July 1977

radio communication

journal of the Radio Society of Great Britain

Photo 1. Front view

REVIEWED IN THIS ISSUE

The Heathkit SB-104 all-solid-state hf bands transceiver

Photo 2. Interior view

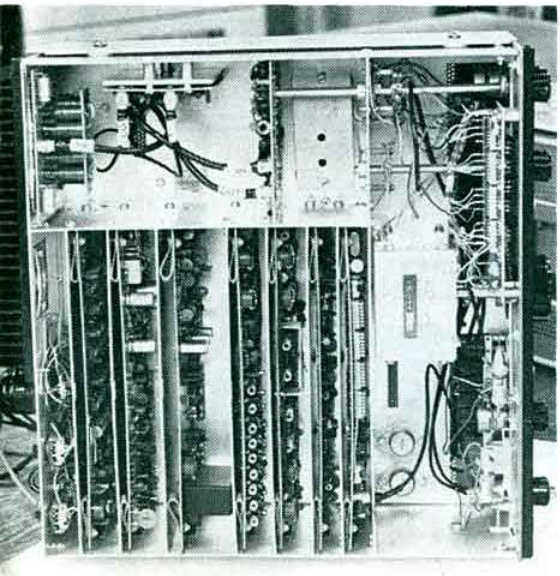

Photo 3. Illustrating use of outrigger board

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	GM3UAG, Ellon, Aberdeenshire (SW)
	144·50	G3PWJ, Brierley Hill (NW)
1045	144·50	G8CDP, Middlesbrough (NW)
	144·50	G8GGK, Croydon, Surrey (SW)
	144·50	G3SMT, 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 and 1900 on 3·590MHz and at 1230 and 1245 on 144·6MHz. This bulletin carries items of interest to rtty enthusiasts.

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July 1977 Volume 53 No 7

CONTENTS

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
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

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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).

YAESU MUSEN

MOBILE/BASE HF TRANSCEIVER

FT-101E (EE-EX)

THE FT101E

Yaesu's top to ten transceiver whose design, reliability and construction (quality and techniques (modular plug-in boards etc.)) set new standards thus establishing the '101 as a world beater, w th over 200,000 now in use. A complete device-packed hybrid station, offering "built ins" that either are 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 2·4Hz at 6dB (1·67:SF)
AM* as SSB
CW* 600Hz at 6dB (2:1SF)
FSK as CW

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

Audio output
3W (int. or 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 AVAILABLE AMATEUR PRODUCT LINE SSB, CW, AM, FM OR FSK FOR MOBILE, PORTABLE OR BASE USE.

WRITE TO ONE OF OUR DISTRIBUTORS FOR A FREE CATALOGUE.

YAESU MUSEN

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 repeat shifts
"S"/centre zero/output meter
Clarifier (IRT also RT + TT)
2·4kHz SSB 12kHz FM bandwidth
Adjustable sensitive squelch
100kHz crystal calibrator
Switchable noise blanker

FT221R SPECIFICATIONS

Frequency range
144-148MHz
600kHz + 1 other shift

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. or 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", 22lb

OUR AGENTS

Amateur Electronics,
508-514 Alum Rock Road,
Alum Rock, Birmingham B8 3HX

South Midlands Communications Ltd,
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Southampton, Hampshire SO4 4DN

Western Electronics (UK) Ltd,
Fairfield Estate,
Louth, Lincolnshire LN11 0JH

South Midlands

TOTTON, HANTS (HQ), LEEDS, DERBYSHIRE,

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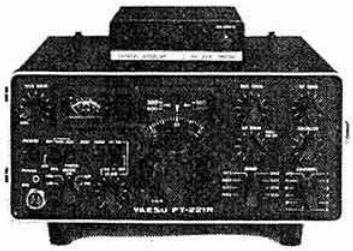

