply with overload protection for using the IC range of mobiles as base stations—£35 + VAT.

GOING ON THE CONTINENT WITH A RECIPROCAL LICENCE? If so, and if you have an INOUE rig, then phone and we can arrange to lend you the crystals, against a deposit, for the continental repeaters. This service is subject to stocks and very preferential rates will be given to customers of ours, our agents, or our appointed stockists.

### IC-225

The ultimate in mobile rigs with 80 channel operation as it stands plus the availability of extra channels if required, or full VFO coverage on transmit and receive when used with the PL-V1 (or a home brew 12MHz VFO). Automatic 600kHz Tx frequency drop and introduction of a tone burst when switched to REP give full UK repeater coverage without needing extra crystals. Tx power 10W, Rx sensitivity 0.4µV for 20dB quieting. Spurious response and radiation better than -60dB. Superb audio tailoring and clipping. £195.00 + VAT.



OUR AGENTS (see below for names and addresses) carry all the more popular range of our stock of ICOM equipment and will be pleased to demonstrate (and of course SELL) it to you if you would care to visit them. It is essential that you telephone for an appointment first though. They all offer the full THANET service and have facilities for attending to minor service problems etc.

### AGENTS

(by telephoned appointment, evenings and weekends only)

#### NORTH

Peter Avill, G3TPX,  
7 Moorland Crescent,  
MAPPLEWELL, Barnsley, Yorks  
Tel: DARTON (022678) 2517

#### LONDON

Terry Barnett, G8BAM,  
7 Cochrane Court,  
Leyton Grange,  
LONDON E10 Tel: 01-556 9366

#### SOUTH-EAST

Crayford Electronics  
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CRAYFORD, Kent.  
Crayford (03225) 24625

### APPOINTED STOCKISTS

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400 Edgware Road,  
LONDON W2

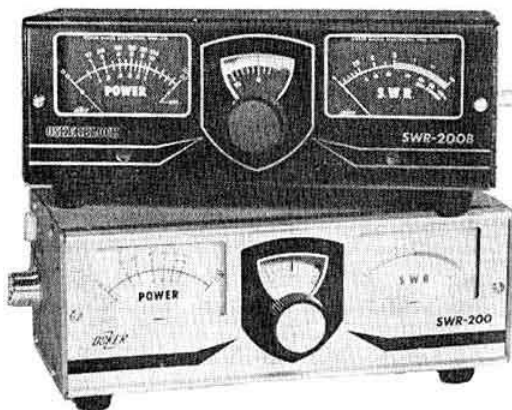
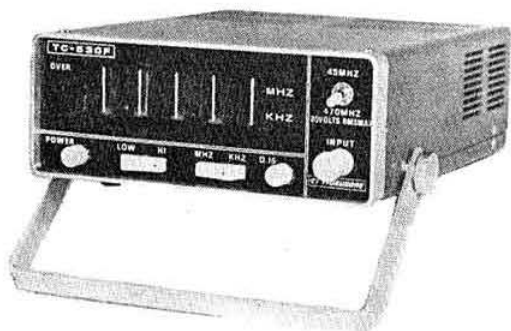
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SPECIFICATION  
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**LA-2 2 METRE LINEAR  
SSB-FM-A.M.-CW 200 WATTS  
P.E.P. OUT FROM A  
RUGGED EIMAC 4X150A  
FOR 10 WATTS OF DRIVE,  
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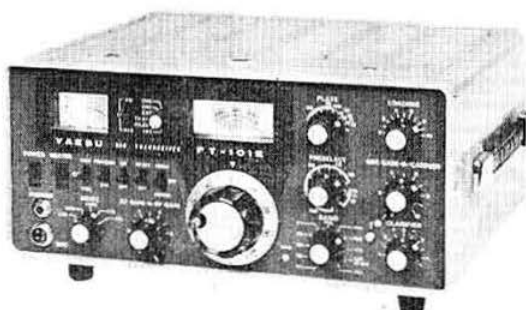
**021-327 1497  
6313**



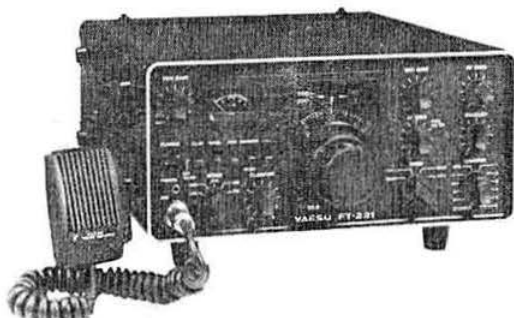
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NEWS  
FROM  
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▲ **THE FT101E—THE LATEST  
VERSION OF THE FAMOUS '101'  
COMPLETE WITH BUILT-IN  
RF SPEECH PROCESSOR  
NOW EX-STOCK!**



◀ **THE FT-221, YAESU'S NEW  
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DELIVERY 2/3 WEEKS. £318.50  
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05093 5131

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UNITED KINGDOM MAIN DISTRIBUTOR  
OF  
THE WORLD'S FINEST RANGE OF AMATEUR  
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## YAESU MUSEN CQ LANDS END TO JOHN O'GROATS

No matter where you live you may like to consider the following facts about our service...

**CONVENIENCE.** If you are buying all you have to do is drop us a line or telephone and quote your Access or Barclaycard number; we'll do the rest promptly.

**AFTER SALES SERVICE.** No need to go even 10 miles to your nearest dealer; we will collect your equipment by Securicor from your own doorstep and save your petrol, precious time and money. This is done **FREE OF CHARGE** on all warranty work. So whether you're in "bonny Scotland" the "Welsh Hills" or "down the road," you won't find a better service than that from WESTERN ELECTRONICS.

**SERVICE DEPT.** For **TEST EQUIPMENT** we have the best such as the latest Hewlett Packard 8554B DC to 1.2GHz spectrum analyser, Tsurudome and Yaesu frequency counters, Marconi calibrated signal generators, Telonic sweep generator; i/c testers many other items. What you also should know when your equipment is serviced is that it is done by the finest **STAFF**; all are highly experienced.

**DELIVERY.** All orders are normally dealt with the same day as received and Communication equipment too heavy for post is despatched by Securicor with whom we have a contract for daily collections and delivery on the next working day. This is the quality of service which we initiated and of which we are still the leaders.

OUR AIM IS YOUR PLEASURE

### YAESU PRICES (Carriage free by Securicor) including VAT.

<b>HF TRANSCEIVERS</b>		<b>HF RECEIVERS</b>		<b>HF TRANSMITTER</b>		<b>REMOTE VFO's</b>	
FT-75B 10-80m, 120w.	£175.00	FR-400DX	£193.75	FL-101 10-160m.	£300.00	FV-50C for FT-75B	£28.75
DC-75B DC PSU for FT-75B	£50.00	FR-101S 10-160m.	£306.25	FL-101RF 10-160m. + Rf processor	£343.75	FV-101B for FT-101B	£60.00
FP-75B AC PSU for FT-75B	£40.00	FR-101S Dig. 10-160m. Digital	£387.50			FV-200 for FT-200	£60.00
FT-101B 10-160m, 260w.	£412.00	FR-101D 2m-160m. + SW Bands	£412.50			FV-401 for FT-401B	£60.00
FT-101EE latest model	£450.00	FR-101D Dig. Digital "101D"	£493.75				
FT-101EE "101EE" + Rf processor	£493.75			<b>SPEAKERS</b>			
FT/FP-200 10-80m, AC only	£268.75			SP-101B for FR/FT-101B/E	£16.25		
FT-201 10-80m, AC/DC	£362.05	<b>VHF TRANSCEIVERS</b>		SP-101PB Phone patch/Spr.	£36.25		
FT-401B 10-80m, 500w.	£387.50	FT-221 2m, SSB/AM/FM	£412.50	SP-401 for FT-401B	£16.25		
FT-501 10-80m, Digital	£498.75	FT-224 24Ch, FM	£162.50			<b>ACCESSORIES</b>	
		SIG 80R 80Ch, FM	£231.25			YD-844 Table Microphone	£16.25
<b>LINEAR AMPLIFIERS</b>		FT-820B 6m, AM/SSB/CW	£243.75	<b>TEST EQUIPMENT</b>		YD-846 Hand Microphone	£7.19
FL-2000B 1200w, 10-80w	£243.75	YP-2AC AC PSU for FT-224	£47.50	YC-355 35MHz AC only	£75.60	Mobile Mounts, Crystals,	
FL-2100B 1200w, for 101B/E	£243.75	FP-2AC + B as above + batteries	£88.75	YC-355D 200MHz AC/DC	£135.00	Filters,	
				YO-100 Monitor Scope	£100.44	Log Book	£1.00

## WOULD YOU LIKE A FREE CDE ROTOR?

... of course you would! So many firms say "ex-stock" and then come up with a whole host of excuses as to why they can't supply that we decided to make you a Special Offer until Sept 30th. Send us your order for our AR30 or AR40 Rotors (with money, of course!) and if we can't supply "ex-stock" then we will give you a free rotor when available. There's a challenge for you! You have nothing to lose!

AR30 .. £25.00 AR40 .. £30.00 CD44 .. £60.00 HAM-2 £90 (Prices carriage paid) VAT 25% extra.

**VALVES (Post and packing 30p) Minimum order £2. MOST VALVES ARE OF FIRST GRADE TOSHIBA MANUFACTURE. VAT EXTRA.**

572B (Cetron)	£11.20	6AW8	60p	6CB6	40p	6GK6	55p	12AU7	50p
5763	£1.55	6BA6	35p	6CH6	85p	6GW8	72p	12AX7	45p
6146	£4.50	6BE6	40p	6CL6	75p	6JS6C	£1.90	12AT7	52p
6146B	£4.85	6BM6	50p	6EA8	50p	6KD6	£1.90	12BY7A	50p
6AH6	£1.05	6BM8	80p	6EH7	50p	6LQ6	£1.90	12DQ6	£2.25
6AM6	55p	6BN8	45p	6EJ7	50p	6U8	55p	OA2	96p
6AN8	55p	6BQ5	45p	6EW6	40p	7360	£5.00	OB2	80p
6AV6	33p	6BZ6	40p						

## Western Electronics (UK) Ltd

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# RADIO SOCIETY OF GREAT BRITAIN

35 Doughty Street, London WC1N 2AE

Telephone 01-837 8688

Founded 1913

Incorporated 1926

Member society, International

Amateur Radio Union

**PATRON: HRH The Prince Philip, Duke of Edinburgh, KG**

## The national society representing all UK radio amateurs

Membership is open to all those with an active interest in radio experimentation and communication as a hobby.

Annual membership rates: UK—£5.50 (including VAT); (Unlicensed members under 18 years of age, £2). Overseas—£5 (USA, \$12).

Applications for membership should be made to the general manager, from whom full details of Society services may also be obtained.

### GENERAL MANAGER AND SECRETARY

G. R. Jessop, CEng, MIERE, G6JP

### EDITOR

A. W. Hutchinson

## CURRENT COMMENT-INFLATION

When the accounts of the Society for the year ended 30 June 1975 are completed they will probably show the worst financial result the Society has ever had in its history. In line with many other clubs and societies in this country the rocketing cost of everything has made it very difficult to see where we are all going. When the budgets were originally prepared for the year that has just ended, an inflation element of as much as 20 per cent was allowed for but, of course, this proved inadequate.

### Subscriptions

These will unfortunately have to increase. Amounts of £7 or £8 per annum have been considered but the final amount must depend on the final accounts, government regulations (VAT may be increased) and the rate of inflation. There will be no increase in subscriptions before 1 January 1976 and at the next Annual General Meeting members will be asked to amend the Articles of Association in order to permit an increase of the subscription. This will permit adequate discussion of the figure to which the present subscription should be raised.

### The future

The budget for the year ending 30 June 1976 has been calculated on a 10 per cent inflation basis (not without a certain amount of scepticism) as this appears to be the government target, and our total expenses will be in excess of £150,000. Against this we can set advertising revenue of approximately £30,000 (assuming the amount of advertising continues at its present level) and income from the sale of books (with the *Radio Communication Handbook* going out of print the Society no longer has a best seller), which, apart from some desultory investment income, leaves the balance to be covered by subscriptions. Whatever happens, the benefit of an increase in subscriptions will not be felt until a full year has passed, so in fact we have budgeted for a deficiency to 30 June 1976.

The budget includes £20,000 in respect of *Radio Communication* postage. This horrifying amount is more than the total Society income of only a few years ago but it is an unfortunate fact that the Society's main item of expenditure (the publication of the monthly magazine) probably reflects more than almost anything else the ravages of inflation.

Another "Current Comment" on this subject next month will give more details and ask for the support of members for an increased subscription which will permit maintenance of membership services after all possible economies have been made.

J. O. Brown, G3DVV

Hon Treasurer



**QSL Bureau**

Please note that under this heading last month it was incorrectly stated that anyone operating in GC on a temporary basis or as a G5+ three-letter call should send *cards* to G3DRN. Cards, of course, go to G2MI; *envelopes* should be sent to G3DRN.

**Lecture at the IEE**

The Society will present a lecture at the IEE (Savoy Place, London WC2) on Tuesday 4 November at 6.30pm. The subject will be a symposium on *Amateur radio satellites*, and the chief speaker will be Pat Gowen, G3IOR, supported by members of AMSAT-UK. In accordance with the usual arrangements light refreshments will be available at the IEE at 6pm.

**Callsign changes**

A paragraph on p578 of the September 1974 issue of *Radio Communication* requested the views of members on possible changes in the use of callsigns and prefixes/suffixes. The response received amounted to 0.006 of the corporate membership and indicated a small majority in favour of a change. Accordingly a submission was made to the Home Office, who rejected this, saying that there was no evidence that any change was desired by the majority of radio amateurs. Accordingly, the matter will not be further pursued at this time.

**Intruders**

The latest report from G3PSM, the co-ordinator of the IARU Monitoring System, lists more than 1,000 intruders on amateur bands below 30MHz. The majority of these are stations operating in *exclusive* amateur bands. The list is circulated worldwide and copies are sent to administrations and to national societies in those countries from where intruder activity has been noted.

Among the "old offenders" noted are three transmitters of Radio Peking and three of Radio Tirana in the exclusive 7MHz band. Despite the poor propagation conditions several harmonics from broadcasting stations are consistently present in the 28MHz band.

The management of intruder watch activities is a valuable and continuing service on behalf of *all* radio amateurs, not only RSGB members, and the results will be invaluable in the preparations for the 1979 WARC.

**Prices of RSGB publications**

It is RSGB policy to keep its book prices as reasonable as possible for the benefit of members. With the current rate of inflation, however, the rising costs of ink, paper, labour and binding materials mean that when any of the Society's publications is reprinted a price rise is inevitable. In addition, the price of all books stocked by the Society and

sent by post are subject to rises due entirely to increased packing and postage costs: the next increase in postal costs is expected at the end of September.

The prices of various other books sold, but not published, by the Society have in some cases risen as a result of fluctuating exchange rates.

**Affiliated societies—discount terms for RSGB publications**

In future, books purchased by affiliated societies will be sold at the following discounts:

Books published by the RSGB.....20% discount

All other publications .....10% discount.

These rates will only apply if the value of the order is £10 or over, based on the cover prices at the time of ordering. If books are collected at RSGB HQ there is no postage charge. Books sent by post will be charged postage and packing.

**The callsign lapel badge is back**

An example of the badge (full size)

Over the last few months many members have asked about the individually engraved callsign lapel badge. It seems that there is considerable demand for a small badge which is suitable for day-to-day use, and the Society is pleased to be able to offer this service to members only once again. The cost is £1 post paid, with an approximate two-week delivery period.

**December RAE**

The RSGB has again arranged an examination centre in London for the RAE to be held on Monday 1 December 1975 from 6.30pm to 9.30pm. Members of the RSGB wishing to sit the examination at this centre should forward payment of £4.25 to the RSGB before 22 October, which is the final date for entry. Non-RSGB members should forward £4.75.

All applications should be clearly addressed to Dept DAE-3, RSGB, 35 Doughty St, London WC1N 2AE. Acknowledgement of receipt of payment will be made immediately, followed by the examination number and venue details which will be forwarded during November.

**May RAE results**

Fifty-nine candidates took the RAE at the RSGB examination centre in May, and the Society is pleased to note that 74 per cent of them passed. Pass slips have already been sent out and certificates will follow.

**Amateur radio represented at astronomical exhibition**

The Newtonian Observatory Astronomical Society of Worthing celebrated its tenth anniversary with a Convention of Astronomers held on 26 July. More than 200 astronomers visited the convention during the day to see the exhibition of astronomical equipment and hear the lectures.

Ron and Joan Ham put on a display at the convention, consisting of a working "portable" solar radiotelescope, a typical vhf converter, a model of their radio observatory, and some samples of solar burst data. They also displayed two pictures of the Oscar 1 satellite accompanied by the

## RSGB Region 1 Regional Meeting

28 September 1975

Commencing 3pm

Woodlands Hotel, Wellington Road, Timperley,  
Altrincham, Cheshire.

Ample parking. Easy access from M56.  
Talk-in facility on 2m. Trade display.  
High tea available at £1.50 per head, which must be ordered  
and paid for in advance.

Names and remittances to G3SMM, 16 Coniston Avenue,  
Sale, Cheshire (tel 061-973 6676) at least one week before-  
hand.

telegram received by the RSGB from America on the day  
after it was launched. It surprised many of the visitors to  
know that the world of amateur radio was so well estab-  
lished in the satellite field.

In addition, Ron Ham gave a lecture on solar radio  
astronomy, illustrated by charts and tape recordings. He  
explained how solar radio waves were first discovered  
through the work of RSGB members in the mid 'thirties, and  
he went on to explain the Society's interest in the propagation  
of radio signals via aurora.

### Oscar construction group

Members who would be interested in participating in the  
construction work for future amateur satellites are asked to  
contact David Walland, c/o G3UEA, QTHR. The type of  
work in which they would be able to participate should be  
indicated.

### "Ham Radio Magazine"

Will subscribers to *HRM* please note that due to the heavy  
postage costs only one reminder of expiry will be sent in  
future. Members are reminded of the economical three-year  
subscription to *HRM* which, at the present rate of exchange,  
is £11.50. This includes delivery by air. Subscriptions should  
be sent to Ham Radio UK, PO Box 63, Harrow, Middlesex  
HA3 6HS, and not to RSGB HQ.

### NZART Golden Jubilee

To mark the 50th anniversary of the New Zealand Associa-  
tion of Radio Transmitters, a conference will be held in  
Auckland, New Zealand, from 4 to 12 June 1976, to which  
amateurs from all over the world are invited. Information  
about the conference can be obtained from: Auckland  
Branch OZ, NZART, PO Box 6597, Auckland, New  
Zealand.

Mr B. W. Rous, G3RHL/ZLIACX, 8 Green Dell, St  
Stephens, Canterbury, Kent CT2 7BU, has been requested  
by NZART to assist amateurs who intend to attend the  
conference with information on travel to and in New Zea-  
land. Requests for information should include full details  
and numbers of the intended visitors.

## 2nd Welsh Amateur Radio Convention

1000-1900, 28 September 1975

Oakdale Community Centre  
Nr Blackwood, Gwent

### PROGRAMME

- 0930 Talk-in commences. GW6GW on 145.5, 145.55,  
145.0MHz fm; GB3BC/R6
- 1100 Official opening by Mr C. H. Parsons, GW8NP,  
President of RSGB
- 1410 Lecture—Two to Bermuda by G3HCT and G3LNS
- Lecture stream A  
1545 Measurement of aerial performance  
Roy Powers, G8CKN
- Lecture stream B  
D Expedition to Kingman  
Reef by Northern  
California SX Club—  
KP6KR
- 1645 Slow scan television  
Grant Dixon
- D Expedition to Spratly  
Island—1S1A
- 1730 — Southern Asia DX Tour,  
1972
- 1830 Results of raffles

RSGB bookstall Raffles Trade exhibition  
SSTV/CCTV display Bring and buy stall

Admission... 50p at door

Further information from S. W. Rees, 10 Tudor Crescent,  
High Cross, Newport, Gwent NP1 9BS. Tel 063-343 4374

### Southampton RSGB Group Convention cancelled

Due to limited support and a clash of date with another  
event, the convention which the Southampton RSGB Group  
intended to hold on 21 September has been cancelled.

## Scottish VHF Convention

13 September 1975

Treetops Hotel, Aberdeen

A full programme of interest to all amateurs has been  
arranged. Speakers will include GM3ZBE, G3FZL, G3DAH,  
GM3OXX and GM3DXJ.

RSGB bookstall Trade stands  
Bring and buy stand

### TICKETS

Convention only... 50p Convention and dinner... £3  
Obtainable from GM8FFX or GM4BKV, please enclose a  
stamped addressed envelope.

# Subjective selectivity and stereocode

by F. CHARMAN, G6CJ,\* and R. HARRIS, G3OTK

**T**HIS article introduces a device which may help in sifting out a wanted signal which is buried in interference and noise. The principle is to process the audio output of the receiver into a stereo type of presentation, so that the ears may be used more effectively to assist concentration.

It should be made clear at the outset that what is offered applies only to morse code reception: the problem has been solved for this case but speech is much more difficult to process in a similar way. Both aspects of the scheme have been discussed recently [1, 2].

The article is in two parts. The first part considers the philosophy of selectivity; the second part the practical details of the stereocode processor.

## SELECTIVITY

Radio signals are not usually "loud and clear", particularly in the hf bands where they are mixed with interference of many sorts—the white-noise murmurs of nature, the more coloured noise, atmospheric and man-made, and a whole crowd of competing signals, many with quite a wide spectrum. In amateur radio it happens very often that the wanted signal is weak, distorted and "buried in the third layer".

The operator tries to separate out this signal and translate it into a message. He applies selectivity in two stages—first in the *machine*, the part of the system ahead of his ears; second, in the part which will be referred to as the *operator*. This latter stage entails hearing, processing, perceiving and finally responding so that the "moving finger writes". The two parts may be termed "machine selectivity" and "subjective selectivity" respectively.

### The machine

The machine is nowadays quite sophisticated and well understood but a little discussion will help the later consideration of the operator, a complex and not well-understood subject.

Aerials can be constructed to help "bring out" the wanted signal, provided it is known what is wanted, but the bulk of the work of providing machine selectivity falls on the receiver. Its main feature is a reduction of the bandwidth to the limit imposed by the signal characteristics, in order to enhance the signal/noise ratio (noise in this context including all unwanted inputs). If the wanted signal is good (T9), then the limit is set by signalling speed, about 100Hz for hand sending. Such a narrow channel is quite unpleasant to listen through because the noise, white or pulse, sharpens up to a tiring continuous note, and even at slow speeds the signal develops "ringing" at the same frequency as a result of shock excitation of the sharp resonance. If the band is reduced

below the speed minimum, the signal becomes blurred and unreadable. This effect is quite independent of how the narrow channel is built up in the receiver.

If the wanted signal has a "bad note" (a wide spectrum), then narrowing the passband reduces the total energy available and decreases the signal along with the noise. The bad spectrum may not be the sender's fault. The signal may be quite good when it starts on its journey, but it may then suffer distortion, mutilation and modulation en route as a result of poor propagation, and the same consideration then applies. In the limit, when the signal is down in the noise level and fading in and out, the s/n ratio can again no longer be improved by band limiting. The signal is now modulated by noise and the narrow band makes the noise particles more objectionable than when a wider band is used. In such circumstances, nothing more can be done except to collect more samples of the signal by other paths, in which case coherent detection can be used with advantage.

Coherent detection works as follows. When one talks about the signal voltage at the detector, it is implied that it is an alternating voltage and the measure is a reference, peak or rms. Noise is a random process, however, and voltage cannot be defined in this way; it can only be defined in terms of its long-time average rate of energy flow. Therefore, when noise and signal are combined at a detector only their energy can be added. On the other hand, if two similar ac signals in phase are applied to a detector, the voltage is doubled and the energy quadrupled. Thus the effect of adding two like signals, each with its own quota of noise, is to double the noise power but quadruple the signal power, a s/n improvement of 3dB. With  $n$  signals coherently detected, the improvement, measured in decibels, is  $10\log_{10} n$ . In practice, this theoretical ratio is not maintained, due to signal instabilities and instrumental limitations. Nevertheless, coherent systems are widely used and radio astronomers are able to extract information from 30dB or more below noise level.

### The operator

The operator cannot be discussed as precisely as the machine. The "mechanical" working of his receptors, ears, eyes, etc., is well explored and fairly well understood, and the parts of the brain which deal with their outputs well mapped, but between the receptors and the final consciousness, or perception, there is a vast network with millions of branches and a high density of feedback. The trouble with compound feedback systems, even the relatively simple electronic ones that can be made, is that when they are probed to find out how they work or do not work the feedback removes the effect of the probing. This is the psychologist's big difficulty. It may be that it will never be known how it all works and possibly it is better that way. On the other hand, the inputs and the resulting outputs can be observed, thus turning the

\* The Firs, Hunger Hill, East Stour, Gillingham, Dorset.

brain into a "black box" for which equivalent circuits can be drawn to fit the observations [3, 4]. Similarly, the facility of discussing neurological processes in the language of electronic communication can be used in this article.

Perhaps the reader is an expert operator or possibly he has sat in with one and watched him extract a message from out of a mess in which other people could barely discover the signal he was copying. The operator learned to do it, and somewhere in his head there were processes at work which far transcended anything which could be wired in front of his earphones. Furthermore, if the reader can do such things himself, he must have noted that the cerebral filters are sharper than those of the receiver but do not ring in the same way. Does the brain defeat the laws of communication as they are known? In such cases the answer usually turns out to be "no"; the brain is more clever than machinery.

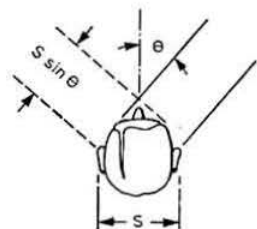


Fig 1. Directional hearing

Consider some of the things the listener may do to extract the message. There are many characteristics of the signal and the spectrum about it which can be, and undoubtedly are, used:

1. The rhythm of the signal; it may be mutilated by propagation or by interference but if the sending is precise then the missing dots or broken dashes can be filled in by the operator because he is "looking" between the pieces and is thus following the pattern.

2. He may know the sender and his fist, and then he can not only "lock on" to the morse characteristics but he also knows the kind of things the sender would say or how he would say them. This kind of "maximum likelihood" estimation may be hazardous but it is better than nothing and it is a typical process both in the brain and in high-resolution radar.

3. There may be garbled or missing words as the text proceeds. His knowledge of the language and its redundancy helps him to determine the errors or missing words. In order to do this, he must set up a circulating loop in the head so that he can "look" up and down the line of signal characters and think about them while still keeping in step with the moving message. This is another typical brain process and the word "look" is significant.

4. He may set up some kind of filter in the hearing mechanism which enables him to reject (inhibit) the interference. There is evidence that such processes occur; the unwanted spectrum is sampled in separate channels and its result used to inhibit its effect on the wanted signal. The effectiveness depends, of course, on the intensity and importance of the interference. If an SOS or rare dx came up among it, he might push the wanted signal into a loop while he examined the intruder.

5. One of the most important processes is the formation of a visual image of the signal and the spectrum about it. Many,

if not all, operators are known to do this. The signal spectrum is seen in the mind's eye against the background of the tuning dial, the loudest signals being in the foreground, the weaker ones more distant. The background noise is the misty horizon or stormy patches, with the little signals floating in and out of view. Moreover, all this is spread out frequency-wise in an image of the tuning dial or of a slice of the band in use. One literally looks at the signals and sees anything from nymphs to ogres.

## Hearing and perception

The physical processes of hearing, seeing, etc are now well understood up to the point where the resulting nerve pulses are transmitted round the brain. However, nothing is perceived until these signals have been processed, analysed, and hawked round the store of past experience. Then, for example, sounds may be perceived in relation to visual memories. That picture of "dx land" which floats over the tuning scale of the receiver has always been very real to this author. Stereocode is intended to reinforce that picture. It may be, of course, that some people (for example, a blind operator) have another type of reaction and it will be important to know if the system helps them.

Copying morse code is a typical psychologist's S-O-R process (stimulus, operator, response). Here, S is the signal, O the operator's brain, processing, sending orders via the motor centres for R, writing it down. The landline operator of olden days was on the job all and every day and it was an automatic process, just a machine, no memory, just S-R.

For most radio amateurs, however, there is an interest in the message and anyway not everyone is as good as all that, so the O carries into perception, producing memory, meaning and maybe emotion as well. One author can still recall the sound of the first amateur signals to reach this country from the antipodes, 50 years ago, such was the thrill they created.

There are many facets of hearing which would make interesting reading, but the wonder which concerns this present discussion is directional hearing or localization of sound. People have the ability to focus attention on one source of sound, in one spatial position, with interfering noise coming from all around; for example, a speaker on the other side of a noisy crowded room—the "cocktail-party effect".

The precision with which this can be done is remarkable and depends on the fact that the human body has two ears, spatially separated, receiving two input samples which are, in general, different. The differences include time of arrival (Fig 1), amplitude and other parameters such as the difference of spectrum and room echo which can be used in conjunction with a stored memory of the local topology. These characteristics are used to determine the direction of the required source and this can be done very accurately for small angles off centre and with decreasing accuracy up to about 60°. It usually results in the head being turned in order to bring in visual assistance but one can, if desired, not look but steer the hearing, just as the beam of an aerial array can be steered by phasing. However, if this steering without looking is tried, it will be found harder to "copy". It is as though a variable delay network in the hearing centre can be used for coherent detection or to produce an error voltage for steering the head and eyes. Many unconscious operations are carried out before the lock-on is obtained but, once done, the wanted inputs are coherent while the others are not and can more easily be ignored.



Whether this localization is done in terms of phase or time delay is still a matter of argument, but recent experiments in connection with stereo sound recording have shown that transient sounds such as the on-off step functions of morse code, for example, are very effective, thus favouring the delay theory. Above about 1kHz the ears are more than  $\frac{1}{2}\lambda$  apart and then, as with aerials, a phase detector would be confused by sidelobes but a delay detector would still function satisfactorily.

Apart from the delay effects, the amplitude differences are possibly just as important. The entrance to the ear is designed for sideways reception and in other directions there is an acoustic impedance mismatch, resulting in a loss to the further ear which may amount to 6dB. It may be that the amplitude difference is first used for wide-angle offset and that the delay is more important for fine discrimination in the forward direction.

## THE STEREOCODE PROCESSOR

### Basis of the stereocode system

If the audio output of a cw receiver is taken and split into two channels, one for each ear, and then delay and gain dispersion is inserted between the two, so that one ear receives the low frequencies earlier and louder than the other (and vice versa for the other side), then two of the most important features of directional hearing have been provided. In this way the audio spectrum is spread out so that the lower-frequency signals appear progressively displaced about a centre frequency to, say, the left, while the higher frequencies are spread to the right. This should bring into action the localization process of hearing to help focus on the signal "on centre" or to "look" up and down the bank of signals.

This turns out to be the case in practice. The localization can of course only take place within the head, for the "outside" source is obviously not there. The visual centres are, however, stimulated and the visual image of the signals definitely enhanced, to the extent that it is important to connect the headphones so as to match the movement of the tuning dial of the receiver.

### Value of stereocode

How much help can this system be expected to give in the reading of signals in QRM? Well, one must not be too optimistic, as only one more facility has been added to all the gadgets on the receiver, albeit a powerful one. Earlier in this article a number of other features of the operator were listed which are cerebral processes independent of binaural hearing, and perhaps too much should not be expected. On the other hand, unless the bandwidth of the receiver must be closed down to prevent blocking by large extraneous signals, it may be that this bandwidth can be traded for more comfortable working and this has an important bearing on the subject of fatigue, especially in such extended activities as contest operating. The direct value of the localization effect can be measured in terms of error counts but the value of wider-band operation compared with listening for hours through a narrow ringing channel can only be determined by a great deal of tedious work.

### Figures

Before discussing the circuit details, some figures about the ears will be useful. They are about 150mm apart. In round figures sound in air travels this distance in about 500 $\mu$ s.

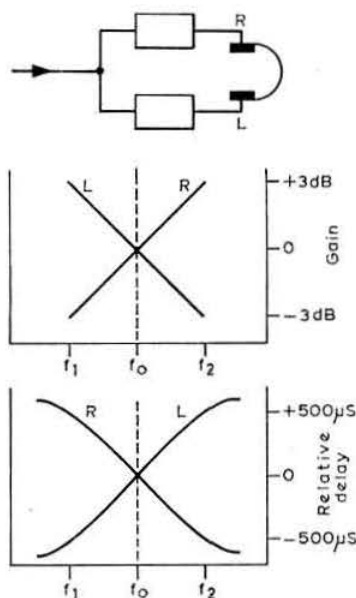


Fig 2. Gain and delay dispersion

Hence, in Fig 1 sound coming from hard right will reach the right ear about 500 $\mu$ s sooner than the left. It has been found that an average subject can discriminate between the directions of clicks about the forward direction down to 3° apart or less, which corresponds to a time delay difference of less than 30 $\mu$ s or a path difference of about 10mm. It does this best for frequencies between 500 and 1,000Hz. Moving away from the forward direction, the sensitivity falls roughly as the cosine of the angle. This is truly remarkable performance for a communication system based on blocking oscillators with a relaxation time which is normally about 1ms.

### Specification

The instrument must split the input into two channels, one for each ear, and between the two outputs it must provide delay and amplitude dispersion matched to those of normal hearing (Fig 2). Thus, over a given passband it must give identical signal outputs at the mid-frequency and  $\pm 500\mu$ s  $\pm 6$ dB at the edges.

The working passband should be narrow enough to give a good rate of dispersion, but not so narrow as to spoil the display with narrow-band distortion. Also, the provision of the required dispersion becomes progressively more difficult as the band is reduced. On the basis of earlier work it has been found satisfactory to use a middle frequency of about 700Hz (musical F), which is a comfortable tone, and a working band of about one octave from 500 to 1,000Hz. This band is compatible with the sharp filter of most modern receivers, provided the bfo can be adjusted to 700Hz on the peak of the passband. It is not essential to introduce the sharp filter except when it is needed to limit overloading, since the signals outside the working band appear to pile up at either end of the "picture".

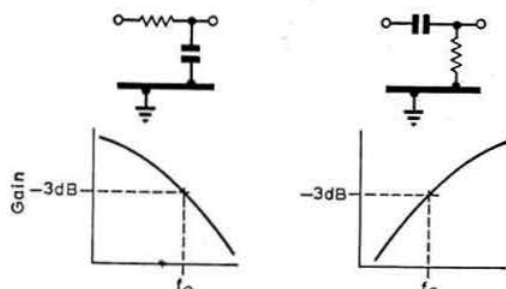


Fig 3. Networks for gain dispersion

The headphones should be reasonably matched and flat across the band—for example, a pair of stereo headphones. The old tinplate-diaphragm headphones are liable to have confusing resonances and delays.

## Networks

It is best to separate the gain and delay processes into separate circuits, using CR potentiometers for gain dispersion and constant-gain all-pass networks for delay. For the former, two pairs like those of Fig 3, with the 3dB loss point at mid-frequency, will nicely provide  $\pm 6$ dB across the octave band. The two types, high- and low-pass, have identical delay curves and do not contribute to delay dispersion.

## Delay

Delay is the time it takes for the envelope of a wave, ie the information, to pass through a given circuit. It should not be confused with phase because it concerns what happens to the envelope rather than the oscillations on which it is carried. Delay is in fact equal to the rate of change of phase between input and output, the phase slope.

In a good rf cable the phase is linearly proportional to frequency, its slope is constant and therefore the time of transmission is the same for all frequencies; it is a distortionless network. In all CR and LCR networks, however,

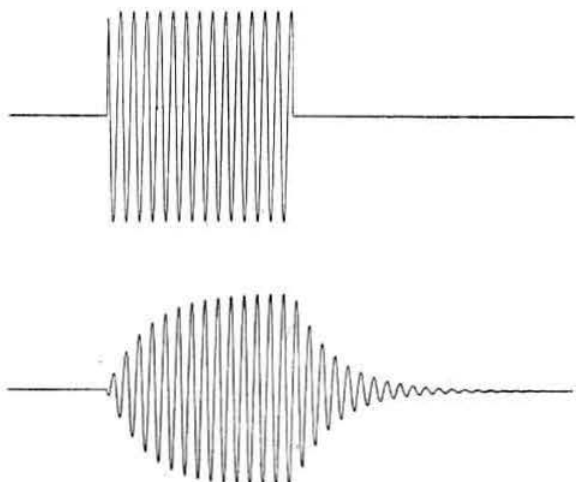


Fig 4. Illustrating delay. Upper curve is the input, lower curve is the output from a circuit with  $Q = 10$

the phase rate, and hence the delay, varies with frequency, so that transient phenomena comprising a spectrum of frequencies suffer distortion because the component frequencies arrive at different times.

In a high- $Q$  resonant circuit, a step- or pulse-modulated carrier well off resonance will pass through weakly, but quickly and not badly distorted. At the resonant frequency, however, it will be heavily delayed because the "flywheel" of the circuit must be "spun up" and this takes a time equal to  $Q/\pi$  cycles of the carrier. It takes a similar time to "unwind" and thus the distortion is considerable. Fig 4 shows the effect on a morse-code modulated audio note passing through a resonant circuit with a  $Q$  of 10. Note that the delay is about three cycles of carrier but the phase measurement would be small. The build-up and decay are exponential, so the reference point is the exponential average of about 0.6 of full amplitude. The delays in the stereocode system are much less and the distortion small.

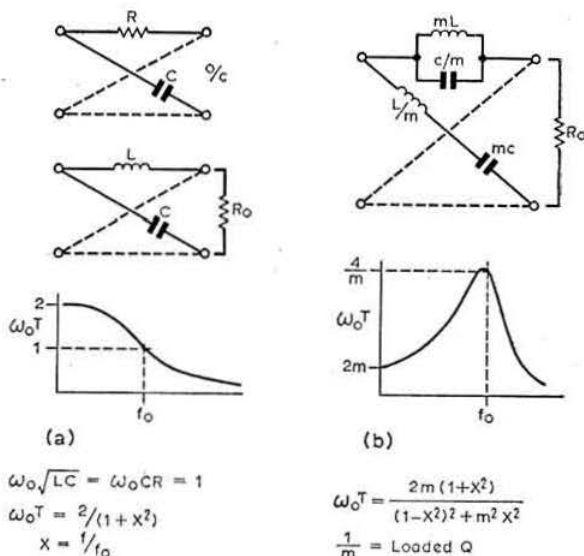
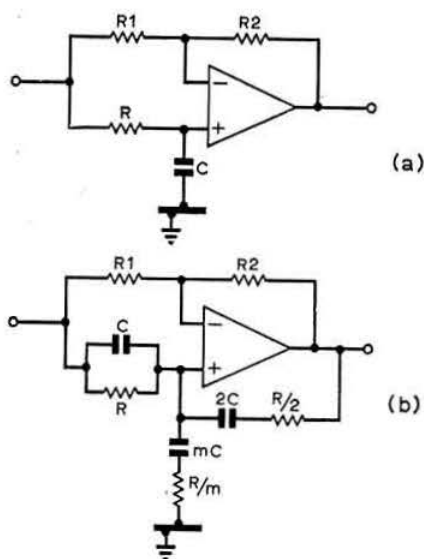


Fig 5. First-order (a) and second-order (b) all-pass networks and their normalized delay curves. Unbalanced equivalents can be derived from these lattice sections. Delay  $\omega_0 T$  is normalized in units of  $1/2\pi f_0$  ( $= CR$ ) seconds. If  $f_0 = 700$ Hz,  $\omega_0 T = 1$  corresponds to 0.23ms

## Delay networks

Fig 5 shows some all-pass networks and their delay characteristics. The first-order networks have a delay which falls with rising frequency and are therefore suitable for the channel marked R in Fig 2, which gives a lead to the higher frequencies. In channel L a rising delay curve is needed, and this can only be obtained by means of the more complex second-order networks. It will, however, be seen that the shape of the curve can be altered by varying the damping factor  $m$ , while the first-order curves have a fixed shape.

The delay at 700Hz must be at least 500 $\mu$ s in order to obtain a delay shift of 1ms across the band 500 to 1,000Hz, and to allow for curvature three first-order sections are needed. The other channel is matched up to equal delay at 700Hz with a suitable choice of  $m$  and  $f_0$  for the second-order



**Fig 6. First-order (a) and second-order (b) all-pass networks using operational amplifiers**

sections and again three are necessary. Earlier models of the processor [5] used six CR sections in channel R, matched by an eight-section LC low-pass filter in the other. It was a difficult and expensive design. Nowadays, with the advent of high-performance operational amplifiers, it is possible to build networks using CR only in which the inductance is simulated by feedback.

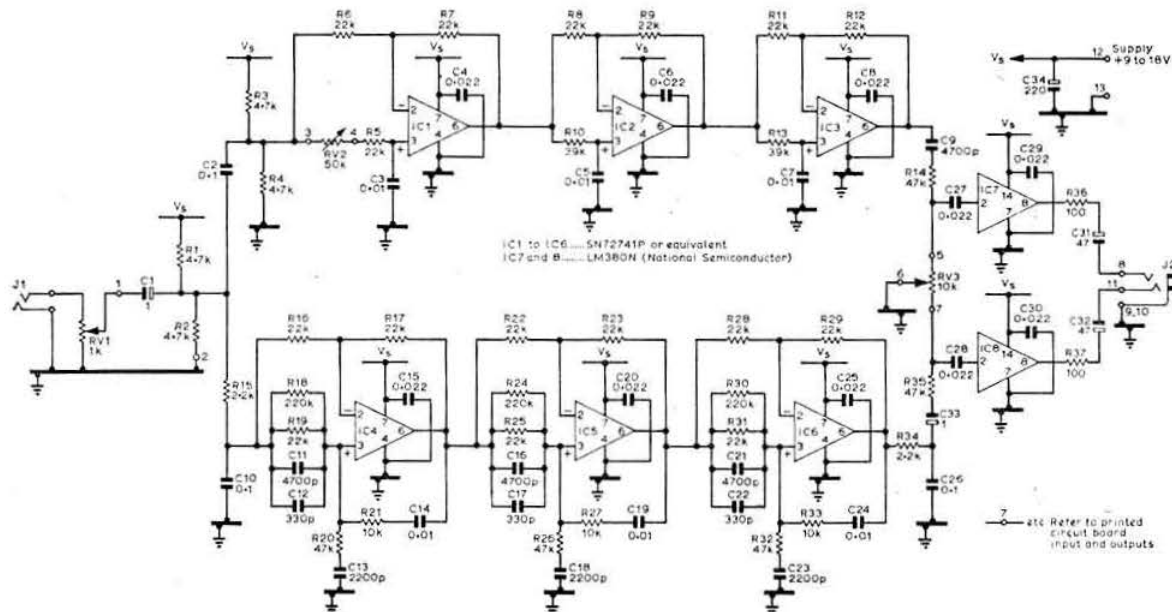
Fig 6 shows the two circuits used. In these R1 and R2 control the gain to unity, which is important, and they should

therefore be matched pairs though their actual value is not critical. In either, the product  $CR$  determines  $f_0$ . The second-order circuit is sensitive to the balance of  $R_1$  and  $R_2$ , and also to the admittance ratio of the two series arms, which must be exactly 2:1. The shunt arm,  $mC$  and  $R/m$ , is not so critical. The effect of unbalance is to cause unstable gain at  $f_0$ .

In the stereocode system, the first-order circuits are based on 400Hz, two being fixed and one being variable in order to give a control for delay balance at mid-band. The second-order circuits resonate at 1,600Hz with an  $m$  value of about 0.5. With this high damping value of  $m$ , the circuit is quite reliable if the components are correct to value.

### Circuit and construction

The complete circuit is shown in Fig 7 and comprises three all-pass networks in each branch, using type 741P (8-pin) amplifiers followed by LM380 output stages. The high- and low-pass CR filters for shaping the frequency responses have been incorporated in the bias components and the potentiometers feeding the output amplifiers. RV1 controls the common gain while RV3 adjusts the differential gain for balance at mid-band. RV2 trims the delay balance at mid-frequency. The unit operates satisfactorily from a single-ended supply between 9 and 18V and will drive stereo headphones of a wide range of impedances. The circuit has been analysed for statistical variations in component values within given tolerances (Monte Carlo analysis) and the second-order all-pass filters found to be sensitive to component values as given above, particularly at 1,600Hz. It is strongly recommended that only components of the types specified in the component list should be used. Full-scale pcb and layout are given in Figs 8 and 9 and, while the layout is not critical, every effort should be made to ensure that the 0.022 $\mu$ F ceramic decoupling capacitors are as close as possible to the supply pins of the



**Fig 7. Complete circuit. J1, J2, RV1, RV2, and RV3 are external to pcb. The pcb connections are numbered**

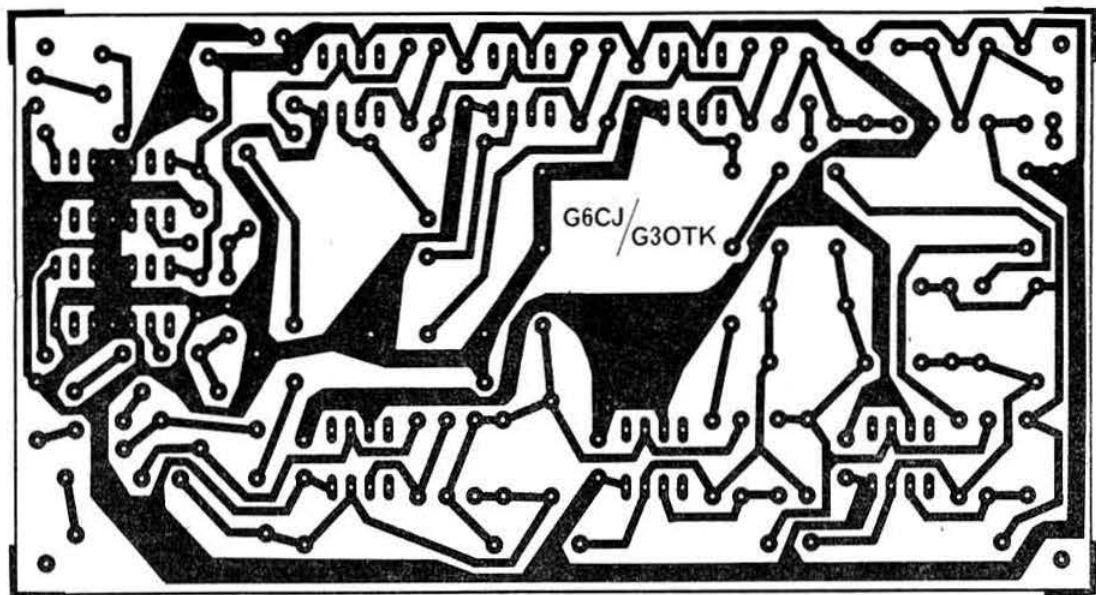


Fig 8. Printed circuit board, copper side, full scale

ics if an alternative layout is contemplated. With the exception of the LM380 power amplifiers, all components and a suitable enclosure are available from a single source.

#### Testing

After visual inspection of the pcb assembly to check the orientation of the electrolytic capacitors and the ics, a supply between 9 and 18V can be applied. The dc bias of each ic can be checked by measuring its quiescent output

voltage (pin 6), which should be close to half the supply voltage.

If all is correct and the components are all in the right places, it will probably work but the amplitude and delay characteristics may need to be checked. This requires an accurately-calibrated audio source, an ac millivoltmeter and a phasemeter. While most amateurs will have access to the first two instruments, phasemeters are not freely available and so a simple "sum and difference" phasemeter has been

Four corner fixing holes are  $\frac{1}{8}$ " dia (3.2mm) — all other holes are No 67 drill

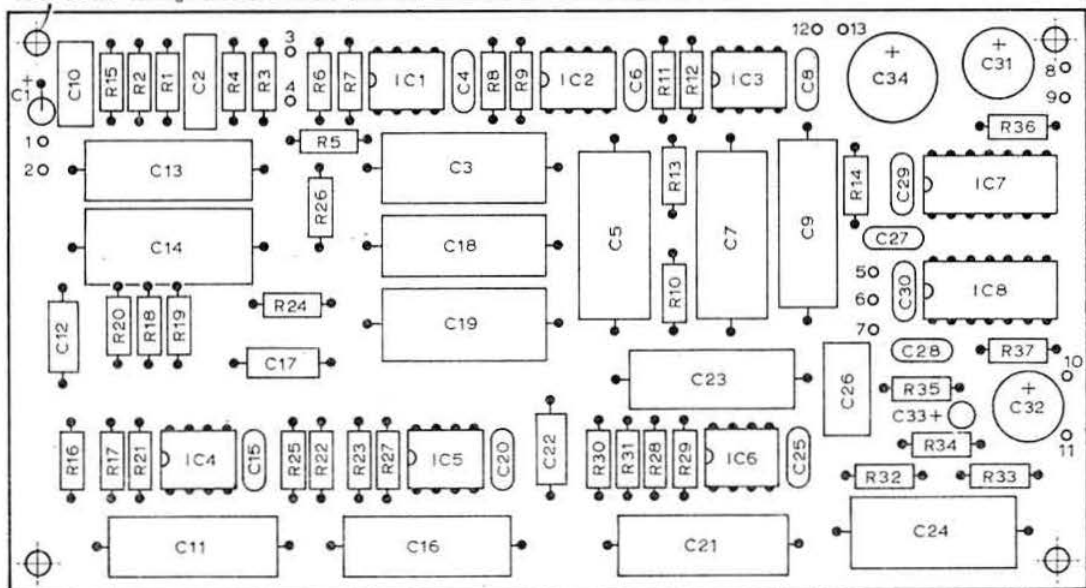


Fig 9. Component layout, plain side



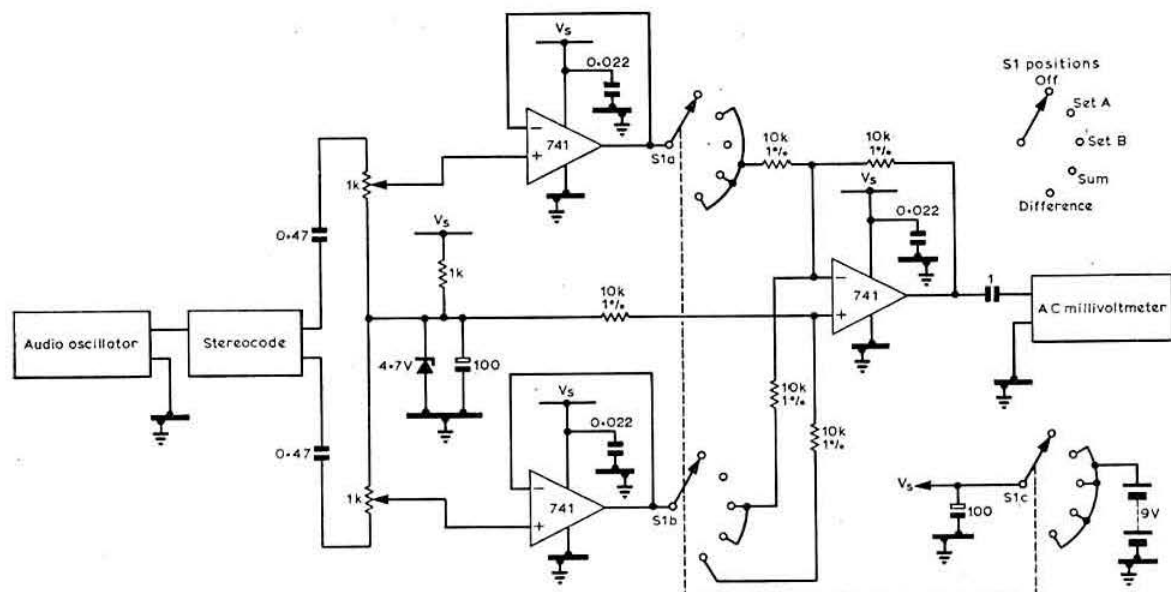


Fig 10. Two-channel phase detector and measuring set-up

designed to make the measurements. The measurement set-up is shown in Fig 10. An input level of about 1V is suitable and at each frequency the amplitudes of the two channels are equalized by selecting SET A and SET B in turn and adjusting the corresponding gain control. The vector sum and difference are then measured by selecting the appropriate switch position, and the phase difference  $\phi$  found from

$$\phi = 2 \tan^{-1}(\text{diff}/\text{sum})$$

Care must be taken in the interpretation of the quadrant in which the phase lies. If in doubt, an intermediate point should be taken. A typical phase plot is shown in Fig 11 together with the delay deduced from it. The delay in milliseconds at any frequency can be found by measuring the slope of the phase plot over, say, 100Hz in degrees per hertz and multiplying the result by 2.78.

The amplitude response of each channel can be taken by switching to SET A or SET B in turn and recording the output

for constant input. Fig 12 is typical, and note that the cross-over point depends on the setting of the gain balance control. A peak or dip of more than about 3dB at 1.6kHz in the second-order branch indicates component error in that branch.

### Using the stereocode processor

All being well, connect the processor to the headphone output of the receiver and set up a good steady tone of between 700 and 800Hz, using, for example, the crystal calibrator in the receiver. The bfo should be adjusted so that this occurs at the centre of the receiver passband.

Now, using one ear at a time, adjust the gain balance until the sound appears equally loud in either ear. This is necessary because the reader's ears may not be alike, and this operation should really be carried out each time he goes on the air. The next step is to set up the delay equality

### Components list for processor

R1, R2, R3, R4	4.7k $\Omega$
R5, R6, R7, R8, R9, R11, R12, R16, R17, R19, R22, R23, R25, R28, R29, R31	22k $\Omega$ $\pm$ 2 per cent thick film, metal film or metal oxide
R10, R13	39k $\Omega$
R14, R20, R26, R32, R35	47k $\Omega$
R15, R34	2.2k $\Omega$
R18, R24, R30	220k $\Omega$
R21, R27, R33	10k $\Omega$ $\pm$ 2 per cent thick film, metal film or metal oxide
R36, R37	100 $\Omega$
All resistors $\pm$ 5 per cent 0.25W carbon film unless otherwise stated	
RV1	1k $\Omega$ linear
RV2	50k $\Omega$ linear
RV3	10k $\Omega$ linear

C1, C33	1 $\mu$ F 35V bead resin tantalum
C2, C10, C26	0.1 $\mu$ F 250V polyester $\pm$ 20 per cent
C3, C5, C7, C14, C19, C24	10,000pF 160V 2 $\frac{1}{2}$ per cent polystyrene

C4, C6, C8, C15, C20, C25, C27, C28, C29, C30	0.022 $\mu$ F 18V miniature disc ceramic
C9, C11, C16, C21	4,700pF 160V 2 $\frac{1}{2}$ per cent polystyrene
C12, C17, C22	330pF 160V 2 $\frac{1}{2}$ per cent polystyrene
C13, C18, C23	2,200pF 160V 2 $\frac{1}{2}$ per cent polystyrene
C31, C32	47 $\mu$ F 40V single-ended pc mounting
C34	220 $\mu$ F 40V single-ended pc mounting
IC1 to IC6	SN72741P or equivalent
IC7, IC8	LM380N (National Semiconductor)
J1	2-pole jack socket
J2	3-pole jack socket
Enclosure	RS Components instrument case Type 11

All the above components, can be obtained from the Amateur Radio Bulk Buying Group. With the exception of IC7 and IC8, they can also be obtained from RS Components Ltd, or Doran Electronics Ltd.

