May 1977

radio communication

journal of the Radio Society of Great Britain

17 May 1977

Telecommunication and development

International Telecommunication Union

World Telecommunication Day

TRIO TS-700G

IT'S THE BEST—FORGET THE REST

AND NOW AT A LOWER PRICE

Specification

FREQUENCY RANGE 144-146MHz
MODES—USB, LSB, FM, CW. AM
RF OUTPUT—More than 15w FM 30w ssb input power
ANTENNA IMPEDANCE—50Ω co-axial
CARRIER SUPPRESSION—Better than 40dB
SIDEBAND SUPPRESSION—Better than 40dB
MAXIMUM DEVIATION— ± 5kHz
REPEATER SHIFT— ± 600kHz
TONE BURST—Automatic 1750Hz
MICROPHONE—Dynamic 500Ω
AF RESPONSE—Speech optimised 400-2600Hz

RECEIVER—Ssb, CW, AM, Single conversion
FM, double conversion
INTERMEDIATE FREQUENCIES—10·7MHz, 455kHz
SENSITIVITY—SSB/CW, better than 10dB S/N at 0·25 microvolts
FM, better than 20dB as at 0·4 microvolts
IF SHAPE FACTOR—Better than 2:1 all modes
AUDIO OUTPUT—More than 2w in 8Ω
STABILITY—Within 150Hz in any 30 minutes after warm up
POWER SUPPLY—120-240 Vac or 12Vdc. All supplies built in
DIMENSIONS—278 × 124 × 320mm
WEIGHT—11Kg

BONUS DEAL

TS-700G PRICE NOW INCLUDES **FREE** MATCHING VOX-3 WITH EVERY RIG

LOW LOWE PRICE

£392.00

INC. VAT @ 12½%

Sole Importers
LOWE ELECTRONICS
119 Cavendish Road
Matlock Derbyshire
Tel: Matlock 2817/2430

ELECTRICKERY

If you are considering the purchase of a multi mode VHF rig, consider the facts that the TS700G is so outstanding in all respects that it is being used as the centre building block for extended station facilities by many radio amateurs and designers. Typical Magic Boxes for doing just this are shown below.

Magic box No. 1 is the Microwave Modules MMT 432/144 linear transverter. By using this in conjunction with your TS700 or 700G, you have all their excellence and facilities duplicated on 70cm transmit and receive. 10 Watts output and a high performance receiver in the MMT 432/144 give you top two band performance at modest cost. The transverter is available direct from us and is normally in stock at all times.

Magic box No. 2 is the Datong Electronics UC/1 up-converter. This amazing black (actually grey) box turns your TS700 or 700G into a fully synthesised HF receiver having continuous coverage from 90kHz to 30MHz in thirty 1MHz bands. All the receive facilities of the TS700G are available—AM for the broadcast stations and aircraft, shipping, etc., LSB and USB for the SSB activity on all the amateur bands from 160 to 10 metres, or RTTY in conjunction with Magic box No. 3.

Pin point tuning accuracy is guaranteed by the TS700G 1kHz readout and easy to read dial. Truly an excellent station addition for the VHF amateur. The UC/1 is available only from Datong Electronics.

Magic box No. 3 is the TD224/DM170 RTTY combination. This all seeing eye used in conjunction with the TS700G and the UC/1 turns those jingle bells into a TV display and adds a further interest to your amateur radio activity. There is a surprising amount of RTTY activity on the amateur bands but the average amateur (and his wife) have been put off the mode by the need to use a clanking noisy teleprinter as the readout device. The TD224 ends all that by converting the RTTY signal into an easily read display on a TV screen. (Any UHF TV set can be used). Full details of the system are available from us, as are the units themselves. Better still, why not visit us and see the whole system in operation; it really seems like Ye Olde Magicke at work. If you promise not to tell anyone, you can see tomorrow's news as well. . . .

ISSN 0033-7803

RSGB NEWS BULLETIN SERVICE

The RSGB news bulletin, callsign GB2RS, is broadcast every Sunday morning on hf and vhf, giving almost complete coverage of the British Isles. Its main purpose is to provide an outlet for amateur radio news items and announcements which, by virtue of their topicality or urgency, cannot wait for the next issue of *Radio Communication*.

The bulletin is prepared early on Thursday morning, and news items, marked "GB2RS news" should reach RSGB HQ by first post that day (telephoned items can also be accepted until 10am). No guarantee can be given of inclusion in part or whole of any item submitted and, once broadcast, items are not usually repeated.

SCHEDULE

Time	MHz	Location and coverage (hf) or beam heading (vhf) of station
0930	3·65	G2MI, Bromley, Kent (SE England)
1000	3·65	G8ML, Cheltenham (SW England)
	144·50	GM3UAG, Ellon, Aberdeenshire (NNW)
	144·50	G8GGK, Croydon, Surrey (NE)
1015	3·65	GI3GAL, Belfast (N Ireland)
	144·50	GI3TLT, Bangor, Co Down (N)
1030	3·65	G2CVV, Derby (N Midlands)
	144·50	G4DCH, Burnham-on-Sea (NW)
	144·50	GM3UAG, Ellon, Aberdeenshire (SW)
	144·50	G3PWJ, Brierley Hill (NW)
1045	144·50	G8CDP, Middlesbrough (NW)
	144·50	G8GGK, Croydon, Surrey (SW)
	144·50	G8BHQ, Stockport (NNW)
1100	3·65	G5VO, Bridlington (NE England)
1115	3·65	G3LEQ, Knutsford (NW England)
1130	3·65	GM3TCW, Wishaw, Lanarkshire (S Scotland)
1145	3·65	GM3HGA, Aberdeen (NE Scotland)

An rtty news bulletin, callsign GB2ATG, is also transmitted every Sunday at 1200 on 3·590MHz and at 1230 and 1245 on 144·6MHz. This bulletin carries items of interest to rtty enthusiasts.

radio communication

May 1977 Volume 53 No 5

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Radio Communication **is published by The Radio Society of Great Britain as its official journal on the first Thursday of each month and is sent free and post paid to all members of the Society**

ABC
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Contributions and all correspondence concerning the **content** of *Radio Communication* should be addressed to: The Editor, *Radio Communication*, 35 Doughty Street, London WC1N 2AE. Tel 01-837 8688. (**Circulation** queries should be addressed to: The Subscriptions Department, RSGB).

Closing date for contributions unless otherwise notified: 4th of month preceding month of publication.

Advertising, other than Members' Ads, should be sent to the above address marked for the attention of Mr C. C. Lindsay. Tel 01-686 5839 (ADVERTISING ONLY).

LOWE ELECTRONICS LTD

PRICE LIST, MAY 1977

	Price incl. VAT £	Carr. £
TRIO EQUIPMENT		
TS820 HF transceiver	625.00	3.00
VF0820 external VFO	108.00	3.00
DG1 digital readout	126.00	3.00
DS1 12V inverter	40.50	.70
YG88 CW filter	36.00	.25
TS520 transceiver 12V dc/240V ac	432.00	3.00
SP520 matching loudspeaker	18.00	.70
VF0520 external VFO	72.00	3.00
TV502 matching 2m transverter	171.00	3.00
CW520 CW filter	36.00	.25
TS700G 2m all mode transceiver*	392.62	3.00
VOX-3 matching VOX unit (free with TS700G)	19.80	.85
TR7200G 10W car transceiver with 10-channels* ~~193.50~~ on offer at	175.00	3.00
VF030G remote VFO with repeater shift	90.00	3.00
PS5 mains power supply/digital clock	58.50	3.00
TR7400A 25W digital FM transceiver	299.25	3.00
TR2200GX 2m (3 ch. fitted)	130.00	3.00
12 ch. fitted	160.00	3.00
VB2200GX 10W amplifier	45.00	.70
Ni-cad battery pack	9.72	.36
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T599S de-luxe transmitter	369.00	3.00
SP599 (to match early JR599)	10.00	.70
R300 general coverage receiver	184.50	3.00
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HC-2 ham clock	13.50	.55
MC10 hand microphone	9.00	.25
MC50 table microphone	23.00	.70
LF30A low pass filter	15.75	.57
BPF2A 2m band pass filter	27.00	.57
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Ni-cad battery pack	9.72	.36
MB1 mobile mounting bracket for TR2200GX/TR7200G/TR3200	9.45	.56
NIHON DENGYO		
Belcom 70A, FM, SSB, CW, AM for 70cm	to be announced	
Liner 430 70cm SSB transceiver	290.25	3.00
R115E regulated psu for Liner 430	31.50	3.00
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UNIDEN EQUIPMENT		
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8010 external VFO	106.87	3.00
8120 matching speaker	31.50	.70
2030 2m mobile 10W FM		
fitted 1 channel	140.62	3.00
fitted 3 channels	148.50	3.00
fitted 5 channels	156.37	3.00
fitted 8 channels	167.62	3.00
fitted 11 channels	178.87	3.00
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TD224 display unit	209.25	3.00
DM170 terminal unit with UHF mod.	105.30	3.00
UHF mod. battery powered	16.87	.25

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We stock FM channels S0, S16 to S24, S32 (145.80) and all current repeater and reverse repeater channels for the equipment we sell.

	Price incl. VAT £	Carr. £
Price per single crystal	2.40	.15
Price per pair	4.80	.15
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NEW AMR217B scanner with 8 crystals	106.87	.85
Seiwa MR-2 monitor less crystals	63.00	.57
Seiwa MS-2 scanner less crystals	67.50	.75
Crystals for the above—each	2.70	.15
VHF AMATEUR RECEIVERS		
NR-56 tunable/crystal 2m FM receiver	54.00	.70
Seiwa MR-2 less crystals	63.00	.57
Seiwa MS-2 scanner less crystals	67.50	.57
NEW AMR217B scanner with 8 channels	106.87	.85
Crystals for the above—each	2.40	.15
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MMC432/144 70cm converter	24.75	
MMC1296/28 23cm converter	28.12	
MMC1296/144 23cm converter	28.12	
MMV432 70cm tripler	19.80	
MMV1296 23cm tripler	33.75	
MMD050 50MHz counter	66.96	
MMD500P 500MHz prescaler	27.00	
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Shinwa 1110 2m band pass filter	13.72	.57
Shinwa 1006 2m low pass filter	11.48	.57
Shinwa 1140 28MHz transverter filter	13.72	.57
Shinwa 1005 H.F. low pass filter	10.80	.57
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10XY/2M	23.96	3.00
Q4/2M	14.85	3.00
Q6/2M	19.80	3.00
D5/2M	12.37	3.00
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XD/2M	8.94	3.00
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MBM48/70cm	19.68	3.00
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12XY/70cm	27.00	3.00
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PMH2/70 for 70cm	5.34	.57
PMH4/70 for 70cm	11.13	.57

LOWE ELECTRONICS LTD

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Twin feeder 300 ohm	.08	
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Please add VAT at 8% to cable prices		
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CL-65 ATU	54.00	3.00
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CS-201 coax switch (SO239 sockets)	11.25	.36
CS-201N coax switch (N type sockets)	15.75	.36
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Daiwa		
SWX-777 In line power/swr meter. 1·8-30MHz Up to 1kW FSD	110.16	.85
SW410 In line power/swr meter. 140-450 MHz. Up to 120W FSD	48.60	.70
SW110 In line power/swr meter. 1·8-150 MHz. Up to 200W FSD	25.92	.70
Hansen		
PM2000 In line peak reading power meter. 3·5-30MHz. Up to 2kW FSD	48.60	.70
FS301 In line power/swr meter. 1·5-30MHz. Up to 1kW FSD	32.00	.70
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SWR-3 In line single meter SWR bridge. 1·8-150MHz	9.50	.57
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6AH6, 6CB6A, 6CL6, 6U8A, 6BM8, 12BY7A, 6EW6 each	.90	.25
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6JS6C, 6KD6 per matched pair	6.03	.36
6LQ6 per matched pair	7.02	.36
6146B/S2001 each	6.30	.36

PLEASE ADDRESS ALL MAIL ORDERS TO MATLOCK

LOWE ELECTRONICS LTD

HEAD OFFICE AND SERVICE DEPARTMENT

119 CAVENDISH ROAD, MATLOCK, DERBYSHIRE DE4 3HE

Telephone: 9 a.m. to 9 p.m. Matlock (0629) 2817 or 2430.
Telex: 377482 Lowelec, Matlock.

Southern Sales Peter, G3ZPB, Communications House, 20 Wallington Square, Wallington, Surrey. Tel. 01 669 6700.

Midland Sales Peter, G3XWX, Soho House, 362-364 Soho Road, Handsworth, Birmingham. Tel. 021 554 0708.

Northern Sales Tom, G4DVZ, 27 Cookridge Street, Leeds. Tel. 0532 452657.

In addition to the above shops which are open from 9 to 5.30 Tuesday to Saturday (Wallington shop closed Saturday afternoon) we have part-time agents who are available at evenings and weekends:

John, G3JYG 16 Harvard Road, Ringmer, Lewes, Sussex. Tel. Ringmer 812071.

Sim, GM3SAN 19 Ellismuir Road, Baillieston, Nr. Glasgow. Tel. 041 771 0364.

Alan, GW3YSA 35 Pen Y Waun, Efail Isaf, Nr. Pontypridd, Glamorgan. Tel. Newtown Llantwit 3809.

So, wherever you are, we have a branch or part-time agent not too far away. At Matlock, the branches, or our agents you will see and can try out the very best in new and secondhand HF or VHF equipment, together with every conceivable aid or accessory for the complete station.

With new products coming along all the time, it is difficult to keep a price list up to date. If you send 50p in stamps, you will receive all current brochures, catalogues, prices. and the antenna booklet that everyone is talking about.

South Midlands Communications Ltd.
TOTTON, SOUTHAMPTON

YAESU MUSEN
2 YEAR GUARANTEE
'24 HOUR' SECURICOR SERVICE

On these pages we make a few suggestions on equipment that you may find suitable for setting up or maintaining a H.F. station. Items detailed give an idea of the tremendous range offered by Yaesu Musen for the discerning radio amateur, and brought to you, with a two year guarantee, and a technical back-up service second to none, by S.M.C.

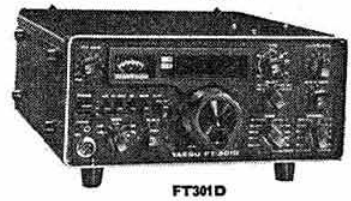
The FT101E a complete mains or 12v. DC station contained in a compact 30 lb. package, 260W, PIP of SSB (with in-built RF speech processor) 180W, CW and 80W or AM 10 to 160m (inc. 10 MHz RX). The sensitive and selective (permeability tuned RF stages and 8 pole crystal filter) receiver offers: threshold adjustable noise blanker, switchable 25 and 100 kHz calibrator, ± 5k clarifier (with separate on/off switch), etc., etc.

The VFO is stable and linear (readout to 1 kHz), external VFO or crystal control can be selected, with LED indicators illuminated accordingly. Carrier level is adjustable for: tune up, AM and for CW operation, whose performance with the semi break-in keying, with side tone, and the optional 600 Hz filter installed is of high order. Linear and transverter provisions are made with sockets for: relay contacts, ALC output, all internal HT supplies, low level RF, heater links and switches, etc., etc.

FT101E

● ***Over 200,000 FT101's are in use around the world !*** ●

The new FT301 transceiver range (with options installed) offers: Full solid state 12v. DC working external matching mains power supplies with speaker, and an external VFO are available. Plug in board construction, 160–10m operation in 500 kHz segments, MSF and CB receive, RF speech processor, noise blanker, front-panel controlled VOX (with M.O.X.) and PPT, semi break-in keying with side tone, clarifier with separate ON/OFF switch, 11" × 5" × 13¾", 25 kHz crystal calibrator, internal VFO or 11 crystal per band (or external VFO with same facility) 3W audio.



FT301D

FP200 FT200

The FT200B. The "Best Buy"—260W PIP (A3j, A1) 75W (A3), 80 to 10m. (28·5–29 MHz, 3 other crystals optional). Sensitive and selective 2·3 kHz at 6 dB (1·75 : 1SF). Solid state, stable, linear (readout to 1 kHz), gear driven VFO, 100 kHz calibrator. VOX/PPT, clarifier (±5 kHz). Semi break-in CW with sidetone, etc., etc. The pre mix oscillator system used, yields: low spurii outputs on transmit, and the good signal handling and low noise capability of a single conversion superhet (whilst retaining a 9 MHz 1F with high image rejection) and single range VFO stability.

FL2100B SP101 FR101 FP101

The FR101D (de luxe) wide coverage (23 (from 1·5 MHz), 500 kHz bands + 4 and 2 metres) receiver. Analysis of the signal path shows: —0-20dB switchable attenuator, two section permeability tuned input filter, Mosfet R.F. stage and mixer (crystal controlled), 3 section top coupled band pass filter, no gain at first I.F., IC balanced mixer, 20 kHz wide crystal filter, shunt diode noise blanker, single FET buffer stage, AM, CW or SSB (RTTY) filter, appropriate detector and audio stage. Add to this, two excellent VHF converters, squelch, FM detector, 1 kHz readout, excellent stability, Tx monitor control, crystal control facility, switchable AGC, transceive capability (FT or FL 101) and that digital readout options are available of this (de luxe), or the standard (less the plug in optional converters, broadcast band crystals, filters, etc.) version.
The FL101 transmitter is the ideal companion to the FR101 forming a superb base station. Operation 160 to 10m (+ two auxiliary bands) using SSB, AM, CW or FSK at 260W, PIP, and if desired the optional RF processor.
The FL2100B operates 80 through to 10m using two rugged 572B carbon anode valves in class B grounded grid, individual tuned input coils for each band and bifilar wound ferrite filament chokes are employed.

It is with deep humility that I express my gratitude to Mr Lowe for not overlooking my contributions in pioneering the leaky feeder underground antenna system. Over a glass of tawny the project was laid in the lee of the noted charity Submarine Communications, which was launched in 1959, went West in '70, returned fire to the infamous privateer Mat Lock, survived foundering in '74 (with rodents scattering hither and thither) and then successfully unloaded the project. This was destined for financial exploitation and as a reference source for their antenna gain measurements (viz. Blowe standard aerials). To improve the system even further Blowe Ground Communications synthesised the image earth concept by using an elevated Trio of copper/zinc alloy spheres. Quantities of matured globes and information on allied subjects should be made direct to the Oriental Emporium, Bi Lo Electronics, 119 Cavendish Road, Matlock, Derbyshire.

SOUTH MIDLANDS COMMUNICATIONS LTD.

OSBORNE ROAD, TOTTON
SOUTHAMPTON, SO4 4DN

Hours of business: 9-5.30; 9-12.30 Saturday

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EVENINGS — AGENTS — QTHR

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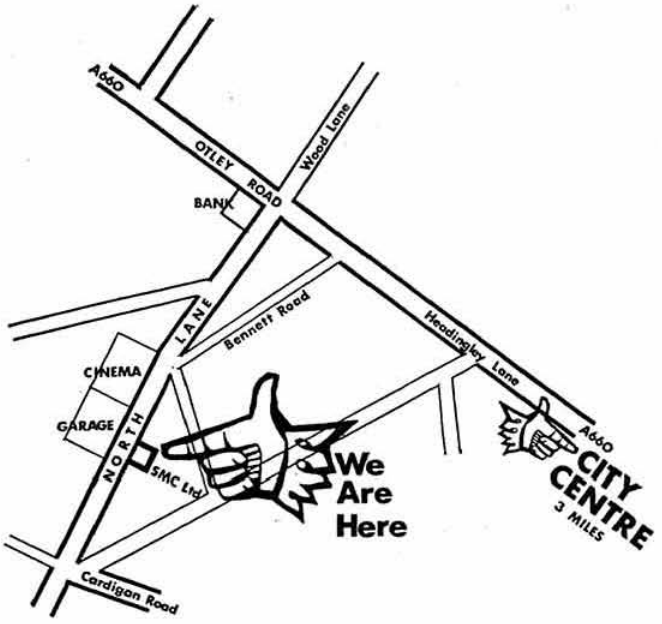
South Midlands Communications Ltd.
THE LEEDS BRANCH



How to find us

If in Leeds City centre, follow signs to "Headingley" or "University", past University on left, over tree-lined Woodhouse Moor, into Headingley. Turn left at third set of traffic lights (well spaced, some pedestrian operated). Into north lane. See map.
If approaching Leeds on M1, leave m/way at "Holbeck & City Centre" sign. Then as above. If approaching Leeds from west, join M62 or M621 then onto M1 as above.
From the north, join Leeds ring road (A6120) then join A660 at West Park roundabout and straight into Headingley.

STOCK. If something you require is not in stock in Leeds, it may be at another branch; please enquire.

EQUIPMENT DEMONSTRATED AT CLUBS
Secretaries are invited to apply.

LARGE RANGE OF SMC STOCK LINES ALWAYS AVAILABLE. MOST YAESU MUSEN MODELS ON DISPLAY

NEW LEEDS REPAIR SERVICE
For any amateur equipment. Come and have a chat with our service engineer, Richard Ginn, BSc.

HY GAIN HF RANGE (Carr. £1.00-£2.50) VAT 12½%

The most common approach to the H.F. band beam is the compromise one of a Tribander. The TH3 range being particularly recommended. A more elaborate multi-bander is the mighty TH6DXX which overcomes by a total of 6 elements problems of non-constant spacing. Optimum back to front and gain is offered only by the mono-banders. A 203BA with 4 elements on 20 metres provides a big signal.
Many stations are restricted by space, planners, finance or a temporary location. The 18AVT vertical offers coverage 10-80m. with a single slender 25' self supporting radiator. It is probably the most popular single antenna of its type on sale today.
For greater power handling elimination of traps ultra low radiation angle for good DX without the use of a rotator, the Hy-Tower standing to a total of 50', entirely self-supporting (occupying only 4 sq. ft. of land) is strongly recommended.

BN86 1 : 1 ferrite Balun	£12.00	TH2MKIII 10-20m. 2 ele.	£94.00
103BA 10m. 3 element	£43.50	TH3INR 10-20m. 3 ele	£96.00
153BA 15m. 3 element	£54.50	TH3MKIII 10-20m. 3 ele.	£137.00
203BA 20m. 4 element	£103.40	TH6DXX 10-20m. 6 ele.	£164.50
402BA 40m. 2 element	£146.00	HY QUAD 10-20m. 2 ele.	£151.80
18V 10-80 Load Vert.	£24.50	DR1015A 10-15m. 3 ele.	£99.00
12AVQ 10-20m. Trap Vert.	£33.50	LA1 Lightning arrestor gas	£20.30
14AVQ 10-40m. Trap Vert.	£47.50	LA2 Lightning arrestor	£3.30
18AVT/WB 10-80m. Vert.	£64.50	HY TOWER Vert.	£162.80

CABLES RF FEEDERS (Carriage extra) VAT 8%

Feeders are the point where amateurs often falsely economise. For mobile use, a cable with a stranded centre (UR76) etc.), for fixed a long unsupported run without a cattenary, or allowing the cable to slap against the mast are taboo, breakages of the centre conductor will arise with disastrous results.
If you are using a 3/16 cable changing to ¼ can be the most cost effective improvement.

UR67 50 ohm Heavy	36p yd	UR39 75 ohm Medium	24p yd
UR57 75 ohm Heavy	42p yd	T3278 75 ohm Distribution	20p yd
75 ohm Flat Twin	10p yd	UR43 50 ohm Solid Cent.	16p yd
300 ohm ribbon	12p yd	UR76 50 ohm Strand Cent.	16p yd

SMC TRAPPED DIPOLES (Post 45p) VAT 12½%

For those with limited space, or restricted interests the SMC trap dipole offers coverage of 10-80 (160)M in 108ft. Suspended as a "V" from the tower excellent results on 80 and 40m are obtained.

S 500W P.I.P. 14 SWG	£19.60	P500W P.I.P. Cu/Terylene	
HP IK P.I.P. 14 SWG	£21.75	braid c/w 75' feeder, etc.	£21.75

MOSLEY TRI-BAND BEAMS (Carriage £2.50) VAT 12½%

Ever popular for HF bands are Triband (10-15-20M) beams such as the TA33 (or for higher powers the Mustang) providing DX potential from the typical urban environment.

TA33 3 ele. 200W R.M.S.	£70.00	TA32 2 ele. 300W. A.M.	£49.00
MUSTANG 3 ele.	£90.00	MUSTANG 2 ele. 1kW	T.B.A.

GEM QUAD FIBREGLASS QUAD (Carriage £2.50) VAT 12½%

The advantages gained by boomless quad construction are not only mechanical. By the provision of optimum element spacing, on all bands covered, back o front and forward gain are optimised.

GQ3E 2 element	£119.00	GQ4E 4 element	£238.00
GQ3E 3 element	£178.00	CKIQ 1 ele. Conv. kit	£66.00

COAX PLUGS (p & p extra) VAT 8%

Whilst it is undoubtedly true that the UHF, PL259 range leave much to be desired over 200MHz, their mechanical performance is excellent. We offer plugs in standard or P.T.F.E. insulation for ¼" (with reducers for) smaller cables, adaptors and converters. For the discerning BNC, N and C types are stocked. For accessory connections we hold from stock phonoplugs, plastic or metal barrelled, jack plugs. ¼" stereo or mono, mic. plugs, power plugs, (for the Yaesu range), and a wide collection of similar ancillaries.

PL259 Standard UHF plug	£0.48	258 Back to back (female)	£0.80
UHF fixed reducer	£0.56	"T" adaptor (2F + 1M)	£1.20
"Solderless" UHF RG8U	£0.51	Right angle (1M + 1F)	£0.90
"Solderless" UHF UR43	£0.51	Phono/car to SO239	£0.55
UG** Reducers state UR43 or 70		SO239 2-hole socket	£0.37

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Access

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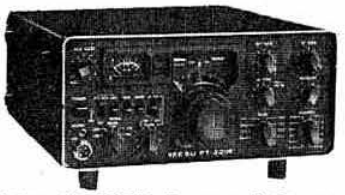
YAESU



FT221R—NOW COSTS LESS!

FT221R—NOW costs less, we have beaten inflation and can offer at lower prices than last year. As an added bonus all new SMC supplied FT221Rs cover 4MHz and are equipped with 600kHz and 1·6MHz shifts.

YAESU'S state of the art, fully modular, plug in board, multimode, 2m transceiver renders over the boards "rats nest" wiring obsolete. A 134 MHz, VCO, automatic varicap tuning of transmitter and receiver, gives you an exceedingly clean signal, sensitive receiver combined with good strong signal handling.

The SMC73 General Coverage Receiver

The SMC73 is an all Solid State, Mains and 12V, communications receiver covering 550kHz to 30MHz in four overlapping ranges. Frequency readout is by two illuminated dials tuned by coaxial spun aluminium knobs, the larger for general coverage, the inner for amateur band (10-80m) band spread (set by use of internal 3·5MHz crystal calibrator).

FET's are employed in the R.F. Amplifier, mixer, VFO and BFO (these latter two stages being fed from independent stabilised supplies) ensuring sensitivity, stability (electrical and mechanical) dynamic range, (helped by adjustable RF attenuator), and marked freedom from "pulling" of both the local and beat frequency oscillators.
An internal loudspeaker (but with jacks for 'phones and external speaker), illuminated signal meter, SO239 (UHF) coax, socket and binding posts for antenna, switchable envelope (A.M.) and product detectors (SSB/CW) (provision on switch for possible fitting of FM demodulator), are all features of this exciting new low price receiver.

SMC73 Ex-stock, only £114.50 + VAT

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From Ten, Six or Two Metres (a '101 etc, a '620B or a '221R).

10W output, balanced Tx mixers, low spurious content, high sensitivity with dynamic range.
Full converter range stocked. S.A.E. details).
(VAT + 12½%)

MMT144/28 or 50	2 metres	£79.00
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MMT432/144	Double conversion	£133.00

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Analog clock with automatic advancing 24 hour time zone hour disc giving, at a glance, time in principal cities or time zone. Battery powered, self starting, shock resistant.

QTR24 only **£13.00** (VAT +8%) p & p 30p

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2 metre, SSB/CW/FM, RF sensing with manual override, "Microstripline" techniques
12V D.C. 10W drive
2" × 6·5" × 10" (11") (VAT + 12½%)
(Over 15 different models—S.a.e. details)
PA10/160/BL 145MHz 160W output **£155**

2 or 70 Superb R.F. sensing, excellent bias arrangements, c/w mounting bracket.
12V D.C. 10W drive
2·5" × 5·2" × 7·5" (8·5") (VAT + 12½%)
APB82A 145MHz 80W output **£95.00**
APB57A 433 MHz 45W output **£95.00**

JAYBEAM 70(4m), 144(2m), 432(70) (Car. about £1) VAT 12½%

For general work, with the emphasis on distant mobiles, Oscar etc, crossed yagis are increasingly popular. However, for maximum gain needed to push your signal over the horizon we would suggest long yagis, on 2, such as the 14Y/2M (offered exclusively by SMC) or the MBM88 for 70.

D5/2m 5 over 5 slot feed ..	£11.00	PBM10/2m 10 ele Para ..	£20.50
D8/2m over 8 slot feed ..	£14.75	PBM14/2m 14 ele Para ..	£25.20
5XY/2m 5 element crossed	£12.90	D8/70 8 over 8 slot feed ..	£12.57
5XY/2m 8 element crossed	£16.10	PBM18/70 18 ele Para ..	£15.00
10XY/2m 10 element crossed	£21.30	MBM48/70 46 ele Multi ..	£17.50
5Y/2m 5 element yagi ..	£6.20	MBM88/70 88 ele Multi ..	£23.40
8Y/2m 8 element yagi ..	£8.10	12XY/70 12 ele crossed ..	£24.00
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14Y/2m 14 ele long yagi ..	£22.00	PMH2/702 way harness ..	£4.75
Q4/2m 4 element yagi ..	£13.20	PMH2/C Circ. phasing ..	£4.10
Q6/2m 6 element quad ..	£17.60	PMH2/2m 2 way harness ..	£5.50

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Top the tower or mount on your chimney stack a 2m gain vertical. The Ringo Ranger (ARX2) offers over the conventional ground plane elimination of unsightly radials and 6dB gain from only 9' 6" (weighs less than 1½lbll)
If you prefer horizontal omnis are available for net control, RAEN, SSB mobile etc, etc.

ARX2 Ringo Ranger 145MHz	£21.50	ARX 450 Ringo Ranger 432MHz	£21.50
AR2 3dB Ringo Vert ..	£12.75	CX1000 29MHz Ringo ..	£25.75

BANTEX VHF WHIPS (Carriage 90p) VAT 12½%

B5 ⅝ 145MHz	£6.35	70½ ¼ 70MHz	£4.00
BGA f.g. ½ 2m fibreglass ..	£8.75	Trunk Lip Mount ..	£5.25
BGA s.s. ½ 2m stainless steel	£8.50	Magnetic Base Mount ..	£8.50
B5U ⅝ 432MHz	£5.00	Standard base unwanted deduct	£0.50

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10' sections without or c/w rigging.
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SELF SUPPORTING
Galvanised lattice 10' sections. Free-standing with climbing steps.
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30' c/w base grillage .. £192.35
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Carriage and rigging (RX) extra.
42' mast .. .. £121.00 (RK £28)
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79' mast .. .. £224.50 (RK £49)
101' mast .. .. £303.50 (RK £76)

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Galvanised lattice, 20' sections
Post, wall, plate, socket mounts

P25	£156.50	W40	£157.50
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MOBILE/BASE HF TRANSCEIVER THE FT101E

FT-101E (EE-EX)

The FT-101E is a complete station in a rugged 30lbs. package, constructed to high standards using serviceable plug in boards and a complement of 14FETs, 26 Bi-polars, 3 ICs, 38 Diodes and 3 valves. The transceiver with the "built-ins" which are often not available elsewhere or come as costly extras:

FT101E FEATURES

160-10 metre inclusive coverage
Multi mode, USB, LSB, CW, AM
Mains 234V and 12V DC
11"(13¾") × 6" × 13" & 30 lbs
Silky smooth precision VFO drive
Readout to better than 1kHz
2 Fix channels per band segment
Semi break in with sidetone
3 models E, EE and EX
Rx on MSF (10MHz) and CB
Front Panel microphone gain
Indicator LED for VFO operation
Eight Pole sharp sided filter
RF speech processor (In IF)
Fully adjustable carrier level
Heater conservation/low power links
Clarifier with indicator LED
SSB and CW filter bandwidths
Valve PA and driver tube
100/25kHz crystal calibrator
Switchable adjustable noise blanker

FT101E SPECIFICATIONS

Frequency range
160-10 metres transceive
M.S.F. and CB receive

Modes
USB, LSB, CW, AM

Frequency stability
>100Hz/½H (A.W.U.)
<100Hz for 10% line change

Backlash
50Hz or better

Antenna impedance
50 ohms, nominal

Power requirements
234V AC 350W
13·5V DC 0·5/5·0/20A

Sensitivity
½ for 10dB N + S/N @ 14MHz

Selectivity
SSB 2·4kHz at 6dB (1·67:1SF)
AM* as SSB
CW* 600Hz at 6dB (2:1SF)
FSK as SSB

Spurious responses
Image > —50dB
Internal spurious <1μV

Audio output
3W (int. and ext. speaker)

Audio distortion
<10% at 3W output

Input power
>260W PIP A3j
>180W DC A1 (50% duty)
>80W A3

Audio response
0.35-2·7Hz ±3dB

Carrier suppression
< —50 dB

Sideband suppression
< —50dB

Spurious radiation
< —40dB

Dimensions
11"(13¾") × 6" × 13" & 30lbs

AT YAESU MUSEN—AMATEUR RADIO EQUIPMENT IS NOT A SIDELINE BUT THE ONLY BUSINESS. OVER 130 LICENSED AMATEURS PROUDLY PRODUCE THE MOST DIVERSE PRODUCT LINE AVAILABLE, SSB, CW, AM, FM OR FSK FOR MOBILE, PORTABLE OR BASE USE. WRITE TO ONE OF OUR DISTRIBUTORS FOR A FREE CATALOGUE.

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MOBILE/BASE VHF TRANSCEIVER THE FT221R

YAESU's state of the art, fully modular, plug in board, multimode, 2 metre transceiver renders over the board "rats' nest" wiring obsolete. A 134MHz, VCO, automatic varicap tuning of transmitter and receiver, gives you an exceedingly clean signal, and a sensitive receiver having outstanding strong signal handling capabilities.

FT221R

FT221R FEATURES

144-148MHz inclusive coverage
Multi mode AM-FM-USB-LSB-CW
234V AC or 12V DC working
11½" (14") × 5" × 11½", and 22lb
Dual speed smooth VFO drive
Readout to better than 1kHz
44 fix channels (4 × 11) (2MHz)
Semi break-in with sidetone
Unique automatic tone burst
P.T.T. microphone supplied
Front panel adjustable VOX
Front panel microphone gain
ALC external phono socket
70W dissipation PA device
600kHz and 1·6MHz repeat shifts
"S"/centre zero/output meter
Clarifier (IRT with RT + TT)
2·4kHz SSB 12kHz FM bandwidth
Adjustable sensitive squelch
100kHz crystal calibrator
Switchable noise blanker

FT221R SPECIFICATIONS

Frequency range
144-148MHz
600kHz + 10W shifts

Modes
USB, LSB, CW, AM

Frequency stability
>100Hz 1½H (A.W.U).
<100Hz for 10% line change

Backlash
>50Hz

Antenna impedance
50 ohms unbalanced

Power requirements
234V AC 30W RX, 90W TX
12V DC 0·6A RX, 3A TX

Sensitivity
0·5μV for 10dB S/N at 145MHz

Selectivity
SSB 2·4kHz at 6dB (1·7:1 SF)
AM as SSB
FM 12kHz at 6dB (2:1 SF)
CW as SSB

Spurious responses
Image > −60dB
Internal spurious <1μV

Audio output
3W (int. and ext. speaker)

Audio Distortion
<10% at 2W

Output power
>14W PEP A3j
>10W F3, A1
>2·5W A3

Audio response
0·3–2·7kHz ±3dB

Carrier suppression
> −50dB

Sideband suppression
> −50dB

Spurious radiation
> −60dB

Dimensions
11½" (14") × 5" × 11½", 22lbs

OUR AGENTS

Amateur Electronics,
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South Midlands Communications Ltd,
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Southampton, Hampshire SO4 4DN

Western Electronics (UK) Ltd,
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Model	Price	VAT	Total	Model	Price	VAT	Total
FT101E	£399.00	£49.87	**£448.87**	FT221R	£299.00	£37.37	**£336.37**
FT75B FP75B DC75B	£269.00	£33.62	**£302.62**	Sigma-80R	£199.00	£24.87	**£223.87**
				FP2AC/B	£65.00	£8.12	**£73.12**
				FTV250	£139.00	£17.37	**£156.37**
FR101 S.Dig	£359.00	£44.87	**£403.87**	FT301D	£580.00	£72.50	**£652.50**
FR101D	£319.00	£39.87	**£358.87**	FL2100B	£234.00	£29.25	**£263.25**
FL101	£315.00	£39.37	**£354.37**	FRG7	£144.00	£18.00	**£162.00**

Other models in the "301" range also in stock—ask for prices. All models carry the WESTERN guarantee and delivery is FREE.

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= **£448.87**
delivered free
Multi U11
£219 + VAT
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★ STANDARD MODEL 40% STRONGER THAN SIMILAR TYPES.

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Size	Head Load at 75mph	Price (inc. VAT)
3S (58ft)	125 lbs.	£322.92
3HD (58ft)	250 lbs.	£383.40
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4HD (75ft)	66 lbs.	£452.52

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WE590 UHF in-line connector, 35p.
WE592 UHF T-adapter, £1.03

} Plus 32p post up to 10 items. 50p over 10. Over 50 post free.

STOP PRESS!! PM2001 VHF PEP meter coming—WATCH THIS SPACE

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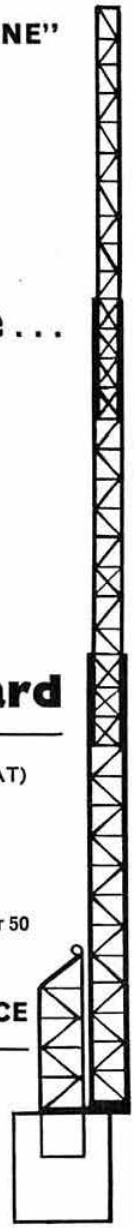

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Termination SO-239.
Complete with mounting brackets for masts up to 1¾" O.D.
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Power capability 100W
Termination Female 'N' Type connector.
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144-148MHz 6dB gain DC Grounded Base Station Colinear.
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Weight: approx. 4lb.
Rated wind velocity: 118 mph.
Termination: Male 'N' Type Connector.
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NEW ! ! ▶

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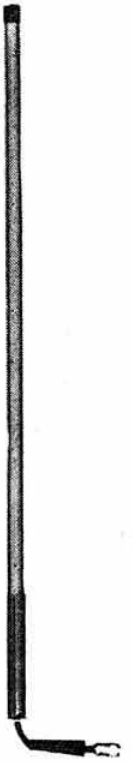
430-440MHz, 9dB gain DC grounded base station colinear.
Power capability 250W.
Length approx 12'.
Rated wind velocity, 103mph.
Termination male 'N' type connector
AVAILABLE NOW
£57.75 plus **£2.50** carriage.