THE FT221R, COMPLETE 2M STATION Ex-Stock

The FT221R. The multimode USB, LSB, A.M., F.M., CW, (with semi-break-in and side tone), 2m transceiver offering the choice of phase locked VFO or 44 crystal channels, simplex or repeater (600Hz up and down shifts), with unique 'double push' auto tone burst, mains or 12V (3A) operation, excellent selectivity, SSB 2.4kHz (1·7: S.F.) or FM 12kHz. Front panel adjustable VOX and mic gain, a calibrator (1MHz ÷ 10), 1kHz readout and linearity. sensitive squelch, clarifier with IRT and IRT with ITT (makes F.S.K. easy), switchable "S" and centre zero tuning meter, noise blanker, serviceable plug in boards all contained in 11¾" (14") × 5" × 11½", 22lb, rigid package. 600kHz and 1·6MHz shifts over 4MHz.

YC221 DIGITAL READOUT UNIT Available around mid July. Price about £70 + VAT

The FT101E (EE-EX)-ex stock. *New Service manual £12*

The FT101E. A complete mains or 12v. DC station contained in a compact 30lb. 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

THE FRG7, general coverage receiver Ex-Stock

The FRG7 is a general coverage solid state receiver with specifications unparalleled in its price range. It uses a Barlow Wadley Triple-mix, drift cancelling loop for continuous, spin-tuned inclusive coverage of 0·5 to 30MHz with calibration accuracy better than 5kHz. Frequency selection is accomplished by setting the RF (pre-selector and range switch), dialling up the required number of megahertz, then tuning the VFO knob as normal.

The receiver is sensitive (0·5μV for 10dB, S + N/N (SSB)) and stable (within 500Hz for any 30 minutes after warm up) with A.M., SSB and CW modes catered for. A 3 position audio filter, RF attenuator, dial lamp conservation switch, recorder and phone sockets are fitted. It is mains powered, but should the supply fail, or portable operation be required, 8 dry cells are automatically switched in.

YH55 HEADPHONES Available around end August. Price about £9.00 + VAT

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◀ VHF HANDHELD

KEN KP202 TRANSCEIVER

144MHz, FM, 2W of RF and ½W of audio. Immunity to image and IF breakthrough and performance to rival all walkie-talkies and many mobile sets.
C/w F plug, leather handle/whip case and telescopic whip.
Fitted 6 channels S20 & S22 + Any 4 of S (0, 21, 23, 24), R (3, 4, 5, 6, 7) **£109.50.**
R channel only crystal tone burst **£10.00.**
Flexible stubby ant. **£5.80** Case **£4.90.**
Base charger KCP2 **£11.75** Ni cads **£8.50.**
F to UHF adaptor **£1.65** (all + VAT).

VHF MONITOR RECEIVER ▶

SEIWA MR2 AND MS2 (+ VAT prices)

Ideal for the SWL, the YL or even the XYL as the monitor receiver to keep you in touch Tiny (2½" × 1½" × 4½") and light (8 ozs.) slip into your pocket or onto your belt with the optional case. Sensitive double conversion superhet with 12kHz. band width, auto squelch, and generous audio output c/w Nicads, Mains Charger, Earpiece, Antenna
MR2(4) 70MHz. 12 switched channels **£53**
MR2 144MHz. 12 switched channels **£53**
MS2 144MHz. 4 scanning channels **£62**
Leather Case **£1.90** Crystals each **£2.00**

MS2

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YAESU

UK MAIN DISTRIBUTOR INTRODUCES SOME NEW LINES

THE NEW REVOLUTIONARY ASTRO 200 Full digital synthesis Solid State 200W HF Transceiver

To pack an entirely modular construction, 10-80m., digital readout transceiver in a box 2·8" × 12·3" is remarkable enough, but with a 0·2μV sensitivity and 100W output from transistors with the boast of:—stability better than 20Hz hour, from an electronically tuned (biased toggle switches with no other moving parts) 100Hz. Step digital synthesiser, good RX front end filtering, TX TVI proofing, unwanted sideband at —60dB, carrier at —50dB, RIT clarifier (+50Hz), inbuilt SWR bridge, semi break in CW with sidetones, etc., etc. is almost unbelievable.