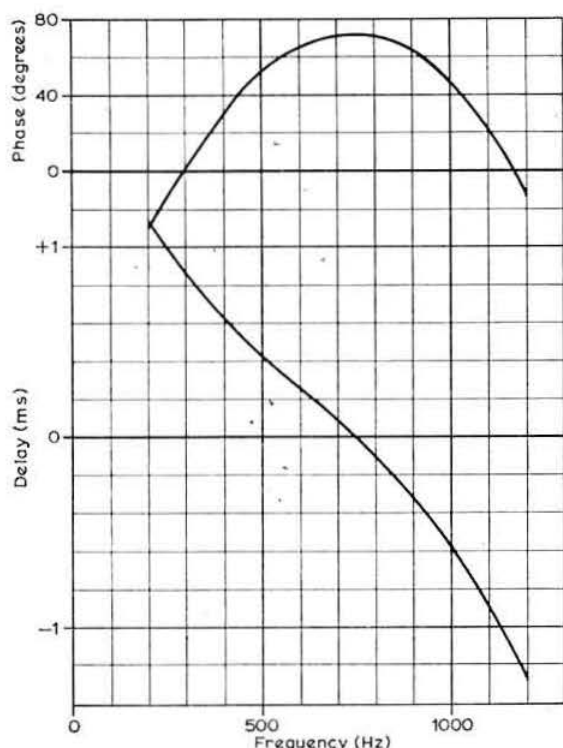


Fig 11. Typical measured phase response and resulting delay curve

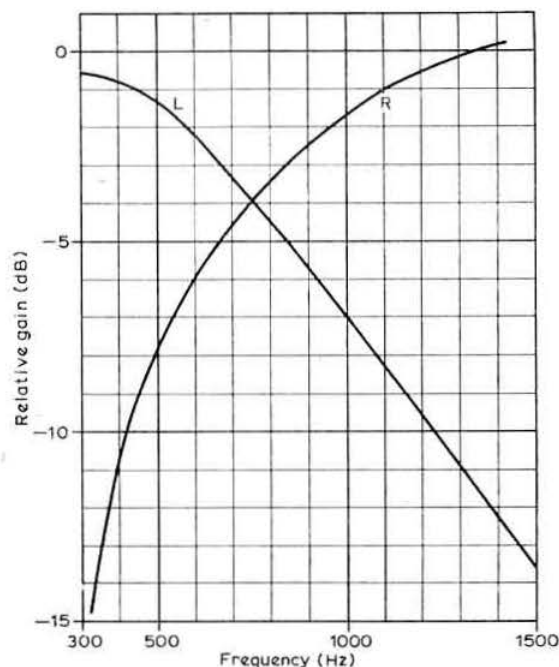


Fig 12. Typical measured gain curves

at mid-frequency. Tune in a good clean 850Hz fsk signal and set it at the centre frequency. Adjust the delay control until the two parts of the signal appear to be separated "in the head".

The processor is now ready to be tested on the air. It should be found that as the receiver is tuned, the signals will "walk" across the listener's inner head or visual image, and to match this to the tuning scale it is advisable to try the headphones the other way round, adjusting the gain balance if necessary.

Too much should not be expected initially. Remember neurological processes are being dealt with which are but poorly understood, and the brain is being given a new experience; it may have to learn. The best thing to do is to leave the processor in circuit, forget all about it and use it for a few days. Then go back to mono and notice how dead it sounds.

## References

- [1] *Amateur radio techniques*, J. P. Hawker, 5th ed, RSGB, p102.
- [2] "Technical Topics", *Radio Communication* August 1973, p548; October 1973, p694; April 1974, p237.
- [3] "The stereophonic recording and reproducing system," H. A. M. Clark, G. F. Dutton, P. B. Vanderlyn, *Proc IEE* Vol 104B, p417, 1957.
- [4] "Mechanism of binaural fusion in the hearing of speech", B. Mc A. Sayers, E. C. Cherry, *J Acoust Soc Amer* September 1957.
- [5] *UK Patent* 916843, F. J. Charman and EMI Ltd.

## Further reading

*The nervous system*, Peter Nathan, Penguin Books, 1973.  
*On the sensations of tone*, Hermann Helmholtz (1885), Dover, 1954. □

# BOOK REVIEWS

*Radio construction for amateurs* by R. H. Warring. 120 pages. 215 by 138mm (8½ by 5½in). Published by Pitman Publishing Ltd. Price £2.50 (casebound).

This book is intended for the beginner to radio construction and provides descriptions of components and details of the construction of simple amplifiers and receivers. The chapters on components and circuit construction appear after details of how to build superhet receivers, which may be thought strange. Constructional details of a number of the equipments are sparse, and a beginner could well be confused. Coil details for some of the receivers are considered to be insufficient.

The book could be useful to those taking the RAE for the first time but its application is limited.

*Principles of transistor circuits* by S. W. Amos, BSc, CEng, MIEE. 320 pages. 215 by 136mm (8½ by 5½in). Published by Newnes-Butterworths. Price £3.20 (limp bound).

This is the fifth edition of a book first published in 1959, and one that is regarded as a standard reference in its field. The latest edition contains additional information on FETs and digital equipment, and dated text has been eliminated. The book deals with semiconductor physics and the design of transistors, amplifiers, receivers, oscillators and generators. Text and diagrams are clear and there is an adequate index.

A book that will undoubtedly find its way to the collections of many radio amateurs and professional engineers.

# 2m ssb transmitter using the FR400SDX vfo

by H. L. GIBSON, CEng, MIEE, G8CGA\*

**O**PERATION in the 2m band has greatly changed in recent years, largely due to the widespread use of commercially-made ssb transceivers. The amateur who is unable or unwilling to acquire one of these rather expensive pieces of equipment finds himself with a decreasing number of stations with whom he can make contact using a.m. or fm, and must consider how to produce an adequate ssb signal at modest cost and without the need for elaborate test equipment. While the hf operator can fairly easily transvert from his hf transceiver, the vhf operator is in a more difficult position.

The only piece of commercial equipment in the author's station is the FR400SDX adopted as a means of receiving all modes properly, and it was decided to build a transmitter using the vfo of the receiver so as to obtain transceive operation. The same design could, however, be used with a separate vfo. Initial attempts based on a commercially-available pcb using discrete semiconductors produced unacceptable suppression of unwanted frequencies and a frightening ability to produce spurious emissions unrelated to the known frequencies. It is not suggested that satisfactory performance could not have been achieved but the author decided that reliably clean performance was too uncertain.

The present design was therefore adopted, using valves throughout; no claim is made for originality but it is believed that it can be built using no more than a dip/absorption wavemeter, a high-impedance rf voltmeter and a receiver—preferably the FR400SDX. An output of at least 6W p.e.p. is obtainable with a carrier suppression of about 56dB relative to p.e.p. and with other spurs more than adequately suppressed. Used as a drive source to a 4CX250B linear amplifier operating at 850V ht [1, 2], an output of more than 100W p.e.p. is obtained.

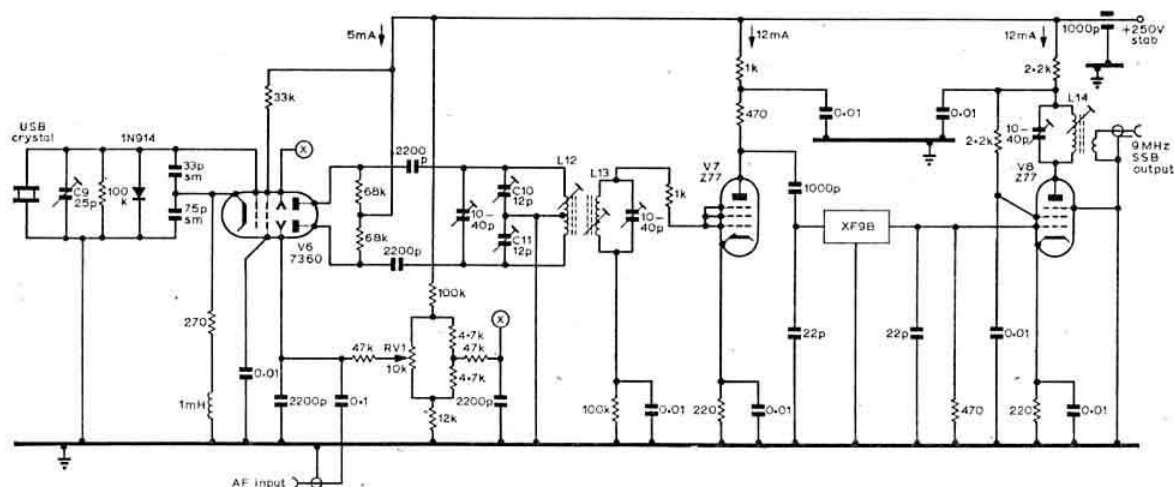
## Circuit description (Figs 1 and 2)

The sideband signal is generated in a balanced modulator using the 7360 beam-switching valve with a Z77 buffer amplifier on either side of the following XF9B crystal filter. An advantage of this system is that the carrier level is set by varying the dc voltage on one of the beam plates. This makes it possible to mount the controlling potentiometer remotely from the transmitter. The audio signal is superimposed on this voltage and it is a simple matter using a high-impedance voltmeter to measure the dc change from suppressed carrier to full p.e.p. output; this equals the peak audio signal required from the speech amplifier. The audio voltage is about 9V peak.

The 9MHz carrier oscillator requires no extra valve, the crystal being connected between grid and cathode of the 7360. A small variable capacitor (C9) across the crystal enables its frequency to be set at the correct point on the skirt of the filter passband. The tuning range is from 8.998600 to 8.998350MHz.

The rf signal is generated by a 70-200MHz overtone crystal using one section of an ECC88 double triode as oscillator and the other section as a frequency doubler. In order to transmit accurately on the receive frequency, this oscillator must be correct to better than 1kHz and the crystal should be specified accordingly in series resonance. Nevertheless, some adjustment is necessary and the frequency can be pulled slightly by adjustment of the anode tuned

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**Fig 1. The 9MHz ssb generator.** Note that the voltage across the 10kΩ carrier level potentiometer varies from 22V to 32V positive to earth. C9: JB type C804, 25pF; L12: 18 + 18t 30swg on 7.2mm dia former, close wound; L13: 22t 28swg on 7.2mm dia former, close wound; L14: As L13, coupling loop 2t at earthy end. These coils were originally supplied by Electroniques with the 10-40pF trimmers already mounted but any similar coils would be satisfactory. L12 was rewound. All have hf iron cores

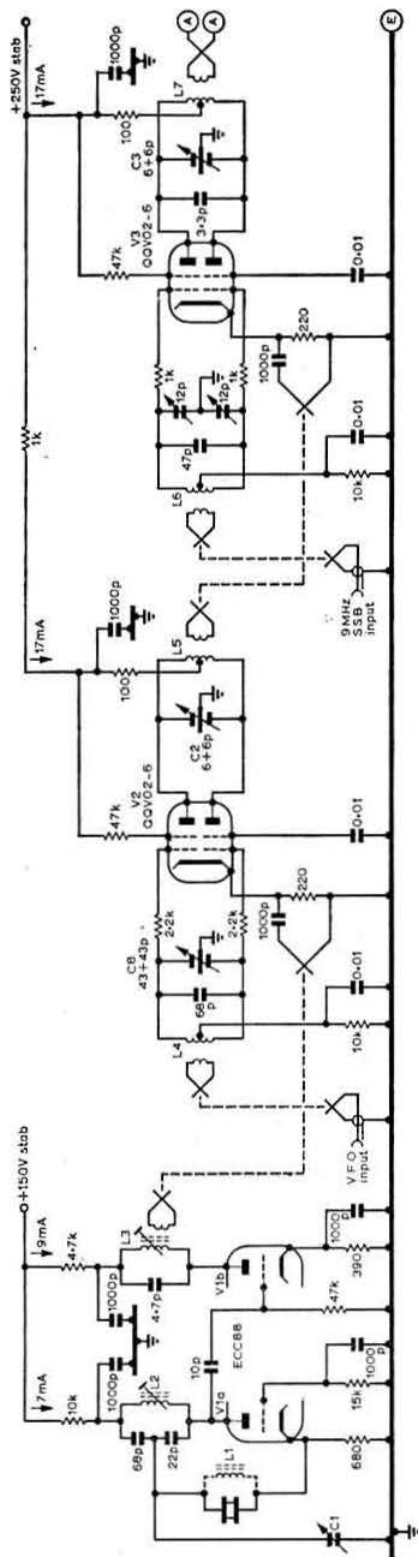
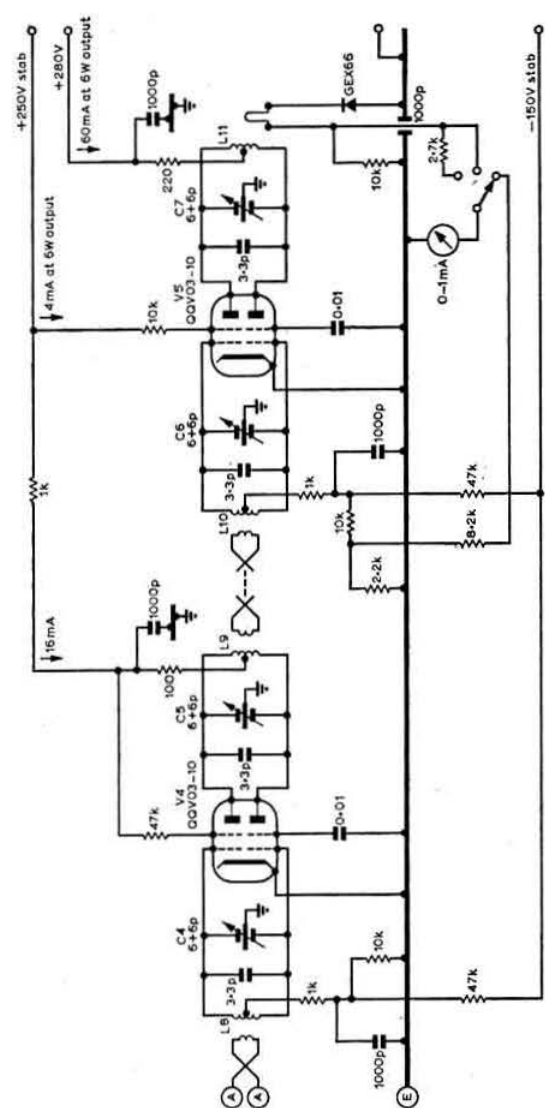


Fig 2. Circuit of rf generator, first and second mixers (top) and circuit of linear amplifier (bottom). C1: JB type C804 reduced to 1 rotor and 2 stators spacing 0.045in; C2-C7: JB butterfly type C714, 6 + 6pF; C8: JB type C808 43 + 43pF; L1: about 12k 28swg wound on dustcore, resonated to 70.2MHz with capacitance of crystal and holder; L2: 6t 28swg 1/4in dia former—Vhf dust core; L3: as L2 but 4t; L4: 30 + 30t 28swg on 1/4in former—no core; L5: 20 + 20t 28swg on 1/4in former—no core; L6: 20 + 20t 28swg on 1/4in former—no core; L7—L11: 6t 16swg wound on 6.5mm drill as former, spacing adjusted for resonance. Low-impedance coupling links all made from 1/0.024in plastic-covered wire as twisted pair. Coupling loops single turns except to L4 and L6 which were 2t



circuit. The inductance across the crystal, shown dotted in the circuit diagram, is intended to be resonated with the capacitance of the crystal and its holder so that feedback only occurs as a result of crystal activity and not merely due to the capacitance. This, however, is only a precaution and the circuit will normally be controlled by the crystal if this inductance is omitted. If the frequency cannot be pulled by the required amount with the crystal capacitance tuned out in this way, rather greater pulling can be achieved with the shunt inductance omitted. If this becomes necessary, careful checks should be made to ensure that the crystal is in control. The variable capacitance C1 is a front-panel control and will give a total range of adjustment of about 3kHz in transmit frequency. The ht supply to the oscillator must be carefully stabilized and must not vary as the anode current of the linear amplifier varies, as this would produce frequency modulation.

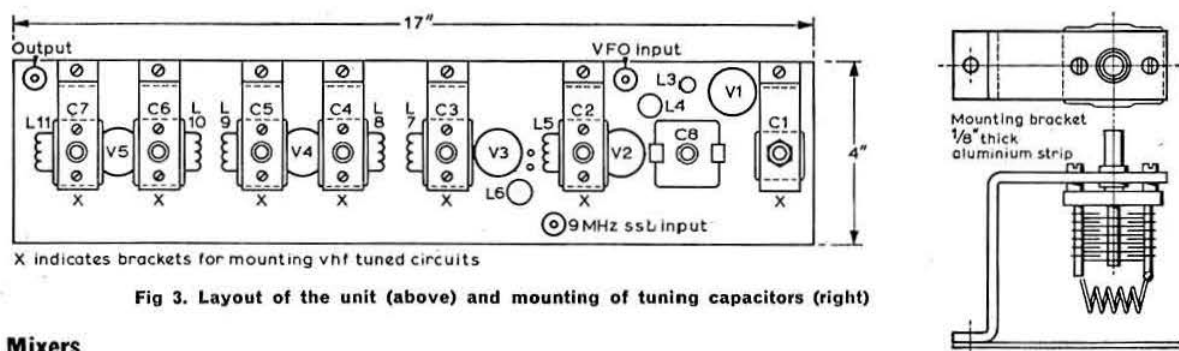


Fig 3. Layout of the unit (above) and mounting of tuning capacitors (right)

## Mixers

The two mixers are almost identical and consist of QQV02-6 double tetrodes, with the lower-frequency signal applied to the grids in push-pull and the higher-frequency signal applied across an un-bypassed cathode resistor. An alternative design which is sometimes published, in which the cathode signal is connected in series with a bypassed cathode resistor so that the dc cathode current passes through the coupling loop, was found to result in instability. Resistive grid stoppers are connected in all the mixer grid leads; these may be unnecessary, but slight instability was once observed showing up as a slight deterioration of carrier suppression and they were put in as a precaution. The low-impedance link between the anode tuned circuit of the frequency doubler and the cathode of the first mixer consists merely of a twisted length of 20swg plastic-covered wire with a single-turn loop at the anode end. Although the vfo output is brought out on the rear apron of the FR400SDX as a coaxial socket, it is at fairly high impedance and it might be worthwhile building a cathode or emitter follower into the receiver to convert to a lower impedance and to eliminate loading the vfo. However, satisfactory results have been obtained by inserting a 100pF capacitor in series with the lead to the output socket at the receiver. With this arrangement, no loss of receiver performance was observed even with a 36in length of coaxial cable between receiver and transmitter. It is necessary to have a front-panel tuning control to follow the 600kHz tuning range of the vfo; as the inductive limb of the tuned circuit has an rf centre tap to earth, it is undesirable that the capacitive limb should also impose an earth, but the spindle of the tuning control needs to be earthed to avoid hand-capacitance effects. A compromise has been adopted by making most of the tuning capacitance a fixed value directly across the inductance.

The push-pull anode tuned circuit of the first mixer is tuned to the difference frequency between the two inputs and thus tunes over 134.9 to 135.5MHz. A front-panel control is provided but can normally be left set at the mid-band position. It may be noted here that one of the unwanted frequencies that could cause trouble is the sum of the two input frequencies to this mixer, as these fall within the upper part of the 2m band. In fact, these products are just detectable on a receiver close to the transmitter but cannot be detected in the final output.

The second mixer has the 9MHz sideband signal applied to the push-pull grids and the output of the first mixer to the cathode by way of a twisted-pair link. No external tuning control is provided but the circuit is brought to resonance by a small split-stator capacitor. Again, most of the tuning capacitance consists of a fixed value directly across the inductance. The anode tuned circuit is physically the same as

that of the first mixer but tunes over the band 144.0 to 144.5MHz. The values used would be capable of tuning over the whole 2m band if required.

## Linear amplifiers

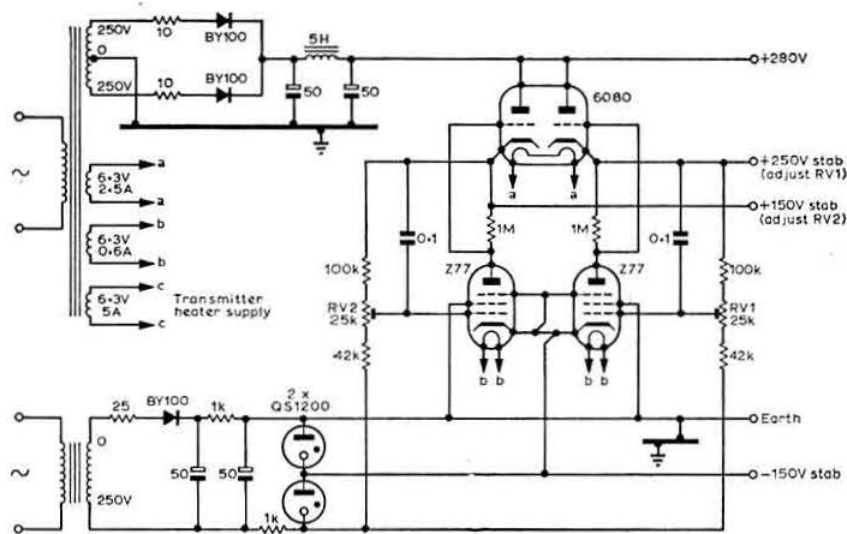
The following two stages use QQV03-10 double tetrodes operating with fixed grid bias. The first stage has a fairly low screen voltage and a bias of about -25V, resulting in an anode current of 16mA at 250V. This stage operates in Class A but could be biased further back if power economy were important. The second stage has a higher screen voltage and about -30V bias, which is adjusted for a no-signal anode current of 20mA. It is intended to operate in Class AB1 and at the start of grid current the anode current is 60mA and the power output 6W. Both of these stages have push-pull anode and grid circuits and are coupled by short links of twisted wire with a single-turn coil at each end. Metal screens are mounted across the valve-holders of both stages.

## Construction (Fig 3)

It is not proposed to give full details of the construction used because anyone attempting such a project will have their own ideas. The balanced modulator is built into one of the standard cast boxes measuring 4½ by 3½ by 2in and contains all the components shown in Fig 1. Care is needed to prevent rf from getting into the box and all external leads enter it via feed-through capacitors of 1,000pF. This also applies to the ingoing socket for audio and to the connections to the carrier-setting potentiometer if this is mounted externally. The remainder of the transmitter is built on an aluminium tray 17 by 4in with the long sides turned up at right-angles to a depth of ½in. The valve-holders are mounted more or less on the centre line of the chassis, while the tuning capacitors are mounted on brackets of ½in aluminium so that they are positioned closely above the appropriate valve-holder. The operating shafts of these capacitors project from the open side of the tray. This layout makes it very easy to work on the construction.

On completion, all the components are enclosed in a complete box formed by fitting a second tray with sides 2½in high over the turned-up edges of the chassis, the tuning controls just passing through the floor of the second tray. The ends are then closed in by pieces of aluminium, preferably bent down on all four sides. The whole is screwed together partly by 6BA screws into suitably-mounted hank bushes and partly by self-tapping screws. As the double tetrode valves cannot be fitted with screening cans without spoiling their





vhf performance, another tray, this time of perforated metal, is mounted over the valve side of the chassis, again with end plates which can well be of solid metal without impairing the ventilation. With adequate use of feed-through capacitors for all supply leads, very little rf can be detected outside this construction.

## Setting up

All the tuned circuits may be initially adjusted for frequency and tuning range with a dip oscillator. Owners of an FR400SDX fitted with a built-in 4m converter have a ready means of setting the 70-20MHz oscillator and can set it quite accurately onto frequency as well as ensuring that no fm occurs as a result of the varying power supply load on transmit. Others will need to set it as accurately as possible with an absorption wavemeter and leave the final adjustment until the transmit signal can be monitored on the receiver.

With the tuned circuits of the sideband generator tuned to a nominal 9MHz, and the carrier balance potentiometer set to one end of its travel, it should be possible to obtain power output at the final frequency and the tuned circuits finally adjusted. At this stage, the capacitor C9 should be at minimum so as to put the crystal oscillator nearer the passband of the filter. The balance potentiometer should then be set at its midway position and the tuning of L12 adjusted carefully for minimum output. A series of trial and error adjustments between the potentiometer and the tuned circuits should result in a carrier level difficult to detect. The variable capacitors C10 and C11, which consist of two 12pF piston-type trimmers mounted on the chassis, were fitted as a means of fine balance but it is doubtful if they make a useful contribution. L12 and L13 are wound on separate formers mounted with  $\frac{1}{2}$ in between centres; it is not certain that the coupling is optimum but it gives adequate results. The method adopted by the author to measure carrier suppression involved the use of a multi-range directional wattmeter (reflectometer) such as that described in [3].

With the carrier inserted by means of the potentiometer and using the 4CX250B linear amplifier, a mean output of 100W was set up. With the carrier suppressed it was possible to change the range of the wattmeter to 1W full scale, and

careful adjustment reduced the carrier to a just-perceptible deflection, estimated as 10mW. From this point downwards, the receiver S-meter was used as an indicator; by adjustment of the carrier oscillator frequency, a reduction of a further three S-points was obtained. There is little doubt that the degree of suppression is adequate even if means of making the final adjustments are not available.

With the transmit signal monitored on the receiver and a small amount of carrier inserted if necessary, the 70-20MHz oscillator frequency should be finally adjusted to give zero beat with the "clarifier" control in mid-position. Although this control may be used to take up small errors in frequency, it is required as an rit control and no more than 1kHz of its total range of some 6kHz should be used to correct transmit frequency errors. The stability of the whole transmitter is such that the transmit frequency is within the range of the "clarifier" control 30s after switch-on and within 200Hz of its long-term stable frequency 3min after switch-on.

## Metering

Constructors will have their own ideas about the metering required; apart from continuously metering the anode current of the final amplifier, the author has provided three switched meter positions. Two of these are derived from the diode loosely coupled to the rf output as a tuning aid. In one switch position the full output from the diode is indicated as an aid to setting the carrier suppression and in the other position the output is attenuated to give nearly f.s.d at peak power. The third meter position measures part of the dc bias of the final amplifier and is intended to show when the stage begins to draw grid current, as shown by a slight rise of bias on speech peaks.

## Power supplies

During testing, the author used a bench supply, the circuit of which is given in Fig 4. It would be quite suitable if a supply had to be constructed for the transmitter. The potentiometers controlling the stabilized voltages could, of course, be presets. The 150V stabilized supply is needed for the 70-2MHz oscillator and may also supply the multiplier. All other supplies are stabilized at 250V except for the anode

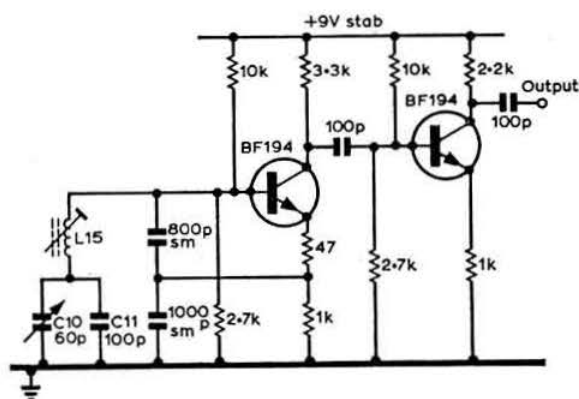


Fig 5. Suggested circuit for separate vfo covering the same range as the FR400SDX (4.9-5.4MHz). The construction would need to follow normal good practice for a vfo. C10: JB type C804, 60pF for 500kHz tuning range; C11: 100pF sm; L15: about 3µH. Values of C11 and L15 are to be adjusted to set the required tuning range

supply for the final amplifier. Send/receive switching was done by removing the 250V line from the two mixers, the first linear amplifier and the screen of the final linear amplifier.

### Use without the FR400SDX

As described, the transmitter will transceive with the FR400SDX over the range 144.0 to 144.5MHz, transmitting upper sideband only. For use with a different receiver, a separate vfo could be constructed. A suggested design which has been built but not fully developed is shown in Fig 5. In the form shown it tunes over the same range as the FR400SDX (4.9 to 5.4MHz) but this range could easily be extended by increasing the range of C10 and reducing the value of C11. The need for extremely rigid construction, a first-class dial mechanism and a power supply of excellent stability is well known.

### References

- [1] "A compact 150W amplifier for 144MHz", *Radio Communication* November 1970.
- [2] "A self-contained linear amplifier for 144MHz", *Radio Communication* February 1970.
- [3] *Test equipment for the radio amateur*, RSGB, p5.6. □

## GB3IOW — a 10GHz beacon

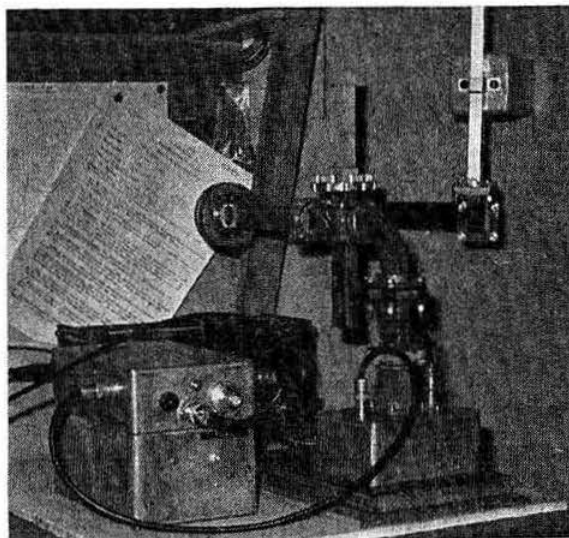
by A. WILLIAMS, G3KSU\*

THE Society's first 10GHz beacon was established at its permanent site on the Isle of Wight on 3 April 1975. Operating continuously on 10.100GHz, it has an rf output of 80mW to a horizontally-polarized omni-directional aerial with approximately 10dB gain in the vertical plane; that is an erp of 0.8W.

The beacon is located on St Catherine's Hill (QRA ZK34A, NGR SZ 494 772, approximately 12km south of Newport, IoW) at 800ft asl, and is housed within a small concrete building belonging to Pye Telecommunications Ltd. This building is located inside the shell of an unfinished lighthouse dating from 1785, the ruined walls of which rise to 20ft above the ground, providing a handy windbreak for the aerial mast and fixing points for the guy ropes. Apart from the generally good take-off, the beacon enjoys the advantages of a warm dry environment, a public mains supply (with a stand-by diesel-electric generator) and a good private approach road.

Prior to installing the system, a 2,000λ-long (12-weeks) non-stop bench test was conducted during which time no faults developed. However, as the hardware is essentially of a simple and reliable nature this was hardly surprising.

The construction of the beacon is shown in the photograph and schematically in Fig 1. The transmitter consists of a Plessey Gunn oscillator with varactor electronic tuning, Type GDVO-101, a 30dB isolator, a 20dB directive coupler (for the wavemeter) and a 30ft-long waveguide run between the



The beacon transmitter

bench and the aerial. All the rf components are of waveguide construction. The power supply for the GDVO-101 consists of two integrated-circuit voltage regulators providing 10V at 500mA for the Gunn diode and approximately 12V for the varactor. The regulators are themselves driven from a stabilized 16V bench power unit. It proved essential to screen the system thoroughly to ensure that none of the outputs of the various vhf and uhf transmitters within the building found their way on to the supplies and modulated the transmitter.

The transmitter is frequency modulated by superimposing a 700Hz sine wave on the varactor's dc potential. Variation

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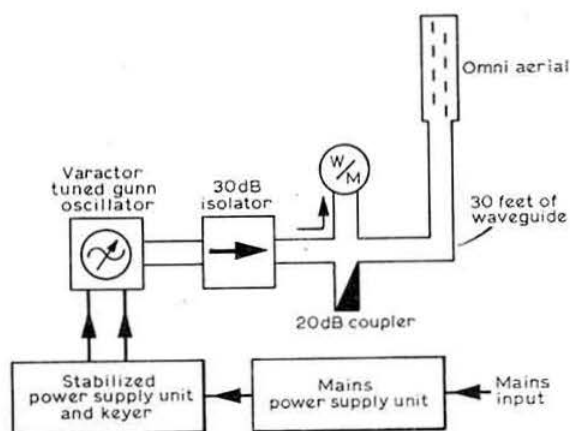


Fig 1. Transmitter schematic diagram

of the amplitude of this audio tone governs the fm deviation, which has been set to  $\pm 100\text{kHz}$ . Keying is accomplished by a 128-bit digital keyer (similar to the G3ZSS design, *Radio Communication* February 1974) which transmits the callsign over a 12s-long period, followed by a 10s-long dash. (At this speed it is possible to write down the individual dots and dashes!) For test purposes there is also provision for manual keying and speech modulation.

The horizontally-polarized omni-directional aerial was

built by Cliff Barber, G4BGP. It consists of a length of waveguide tapered over  $3\lambda$  to a length of reduced height guide  $\lambda/10$  high. Eight pairs of slots cut into the guide act as radiators. The circularity of the aerial is reasonably good, the aerial gain varying with the direction only from 7 to 11dB. The aerial is weatherproofed by using a length of plastic drain pipe sealed with glass fibre.

The site itself is clear except for one obstacle; a 150ft-high lattice tower standing only 25ft from the 3cm aerial and producing a shadow between  $010^\circ$  and  $040^\circ$  (magnetic). However, early fears that this structure would provide an unacceptable amount of signal attenuation have proved to be unfounded, local measurements showing a typical loss of only 3dB.

Initial signal measurements made on the island, and also on the mainland by Don Hayter, G3JHM, and Peter Tunbridge, G8DEK, are shown in Fig 2. These indicate that the general coverage is as could be predicted, with the only severe obstacle being the high ground to the north of Ventnor. In practice this means that coverage between  $060^\circ$  and  $100^\circ$  (magnetic) will normally be restricted to airborne receivers, except during periods of severe anomalous propagation, ie very good conditions!

The frequency stability of the GDVO-101 is remarkably good, being typically  $\pm 1\text{MHz}$  per day. However, future plans include a crystal-locked source with the crystal oscillator temperature controlled for minimum drift. Also it is hoped to increase the transmitter power substantially in the near future.

It would be inappropriate not to mention those who have lent both practical and moral support to the project and to whom the Society is indebted. Therefore our thanks are due to Pye Telecommunications Ltd for the use of their site; Dr Fred Myers of the Allen Clark Research Centre (The Plessey Co Ltd, Caswell, Northants) for the Gunn oscillator; Richard Ferryman, G4BBH, for waveguide items; and to the various members of the Vectis VHF Group for the construction, testing and installation of the complete system.

More reception reports are now eagerly awaited! □

## Catalogue received

Doram Electronics Limited, one of Britain's leading mail-order electronic component distributors specifically servicing amateur radio, electronic and hi-fi enthusiasts, have published a new edition of their catalogue.

The new 100-page catalogue priced at 60p (including postage) supersedes Doram's first successful catalogue. It contains a new 16-page data section plus specifications and illustrations of many thousands of components and audio accessories. Also included is a unique and free up-date product and price information service.

Of particular interest to radio and hi-fi enthusiasts is the inclusion of a new turntable kit and record deck, a full range of quality blank cassettes, magnetic cartridges, speakers and speaker cabinets, microphones, earphones, crystals, trimmer capacitors, radio and audio modules and a full styli range.

Doram's new catalogue is available by return of post from: PO Box TR8, Leeds LS12 2UF.

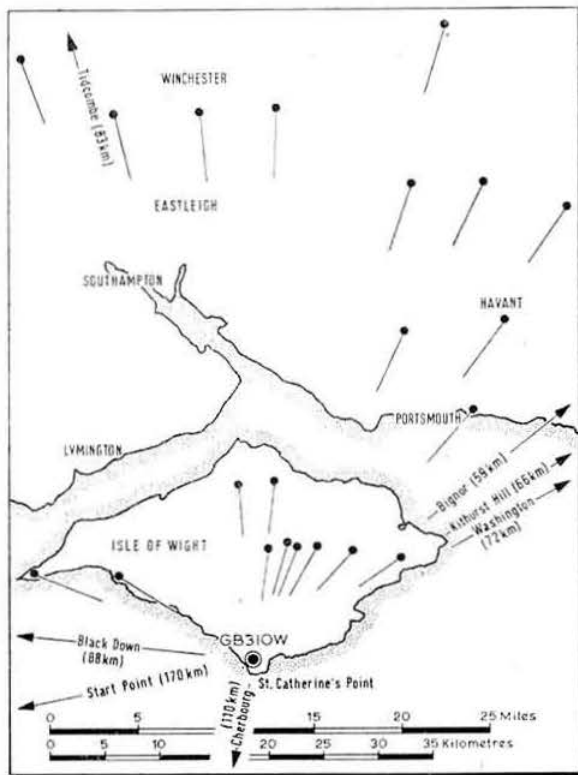


Fig 2. Beacon coverage to 31 July

# TECHNICAL TOPICS

by PAT HAWKER, G3VA

At one time, September traditionally marked the opening of a new season for amateur radio construction and operation. Today, activity continues indoors or outdoors the year round and the darker evenings have lost much of their former significance. Nevertheless we have the beginnings of a new sunspot cycle to look forward to even if no great increase in solar activity can be expected for a while yet. And, as several of this month's items show, there are plenty of areas still open for experimentation and for further evaluation and development.

## Home Office tvi statistics

Although some of us remain more than a little dubious as to how accurately the annual Home Office statistics (based on the work of the Post Office interference investigations) really reflect the true situation of radio and television interference, there can thankfully be little doubt that the 1974 figures, which have recently become available, show a significant improvement all round. The continued swing to uhf reception of television appears at last to be resulting in a worthwhile reduction of interference complaints. Complaints generally have fallen by about 46 per cent on both Bands 1 and 3 for an increase of about 8 per cent on Bands 4 and 5. One can but hope that this means that more attention is being given by receiver manufacturers to making uhf tv sets reasonably immune to out-of-band interference and that there is at last a real improvement in the design of central heating thermostats (an improvement for which amateurs as well as viewers must be grateful).

New complaints received during 1974 amounted to 42,177 cases, and during the year 42,001 cases were closed, representing 48,371 interference complaints. New cases fell by 14 per cent on 1973 and complaints by 18 per cent.

Complaints ascribed directly to amateur stations (ie not including those cases where the viewers' aerials or receivers were held to be inadequate) amounted to 886, a very useful drop of 283 or over 24 per cent on the previous year. This is the first time the total has dipped below a thousand for a number of years.

Table 1 shows the changing pattern of amateur station interference over the past seven years, corresponding roughly to the changeover period from vhf to uhf television (ITV and BBC1 began uhf duplication in Bands 4 and 5 in November 1969). It should be appreciated that the total number of amateurs has steadily increased during the period, from roughly 15,000 to 20,000 (not counting mobile licences usually held in addition to a fixed licence). But of course nobody has any real measure of how amateur activity fared during this period. The uhf tv service, which is planned to relatively high levels of signal strength, now has a population coverage better than 95.5 per cent which means that the former problem of extensive "fringe" areas where viewers depended on weak vhf signals is gradually being whittled away. It is difficult to find out exactly how many tv viewers in the UK still depend on the vhf services as this differs in different regions, but it would seem likely that this varies from a minimum of about 5 per cent to a

TABLE 1

LW/MW	1968	1969	1970	1971	1972	1973	1974
Band 1	55	48	28	38	56	61	75
Band 2	725	821	630	467	462	329	140
Band 3	34	44	40	44	55	58	71
Band 4-5	319	492	394	300	306	221	108
Mobile	12	26	65	173	348	488	480
Totals	6	11	4	5	15	12	12
	1,151	1,442	1,161	1,027	1,242	1,169	886

Bands 1 and 3 are used for 405-line television (vhf); Bands 4 and 5 are used for 625-line television (uhf); Band 2 is used for vhf/fm sound broadcasting. Mobile refers to the public authority and commercial mobile services.

maximum (in Northern Ireland) of about 15 per cent, with about 8 per cent a fair average for the country. But of course we cannot afford to relax too much since there is the prospect that in the 'eighties Bands 1 and 3 will be re-engineered for 625-line television.

## Class E high-efficiency amplifiers

For many years there were only Classes A, AB, B and C to worry about, but then a decade or so ago along came Class D (see *Amateur Radio Techniques*) with its promise of achieving much higher efficiency by using the valve or transistor as a switch, rather than as a conventional amplifier. The real importance of higher efficiency is not just that one gets rather more output for a given input but that, since so little power is dissipated in the output device, it allows this to be run at much higher input than for less efficient modes. For example, a very early form of Class D amplifier (*TT* April 1959) showed that it was possible for a KT45 line-output valve to provide 200W (rms) output at 1MHz. Class D also seemed to offer a useful way of achieving more power output from rf transistors in the days when normally output had to be measured in milliwatts.

Unfortunately, both for af and rf applications, some of the Class D designs did not prove as satisfactory or as simple as their advocates suggested, and relatively little use has ever been made of the system by amateurs. In effect, in a Class D amplifier, the device acts as a switch controlling a larger output power than is needed to control it (just as a relay can be used as a low-frequency amplifier). The idea was conceived as long ago as 1931, although not given the name Class D until many years later.

Now D. R. Powell, G3ZXX/F0HX/C31DV, has drawn attention to an interesting paper "Class E—a new class of high-efficiency tuned single-ended switching power amplifiers" by N. O. Sokal and A. D. Sokal (*IEEE Journal of Solid-state Circuits*, Vol SC-10, No 3, June 1975, pp168-76). This describes a form of switching amplifier which can be used, for example, to provide an output of 26W at 3.9MHz from a pair of Motorola 2N3735 TO-5 transistors (the choice of frequency and the fact that both authors mention their membership of ARRL suggest an amateur radio connection!).

The Class E arrangement (Fig 1) is a development of the



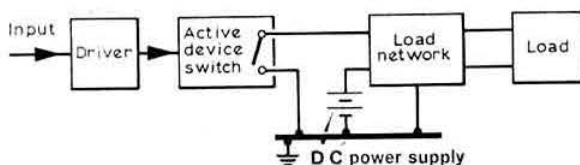


Fig 1. Block diagram of single-ended switching-mode amplifier

Class D switching amplifier but with a specific form of output network; among other advantages it is claimed that this type of load network means that the switching time of the active device can be a substantial fraction of the ac cycle (for Class D one normally requires very high-speed switching transistors). The component values used in this new type of load network differ significantly from those normally found in conventional amplifiers. Harmonic output and power gain are stated to be comparable with that of conventional amplifiers, but normally for transistors any such output network would be used in conjunction with further matching networks to reduce harmonic content—as in conventional amplifiers.

The authors note that increasing efficiency of an amplifier from, say, 80 to 90 per cent might seem of relatively minor importance. But in reality such a change halves the collector dissipation, giving the option of either doubling the power output, halving the number of output transistors, reducing the heat sink volume and weight by a factor of about 2-8, or halving the junction temperature rise and so decreasing the transistor failure rate.

These are thus very real advantages and underline the potential importance of Class E. The IEEE paper goes into the design procedure in some detail and only the barest facts can be given here. However, networks for 3.9MHz and 10MHz shown in Fig 2 are taken from the paper and should give some idea of the component values. At 3.9MHz, 26W output is achieved with only four per cent of the dc input dissipated in the transistors; output at 10MHz is given as 20W but it is not clear if this is with the same parallel 2N3553 devices. Both rf power transistors and switching transistors (eg Motorola 2N3735, National Semiconductor 2N6376, RCA 2N5262) are reported as working well in

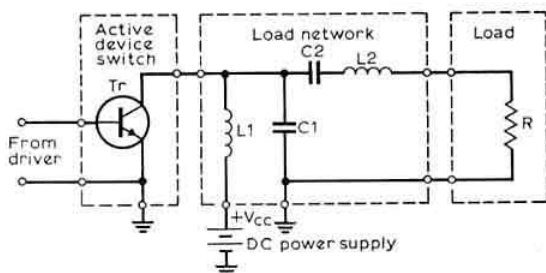


Fig 2. Circuit diagram of the form of Class E high-efficiency rf power amplifier described by N. O. and A. D. Sokal in *IEEE Journal of Solid-state Circuits*. Component values for amplifier designed to deliver 20W at 10MHz using Q<sub>1</sub> of 6, V<sub>cc</sub> of 27V dc, L<sub>1</sub> rf choke, V<sub>ce</sub> (sat) 2V, L<sub>2</sub> 1.72μH, C<sub>1</sub> 162pF, C<sub>2</sub> 200pF, R 18Ω. At 3.9MHz circuit details L<sub>1</sub> 63 turns of 24swg on Indiana General CF111-Q2 ferrite toroid (approx 68μH and 0.1Ω dc), L<sub>2</sub> 3.45μH and 0.4Ω ac, C<sub>1</sub> 713pF, C<sub>2</sub> 600pF, R 10.3Ω and V<sub>cc</sub> 23.1V dc

this circuit, though it is stated that at present neither class of transistor is optimized in design and construction for this application; changes in transistor design and packaging could yield transistors which would give even better results than those obtained so far. The authors warn that as with other kinds of high-efficiency equipment, protection should be provided against accidental low-efficiency operation (ie accidental high power dissipation) if advantage is being taken of the normal high efficiency by reducing the heat-dissipation capability; the higher the operating efficiency the more important this requirement becomes.

It should be noted that the calculations given in the paper are based on fixed-frequency operation, but it is stated that provision can be made for varying C<sub>1</sub>, C<sub>2</sub> and/or L<sub>2</sub> or by other methods for tuning across a band.

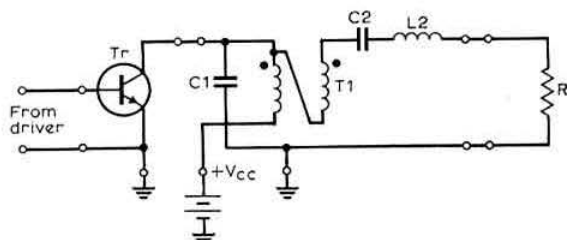


Fig 3. Impedance transformation between load and switch by adding a winding to L<sub>1</sub>. Leakage inductance between the T<sub>1</sub> windings can be absorbed into L<sub>2</sub>; this increases the efficiency by eliminating the losses of the portion of L<sub>2</sub> replaced by the leakage inductance

### Delay-line oscillators

In the July *TT* I referred again to the work at the Mullard Research Laboratories in which a PAL colour television delay line is used as a basic reference source to stabilize an oscillator. The original delay-line oscillator was described in *TT* in August 1972, as well as in *Electronics* and *Wireless World* and was a fairly complex arrangement based on a phase-lock-loop and providing a series of output frequencies spaced 15.625kHz apart; only the basic block diagram was provided.

The stability of an oscillator of this type is determined by the phase stability of the delay line (which is designed to delay any signal near 4.4MHz by precisely one television line or, for the 625-line system, 64μs). The Mullard work has indicated that with mass-produced PAL delay lines as used in domestic receivers, this could provide a frequency stability that is rather less than with a good crystal oscillator but considerably better than for most LC arrangements. The more recent Mullard work, reported in the July *TT*, showed that the original system could be extended by using goniometer-type phase-shifting networks to provide a continuously-tuned oscillator while retaining the advantages of delay-line stabilization. Such a system would appear to be very suitable for amateur radio applications, both for transmitting or receiving, but would not be particularly simple to put together.

But within a few days of the July issue being published, I received an enthusiastic letter from Brian F. Rose, G3ULR, reporting that he had discovered a novel and much-simplified way of using PAL delay lines for stabilizing oscillators and that this lent itself to vxo-style "pulling" techniques to provide, in effect, a stabilized, locked oscillator capable of

being set to any frequency within a wide tuning range which could extend over several megahertz on the basic range.

He achieves this without any complex pll by using a perfectly conventional vfo plus the addition of a PAL delay line and a switch to allow this to be readily set to provide three different time references. It is rather like a modern form of the original vxo—the so-called “Goyder lock” of the mid-twenties.

### The G3ULR PALO

To the above simple but imaginative arrangement Brian Rose gives the name “PALO” or PAL delay-line oscillator. Following his own tests, he sent along one of his prototypes and this shows that the PALO is capable of a very useful degree of long and short-term stability, comparable to a good vxo but with a much wider tuning range, and should be simple and cheap to build. Its one significant disadvantage, so far as I can judge, is that when compared to a continuously tuned vfo, the process of setting it to a required frequency is made a little complicated by the process of “locking and pulling”, with some care needed close to the “lock boundaries” to ensure that the PALO does not flip over to the next locking position. At the time of writing no attempt has been made to determine the effects of temperature or to quantify the frequency stability. I can say only that when zero beating the PALO harmonics to harmonics of a 1MHz crystal at frequencies between about 15 and 25MHz it turns in an impressive performance. The simplest form, without mode switching, is shown in Fig 4 and a full PALO in Fig 5.

G3ULR considers that the stability is better than any vxo he has used, and he found that leaving one unit on for 24 hours and simultaneously increasing the room temperature from 65°F to 85°F produced a shift of only 200Hz when measured on a BC221 at 5.5MHz. It would also be fair to point out that no attempt has yet been made to add any

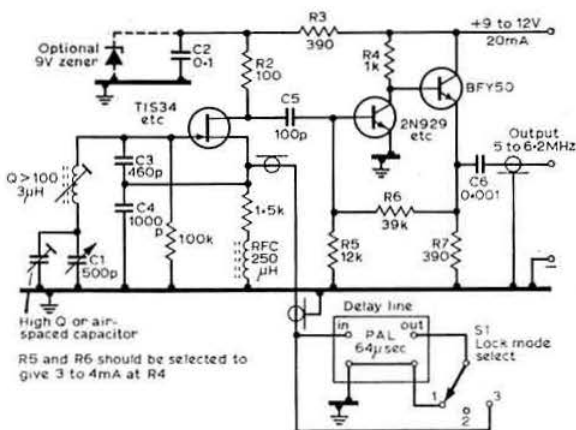


Fig 5. Diagram of the prototype G3ULR PALO with lock mode switching on the delay line: switch position 1 provides 7.8kHz spacing. In all modes the Clapp oscillator locks to the delay line and substantially continuous tuning is possible with modes 1 and 2 together permitting the oscillator to be tuned to any frequency (this may not always be achieved with the supply line significantly below 12V)

form of temperature correction or to assess fully whether the designs are optimum. All one can say with certainty is that the system looks very promising and seems to be reproducible. An advantage over such digital techniques as the “huff and puff” stabilizer is the absence of any high-speed pulses that can be a source of interference, though the overall stability is probably a little lower and tuning more difficult.

In essence the PALO comprises a standard vfo (Colpitts or Clapp type are probably the easiest to convert but other types could almost certainly be used) using any type of active device, valve, bipolar transistor or fet, and with a tuning range in the general area of 4-43MHz (in practice anywhere between, say, 3 and 6MHz or so). The delay line is simply connected across the earthy side of the capacitive network as shown in Figs 4 and 5. When this is done it should be found that the oscillator “locks” at regular intervals (the intervals depending upon which mode the delay line is switched to), and that this frequency can then be “pulled” over a limited range by varying the vfo tuning. For each “mode” there are thus a series of stabilized ranges, separated by “forbidden zones”: Fig 6. By switching the mode of the delay line in the manner devised by G3ULR three different sets of stabilized ranges and three different forbidden zones should be obtained. It will then be found that the forbidden zones are interleaved so that with care the oscillator can be adjusted to any required frequency within the main vfo range. In testing the G3ULR prototype initially we found some occasions when a selected frequency could not be obtained, but this problem vanished when the supply voltage was raised to 12V. But it does take some getting used to as it is easy to go near the edge of a pulling range and have the PALO flip over to the next or next-but-one region.

In one mode the basic tuning ranges are separated by about 15.6kHz; in the second mode by about 7.8kHz; the third mode also gives 7.8kHz spacings but shifted by 3.9kHz. These modes are all obtained with a single delay line by means of a panel switch. The delay lines used by G3ULR

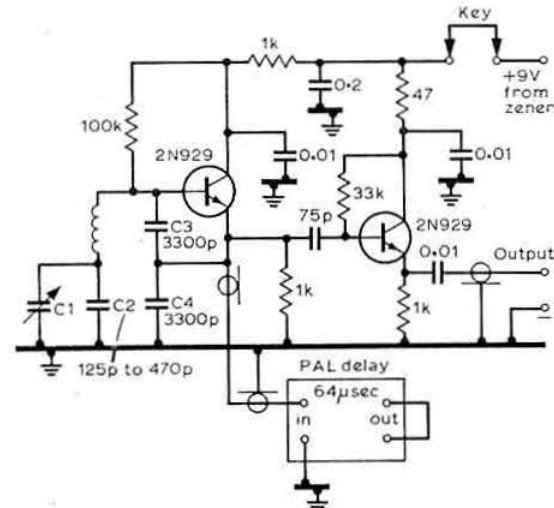
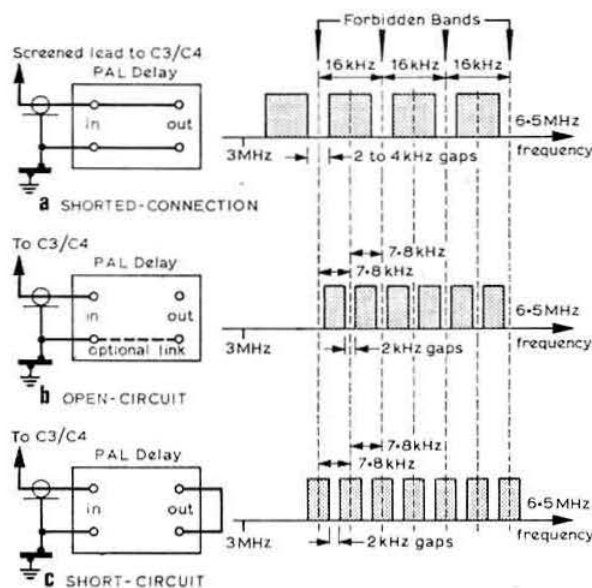


Fig 4. Showing the direct addition of a PAL delay line to an otherwise unmodified vfo to give locked operation anywhere in the band 3 to 6.5MHz. G3ULR finds that this circuit works best with C1 about 400pF at 5.5MHz. Keying characteristics reported to be excellent



**Fig 6.** Showing in detail the three modes of using a single PAL delay line developed by G3ULR, together with the resulting frequency bands over which the oscillator can be pulled together with forbidden bands (width of these bands will be determined by the degree of "pulling" which can be achieved with the PALO). Note that the "gaps" in mode B interleave with those of mode C

are type MS-11P marked KSS; if Mullard DL20 lines are used, connect them so as to omit the internal transformers.