ASPN701UK ▶

430-440MHz 12dB Gain. DC Grounded Base Station Colinear.
Power Capability 250W,
Length approx. 18'.
Weight approx. 9-5lbs.
Rated wind velocity 128 mph.
Termination Male 'N' Type Connector.
Available now.
£135.00 plus £2.50 carriage.



MOBILE ACCESSORIES

ASP332

Gutter mount suitable for use with ASP629, ASP393 complete with 10' RG-58U cable and PL-259 connector **£8.09** plus 50p post and packing.

K-203

No hole boot mount. suitable for ⅝" hole snap in mount, easily adaptable for other mounts. **£3.70** plus 50p post and packing.

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New Magnetic Mount ▶

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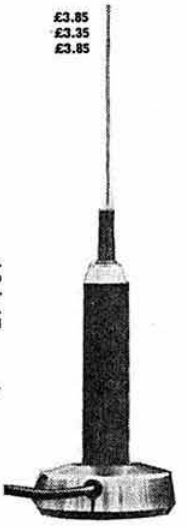

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FDK

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SSB/CW/FM/AM 144/148MHz 230V/12VDC

LATEST MODELS NOW INCLUDE ± 600kHz & + 1.6MHz REPEATER SHIFT XTALS

FEATURES Immediately you see the FDK Multi-2700 Transceiver you realise it is a little different from the rest. Of course it has all the standard features you would expect of a modern 2 metre all-mode transceiver in 1977. But FDK engineers have gone a little further to provide the most versatile single package station available today. In the space available it is impossible to list all its many features but if we whet your appetite a little, we have a feeling that you will want to send for the full 4-page brochure on the Multi-2700.

That such things as VOX, IRT, noise blanker, crystal calibrator, etc., are fitted as standard, goes without saying. But FDK is a lot more versatile than this. For example, whilst other operators get bored with flat conditions on 2 metres you can enjoy the excitment of chasing inter-continental DX through OSCAR 6 and 7. America, Canada, Africa, Russia; they are all within your grasp with the Multi-2700. Simply press the OSCAR button on the front panel and you automatically receive the 29MHz downlink signals. And for the future 70 cms downlink planned by JAMSAT an optional converter will be available. Thinking of transverting to 70 cms? No problem, simply plug in a Microwave Modules transverter and you have all-modes on 70cms—How about absorbing the excess 2 metre RF drive to the transverter? Don't worry, the Multi-2700 has an all-mode low power switch—What about repeater operation on 70 cms? That's all taken care of; you can programme the Multi-2700 for two additional repeater shifts at the flick of a switch—Going getting a little rough? A flip of the switch brings in the built-in speech clipper for an extra few dB of talk-power—Sked coming up on a pre-arranged frequency? Just switch over to the synthesizer and dial up the frequency—if he's a little late simply leave the synthesizer setting and switch in the other vfo to carry on listening around the band—no cranking of dials necessary to OSY from one end of the band to the other—both vfos work on all models—Crystals? You won't need them; this rig has 200 crystal controlled channels plus a vxo to complement its versatility. With crystals costing £250 each that's worth £500 alone. Send today for the 4-page brochure and get the full story. **£449 inc. VAT & delivery via Securicor**

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Complete with Autoscan for safer driving!

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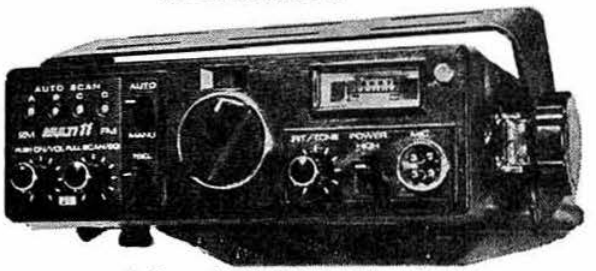

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PBM10/2M 10 ele. parabeam ..	£23.00	(£1.50)
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5XY/2M 5 ele. crossed yagi	£14.50	(£1.25)
8XY/2M 8 ele. crossed yagi	£18.10	(£1.50)
10XY/2M 10 ele. crossed yagi ..	£23.95	(£1.75)
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HM/2M Mobile halo with mast ..	£3.00	(£2.75)
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GM3GRX Eric Simpson, 6 Drossie Road, Falkirk, Stirlingshire. Tel. 0324-24428

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MORE AND MORE PEOPLE ARE GOING TO BE SAYING "I LIKE ICOM"

Two excellent rigs have been added to the popular ICOM range: The 215, a 3W hand portable, and the 240, a 10W synthesised programmable mobile transceiver.

ICOM IC-240 £198

The IC-240 is the start of a revolution in 2 metre transceivers. It has all the advantages of the highly popular IC-22A, with its easily selected 22 Channel capability, but does it all with a phase locked synthesised system. Hence you can program it for all 22 channels *WITHOUT HAVING TO BUY ANY CRYSTALS.* Channels are hard wired using diodes according to clearly described instructions. We supply the UK version with 15 channels already wired in, these being 10 simplex and 5 repeater. Thus there are 7 more frequencies for you to program at your own whim—ideal for RAYNET and local net use. You can program for any of the 80 channels at 25kHz spacing between 144 and 146MHz.

As an optional extra, a scanning system will be available shortly which will scan all 22 channels.

The IC-240 has the same excellent FM performance as the well known and highly popular IC-22A.

Duplex (for repeater use) operates by shifting the RECEIVE frequency. This means that by switching to SIMPLEX when using a repeater channel you will automatically be listening on the INPUT channel of the repeater without having to wire in special "Reverse Repeater" channels. A 1750Hz tone burst is, of course, built in.

The channels already programmed are:
SIMPLEX S0, S16, S17, S18, S19, S20, S21, S22, S23, S24.
REPEATER R3, R4, R5, R6, R7.

NOTE: PRICES MAY VARY ACCORDING TO THE STATE OF THE POUND AND VAT

ICOM IC-215 £162 (with 12 channels fitted) (while stocks last)

ICOM are pleased to introduce their first FM portable and a careful look at the features will soon show how popular it's going to be. You can use it *ANYWHERE.* Change vehicles, use it in the shack or take it for a walk to the local high spot and you have the high quality FM communication, for which ICOM are so famous, available all the time. The batteries are larger than those of its competitors, thus giving considerably longer life. The 3 watt output and high sensitivity receiver makes it a useful main station set, where it can be operated from an external power supply and a good antenna system. Thus the IC-215 can be a good starting point for the man who has just obtained his licence and wants to get on the air without having to spend too much money.

The unit incorporates 15 channels to select from: 12 by the main channel selector and a further 3 by the function switch. All crystals are plug-in type HC-25/U and are the same as the crystals used in the popular IC-22A. Being fundamental crystals, they are tunable over a reasonably wide range and a separate trimmer is supplied for each crystal making accurate frequency adjustment possible. This is very important for optimum results with minimum interference.

The output power can be switched to 3W on HT for long distance work or 0·5W on LOW for short distance contacts or working a nearby repeater. Battery consumption is minimised in the LOW power mode.

Sockets for external power and antenna are provided on the rear. The antenna socket takes a standard PL259 plug and, a fully collapsible antenna is built into the top of the rig. This can be unscrewed and removed to provide a screw socket for a flexible helical antenna. We have had an Antenna Specialist flexible antenna specially made and tuned to suit the IC-215.

Why not see and buy the excellent ICOM range at your nearest Thanet agent—phone for an evening or weekend demonstration.

LONDON—Terry G8BAM (01-556 9366)
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WALES—Tony GW3FKO (0222 702982)
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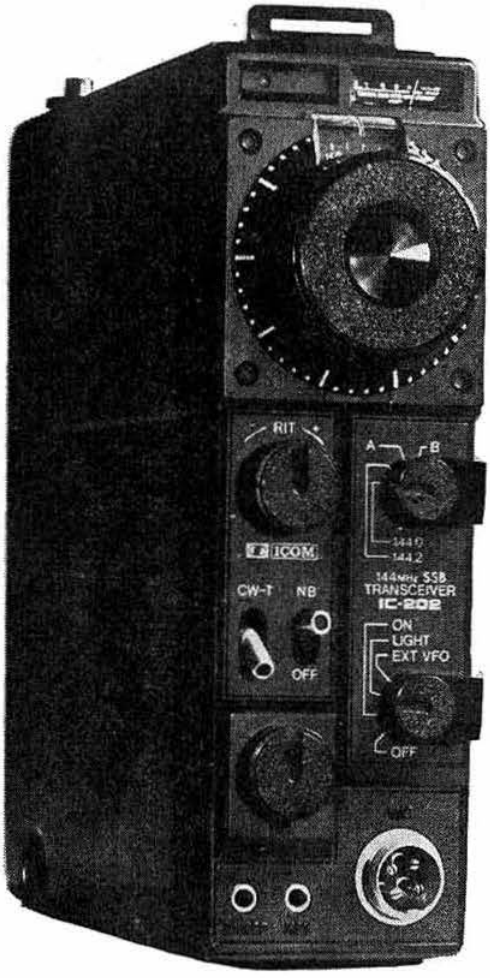

ICOM **IC-202 £172.00**

INCL. VAT (£35.00 deposit)

The IC-202 is a 2 metre SSB/CW transceiver designed to be operable anywhere, like most portables, but with big station features such as a very effective noise blanker, RIT, S & RF meter, and a full 3 watts output. Two built-in crystals in the stable VXO allow operation between 144·0 and 144·4MHz. If you wish to expand the range of the IC-202, Icom have also provided 2 spare crystal scockets for your convenience. With a slight retuning of the IC-202, and installation of a special crystal, you may also work through Oscar.

The aluminium diecast frame provides a very strong yet light housing for the 2 circuit boards and the aluminium sides snap off easily if service is ever necessary or to change the batteries.

The IC-202 operates on 9 inexpensive C cell batteries, or an external 13·8V DC source. We recommend the IC-3PS which not only provides power for the IC-202, but also doubles as a stand and holder for the IC-20L 10 watt linear amplifier.

You can use the built-in whip antenna for portable use or another antenna connects to the external antenna connector on the back of the IC-202.

We feel sure that you will have years of lasting enjoyment from an IC-202, manufactured by the leader in communication equipment: Inoue Communication Equipment Corporation. The signal is as clean as you would expect from ICOM equipment—It won't get you into repeaters unintentionally!

FEATURES:

- ★ Power Indicator LED
- ★ S and RF meter
- ★ Dial calibrated on 10kHz increments with a total coverage of 200kHz. The operating frequency is read by adding the frequency shown on the dial to that shown on the crystal switch.
- ★ RIT. Independently swings the receiver frequency by ±3kHz.
- ★ CW or SSB
- ★ Noise Blanker
- ★ 4 position crystal switch
- ★ Built-in speaker with socket for external speaker if required
- ★ External VFO socket.
- ★ Whip antenna and socket for external antenna
- ★ External 13·6V DC input or internal batteries

ACCESSORIES SUPPLIED:

Microphone
Microphone Case
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Power Supply Plug
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9 Dry Cells type C
Comprehensive English Handbook

OPTIONAL EXTRAS:

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Charger, **£12.00** + 50p p & p.

Don't forget the IC-30A for 70cms, £225 incl. VAT

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

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EDITOR
A. W. Hutchinson

ANNUAL SUBSCRIPTION RATES

UK corporate: £8, including VAT. **Overseas: £8.**

Associates under 18: £3. **Students aged 18 to 21: £4.50.**

OAPs with 15 years' membership: £4.50. **Affiliated societies:** £6.50 (including *Radio Communication*); £3.25 (excluding *Radio Communication*).

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Zone B: Regions 3, 4 and 5
Zone C: Regions 7, 8, 19 and 16
Zone D: Regions 6, 9, 17 and 20
Zone E: Regions 10 and 11
Zone F: Region 15
Zone G: Regions 12, 13 and 14

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Region 1	Cheshire, Cumbria, Greater Manchester, Isle of Man, Lancashire, Merseyside.
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Region 3	Hereford and Worcester, Salop, Staffordshire, Warwickshire, West Midlands.
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Region 19	Greater London north of River Thames, Hertfordshire.
Region 20	Avon, Gloucester, Somerset.

QTC
amateur radio news

Morse test fee
The Home Office advises that from 1 July 1977 the fee for the amateur licence morse test will be increased to £6.

Affiliated societies' correspondence
Officers of affiliated societies when writing to RSGB on behalf of their societies are asked to quote the society's callsign. This will speed up the handling of renewal subscriptions and amendments to the records, particularly changes of address to which *Radio Communication* should be sent.

Personal insurances for members
Readers will no doubt remember the earlier reference to club insurances provided by the Sun Alliance & London Insurance Group. They may also be interested to know that the Sun Alliance automatically provides accidental damage cover on all television, radio (including communication equipment but not antennas and masts), hi-fi and similar equipment while in the home as part of their new Master-Cover policy on the contents of the dwelling.

Preferential terms are available to members of the Society. For further information please contact: Sun Alliance & London Group, 40 Chancery Lane, London WC2A 1JB (Telephone: 01-831 7414 Ext 261).

Facts and figures
The Home Office advises that the following numbers of amateur licences were in force at 30 March 1977:

Class A 16,011 Class B 6,349

At the same date the latest callsigns issued in the G4 and G8 series were G4FXV and G8NFY respectively.

BARTG Convention 21 May 1977
The annual convention of the British Amateur Radio Teleprinter Group will be held on Saturday 21 May 1977 at the Village Hall, Meopham, Kent. The features include lectures, trade stands, bring-and-buy stall and a tape factory, all of interest to the rtty enthusiast.

Doors open at 11am. Trains to Meopham station will be met until 1.15pm.

Raynet
Milton Keynes Group held their first annual dinner on 26 March where the guests of honour were Mr Bernard Beckett, the county emergency planning officer, and his wife. A pleasant evening was enjoyed by all. After dinner Mr Beckett spoke on how pleased he was that CEPOs had been appointed as user services, and the role he saw Raynet playing in county emergency plans.

May we remind would-be members in Milton Keynes that group expansion is vital in the new city. Applications should be sent to Mrs L. A. Crane, G3PED, QTHR, honorary registrations secretary.

VACANCY AT HQ

Technical secretary

A vacancy exists at RSGB HQ for a technical secretary to deal with technical matters related to a number of the Society's activities, and to attend certain committee meetings to provide liaison between those committees and HQ.

Applications are invited from technically qualified, active and licensed amateurs, giving details of past experience and salary required. They should be addressed to the general manager at RSGB HQ and marked "Confidential".

"The G3PLX Mk2 rtty video display unit"
The author of this article published in the April issue advises:

(1) In Fig 4 pin 15 of IC27, IC28 and IC29 should be earthed.
(2) With some PROMs used for IC2 and IC3, it has been found necessary to add 0·01 μF capacitors from pin 15 of IC2 and IC3 to earth to prevent spurious triggering of the LTRS/FIGS latch.
(3) Catronics Ltd, Communications House, 20 Wallington Square, Wallington, Surrey SM6 8RG are offering kits of integrated circuits, including programmed PROMs, and Veroboards.
(4) The Clare-Pendar KB5 keyboard is available from Electronic Brokers, 49–53 Pancras Road, London NW1 2QB, price £22.68 inclusive of VAT and postage.

RNARS morse proficiency transmissions
The Royal Naval Amateur Radio Society runs the popular morse transmissions (QRQ runs) on the first Tuesday of each month on 3,520kHz ± QRM at 2000 local time (UK), from the RNARS HQ station G3BZU.

Speeds are transmitted from 15wpm to 40wpm in increments of 5wpm. All speeds are of a 3min duration and must be copied 100 per cent correct. Certificates are awarded for the 15wpm and 20wpm copied correctly, with endorsement stickers at all other speeds. A person must obtain the basic certificate before endorsement stickers can be obtained, and even then they must be claimed in chronological sequence. A charge of 30p is made for each certificate, and an sae is required for endorsement stickers if not claimed with the basic certificate. The equivalent in IRCs is acceptable from people in Europe.

The initial scheme was started in December 1962 by Dave Pilley, G3HLW (now VK2AYD), who was also the first QRQ manager. The 15wpm run was only introduced to the runs in January 1975, and has since proved very popular among the slower morse readers. At present the QRQ manager is Mick Puttick, G3LIK, who makes up the texts, operates the transmission, marks the submitted copies and issues certificates and/or stickers to successful applicants. Since the transmissions began there has been a total of 859 certificates issued not only to amateurs in the UK but all over Europe, where the battle to read through the heavy interference is on the increase.

The equipment used for these runs at G3BZU is a KW

Viceroy transmitter, an Eddystone EA12 receiver, and a dipole antenna. The G3BZU QTH is on top of the second highest point in Hampshire which is why the site has such a good take-off point. In the years ahead, it is hoped that the RNARS will be privileged to give a continued first-class morse run to the many readers each month.

Help wanted

2511 (Longfield School) Squadron of the Air Training Corps is looking for a person to operate its vhf transceiver. The equipment is fully operational but is unused at present because the squadron cannot spare staff for the job. The operator would be asked to attend on Tuesday nights at the squadron's meeting place at Longfield School, Longfield, Kent. The equipment is voice only, and no morse aptitude is needed. Interested persons should contact F/Lt D. M. Edmunds, Officer Commanding, 19 Cedar Drive, Sutton-at-Hone, Dartford, Kent (tel Farningham 863917 evenings or weekends).

PA0AA

The national Dutch amateur radio station PA0AA makes official transmissions each Friday on 1,827kHz, 3,600kHz, 7,040kHz and 144·800MHz as follows:

1900-2130gmt: News for the amateur in Dutch and English; morse code exercises for beginners and advanced operators at 1930gmt.

2030gmt: RTTY bulletin, 45 bauds.

2100gmt: News on phone.

Code-proficiency runs are transmitted at various speeds on the last Friday of the month at 2130gmt.

"Recent Developments in Amateur Radio"

A COLLOQUIUM on the above subject, jointly organized by the Institution of Electronic and Radio Engineers and the Radio Society of Great Britain, was held on 24 March 1977 at the Royal Institution, Albemarle Street, London, and chaired by Mr T. W. Welch, G3AYO. The purpose of the meeting was to enable amateurs, each speaking in the field of his own particular expertise, to give a lecture, with questions and discussion to follow, with an audience of professionals.

The opening talk, by Dr D. S. Evans, G3RPE, was entitled **Do it yourself on 10GHz**. He produced evidence of the significant super-dx QSOs that have surprised both amateurs and professionals alike, and of the nature and distances of the paths themselves. He illustrated his talk on the low-power, simple and inexpensive equipment employed by demonstrating the relative ease of construction of the apparatus shown, including the use of dustbin lids as antennas.

Mr P. J. A. Gowen, G3IOR, chairman of AMSAT-UK, followed this by introducing a brief illustrated talk on the **history of the Oscar series** of amateur radio satellites, leading to the Oscar 8 satellite due for launch in November 1977 and the first Phase 3 high altitude elliptical orbit spacecraft due for December 1979. The communication abilities, optimum frequency, possibilities and control facilities envisaged were discussed, with the probable future of launches from the shuttle and of geostationary satellites for amateurs in the 'eighties. Mr M. Sweeting, G3YJO, designer and developer of the Oscar 6 command station at the University of Surrey, spoke on the need for, and means of, amateur spacecraft command control, and of the sophisticated computer-based auto-complex now employed, and of its future development.

Image transmission was the title of the contribution by Mr C. Grant-Dixon, G8CGK, who spoke of the history of the development of amateur slow-scan television, from the first experiments by Baird which have now led to modern digital techniques producing adequate pictures even from a cheap cassette recorder. An excellent demonstration of functioning equipment was produced to emphasize the high definition possible.

Mr R. Powers, G8CKN, introduced the subject of repeaters and mobiles by his talk on the development of **"Susan" alias GB3SN**. He demonstrated how the advanced techniques in use at the Hampshire repeater with its single antenna, special audio processing and highly developed "psychology based" input selector had substantially improved the possibilities of through-repeater communication.

The meeting was due to finish with the showing of the BBC Wales film *Amateur Radio* but the mutual interest in having a sufficiency of time available for the lectures prevented this.

Excerpts and interviews with the speakers were recorded by Frank Hennig for the "World Radio Club" programme transmitted in the BBC World Service on 6, 8 and 10 April.

G3IOR

The "ultimate" keyer?

by C. I. B. TRUSSON, MSc, CEng, MIEE, G3RVM*

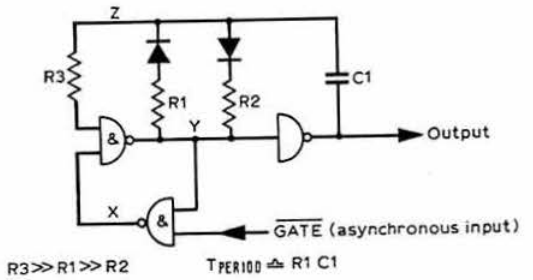

Fig 1. Gated cmos multivibrator

Introduction

In 1970 the author designed an electronic cw keyer using pmos circuits [1]. This keyer circuit was constructed in a die-cast box about 6 by 4 by 3in together with a rather inefficient sidetone oscillator circuit which drove a small transistor radio-type 8Ω loudspeaker. The power requirements of the multivibrator, logic circuit and the sidetone circuit necessitated the use of a mains power supply which was included within the box. A separate Ten-Tec KR1 squeeze key paddle unit was used so that the total area occupied on the operating table by the keyer and the interconnect and mains leads was not insignificant. For the last 18 months the author has been using a keyboard keyer [2] which in terms of performance is the ultimate but takes up even more space. Now, for domestic reasons, the author's radio station is to be relocated to a smaller space and therefore the physical size of the keyer becomes more important. He also wanted to make the station more portable for contest /A and /P operation, and therefore decided to try and construct a new keyer in the small Ten-Tec paddle unit only 4 by 4 by 2in.

Another disadvantage of the original 1970 keyer was the tendency for it and/or the author to generate frequent hard and soft cw errors when using it—hard errors being those when a character was actually sent wrongly with perhaps a dot too many due to poor self-control over the timing of the paddle movements, and soft errors where the spacings were not quite correct as a result of marginally incorrect control over the paddle. Therefore it was decided to incorporate iambic mode operation into this new keyer to see if the reduced number of paddle movements actually resulted in less hard and/or soft errors. Other requirements were that the design should be logically sound so that good cw could be obtained over a wide range of cw speeds and with a wide operator tolerance on the timing of the paddle movements; the power dissipation of the logic and sidetone circuit should be very low to allow the keyer to be powered by a small PP3 battery; and the output to key the transmitter should be a transistor instead of a reed relay to save power and size and give very accurately timed bounce-free output.

The cmos design described by G3GJX [3] met some of the requirements detailed above and provided a good basis for this design. In fact the actual logic used by G3GJX was very similar to that of the author's 1970 design, but the use of cmos circuits and a crystal insert for the sidetone output allows battery operation and small physical size. The keyer described here overcomes the timing problems associated with the straightforward cmos-gated multivibrator. It meets all the author's requirements and to achieve iambic operation uses only one more cmos ic than the G3GJX design (even then, one D-element in a dual D-element pack is unused!).

The multivibrator design

All electronic keyers use a gated multivibrator to define the basic periods of dots/dashes and inter-dot/dash spaces. It is necessary to gate the multivibrator so that the start of the first dot/dash of a character occurs at the instant when the paddle is operated and not at some ill-defined later time. An alternative would be to use a presettable divider clocked by a free-running multivibrator, but this divider would need to be at least a divide by 16 to make any start-up delay insignificant and would undoubtedly require more components than the gated multivibrator. The design of the gated multivibrator, however, needs careful consideration if the first dot/dash of a character and the spaces between the dots/dashes within a character are always to be of the correct period. The author's 1970 design used a discrete component emitter-coupled multivibrator which performed satisfactorily, but it required too many components and consumed too much power to be considered for this design. The straightforward cmos 2-inverter multivibrator described in most cmos data/applications books would seem to be an ideal basis for a low-power gated multivibrator.

The cmos 2-inverter multivibrator circuit can be simply gated by making the first inverter a 2-input NAND gate and applying the "gate" signal as an input to the NAND gate. However, such a circuit has two problems: (1) the first half-period of the multivibrator, after it has been gated on, will be up to 50 per cent longer than the normal free-running half period, because the initial charge on the timing capacitor is different in each case and is a function of the time since the multivibrator was last gated off. (2) If the multivibrator is gated off at a time when the output is high and then gated back on again the interrupted period will be shorter than a normal period. This problem cannot be overcome by delaying the negative-going edge of the gating signal, except over a very limited frequency range.

The circuit shown in Fig 1 overcomes (1) by making the positive output period of the multivibrator short compared with the negative period, so that although the first positive period is longer than normal the error is only a small percentage of the total period. Two timing resistors are used with diodes to switch the timing current between them, with $R1 \gg R2$.

*19 Happylands, Ashton Keynes, Swindon, Wilts.

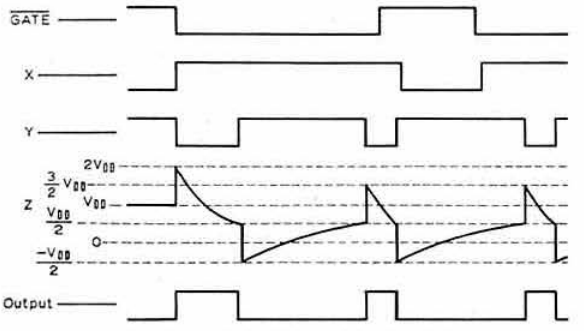

Fig 2. Multivibrator timing diagram

Although the positive period is now short, (2) still exists. There is still a possibility of the multivibrator being gated off during this period and causing a short negative period if the multivibrator is gated back on. In fact, (2) is easily overcome by adding a NAND gate as shown in Fig 1. Then the gating signal for the multivibrator X cannot go low until point Y has gone high and the output low.

The operation of the multivibrator is illustrated by the timing diagram of Fig 2. Initially, the point Z is at V_{DD} since it is assumed that some time has elapsed since the multivibrator was last gated off. As a result the first positive output period is long. The author has illustrated how in the second output period the asynchronous gate signal can try to gate the multivibrator off while the output is high, then gate back on again without disturbing the output period. For clarity the positive periods are shown relatively long in the diagram.

This gated multivibrator circuit, when used in a cw keyer, ensures that the first dot/dash of a character is not significantly longer than a dot/dash within a character and that there is no possibility of obtaining a short inter-dot/dash space if the paddles happen to be open during the positive period of the multivibrator at the start of the space.

The keyer design

The complete logic/circuit diagram of the new G3RVM keyer is shown in Fig 3 and the pin connections for the cmos ics used in the design are shown in Fig 4. The operation of the keyer is illustrated by the waveforms of Fig 5 in which the keyer is sending "CQ".

The top two waveforms of Fig 5 show the inputs to the keyer from the dot and dash paddle contacts; a high level corresponds to the contacts being open and a low level corresponds to the contacts being closed. Sending "CQ" in

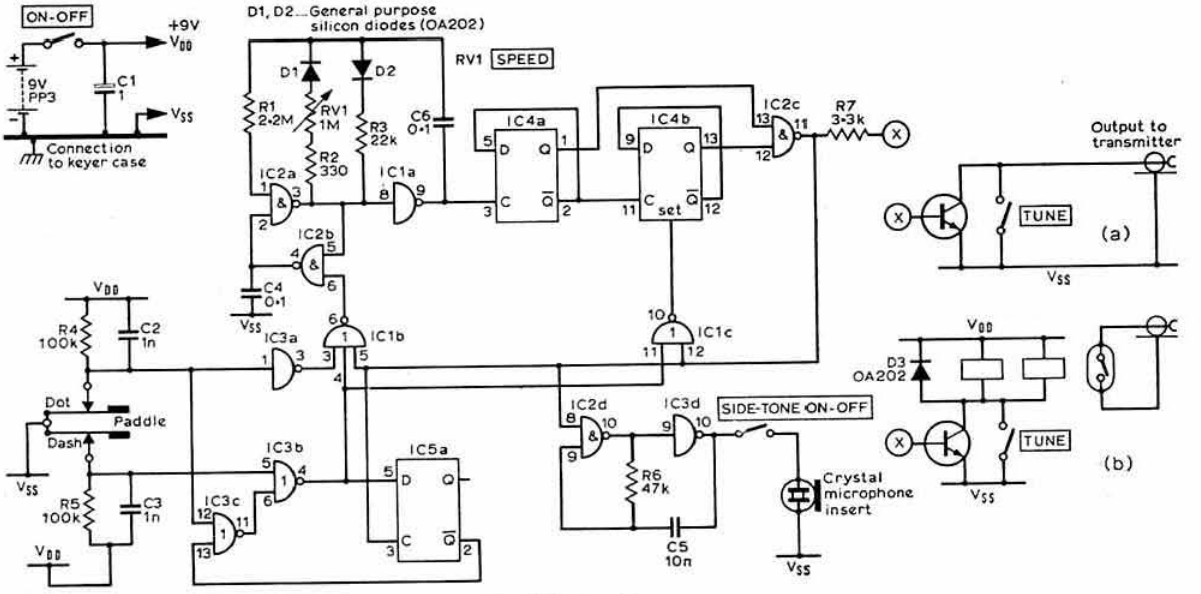

Fig 3. Logic diagram.

(a) Output transistor with ratings suited to driving the transmitter—see text (eg BSX21). To cater for opposite polarity tx input, reverse connections in o/p plug to tx.

(b) Alternatively, connect RS reed relay coil type 3 (with coils in parallel) to V_{DD} and use type 6-RSR-A reed to drive tx. The tune switch in circuit (b) is better connected across the reed contact to avoid flattening the battery if left on inadvertently.

Notes

(1) V_{SS}, earth, is connected to pin 7 and V_{DD}, the 9V supply from the battery, is connected to pin 14 on each cmos pack

IC list	Cmos part No
IC1	4000
IC2	4011
IC3	4001
IC4	4013
IC5	4013

(2) Connect pins 2 and 8 of IC3 to V_{SS}. Connect pin 13 of IC1 to V_{SS}. Connect pins 4, 6, 10 of IC4 to V_{SS}. Connect pins 4, 6, 10 of IC5 to V_{SS}, and also pins 8, 9, 11 if dot store not added.

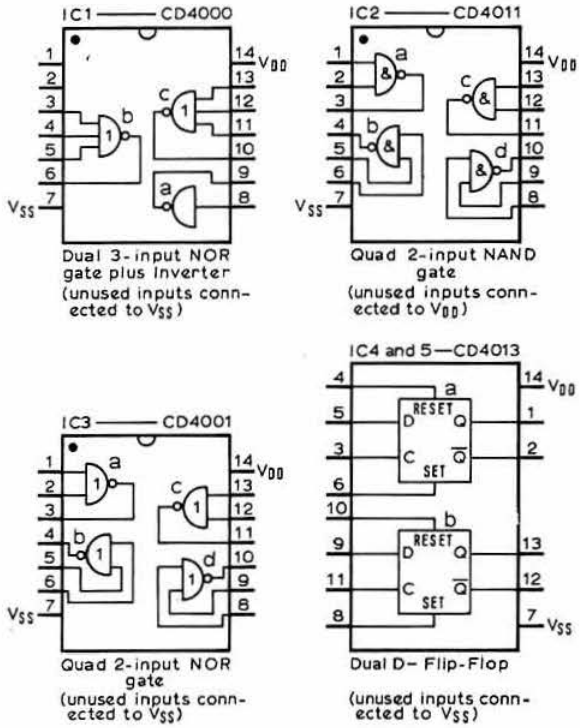

Fig 4. Pin connections

iambic mode requires just one squeeze for the "C" with the dot closure slightly delayed with respect to the dash, and one squeeze for the "Q" with the dot closure further delayed with respect to the dash. The keyer only senses the state of the dot and dash contacts on the positive edge of the output signal. There is, therefore, a considerable tolerance on the exact timing of the paddle movements by the operator.

Initially, in Fig 5, the dot and dash contacts are shown open, ie the input voltages are pulled up to V_{DD} by the pull-up resistors. IC5A is the iambic store and the logic state on pin 2 of IC5A is determined by whether a dot or dash was sent previously. At the start of a new character the state of IC5A is immaterial. The outputs of the D flip-flops, IC4A pin 1 and IC4B pin 13, are initially high. The multivibrator is gated off with pin 9 of IC1A low. The keyer output, pin 11 of IC2C, is low, which holds the output transistor off. If at switch-on the D flip-flops do not come up in the high state, as assumed above, then the output, pin 11 of IC2C, will go high. This causes pin 6 of IC1B to go low, which gates on the multivibrator causing IC4A and IC4B to clock until their outputs do go high, at which time pin 11 of IC2C goes low, pin 6 of IC1B goes high and the multivibrator is gated off. Therefore the keyer always goes to a well-defined state at switch-on.

At the start of the "C" in Fig 5, the dash contact is closed, causing pin 5 of IC3B to go low, pin 4 of IC3B to go high, pin 6 of IC1B to go low, and the multivibrator to be gated on. IC4A is clocked, which then clocks IC4B because its set input, pin 10 of IC1C, is low at this time. The keyer output, pin 11 of gate IC2C, goes high and remains high for three

TABLE 1—Logical operation of the iambic keyer

State of dot input Pin 1 of IC3A	State of dash input Pin 5 of IC3B	State of iambic store Pin 2 of IC5A	Keyer output which follows
Low	High	Don't care	Dot
High	Low	Don't care	Dash
Low	Low	Low	Dot
Low	Low	High	Dash
High	High	High	Space

multivibrator clock pulses, causing the output transistor to be switched on for the duration of a dash. At the start of the dash, on the positive output edge from pin 11 of IC2C, the high level on pin 4 of IC3B is clocked into IC5A, the iambic store. During the fourth clock period of the multivibrator, the space following the dash is timed, then at the end of this space the keyer determines what is to follow next—a dot, a dash or inter-character space. In Fig 5, after the first dash of the "C", both paddle contacts are closed, indicating to the keyer that the iambic mode of operation has been selected by the operator. In the iambic mode, when both contacts are closed, the keyer sends the opposite of what was sent previously. In this case a dot is sent next, because the inverse output of the iambic store, pin 2 of IC5A, is low as a result of sending a dash previously. Pin 11 of IC3C is high, pin 4 of IC3B is low and pin 10 IC1C is high which holds IC4B set and prevents it from clocking. Therefore, IC4A is clocked low for a clock period then back to its high state for a period, generating a dot followed by a space at the keyer output. Again when pin 11 of IC2C goes high, at the start of the dot, IC5A is clocked. On this occasion, pin 4 of IC3B is low so a low level is clocked into IC5A causing pin 2 to go high.

The basic logic of the iambic keyer is described in Table 1, where the decision to send a dot or a dash is made by the keyer at the start of each dot/dash and is a function of the present state of the dot and dash paddle inputs and the state of the iambic store. The task of following through the remainder of the waveforms of Fig 5 will be left as an exercise for the reader.

The logic circuitry used to achieve iambic operation in this design is believed to be minimal. The simplicity of the logic is derived from the fact that the straightforward keyer circuit without the iambic store would send a string of dashes if both paddle contacts were closed together. Therefore, when a dash needs to be sent in iambic mode, there is no need to incorporate gates to inhibit the input signal from the dot contact. Only when a dot is to be sent in iambic mode is it necessary to use gates to inhibit the signal from the dash contact. These gates are IC3C and IC3B, driven by the iambic store, IC5A.

By avoiding the need for delay circuitry in gating the multivibrator and omitting a set input to IC4A, the circuit is completely safe logically and essentially free of race hazards. With the multivibrator components shown, the keyer will send cw from 8 to 40 words/min with no problems.

The capacitor on the output of gate IC2B filters out a potential glitch as a result of IC4A clocking to a "1" at the end of a dot or dash, causing input 6 of gate IC2B to go to a "1" before regeneration of the multivibrator is complete and pin 5 of IC2B has reached a good safe "0". The delay as a result of this small capacitor is only about 100μs so that the

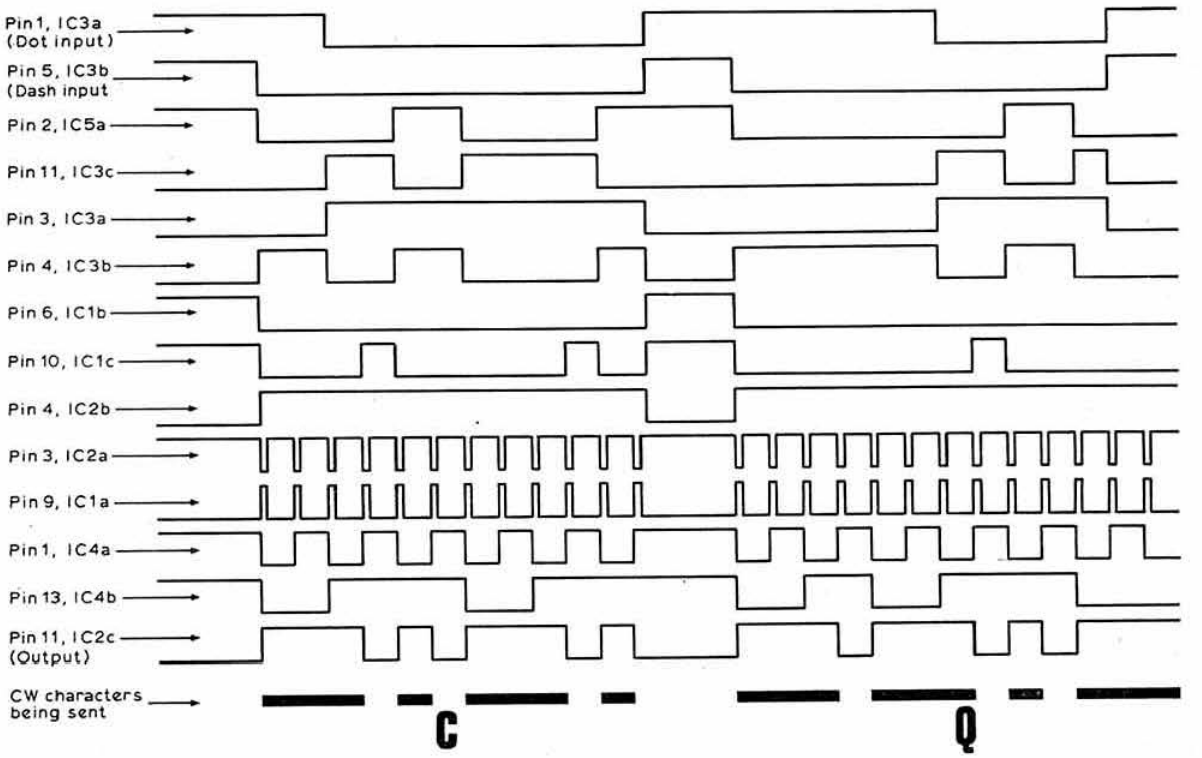

Fig 5. Timing diagram

glitch is safely removed without adding any delay that might be noticeable to the operator.