SMC ESTABLISHES A NEW PLATEAU OF SOPHISTICATION—DEMO MODELS IN TOTTON!

AN ALL SOLID STATE MOBILE KILOWATT!!

The MA1000 produces up to 600W output, with 10dB gain, across a 2 to 30MHz from 4 hybridised push pull stripline linear transistor pairs. No tuning is required but 5, 5 section tchbycheff L.P.F. may be manually or remotely switched in. The unit uses devices rated to withstand infinite VSWR, a large heatsink, a high speed magnetic circuit breaker, best quality components, reverse polarity protection and a thermostatic "switch through" control.

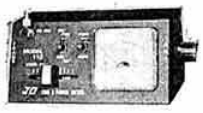
260 250

HIGH QUALITY LOW PRICE SMC—HS VHF ANTENNAS (Vat 12½% Carr 95p)

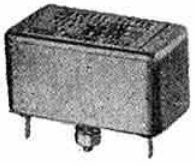
250 (29 or 145MHz)	¼λ effective, DC short, snap mount, matching transformer, shock spring tapered whip c/w 12" cable & PL259	ONLY £11.75
GDX1 80 to 480MHz	Discone, omnidirectional, 3dB¼. Excellent VSWA	£37.50
260 (70 or 145MHz)	High gain, gutter mount, tapered coil and whip, 90° sprung fold over	£17.15
25	Trunk lip mount for snap bases	£2.95

LARGE RANGE OF ANTENNAS & ACCESSORIES, BOTH HF & VHF

FOUR NEW POST-FREE BARGAINS! *(FOR JULY ONLY)*



Power, VSWR, Field Strength-meter
Frequency independent (1.8-150 MHz) 50 ohms 10 & 100W F.S.D. SO239 connectors JD110 (+ VAT 8%) **£8.45**



Extended crystal Filter range
For the FT101 Range (+12½% VAT)

YF30FC1 350Hz 6 pole	£18.00
YF30OHC1 350Hz 8 pole	£20.75
YF30FCW 600Hz 6 pole	£18.00
YF30F12 12kHz 6 pole	£18.00

Boom Microphone 'Headset'
600 ohms magnetic light-weight boom mic (only)

MD35 complete	£14.75
Microphone only	£9.75
Footswitch only	£5.95

Stabilised 12 Volt Power Supply

12VDC from 240VAC 3 Amps (5A peak) 3½lbs 3" × 4½" × 6" ODR123C (+8%VAT) **£12.55**

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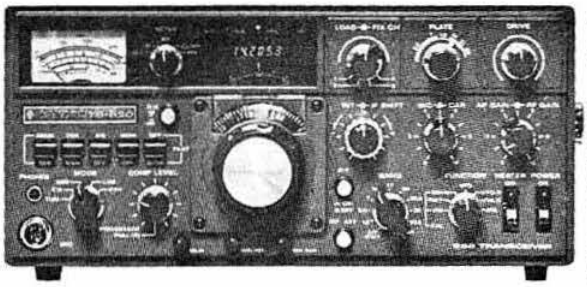
LOWE ELECTRONICS LTD



The ultimate transceiver . . . TRIO's TS-820. No matter what you own now, a move to the TS-820 is your best move. It offers a degree of quality and dependability second to none, and as the owner of this superb unit, you will have at your fingertips the combination of controls and features that, even under the toughest operating conditions, make the TS-820 the leader that it is.

Unprecedented demand plus the painstaking care TRIO lavishes on each TS-820 has created a back-log of orders, but rest assured, it's well worth waiting for. Once you have operated the TS-820 you will not be satisfied with anything else.

Features

Following are a few of the TS-820s many exciting features.

SPEECH PROCESSOR ● An HF circuit provides quick time constant compression using a true RF compressor as opposed to an IF clipper. Amount of compression is adjustable to the desired level by a convenient front panel control.