G3ULR suggests that the delay line acts as a flywheel of high Q, selecting the precise frequency by producing a lower loss than the external tuned circuit; however, the tuned circuit, by introducing a phase shift in the feedback loop, continues to trim the output frequency. Waves launched into the delay line are reflected after an interval determined by the mode of the delay line connections and are required to be in phase with the launching tank-circuit wave in order to reinforce the oscillation. The oscillator enters a forbidden zone whenever the delay line contains an odd number of quarter periods. Dial calibrations should be the same for modes (a) and (b) but the "hopped" mode (c) shifts the calibration. This explanation is a much shortened version of G3ULR's notes but it is felt that at this stage it would be more useful to have feedback from the experience of those who try the system.

The coupling into the delay line will depend upon the circuit constants used in the oscillator; coupling increasing when L1 is reduced and a larger value of C1 is used. The coil should be of high-Q construction. While the PALO can provide good keying characteristics, G3ULR points out that with high coupling into the delay line it is advisable to keep the oscillator running since it may jump into the wrong channel when operating near the forbidden bands. Keying on exact PAL frequencies can provide better characteristics than a crystal oscillator.

The forbidden zones (Fig 6) on each mode appear to be a minimum of approximately 2 to 3kHz wide, though this may vary with oscillator characteristics. The oscillator will resist any attempt to be pulled into these zones from the

channel above or the channel below; G3ULR prefers using the 7.8kHz spacings with the 15.6kHz spacing mode providing a useful "coarse" tuning facility.

He has a number of ideas for using the technique as a switch-tuned vfo, or as a channelized vfo, to avoid problems of calibration with the offset mode.

It is hoped that these details, brief though they may be, will encourage others to give the idea a trial. Clearly there is still a considerable "unknown" quantity about exactly how practical and useful this technique may prove. Some may say that they would prefer to improve the basic vfo to provide sufficient stability without using a delay line; others might opt for delay lines but with the full treatment suggested by the Mullard work.

But one thing seems certain, G3ULR has come up with some ingenious ideas that deserve careful assessment and evaluation. The very latest tests show short-term (5 min) stabilities of the order of 1Hz!

### Elastic aerial supports

Those of us who use trees as aerial supports know the problems only too well. I once virtually wrecked a window frame that was less strong than the aerial wire. The counterweight technique still leaves the branch constantly rubbing the support wire. For a time I used a metal spring that I believe had come originally from one of those old chest expanders, but they do corrode.

Brian Castle, G4DYF, has been using a piece of heavy-gauge elastic between the nylon lanyard and the aerial. By means of a spring balance with the wire temporarily rigged at ground level he found the tension in a total span of about 170ft was of the order of 25lb when the wire was pulled really tight. This tension can be sustained by minimal extension of a double length of the heaviest gauge of readily available elastic (about 1/4 in diameter, nylon braided, as sold by builders merchants and ship chandlers). The length required can be estimated by watching the sway of the selected tree and then allowing a further margin for safety and checking that the elastic can provide this. A loose loop of rope between the ends will keep the aerial up when finally the elastic breaks, as it is sure to do eventually. By putting the elastic in the horizontal span one avoids the constant sawing of the rope through the pulley.

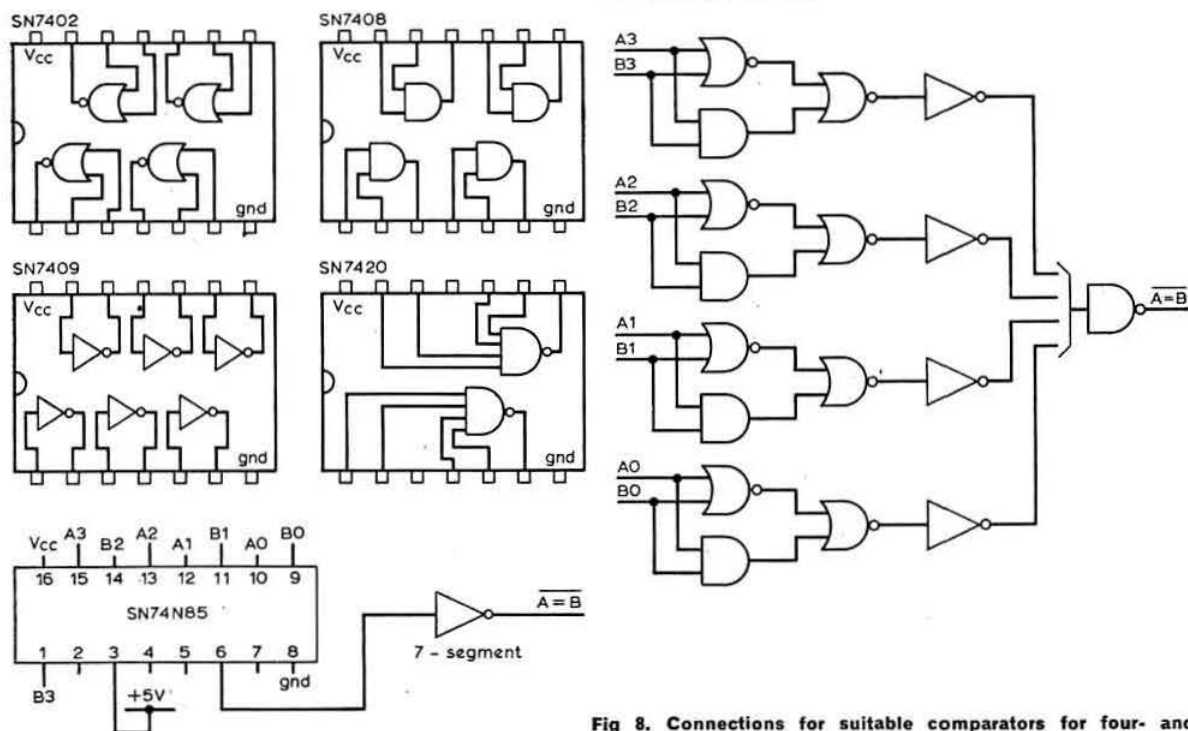
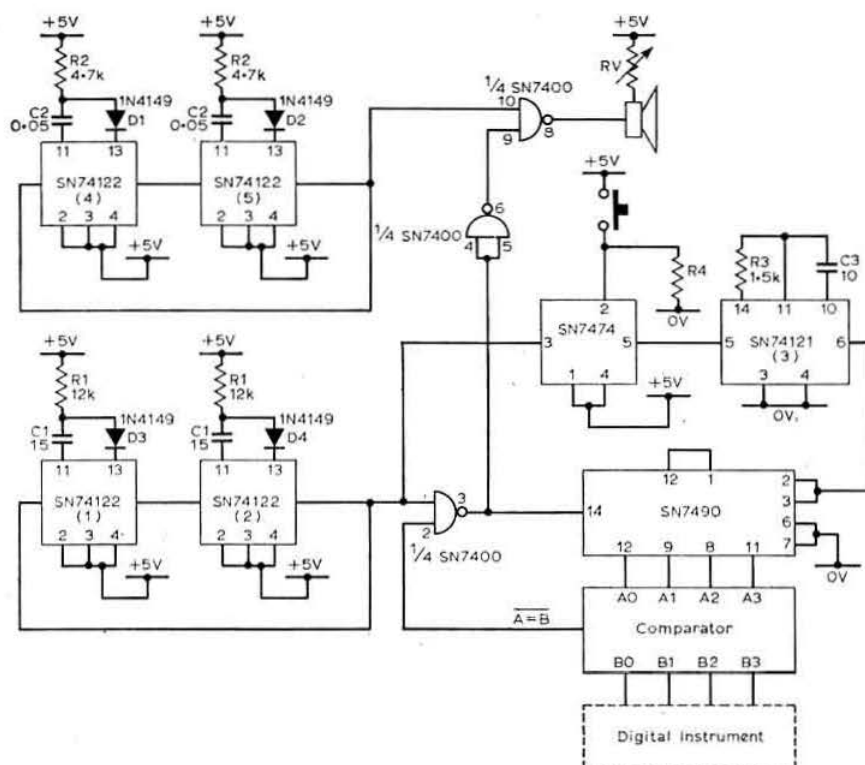
### Audible output from digital instruments

Over the years many sightless amateurs have been greatly helped by the technique of providing an audible output from test instruments that results in a change of tone with change of reading. The modern swing towards digital instruments, such as frequency meters and test meters, poses a new problem.

Alan Collinson, G4BNS, recently designed a unit to overcome this difficulty, which can be constructed for about £5. He explains its operation as follows.

In a digital instrument the display devices are driven by binary-coded decimal signals. The bcd signal may be encoded, for example, to drive a seven-segment display; nevertheless, at some point in the circuit there will generally exist a four-bit bcd signal for each displayed digit (and, if not, a simple addition to the circuit takes care of this).

The four-bit signals must be brought out of the instrument to a four-pole and n-way switch so that each of the n signals may be addressed to the "bleeper" by selection of a position





on the switch. When a digit is selected the following cycle of operations commences (see Figs 7 and 8).

When the hand switch is pressed the input of the SN7474 flip-flop goes high; on the next positive edge of the low-speed clock the Q output of the device goes high. Then the transition of this low-to-high output triggers monostable 3 (SN74121), producing a short reset pulse to the decade counter (SN7490).

On being reset the outputs of the counter fall to zero. The counter output and that from the digital instrument are now in general unequal, and the output of the comparator rises to the high state. The output of the comparator is applied to the NAND gate (SN7400) feeding the decade counter. This gate is now enabled and the counter receives pulses from the low-speed clock.

The same input which causes the counter to count is inverted and gated with audio frequency, producing an audible beep for every input pulse.

When sufficient pulses have occurred for the counter to register the same as the instrument the comparator returns to "low", inhibiting the NAND gate and preventing any more pulses going to the counter and to the audio circuit.

The device is now ready for the next cycle of operations, and it should be noted that when the hand switch is pressed it must not be released until the beeps start. The length of the beeps and the spacing between them may be varied by changing the value of R1. The volume of the beeps can be varied by changing the value of the resistor in series with the loudspeaker.

Two types of comparator may be used, an SN74N85 four-bit magnitude comparator, or a discrete gate system. Either will suffice and there is little cost difference between them.

To obtain a readout from a seven-segment readout display, the SN7490 should have a seven-segment encoder on its bcd output and the comparator should be seven-bit instead of four-bit.

G4BNS also passes on a useful tip in constructing any digital circuits and that is to use plenty of decoupling capacitors; these eliminate false triggering of monostables and flip-flops which can otherwise cause a circuit to malfunction.

### Third-method ssb—a warning

Several readers have pointed out that the enthusiastic comments by G3BY on the de Muijnck third-method ssb generator (TT, May 1975) may have suggested that, come what may, no unwanted sidebands will be produced but only, at worst, inverted speech in the same channel as the wanted sideband. It has to be questioned whether the very simple af filter used by G3BY is normally capable of reducing unwanted sidebands to a really satisfactory degree.

R. J. Forsyth, G3PRM, stresses that there is a possibility of four sidebands being produced, occupying a bandwidth three times the modulation bandwidth, as follows (with  $\omega_m$  modulation frequency;  $\omega_p$  pilot frequency;  $\omega_c$  carrier frequency):

- |                                      |                             |
|--------------------------------------|-----------------------------|
| (1) $\omega_c + \omega_p + \omega_m$ | the usual unwanted sideband |
| (2) $\omega_c + \omega_p - \omega_m$ | the wanted lower sideband   |
| (3) $\omega_c - \omega_p + \omega_m$ | inverted speech in (2)      |
| (4) $\omega_c - \omega_p - \omega_m$ | inverted unwanted sideband  |

In a perfect third-method generator only No 2 will be present at the output. No 3 will exist only if the phasing and/or amplitude balance is incorrect. No 1 will exist only if the frequency response of the filter is imperfect. No 4 requires

(a) an imperfect filter and (b) incorrect phasing and/or amplitude balance. Since, in practice, adjustments are bound to be less than ideal, some element at least of all four will be present, with No 4 the weakest.

G3PRM points out that No 1, the conventional unwanted sideband, relies on the audio filter(s) for its suppression. The action of this kind of generator is to transform a low-pass filter (symmetrical about zero frequency) into a filter with the same shape but symmetrical about some other frequency, in this case  $\omega_c$ , so that it has a bandpass characteristic. G3PRM is convinced that a simple two-pole filter of the type used by G3BY is unlikely to provide unwanted sideband suppression better than 10dB, or a little more if a good audio filter is used in the microphone lead.

This does not mean, of course, that a third-method generator is incapable of excellent results, but G3PRM is concerned that a spate of designs using excessively-simple audio filters could lower ssb standards. He is most anxious that the requirements of the filters for this application should be fully appreciated before too many units are tried, in all innocence, on the air.

### Long delay echoes unheard

We have referred a number of times to the interest in long-delay echoes (LDES)—hf signals with reported echoes of several seconds, too great for explainable round-the-world or other conventional ionospheric reflections, too strong for earth-moon-earth propagation. I have never been attracted to the theory, firmly advanced in some quarters, that this is the result of activity by the little green space men (not from any disbelief in extra-terrestrial intelligence but just because the technique seems inherently unlikely). Indeed my own feeling (TT, November 1969) tends to support "a possibility that the echoes could be of subjective origin—that is to say that some of the echoes may in reality be generated within the listener... this does not mean that such listeners are "going round the bend", rather perhaps that this is some sort of reverse *déjà vu* experience—most of us have known that odd but vivid impression of apparently having lived through a particular experience before". This was a possibility considered by Professor Villard when he rekindled interest in LDES in 1969.

Peter Duffett-Smith, G3XJE, of the Cavendish Laboratory now reports in the *Journal of Atmospheric and Terrestrial Physics*, 1975, Vol 37, pp455-460 on "an automated search for radio echoes of long delay at 7, 9 and 20MHz". This describes an experiment during February to September 1973 in which fully-automatic correlation receiving techniques were used to search for even weak echoes in a noisy background; this was used in conjunction with two-tone transmissions each lasting 2s and repeated every 30s with effective radiated powers of 0.5 and 2.5 kW (the higher power on 20MHz was the result of using a rotary Yagi beam). More than half a million transmissions were made—with no positive results. This number is at least 10 times greater than during any previous deliberate searches and G3XJE concludes: "the null result of this experiment suggests that the phenomenon of long-delayed echoes should be treated with reserve until it is conclusively established". It could be argued that the experiment does not cover all possible sunspot conditions or occasional visits of a space craft, but it does seem a rather substantial nail in the coffin of LDES as an objective, measurable, recordable, natural phenomenon.

# A teleprinter message generator

by A. J. MITCHELL, GM3UDL\*

THE author has been rebuilding his rty station over the past 12 months and had intended to include an auto transmitter among the equipment, mainly for the purpose of generating tests and CQ calls. Unfortunately no suitable machine could be obtained on the surplus market and therefore the author began to consider electronic character generation. After some experimentation, a fairly straightforward design was produced and is described below.

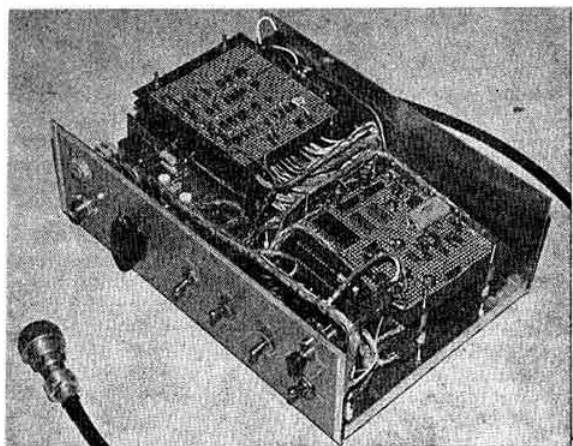
## General description (Fig 1 and Table 1)

The operation of the generator may be best described by comparison with its mechanical counterpart. In an auto transmitter (or tape reader) the characters to be transmitted are stored as rows of holes in a paper tape. Each row represents one character, with a hole representing a mark and the absence of a hole, a space. Five positions for mark or space exist in each row since the character information is held within the final signal in five "pulses". The reader is referred to *Radio Communication Handbook* [1] for a description of the teleprinter code and basic information on rty.

Under the control of the motor, the speed of which is stabilized, a start pulse (space) is generated, the holes where they exist are detected sequentially and a stop pulse (mark) is inserted. Finally, the tape is moved along so that the next row is ready to be "read". Note that two directions of movement are required, across the tape for reading and along the tape to pick up each new character.

In the electronic generator, the character information is held by a pattern of diodes in a matrix, each diode being equivalent to a hole in paper tape. In fact, it was decided to store three separate messages (see Table 1) and hence there are three matrices, each containing a maximum of 64 characters. These matrices and their input-output circuitry could be replaced by programmable read-only memories (PROMs) but this would at least double the cost of the message store as well as complicating the message selection process.

The matrix output (after message selection) is in the form of five lines bearing either earths (mark) or open circuits (space). These lines are "read" sequentially by a circuit which accepts information in this parallel form and, under the control of an external timer, selects the lines one at a



time producing a serial output. The parallel-to-serial converter also inserts start and stop pulses.

The timer and control circuits provide the accurately-timed commands which operate the rest of the system. Apart from controlling the converter, these circuits produce a pulse at the end of each character which changes the matrix output to the next character, an operation analogous to moving the tape in an auto transmitter. This function is performed by the character address decoder, which "addresses" each character in turn by applying an earth to each matrix input line. Note that the decoder addresses the correct character in all three matrices simultaneously and hence the message selector is on the matrix output lines. Thus the message selection process involves selecting five out of 15 and not five out of 192 as would have been the case if input line selection was used.

The whole generator is represented as a block diagram in Fig 1.

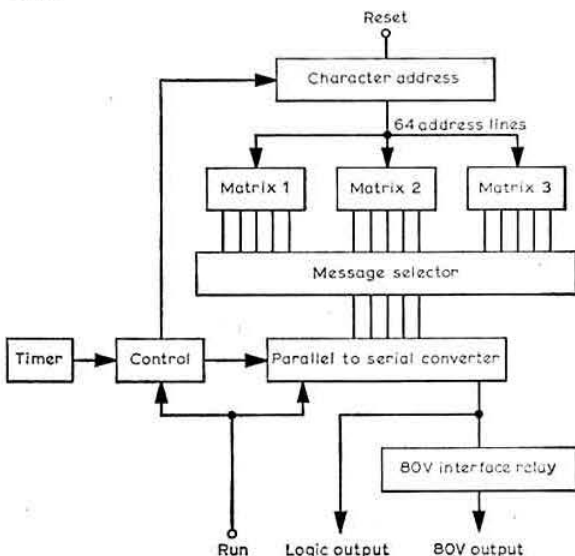


Fig 1. Block diagram of generator

\* 7 Linetree Crescent, Newton Mearns, Glasgow G77 5BJ.

Table 1. Contents of the three matrices

Character No	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Matrix 1	CR	LF	LS	T	H	E	=	Q	U	I	C	K	=	B	R	O	W	N	=	F	O	X	=	J	U	M	P	S	=	O	V	E
Matrix 2	CR	LF	LS	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R
Matrix 3	CR	LF	*	LS	C	Q	=	C	Q	=	C	Q	=	C	Q	=	C	Q	=	C	Q	=	C	Q	=	C	Q	=	C	Q	=	C

Character No	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
Matrix 1	R	=	T	H	E	=	L	A	Z	Y	=	D	O	G	=	F	S	1	2	3	4	5	6	7	8	9	0	=	+	+	+	LS
Matrix 2	E	S	T	=	F	R	O	M	=	G	M	F	S	3	LS	U	D	L	=	I	N	=	G	L	A	S	G	O	W	*	*	*
Matrix 3	C	A	L	L	I	N	G	=	C	*	F	=	F	=	R	O	M	=	G	L	A	S	G	O	W	*	*	*	*	*	*	*

CR = carriage return, LF = line feed, LS = letters shift, FS = figures shift, = = space, \* = all space

## Parallel-to-serial converter

It is not the purpose of this article to explain the operation of ttl circuits, so it is assumed that the reader is aware of the basics which have been covered elsewhere. The appropriate section of *Amateur Radio Techniques* [2] gives a good summary of features and terminology.

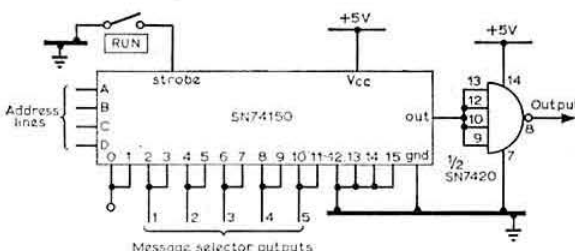


Fig 2. Parallel-to-serial converter

The basis of the converter is a single chip, SN74150, normally called a 16-to-1 data selector, which is essentially 16 gates, any one of which can be enabled by applying a binary code to four address lines (four lines can carry 16 different combinations, equivalent to decimal 0 to 15). The enabled gate ties one of the input states to the output line and thus the whole circuit may be thought of as a remotely operated single-pole 16-way switch. If the address lines are sequentially stepped through the 16 combinations, the inputs will be read in turn. Reference to Fig 2 will show that the 16 inputs are wired in pairs and if it is understood that in the generator (other than at the output) "0" is mark, then it will be seen that as the SN74150 is stepped along, the output carries first a space, then the five matrix output lines in turn and finally a mark. Pin 9, which is taken to "0" via part of the RUN switch, provides a convenient means of switching the output to a permanent mark when the generator is not running. This "strobe" input enables the chip

when a "0" is applied and disables the chip on an open circuit (equivalent to "1" since the circuitry allows the input to rise toward the supply line in this condition).

A gate, in this case the spare half of the SN7420 used in the control circuit, is wired as an inverter and connected in the output line for the purpose of "cleaning up" the waveform. This is only necessary because of the spread of resistance values in the various gates in the SN74150, which causes the output waveform to look rather like a staircase when lightly loaded. This is, of course, no problem when using the SN74150 to drive more ttl, but since the generator could be used to drive a relatively high-impedance load other than a saturating transistor, it is as well to use the extra gate with its single "1" value.

## Control and timer

The real difficulty in producing a teleprinter signal by digital means is the fact that every seventh pulse (stop) is 30ms long and not 20ms like all the others. The only practical way around this appears to be the use of a basic 10ms pulse length, stringing these together as six pairs and a group of three. Hopefully it will now be obvious why the parallel-to-serial converter inputs are in pairs, except for inputs 12-15 which are taken to a permanent mark and become the 30ms stop pulse.

Consider the operation of the control circuit of Fig 3. Every time a pulse from the left-hand monostable (SN74121) is completed, the outputs of the 4-bit binary counter (SN7493) are advanced by one (D is the most significant digit of the 4-bit binary number addressing the converter). Therefore the number DCBA advances from decimal 0 to 15 in 150ms if the monostable is triggered every 10ms. If nothing else were done, DCBA would revert to 0 after another 10ms, or in other words the whole sequence would cycle once every 160ms. Since a sequence time of 150ms is required, the appearance of 15 (ie 1111) at DCBA is detected by the SN7420 NAND gate and its output goes to "0". This

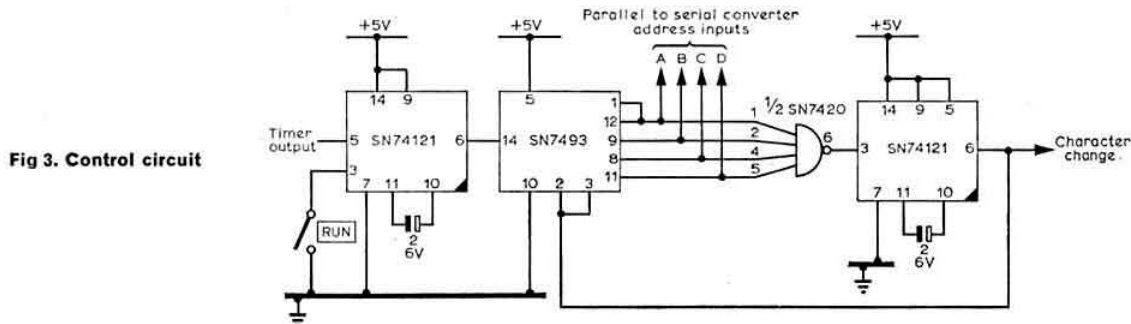
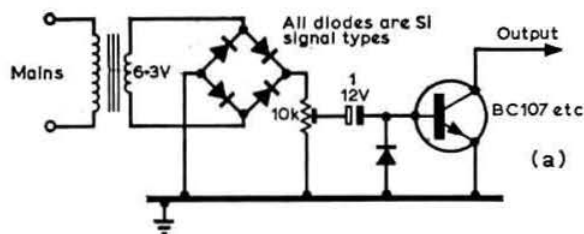
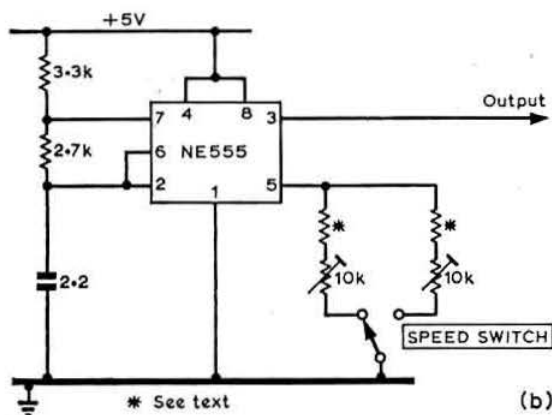


Fig 3. Control circuit



(a)



(b)

Fig 4. Timer circuits

"0" causes the right-hand SN74121 to fire and its rising edge clears the SN7493 outputs to "0". Since the propagation delays of the circuits involved total some 140ns, the distortion introduced by the slightly long stop pulse is only

$7 \times 10^{-6}$  per cent, which is negligible (a telegraph relay introduces about three per cent distortion into a teleprinter circuit).

The author has found that it is good practice to produce a definite pulse to reset counters—it would be unreliable to hope that the SN7420 output (a very short pulse) would, after inverting, reset the SN7493, although this is theoretically possible. Hence the inclusion of the 4ms monostable in the reset line.

Therefore, every time the generator completes a character a 4ms "1" pulse appears in the control circuit, which is convenient since this is exactly the requirement for advancing the matrix to the next character via the address decoder.

It is also convenient that the 10ms interval pulses required to drive the generator on 50baud speed may be obtained by doubling the mains frequency as shown in Fig 4(a). Having initially used the mains-locked circuit, the author decided that operation on 45.5 or 50baud was preferable and therefore the circuit of Fig 4(b) was developed, using the well-known NE555 timer chip running at 91 or 100Hz as appropriate. The unmarked resistors should have a value of around 4k $\Omega$  and the 10k $\Omega$  pots will enable the frequency to be set, preferably with the help of a counter. Using a non-electrolytic 2.2 $\mu$ F capacitor and good-quality resistors, this circuit is very stable after an initial warm-up of 15s or so. In fact, the author plans to use the NE555 output to trigger a 250V ac inverter driving the teleprinter synchronous motor, to avoid gear changing.

Either of these timer circuits feeds the control circuit input monostable which is enabled by the other contacts on the RUN switch. The monostable is not strictly necessary when using the NE555 circuit (apart from the ease of switching the signal on and off), but it is absolutely essential when using the simpler system since in that case many spurious pulses will be present which will ruin the generator timing.

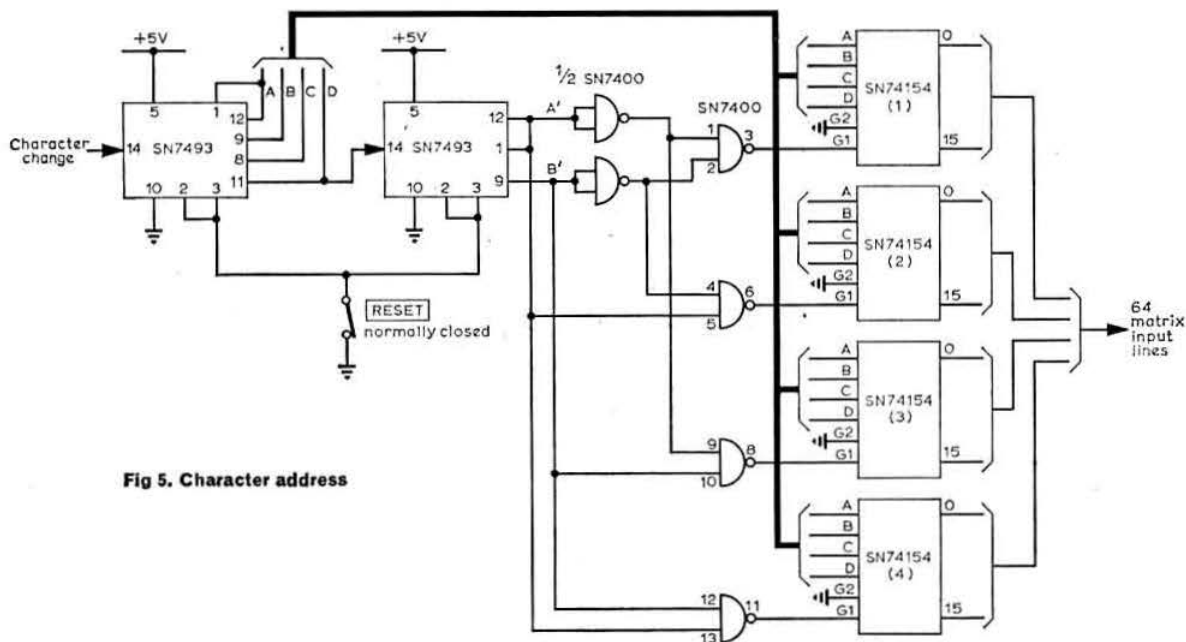


Fig 5. Character address



## Character address

The circuit of Fig 5 looks complicated at first sight, but bear in mind its function: to apply "0" to each of its 64 output lines sequentially, moving along once for each character change pulse from the control circuit.

On the right of the diagram are four blocks which are labelled SN74154. These chips are really the opposite of the SN74150 used in the parallel-to-serial converter in that they apply one data input to any of 16 output lines under the control of four address lines, DCBA. It happens that one can use the data-gate inputs G1 and G2 to enable the chip in much the same way as the strobe input of the SN74150 and therefore one can select one out of several chips. Thus in order to apply "0" to any one of 64 outputs, using four chips, the DCBA inputs are paralleled A to A, B to B, etc and addressed with the four least significant digits of the output number. The appropriate chip is enabled by making its G inputs "0". For example, to apply "0" to output line 17 (binary 10001), DCBA is made 0001 and chip 2 is enabled with "0" on its G inputs.

On the left of Fig 5 will be seen an SN7493 counter which is used to address the DCBA lines, as in the control circuit, stepping on each time a character change pulse is completed. Therefore, after every 16 characters the DCBA lines revert to 0000, at which point it is necessary to enable the next SN74154. This is done by using the D line to step another SN7493 and then detecting the four possible states of its A' and B' outputs, ie 00 = chip 1, 01 = chip 2, 10 = chip 3, 11 = chip 4 and then back to 00 and chip 1. It will be remembered that the G lines require "0" to select the appropriate chip, so it can be seen that the inputs of the gate which drives chip 3's G1 inputs are B' and A' (not A') which means that its output will be "0" when B' = "1" and A' = "0", as was required.

In order that the matrix outputs may be returned to the first characters, a RESET switch is included which, when opened, clears all SN7493 outputs to "0", thus selecting output 0 on chip 1.

## Matrices and message selection

Refer to Fig 6, which shows the circuit of the first few characters in matrix 1 ("Quick brown fox" message), and bear in mind that each character is enabled by applying "0" to the appropriate input line. Therefore, "0's" appear on the output lines via the diodes (which incidentally can be any germanium signal types, providing they can pass a forward current of about 2mA) and form the character in a pattern of "0" (mark) and open circuits (space). Since each output line will be connected to a gate input in the message selector, the open circuits become logic "1" as mentioned earlier.

The remaining logic circuitry, the message selector, contains 20 NAND gates (five SN7400 chips) and is simply a solid-state 5-pole 3-way switch, of which one "pole" and the operating switch are shown in Fig 7. The upper three NAND gates plus the diode OR gate actually form the switch, while the lower gate is merely an inverter. Operation of this circuit is simple in that "0" on either or both the inputs of the switching gates causes a "1" output, and hence the two gates whose switch inputs are set to "0" by the selector switch will remain with "1" outputs no matter what their matrix inputs may be. Therefore the output of the selected switching gate will be the inverse of its matrix input and when the appropriate matrix line is "1", the switching gate output

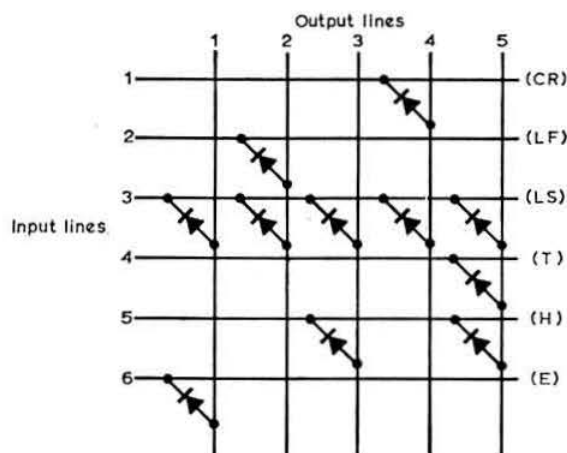


Fig 6. First six characters in matrix 1

("0") will pull the inverter input down via the diode. Thus the inverter output is the same as the selected matrix line.

A word of explanation about the design of the matrices now follows, since the constructor will need to use his own call sign or may wish to generate different messages from those used by the author. Obviously the method of storing the characters is by wiring a diode in for each mark, connecting the appropriate input line to the output line or lines to carry a mark. If the reader will now mentally step back and consider the matrices in relation to their input and output circuitry, he will see that each of the 64 outputs of the character address unit is connected to an input of all three matrices. When that SN74154 output is selected, the "0" that it is producing could be fed, if that character was "letters shift" (five marks) in all three matrices, to all 15 matrix inputs in the message selector—in other words, one

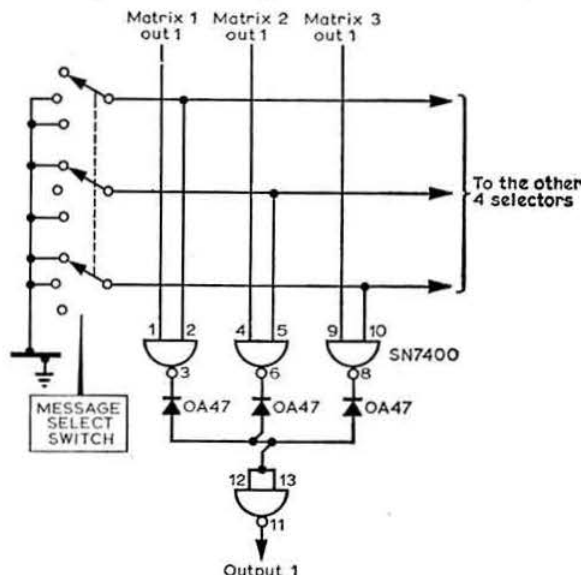


Fig 7. Message selector

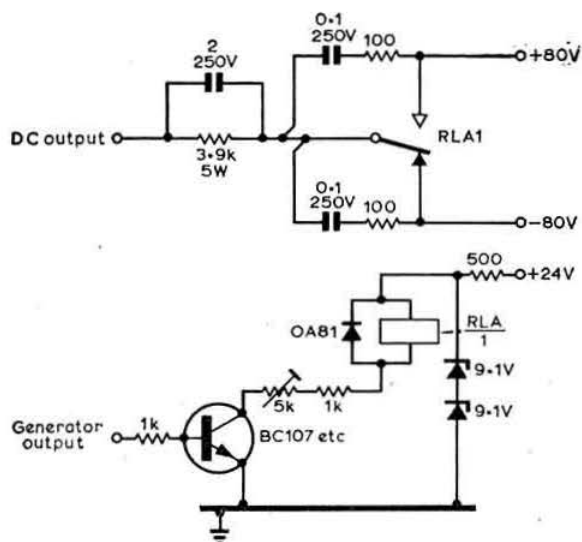


Fig 8. Output relay circuit

output feeding 15 inputs. Now a feature of the SN74 series ICs is that, in general, one output may only be loaded with a maximum of 10 inputs, so that if only two messages were required there would be no problem. However, three messages can be fitted in if the total number of marks in each character in all three matrices is added up and the messages organized so that this total is 10 or less. As can be seen from Table 1, "all space" characters can, if necessary, be included to reduce the loading.

### Output arrangements

For the sake of completeness, the circuit is given in Fig 8 of an interface between the generator and the standard teleprinter magnet supply of +80V and -80V with respect to earth. The author uses a mercury-wetted relay which operates on about 12V. This relay is not the polar type and does require a diode across its coil to damp the de-operate action, so as to minimize bias distortion. The distortion introduced by this interface is about four per cent which is reasonable.

The use of the interface is only suggested for teleprinter alignment purposes or if a high-voltage drive is required to operate, for example, a valve fs keyer. However, since the generator logic level output has been found to have no measurable distortion, its use to drive such items as afsk oscillators direct or via a single transistor buffer is recommended. A suitable oscillator was described in a recent issue of the *BARTG Newsletter* [3] and has been included in the author's generator.

### Construction

There appears to be only one major point to remember when constructing this type of generator. If an 80V interface is to be included in the box, run the relay tongue (output) line in screened cable and route it away from the other wiring. If this precaution is not taken, spikes can get on to the +5V line and be efficiently propagated throughout the circuit.

Mercury-wetted relay contacts open very fast indeed and the 0.1μF 100Ω quenching networks are there not only to

help to suppress spikes, but are also absolutely essential to stop the contacts from burning out due to arcing.

As to the rest of the unit, the author built the circuitry on a total of eight Lektrokit chassis plates No 4, which are paxolin-type panels perforated on a 0.1in matrix. Two panels were used for each matrix, one for the character address and message selector circuits and one for the timer, control and parallel-to-serial converter circuits. The relay (which has to be mounted vertically) and the shaping and quenching components are tucked in a corner on a small perforated board.

None of the circuit layout appears to be critical, and since the author has laced up all the wiring between panels, there does not seem to be any problem with pick-up between various parts of the circuit. Making a generator of this type is more a matter of perseverance than anything else since, particularly when wiring the matrices, very many connections have to be made in a definite order. If some colour-coded multicore cable is stripped down and used, identification of circuits is made much easier.

### Conclusion

It would be difficult to give a price for the parts used in this unit since there are many differences between the prices quoted by the various suppliers, and some parts may be found in the junk box. The author's generator cost about £12 (exclusive of the case) but there were some surplus SN74 series ICs available at the time the unit was designed, and the 400 or so diodes were available, being the remains of a bargain pack of 1,000 unmarked diodes bought very cheaply a few years ago.

As a part of an amateur teleprinter system, this message generator has the advantages that it is silent and does not require adjustment. It is, however, obviously not so flexible as the mechanical auto transmitter. Perhaps the ideal situation would be to use this generator in conjunction with an auto transmitter for long messages and picture tapes.

### References

- [1] *Radio Communication Handbook*, pp11.1 to 11.7.
- [2] *Amateur Radio Techniques*, 5th ed, pp37-39.
- [3] "Band-limited rty signals", G3UDB, *BARTG Newsletter* September 1974.

## BOOK REVIEW

*Operational amplifier projects for the home constructor* by R. M. Marston. 123 pages. 222 by 142mm (8½ by 5½in). Published by Newnes-Butterworths. Price £2.80 (casebound), £1.80 (limp bound).

The operational amplifier has become one of the most widely used forms of integrated circuit now available: basically a high-gain dc amplifier, the op-amp has many applications in amplifiers and instruments, in addition to domestic uses.

This book describes the op-amp and then presents the essential details of 110 projects. The circuits are stated to have been fully evaluated and use internationally available components. Sufficient explanatory details have been added to the circuitry to aid construction. The text and diagrams are clearly presented.

The book is a companion volume to those already available from the same author dealing with semiconductors, ICs and thyristors, and is worth its cost for the project circuitry alone.

## RAE COURSES 1975-76

(See also page 607, August issue)

**Bangor.** Bangor Technical College, Bangor, Co. Down. Tutor, C. A. Billington, G3WSS. Two evenings per week. Details from G3WSS, tel Holywood 4277.

**Beckenham.** Beckenham and Penge Adult Education Centre, 28 Beckenham Road, Beckenham, Kent. Tutor, J. M. Tripp, G3YWO. Wednesdays, 7.30-9.30pm, commencing 24 September. Enrolment 15/16 September or upon first attendance.

**Bedford.** Westfield School, Bedford. Tutor, E. Elsley, G3YUQ. Wednesdays, commencing mid-September. It is also hoped to run a Morse class on Tuesdays with another tutor. Details from the headmaster, tel Bedford 67353, or G3YUQ, tel Bedford 65171 day-time.

**Birmingham.** Holte Adult Education Centre, Wheeler Street, Hockley, Birmingham. Tutor, K. Frettsome, G4ABV. Wednesdays, 7.15-9.15pm (Morse) and Thursdays, 7.15-9.15pm (RAE), commencing September.

**Borehamwood.** Borehamwood College of Further Education, Elstree Way, Borehamwood, Herts WD6 1JZ. Tutor, G. L. Benbow, G3HB. Wednesdays, 7-9.15pm, commencing 24 September. Enrolment 4-8pm, 10/11 September.

**Burgess Hill.** Marle Place Adult Education Centre, Leylands Road, Burgess Hill, Sussex. Tutor, F. R. Canning, G6YJ. Tuesdays, 7.30-9.30pm, commencing 23 September. Fee £10.50. Details from the principal at the centre, tel Burgess Hill 6355.

**Crawley.** Ifield Evening Centre, Crawley. Tutor, R. Scrivens, G3LNM. Mondays, 7-9pm, commencing 22 September. Enrolment 10 September. Details from G3LNM, tel Crawley 22540.

**Croydon.** Technical College Annexe, Tamworth Road, Croydon. Tutor, P. L. A. Burton, G3ZPB. Thursdays, 7.30-9.30pm, commencing 2 October. Enrolment 10am-3pm, 20 September, or on first evening. Details from G3ZPB, tel 01-669 6700 (day) or Dowland 51413 (evenings).

**Dundee.** Kingsway Technical College, Old Glamis Road, Dundee. Thursdays, 6.30-9pm, commencing 4 September. Enrolment at class or via the college. Details from G3YVX, tel Dundee 75054 or 89366.

**Greenock.** James Watt Technical College, Finnieston Street, Greenock. Details from G3DOD, tel 0475 23742 or 0475 24423.

**Harrow.** College of Further Education, Hatch End, Harrow. Wednesdays, commencing 1 October. Enrolment 24 September. Details from D. T. Busby, tel 01-864 4411 ext 39 during office hours.

**Ilkley.** Ilkley Grammar School, Ilkley. Mondays, 7.30-9.30pm, commencing 22 September. Enrolment 7.30-9.30pm, 15 September at the King's Hall, Ilkley.

**Knottingley.** Knottingley High School, Knottingley, West Yorks. Tutor, A. E. Ashby, G3HCW. Wednesdays, commencing 17 September.

**London (Chingford).** Friday Hill House Community and Adult Education Centre, Simmons Lane, Chingford, London E4. Tutor, J. E. Johnson, G2HR. Mondays, 7.30-9.30pm, commencing 22 September. Enrolment 15 September. Fee £4.50. Details from G2HR, tel 01-529 2932.

**London (Ealing).** Acton Technical College, High Street, London W3 6RD. Wednesdays, 6.30-9pm, commencing September. Enrolment 6.15-8.15pm, 11, 17 September.

**London (Eltham).** Eltham Institute and Art Centre, Eltham Hill School, Haimo Road, London SE9. Tutor, J. M. Tripp, G3YWO. Tuesdays, 7.30-9.30pm, commencing 23 September. Enrolment by post 27 August to 3 September. Personal enrolment 15-19 September.

**London (Holloway).** Holloway Institute (Archway Annexe), Highgate Hill, London N19. Tutor, B. C. Bond, G3ZKE. Mondays, 7-10pm, commencing 22 September. Enrolment 15 September onwards. Details tel 01-485 7065.

**London (Holloway).** Shelburne Radio Club, Shelburne Youth Centre, Benwell Road, London N7. Tutor, R. Cummings, G3SLF. Mondays, 7pm, commencing 1 September.

**London (Islington).** De Bevoir Evening Institute, Tottenham Road, Balls Pond Road, London N1. Tutor, F. Barns, G3AGP. Enrolment 15 September onwards. This course is a revision course for those who have unsuccessfully taken the RAE and do not want to start again from scratch.

**Loughborough.** Loughborough Technical College, Radmoor, Loughborough, Leics LE11 3BT. Tutor, D. R. Doughty, G3FLS. Tuesdays, 6-7pm (Morse), 7-9pm (theory and practical), commencing 16 September. Enrolment 6-8pm, 8-10 September. Fee £5.35.

**Perth.** Technical College, Crief Road, Perth. Tutor, D. Morris, G3YEW. Mondays, 7-9pm, commencing 15 September. Details from the principal, tel Perth 27044.

**Peterborough.** Peterborough Technical College, Peterborough. Tutor, G. Morris, G3SGC. Details from the tutor at 12 Rockingham Road, Sawtry.

**Portsmouth.** Further Education Centre, Drayton Road, North End, Portsmouth. Tuesdays and Thursdays. Details from the principal or G6NZ.

**Princes Risborough.** Adult Education Centre, Merton Road, Princes Risborough. Mondays (theory—tutor, R. E. Whiting, G3POF) and Thursdays (Morse—tutor, S. Ford, G4ACV), 7-9pm. Enrolment 7-9pm, 10/11 September.

**St Helens.** St Helens College of Technology, St Helens. Mondays and Thursdays 6.45 to 9.15pm. Enrolment 6-8pm, 4, 5, 8, 9 September. The college also offers a practical electronics course for constructors: Tuesdays and Wednesdays, 6.30-9pm. Details of both courses from E. H. Lewis, Department of Electrical and Electronic Engineering at the college.

**Sheffield.** King Edward VII School, Darwin Lane, Sheffield 10. Fridays, 7pm, commencing October. Details from J. Bell, G3JON, tel Sheffield 367774 (home) or 732333 (office).

**Southend-on-Sea.** Southend-on-Sea College of Technology, Engineering Department, London Road, Southend-on-Sea, Essex. Enrolment 8-10 September.

**Wembley.** Wembley Evening Institute, Copland School, Cecil Avenue, Wembley, Middx. Mondays, 7-8pm (Morse), 8-10pm (theory) commencing 15 September. Enrolment 7-9pm, 8-11 September. Fee £4 approx. Details from G8CZQ, tel West Drayton 47258.

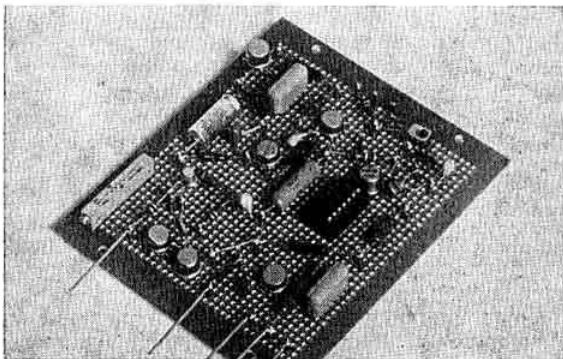
## NEW PRODUCT

### Lektrakit circuit kit

Lektrakit recently announced the availability of their low-cost re-usable Circuit Assembly Kit No 13 that will prove of as much interest to home constructors and amateur designers as it will to professional design and development engineers.

Their new kit, which is simple to assemble and quick to dismantle, comprises five plain double-sided circuit boards together with 500 standard pre-tinned brass solder pins. At £4 a kit, plus VAT, it represents a real saving over the cost of having to buy the items individually.

The re-usable circuit boards are made of srpb (synthetic resin bonded paper) and measure 4½ by 4in. They are perforated with 0.052in diameter holes on the international 0.1in matrix, and are thus ideally suitable for link wiring and mounting standard components on either side. This allows single or double-sided pcb arrangements. 24-way edge connector adaptors (type LK-2241/2261) at 0.15in and 0.1in pitch are available for use with the kit. The kit is manufactured by Lektrakit Ltd, 3 Trafford Road, Reading, Berks RG1 8JR.



# FOUR-TWO-SEVENTY

by MARTIN DANN, G3NHE\*

## DX news

The customary application of the law that big news breaks occur *immediately after* the deadline meant that much of the excitement at the beginning of July, notably the Jubilee Contest on 5/6 July, missed the August issue. Seldom can a major 24h event have taken place under such sustained good conditions, particularly on the higher frequencies. On both 2m and 70cm the dx was rolling in from start to finish, and continued to do so until the following Tuesday morning. There is little doubt that a good deal of ducting was involved, favouring some parts of the country more than others—the north-west, in particular, having a very lean time of it. Most of the dx was coming in from a fairly narrow segment between E and NE, 2m producing many contacts with SM, LA, OZ and DL as well as SP, and we have a report from GM4CXP that he heard snatches of a UR2—not bad going via tropo.

With over 100 stations worked in several cases, and the multiplier of five, the contest scores on 70cm are going to be particularly high. Most participants we have heard from report that between 70 and 75 per cent of their total was made up of Continental contacts which will give a very high scoring rate. G3XDY/P clocked up 10 countries on 432MHz; G, GC, GD, PA, DL, DM, OZ, SM, F and ON. John Quarmby, G3XDY, was interested to note that the UK is not the only country to have signal quality problems during contests.

Unfortunately, all this excitement on 2m and 70cm left 4m out in the cold, not only because of the lack of Continentals on this band, but also because the conditions did not match the excellence of those on the higher frequencies. With G3LVP in Essex, things were not as good on 4m as they had been during the 1974 Jubilee Contest, and G3ZIG of Norfolk found the going grim. Conversely, G3XDY/P felt that conditions on 70MHz were quite good but found activity poor; he managed five countries among his 34 contacts on this band.

With the father and son team of SM7AED and SM7FJE, Arne and Bo Nilsson, the good conditions lasted from 30 June to 9 July, but things really warmed up during the contest week-end. SM7FJE worked 125 UK stations during this event, and in the following days another 125, so, together with his father's total of 100, between them they had some 350 contacts with these islands during the lift. Bo also reports an auroral opening on 8 July at around 0500gmt, and again between 1500 and 1900gmt, when a string of stations in exotic-sounding QTH locator squares was worked. Their best N-S dx was SM2AID (locator square LZ) during the early morning session. There are no reports from G or GM so far, so presumably this opening did not extend into the UK.

SK6AB passed on over the air a list of Swedish stations active on 70cm. Besides himself in FR30c, these are:

SM7BAE (locator square GP), SM6CKU (GR), SM6PF (GS), SM6FBQ (GS), SM5LE (JT), SM4DHN (GU), SM4AXY (HT). At least six of these were worked during the opening, SM5LE probably being the best dx.

Claus Neie, DL7QY, found conditions between Berlin and the UK better at the end of June than during the contest, when due north was his best direction, enabling him to work three UR2s for a new country on 70cm. Another new country for Claus, this time on 2m, was GC8CEY at 0130gmt on 26 June. During the contest G3XDY/P (ZN48j) was the only British station worked by DL7QY on both 2m and 70cm. G3XDY himself worked two other Berlin stations on 432MHz, DK0UK and DC9CSA.

Norman Fitch, G3FPK, found the tropo conditions during the "Jubilee" superb, never having experienced such an opening before. He is a little annoyed, however, for missing out on OH1N1, worked by G3POI on cw at around 0845 on the Sunday. No complaints from G3XTT/P, who thoroughly enjoyed the event: he was interested to discover that while only 13 per cent of his contacts were on the key, they amounted to 26 per cent of his total score on 2m. Operating from Northamptonshire, Don worked 13 countries on 2m, including SP111 and SP1CDT.

Back to the sporadic-E opening on 2 July; G3IUD in XK75j, on the Lizard in Cornwall, made what is the best dx QSO we have heard of so far, working LZ2FR in Uldin at a QRB of around 2,300km. Mike also called YZ2KDE on cw without success, and heard bursts of stations in UA, OK and HA without copying full callsigns. G3IUD reports that the opening lasted from 0930 to 1120gmt down in Cornwall.

## UK auroral warning scheme

In May's *Four-Two-Seventy* we reported the intention of the RSGB Scientific Studies Committee to inaugurate an auroral warning scheme in this country to link up with the Dubus scheme already in operation throughout the continent. This has now been put into operation, and a succession of auroral openings to test the system thoroughly is now needed.

The UK network is initially activated by both the Dubus link into South Wales, and by a Swedish link (SM5BSZ) into Scotland, where the network consists of GMS 3JFG, 3PIL, 8FFX and 3GUI. The warning will only be passed south if the aurora is heard in Scotland, in which case the English network will be alerted. This consists of Gs 3JJI, 8HDS, 3NHE, 5UM, 8FQE, 3IPV, 6PG, 3FD, 3COJ, 4BWG, 4AIR, 3OHH, 3USF (who is the link with the South Wales and Dubus system), 3NSM, 2FKZ, 3POI and 3DAH.

These, therefore, are the stations on which to keep an ear to be sure not to miss any auroral activity. In some cases stations on the list already have arrangements with locals to warn them by telephone in the event that they themselves are alerted through the network, and by these means it is hoped that a rapid mobilization will be achieved when openings occur, allowing a high level of activity during the

\* 49 Windermere Court, North Anston, Sheffield S31 7GJ.



early stages of an aurora when, frequently, the best dx is worked.

The UK system is designed to have primary and secondary warning routes so that the network continues to function even when a station is unobtainable. It is also designed to eliminate, as far as possible, unnecessary false alarms; for example if weak signals are heard in Scotland and the warning telephoned through to the northern G network, which hears no signals, then it is most unlikely that southern and western England will receive any auroral signals, so the warning will not be passed on.

As we suggested in the first paragraph, the system now needs testing "under fire" to ensure its efficacy, but the organizer, Charlie Newton, G2FKZ, will adjust the scheme should any difficulties arise. He makes the point that this is a serious research project which requires not only widespread activity during auroral openings, but also accurate log-keeping and the sending of information to the RSGB Scientific Studies Committee. This information should consist of the usual exchanges, timed accurately, plus beam headings which should be recorded as precisely as possible. If the other station's beam heading can be obtained, then so much the better, and the way to ask for this is "QTF/A?" ("What is your auroral beam heading?").