There can be no input contact bounce problems during the sending of a character, since for correct timing the operator must ensure that the paddle contacts are in their required state before the end of each inter dot/dash space. Only at the start of a new character is there a potential contact bounce problem—if a contact closure occurs which gates on the multivibrator but then bounces open again before the output signal from pin 11 of IC2C has gone high. However, this hazard is easily avoided by incorporating two small 1nF capacitors on the paddle inputs to hold the inputs low while propagation takes place through the cmos logic. The time constant of these capacitors with the 100kΩ pull-up resistors is too short to cause any significant delay in the inputs going back high.

In Fig 3 the output of the keyer, pin 11 of IC2C, gates a simple multivibrator consisting of IC2D and IC3D which oscillates at 1kHz. This signal can be switched to drive a crystal insert to provide a low-power sidetone for monitoring and practice purposes. The arrangements of the side-tone on/off switch allows an insert to be used with an earthed case.

In the quiescent state, the keyer takes very little current from the small PP3 battery. The cmos gates are all static with the multivibrator gated off so they take no CV^2f power and the other components in the keyer have no voltage difference across them, so they also dissipate no power. The only current which is taken from the battery is the leakage current to the cmos ICs. Summing the maximum data sheet leakage currents (20μA for a dual-D and 1μA for a gate pack), the maximum current taken by the keyer is 43μA. At this current the battery life will not be significantly impaired if left switched on for a few months—a very useful feature for any battery-operated equipment. When the keyer is actually being operated, the average current taken from the battery is 3mA at 9V, going down to 1mA when the battery voltage drops to 5V. A PP3 battery will last for 200h under these conditions, so battery replacement should be very infrequent, even for the keenest of operators. (200h of keyer operation corresponds to 400h of station operation, assuming 50 per cent of the time is spent transmitting and 50 per cent receiving.)

The keyer output transistor shown in Fig 3 needs to be suitably rated to drive the key input of the transmitter which is to be keyed. The minimum available base current to the output transistor at 5V supply is 1mA. Therefore, using a transistor with a minimum β of 40, 40mA can be sunk from the transmitter input. When the output transistor is turned off its collector-emitter breakdown voltage must be sufficiently high to avoid breakdown at the open circuit voltage of the transmitter input. For some valve transmitters requiring a large current to be sunk a reed-relay output may have to be used as in the G3GJX keyer (see output circuit (b)).

Finally, the keyer includes a "tune" switch across the output transistor to allow the transmitter to be held on for tune-up purposes. This switch may not be required when the keyer is used with transmitters with a front panel "tune" switch.

C

Dot store

Subsequent to constructing the keyer as per the logic diagram of Fig 3, it was suggested to the author by G3IBB that a dot store should be incorporated into the design because, although it is not a great advantage in an iambic keyer, it would be very useful to anyone wanting to operate the key in the non-squeeze mode or construct it with a single paddle. A dot store makes the sending of a single dot, within or at the end of a character, more operator tolerant, by allowing the dot paddle to be operated and released during the dash preceding the dot. A dot store was, therefore, designed and built into the keyer.

The dot store circuit shown in Fig 6 utilizes the D-element which was unused in the initial design; therefore the only additional components required are a resistor and capacitor. When a dot is being sent, the iambic store output, pin 2 of IC5A, is clocked to a "1" which sets the output of the dot store, pin 13 of IC5B to a "1". This is its quiescent state. When a dash is being sent or during the space following a dash, the iambic store output goes to a "0" which is applied to the D input of IC5B, and if during this time the dot paddle is operated, pin 3 of IC3A goes to a "1" causing the "0" to be clocked to the output of the dot store, pin 13 of IC5B. This holds the dot input to the keyer at a "0" via the 10kΩ resistor until the stored dot has started to be sent, at which time pin 2 of IC5A goes to a "1", setting the output of IC5B back to a "1". The gating function on the input is achieved by means of the 10kΩ resistor to avoid having to add another cmos pack! To prevent the dot store clocking, as a result of contact bounce whenever the dot paddle is removed, the 1μF capacitor provides a 10ms anti-bounce time constant with the 10kΩ resistor. The positive clocking edge on pin 11 of IC5B is fast when the 1μF capacitor is discharged through the paddle switch, but the negative non-clocking edge is slow and could cause mal-operation of the D-element, although in practice no problem has been observed.

Keyer construction

The Ten-Tec KR1 keyer paddle unit was intended for use with external keyer electronics. However, this keyer design, requiring only five cmos ICs and a few other small components, was easily constructed on a piece of Veroboard 4 by 2in and mounted together with a PP3 battery within the small unit. Any paddle, commercial or home made, should be suitable. A commercial paddle will certainly be more costly than the electronic components in this design, which cost only £5. The cmos ICs are readily obtainable from distributors on a cash with order basis.

The author has also designed a printed circuit layout for the keyer (including dot store). If there is sufficient interest he will have some boards manufactured for resale either by themselves or as complete modules with components assembled. For details send an sae to the author.

Iambic mode in practice

When the author started to design his new compact keyer in September 1976, he decided to incorporate iambic mode operation, but was far from confident that this would in fact help him to send good error-free cw. With an ordinary electronic keyer the mental effort needed to convert from morse code to paddle movements is not too great (left for a dot and right for a dash), but it was thought that with an iambic keyer this conversion could be more difficult. It was anticipated that soft errors might well be reduced by iambic operation as a result of the fewer paddle movements involved, but it was thought that hard errors might be greater.

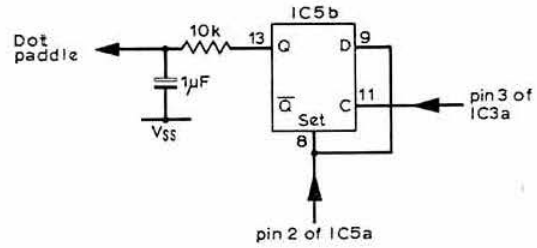

Fig 6. Dot store

In fact the author found that after practising for a few minutes each day for a fortnight the mental conversion from morse to iambic mode paddle movements became a reflex action, and after two months of operation with the keyer he was fully converted to this mode. The cw produced, while not quite up to the standard of the author's keyboard keyer, is a great improvement on his previous electronic keyer, errors being relatively few and far between.

Anyone wishing to operate the keyer in the normal mode can do so, without the iambic circuitry causing any ill effects. This could be a requirement when a number of operators are sharing the same keyer during a contest.

Acknowledgement

The author would like to thank Roy Walmsley, G3IBB, for many useful discussions over the air with regard to keyer design and for constructing a keyer to this design to help prove its reproducibility.

References

[1] "Electronic morse keyer" by C. I. B. Trusson, MSc, G3RVM, and M. R. Gleason, BSc, *Wireless World* August 1970.

[2] "Morse keyboard and memory" by C. I. B. Trusson, MSc, CEng, MIEE. *Wireless World* January 1977.

[3] "A fourth generation cw keyer using cmos ICs" by E. B. Grist, G3GJX, *Radio Communication* September 1976. □

INTERFERENCE PROBLEMS

Members accused of causing interference or who suffer interference from external sources are invited to seek the assistance of the Interference Committee in solving their problems.

Enquiries should be addressed to: The Chairman, Interference Committee, RSGB, 35 Doughty Street, London WC1N 2AE.

World Administrative Radio Conference for the general revision of the Radio Regulations

International Conference Centre, Geneva, Switzerland

24 September 1979 for 10 weeks

Participants

Delegations from the 153 countries who are members of the International Telecommunication Union with observers from recognized international organizations (which includes the IARU).

Agenda

After a great deal of discussion, the Council of the ITU decided that the work of the conference should be concentrated upon Articles 1 to 7 of the Radio Regulations, with such attention as might be necessary to Articles 9/9A and 12 to 20. This means that the table of allocations will receive the major attention, and matters related to a single service may be considered later by an appropriate service conference.

Present position

Many meetings between administrations and the representatives of the various services concerned (eg broadcasting, mobile, maritime, amateur etc) have already taken place and these will continue well into 1979. In addition, meetings of the various groups continue to be held, eg CEPT, PANAFTEL, OIRT, Arab Telecoms Union and others.

In W Europe we are concerned with CEPT which comprises the administrations of 26 countries. There always exists the possibility that these nations might adopt a common position towards certain questions affecting the amateur service; perhaps, in some cases, without consultation with their amateur service representatives.

Within the IARU there is already worldwide agreement on the basic proposals to be presented to administrations. There may be minor national deviations from this plan but this is a position which has never existed before any major international telecommunication conference. The position is continually under review and further meetings of delegates from all IARU regions of the world are scheduled for 1977 and 1978.

In the UK the views of the RSGB were presented to the Home Office in June 1976, and the matters discussed at a meeting have been incorporated in a 25-page booklet subsequently sent to the Home Office. Further meetings are scheduled to be held later in 1977.

Future action

The IARU and its regional organizations will continue to act as information gathering agencies, obtaining and distributing material concerning the proposals coming from other services and the steps to be taken by the amateur service to counter threats to our allocations. Worldwide co-ordination an all matters likely to affect WARC 1979 will continue.

Nationally, the RSGB must maintain contact with the Home Office up to the time of the conference and seek to obtain favourable consideration for the amateur service. Proposals may be made which will involve "trading" and the various considerations must have careful discussion.

Within the Society the Telecommunications Liaison Committee and the Telecommunications Liaison Officer have particular responsibilities at this time. Where matters of a specialist nature are concerned the TLO will seek the advice of the appropriate Society committee(s) and, if necessary, refer the question to the Council.

The Home Office has already agreed that the RSGB may nominate a member for the UK delegation to WARC 1979. This is a valuable privilege and well worth the expense of maintaining a radio amateur on the delegation during the conference period.

It should be noted that the Radio Regulations, on which conference proposals must be based, have been rearranged and the new document will not be available for general distribution until September 1977. By attendance at the Broadcasting Satellite Conference in January 1977 the IARU and its member societies are already informed on the new document.

The question is often asked "What can I, as an ordinary member, do to help the efforts made on behalf of all radio amateurs?" The answer to this consists of three recommendations:

(a) Become a member of your national society and give it your support.
(b) Acquire at least a basic understanding of what is involved in WARC 1979.
(c) When operating on the air display a responsibility worthy of the amateur service.

G2BVN

NEW PRODUCT

EL-40X antenna

This comprises a kit for the erection of a trap dipole for the 3·5 and 7MHz bands. The material supplied includes a balun with a centre insulator and support tubing, vinyl-covered copper wire and two traps. Accompanying the kit is a comprehensive leaflet covering the erection and subsequent adjustment for the user's preferred frequencies. It is recommended that the antenna be used in the inverted-V configuration with the elements between 15° and 45° below the horizontal. Clamps are supplied to attach the centre insulator/balun supporter to an existing antenna support, eg a tower used for a rotary beam. The feeder should be of 50Ω impedance and nylon clamps are supplied for mast attachment. In practice the erection of the antenna is a simple procedure and the suggested measurements for resonance proved accurate. Adjustment of the length to provide a minimum swr at the preferred operating frequencies is a few minutes work using an swr meter.

Priced at £27 inc VAT and carriage, further information on the EL40X can be obtained from Waters & Stanton Electronics, 31 Spa Road, Hockley, Essex. Tel 03-704 6835.

The "disappearing inductance"—a new trick and some better beams (Part 2)

by L. A. MOXON, BSc., CEng, MIEE, G6XN*

Matching principles

Fig 12(a) represents any $\lambda/2$ element with a parallel feed, such as a T or delta match. Selecting points A and B at random, the wire joining them can be regarded as an inductance L tuned by the capacitance C14 of the outer portions, as shown on the right. As an approximation, provided L is not too large or too small, the current-loop radiation resistance R can be regarded as being in series with it, giving rise to an equivalent parallel resistance $\frac{\omega^2 L^2}{R}$ between A and B.

To use the same antenna at 28MHz we need only connect a small capacitor C28 across L, thereby tuning it to resonance so that it acts as a centre insulator and the dipole becomes two half-waves in phase (Fig 12(c)). By "borrowing" some of the dipole to act as an inductance, the half-waves have been shortened, ie capacitance has been subtracted, but it is easily replaced by a slight increase in the value of C28. The loop radiation is stepped up by the antenna itself acting as a $\lambda/4$ transformer, so that it appears as a resistance $\frac{Z_a^2}{R}$ across L, where Z_a is the characteristic impedance of the antenna.

On 21MHz the antenna, looking outwards from AB, is an inductance L_a in parallel with L as shown in Fig 12(b). It is convenient to choose the length AB so that L and L_a are roughly equal, and a radiation resistance R measured at a current antinode becomes roughly 2R when the reference point is altered to the centre of the element. If I is the current in the element at this point the total circulating current in C21 (Fig 12(b)) is 2I, and the parallel impedance R_p is again given by $\frac{\omega^2 L^2}{R}$. Typical values for these quantities are given in the table below for dipoles and also for beams not subject to aperture restriction.

Band (MHz)	R (dipole)	R (beam)	ωL, or Z_a	R_p (dipole)	R_p (beam)
14	70	20	200	570	2,000
21	200	100	300	450	900
28	200	150	600	1,800	2,400

* 1 Stoner Hill House, Froxfield, Petersfield, Hants.

For an swr better than two, which is adequate for most purposes, an impedance variation of 4:1 is allowed, so the above impedance figures provide a reasonable starting point for the design of a matched feeder system. In principle, all that is needed to use the linear resonator itself as the matching device is to tap the feeder across the appropriate fraction of L, given by $\sqrt{Z_o/R_p}$ where Z_o is the feeder impedance. For example, if a 300Ω feeder is tapped across 45 per cent of L a 5:1 impedance ratio is obtained and the worst swr in the case of the beam will be 1·7.

This example is based on arbitrary assumptions and in fact does no more than establish a "tendency to match", but with this as a starting point it is usually possible to obtain much lower values of swr than those indicated above.

Component ratings

In the case of the beam the above figures imply a maximum voltage at 28MHz of 1kV across L and perhaps twice this across the capacitor for an rf power level of 400W. The element centre current at 21MHz is 2A and the current in the capacitor about 4A. To interpret these figures in terms of component ratings the reader should refer to Fig 4 and the accompanying text. With variations in design parameters the voltages and currents may be increased or decreased, and the example gives only a rough idea of likely magnitudes.

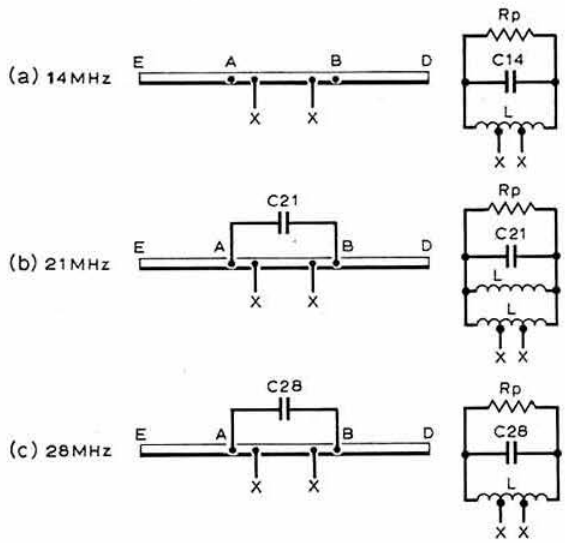

Fig 12. Principle of multiband matching (not to scale). (a) Inductance (L) of AB is tuned by the capacitance of AE, BD. Rp is the radiation resistance referred to the terminals of L which acts as a step-down autotransformer. Value of feed-point impedance depends only on the distance XX so that A.B are arbitrary points which can be chosen to coincide with the terminals of the linear resonator of (b) or (c). (b) Inductance L is roughly equal to the inductive reactance of AE, BD which appears in parallel with it. C21 tunes both reactances, and the radiation resistance can again be represented by a parallel resistance Rp. (c) L and C28 form a parallel resonant circuit to act as an insulator between the two half waves and allow them to be energized in phase. It also acts as a transformer to match the radiation resistance Rp into the feedline. To compensate for "borrowing" part of the antenna to form the inductance, the value of C28 is slightly increased

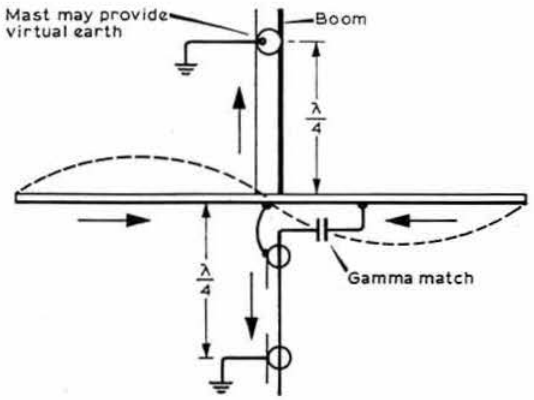

Fig 13. Excitation of full-wave mode by unbalanced feed. Centre of element is virtually isolated from earth so an incoming wave could set up the current distribution shown dotted. Voltage can therefore be developed across the feeder. By reciprocity this mode can also be radiated, but not with a balanced feed. Arrows indicate current flow and the feeder length may be any odd number of quarter waves. The linear resonator capacitor is not shown as it has no effect on this mode

Spurious resonances

Under certain "fault" conditions, or when adjustments are badly out, it is possible to excite spurious modes of radiation in elements using linear resonators. The most obvious one is the full-wave resonance involving two half-waves in antiphase. DL1FK [2] warns against this to the extent of ruling out the use of full-wave elements, but this mode cannot in fact be excited with a symmetrical feed system and is easily detected. It is predictable that it could be excited quite efficiently with an unbalanced feed under certain extreme conditions (Fig 13). Due to normal tolerances its presence has been detected when using a balun, but only in a very weak form, and for this purpose the resonator had to be badly detuned, since otherwise the unwanted mode was completely swamped by the wanted one. The unwanted mode is associated with current flow in the boom, and if both modes are present there will be unequal currents in the two halves of the radiator. If the full-wave mode is present alone, a pick-up loop moved along the radiator indicates a null in the centre. It is likely that under some conditions this mode could cause confusion when looking for resonances with a gdo.

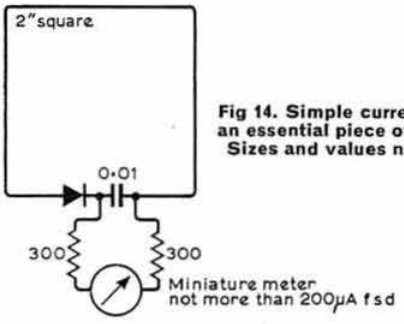

Fig 14. Simple current probe—an essential piece of test gear. Sizes and values not critical

It is possible when using a gdo, or with sufficient mistuning, to excite a mode in which current is wholly or mainly confined to the "trombone" section and there is little or no radiation from the antenna. This is most likely to be experienced at 21MHz and a low value of swr is no guarantee that it is not occurring. More conclusive evidence is provided by the following symptoms:

(*a*) Equal currents in the inductive and capacitive branches, little or none in the remainder of the elements.
(*b*) Inability to tune the parasitic elements or obtain useful field strength readings.
(*c*) Smoke rising from the balun!

If capacitance is being increased from a low value this is the *first* mode encountered. The remedy is to increase the capacitance until a reasonable ratio of inward-to-outward-flowing inductive current is achieved. This is typically about 1 to 1·5 in the case of Fig 3 and 0·3 to 0·6 in the case of the outer circuits of Fig 8.

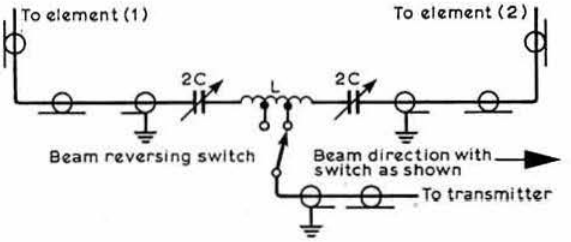

Fig 15. Phasing network for 2-el beams. Elements must be antiphase connected, ie if inner of coaxial goes to right-hand side of one element it goes to the left of the other. LC adjusted for resonance approximately at frequency in use but detuning compensates for mismatches and mutual reactances, to maintain equal element currents. Typically for 14MHz, 2C = 200pF maximum, L ≈ 1·6μH. Capacitors and taps adjusted for best back:front ratio or maximum gain. Method can be adapted for any type of feeder. Too high a value of L results in excessive rf voltages. Coaxial outers bonded together

Measurements of this kind need only be very rough. Fig 14 shows a simple "relative current" meter which may be calibrated against any other rf indicator of known characteristics, such as an oscilloscope. Small size is important for avoiding capacitance pick-up, and the meter should be held at a constant distance such as 0·5in (which can be judged roughly by eye) from the conductors carrying the current to be estimated. The distance should be slightly increased for conductors of smaller diameter. It will be found useful to remember that at 21MHz the current flowing into the capacitor must of necessity be equal to the sum of the two inductive currents, provided the point of observation is close to the junction of the conductors.

If a gdo is coupled in off-centre, many spurious modes will be observed. This happens with any "plumbers delight" beam, the modes corresponding with the many different ways in which a wave can wrap itself round the structure.

Other options

The ideas described can in principle be applied to any type of full-sized beam, and in the case of a quad the added gain obtainable at 28MHz is increased from 2 to 3dB. The quad then turns into a "bi-Square" for which most handbooks

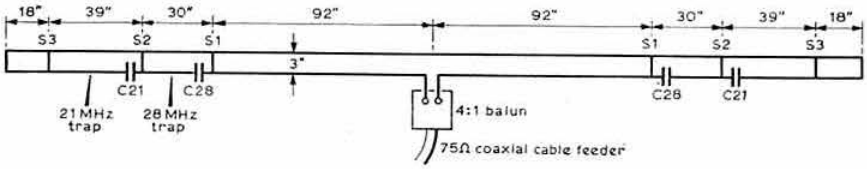

Fig 16. Trapped dipole using linear resonators. Details based on experimental model but not critical. Tuning requires adjustment of overall length on 14MHz and movement of shorting bars S2, S3 respectively, and in that order, for 28 and 21MHz. Tuning of traps can be used to compensate for small length errors on 21/28MHz. A refinement would use two straps for S2, the inner ones for 28MHz tuning, and the outer ones for length adjustment on 21MHz. Variable capacitors were used but calculated values for C28, C21, are 21, 28pF. It is important after adjustment to maintain the shape of the trap sections, eg by rigid construction or adequate spacers

claim a gain of 4dB for a single element, although this is not consistent with the stated value of radiation resistance. Each loop requires two resonators, one at each current loop, and care must be taken in the construction to ensure that the resonator maintains its shape. In this case triband operation demands rather more ingenuity but should be feasible if the "diamond" construction is used. Initially elements can be tuned up lying on their sides at low height, and final tuning carried out using the lower resonators only.

If only two elements are used it is recommended that both be driven, using a phasing line of the type illustrated in Fig 15. This was the system used with the earlier split-element lumped-circuit beam; it offered a number of advantages, the importance of which was repeatedly underlined in the course of later developments which did not provide the same facilities. These advantages are as follows:

(*a*) Instantaneous beam reversal. This is very important for certain areas and directions such as ZL1, since there are many times when propagation is equally likely to be long or short path. It also halves the average time required for beam rotation, besides providing an instantaneous check that the beam is functioning correctly.
(*b*) Any tuning errors, from whatever course, can be ironed out by adjustment of the phasing line. It was even found possible to "pull" the tuning all the way from 14 to 21MHz or vice versa for a loss of only 2 or 3dB!
(*c*) The loss of gain arising from excessive spacing at 28MHz can be held to 0·5dB as against 1·0dB for a parasitic array, and back-to-front ratios are improved considerably.

In this connection it must be stressed once again [8] that the use of lengths of transmission line for phasing close-spaced beams is basically unsound, since they must be individually and accurately matched at the "top end". This is rarely attempted and difficult to ensure even at a single frequency, since matching and phasing are interdependent, and with spacings other than $\lambda/8$ the reactive component of the mutual impedance can cause the radiation resistance of one element to be zero or even negative, which, to put it mildly, creates something of a matching problem!

Any long wire can be used, in effect, as a high-gain collinear array at frequencies which are high compared with its normal resonance, merely by the insertion of series capacitors at appropriate intervals [9], but it can then no longer be used as an efficient low-frequency antenna. If, however, instead of cutting into the wire the capacitors are merely bridged across short sections of it to form the equivalent linear resonators, this difficulty disappears and it must obviously be possible to use, say, a 14MHz dipole or driven element as a 10-el collinear array at 144MHz without interfering with 14MHz operation, though the practical details have not been worked out.

Advantages of 3-el designs

In view of the above comments, some justification is needed for the 3-el designs described. The main advantage in the case of a triband beam is undoubtedly the improvement in front-to-back ratio at the higher frequencies, this being relatively poor with two wide-spaced elements. At the same time the wider spacing is equivalent to an increase of aperture at the higher frequencies and, because of the large values of radiation resistance due to wide spacing and full use of the elements, adjustment can be biased in the direction of higher gain than might be expected merely from the increase in effective length of the element. These aspects have not as yet been fully evaluated.

In the case of a monoband beam the extra decibel of gain is probably not cost-effective, but this is not the only consideration and such beams are readily reversible by the use of two relays. With multiband operation the problem of reversal with 3-el beams is much more difficult and, taking this in conjunction with the extra length of boom, the author is left in some doubt as to whether the decision to use 3-el was in fact the right one.

Improved traps

The heading may seem inconsistent, since most of this article has been devoted to getting rid of traps! In fact, the author believes that the use of traps could be greatly extended; but there are wrong as well as right places for them and the elements of full-sized rotary beam antennas are most emphatically the wrong place—a view which has some support from other quarters [5]. Multiband operation of *rotary* beams by aperture restriction has never made much sense to the author, particularly since beams without traps are not merely better but can be made lighter and cheaper as they do not have to support the weight of the traps. With fixed antennas, and particularly beams, the situation is different because use of the full aperture narrows the beam and restricts the area of coverage. Whether this is good or bad depends entirely on the nature of the service or the requirements of the individual amateur whose main interests may lie in a particular direction.

Another "right place" for traps is in an inverted-V dipole or beam element. The inverted-V is a particularly important type of antenna, since it needs only a single support of light construction, and with two elements performance equal or

better than that of a rotary beam can be achieved at trivial cost—though, if space is restricted and all-round coverage required, it may be difficult to alter the beam direction or achieve the ideal of two or three switchable arrays. Inverted-V elements can be multibanded by the methods described above, but it is usually better to use traps.

There are several reasons for this—first, due to the slope of the V, use of the full aperture is accompanied by a reduction in effective height and this will be the more important of the two effects unless the apex angle or the height is large. Second, at the higher frequencies, unless the apex angle is greater than 120° there will be considerable radiation off the ends, and since it is unlikely that the beam can be quickly changed in direction the restriction of area coverage may be another important factor. If an inverted-V element is required to support the weight of traps, its main advantages are lost, but the linear resonator provides the answer since there are no coils or weatherproofing involved, only small capacitors and short extra lengths of wire—though provision must be made for accurate maintenance of the shape of the linear resonators.

As yet this idea has been tried out only to the extent of "proving the principle", using a folded-dipole type of construction as illustrated in Fig 16. The reduction in length compared with a standard 14MHz dipole is due mainly to the capacitive end-loading effect produced by the wires leading to the capacitors, very little of it being attributable to the resonators as such. Variable air-dielectric trimmers were used but not measured; the values given in the figure have been calculated and should be regarded as rough guidelines only. As calculated, the measured swr was close to unity on 14 and 28MHz but rose to 1·8 on 21MHz. Bandwidth was not measured.

One idea for building an efficient multiband miniature beam is based on the use of traps. This objective is to achieve minimum size without significant losses, in which case the maximum possible amount of capacitive end-loading is essential and losses in loading coils are not acceptable. At the higher frequencies it is necessary to shed all or part of this loading, as in the G3IMX miniquad [10]. but traps are also lossy devices and if miniaturization is carried to the limit the losses in conventional traps become unacceptable. By virtue of the "disappearing inductance" feature, this problem should not arise with linear traps.

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[9] F. E. Terman, *Radio Engineers Handbook*, 1943, p773.

[10] E. G. Jolliffe, G3IMX, British Patent. See also "Technical Topics", *Radio Communication* March 1976.

RSGB QSL BUREAU SUB-MANAGERS

(At 15 April 1977)

G2:	J. W. Russell, G2ZR, 55 Holcombe Close, Bathampton, Bath BA2 6UP.
G3 and G4 two-letter calls, G5 calls:	E. G. Allen, G3DRN, 30 Bodnant Gardens, London SW20 0UD.
G6 calls; G8 calls:	Mr & Mrs A. J. Mathews, G6QM, 62 Ashlands Road, Hesters Way, Cheltenham GL51 0DE.
G3AAA-DZZ:	C. A. Bradbury, BRS1066, 13 Salisbury Avenue, Cheltenham GL51 5BT.
G3EAA-HZZ:	S. L. Newport, G4DEV, 101 Elibank Road, Eltham, London SE9 1QJ.
G3IAA-KZZ:	G. L. V. Butler, G2BUL, 130 Coulsdon Road, Old Coulsdon, Surrey CR3 2LE.
G3LAA-NZZ:	C. A. P. Henderson, G4FAM, 76c The Avenue, Beckenham, Kent BR3 2ES.
G3OAA-PZZ:	J. H. Brazzill, G3WP, 43 Forest Drive, Chelmsford, Essex CM1 2TT.
G3RAA-RZZ:	D. Dell, G3PQF, 6 Rye Close, Farnborough, Hants GU14 9LU.
G3SAA-TZZ:	E. G. Allen, G3DRN, 30 Bodnant Gardens, London SW20 0UD.
G3UAA-VZZ:	M. Newton, G3UKW, 2 Marlowe Court, Garforth, Leeds, LS25 1PR.
G3WAA-XZZ:	F. G. Rylands, G2VF, 39 Parkside Avenue, Millbrook, Southampton, Hants SO1 9AF.
G3YAA-ZZZ:	H. R. Boutle, G2CLP, 14 Queen's Drive, Bedford.
G4AAA-AZZ:	C. Johnson, BRS31379, 118 Harvest Road, Smethwick, Warley B67 6NG.
G4BAA-BZZ:	R. F. Rawlings, G3WBV, 74 The Lindens, Fieldway, New Addington, Surrey CRO 9EL.
G4CAA-CZZ:	T. Cheesley, G4CHP, 2 Willows Close, Upper Tasburgh, Norwich NR15 1NE.
G4DAA-DZZ:	D. Buckley, G3VLX, 16 Wood Ride, Petts Wood, Orpington, Kent BR5 1PX.
G4EAA-EZZ:	P. C. Barry, BRS22730, 32 Rutland Avenue, Sidcup, Kent DA15 9DZ.
G4FAA-FZZ:	E. Gibbins, 23 Derry Downs, Orpington, Kent BR5 4DT.
G4GAA-GZZ:	B. R. George, G3ZOH, 43 Magnolia Drive, Biggin Hill, Kent.
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GI:	R. R. Parsons, GI3HXV, 45 Erinvale Avenue, Belfast BT10 0FP.
GJ:	L. D. Woolf, GJ8AAZ, 57 Elizabeth Avenue, St Brelades, Jersey, CI.
GM:	D. R. Macadie, GM6MD, 11 Marchmont Road, Ayr KA7 2SB.
GU:	W. E. Butt, GU2FZC, "Meo Voto", Green Lanes, St Peter Port, Guernsey, CI.
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BRS and A numbers:	D. Bourne, G4CYW, "Roughways", Chub Tor, Yelverton, Devon PL20 6HY.

A new era in amateur radio

by J. KASSER, G3ZCZ/W3*

AMATEUR radio is about to undergo a fundamental change. Over 50 years ago the discovery that the hf bands would support long-distance communication revolutionized amateur radio as it was then. For at that time amateurs were limited to working their friends across town or the occasional dx station using high power and long wire antennas on the long wave bands. With the introduction of the short wave bands dx contacts became commonplace with small antennas and relatively low power. Encouraged by this dx potential, amateurs explored the short waves using shorter and shorter wavelengths to work the world. Time passed, the technology improved and frequencies became higher—wavelengths shorter—until a barrier was found at a wavelength of about 10m. The ionosphere allowed reasonably reliable dx contacts only at frequencies below about 30MHz. Thus for years dx contacts were in the main limited to hf. Now that barrier is being broken and a fundamental change in amateur radio is about to take place.

In the change that amateur radio is about to undergo, whole new bands will open up with characteristics unlike any of those existing at present. When will that change take place? It will begin with the successful launch of the first AMSAT Phase 3 spacecraft now scheduled for late in 1979.

AMSAT is a world-wide organization of radio amateurs with more than 3,000 members in over 85 countries, together with members of national organizations such as AMSAT-UK and AMSAT-DL. However, everyone communicating via the AMSAT Oscar 6 and 7 spacecraft is not a member of AMSAT, and there is no requirement that they become members. It is estimated that many thousands of radio amateurs have made use of these spacecraft. If one counts the amateurs who have been involved in: (a) commanding the spacecraft so as to ensure that they are available for use when scheduled; (b) publicizing AMSAT and making known the capabilities of the existing satellites and the potentials of the new ones; and (c) building new ones, it will be found that only a few hundred out of an estimated 750,000 radio amateurs, world wide, are pioneering the way into the satellite era of amateur radio.

AMSAT is currently managing the day-to-day operation of the Oscar 6 and 7 spacecraft. These satellites are in low altitude orbits and allow communication ranges of up to 5,000km or so without any skip zones. However, the band is open for only about 20min five or six times a day when the satellite passes within range. While satellite communication is indeed possible, it is somewhat more difficult than conventional communication using the hf bands. The Phase 3 spacecraft will open the vhf bands for hours at a time. In use these bands will appear to be similar to the hf bands, in that they will open up for communication with stations to the east of the user, slowly change to include areas to the north and south and then open up to the west before closing down. There will, however, be a lot of overlap between these areas. Contacts will be possible with the whole of the northern hemisphere and much of the southern for hours at a time with no skip zones.

No skip zones! Imagine what that will mean! Anyone in the northern hemisphere will be able to hear anyone else. Imagine a round table QSO between stations in New York, Washington, Los Angeles, Miami, Tokyo, Paris, Tel Aviv and Moscow all able to hear each other at the same time—this is not possible using the hf bands. Nets, emergency traffic handling, educational demonstrations and plain CQ calls will all assume a new dimension.

Historically AMSAT has worked to build operational, simple-to-use satellites and now its goal is within sight. The space programme has been international in the true co-operative spirit of amateur radio. AMSAT's first spacecraft was Australis-Oscar 5, built in Australia, by amateurs at Melbourne University. It was not a communication satellite but carried, among other equipment, a prototype command system which proved that radio amateurs could control the operation of satellites in outer space. Oscar 6, built by Australian, German and American amateurs, was the first long-life amateur radio communication satellite. Designed for a one-year lifetime it is now showing signs of old age after 4½ years of faithful service. Oscar 7, built by American, Australian, Canadian and German amateurs, is now approaching its three-year operational design lifetime.

In order to keep interest in space communication active until 1980 when the first Phase 3 spacecraft is expected to become operational, AMSAT is stretching its resources and building one more low-orbit satellite (known as Oscar D until launch). Oscar D is a joint effort of the Japanese AMSAT Association, Project Oscar, and the ARRL all working closely in co-operation with AMSAT. Oscar D is presently scheduled for launch in late 1977 and is primarily intended for continuing support of the educational programme. Once the spacecraft is launched and in orbit it will become Oscar 8 and will be considered to be in the public domain so that anyone can use it for communication purposes. The ARRL will then become responsible for all the operation management aspects of the satellite, with AMSAT acting as technical consultants to ensure operation consistent with the design of the spacecraft. The ARRL will also pay AMSAT the sum of £30,000 to partially reimburse the development and construction costs of the spacecraft. Space satellites are not cheap. Oscar 7 cost in the neighbourhood of £36,000 but a similar commercial communication spacecraft could have cost £1,200,000.

AMSAT also has a policy of not "obsoleting" equipment. Oscar 6 carried a 145·9/29·5MHz transponder. Oscar 7 introduced a uhf/vhf transponder on 432/145·9MHz. This transponder designated as Mode B (145·9/29·5MHz became Mode A) clearly demonstrates the superior capabilities of vhf for amateur satellite transponders. The Mode B link on Oscar 7 is clearly superior to the Mode A links of Oscars 6 and 7. Oscar D will also carry a Mode A transponder and a new Mode J transponder (built in Japan) on 145·9 (up)/435·15MHz (down). Similarly the first of the Phase 3 spacecraft will carry two transponders, utilizing Modes A and J. Thus as amateurs become interested in satellite communication and obtain equipment, they can be sure that their investment will not become obsolete with the passing of any one spacecraft.

The Phase 3 spacecraft will be accessible with full quieting ssb or cw signals by any amateur radio station using an output power of the order of 50W and small rooftop style

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antennas. Thus any apartment dweller with a balcony having some northern exposure will be able to work the world. In fact the performance of this equipment communicating through a Phase 2 spacecraft will usually be superior to a kilowatt-quad combination on the hf bands. Details of the Phase 3 satellite appeared in page 512 of the July 1976 issue of *Radio Communication*.

Amateur spacecraft have long passed the days when launches were made available because the spacecraft were there, or to demonstrate that amateurs could do it too. There are now many spacecraft competing for all-too-few launch opportunities. AMSAT thus has to show how the piggy-back launch can be implemented for a minimum of cost to the launching agency, and also show cause why a spacecraft should even be carried aloft in the first place. Thus the Oscar series spacecraft have also been used for scientific and public service demonstrations of communication capabilities. There have been educational transmissions to introduce the space sciences to students in classrooms, and demonstrations of an emergency crashed aircraft locating technique in Canada and the USA which has shown that it is possible to pin-point the position of a simulated crash site to within a few miles of the exact location. NASA is now studying an operational satellite system to do just that, saving incalculable numbers of lives and thousands of dollars in search and rescue costs.

Data collection techniques using remote sensors relaying data via satellite to a central location have been demonstrated. Mobile terminals have been set up in cars, boats and private aircraft. Medical emergency traffic has been simulated. Electrocardiograph data has been transmitted coast to coast; phone patches have linked Hawaii to the mainland USA; direct "broadcasting" experiments have taken place. Many of these activities are only being talked about by the professionals, or if they are being done this is at many times the cost in terms of spacecraft and ground equipment.

Oscars 6 and 7 have paved the way. They have shown that amateurs can use the satellite bands and have some grasp of the potential that they have to offer. But impressive as these are, much is yet to come. Contacts via Oscars 6 and 7 require some technical expertise—the spacecraft must be tracked as they speed across the sky, passes last only about 20min and ranges are limited. The Phase 3 spacecraft will change that, and spacecraft QSOs will become very simple to implement. Communication will be possible for hours at a time, but these capabilities will not come free. Hardware costs for the first Phase 3 spacecraft are estimated as £100,000 (a government or commercial spacecraft providing similar performance would cost millions).