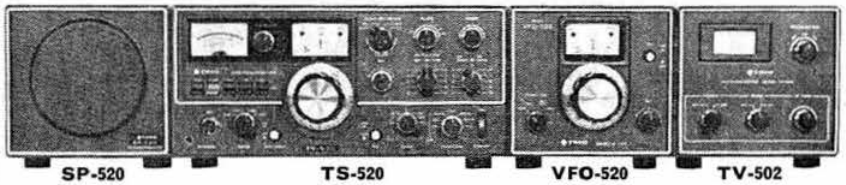
IF SHIFT ● The IF SHIFT control varies the IF passband without changing the receive frequency. Enables the operator to eliminate unwanted signals by moving them out of the passband of the receiver. This feature alone makes the TS-820 the pacesetter that it is.

PLL ● The TS-820 employs the latest phase lock loop circuitry. The single conversion receiver section performance offers superb protection against unwanted cross-modulation. And now, PLL allows the frequency to remain the same when switching sidebands (USB, LSB, CW) and eliminates having to recalibrate each time.

TS-820	.. ..	**£625 inc. VAT**
DG-1	.. ..	**£126 inc. VAT**

Specifications

FREQUENCY RANGE: 1·8-30MHz (160-10 metres)
MODES: USB, LSB, CW, FSK
INPUT POWER: 200W PEP on SSB
160W DC on CW
100W DC on FSK
ANTENNA IMPEDANCE: 50-75 ohms, unbalanced
CARRIER SUPPRESSION: Better than 40dB
SIDEBAND SUPPRESSION: Better than 50dB
SPURIOUS RADIATION: Greater than −60dB (Harmonics more than −40dB)
RECEIVER SENSITIVITY: Better than 0·25μV
RECEIVER SELECTIVITY:
SSB 2·4kHz (−6dB)
4·4kHz (−60dB)
CW* 0·5kHz (−6dB)
1·8kHz (−60dB)
* With optional CW filter installed.
IMAGE RATIO: 160-15 metres: Better than 60dB
10 metres: Better than 50dB
IF REJECTION: Better than 80dB
POWER REQUIREMENTS: 120/220 VAC, 50/60Hz, 13·8 VDC (with optional DS-1A DC-DC converter)
POWER CONSUMPTION: Transmit: 280W. Receive: 26W (heaters off)
DIMENSIONS: 13¼" w × 6" h × 13$\frac{3}{16}$" d
WEIGHT: 35·2lb (16kg)
DG-1, digital readout optional



SP-520 TS-520 VFO-520 TV-502

TS-520	.. ..	**£432 inc. VAT**
SP-520	.. ..	**£18 inc. VAT**
VFO-520	.. ..	**£72 inc. VAT**
TV-502	.. ..	**£171 inc. VAT**

As a TS-520 owner, you go on the air with a sense of pride and confidence. Thousands of these precision-built beauties are in operation all over the world . . . in ham shacks, field day sites, in DX and contest stations and in countless mobile installations. No other rig has ever offered the performance, dependability, versatility and value that is built into every TRIO TS-520.

You have certainly heard the TS-520s clean signal on the air and have probably heard a lot of glowing praise by other hams. So if you don't already own a 520, maybe it's time you did.

MODES: USB, LSB, CW
POWER: 200W PEP input on SSB, 160W DC input on CW
ANTENNA IMPEDANCE: 50-75 ohms, unbalanced
CARRIER SUPPRESSION: Better than −45dB
UNWANTED SIDEBAND SUPPRESSION: Better than −40dB
HARMONIC RADIATION: Better than −40dB
AF RESPONSE: 400 to 2,600Hz (−6dB)
AUDIO INPUT SENSITIVITY: 0·25μV for 10dB (S + N)/N
SELECTIVITY: SSB 2·4kHz (−6dB), 4·4kHz (−60dB), CW 0·5kHz (−6dB), 1·5kHz (−60dB) (with accessory filter)
FREQUENCY STABILITY: 100Hz per 30 minutes after warm-up
IMAGE RATIO: Better than 50dB
IF REJECTION: Better than 50dB
TUBE AND SEMI-CONDUCTOR COMPLEMENT: 3 tubes (2 × S-2001, 12BY7A), 1 IC, 18 FET, 44 transistors, 84 diodes
DIMENSIONS: 13·1" w × 5·9" h × 13·2" d
WEIGHT: 35·2lb