### Band plans

Chris Towns, GM8BKE, feels that there is some confusion as to when the move to the new ssb calling channels on 144.3MHz and 432.3MHz should come into effect. Although Chris understood it to be immediate, he has heard one or two on-the-air complaints about the apparent lack of direction on this matter. We can confirm that Chris is right, and we should be using the new calling channels *now*—the recommended band plans became effective from the end of the Warsaw conference. We hope that this clears up any confusion that may have arisen.

Strong criticism of the new arrangements for the 70cm band has been received from Alan Morris, G8ENS-G6AGH/T, who makes the following points:

1. Many groups have bought crystals for GB3PY and GB3LT, and the move to the new frequencies will mean a lot of wasted expense.
2. The reduction from 2MHz to 1.6MHz spacing of repeater input and output frequencies will make listen-through working more difficult.
3. Newcomers to 70cm will not be able to listen to the repeaters because they will be outside the 432-434MHz communication band.
4. The new tv frequencies, even using vestigial signals, will extend 1MHz outside the 70cm band.
5. The repeater output frequencies are only a few kilohertz from the 4.43MHz colour sub-carrier of the tv signal.
6. The RSGB must have rather "odd" tv sets with the sound i.f. below the vision i.f.; everybody else uses sound *above* vision.

In case there are others who hold similar views, Richard Baker, G3USB, who was closely involved with this side of the band planning at the Warsaw conference, replies as follows:

1. It is unfortunate that GB3PY and GB3LT should have to change frequency. However, better these two now than dozens later, or the existence of two non-

compatible uhf repeater systems in the north and south of the country.

2. The repeater plan was constrained by the band 432-433MHz (dx working) on one side, and by the space allocation (435-438MHz) on the other. A 2MHz spaced system would not fit *within* these limits, so a 1.6MHz system was adopted. Since it is possible to "listen-through" at 600kHz spacing on 2m, it is hardly more difficult at 1.6MHz spacing on 70cm.
3. A second crystal in the converter will overcome this; also, point 3 conflicts with point 2 since the wider spacing would make it more difficult to spread a converter bandwidth.
4. A vestigial usb signal of 0.75MHz bandwidth will remain inside the band with a carrier of 439.25MHz. The point is that the sideband is tailored so that it *does* fit inside the band. This degree of sideband suppression is the same as the CCIR system used in most of Europe.
5. Colour tv is not a dx mode: it requires very strong signals and is certain to be used with a high-definition luminance signal. This operation is far better carried out in the "wide open spaces" of 1.296GHz. A limited bandwidth mono signal is used by the majority of 70cm amateur tv users to achieve maximum useful range.
6. Amateur tv systems in the UK and Europe have been using a "sound-low" system for a long time: this plan does not change that.

Richard Baker adds that despite the suggestion that the new 70cm plan was "pulled out of a hat at random", a great deal of work and discussion went into the determination of these band plans.

### The three-peaks expedition

Congratulations to the GB3UKP team which successfully conquered the highest mountains in Scotland, England and Wales in the same day, operating on 2m ssb from all three sites. Opening up at 0001 on 5 July, the team, led by GM8FVC, worked 17 stations from Ben Nevis before leaving the summit at 0030. Less than 11 hours later GB3UKP was back on the air from Scafell, and this time 22 contacts were made, including EI2AK near Dublin. By 1330 the group was on the road again heading for Snowdon, the summit of which they reached at 2015. Their 23 contacts from this site included the best dx of the trip, GM8FFX in Aberdeen at 450km.

In all, the expedition had 62 contacts with 48 different stations, six of which (GM8EUG/P, GM8ILE/P, GM8IZH/P, GM8HEY, GW8EQH and G8DVD) were worked from all three sites. Douglas McLay, GM8FVC, wishes to pay tribute to all those who helped in so many ways to make the attempt successful.

### Around the bands

A welcome newcomer to 4m is G6WR of Whitehaven in Cumbria who, many years ago, used to work the old 5m band. He was persuaded onto 2m about a year ago by that other well-known Cumbrian, G3BW, and then he took a fancy to 4m, making his first contact on the band during May of this year.

G3ZIG of Watton, Norfolk, wonders if anyone else is active on 4m between 6.30 and 7.30am. He checks the band

## UK REPEATER STATUS

No	Callsign	Chan	Location	Sponsoring group	Status
1	GB3PI	R5	Barkway, Herts	Pye Telecom ARG	O
2	GB3BC	R6	Mynydd Machen, Gwent	Bristol Channel RG	O
3	GB3MH	R7	Milvern Hills, Worcs	Mid-Severn Valley RG	O
4	GB3LO	R7	Crystal Palace, London	UK FM Group (London)	O
5	GB3SN	R5	Fourmarks, Hampshire	UK FM Group (Southern)	O
6	GB3PO	R3	Martlesham Heath, Suffolk	South Anglia Repeater Group	HO
7	GB3NA	R3	Barnsley, Yorkshire	UK FM Group (Northern)	O
8	GB3CS	R4	Black Hill, Central Scotland	Central Scotland FM Group	HO
9	GB3HH	R4	Buxton, Derbyshire	Sheffield University	HO
10	GB3LT	RU1*	Luton, Bedfordshire	Dunstable Downs RC	HO
11	GB3NB	—	Bacton, Norfolk	NA	NA
12	GB3PY	RU1*	Cambridge	Pye Telecom ARG	O
13	GB3BM	R5	Birmingham, Worcs	Midland Amateur RS	L
14	GB3NC	R4	St Austell, Cornwall	Newquay & D ARS	HO
15	GB3GN	R7	Aberdeen	Norfolk FM Group	P
16	GB3RF	R7	Burnley, Lancashire	North Western Repeater Group	HO
17	GB3KR	—	Dover, Kent	Kent Repeater Group	NA
20	GB3WW	R7	Carmel, Dyfed	West Wales Repeater Group	P
21	GB3MP	R4	Meel-y-Parc, Clwyd	UK FM Group (Western)	P
24	GB3??	RU1*	Chelmsford, Essex	Essex Repeater Group	HO
25	GB3CI	RU1*	Corby, Northants	Corby Technical College ARG	P
26	GB3SD	RU1*	Portland, Dorset	South Dorset Repeater Group	P
28	GB3HW	RU3*	Harrow, North London	UK FM Group (London)	P
29	GB3NS	RU1*	Banstead, Surrey	UK FM Group (London)	P

Key: HO—Awaiting Home Office approval  
 L—Licensed  
 NA—Not approved by Home Office  
 O—Operational  
 P—Proposal received  
 \*—To be confirmed

Note that the missing numbers represent promised proposals not yet received.

every morning, but due to the lack of activity he usually ends up on 80m, so skeds would be welcomed.

Another 2m newcomer, G3GRL, who has quite a reputation as a dx cw operator on the lower frequencies, finds, like many skilled telegraphists, that this mode is a restful haven from the quacking of sideband. On the night he made his debut on 2m, the cw end was so full of Monday-nighters enjoying the lift that it was difficult to find a clear spot below the new calling channel of 144.05MHz.

A good deal of cw activity has been noted around 144.1MHz from operators using modified Liner 2s, so it is well worth 2m telegraphists bearing in mind that the cw segment is not restricted to that 50kHz below the calling channel, but extends to 144.15MHz.

Further key news from those out-on-a-limb operators, G3BW in Whitehaven, and G3AUS near Exeter, both of whom consistently put A1 onto 432.2MHz and below and find many weak signal takers who would not be workable on any other mode.

Still in the west country, the Newquay & D ARS hold a nightly net at 1700gmt on 144.468MHz a.m. and they would welcome callers from further afield.

### Beacons

Unfortunately it was not possible to complete the modifications to the GB3VHF oscillator chain by mid-July as anticipated, so at the time of writing the beacon is still off the air. Remarks overheard show just how much reliance is placed on this 2m landmark and how lost users of the band feel while it is missing. It is perhaps due to the very few times (power crisis excepted) that GB3VHF is off the air that such consternation is caused when that familiar blip is missing.

Another beacon whose absence, when it occurs, is conspicuous, particularly on a Sunday morning, is the Sheffield University 4m beacon, GB3SU. The last time we reported

that there had been brief interruptions to its activity was when dust caused flash-over and blown fuses. The reason for GB3SU's several disappearances during July was flash-over of a more elemental kind, and on three separate occasions the main power trips to the university site at Harpur Hill were blown out during severe electrical storms. Fortunately no damage was done to the beacon equipment and it was soon back, burbling happily away at the top end of 4m.

The excellent conditions at the beginning of July allowed many Continental beacons to be identified on the vhf/uhf bands. Of particular interest are the 70cm Scandinavian beacons; in Denmark, OZ7IGY (432.018MHz), OZ6MBA (432.45MHz) and OZ1ALS (432.982MHz) were all good signals in this country during the lift, while from Sweden SK6UHF on 432.053MHz was also heard, but there are no reports yet of the Oslo beacon, LA1UHF (432.07MHz) in FT04j, probably due to its N-S beam heading.

The proposal for the Emley Moor beacon has now gone to the Home Office for approval. The callsign will be GB3EM and the proposed frequency is 432.91MHz. GB3EM will run 10W rf to, initially, an 8/8 aerial giving 10dB gain.

The reason for the lack of signal from GB3GEC in the north is that the beam direction is south-east, although, when conditions are at all above average, the beacon is audible at G3NHE.

### Slow scan

Richard Thurlow, G3WW, just missed the August deadline with the news of his sstv activity on 2m. At 0955gmt on 5 July he noticed "descending horizontal venetian blind" patterning on Anglia tv, so he switched on the 2m ssb gear. A 6min call on 144.28MHz produced a reply from DC2BE in Emden, and a two-way video contact resulted with good signals in both directions. This was Richard's second two-way sstv contact outside the UK despite repeated "CQ sstv" calls on both video and ssb throughout the good conditions.

Richard was disappointed by the lack of interest in sstv shown at the VHF Convention this year, but perhaps the forthcoming SSTV Convention at Aston University, Birmingham, on 11 October, organized by the British Amateur Television Club, will provide some consolation.

From hill-top sites in North Yorkshire, G4BLL and G3UEU have been making successful sstv contacts using a Liner 2, W6MXV and Venus monitors and pictures recorded from a flying spot scanner. Best dx so far is G3VKV in Cheltenham at about 150 miles, and anyone wishing to make skeds for 2m two-way sstv contacts with North Yorkshire should contact G4BLL or G3UEU.

### Contest comment

We have already mentioned the remarkable conditions under which the July VHF Open (Jubilee) Contest was held, but one disappointment expressed by several participants was that while the Continentals were obviously including 23cm in their contest, it was not included in ours. Apart from that, the weekend of 5/6 June will remain a weekend to remember for many stations.

The VHF Contests Committee struck lucky again with the

Continued on page 706

# MICROWAVES

by DAIN EVANS, G3RPE\*

## PA0 on 3-4GHz

During the recent spell of fine weather which seems to have produced dx conditions on most bands above 30MHz, with GB3DD being heard S9 in Copenhagen as well as in Holland and Germany, G3LQR (Suffolk) not surprisingly has been noting abnormal signals in tests with PA0DBQ in Delft. With signal strengths on 432MHz up to 80dB above noise over this 225km path, one wonders if they have been observing super-refraction. Certainly the humidity ducts actually seen in the Irish Channel during May were many hundreds of feet in height and therefore thick enough to allow this mode of propagation even at 432MHz.

Strong signals were also exchanged on 2-3GHz and in one direction on 3-4GHz: when G3LQR's 2-3GHz signals were 30dB above noise his 1W at 3-4GHz was 12dB above noise. As is to be expected, PA0DBQ's 60mW signals did not get through under these conditions. However, on 18 June G3LQR's 2-3GHz signals rose to 40dB above noise, and his 3-4GHz signals were +18dB. PA0DBQ's 3-4GHz signals were at last heard peaking up to 7dB above noise to give G3LQR his first contact on the band, a new UK record and the first G/PA0 contact on 3-4GHz all in one.

G3LQR's transmitter for 3-4GHz uses a BXY37 varactor tripler from 1-152GHz, the aerial being a dish 5ft in diameter fitted with a log-periodic feed for 1-3, 2-3 and 3-4GHz. The receiver front-end is similar to the G3EEZ design (*Radio Communication*, December 1971, p828) but with a transistorized local oscillator chain. The latter employs a 360MHz driver followed by a doubler and then a quintupler to 3-600GHz, 3-456GHz being tuned via a 144MHz i.f. The same 360MHz driver is used to generate 2-160GHz for the local oscillator for the 2-3GHz receiver which also uses a 144MHz i.f. The corresponding transmitter uses the doubler described in the June 1975 *Microwaves*.

## A stabilized low-voltage power supply

The circuit shown in Fig 1 due to G8CGN will find application in many areas where a highly-stabilized current of several amps is required. It was initially intended to supply a high-power Gunn oscillator, and indeed is currently in use in the 10GHz beacon GB3IOW. It was developed from the low-power version described in the April 1974 *Microwaves*, which should be referred to for details of afc inputs and tone and speech modulators. A feature of the present circuit is the use of a complementary Darlington output configuration instead of the more common emitter-follower circuit, which has the advantage of halving the voltage drop across the output pair. Most types of TO5 npn transistors can be used for TR1 provided that  $P_{diss}$  is greater than 500mW and  $I_{c\ max}$  is greater than 300mA. TR2 can be any power pnp type provided that  $P_{diss}$  is greater than about

10W and  $I_{c\ max}$  greater than a few amps. The  $f_t$  of TR1 should preferably be greater than that of TR2 to avoid the risk of oscillation within the Darlington pair.

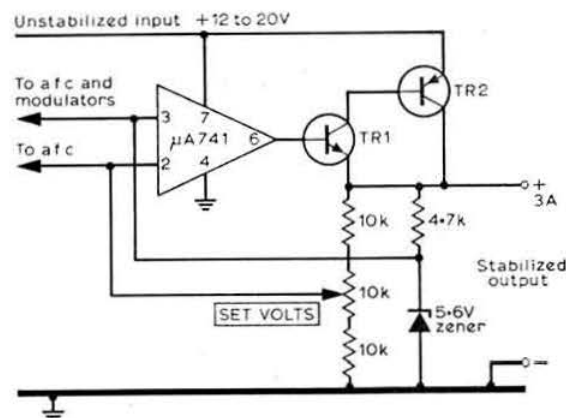


Fig 1. Circuit of a high-power dc stabilizer. TR1 2N2102, TR2 MJ3701 or similar

With the devices suggested, the maximum current is 3A. This can be increased to 4A by using two MJ3701 transistors in the output. With appropriate transistors, the input can be increased to 35V and the output to several amps. The unit can be converted to a negative earth supply by using a pnp transistor for TR1, an npn for TR2, and reversing the ic connections 4 and 7 and the zener diode.

The writer has used this circuit to provide a stabilized 12V supply to a klystron psu, using a BFY51 fitted with a small heat sink as TR1, and a NKT404 mounted on the chassis as TR2. The results obtained are most impressive: at an output current of 1A, the output voltage varied by only 2mV when the input voltage was changed from 14.2 to 20.5V. With a fixed input of nominally 18V, the output voltage changed only by 3mV as the load was increased from 1 to 5A.

The stabilizer greatly simplified the design of the klystron supply. The heater is now fed directly from the 12V supply via a dropping resistor, and the +500V resonator supply obtained from an inverter no longer needs additional stabilization—it varies by only 200mV for a change in battery voltage from 14 to 20V. The -400V reflector supply is additionally stabilized by gas tubes, and when the input was varied over the same range the output variation was less than 50mV, the limit of detection of the dvm in use.

The effectiveness of this circuitry is partly due to the very high gain of the ic amplifier, and it may prove necessary to add decoupling capacitors of about 0.01µF across, for example, the zener diode and the output to suppress parasitic oscillations. □

\* 4 Upper Sales, Chaulden, Hemel Hempstead, Herts.



# THE MONTH ON THE AIR.....

..... by JOHN ALLAWAY, G3FKM\*

THE writer can think of no part of the world outside Britain where stations operating from a country other than that in which their home licence is issued do not use either a specially issued new callsign or their own call followed by a suffix denoting their temporary location. From discussions with a number of non-G UK licensees the impression is gained that an overwhelming number would favour a change from our present highly-confusing system to that followed in the rest of the world. Thus G3FKM operating from Wales would become G3FKM/GW. Readers views, either supporting or disagreeing with the suggestion, would be very welcome.

G4DJA reports that his callsign is being pirated on 3.5MHz ssb, most likely by someone in the south.

## Top band news

VK3CZ has supplied a list of sunrise times in Victoria. Those given apply to the 15th of the month: September 2020, October 1934, November 1859, December 1851, January 1914, February 1948, March 2019, April 2049 and May 2117. In the period 2 February to the end of June the only UK station logged was GD4BEG on 4 and 5 May, but no contact was made. This was his first-ever logging of a British station in that month. DHJ was logged on a number of occasions, and QSOs were effected with JA2GQO, PY1RO, W4EX, WA7ILC, W5SUS, KV4FZ and KH6CHC.

GD4BEG says that, following the success of previous UK-ZL schedules during the spring equinox, it has been decided to repeat the experiment in the coming autumn. Skeds will commence on 20 September and continue until 3 November at our sunrise time. During the spring, signals peaked 30min before sunrise and were often audible for 30min after, so that times will be local sunrise time plus and minus 30min. Europeans should transmit around 1.826MHz and listen between 1.875 and 1.880MHz. Please send reports to G3FKM.

## DX news

T75AA will be the callsign of an expedition station operated by CRAG members from Tikal, the ancient Mayan capital now located in the heart of the Guatemalan jungle. It will be on the air from 0001 13 September to 2400 15 September, and will use the following frequencies ( $\pm 5$ kHz): 3.780, 7.080, 14.195, 21.300 and 28.600MHz. Two-metre signals will be radiated on 146.940 and 146.520MHz. The expedition is to celebrate the anniversary of Guatemalan independence, and special QSLs will be sent to all. Special TIKAL certificates will be available by air mail upon receipt of \$2.

Reg Cherrill, W3HQO/G3XNV, is still receiving QSL cards from those who have contacted 9G1GD. It seems that Reg can no longer verify such contacts and he believes that 9G1GD's call is being used by a pirate.

Peter Smith, formerly ZD7PS, has now returned to the

UK and is active again as G3TJE. He made 3,500 QSOs from St Helena during his 12 months' stay. His next overseas tour will be in 18 months' time when he hopes to visit another dx location.

G4CWP reports the receipt of a letter from a UK citizen at present in Thailand which says that at present all amateur radio activity is banned. This seems to be the result of trouble from non-Thai operators (not British).

Canadian stations will be using special prefixes between 1 August 1975 and 31 July 1976 to celebrate the Summer Olympic Games. VEs will use XJ, and VO's will become XNs. There will be a special station on the air from the site of the games in Montreal using the callsign CZ20 from 17 July to 3 August 1976. VE3EDC has been signing as XL3EDC during July to mark the centenary of the commencement of work on the Canadian Pacific Railway at Thunder Bay.

TF7V operated from Westman Is from 11 to 13 July. The special call was given to the station which was located on Helmaey Is, formed as a result of volcanic activity two years ago.

4K2AB was a special station on the air from an exhibition in Vilna (UP2) in mid-July. QSLs should be sent via UP2BAS. WG3AS was active from Goddard ARC and WU5AST from Houston for the duration of the Apollo-Soyuz mission.

KH6EVM/KP6 is reported to have been heard in the Pacific Net at 0600 on 14.265MHz, and later on the Inter-Island Net at 0800 on 14.310MHz. He will be on Palmyra Is for some time yet. VR1AT is located on Ellice Is. ZK1DA hopes to operate on 7.005MHz cw soon, and should be listened for around 0700 on Sundays.

Stations in Mozambique are using the prefix C9M in place of CR7—eg CR7AF is now C9MAF. W3HHV acts as QSL manager for 9J2s KC, SJ, TJ and WK.

Saudi Arabia and Iraq are reported to have eliminated the 824 neutral zone and shared the territory equally. This may mean the deletion of yet another DXCC country wef 2 July 1975. JY5UMN says that the Arabian Knights Net now meets at 1200 14.195MHz each Sunday. ST2SA often joins the International DX Net which meets daily at 0600 on 14.250MHz, net controller in this instance is JY3ZH. VS5MC was due to leave Brunei on 5 August for the UK. W2AUS is due to come on the air as VS5WM soon. 9N1MM meets HV3SJ regularly at 1530 on Saturdays on 14.275MHz. 9M8VLC is frequently to be found between 1400 and 1600 in the band section between 14.190 and 14.225MHz.

Those still needing confirmation from the first Mt Athos expedition (SY1MA) will be interested to learn that DJ6TK still has the logs and a supply of QSLs.

All QSLs for CE9 and XQ9 stations located in the Antarctic should be sent to the Chilean Federation of Radio Amateurs, Box 72, Valparaiso, Chile. No other route or address is correct.

The first two-way cw DXCC has been issued and was achieved by W3KT.

G3NRQ recently spent several weeks in Pakistan and attended a meeting of the Pakistan ARS in Lahore. He was

\* 10 Knightlow Road, Birmingham B17 8QB.



received with great courtesy but was unable to obtain operating permission. It seems that it can take residents 18 months to get a licence, and the severe import restrictions and high duty rates make equipment very scarce.

G3GKI has been on the air as VS6EY and hopes to be back in the UK this month. He has been active around 1500 on 14.090MHz.

One area which is not lacking in activity at the present time is the Indian Ocean. Summarizing recent reports it seems that FB8s ZE, ZF and ZG are all being worked on 14MHz ssb and all QSL via F8US. FB8s XJ, XL and XM use the same band and mode but QSL via F2MO. FB8WD, on Crozet Is, also favours 14MHz and his QSL manager is F5QE. On the Comoro Is FB8s CI, CJ and CK are all active on 14MHz, the latter asking for cards to BP 186, Moroni. FR7ZQ/G has been worked from Glorioso Is and should be QSLd to his FR7ZQ address or via REF. Other stations in the same area include FR7AI/E, FR7ZL/T and FR7ZU/J.

QSLs for KH6GKD/KB6 and VR1PE should be sent direct to the address in *QTH Corner*, together with two IRCs and *not* via the bureau.

The following stations with VK0 prefixes are believed to be active: VK0s CC, CG and GW (from Casey Base, Antarctica), VK0AL (Dovier Base), VK0IN (Mawson), and VK0DA (MacQuarrie Is).

## Dxpeditons

DK7PF and DK7PV will be in Liechtenstein between 1 and 16 September. They will use all bands 3.5 to 28MHz with cw and ssb.

PY7YS/0 is expected to be on the air from St Peter and Paul Rocks about 15 September.

3B8DL's intended trip to Rodriguez Is has been postponed for a while as Roddy no longer has his HW16. 3B9DL will appear at a later date.

TU2EF will be paying short visits to 6W8, TJ, TN, TR, TT, TZ, XT and 5V in late September. He will be taking his KWM2A and dipole with him and has applied for licences to operate from Chad and Mali. Any such activity is likely to be of very short duration.

## Contests

### The Scandinavian Activity Contest

1500 20 September to 1800 21 September (cw).

1500 27 September to 1800 28 September (phone).

3.5 to 28MHz. Work Scandinavian prefixes and exchange RS/T and serial QSO number. Rule sheets available from G3FKM (*sae please*).

### The VK/ZL Oceania DX Contest

1000 4 October to 1000 5 October (phone).

1000 11 October to 1000 12 October (cw).

All bands 1.8 to 28MHz. Two points for contacts with VK or ZL. Final score reached by multiplying total QSO points by sum of different VK/ZL prefixes worked on each band added together. Exchanges consist of RS/T and serial QSO number (from 001). Logs should indicate date, time, station worked, band, number sent and number received. Each new prefix should be underlined and separate log sheet used for each band. Entries may be single or multi-operator. Logs must be posted to reach: VK/ZL Manager, WIA, GPO Box 1002, Perth, 6001, W. Australia, before 31 January.

Listeners may enter and should log only VK and ZL stations, showing date, time, call, callsign of station being

## QTH Corner

A3SAK

F0CH/FC

G4ATC

KB6CU

KH6GKD/KB6

KS6FF

VP2GEB

VR1AT

VR1PE

VR1JA

WG3AS

Z07PS

ZK1DA

5N2NAS

9M8VLC

see KS6FF

HB9TL, Weinfelderstr 29, CH 8580 Amriswil, TG, Switzerland.

via G3COY.

J. Dudek, Box 1158, Canton Is, 96736.

see VR1PE.

W6KLI, 16933 Loukelton, Valinda, Cal, 91744, USA.

E. Banks, 23 Marrett Court, Marrett Rd, St. Heller, Jersey, CI.

c/o Weather Station, Funafuti, Ellice Is.

KH6GKD, 92-574 Akaula St, Ewa Beach, Hawaii, 96706.

JA1UMN, Hiroyasu Satoh, 4131-837 Soya, Soya Ku, Yokohama 246, Japan.

WA3NAN, Goddard ARC, PO Box 86, Greenbelt, Md, 20770, USA.

G3TJE, 118 Glebe Rd, Deanshanger, Milton Keynes, MK19 6LZ.

WA5OCN, 5014 Loch Lomond Drive, Houston, Tex, 77035, USA.

Nigerian Army Signals RC, Box 448, Apapa, Lagos, Nigeria.

WA7PEZ, 1454 Barton St, Eugene, Ore, 97402, USA.

RSGB QSL Bureau, G2MI, Bromley, Kent BR2 7NH

worked, RS/T of the VK/ZL station, band and points. Scoring is the same as in the transmitting section, and a summary sheet showing callsign, name and address, details of equipment, and for each band QSO points and total multipliers. A signed declaration that all rules have been observed should be made (summary sheet and declaration should also be sent in by transmitting entrants).

In the 1974 event G3SEM led the UK phone entry with 1,030 points, G3EBE (378) and GW3NNE (666) also entered. In the cw section G3KMO (1,207), G6CJ (396) and G3PVA (272) were listed. A8482 was the only UK listener entry (1,768 points).

## SSTV convention

A special slow-scan tv convention organized by the British Amateur Television Club will take place at Aston University, Birmingham, from 1000 to 1800 on Saturday 11 October. It will be open to all who are interested—whether members of BATC or not. There will be lectures and a display of equipment. Admission will cost 50p, and tickets may be obtained from G8DLX, QTHR.

## Awards

### The Brisbane DX Club Certificate

For confirmed contact with five members. After working the fifth send QSLs for all five to him and he will arrange for the certificate to be sent free of any charge.

## Band reports

Conditions have been fairly good on 14MHz into the Pacific area in the mornings, and there have been a number of occasions when signals from the USA have been heard on 28MHz. Europeans have been worked regularly on the latter band between 0800 and 2100.

Many thanks to the following for submitting logs and information: Gs 2HKU, 3HB, 4RZ, 5JL, 6GH, 3UYM, 4BHI, 4BTI and 4COR. BRSSs 17567, 17991, 31301 and 35608. As 8088, 8312, 8428, 8713, 8752 and 8890.

Stations listed in italics were using cw, the rest ssb.

1.8MHz 0000 KV4FZ, VE1MX, W1HGT, W2DEO.

14MHz 0600 KH6, VR1PE, W6/W7, 0700 KH6GKD/KB6, KS6FF, 5W1s AR, AU. 0800 JT0AE, KB6BU, PU0YS, VR1AC, 5N2NAS. 1400 JA, JT1AI, VS5MC. 1500 HM, JT1s AO, BA, VK9XI, VU7GV, 9M6ML, 9N1MM. 1600 AP, DU, VS9MB, YB0, 3B8DO, 4S7, 9M8HG, 1700 SU1MA, TR8SS, VS5PM, XW8HK, 9V1SO (QSL to G3XGY). 1800 AP, HZ, KH6CF, VQ9SS/C, OE5CA/YK. 2000 EA5ES/EA9, VP8, VP9, ZD7, 5H3.

2100 ZFIAL (QSL to WA4SVR). 2200 FP0XX, JA, LU2DZ/SU, K4TJ/VP2A, W7. 2300 VP1IL (QSL to SM6PF), W6.

28MHz. 0800 CN8BF. 1100 W2LBB. 1500 PY, ZS. 1600 LU, W1-W4. 1700 W2, W3, W4, W8. 1800 CE, PY. 1900 VE1, VE3. 2000 CE, LU, VP2LAW.

Very many thanks to all correspondents, and also to the authors of the following for information: DX News Sheet (Geoff Watts), the 29 DX Club Newsletter (VK6WA), the DXers Magazine (W4BPD), Long Skip (VE1AL/3), the West Coast DX Bulletin (WA6AUD), DXpress (PA0TO), and the Ex-G Radio Club Bulletin (W3HQO).

Please send all items for October issue to reach G3FKM no later than 3 September, and for November by 8 October.

## Propagation Predictions

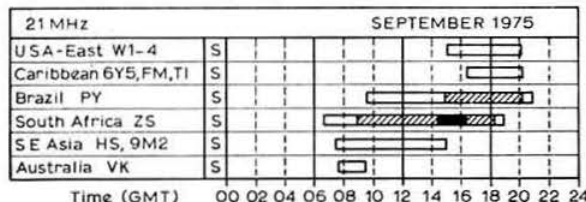
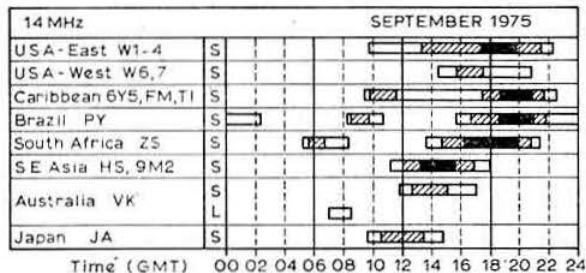
Only a slow improvement of conditions on hf bands will occur during September and continue into October and November. In years of maximum sunspot activity the seasonal change is very marked, but during the present low activity the seasonal change will make little difference on 28 and 21 MHz.

28MHz will be of little practical importance for dx traffic. Even the season for short-skip will come to an end on 28 and 21 MHz during September. For dx the most favourable time for traffic with South Africa will be from about 1430 to 1630gmt.

14MHz will remain the main dx band, but because of the present phase of the equinox there will be fewer contacts via the indirect path. Under favourable conditions traffic with KH6 may be possible from about 1630 to 1900gmt.

Longer nights and advancing autumn mean practically no dx during the second half of the night. Because of this, 7MHz will carry most dx during the latter half of the night. Contacts will be possible on both 7 and 3.5MHz when the greater part of the path lies in darkness. This is most important for 3.5MHz. Longer nights and the decline in "static" level will improve dx conditions on 7 and 3.5MHz. Local traffic will be interrupted by the dead zone at various times during the night on 3.5MHz.

The provisional sunspot number from the Swiss Federal observatory for July was 28.3. The month showed an even daily distribution of solar activity. The Telecommunications Services Centre at Boulder predicts low solar activity during the coming month with MUFs near or slightly below seasonal normals. The predicted smoothed monthly numbers for November, December 1975 and January 1976 are 9, 8 and 7 respectively.



S Short path 1-5 days 6-20 days  
L Long path Openings on more than 20 days in the month

## FOUR-TWO-SEVENTY

Continued from page 702

144MHz QRP contest on 27 July, when above-average inter-G conditions meant that full advantage could be taken of the good support for this event from G, GC, GD, GM, GI and GW. How nice it was to tune over the sideband end of 2m during a contest to hear a string of good strength signals without the succession of rock-crushing band-eaters to be found in full-power events.

### VHF/UHF records

The recent sporadic-E and extended tropo openings may well mean that the list of vhf/uhf distance records published in *Four Metres and Down* last October could be out of date. Some of the recent contacts with LZ, for example, might be pushing the existing G3DAO-LZ2FA record on 2m of 1,350km. It is suggested, therefore, that any claims for contacts which the participants think are of a greater QRB than the existing records should be sent to G3NHE as soon as possible so that an up-to-date list can be published. Please include full details of the contact, QRA of both stations and the distance claimed.

### Awards

The latest information on FMD awards issued is:

144MHz Transmitting: certificate No 449 to G8IWA of Beverley; No 450 to G3UOK; and to G4DLB certificate No 451, 14 of his 30 counties being worked on the key.

144MHz Senior Transmitting: No 77 to G4CDF and No 78 to GW8DUP, who includes five m-s contacts with such countries as I1 and OE, which, of course, he had to do by ssb, not cw.

70MHz Senior Transmitting: No 27 to G3HBG.

432MHz Senior Transmitting: No 24 to G3UBX, a creditable performance from a very poor site.

1.296GHz Transmitting: No 7 to G3NHE.

### Miscellany

G4BLL and G3UEU operate portable most Sunday afternoons on 2m from various sites, 2,000ft and over, in North Yorkshire from 1400 to 2000gmt. Equipment used is a Liner 2 with speech clipper and an 8/8-el beam on a 16ft portable mast.

Paul Casling, G3MWZ, will be signing /LX/P from Luxembourg (QRA DJ22) during the IARU vhf contest on 6/7 September, hoping to spend much of the time beaming towards the UK.

Victor Budas, GM3VTB, made no fewer than 70 contacts on 2m with Continental stations in a four-hour period from Cairn O'Mount on 30 June, using a Liner 2 and a 4-el beam. He also managed to access the Stavanger repeater on R6, although signals from Norway tended to be better direct.

Thanks to those who have sent information on QRBs of super dx recently. It was interesting to note how close the various results were, whether calculated from the QRA locators by computer, or by other methods. The information will be used when the up-to-date dx record lists are prepared, as mentioned earlier.

Finally, all items for the October issue should reach G3NHE by 3 September, and for the November issue the deadline is 8 October.

# SWL NEWS

by BOB TREACHER, BRS32525\*

As our very fine summer rolls on relentlessly with energy-sapping temperatures in the mid-eighties, the country's listeners seem to have deserted their receivers and turned instead to the beach and the countryside. This has meant that news and comment this time is at a minimum. However, I am sure that once the summer heatwave has passed there will again be a tremendous amount of listening going on all over the country.

## SWL contest news

Chris Henderson of the Cray Valley RS has forwarded the results of that society's 1974 Listeners Contest. In the single-operator section D. Kendall, BRS24643, came first with 115,020 points, followed by K. Kerr, A8482, 92,264 points, and M. Hardy, ZE101, 91,520 points. The multi-operator section was headed by D. Whittaker, BRS25429, and A. Miller, G-5218, with 106,978 points. Chris says that certificates will be issued as soon as printing difficulties have been resolved, so please be patient.

Also from the Cray Valley RS, we have received the rules for its 1975 contest. This will be held between 1800gmt 27 September and 1800gmt 28 September. The rules are basically the same as last year (see *Radio Communication* August 1974 p540). Entries must go to Miss D. A. Long, 11 Oakfield Gardens, Beckenham, Kent BR3 3AY, to arrive not later than 17 November. Log sheets and rules can also be obtained from Denise Long.

## How not to QSL

Your scribe still receives letters from amateurs in England who become slightly aggravated when an swl in, say, Luton sends a report to a local station stating that he was 57 at his QTH when the station which he happened to be in QSO with in, say, Margate gives him 59. Listener reports over such short distances are totally useless to the person they are sent to and waste time and money on the part of the listener. If you are going to send cards to stations please ensure that they are (a) dx stations, (b) those in rare areas of the world and (c) those who appear to be getting no replies to their CQ calls. The average amateur does not usually welcome short-range listener reports especially when he is getting QSOs over much greater distances. If enough is said in the columns of this and other radio magazines, perhaps, in time, every listener will know exactly how to QSL correctly and, more important, be able to judge to whom cards should be sent. In this way QSL return rates will soar.

## The month's happenings

It is very pleasing to find that licensed amateurs as well as swls read these pages. G3KDP in sunny Cornwall writes to advise of the emergence of 10m as a short-haul dx band once more. Tony backs this view up with proof of contacts to the USA, Caribbean and South America during a long session on the band during July. As well as this dx, many European stations have been heard throughout the summer during the afternoon and early evening hours. This view has been

1975 COUNTRIES TABLE

Station	10	15	20	40	80	160	Total	Mode
BRS17567	61	127	214	58	160	8	628	ssb
BRS35943	35	127	200	85	139	0	586	ssb
A8312	34	90	168	89	115	29	527	ssb/cw
A8428	28	99	184	46	109	5	471	ssb
BRS25901	32	72	182	69	78	7	440	ssb
BRS35608	6	27	195	146	55	0	426	cw
A8088	29	61	110	38	50	11	299	ssb
BRS34658	4	8	64	45	94	7	222	ssb
BRS35454	0	2	96	8	51	3	160	ssb
BRS35754	0	0	38	0	51	1	90	ssb

backed by numerous swls who only hope the band will remain lively enough for the autumn contests in order that their 10m totals can improve.

Andrew Roberts, A8428, managed to log both the stations which are active in the "country" named "Morokuilen". Morokuilen is a beautiful country on the LA/SM border between Kongsvinger and Charlottenberg and consists of camping sites, a shop, theatre and petrol station. The radio stations are LG5LG and SJ9WL and are maintained by the NRRL and SSA. Apparently the stations may be operated by amateurs from all countries. QSLs for LG5LG go via LA4YF and for SJ9WL via the SM-bureau. Those requiring a QSL must send at least three IRCs with the card, even if it is sent via the bureau, as this is their contribution to the LG5LG/SJ9WL Fund for handicapped LA/SM amateurs. This is a very worthwhile venture, but the only problem is that Morokuilen does not count as a DXCC country!

Neville Spry, BRS17567, has found the weather very bad on listening and only manages to do this during the early morning and late evening. However, Neville was pleased with 5W1AR, KH6GDK/KB6 and VRIPE on 20m, who were all probably suffering with heatwave conditions also.

Our 160m expert, Dave Sharred, A8312, has been defeated by school examinations which meant that his brother Stan, A8313, heard cw-type 160 transmissions from VP8NP, CX3BR and ZP9AY. However, I think a minor outbreak of war occurred in the Sharred household when Stan heard PU0YS on Fernando de Noronha while Dave was dealing with other more pressing examination commitments. Dave reports confirmations from GC4BUE/P, CT3/DJ6QT, OE2JG, 4X4UR and JY9FOC. This now gives him 23 160m confirmations out of 36 heard. He has also received a certificate for a second place in the Verulam ARC 160m Contest, a first in the Chiltern Contest and sixth in the Cray Valley Listeners Contest, all of which took place earlier in the year.

Robert Maskill, BRS35454, will probably be very surprised to learn that 5HMOC is the registration of an East African Airways Super VC10. No doubt the operator was Bob, 5Z4LW, who, your scribe believes, is a pilot for the said air line, and who is allowed to use 5HMOC/AM on flights.

That is about all we have this time; the deadline for the November issue is 29 September, so until the November *SWL News*... Good dx and keep the news coming! □

# Inter-satellite communications using the Oscar 6 and Oscar 7 satellites

by Dr P. I. Klein, K3JTE, and R. Soifer, K2QBW\*

The frequency plans of the communications transponders aboard Oscar 6 and Oscar 7 are such that output signals from Oscar 7 can be retransmitted through Oscar 6 when the two spacecraft are within range of one another. This makes possible inter-satellite communications and tests of this unique type of link using stations operating in the amateur service.

Oscar 6 was launched on 15 October 1972 into a 1,460km circular polar orbit. The spacecraft contains a linear transponder capable of relaying uplink signals in the 145-90-146-00MHz portion of the 2m band, frequency translating them to 29-45-29-55MHz in the 10m band. Oscar 7 was launched on 15 November 1974 into a near-circular polar orbit very similar to that of Oscar 6 and contains a linear transponder designed to relay uplink signals in the 432-125-432-175MHz portion of the 70cm band, frequency translating them to 145-925-145-975MHz, which falls within the input passband of the Oscar 6 transponder. The power output of the Oscar 7 transponder is approximately 2W average (8W peak). Fig 1 illustrates the inter-satellite path made possible with the transponders linked together.

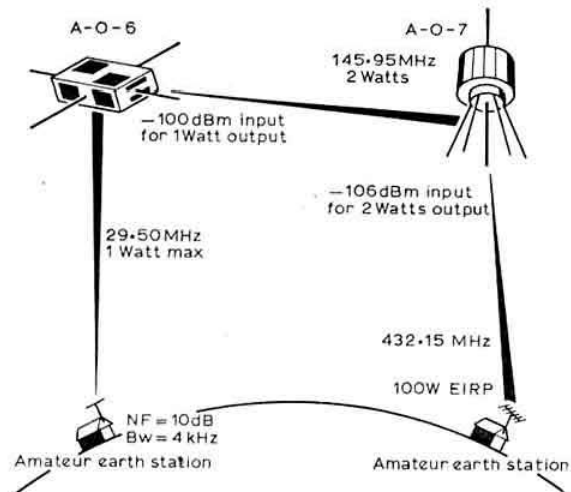


Fig 1. Ground-satellite-satellite-ground links involved in Oscar 6 and Oscar 7 inter-satellite communication

The two spacecraft are in nearly identical orbits. The period of Oscar 7 is calculated as 114-9447min, as compared with the 114-9945min period derived for Oscar 6. Thus Oscar 7 overtakes Oscar 6 at the rate of 0-0498min/orbit, or approximately 270km per day. The sensitivity of the Oscar 6 transponder is such that a -100dBm input signal in the 2m band will produce an output of nearly 1W in the 10m band, a level sufficient to produce signal-to-noise ratios of the order of 20-30dB at typical ground terminals, depending upon the characteristics of the receiving station and the slant range to the spacecraft. In actual practice, amateur radio operators are often capable of tolerating signal-to-noise ratios of the order of 0dB, particularly when telegraphy is used. Therefore it was expected that at separation distances of the order of 5,000km inter-satellite communication would still be possible. The link calculation corresponds to an inter-satellite free-space path loss of 150dB, and assumes a 2W signal transmitted from Oscar 7 to Oscar

6, an input sensitivity of -120dBm for the Oscar 6 receiver, a 3dB polarization mismatch between the two satellites, and a 0-10dB signal-to-noise ratio at the ground receiver for the Oscar 6 re-transmitted signal.

The possibility of inter-satellite communication was realized two months after the launch of Oscar 7 as observations of successful Oscar 6/Oscar 7 linked communications began to become more frequent. The first reported inter-satellite transmission (one-way) occurred on 6 January 1975, during Oscar 7 orbit 643 (Oscar 6 orbit 10,172) when the two spacecraft were 7,000km apart. The transmitting station W5HN in Dallas, Texas, was using cw and was received at station K5AXH in Richardson, Texas. During the few days before and after 1 February 1975, as the two spacecraft reached separation distances perhaps as close as 10km, numerous stations could be heard communicating through both of them linked together. Two-way inter-satellite communications reports were received from 15 radio amateurs who successfully used both A1 and A3J transmission modes. Fifty-five amateur stations in 12 countries were involved in these contacts, which occurred at satellite separation distances of up to 2,000km. Among the longest distance contacts reported were two-way communications between Finland and Japan, and between Japan and Canada.

Successful two-way communications were accomplished between stations transmitting through different satellites at the same time, ie one station transmitting through Oscar 7 and the other transmitting through Oscar 6, and also between stations where both operators were transmitting through Oscar 7 and listening to their signals retransmitted through Oscar 6.

It is hoped that future application of these inter-satellite techniques will lead to extension of the station-to-station communication range, at least in one direction, between users of low and medium altitude communications satellites. Because of their slightly different periods, Oscars 6 and 7 can be expected to approach close together every six months, permitting additional experiments with this interesting and relatively unique mode of satellite communications. □

## OBITUARIES

The Society records with regret the deaths of the following radio amateurs:

### Mr H. N. D. Mahoney, G3SUK

Desmond Mahoney died on 29 July, aged 56. He was vice-chairman of Stowmarket Amateur Radio Society and active on most bands.

### Mr D. C. Pickering, GW8CGH

Don Pickering died on 2 July. He had been very active on 144MHz for several years and was often heard through GB3BC from the Welsh coast.

### Mr N. B. Simmonds, G3XRH

Bert Simmonds died on 20 June, aged 74. Although active in amateur radio since 1921, he did not, for business reasons, become licensed until 1968. The radio firm of Simmonds Bros, which he and his brother established in 1922, was among the founder members of the then British Broadcasting Company.

He joined the Slade Radio Society in 1928 and more recently the Stourbridge and District Amateur Radio Society. For 47 years he was continuously active in df, and in fact succumbed to his terminal illness on his last such outing on 4 May.

### Mr R. H. Smart, G3MMC

Bob Smart died on 6 July, aged 46. He was for some time the RAE course lecturer at the Grafton Radio Society, and his call was well known on the bands.

### Mr J. Wadham, G3ENE

Joe Wadham died in May. He was active on all the hf bands but his main interest was in 80m, and he was often to be heard on the Rotary and Royal Signals nets.

### Mr A. Ward, G3GPH

Alec Ward died on 2 August, aged 74. His main interest was in top band and 80m.

\* The Authors are with the Radio Amateur Satellite Corporation (AMSAT).



#### Mr J. A. Woolley, G3ESR

Joe Woolley died on 28 July. He will always be remembered for the work he and his wife Frances, G3LWY, did in organizing and building up the Radio Amateur Invalid and Bedfast Club. Their devoted and painstaking attention over 12 years raised it to its present level from which it will progress on the lines he and Frances established.

He did not wish for any flowers, but donations could be sent to the RAIBC treasurer, Tom Shepherd, G3HPJ, 59 Paintain Road, Loughborough, Leics LE11 3LZ.

We have also been advised of the death of Mr F. J. Dowie, B.R.S 34288.

## The 1976 National VHF/UHF Convention

The RSGB VHF/UHF Convention has become an established and popular event in the radio amateur calendar. For some years now, the event has been held at the "Winning Post" near Twickenham, and numbers attending have grown from 370 in 1971 to 719 in 1975. The VHF Committee feels that the convention has now outgrown the accommodation available at the "Winning Post" and that the event should be expanded in both size and scope.

To this end, the committee has decided, after due consideration, that the facilities required will be more than adequately provided at Brunel University, Uxbridge, and next year's convention will take place there. It will be a two-day event, running from Saturday lunch-time 8 May to Sunday lunchtime 9 May. This should allow time for those at some distance to travel in daylight hours.

The advantages of the venue will be apparent from the following details:

#### Accessibility

Road access is very good with the M40 motorway running quite close by; this will make travel from the west relatively easy. Approaching from the north, the A1 and M1 terminate only a few miles from the start of the M40 in West London. From other directions there are also few problems.

For rail travellers, the London Underground runs to Uxbridge, from which station it is only a short bus or taxi ride to the university. For the "jet set", Heathrow is only a few miles to the south.

#### Accommodation

This is available on the campus for up to 100 people in single rooms. Bed and breakfast will be provided for approximately £3 per person. It is hoped that the maximum number of people will take advantage of this facility and participate in the expanded Sunday programme.

#### Catering

This is all provided on site and consists of breakfast for those staying overnight, mid-day snacks and the convention dinner on Saturday evening.

#### Lecture facilities

There are available to us a number of large lecture theatres fully equipped with audio-visual aids. This will enable at least two lecture streams to run, with another if demand and volunteers allow.

#### Trade stand facilities

These will be two to three times larger than those previously available and it will be possible to leave them assembled throughout the weekend.

#### Social environment

First, the whole convention will be self-contained and it will not be necessary, if so wished, for anyone to leave the campus during the event. In addition to the catering facilities, a bar will be available for our exclusive use with a large area of seating accommodation for those who come to the convention for purely social reasons. However, Uxbridge town centre is not far away if anyone wants to go shopping. It is hoped that a ladies programme can be organized for both days so that the convention really can be a family outing.

At the moment plans for lecture streams and the programme in general are, obviously, very tentative. Here we have an opportunity to really expand this popular event and if any member has any suggestions as to how the 22nd VHF/UHF Convention could be improved in the light of these new facilities, the VHF Committee would be very glad to consider them. □

## COUNCIL PROCEEDINGS

A brief report of the Council meeting held on  
11 June 1975

**Present:** Mr C. H. Parsons (President, in the chair), Dr E. J. Allaway, Messrs R. J. Baker, J. O. Brown, R. W. Fisher, W. J. Green, L. E. Newnham, W. McGonigle, J. R. Petty, D. M. Pratt, W. A. Scarr, R. F. Stevens, F. C. Ward (members of Council), G. R. Jessop (general manager), A. W. Hutchinson (editor), J. A. Evans (minutes secretary).

Apologies were received from Messrs D. M. Thomas, A. E. Smith and D. Byrne.

#### Financial report

Mr Brown reported that the Finance & Staff Committee had discussed raising the annual subscription by £2 per annum.

The President thought that the benefit of a subscription rise starting in January 1976 would not be felt for one year, and should the present rate of inflation continue, it could be that an increase of £2 would still not be sufficient to cover expenses. The subscription could only be raised by an amendment to the Articles of Association at the AGM, and that it was then up to Council to advise on the amount.

Council discussed various matters relating to subscriptions and Society administration costs and several suggestions were put forward.

Mr Brown said *Radio Communication* costs were a problem and that the situation was unlikely to improve. Mr Stevens said that at the previous night's meeting of the Technical & Publications Committee various proposals had been made to reduce costs. Other suggestions were put forward during the subsequent discussion.

Council approved a recommendation of the Technical & Publications Committee to increase the charge for members' advertisements from 40p to 50p from 1 September 1975.

#### General manager's report

As a result of printing the return address on the *Radio Communication* wrappers there had been a noticeable increase in the number returned. This provided useful information for the records section and reduced waste of copies.

#### Membership and affiliation

Figures for May showed a total of 121 new members, and a loss (including deceased) of 34. The gain of 87 brought the total increase for the year so far to 652, an annual rate of 1,565.

It was resolved:

- (i) to approve the applications for membership and accordingly elect 183 new members;
- (ii) to accept reduced subscriptions from 15 members;
- (iii) to waive the subscriptions of 13 members on the grounds of blindness or other disability;
- (iv) to grant affiliation to the Corby Technical College Amateur Radio Group (CTCARG), the St Kitts-Nevis-Anguilla Amateur Radio Society, the Leicester Telephone Area Amateur Radio Club, the Radio Club de Rueil Malmaison, the Ealing & District Amateur Radio Society and the Hinkley Point Sports and Social Club Amateur Radio Society (Bridgwater).

#### Trophies

The President gave an account of the correspondence between himself and Mr F. T. Calvert, the father of the late Michael Calvert, G3WXS, holder of the Somerset Trophy on behalf of the Bangor University GW3UCB team at the time of his death. Mr Calvert wished to establish a memorial to his son in the field of amateur radio and had agreed with the President that the memorial should take the form of a plinth for the Somerset Trophy.

In addition a sum of £6.85 was donated by Mr F. T. Calvert who wished it to be given to a charity connected with radio, and it had been agreed that the RAIBC would receive the money.

The President's actions in this matter were ratified by Council. Considerable discussion on the subject of the John Rouse Memorial Trophy took place. In view of the quantity and quality of the entries, there was a real need for a second trophy in the home construction contest held in connection with the RSGB VHF Convention, and it was decided that the trophy be used for that purpose.

#### Regional and area representation

The complete list of new regional and area representatives having been circulated, Council approved the appointments.

**Region 6 ballot.** A total of 52 had voted for Mr Andrews and a total of 11 had voted for Mr Connell.

**Region 7.** It was agreed that Mr R. S. Hewes was eligible for appointment and that the Echelford Club should come within his region. This had been agreed with the Region 19 representative.

**Region 11.** The post was still vacant.

#### Membership and representation

Mr Scarr explained why the proposed Membership & Representation Committee meeting schedule to take place at Canterbury was not held. After a general discussion on the venues of future meetings of the committee it was decided to hold the next meeting at RSGB headquarters on the morning of the next Council meeting day.

#### Committee minutes

Council accepted the minutes of the following committee meetings: Raynet (13/75), HF Contests Committee (13/75), VHF Contests Committee (24/3/75, 24/4/75), Mobile & Exhibition Committee (25/3/75, 29/4/75), Finance & Staff Committee (10/4/75), Interference Committee (10/4/75), Education Committee (12/4/75), Educational Visits Scheme (19/4/75), Technical & Publications Committee (29/4/75), VHF Committee (30/4/75), Telecommunications Liaison Committee (13/5/75).

**Interference.** Mr Stevens reported that the special interference issue of *Radio Communication* in May had been very well received in several countries. It was agreed that a letter be sent to the chairman of the Interference Committee thanking him for the committee's efforts.

The Interference Committee had recommended to Council that Mr L. Carpenter, G4CNH, should be asked to join the committee. This was agreed.

**Education.** It was agreed that the Education Committee should arrange for a talk, "The world of amateur radio", to be given at the Science Museum on 3 January 1977.

**VHF Contests.** It was agreed that the VHF Contests Committee should have its terms of reference extended so that it could deal with certain contest irregularities.

## Nominations for election to the 1976 RSGB Council

The Articles of Association require that not later than 10 September in each year the Council will send to each member entitled to vote a list of those Council members who retire by rotation or for any other reason on the succeeding 31 December. The list must indicate those members who are willing to accept nomination for re-election and the list must also indicate whether the vacancies are to be filled by election of an ordinary member or on a zonal basis.

The following members retire at the end of this year:

#### Ordinary members

Dr E. J. Allaway, G3FKM, who will relinquish his office as a Council member if he is, as proposed, appointed President for 1976.

Mr L. E. Newnham, G6NZ, (by rotation) who will accept nomination for re-election.

Mr F. C. Ward, G2CVV, (by rotation) who does not wish to be re-nominated.

#### Zonal members

Mr W. J. Green, G3FBA, (by rotation) who does not wish to be re-nominated.

Mr W. A. Scarr, G2WS, (by rotation) who will accept nomination for re-election.

Not later than 10 October next any 10 corporate members may nominate any qualified member to fill one of the above vacancies, by delivering in one closed envelope to the secretary of RSGB, their respective nominations in writing together with the written consent of such member to accept office if elected. Each such nominator shall be entitled to nominate only one member for election.

In the event of insufficient nominations being received to fill all vacancies arising, Council has power to fill any remaining vacancies.

Members nominated for election to the Council on a zonal basis must be resident within the zone for which they are nominated and the nominators must be corporate members resident in that zone.

Under Section 185 of the Companies Act, the election of any member over 70 years of age at the date of election has to be confirmed by a special resolution at the AGM.

## RAYNET

by S. W. LAW, G3PAZ\*

As this contribution is written, the RSGB Woburn Rally has finished in a blaze of sunshine; and if the attendance was any criterion, a blaze of glory also! No results are yet to hand but business at the Raynet stand was brisk and interest by no means lacking. Many points were discussed between visiting members and our representatives on duty, all of whom found the occasion most stimulating despite the almost tropical conditions.

Out thanks to those who have sent in reports of activities from various regions. Unfortunately space does not permit a full run-down on all of the matter received, but correspondents may rest assured that the Raynet Committee considers all letters at its meetings, and discussions ensue on all points of interest.

#### Group news in brief

It is understood that a Raynet stand was arranged and manned by the Surrey group for the Guildford Show at the end of August but details are not to hand at the time of writing.