How can you help?

First of all you can become a member of AMSAT and/or AMSAT-UK. Dues for AMSAT are only £6 per year. If you are already a member and even if you are not, you can become a life member for a donation of at least £60. You will then receive the *Amsat Newsletter*, a quarterly publication devoted to amateur satellite communication. It contains details about existing, future and planned spacecraft; operating news, and acts as a forum for a dialogue between communicators. You can also encourage your local radio club to become a member society at £12 per year (£120 life).

You can also help the Phase 3 programme financially by sponsoring part of the satellite. You can sponsor any number of solar cells (£6 each), battery cells (£120 each), solar panels (£1,200 each), transponders (£3,000 each), an on-board-microcomputer (£5,000) or a rocket motor (£6,000). All sponsors will receive a certificate suitable for framing acknowledging their contribution. A plaque honouring for posterity contributors of £600 or more will be carried on the spacecraft in orbit around the earth; contributors will receive a replica of the plaque as a memento.

Information regarding current satellites and the contact points for further enquiries within the UK appears on page 371 of this issue. Your participation will be welcome. □

BOOK REVIEW

The Radio Amateur's Handbook. 54th edition, 1977. By the HQ staff of the ARRL. 704 pages, profusely illustrated. Obtainable from RSGB Publications (Sales), 35 Doughty Street, London WC1N 2AE, price £8.05 (paperback), £11.31 (hardback), including postage and packing.

The introduction to this edition has an interesting map of the USA with the various power allocations to each 25kHz segment of the 1·8MHz band, coded for quick reference, in all states, including Alaska and Hawaii.

The section on coupled circuits has been rewritten, and extended. The appearance of *susceptance*, and *admittance*, was long overdue, though the similar unit *conductance* has usually been included. Perhaps the definitions "amps per volt in phase" for *conductance* of a circuit; "amps per volt in quadrature" for *susceptance*; and simply "amps per volt" for *admittance*, would be a helpful addition. While on this subject, it is remarkable that the simple concept of *phasors* (rotating vectors) is absent in a book so concerned with alternating quantities, especially as the growth, decline, and reversal of the shadow on the wall of a rod rotating in the vertical plane at right angles, clearly gives the instantaneous value idea, and "phase" and "phase difference" follow with great advantage to the understanding of modulation, side-bands, heterodynes etc.

In the power supply section a new 0–25V adjustable power supply employs the National LM317K adjustable voltage regulator.

Filter design gets enlarged treatment and the Butterworth, Chebyshev, and elliptic-function modes are added for useful coverage of general principles and such problems as variable VFOs, interference etc.

The K1ZJH solid-state transceiver, 17 pages of it, is new. It is a sophisticated design with a digital read-out, and "beginners are not encouraged to attempt duplicating the circuits of this advanced project". Absent are the T-9er, the 10W package for 1·8MHz, the two-band solid-state transmitter, and several other suitable items for the modest-power constructor. The 2kW amplifier using an 8877 triode is redesigned; and an amplifier for QRP transceivers is new. The tripler amplifier for 432MHz has been redesigned.

A section on receiver design gives more general coverage than hitherto, and a useful constructional item is a converter to allow reception on amateur-band receivers of the NSB transmissions from WWV and WWVH, from which propagation reports are radiated hourly.

Amateur radio afloat is an addition which will interest those amateurs who may combine boating with radio, and a "minimisers dream receiver" is an up-dated version of the Goodman design using valves (45th edition). The present modified design is of solid-state construction throughout and operates on the 7MHz band. but has room in the cabinet for one or two converters.

The transistorized vox is replaced by a new design employing ICs but retains low-cost and small size; it has improved operational characteristics by the use of modern circuit techniques.

The section on tvi has been rewritten and enlarged, and though the electric clock has gone, a newcomer to the test equipment section is a 50MHz frequency counter.

These are only a few of the changes and additions which have been made in this edition, and many others wil be noticed, such as propagation prediction with a table of time and frequency stations, and the rewritten coverage of transmission lines, but they may allow the reader to realize that this book, of such established excellence and reliability, is also always new. *T. P A.*

Multiple beacons and other aspects of microwave band planning

Introduction

This article is intended to form a basis on which to discuss the planning of beacon and working frequencies in the microwave bands. It is mainly concerned with the setting of standards for narrow-band crystal-controlled equipment but it also covers standards for wide-band equipment for the 10GHz band.

The RSGB Microwave Sub-committee feels that with the rapid growth of activity in this part of the spectrum, it is important that some planning is done before too many local standards are adopted: we have not got so much effort that we can afford to waste it by later having to modify much equipment. It seems an obvious point to make that good planning may well have a profound effect on the rate at which bands are developed and, conversely, bad planning could well slow it. Decisions about planning the lower microwave bands may have a significant effect on those at higher frequencies, so it is important to take the general view from the start.

The problem of allocating beacon frequencies is the most urgent at this time, although there is sufficient interest in repeaters, including cross-band and tv repeaters, to make planning for them only marginally less urgent.

Recommendations

1. Because of their increased value as propagation indicators, multiple beacons which derive their output frequencies from a single driver should be encouraged.

2. Crystal-controlled beacons should preferably be set on harmonics of exactly 1,152MHz, eg 2,304·00MHz, 5,760·00 MHz, so that they may be used as both frequency standards and as frequency transfer standards for all the microwave bands including potential bands above 40GHz. They will also act as band-edge markers for the crystal-controlled sub-bands at n × 1,152 to n × 1,152 + 2MHz.

3. The preferred working frequencies should be harmonics of 1,152·1MHz exactly. Later, harmonics of 1,152·05 or 1,152·2MHz could also be used.

4. In countries where activity is not highly developed, it is suggested that wide-band beacons on 10GHz be established on 10,400MHz, with the preferred working frequencies within the range 10,400 to 10,500MHz. Narrow-band beacons will of course be set at 10,368MHz, with working frequencies in the range 10,368–10,370MHz.

5. Much of the present wide-band activity in the UK is in the range 10,000–10,100MHz. If recommendation 4 is accepted, then UK amateurs will have to consider whether or not they also will adopt the same standard.

Crystal-controlled beacons

The preferred parts of the microwave bands for narrow-band working have long been established as n × 1,152 to n × 1,152 + 2MHz. At this time there appears to be no reason for changing these preferences, particularly at frequencies up to 10GHz. Whether the 24GHz sub-band at 24,192–24,194MHz is always to be included in this scheme or whether it should be regarded as the start of a new system based on harmonics of 24GHz, if bands at higher frequencies should be allocated, will require careful consideration at a later stage.

It is suggested that the preferred frequencies for the first beacons be multiples of 1,152MHz, ie 2,304, 3,456, 5,760, 10,368 and 24,192MHz. The advantages of this philosophy are:

(*a*) It encourages the development of multiple beacons which use a single driver with a number of different multipliers to produce beacons for as many of the microwave bands as is required. Apart from simplifying equipment (especially if the driver itself can be keyed), thinking in terms of a single unit producing beacons for several bands at a time rather than the present band-by-band approach, could be most stimulating.

(*b*) An important advantage of this approach is that it becomes possible to tune a harmonic generator to a beacon output which is audible at a lower frequency, eg 2,304MHz, and use this to set receivers *precisely* for associated beacons at higher frequencies and simply wait for signals to come out of the noise. This tuning process could also be done automatically of course. The improved monitoring could well result in a significant change in our ideas on the frequency of occurrence of "openings" on these bands, a point of fundamental importance.

For harmonics of beacons at lower frequencies to fall within the crystal-controlled sub-bands at higher frequencies, their drivers *have* to be within 100kHz of 1,152MHz, and preferably within 10kHz. This cuts right across the present vhf philosophy of putting beacons near the centre of the narrow-band allocations. The question may then be asked: Why not put beacons on harmonics of *exactly* 1,152MHz in as many cases as possible? This would mean that a harmonic generator tuned to zero beat with *any* beacon would provide a frequency reference for *all* other beacons whatever their frequency.

Because highly directive antennas are normally used on the microwave bands and ranges tend to be limited, it is possible that a larger number of beacons than at first expected can be operated on a single frequency without undue interference. However, where interference would be excessive, beacons will have to be operated at other frequencies, and it is suggested that the frequencies immediately *below* the sub-band be considered for this purpose. Note that a shift of 5kHz at 1,152MHz corresponds to a change of 0·045MHz at 10,368MHz or 0·105MHz at 24,192MHz.

Working frequencies for crystal-controlled equipment

It is suggested that similar philosophies can profitably be applied to working frequencies for crystal-controlled equipment, with preferred frequencies being based on harmonics of, for example, 1,152·1MHz, ie at 2,304·2MHz, 5,760·5MHz, etc. The advantages in being able to set both transmitters and receivers to known frequencies would appear to be considerable. Other advantages include the possibility of bulk-buying relatively large numbers of virtually identical crystals from a single source. Not only would better quality crystals be obtained for the same price, but presumably they would have similar temperature and ageing characteristics which would increase the predictability of their frequency. If standard I.F.s can be agreed, the same bulk-buying philosophy could be applied to local oscillator crystals.

Wide-band (non-crystal-controlled) beacons

At present, beacons using free-running oscillators appear to be operated only on 10GHz: the only two known to be in operation are in the UK, and these are on 10,100MHz. The latter frequency reflects the concentration of UK activity in the region 10,000–10,100MHz which originated from difficulties in tuning surplus X-band radar (particularly 723/AB klystrons) much above these frequencies. A significant disadvantage of this is the 300MHz gap which exists between this part of our allocation and that clearly preferred for narrow-band working at 10,368MHz. This means that some frequency-sensitive components such as filters, isolators and circulators, and even some forms of antenna feeds, may not cover both ends of the band, thus making equipment less compatible.

For this reason it is suggested that 10,400MHz be considered as the preferred beacon frequency for wide-band operation, with 10,400–10,500MHz as the preferred working frequencies. The advantages of this philosophy would seem to be:

(*a*) The 30MHz gap between the narrow-band and wide-band parts should encourage the construction of compatible equipment while being sufficient to minimize the risk of interference. Wide-band receivers could easily be made to cover both the wide-band and the narrow-band parts of 10GHz.

(*b*) All countries in IARU Region 1 which have a 10GHz allocation include the top end of the band. Some countries, eg Austria, Yugoslavia and Switzerland, do not have the lower 250MHz, and to suggest that these countries operate different standards would seem to be an unfortunate policy. Indeed it could be argued that by concentrating our efforts in a restricted part of the spectrum we may improve our chances of retaining that part.

(*c*) Although it can be argued that the availability of "surplus" equipment is an advantage of using the low end of the band, the same argument now applies to the top end. Intruder alarm and police radar equipment operates on the range 10·5–10·6GHz and this would be expected to be rather more readily modified to cover the region 10,400–10,500MHz.

RSGB Microwave Sub-committee

oscar news

Oscar 6

Uplink 145·900 to 146·000MHz. Downlink 29·450 to 29·550MHz.
Recommended modes: A1, A3j.
Uplink power required: 80W eirp at 2,000 miles slant range.
Downlink sensitivity desired: 0·1μV for 5dB/noise.
Beacon on 29·450MHz ± 4·7kHz doppler shift, modulated by A1 (cw) telemetry giving spacecraft environment or codestore messages in cw. Speeds: 10 or 20 wpm.
UHF beacon on 435·1MHz ± doppler, very weak and can only be copied using receiver with good s/n ratio with high antenna gain on overhead orbits.

Oscar 6 may be employed for repeater contacts on **ascending orbits** on Monday, Thursday and Saturday evenings (south to north). It is important that it is not used at other times when it may be found to be ON, otherwise important scientific experiments may be lost, and the battery charge depleted.

Oscar 7

Uplink Mode B 432·125 to 432·175MHz. Downlink Mode B 145·975 to 145·925MHz; inverted.
Recommended modes, A1, F1, F2, A3a, A3j.
Uplink power required: 100W eirp at 2,000 miles slant range.
Downlink sensitivity desired: 0·1μV for 5dB/noise.
Beacon on 145·972MHz giving environmental telemetry in rtty space only format, with morse cw or codestore on Sundays on Mode B.
UHF beacon: as for Oscar 6, but fsk, only when in Mode A.
Uplink Mode A 145·850 to 145·950MHz. Downlink Mode A 29·4 to 29·5MHz; linear.
Recommended modes A1, A3j.
Uplink power required: as Mode B. Downlink sensitivity: as Mode B.
Beacon on 29·502MHz cw, telemetry, codestore on most Sundays.

Oscar 7 may be used for through repeater communication on any day excepting Wednesdays, when it is reserved for special experiments, pre-booked with AMSAT.

The repeater employment is alternative days Mode A and B, Sunday 1 May 1977 is a Mode A day. All users are requested **not** to exceed the maximum power listed, and only to use the satellites according to the arranged schedule, and to avoid transmitting on any of the beacon frequencies.

Every **Monday**, irrespective of satellite or mode, is a QRP day when the transmitted power shall not exceed 10W erp.

Orbital predictions

The Oscar 6/Oscar 7 orbital calendar for 1977 published by W6PAJ is obtainable from G4EZN, QTHR. The cost is £1.50 to members of AMSAT-UK and £3.00 to non-members.

Weekly information giving reference orbits can be heard on the GB2RS news bulletins, and the two AMSAT-UK nets on Sundays, on 3,780kHz at 10.15am and on 144·280 MHz at 7.30pm.

Orbital data for the two satellites is:

Satellite	Period	Longitudinal increment
Oscar 6	114·994min	28·74 per orbit
Oscar 7	114·944min	28·73 per orbit

HAF4C

The special call HAF4C will be used for satellite operation only from the Technical University of Budapest from 20 May 1977 until the end of the year. This commemorates the foundation of the first radio club in Hungary in 1924.

Further information

Enquiries regarding membership of AMSAT and AMSAT-UK should be directed to G4EZN, QTHR, and technical enquiries to G3RWL, QTHR. Copies of *Keeping track of Oscar* by G2AOX and the orbital plotting maps are obtainable from RSGB Publications (Sales). □

technical topics

Pat Hawker, G3VA

EACH month when starting to put together another *TT* I run over the various items I intend to include and try to ensure a pattern and a balance. Almost invariably, however, the final result is something rather different; preparing an item often brings to mind some related information that demands to go in; so something else may be squeezed out or found to present some problem that requires further consideration. Then again some of the ideas for sstv and rtty etc clearly need a full-length article and cannot usefully be digested in a paragraph or two. So if what finally appears seems unfair to your own interest, one can say only that it was not intended so; one tries to represent all modes and all bands; from ssb to cw, not forgetting a.m. which suddenly seems to need the special support one used to give to nbfm a few years back!

General-purpose fault-finding probe

Several designs for logic level detecting probes using light-emitting-diode (led) indicators intended for use when checking out digital circuitry have been presented in *TT*. However, in *Electronic Design* (3, 1 February 1977, page 72) L. H. Logan describes a simple probe-type device intended for general-purpose fault-finding on any type of equipment: Fig 1. It can be used as a convenient substitute for the normal multi-testmeter when fault-tracing since it eliminates the need to keep stopping to switch meter ranges etc. It provides an indication of the presence of either ac/dc potentials (indicating which) between 1·5V and about 500V, whether there is continuity between two points and some indication of the resistance between the two points. Of course it does not *measure* potentials and gives only a rough indication of ohms—but when carrying out quick checks on a piece of equipment this is often unnecessary, at least during preliminary checks.

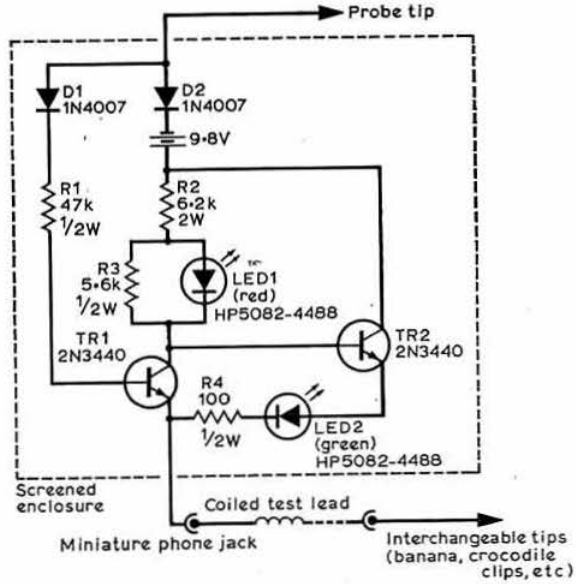

Fig 1. Test probe for general-purpose fault-finding without having to switch scales, etc as with multi-testmeters (*Electronic Design*)

The whole unit can be built in a small insulated casing, for example the housing of a penlight flashlight, and operated from a miniature (American AA size) mercury battery. For other forms of construction a conventional PP3 battery could be used.

When the test leads are placed across two points between which there is continuity but no potential difference, current from the internal battery forward biases TR2 and turns it "on" and the green led lights, but the small base current is not sufficient to cause the red led to light. The lower the resistance between the two points, the brighter the green led. If the resistance is more than about 5kΩ neither led lights. One can use this facility not only to test component and wiring continuity but also the operation of "wipers" on potentiometers etc. If the external circuit includes a semiconductor, the green led lights only when the probe tip is connected to the n-type material, and this provides a further useful test.

Should the probe tip be connected to a point more than about 1·5V positive with respect to the test lead, the emitter-base junction of TR2 is turned "on" and the red led lights, with the green led staying dark. If neither led illuminates, even when the test lead and test probe are interchanged, the two points are either "open circuit" or have more than 5kΩ resistance between them. If the red led lights no matter which way round the test lead/test probe are connected, then the potential difference between the two points must be ac.

One suspects that a few minutes' practical use with the fault-finder is likely to underline its usefulness rather more than this description. The feature that seems really attractive is that the various checks can be carried out quickly, without having to keep fiddling with the range switch of a multi-testmeter.

It is pointed out in *Electronic Design* that the test leads should be kept from touching when not in use, to prevent draining the internal battery; for this reason L. H. Logan suggests that the test lead should be made removable although a possible alternative, eliminating the need for the miniature jack plug and socket, would be to have an insulated cap fitting over the probe tip when not in use.

Injection-locked oscillators

While the integrated circuit has successfully taken many of the complications out of phase-locked-loop control of oscillators, it is still worth noting there is a long-established alternative approach to the problem of making two oscillators run exactly in step with one another. This is the injection-synchronized oscillator where a little output from a stable source is fed into a self-excited oscillator, which then automatically "locks" to the source and will do so at multiples and sub-multiples of the injected frequency. One example of this approach, which has appeared in several editions of *ART*, stems from HB9CM who showed how a

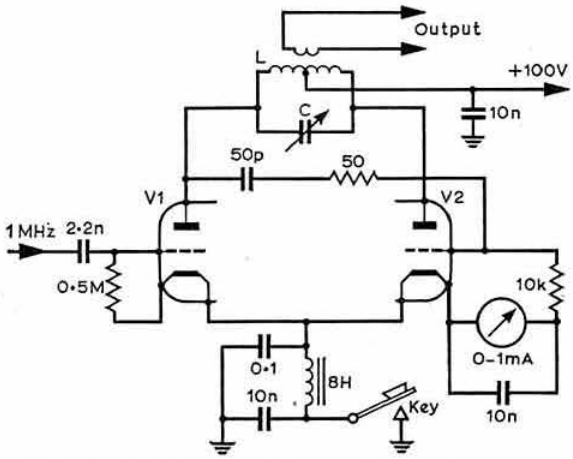

Fig 2. Injection-locked oscillator used for 14 and 21MHz transmitter experiments by CN2AQ as one application of simple synchronized oscillators (*Electron*)

1·8MHz power oscillator (in his case using an 837 valve) can be stabilized by injecting a little of the output from a 3·6MHz transmitter, thus providing an easy means of getting on 1·8MHz cw with one of the many hf equipments which do not themselves cover this band.

Another interesting application appears in Dick Rollema's "Reflecties door PA0SE" in *Electron* (March 1977) as a result of some experiments carried out by S. J. Quast, CN2AQ. This shows how a double-triode valve oscillator (12AT7, 12AU7 etc) can be arranged to provide a series of stable outputs at 1MHz intervals from about 12MHz to 32MHz by injecting some output from a 1MHz crystal oscillator: Fig 2. Such a facility could be used as the basis for a general-coverage receiver having 1MHz-wide tuning bands, but CN2AQ has been using it to provide a low-power cw transmitter on 14 and 21MHz. The stable signal is fed in via a 6AH6 cathode follower; for this particular application the crystal would need to be on the low side of 1MHz to avoid band-edge operation.

Touch-keying: overcoming the problems

W. D. Stirling, GM4DGT, was interested to see the brief notes in the February *TT* (page 130) about an add-on touch-paddle for the G3GJX keyer. He has built and used touch-keyers for almost three years and is convinced that most of the problems often associated with this type of keying (notably when used by those of us lacking the softness of youthful fingers) arise from the necessarily high-impedance input circuitry. Not infrequently one finds that instead of a "touch" keyer one ends up with a form of random auto-keyer that seems determined to send its own coded messages regardless of what you want to send! This tendency often increases when a high swr or end-fed antenna spreads rf around the operating position.

A second penalty with high impedances, GM4DGT has found, is what may politely be referred to as the "humidity effect" or in more earthy terms the secretion of finger dirt, due to sweating, between the pads of a touch matrix, resulting in the disappointing results to which G3GJX referred in his notes.

GM4DGT puts forward a number of practical suggestions based on his experiences:

(1) Make the input impedance as low as possible consistent with reliable keying. Nevertheless it must be recognized that an occasional dot or dash may be missed from this cause (a useful excuse for the operator!) though in practice this is more likely to be due to operator mistiming on clock-controlled keyers.

(2) Use the smallest practical area for the touch-pads and use a good insulator to mount them on: srbp can absorb enough moisture to cause self-triggering. A material such as ptfe is recommended, although GM4DGT reminds readers that there can be a health hazard in machining ptfe.

(3) Thoroughly decouple the input lines and fit ferrite beads.

GM3DGT believes that the arrangement shown in Fig 3 has the advantage that it can be used across the contacts of most keyers with little modification and is workable from a 5V supply. It was originally designed as part of a laboratory experiment to sense water presence and operates with as much as $10^{10}\Omega$ when the desensitizing resistor is removed. It has been used for normal rag-chewing and for contest operation. Construction requires much less mechanical skill than conventional paddles and contacts.

The use of complementary transistors increases the flexibility in that a variety of makes of keyers can be accommodated and the supply current can often be taken from an

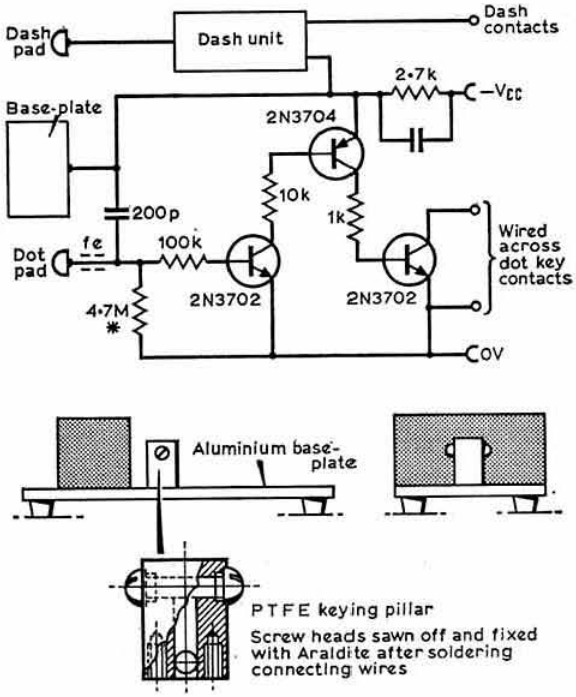

Fig 3. Dot unit circuit and details of GM4DGT touch-keying facility for use with el-bug keyers. A four-way screened cable connects the two similar units to the key. Almost any small-signal complementary transistors can be used and in many cases power taken from the keyer. The details can be varied in many ways to suit individual keyers. The resistor shown as 4·7MΩ desensitizes the unit and this value should be adjusted as necessary

existing keyer, or if necessary with a separate supply and adequate decoupling to provide a low impedance path between the "common" lines.

GM4DGT's keyer uses pnp transistors (*Radio Communication Handbook*) and the add-on unit of Fig 3 is incorporated. The decoupled 2·7kΩ resistor in the supply line guards against the effects of any short-circuits and the whole unit then connects via four-way screened cable into the keyer proper so that it may be unplugged when it is desired to use the original paddle.

GM3DGT mentions that a final "touch" can be achieved by replacing the keying relay by a suitable switching transistor; in this way the whole keyer becomes completely solid-state, with no mechanically moving parts (fingers excepted) so that even the most ardent cw operator can forget all about metal fatigue! However, it must be appreciated that "touch keying" is a skill that has to be acquired in its own right. For example, one must forget about resting a lazy finger on the "paddle", and finger movements have to become as clean and concise as possible. But then, surely, much of the appeal of cw operating is that it represents the exercise of a human skill, patiently acquired?

Quartz multivibrator

A class of oscillator that is relatively little used at present in amateur radio equipment is the crystal-controlled multivibrator. It is apparently possible to design these oscillators to provide a near-perfect square-wave output which should prove useful for such applications as switching mixers, product detectors, and as clocks for many digital systems.

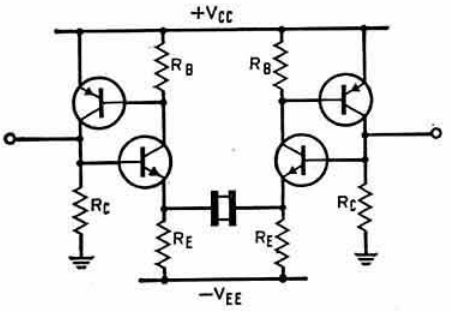

Fig 4. Quartz multivibrator using two regenerative switches. Typically Rc 100Ω; Rb 330Ω; Re 3·3kΩ; Vcc 6V; VEE 12V. BSX28 npn transistors; BSX29 pnp transistors (*Proc IEEE*)

A quartz multivibrator using two regenerative switches is described by Spasoje Tesic and Dragon Vasiljevic of the University of Belgrade in a letter to *Proc IEEE* (January 1977): see Fig 4. It is claimed that this oscillator provides a rectangular waveform with transitions completed in as little as 10ns (or much less than the time it takes a radio wave to cross a road!); it can be heavily loaded without impairing stability; and provides an output approaching Vcc with little change of frequency with large changes of Vcc (so that it is possible to control oscillator output simply by varying Vcc).

It is stated that the circuit has been tested using crystals over the frequency range of 0·1 to 10MHz and generally to be non-critical in value of resistors, devices etc. It needs two npn and two pnp transistors (eg BSX28 for npn, BSX29 for pnp), a Vcc of about 6V and a $-V_{EE}$ of about 12V.

Quad-fet mixer on 14MHz

It is now generally accepted that the key to better receiver performance is the use of mixers of wider dynamic range. Today, the all-solid-state receiver *can* outperform valve receivers, but only if designed very carefully for good signal handling. Opinion is still rather divided on the best approach; the Schottky double-balanced diode mixer is one of the front-runners, but for low-noise performance on 21 and 28MHz it does arguably require an rf stage of equally good dynamic performance and often a very good pre-amplifier for the i.f. strip. Significantly better dynamic range can be achieved when such diode mixers are associated with high or medium level oscillator injection, as was underlined in DJ2LR's recent article in *Ham Radio* (October 1976).

More controversial is the use of the various forms of balanced and double-balanced fet mixers such as those developed by Rafuse of MIT/RCA and Ed Oxner (ex-W9PRZ) of Siliconix. DJ2LR considers that while these offer advantages in test instruments their application in hf receivers "remains debatable"— a view not likely to be supported by several British firms!

Writing from Malden, Mass, Tony Garratt-Reed, ex-G3VBZ and hopefully soon a WA1, reports a personal evaluation on hf of one of the quad-fet mixers developed by Ed Oxner (*EDN* 5 July 1974 etc) and then shown to be capable of the following performance as a vhf mixer: two-tone third-order intermodulation output intercept +34dBm; gain +4dB; and with other good properties. With a view to using such a mixer in an hf transceiver, G3VBZ tested one at 14MHz; Fig 5. He writes:

"T1 is the input matching transformer, which must match the 50Ω source to the source impedance of the fet, about 25Ω. The original design used a transmission-line transformer but I used a conventional 2:1 + 1 winding on a ferrite toroid. T2 is merely a 2-turn bifilar secondary, wound on the oscillator coil. Matching here is less important, as the gate impedance is high. R1 and C1 form the bias network. C2L1C4 and C3L2C5 are pi-matching networks to transform the output impedance of the FETs (about 2kΩ) to the impedance of T3 which is a conventional trifilar ferrite transformer. I used the formulae in *RCH* to compute the values for the pi-network, assuming a Q of 12.

"The mixer worked very well. I do not have enough equipment to perform absolute measurements, but I can compare; so I used my HW101 as a standard. Briefly, I found that at 14·3MHz the mixer, converting to 3·8MHz, gave barely-audible third-order im products with 15dB attenuation from the test oscillator I used. The HW101, on its own and operating at 14·3MHz, gave the same result with 63dB attenuation.

"I was not able to check the sensitivity and noise floor of the HW101 on the two bands, but assuming they were the same (probably within a few decibels), and neglecting stray coupling, then the quad-fet mixer on its own is indicated as having 32dB more dynamic range than the HW101, at the high-power end. An experiment with a low-power test oscillator quickly revealed that the minimum discernible signal for the mixer/HW101 combination was 5dB lower than for the HW101 on its own.

"This enormous increase in dynamic range surprised me, and led me to wonder if I was getting stray coupling of the test oscillators to the receiver; I attempted to check this, with negative results.

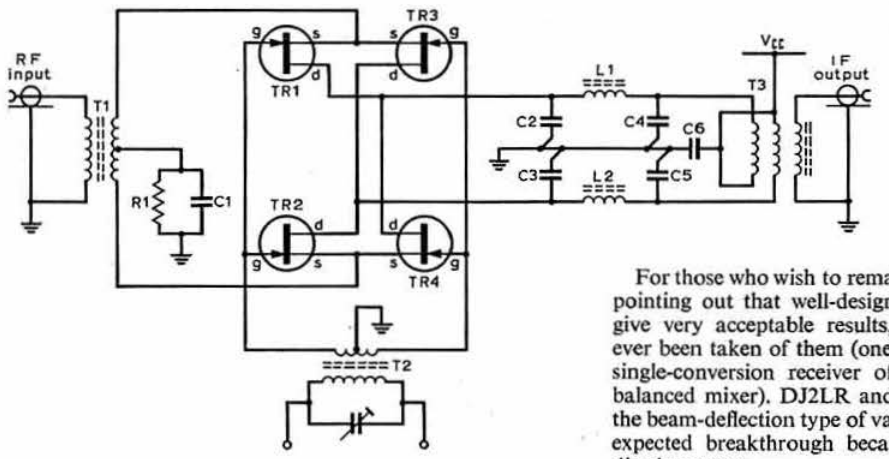

Fig 5. Wide dynamic range quad-fet mixer tested by G3VBZ on hf and based on Ed Oxner's design

"The devices I used in the mixer were 2N5459. Ed Oxner indicated that the devices should be matched within 10 per cent, and I was able to find four suitable ones in a batch of 12. Siliconix do manufacture a quad-fet device with the transistors suitably matched (type U350) but for amateurs this is expensive and practically unobtainable in small quantities. My Vcc was 12V and I found that the bias on the FETs was extremely critical (I used a 10-turn 500Ω pot for R1). The local oscillator input was also important and I used a pot in the supply line to adjust this. Even with the low Q of the pi-networks, I found the tuning to be critical and I had to connect trimmers in parallel with C2 and C3 in order to get the best results. The local oscillator voltage was of the order of 1V p-p.

"The significance of this arrangement seems to me to be as follows: calculations of the required pre-filter gain in a single-conversion ssb receiver with 9MHz i.f. give a net figure of 0dB. This can be achieved with a diode mixer *plus* rf amplifier, or by a quad-fet mixer *without* amplifier, allowing 4dB for loss in the signal-frequency tuned circuits.

"Either arrangement, feeding a XF-9B 9MHz filter and an i.f. strip having a 5dB noise figure, gives an overall noise figure of 14dB, which is suitable for use on all hf bands except perhaps 28MHz. Whether it is easier to build a high-performance rf amplifier plus diode mixer rather than this quad-fet mixer alone is open to dispute! One thing I have not established is to what extent the quad-fet mixer is broad-banded. However, I see no reason for it to be any inferior in this respect to the diode mixer.

"As I was doing these experiments, I read your comments (*TT* January) on 'how good is good enough?' This led me to one or two other experiments. On 3·5MHz in quietish conditions, my S-meter reads about S3. To get the same reading on the third-order im products, the fundamentals read about S9 + 30dB, a not very remarkable signal level at all. Hence the HW101 *could* be greatly improved. According to my measurements, the 3rd-order im from the quad-fet mixer would be only just audible at this level of input, and before the products reached the equivalent of S3 the fundamentals would be over S9 + 40dB—still not a signal level to be totally unexpected. Of course, on 14MHz say, things are much quieter, and intermodulation products become even more significant."

For those who wish to remain faithful to valves, it is worth pointing out that well-designed *balanced* valve mixers can give very acceptable results, though little advantage has ever been taken of them (one exception was the GEC naval single-conversion receiver of the 'sixties using a 12AU7 balanced mixer). DJ2LR and others have pointed out that the beam-deflection type of valve (7360 etc) did not prove the expected breakthrough because it introduced some other disadvantages.

More on linear ohmmeters

In the March *TT*, details were given of a linear ohmmeter using low-voltage discrete transistors developed by Cedric T. Marshall, G3YRN, and based on the earlier unit (*TT* January) incorporating an integrated-circuit operational amplifier. Since his original report, G3YRN has continued with the development of this ohmmeter, from the bench mock-up stage to a finished 11-range instrument measuring up to 3MΩ. In the transition a number of points have arisen which he feels will be of interest and assistance to other readers constructing similar instruments. He lists these as follows:

(1) A simple constant-current feed to the reference zener is well worthwhile and makes the instrument virtually independent of battery voltage down to about 7V: see Fig 6.

(2) The BC108 and BC178 transistors in the ohmmeter part of the circuit should preferably be selected for high gain at low collector currents.

(3) For ranges from 300kΩ upwards, the base current of the BC108 flowing through Rx becomes comparable with the constant current needed to generate the balancing 3V across Rref. This does *not* affect the linearity but does require compensation with values of Rref somewhat higher than the required fsd. For example, G3YRN found that his base current was about 0·3μA so, for instance, the 1MΩ range with a constant current of 3μA required Rref to be 1·11MΩ to give 3V with the remaining 2·7μA.

(4) Care should be taken not to blame the instrument for any non-linearities in the meter movement. With some of the

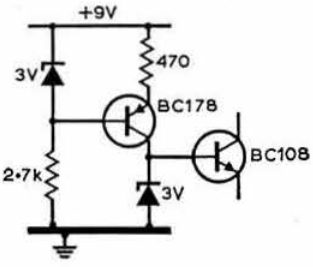

Fig 6. Simple constant-current feed to the reference zener used by G3YRN in his linear ohmmeter

cheaper movements a check against a good quality milliammeter can be quite a sobering experience.

(5) It was found when setting up ranges that this proved to be an excellent demonstration of how a soldering iron can permanently alter the value of a resistor!

G3YRN has built his linear ohmmeter in the same case and sharing the same meter as a linear capacitance meter (see, for example, January *TT*). The whole instrument, he reports, is a joy to use.

That medium-wave loop

In the February *TT* we included an illustration of a seven-turn large frame antenna which seems particularly useful for nulling out interference when chasing dx on mf or 1·8MHz. This illustration was redrawn from one that was published recently in *Electronics Australia*. Eric Dowdeswell, G4AR, has drawn my attention to an article by Charles Molloy on "Medium-wave dxing" which appeared in *Practical Wireless*, April 1970, and it is clear that this was the original source of this particular design about which the author wrote: "No one should be deterred from dxing on the medium waves through lack of an outside aerial.... No serious mw dxer would be without a loop ... frequently it is possible to null-out different stations on the same frequency, eg on 1,070kHz CBA in Canada can sometimes be heard free of interference if the null is pointing towards LR1 in Buenos Aires and similarly LR1 can be heard with CBA nulled out. There are additional benefits to be had from a loop. Static is reduced; in early summer when much of it comes from thunderstorms to the south, it can be eliminated when listening to the west ...". It all sounds pretty good going and a useful reminder of what can be done at mf.

Jan Martin Noding, LA8AK, writing from Bergen, Norway, also mentions that he has tried this type of frame receiving antenna on 3·5MHz and reports "the results were quite surprising, several W stations were heard above 3·8MHz".

Dial marking stencil

Faced with the problem of marking dials and scales on the panels of home-constructed equipment, John R. L. Walker, ZL3IB, (*Break-in*, December 1976) devised the stencil device shown in Fig 7. It is made from 2mm thick perspex with a radial straight edge and set of holes at regular intervals for drawing circular scales. The perspex stencil is fixed to a small instrument-type knob by means of three countersunk screws.

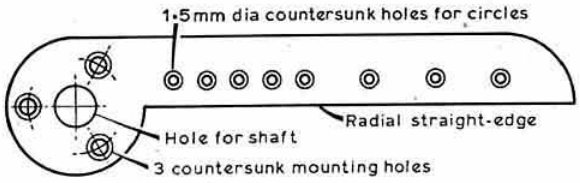

Fig 7. Dial marking stencil used by ZL3IB

To use, the stencil is simply mounted on the shaft of the component concerned (switch, variable capacitor, potentiometer etc) and arcs of circles drawn by inserting a stencil pen into a hole at the required radius and then slowly rotating the stencil. Calibration marks are made using the radial straight edge.

ZL3IB mentions that his usual constructional practice is to spray-paint panels with an aerosol paint spray and then, when dry, bake them at 60-90°C (in the kitchen oven if necessary and if you can get away with it). Just before labelling he wipes over the panels with methylated spirits to remove any grease or fingerprints and then he marks out the scales and labels using Pelikan type "T" black drawing ink (this is a special type of indian ink for use on plastic sheets with overhead projectors and is often obtainable from suppliers of drawing office equipment). For labels Letraset can be used, but ZL3IB prefers standard lettering stencils with the Pelikan "T" ink as this tends to be more versatile, easier to correct and less expensive. Finally he uses a thin coat of clear polyurethane varnish to protect the panel and lettering against abrasion.

Extending the logic probe

TT December 1976 included a flexible logic probe, originally described by Arthur R. Klinger in *Electronic Design* and using a 555 timer ic to provide accurate level detection. Paul C. Mullineaux, G3XEN, built one of these but used a 556 instead of the 555: the 556 is in effect two 555 devices in the same package. This has allowed him to build-in an additional af test oscillator and this extends the usefulness of an already useful test unit: Fig 8.