STOP PRESS! TS-520 NOW AVAILABLE WITHOUT 12V INVERTER AT ONLY £405 inc. VAT

For those who want a good low cost 2 metre FM receiver, we are delighted to offer a much up-dated version of the Lowe Monitor. Made for us in Japan (where else), the ASV 1515 can take up to 12 xtal controlled channels, has a proper 15 kHz filter, a mains/12 volt power supply and loudspeaker built in and a new FET front end for higher sensitivity. Price? £39.50 inc. VAT. Crystals ex stock at £2.40 each. Use a good 70 cm converter in front of it to keep in touch with the increasing activity on that band. Full details on request.

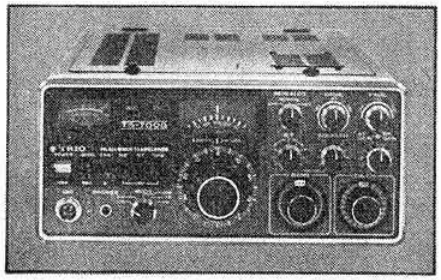
Is it a sign of the times that we sold out of 2 metre SSB gear on the first day at Alexandra Palace and had to rush more TR7010 from Matlock? The idea of real DX is catching on, and with the TR7010 still costing only £175 including VAT, it's the best way to get in on the action.

Rallies. Must congratulate the organisers at Drayton Manor and Belle Vue for first class arrangements. Regret we will *not* be at Woburn this year but will be covering most other events including Preston—at which the charge for the whole rally is exactly the same as the hire cost for *one table* at Woburn????

Congratulations on a timely story from Pat Hawker in June Technical Topics. It may seem odd that a purveyor of sophisticated (or should one say complicated) equipment should welcome such a warning, but the sad truth is that fewer and fewer amateurs understand what is going on inside their equipment and it would be pleasant to see some simplified equipment around instead of more and more complex boxes.

If any club needs a talk on current equipment techniques as distinct from a show of black boxes, we will do our best to oblige.

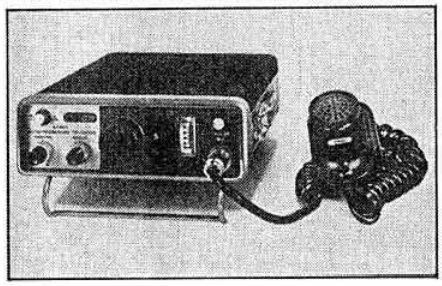
LOWE ELECTRONICS LTD



TS700G £392.62 INCL VAT

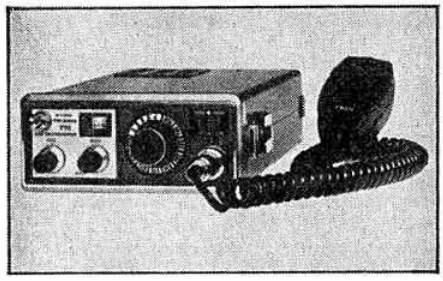
The standard by which all others are judged. Full 2 metre coverage, VFO or crystal controlled. All modes AM, FM, USB, LSB, and CW. Mains or battery operation. Normal and reverse repeater facilities. Trio exclusive tuning fork access tone generator. Plus, of course, Trio quality and reliability backed by Lowe Electronics service. If you haven't seen it yet, go to one of our branches and be prepared to be impressed.
15 Watts output. 0·25 microvolt sensitivity. European standard FM selectivity. This rig has all others beaten.