The Cleveland group (Tees-side area plus Yorkshire moors) have sent in a sample newsletter and reports, also news of the trials of the group in making a cine film of a "disaster operation". As there are some 60 libraries in their area which may be interested in showing the proposed 45min film there should be no lack of bookings once the production difficulties mentioned by G8EIA are surmounted. Another group interested in a film record is the new Havering group (controller G8GGU) who have already cut their teeth on an NFD film with the co-operation, we understand, of the Hornchurch Cine Club.

The group at Dudley (G8CZM controller) are no doubt finding their feet and we hope to hear more of them in due course. A new controller in the Mid-Thames group is M. J. Lee, G3XUQ. Mid-Kent also now have G4AKQ who takes over from Ted Kent. In Cambridgeshire we have acting controller M. Brogan, G8JHE, of Ely. In addition we hear from G3YRZ that a group may be formed centred on Cambridge University; more about this later. In Glasgow GM3VTB replaces Terry Darke who has resigned, while NE London/SW Essex now has G8EAY to replace resigned controller R. Clarke.

#### Raynet supplies

May we remind members who might not have had the opportunity to stock up at Woburn that our supplies officer, Mrs Jane Balestrini (see G3BPT, QTHR) has ample supplies as follows: Headed Raynet notepaper; 50 sheets @ 45p. 100 sheets @ 80p. RAEN label badges; 30p (Please ask for quote if callsign also). Raynet Manuals; 20p. New style Raynet black on yellow identification stickers; 20p. All prices are inclusive of postage. □

\* 130 Alexandra Road, Croydon, Surrey CR0 6EW

## Looking ahead

**13 September**—Scottish VHF Convention, Treetops Hotel, Aberdeen.

**28 September**—RSGB Region 1 Regional Meeting, Woodlands Hotel, Wellington Road, Timperley, Altrincham, Cheshire.

**28 September**—2nd Welsh Amateur Radio Convention, Community College, Oakdale, Nr Blackwood, Gwent.

**11 October**—SSTV Convention, Aston University, Birmingham.

**30 Oct-1 Nov**—Amateur Radio Retailers Association Exhibition, Granby Halls, Leicester.

**4 November**—RSGB lecture at IEE, Savoy Place, London.

**5 December**—RSGB AGM, Royal Society of Arts, John Adam Street, Adelphi, London WC2.

# YOUR OPINION

## Operating and behaviour

The Editor

Radio Communication

Sir—What is happening to "ham radio"? An 80m net chatting about the EEC referendum; caustic interruptions on 2m repeater channels, and discussions about which beer is best.

Two other unfortunate incidents were at a recent rally near Eastbourne. A visiting station took over the talk-in frequency and directed one mobile four miles in the wrong direction for a "joke". The same evening a person was responsible for shorting the aerial and earth of another visitor's rig resulting in damage to the pa.

It is hoped that these incidents are rare and that the culprits will be shunned by those wishing to retain our bands.

In general, we have found that the standard of operating is high, and that it is still improving.

D. W. Payne, G3KCR, B. Buschl, G8KAS

The Editor

Radio Communication

Sir—I would like to air my views on two or three subjects concerning this hobby of ours, which at the present time seems to me to be suffering from several ills.

Going back to two previously-published letters: those of G3LCS (July 1974) and G3UXV (February 1975), and speaking as a second-class citizen (ie a "G8"), I must agree with some of D. A. Shepherd's remarks, but with all of S. R. Alderton's comments. I think it was a sad day for 70cm activity the day the G8s were permitted to use 2m, although perhaps the odd few G8s did use it to generate interest and cross-band activity.

I have recently returned from my holidays in Somerset—complete with 2m mobile gear—and regret to say that I was not impressed with the use of this band in the south-west, at least from what I heard of it. First of all was the fm activity via the GB3BC repeater—complete lack of normal procedures, lots of chatter with no call-signs, and very bad operating manners. If this sort of activity spreads throughout the country we will soon have a situation like the USA with its 27MHz Citizens Band. At the Longleat Rally, several amateurs were using 2m walkie-talkies, discussing relative prices of goods between marquees (no call-signs, of course). In spite of appeals on the public address system for radio silence, as these activities were interfering with the talk-in station, the chatter continued.

I sometimes wonder if the RSGB really is looking after our interests, or if they are just out to increase the number of members at all costs. A similar thought has been voiced by local members who attended the VHF Convention in May, in view of remarks passed on repeaters and fixed-channel fm activity, and also the rumours of "giving away" the 70cm band. This latter seems to be generally believed on the Continent, too.

I am one of those (despised) people who are exclusively interested in vhf/uhf/shf, and if the present trend continues will drop 2m and concentrate on 1-296GHz upwards—providing I am allowed to, of course.

For the record my present activities embrace 70cm, a.m. and fm, a 70cm video tx running 625-line vestigial sideband and simultaneous nbm sound, slow-scan video on 2m, and some 23cm gear in the process of being built. Most of the gear is homebrew, but I am by no means prejudiced against factory-produced equipment except those oriental fm "squawkboxes" which have anything up to 60kHz of deviation on board.

If the only way of cleaning up the amateur bands is to either do away with the G8s, or limit the time for which such a licence may be held, then I for one would agree to go for an "A" licence, although I have little interest in the hf bands.

L. J. O'Loughlin, G6AGC/T, G8AXC

The Editor

Radio Communication

Sir—In 4-2-70 of the March issue I was perturbed to read of two amateurs in the north-east of Scotland expressing concern regarding the growing number of repeaters and the misuse which can take place. This argument is related closely to the one where people condemn all teenagers with long hair due to the activities of a minority of teenagers.

I have at last, however, discovered the real reason behind the

opposition on the part of some ssb enthusiasts, they are not just anti-repeater, but also anti-fm as well. This was brought home to me during an opening to Norway when I found one of the local ssb enthusiasts calling an LA station using ssb on a simplex fm channel! Obviously the amateur in question wishes to expand the ssb frequencies over the whole 2m band, and if we again follow the argument used in that article should now be asking for the banning of ssb!

M. D. Brunton, GM8GDN

## QSL cards and awards

The Editor

Radio Communication

Sir—In these days of exorbitant printing costs and even worse postal charges, it does seem that a great deal of our own money and that of the Society, to say nothing of the QSL Bureau's time, is wasted in sending around the world cards which are not wanted and are never collected.

May I suggest that one of the silliest and most wasteful sayings in amateur radio is "The ultimate courtesy of a QSO is a QSL".

Fine, if a QSL is required but sheer waste if it is not.

Here is a new precept by which to regulate our habits: "Never QSL" unless: (a) a card is requested during the QSO; (b) you want a card; (c) you receive a card.

Observance of these three simple rules will ensure that everyone who wants a card will get one and thousands of unwanted cards will never be sent.

The RSGB QSL Bureau handles roughly 1½ million cards each year and some 600,000 of these are never claimed and have to be destroyed. Apart from the waste of paper, the cost of pushing them around is quite shocking. A 22lb parcel sent by G2MI to a sub-manager costs £1.09 and a 4lb packet by printed-paper rate to a foreign country costs 54p: both rates are due to increase.

Quite obviously, the exercise of a little common sense can effect a very worthwhile saving of the Society's money and that, fellow members, is YOUR money.

A. O. Milne, G2MI, RSGB QSL Manager

The Editor

Radio Communication

Sir—I think most of us are familiar with the case when we send a QSL card and enclose an s.a.e. hoping to get one in return, only to find that we have wasted our time and money as nothing is forthcoming. It would appear that this sort of thing is now spreading to awards, and I give my own experience without any comment.

On 9 August 1974 I submitted a claim for the BudaPest award. I fulfilled all the requirements laid down and enclosed the necessary 8 IRCs. Months passed and nothing was forthcoming. I wrote again on 8 March 1975 but did not receive the courtesy of a reply. I wrote again on 23 May 1975 without receiving any reply.

There is no doubt a lesson to be learnt from this which no doubt your readers will be able to interpret.

B. Pettman, G3MLN

## Advertiser's comments

The Editor

Radio Communication

Sir—I note that in recent issues of this journal, one of the principal advertisers has taken to making comments of a somewhat sarcastic nature on the organization of repeaters and on the new vhf band plans.

The repeater network in this country has been established by efforts of a number of amateurs who have put a great deal of work and money into it. The result has been an unprecedented market for vhf mobile and hand-portable equipment.

The vhf band plans were compiled by the IARU with full participation and support by RSGB representatives, whose personal, and largely unrecognized, efforts have again been considerable. The result of this has been a large demand for vfo-controlled 2m rigs and new crystals for channelized sets.

The advertiser referred to, along with other equipment importers, has received a considerable financial benefit from these developments without making any apparent contribution. May I suggest therefore that he restricts his remarks to sensible suggestions which could best be made on your letters page. The individuals concerned would then no doubt give such comments the attention they deserve.

Humour is always welcome in advertisements, as in any other medium, but not remarks which are offensive to those defending and advancing amateur radio.

R. C. Greenleaf, G3VAG



# Destination Guernsey

by A. SLATER, G3FXB

The Channel Contest Group team which won the NFD Trophy this year.

Left to right: G4BVH, G4BUE, G3XBN, G3ZQW, G3MXJ, G8OS, Paul, G3FXB



CONTEST activity from the British Isles, at least on the hf bands, has been at quite a low ebb for many years. Often when perusing the results of major hf contests it is quite sobering to find more entries from such countries as Bulgaria, Czechoslovakia and Hungary than from the UK. From this one can only conclude that we are rather lacking in competitive spirit, as indeed our present economic problems might confirm, or that the average amateur station is beset with so many problems of restricted aerial space, planning problems and rfi/tvi that he feels contests are a waste of effort. The author feels that it is a bit of both, but also that after 25 years of contesting from an average location it is possible with tenacity, energy and goodwill to one's neighbours to run up good scores. Nevertheless if you feel that the odds are too great you can do as a group of us on the Sussex coast have done—form an organization purely with multi-operator entries in contests in mind.

The Channel Contest Group was formed two years ago and was subsequently licensed as G4DAA. It originally consisted of G3FXB, G3MXJ, G3XBN, G3ZQW, G8FMJ and a most helpful swl who happens to be the writer's son-in-law. Subsequently we dropped vhf from our activities, feeling that we were better equipped with knowledge and gear to operate hf. At that time we were also joined by G4BUE and G4BVH. The object of the group is to participate in major hf and RSGB contests on a multi-operator basis; as such we were fortunate indeed to secure the co-operation of G8OS, a Sussex farmer, for the use of one of his fields and also his caravan. We were thus able to operate with no risk of rfi/tvi and no electrical noise, from a QTH with a river nearby giving an excellent water table plus a good take-off in all directions. Admittedly there is much work involved in the staging of each event as the quad and hf aerials have to be erected each time and subsequently dismantled, and a generator hired, but the effort is amply repaid not only in the high scores obtained but in the opportunity afforded to members to work the pile-ups with no fear of incurring the wrath of neighbours and yet with the thrill of operating a nice fat signal.

Another spin-off of a group such as "Channel" is of course the social side. The gathering of people of similar interests leads to much interesting rag-chewing and some highly humorous situations, and our group goes one better than the normal annual dinner. Every possible excuse is found for a dinner—normally every two months or so to which the XYLS come—an occasion enjoyed by all.

The past season did present problems to "Channel" insofar as the very wet autumn precluded operation from the farm in the CQ World Wide contests, but at least CQ Magazine ran a tabulation of club scores so we could all operate from home and make some contribution to the club score. It was hoped that the field would be dry enough for the end of March and the CQ WPX SSB Contest but doubt about this coupled with the visit of W2AO and W2AX of "The Order of Boiled Owls" to the author's QTH on their return from a contest expedition to Madeira prompted the thought that "Channel" might consider their own dxpedition. What more logical choice than the Channel Islands? Not all that far from the south coast and certainly possessing greater rarity value both in prefix and country status than G4.

One of our group knew Dick, GC4CHY, who in turn passed us on to John, GC8EVH, the secretary of the Guernsey Radio & Electronics Society. The co-operation from John was excellent. After consulting society members he offered us membership of the society with the attendant use of its excellent hf building at St Martins, and also offered to arrange guest house accommodation for us, the hire of the scaffold poles necessary for aerial erection,

and a welcoming party for our arrival at St Peter Port. For our part we decided to load all our gear into and on G4BUE's long-suffering Avenger and travel by boat from Weymouth. The contest was to be over the Easter week-end so hearts sank somewhat when we heard of the projected industrial action by BR ferry staff over Easter. Fortunately our passage was booked for the day preceding this action but another potential hazard was the projected blockading of ports by fishermen. Fortunately our trip was uneventful and the welcoming party ferried us to their hf and then to our guest house. This was to set the pattern for our entire stay, even to the extent of a mad drive through the 9am traffic of St Peter Port to rescue our tickets which in the rush of departure got left behind at the guest house.

The hf proved to be ideal for our purpose. We were a trifle concerned about the proliferation of 405 tv aerials fairly close at hand with horizontal polarization on Channels 4 and 9, but in fact no problem was experienced. A friendly farmer co-operated by permitting our aerials to be erected in a field adjoining the hf, so the quad went up to its normal 60ft by the gin pole technique and the mast also served to support the inverted-V dipoles. One thing about Guernsey is the absence of overhead power lines—in fact virtually everything is underground and the resultant low noise level is hard to believe. Our only noise problem was, of all things, snow static.

Conditions were not too good over the contest week-end but we managed 1,837 scoring contacts with 338 prefixes, knocking off a DXCC in the process and proving that Guernsey is quite a dx man's paradise.

As members of the Guernsey Radio & Electronics Society, we say thank you to all the fellows over there for all their help. We hope we can do it again, and that this account will encourage other groups to partake more in hf contest work and increase the level of competition in the UK. For our part we like to dream of an expedition to some exotic African country and a crack at a world record made possible by the geographical advantage that the CQ scoring system gives to such areas. □

## SSTV CONVENTION

1000-1800, 11 October 1975

Aston University, Birmingham

This convention is being organized by the British Amateur Television Club, and is open to all interested in sstv whether or not they belong to BATC. There will be lectures, a display of equipment, and plenty of opportunity for the exchange of ideas.

A charge of 50p will be made and tickets may be obtained from M. Crampton, G8DLX, 16 Percival Road, Rugby CV22 5JS.



# NFD 1975 results

**F**ANTASTIC wx—fantastic short skip to Europe—is typical of the many comments received this year, and it nicely sums up what was one of the best NFDs ever. While little dx was worked, as was to be expected at the sunspot cycle minimum, the higher frequency bands were wide open to Europe for much of the weekend, and as a result some very high scores were made.

A total of 90 entries were received, which is three less than last year, but one more than in 1973. The adjudicators are very pleased to report that no-one had to be disqualified this year—the first time that this has occurred in NFD for some years. Long may it continue!

The 2E26 was still the favourite pa valve, and with the revised power rule introduced last year many groups were running inputs of 40-60W. Several enterprising clubs sought-out valves capable of running 100W or so which still came within the 13-5W anode dissipation limit. These valves included the PL36 and the PL504.

The use of outboard pa units with "standard" transceivers has increased since last year. This method of meeting the provision of NFD Rule 10 is far better than the direct substitution of a high-power line output valve by a valve such as the 2E26. It entails little or no modification to the transceiver, and means that a highly efficient Class C pa stage can be constructed to give maximum power output.

## Double-station section

This year the three leading groups have all beaten the previous highest total score of 2,805 points made by the Ariel RG last year.

The NFD Trophy goes to the Channel CG, as winner of the double-station section, with a record score of 3,329 points. Their "A" station (G3MXJ/P) employed an SB301 receiver and an SB401 transmitter driving a PL36 outboard pa unit running 10W input on 160m and 90W input on 40m and 15m. The aërials were a 270ft centre-fed for 160m, an inverted-V for 40m, and a 2-element quad for 15m. The operators were G3MXJ and G4BVH who amassed a total of 485 contacts. The "B" station (G4DAA/P) ran an FRDX400 rx with a Q-multiplier, an FRDX500 tx with another PL36 outboard pa unit running 65W. A dipole was used on 80m, and a 2-element quad on 20m and 10m. Operators G3FXB and G4BUE keyed a total of 554 contacts, which works out to be an average of over 23 an hour.

In second place, with 3,143 points, is the Glenrothes & D ARC which takes both the Gravesend Trophy and the Scottish NFD Trophy—a well-deserved honour. The "A" station (GM3OLK/P), operated by GM3PFQ and GM3YOR, used an FT101B with an external pa unit running 10W on 160m and 40W on 40m and 15m. The aërials were dipoles for 160m and 40m, an 18AVQ vertical for 40m, and a 2-element quad for 15m. GM3OLK and GM3YOR operated the "B" station (GM3YOR/P)—the equipment was an SB102 running 40W to a 2E26 pa, an 80m dipole, and a TH3 Mk3 at 25ft for 20m and 10m.

## Single-station section

The Bristol Trophy stays with the East Barnet ARCC which surpassed its 1974 record-breaking score of 1,303 points to set a new record of 2,021 points. G5FA/P was operated by G3KTZ, G3RPB, G3RTE and G3UGK who jointly maintained an average QSO rate of nearly 27 contacts an hour to reach a total of 645 contacts. On 160m they used a Drake R4B and a T4X plus a 10W 2E26 pa unit, while on the other bands they had a Ten-Tec transceiver with a 2E26 external pa running 22W. Their aerial farm was quite impressive—dipoles for 160m, 80, 40 and 10m, a ZL special for 40m, a 2-element quad for 20m and 15m, as well as a V-beam and a ground plane for 20m.

The Rascal ARG (G3RAC/P) is the runner-up with a score of 1,760 points made by operators G3CYL, G3KLH, G3PGM, G3UJI and G3WKH. The station consisted of an RA1772 receiver, a TRA931 driving a 2E26 pa unit to 10W on top band and 25W on the remainder. Aërials were a dipole for 160m, sloping delta loops for 80m and 40m, and a 3-element quad for 20m and 15m.

## NFD Trophy

Channel Contest Group	3,329 points
<b>Gravesend Trophy and Scottish NFD Trophy</b>	
Glenrothes & D ARC	3,143 points

## Bristol Trophy

East Barnet Amateur Radio Contest Club	2,021 points
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## Frank Hoosen (G3YF) Memorial Trophy

Channel Contest Group	930 points
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## Leading scores on individual bands

1.8MHz	Mansfield ARS	586 points
3.5MHz	Reigate ATS	813 points
7MHz	Ariel RG (BBC)	768 points
14MHz	Channel CG	930 points
21MHz	Glenrothes & D ARC	616 points
28MHz	Channel CG	313 points

## Overseas station giving most points to NFD entrants

EL1AA/P	372 points
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## Scottish NFD Trophy

As recorded earlier, the Glenrothes & D ARC—last year's GM runners-up, wins the Scottish NFD Trophy with 3,143 points; a massive lead over the Ayrshire ARG (GM4KJF/P and GM3WIL/P) which scored 1,436 points to become this year's runner-up. In third place is the single-station entry of The Hamsters (GM3UWX/P) with 1,062 points.

## 1.8MHz

As usual, top band proved to be mainly a "bread-and-butter" band. Despite the hot summer weather, static levels remained low and many stations commented on the poor level of activity—most clubs spending only 2-3 hours on the band. Some dx was heard—a few reports of signals received from PY1RO and PT8DM—but no QSOs were recorded.

The band award this year goes to the Mansfield ARS (G3GQC/P) which made 152 contacts worth 586 points, with operators G3DBF, G3DBZ, G3EQF, G3JUY and G3XWZ. The aërials used were a dipole and a 3-element phased array beaming on OK or W/K. As in past years, G3GQC/P was a single-band entry.

## 3.5MHz

Even though the so-called dx bands were wide open to EU, 80m was far from deserted—indeed, activity was very high, as indicated by the fact that this year the band leader's score is an all-time record, surpassing by more than 100 points the best previous total of 708, made by the Edgware & D ARS last year.

The Reigate ATS (G3NKS/P) takes the band honours with a score of 813 points (no relation to the pa valve!) from 327 QSOs made by operators G3KAX, G3NKS, G3XIG and G4ARO. The station consisted of an FT401 driving a 2E26 outboard pa unit running at 60W, while the aerial was an inverted-V dipole aligned NE-SW.

Moving up from third place in 1974 is the 80m runner-up, the Maidenhead & D ARC (G3WKK/P), operated by G3FVC, G3RYV, G3UKS, G3ZPK and G4ALG. They made 305 QSOs worth 738 points, using an SB301, a transverter with a 6BW6 pa running 40W, and a half wave dipole.

Moving down one place from 1974 to take third place is the Veteran Operators' Club (G3VOC/P), whose operators G3ANK, G3TAA and G3VLT keyed 264 QSOs for 691 points.

All the leading stations on this band—including G4DKN/P in fourth place—were single-band entries.

Needless to say, nearly all of the contacts were with G/EU stations, with only the very occasional QSO with W/K.

## 7MHz

Very fast and very furious—but oh, the QRM!

As always, plenty of contacts were to be had on 40m at any time during the contest, mainly with G/EU, but also with several W/VE stations during the night. However, the QRM, especially from bc stations, was at times diabolical.

The band leader is the Ariel RG (G3GDT/P), operated by G3POI and G3COJ, with 768 points from 239 QSOs. The station consisted of a KW2000 running 40W to a 2E26 pa, and two dipoles at right-angles.

# SINGLE-STATION SECTION

Posn	Club or group	Call sign	1.8MHz	3.5MHz	7MHz	14MHz	21MHz	28MHz	Total
1	East Barnet ARCC	G5FA/P	236	453	337	574	340	81	2,021
2	Racal ARG	G3RAC/P	296	361	476	456	171	0	1,760
3	Bristol CG	G6YB/P	310	224	342	429	199	64	1,568
4	Chelmsford ARS	G3KRZ/P	294	323	371	313	142	49	1,492
5	Verulam ARC	G3VER/P	280	456	256	340	129	12	1,473
6	Guildford & D RS	G6GS/P	158	255	392	506	152	6	1,469
	Maldstone YMCA ARS	G3TRF/P	368	256	428	417	0	0	1,469
	East Notts CG	G3TBK/P	252	470	747	0	0	0	1,469
9	Durovernum CG	G3XDV/P	440	480	541	0	0	0	1,461
10	Loyland Hundred ARG	G3GGS/P	254	224	397	327	190	57	1,449
11	Worcester & D ARC	G3GJL/P	151	180	194	489	293	99	1,406
12	Swansea RS	G3VZL/P	14	150	81	859	228	0	1,332
13	Sunderland ARS	G3RDI/P	226	252	260	377	161	66	1,297
14	Leicester RS	G3LRS/P	356	250	239	377	12	0	1,234
15	Leicester Poly ARS	G3SDC/P	316	227	128	558	0	0	1,229
16	KW RC/Cray Valley RS	G4AUJ/P	334	171	206	398	94	0	1,203
17	Port Talbot ARS (BSC)	GW3EOP/P	0	241	106	473	310	66	1,196
18	Horsham ARC	G3TNO/P	160	123	172	421	230	60	1,166
19	Blackpool & Fylde ARS	G8GG/P	234	240	46	564	80	0	1,164
20	North Notts CG	G3FDW/P	286	301	304	173	46	0	1,140
21	Gloucester	G3MA/P	376	228	221	137	175	0	1,137
22	Liverpool & D ARS	G3AHD/P	358	268	144	290	44	4	1,108
23	Sheffield ARC	G3PHO/P	434	125	114	42	374	16	1,105
24	Hereford ARS	G3YDD/P	342	180	257	239	61	0	1,076
25	Addiscombe ARC	G4ALE/P	230	127	187	302	218	9	1,073
26	The Hamsters	GM3UWX/P	0	160	138	469	245	50	1,062
27	Chiltern ARC	G3CAR/P	422	176	280	125	24	30	1,057
28	Conway Valley ARS	GW6TM/P	134	193	315	349	51	0	1,042
29	Crystal Palace & D ARC	G3VCP/P	312	276	131	180	117	25	1,041
30	ARC of Nottingham	G3EKW/P	0	334	107	357	240	0	1,038
31	Bangor & D ARS	G1XRX/P	166	128	44	361	250	56	1,025
32	Bury & Rossendale RS	G3BRS/P	292	185	315	196	34	0	1,022
33	Hull & D ARS	G3AMW/P	198	321	227	237	35	0	1,018
34	Bromsgrove & D ARC	G3VGG/P	0	284	120	368	204	37	1,013
35	Chippenhams & D ARC	G3VRE/P	210	283	321	186	12	0	1,012
36	Garendon School RS	G3MKX/P	314	220	109	141	63	26	973
37	Oxford & D ARS	G8IB/P	0	387	159	231	169	0	946
38	Reading ARC	G3ULT/P	224	233	169	287	14	9	936
39	Scarborough ARS	G4BP/P	0	265	199	376	92	0	932
40	Harlow & D ARS	G6UT/P	0	474	430	18	0	0	922
41	Greeneck & D ARC	GM3ZRC/P	0	46	56	667	150	0	919
42	Colchester RA	G3CRA/P	318	334	219	39	0	0	910
43	Ilford RSGB Group	G3XRT/P	366	429	107	0	0	0	902
44	Catterick Garrison ARC	G3CJO/P	322	323	36	82	59	0	832
45	Cheltenham ARS	G5BK/P	74	266	208	266	4	0	818
	Sheffield & D ARS	G3FJE/P	272	300	171	65	10	0	818
47	Reigate ATS	G3NKS/P	0	813	0	0	0	0	813
48	RC of Workop	G3RCW/P	10	252	271	253	8	0	794
49	West Kent ARS	G3WKS/P	0	293	301	98	93	0	785
50	Purley & D RC	G3TWJ/P	274	169	68	190	81	0	782
51	Newbury & D ARS	G3WOI/P	450	321	0	0	0	0	771
52	Echelford CG	G3YCO/P	0	378	25	243	111	13	770
53	Easington & Hartlepool RSGB Group	G3IDV/P	206	293	99	242	0	0	750
54	Havering & D ARC	G3TTB/P	422	306	18	0	0	0	746
55	Echelford ARS	G3UES/P	0	0	743	0	0	0	743
56	Maldenhead & D ARC	G3WKK/P	0	738	0	0	0	0	738
57	Telford & D ARS	G3ZME/P	0	0	0	713	0	0	713
58	Veteran Operators' Club	G3VOC/P	0	691	0	0	0	0	691
59	Salisbury R & ES	G3FKF/P	0	0	673	0	0	0	673
60	Farnborough & D RS	G4DKN/P	0	668	0	0	0	0	668
61	South Dorset RS	G3SDS/P	272	181	186	21	0	0	660
62	Stevenage & D ARS	G3SAD/P	210	273	75	90	0	0	648
63	Woodmansterne Group	G3KTA/P	266	310	46	10	0	0	632
64	Southdown ARS	G3WQK/P	0	340	0	290	0	0	630
65	Mid-Lanark ARG	GM3PXX/P	18	124	102	257	109	0	610
66	Mansfield ARS	G3GQC/P	586	0	0	0	0	0	586
67	Bridgwater	G4QK/P	0	174	56	262	72	0	584
68	RAFARS Locking	G8FC/P	0	127	0	264	171	0	562
69	Eccles & D RC	G3GXI/P	0	0	557	0	0	0	557
70	Preston ARS	G3KUE/P	182	212	110	0	0	0	504
71	Axe Vale ARC	G8CA/P	274	193	0	0	0	0	467
72	Weston-super-Mare RS	G6LQ/P	22	224	195	10	0	0	451
73	Great Yarmouth RC	G3YRC/P	130	224	83	0	0	0	437
74	Derby & D ARS	G2DJ/P	0	232	193	0	0	0	425
75	Stockport RS	G6UQ/P	340	0	0	0	0	0	340

# DOUBLE-STATION SECTION

Posn	Club or group	"A" Station	"B" Station	1.8MHz	3.5MHz	7MHz	14MHz	21MHz	28MHz	Total
1	Channel Contest Group	G3MXJ/P	G4DAA/P	398*	390	705*	930	593*	313	3,329
2	Glenrothes & D ARC	GM3OLK/P	GM3YOR/P	442*	440	564*	815	616*	266	3,143
3	Ariel RG (BBC)	G3GDT/P	G3BBC/P	368*	541	768*	787	460*	163	3,087
4	Croydon Group/Surrey Radio Contact Club	G3BFP/P	G6LX/P	314*	429	573*	918	371*	185	2,790
5	Crawley ARC	G6RC/P	G3TR/P	326*	401	416*	849	414*	44	2,450
6	Torbay ARS	G3LHJ/P	G3NJA/P	396*	347	492*	790	360*	38	2,423
7	Wirral ARS	G2AMV/P	G3NWR/P	316*	264	404*	568	418*	0	1,970
8	RS of Harrow	G3EFX/P	G3HBR/P	318*	420	374*	382	233*	162	1,889
9	Edgware & D RS	G3ASR/P	G3GC/P	368*	340	465*	210	293*	65	1,741
10	Sutton & Cheam RS	G3LCH/P	G2DMR/P	450*	469*	367	135	210	104*	1,735
11	Ayrshire ARC	GM3KJF/P	GM3WIL/P	288*	187	413*	424	124*	0	1,436
12	Bracknell ARC	G4BRA/P	G4AUC/P	338*	250	237	254*	174	162*	1,415
13	Clifton ARS	G3GHN/P	G4DBW/P	310*	376	427*	227*	0	0	1,340
14	Thames Valley ARTS	G3TVS/P	G8SM/P	410*	287*	87*	201	133	13	1,131
15	Grimsby ARS	G3YMF/P	G3CNX/P	96*	277	237*	145	63	0	818

\*Indicates bands worked by "A" station



Thames Valley ARTS at Kempton Park Race Course. XYLs, children and members gather at the "B" station tent

#### Overseas check logs

Posn	Callsign	Points to G stations	Posn	Callsign	Points to G stations
1	E11AA/P	372	11	OK8CQ	84
2	9J2NFD/P	360	12	OK2PAW	48
3	F0BJO/P	248	13	ZE3JO	48
4	E14LR/P	232	14	VS6HI	36
5	OK3CWQ	216	15	OK1DAV	26
6	E15WW/P	180	16	OK1KZ	16
7	OK2BLG	146	17	ZS6BMS	15
8	ZC4RH	138	18	E15F	10
9	8SK0HB/P	114	19	OK2LN	4
10	OK1BLC	96	20	W10PJ	3

#### British Isles check logs

Received with thanks from: G3CGD, G3FVC/P, G3REI/P, G3VQO, G4DXI/P, G6UQ/P (80-10m), G8JMP, GM3WTA.

The East Notts CG (G2TBK/P) is in second place with 747 points from 206 contacts. An EA12 rx, a home-brew tx running 15W to a QV04-7 pa, and a pair of phased dipoles were used. The operators were G3SHY and G3YCT.

#### 14MHz

As usual, 20m carried much contest traffic throughout most of the event. During the night rather odd conditions prevailed, with both long and short skip producing quite strong signals simultaneously from DL, W6, 9J2 and several other areas. A few contacts with Australasia appear in the logs, as well as the occasional QSO with ZS6HVB/P and VP9HM/P.

The leader on this band is the double-station section winner—the Channel CG (G4DAA/P), which made 285 contacts, scoring 930 points in a total period of 12 hours. The operators on this band were G3FXB and G4BUE: using a PL36 at 65W input into a 2-element quad they produced a log from which the adjudicators could only deduct three points—an excellent achievement indeed.

The band runner-up was Croydon/SRCC (G6LX/P) which, although making three more contacts than Channel, had a checked score 12 points lower. The operators were G3BFP, G3IAS, G3UKI and G6LX, and they used a 2E26 at 50-60W into an 8-element W8JK or a 2-element beam.

Subject to Council approval, the Frank Hoosen (G3YF) Memorial Trophy will be awarded to the Channel CG.

#### 21MHz

The absence of good dx conditions was more than compensated for by the excellent short-skip propagation into Europe for most of

the daylight hours. No North Americans appear to have been worked, but several African stations often feature in the logs, notably 9J2B/P, 9J2NFD/P and ZE3JO.

The band leader is the Glenrothes & D ARC (GM3OLK/P) with 616 points from 202 QSOs—an excellent score which has only been bettered during periods of high sunspot activity. Operators GM3PFQ and GM3YOR keyed an FT101B with a 40W 2E26 outboard pa driving a 2-element quad at 25ft.

The NFD Trophy winner, the Channel CG (G3MXJ/P), takes second place with 593 points from 181 contacts.

#### 28MHz

One group commented: "This band closed within minutes of start of contest." Maybe it did for them, but the first and second stations on 10m found the band open long enough to score totals exceeding the previous record (187 points in 1969) by a good margin. When it is noted that the groups concerned operated from opposite ends of the country, and that QSO rates of 37/hour were achieved, it is clear that contacts were available to all for the asking, but only seven stations scored more than 100 points.

Only five dx contacts appear in the logs, with 4X4, 9G1, 9J2 and 9L1, but the exceptional short-skip conditions brought sufficient Europeans within range to enable the Channel CG (G4DAA/P), to score 313 points from 120 QSOs. Operators were G3FXB and G4BUE. For those who want to know when they should have checked 10m, the high scoring rates were achieved around 1230 and 1600.

It is refreshing to note that NFD still offers a technical challenge, in that several groups complained of the unwillingness of their outboard pa stages to produce more than a flea-bite. Highest temperatures must have occurred at the Sutton & Cheam RS site as they reported aerial collapse with exhaustion, fortunately at the end of the contest.

#### Overseas check logs

The Irish Leprechaun Contest Group (E11AA/P) gave most points to NFD entrants, with a score of 372 points. They used a TX50A, an FR400, and a centre-fed 370ft aerial. Operators were E1s 2BB, 2CA, 2CL, 7CC and 8CC.

Runner-up is the "Lusaka All Time DX and Mosquito Swatters Portable Association", otherwise known as 9J2NFD/P! The Swatters were 9Js 2BL, 2BO, 2CE and 2CL, and in between attacks they operated an FT101 into a rhombic with 100m legs at 120ft.

In third place is F0BJO/P, better known as G3VPW/VP8KF, who used an FT101 and an 18AVT from a site in the Pyrenees.

The HF Contests Committee is most grateful to those who sent in check logs. They were all most useful.

## Inspections

Representatives of the HF Contests Committee were once again out in force, and they were invariably made most welcome. Indeed, some groups appeared to treat the arrival of the inspector as the social highlight of the weekend!

The committee offers its sincere thanks to all those who acted on its behalf to ensure fair play in the contest.

Thanks also to those groups who notified the committee of last-minute changes of site, or of decisions not to participate. This saved our inspectors several fruitless journeys.

## Comments from competitors

"Operating: EU—very good, UK—appalling; small wonder that there is so little G activity in major contests."—*Channel CG*.

"Best wx for years. Keep the double-station section and the present pa limit."—*Ariel RG*.

"This year we needed the fridge, but forgot to take it. Lucky that we had a nearby friendly off-licence."—*Croydon/SCCC*.

"One of the best NFDs for a very long time."—*Torrey*.

"Why not drop the pa restrictions?"—*Sutton and Cheam*.

"Thanks for the lovely wx this year."—*Grimby*.

"The sooner the ridiculous valve dissipation rule is scrapped, the better."—*Verulam*.

"The tx packed up one minute before the start!"—*East Notts CG*.

"We believe that the power restrictions are unrealistic."—*Worcester*.

"Leave the rules as they are."—*Sunderland*.

"My 25th NFD—I was 28 in May!"—*G3RZP (son of G8ON)*.

"FB contest. Here's to many more."—*Gloucester*.

"It was not our year for generators. Two failed, and a third was only kept going by borrowing a fan belt from one of the operators' cars."—*Chiltern*.

"Please raise dissipation limit to 18W."—*ARC of Nottingham*.

"Wish the wind would blow stronger towards EU."—*Ilford*.

"What about a multiplier for clubs using battery power only."—*Reading*.

"Keep the contest cw and low power."—*Garendon School*.

"Too many duplicates—caused by operators being distracted by an xyl in a vy fb bikini!"—*Reigate*.

"G4EDX only got his licence on the day of the contest... and operated single-handed through the night."—*Derby & D ARS*.

## Comments from the HF Contests Committee

The logs which are sent to the committee are the sole means by which the adjudicators judge the contest, and we are pleased to say that most groups take care to submit them in a neat, tidy and accurate manner. To them—many thanks. But to the few who persist, year after year, in forwarding scruffy, semi-illegible and inaccurate logs—the adjudicators' comments are unprintable in this journal! This year's logs contain the records of well over 30,000 QSOs, and the adjudication was not made easy by the fact that some logs had to be carefully deciphered before the contest exchanges could actually be checked.

For some years now the committee has been waging a war against the inclusion of "unmarked duplicates for which points have been claimed", on the basis that it is the responsibility of the entrant to ensure that the logs he or she submits are as accurate as possible. We do not object to a station being worked more than once on a particular band, so long as the repeat contacts are clearly marked as duplicates, and no further points are claimed. (Some groups cross-reference their duplicates by noting the appropriate serial numbers—this is most useful—many thanks.) The general rules now allow the adjudicators to deduct five times the claimed score for repeat contacts not marked as duplicates. Several groups would have been more highly placed had they taken proper notice of this fact.

## The future

The HF Contests Committee constantly keeps the rules of events under review, and NFD is no exception.

Many comments about the rules are always received with contest entries, but it is not often possible to reply to these individually. However, they are most useful and due note is taken.

The NFD power rule is naturally the one which produces most comment—both inside and outside the committee. The use of higher power would bring about an increase in the number of contacts made, and might encourage more groups to participate if it meant that standard rigs did not have to be modified—both these facts would surely be welcomed. However, on the other hand there is the traditional lower-power concept of NFD which is still held dear by many groups, as well as the necessity to ensure fair play. Star-gazing into the not-too-distant future, one could envisage the demise of the double-station section through lack of support

(numbers continue to fall with each successive year), and then perhaps instead there could be low- and high-power sections, as in some European field days—still on cw, as the present committee has no intention of introducing ssb into NFD.

Another possibility in the long term is the harmonization of field day rules throughout Europe, so that national results could be amalgamated to produce, for instance, "the top 10 in Europe".

It must be emphasized that these ideas are very tentative, and any changes to the rules of NFD will be made only after all the comments received with the logs, or by letter, are carefully considered and fully discussed in committee.

## Final

By the time this report appears in print, certificates of merit will, hopefully, have been posted to all the overall leaders, the band leaders, and the leading overseas check logs.

NFD is now over for another year for both the groups and the HF Contests Committee. Soon, however, both will be preparing for 1976—the groups planning bigger and better things, and the committee endeavouring to organize a popular, well-supported and enjoyable field day.

We hope to see you all again next year.

# CONTEST NEWS

## 432MHz Autumn Cumulative Contest rules

2030-2230gmt, 27 October; 4, 12, 20, 28 November; 6, 16 December.

All entries and checklogs to: VHF Contests Committee, c/o G5HD, 100 Shirley High Street, Southampton SO1 4FB.

The following general rules, published in the January issue of *Radio Communication*, will apply: 1, 2, 3, 4b, 5a, 6a, 7a, 8b, 9a, 10b, 11-22.

## 144MHz CW Contest rules

2000-0100gmt, 1 November.

All entries and checklogs to: VHF Contests Committee, c/o G3FZL, 11 Liphook Crescent, London SE23 3BN.

The following general rules, published in the January issue of *Radio Communication*, will apply: 1, 2, 3, 4b, 5a, 6b, 7a, 8b, 9a, 10a, 11-22.

## 432MHz Open Contest rules

1000-1800gmt, 16 November.

All entries and checklogs to: VHF Contests Committee, c/o G3SEK, 83 Portway, Didcot, Oxon, OX11 0BA.

The following general rules, published in the January issue of *Radio Communication*, will apply: 1, 2, 3, 4a, 5a, 6a, 7a, 8a, 9a, 10a, 11-22.

## 144MHz Fixed Contest rules

1000-1800gmt, 7 December.

All entries and checklogs to: VHF Contests Committee, c/o G3VPK, "Maple Leaf", Great Braxted, Witham, Essex CM8 3EJ.

The following general rules, published in the January issue of *Radio Communication*, will apply: 1, 2, 3, 4c, 5a, 6a, 7a, 8b (but no award for portables), 9a, 10a, 11-22.

\* In response to several requests, entrants who declare that they have not transmitted ssb will be listed separately. An award will be made if appropriate.

## 7th BARTG VHF RTTY Contest

1700-2300gmt 13 September, 0600-1200gmt 21 September

This contest, on the 144MHz band, will be open to all licensed amateur radio stations in Zones 14 and 15 permitted to use rtty. Logs must be received by E. Yeomanson, G3IIR, 32 Gaymesford Road, Forest Hill, London SE23 2UD, by 25 October 1975.

Full rules of the contest can be obtained from E. H. Double, 89 Linden Gardens, Enfield, Middlesex.



## 432MHz Open Contest results

Moderately good conditions during the first few hours helped to make this an enjoyable event. ON5FF/P and PA0FWS were much in evidence, otherwise Continental activity was low. Signals were mostly first class with almost every station using some, and a few completely, home-built ssb equipment. Leading stations are now using an extremely good surplus 2GHz transistor in their converters.

The Council Cup goes to GW3UCB/P with another impressive win, with certificates to GW8AWM/P, and to G3NHE the leading fixed station.

### G5HD

Posn	Callsign	Score	QSOs	QRA	Best dx	Km
1	GW3UCB/P	613	81	YN75	ON5EB	578
2	GW8AWM/P	282	48	YM54	ON5FF/P	475
3	G3WDG/P	238	46	ZL52	PA0FWS	361
4	G8AGU/P	232	28	YL71	ON5FF/P	470
5	G3OBD/P	230	34	YK09	G3BW	405
6	G3NHE	202	40	ZN54	ON5FF/P	420
7	G3OSS	185	47	ZL40	G3AUS	260
8	G3JVL	167	33	ZK16	GW3JQA/P	339
9	G3ZYC	163	39	ZN73	ON5FF/P	420
10	G3XBY	160	30	ZM52	ON5FF/P	385
11	GW3JQA/P	159	21	XM17	G3JVL	340
12	G4DGO	140	35	ZL24	ON5FF/P	340
13	G3XDY	138	20	ZN50	ON5FF/P	370
14	GW4ALE/P	126	21	YM75	ON5FF/P	460
15	G3SFG/P	107	27	AL22	GW3UCB/P	270
16	G8EOP	84	14	ZN22	G8AGU/P	270
17	G2AXI	73	20	ZL55	ON5FF/P	320
18	G5DF	71	17	ZL45	G8BCL	270
19	G8DCA	65	17	ZK10	GW3UCB/P	302
20	G4DLB/P	58	20	ZM73	GW3UCB/P	158
21	G3OHM	53	17	ZM41	G3XDY	165
22	G8BMP	47	23	ZM21	G3KMS	110
23	GW8ADP/P	39	15	YL25	GW3UCB/P	143
24	G8EHX/A	35	15	ZN75	GW3UCB/P	140
25	G8BXJ	23	9	YL38	G8AGU/P	110
26	G2DSP/P	23	13	ZK08	G3OBD/P	180
27	G3KUE/P	22	6	YN18	GW3JQA/P	180
28	G4AWL	5	5	ZK15	G8BHI	26

### LISTENERS

Posn		Points	QSOs		Best dx	Km
1	BRS34348	190	30	AL53	GW3JQA/P	380
2	BRS26431	129	29	ZM03	ON5FF/P	422
3	BRS18822	62	18	ZL40	ON5FF/P	280
4	BRS28005	60	16	ZK09	GW3UCB/P	315

## High Wycombe DF Qualifying Round results

Twenty-two teams assembled at Cholesbury Common for the start, and good signals were heard from both transmitters.

However, the "A" station was the better signal, and most contestants decided to head for this site. Nobody suspected that the distance from the start was 25 miles, and as a result it was 1446 before the first team arrived. The good signal was accounted for by an aerial suspended from a tall tree and strung across a disused railway cutting, and the earth system was in a spring. All contestants except one managed to find this site by the end of the contest.

The "B" station was 400 yards from the start at an old fort site, using a frame aerial directed at the start. The first contestant to find this transmitter was at 1419.

Thirteen teams found only one transmitter and one team failed to find either. Subject to confirmation, R. Parsons and D. Holland qualify for the Final.

Posn	Name	Club	Station A	Station B
1	M. P. Hawkins	Chelmsford	1540	1430
2	R. Parsons	Essex University	1555	1430
3	D. Holland	South Manchester	1556	1419
4	E. L. Mollart	Oxford	1446	1603
5	J. R. Vickers	Stratford	1505	1617
6	A. Butcher	Chelmsford	1510	1617
7	B. Bristow	Oxford	1510	1618
8	D. Newman	Rugby	1520	1630

## 144MHz Portable Contest results

There was a good response for this contest despite the 24-hour operating time, while the weather and enjoyment seem to have been of a high order. Although dx was not so good, the dx column appears to show otherwise. Operating and manners were also good.

There were the usual complaints of splatter on the 427s; surely the cure is to improve, check and use equipment in the proper manner. The use of primarily-designed mobile equipment for portable work was remarked upon. The registering of the site for operation was requested to avoid problems of dual use or adjacent sites, but the decision to go portable could be spontaneous.

The entry was almost the size of the VHF NFD section and time spent accepting, adjudicating and tabulating the results was considerable. It was noted that a number of stations were portable but did not send logs.

Awards are recommended for GW3WAS, G8BQX and GW3UCB. Check logs are acknowledged from G2DJ/P, G3FPK, G3MWZ/M, G4DRO, G8BKR, G8FBL, G8FPH, G8GXE/P, G8JGK, G8JYR/P, G8IZD and BRS28005.

### G8ACJ

Posn	Callsign	Score	QSOs	Cnty	Best dx	Km
1	GW3WAS	4,085	487	CWD	DK5QD	870
2	G8BQX	3,930	406	SXE	DC6GF	580
3	GW3UCB	3,276	436	CWD	DC9KT	741
4	G3XDY	2,591	369	LCN	DC0JE	599
5	GW8BHH	2,554	375	PWS	DC3KT	733
6	G4CCC	2,534	351	SOM	DB1KG	690
7	GW4ALE	2,190	372	CWD	PA0CIS	470
8	G4CLC	2,037	371	LEC	DL8AWA	633
9	G3FEC	2,030	348	WLT	DL0WU	615
10	G3PFM	2,024	303	DOR	PA0BGO	522
11	G3SDS	1,971	274	DOR	GM4BWT/P	683
12	GW3OXD	1,965	309	PWS	PA0FTF	645
13	G3AHD	1,784	254	YSN	G3WOH	565
14	G4BWG	1,644	304	SRY	GM4BWT/P	648
15	G4DDP	1,590	255	ESX	DC6KL/P	547
16	G4CFI	1,554	216	SFK	DK5OD	622
17	GM4BWT	1,551	123	GRN	G4CRC/P	780
18	G3JQE	1,525	285	SRY	PA0RDY	410
19	G3XLH	1,472	218	YSN	GC3SFG/P	535
20	GC3SFG	1,467	137	JER	PA0ULY	590
21	G4ATV	1,466	308	—	GM4BWT/P	540
22	G3UEE	1,453	239	YSN	GC3SFG/P	537
23	GW5BI	1,380	264	GW	ON6DH	506
24	G8IWD	1,370	203	DOR	PA0CIS	425
25	G4DZO	1,330	235	SXE	FICZX	568
26	G3WIR	1,319	268	OFE	GM4BWT/P	597
27	G3LCH	1,303	249	SRY	GM3WYL/P	604
28	GW8CSA	1,267	206	GW	PA0HD	530
29	G3XTT	1,129	257	NHM	GM3WYL/P	440
30	G8GMC	1,117	209	BRK	GM4BWT/P	610
31	GW3WRA	1,082	166	PWS	DC9KT	720
32	G8GPK	1,052	191	WLT	GM4BWT/P	600
33	G4CRC	1,002	104	CNL	F6CIS	575
34	G3HOX	945	182	LNH	GC3SFG/P	510
35	GW8JBZ	942	186	PWS	G8BQX/P	313
36	GW8DLX	936	153	PWS	PA0CIS	470
37	G8GDK	921	239	BKS	PA0WCH	405
38	G3SAD	903	192	HFD	F8SQ	390
39	G8FCX	897	175	WSX	G8FRR/P	390
40	G8AUN	887	103	NOR	GM4BWT/P	490
41	G4CTF	806	212	WMD	ON6DH	500
42	G3FLH	797	85	IOE	G8BQX/P	514
43	G4DLB	770	183	OFE	GM4BWT/P	475
44	G8HLM	766	90	KNT	DK6DD/P	410
45	G3KIN	744	184	SRY	G3FLH/P	435
46	G3OHM	733	215	WKS	GM4BWT/P	496
47	GW8ARQ	731	147	CWD	G8FUF	305
48	G8HYF	708	104	HBS	ON6DH	360
49	G8FMT	706	150	BFD	G3FLH/P	380
50	G8FRR	696	101	CBA	G8FCX/P	410
51	G4DSC	694	88	YSN	F1BHL	562
52	G4ASE	681	144	LEC	GM4BWT/P	460
53	G4CDY	675	151	SXE	F0MD	525
54	G8CDL	669	147	BFD	GM4BWT/P	490
55	G8JZA	628	150	KNT	G4VEV/P	400
56	G3JFO	621	99	HBS	GC3SFG/P	510
57	G3ZLQ	620	158	OFE	G3IUD	360
58	G8ECO	605	150	SRY	G3SLH/P	410
59	G3OUR	593	136	GLR	ON6DH	429
60	G8JAP	490	113	HFD	G3FLH/P	380
61	G8EAO	475	99	SFK	G4CCC/P	310
62	GM8AKB	453	65	—	—	—
63	G3WTP	448	160	BFD	GW4ALE/P	220
64	G8GBY	431	93	HBS	G3SDS/P	408
65	G8EWM	378	55	DWN	G3PFM/P	380
66	G4DDC	324	90	BFD	G3AHD/P	280
67	G5UM	311	73	LEC	G3IUD	390
68	G3CGQ	304	84	BKS	GC3SFG/P	260
69	GM4EAF	302	52	TYS	G4CLC/P	460
70	GM8GFF	237	34	BDS	G4CLC/P	365
71	G4DFI	228	58	KNT	F5ZA	382
72	G3CMH	186	42	DOR	G3XDY/P	325
73	G8JEG	156	58	ESX	G4CCC/P	262
74	GM8JJJ	124	14	SCD	G4CCC/P	515
75	G3CVB	106	28	DOR	G3XDY/P	320
76	G8JWM	46	16	HBS	G4BWG/P	282

## June Microwave Contest results

There was a drop in entries compared with last year, from 30 to 26. The entry from GM increased to six, but the only entry from GW was for part of the time only. Once again there was difficulty over the band and mode to be used for talk-back, and the problems were exacerbated by the concurrent contest on 2m: the VHF Contests Committee recommends 70cm.

Only four bands of the possible six were used, with most activity on 23cm and 3cm. Several stations suggest that 23cm should not figure in the contest, or that the multipliers be adjusted to encourage the higher frequencies. There was some dissatisfaction with fixed stations being allowed to enter, although it is notable that only two of them were on a band other than 23cm.

Conditions generally were normal, although some stations found a lift, and the weather was good. Congratulations to the overall winner G3WDG/P (again!) and the band leaders, who will receive certificates.

P.W.W.

Posn	Callsign	Score	23cm	13cm	9cm	3cm	Cnty	ASL/ft
1	G3WDG/P	6,539	5,480	219	—	840	WLT	870
2	G4BEL*	6,024	6,024*	—	—	—	CE	120
3	G3JVL	4,453	4,240	—	—	205	—	6
4	G3NHE	3,758	3,758	—	—	—	YSS	425
5	G(W)4BRS/P*	3,215	—	—	—	3,215*	—	25/2,906
6	G3KMS	3,102	3,102	—	—	—	GM	750
7	G6XM	2,950	2,950	—	—	—	WLE	420
8	G3WXC/P	2,550	—	—	—	2,550	IOW	773/20
9	G3VPP/P	2,176	—	—	—	2,176	DVN/DOR	20/—
10	G3DY	1,940	1,940	—	—	—	—	—
11	G4DDC/P	1,620	1,564	56	—	—	BFD	800
12	G8HEH/P	1,025	—	—	—	1,025	FFE	1,471
13	G5ADP/P*	968	312	291*	—	—	GR	1,070
14	G5AGN/P*	614	—	—	—	614*	SFD	1,520/1,580
15	G8DSX/P	465	—	—	—	465	—	1,017
	G8DXJ/P	465	—	—	—	465	—	1,017
	G3EGV/P	465	—	—	—	465	DT	50/500
18	G8BKE/P	420	—	—	—	420	SG	1,024
19	G3EEZ/P	414	—	—	414	—	SE	1,500
20	G83RVL/P	410	—	—	—	410	—	600
21	G4CHF/P	360	—	—	—	360	FRH?	1,017
22	G3PHO/P	150	—	—	150	—	—	1,416
23	G3WJG/P	93	37	56	—	—	Oxon	647
24	G8DNF/P	50	—	—	50	—	DYS	1,800
25	G3TQF/P	10	—	—	—	10	Leics	300
	G3TDX/A	10	—	—	—	10	—	305

\* Band leaders

## RSGB Region 1 VHF Contest results

### Section 1. Multi-operator

Posn	Group	Mult	4m	2m	70cm	Total	Best dx
1	N Liverpool	2/2/1-8	633	1,290	1,404	3,327	396
2	Liverpool & D	1	719	1,855	—	2,575	490
3	Ainsdale	2	451	1,790	240	2,481	390
4	S Manchester	1.8	—	1,892	205	2,097	405
5	Bury & Ross'le	1	353	1,613	—	1,966	307
6	Isle of Man	1	—	1,711	—	1,711	501
7	Wirral	1.4	—	1,421	—	1,421	340

### Section 2. Single-operator

Posn	Callsign	Mult	4m	2m	70cm	Total	Best dx
1	G8EXI	1.6	—	3,883	—	3,883	505
2	G2HDZ	1.4	571	1,421	874	2,866	455
3	G4BWW	2	—	1,494	964	2,458	362
4	G4CZP	2	—	2,434	—	2,434	430
5	G2AXH/P	1	—	1,339	—	1,339	365
6	G4BYP	1.8	449	785	—	1,234	310
7	G8IAT	1.1	—	883	—	883	368
8	G4EDV/P	1	—	818	—	818	425
9	G3NKL	1.2	379	—	127	506	359
10	G8BCG	1.2	—	—	427	427	230
11	G8FDL	1.2	—	379	—	379	202
12	G3ZOD/P	1	348	—	—	348	356
13	G3SVW/A	1.4	—	234	—	234	170

### Section 3. Outside region

Posn	Callsign	R1-QSOs	Mult	2m	70cm	Total	Best dx
1	G4CDF	41	1.8	1,183	—	1,183	270
2	G8BKR	16	1.6	515	—	515	330
3	G8JXK	16	1.4	492	—	492	395
4	G8FBL	18	1.6	458	—	458	253
5	G8JHV/P	14	1	360	—	360	478
6	G8JHV/P	18	1	330	—	330	305
7	G4DLB	9	1.2	182	36	218	325
8	G3XFW	6	1.4	185	—	185	356
9	G8JXV	1	1.2	25	—	25	240

## Section 4. 23cm

Check log received from G4DDC/P but no Region 1 QSOs made.