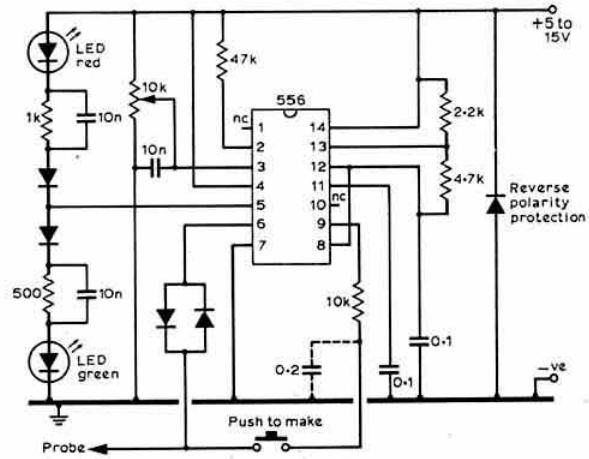

Fig 8. Combined logic probe/af oscillator built by G3XEN. Diodes 1N914. The 0·2μF capacitor (dotted connections) can be fitted to make the af oscillator output more sinusoidal

G3XEN lists some points to note:

(1) When the af oscillator is on, each led lights equally with the 10kΩ preset for 50 per cent of Vcc.

(2) The probe can still test the logic states when the oscillator is on.

(3) The oscillator works whether the probe is at Vcc or 0V as the 555 will sink or source.

(4) When using red and green LEDs it is useful to make the value of the limiting resistor for the green led half that for the red as this will make the light output of the two colours look similar.

He mounted his probe in an old "Savbit" solder dispenser.

microwaves

Dain Evans, G3RPE*

GB3DD

Two bits of news about the 1,296MHz beacon GB3DD which is on the Dunstable Downs at ZL08e. Since 13 March it has been operating on 1,296·89MHz in line with the current IARU beacon plan agreed at Warsaw. It is also now operating at higher power; the relatively high loss feeder having been replaced by FXJ4 feeder since 24 March. G3COJ reports that its signal with him is now 20dB over noise at his QTH near High Wycombe.

Microwave Award

The latest award on 1·3GHz is No 4 to GD2HDZ for his 1,130km contact with HB9AMH/P referred to in the March *Microwaves*.

A cumulative contest for 10GHz

For some time there has been a demand for a cumulative contest for 10GHz, and one has been organized for 1977. Five events will be held, the first two being on 22 May and 19 June. Each will last from 1100 to 2000gmt, and the best of three will be selected. Full details are given in "Contest News", but two features are worth emphasizing: information about who is going where will be circulated prior to the contest if this is sent in by intending participants, and the results will be analysed in terms of propagation. For the latter, unsuccessful contacts often are most valuable and therefore should be logged and sent in.

10GHz news

The growth of activity on 10GHz on the Continent is of course welcome news in itself, but more so because in the future we will be looking to our near (and not so near) neighbours for our dx as our equipment matures. So we are pleased to hear more good news from France. On 15 March, F1AVY on a site 1,700m high near Grenoble worked F8DO near Macon over a 153km path passing over Lyon to set up what surely must be a new French record. Their equipment used 20mW Gunn oscillators as transmitters/self-excited mixers with standard fm broadcast receivers tuned to 108 MHz as I.F.s. Antennas were dishes made from (their words) "cook-lids" 27 and 45cm diameter. The distance worked just exceeds the Microwave Award distance on this band, and so this contact could be used to claim their award if they so wished. Also involved with the contact were F1CVJ and F1BGL.

G3JHM reports that an swl near Lannion in Brittany is currently building, and will be operating with F5ZA during the summer. In the Paris region, F6DLA is reported to be interested, as is F1DPC, F1BFO and F1BCS. As noted last month, F8TD is already operational and has had a 53km contact with F6COW.

SM6HYG now has equipment working based on Gunn oscillators and is merely waiting for spring before beginning tests. He is especially interested in exploring super-refraction between Sweden and the UK. His site is ideal: he lives on a tiny peninsula 150m from the sea and 20m above it at FS58f, which seems to have a clear view of the coast of NE England and SW Scotland through the Skagerrak at a distance of roughly 900km. I am sure that he would like to hear from anyone wishing to make tests. His name and address are: Carl-Gustaf Blom, SM6HYG, Kvarnberget 3, 453 00 Lysekil, Sweden.

DF3GJ writes from Heidelberg that the 10GHz "disease" has now spread to SW Germany. He picked up the bug when he spent a year in Cardiff as GW5BPC and became a member of the Barry Radio Society/GW4BRS. The first contact was between HB9RG operating D and DK4GD over a 15km path. The next day, HB9RG and DJ3EN had a contact over a short path to make what may be the first HB–D contact on this band. The equipment used Gunn oscillators as self-excited mixers with dishes 1·2m in diameter.

DL7QY's latest efforts have centred on a cw/ssb transverter for 10,368MHz. The receiver consists of a GaAs fet type NE24483 preamplifier which has an nf of 3·5dB and a gain of 9dB at 10GHz, followed by a filter at 10,368MHz and a 1N23 mixer. A low-noise head amplifier at 1,296MHz based on the NE02135 device completes the front end. The local oscillator drive is taken from the main transmitter drive which starts at 63MHz and ends up at 9,072MHz with 80mW. The latter is mixed with 1,296MHz cw or ssb in a WG16 mixer using a BXY40 mixer. The 8mW output is filtered and amplified by a HP TWT to produce an output of 5W. The antenna used is a dish 0·4m diameter, which implies an erp of about 5kW. DL7QY reports that the stability is quite adequate for ssb: during the first hour after switch on the drift is 150kHz, but thereafter is only about 4kHz/h. He expects to give details in *DUBUS-INFO* issue 2/77.

His equipment for other bands is follows:

432MHz	350 W rf	Rx nf 1·6dB	Antenna 18dB gain
1,296MHz	170 W rf	Rx nf 2·0dB	Antenna 1·2m dish
2,304MHz	60 W rf	Rx nf 2·5dB	Antenna 1·3m dish
3,456MHz	2·5 W rf	Rx nf 3·1dB	Antenna 1·3m dish
5,760MHz	1·5 W rf	Rx nf 5·5dB	Antenna 1·3m dish

The last two units were referred to in last month's column. He is interested in making contacts on all these bands and suggests contacting him during openings either on 432·200MHz ssb or directly at 1 Berlin 62, Martin-Luther-Strasse 121, tel (030) 7 8244 18.

On the home front, G3JHM reports that he had a 59km contact with G8GKV on 13 February to give the latter station his first 10GHz contact. The path was from Devil's Dyke, 4km NW Brighton, and was followed immediately by a contact with G8BDJ. He also has had contacts with G8ARO. G8BCO has rebuilt his equipment in a more compact form for the forthcoming season and intends to concentrate his efforts on exploring non-optical paths. G3JHM notes the use of 144·33MHz as the preferred talk-back frequency in these tests. □

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4-2-70

Graham Knight, GM8FFX*

Beacons

The frequency of the Durham beacon, GB3NEE, which has been slightly low, has been reset by beacon-keeper G3YMK to the correct frequency of 144·130MHz. The Crowborough beacon, GB3SX, is temporarily off the air; once maintenance has been completed service will recommence on 70·684MHz. The extremely reliable Sutton Coldfield beacon, GB3SUT, on 432·890MHz has a new keyer which sends both the callsign and the QTH locator. Two slot-fed 8-over-8 antennas are used to beam the 60W of erp N and SE.

The callsigns of all French beacons are to have the prefix FX, and their repeaters will be prefixed by FZ. The beacon service in France is to be extended by the addition of two further 144MHz transmitters to be located at Chartres and at Marseilles. Still signing F3THF is the beacon on 144·905MHz from near Paris; F7THF is the callsign currently used on 144·904MHz by the beacon near the Swiss border in QTH locator DH15G. The first FX to be heard in this country was FX0THF from AI46H; it is on the rather low frequency of 144·740MHz.

Aurora

No reports of auroral contacts have been received this month. Dick Noble, GM8AZS, of Elgin, noticed a very bright visual display on 10 March but this was not accompanied by any radio event.

Recent auroral contacts between G4FNF and GM8FFX on 145·550MHz have been monitored by several fm operators with so-called "black boxes". Enquiries have since been received requesting details of the above contacts and advice on how to use commercial units for auroral contacts.

The transmitters used were adjusted for narrow-band phase modulation. Both signals, being phase modulated, could be received by local stations using normal fm receivers but could only be resolved at the far end *via the aurora* on receivers equipped with a product detector. As many commercial units do in fact use phase modulation, it may be worth adjusting the deviation so that a transmitted signal can be resolved by a local amateur with a sideband receiver. All that is then required to work via the aurora is a separate receiver with a product detector.

Reports of further phase modulated auroral contacts would be welcomed by *4-2-70* and the Propagation Studies Committee.

Repeaters

GB3LO, the London 144MHz repeater, has been closed down by the RSGB at the request of the Home Office because the licence has been contravened. The Society views this situation extremely seriously and will be conducting a full investigation. GB3PI, the Hertfordshire 144MHz repeater, is not operational at the time of writing; the equipment is being serviced and will be back on the air soon.

GB3RF, at Rossendale Forest near Burnley, operates on an input frequency of 145·175MHz and is now using a completely-solid-state repeater. The logic used in the new repeater has been developed by G3RKL and is similar to that used on GB3TW, GB3NA and GB3HH, but in normal operation sends a K instead of the pip tone sequence. Still to be incorporated is the logic to indicate when it changes over to the stand-by power supply, pips will then replace the K.

Changes have also been made to the GB3MP repeater at Moel-y-Parc in North Wales. The valve transmitter, which gave very reliable service, has been replaced by a solid-state unit giving 15W erp. Gordan Adams, G3LEQ, claims GB3MP has the most sensitive receiver in the country—thanks to the Trio receiver board.

Detailed below are the locations of the 31 proposals for 432MHz repeaters received under Phase 2. These have all been submitted to the Home Office and the block licence is expected to be issued to the RSGB shortly.

GB3AV—Aylesbury, Bucks
GB3AW—Newbury, Berks
GB3BK—Reading, Berks
GB3BN—Bracknell, Berks
GB3BS—Bristol, Avon
GB3CE—Colchester, Essex
GB3CH—Liskeard, Cornwall
GB3CK—Ashford, Kent
GB3CR—Mold, Chester
GB3DT—Wimborne, Dorset
GB3DY—Alport Heights, Derby
GB3ED—Edinburgh
GB3GL—Glasgow
GB3LE—Markfield, Leicester
GB3LH—Shrewsbury, Salop
GB3LI—Liverpool
GB3MA—Manchester
GB3MK—Milton Keynes, Bucks
GB3ML—Blackhill, Strathclyde
GB3MS—Malvern, Worcs
GB3NH—Upper Mounts, Northampton
GB3NM—Mapperley, Nottingham
GB3NT—Wickham, Tyne and Wear
GB3NX—Crawley Down, West Sussex
GB3OX—Headington, Oxford
GB3PB—Peterborough
GB3SP—Milford Haven, Dyfed
GB3SV—Stortford, Herts
GB3TS—Middlesbrough, Cleveland
GB3US—Sheffield
GB3WY—Bradford

Two additions can be made to last month's list of 432MHz repeaters. GB3NK at Chelsfield, Kent, is now operational on an input frequency of 434·700MHz, and GB3PH at Portsdown Hill, Hampshire, is operational on 434·650MHz. GB3HU, Hull; GB3IH, Ipswich; and GB3LV, Cheshunt, Herts; are all expected to be on the air shortly.

A proposal received by the RSGB for GB3LR, at Moel Gaer, Clywd, a linear 432MHz to 144MHz repeater has been considered by the VHF Committee which has recommended a change in the output band. This is in line with the recent meeting of vhf managers in Amsterdam at which it was agreed not to encourage future linear repeaters with outputs in the 144MHz band.

A proposal under consideration at the present time is for GB3PT, an rtty-only repeater for the 432MHz band, to be located at Barkway, Hertfordshire.

Seventy centimetres

Conditions have been very good on the 432MHz band and several recent openings are reported by correspondents.

Steven Ruff, GI8EWM, in County Antrim, worked over 700km to ON6AT/A in QTH locator BK18F with just 10W to a Multibeam; he often monitors contacts between G3BW at Whitehaven and G3BA at Sutton Coldfield, and thinks Spain should be possible from GI as it is mostly a sea path. Mark Tonna, F9FT, recently worked EA1CR. HB9AMH/P operating from a mountain top in Switzerland, gave many G stations their first 432MHz contact with QTH locator DH66C. Alex Dunn, GM8DMZ, near Ayr, heard the HB9 station but was unable to work him with 10W; he has now

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added an Electronic Developments linear amplifier and is very pleased with the improved results he gets running 50W.

Conditions held up for the March 432MHz Open Contest and a great many stations were operating from portable sites despite snow on the ground in some of the higher places. Mike Dormer, G3DAH, at Herne Bay, worked G8AGU/P in Devon and G4ASR/P in Cornwall; he noticed considerable selective ducting which enabled G3VPK, only a short distance away, to work stations Mike could not hear at all. Willie McLintock, G3VPK, had a great time in the contest with many GD, GI, GM and EI stations among his 71 contacts.

Dave Butler, G4ASR, operating portable from The Lizard, Cornwall, had problems with the wet conditions at the portable site; he worked G8FUF, Southend; G3FZL, Croydon; G4BRA/P, Oxford; and G3JQA/P in Staffordshire. Best dx from The Lizard was G3XDY 500km away in Ipswich. PA0EZ and PA0VV were heard by Dave but not worked. John Quarmby, G3XDY, operating from his new QTH worked many G stations, two in Belgium and 25 in Holland. The Bracknell Amateur Radio Group operating G4BRA/P in Oxford from QTH locator ZL26F did very well and had amassed 70 contacts in the contest by 1100gmt.

Harold Meezra, BRS34348, listening at home in Chatham heard more than 50 stations during the contest. Best dx at Harold's 300ft asl site was Arthur Breeze, GD2HDZ. PA0FWS, PA0MAR and ON6UG were the loudest Continental stations heard, while a consistent 5 and 9 signal was received throughout the contest from G8HVY/P in Dorset from QTH locator YK28G.

Malcolm Bannerman, GM3ZXE/P, at Cairn o' Mount (YQ08G) and Norman Hendry, GM8CBQ/P, in Aberdeenshire (YR51E) were the two most northerly stations heard during the contest. GM4DMZ/P at the Mull of Galloway, using 50W to an 88-el Multibeam, worked 67 stations including G3JXN in London. The best contact was at a distance of 510km, stations heard but not worked were G3OSS and G3FZL.

As the above reports show, sideband activity on 432MHz is increasing rapidly with several stations scoring more than 100 contacts. The results show that dx contacts are possible on this band with relatively low power, many of the portable operators made very long distance QSOs with just 10W. Scores heard during the contest were G3UBX/P in Shrewsbury with 114 contacts at 1500gmt, G3JQA/P at 122 by 1550gmt and G4BRA/P with 133 towards the end of the afternoon. The next 432MHz contest takes place on 15 May.

Four metres

Dave Butler, G4ASR, will be operating portable from The Lizard, Cornwall, during the month of September and is looking for long-haul skeds for this period—particularly with Scottish stations. The Lizard is in the rare QTH square XJ and Dave has an excellent portable site more than 250ft asl. The antenna to be used will be a 6-el Yagi. Skeds and further details are available from G4ASR, QTHR.

Dave Dalrymple, GM3OLK, and Drew Givens, GM3YOR, of the Glenrothes ARC have postponed plans for an expedition to the Faeroes. This year's trip will be to the Shetland Islands, and although 144MHz and 432MHz are included in the plans a special effort will be made on 70MHz. Dates for this interesting expedition are 12-29 July. On the 1975 and 1976 expeditions, GM3OLK and GM3YOR gave consistently good signals from all Northern Ireland counties and from the Outer Hebrides. We hope the 1977 expedition meets with good conditions and similar success. Requests for details to GM3YOR, QTHR.

REAL DX 1977

70MHz	GM3ZBE	— G4CVI	650km
144MHz	G3SEK	— UR2RX	1,758km
432MHz	GW4CQT	— HB9AMH/P	860km

Derrick Dance, GM4CXP, and Alex Allan, GM3ZBE, continue to be active on the band but both find contacts difficult under present conditions. GM3ZBE reports contacts with G4CVI at Leatherhead and G3FIJ at Colchester. Alex runs 50W to a 3-el beam from his 600ft asl site to the north of Aberdeen.

W1HDQ

Ed Tilton, W1HDQ, the opening speaker in the vhf stream at the Alexandra Palace Exhibition and Convention, has been associated with the ARRL for more than 30 years. He was the first contributing editor to *QST*, and is currently on a special assignment dealing with propagation research, after having "retired" some two years ago. He has been associated with much of the pioneering work on vhf in the USA and was at the North American end of the first transatlantic contact on 50MHz. He is no stranger to conventions, having probably attended more of these functions than any other ARRL staff member.

The grapevine

Haydn Bate, G8AMD, is the new chairman of the Repeater Working Group . . . The French say their 144MHz beacon system is to be expanded in hexagonal patterns – so much more sensible than circles . . . A new 432MHz transceiver from Japan will soon be on sale in Britain; it features all modes and coverage from 430 to 440MHz . . . G4CMV at Leeds heard both HB9HB on 144·125MHz and F7THF in locator DH15G last month but was unable to work any Swiss stations . . . GM4CXP has brought an fm rig so he can listen to the repeaters . . . A letter from Germany mentions a proposed Russian equivalent to Oscar . . . The QTH locator map seems to show the Shetland Islands in the wrong square . . . There is reputed to be a CT1 beacon on 145·500MHz; can anyone confirm this information as it is unlikely to be heard here on the fm calling frequency.

Late news

Conditions were only average for the April 70MHz Contest. Good signals were heard from G3OHH, G4CVI and G3JYP. G3WKF/P in Cornwall was an outstanding signal with G3DAH. High scoring stations included G3MOT at Reading, G4ERP in Cheltenham; G3UUT/P in Yorkshire was at 54 contacts by 1700gmt; GW3WCS/P finished with 63 contacts; and GW3WRA/P, operating in the snow at 2,400ft asl, had 71 contacts. Both GW operators felt the contest was too long and would have preferred a shorter contest.

Finally, thanks to all correspondents this month. Please send all your news, views, and photographs to PO Box 49, Aberdeen. □

the month on the air

John Allaway, G3FKM*

THE opening paragraph of the March *MOTA* concerning the Region 1 Band Plan as applicable to the 3·5MHz band produced correspondence of great interest. It was intended to try to encourage the use of the 3,500–3,600kHz band and to draw attention to the fact that band plans are not something agreed many years ago and left unaltered in spite of changing circumstances (as has been suggested). However, some read the paragraph as an indication that the RSGB was ready to propose changes detrimental to those who favour the use of cw. Others expressed the view that the Society is "anti-cw" (without providing the evidence) and does nothing to protect the sub-bands, and yet others suggest that "scruffy looking university types" or "the senior citizens of the 80m phone band" (two phrases actually used) would deprive them of their favourite operating space.

Your scribe, being a dyed-in-the-wool dx operator, believes that he enjoys both cw and phone operation, depending on the circumstances. To him it is very clear that the standard of operating as a general rule is better in the cw sections, and the very last thing that he would like to see would be the demise of the skilful user of the morse code. His contact with the Society at fairly close quarters for several years would also cause him to say that these views are fairly widely shared and that there is little or no likelihood that the RSGB will propose or support any proposition for the reduction of cw bands at the Region 1 Conference next year.

W0PRY would be very grateful to anyone who could help him to trace an operator of the RAF Steamer Point ARC in Aden who was active from VS9ASP in March 1967 and whose name was Keith. Please contact G3FKM.

G4CXN points out that W3OP is 73 years old and uses an indoor aerial. He runs low power on cw and readers are asked to give him the pleasure of a contact if they hear him.

G4FPK reports that his callsign is being used by a pirate in Paisley using the call GM4FPK.

Top band news

Stations in France received permission to operate on 1,826kHz during international contests from 16 March 1977.

The February issue of the W1BB *160 Meter DX Bulletin* reminds readers of the importance of the "dx window". During dx openings other stations are requested to try to avoid using the section 1,825–1,830kHz. The 1976–7 winter season provided Stew with contacts with 151 different dx stations in 60 countries (by 1 February) in comparison with the 1975–6 season when the totals were 140 and 56 respectively. Four all-160m DXCCs have now been issued—to W1BB, KV4FZ, W1HGT and W8LRL, and it is believed that W4BRB, K1PBW, W2QD and WA8IJI may be waiting for QSLs. W4BRB hopes to have the first W 6BDXCC. ZE7JX reports that he now has a 55ft vertical with 193 130ft radials—over 16,000ft of buried wire! VE7UZ has a 134ft vertical with top loading and 40 $\frac{1}{4}\lambda$ radials and has contacted G3SZA, GD4BEG, G3CWI, G3MYI, GM3CFS, G4EOK and G3ZYY since late October. K6SE has also been adding radials to his two phased verticals and now has 31 under each—a total of $1\frac{1}{2}$ miles of wire—resulting in contacts with GD4BEG, G3MYI, and an RST 599 contact with EI8H. W1BB would like to hear from anyone using a loop aerial regularly for 1·8MHz work (S. S. Perry, 36 Pleasant Street, Winthrop, Mass, 02152, USA).

DX news

The award manager of RAAG has written to point out that the DXCC country often referred to as Rhodes is in fact the Dodecanese Is, a large group of about 28 islands, 18 of which are inhabited, including the island of Rhodes. The others include Kos, Leros, Kasos, Kalimnos, Karpathos, Astipalea, Kasteloritzo, Nisiros, Patmos, Simi, Tilos, Lipsi, Pserimos, Giali, Halki, Alimia and Saria. Amateur activity from the group at the present time is very low, and SV0WZ is expected to leave Rhodes in mid-June. He is often to be found keeping a schedule with OE3NH at 1500 on 14,305kHz.

West Coast DX Bulletin dated 22 March included extracts from the annual report of the ARRL DX Advisory Committee for 1976. Rule 9 now says that all stations must be contacted from the same country (the effect of this change on 5BDXCC is still under consideration). A recommendation that DXCC holders should be deprived of their membership if they act as M/Cs of "lists" was rejected. It was decided that the Dry Tortugas Is (off the Florida Keys) should not be granted DXCC status, nor should the Pribilof Is (KL7), any of the Finnish/Swedish islands in the Torne, Muonio and Konkama rivers (on the SM/OH border), the Pelagic Islands, or any of the Israeli-held areas of Jordan, Syria or Sinai. The suggestion that the requirement of 500 miles separation (rule 2b) should be reduced to 400 was rejected, and a resolution not to consider requests for exceptions to be considered in future was passed unanimously. A proposal that a DXCC for satellite contacts should be issued is being considered.

VP1DC is regularly to be found from 1230 on 14,240kHz on Wednesdays and Fridays. VP1MPW says that any QSLs received direct or via W5QPX without sae and return postage will be answered via the bureaux after his return to the USA next year.

Stations in Australia used the AX prefix during Her Majesty The Queen's visit.

C21PS has been contacted at 1100 on 14,325kHz and LA7JO has been acting as M/C at this time. Another Nauru station—C21IB—has been heard at around 0800 on 14,265kHz. Two stations are active at the present time on Norfolk Is—VK9s JA and JD. VR1AG has been reported on 14,253kHz at 0800 and is located on Ocean Is. On Johnston Is both KJ6BJ and KJ6DL are currently available. It is believed that a tri-band beam is on its way to VK0AC and this should make contacts with Macquarrie Is rather easier.

Long Skip notes that QSL cards for VE8 stations in Yukon Territory may be sent to PO Box 4597, Whitehorse, Yukon, Y1A 2R8, Canada. This bypasses the central bureau.

G3BII passes along the news that ZE2JV has revised his 28MHz "beacon" schedule. He now operates on Saturdays,

* 10 Knightlow Road, Birmingham B17 8QB.

Sundays and public holidays from 0630 to 1900, and Mondays to Fridays inclusive from 1430 to 1900. At the end of each period of transmission Ray calls "CQ" and listens for cw replies, he also breaks during transmission and does likewise. His transmitter runs 30W to a 3-el beam on the beacon mode, with fsk keyings, but he uses higher power and also ssb when in contact.

Michel, FK8CO, reports that he will be on 7,010kHz cw from 0615 to 0730, and on 14,170kHz ssb from 0750 to 0900 most days using his FW8CO callsign until July. In the same area FO8EU and FO8DO are often active near 14,110kHz at around 0700 and each speaks good English.

Expeditions

GM3YOR and GM3OLK will be visiting the Shetland Is from 12 to 29 July and will have equipment to operate on all bands 1·8 to 432MHz. There will be no operating schedule but they hope to cover all bands adequately on cw and ssb. Some activity may take place en route to Aberdeen from Kircaldy before or after the dates mentioned.

3B8DA is hoping to make a visit to Agalega Is to operate as 3B6DA sometime after the local cyclone season is over.

TU2EF will be visiting Gabon, the Central African Republic, Tchad and Mali, and hopes to operate from the stations of resident amateurs. No details of dates were available at the time of writing.

Welcome

The following overseas amateurs joined the Society during March: DB5NA, DJ3WM, DK6KL, DK6KY, EA1PI, EA5ME, EI9CC, F1DPU, F2EM, F9TL, I1DLG, I3STN, KL7IQM, LA5SF, OH1FS, PA0CFS, PE0MAR, PE0MTC, PY7ALC, SM5AOG, SM6CED, SM7GSF, SM7HBC, SP3AGE, VE3CDJ, VE3EHC, VE6HO, VE7AUZ, VE7BAR, VK2AQH, W1BJD, WA6MHD, WB6HMS, K6KCO, WA7QBY, K9LOF, ZS6BPG, ZS6N, 4Z4PR, 9G1AJ and 9H1DZ.

News from overseas

A4XVK closed down on 24 February and was due to re-activate G4BVH following his return to the UK on 22 March. Peter made 4,500 contacts with 131 different countries during his stay on Masirah Is.

ZC4DC, who was formerly also G8CLU, has now acquired the call G4FUA. He will be returning to Britain later this year.

Bob Boughton, G3RBB, is at the present time in Antigua using the callsign VP2AZB. He is on the air nearly every day between 1500 and 1700 on 21,285kHz, and from 2100 to 2200 on 14,195kHz using ssb only. When conditions permit he also operates on 28,600kHz around 1900. Bob is looking especially for UK contacts and will QSL all via the bureau. He is using an FT250 with a vertical aerial, and made 1,000 contacts during his first 36 days on the air but only about 30 with the UK. He is a member of the RSARS.

Alex Whitehill, GW3IRK, is now in Tehran and is using a Trio TS520 with Hy-Gain 18AVT/WB aerial on all bands 3·5 to 28MHz. His callsign is EP2IK.

Ron Macfarlane, 7Q7RM, has been receiving QSL cards for a station which has been using the callsign 7Q2SN—particularly from VK, ZL and P29. All contacts were on 14MHz ssb and the name given was Vincent; they seem to have taken place in early February. There is no amateur activity permitted from Malawi at present.

I4BFY is the QSL manager for the special Guglielmo Marconi memorial station IY4FGM (formerly I0FGM and II4FGM). This is located at Pontecchio Marconi (near Bologna) inside the house where Marconi conducted his first radio experiments. During the WPX contest the station made some 2,000 contacts. It is usually active on Saturdays and Sundays between 1400 and 1900.

QTH Corner

AP2P	Khurshid Alam, Box 526 Rawalpindi, Pakistan.
CR3AGD	J. Svensson, Berghemsv. 11, S-86021 Sundsbruk, Sweden.
D6AC	(see FH0BKZ)
EP2IK	A. Whitehill, IBAC, PO Box 14/1684, Tehran, Iran.
FH0BKZ	J. Billaud, 11 rue R. Champenier, F-58000 Nevers, France.
FR7ZL	G. P. de la Rhodiere, Les Alizes, 97417 La Montagne, Reunion Is.
FR7ZU/T	via F9MS, C. Ronsiaux, 63 Rue Voltaire, F-92 Suresnes, France.
IB0CBM	I2YDX, PO Box 4, 21100 Varese, Italy.
IY4FGM	via I4BFY, R. Borhy, 133 via Toscana, 40141 San Ruffillo, Bologna, Italy.
JT0ICB	c/o UB5ICB, CRC, Box 88, Moscow, USSR.
JA1PIG/PZ	via JARL, or Box 1237 Paramaribo, Surinam.
VP2AZB	R. Boughton, PO Box 1203, St Johns, Antigua (or via G2MI).
VP2MAQ	YASME, PO Box 2025, Castro Valley, Calif, 94546, USA.
VS5MS	Box 2202, BSB, Brunei.
W3HNK	now J. Arcure, Box 73, Edgemont, Pa, 19028, USA.
ZC4DC	via CARS, PO Box 1267, Limassol, Cyprus.
ZL3OG/C	c/o Radio Station, Chatham Is, New Zealand.
6W8FOC	val DL1RK.
7P8BE	VE3FXT, G. A. Collins, RR1, Dundas, Ontario, L9H 5EI, Canada.
9J2BO	B. Otter, Chinsali Girls Secondary School, Box 200, Chinsali, Zambia

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

Contests

USSR Contest

2100 21 May to 2100 22 May.

3·5 to 28MHz, cw and ssb—the same station may be worked on each band once only. Exchange RS/T plus serial QSO number (from 001). Soviet stations will also send the number of their region. Contacts with same continent count two points and with others five. Own country only counts for multiplier. Listeners count one point for reporting one exchange, and three if both sides are reported. The multiplier is the total of countries or regions from each band added together and multiplied by total QSO points. Categories are single-operator single or multi-band, and multi-operator single transmitter all band. A special certificate is awarded to all who make at least 50 contacts with Soviet stations. Entries must be posted before 1 July to Krenkel Central Radio Club, "CQ-M" Contest Committee, PO Box 88, Moscow. Note that contacts in this contest may be used in lieu of QSLs for USSR awards if the request accompanies the log.

The WAB Contests

0900–2100 15 May (lf phone).
0900–2100 19 June (lf cw).
0900–2100 17 July (vhf).

Single- or multi-operator, single- or multi-band. Only one transmitter may be used at any time. There is also a mobile entry category. Exchanges consist of RS/T, QSO number (from 001), WAB area, county, and book number (if any). Stations may be worked on each band and each contact counts five points. Multiplier consists of different WAB areas and DXCC countries contacted (own country counts once)—each counts once only. Mobile operators may work the same station from each area but only count QSO points and only one multiplier. Logs should show title of contest, name and address, QSO details, total claimed and multipliers.

Details of operators if multi-op. They should reach D. Dhuglas. GM4ELV, 3 Kirk Field Place, Arrocher, Strathclyde, by 4 July, 1 August and 5 September respectively. The usual signed declaration of legal operation should be enclosed.

World Telecommunications Contest
0000–2400 14 May (phone).
0000–2400 21 May (cw).
See April *MOTA*.

REF Le Mans Contest
Contacts with F6KFI and F1KFI during the Le Mans race (11–12 June) count 12 points on hf and 15 on vhf/uhf. Contacts with other stations in Section 72 of REF made between 1 June and 31 August count three points. A Section 72 station may only be contacted once only on each band per week. Logs should be posted by 20 September to V. Grare, F9AJ, Soulitre, 73270 Le Breil sur Merize, France. Diplomas will be awarded for scoring 25 points (please enclose two IRCs) and cups to the top scorers on hf and vhf.

The Jordanian Silver Jubilee Award

This is being issued by the Royal Jordanian Radio Amateurs Society to celebrate HM King Hussein's Silver Jubilee. It will be awarded to those who contact 10 Jordanian stations during the period 2200 24 May to 2200 25 June and who are using the special JY25 prefix. Any band/mode may be used but each JY25 may only be contacted once per band. Send a list of contacts, plus the QSL cards for the stations worked and 10 IRCs to: RJARS, PO Box 2353, Amman, Jordan.

"DXNS Prefix-Country-Zone list"

No apologies for drawing readers' attention to this excellent and comprehensive list once again. It details all amateur radio prefixes currently in use and others used in the past five years. It also gives ITU allocations, DXCC status, CQ zone, and ITU zone of every country and is available from Geoff Watts, 62 Belmore Road, Norwich NR7 0PU, price 35p in the UK, four IRCs overseas, or six IRCs by airmail. Space is provided on the list for the addition of new allocations.

Band reports

Conditions have continued to improve on the hf bands, and the "woodpecker"—although fairly active and regularly causing problems on 7, 14 and 21MHz—has seemed to be transmitting for shorter periods than before.

Since the mention in last month's columns of G4DLB's mobile 1·8MHz activity a letter was received from G4BUD saying that G3MYI/M contacted K1PBW earlier in the winter (date unspecified), and that he himself has had contacts with Europe using 20W p.e.p. to a 10ft home-made whip.

Many thanks to all correspondents, and to the following for providing items for the following table: G2s FTK, HKU; G3s GVV, HSH, RCA, RMF, UOL; G4s RZ, EAN, EHQ; G5JL; G6GH; BRSs 17567, 31301, 35608, and As 8312 and 8961.

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

1·8MHz. 0100 *KV4FZ*. **0300** K3UEI, PT2CW. **0400** VP2DD. **0500** *FG7AR/FS7, KV4FZ, W1HGT,* K1PBW, *WA5LES, YV4BK*. **2200** *EA8CR,* HB0LL, *YUs, 4U1ITU*. **2300** *IS0LYN*.

3·5MHz. 0000 AP2KS. **0100** *HM5YN, ZD8DO, ZB2CJ*. **0200** *FY7AH, OH6NO/SU, TR8MG,* VP2s ABC, VBK. **0400** *HK0TU*. **0500** VE1BFV (Sable Is—QSL to W3HNK), VP1RS, ZF1MA. **0600** *N6AA,* VP2SAG, ZLs. **0700** *OX3ZM, VP2MAQ*. **1900** JA5ANT, YB0AAG. **2100** VU2GL. **2200** 6W8DY, 9G1AJ, 9Y4RH. **2300** *JT0ICB,* VP2VBK, ZD8EW.

7MHz. 0000 *WA6EGL/VP9*. **0100** *AP2MC, VU2GW*. **0200** *TR8MG, VPs 2DD, 2MAQ, 8AI*. **0500** *VP8ON, 8P7GO*. **0600** *K7UR, VK0AC, ZLs, 9L1CD*. **0700** *VKs, ZLs, W1-W6*. **0800** *FP8DF, VKs, ZLs,* **2200** KP4s, KV4.

14MHz. 0700 ZD7SD. **0800** FK8BY, KM6FC, OZ3DX/SU (QSL via OZ bureau), VK4AAU/LH, VR3AH. **0900** JAs, JT1KAA, VR4DH, VS6FN, ZLs. **1000** *4S7VG*. **1200** HK0TU. **1300** *ZL3GQ*. **1400** FR7BI, HM2KL, *VS5MC*, 9V1TB. **1500** KG6JIA, S79R. **1600** FL8PF, FR0DCK, FR7ZL/T, W6/W7s. **1700** D6AC, KL7FCH, P29JS (Box 2053, Konedababu). **1800** FG7AR/FS7, KH6BB, XT2AS (QSL to PA0SWL), *ZL2BF*, 6V8DF/5A. **1900** CR3AGD, FH0BKZ, KC4AAA, VP1DK, *VP9HY*. **2000** HK0TU, VP2ABC (Box 444, Antigua), *ZD7PV*. **2100** *HH2EL*, HK0BMO (QSL to YN8ARC), *YV9AJ*, 4T4AKL (= OA4AKL). **2300** HU1A (YS, QSL to W3HNK).

21MHz. 0800 *VK6AQ*. **0900** FR7ZL/T, JAs, VE2ZN/SU, *UA0YT* (Zone 23), 9N1MM. **1000** JAs, P29GR. **1100** FG7AR/FS7, *VS5MC*, VS6GG, 4W9GR. **1200** A4XFE, AP2P, TA1ZB, VK8NDK, *VUs, 3B8DT*, 5B4ES. **1300** AY8CW (= LU), *HK0TU*, VP2MAQ. **1400** A9XBC, VE3FXT/3D6, YBs. **1500** *VP8ON*. **1700** CR3AGD, VP8PC, W6/W7s, ZD7SD. **1800** D2ARM, *TR8CQ*, W7s, 9L1NP. **2000** ZF1MA.

28MHz. 0900 VU2DK. **1000** JY5RBA, WA9BVB/4s, 5B4CY, DL, PA, UB5, ZE, 9J2. **1100** JY5YJ, S79DF, 9K2DR. **1200** *ST2SA*, YB0ACH, ZE, ZS, 5B4, 9H1CH, 9J2. **1300** TU2FH. **1700** PY5AKY, TU2FH, 3B6BD. **1800** EA8s, BK, JU, KC4AAB/MM (off S Shetlands). **1900** FG7AS, LU, PY, XQ3EA, ZP.

Acknowledgements to the authors of the following for items obtained from their publications: *DX'press* (**PA0TO**), *CQ Magazine* (**W1WY**), the *Ex-G Radio Club* (**W3HQO**), the *29DX Club Bulletin* (**VK6RV**), *Long Skip* (**VE1AL/3**), and the *West Coast DX Bulletin* (**WA6AUD**).

Please send all items for June issue **to reach G3FKM** no late than **7 May** and for **July** by **11 June**. □

Propagation predictions

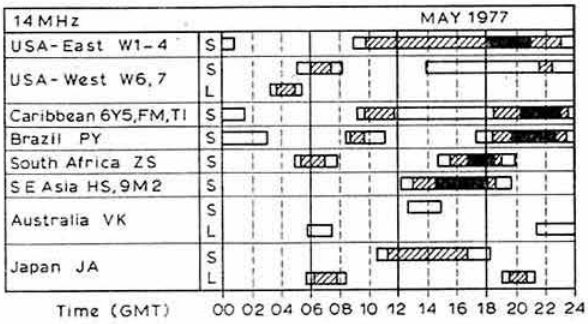
Summer conditions in the ionosphere become more and more established during May, and as a result of the short nights the F2 night frequencies are much higher compared with those of the winter months. This will lead to a considerable improvement in dx on the 14MHz band during night-time.

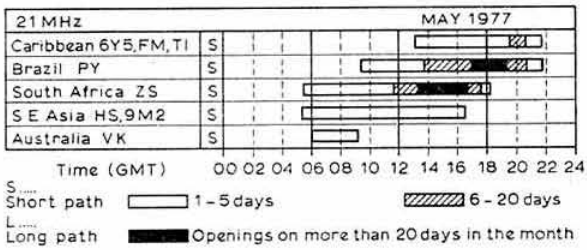
The slight increase in sunspot activity will not at first lead to any great improvement on the hf bands. Therefore **28MHz** will not be of any practical importance for dx, but both **28** and **21MHz** may liven up later in the month for short periods because of sporadic short-skip over distances of about 700–1,800km. Traffic with North America and Japan will not be possible on 21MHz. Perhaps North America will be heard in conditions influenced by Es layer transmissions; the most favourable time for this will be around 1700–2000gmt.