★ **This special price includes a free matching VOX3 unit** ★



TR7200G £175.00 INCL VAT

The TR7200G has set all 2 meter FM operators talking about its outstanding performance on both transmit and receive. Not only is it the best engineered transceiver on the market, but it's also the most sensitive at 0.3μV for 15dB quieting and has the cleanest transmitted signal both in and out of band (the economy transceivers simply lack the interstage filtering to ensure that the owner is not put off the air by the Home Office.)
Supplied complete with microphone, mobile mount, power leads, spare fuses and incorporating the TRIO exclusive tuning fork access tone generator, the TR7200G includes ten fitted channels, normally R3, R4, R5, R6, R7, S20, 21, 22, 23, 24.



TR3200 £171.00 INCL VAT

The newest FM handy transceiver from the TRIO range. Superb performance for the 70cm. operator, 12 channel capability in the range 432-436MHz with three channels fitted (SU8, SU18, SU20). Transmitter output switched 2W/400mW and incorporating the TRIO exclusive 1750hz tuning fork access tone generator. ¼-wave detachable antenna for high gain performances on both transmit and receive.
Supplied complete with all accessories as the TR2200GX and with the new miniature handy microphone.

★ **The price includes the all-important battery charger for the optional re-chargeable battery pack. The battery pack costs £9.72 incl. VAT** ★

TR7010 Join the SSB revival for only £175.00 INCL VAT

Following the worldwide success of the TS700, Trio have taken the TS700 basic design and packaged it for 2 metres SSB mobile use.
The TR7010 sets new standards in receiver sensitivity and low spurious emission on transmit. Operating CW and SSB from 144·1-144·335MHz, the TR7010 covers CW SSB and beacon activity. 48 5kHZ channels plus VXO and RIT provide continous coverage.
Single conversion using an IF of 10·7MHz with a superb crystal filter provides outstanding selectivity. Wide range amplified AGC and newly developed FET devices in RF amplifier and mixer stages allow maximum sensitivity to be used with freedom from overload due to adjacent signals.
Single conversion transmitter with fully balanced mixer system generates a beautifully clean signal with crisp audio quality.

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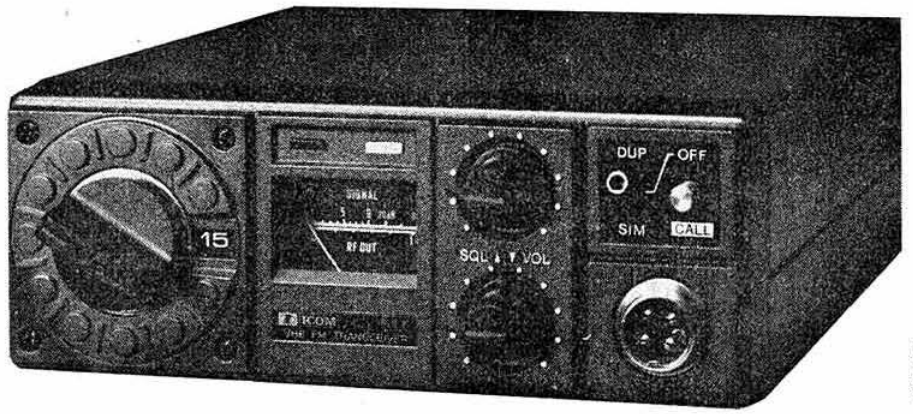

£198
INC VAT

DIMENSIONS
156mm wide
58mm high
218mm deep

IC-240 THE WORLDBEATER FOR FM MOBILE

THERE ARE SEVERAL CHEAPER ALTERNATIVES BUT IF YOU LOOK CAREFULLY INTO IT YOU WILL FIND THAT TO BUY ONE IS FALSE ECONOMY

★ **Can be easily programmed to any channel of your choice.** The IC-240 contains a synthesiser instead of banks of crystals. This contains a programmable divider which can be programmed by YOU for each of the 22 channel positions merely by putting diodes in the appropriate places as indicated by a chart provided in the handbook.

★ **Quick, easy selection of channels.** The IC-240 has a single knob, 22 position, channel selector. Anyone who drives in traffic and wants to change from one popular channel to another knows the problems of channel changing when this involves several knobs or even a single one when it has to be used in conjunction with a digital display which requires peering at.