There was plenty of activity and fair dx—Liverpool & D ARS made several F and one PA0 QSOs. North Liverpool RC won the G3SMM shield, and G8EXI the G2CIP Shield.

## Salisbury DF Qualifying Round results

Fourteen teams assembled at the start high on Salisbury Plain, signals were good, and finding both transmitters was not too difficult. Station A was 8.5km west of the start, with the only easy approach from the far end of Grovelly Woods. Station B was 12.5km east of the start near Cholderton, also in a thickly wooded area.

Thanks are due to G4AJD (the "B" station operator), particularly as it was his first experience of a df competition. Sir Evan Nepean, G5YN, again directed the event, and the contest was arranged as usual by Bert Newman, G2FIX, on behalf of the Salisbury RES.



Paul Tyler arriving at Station B

Posn	Name	Club	Time of arrival	Station A	Station B
1	B. J. Mahony	Rugby	1500	1422	—
2	M. P. Hawkins	Chelmsford	1511	1417	—
3	G. A. Whenham	Coventry	1422	1520	—
4	P. H. Lisle	Cambridge	1522	1447	—
5	T. C. Gage	Oxford	1422	1522	—
6	W. North	Chiltern	1526	1447	—
7	D. E. Newman	Slade	1526	1422	—
8	A. W. Butcher	Chelmsford	1529	1456	—
9	I. Butson	Chelmsford	1529	1443	—
10	P. J. Tyler	Oxford	1422	1552	—
11	G. J. Reason	Banbury	1426	1607	—
12	J. R. Vickers	Stratford-on-Avon	1502	1626	—
13	J. Coombes	Salisbury	—	1448	—
14	P. Woollett	Dartford	1544	—	—

Subject to confirmation, B. J. Mahony and G. A. Whenham qualify for the final.

## Contests calendar

6-7 September	—VHF NFD and SWL (Rules in March issue)
6-7 September	—IARU Region 1 VHF (Rules in May issue)
13-14 September	—European DX Contest (Phone)
14 September	—80m Field Day (Rules in August issue)
21 September	—DF Final—Slade
5-6 October	—RSGB UHF Open and SWL (Rules in May issue)
12 October	—21-28MHz Telephony (Rules in May issue)
18-19 October	—7MHz CW (Rules in June issue)
25-26 October	—CQ WW DX Contest (Phone)
26 October	—70MHz Fixed (Rules in July issue)
1-2 November	—144MHz CW (Rules in September issue)
1-2 November	—7MHz Phone (Rules in June issue)
8-9 November	—2nd 1.8MHz
16 November	—432MHz Open (Rules in September issue)
29-30 November	—CQ WW DX Contest (CW)
7 December	—144MHz Fixed (Rules in September issue)

# CLUB NEWS

RSGB affiliated societies and clubs, and RSGB groups, are invited to submit items for inclusion in "Club News" to their regional representatives (not direct to the editor). In the case of Region 11 clubs, they can send them direct to the editor until an RR is appointed.

Items of news and dates of forthcoming events should reach RRs by 29 September for the November issue.

**REGION 1—RR B. O'Brien, G2AMV, "Tanglewood", Anthony's Way, Heswall, Wirral, Cheshire L60 0BP.**  
**Ainsdale (AARC)**—Thursdays fortnightly, 8.15pm. 11, 25 Sept, 9, 23 Oct, 6, 20 Nov. Ainsdale Scout Headquarters. Further details from G2CUZ.

**Blackburn (East Lancs ARC)**—First Thursday in each month, 7.30pm. YMCA, Shearbank Road, Blackburn. Visitors always welcome. G6CJ will be visiting the club in Sept to give his lecture on aerials. Other clubs in the area are invited to attend. Sec G4CDR.  
**Blackpool (B&DARS)**—Mondays, 8pm. Pontins Holiday Camp, Squires Gate. Morse tuition 7.30pm.

**Bolton (B&DARS)**—Third Wednesday in each month, 8pm. Clarence Hotel, Bradshawgate. Sec G4AQB.

**Bury (B&RRS)**—Second Tuesday in each month but with informal meetings including morse and RAE classes every Tuesday. Mosses Community Centre, Cecil Street, Bury. The 18AVT aerial has been mounted on the community centre roof and is under test. The club entered the HF NFD and RSGB Region 1 VHF Contests and a good turn-out by the members made them very enjoyable—the good weather helped. Sec G4ECM, tel Heywood 65911.

**Carlisle (C&DARS)**—Mondays, 7.30pm. Currock House, Lediard Avenue, Currock, Carlisle. A very full programme of lectures and demonstrations has been arranged for the coming months. Full details from G8DVD.

**Chester (C&DARS)**—Tuesdays 8pm except first Tuesday in month. YMCA Chester. Full details from GW8DMR.

**Douglas IoM (Manx ARS)**—Mondays fortnightly. Highlander Inn, Crosby. Visitors welcome. Sec GD2HDZ, tel Laxey 465.

**Eccles (E&DARC)**—Tuesdays, 8pm. Bridgewater School, Worsley, Manchester. Club 2m net, 11am Sundays on 145.66MHz. All visitors and prospective members welcome. Sec G4AEQ.

**Lancaster University (UoLARS)**—Wednesdays, 7pm. Furness College. RAE and morse classes. The society is active on the hf bands and 2m using G3ZBY and G8DOU. Skeds and visits welcomed; enquiries please to Colin Pegrum, Department of Physics.  
**Leyland (LHARG)**—Second Monday in each month, 7.30pm. "Rose & Crown", Ulmes Walton, Leyland. Net nights Saturdays 2000gmt on 145.8MHz. Details from G3XIL.

**Liverpool (L&DARS)**—Tuesdays, 8pm. Conservative Association Rooms, Church Road, Watertree. Sec G3WCS.

**Liverpool (North Liverpool RC)**—Tuesdays, 8.30pm. Informal meetings. "Nags Head", Thornton, Crosby, Liverpool 23. Visitors welcome. Sec R. B. Porter, 11 Cranmore Avenue, Crosby, Liverpool L23 0QD.

**Liverpool University (UoLARS)**—Details of meetings from J. M. Pagett, G8IAV, c/o The Students Union.

**Manchester (M&DARS)**—Wednesdays, 7.30pm. All meetings include morse classes. 203 Droylesden Road, Newton Heath, Manchester 10. Sec G3IOA.

**Manchester (South Manchester RC)**—Fridays, 8pm. Sale Moor Community Centre, Norris Road, Sale, Cheshire. Morse practice precedes the lectures. The vhf lads meet on Mondays at the club shack, Greeba, Shady Lane, Manchester 23, at 8pm. Visitors are welcome on both evenings. 5 Sept ("Light" by C. Scholefield, G8GDM), 12 Sept (Visit by TAVR Royal Corps of Signals), 19 Sept (Visit by B. O'Brien, RSGB Regional Representative), 26 Sept (Surplus equipment sale), 3 Oct ("Astronomy" by C. Tredwell, G8CHW), 10 Oct ("Communication in Antarctica" by R. P. Smith, G3SVW), 17 Oct ("More of the good old days" by D. Barber, G2AKR), 24 Oct (Films), 31 Oct ("QRP" by W. R. Parkinson, G3FNM). Hon sec G8GDM.

**Manchester University (MUARS)**—Details of meetings from sec G. T. Phelan, G8EPS, c/o The University Union.

**University of Manchester (UoM—IoS&TARS)**—G3CXX is active on all hf bands and G8FOT on 2m and perhaps 23cm. Items for club magazine/newsletter, or letters from intending members gratefully received by G8GOS.

**Preston (PARS)**—11, 25 Sept, 9, 23 Oct, 6, 20 Nov. Morse practice 7.30pm, main meeting 8pm. "Windsor Castle" (private room), St Paul's Square, Preston.

**Salford (Dial House RS)**—Wednesdays, 5.30–9.30pm. Dial House, W45, 55 Portland Street, Manchester M60 1BA. Net channel 145.25MHz a.m.—most members are now mobile on this channel, and the club station G3WDH now monitors this frequency every club night for calls from any other station. Sec G8JCN.

**Stockport (SRS)**—Second and fourth Wednesdays in each month, 8pm. Blossoms Hotel, Buxton Road, Stockport. Sec G3FYE.

**Thornton Cleveleys (TCARS)**—First and third Wednesdays in each month, 8pm, morse practice from 7.30pm. St John Ambulance Hall, Fleetwood Road North (next to "Gardener's Arms"), Thornton. Details from sec G8OY.

**Warrington (W&DARS)**—Tuesdays, 7.45pm. Grappenhall Community Centre, Bellhouse Lane, Grappenhall. Sec J. Weaver, c/o Grappenhall Community Centre.

**Wigan (W&DARS)**—First and third Wednesdays, second and fourth Tuesdays in each month. Poolstock Cricket Club, Keats Avenue, Poolstock, Wigan. Sec G8FTF.

**Winsford (Mid-Cheshire ARC)**—10 Sept (AGM), 24 Sept (Slide quiz by G8KIX), 8pm. Technical Activities Centre, Verdin Comprehensive School, Grange Lane, Winsford. Visitors welcome. Club station G3ZTT is on 160m and 80m most Wednesdays between 7.30 and 8pm. Anyone requiring talk-in, club newsletter or details of club meetings should contact sec G3SIQ, 83 Ash Road, Cuddington, Nr Northwich, Ches. Club nets: Mondays 8pm, 160m; Tuesdays 8pm 2m (around 145.5).

**Wirral (WARS)**—First and third Wednesdays in each month, 7.45pm. Sports and Recreation Centre, Grange Road West, Cloughton, Birkenhead. Sec G3DLF.

**Wirral (Wirral DXA)**—Members or visitors, who will be welcome, should contact sec G3VZM for details of meetings.

**Merseyside members** meet for lunch on the first Monday in every month. Please obtain details and book beforehand with G3VQT or G2AMV.

**REGION 2—RR R. C. Andreang, G4CMT, 6 Beech Avenue, Bilton, Hull, North Humberside.**

**Barnsley (B&DARC)**—First meeting of winter session will be at King George Hotel, Peel Street, Barnsley. (Date not notified).

**REGION 3—RR H. S. Pinchin, G3VPE, 61 Cole Bank Road, Hall Green, Birmingham B28 8EZ**

**Birmingham (Midland ARS)**—16 Sept, 21 Oct (AGM). 8pm. The Birmingham and Midland Institute, Margaret Street, Birmingham. G3ZKQ.

**Birmingham (Slade R&SS)**—5, 19 Sept, 3, 17, 31 Oct, 8pm. The Committee Room, Church House, Erdington, Birmingham. G8GRC.  
**Birmingham (South Birmingham RS)**—First Wednesday in each month. 8pm. Hampstead House, Fairfax Road, West Heath, Birmingham 31. G8GDZ.

**Bromsgrove (B&DARC)**—12 Sept (Discussion on repeaters), 28 Sept (Coach to Blackwood Convention GW6GW—apply early), 10 Oct (Auction sale—surplus equipment), 18, 19 Oct (JOTA). 8pm. Avoncroft Art Centre, Bromsgrove. Sec J. Dufrane, 44 Hazelton Road, Marlbrook, Bromsgrove.

**Coventry (CARS)**—Fridays, 8pm. Baden Powell House, St Nicholas Street, Radford Road, Coventry. Club will enter VHF NFD on 6/7 Sept on 4m, 2m and 70cm. 18, 19 Oct (JOTA). G3HDO.

**Dudley (DARC)**—Second and fourth Tuesday in each month, 7.45pm. Central Library, Dudley. G4BFT.

**Hereford (HARS)**—5, 19 Sept, 3, 17 Oct. Civil Defence HQ, Gaol Street, Hereford. G4CNY.

**Lichfield (LARS)**—First Monday and third Tuesday in each month. 8pm. Swan Hotel. Tuesday meetings are rather-nites. Active contest group. Sunday net 11am, 21.150MHz. G3NLY.

**Solihull (SARS)**—16 Sept ("Interference" by F. C. Ward, G2CVV), 18, 19 Oct (JOTA), 21 Oct (AGM). 7.30pm. The Manor House, High Street, Solihull. G4AEJ.

**Stourbridge (S&DARS)**—2 Sept, 7 Oct, 3 Nov (Informals at "Shrubbery Cottage" Public House, Heath Lane, Stourbridge), 15 Sept ("DIY and mini-quad" by G3XKM), 20 Oct ("QM70 Products"

by G3ZUL. 7.45pm. Oldswinford Hospital School, Heath Lane, Stourbridge. G4CLX.

**Stratford-upon-Avon (S&DRC)**—Meetings suspended—for information contact G3OQQ.

**Sutton Coldfield (SCRS)**—Second and last Monday in each month. 7.30pm. Central Youth HQ, Clifton Road, Sutton Coldfield. Sec Norman Sanderson, 130 Willmott Road, Sutton Coldfield B75 5NW.

**Telford (T&DARS)**—Wednesdays, 7.30pm. Phoenix Centre, Webb Crescent, Dawley. G4AXZ.

**Wolverhampton (WARS)**—8 Sept (Natter-nite), 15 Sept ("Safety in the shack"), 29 Sept (Natter-nite), 6 Oct (AGM), 13 Oct (Natter-nite), 20 Oct (Members' film and slide show). 8pm. Neachells Cottage, Danescourt Road, Stockwell End, Tettenhall, Wolverhampton. G8GCV.

**Worcester (W&DARC)**—1, 15 Sept (AGM), 20 Sept, 6, 18, Oct. 8pm. The Old Pheasant, New Street, Worcester. G8ASO, tel Worcester 351565.

#### REGION 5—RR P. F. Chilcott, G4BBA, 258 Coneygree Road, Peterborough PE2 8LR.

**Bedford (B&DARC)**—4 Sept (Members' gear, G3FWA), 6/7 Sept (VHF NFD), 11 Sept (Junk sale, G3XKB), 13 Sept (Barbecue), 18 Sept ("Centimetric dishes", by G8JXW), 25 Sept (Films), 2 Oct (AGM), 9 Oct (A longer lecture by Bob Woodhouse), 16 Oct ("IARU and RSGB" by G3MXJ), 23 Oct (Speaker from Sinclair Electronics), 30 Oct ("Going mobile" by G3LWJ). 8pm. United Services Club, The Broadway, Bedford. Further details from G8FMG.

**Peterborough (GPARC)**—Greater Peterborough ARC has just been formed, details from G4BBA.

#### REGION 6—RR D. C. Andrews, G4CWB, 63 Bulmershe Road, Reading, Berks RG1 5RH.

**Maidenhead (M&DARC)**—4 Sept ("Contest operating with special reference to VHF" by Steve Rawlings, G4ALG), 16 Sept ("Micro-circuits" by Jack Wilson, Slough College), 2 Oct ("Propagation and band usage" by Dave Vizard, G3UKS), 21 Oct (Programme by Post Office). 7.30pm. British Red Cross Hall, The Crescent, Maidenhead. Sec G3FVC.

**Oxford (University RS)**—27 Aug to 10 Sept (Dxpediton to Guernsey, 160 to 10, 4, 2, 70—skeds arranged by sec). 10 Oct (Stand at Freshers' Fair in Examination Schools, High St, Oxford—all welcome). Sec G4BYB.

**Reading (RARC)**—First and third Tuesdays in each month, 8pm. "White Horse", Emmer Green. Sec G4CCC.

#### REGION 7—RR R. S. Hewes, G3TDR, 24 Brightside Avenue, Laleham, Staines, Middx.

**Addiscombe (AARC)**—Tuesdays, 9pm. "Spread Eagle", Portland Road, South Norwood. Sec G4CZB.

**Ashford, Middlesex (Echelford ARS)**—8 Sept (To be confirmed), 25 Sept ("Transmitter techniques—old and new" by Cliff Touch, G2HDJ), 13 Oct (Film show), 30 Oct (Inter-club quiz). 7.30 for 8pm. Visitors very welcome. St Martin's Court, Kingston Crescent, Ashford. Sec G2FNK, tel Staines 54828.

**Bexley Heath (North Kent RS)**—Second and fourth Thursdays in each month. St Mary's Institute, 2 North Cray Road, Bexley. 8pm. Sec G4ARQ.

**Cray Valley (CVRS)**—First and third Thursdays in each month, 8pm. Eltham United Reformed Church Hall, 1 Court Road, SE9. Sec G3YWO.

**Croydon (Surrey Radio Contact Club)**—Third Tuesday in each month, 8pm. "The Ship", 47 High Street, Croydon. Sec G3FWR, tel 01-657 3258.

**Crystal Palace (CP&DRC)**—20 Sept ("HF aeriels and matching units" by Bob Burns, G3OOU), 18 Oct (To be announced). 8pm. Emmanuel Church Hall, Barry Road, SE22. Sec G3FZL, tel 01-699 6940.

**Esher (Thames Valley ARS)**—3 Sept (To be announced), 1 Oct (Inter-club quiz, and talk by G3MXJ on recent IARU conference in Warsaw). 8pm. King Georges' Hall, Esher, (next door to fire station). Sec G3ZNV.

**Guildford (G&DRS)**—Second and fourth Fridays in each month, 8pm. Model Engineering HQ, Stoke Park, Guildford, Surrey. Sec G3SYM.

**Kingston (K&DARS)**—Second Wednesday in each month, 8pm. Tolworth Scout Hut, Stirling Walk, Raeburn Avenue, Surbiton, Surrey. PRO G8HUW.

**Reigate (RATS)**—2 Sept, 21 Oct (Natter nights) "Marquis of Granby", Houley Lane, Redhill, 16 Sept ("Amateur Radio Bulk Buying Group" by P. Burton), 7 Oct (To be arranged). 8pm. St Marks Church Hall, Alma Road, Reigate. Sec G3RIN, tel Reigate 47659.

**Sutton & Cheam (SCRS)**—18 Sept (Inter-club quiz), 7.30pm. The Library, Cheam. Date and QTH of Oct meeting to be announced. Sec G4BOX.

**Wimbledon (W&DRS)**—Second and last Fridays in each month, 8pm. St John Ambulance HQ, 124 Kingston Road, Wimbledon SW19. Sec G3XTC, tel 01-664 3698.

#### REGION 8—RR D. N. T. Williams, G3MDO, 'Seletar', New House Lane, Thanington, Canterbury, Kent.

**Burgess Hill (Mid-Sussex ARS)**—Marle Place, Leylands Road, Burgess Hill, Further details from G3RXJ.

**Canterbury (East Kent RS)**—First Thursday in each month. Westgate Hall, Canterbury. Third Thursday in the month devoted to the constructor. Sept (Festival by G3EMU), Oct (Thanet Electronics). Further details from G3XDV.

**Chichester (C&DARC)**—First Tuesday in each month. Lancaster School, Basin Road, Chichester. Details from G8EPJ. Tel 0243 88069.

**Crawley (CARC)**—24 Sept (Junk sale), 22 Oct ("FM" by Geoff Stone, G3FZL). United Reform Church Hall, Ifield, Crawley. Further details from G3MGL.

**Dover (South-East Kent YMCAARC)**—First and third Wednesdays in each month. All meetings in three parts (1) Morse tuition, (2) Talk/demo, (3) Practical. The shack is open to all members any evening 7-10pm. Further details from G8DRS.

**Horsham (HARC)**—First Wednesday in each month. Civil Defence HQ, Moons Lane, Brighton. Further details from G3NPF.

**Maidstone (MYMCAARS)**—"Y" Sports Centre, Maidstone. First and third Fridays devoted to the beginners.

**Medway (MARTS)**—Fridays, 7.30pm. "Aurora Hotel", Gillingham. Details from G8FHN.

**Tunbridge Wells (West Kent ARS)**—Twice monthly. On Tuesdays following the Friday meeting in the Drill Hall, Victoria Road, meetings for general ideas and construction. Details from G4CCQ. Tel Lamberhurst 393.

#### REGION 9—RR H. W. Leonard, G4UZ, 4 Start Bay Park, Strete, Dartmouth TQ6 0RY.

**Camborne (Cornish RAC)**—First Thursday in each month, 7.30pm. SWEB Clubroom, Pool, Camborne. Details from G3NKE, tel Camborne 2419.

**Exeter (EARS)**—Second Monday in each month, 7.45pm. Coombe House, Coombe Street, Exeter. Full details from sec Jack Bawden, 232 Exwick Road, Exeter EX4 2BA.

**Newquay (N&DARS)**—Alternate Wednesdays, 7.45pm. Treviglas School. Full details from G8GOR.

**North Devon (NDRC)**—Second Wednesday in each month at QTH of G4CG, Barnstaple; fourth Wednesday in each month at QTH of G2FKO, Bideford.

**Penzance (Cornish RAC)**—Third Thursday in each month, 7.30pm. The Guildhall, Penzance. Details from G3NKE, tel Camborne 2419.

**Plymouth (PRC)**—First and third Tuesdays in each month, 7.30pm. Virginia House, Bretonside, Plymouth. Visitors always welcome. Sec G8JES, 36 Higher Mowles, Higher Compton, Plymouth PL3 6NE.

**Saltash (S&DARC)**—First and third Fridays in each month, 7.30pm. Burraton Toc H Hall, Saltash. G4DHA.

**Torbay (TARS)**—Tuesdays, with special meeting on last Saturday of each month. RAE course, enrolment 2 Sept, starts at club 7 Oct. 27 Sept ("Rock climbing" by C. Waddington), 25 Oct (TARS slides—events of the year in colour). G3UIQ.

#### REGION 10—RR R. G. Barrett, G8HEZ, 23 Carshalton Road, Beddau, Pontypridd, Glam.

**Barry (BCoFERS)**—Thursdays, 8pm. Barry Rugby Football Club, Reservoir Road, Barry. Details from sec GW3VPB.



**Blackwood (BARS)**—Fridays, 7pm. Oakdale Community Centre, Oakdale, Nr Blackwood. Details from sec GW3KYA.  
**Cardiff (CRSGBG)**—Second Monday in each month, 7.30pm. BBC Social Club, 118 Newport Road, Cardiff. Details from GW3GHC.  
**Pembroke (PRSGBG)**—Last Friday in each month. Defensible Barracks, Pembroke Dock. Details from GW3AKO.  
**Pontypool (PRSGBG)**—Tuesdays, 7pm. Educational Settlement, Park Hill Road, Pontypool. Details from GW3JBH.  
**Porth (Rhondra ARS)**—Every other Thursday, 7.20pm. Transport Employers Club, Porth. Details from GW3PHH.  
**Port Talbot (PTARS)**—Thursdays, 7.30pm. BSC Sports and Social Club, Margam. Details from GW3ACF.  
**Sully (S&DSWC)**—Tuesdays, 7pm. Sully Bowls & Social Club, 59 South Road, Sully. Details from GW4CJC.  
**Swansea (SARC)**—Tuesdays fortnightly, 7.30pm. The Commercial Inn, Killay, Swansea. Details from GW4BIQ.  
**Tonduu (Glamorgan VHF/UHF Group)**—Third Tuesday in each month, 7.30pm. NCB Social Club, Tonduu, near Bridgend. Details from temp sec GW8HEZ.

A group of amateurs is hoping to form a club in Newport (Gwent). If anyone is interested would they please contact GW3YTJ.

Amateurs in Region 10 wish Joe Ludlow, GW3ZTH, and his family 73 and good luck in their new home in South Africa.

#### REGION 13—RR Rev S. J. Smith, GM4DNM, St Ninians, 6 Derren Drive, Cardenden, Fife KY5 0JG.

**Berwick (BARS)**—Last Sunday in each month, 3pm. Tweed View Hotel. Further details from GM8IO.  
**Dunfermline (DRS)**—Second Wednesday in each month, 7pm. CCTV Studios, Pittencrieff School, Mailland Street, Dunfermline. Further details from GM8HEY.  
**Edinburgh (Ferranti, Edinburgh AR Section)**—Second and fourth Wednesdays in each month, 7pm. Recreation Club, Stewart Terrace, Edinburgh. Non-Ferranti employees can attend by arrangement with the society. Further details from N. F. MacLeod, GM4DHN, 54 Drumbrae South, Edinburgh.  
**Edinburgh (Lothians RS)**—11 Sept (Presidential address), 25 Sept (Sale), 9 Oct (Project design), 23 Oct (GM3EDL). Adult Education Centre, Riddles Court, High Street, Edinburgh. Sec GM8BJF.  
**Glenrothes (G&DARC)**—First Sunday in each month, 7.30pm. Old Nursery Building, Leslie, Fife. Sec GM3YOR.  
**St Andrews University (USTAARS)**—Details from R. Marchant, GM3ZCQ, Dept of Physics, North Haugh, St Andrews.

#### REGION 14—RR A. J. Mitchell, GM3UDL, 7 Limetree Crescent, Newton Mearns, Glasgow G77 5BJ.

**Ardeer (ARCARS)**—Thursdays, 7.30pm. Ardeer Recreation Club, Stevenston, Ayrshire. Details from GM8BOM.  
**Ayr (ARG)**—Every second Sunday evening at the Community Leisure Centre, 24 Wellington Street. Details from GM3THI.  
**Falkirk (F&DRSGBG)**—Temperance Cafe, Lint Riggs, Falkirk. Further details from GM3OQI.  
**Glasgow (West of Scotland ARS)**—Wednesday and Friday evenings, 7.30pm. 22 Robertson Street. Programme and further details from GM3RHR, tel 041-772 3805.  
**Greenock (G&DARC)**—Tuesdays and Fridays, 7.30pm. Watt Library, Union Street. Details from GM3LYI.  
**Motherwell (Mid-Lanark ARS)**—Fridays with alternate meetings informal. Formal meetings recommence 5 Sept. Weekly morse classes will be held. Wrangholm Hall Community Centre, Jerviston Street. Details from GM3KMG, tel Hamilton 28759.

#### REGION 15—RR H. J. Campbell, G8FOK, 26 Kilcoole Park, Belfast BT14 8LB.

**Ballymena (BRC)**—Tuesdays, 8pm. 86 Old Cullybackey Road, Ballymena. RAE and morse classes. Fridays, club night; Sundays, special projects, 3pm.  
**Bangor (B&DARS)**—First Friday in each month, 8pm. Redcliff Hotel, Seacliff Road, Bangor, 5 Sept (AGM). Sec G3YMY.  
**Belfast (QUORC)**—Tuesdays, 8pm. Queen's University Radio Club, 37 Fitzwilliam Street, Belfast. All welcome.  
**Belfast (CoBYMARC)**—Saturdays, 2.30pm. 7 Brunswick Street, Belfast. All welcome. Sec G14CRO.

**Belfast (BRSGBG)**—Third Wednesday in each month, 8pm. 90 Belmont Road, Belfast. 17 Sept (AGM). New members and visitors especially welcome. For further information contact G8FOK.  
**Mid-Ulster (MURSGBG)**—First Sunday in each month, 3pm, at G8BAC QTH. 7 Sept (AGM). All welcome.  
**North Ulster (NURSGBG)**—21 Sept (Mobile rally, Castle Grounds, Antrim). Details from G8AYZ.

#### REGION 16—RR R. E. G. Kendall, G8BNE, "Wesley", Rannworth Road, Hemblington Corner, Blofield, Norwich NR13 4PJ.

**Chelmsford (CARS)**—First Tuesday in each month, 7.30pm. Marconi College, Arbour Lane, Chelmsford. Details from B. G. Tew, G3WFF, 334 Gloucester Avenue, Chelmsford.  
**Colchester (U of Essex ARS)**—Details from J. Masterton, G8FUL, Eddington 6.  
**Great Yarmouth (GYRS)**—Last Thursday in each month. 67 Southdown Road, Great Yarmouth. Details from G3NHU.  
**Harlow (H&DRS)**—Tuesdays, 8pm. Mark Hall Barn, First Avenue, Harlow, Essex. Details from G3WUX.  
**Ipswich (IRC)**—Details from J. Gee, G4BAV, 35 Neath Drive, Stoke Park, Ipswich.  
**Loughton (L&DRS)**—Second and fourth Fridays in each month, 8pm. Loughton Hall, near Debden Station, Sec G4CMD.  
**Lowestoft (L&DARC)**—Twice weekly, 7.30pm. YMCA, Park Road, Lowestoft. Details from G4AJQ.  
**Martlesham (MRS)**—Details from G. Murchie, G8AXU, Post Office Research Centre, Martlesham.  
**Norwich (Norfolk ARC)**—Wednesdays, 7.45pm. Crome Community Centre, Telegraph Lane East, Norwich. 3 Sept (Business meeting), 10 Sept (Informal and morse practice), 17 Sept ("Power supplies" by G2CDX/G8BNE), 24 Sept (Informal), 1 Oct (Surplus equipment sale), 8 Oct (Informal), 15 Oct ("Simple receivers" by G8BNE/G2CDX), 22 Oct (Informal), 29 Oct ("TV maintenance" by G3VYN). Sec G4ARN, Crome Community Centre.  
**Norwich (U of East Anglia R&EC)**—Details from P. Gowen, G3IOR.  
**Stowmarket (S&DARS)**—Details from sec K. J. Bertrand, 35 Curwen Road, Stowmarket.  
**Vange (VARS)**—Thursdays, 8pm. Youth Hall, Barstable Community Centre, South Riding, Basildon. Details from Mrs D. Thompson, 10 Feering Row, Basildon.

#### REGION 17—RR L. Hawkyard, G5HD, 100 Shirley High Street, Southampton, Hants.

**Basingstoke (BARC)**—First and third Saturdays in each month. Chineham House, Popley, Basingstoke. 7.30pm. Sec G8FKT.  
**Basingstoke (UKFMG—Southern)**—First Wednesday in each month, 8pm. Chineham House, Popley, Basingstoke. Sec G3ZRM. Details from G8HWO.  
**Bournemouth (Wessex ARG)**—First Friday in each month and the Monday 17 days later, 8pm. Cricketers Arms, Windham Road. Sec G8BBN.  
**Chippenham (C&DARC)**—Meetings every Tuesday, 7.30pm. The Boys High School, Hardenhuish Lane, Chippenham. G3UFN.  
**Fareham (F&DARC)**—Wednesdays, 7.30pm. Porchester Community Centre, Room 9. Details from G8FFI.  
**Farnborough (F&DRS)**—Second and fourth Wednesdays in each month, 7.30pm. Railway Enthusiasts Club, Farnborough. Sec G8ECO. PRO G8ATK.  
**Jersey (JARS)**—Sundays, 8.30pm, and Fridays, 8pm. Le Hocq Tower, St Clement, Jersey. Sec Mary McTaggart, 19 Parade Road, St Helier.  
**Portsmouth (P&DRC)**—Wednesdays, 7.30pm. Portsmouth Community Centre, Malins Road, Buckland, Portsmouth. G3NCO.  
**Salisbury (SR&ES)**—Tuesdays. Salisbury Activity Centre, Wilton Road. Sec G2FIX.  
**Southampton University (SUARC)**—Tuesday evenings, also informal meetings every lunchtime during term in the clubroom, Old Union Building. Sec I. Mercer, G3ZER.  
**Southampton (SRSGBG)**—Second Saturday in each month at the Lancaster Building, Southampton University, also Wednesday at the clubroom, Kent Road. Both at 7.30pm. G4AEU.  
**South Dorset (SDRS)**—First Tuesday in each month, 7.30pm. Lecture Hall, South Dorset Technical College, Newstead Road, Weymouth. G3WAO.

**West Dorset (WDARG)**—First Friday in each month, 8pm. British Legion Club Hall, Dorchester. Sec L. A. Barnes, G8GHU, Flat 1, 107 The Esplanade, Weymouth.

**Winchester (WARG)**—First and third Fridays in each month, 7.30pm. Antrim House, St Cross Road, Winchester. Sec G4BKE.

**REGION 18—RR P. J. Fay, G3AKG, 5 Harland Way, The Glebe, Washington, Tyne & Wear NE38 7RB.**

**Easington (EAR&EC)**—Tuesdays and Thursdays, 7.30pm. Easington Village Workmen's Club (3min from A19). CW practice, 80m and 160m operation. Sec G3VSS.

**Morpeth (Northumbria EC)**—Thursdays, 7.30pm. Old Wheatheaf Yard, Morpeth, except first Thursday each month when a lecture is held (open to public) at Ashington High School Annex, 7.30pm. Sec G8GVN.

**South Shields (SSD&RS)**—Fridays, 7.30pm. Trinity House. Old and new members welcome. Sec G8BQF, 67 Lauderdale Avenue, Kings Estate, Wallsend.

**Sunderland (SARS)**—Next meeting first Tuesday in Sept, RAF Club, Sunderland, 7.30pm. Thereafter first and third Tuesdays in each month, 7.30pm. Sunderland Polytechnic. Sec G4DQA.

**Will unattached members** interested in forming a small tvf committee in the region please write to G3AKG.

**REGION 19—RR D. S. Smith, G4DAX, 151 Hamperhill Lane, Oxhey, Watford, Herts.**

**Acton, Brentford & Chiswick (ABCR)**—16 Sept (Members' holiday reports), 21 Oct (Contest procedure discussion), 7.30pm. Chiswick Trade & Social Club, 66 High Road, Chiswick W4.

**Barking (BR&ES)**—Mondays (Constructional), Wednesdays (CCTV techniques), Thursdays (Informal). Starting in Sept, more classes Tuesdays, 7.30pm. Westbury Recreation Centre, Westbury School, Ripple Road, Barking, Essex. Sec G8JEG, tel 01-599 1103.

**Cheshunt (CRDRC)**—Wednesdays, 7pm. Rosedale Sports Club, Andrews Lane (off Goffs Lane), Cheshunt, Herts. Sec R. E. Chastell, 4 Fairley Way, Cheshunt, Herts.

**Chingford (Silverthorn RC)**—Fridays, 7.30pm. Friday Hill House, Simmonds Lane, Chingford E4. Visitors very welcome. Sec G4AJA, tel 01-529 2282.

**Edgware (E&DRS)**—11 Sept ("Single conversion receivers for 2m and 4m", Robin Hews, G3TDR), 25 Sept, 9 Sept, 23 Sept (To be announced), 8pm. Watling Community Association, 145 Orange Hill Road, Edgware.

**Harrow (RSH)**—Fridays, 8pm. Sea Cadets HQ, Woodlands Road, Harrow. Sec G3KDL, tel 01-902 2570.

**Havering (H&DARC)**—Wednesdays, 8pm. British Legion House, Weston Road, Romford.

**Holloway (Grafton RS)**—Fridays, 7.30pm. Archway School Annex, Whittington School, Highgate Hill, N19. Details from John Hitchins, 46 Granville Road, Finchley N12. Tel 01-346 2744.

**Ilford RSGB Group**—Thursdays, 8pm. 50 Mortlake Road, Ilford, Essex. Further details from sec G3YMW.

**New Cross (Clifton ARS)**—Fridays, 8pm. 224 New Cross Road, London SE19. Details from sec R. A. Hinton, 48 Camilla Road, Bermondsey SE16.

**Northolt (British Airways European Division ARS)**—First Monday in each month. Trident Club, Western Avenue, Northolt, Middlesex. This club is open to non-BA employees by invitation. Contact G3OUF, tel Amersham 21573 for details. Civil Aviation Sunday net at 1100-1200gmt on 3-68MHz, listen for G3NAF or G3BEA.

**South Kensington (Baden Powell House Scout ARG)**—Third Tuesday in each month, 8pm. Baden Powell House, Queensgate, South Kensington.

**Southgate (SRC)**—Second Thursday in each month, 8pm. The Green, Winchmore Hill, N21. Sec G4AEZ, tel 01-336 7166.

**St Albans (Verulam ARC)**—Third Wednesday in each month, 8pm. Market Hall, St Albans. Visitors very welcome. Further details from sec G3YHY, tel Watford 25633.

**UK FM Group, London**—Second Tuesday in each month, 7.30 for 8pm. Grove Park Hotel, Junction Bolton Road and Spencer Road, Grove Park, Chiswick. Talk-in S20. Meeting sec G3TJA.

**Welwyn (Mid-Herts ARS)**—Due to falling attendance and rising cost, it was decided at an EGM on 21 July to close the Mid-Herts Amateur Radio Society. A farewell dinner will be held at the "Plume of Feathers", Tewin, on 19 Sept. All ex-members are welcome.

**REGION 20—RR R. G. Mather, G3GKA, 8 Hills Close, Keynsham, Bristol.**

**Bath (B&DRG)**—Mondays, 8.30pm. Church of the Ascension, Claude Avenue, Oldfield Park, Bath. Further information from John Noden, Flat 4, 30 Paragon, Bath BA1 5LY.

**Bristol (BR&GBG)**—29 Sept ("Communications through the ages" by Prof Sanders), 13 Oct (Film show), 27 Oct (Visit of HQ staff member), 24 Nov (Capt J. Cooper, G3DPS, gen sec R Sigs), 7pm. Becket Hall, St Thomas St, Bristol 1. Sec G3ULJ.

**Bristol (BARC)**—Tuesdays, 7.45pm. 24 Bright Street, Barton Hill, Bristol 5. G4BZZ.

**Bristol (Shirehampton ARC)**—Fridays, 7.30pm. Twyford House, Shirehampton. New members most welcome. G4BOL.

**Bristol (BUARS)**—Most Saturdays during term time, 2.30pm. Dept of Physics, Royal Fort, Tyndall Avenue, Bristol 8. Full details from G3WDG.

**Cheltenham (CR&GBG)**—First Thursday each month, 8pm. Royal Crescent Hotel, Clarence St, Cheltenham. Sec G3KIL.

**Gloucester (GARS)**—First Thursday in each month, 8pm. Oddfellows Club, Barton St, Gloucester. 4 Sept (AGM). Remaining Thursdays informal club night, G4AYM, The Chequers Bridge Centre, Painswick Road, Gloucester 8.

**Taunton (T&DARS)**—Fridays, 7.30pm. Jelalaband Barracks, The Mount, Taunton. Sec G. Sweetman, "Little Copse", Monkton Heathfield, Taunton. Tel West Monkton 298.

**Weston-super-Mare (W&MRS)**—Second Friday in each month, 7.30pm. Room Lewis M2, Worle School, New Bristol Road, Worle. G3PQE.

**Yeovil (YARS)**—11 Sept (RSGB tape and slide lecture "Semi-conductor devices"), 25 Sept ("Construction techniques" by G3XFW), 9 Oct (RSGB tape and slide lecture "Basic valve circuits"), 23 Oct (Question and answer session). Thursdays, 7.30pm. The Youth Centre, 31 The Park, Yeovil. Sec G3NOF.

## Special event stations

**Denby Dale Pie Anniversary, 30 August-5 September**  
GB2DDP will be operated by the Denby Dale & D ARS from the Denby Dale Pie Hall on 160-2m on the occasion of the exhibition/celebration of the anniversary. Special QSL card.

**Cheshire Gathering, 12-14 September**  
G3CVW/A will be operational during the gathering of Venture Scouts and Ranger Guides at Oulton Park, Cheshire. Contacts with stations connected with Scouts and Guides particularly welcomed.

**Basingstoke Show, 20-21 September**  
GB3BS will be operated by Basingstoke ARC during this show at Stratton Park, Kempshott, Basingstoke. Operation on 3-5, 14, 21MHz ssb, 144MHz cw and fm. Talk-in available. QSLs via bureau or direct on receipt of sae by G3CBU.

**National Railway Museum, York, 27 September**  
GB2NRM will be operated by York ARS from 1000 to 1830 at the opening of the museum. Operation on 160-10m and 2m, a.m., ssb and cw. Special QSL card.

On 27/28 September, GB3SDR will be on the air from Darlington, hf ssb cw. Special QSL card.

## Mobile rallies calendar

- 21 Sept** —Peterborough R & ES Mobile Rally, Walton School, Peterborough. Talk-in on 160m and 2m. Details from G8GNV, QTHR.
- 21 Sept** —North Ulster Group Rally, Castle Grounds, Antrim. Microwave and repeater demonstration. Exhibition "Amateur radio through the ages". RSGB bookstall. Trade stands. Swap shop. CCTV. Facilities for families at nearby Antrim Forum.
- 28 Sept** —Harlow & D ARS Rally, Netteswell School, Harlow. Details from G8JXU, Mark Hall Barn, Harlow, Essex.

# MEMBERS' ADS

These subsidized flat-rate advertisements are accepted as a service to members of RSGB. They must be submitted on the Members' Ads order form printed in each issue of *Radio Communication*, or on a postcard similarly laid out. Each must be accompanied by a recent *Radio Communication* wrapper addressed to the advertiser, as proof of membership, and a remittance by postal order or cheque for 50p (stamps not accepted). They will not be acknowledged. Those not clearly worded or punctuated will be returned. No correspondence concerning this service can be entered into.

The closing date for each issue is the 1st of the preceding month, but no guarantee of inclusion in a specific issue can be given.

**Post to: MEMBERS' ADS, "RADIO COMMUNICATION", 35 DOUGHTY STREET, LONDON WC1N 2AE**

## FOR SALE

**AR88D**, good cond, some spare valves, manual, will del 50 miles, £32. Morris, 6 Kent Avenue, Shotton, Clywd. Tel Deeside (Clywd) 818252.

**KW2000A**, ac psu and 201 mic, exc cond, £125 ono. G3XVX, QTHR. Tel Cuffley 2553.

**VFO**, very stable, suitable 2m etc, comprising LM13 freq meter, psu and amp, outputs 2MHz and 4MHz, £15 ono. G3ZRM, QTHR. Tel 0252 26108.

**TW Communicator** and mains psu, £40. TW top band tx and PSUs, £25. Various xtals for 2 and 4, 75p each. Pye handset, £4. Top band command rx, £5. Green 2m tx, £6. Emupressor, £6. 4m and 70cm converters, £5 each. G3YNT, QTHR.

**Yaesu FL50B** and vfo FV50B, exc cond, £75 the pair. G4FD, QTHR.

**BC221**, complete original charts and power supply, £20. Tel Hornchurch 55143.

**Princess 150W cw tx**, 3.5-28MHz, includes Eddystone 898 dial, pair TT21s and psu, £20. Garner, 33 Randall Road, Chandler's Ford, Hants. Tel Chandler's Ford 4546.

**Redifon GR285 "private deck"**, fb cond, circuits, £20. Solid-state 75W modulator module, sec load approx 2k $\Omega$ , requires 24V dc supply, £10. Marine bands solid-state exciter 1.6-25MHz, A1/A2/A3 emission, handbook, £20. All items carriage paid. G3JMJ, QTHR. Tel 073-271 3467.

**FM stereo decoder kit**, as per *Radio and Electronics Constructor* September 1974, less coils, £2.20 post paid, with circuit diagram if required. Smith, 609 Devonshire Road, Blackpool, Lancs FY2 0AR.

**Coaxial switch**, dc-2GHz, two single-pole six-way in one unit, "N" connections, 50 $\Omega$ , vswr 1:3:1 dc to 500MHz, 1.5:1 to 1.5GHz, complete with plugs, control/power unit, leads, £55. G4DDM, QTHR. Tel 049481 (Penn) 4483.

**Going ssb**: Heath DX60B tx, 90W 80-10m a.m. and cw, professionally built. Matching HG10B vfo, factory aligned, very stable, all bands including 2m. Both mint cond, delivery ok GI, £55. G4ICPP, QTHR. Tel Larne 5407.

**Pye fm 2m base station** with manual, £10. Prinz R999 eight-band rx, mains, battery, lw, mw, 1.6-4MHz, 4-12MHz, 38-174MHz in four bands, tuning meter, in original packing, £25. Buyers collect. **Wanted**: Unmodified R1155 rx and EC10 Mk2. G8CBE, QTHR.

**Heath SB-303** including a.m./cw filters, SB-600 spkr, SB-401 with xtal pack, spare valves, and all connecting cables, very good cond, £325. Shipping extra. R. Glavice, US Navy Base, Londonderry, NI.

**Video tape recorder**, Philips vcr N1500, a few hours use, exc cond, handbook, £385. Buyer collects or by arrangement. GM4BAG, QTHR.

**Porcelain or china formers**, ribbed, three off 5in by 2 $\frac{1}{2}$ in, two off 5in by 2in, good cond, 30p each post free. M. F. Smallwood, 7 Reservoir Road, Southgate, London N14 4BN.

**Echo 40-10m vertical**, £10. **Wanted**: VHF receiver type R1132 or similar, aircraft bands. G3NXX, QTHR. Tel 0562-850570.

**Set of three G3HSC Morse records**, four Communique Ip Morse tapes, intro and 8-13 wpm, £5 lot. G4CUW, QTHR.

**Trio 7200**, as new with seven sets of xtals inc GB3LO, £90. Advance psu to use above as base unit, £12. New Redifon marine vhf hi-band GR286 Mk3, ideal for 2m (private deck), £19. New BSR Autochanger stereo, £5. 24 Thornwood Road, London SE13 5RG.

**SB220**, £110. HW101 and hb ac psu, £155. KW103, 75 $\Omega$ , £12. Multi-7 2m 10W fm fitted 144-48, 144-60, 145-0, R5, R6, R7, S20, 21, 22, 23, 24, £110. New IBM model B typewriter (not golf ball), long carriage, remote control magnets, £30. Tel Clipston (085886) 307.

Valid advertisements not published in the issue following receipt will be held over until the next issue.

Trade or business advertisements, even from members, will not be accepted for Members' Ads but should be submitted as classified or display advertisements in the usual way.

The RSGB reserves the right to refuse advertisements, and accepts no responsibility for errors or omissions or for the quality of goods offered for sale. Advertisements may be edited or abbreviated as necessary.

Members are advised to enclose a stamped addressed envelope when replying to advertisements.

**Texan teak cabinet**, £2. Gardners SL20C low-field slimline transformer 20V 1A, £4.50. Five spun aluminium knobs, 30p each. HC6U xtals for R4, R6, 8/45MHz, £3.75 a set. All above new, post extra. P. I. Martin, GM4AZC, QTHR. Tel Troon 311245.

**SSTV monitor**, solid state, 3in tube, £35. Buyer collects. G3VXZ, QTHR. Tel Maidenhead 27350.

**Standard C146A walkie talkie**, only three months old, stubby aerial and external aerial adaptor, £75 or exchange for 10W mobile fm rig, anything considered but must be good cond. G8IZB, Mandysen Kennels, Whiteparish, Salisbury, Wilts. Tel 07948 457.

**Cambridge AM10D**, dash mounting, good cond, complete and working on 2m, a.m. and fm, six-channel facility, 1,750Hz toneburst, xtal on 145-0, £45 ono. G8JQD, Little Orchard, Broad Clyst, near Exeter. Tel Broad Clyst 493.

**Datong speech clipper**, as new, £35. Grundig Satellit 1000 gen cov portable rx, 150kHz to 30MHz with bandspeed and vhf, fine quality, original packing, £90. G3TFW, QTHR. 01-657 8391.

**Hartley 13A scope**, full working order, £30. Colour tv parts, new, Pye: 697 i.f. aligned, £12; 697 decoder, £8; CT70 lopt, £10. New Philips S-S G6 convergence, £4. RBM CTV182 timebase, used, £4. Arnfield, 29 Lapwing Lane, Brinnington, Stockport.

**B/M Vanguard**, complete with fet preamp, rx tunable plus two fixed channels, £20. Buyer collects or pays half delivery. GW8HDH, QTHR. Tel 0792 22287 after 6pm.

**Crossed five-element Yagi**, with harness and 24ft of 2in dia (4 ft lengths) steel mast with large base plate, AR30 will fit, £12. Will not separate. 38 Topcroft Road, Erdington, Birmingham. Tel 021-350 4035 after 5.15pm or all day weekends.

**Assembled Sparkrite Mk2 ignition kit** and tacho slave unit, for neg chassis, unused, £9. Joystick and type 3 tuner, £3. **Wanted**: HRO handbook for copy. GW8GAV, QTHR. Tel Porthcawl 2805 after 7pm weekdays.

**2m handy talkie**, 2W rf, two channels: GB3LO, S22, £50. G4CTJ, QTHR.

**KW Vanguard**, SX110, BC221, £65. Buyer collects. Tel Derby 23187. G2OU, QTHR.

**Braun SE600 2m all-mode tx/rx**, digital readout, new cond, functioning perfectly, new price over £1,100, plugs, mic, handbook, virtually immune to cross mod, full spec on request, £550 ono. Davies, GW8EHR, Tynewydd Lodge, Hendy, Dyfed.

**J-beam Multibeam 2m aerial**, £12, buyer collects. BAY96 varactor, typ 20W at 144MHz for 13W at 432MHz, £5. 98-0278, 98-2222, 98-4167, 98-6111, 100-2639, 100-4583, 100-6528, 100-8472, 102-2923, 102-6163, 103-2642, 104-3980, 105-3699 xtals type HC18U, £1. Mr Prank, 17 Muscade Close, Tiptree, Essex.

**Solid State Modules Sentinel mosfet 2m converter**, i.f. 2-4MHz, as new, £12. Also xtals HC18/U 72-425, 89-115 (2), 12-827 (2); FT243 23-2MHz, £2.50 lot. ICs: Sinclair IC-12 audio amp, Ferranti ZN414 trf rx, £2. **Wanted**: AM10B/D and HW17A. G8GZZ, QTHR.

**Brand-new FT200** with FP200 ac psu in original packing, £240. SB303 rx, mint, SB400 tx, Shure 44T, linear (400W o/p), HM102, TH2, AR22, 12ft lattice tower, £350 ono. J. Reid, 160 Sicily Park, Belfast. Tel Bangor 66121.

**KW Vanguard 80-10**, £20. KW Valiant and psu, mod not working, £8. Two-EL84 amp, useful, £6. Swiss Lodge, Green Drive, Lytham, Lancs. Tel Lytham 7817.

**AR22**, 15m control cable, £25. 2m Parabeam, £12.50. Hamgear PM11D, £6. Shure 201, £2.50. Microwave Modules 2m conv, 28-30 i.f., £10. 902A scope tubes, £5 each. 2Q4 phase network, £2.50. **Ham Radio** 1969 onwards, 10p per copy. Carriage extra. G3GHB, QTHR. Tel Inkberrow 792582.



**RX107**, working, good cond, free to any scout troop or similar organization. Peter Gardner, 47 Wilson Street, Grangemouth, Scotland. Tel Grangemouth 3702.

**Telford TC10 multimode**, £110. Sigmasizer 200 fm tx/rx, 200 channels with extra a.m. receive position, £130. Garex Mk2 Two-mobile, a.m./fm tx/rx, £60. Transformer, 1,000V 200mA, 6-3V 3A, £5. Carriage extra. Letters only please. G8IQO, QTHR.

**6146B, 6JS6**, £3 each. 6AC7, 6K8M, 6SJ7M, 6SC7M, 6AG7M, offers. DA41, £1. Heathkit HM11U rpm, slight crack in meter case otherwise ok, £2.50. Tel Leeds 784074. G2UZ, QTHR.

**Fidelity tape recorder** with 5in tape, mic, record/playback lead, instruction book, £10. 2k $\Omega$  headphones, 50p. Microscope, 100 $\times$ , 200 $\times$ , 300 $\times$ , with slides, £3.50. Telescope, 50 $\times$  40 magnification, £3. Carriage extra. G8JJC, QTHR.

**AM25B, AM10B**, complete less controls, £10 each ono. Sommerkamp TS-912G 10m, £60 pair. Would exchange for W15 a.m., dash or boot, low band. All plus carriage or collect by arrangement. S. Hopkins, 5 Bog Hall, Whitby, North Yorks. Tel Whitby 3443, 9am to 5pm.

**Eddystone 730/4 modern gen cov rx**, £75. QRO linear, all components, valves ready for assembly, £22.50. Pair boxed 6GJ5, £3.50. Kokusai mechanical filters, 455kHz, 4kHz b/w, £2.50. 4m xtals, FL8 filter, Collins mod transformer, AR88 xtal. Carriage please. G2HCV, QTHR. Tel 01-954 2960.

**Trio JR310**, full coverage 10m, £50 ono. Emsac TX2 2m a.m./fm/cw tx, five xtals, ac psu and boom mic, £30 ono. Codar AT5 and ac psu, £15 ono. Sentinel 2m converter 28-30MHz o/p, £4. G8GOX, QTHR.

**E-Z match**, £12. Hamgear PM2 preselector, mains, £10. Buyer collects. G. Thompson, 49 Widney Avenue, Birmingham B29 6QE. Tel 021-472 4678.

**Brand-new 32-piece socket wrench set**, unused, combined AF and MM with spark-plug socket and all accessories, bargain, only £12 carriage paid. SAE with enquiries. G8JDU, "Sunnyfields", Lighthouse Road, St Margaret's Bay, Dover, Kent.

**G2DAF type linear and psu** with two spare 813s, £50. Two high-band Pye base RXs, £5 each. 2m and 4m TXs, £30 each. Type 10 xtal cal with built-in power supply, £5. G3MNV, QTHR. Tel 021-353 3012 evenings.

**Heathkit SB-200 linear**, immaculate, hardly used. Datong rf clipper, mint. Offers. G3XTN, QTHR.

**Yaesu FTD560 tx/rx** plus matching spkr, 600Hz cw filter and 120Hz audio filter, exc cond, protective cover still on front panel, £250. G3YHD, QTHR. Tel 061-748 9152.

**Magnum Six** for FT101, perfect, £55. Wanted: R4B, R4C or 75S3 rx, why? G3MPN, QTHR. Tel Wymondham 3382.

**Heath HW202** on 145/145-5, tone encoder, £95. GR-98 aircraft rx, mains/battery, £35. Post extra. Both vgc, with manuals. Wanted: Two uhf bases and chimneys for 4CX250s, 70cm converter, 10MHz b/w (approx) scope. G8JAI, Beckgatehead, Barbon, Carnforth, Lancs.

**J-beam Triple Three multi-band beam**, £30, or exchange for Storno Viscount. Panoramic rx unit 28-30MHz, large and heavy, £8. 898 dial, £5. UM1 and UM3 mod transformers, £3. KT88 and TT21 valves, £2 pair. G3JTO, QTHR. Tel 01-894 7249.

**Seiwa tx/rx**, 25W rf, 12V, fitted 145-0, S20, S21, S22, R5, R6, R7, toneburst, new, £150 ono. Heath monitor scope, £40. 19in rack, 21in high, suit base stn, £2. C146A xtals, 145-32, £4. TCS12 240V psu, £10. G4BXD, QTHR.

**Liner 2**, mint cond, £130. SB610 monitor scope, £45. Heathkit HD-10 keyer, £20. Heathkit QRP cw tx/rx, £25. QM70 transverter 28/144MHz, £30. Heathkit vvm/probe V-7AU, £22. Wavemeter W1191, 100kHz-20MHz, £5. Equipment of late G3DJX. G4CRM, QTHR. Tel Waterlooville 52442.