Conditions for dx will improve on **14MHz**, especially during late evening and at night. The summertime Es short-skip conditions, which may improve 28 and 21MHz, will lead to some QRM on 14MHz, mainly in the afternoon and early evening. As 14MHz lies much lower than 28 and 21MHz there will be no interruption by the dead zone and many more European stations will be heard on 14MHz than on 28 and 21MHz. Summer conditions will mean extra dx chances via the indirect path, specially with western North America and Japan. Traffic with western North America during the morning will only be possible after the middle of the month, but should continue with few interruptions until August.

The rise of summertime QRM will lead to a worsening of dx conditions on **7MHz**, the most favourable time being the latter half of the night and early morning, provided the greater length of the path lies in darkness. Conditions on **3·5MHz** will remain as they were in April, and the band will only seldom be interrupted by the dead zone.

The provisional sunspot number for March 1977 from the Swiss Federal Observatory was 8·0, with the month showing little solar activity at any time. The predicted smoothed numbers for July August and September are 19, 20 and 21 respectively.





HF PROPAGATION STUDY

Predicted HPFs (MHz × 10) for May 1977

GMT =	00	02	04	06	08	10	12	14	16	18	20	22	24
Aden	150	141	166	234	242	246	263	289	305	244	200	162	150
Ascension	158	130	136	115	237	243	251	284	324	333	276	202	158
Bahrain	145	139	178	230	238	242	255	267	279	255	200	162	145
Bangkok	139	136	183	214	224	228	220	227	204	199	178	153	139
Barbados	176	131	115	124	128	220	229	223	229	252	274	237	176
Bermuda	172	121	96	102	140	204	210	210	216	216	229	223	172
Bogota	178	128	115	121	140	204	229	216	223	235	255	235	178
Buenos Aires	166	140	133	144	129	223	241	251	280	285	305	229	166
Cape Town	153	153	121	235	242	248	261	305	343	242	204	140	153
Colombo	141	136	191	229	234	241	247	255	267	199	176	153	141
Cyprus	136	130	144	216	223	227	235	242	258	260	221	166	136
Dakar	129	150	136	166	237	243	251	284	324	333	276	178	129
Denver	153	128	96	102	108	115	153	172	185	185	191	191	153
Fairbanks	153	128	134	153	159	159	153	153	153	153	159	159	153
Falklands	149	125	122	128	154	204	242	257	290	300	286	153	149
Gibraltar	106	96	83	125	158	161	163	166	176	190	182	147	106
Hongkong	136	136	174	201	205	204	206	205	204	183	162	161	136
Honolulu	153	128	128	153	172	166	147	128	166	178	178	172	153
Iceland	101	75	77	115	139	144	148	145	145	148	152	135	101
Jamaica	173	122	96	111	130	178	214	213	215	220	230	227	173
Lagos	153	152	129	229	239	246	255	303	335	336	253	128	153
Las Palmas	149	129	119	158	210	218	220	235	252	258	255	204	149
Lima	174	134	124	125	138	140	232	227	242	257	280	238	174
Los Angeles	153	128	102	115	96	96	134	166	185	191	191	178	153
Malta	117	112	102	171	186	190	194	204	208	223	200	158	117
Mauritius	153	140	153	235	242	248	267	305	293	229	191	153	153
Mexico	166	121	77	115	128	115	191	204	204	204	216	204	166
Moscow	108	106	131	169	182	176	185	182	192	204	190	148	108
Nairobi	153	147	136	237	242	248	265	305	328	305	206	150	153
New Delhi	140	135	188	220	229	232	229	232	252	200	182	153	140
New York	166	121	77	88	128	178	188	194	201	199	209	204	166
Osaka	138	140	159	181	191	191	191	191	176	153	153	164	138
Perth	141	136	191	229	234	239	176	140	140	130	128	119	141
Rio de Janeiro	163	143	134	135	136	237	242	255	289	298	305	228	163
Salisbury	153	149	128	237	242	249	267	308	333	318	239	138	153
Seychelles	153	128	166	233	242	249	267	295	305	267	230	155	153
Singapore	140	135	188	220	229	232	229	233	229	178	150	130	140
Suva (S)	153	153	153	166	178	185	178	178	153	166	178	172	153
Suva (L)	159	153	134	178	140	128	128	115	115	102	255	178	159
Sydney (S)	136	136	174	201	205	174	140	153	138	128	128	161	136
Sydney (L)	171	135	126	128	128	102	89	86	79	77	138	210	171
Teheran	141	136	191	229	234	241	247	255	267	262	204	159	141
Vancouver	147	128	128	140	134	134	140	153	159	159	166	172	147
Wellington (S)	140	140	159	178	172	147	140	128	128	128	191	166	140
Wellington (L)	159	147	134	140	102	96	96	102	102	102	159	197	159

For information on the use of this table, see page 284, *Radio Communication* April 1976. Please send reports to Mr J. Spurling, G4AQI, 15 Tibbs Hill Road, Abbots Langley, Watford, Herts WD5 0EE.

obituaries

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

Mr P. Briscombe, G8KU
Percy Briscombe died at the age of 68 on 22 March. He was a founder member of the Scarborough ARS in 1934, and was its secretary for over 30 years.

Mr R. J. Carter, G5UU
R. J. Carter died on 21 March. First licensed in 1936, he was mainly active on 14MHz cw dx pre-war, and returned to the air in the early 'seventies at the behest of GW6WM.

Mr J. Doherty, G3NHD
Jim Doherty (also known as "Nice Hawaiian Dancers") died on 17 December 1976. He was well known on top band in the 'sixties.

Mr L. A. Kelsall, VK2AKV
Lawrie Kelsall died on 18 February. Formerly of Birmingham, he was a former secretary/treasurer of the Australian chapter of the Ex-G Radio Club.

Mr P. J. MacConnachie, GM3CRY (ex VP9K, ZC2AB, 4S7MC)
Mac MacConnachie died on 27 March. He was well known on hf and 2m, and particularly for his slow morse transmissions on Tuesdays on 80m.

Mr V. Mayhead, G2ACA
Vic Mayhead died on 10 February. He was a founder member of the Beekeepers Net, and at the request of the Mole Apiary Club (of which he was chairman) G4BCY will be /P at their headquarters in West Molesey, Surrey, from 1530 to 1630 on 28 May, on 3,750kHz, as a tribute to him.

Mr U. Passera, HB9CK
Ulysse Passera died on 11 March aged 96. He was a pioneer of radio with the Swiss army in 1905, and after his retirement in 1937 became a very active amateur.

Major L. J. Thomas (Royal Signals, ret), G3BXO (ex-VU2FX)
Lewis James Thomas died at the age of 68 on 15 March. His interest in radio commenced in the first world war, and at the age of 15 he joined the Royal Signals. In the 'twenties and 'thirties he operated as VU2FX. In 1946-7 he was the first amateur to work on 2m from the Leeds area using home-built equipment, but his greatest interest was hf, particularly 21MHz cw.

The Society has also been notified of the deaths of:
Mr E. G. Lelliott, G4DNK, on 13 November 1976;
Mr R. Liddell, GM3BXL, on 14 February;
Mr A. Pemberton, BEM, G2JY, on 22 March;
Mr S. H. Webber, RS36226, on 2 March.

Special event stations

13-14 May, University of Leeds Open Day
The LUUARS will be operational on both days, using G3LUU and G8LUU on hf and lf respectively, from the Engineering Department.

25 June, Kendal Grammar School Fete
Exhibition station G3NQX/A will be operational during the afternoon on ssb 10 to 160.

Looking ahead

6-8 May—RSGB International Radio Communication Exhibition and Convention, Alexandra Palace, London.
10 September—Scottish Amateur Radio Convention, Adam Smith Centre, Kirkcaldy.
17-18 September—NW Amateur Radio Convention, University of Lancaster.
25 September—Welsh Amateur Radio Convention, Oakdale Community College, Blackwood, Gwent.
15-16 October—Jamboree on the Air.
27-29 October—ARRA Exhibition, Granby Halls, Leicester.

contest news

144MHz Portable Contest rules

1600-1600gmt 28-29 May 1977.

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

The following general rules, published in the January 1977 issue of *Radio Communication*, will apply: 1, 2, 3, 4d, 5a, 6a, 7a, 8, 9a, 10a, 11–22.

Summer 1·8MHz Contest rules

1. The general rules for RSGB hf contests, published in the January 1977 issue of *Radio Communication*, will apply.

2. **When.** 2000gmt Saturday 25 June to 0100gmt Sunday 26 June.

3. **Eligible entrants.** All radio amateurs licensed to use 1·8MHz. Multi-operator or single-operator entries will be accepted. There will be two sections:

(a) British Isles stations (single or multi-operator);

(b) Overseas stations (single or multi-operator).

4. **Contacts.** CW (A1) only in the 1·8–2MHz band. County code (three letters), as published in the January 1977 issue of *Radio Communication*, must be sent by all British Isles entrants after the report/serial number. Overseas entrants will only send report/serial number.

5. **Scoring.**

(a) **British Isles stations.** Three points for each contact, with a bonus of five points for the first contact with each new British Isles county, and for the first contact with each new country outside the British Isles.

(b) **Overseas stations.** Three points for each contact with a station in the British Isles (not EI), with a bonus for five points for the first contact with each new county.

6. **Logs.** Column 5 to be headed "Code received". The county code as sent must be shown on the top of each log sheet. Entries must be addressed to the RSGB HF Contests Committee, c/o P. Miles, 28 Scotch Orchard, Lichfield, Staffs WS13 6DE.

7. **Awards.** The winner, second and third placed entrants in each section will receive a certificate of merit.

10GHz Cumulative Contest rules

1100-2000gmt 22 May, 19 June, 17 July, 21 August, 18 Sept.

All entries, checklogs, and information sheets to: VHF Contests Committee, c/o Mr C. W. Suckling, G3WDG, 31 Oakwood Road, Chandlers Ford, Hants SO5 1LW.

This contest, new to the calendar, will be a cumulative event, with three activity periods to count towards the final score. Entrants unable to be active for three periods are strongly encouraged to send in logs; these will be included in the table of results, but will not be eligible for an award.

During each activity period a station may change location once (see General Rule 5b). Contestants may start from a new site for each activity period.

The contest exchange shall be as defined in Rule 11, except that the location information shall be the QTH and an eight-character NGR, as defined on the OS 1:50,000 map; for international contacts the QTH locator may be given instead of the NGR. The NGR of every site used must be given on the contest cover sheet.

The information to be logged shall be as defined in Rule 12 (with NGR instead of QTH locator). In addition, **all unsuccessful contacts** must be logged.

Entrants are recommended to send details of their equipment (both microwave and talkback), including frequencies and modes in use, and of their intended locations, to the above address to arrive no later than the Friday nine days before each particular activity period. These details will be put together to form an information sheet, which will be sent before each event to those people who had included SAEs with their information.

Except where modified above, the following general rules for vhf/uhf/shf contests, published in the January 1977 issue of *Radio Communication*, will apply: 1, 2, 3, 4b, 5b, 6a, 7b, 8, 9b, 10b, 11-22.

VHF NFD 1977 rules

There is only one change to the rules for VHF NFD 1977, this being the scoring system as suggested in the 1976 result report (*Radio Communication* October 1976). The new system abolishes the use of band multipliers and ensures equal weighting of bands by dividing each station's score by that of the band leader. The resulting "performance figure" will range from 1,000 for band leader down to 0 for a non-entrant. The overall score of each group is the sum of its "performance figures" on the bands in use. Figures in square brackets refer to the general rules for vhf/uhf/shf contests published in the January 1977 issue of *Radio Communication*.

1. **Duration.** From 1600gmt 2 July to 1600gmt 3 July 1977.

2. **Bands.** Up to four separate stations can be used, operating on the 70, 144, 432 and 1,296MHz bands. Only one station can score or give points on each band. Single-band entries on 144MHz will not be accepted.

3. **Operators.** Any RSGB member or group of members operating from the British Isles may take part (nb, this excludes Eire). Two groups operating from the same site can combine their scores subject to Rules 2 and 4. Each group should send its own summary sheet.

4. **Stations.** All the stations forming one entry must operate from within a circle of 1km radius centred on the operating position of any of the stations. Proof of permission to use a site may be required. All equipment, including antennas, must be installed on the site during the 24 hours preceding the contest or during the contest. The site may not be used for any transmitting activities by the group or member during the five days before this time.

Stations may not use public mains supply. Power for all equipment must be derived from an on-site generator or battery.

5. **Scoring.** (a) On the 70, 144 and 432MHz bands, contacts will be scored by radial rings [7a].

(b) Contacts on 1·3GHz will be scored at one point per kilometre.

6. **Contest exchanges.** (a) Contestants must exchange both callsigns, signal report, serial number (starting at 001 on each band), locator and QTH [11]. Only one scoring contact on each band may be made with each station [10a].

(b) The QTH given on 1·3GHz must differ in form from that given on the other bands, eg a location given as "10km north of Marlborough" on 432MHz could be given as "8km south-east of Swindon" on 1·3GHz.

The 1·3GHz station may operate on any other band for the purposes of arranging a contact, but the exchange of contest information must take place on 1·3GHz only and may not be interrupted by recourse to another band. CQ calls on another band should clearly be "for 1·3GHz only."

7. **Entries.** (a) All entries must be postmarked not later than 18 July 1977.

(b) Separate sets of logsheets and 427 cover sheets are required for each band.

(c) A summary sheet must also be completed. Otherwise the scores on each band will be listed but the total will not appear in the overall results table.

(d) Entries must be addressed to: The Secretary, VHF Contests Committee, 100 Shirley High St, Southampton, Hants SO1 4FB.

8. **Other rules.** The following general rules will also apply: [5a, 6a, 9a, 10a, 11-22].

9. **Awards.** The Surrey Trophy will be awarded to the overall winners, and certificates of merit will be awarded to the overall runner-up, the leading entry from each country and the highest scoring station on each band. The Tartan Trophy will be awarded to the leading Scottish entry.

Listeners' Contest rules

A listeners' contest will take place at the same time as VHF NFD. Each band will be treated as a separate event. Listeners' contest rules 1-3 (January 1977 *Radio Communication*) will apply.

DF Qualifying Event Medway

Date: 29 May 1977.

Map: OS Sheet 178, The Thames Estuary.

Assembly: 1300bst for start at 1320bst.

Location: Car park/picnic area south side of A2 NGR681696. Accessible, with care, by taking Cobham/Shorne turn off from A2 from London direction and passing back over main road then turning back to A2 as if to return to London but immediately turning right into starting area.

Intending competitors are asked to notify Mr C. D. Plummer, 57 Hillshaw Crescent, Strood, Rochester, Kent ME2 2PT (Tel 0634

Contests calendar

7-8 May	IARU Region 1 144/432/1,296MHz Open (Rules in April issue)
14 May	1·3GHz Open (Rules in April issue)
15 May	432MHz Open (trophy) and SWL (Rules in April issue
15 May	DF Qualifying Event Dartford Heath (Details in April issue)
22 May	Queen's Jubilee Phone (Rules in April issue)
22 May	10GHz Cumulative (Rules in this issue)
28-29 May	144MHz Portable (Rules in this issue)
29 May	DF Qualifying Event Medway (Rules in this issue)
11-12 June	HF NFD (Rules in February issue)
18-19 June	Microwave (3·4-24GHz)
19 June	DF Qualifying Event Rugby & Coventry (Rules in May issue)
19 June	10GHz Cumulative
25-26 June	Summer 1·8MHz (Rules in May issue)
2-3 July	VHF NFD and SWL (Rules in May issue)
10 July	DF Qualifying Event Salisbury
17 July	3·5MHz FD
17 July	10GHz Cumulative
24 July	DF Qualifying Event Stratford
31 July	144MHz QRP
7 August	DF Qualifying Event Chelmsford
13-14 August	70MHz Open (trophy) and SWL
14 August	RSGB Region 1 VHF
21 August	DF Qualifying Event Slade (Birmingham)
21 August	10GHz Cumulative
3-4 September	SSB FD (Rules in April issue)
3-4 September	144MHz Open (trophy) and SWL
18 September	DF Final South Manchester
18 September	10GHz Cumulative
1-2 October	UHF (432MHz-2·3GHz)
8-9 October	21/28MHz
15-16 October	7MHz Phone
23 October	70MHz Fixed
October-November	432MHz Cumulative
5-6 November	7MHz CW
5-6 November	144MHz CW
12-13 November	2nd 1·8MHz
4 December	144MHz Fixed

74641 home, or Erith 33000 office) not later than 16 May. Please bring own sandwiches etc for tea to keep costs down.

DF Qualifying Event Rugby and Coventry

Date: 19 June 1977.
Map: OS Sheet 152, Northampton and Milton Keynes.
Assembly: 1300bst for start at 1320bst.
Location: Bucknell Woods car park NGR659448.

Intending competitors requiring tea are asked to notify Mr Newman, Haynes House, 78 High Street, Whittlebury, Towcester, Northants (Tel 0327 857350) not later than 12 June.

Cray Valley RS Queen's Jubilee Contest rules

10m 1400-1700bst Saturday 4 June
160m 0900-1200bst Sunday 5 June
2m 1400-1700bst Sunday 5 June
Sections
10m and 160m—Separate sections for ssb/cw and a.m./cw.
2m—Separate sections for fm and ssb
Reports
160m and 2m—Report, serial number (starting 001) and administrative county, and in the case of Cray Valley members, CV.
10m—Report and serial number (starting 001) and in the case of Cray Valley Members, CV.
Points scoring
160m and 2m
10 points for working G3RCV and G8FCV club stations.
3 points for non-Cray Valley stations working Cray Valley stations.
2 points Cray Valley stations working Cray Valley stations.
1 point for other contacts.
Final score = total points score × (number of different counties + number of different countries).

10m
10 points for working G3RCV club station
3 points fo working Cray Valley stations
2 points for other contacts
Final score = total points score × (number of different countries)
Completed logs should show score claimed and be submitted (postmarked not later than 17 June 1977), as follows:
Non-Cray Valley members to: Mr R. A. Treacher, 392 Rochester Way, Eltham, London SE9.
Cray Valley members to: Mr S.W. Coursey, G3JJC, 49 Dulverton Road, London SE9 3RJ.
SWL entrants. The above rules apply but additionally both stations must be shown and must be taking part in the contest.
Certificates will be issued at the discretion of the committee of Cray Valley Radio Society.

your opinion

REPEATERS

The Editor
Radio Communication

Sir—With the increasing usage of repeaters throughout the country it behoves us all to obtain the best utilization possible from them. They represent what is effectively a single simplex link serving between 20 and 5,000 subscribers per channel.

Could we therefore keep both the "overs" and the duration of each contact to a minimum, to maximize efficiency. This could also be achieved by avoiding the totally unnecessary repetition of call-signs, and being careful to watch the time-out period, thus enabling the next one in the queue to get in, before drop-out. Regretfully, there still exists a peculiar form of amateur malaise which might be dubbed as "emittor mortis"; this takes the form of a progressive paralysis, and is triggered by the close proximity of a microphone. If these long-winded types could be induced to operate in 10/30s bursts, not only would repeater operation be simplified but operating generally would become more pleasant and natural. Not only are these 5/5min overs bad operating but, in a day-to-day context, totally unacceptable: why have dual standards on the air?

As good operating is synonymous with good manners, can we hope to have more of both in the future.

B. S. Sutherland, G3IES

Sir—Comments heard on the air that the use of repeaters is "not amateur radio" raises the query why the use of this new technique is not so? A parallel technique on a larger scale is the use of the orbiting satellite as a repeater; is this also "not amateur radio"?

The definition of amateur radio as the operation of home-made equipment was current in the early days but is now out-dated. It might be said that the almost universal use of commercial, professional radio equipment is "not amateur radio" but this is not accepted.

The notion of relaying messages from station A to station C through a third station B is not new. In the early 'twenties the American Radio Relay League existed for the purpose of relaying messages. The British equivalent was the British Wireless Relay League and later the Transmitter and Relay Section of RSGB but with more restrictions than the American counterpart.

The current repeaters are a credit to all those people who have spent so much time and money in establishing them. Their purpose is to open up to stations unfavourably situated the possibilities of working others who cannot be worked direct.

Good luck to those people using repeaters: the modern mode of communication.

H. Turner, G8VN

SLOW MORSE

The Editor
Radio Communication

Sir—May I express my thanks to the slow morse transmission service. It has taken me 10 months to acquire the necessary speed, which would not have been possible without their help, especially G2FNK, G3WVJ and G3ASR/A, my local transmissions.

F. D. Pratt, G4FXJ

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).

Items of news and dates of forthcoming events should reach RRs by 26 May for the July issue.

REGION 1—RR W. M. Furness, G3SMM, 16 Coniston Avenue, Sale, Cheshire M33 3GT.

Ainsdale (AARC)—5, 19 May, 2, 16, 30 June. 8.15pm. Ainsdale Scout Headquarters. Further details from G2CUZ.

Blackburn (East Lancs ARC)—First Thursday in each month, 7.30pm. YMCA, Blackburn. Sec E. A. Lomax, G4DGR, West End PO, Accrington, Lancs.

Blackpool (B&DARS)—Mondays, 8pm. Pontins Holiday Camp, Squires Gate, Morse tuition 7.30pm.

Bolton (B&DARS)—Main meeting first Wednesday in each month informal meeting third Wednesday in each month, 8pm. Bolton Recreation Club, Kensington Place, Bolton. Hon sec G4FSN (ex G8LXD).

Bury (BRS)—Main meeting on the second Tuesday in each month. RAE classes and morse instruction every Tuesday as well as an informal meeting of club members. Mosses Community Centre, Cecil Street, Bury. Sec E. R. Thirkell, G4FQE, 59 Oulder Hill Drive, Bamford, Rochdale, tel Rochdale 46585.

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 for first Tuesday in the month. YMCA Chester. Further details from the ASR. G3PYU.

Douglas (IoM ARS)—Mondays fortnightly. Highlander Inn, Crosby. Visitors welcome. President GD3JIU; treasurer and GD QSL manager GD3GQX, Sec GD8LFA, 20 Terance Avenue, Douglas (tel 22295).

Eccles (E&DARC)—Tuesdays, 8.30pm. White Swan, Worsley Road, Swinton. Sec G4AEQ.

Lancaster University (UoLARS)—Wednesdays, 8pm. Furness College. Visitors are welcome, as are skeds on hf and 2m—club callsigns are G8DOU and G3ZBY. There are RAE and morse test classes. Enquiries to John Morris, G4ANB, Dept of Physics.

Leyland (LHARG)—Second Monday in each month, 7.30pm. "Rose & Crown", Ulnes Walton, Leyland. Details from G3XII.

Liverpool (L&DARS)—Tuesdays, 8pm. Conservative Association Rooms, Church Road, Wavertree. Sec G4EST.

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

Liverpool University (UoLARS)—Meeting at lunchtime and on Mondays, 5pm. Club shack, Reilly Building. The club is active on all bands 80/2m—callsigns G3OUL/G8JUL. Details from hon sec, c/o Students' Union or c/o GW4FJK.

Manchester (M&DARS)—Wednesdays, 7.30pm. 203 Droylesden Road, Newton Heath, Manchester 10. Sec G8IYX.

Manchester (South Manchester RC)—6 May (Mini df), 13 May (AGM), 20 May ("Electronic organs" by J. K. Birch, G2FOS), 27 May (Visit to PO Microwave Tower), 3 June ("Radio communication in Antarctica" by R. P. Smith, G3SVW), 10 June ("Navigation" by J. Keilly, G8KUP), 17 June ("Fets and their uses" by R. V. Heaton), 24 June ("Return to amateur radio—problems and pleasures" by J. Osler), 1 July ("Transistor oscillators and amplifiers" by W. L. Seddon, G3VIW), 8 July (Activity Night). 8pm. Sale Moor Community Centre, Norris Road, Sale. Informal meetings Monday evenings at "Greeba", Shady Lane, Beguley, Manchester 23. Details from hon sec G3VIW.

Manchester University (MUARS—G3VUM). Interested parties should contact G4AOS, QTHR.

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 sec, c/o UMIST.

North Western Repeater Group—Informal meetings on the third Thursday in each month, 8pm. "Globe Club", Willows Lane, Accrington, Lancs. Details from sec G8HQW.

Preston (PARS)—Thursdays fortnightly commencing 10 March. Meetings commence at 8pm. "Windsor Castle" (private room), St Pauls Square, Preston. Sec G8KTM.

Salford (Dial House RS)—Wednesdays, 5.30-9.30pm. Dial House, 21 Chapel Street, Salford, Lancs. Net channel 145·25MHz fm—the club station G3WDH monitors this frequency every club night for any other station. Details from sec G8JCM, c/o M38 at above address.

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 "Gardner's Arms"), Thornton. Details from sec A. Bullock, G8MKO, 26 Lancaster Avenue, Thornton Cleveleys, Blackpool.

UK FM Group (Western)—All inquiries to G. Adams, G3LEQ.

Warrington (W&DARS)—Tuesdays, 7.45pm. Grappenhall Community Centre, Bellhouse Lane, Grappenhall, Warrington. Sec R. E. J. Staples, G3MMD, 3 Willow Close, Lymm, Cheshire, tel Lymm 3533.

Wigan (W&DARS)—First and third Wednesdays of each month. Poolstock Cricket Club, Keats Avenue, Poolstock. Sec A. Cunliffe, G4EII, 50 Langholm Road, Garswood, Wigan.

Winsford (Mid-Cheshire ARC)—Wednesdays. Technical Activities Centre, rear of Verdin Buildings, Verdin Comprehensive School Grange Lane,Winsford. RAE class 7pm to 8pm. Morse class every third Wednesday. Net nights 160m Mondays, 8pm, 2m (fm) Tuesdays 8pm. Sec G8HAV.

Wirral (WARS)—First and third Wednesdays in each month, 7.45pm. Sports and Recreation Centre, Grange Road West, Claughton, Birkenhead. Sec G3DLF.

Liverpool Luncheon Club—members wishing to attend should contact G3VQT or G2AMV.

Basil O'Brien, G2AMV, would like to thank all members in Region 1 for the truly magnificent gift that he received after the Region 1 lecture at Warrington on 1 April. It has been a pleasure to look after the north-west of England's interests for a quarter of a century. The engraved silver salver and the memory of the occasion will be cherished for the rest of one's lifetime. Indeed words are not adequate to express gratitude at such generosity.

The 1977 North West Amateur Radio Convention will be held on 17-18 September 1977. Its format will be similar to that used with great success for the first two conventions. Further details will become available early this year. Enquiries to J. R. Morris, Dept of Physics, University of Lancaster.

Region 1 vhf contest, 14 August 1977—enquiries to G2CUZ.

Region 1 area representatives. NE Manchester—G3IOA. NW Manchester—G8GTP. S Manchester—G8BHQ. Liverpool—G4EST. Southport & District—G2CUZ. Warrington—G3MMD. Wirral—G2FOS. Isle of Man—GD3KGC.

REGION 2—RR R. C. Andreang, G4CMT, 6 Beech Avenue, Bilton, Hull, Humberside.

Barnsley (B&DARS)—Fourth Friday in each month, 7.30pm. King George Hotel. Peel Street, Barnsley. Sec G3LRP.

Denby Dale (DD&DARS)—Wednesdays, 7.30pm. Pie Hall, Denby Dale. Visitors always welcome. Sec G3FQH.

Goole (G&DARS)—Fridays, 7.30pm (during school term only). Goole Grammar School. Details from chairman G3VBI.

Halifax (Northern Heights ARS)—7.45pm. Peat Pitts Inn, Ogden, Halifax (four miles north of Halifax town hall). Sec G3MDW.

Hornsea (HARS)—Wednesdays, 8pm. Rear of Victoria Hotel, Hornsea (facing Hornsea Mere). 16 July (Mobile rally, our first). Details from sec G4CHH.

Hull (H&DARS)—Fridays, 7.30pm. Dorchester Hotel, Beverley Road, Hull. Sec G3LZQ.

Leeds (White Rose RS)—Wednesdays, 7.30pm. (Lectures start 8pm). Area Rep Connie, G4CUY, reports the sad loss of G3BXO/VU2FX, a long time RSGB member. Sec G4DZI.

Leeds (LUUARS)—Tuesdays, 8pm. Union Annexe (second floor), Woodhouse Lane. All new students welcome. Sec G4CNG, QTHR, or at "E" block, Lupton Flats, Alma Road, Leeds 6, during term.

Otley (OR&ES)—Tuesdays, 8pm. 14 Back of Court House Street, Otley. Sec J. H. Marchbank, 116 Brooklands Lane, Menston, Ilkley, W Yorks LS29 6PJ.
Scarborough (SARS)—Fridays, 7.30pm. Scarborough Technical College, Corby Road, Scarborough. Reports the sad loss of G8KU, Percy Briscombe, a founder member of our club. Sec. G3RTN. PRO Charles Whitaker, 1 Ryefield Close, Eastfield, Scarborough.
Sheffield (SU&PRS)—University—Wednesdays in term, 1pm. The "Red Deer", off Main Street. Details G4BXN.
Polytechnic—Thursdays in term. Details G4DHF/A, tel 303758.
Sheffield (Association of Sheffield ARCs)—Chairman G4EXK. Sec B. Flounders. All association meetings Room 3106, Sheffield Polytechnic, 7.45pm.
Wakefield (W&DARS)—7.30pm, Ines Road School, Wakefield, Sec G3WWF.
York (YARS)—Fridays, 7.30pm. (except for the third Friday in the month). United Services Clubroom, 61 Micklegate, York. 30 May (Visit to Hull College of Further Education Marine Radar/Radio Section). Special event stations: 14 May, Dunnington School; 7 June, Bishopthorpe (Queen's Jubilee); 12/13/14 July, Great Yorkshire Show, Harrogate; 16 July, Joseph Rowntree School Fete, New Earswick; October JOTA. The club is hoping to get the local education authority to run an RAE at the local technical college. All interested please contact sec G3WVO.

REGION 3—RR H. S. Pinchin, G3VPE, 61 Cole Bank Road, Hall Green, Birmingham B28 8EZ

Birmingham (Midland ARS)—31 May, 5 July (Construction and club station). 7pm. Brasshouse Centre, off Broad Street, Birmingham. 24 May (Film show), 21 June ("History of tape and tape recording" by representative from BASF). 8pm. Room 110, University of Aston, Gosta Green, Birmingham. G3ZKQ.
Birmingham (Slade RS)—Alternate Fridays, commencing 13 May. 8pm. The Committee Room, Church House, Erdington, Birmingham. G4FGF.
Birmingham (South Birmingham RS)—Shack night Fridays, 7.30pm. 1 June ("Radio in a Japanese prisoner of war camp" by Tom Douglas, G3BA), 6 July (Lecture). 8pm. Hampstead House, Fairfax Road, West Heath, Birmingham B31 3QY. G8KPA.
Birmingham (Birmingham University RS)—Every Tuesday during term, 7pm. Students' Union. G3IUB. Sec G4CKK.
Bromsgrove (B&DARC)—13 May ("Making receivers in a prisoner of war camp in Siam" by Tom Douglas, G3BA), 10 June, 8 July. 8pm. Avoncroft Art Centre, Bromsgrove. G8JTK.
Cannock Chase (CCARS)—First Thursday in each month (Business meeting), other Thursdays (HF and vhf club stations, natternites, morse classes, talks etc.) Visitors welcome. 9pm. Bridgtown Social Club, Walsall Road, Greenock. G4CHI.
Coventry (CARS)—Fridays, 8pm, Baden Powell House, 121 St Nicholas Street, Radford, Coventry. G8DMI.
Coventry Technical College (CTCARS)—Mondays and Thursdays, 7pm. Winfray Annexe of the College. G8ISJ.
Coventry (University of Warwick ARS)—Wednesdays during term. Talk-in on S20. 7pm. Cryfield Farm, University of Warwick, Coventry. Vice-president G8MIA.
Hereford (HARS)—First and third Fridays in each month. Civil Defence HQ, Gaol Street, Hereford. G4CNY.
Lichfield (LARS)—First Monday and third Tuesday in each month, 8pm. Swan Hotel. Tuesday meetings are natter-nites. Sunday net noon, 21·150MHz, G3RTY.
Lichfield (Chad RC)—Alternate Wednesdays, commencing 11 May. 8pm. The Naval Club, Burton Old Road, Lichfield. G4ESK.
Mid-Warwickshire (MWARS)—First and third Mondays in each month, 8pm. 61 Emscote Road, Warwick. G8CXL.
Redditch (RRC)—Second and fourth Thursdays in each month, 8pm. WRVS Centre, Salop Road, Redditch. G3EVT.
Shrewsbury (Salop ARS)—Thursdays, 7.30pm. New members welcome. The Albert Hotel, Smithfield Road, Shrewsbury. Joint secs Bob Carter, 11 Ash Close, Sutton Farm, Shrewsbury SY2 6HU, and Dave Doody, 56 Ellesmere Road, Shrewsbury SY1 2QP.
Solihull (SARS)—17 May ("History of the amateur licence" by Fred Ward, G2CVV), 21 June (Surplus sale). 7.30pm. The Manor House, High Street, Solihull. G4EQF.
Stoke-on-Trent (S-on-TARS)—Thursdays, 7.30pm. 2A Racecourse Road, Oakhill, Stoke-on-Trent. G4CWN.
Stoke-on-Trent (North Staffs ARS)—First and third Mondays in each month—lectures etc. Second, fourth and fifth Mondays in each month—natter nites, Raynet and club station G4BEM. Newcomers welcome. 7.30pm. Harold Clowes Community Centre, off Dawlish Drive, Bentilee, Stoke-on-Trent. G3YBY.
Stourbridge (S&DARS)—Informals on the first Tuesday in each month, 9pm. "Shrubbery Cottage" public house, Heath Lane, Oldswinford, Stourbridge. 16 May, 20 June. 7.45pm. Longlands School, Brook Street, Stourbridge. G4CLX.
Sutton Coldfield (SCRS)—Second and fourth Mondays in each month. 7.30pm. Central Youth HQ, Clifton Road, Sutton Coldfield. Sec Mrs Liz Furness, 4 Goodere Drive, Polesworth, Tamworth, Staffs B78 1BZ.
Tamworth (TARS)—Second and fourth Mondays in each month. Indoor Sports Centre, Corporation Street, Tamworth. New members welcome. G4EUF.
Telford (T&DARS)—Wednesdays, 7.30pm. Phoenix Centre, Webb Crescent, Dawley. Visitors welcome. G4AXZ.
Willenhall (W&DARS)—Alternate Wednesdays. Morse classes available at the end of each meeting. "The Three Crowns", Stafford Street, Willenhall. G3YHN, XYL.
Wolverhampton (WARS)—9 May (Natter-nite), 16 May (Surplus sale), 30 May (Natter-nite), 13 June ("Electronic organs" by G6GR), 20 June (Natter-nite), 4 July. 8pm. Neachells Cottage, Danescourt Road, Stockwell End, Tettenhall, Wolverhampton WV9 9PH. G8EDG.
Worcester (W&DARC)—21 May (Brains trust), 6 June (Magazine evening), 18 June (Night on the air at the club shack), 4 or 11July (to be decided—see sec), 10 July (Upton rally). 8pm. The Old Pheasant, New Street, Worcester. G4DXE.

REGION 4—RR T. Darn, G3FGY, Sandham Lane, Ripley, Derbys.

Derby (D&DARS)—4 May (Surplus sale), 11 May ("Radio in the RAF" by Brian Ridgway), 18 May (Lowe Electronics demonstration), 25 May (Film show), 1 June (Surplus sale), 8 June (Open), 15 June (Film show), 26 June (Open), 29 June (Technical topics). 7.30pm. Clubroom, 119 Green Lane, Derby. Morse classes Tuesdays and Fridays, 7pm, when arranged. G3VGW.
Derby (NHCAARG)—Fridays, 7.30pm. Nunsfield House, Boulton Lane, Alvaston, Derby. G4CTZ.
Grimsby (GARC)—First and third Thursdays in each month. 8pm. Alexandra Social Club, Cleethorpes. G4EBK.
Leicester (LRS)—Mondays, 7.30pm. Club House, Gilrose Estate Cottage, Leicester. G4ERT.
Mansfield (MARS)—First Friday in each month, 7.30pm. "The New Inn", Westgate, Mansfield. G3XWZ.
Melton Mowbray (MMARS)—20 May ("Repeaters" by G3PVG), 23 June (Visit to police operations room at Epperstone, Notts, by courtesy of G3XVZ). 7.30pm. St John Ambulance Hall, Asfordby Hill, Melton Mowbray. G3NVK.
Nottingham (ARCoN)—10, 17 Mar (Activity night), 24 Mar (The one that got away, or the home brew that failed to ferment), 31 Mar (Junk sale), 7 Apr (AGM), 14 Apr (Activity night), 21, 28 Apr. 7.30pm. Sherwood Community Centre, Mansfield Road, Sherwood, Nottingham. G4EKW.
Nottingham (NURS)—Alternate Wednesdays during term time. Details from Roger Dixon, G4BVY, c/o Students' Union.
Scunthorpe (SARC)—Tuesdays, 7.30p.m. The Shack, Grange Farm Hobbies Centre, Franklin Crescent, Scunthorpe, South Humberside.

Region 5—RR P. F. Chilcott, G4BBA, 258 Coneygree Road, Peterborough PE2 8LR.

Bedford (B&DARC)—Thursdays, 8pm. United Services Club, Broadway. New members always welcome. Sec G4FEV.
Cambridge (C&DARC)—Fridays, 7.30pm. Corporation Yard, Victoria Road. Sec G4BAO.
Cambridge University (CUWS)—Tuesdays during term. Sec G4EAG, St Catherine's College.
Corby (CTCARG)—Mondays, 7.30pm. Corby Technical College. Clubhouse and GB3CI in grounds.
Dunstable (DDRC)—Fridays, 8pm. Chews House, 77 High St South. Sec G3WXS.
March (M&DARS)—Tuesdays, 7.30pm. 2 Grays Lane. Sec G8GNE.
Northampton (NRC)—19 May (Junk sale), 26 May ("Television" by Gordon Vine, G3KLV), 16 June (Annual df hunt). Thursdays, 8pm. Spencer Dallington Community Centre, Tintern Avenue, off Gladstone Road. Sec G8LHR.
Peterborough (GPARC)—26 May (Jubilee station preparations), 11 June (GE4EHW on the Embankment), 23 June (VHF NFD preparations). 7.30pm. Southfields School. Sec G4BBA, tel 65213.