★ **Instant facility for listening on all repeater input channels at the flick of a switch.** It is a tremendous advantage to be able to listen on the INPUT channel of a repeater in order to determine whether a direct QSO is possible. With the IC-240 this is possible merely by flicking the control switch on the front panel from DUP to SIM.

★ **Built in tone burst which can be completely automatic.** The tone burst is easily made automatic so that the tone is placed at the beginning of each transmission when on Duplex. This is a necessary feature while some UK repeaters need feeding with a tone at the beginning of each over rather than only for initial opening as recommended by the RSGB. We do this mod for you if you buy from a THANET agent or shop.

★ **Second-to-none receiver.** The receiver on the IC-240 is really sensitive. Simply comparing maker's specs will not give you the true picture. The re-designed discriminator circuit makes the 240 by far one of the best receivers on the market. Ask someone who has one!

★ **Excellent modulation and clipping.** The modulation and clipping on the IC-240 are designed to provide a high quality, easy to read, signal without over deviating. Many sets neglect this point with the result that you either have to turn up the mod to be read at all, and then find that you over-deviate on peaks, or you keep the deviation down and are accused of mumbling! The ICOM quality of modulation is well known and is hard to beat.

★ **Really solid construction.** There is nothing cheap and nasty about the IC-240. It is a really solidly built piece of gear which is highly reliable. Of the hundreds already sold very few had to come back for repair under warranty, their record in this respect being much better than many crystal controlled sets.

★ **Automatic PA protection.** The PA has a continuously variable PA protection system which gradually cuts down the output power as the set is fed into a worse VSWR.

★ **Very adaptable for adding a cheaply constructed scanner to cover the whole fm band.** The greatest asset of the IC-240 is the way it lends itself to the experimenter in digital logic. It is easy to design periferal equipment to do interesting things such as scan the band or provide other frequencies which are not programmed into the set already. Several circuits for scanners will no doubt be published shortly and we hope to be able to offer a kit for a scanner with six digit frequency display for something in the region of £20. You can soon spend this on crystals!

IT WILL **HAVE** TO BE AN IC-240 FROM **THANET** — YOUR **ICOM** SUPPLIERS

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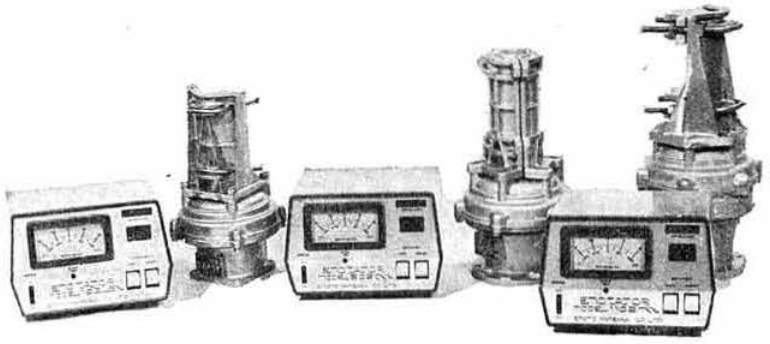
FAMILY

Posing for you (left to right) are:

103LBX—for lighter HF and medium to large VHF arrays.

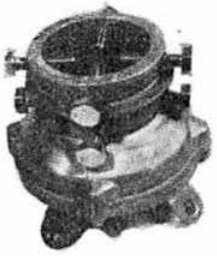
502CXX—the really new boy for medium HF and larger VHF/UHF arrays.

1102MXX — for the largest tribanders and monobanders.



ALSO . . . the powerful **1103MXX** (not shown)—a geared down 1102—greater torque, slower rotation for the really big stuff . . .

. . . AND TO MAKE THEM EASIER TO LIVE WITH . . . .



MB300 MAST BEARING

The best answer to your rotary mast problems. Robust, ball-bearing fitted unit with stainless hardware. Complete with 4 lugs for guying rotary masts up to 62mm. dia.—or can be bolted to flat tower plate as an alignment bearing.