**Minimitter tx**, 240W, a.m./cw, 10-80m, good cond. For cash or will exchange for a good rx covering amateur bands in good cond. Best offer secures. Chris, 10 Parkhill Road, Sidcup, Kent. Tel 01-300 0564 after 6pm.

**Trio TS515**, psu, mint, PAs unused, £200. Europa 2m transverter, £65. Wanted: Base and chimney for 4CX250B. G8JGS, Velden, Yelverton, Devon. Tel Yelverton 3320.

**Advance sig gen Type E**, 100kHz-60MHz. AR88D for spares, working. Rohde and Schwarz monitor rx 80-300MHz. Eddystone EP17R panoramic adaptor, FRDX500 rx with 2m converter. Eagle SG70 sig gen. Europa transverter with transformer and ae relay in case. Offers to G4CEQ, QTHR. Tel Downland (Surrey) 55908.

**FT75**, ac/dc psu, vfo 50C, mobile mounts, £150 ono. Asahi 3-el beam, 10-15-20, little used, £40. Trio external VFO30 for TR7200G, £40. Liner 2 ssb tx/rx, good order, £115. John Doyle, 54 Bryncatwg, Cadroxton, Glam. Tel Neath 2942 evenings.

**AR88LF**, SDRAC xtal calibrator. Homebrew transistor 2m converter and preamp, 24-26MHz output. Mullard 510 amplifier. Cossor

144AB low-band tx/rx, 320 in final. Offers invited. Wanted: 2m hand-held tx/rx. Details and price please. G8DLT, QTHR. Tel Broadstone 5370.

**Clearing loft**: HRO coil boxes, various frequencies, £3. Many valves, radio/tv, rx/tx, hf/vhf including "difficults". Several parcels good junk, suggest £2.50, state preferences. HRO dial, new, £3. Much gear to end of valve era. SAE list. All post-paid. G8ATY, 1 Rhymer Close, Hanslope, Wolverton, Bucks.

**FT220**, absolutely as new, latest model, with handbook and all leads, £265. Personal circumstances cause sale. Also 2-5A thermocouple rf ammeter, mint cond, £2. G3ZPF, QTHR.

**FT2FB**, mint cond, with rx pre-amp built-in, mobile mount, 10-channel, works well, £90 ono. G4AKG, QTHR. Tel 01-686 1756.

**DST100 comm rx**, 50kHz-30MHz, needs attention, circuit available, £10 ono. Cossor 339 scope, £9. 1155 rx with inbuilt psu, £3. Prefer buyer collect or arrange carriage. Page, 6 Mold Crescent, Banbury, Oxon OX16 0EZ.

**KW2000E**, ac psu, KW107, Mosley Atlas aerial, all with handbooks. Skeds invited. Prefer buyer inspects/collects. Offers. Going vhf. G3XLL, QTHR. Tel Norwich 48685.

**FT2-auto**, exc cond, with handbook, £125. G8AER, QTHR. Tel 0264 65112.

**Cossor "Caritel" vhf hand-portable tx/rx CC3-AA/B3**, unconverted, with batteries, circuit, 2m conversion details etc, £6. RG213U (UR67) 50 $\Omega$  coaxial cable, 77ft, £4. Beckman miniature 15-turn duodial, £1. IC 100kHz xtal calibrator, £3.50. 4CX250Bs, ex-equipment, £3 per pair. Mains sig gen 120kHz-84MHz, £3.50. All carriage extra. G8ENI, QTHR. Tel Cheslyn Hay 415374.

**Omega TE7-01 noise bridge** with instructions, £12. GM3AWW, QTHR. Tel 041-639 2370.

**Cossor 1035 double beam scope**, £12. R107 front end, £2. R1132A, £1. R1155 for spares or rebuild, £2. Buyer collects. G8BDA, QTHR. Tel Deeside 814693.

**Creed 47 (PO No 11) tape teleprinters** with tape and maintenance manuals, working when last used. Delivery possible. Offers. G3RWL, QTHR. Tel 01-366 4297.

**I need space (and money!)** so am offering Marconi HR55N 70-100MHz rx with mains psu in 19in rack table-top case, £6. Also HAC "DX" rx, £2.50, prefer buyer collects (after 4pm). R. Barns, 97 Ringmer Road, Worthing, Sussex.

**2m a.m. tx**, 25W, eight-channel, mains psu, £10. DX40U, partially rebuilt, all parts and manual available, plus VFU, £13. BC348 rx, transistor af, mains psu, £10. Vibroflex bug key, £4. 2m converter, 6-8MHz i.f., £3. G3XVN, QTHR. Tel 0630 3995.

**G3ZVC Plessey SL600 9MHz ssb tx/rc board**, with QC1246 filter, built complete, fully working, £55. G8FXF, QTR. Tel 01-231 0879.

**SSM Europa**, immac, little used, gone /P with Liner, £65 carr paid. G3YPS, QTHR.

**23cm wavemeters**, brand new, £17.50. 9cm klystron, tested, £6. 400MHz disc-seal triodes, tested, £3.50. Oscar FT43 xtals, £1.25. 3cm waveguide, klystrons etc. SAE requirements. Wanted: Valve 3C22, heavy beam rotator, 4X150A uhf pte base and chimney with clips. G3IUD, QTHR.

**Solartron oscilloscope**, double-beam, very versatile, offers. Large quantity of old valve radios, valves, service sheets, components etc as a lot, cheap. C. Sawyer, 210 Gordon Avenue, Camberley, Surrey. Tel 0276 29460.

**Barlow Wadley XCR-30 Mk2**, nearly new, hardly used, accept £105. SAE appreciated. S. J. Vyas, 10 Frensham Grove, off Hollingwood Lane, Bradford BD7 4AN.

**Heath HW101 tx/rx**, mint, with HP-23 ac psu, ptt mic, matching Heath speaker with switchable integral CWF-2 audio filter plus top band transverter working with above, all handbooks etc, as new, £190 complete. Carpenter, 10 Avenue Road, Frome, Somerset BA11 1RP.

**AR88LF** works ok, with handbook and spkr, £25 delivered 40-mile radius. DX40U and VFU, both working well but rough externally, offers. Roger Thomas, 13 Northways, Porthcawl, Mid Glam.

**Trio JR-310**, 10-AZ ssb filter, SO-259 socket, SP5D spkr, Microwave Modules 2m converter (new), £85 the lot, carriage extra. Wanted: KW2000A, 2000B, TS515, or similar ssb tx/rx. Falkner, 22 Queensway, Wellingborough, Northants. Tel Wellingborough 3761.

**160m tx**, prof built, a.m./cw, immac audio and cw note, suits break-in, any demo, £15 ono. Tel 01-648 5895.

**KW2000E** with ac psu, vgc and limited use, current price £427.50, accept £250 ono. G8WS, QTHR. Tel 0628 23239.

**Xtals**, 38,666-kHz in HC18/U, £2.50. 100kHz oscillator modules in sealed can but adjustable, 5V dc supply, £5. Small ceramic trimmers, 8pF, 12pF and 20pF, 60p for 10. 7475, 7490, 74141 ICs, all at 40p each. P. Smith, 49 Hucknall Avenue, Ashgate, Chesterfield, Derbyshire.



**Heathkit HW17A 2m tx/rx**, £35. Chris Brown, White Heath Road, Thurton, Norwich. Tel Thurton 213 evenings.

**New relays**, 6V to 250V, ac and dc coils, sub-miniature through to power, £1 for five, £2 for 12. G8ACF, QTHR. Tel Orford 328.

**Heathkit IO-12U wideband scope**, 4.5MHz bandwidth, plus HFV-1 tv/fm alignment generator, factory built, never used, sweep 3-6MHz-220MHz, marker osc 20-180MHz xtal, best offer over £100. Buyer collects. G4BXU, QTHR. Tel Thanet 20009.

**Collins 2m 150W tx**, 4X150A in coaxial cavity, modulator two 6146s. AR88D. DL6SW converter, handbooks, many spares. Offers. 821 tx/rx on 144-486, £10. 821 tx on 144-50/145-00, rx 144-146, 12V and mains psu, S-meter, spares, £30. G8CEZ, QTHR.

**FR-50B**, calibrator, mint, £60. HW-17A with /M psu on 145-00MHz, exc, cables, mounting included, £45. Sentinel converter, 144/28MHz, mint, £10. *Wanted*: HF bands tx/rx, about £100-£120, why? G8EYU, QTHR. Tel Needham Market 720631 ext 439, office hours only.

**Heath HW30 "twoer"**, overhauled and new valves by Heath, manual, 12V psu, 230V to 120V trans, spare RCA pa valve (new). This rig quite good, portable, with coaxial aerial socket. Further details, offers, post. G8EQP, QTHR. Tel Birstol 777666.

**Closing down**: KW1000, KW2000A, psu and spkr, Shure mic, EK9X keyer, reflected power meter, aerial Z-match and lp filter, all in perfect cond. Manuals and book with LM14. Any inspection. G3COL, QTHR.

**FRSDX400 rx**, mint cond, £150. G4DYR. Tel Wolverhampton 763256.

**Codax AT5 tx**, 250/S ac spu, 12M/S dc psu, T28 rx, 12R/C remote control unit, circuits etc, good cond, £40 carriage paid. GM3XON, QTHR. Tel 031-334 3863.

**Versatower P40**, good cond, £150 ono. FT101 Mk1, modified 160m, £250 ono. G4BXR, QTHR. Tel Stony Stratford 3423.

**KW77 amateur bands rx**, £45. QRO hf linear with monitor scope built-in, £32. 160m a.m./cw tx, £15. Truvox R104 transistor tape recorder, £32. KB Featherlight portable tv (valve), £16. G8GVY, QTHR. Tel Brighton (0273) 411874 early evenings.

**Swan 350 tx/rx**, 80-10m, 400W p.e.p., exc cond and good buy at £185. Available late September. G3SVH, QTHR. Tel Cheslyn Hay 414524. Buyer collects or carriage extra.

**Mobile ssb power unit**, 12V input, 800, 300, —100V output, Pye brand, new, boxed, £24. Sentinel medium wave to 2m converter, £12.50. *Wanted*: Osler power meter, FV101 vfo. G4DGM, QTHR.

**"Wireless World"**, 400 copies, some pre-war. 27 vols of *Practical Wireless*, also some *Practical Mechanics*. Offers. RTTY auto 1B, £5. 655, no read head, £3. G3CTR, QTHR. Tel 01-237 4604.

**Yaesu FT101B, FV101B, SP101B**, brand new cond, few hours use only, in original packing, with manuals, £400 comp or might split. Tel 041-776 7761 daytime or 041-942 2767 evenings.

**Heath 20m tx/rx**, ac psu, £35, postage £1.50. Stolle aerial rotator automatic comp, £15, postage £1. Suitable small beam (hf) or vhf. Shure 202 mic, £2.50, postage 50p, to clear. Letters only please to G4CNE, QTHR.

**Exchange for good linear amp**, Howland West R100 tuner amp 20W stereo a.m. pair Linton 20 spkrs Grundig C250m radio cassette, all perfect, cost £178 this year, spare tapes, full instructions, G3MLP. Tel 09334-2469 evenings or weekends.

**HW101** with ac psu exc, £165 ono. Will deliver reasonable distance. Also 4m Ranger and 1b Viscount, offers. G4CCN, QTHR. Tel 0305 5987.

**KW2000E** plus ac psu, some spare valves. Buyer collects or pays carriage, £300. G3NFV, QTHR. Tel Lea 75204 after 6pm.

**SB600 spkr**, £7. KW2000 dc psu, £15. Creed 7B 24V with psu and DL6EQ converter and tone generator, plugs into mic socket of ssb tx/rx, £30. Buyer collect. Consider exchanges. 35mm camera accessories. G3DGS, QTHR.

**Precision Standards Corp** calibrating voltmeter, ac dc null instrument, digital readout on balancing dials, manual, £100. CDR aerial rotator mast and 8-element 2m Yagi, £15. Mains voltage stabilizer, manual, £30. Other items. Cook, Old Lodge, Sevenhills, Cobham, Surrey. Tel 3117.

**Inoue IC700R rx**, vgc, 230V ac or 12V dc, £55 ono. G4BNM, QTHR. Tel Wellingborough 76588.

**Liner 2** with preamp, £120. Professionally aligned for 144-10-144-33 coverage. FT200 with FP200, mint cond, £180. YD844 desk mic, £12. GW4CBR, QTHR.

**Drake 2B rx**, 2BQ Q-multiplier, 100kHz calibrator, spkr, manual, £80. USA TA33JNR AR22 rotator cables and coaxial, £50. Electrovoice 729SR mic, £5. 1928 Brandes radio rx long and medium waves, manufactured by ST & C, with horn, spkr and spare valves, in working order, offers, G3ONU, QTHR. Tel 01-950 2354.

**IC210** with reverse repeater facility, £225. Codar CR70A and PR30A preselector, £30. Single-channel radio control (27MHz band) tx/rx, £15 ono. G8IAL, QTHR.

**Liner 2** with pre-amp, £128. Shure 444T, £17. 10-15-20m Hy-Gain 12AVQ, £23.50. Original packing and manuals. 2m TXs 10W-150W, ring for details. 625 camera comp TK204VD, £20. 15yd UR67, £4. G8CGG/G4DVE, QTHR. Tel 0384 55816.

**Trio 9R-59DS** gc rx with mains stab, also spkr cabinet, mint cond, £45. G3UQZ, QTHR. Tel 021-373 8806.

**Garex Fourmobile**, new cond, with four 70MHz xtals. Also 70MHz Emsac converter 29-30MHz i.f. *Wanted*: Good vhf rx R216 or similar coverage a.m./fm. G3ADZ, 6 St Mark's Avenue, Rugby CV22 7NP. Tel Rugby 815222 evenings, weekends.

**Heathkit GD-1U gdo**, £10. Eddystone 640A rx, £15. Pye base station 2m, psu and mod, £15. 2m fet converter, 30MHz i.f., £6. BC221, psu, charts, £12.50. G3PQP, QTHR. Tel 021-236 0714 (10am to 6pm).

## WANTED

**RCA AR88D trimming tools**, tuning dial, S-meter, or would consider scrap AR88D. Also ex-RAF box kite. Mr P. M. Cleaver, 86 Main Road, Dovercourt, Harwich, Essex. Tel Harwich 2195.

**Heathkit SB102**, HP23B psu and spkr. Barwood, 41 Wingfield Road, Knowle, Bristol 3. Tel 772804.

**3-el three-band beam**. KW linear. Transverter, 144MHz. 12MHz xtals for 144. Pye W15 fm chassis. R. J. Richardson, 84 The Drive, Isleworth, Middlesex. Tel 01-560 7150.

**Bandscanner rx by Sontronic**, for experiments, also *History of Radio Telegraphy and Telephony* by Blake, Radio Press. Williams, 204 Dysart Road, Grantham, Lincs.

**FT101 or similar**, reasonable price please. G2BUW, QTHR. Tel Romford 43122.

**"RSGB Bulletin" bound volumes for 1965-67 (Vols 41-43)**. Someone reading this advertisement must have these, much needed by me to complete collection. Can you help? G3YMM, QTHR. Tel 01-689 4471.

**Manual and/or service info for IBM 735 typewriter/printer and Creed 75RPRK4**, to buy or borrow. G8DKU, QTHR. Tel 0429 67419 evenings.

**Information on transponder unit RT-279/APX**, circuit, hand-book etc. Any literature will be returned safely as soon as possible. G3JTI, QTHR.

**TA31**, state price, age, cond etc. G3IJZ, QTHR.

**Urgently require pair of 81As**. BC348Q plus cash payment. Please contact G2RU, QTHR. Tel Dunstable (0582) 605570.

**Xtals**, 200kHz for filter. Also FT241A type channel 324. Must be good workers. GW3DVG, QTHR.

**Bound volumes "Radio Communication"**, 1971 and before, must be in good cond (not Easibinders). Baylis, Yew Tree Farm, Emery Down, Lyndhurst, Hants. Tel Lyndhurst 2118.

**"Radio Communication" May 1974 issue**. M. Michaelis, Rosbachstrasse 15, D8400 Regensburg, West Germany.

**Eddystone 940 rx**, must be in top cond. Also Eddystone spkr type 688, 814, 899 etc. Also 4m transverter. Offers to G3OHC, QTHR. Tel 061-973 6790.

**Collins 51J3 or 75A4**, or similar gen cov rx. Exchange KW204, brand new and virtually unused, plus Lafayette HA350 in near mint cond, plus MFJ audio filter with mains psu. G5LH, QTHR.

**Viceroy tx or similar**, also hi-gain 18AVT vertical. K. A. H. Rogers. Tel Essendon 251.

**Homebrew or commercial 2m or 4m, fm or ssb low-power transceivers or separates**. G3VYY, QTHR.

**Plug-ins for Bird 43 wattmeter**. Also Tek 546 spectrum analyser plug-ins. Helmut Troess, 688 Neunkirchen, Ostertalstrasse 33, West Germany.

**CRT type 4EP7**, suitable for Solartron CD711S2 scope. G3XTQ, 5 Station Road, Sandy, Beds.

**2m fm "black box"**, IC22A, TR7200G or similar late model. Antenna Specialists 5A/8 whip with "no-holes" boot mount. Brown Bros (USA) twin lever keying paddle. Only immaculate equipment considered. G3FCW, QTHR.

**Dow Key DK60G coaxial relay** with 6V ac coil. Also Joystick VFA with 4RF or low Z. Sherwood, 8a Welles Street, Sandbach, Cheshire.

**Drake T4X tx**. G3VLX, 16 Wood Ride, Petts Wood, Orpington, Kent BR5 1PX. After 13 September. Tel Orpington (0689) 26584.

**FRDX400/FLDX400**, FT101, FT201, SB300/SB400, TS520, must be immac, sensible price, complete with manual. Details and price to G3UZM, QTHR.

**Collins TCS12 tx**, clean exterior cond, unmodified. G3YNN, QTHR.

**Elan beam**, Akai tuner or tuner-amp, B&O 3000 etc. Heath vfo. 8 Heythrop Drive, Middlesbrough.

**Triband 10-20m quad or beam rotator** and 30-40ft tower. Prefer crank-up or tip-over. For sale: Operation maintenance manuals for AR88LF and SP600JX. W5DHO, Fen End Farm, Abbotsley, Hunts. Tel Great Gransden (07677) 371.

**Creed type 75** or similar teleprinter. G3SZY, QTHR. Tel Stetchworth 366.

**Pye a.m. Bantam**, high or low band. Also battery charger, rechargeable batteries or dry battery holders. GM3ZDG, 55 Cradlehall Park, Inverness IV1 2DA. Tel 0463 39360 daytime only.

**G3TDZ rx/tx** or working tx or rx boards. Good price paid. G4ASB, QTHR. Tel 0332 74479.

**Compact sig gen** (eg Nombrex or Avo), with or without xtal calibrator. Also BC221 with original charts with or without psu. GM4DQD, Zoar, Wadsworth, Girsia, Shetland, ZE2 9SQ.

**Eddystone 840A/C, 870A, 750, EC10** wanted for parts. Must be ok mechanically. G3PSQ, QTHR. Tel 0232 20084 9am-5pm except Weds and Sats, or 0232 666182 evenings.

**Sommerkamp FL1000 linear**. Also Eddystone EC10 and Microwave Modules or Sentinel 2m converter. W. A. Mitchell, 32 Gordon Road, Marnfield, Aberdeen AB1 7RL.

**HQ1 minibeam**. MacLeod. Tel 041-959 4455.

**Circuit diagram for Hartley oscilloscope CT436**, beg, buy or borrow. Due to loss of Y1 beam. Postage refunded. D. J. Parkin, 27 Henda Lane, Kettlethorpe, Wakefield, Yorks WF2 7NT. Tel Wakefield 58654.

**Frequency absorption meter 1-300MHz**. Low-pass filter 30MHz. Turner, 18 Melfort Road, Newport, Gwent.

**FT101 with 160m**. Also 18AVT/WB vertical. Details and price. G3PXD, QTHR.

**"QST" magazines**: Jan, Feb 1975. Feb, Mar, May, Aug 1966. Complete 1961 volume. *Ham Radio*: Sep, Nov 1968. Feb 1969. Very good prices paid, complete volumes purchased if required. Coull, "Domel", Elham, Kent. Tel Elham 244.

**Good price paid for information or circuit diag** on Minimitter TR7 top band rx, also source for i.f. coils etc. Could photostat and return any originals. G3URG, QTHR. Tel Nottingham 291985.

**HRO, EC10 or other hf rx** required for beginner. Details and price, please. J. White, 11 Shrewsbury Road, London N11. Tel 01-253 0661 ext 18 (office) or 01-368 0332 evenings.

**Hammarlund SP600JX rx**. Only one in unmarked cond, unmodified, with original manual and sensibly priced acceptable. G6RF, QTHR. Tel Perranporth (Cornwall) 2149.

**Good-quality morse key** required by young student soon to sit for RAE and GPO morse test. Steve Pocock, "Lanfine", 57 Golden Avenue, Angmering-on-Sea, Sussex BN16 1QX. Tel Rustington 4123.

**Circuit diagram plus handbook** and any other gen on the TCS6 tx. Will buy or photocopy and return. GW3OIM, QTHR.

**Pye Cambridge**, six-channel, AM10D, a.m./fm in good working order 2m band. Plus mounting bracket and handbook if poss. John. Tel Brighton 31241 after 8pm.

**Pye 2207 Ranger manual** to buy or borrow. Loan will be promptly returned. R. D. Eager, Darwin College, The University, Canterbury, Kent.

**Linear FL2000, FL2000B, KW1000 or similar**, good working order essential. G4DCI, QTHR. Tel Nottingham 231430.

**KW600 or 1000 linear**. G4DVR, QTHR. Tel 01-337 2025.

**40/60ft mast, Versatower or similar**. Also Ham 90 rotator and KW107 atu. Lee, 106 Harrowdene Road, Wembley. Tel 01-904 2104.

**2m a.m. fm tx**, about 20W input with mains supply and circuit, several xtal positions or vfo neatly built, sensible price. G3EJA, 9 Holybrook Road, Reading.

**Good price paid for Jan, Feb, Mar, Apr 1975 QSTs, Dec 1971 Ham Radio**. AVO valve tester VCM163. Valve voltmeter 1041C. Output meter TF893A. TDMS 70. For sale: Large aerial rotator, £25. A Fletcher, 62 Moorbridge Lane, Stapleford, Nottingham. Tel 0602 397446.

**FT101B**, no faults. Also rf ammeter, 2A full-scale. For sale: Few 4X150A. Parker, 133 Station Road, Cropston, Leicester LE7 7HH.

**KW Ez-match** in good cond. G8ACB, QTHR. Tel Wombourne (090-77) 3037.

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5XY/2m 5 el. crossed yagi	£10.25	(1.00)
8XY/2m 8 el. crossed yagi	£12.75	(1.00)
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## New Exciting Lines!

This month sees some exciting new lines in amateur radio coming your way. Items that will be of great interest to the licensed amateur and short wave listener. Unfortunately our range of products now stocked are so wide that we cannot possibly list everything each month. However, we now have a complete stock list with prices and details of all our equipment and if you send us a large stamped addressed envelope we will despatch a copy to you by return. Just to what your appetite here are a few new items available soon:

TET all solid state 2m trans- verter	£90.00	(50p)
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40/80 loaded dipole 2kW 28m long	£13.80	(50p)
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Belcom AMR-104 auto scanning 2m rx 240V AC/12V with 3 channels	£65.00
Marine version fitted 8 channels	£86.00

### SOLID STATE MODULES—EX STOCK

#### TRIO PRODUCTS (Inc vat)

QR666 receiver 160-10m plus general coverage 240V AC/12V Send for full gen.	£162.50	(n/c)
Matching calibrator	£10.95	(25p)
FM adaptor	£25.50	(25p)
HC-2 Ham Clock	£11.85	(50p)

#### SECOND HAND ITEMS (Ex vat)

HA350 80-10m rx very good	£70.00
CR70A gen. coverage rx	£27.00
HW17 a.m./fm 2m transceiver	£40.00
Yaesu FR50B receiver	£67.00

### ROTATORS

AR30	£31.25	(1.00)
AR33	£45.95	(1.00)
AR40	£37.50	(1.00)
CDE44	£75.00	(1.25)
Ham M	£112.50	(1.50)
Stolle 2010	£46.75	(1.00)
Stolle 2030	£52.95	(1.00)
5 core control cable	18p	yd (1p)

### AERIAL FEEDERS

50 ohm UR43	18p	(1p)
50 ohm UR67/RG8U	38p	(2p)
75 ohm standard	10p	(1p)
75 ohm UHF low loss	14p	(1p)
300 ohm feeder	8p	(1p)

### MICROWAVE MODULES (inc VAT)

NEW1 70cm transverter	£77.50	(50p)
2m converter 2-4/4-6/28-30	£18.90	(25p)
4m converters 28-28-7	£18.90	(25p)
70cm converters 28-30/144-146	£22.60	(25p)
2m dual o/p pre amp	£11.30	(25p)
1,296MHz converters 28-20	£31.30	(25p)
2m converter 28-30/116 osc o/p	£19.90	(25p)

### 2m VHF HAND PORTABLES (inc vat)

Ken KP202 2W o/p 145/145-5 six channel	£94.05	(75p)
Ken KP202 as above with 1750Hz tone	£100.62	(75p)
Base charger units 240V AC	£11.00	(50p)
Leather case	£4.69	(50p)
6' helical whip	£5.31	(15p)
Extra channels (30% discount if pur- chased with KP202)	£3.75	(10p)
Set 10 Eveready Ni-cads	£9.72	(50p)

### HY-GAIN ANTENNAS (inc VAT)

12AVQ 10-20m vertical	£31.88	(1.00)
14AVQ 10-40m vertical	£45.00	(1.00)
18AVT 10-80m vertical	£65.00	(1.25)
TH3 1m 900V 3 element beam	£92.50	(1.50)
TH3 Mk 3 2kW 3 element beam	£124.85	(2.00)

G-whips mobile antennas—ex. stock  
VHF 2 & 4 metre whips—ex. stock

### MINI-PRODUCTS COMPACT BEAMS

HQ-1 hybrid quad 10-15-20m	£69.95	(1.50)
B24 2 element yagi 10-15-20m	£57.50	(1.50)
RK3 reflector element for B24	£33.75	(1.00)
C4 vertical 10-15-20m	£33.75	(1.00)

### 2 METRE SSB (inc VAT)

Liner-2 2m ssb transceiver	£181.25	(n/c)
Matching PSU	£26.25	(75p)

### MICROPHONES

Shure 201	£7.40	(30p)
Shure 444	£16.25	(50p)
Yaesu YD844	£18.86	(50p)

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**200 DISC CERAMICS** for 57p.  
**F.M. I.C.'s** like TAA 570 untested. 5 for 57p with data.  
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**BF 224 600MHz R.F. AMPLIFIER TRANSISTORS** 6 for 57p.

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**20 P CHANNEL MOSFET's** with circuits @ 68p.  
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**FERRANTI ZTX 107 (BC 107) TRANSISTORS** 8 for 57p.  
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 MC6 coils for VHF TX exciters and converters 3½ or 4½ t 14p  
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 10RA min RF chokes 5, 1 and 43MH ex stock 27p each  
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**FILTERS BY TOKO:**

MFHT 455kHz mechanical filter with silicon transistor in/out impedances. Available with BW of 4 and 7kHz £1.45  
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Fuller information on all TOKO items is included in our data folder/catalogue 40p inc. pp. price lists free with an SAE.

**Linear ICs for wireless (other types in free list—SAE pse)**

CA3089E	1.94	For PLL	For Audio	
CA3123E	1.40	NE560B	3.19	LM380N 1.00
TBA120	0.75	NE561B	3.19	LM381N 1.85
TBA651	1.81	NE562B	3.19	TBA810AS 1.30
MC1350	0.70	NE565A	2.75	MC3401 0.68
MC1310P	2.20	NE567V	2.75	8038CC Waveform
CA3090AQ	3.75	NE566V	2.00	generator 3.10

300pF SWING VARICAPS: MVAM2 1.05, MVAM1 2.75.  
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37 HIGH STREET, BRENTWOOD, ESSEX. CM14 4RH  
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## An excellent speech compressor for only £7.80

### THE EMUPRESSOR

This old favourite will give your audio a lift at low cost. No clipping, so minimum distortion, practically the same output whether you speak into the Mic. or ten feet away. No knobs to adjust, fit and forget. A sample tested gave a 6dB change of output for 60dB change of input. Fitted with co-ax sockets for in and output. Needs 12vdc at 35mA supply. Size is only 4½ x 2½ x 1½" so you should be able to find room for it somewhere.

### THE EMU VFO

This unit is proving a huge success so it is now available for 6, 8, 9 or 12MHz to give others a chance to take advantage of this small VFO. There is a sine wave output of not less than 2v p-p into low impedance via a co-ax socket. It is tuned by a potentiometer (supplied) and the VFO is housed in a die-cast box 114 x 64 x 30mm and a polythene box for optional thermal insulation. A separate diode to give you good quality FM or FSK is employed. A supply of 12vdc Neg. earth is required to power the unit. Stability is adequate for most Amateur applications. Price £10.50.

### THE EMU FM-UNIT

This will look after the Rx side of the FM station. A compact add on unit measuring 6 x 2½ x 2½" containing limiters, squelch, audio and output stages giving approx. 1 watt for a low imp speaker. There is also an output from the "S" curve that can be used for AFC, etc. There is only one connection needed to the main Rx, a small capacitor to the last IF stage and fed via co-ax to the Unit. A negative earth 12vdc supply is required to power it. For those wishing to include inside an Rx there is a PC board version. 450/465kHz or 1.6MHz. Price £13.50. PC version £11.50.

### THE EMU MARKER

The well-known crystal calibrator still available in a 4½ x 2½ x 1½" box. There are 3 co-ax sockets on top, one for each of the outputs which are 1MHz, 100kHz and 10kHz or in the Emumarker 25 the last output is 25kHz instead. Most useful for finding spot frequencies. This needs a supply of 9vdc at 100mA. Price £10.50.

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This will send your own call sign at intervals in Morse from a small speaker or from a jack socket to wire in to the modulator if preferred. It is all solid state with TTL 74 series and will give your station a distinctive sound. Price £28.50.

Post and packing all units to UK. 15p.

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# THE REAL THING!

Of the advertisers appearing in this magazine we believe we were:

**FIRST to offer you VHF converters—The Sentinel range.**

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**FIRST to bring you VHF transverters—The Europa range.**

Not only were we the first to bring you these units but we have maintained our position for nearly eight years as the leading VHF/UHF manufacturers by following a policy of constant development (as new techniques and devices become available) and a first class BEFORE and AFTER sales service. The performance of our units cannot be surpassed anywhere.

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- ★ Transmits any modes with a drive power of 200mW.
- ★ Crystal used is very high stability and close tolerance. 5ppm, unit.
- ★ Size: 9" x 4 1/2" front panel, 4 1/2" deep.
- ★ Low price, £109.37 complete to plug in. Ex stock. Price less valves (2 x QQV03/10 and 1 x QQV06/40A) £93.75.



**NEW!** We now have in stock a complete AC PSU for the Europa, Type CPS10. This supplies all the voltages to power the Europa or the Europa B. It also contains a 50 ohm adjustable dummy load power attenuator and change over relay to reduce the 10 metre output power to a level for driving the Europa. This makes the Europa B compatible with HF equipment without transverter output sockets with NO modifications. Size: Same as the Europa B. Price £50.00. Ex stock.

**VHF CONVERTERS—2 METRES, 4 METRES, 70CM, SATELLITE BAND, MARINE BAND and many others from stock. Other frequencies to order—please enquire.**

## SENTINEL DUAL GATE MOSFET 2 METRE or 4 METRE CONVERTERS

- ★ N.F.—2dB. Gain 30dB. Supply 9-15V.
- ★ No oscillator frequency multiplication.
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- ★ High signal protection and overvoltage and reverse voltage protection diodes are built in.
- ★ 2 metre I.F.s 28-30MHz, 2-4MHz, 4-6MHz, 4 metre I.F. 28-29.7MHz.
- ★ Size: 2 1/2" x 1 1/2" x 3" long except the 2-4MHz and 4-6MHz which are double conversion and 4" long.
- ★ Price only £18.75 delivered from stock.

**All the prices include 25% VAT and British Isles delivery. We can give same day COD service (£50 limit) or ACCESS or BARCLAYCARD delivery or HP. If you want any detailed information or help we are a telephone or letter away so do not hesitate to ask us. Paul G3MXG.**

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# SOLID STATE MODULES

63 Woodhead Road, Solid, Lockwood,  
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## SENTINEL X DUAL GATE MOSFET 2 METRE CONVERTER

A de luxe version of our Sentinel converter, containing a mains power supply or external battery operation. It has front panel RF gain control. Technical data is the same as the Sentinel. Size: 5" x 1 1/2" front panel, 4" deep. Stock I.F.s 2-4MHz, 4-6MHz, 28-30MHz. Price: £24.37.

## THE SENTINEL 2 METRE CONVERTER KIT, 28-30MHz Ex stock.

The kit is supplied with printed circuit board drilled and all coils mounted to make assembly so simple. All components, metalwork, nuts and bolts etc are supplied. Performance data is the same as our Sentinel converters. Price: £12.74. IF it doesn't work, send it back with £2.30 and we will fix it for you.

## THE SENTINEL MF DUAL GATE MOSFET 2 METRE TO MEDIUM WAVE CONVERTER in two switched bands. Price: £23.44.

## UHF CONVERTERS

### SM 70 FET CONVERTER

- ★ I.F. output 144-146MHz. Noise figure-3.5dB, Gain-30dB.
- ★ Size: 2 1/2" x 3" x 1 1/2".
- ★ By using the SM70 with your 2 metre receiver you can get excellent 70cms receiving performance for only £18.75. Ex stock.

**PRE-AMPLIFIERS** 2 metres, 4 metres, 70cms, Satellite Band, Marine Band etc from stock other frequencies to order.

## SENTINEL LOW NOISE FET PRE-AMPLIFIER—Ex stock. If you want the ultimate in 2 metres sensitivity and selectivity:

- ★ Built in a box which matches our converters.
- ★ Isolated supply lines make it compatible with any existing polarity.
- ★ Low noise figure—1dB. Gain—18dB.
- ★ High selectivity tuned circuits. Price: £8.52.

## THE PA3 DUAL GATE MOSFET PRE-AMPLIFIER Ex stock

- ★ Small (about one cubic inch) printed circuit board pre-amplifier developed to fit inside transceivers where it can be wired into the receiver aerial lead after the c/o relay.
- ★ Low noise figure—2dB. Gain—18dB. Price £6.87. Supplied with fitting data.

## SM 71 70CM PRE-AMPLIFIER Ex stock. A selected 2 stage FET pre-amplifier.

- ★ Noise figure—3.5dB. Gain—18dB.
- ★ Size: 2 1/2" x 4" x 1 1/2"
- ★ Price: £11.25.

As a result of a professional contract to manufacture pre-amplifiers near 70MHz we can now offer 4 metre Sentinel Pre-amplifiers from stock. Price: £8.52.

# GAREX (G3ZVI)

Printed circuit boards from Pye R/T equipment, with circuits. All transistor, all in good used condition, unless otherwise stated.

10.7MHz I.F. board £2.15  
2nd mixer 10.7MHz to 455kHz with 11-155MHz xtal £2.40  
455kHz block filters 25kHz chann. spacing, low impedance £2.05  
25kHz chann. spacing, high impedance 85p  
12kHz chann. spacing—details & prices on application

455kHz A.M. I.F. board (ex AM25B) £1.25  
455kHz A.M. I.F. board ex AM10, AM25T £1.80

Squelch boards (ex Cambridge) AM 40p (ex AM25T) 50p  
(ex AM25B) Type A or B, 17p. 2 for 30p

Mic. amplifier board ex AM25B 95p ex AM25T 95p

Mod. output board ex AM25B or T 50p

Rx Audio board ex AM25B 50p; ex AM10 £1.70; ex AM25T 50p

6kHz Audio block filter ex AM25B 30p

AGC Assembly ex AM25B 30p

Mic. preamp board, 2 transistor, emitter follower output 60p

Modulation transformers with connection data

p.p. NKT404/OC28/OC35 to QQV03-10 £1.45 Driver to suit 45p

Audio Transformers 6A05 to 312 & 1052, pp NKT404 to 312, small or large.

Drivers to suit, small or large. 40p ea, any 2 for 70p, 3 for £1.00.

L1 Choke 3A 0-1Ω, for psu or haw filter, 40p each, 3 for £1.00.

Camera video board (Lynx) new £4.40

Rectifier plug in valve replacement stack of silicon diodes, full wave 2.6kV

p.i.v. at 400mA. Int. oct. base, wired as 5U4, easily moded, 90p

Circuit breakers, panel mounted, 0.3, 0.5 amp (new) 60p

Reed switch S.P.C.O. 33mm x 5mm dia. (75mm over leads) 10VA rating 40p

Reed relay coils to match above, 24V (2.5k res.) 25p

Painton (min. Jones) connectors, chassis mtg. 18 way female 35p

ditto, 6 way (2 pins at rt. angles) male or female 17p

Toggle switches, SP biased off 17p

Crystals HC6U: 12-700MHz, 11-155MHz 60p

HC6U for 2m Tx 9-0656, 9-0688, 9-0719MHz £1.70

Valves (New or tested ex. equip.) EB91, EC91, EC82, ECF80, ECH85,

EC84, EL91, 6BH6, 6BJ6, 6CB6, EZ81, EY81 17p each, any 4 for 60p

Transistors (tested, with mtg. kits) NKT404 17p each, 4 for 60p

Integrated circuits (new, full spec.)

723 voltage reg. TO5 metal case, 2/37V out at 150mA for 5/46V in 90p

SN7660 FM quadrature detector £1.45

CD4001 AE quad. 2-input NOR gate for tone-burst gen. 40p

NE555 Timer for tone-burst gen. or time-out indicator 75p

Relays 12V 2 pole co 6A contacts, ex-Cambridge 30p

Miniature 12V plastic cover 2PCO 40p; 4PCO 45p

25 AMP 6V single make 6V double make 12V d/make 12V s/make 45p

Type 2400 ex AM25, please specify coil/contacts required 30p

Toroidal inverter transformers (with circuits)

Input 12V DC, output 265V 150mA (Cambridge) £2.05

Input 12V DC, output 170/375V 180mA (Vanguard) £2.05

Input 12V DC, output 80/130V 150mA (Ranger) £1.85

HT choke suitable for 2-3kHz inverters 60p

Rectilinear pots multiturn, preset, p.c. mtg. (new)

10, 20, 25, 100, 250, 500, 1-5k, 2k, 2.5k, 35p each, any 4 for £1.

Air spaced Trimmers (ex) small: 2-20p, 2-4-30p, large: 10p, 25p

small 2-20p with spindle 1" x 1" 30p

Butterfly trimmers large 2 x 17.5p, 2 x 10p 80p

Beehive trimmers 2-8p 5p

Taper trimmers 2-10p, multiturn, OK for UHF. 70p

Tx Multiplier Transformer for AM10, AM25B or T, High or Low Band 35p

Other Pye coils and transformers also available

10.7 IFT (valve type) 2 1/2" x 1" square double tuned 25p; 2 for 40p; 6 for £1.00

Modulator kit for QQV03-20a. Includes all necessary components; ready

assembled pc boards, driver and output transformers, power transistors

(with mtg. kits) circuit and connection details; also suitable for QQV03-10,

for 12V working, bargain price £2.95

Type 2, similar to above, but output transformer has additional 152

output winding for pub. address £3.20

Rx audio kit similar to above, but 3Ω output £1.40

Mobile PSU 12V DC input (floating for + or - E) transistor Inverter 170,

220 or 380V DC at 180mA output, fully smoothed, chassis section, self-

contained, fully wired and tested, with circuit £5.55

As above, but partly assembled (as cut out), complete with all com-

ponents, circuit, finish-it-yourself £3.40

BNC 50ohm free sockets (new) 15p ea; 12 for £1.30, 50 for £4.50

Rotary Converters 12V DC to 320V 160mA DC £1.70

Fist mike, PTT db carbon insert, curly lead, octal plug, for Murphy, also

BCC69 Reporter 90p

Input transformer for above mike 40p

STC AM661 mobiles, hi-band, 6-channel, 12kHz, complete, £54.00

Unless stated otherwise, components are ex-equipment, in good condition,

your satisfaction guaranteed. Wherever possible, full supporting data is

given. Prices quoted are inclusive of UK post & packing & VAT at 25%

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Following a review of VAT rates by H.M. Customs and Excise we have been directed to charge 25% VAT on most of our items as from September 1st 1975. The exceptions at present to the above ruling are the Standard frequencies 100 and 1000kHz which remain at 8%.

## MADE TO ORDER CRYSTALS

Holder types available HC6/U, HC18/U and HC25/U.  
Fundamental crystals 50ppm (0-60C) or 30ppm (ambient) 2-21MHz £2.75

Please specify load capacity when ordering.

Overtone crystals 50ppm (0-60C) or 30ppm (ambient) 21-105MHz £2.75

Frequencies below 4MHz not available in HC18/U or HC25/U.

Fundamental crystals between 1-5 and 2.0MHz. £3.25

## CRYSTALS IN POPULAR FREQUENCIES

We have now added many of the IARU recommended 70cm channels to our stock list together with two additional 2 metre repeater channels and 145.3MHz.

## TRANSMIT CRYSTALS (MHz) in HC6/U Price £1.85

S20	S21	S22	S23	R3	R4	R5	R6	R7
145-500	145-525	145-550	145-575	145-075	145-100	145-125	145-150	145-175
4-0416	4-0423	4-0430	4-0437	4-0298	4-0305	4-0312	4-0319	4-0326
8-0833	8-0847	8-0861	8-0875	8-0597	8-0611	8-0625	8-0638	8-0652

RU1	SU20	SU22	GB3PY
144-342	144-400	144-500	144-520
433-025	433-200	433-500	433-550
			431-350

8-0189	8-0222	8-0277	8-0287	7-9879	8-0555	8-1000	8-7825
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12-0284	12-0333	12-0416	12-0430	11-9819	4-0277	4-0500	
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## RECEIVE CRYSTALS (MHz) in HC6/U Price £1.85. 44MHz range also in HC25/U. Price £2.10

S20	S21	S22	S23	R3	R4	R5	R6	R7
145-500	145-525	145-550	145-575	145-075	145-100	145-125	145-150	145-175
10-3603	10-3621	10-3639	10-3657	10-3728	10-3746	10-3764	10-3782	10-3800
44-9333	44-9416	44-9500	44-9583	44-9916	45-0009	45-0083	45-0166	45-0250

RU1	SU20	SU22	GB3PY
434-625	433-20	433-500	433-550
			433-350

30-2803	30-1785	30-2000	30-2035	30-1892	10-3246	10-3817	29-7800
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					44-7668	45-0333	
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Crystals supplied in 3 weeks to any stated frequency for the following V.H.F. transceivers Bellek, Icom, Standard, Trio and Yaesu. Price £2.10/Crystal.

## REPEATER I/P CHANNEL CRYSTALS in HC6/U. Price £1.85

R3 44-7916MHz R4 44-8000MHz R5 44-8083MHz R6 44-8166MHz R7 44-8250MHz

## CONVERTER CRYSTALS (MHz) in HC18/U. Price £2.65

38-6666 70-0000 101-0000 105-6666 116-0000

## PYE POCKETPHONE CRYSTALS in HC18/U. Price £4.00/pair.

for 433-200MHz GB3PY 433-500 (SU20)

## BURNDY LION CRYSTALS for GB3PY in HC25/U. Price £5.09/pair

## LOW FREQUENCY STANDARDS 8% VAT.

100kHz in HC13/U (Same base as HC6/U) Price £2.50

1000kHz in HC6/U. Price £2.50.

All prices include postage to UK and Irish addresses. 10% discount on orders of 5 or more crystals. Crystals supplied to any specification for industrial, mobile radio or marine use etc. State equipment/specification when enquiring. Please send see with all enquiries.

The above prices are exclusive of VAT, Please add 25% unless otherwise stated.

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Tel: Crayford (03225) 24625



70MHz	A5-2	1λ hinge whip	£3.40
144MHz	A5-6	2λ hinge whip	£4.97
	A6-5	2λ screw whip	£4.78
	CPW58	2λ window mount	£7.97
	GP258	2λ mast mounting ground plane	£8.94
	B2-5	2λ boot mount	£6.13
	FX2BNC	helical flexible	£3.44
432MHz	A6-9	2λ screw whip	£3.78
	CPU58	2λ window mount	£6.97
	GPU58	2λ mast mounting ground plane	£7.98

Whips are constructed using PVC coated copper plated steel rods: 2λ units give 4dB gain. Carriage, 4M & 2M £1.30, 70cm 45p. Prices do not include 25% VAT which should be added to the total. SAE will bring full details.

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## THE G3ZVC SSB TRANSCEIVER

PCB, £2.20 CRO71-8A Toroid, 24p MD108 Ring Mixer, £6.80.  
QC1246 AX Filter, £29.70 or YF-90F Filter, £17.50 (Not recommended for HF Band use)  
MiniKit 1 (containing all the above), £38.85 or £26.70  
MiniKit 2 (semiconductors) £30.40 MiniKit 3 £4.30  
**SPECIAL PRICE FOR COMPLETE KIT, £73.10 or £61.00**  
Also available—but not included in kits: *Reprint of article (September 1974)*, 20p plus SAE 2552 Loudspeakers—21", £2.70 or 5", £2.80 Metal Cabinet, £1.55 Min. 5052 coaxial connectors—PCB mount socket, 44p and plug, 85p.  
The first of a series of add-on units for the G3ZVC SSB Transceiver are now available:  
2m Preamplifier Kit with tailored bandpass and gain to suit G3ZVC Board. PCB size: 3.5" x 1.5". Price £5.05.  
12V to 6V Regulator/HW Audio Amplifier Kit to power the G3ZVC Board from +12 volt supply and provide increased audio output. PCB size: 3.5" x 1.5". Price £7.65.  
2m VFO Kit (by DUSHD-VHF Communications, Edition 1/71).  
This VFO is of the mixer type, having VFO tuning 11 to 13MHz and a crystal oscillator of 62MHz. Kit price £36.50 VHF Communications Edn. 1/71 85p extra  
Components for HF Preset Unit also available—write for details.

## G3TDZ 2m TX/RX

PCBs: RX, £2.02 TX, 98p; 3 gang x 17pF, £2.50; Drive Drum, 34p; C.D. Spindle, 36p; Cord Spring, 8p; 4mm coil Formers, 8p each or 75p for 10; Cores, 11p each or 13p for 10; Ferrite Beads, 1p each or 45p for 50; Trimmers: 10pF, 20p 35pF, 45p; Filter, 55p; 21" Loudspeaker, £2.67; Crystals: Rx, £3.10 Tx £3.15 (72-05, -3, -35 -4, -625, -675, -75, -9MHz).  
MiniKit 1, RX, £12.60 TX, £5.45 (State Xtal frequency required).  
MiniKit 2 (Semiconductors), RX, £5.80; TX, £4.55; MOD £2.10.  
MiniKit 3 (Rs. & Cs.), Rx, £3.10; Tx, 65p; MOD, £1.75.  
Special price for complete kits, RX, £21.20; TX, £10.50; MOD, £3.80.  
(Modulator kits do not include PCB or transformer.)  
Also available, but not included in kits: *Reprint of article (April 73)*, 20p plus large SAE:  
Ni-Cad Batteries, £24.50 for 10 (£2.65 ea £15 for 6).

## G3XGP MINI D.F.M.

PCBs: I/P Amp, £1.10 Display, £1.50 Clock: 100kHz or 1MHz, £1.20, Minitor, £1.45  
Lcd, 25p Transformer, £2.00 Switch, 64p Pointer knob, 17p Round Knob, 30p 10 turn pot, 1k52, £3.45 1MHz Crystal, £3.25 35pF Trimmer, 45p.  
MiniKit 1 (containing the above), 100kHz (without Xtal), £16.95.  
1MHz (including Xtal), £20.15  
MiniKit 2 (semiconductors), 100kHz, £19.10; (Add 50p if 30MHz l.c.s required—  
1MHz £19.00 DM7490 & 74H00)  
MiniKit 3 (Rs & Cs), £2.30.  
Special price for complete kit (1MHz Clock version), £40.00 (+50p for 30MHz l.c.s)  
Also available, but not included in kits:  
*Reprint of article (June 73)*, 20p plus SAE: Metal Cabinet, £5.50; 74196, £1.60

We are also agents for Mini-Beam HF aerials, and Jaybeam VHF aerials. Write for free Price List (SAE please). All prices include VAT at current rates. Please note that our minimum UK post & packing charge, except where indicated is 15p. Export orders welcome—write for export price list.  
Cheques and P.O.s should be crossed and made payable to "Amateur Radio Bulk Buying Group" or pay by G.I.R.O.—Account no. 31 523 4008.  
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## A DIGITAL FREQUENCY METER WITH BUILT IN PRESCALER

Enabling frequencies up to over 150MHz to be read directly. Using the new model DFM4 from Catronics Ltd., it is now possible to measure frequencies on all bands from 160m to 2m without any range switching, input level control adjustment or other operation. Additionally a low frequency position may be switched to, enabling audio frequencies and I.F.s to be read directly. This is a 7-digit model with 4-speed time base having gate times of 10S, 1S, 100mS, and 10mS with built in automatic memory. The instrument is housed in an attractive two-tone metal cabinet approx. 9in x 3 1/2in x 6 1/2in. Write for full specification details.  
Price £120 (+ insured post—£1.00). Delivery—approx.—2-3 weeks.  
Normal H.F. versions (40MHz max.) now in stock—5 digit model DFM2, £80; 7 digit model with l.c. memory £95.

## CRYSTAL and CERAMIC FILTERS

We are now the leading UK stockist for KVG Filters and normally hold the following range in stock (—9B model may be subject to temporary shortages):

Model	Application	6dB BW	Stopband	Supplied	Price
XF-9A	SSB TX	2.5kHz	45dB	2 x Xtals	£22.85
XF-9B	SSB RX/TX	2.4kHz	100dB	2 x Xtals	£30.80
XF-9E	FM	12kHz	90dB	None	£28.85
XF-9M	CW	500Hz	90dB	1 x Xtal	£22.90

### S.E.I. and Y.T.K.

QC1246AX	SSB/RX/TX	2.4kHz	100dB	2 x Xtals	£29.70
YF-90F	SSB RX/TX	2.4kHz	70dB	2 x Xtals	£17.50

### MURATA

BFB455A	Resonator	15kHz	—	—	43p
CFR455H	AM RX	6kHz	55dB	—	£11.45
CFS455H	AM RX	6kHz	70dB	—	£14.80
SFW-107MA	RX BC	250kHz	50dB	—	£1.20

## FERRITE BEADS and TOROIDS

FX1115 Beads—1p each or 45p for 50.  
FX1886—3mm Toroid—for use up to 30MHz—5p each.  
CRO71 8A—8mm nylon coated toroid for RF transformers, etc.—24p each.  
FX1585—1" toroid for use up to 10MHz—14p each.  
FX1588—1" toroid for use above 10MHz—22p each.  
4324R/1—similar to FX1588—1 1/2"—for curing TVI etc—30p each.  
FX1898—6 hole bead for suppressing parasites—6p each.

## NEW DECON DALO PEN

We were first to bring you the Decon Dalo printed circuit board pen and now we are first to bring you the new Improved "Quick-Dri" version. Still the same price from us—85p.

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Large stocks of the following available for immediate delivery:  
2m Converters with 28-30MHz O/P, £18.90 Local oscillator output version for transverter use, £19.90 2-4MHz and 4-6MHz O/P also in stock, £18.90.  
2m Mosfet Preamplifier giving 18dB gain, £11.30.  
70cm units: Converters with 144-146MHz O/P, £22.60 and 28-30MHz O/P, £22.60.  
Varactor Tripler with 14W max O/P, £21.90.  
SSB Transverter for operation with 28-30MHz equipment, 4W O/P on 70cm, in stock soon at £77.50.

## 150MHz PRESCALER FOR D.F.M.s

This unique unit will extend the frequency range of any 15MHz Digital Frequency Meter to read up to 150MHz, enabling it to read VHF converter crystal frequencies and 4m & 2m transmit frequencies directly. Specification as follows: Single input socket and a switch allows 50Hz to 20MHz at better than 50mV sensitivity or 10MHz (at 50mV) to 150MHz (at approx. 100mV) high impedance to give TTL compatible output. Two versions available:  
PCB Module approx. 3.5" x 1.8" requiring 5V (stabilised at 160mA and 9-12V at 10mA with full connection instructions).  
Complete Boxed Unit, with switch, input and output sockets and regulator requiring 9-12V at 200mA. (All power supply requirements are —ve earth)  
PRICES: PCB Module—£25; Boxed Unit—£35 (Add 25p p & p)

## CRYSTAL CALIBRATOR

Catronics model M6 giving outputs at 1MHz, 200kHz, 100kHz, 50kHz and 25kHz at the flick of a switch, with harmonics audible up to 2m band, 6 volt supply. Complete PCB module, accurately set to frequency and switch assembly—£8.90. Also now available—kits of parts for regulator for operation on 9 to 20 volt supplies, £1.60.  
Complete Boxed Unit with battery, £12.50.

ALL CATRONICS PRODUCTS ARE AVAILABLE FROM:

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## New Address

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### 144MHz Mosfet Converters

#### UPDATED SPECIFICATION

The overwhelming response to the introduction of our 144MHz SSB receive converter has indicated the requirement for a tightly specified converter for use with modern highly accurate 28-30MHz receivers. To this end we have now standardized the design of our 28-30MHz converter using a zener-stabilized 116MHz crystal oscillator, giving a typical read-out error of better than 1kHz. The converter is now available in the two versions, with and without the local oscillator output facility.

**MMC144/28** Price £18.90 inc. VAT  
**MMC144/28 LO** (with 116MHz output) Price £19.90 inc. VAT

#### SPECIFICATION

Noise figure: 2.8dB max. Gain: 27dB typ.  
Image rejection: 65dB typ.  
Crystal oscillator: 116MHz (zenered)  
Frequency error at 144MHz: 3kHz max.  
Power supply: 35mA at 12 volts.  
116MHz o/p power: 5mW min. (LO o/p version)

We have extended our popular range of single conversion converters to include the following I.F.s:  
9-11, 12-14, 14-16, 18-20, 24-26, 28-30MHz Price £18.90 inc. VAT

### 144MHz DOUBLE CONVERSION MOSFET CONVERTER

I.F.s available ex-stock: 2-4, 4-6MHz Price inc. VAT £18.90  
This unit was developed to meet the heavy demand for a converter suitable for use with receivers having better performance at lower frequencies. It uses two dual-gate mosfet mixers, both fed from the output of a 70 or 71MHz crystal oscillator. Selectivity is obtained at the first I.F. in the 74MHz range, thereby overcoming the usual problems associated with low-I.F. single conversion converters.