Peterborough (PR&SS)—19 May (DF hunt). Third Friday in each month, 7.30pm. Scout Hut, Occupation Road. Sec G3EEL.
Shefford (S&DARS)—5 May ("History and development of Barclays Bank" by G4ARL), 12 May ("Oscar" by guest speaker G3RWL), 19 May (Visit to Bedford club), 26 May ("Plastic embedding" by guest speaker Mrs Culpan). 8pm. Church Hall. Sec G8HHO

REGION 6—RR D. C. Andrews, G4CWB, 63 Bulmershe Road, Reading, Berks

Banbury (BARS)—Fridays, 7.30pm. 43 North Bar, Banbury. New members and visitors welcome. Sec S. L. Terry, tel Banbury 4769.
Bracknell (BARC)—First and third Mondays in each month, 8pm. Alternate Mondays, morse. Visitors welcome. Sec G3YMC.
Burnham Beeches (BBRC)—First Monday in each month, 8pm. Hedgerley Scout HQ. Sec Peter Fynn, tel Farnham Common 2609.
High Wycombe (Chiltern ARC)—Fourth Wednesday in each month, 8pm. 42 Castle Street, High Wycombe. Information from G8HDL, tel High Wycombe 31314.
Maidenhead (M&DARC)—First Thursday and third Tuesday in each month, 7.30pm, British Red Cross Hall, The Crescent, Maidenhead. Sec G4ALG.
Milton Keynes (MK&DRS)—Second Monday in each month, 8pm. Lovat Hall, Silver Street, Newport Pagnell, Milton Keynes. Sec G3THC, tel Milton Keynes 316730.
Newbury (N&DARS)—First Monday in each month, 7.30pm. Newbury College of Further Education, Oxford Road, Newbury. Sec G4EEE.
Oxford (O&DARS)—Second and fourth Wednesdays in each month, 7.30pm. Civil Service Sports Club, Marston Road, Oxford. Visitors welcome. Sec G4BHR.
Oxford (Oxford University RS)—Wednesdays, 62 Banbury Road, Oxford. Sec G4CNV, Keble College, Oxford.
Reading (RARC)—3 May ("Aerial Circus" by "Dud" Charman), 17 May ("3cm" by G8ECO), 7 June (VHF NFD preparation), 21 June (Alignment evening), 5 July (TBA). 8pm. "White Horse", Emmer Green, Reading. Sec G4CCC.

REGION 7—RR N. A. Smith, G3HFO. 7 The Byeways, Surbiton Surrey KT5 8HT

Addiscombe (AARC)—Tuesdays, 9pm. "Spreadeagle", Portland Road, Woodside. Sec G3SJX.
Ashford, Middlesex (Echelford ARS)—Second Monday and last Thursday in each month. 7.30 for 8pm. St Martin's Court, Kingston Crescent, Ashford, Middlesex. Sec G3TDR, tel Staines 56513.
Bexley Heath (North Kent RS)—Second and fourth Thursdays in each month, 8pm. St Mary's Institute, 2 North Clay Road, Bexley. Sec G4ARQ.
Coulsdon (CATS)—5 May ("Field effect transistors" by G8JLD), 16 May (Activity night and club projects), 2 June (NFD arrangements). First Thursday in each month, 8pm. 10th Purley Scout HQ, Chipstead Valley Road, Coulsdon. Third Monday in each month, 8pm. 1st Purley Scout HQ, Purley Park Road, Purley. Arrangements are being made for a lecture and demonstration of the Oscar tracking station at Surrey University. Hon sec G4DLD, tel Burgh Heath 59956.
Cray Valley (CVRS)—First and third Thursdays in each month, 8pm. Eltham United Reformed Church Hall, 1 Court Road, Eltham, London SE9. Secretary G3YWO.
Croydon (Surrey Radio Contact Club)—First and third Wednesdays in each month, 7.30 for 8pm. TS "Terra Nova",34 The Waldrons Croydon. Sec G3FWR. tel 01-657 3258.
Crystal Palace (CP&DRS)—Third Saturday in each month, 7.30pm. Emmanuel Church Hall, Barry Road, London SE22. Sec G4AVV, tel 01-653 4340.
Guildford (G&DRS)—Second and fourth Fridays in each month. Model Engineers HQ, Stoke Park, Guildford. Sec G4BHQ, tel Guildford 76375.
Kingston (K&DARS)—11 May (Junk sale). Second Wednesday in each month, 8.15pm. Berrylands Scouts and Guides HQ, Stirling Walk, Raeburn Avenue, Surbiton. Sec G4APG.
New Cross (Clifton ARS)—Fridays, 8pm. 225 Bew Cross Road, London SE14. Details from R. A. Hinton, 58 Camilla Road, Bermondsey, London SE16.
Reigate (RATS)—Third Tuesday in each month, 8pm. Constitutional Centre, Warwick Road, Redhill. Sec G3ZSX, tel Reigate 43130.

Mike Pharaoh, G3LCH, receiving the Stanley Vanstone Trophy, on behalf of Sutton & Cheam RS members, from Lord Wallace at the Sutton & Cheam RS annual dinner and ladies' festival

Sutton & Cheam (SCRS)—Third Thursday in each month, 7.30pm. Sutton College of Liberal Arts, Cheam Road, Sutton. Sec G4BOX.
Thames Ditton (Thames Valley ARTS)—8 June (Exceptionally moved to a Wednesday, NFD discussion, presentation of Caernarvon trophy and natter-nite), 5 July ("Presentation of television programmes" by G3OGP—ladies will find this talk interesting). First Tuesday in each month, 8pm. Giggs Hill Green Library, Giggs Hill Road, Thames Ditton. Sec G3ZNW.
Wimbledon (W&DARS)—Second and last Fridays in each month, 8pm. St John Ambulance HQ, 124 Kingston Road, Wimbledon. SW19. Sec G3XTC, tel 01-644 3698.

A meeting of area and affiliated society representatives in Region 7 was held on 3 March at Sutton Central Library. Ten of the 14 affiliated societies in the region were represented and Denis Andrews, G3MXJ, zonal manager for Zone C was present. Pending further discussion, a scheme of area representatives covering the whole region and all affiliated societies was agreed. The participants agreed that the meeting had been useful and that similar meetings should be held regularly in the future.

REGION 8—RR D. N. T. Williams, G3MDO, "Seletar", New House Lane, Thanington, Canterbury, Kent.

Burgess Hill (Mid-Sussex ARS)—5 May ("In the steps of Lawrence of Arabia" by Alan Willson, G3WNS), 19 May ("A wanderer reminisces" by Louis Varney, G5RV), 2 June ("Topography" by Alf Lee, G4DQS), 16 June ("The development of the navigational aid" by Brian Kendal, G3GDU), 30 June ("Windmills evening"). 7.45pm. Marle Place, Burgess Hil, Details from G3PEQ.
Canterbury (East Kent RS)—("Synthesized Icomery" by G3VJF), 5, 19 May (Informal meeting at The Long Reach), 2 June ("Digital horology" by G3WAW), 16 June (Long Reach). Details of future events from G8GHN.
Chichester (C&DARC)—First Tuesday and third Thursday in each month. Lancastrian Boys School. Details from G4ETU, tel 0243 88069.
Crawley (CARC)—United Reform Church Hall, Ifield, Crawley. Details of future events from G3MGL.
Dartford (DHDFC)—Second Friday in each month, 8pm. The Scout House, Broomfield Road, Dartford.
Dover (South East Kent YMCAARC)—4 May (HF evening, sked arrangements to G8KEN), 11 May ("Club slides and film"), 18 May

(Natter night), 25 May (To be arranged), 1 June (Details for NFD and Jubilee), 8 June (HF and vhf portable evening), 15 June (Open night), 22 June (HF NFD), 29 June (To be arranged). Further details from G8KEN.

Eastbourne (Southdown ARS)—2 May (Junk sale), 23 May (Discussion on NFD and contests), 13 June (Open air meeting at Butts Brow), 18/19 June (Visit of Radio Club de Normandie to SARS). All meetings at Chaseley Home, South Cliff, Eastbourne. Details from Sec G8CVV. PRO G3LFZ.

Gravesend (GRSGBG)—Mondays, 7.30pm. The Windmill Tavern, Shrubbery Road, Gravesend.

Hastings (HERC)—Details of club events from G8DNO.

Hastings (ITT(H)S&AC)—Details of club activities from G8DNO.

Horsham (HARC)—First Wednesday in each month. Civil Defence HQ, Moons Lane, Brighton Road, Horsham. Details of future events from G3NPF.

University of Kent (UKC)—Wednesdays, 3.30pm (during term). Further information from Jon Hudson, G4ABQ, Rutherford College, University of Kent, Canterbury.

Maidstone (MYMCAARS)—First and third Fridays devoted to the beginner, RAE and morse tuition, 7.30pm. Melrose Close, Loose, Maidstone. Alternate Fridays, a wide variety of lectures and use of the club shack. Details from Harry Poppy, G8KMX, tel Maidstone 61792.

Medway (MARTS)—Fridays, 7.30pm. Aurora Hotel, Gillingham. Details from G8APB.

Ramsgate (Kent Coast ARC)—12 May (There will be **no** meeting at the Grosvenor Court, but we hope to arrange a visit to HM Coastguards at Dover). Further details from G4DTA QTHR.

Tunbridge Wells (West Kent ARS)—Details of future events from G8LMV.

Worthing (W&DARC)—Whitstable (Kent Repeater Group). Details of meetings from G3XDV, 5 Lambs Walk, Whitstable, Kent. Tuesdays, 8pm. Adult Education Centre, Union Place, Worthing. Details from P. J. Robinson, G8MSQ, 46 Hillview Road, Worthing.

REGION 9—RR H. W. Leonard, G4UZ, 4 Start Bay Park, Strete, Dartmouth TQ6 0RY

Camborne (Cornish RAC)—5 May ("Frequency counters" by G3OCB), 2 June ("Marconi—Cornwall and the new world" by G3VWK), 7 July ("Standard frequencies and time signals" by G2ABC). 7.30pm. SWEB Clubroom, Pool, Camborne. Visitors always welcome. Full details from G3NKE, tel Camborne 2419.

Exeter (EARS)—Second Monday in each month, 7.30pm. Community Centre, St Davids Hill, Exeter. Details from G3HMY.

Newquay (N&DARS)—Alternative Wednesdays, 7.45pm. Treviglas School, Newquay. Details from G8GOR, tel Newquay 4168.

North Devon (NDRC)—Second Wednesday in each month at QTH of G4CG, fourth Wednesday at QTH of G3FKO. Details from G4CG.

Plymouth (PRC)—3 May (AGM). First and third Tuesdays in each month, 7.30pm. Virginia House, Bretonside, Plymouth. Visitors most welcome. G4EJO.

Saltash (S&DARC)—6 May ("Tvi/bci" by G3VWK), 20 May (Surplus equipment sale), 3 June (Tape/slide show—"Dxpedition to St Pierre et Miquelon"). 7.30pm. Burraton Toc-H Hall, Saltash. Sec J. Reynolds, G8LLR, 47 Lulworth Drive, Roborough, Plymouth (tel Plymouth 771135).

Torbay (TARS)—Fridays, with special meeting on the last Saturday in each month, 7.30pm. Rear of 94 Belgrave Road, Torquay. Torbay net weekdays 10.30am on 3·785MHz. G3UIQ.

REGION 10—RR R. G. Barrett, GW8HEZ, 23 Carshalton Road, Beddau, Pontypridd, Glam.

Barry (BCoERS)—Thursdays, 8pm. Barry Rugby Football Club, Reservoir Road, Barry. Details from sec GW3VBP.

Blackwood (BARS)—Fridays, 7pm. Oakdale Community Centre, Oakdale, Nr Blackwood. Details from sec GW3KYA.

Bridgend (Glamorgan VHF/UHF Group)—Second Wednesday in each month, 7.30pm. NCB Social Club, Tondu, nr Bridgend. Details from sec GW8HEZ.

Cardiff (CRSGBG)—Second Monday in each month, 7.30pm. The Pantmawr Inn, Pantmawr Estate, Cardiff. Details from sec GW3VOW, 9 Millrace Close, Lisuane, Cardiff.

Merthyr (Hoover ARS)—Mondays, 7.30pm. Hoover Social Club, Pentrebach, Merthyr. Details from sec GW8HHY, QTHR.

Newport (NARC)—Mondays, 7pm. Adult Education Settlement, Brynglas Road, Newport. Details from sec GW8MER.

Pembroke (PRSGBG)—Last Friday in each month, 7.30pm. Defensible Barracks, Pembroke Dock, Dyfed. Details from sec GW3XJQ.

Pontypool (PRSGBG)—Tuesdays, 7pm. Education Settlement, Park Hill Road, Pontypool. Details from GW3JBH.

Port Talbot (British Steel Corporation ARS)—Thursdays, 7.30pm. BSC Sports and Social Club, Margam. Details from GW4ESV.

Rhondda (RARS)—Every other Thursday, 7.20pm. Transport Employees' Club, Porth. Details from GW3PHH.

Sully (S&DSWC)—Mondays, fortnightly, 7pm. Sully Bowls and Social Club, 58 South Road, Sully. Details from sec GW8JHF.

Swansea (SARC)—Tuesdays fortnightly, 7.30pm. The Commercial Inn, Killay. Details from sec GW4AYJ.

REGION 11—RR P. H. Hudson, GW31EQ, "Silhill", Dinas Dinlle, Caernarvon LL54 5TW.

Bangor (UCNWARS)—Thursdays, 7.30pm. Small lecture theatre, School of Engineering Science.

Conway Valley (CVARC)—12 May (Discussion on NFD), 9 June (AGM). The Quaries, Llandulas, Colwyn Bay.

Rhyl (R&DARC)—It is regretted that this club has been closed until further notice.

REGION 12—RR Frank Hall, GM8BZX, 45 Priory Cottages, Lunanhead, Forfar, Angus DD8 3NR

Aberdeen (ARS)—6 May (junk sale), 13 May (Repeater progress in Britain), 20 May (VHF night with tapes of aurora, meteor scatter and tropo dx). Friday evenings. Clubroom, rear of 91 Crown Street, Aberdeen. Sec GM4BKV.

Dundee (Kingsway Technical College ARC)—Wednesdays, 6.30pm. Kingsway Technical College. Visitors welcome. Sec Robert Officer, 17 Broomwell Gardens, Monikie, Broughty Ferry, Dundee DD5 3QP.

Inverness (Technical College ARC)—Every second Wednesday 6.45pm. Room C30, Inverness Technical College. Sec John Reid, 37 MacEwen Drive, Inverness.

Lerwick (LRC)—Wednesday evenings. Annsbrae House, Lerwick. Sec GM3HTH.

Moray Firth (MFARS)—Wednesdays, 7.30pm. Elgin Technical College. Sec GM8LVG.

REGION 13—RR A. B. Givens, GM3YOR, 41 Veronica Crescent Kirkcaldy, Fife KY1 2LH

Berwick upon Tweed (Border ARS)—First and third Fridays in each month, 7.30pm. Roxburgh Hotel, Berwick upon Tweed. Details from GM8IIO.

Dunfermline (DARS)—Second Wednesday in each month, 7.30pm. CCTV, Studio, Pittencrief School, Maitland Street, Dunfermline. Details from GM3MGX.

Edinburgh (E&DARC)—Tuesdays, 7.30pm. City Observatory, Calton Hill, Edinburgh. Details from J. Martin, 22 Ross Gardens, Edinburgh EH9 3BR. Tel 031-667 8707.

Edinburgh (Lothians RS)—12 May (Junk sale), 26 May (To be announced), 9 June (AGM), 23 June (Forward planning and VHF NFD preparation). 7.30pm. Edult Education Centre, Riddles Court, High Street, Edinburgh. Details from GM4BYF.

Edinburgh (Pioneer Club)—Tuesdays, 7.30pm. Church Hall, Ravenscroft Place, Gilmerton, Edinburgh. Details from GM4DTJ.

Glenrothes (G&DARC)—First Sunday in each month and every Wednesday, 7.30pm. Old Nursery School, Provosts Land, Leslie, Fife. Details from GM3YOR.

REGION 14—RR A. J. Mitchell, GM3UDL, 7 Limetree Crescent, Newton Mearns, Glasgow G77 5BJ.

Ardeer (ARCARS)—Tuesdays, 7pm. RAE/morse classes on Thursdays, 7.30pm. 31 Lumsden Place, Stevenston, Ayrshire. Details from GM8BOM.

Ayr (AARS)—Every second Sunday evening. Community Leisure Centre, 24 Wellington Square, Ayr. Details from GM3THI.

Dumfries (D&GREC)—16 May (Short wave listening), 20 June (ICs), 18 July ((Model control). First and third Mondays in each month, 7.30pm. Edenbank Hotel, Laurieknowe, Dumfries. Details from C. Rodgers, 5 Elder Avenue, Lincluden, Dumfries.

Falkirk (F&DARC)—Temperance Cafe, Lint Riggs, Falkirk. Details from GM3OQI.
Glasgow (West of Scotland ARS)—Fridays, 7.30pm. 22 Robertson Street, Glasgow. Each alternate meeting informal. Details from GM4FDM.
Greenock (G&DARC)—Tuesdays and Fridays, 7.30pm. 22 Inverkip Street, Greenock. Details from GM3LYI.
Motherwell (Mid-Lanark ARS)—Fridays, with alternate meetings informal. Wrangholm Hall Community Centre, Jerviston Street, New Stevenson, Motherwell. Details from GM8FHK.

REGION 15—RR H. J. Campbell, GI8FOK, 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. Sec GI8LSF.
Bangor (B&DARS)—First Friday in each month, 8pm. Redcliffe Hotel, Seacliff Road, Bangor. Sec GI4EMS.
Belfast (QUoBRC)—Tuesdays, 8pm. Queen's University Radio Club, 37 Fitzwilliam Street, Belfast. All welcome.
Belfast (CoBYMCARC)—The club is active on the air from 7.30pm on Tuesdays and 2.30pm on Saturdays. Meeting at same times. 7 Brunswick Street, Belfast. Sec D. Kane.
Belfast (BRSGBG)—Third Wednesday in each month, 8pm. 90 Belmont Road, Belfast. Interesting spring programme arranged. Visitors most welcome. Further details from GI8FOK.
Carrickfergus (CYMCARC)—Last Monday in each month, 8pm. Carrickfergus YMCA. New members very welcome. Sec C. Morrison GI8KZU, 3 Donegall Square, Carrickfergus, Co Antrim.
Mid-Ulster RSGB Group—First Sunday in each month, 3pm. At QTH of GI4BAC. Sec GI3WWY.
North Ulster (NURSGBG)—For details contact GI8AYZ.

REGION 16—RR R. E. G. Kendall, G8BNE, "Wesley", Ranworth Road, Hemblington Corner, Blofield, Norwich NR13 4PJ.

Chelmsford (CARS)—First Tuesday in each month, 7.30pm. Marconi College, Arbour Lane, Chelmsford. Details from R. Brocks, 30 Rowan Drive, Heybridge, Maldon.
Colchester (CRA)—Wednesdays, 7.30pm. 114 Ipswich Road, Colchester (above Candor Motors). Details from G3YAI.
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. The club hopes to introduce regular RAE and morse tuition, as well as a series of lectures on a wide range of radio and electronic topics. Details from G3WUX.
Ipswich (IRC)—11 May ("Planning permission for amateur aerials" by J. H. Quarmby, G3XDY). 25 May (Final planning meeting for East Suffolk Wireless Revival), 29 May (East Suffolk Wireless Revival, IACSSA Sports Ground, Foxhall, near Ipswich). Details from G4BAV.
Loughton (L&DRS)—Second and fourth Fridays in each month, 8pm. Loughton Hall, near Debden Station. Sec G4CMD.
Lowestoft (L&DARC)—Fridays, 7.30pm. Morse class every Tuesday. YMCA, Park Road, Lowestoft.
Martlesham (MRS)—First Wednesday in each month. Details from M. Appleby, PO Research Centre, Martlesham, Ipswich.
Norwich (Norfolk ARC)—Wednesdays, 7.45pm. Crome Community Centre, Telegraph Lane East, Norwich. Details from G4EOL.
Norwich (U of East Anglia R&EC)—Details from P. Gowen, G3IOR.
Vange (VARS)—Thursdays, 8pm. Youth Hall, Barstable Tenants' Community Association, Long Riding, Basildon. Details from Mrs D. Thompson, 10 Feering Row, Basildon SS14 1TE.

REGION 17—RR L. Hawkyard, G5HD, 100 Shirley High Street, Southampton, Hants.

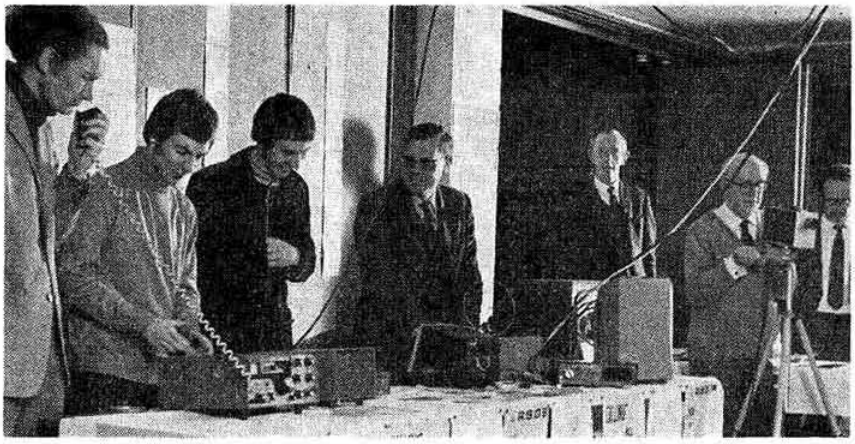
Basingstoke (BARC)—First Saturday and third Wednesday in each month, 7.30pm. Chineham House, Popley, Basingstoke. Sec G3CBU.
Basingstoke (UKFM Group, Southern)—4 May. Chineham House, Basingstoke. Details from PRO G8ECO.

Three old timers who visited an exhibition organized by the Wessex Group and Poole RAS to mark the 75th anniversary of Marconi's first transatlantic transmission: G6DW, G6MB and G2DX

Bournemouth (Wessex ARG)—First and third Fridays in each month, 7.30pm. The Dolphin Hotel (club room), Holdenhurst Road, Bournemouth. Special meeting 20 May at Bournemouth School, East Way, Bournemouth, 7.30pm. (Lectures by F. J. H. Charman, G6CJ, on aerials and by W. K. Alford, G2DX, on "The early days of wireless"). Visitors most welcome but please notify Sec G. Cole, G4EMN, tel Bournemouth 20027.
Chippenham (C&DARC)—Tuesdays, 7.30pm. Sheldon School, Hardenhuish Lane, Chippenham. Sec G8BXG.
Fareham (F&DARC)—Wednesdays, 7.30pm. Porchester Community Centre, Room 9. Sec D. Thompson, tel Fareham 2799.
Farnborough (F&DRS)—Second and fourth Wednesdays in each month, 7.30pm. Railway Enthusiasts' Club, Access Road, off Hawley Lane, Farnborough. Sec G4FEA.
Guernsey (GRES)—Tuesdays and Fridays, 8pm. Details from sec GU8ITE, PO Box 100, Guernsey.
Horndean (H&DARC)—Second Thursday in each month, 7.30pm. Merchiston Hall, Horndean. Net Sundays 6.30pm. 21·40MHz. Sec G4CHO.
Jersey (JARS)—Sundays, 10.30am, and Fridays, 8pm. Le Hocq Tower, St Clement, Jersey. Sec Mary McTaggart, 19 Parade Road, St Helier.
Poole (PRAS)—Last Friday in each month, 7.30pm. Poole Technical College. Sec Graham Tizzard, tel Poole 4641 ext 34.
Portsmouth (P&DRC)—Wednesdays, 7.30pm. Portsmouth Community Centre, Malins Road, Buckland, Portsmouth. G3CNO.
Salisbury (SR&ES)—Tuesdays, 7.30pm. Salisbury Activity Centre, Wilton Road. Sec G2FIX.
Southampton University (SUARC)—Tuesday evenings, also informal meetings every lunchtime in the clubroom, Old Union Building. Sec A. George, G4ESZ.
Southampton (SRSGBG)—Second Saturday in each month, Lanchester Building, Southampton University; Wednesdays, the clubroom, Kent Road; both at 7.30pm. AR G4COM.
South Dorset (SDRS)—7.30pm. Lecture Hall, South Dorset Technical College, Newstead Road, Weymouth. Details from G3YWG.
Swindon (SD&ARC)—Alternate Wednesdays, 7.45pm. Clubroom above Coldharbour Public House, Blunsdon, just north of Swindon. Sec G8KWC.
Winchester (WARC)—First and third Fridays in each month, 7.30pm. Antrim House, St Cross Road, Winchester. G4BKE.

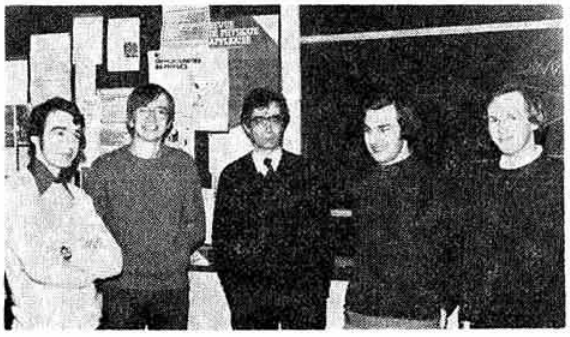
REGION 18—RR P. J. Fay, G3AKG, 5 Harland Way, The Glebe, Washington, Tyne & Wear NE38 7RB.

Durham (DUARS)—Alternate Wednesdays during term. Physics Dept, Durham University. All local amateurs are welcome to join. Talk-in by G4DUR on R5 or S20 before all meetings. A series of lectures is being arranged for May-June. Details from M. Warrington, G4EMW, Van Mildert College, Durham.



The stand of the Radio Society of Harrow at the HAVS Exhibition on which was demonstrated 20m operation, cctv and a vdu designed and built by G8EIM. Left to right: G3YQV, G4FBK, G4AUF, G3MLS, G3KDL, G3KRT and G3LSY

Easington (AR&EC)—Tuesdays and Thursdays, 7.30pm. Easington Village Workmen's Club. RAE and morse tuition if required (the club has a good RAE pass record). ATV can be received on 625 lines. The club is now equipped with an hf transceiver as well as other gear. Sec G4COI.
Great Lumley (AR&ES)—Every second Wednesday, 7.30pm. Great Lumley Community Centre, Great Lumley. Assistance with the RAE and morse is given at all meetings and all amateurs and SWLs are welcome. Sec G8JLQ.
Hartlepool (HRC)—Mondays, 7.30pm. Methodist Church Hall, Grange Road. Sec G3NWU, 73 Eamont Gardens, Hartlepool.
Middlesbrough (PORC)—The following events have been arranged for May: visits to BBC Radio Cleveland, the *Evening Gazette* and to Tees and Hartlepool Port Authority. Sec G8CDP.
Morpeth (Northumbria RC)—Now meets Thursdays, British Legion premises, Gambois, nr Blyth. Sec G4AVO.
Newcastle (Tyne & Wear Repeater Group)—First Wednesday in each month, Arts Common Room, University of Newcastle. The second monthly meeting has been dropped. GB3TW is working well and is in almost continuous use. Some of those using it are members neither of the group nor of the RSGB—equipment has to be paid for and the group needs your subscriptions if it is to survive. All amateurs are welcome to join. Details from G3URE.
South Shields (SS&DRS)—Fridays, 7.30pm. Trinity House, Old and new members welcome. Sec G8BQF, 67 Lauderdale Avenue, Kings Estate, Wallsend.



A group after a recent lecture "IC chips with everything" by Dr M. J. Morant at Durham University R&ES. Left to right: G8HVB, G4DOC, Dr Morant, G4EMW and G4EEJ. *Photo:* **A. J. Barlow**

Teesside Repeater Group—This group is applying for affiliation to the RSGB, and its application for repeater GB3TS/70 has been accepted. The group is open to all amateurs. Sec G8CDP.
Tyneside (TRC)—Mondays, 8pm-9.30pm. The Community Centre, Vine Street, Wallsend. Sec F. Addison, 3 Wilton Close, Whitley Bay, Tyne & Wear.

A mobile rally to be held in the north-east at some later date has been suggested. Interested clubs should write to G3URE and give him their ideas on the subject.

A visit by the zonal representative is proposed for late summer. G3AKG would welcome ideas on what RSGB members would like to lay on for this occasion.

REGION 19—RR D. S. Smith, G4DAX, 151 Hamper Mill Lane, Oxhey, Watford, Herts.

Acton, Brentford & Chiswick (ABCRC)—17 May (The IARU & the World Administrative Conference 1979), 21 June ("2m antenna tests" by G3IGM). 7.30pm, Chiswick Trade & Social Club, 66 High Road, Chiswick. Sec G3GEN.
Barking (BR&ES)—Mondays (Constructional), Wednesdays (CCTV techniques), Thursdays (Informal). Morse classes Tuesdays. 7.30pm. Westbury Recreation Centre, Westbury School, Ripple Road, Barking, Essex. Sec G8JEG, tel 01-599 1103.
Cheshunt (CDRC)—New premises—Church Room, Church Lane, Wormly, Herts. Wednesdays, start 8pm.
Chingford (Silverton RC)—Fridays, 7.30pm. Friday Hill House, Simmonds Lane, Chingford E4. Visitors very welcome. Sec G4AJA, tel 01-529 2282.
Ealing (EDARS)—Tuesdays, 8pm. Northfields Community Centre, Northcroft Road, London W13. Sec R. Blackwell, 4 Colnbrooke Avenue, West Ealing, London W13 8JY.
East London RSGB Group—15 May (F. C. Judd, G2BCX). 3pm. Wanstead House, The Green, Wanstead, E11. Sec G4CJQ, tel 01-524 3169.
Edgware & District RS—12 May ("Getting going on tv and rtty" by G4CNW), 26 May (to be announced), 28 May (Demonstration station at Stanmore Broadway as part of Stanmore Carnival Week), 9 June (final preparation for NFD), 23 June (to be announced).
Harrow (RSH)—13 May (practical), 20 May ("Modulation" by D. Napin), 27 May ("Slow scan tv" by P. Johnson, G8EIM), 3 June (Practical), 10 June (Junk sale), 17 June (Mobile ramble), 24 June (Practical), 1 July VHF NFD planning).
Havering (H&DARC)—Wednesdays, 8pm. British Legion Club, Western Road, Romford.
Holloway (Grafton RS)—7.30pm. Holloway Institute, Archway Annexe, Highgate Hill, London N19. Sec G3ZKE.
Ilford RSGB Group—Thursdays, 8pm. 50 Mortlake Road, Ilford. Details from D. T. Sapworth. G3YMW.

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, London N21. Sec G4AEZ, tel 01-366 7166.
St Albans (Verulam ARC)—26 May (Operating techniques), 23 June ("Tonebursts and operating aids" by G8BNR). 7.30pm. Market Hall, St Albans. Informal meetings second Thursday. RAFA. HQ, Victoria Street, St Albans.
Stevenage (S&DARS)—First and third Thursdays in each month, 8pm. Hawker Siddeley Dynamics Ltd., Gunnels Wood Road, Sec Trevor Tugwell, 11 The Dell, Stevenage.

REGION 20—RR G. Mather, G3GKA, 8 Hills Close, Keynsham, Bristol.

Bath (B&DRG)—Tuesdays, 8.30pm. The Crypt, Ascension Church, 35a Claude Avenue, Oldfield Park, Bath. Sec N. S. Cridland, Flat 3, 30 Paragon, Bath BA1 5LY.
Bristol (BRSGBG)—30 May ("IBA technical development" by Jim Slater at HTV Studios), 27 June (Potted lectures), 25 July ("Amateur tv" by G8FNR, G8GLQ and G8KGH). 7-9.30pm. Small lecture theatre, Queen's Building, University Walk, Clifton, Bristol 8. Sec G4FRG.
Bristol (BARC)—Tuesdays, 7.30pm. The University Settlement, Barton Hill, Bristol 5. Sec G8KGE.
Bristol (Shirehampton ARC)—Fridays, 7.30pm. Twyford House, Shirehampton. New members most welcome. G4BWB.
Cheltenham (CARS)—Wednesdays, 8pm. St Marks and Hesters Way Community Association, Brooklyn Road, Cheltenham. Visitors very welcome. Sec G8JAY.
Gloucester (GARS)—Thursdays, 7.30pm. The Chequers Bridge Centre, Painswick Road, Gloucester. Formal meeting on the first Thursday in each month. Sec G3MA.
Taunton (T&DARS)—Fridays, 7.30pm. Jelalabad Barracks, The Mount, Taunton. Sec G. Swetman, "Little Copse", Monkton Heathfield, Taunton. Tel West Monkton 298.
Weston-super-Mare (WsMRS)—Second Friday in each month, 7.30pm. Room Lewis M2, Worle School, New Bristol Road, Worle. G3PQE.
Yate (Y&DARC)—First Saturday in each month, 8pm. G3RQN QTH. All welcome, including SWLs. Local chat channel S24, 145·6MHz, 2100 Wednesday and Saturday. Further info from G8LGC
Yeovil (YARS)—Due to possible change of venue, contact Sec G3NOF.

Info for "Club News" to G3GKA by 17 May for July issue, due to holidays.

Mobile rallies calendar

22 May	Welsh Mobile Rally, Barry Rugby Football Ground, Merthyr Dyfan Road, Barry, South Glamorgan. Trade stands, raffles, talk-in by GW3VKL on 2m, S20 and via GB3BC on R6. Details from GW2DPD.
22 May	Northern Mobile Rally, Victoria Park Hall, Keighley. 11.30-18.30. Talk-in on 144·25MHz, S22, 433·20MHz. Usual attractions. Details from G8DFZ, QTHR.
29 May	Hull & D ARS Rally. Details and venue later. Full details from G3LZQ, 73 West Hall Garth, South Cave, Brough, Humberside HU15 2HA.
29 May	East Suffolk Wireless Revival, Civil Service Sports Ground, Bucklesham Road (four miles SE of Ipswich, near A45). Demonstrations, home constructors' competition, vhf/uhf antenna gain testing, df hunt, drive-in test facility for mobiles, trade stands. Talk-in on R3, S22, SU8, 144·28, 70·28. Details from G3XDY, QTHR.
29 May	Southend & D RS Mobile Rally, FitzWimarc School, Hockley Road, Rayleigh, Essex. 1030-1700. Talk-in on G5QK 1,975kHz, G8MRS S22, monitoring 2m S channels, also RB10, 70cm. Details from M. Daniels, 25 Sweyne Avenue, Southend, Essex SS2 6JQ.
5 June	Maidstone YMCA ARC Mobile Rally, "Y" Sports Centre, Melrose Close, Loose, Maidstone, Kent. Talk-in on 160m, G3TRF; 2m G3YSC. Admission: (on foot) adults 25p, children 10p; (by car) £1 including parking and passengers. Details from G3WXL, QTHR.
12 June	Longleat Radio Rally, Longleat House, Longleat, nr Warminster, Wilts. This year the rally will take place in conjunction with the Silver Jubilee events at Longleat House, where the band of the Royal Signals and the Royal Marines Reserve Unarmed Combat Display Team will be in attendance. The band of the Royal Signals will "beat retreat" on the forecourt of Longleat House at 6pm. The President of the RSGB, Lord Wallace of Coslany, will be present. Talk-in stations will be operational on 160, 80 and 2m (callsigns to be announced). As well as trade stands there will be a grand raffle, RSGB bookstall and a bring and buy stand. Overnight camping is permitted from 6pm on Saturday 11 June. No charge is made for entrance to the rally, but visitors must pay for entrance to Longleat Park. Details from G3ULJ, QTHR.
12 June	Elvaston Castle Mobile Rally, Elvaston Castle Country Park, 5 miles SW of Derby on B5010. Talk-in from 10am on G8KGC/P 2m fm S22, and ssb; G3EEO/P on 160m. G3ZBI/P exhibition station. No charge for rally but local authority parking charge of 25p per car and £1 per coach. Details from G3WFU, QTHR.
19 June	Royal Naval ARS Mobile Rally, HMS *Mercury* on South Downs between Clanfield and East Meon. Signs on A3 S of Petersfield and A272 W of Petersfield. Gates open 11am. Talk-in on GB3SN, 2m; 4m, 3,660kHz. In addition to usual attractions there will be arena displays by Cowplain NTC Band, Volunteer Boy Cadet Corps Field Gun teams, Kelly Squadron of HMS *Mercury*, and pre-1963 racing cars. Details from G3LIK, QTHR.
10 July	Upton Radio Rally, Hill High School, Upton-on-Severn. Details from G8ASO.
16 July	Hornsea ARS Mobile Rally, Hornsea School and Hall Garth Park, Hornsea, N Humberside. Held in association with Hornsea Carnival. Details from G4CHH, QTHR.
17 July	Cornish RAC Mobile Rally, Truro Rugby Club Ground. Details from G3NKE, QTHR.
7 August	**RSGB National Mobile Rally, Woburn Abbey** (This rally has been reinstated)
14 August	Derby Mobile Rally. Lower Bemrose School (Ryknеld School). Details from G3FGY, QTHR.
14 August	Pembroke RSGBG Bucket and Spade Party, Regency Hall, Saundersfoot. Details from GW3XJQ.
21 August	Preston ARS Mobile Rally, Walton le Dale County Secondary School, Bamber Bridge, Preston (one mile from junction 29 on the M6). Talk-in on 2m. Trade stands, raffle, bring and buy stall, plenty of parking space. Doors open at 11.30am. Details from G8KTM, QTHR.
28 August	Torbay ARS Mobile Rally, Haldon Racecourse, nr Exeter. Details from G3UIQ, QTHR.
18 September	Peterborough Mobile Rally, Walton Secondary School, Mountsteven Avenue, Peterborough. Talk-in station G3DQW on 2m. Details from G3EEL, QTHR, tel Peterborough 62881/65423.
25 September	Harlow & D ARS Rally, Netteswell Comprehensive School, Harlow. Details from G3WUX, G8FRG, G3YDI, QTHR.

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 alternate issues 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. 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. Traders who are members must enclose a signed declaration that the items for sale or wanted are part of, or intended for, their own personal amateur station.

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.

Post to: MEMBERS' ADS, "RADIO COMMUNICATION", 35 DOUGHTY STREET, LONDON WC1N 2AE.

FOR SALE

Free lighting for your shack. Lucas 12/24V dc wind generator in strong wind will produce up to 15A, highest offer secures. 1200cc Volkswagen car engine, secondhand but believed ok, offers. *Urgently wanted:* Pye Cambridge FM10MC osc/mult board. G3UPV, QTHR. Tel Chapmanslade 418 after 6pm.

R1392D rx, 95-150MHz, good cond, manual and circuit diagram, £19. A510 QRP tx, 2-10MHz, £6. PCR Mk3, good comms rx, £18. *Wanted:* RA1 or GC1U rx. AM10 Cambridge, rx must work on 2m, tx not important. MI Wright, 27 Bulbridge Road, Wilton, Salisbury, Wilts.

Liner 2, PA3, mic, mobile mount, manual, £110. FT200, ac psu, DC200, blower, full 10m, mic, handbook, £200. Both vgc. G3SOE. Tel Wolverhampton 52251 day, 752760 evenings.

Liner 2, inc mic, mobile mount, preamp in original packing, £110 or will swop and cash adjustment for hf tx/rx, FT200 etc. *Wanted:* KW E-zee match. G8JKA, QTHR. Tel Flwd 4094 between 6-7pm.

Pair QQVO6-40, one new, one used, £6. MM 70cm converter, 144MHz, 146MHz i.f., in box with mains psu, £18. SSM 2m converter, 2MHz, 4MHz i.f., £10. GW8KSF, QTHR.

RSGB Bulletins, Feb, March, July 1946, March to July and Oct, Nov 1947, Jan, March, June 1949. G3RSD, 6 Fairfield Court, Cleethorpes DN35 0QW.

FT101, exc cond, £265. KW600 linear amp, £85. Carr extra. G4EDB, QTHR. Tel Shipley 54993.

Xtal filter experiment, HC6U 8965·25, 8968·75, 8971·87, 8973·43 9328·13, 9497·22, 9498·6, 9501·35, 9502·77, all £1 six or more of each. 2DAF rx filter, 8499·1 (2), 8500·9 (2), 8498·6 (1), 8500 (1). W15FM 6ch lb, £65. Vanguard fm lb, £35. FM10D, s/c lb, £30. All plus postage. G3WR, QTHR.

FL2500 linear, £200. YO100 Monitorscope, £80. Both ono. Teleprinter term units, reader, perforator etc. BC221 vvtm fm sig gen. *SWM, RadCom.* Offers. Effects G3FDF. G4AMK, QTHR. Tel 0533 23382 office, 0664 2755 home.

14AVQ/WB, with maker's 80m loading coil, good cond, £35. Heathkit tv alignment gen, mint, £30. Vanguard AM25B, 6ch 2m, exc cond internal, needs xtals, £25. Buyers collect. *Wanted:* Labgear wideband multiplier E5026. GW3GWA, QTHR. Tel 097 881 3891 working hours.

Trio 9R59DS rx, fitted voltage stabilizer, manual, with loudspkr, vgc, £45. J. Donnithorne, G8MKX. Tel 0342 26366 after 5pm.

Trio 7010 2m ssb tx/rx, new and in absolutely mint cond, with mic and car mount, offers. G3XFB, QTHR. Tel Brewood 850033.

Eddystone EC10 Mk1 rx, 550kHz to 30MHz, hardly used, in vgc with spare front plate, £55 ovno. Buyer collects. Martin Barson, 31 Aldbourne Road, Burnham, Bucks. Tel Burnham 3756.

FTDX401, mint, spare finals, unused, £250 ono. G4GJ, QTHR. Tel Bingley 2965.

Liner 2, 144·1-144·33, immac cond, untouched, maker's original carton, ac psu, 8-el Jaybeam, ⅜ Bantex and new base, £125. CR100, £25. GD1U wavemeter, £10. 28-144 tx/rx, transverter h/b, built for KW2000 QQVO6-40 pa, tank circuit needs attn, £20. GW4BCB QTHR.

Four 4m fm mobiles. Cossor 6ch dash mount, fitted 70·475, 70.500, 70·525, all transistor except quick heat driver and pa, super sensitive rx, tx o/p 20W plus, good cond, comp mic and cables, £65 each. G3HTC, QTHR. Tel Sunbury 84422.

Property of late GM3BGW. KW Vanguard, 160/10m. KW swr meter. RF sig gen. *Radio Communication Handbook*, 4th edition. *Amateur Radio Handbook*, 3rd edition. Hartmann and Braun Multavi 2. Various meters. Offers. GM3YAN, QTHR.

FTDX401, SP401, YD844 and manual, mint. 9R59DS gen cov rx with SP505, vgc. KW E-zee match. KW 50Ω dummy load, unused. SWR/imp bridge, 80–10m. Trapped dipole antenna system. Various amateur radio handbooks. L. W. Briggs, 6 Daisy Lane, Locksheath, Southampton SO3 6RA. Tel 04895 4405.

FT101B, 600Hz, filter YF30F600, £16. 4CX250B holder and chimney, £5.50. Solid state exciter, 1·6-26MHz, £18. Valves—6146, £2.50. 6146B, £3. 5B254M and holder, £2. QZO6-20, quick heat 6146, £1.50. QVO8-100B, £5. Modulator, 75W. 24V dc, £10. G3JMJ, QTHR. Tel 073 271 3467.

Trio JR500SE amateur bands rx, with top band conversion, exc cond, with matching spkr, £50. Heathkit DX100U tx with SB10U ssb adaptor, used recently on the air, will split if necessary, £30. G4FIE. Tel 0533 773870.

Clearing workshop, valved comms rx, preamp, sig gen, xtal marker, oscilloscope, vhf converter etc, cheap, suit beginner, sae list. Hurley, 8 Queens Road, Tipton, West Midlands.

FT101B, immac, little used, mic, manual etc, £350. HQ1 Minibeam, £40. Transformers, mod UM1, unused, £3. Parmeko, mains, 450V, 400V, FW 250mA, lts 2 by 4V 3A, 2 by 4V 4A, 5V, 6·3V, 3A, 2 by 6·3V 4A, £5. Four Brimar unused 5763s, £1 each. Carr extra. G4AHI QTHR. Tel Rayleigh 774195.

FV101B. KW109. *Wanted:* MMT432/144 transverter or similar. GI3VYY, QTHR. Tel 0232 743520 daytime.

QQVO6/40As, as new, gold plated pins, £6. Micromatch vhf/uhf reflectometer module, microwave diode probes, inline "N" type, £4. HC6U converter xtals, 31·1111, 32·2222, 34·4444, 35·5555, 35·0000, 36·6666, 37·7777, 38·3333, 38·8888, 40·0000, 41·1111, 41·6666, 43·3333, 45·0000 (R4), 60·75MHz, £1 each, carr extra. G8ENI, QTHR. Tel 0922 415374.

Two h/b txs, both with built-in power supply and vfo, 807 pa approx 20W i/p, cw only but room for modulator, one covers 80 and 40m, second covers 20m, £6 each or £10 for pair. 80m Command rx, £5. G3VST, QTHR. Tel Crayford 521383.

Philips N2204 cassette recorder, good cond, £15. Cossor 339 dual trace scope, £5. Buyer collects. R. Hammond, 43 Durant Road, Hextable, Kent. Tel Swanley 64356.

FTDX401 tx/rx, exc cond, £275. Belcom FS10078 16ch Autoscan tx/rx, five repeater, nine simplex, autoburst, narrow filter, as new, £140. Shure 201, £4.50. DM501, £4. Cambridge Dash a.m. tx/rx, 145 band tunable rx, £25 plus carr. G2HJD, QTHR. Tel 0533 882764.

Joystick, Joymatch 3, no reasonable offer refused, both brand new in cartons, will pay postage. *Wanted:* Trio/Kenwood TX310, overseas members note. Command tx, 2·1-3MHz, without tubes ok. GI6VU, QTHR.

Liner 2, 144·10-144·38, £120. CR100, £20. Telequipment Serviscope, £20. With manuals. Xtals—HC6U 8·065, 8·083, 11·155, 11·191, 11·254, 11·256, 24·033, 40·1, 72·143, 72·262MHz; HC18U 38·533, 36·072MHz, £1.50 each. G8GHU, 29 Overlands Road, Wyke Regis, Weymouth, Dorset.

Two DX100s, one needing repair, £40. One Eddystone B40A rx in wkg order, £25. One KW160 tx needing repair, £15. Many valves, spares etc. L. Loudon, 174 Minstead Road, Erdington, Birmingham Tel 021 327 5937.

Heathkit oscilloscope OS2, 3in screen, ideal monitor, £25. G3YWS, QTHR. Tel Newark 2413.

Jaybeam 8 over 8 slot, used but ok, £7. G4EGY, QTHR. Tel 0602 263142 night, 0602 582981 day.

Trio 2200, 145·0, 145·5, 145·55, 145·325, lo, sn, nicads, h/b power amp, 15W i/p power, £100 ono. G4DSO, QTHR. Tel 07357 2119.

HRO-MX rx, full set of gen cov coils, 15m bandspread coil, power supply, spkr, £30. Joystick antenna and tuner, £20. H/B 500W linear amp, £25. Raby, G3ZPE, 20 Lime Tree Road, Bilbrook, Codsall, Staffs WV8 1NT.

FT75 ssb/cw tx/rx, comp with ac and dc power supplies, mic, leads, spkrs etc, exc cond, £159 inc Securicor carr. G4BVH, 73 Dudley Road, Brighton, Sussex. Tel 0273 504634 evenings.

Trio TS515/PS515, 80-10 tx/rx, 180W ssb, tx/rx, 180W ssb, cw, fan cooled 6146Bs, nice cond, main station rig in good wkg order, £200. Will share Securicor transit. G4ACK, QTHR.

Heathkit HW100, good cond, with h/b psu and manuals, £160. Hallicrafters SX28 super Skyrider rx, 0·55-42MHz, manual, £25. Buyers must collect, consider exchange 2m/70cm gear, why? G8MES. Tel Sheffield 389229.

Datong rf clipper, £29.50. SP101 spkr, £10. Spacemark ETM2 keyer, £23. 30 Governor springs for rtty, £3. 150 keyboard buttons for mod 75s, £3. *RSGB Bulletin*, 1960–65, bound, £3 per vol. GW 3SFC, QTHR. Tel 0685 88 4880 after 5pm.

Heathkit HP23B power supply, assembled, never been used, £45 inc carr. G4DDM, QTHR. Tel 049481 4483.

2m 8 over 8 slot Yagi, £9. 4m 4-el Yagi, £5. AM25B Vanguard, xtalled 70·26, clean, wkg, tuned ok, less control gear, £10. RTTY Creed 7E/RP tu reader, psu, wkg 170 shift 45 bauds, £50. G4BJD, 5 Elms Drive, Quorn, Leics. Tel 0509 414007.

Storno Viscount, less tx, psu, £9. Microwave intrusion alarm, £25. Radiovisor invisible ray, £18. 144MHz tx, less psu, £3. Canadian Marconi communications rx, 1944, £6. Screened pvc flexible, £1 per 12m (pro rata). W. H. Joyce, 41 Rochdale Road, London E17 8JF. Tel 01-539 5421.

2m to 70cm tripler, exc cond. £14. *Wanted:* Chart recorder, barograph. Sweetland, 5 Ridgeway, Ingatestone, Essex CM4 9AS. Tel Ingatestone 2797 after 6pm.

Tower, 24ft, base insulators 1·675in top pipe, £15. 100ft ¼in coaxial, £3. Two 61 note organ keyboards, £12 each. 30 note oak pedalboard, £25. Note generator, £15. IC dividers, stop switches, many others. Buyer collects. G3LWT. Tel 048 86 3396.

B44 on 70·20, rx tunable, £10. Cossor CC3 tx/rx, tx fm on 2m, rx needs mods, £5. 12in Wharfdale spkr, 25W, as new, £8. *Wanted:* Vanguard 2m xtals, buy or exchange. G4FAL, QTHR. Tel 01-946 9262.

Linear amp, 2 × 813 passive grid with separate psu, less cases, wkg, £40. Must collect. Hartley 13A twin beam oscilloscope with manual, probe and mains lead, wkg, £28. Must collect. Mains transformer, 500–0–500V, 250mA, £4. SAE enquiries. Carr extra. G4DFE, QTHR.

Trio R599S rx, top band through 2m, nine months old, gone vhf, suit swl or G4s going hf, when coupled with TX599 will give twin vfo separates, nearest offer to £300. GW8MVA, 27 Helo Ty Gwyn, Llanbradach, Mid-Glam, Caerphilly. Tel 0222 862168.

Jaybeam MBM88/70cm, 88-el antenna, as new, assembled and varnished, £20. 80m top loading coil for 18AVT/WB, new, unused, £4. Advance constant voltage transformer, 250W, essential for colour printing, £15. *Wanted:* Power supply modulator unit for LG300. G3AZI, QTHR.

FT101, FV101, cw filter, fan, unused, mobile mount, all in mint cond, at present sitting unused in shack, need space so first cheque for £325 secures. Buyer inspects and collects. G3NAC, QTHR. Tel 0954 60584.

Liner 2, £100 or will exchange for good Hamband rx with full 10m band. Write (no phone calls or callers) to: P. Johnson, G8KNV, The Nevil Crest and Gun, Eridge Green, nr Tunbridge Wells, Kent.

Smallest 10W 2m fm tx/rx, Standard C140 12ch plus CV110v of, toneburst, fitted three simplex, three repeater, perf, £130. G2AXO, QTHR. Tel 0604 61794.

FT2 Autoscan tx/rx, 12/240V, 2m, mobile/fixed, supergain preamp, channels five simplex, three repeater, covering six repeaters, toneburst diode switched to repeater channels, mobile mounting bracket, manual, £145. G3FWA, QTHR. Tel Bedford 854687.

Heathkit 10-12U 5in lab scope, £35. Hammarlund HQ170 rx, 1·8-54MHz, with built-in spkr, £75. BC221 with charts, £15. G3XC, QTHR. Tel Fraddon 485.

KW2000B mains psu, £180. DC psu, £20. Codar AT5 250/S mains psu, £15. G3FIF 160m coil and antenna base, £10. T28, £10. CR100/B28, £10. Tx Geloso exciter 4/102, 80-10m, 807 pa in cabinet, £10. G3PER, QTHR. Tel 0524 52659.

145MHz QRO mobile. FM60B boot mounting. 6ch S20 fitted with mounting rack, control box, cable, mic and spkr, 12½kHz filter, £40. Prefer buyer collects but delivery arranged Manchester area. G8BEQ, QTHR.

RTTY Creed 7B/RP teleprinter, good order, with base and silence cover, £25. Creed 444 receive only teleprinter (no keyboard), built in reperforator, with base and silence cover, £35. Both carr extra by arrangement. G3RDG, QTHR. Tel 01-455 8831.

Heathkit HW32A 20m tx/rx, calibrator, ac Heath psu, unmarked, £75. Amps, valves, transformers at junk prices. Cain. Tel Alnwick 2487.

Furzehill V200A valve millivoltmeter, 1mV to 100V, audio to 10MHz, £15 plus post. Chorley, 7 Fox Field, Everton, Lymington, Hants. Tel Milford-on-Sea 5231.

FR101S with matching spkr, immac cond, no mods, as new, instruction book, accessories, box and packing, £250. G8MGV. Tel 01-590 8791.

Heathkit SW717, gen cov, well constructed, exc cond, manual, £50. Heathkit Mohican, good cond, battery operated, £20. Brian Pogson, Top Flat, Sunny Beach, Esplanade, Seaton, Devon EX12 2NP. Tel Seaton 20411 after 4.30pm.

KW2000E, in exc new cond, £280 ono. Standard C146A, S20, S22, R5, R7, nicads, as new, little used, £110 ono. G8EPE, QTHR. Tel 021-705 7158.

FT101 Mk 2, fan, cw filter, had very little use, mint cond, £295. G3KDH, QTHR. Tel Tring 3505.

FT200, FP200, unmarked cond, full 28MHz, spare set valves, inc pa, new YD844 table mic, original packing, £210. Less mic, £200. Liner 2, new, used few times, not mobile, mint, comp, original packing, £110. G3UHH, QTHR. Tel Watton 238.

EA12 rx, with manual, good cond, £90 ono. Buyer inspects and collects. E-zee match, £10. Tel 058-04 2636.

FM Redifon GR286 (private and international decks), scanner built-in with SO, S20, S22, R3, R6, plus 144·4 tx, £60 ono. Pye U450 tx/rx, SU8. RB4, RRB4, £65 ono. G. B. Packer. Tel 072 886 214.

Collins KWT6 tx/rx, o/p 500W usb/lsb, 125W cw, 2-30MHz, comprises blower, hv psu, lv psu, audio/control, sideband generator, linear amp, antenna coupler/vswr indicator/spkr, interconnect junction box, mounted on 7ft rack with all interconnect cables and manual, offers over £150. Buyer collects. Shinwa 1pf type 1005, unused, £8. G3GJX/Doram cmos keyer, £6. Tel Bourne End 25541.

Marconi HU13 rtty tu with psu, valves, h/b and connectors, weight 55lb, £22 if collected or carr extra. Xtals 3,579kHz like HC6U (8 off), 75p. HC6U 8,081kHz (2 off), S18, 10XJ 8,064kHz, RB6 i/p. 10XJ 8,053kHz RB10 1/p, £1 each. Tech. Sec, G3RAF, QTHR. Tel Banwell 2131 ext 335.

Pye equipment for sale. PF1 Pocketphones, tx/rx, £20. F460 base station, offers over £150. Highband Cambridge AM10D, 12·5kHz, £40. 25kHz, £30. Vanguard AM25B/6, 6ch, lowband, with cradle, control box, lead, mic and clip, battery lead, £9. Pack only, £6.50. All plus carr. J. Griffiths, The Grange, Gladstone Street, Abertillery. Tel 049-532 3111 any time.

QM70 28/144 solid-state transverter, 2W o/p, £35. Kit of parts for ssb polyphase exciter, £7. GM8LVA, Quetta, Lesmurdie Place, Lossiemouth, Moray IV31 6AQ. Tel Lossiemouth 2728.

Tired of talking to yourself? Try my automatic, infinitely adjustable repeater/timer, rf activated, no connections to your rig necessary, cheap to build, PP3 lasts for ages. Send 50p to cover costs for circuit diagram. G8KEP, QTHR.

Solartron CD711 db scope, moderate cond, some faults, only one beam operative, large and heavy, £25 or swop for 2m or 70cm rx. Some transformers, letter for details on above, all answered. Ian Wylie, 3 The Elms, Countesthorpe, Leicester.

Storno 600 5 RPT and 433·2MHz, as new, £100. MM432/28 boards, 6W o/p, £45. Liner 2, modded, requires assembly but wkg on 10m, £70 ono. G3ZVC board, £45. G8FAT, QTHR. Tel 01-954 2311 ext 298 (ask for Barry).

Oscilloscope Solartron CD513, £25. Buyer collects or arranges carr. G3NZU, QTHR. Tel 061-437 8614.

144MHz 14-el Parabeam, very little used, comp with UR67 feeder, £16. G8AJM, QTHR. Tel Reading 64903 after 6pm.

Liner 2, all accessories, vgc, £115 ono. GM8AKB, QTHR. Tel 0968 72299.

KW202, KW204, good cond, £155 each. Microwave Modules 28/144 converter, as new, £15. Buyer to inspect and collect. G3ZAG, QTHR. Tel 01-205 5601.

Liner 2, vgc, improved rx, 144·10 to 144·33, all accessories for mobile incl manual, £100. G8KUN, QTHR. Tel 0582 21302 after 6pm.

Standard C826MC 12ch 2m fm, good performer, £135 or exch TR7010, C146A or hf gear. ASP393 2m whip, £6.50. Transistor Ranger, 70MHz, £5. G4AFY, QTHR. Tel Kidderminster 63358.

TR22006 2m tx/rx, nicads fitted R5, R7, 145·5, 145.55, 145.8, all accessories, £110. FRDX400, rx fitted, 2m and 3m conversion, £160. Both as new. G8KRK. Tel Drayton 313 after 7pm.

KW E-Zee Match, as new, £20. Graham, 67 Tregenna Avenue, South Harrow, Middx.

Sommerkamp FT250 tx/rx with ac power supply, £215. 18AVT/WB vertical antenna, £38. G3WWH, QTHR. Tel Bayston Hill 3383.

Stout Ali 8ft 6in boom with spider ends, some 15m and 20m elements, used but good, will fit on roof rack, £15. Two new 6HF5s, £8. Boxed KT66, £1.50. Gamma match diecast case, £4. G3AO, QTHR. Tel Chinley 50639.

Microwave Modules converters, 144MHz, 18-20MHz i.f., £12. 432MHz, 18-20MHz i.f., £15. Ex-equipment 572B valves, £4 each. QQVO3-20A, £3. Poulter, 119 Aragon Road, Morden, Surrey. Tel 01-330 3031 after 6pm.

Akai VTS110 portable video tape recorder with power supply, camera and vhf modulator, comp with suitable 625 vhf monitor rx, wkg, £250 ono. Low-band fm Westminster, £55. New coaxial relays type 951, 12V, £3.50. G8GJY, QTHR. Tel Dalston 710495.

Mobile digital 2 with toneburst, new in original packing, with mic and accessories, used 10 hours as base station, covers all channels, cost £275, accept £225. G5FH, QTHR. Tel Highcliffe 5974 evenings.

Yaesu YD844 mic unit, used for only half an hour, genuine, unwanted present, £12. G4ENW, QTHR. Tel Southend 525569.

CR100 gen cov rx, 60kHz, 30MHz, wkg, with spkr, spares and manual, £12. Buyer collects. G4BLS, QTHR.

Heath RA1 rx, factory-built, £30. Heath DX40 tx, factory-built, £22. Lafayette KT390 Starflite tx, similar to Heath DX60, cw/a.m., 90W, £22. Prefer buyer inspect/collect. Burgis, 11 Morningside Avenue, Portchester, Fareham, Hants.

SB200 linear amp, mint cond, £250 ono. G4CGV, QTHR. Tel Littlehampton 6161 ext 55 day.

Storno Viscount, fm highband, ex radiophone, with controls, 20 xtals and cables, good order, £35. GM8HQZ, QTHR.

18AVT trap vertical antenna in good cond, £40. G3MSW. Tel Harrogate 879202.

Yaesu FL200B, FR100B, FL1000, £220. Atlas vertical antenna, £15. TA33 beam, £30. Channel master rotator, £15. Lattice steel mast, 6 by 10ft sections plus base plate, £50. Taylor 45C valve tester, £12. BC221, £12. Heathkit Monitorscope HO10, £20. G3KYM, QTHR.

AM25BV, manual, £2. Xtals S0 and S20 tx/rx, £3 per pair. 11·155MHz £1 inc post. 3/20A, £1.50. 25kHz filter, £1.50. Other s/h spares available. *Radio and tv servicing, 1971/72 models,* as new, £3 plus post. G8JAI, QTHR.

C828 mobile tx/rx plus hand portable case, U11 nicads, spares (inc battery charge and cond indicator) helical and whips, comp portable setup measures 10 by 5 by 2, sell £150 or swop sideband 2m DX40U tx, £25. 9R59D rx, £35. G4CBZ. Tel Haywards Heath 57609.

Panadaptor, 450-470kHz i.f., purchased new, mint, comp set of spares, £50. TV-2C/U complex American valve tester, all manuals and valve data to 1974, £45. 30MHz panadaptor, £15. Crystal calibrator 10kHz, 100kHz, 1MHz, mint, £15. Fletcher 62 Moorbridge Lane, Stapleford, Nottingham. Tel 0602 397446,

2m gear, scanning fm rx digital readout, 8ch, vfo, £25. FM tx toneburst, timeout indicator. £12. Lowe monitor rx, rec 1420, £12. Truvox tape recorder, £10. GW8JOJ, 12 Black Barn Lane, Usk, Gwent NP5 1BP.

QTH, residential area north of York, comprising three bedrooms, bathroom, dining room, kitchen, cavity wall insulated, large garage and carport, good gardens, three-stage Versatower approved, no tvi, £10,500 ono. G3ZDI, QTHR.

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FL2000B linear, mint cond, £200 ono. Also Datong rf clipper, exc cond, £30 ono. G4DCI, QTHR. Tel Notts 231430.

Storno Viscount, wkg 2m inc t/b, preamp, 2 sets xtals S20, R6, single channel, £35 ono. Buyer collect or arrange carriage. G4DRS, QTHR. Tel Silsoe (0525) 60478 evenings.

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Icom IC210, exc cond, £170 ono. GW3NSP, QTHR. Tel 0222 753622.

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Steel equipment case, 16¾in wide, 7¾in high, 7¾in deep, ideal tx/rx/atu, £1. Calibration book, type MC177M for BC221 freq meter, serial No 5785, £1. Nombrex rf/af transistorized sig gen, requires alignment, £1. Buyers collect case and sig gen. G3MQY, QTHR. Tel Ringwood (Hants) 4625.

Late Trio TS700, superb cond, with rx preamp, Trio vox unit and four fixed-channel xtals (R6, R3, S15, 145·20), £255. G8IMI, QTHR. Tel Haverhill 2852 after 7pm.

Labgear Colourmatch 625 pattern generator CM6004-PG, dots and raster, cross hatch and lines, grey scale, adjustable tuning; for setting up colour tv convergency; ok also for b&w, £30. Trio 7010 two months old, replaced with FR221, £155. G3AZI, QTHR. Tel 0772 37815.

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Eddystone EC10, vgc, £45. Complete rtty terminal, Creed 3X and psu; tv AP66862, FSR1X and psu plus all connecting cables, £25. Sig gen 1-130A 100-155MHz, £7. All buyer collect or carr extra. G3XGK, QTHR. Tel Lowestoft 64160.

Pair Pocketphones, working 433·2MHz with batteries, £30. Joystick IIIb, as new, £20. Two G8AEV converters, 4-6MHz, 28-30MHz, not working, £5 each. G3TDZ 2m rx rough, £10. *Wanted*: Telford 2m tx or similar. G8EHU, QTHR. Tel 0283 790454.

Microwave Modules MMA 144 2m twin output pre-amplifier, new and unused, present price £14.62. £9 inc postage. GW8NP, QTHR. Tel 0222 68768.

FT2FB, 12ch inc S20, 21, 22, 23, 24, R3, 4, 5, 6, 7, as new, in original packing plus handbook, £120 ono. Pair Hallicrafters SR42A 2m tx/rxs, rx tunes 144-148, 12V dc or 117V ac, £60 each or £110 the pair. G4BZP, QTHR. Tel 0509 880279.

Genuine sale. FT101EX plus t/band, purchased Dec 76, never on air, mint, boxed, £399 or offer. Lowe 1420C 2m fm Monitor, S0, S20, S22, R5, R7, 144·48, little used, £15. Manual for FT2 Auto, £1. G8KOP, QTHR. Tel 01-349 1122 days, 01-200 0466 evenings/weekends.

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NR56 144MHz rx, full vfo or xtals, three weeks use only, £45. FT2 auto, fully xtalled, £150. Pair 28·5MHz walkie-talkies, £25. Trio 2200 xtals, 144·48, £2. Pye 6-12V inverter, £4. *Wanted:* IC202, why? 23cm. G8GHZ, QTHR. Tel Northampton 61794.

KW Vespa Mk2 tx with psu and KW201 rx with circuits and manuals, exc cond, £150 or £80 each. Going tx/rx. G4CHW, QTHR. Tel Bath 316278.

Direct-reading capacitor checker kit Heathkit IT28, brand new, £35. Four-band rx kit Heathkit SW717, brand new, £50. P. M. Shepherd, 51 Silkmore Lane, Stafford. Tel 3620.

Mic/tel headsets, Hosiden BH001 200/15Ω, modern design, new, boxed, £6. 30p post. Edgewise meters, 2in scale, 0·5 or 1·0mA fsd, new, £1.75, 15p post. Roband stabilized psu, 450-550V, 150mA, 2 by 6·3V htrs, £12 plus carr. G3YLO, QTHR. Tel Berkhamsted 73717.

Valve voltmeter (American), 2·5 to 1,000V fsd, ac/dc 1,000Ω to 1,000MΩ fsd with circuit, £18. Simpson multimeter, 100,000Ω/V with leads, £11. Brand new oil filled ht transformer, 2,800-0-2,800V 750mA, 115/230V i/p, £15, carr by arrangement. G8ACF, QTHR. Tel Orford 328.

WANTED

V3Jr vertical antenna. Dan, 29 Lymington Close, Norbury, London SW16 4QL.

Wanted for construction, one ASCII computer keyboard panel,or where obtainable in UK; wanted by DL1OY, write via G2DHV. Geological microscope, rotating analyser, any cond, cheap, slides. G2DHV, QTHR.

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Racal MA74 wideband matching transformer, 50/600Ω. Tel 0473 79186.

Europa B transverter. GM4DZX, QTHR. Tel 041 959 4455.

Creed 75 spares. Gears for 75 bauds, ie motor pinion GR2201 and driven gear 4009/95A (governed motor). Need rotor or a complete motor, good price paid. SM7DMG/7, Ekil Hedetun, Kaemnaersv 11N210, S-22246 Lund, Sweden.

Drake R4 or 2B/2BQ, any cond considered. O'Kane, 218 Woodlawn Park, Firhouse, Co Dublin. Tel 0001-512 436.

Any of the following. Good gdo for hf and vfo bands. Marconi Marine or Junkers key. ETM-3C keyer. KW or Heath 50Ω dummy load. Oskerblok power meter. FL101 tx or FT101B tx/rx, must be perf. G4FVH, 4 Cherry Tree Avenue, LFE, Leicester LE3 3HN.

Manual or circuit diagram of G&E Bradley oscilloscope type 148, buy or borrow and copy. R. K. Simmons, 29 Red Lion Lane, London SE18 4LD.

Bird 43 Thruline inserts required, 5B, 10B, 25B, 5C, 25C, 50C, 5D, 25D. Pye PG1AM, high or low band, any cond. J. Griffiths, The Grange, Gladstone Street, Abertillery. Tel 049 532 3111 any time.

KW Atlanta, 2000B, FPM300 or similar ssb/cw rig, why? TA32, Elan beam 10/15m. G4AFY, QTHR. Tel Kidderminster 63358.

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Heath SB640 and SB500. G5JZ, QTHR.

FM i.f. strip for Cambridge FM10D. GM2CQI, QTHR.

DC200 dc psu for FT200, urgently required by G4ETG/ZC4DH. G-whip mobile antenna. All letters answered. 22 Chalcrofts, Alton, Hants GU34 2HD. Tel Alton 85002 any time.

Ham-M or Ham 2 rotator. G4DJC, QTHR. Tel 0245 69034.

Manual for Hartley Scope, 13A. Loan or purchase. M. Gregory, 84 Victoria Avenue, Bloxwich, Walsall, Staffs. Tel Bloxham 77189.

Manual and circuit diagram for Lafayette HA350 rx, purchase or loan. Ron Lindsay, School House, York Road, Fridaythorpe, Driffield, North Humberside. Tel 88308.

Urgent, will the Scottish amateur who borrowed my HW101 manual at a WOSARS meeting please return it. GM3ZCT, QTHR.

Good quality aircraft band rx. Sony, Nova-Tech, Park-Air, Heathkit, Volstatic, etc, model requiring attn considered if comp. Surplus or obsolete aeronautical or marine charts, flight guides etc, why? required for collection. G8IYK, 13 Hodgebower, Ironbridge, Telford, Salop.

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Eddystone S640 rx in first class unmod cond, will collect reasonable distance. Burgis, 11 Morningside Avenue, Portchester, Fareham, Hants.

Codar AT5 tx, with ac psu, must be in good cond and appearance, all replies answered. GI3GTR, QTHR. Tel Holywood 3890.

EC10, TC7, 2m converter, 4–6MHz. 750, 840 or similar GC rx, will collect reasonable distance. GW3DSV, QTHR.

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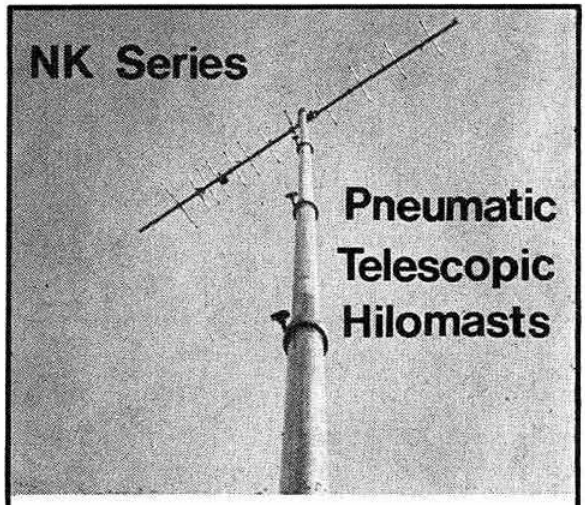

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1μA battery drain—Why switch off?

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MMT144/28 — 28MHz to 144MHz all mode solid state linear Transverter
RX — Gain: 30dB Noise Figure: 2·5dB
TX — Required input: ¼ watt. Power output: 10 watts continuous
PRICE — **£88.88** inc. VAT

MMT432/28 — 28MHz to 432MHz all mode solid state linear Transverter
RX — Gain: 30dB Noise Figure: 3·0dB
TX — Required input: ¼ watt. Power output: 10 watts continuous
PRICE **£109.13** inc. VAT

MMT432/144— 144MHz to 432MHz all mode DOUBLE CONVERSION solid state linear Transverter
RX — Gain 10dB Noise Figure: 3·0dB
— Separate receive converter output gives independent second receiver facility
TX — Required input: 10 watts (Suitable 10 watt termination network supplied)
— Automatic RF VOX minimises the interconnection between the transceiver
— Power output: 10 watts continuous
PRICE — **£149.63** inc. VAT

All three models are designed around latest state of the art devices, and high stability construction techniques are the main theme throughout.
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For further data on these and our converters, frequency counters etc., please do not hesitate to contact our sales department at your earliest convenience. If you need any technical advice just a phone call will put you in touch with our technical staff.

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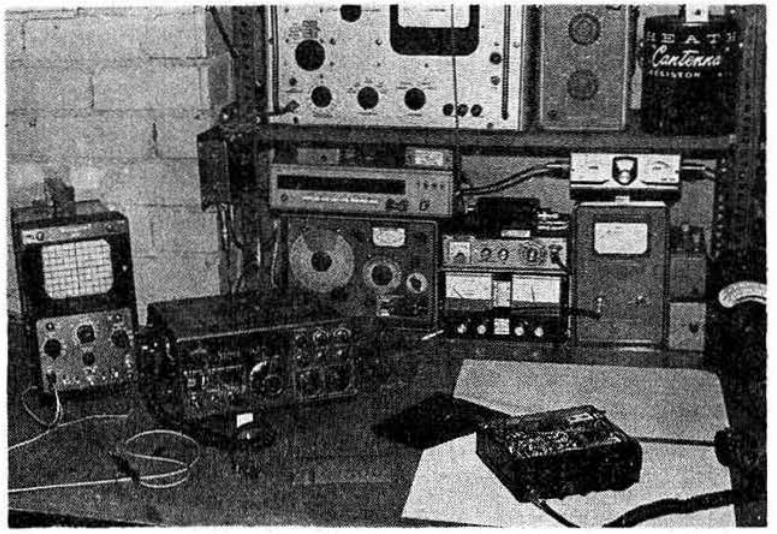

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★ Operates from 12V AC or DC.
★ 10W OUTPUT.
★ 2dB N.F. for 2 metres, 3dB for 70cms; gain 30dB, IF 28–30MHz.

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2 metres, 4 metres, Marine Band, Satellite Band, other frequencies to order. 2 metre IFs, 2–4MHz, 4–6MHz, 28–30MHz. 4 metres IF, 28–28·7MHz. Performance cannot be bettered. Price **£18.00** + VAT = **£20.25.** Ex stock.

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NEW! THE SENTINEL AUTO 2 METRE PRE-AMPLIFIER
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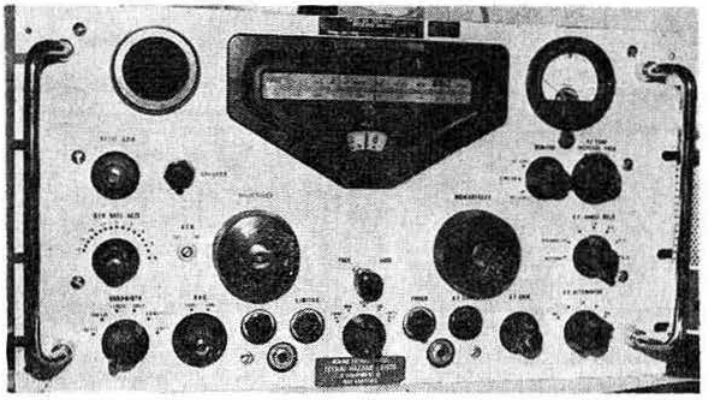

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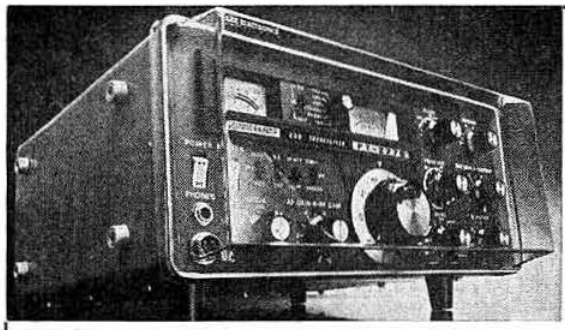

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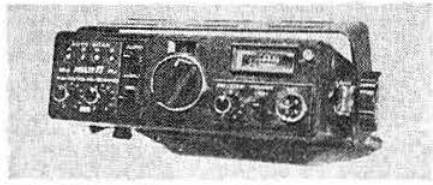

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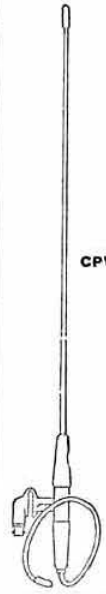

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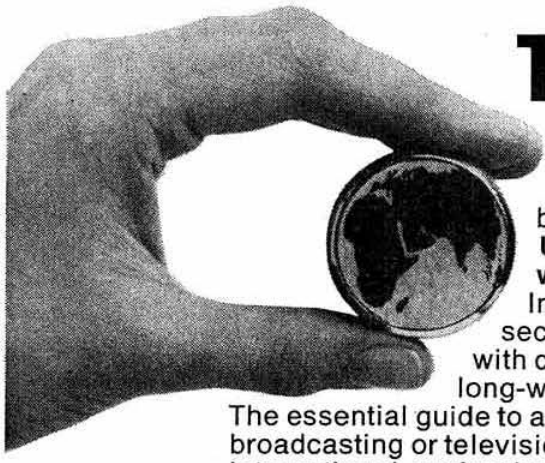

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Data sheet for UC/1 available free on request. Also available: Frequency-agile Audio Filter Model FL1; Universal RF Speech Clipper; details on request, or refer to our advertisement in the last issue.

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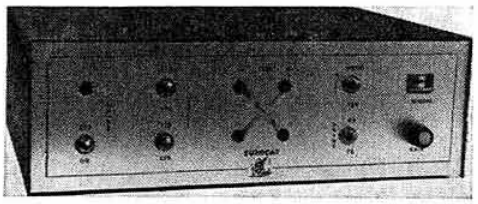

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★ Front panel controls for
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SSB Transceiver by G3ZVC—Sept. '74. Complete kit £73.50.

2M A.M. TX/RX by G3TDZ—Jan. '73 and VHF/UHF Manual. Complete kit for Receiver, £21.60; Transmitter, £9.40; Modulator, £3.85 (does not include PCB or transformer).

Mini D.F.M. by G3XGP—June '73. Complete kit using 1MHz clock oscillator, £41.75 (plus 50p for 30MHz i.c.s.).

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