### 136MHz SATELLITE BAND CONVERTER

I.F.s available: 28-30MHz and others Price inc. VAT £18.90

### 70MHz MOSFET CONVERTER

I.F.s available: 4-4.7, 14-14.7, 18-18.7, 28-28.7MHz  
Price inc. VAT £18.90

### 432MHz MOSFET CONVERTER

I.F.s available ex-stock: 14-16, 18-20, 24-26, 28-30, 144-146MHz  
Price inc. VAT £22.60

### 432MHz VARACTOR TRIPLER

Maximum input power at 144MHz: 20 watts. Typical output power (at maximum input): 14 watts. Price inc. VAT £21.90

### 144MHz DUAL OUTPUT PREAMPLIFIER

Gain 18dB, N.F. 2.8dB. Ex-stock Price inc. VAT £11.30

## MICROWAVE MODULES LIMITED

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COPAL "T-11" Battery, tuning fork controlled, alarm in Gold	£19.95

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THURS, FRI, SAT — 30, 31 OCTOBER, 1 NOVEMBER 1975.

**ADMISSION 30 pence**

**MORE STANDS — NEW IDEAS — STILL PLENTY OF ROOM TO MOVE AROUND  
MORE INFORMATION IN NEXT MONTH'S ISSUE.**

FURTHER DETAILS, TOM DARN G3FGY QTHR.

## HOW'S IT WORK?

— On transmit the double side band suppressed carrier signal from the FT101 is applied to Q1 amplifier slightly and then converted to SSB by the SSB filter. As with any SSB signal each voice frequency then represents one (and only one), radio frequency, and this signal is further amplified by Q2 and Q3. As the mic gain is advanced the signal eventually becomes strong enough for the peaks to be clipped by the second set of clipping diodes. Q3 has a gain of about 10dB so that if the mic gain is advanced to give a total of around 20dBs of clipping this is shared by the two sets of diodes ensuring that neither of the stages can be overloaded. Q4 provides isolation from the clipping diodes, and passes the signal back to the transmitter via the output control.

On receive the signal path is the same, but the gain is reduced and the output control is disconnected. This is achieved by wiring the clipper to the FT101 TX/RX switching circuits resulting in 13 volts being applied to pin 7 in the transmit mode only. The fact that the diodes are in circuit on receive does not matter, as only a colossal local signal could cause them to clip. As they are after the SSB filter, this does not matter, and as the extra gain is provided within the automatic gain control circuit loop, this works better with the clipper in position, and the FT101 has less tendency to overload on strong local signals.

The clipper was originally designed to go with the FT101 Mark 2 which was rather short of receive gain, and here the improvement on receive is extremely noticeable. Several users have commented that they would consider the unit worth the cost for the improved receive performance alone when used with this model. The FT101B has of course improved gain and selectivity when compared with the Mark 2 and here the difference in receive performance is less noticeable. It is still worth while however, when one considers that hardly any extra components are used in achieving it, and that the overload problem is reduced.

## SO NOW YOU KNOW!

**Note: latest unit  
has:—**

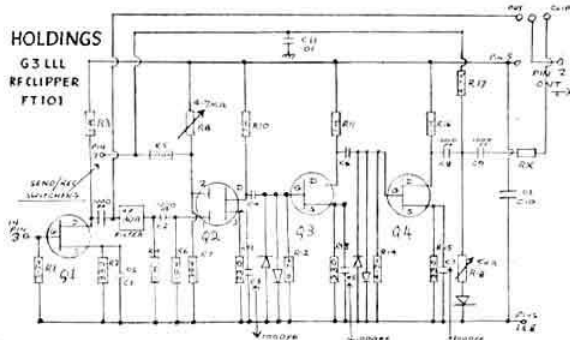
Improved appearance  
In/Out Switch  
Free 444 mic, to UK  
purchasers until Sept.

G3LLL's RF Clipper for  
FT101 Mark 1, Mark 2 or  
B) state which) **£45.00**  
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Kit (not suit 401B) **£10.00**  
FT101B **£330.00**

Ask about G3LLL's Clip-  
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Special 444 mic with  
normal/DX switch wired  
with plug **only** for FT101  
**£15.00**

FT101 mic plug **£1.00**  
All plus 25% VAT UK  
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● Buying a 101 — We pre-wire for clipper free of  
charge on all we sell ●

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**NEW RADIO TELEPHONES.** FM or AM. High, low and Marine bands. Catalogue on request.

**LINER 2.** Add on amplifier module comprising of 40 watts P.E.P. amplifier and preamp for the RX. Extremely simple to use with any liner 2, but could be easily adapted for use with any TX RX requiring more power and better sensitivity. With RX preamp £60.53  
Without RX preamp £51.38

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Various New and Second-hand. Prices on application. Discounts on quantity.

MR 960 Units LB Bootmount used condition. No remote units. Can be converted to 12.5Kc/s. £7.50

New Power Unit for transmitter. Complete £47.50.

Steel cases (blue) for the above Units. £35.00.

New 50 Watt AM Transmitter Chassis less Valves & Coils £47.50.

N.B. The above Unit can be used on 12.5Kc/s.

5 pin type B din plugs	26p	5 pin type B din sockets	19p
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Toggle switches 10 amp—25V (centre off position)	28p
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**MC MURDO RED RANGE**

24 way plugs	56p	12V 2-2 lamps MCC 643	20p for 10
32 way sockets	69p	6-5V 3 volts lamps MCC	20p for 10
32 way plugs	69p		
F. & E. plugs	62p		

**TRANSISTORS**

2N 2569	28p	PT 4176B 10W	92p
PT 4176D 44W	£3.54	PY 4176A 3W	65p
PT 4176C 20W	£2.57		
2N 4427 5W	92p		

Various other transistors. List on application.

PL 258 plugs	46p
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**ULTRA FM & AM BASE STATION.** 12kHz type approved In extremely good condition. In working order. complete with desk controller 7-8 watts £83.75

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**H.B. CAVITY FILTERS** £6.38

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**PYE PILOT UNIT**—new condition, 3 channels £126.25

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**ELAC** 5x3 at 8 ohm elliptical, new £1.03

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Two and Four Metres  
TRANSVERTERS**

We believe that our Transverters are the best available on the amateur market. We incorporate in our design a Microwave Modules converter, and the RF section is designed for high output power along with a clean output spectrum. Our Transverters are both thermally stable and free from any instability under all operating conditions. But don't take our word for it, ask a MAGNUM owner.

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We also manufacture two Linear Amplifiers, one for 2 metres, the other for 70 cm.

**2m Linear Amplifier/Receive Preamp.**

Self contained mains power supply with 12 volt stabilised output.

High output power. Built in drive attenuator.

Microwave Modules receive preamp with RF gain control.

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Drive required—up to 5 watts. Output up to 50 watts.

Fully compatible with M.M. 70 cm Transverter.

Power requirements 6.3 volts and 400-1,000 volts DC.

Supplied with BNC sockets and power plug.

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**J. M. G. ELECTRONICS**

**BYE-BYE CROYDON,**

**HELLO CRAWLEY SX.**

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**16<sup>A</sup> HIGH STREET,  
CRAWLEY  
SUSSEX**

(Rear of Driving School by roundabout)

However, we will see you at most of the rallies next year & of course at the Leicester show. Mail order will continue as best as possible & all SAE's will be answered.

**VY 73's de John (JMG Himself)  
& Frank (G3ZMF)**

# NEW! Universal R.F. Speech Clipper

## INCREASES 'TALK POWER' — ELIMINATES 'FLAT TOPPING'

### Easy to install — long battery life

★ Simply connect in series with your microphone lead. Needs no internal connections to your transmitter. Push-to-talk facilities are retained.

### STOP PRESS!

H.M. Customs and Excise have now revoked their interim ruling which enabled us to charge VAT at the old rate of 8% instead of 25% on our r.f. clippers. However as our contribution to price stability in the UK we have decided that

**FOR A TRIAL PERIOD WE WILL ABSORB THE WHOLE OF THE INCREASE IN VAT OURSELVES.**

The VAT inclusive price of complete Datong r.f. clippers in the UK is therefore the same as before the new VAT rate was introduced.

Note: this offer applies only to complete clippers despatched to addresses in the UK. It does not apply to our clipper module.

Total UK prices including post, packing and 25% VAT are as follows:

<b>MODEL</b>	
Stereo jack input socket	£48.60
4-pin Jap input socket	£50.76
4-pin Jap input socket and matching output lead	£52.38



See Rad Comm (August 1974) and S.W. Mag (July 1975) for reviews of this equipment.

### R.F. Speech Clipper Module

The Datong r.f. speech clipper is also available in the form of a completely assembled, aligned, and tested printed circuit board identical to that used in the range of cased units. The P.C. board measures 90 x 98 mm. and the total above-board height is 13 mm.

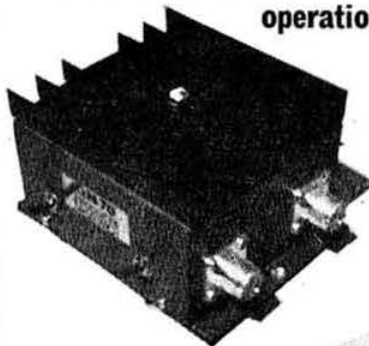
Write or phone for free copies of the detailed data and instruction sheets.

UK Price: including mounting hardware, full instructions, and delivery by first class letter post, only £19.50 plus 25% VAT (ie. £24.38 incl. VAT). Terms: cash with order.

## DATONG ELECTRONICS LTD.

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Got a Liner 2, Multi 2000, FT224, FT2FB, etc? Want 50 watt rms output? 12V operation, RF switched



Just connect in the aerial line. All solid state linear amplifier for fm, a.m., ssb & cw £50.00.

28/144MHz high power Transverter featuring 200W rms input. 2 I.F. outputs (for transceive and split frequency working), FET converter. Rugged yet attractive styling.

Suitable for Transceivers with 12.6V or 6.3V heater supplies. 6.3V version at NO EXTRA COST. £97.75.

Our most successful and world famous 28/432MHz ssb Transverter. All solid state, 4W rms output under true linear conditions. Micro-strip pa circuitry, aligned for minimum spurious output and maximum output.

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## BEWARE OF IMITATIONS!



We also produce: 432MHz linear amplifier. Fully compatible with our 28/432 Transverter and producing up to 100W p.e.p. output. £34.50. 28/144 solid state transverter: Even we have been staggered at the popularity of this little rig. 5W p.e.p. output, all solid state 12V operation. 2 x I.F. outputs. Fully metered sufficient power to drive QOV6-40A linear to full output £51.75. Mains psu in matching cabinet £17.25.

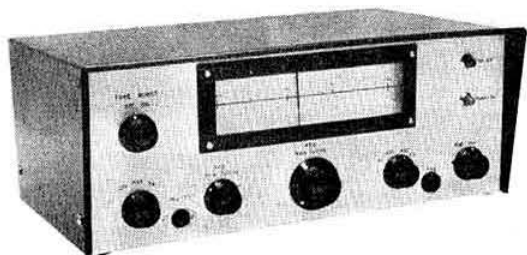
All prices include carriage and VAT (25%). All units, parts & labour guaranteed for 12 months. Send large S.A.E. for our catalogue.

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See you at the Leicester Show

# TELFORD COMMUNICATIONS



FULL 2 METRE COVERAGE

SSB, FM, AM, CW

## TC10 Mk. 2 TRANSMITTER

Dual frequency repeater access tones 1700 and 1750Hz. Full Band coverage with high stability mixer vfo. 144-30 xtal controlled A3J calling channel. Integral mains psu, aerial change over and muting relays. 10 watt rms output. Delivery now 2 to 3 weeks. £140.00.

TC7 Mk. 2. Tunable I.F. 28-30MHz ex-stock. £50.00  
TC6 mixer vfo. 48 or 45MHz output. Ex-stock. £30.00  
TC5 2 watt 5-channel. 12 volt neg. earth tx. £35.00  
"G8AEV" Mk.2. 2 metre converter. 28-30MHz I.F. ex-stock £13.00  
TC7 "Bandsearcher" unit. Ex-stock. £5.00  
2 Metre 10 watt aerial filter. Ex-stock. £6.00

### AGENTS:

LONDON AREA Reg Vincent, Hoddesdon 64285. Evenings only.  
SCOTLAND J. J. Connelly, Duntocher 76994.

### SEE THE GEAR AT:

HARLOW AND DISTRICT, A.R.S. RALLY, 21st SEPTEMBER.  
STAND 27, A.R.R.A. EXHIBITION, LEICESTER. OCTOBER  
30/31, NOVEMBER 1st.

Further details of all units available from Agents or direct from our factory on receipt of a large s.a.e. All prices exclude VAT, add 25%. Securicor delivery of TC10 and TC7, add £4.50 plus 8% VAT. HP terms available. 73. G8ARS.

FOR ALL YOUR 2 METRE SOLID STATE  
BRITISH-BUILT EQUIPMENT

78B HIGH STREET, BRIDGNORTH

WV16 4DS SALOP

Telephone 074-62 4082

9 am - 5.30 pm

## FM CRYSTALS — Repeaters and Simplex

HC25/UR2	R3	R4	R5	R6	R7	R8
Tx 6 04375	6 04479	6 04583	6 04687	6 04792	6 04896	6 05000
Tx 12 0875	12 0896	12 0917	12 0937	12 0958	12 0979	12 1000
Tx 18 1312	18 1344	18 1375	18 1406	18 1437	18 1469	18 1500
Rx 14 9944	14 9972	15 0000	15 0028	15 0056	15 0083	15 0111
Rx 44 9833	44 9917	45 0000	45 0033	45 0167	45 0250	45 0333
Rx 52 1167	52 1250	52 1333	52 1417	52 1500	52 1583	52 1667
145 0	S20	S21	S22	S23	S24	
Tx 6 04167	6 06250	6 06354	6 06458	6 06563	6 06667	
Tx 12 0833	12 1250	12 1271	12 1292	12 1313	12 1333	
Tx 18 1250	18 1875	18 1906	18 1938	18 1969	18 2000	
Rx 14 9222	14 9778	14 9806	14 9833	14 9861	14 9889	14 9361 14 9389 14 9417
Rx 44 7667	44 9333	44 9417	44 9500	44 9583	44 9667	44 8083 44 8167 44 8250
Rx 51 9000	52 0667	52 0750	52 0833	52 0917	52 1000	51 9417 51 9500 51 9583
HC6/U R5, 6, 7, S20, 21, 22 in 4, 8, 10, 44/45 MHz ranges. SAE for lists.						
40,5000 for Cambridge tunable conversion (Rad. Com., Dec. 74)						
Inclusive price £2.95 each						
Giro 53 563 4007 Phone 04 868 7597						

### HARTLEY CRYSTALS

Green Lane, Milford, Godalming, Surrey GU8 5BG

# G. W. M. RADIO LTD.

ALL PRICES include VAT and Post or Carriage.

**BRT400.** 150 kc/s to 380 kc/s, 510 kc/s to 30 Mc/s, £65. TCS (untested, no PSU) 1-5Mc/s to 12 Mc/s, £20. A few Racal RA17 for callers only, from £265. Pocket Receivers, Sharp Radio FX-184AU. 520 to 1620 kc/s and 108 to 136 Mc/s. Very excellent performance on Aircraft band, £11.50.

**RADIO TELEPHONES.** Storno Marine 6 channel (fitted for channel 16 only and good working order) for AC mains supply, £35. Vanguard Units only, no accessories. Multi channel, also Single channel transistor type, either £10. All low Band. From time to time we have licensable R/Ts, phone for latest stock position.

**COMPASSES.** "ERMER" illuminated hand bearing liquid filled, good quality, £22.75.

**METERS.** 2 1/2" x 2 1/2", 1ma 100 ohms, calibrated 0 to 1.0 and 0 to 5, £1.60. Three types in desk top cases, all £2.50. 50-0-50 Microamp, 1000 ohms, calibrated 5-0-5. 100 microamps, 1000 ohms, calibrated 0-10. 1ma, 100 ohms, calibrated 10-0-10. New condition. BC221 complete charts, no PSU, £15. **AERIAL VARIOMETER TUNERS** for 19 set, £2.32. Aerial insulators, 1 1/2" white egg type, 6 for 67p, Pyrex 2 1/2", 67p.

**CRYSTAL OVENS,** octal based for 2 HC6U crystals, 12V, 75p.

**TRANSMITTER P.A.** units STC T4188, tunes 2.8 to 18 Mc/s manual or 28V meter drive. 13" x 8" x 8". Pair CV2518 (4 x 150) 28V blower cooled. Bases are NOT UHF type. Ideal basis for Linear Amplifier construction, £10.50.

**EX-MINISTRY** quality wrist watches. VERTEX, screw back case, £9 and LEMANIA stainless steel, screw back case Chronographs 1/5th second, stop/start/return button, minutes dial, £16.75. Fully overhauled, new strap and sent by registered post.

**REED RELAYS,** 4 reed normally open, 5v DC coil as used in recent keyer designs 15p each post 10p for any number. Also reed inserts 1.85" overall (body length 1.1") diameter 0.14", max ratings 250v DC and 500 ma. Gold clad normally open contacts, 75p per dozen, £4.12 per 100, £30.25 per 1,000.

**POCKET DOSIMETERS** (Radio activity monitors) 10 for £1.25.

All receivers and Test Equipment are in working order at time of despatch. Carriage charges are for England and Wales only.

Terms: Cash with order

Early closing Wednesday

**G. W. M. RADIO LTD.** 40-42 PORTLAND ROAD,  
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TOWERS  
ROTATORS  
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ROPES

Send for HANDBOOK containing full details of  
Antennas and other technical information. 33 pages  
30p. Refundable upon purchase of Antennas.

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TRI-BANDERS		
Mustang	3 Elements, 10, 15 and 20 metres ..	£70.00
TA-33 Jr.	High Power Model Incl. Balun	
	3 Elements, 10, 15 and 20 metres ..	£61.00
TA33 Jr.	3 Elements, 10, 15 and 20 metres ..	£53.00
TA32 Jr.	2 Elements, 10, 15 and 20 metres ..	£37.00
TA31 Jr.	Rotary dipole, 10, 15 and 20 metres ..	£23.00

**MOSLEY**  
Electronics Ltd

BASIC  
PRICES  
ADD VAT

All antennas available ex works carriage extra

Administrative Address only

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Norwich, NR5 0BD, England.



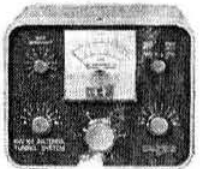
# PROFESSIONAL PERFORMANCE

with  
**KW**



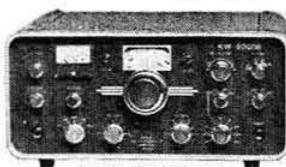
**KW 108**

**KW 108 Monitor Scope** Monitor your transmissions 10-160m, two-tone test generator incorporated to ensure optimum linearity for ssb.



**KW 107**

**KW 107 Antenna Tuning System.**



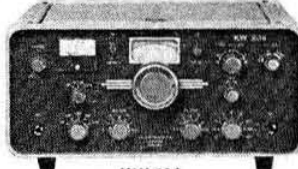
**KW 2000E & Power Supply**

**KW 2000E Transceiver** covers all HF Bands 10-160 metres (10 metres in 4 Bands), 500kHz vfo. SSB/CW. Outstanding Tx audio quality. Excellent Receiver signal-noise figures. Includes VOX, break-in CW, 100kHz and WWV calibrator. Reliable 6146's in PA.



**KW 1000**

**KW 1000 Linear Amplifier** 10-80 metres. 1200 watts p.e.p. input max. Designed to be "driven" by KW 2000A/B/E or other Unit of similar power.



**KW 204**

**KW 204 Transmitter** Well known for really good audio quality (ssb) and a favourite with cw enthusiasts. 10-160 metres. Reliable PA.

**Other KW Favourites.** KW 1000 Linear Amplifier KW E-Z match ATU; KW 150 ATU; KW 103 SWR/RF Power meter; KW Dummy Load; KW Traps (The original and best); KW Trap Dipoles; KW 109 Super-match (High Power Version); KW Low pass Filter; KW Balun; KW Antenna Switch.

**Stockists for Hy-Gain** beams and verticals. CDR rotators, Shure microphones etc.

Easy terms available over 12, 18 or 24 months

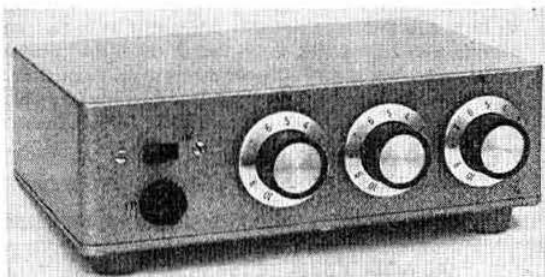
**KW**

**Communications Products**  
**DECCA COMMUNICATIONS LTD**

Write or phone for catalogue to:  
1 Heath Street, Dartford, Kent.  
Tel: Dartford 25574/21919  
Cheques to Decca Communications Ltd.

## TECHNICAL ASSOCIATES

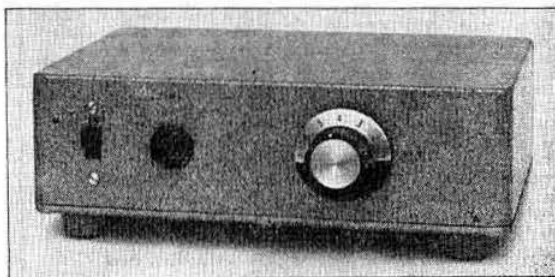
FOR THE T.X. AMATEUR AND THE S.W.L.



**AUDIO COMPRESSOR**

★ Suitable for SSB/AM/FM ★ pure compression, no clipping! ★ 14 transistors ★ 24 to 26dB of compression, with less than 1% distortion ★ fast attack time in the order of 200 microseconds ★ variable decay time, on front panel 1/2sec to 2secs ★ variable noise gate on front panel prevents ambient noise level tripping vox or being tx in pauses in speech ★ does not produce hard audio! ★ gives high talk power without high cost rf clipping and distortion making at clipping ★ all functions routed to output in "off" position ★ goes between mic and tx no mods involved ★ standard jack socket input ★ runs from internal PP6 battery, draws 3.5 m/a ★ these compressors have been tested alongside commercial rf and at clipers, the only difference at the receiving end was far superior audio quality on the Technical Associate compressor. Why pay more?

**£22.50 + VAT**



**AUDIO FILTER**

★ 9 integrated circuits ★ covers ssb and cw in one unit ★ built in loudspeaker amplifier ★ headphone socket ★ 8 positions of filter ★ high pass-2.5kHz-2.00kHz-1.5kHz-200Hz-150Hz-110Hz-80Hz ★ no mods to equipment, goes between rx and loudspeaker ★ bypass switch allows unit to be left in circuit ★ makes the superb rx better and the poorest rx superb ★ runs from internal PP9 type battery ★ no ringing when in circuit ★ your rx volume control controls the audio a/p of the filter.

**£26.00 + VAT**

**83 SCOTLAND WAY • HORSFORTH • LEEDS • YORKSHIRE**

# CW IS STILL VERY MUCH ALIVE!

## SAMSON ELECTRONIC KEYERS

—the choice of Ships and Coast Stations the world over. Two different models:

### ETM-2b TRANSISTORISED KEYS

Developed from the well-established ETM-2. Printed circuit 11 transistors, 6 diodes. Ratio Control. Single paddle. Speed control, 8-50 wpm. Sidetone oscillator. Almost-inaudible sealed relay. Grey case 4" x 2" x 6". Powered by four ZM9 mercury batteries available world-wide (Price includes batteries). Well engineered keying lever, fully adjustable gaps and tensions.

**ETM-2b** —with make-break relay contacts,  
(Ratings: 1A, 400V, 30W max.)  
Complete with mercury batteries, £42.77  
(or with penlite batteries, £41.05)

**ETM-2bs** —with spdt changeover relay contacts,  
(Ratings: 0.5A, 250V, 10W max.)  
Complete with mercury batteries £48.56  
(or with penlite batteries, £46.83)

### ETM-3b INTEGRATED CIRCUIT SQUEEZE-KEYER

Printed circuit with 4 ICs and 13 semiconductors. Twin paddles. Constant 3:1 ratio. Speed control, 8-50 wpm. Operate/Tune button. AC mains power supply 110/220-240V. Almost-inaudible sealed relay. Grey case 4" x 2" x 6". The renowned SAMSON keying lever movement with fully adjustable gaps and tensions. Can be used either as an iambic mode squeeze-keyer (characters made with fewer paddle movements—you can make a 'C' with one squeeze)—or as a normal electronic keyer.

**ETM-3b** —with make-break relay contacts,  
(Ratings: 1A, 400V, 30W max.), £49.71

**ETM-3bs** —with spdt changeover relay contacts,  
(Ratings: 0.5A, 250V, 10W max.), £35.78

## OR, IF YOU LIKE IT STRAIGHT

### JUNKER PRECISION HAND KEY

A superbly engineered straight hand key used for many years by professionals afloat and ashore. With this key you can't help but send good Morse. Free-standing—it does not have to be screwed to the operating desk. Good weight distribution and large rubber feet stop it sliding or rocking. Weight 2½ lbs. Front and back contacts of precious metal, with fine adjustment of contact gaps by positive click-stop action. Lever-action spring tension adjustment. Spring pigtail at keying arm pivots ensures good contact. Insulated keying arm, moulded knob with rubber anti-slip insert. 3-way terminal block and cable clamp at rear. Key-click filter (L, C & R) built into base. Rear-hinged cover (with spring catch) and other metal parts finished in attractive hammertone grey. Base area: 3½" W x 7½" D. Overall height: 2½". £21.48

### BAUER KEYING PADDLE

Single-paddle unit on 1½" x 2" base for home built El-Bugs. Adjustable gaps and tensions. £6.68

88mH Toroids for CW, RTTY, SSTV and other filters. 65p each.

ALL PRICES INCLUDE 25% VAT

ALL GOODS POSTPAID UK



Please send stamp with enquiries.

## SPACEMARK LTD.

THORNFIELD HOUSE, DELAMER ROAD,  
ALTRINCHAM, CHESHIRE  
(Tel: 061-928 8458)

## REG. WARD & CO. LTD.

(G2BSW)

### K.W.

108 Mon. Scope .. ..	£85.00
103 VSWR Meter and combined Power Meter	£16.00
E-Z Match, 10-80m, ATU	£22.00
107 Combined E-Z Match, VSWR and RF Power Indicator, Dummy load and Antenna Switch for 4 outlets .. ..	£68.00
109 High Power ATU ..	£78.00
Trap Dipole Co-axial Feeder .. ..	£25.00
Trap Dipole with Balun	£29.00
3-way Antenna Switches (for co-ax) .. ..	£6.00

Park Air 2m A.M. Tx, 4  
Xtal channels, with  
handbook, spare valves  
and Shure desk mic. ..

### USED EQUIPMENT

Valves for Yaesu, etc, 6BZ8, 6G8, 6KD6, 12AX7A, 12BY7A, 12AU7, RCA Valves for KW equipment etc.	
Sentinel 2m Preamps and 2m converters/Europa transverters. J Beams and Stoile rotators, 140' 14g enamel ant. wire, insulators, 52 & 75 ohm co-ax, and UHF plugs, sockets and reducers, G-Whip mobile antenna, Wightraps, Mast couplers.	
KW 202 Amateur Band Receiver .. ..	£145.00
YAESU FT401 TCVR, fitted c/w filter, fan, etc. ..	£255.00

### AMTRON KITS

TRADE INS WITH PLEASURE. OUR STOCK OF GOOD SECOND-HAND EQUIPMENT CHANGES DAILY—LET US KNOW YOUR REQUIREMENTS. Due to currency fluctuations prices of imported equipment are liable to alteration. Add 25% VAT to all prices except used equipment.

HP TERMS AVAILABLE

CARRIAGE EXTRA ON ALL ITEMS

AXMINSTER, DEVON EX13 5DP Telephone 33163

## BRITISH FT.101 OWNERS— GET A 444 MIC FREE

Your good signal brings us export orders for our RF Clipper, so to ensure that your signal is the best possible we are offering a FREE 444 MIC to all British Class "A" licence holders who buy our RF Clipper during July, August and September. RF Clipper £45.00 + VAT. Xtal inserts for mobile mic—2 for £1.62 + VAT, 101 mic plug £1.00 + VAT. Details:

G3LLL, HOLDINGS LTD.,

39/41 Mincing Lane, Blackburn BB2 2AF. Tel: 59595/6

## 2-METRE CRYSTALS for Pye Cambridge, Storno Viscount, etc

All popular channels in stock in HC6/U:

4 & 8MHz Tx and 10 & 11MHz Rx	£1.80 ea
36MHz Tx and 45MHz Rx	£2.25 ea
36 & 45MHz for Pye Equipment	£2.85 ea

FREQUENCY STANDARDS: 100kHz 100 PPM and 1MHz 50 PPM—£3.00, 10MHz 20 PPM—£2.00

10% off for eleven or more of any frequency, post free but please add VAT.

Made to order crystals, including those to current radiotelephone specs—delivery five weeks. Also, L.F. TO-5 clock crystals (10-250kHz), prices from £2.22. Please send for details.

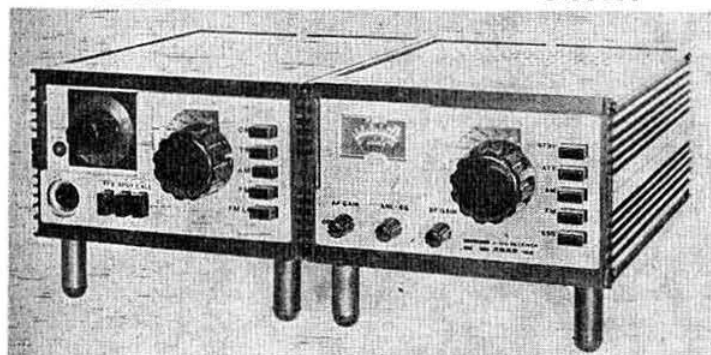
## INTERFACE QUARTZ DEVICES Ltd

29 MARKET STREET, CREWKERNE, SOMERSET  
Tel: (046031) 2578, Telex: 46283

# STEPHENS-JAMES LTD

G3LRB

G3MCN



## ARAC 102 MOSFET RECEIVER

28-30MHz 144-146MHz AM, FM, SSB  
12V DC OPERATION IDEAL FOR OSCAR 7 TRACKING £108  
ATLAS 228 TRANSMITTER 144-146MHz AM/FM 8 watts £145

## WE'VE MOVED

NEW ADDRESS 47 WARRINGTON ROAD  
LEIGH, LANCS. TEL 052-35 76790

Our new larger premises offer you full demonstration facilities on all equipment. Easy access to M6/M61/M62/M63 turn at the Greyhound Motel on the A580 (East Lancs Road). Large range of new and secondhand equipment from stock. All Guaranteed Air Tested

Stockist for the current range of equipment available

★ YAESU ★ DECCA COMMUNICATIONS ★ SWAN ★  
STE(Milan) ★ DRAKE ★ OMEGA ★ HY-GAIN ★ G-WHIPS ★  
ATLAS ★ SPACEMARK ★ C.D.R. ★ MICROWAVE  
MODULES ★ ELECTRONIC DEVELOPMENTS ★ SOLID  
STATE MODULES ★ SHURE ★ AMTRON ★ BARLOW  
WADLEY ★ EAGLE ★ KATSUMI ★ JAYBEAM

Send for details and current price list. Due to high rate of postage SAE with all general enquiries please.

## ACCESSORIES

All prices include VAT at current prices

Single Meter SWR Bridge .. .. .	£8.60 Post 20p
Twin SWR meters .. .. .	£11.00 .. 20p
Osker SWR meter .. .. .	£22.68 .. 20p
Omega Noise Bridge TE-701 .. .. .	£22.50 .. 20p
Omega Noise Bridge TE-702 .. .. .	£30.00 .. 20p
Planet Speech Compressor .. .. .	£32.39 .. 30p
MF100 Audio Generator .. .. .	£22.00 .. 30p
Morse Practice Oscillators .. .. .	£3.50 .. 20p
SWL Tuning unit .. .. .	£14.00 .. 20p
Absorption wavemeter, 65-230 MHz ..	£16.00 .. 20p
Dipole "T" Pieces .. .. .	32p .. 20p
2 1/2" Plastic Insulators .. .. .	15p .. 20p
PL259 Plugs 45p SO239 Sockets, 40p; cable reducers 14p; 300 & 75 ohm twin feeder, 8p yard: UR43, 16p; UR67, 40p; Due to postal increases minimum postage charge 20p.	

## TERMS

We can offer on the spot Credit and HP terms. Part exchanges welcome. We are always in need of good secondhand equipment. If you require top price for your equipment we can sell it for you at a small commission. Full after sales service. All equipment is guaranteed air tested.

# P.M. ELECTRONIC SERVICES

TX AND RX CRYSTAL AVAILABILITY AND PRICE CHART  
PRICES: (a) £2.00 (b) £2.50  
AVAILABILITY: (a) Stock items, normally available by return (we have over 3,000 items in stock), (b) Four weeks normally but it is quite possible we could be able to supply from stock.

CRYSTAL FREQUENCY RANGE Use (Tx or Rx) and Holder	4 MHz-TX-HC6/U	6 MHz-TX-HC35/U	8 MHz-TX-HC6/U	10 MHz-TX-HC6/U	11 MHz-TX-HC6/U	14 MHz-TX-HC35/U	18 MHz-TX-HC35/U	36 MHz-TX-HC6/U	44 MHz-TX-HC35/U	48 MHz-TX-HC6/U	52 MHz-TX-HC35/U	72 MHz-TX-HC35/U
OUTPUT FREQUENCY	4 MHz-TX-HC6/U	6 MHz-TX-HC35/U	8 MHz-TX-HC6/U	10 MHz-TX-HC6/U	11 MHz-TX-HC6/U	14 MHz-TX-HC35/U	18 MHz-TX-HC35/U	36 MHz-TX-HC6/U	44 MHz-TX-HC35/U	48 MHz-TX-HC6/U	52 MHz-TX-HC35/U	72 MHz-TX-HC35/U
144-030	...	b	b	b	b	b	b	b	b	b	b	a
144-433.2	...	a	b	b	b	b	b	b	b	b	b	a
144-480	...	a	b	b	b	b	b	b	b	b	b	a
144-609	...	a	b	b	b	b	b	b	b	b	b	a
144-700	...	a	b	b	b	b	b	b	b	b	b	a
145-000	...	a	a	a	a	a	a	a	a	a	a	a
145-050 R2T	...	a	a	a	a	a	a	a	a	a	a	a
145-075 R3T	...	a	a	a	a	a	a	a	a	a	a	a
145-100 R4T	...	a	a	a	a	a	a	a	a	a	a	a
145-125 R5T	...	a	a	a	a	a	a	a	a	a	a	a
145-150 R6T	...	a	a	a	a	a	a	a	a	a	a	a
145-175 R7T	...	a	a	a	a	a	a	a	a	a	a	a
145-200 Rnet	...	a	a	a	a	a	a	a	a	a	a	a
145-300	...	b	b	b	b	b	b	b	b	b	b	b
145-350	...	b	b	b	b	b	b	b	b	b	b	b
145-400	...	b	b	b	b	b	b	b	b	b	b	b
145-500 S20	...	a	a	a	a	a	a	a	a	a	a	a
145-525 S21	...	a	a	a	a	a	a	a	a	a	a	a
145-550 S22	...	a	a	a	a	a	a	a	a	a	a	a
145-575 S23	...	a	a	a	a	a	a	a	a	a	a	a
145-600 S24	...	a	a	a	a	a	a	a	a	a	a	a
145-650 R2R	...	b	b	b	b	b	b	b	b	b	b	b
145-675 R3R	...	b	b	b	b	b	b	b	b	b	b	b
145-700 R4R	...	b	b	b	b	b	b	b	b	b	b	b
145-725 R5R	...	b	b	b	b	b	b	b	b	b	b	b
145-750 R6R	...	b	b	b	b	b	b	b	b	b	b	b
145-775 R7R	...	b	b	b	b	b	b	b	b	b	b	b
145-800 Rnet	...	b	b	b	b	b	b	b	b	b	b	b
145-950	...	a	a	a	a	a	a	a	a	a	a	a

## CRYSTALS FOR AMATEUR AND PROFESSIONAL USE

V.A.T. AS A RESULT OF THE BUDGET VAT AT THE RATE OF 25% MUST BE ADDED TO OUR PRICES WHICH ARE NOW SHOWN EXCLUSIVE OF VAT. HOWEVER WE ARE PLEASED TO ANNOUNCE THAT AS A RESULT OF A NEW AGREEMENT WITH OUR SUPPLIERS WE HAVE BROUGHT DOWN THE BASIC COST OF MANY OF OUR STOCK ITEMS.

N.B. Frequencies as listed above but in alternative types of holders are available at per code (b).  
ORDERING: All we require to know is (1) output frequency, (2) crystal frequency range and (3) the holder. It is not necessary to give the exact crystal frequency when ordering any of the above range.

## BURNS ELECTRONICS

We are pleased to announce we have been appointed Northern Stockist of BURNS ELECTRONICS kits, etc., and are able to supply most of their products from stock. We will also be representing them at many of this year's rallies.

## MARKER CRYSTALS

1 MHz and 5 MHz in HC6/U and 10-0 MHz and 10-7 MHz in HC6/U and HC25/U at £2.50 each.

AND PYE CAMBRIDGE (U10B) UHF CRYSTALS  
Crystals for the above equipments for use on 433.2 MHz (TX and RX) and for GB3PY are available at £4.00 per pair.

CONVERTER/TRANSMITTER CRYSTALS — HC18/U  
New low price—£1 at £2.80 each. 38-6666 MHz (144/28), 42 MHz (70/28), 58 MHz (144/28), 70 MHz (144/4), 71 MHz (144/2), 95 MHz (432/52), 96 MHz (1296/432/144) 101 MHz (432/28), 105-6666 MHz (1296 MHz (1296/28) and 116 MHz (144/28).

CRYSTAL SOCKETS—HC6/U AND HC25/U (Low loss)  
16p each plus 10p P. & F. per order (P. & F. free if ordered with crystals).  
CRYSTALS SPECIALLY MANUFACTURED FOR AMATEUR USE TO CUSTOMER REQUIREMENTS

In either code PE ( $\pm 0.003\%$  at ambient) or code ID ( $\pm 0.005\%$  0 to 60°C) in HC6/U 2-105 MHz and HC18/U and HC25/U 4-105 MHz all £2.80 each. Delivery usually about 4-5 weeks. Fundamentals (2-21 MHz) will be supplied to 30pf circuit conditions and overtone (21-105 MHz) will be supplied to series resonant conditions unless otherwise specified. For details of closer tolerance crystals please send S.A.E.

CRYSTALS TO COMMERCIAL SPECIFICATIONS  
We can supply crystals to most commercial and MIL specifications, with an express service for that urgent order. Please send S.A.E. for details or telephone between 4.30-7 p.m. and ask for Mr. Norcliffe. (Regret no phone enquiries May 26-June 23).

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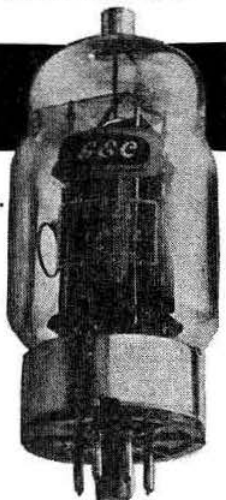
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3 pin DIN plugs, 4 for 50p.  
Din 3 pin Line Sockets, 15p each.  
Din 6 pin Right Angled Plugs, 20p each.  
Din Sockets 5 pin, 270 deg. 4 for 50p.  
Din Speaker Skts, 2 pin, 4 for 30p.  
I.F. Cans  $\frac{1}{2}$  in square, suitable for rewind, 6 for 30p.  
R/S Midget 3 pole, 4 way, rotary switches, 40p each.  
Miniature earphones with min. jack plug, 2 for 50p.  
1 Meg. lin pots  $\frac{1}{2}$  plastic spindle, 2 for 50p.  
50k ohm lin. pots,  $\frac{1}{2}$  plastic spindle, 40p each.  
Mixed electrolytic, large bag, £1.00.  
OC200 Transistors, 6 for 50p.  
BSY95A Transistor, 6 for 50p.  
PNP Audio Type TO5 Transistors, 12 for 25p.  
BFY51 Transistors, 4 for 60p.  
BYX 38/300 Stud Rectifiers, 300V at 2-5A, 4 for 60p.

**HIGH QUALITY SPEAKERS.**  $\frac{8}{16}$ "  $\times$  5" elliptical.  
2" deep, 4 ohms, Inverse magnet, rated up to 10W  
£1.50 each, or 2 for £2.75. (Quantity discount available.)

## ELECTROLYTIC CAPACITOR PACKS

47mfd at 6.3V, 5 for 25p. 33mfd at 25V, 5 for 40p.  
22mfd at 6.4V, 5 for 30p. 47mfd at 25V, 5 for 40p.  
100mfd at 6.3V, 5 for 35p. 100mfd at 25V, 5 for 45p.  
220mfd at 6.3V, 5 for 40p. 220mfd at 25V, 5 for 50p.  
330mfd at 6.3V, 5 for 40p. 330mfd at 25V, 5 for 75p.  
470mfd at 6.3V, 5 for 45p. 470mfd at 25V, 5 for 95p.  
3300mfd at 6.3V, 5 for 95p. 1000mfd at 25V, 5 for 95p.  
1mfd at 10V, 10 for 25p. 3.3mfd at 35V, 6 for 30p.  
33mfd at 10V, 5 for 30p. 10mfd at 35V, 5 for 40p.  
100mfd at 10V, 5 for 40p. 33mfd at 35V, 5 for 40p.  
220mfd at 10V, 5 for 40p. 47mfd at 35V, 5 for 45p.  
330mfd at 10V, 5 for 45p. 100mfd at 35V, 5 for 60p.  
470mfd at 10V, 5 for 60p. 220mfd at 35V, 5 for 75p.  
3300mfd at 10V, 5 for 95p. 330mfd at 35V, 5 for 95p.  
2.2mfd at 50V, 10 for 40p.  
33mfd at 16V, 5 for 35p. 22mfd at 50V, 5 for 40p.  
330mfd at 16V, 5 for 60p. 33mfd at 50V, 5 for 45p.  
1000mfd at 16V, 5 for 95p. 330mfd at 50V, 5 for 95p.  
64mfd at 65V, 5 for 65p.  
1mfd at 100V, 10 for 25p.  
0.0015mfd min. disc ceramics, 20 for 20p.  
390pf tantalum at 500V, 10 for 30p.  
Dubbiliter Electrolytics, 500uF, 450V, 2 for 50p.  
Dubbiliter Electrolytics, 100uF, 275V, 2 for 50p.  
Plessey Electrolytics, 470uF, 63V, 3 for 50p.  
TCC Electrolytics, 1000uF, 30V, 3 for 60p.  
Plessey Electrolytics, 1000uF, 180V, 40p each, (3 for £1.00).  
Dubbiliter Electrolytics, 5000mfd at 35V, 50p each.  
Dubbiliter Electrolytics, 5000uF, 50V, 60p each.  
Dubbiliter Electrolytics, 5000mfd at 70V, 65p each.  
ITT Electrolytics, 6800mfd at 25V, high grade, screw terminals, with mounting clips, 50p each.  
Plessey Electrolytics, 10,000mfd at 63V, 75p each.  
Plessey Cathodray Capacitors, 0.04uF at 12.5kV DC. Screw terminals, £1.50 each.

## ALL BELOW—ADD 8% VAT

### PLUGS & SOCKETS

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BNC Plugs. (Amphenol, new, packed). 35p each. (4 for £1.20).  
BNC Sockets. (4 hole chassis mounting, lead type) 35p each (4 for £1.20).  
Greenpar (GE30015) Chassis Lead Terminations (These are the units which bolt on to the chassis, the lead is secured by screw cap, and the inner of the coax passes through the chassis), 30p each, 4 for £1.00.  
PL259 Plugs (PTFE) Brand new 50p each, or 5 for £2.25.  
Reducers for above 15p each.  
SO239 Sockets (PTFE) Brand new, (4 hole fixing type) 50p each or 5 for £2.25.  
25-Way ISEP Plugs and Sockets 40p set (1 plug + 1 skt) Plugs and sockets sold separately at 25p each.  
Andrews 44AN Free Skts (N-type) for FH4/SOB or FH4/SOB cable £1.00 each.  
Bulgin Round Free Skts, 3 pin, for mains input on test equipment, etc. 25p each.  
SO239 Back To Back Sockets £1.25 each.  
BNC Insulated Sockets (single hole type) 65p each.  
Bulgin Flat 2 pin Flex Connectors. None, reversible. 40p each.  
Mains Lead and Socket, as used on Continental test equipment. New. 50p each.

### VALVES

QQVO3/10 (ex equipment) 75p each.  
2C39A (ex equipment) £1.00 each.  
QQVO2/6 (ex equipment) £1.00 each.  
4CX250 B (ex equipment) £2.10 each.  
4CX250B (ex equipment) £1.50 each.  
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150B2 Mullard 150V Reg. (Equiv. OA2) (new boxed) 40p.  
**VARIABLE STABILISED PSU**, solid state, 240V AC input, output 0-24V DC at 500mA + 32V at 50mA (approx.) Size  $\frac{1}{2}$ "  $\times$  4"  $\times$  2" (voltage controlled by external 5k ohm pot) (less 5k ohm pot) £5.00 each.  
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AS ABOVE, but 100-WATT (Ex-equipment) £3.00.

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TYPE 129 400V at 200mA, 200V at 10mA, 6-3V at 500mA, £1.25.  
TYPE 12703 400V at 10mA, 200V at 5mA, 6-3V at 400mA, £1.25.  
TYPE 70462 250-0-250V, 50-0-50V, 6-3V, £1.75.  
TYPE 125BS approx. 125V at 30mA, 65p.  
**HELLERMANN LUBRICANT GRADE C**. The ideal lubricant for all rubber goods, Good electrical insulator. 75p per bottle.

## ALL BELOW—ADD 8% VAT

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Bandpass filters 27-5-30MHz, RT type, 50p each.  
Arrow 10A, 250V black plastic rocker switches, 4 for 50p.  
16-DIC IC Sockets, 4 for 50p.  
Miniature microswitches, with roller spring, 2 for 50p.  
Eddystone 3140P black knobs,  $\frac{1}{2}$ " dia., 25p each.  
Lead suppressors (10 k ohm) for mobile plug leads, 4 for 50p.  
Mixed washers, per pack 15p.  
5A Mains circuit breakers, 75p each.  
Hash filters (for mobile supply leads), 2 for 40p.  
Heavy duty 15-way turret tag-strips, 5 for 30p.  
Speed nuts, per pack, 20p.  
Black Plastic Knobs,  $\frac{1}{2}$ " dia.,  $\frac{1}{2}$ " in. spindle, 4 for 50p.  
Ring Magnets, 7mm inside dia., 20 for 50p.  
Ferrite coils on  $\frac{1}{2}$ " dia. ferrite rings, 3 for 50p.  
Heatsinks (Approx. 3  $\times$  4  $\times$  2" high), 12 fins (drilled for 1  $\times$  TO3 transistor) Brand new 45p each.  
VHF RF chokes (wound on 22k  $\frac{1}{2}$ W Resistors), 5 for 35p.  
Small Chrome handles  $\frac{1}{2}$ " dia., 11" between holes. 1" clearance, tapped 4BA (with screws & washers) 2 pair for 40p.  
Relays, single pole, Change over, 12V DC, approx.  $\frac{1}{2}$ "  $\times$  1"  $\times$  1" 35p each.  
**AT LAST WE HAVE A STOCK OF THE TRIMMERS YOU'VE ALL BEEN ASKING FOR!**  
2-6pF, 10mm circular ceramic trimmers (for VHF/UHF work), 3 pin mounting, 5 for 50p.  
**CERAMIC HIGH VOLTAGE PILLARS**, (metal ends, tapped 4BA) approx. 1" long, 10 for 60p.  
Colls on  $\frac{1}{2}$ " dia.  $\frac{1}{2}$ " long paxolin formers, 5 for 20p.  
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3 pin min. mains plug and socket, 40p set.  
Springs, 1" long  $\times$   $\frac{1}{2}$ " dia., per pack, 25p.  
LF chokes on  $\frac{1}{2}$ "  $\times$  2" cores, 5 for 20p.  
TO3 transistor insulator sets, 10 for 50p.  
PC Board Withdrawal Handles, mixed cols 8 for 50p.  
Solder, 20SWG, 60/40 alloy, approx. 9yds 25p.  
Perspex Coil Formers,  $\frac{1}{2}$ "  $\times$  1" dia, 5 for 25p.  
Turret Tags,  $\frac{1}{2}$ " in. dia., 25p pack.  
Rotary Switches, min. 4 pole 2 way, 2 for 50p.  
Telephone Type Earpiece Insert, 50p.  
Reeds (for reed relays) Single-pole make, 5 for 30p.  
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ICs, some coded, 14DIL type, untested, mixed, 20 for 25p.  
24V Min. Reed Relays, encapsulated single-pole make, 2 for 50p.  
Chassis Tags, 25p pack.  
Cable Clips, for nailing cable, 15p pack.  
Miniature Slider Switches, 2 pole, 2 way, 5 for 50p.  
Rotary Switches 9 way 4 pole (separate wafers, ceramic)  $\frac{1}{2}$ " spindle, 40p each.  
11" Polythene chassis mounting fuseholders, 6 for 30p.  
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Multiturn Pots, 10 turn,  $\frac{1}{2}$ " spindle, (ex-equip), following values available, 2k ohm, 5k ohm, 400k ohm, £1.00 each.  
**MOBILE CONVERTERS**, 24V DC, input 13-8V at approx. 3-4A DC output, fully stabilised, £3.50 each.  
**SIFAM 100mA METERS**. Black rectangular type 24,  $\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " (Modern Pye type) marked 0-50, 0-100 0-150, 0-750, all on one scale (supplied separately) with scale £2.75.  
As above, but 50mA,  $\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " with scales fitted, £5.00 each.  
**Pkts of 2BA NUTS** (The self-locking ones with the nylon insert) 100 for 50p.  
**SPECIAL OFFER WHILE STOCKS LAST**  
**SILVER ZINC RECHARGEABLE BATTERIES**, 12V, 1600mA/Hours  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " (as used in ITT TXR's). Type ST12B160, Brand new, £1.75 each, 2 for £3.00.



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*journal of the Radio Society of Great Britain*

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**ELECTRONIQUES SLOW MOTION DIALS** type SMD2 MK3, 6-1 and 36-1 reduction with clear moulded front size 6 1/2" x 4" supplied with two pointers and spare scale, ideal for VFOs, receivers etc. £3.75 each.

**400mW NEWMARKET AMPLIFIERS** type PC2 15 ohm Imp output input 1k ohm new boxed £1.50.

**EDGEWISE METERS** 100 microamp FSD display area 1 1/2" x 1 1/2", depth from mounting flange 1 1/2", scale calibrated 0-100, made by Ernest Turner and not to be confused with cheap tuning meters new boxed bargain at £2.60.

**18pF MULLARD TUBULAR TRIMMERS** 12p each, 6 for 60p, 10 for 85p.

**CERAMIC TRIMMERS**, 1/8" dia. two types available 2-8pF and 4-20pF, 10-40pF, 6p each

**CERAMIC TRIMMER** 1/8" dia. 7-35pF 6p each.

**MULLARD SEMI AIRSPACED TRIMMERS** 1-4-5-5pF, 2-10pF and 2-22pF, all at 8p each.

**MULLARD FILM DIELECTRIC TRIMMER** 7-100pF 7/16" x 1/8" 20p each. (P.C. mounting).

**MINIATURE OXLEY AIR SPACED TRIMMERS** 1-10pF 1/8" sq. 18p each 10 for £1.40.

**MINIATURE SPLIT STATOR TYPE TRIMMERS** 1/8" x 1/8" base 10pF per section 35p.

**700 MFD 200 vW Electrolytics** ideal to put in series for linear PSU etc, new recent manufacture £1.65 pten p/p 30p pten.

**JACKSON 3 gang 500pF TUNING CAPACITORS** 75p each.

**RCA VHF/UHF POWER TRANSISTOR** marked 61387 this is a selected version of an RCA 40941, 1 watt output at 400MHz (10dB gain) with 28 volts on collector. 1 watt output at 175MHz (17dB gain), OK for 70cm capstan type construction. £1.50 each.

**RCA VHF/UHF POWER TRANSISTOR** marked 61389 this is a selected version of a RCA 2N5914, 2 watt output at 470MHz (7dB gain) with 12 volts on collector, requires 0.4 watt drive for full output, 1 watt of drive will give 5 watts RF output at 145MHz. £2.00 each, capstan type construction.

**BLV36 RF VHF power transistors** 12v DC 13 watts RF output at 175MHz for 4 watts drive with copy of circuit £2.57 each brand new unused.

**BA111 VARICAP DIODES** 23p each.

**HP 5082-2800 HOT CARRIER DIODES** ideal for UHF/VHF mixer etc. 60p each or 4 for £2.00.

**ORP61 photoconductive cells**, brand new, Mullard, 35p each.

**PYE BOOT MOUNT RANGER** control boxes less cable and microphone, used condition, £1.00 each. Post 50p.

**PYE MICROPHONES** oval type, used but good condition, £3.00.

**MONSANTO L.E.D. TYPE MAN.1**, as used in digital clocks etc. these are ex-new equipment and supplied with data sheet, operating voltage 6 volts at 30 mA set of four £3.50, additional displays, 90p each.

**MINIATURE OXLEY P.T.F.E. F/T INSULATORS** "drill 3/32" hole & push in," 50 for 75p.

**FERRITE RINGS** 9/16" dia. 7/16" internal dia. x 3/16" thick 10p each.

**FIBREGLASS P.C. BOARD** one size only 8" x 5" 1/16" thick, single sided 40p, double sided 45p.

**F30AM PYE** high band base station & MF5AM mobile complete with crystals £325.00. Prefer buyer to collect.

We hold a large stock of ITT STARPHONE spares P.C. Boards, Coils etc. send us your wants, we may be able to help. S.A.E. please.

**SILVER ZINC RECHARGEABLE BATTERY** type ST12B160 to suit the ITT SF1 UHF portable Starphone. 160 mA/h 12 volt new price £2.00 each, 2 for £3.75.

**CHARGER UNIT** to hold one of the above batteries requires approx 28 volts D.C. at 40 mA. £2.25.

**MINIATURE S.P.C.O. TOGGLE SWITCH** 1/8" dia x 1/8" long ex-new equipment 40p each, two for 75p.

## 59 Waverley Road, The Kent, Rugby, Warwickshire.