1213 BRACKET

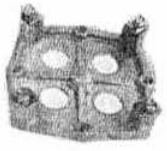
A unique 3-piece mounting bracket for fixing your rotor to a mast or for exact centring of antenna stub masts. All stainless hardware—takes masts from 40 to 62mm. dia.—fits 502CXX and 1102/1103MXX rotors. Standard as top bracket on 502CXX.

1211 BRACKET available for mast-top mounting of 103LBX, same as top bracket (see *photo*).

450 FLEXIBLE COUPLER

Fits between 103LBX and tower mounting plate or mast bracket (1211) to compensate for slight mis-alignment bearing.

Rotor "floats" in the 450 and thus allows the the upper stub mast to align within bearing, to avoid excessive wear and possible rotor damage.



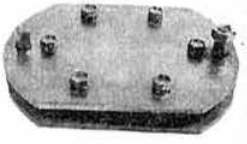
PRICES

103LBX	£78.75
502CXX.. ..	£111.38
1102MXX ..	£163.13
1103MXX ..	£168.75
450	£5.63
451	£10.69
1213	£14.06
1211	£8.44
MB300	£14.06

All include carriage/VAT

451 FLEXIBLE COUPLER

Fits between tower mounting plate or mast bracket (1213) to provide same facility as 450 flexible coupler —but to fit 502CXX or 1102/1103MXX type rotors. A worth-while adjunct to your system to avoid wear and tear through slight bearing mis-alignment.



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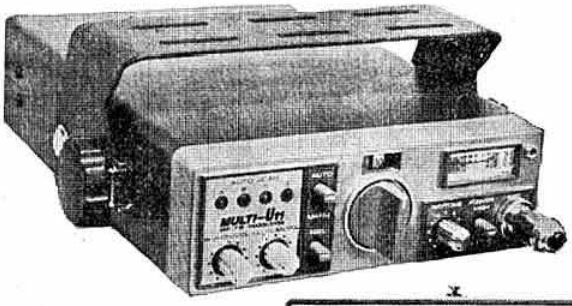
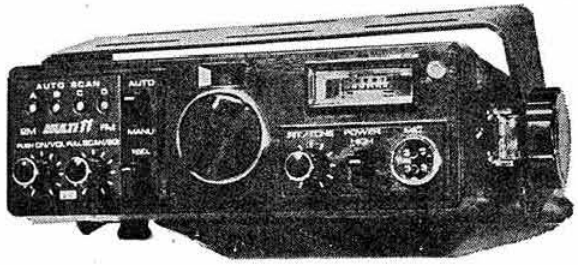
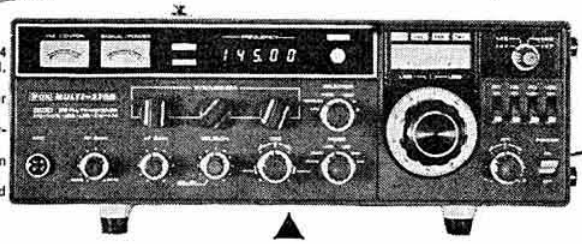
70cms fm has opened up a completely new era in fm mobile operation. If you haven't yet tried it then send an SAE for full details of the transceiver that every one is using. 70cms FM—the place to meet a lot of nice people! **£249, 9 ch's fitted.**

FDK for 2 metres Multi-II

This top selling FM transceiver has the finest front end on the market. Add to this its 4 channel auto-scan facility, punchy 12 watts output and a host of other features, and you have today's most advanced 2 metre fm mobile. SAE for leaflet. **£209, 7 ch's fitted.**







FDK ACCESSORIES

AC PSU with switched voltage outputs, 4 amps capacity and short circuit protected. **£63.50.**

Sound box for fitting beneath M11 for deflecting sound forward. **£10.50.**

Desk top aerial fits most monitor receivers and transceivers **£2.50.**

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Mobile mounting brackets (one supplied with each transceiver) **£6.00.**

DC power leads **£1.65.**

FDK XTALS

U-11 reverse repeat pair **£5.90.**

M-11 S21/22/23 sets 6 **£10.00.**

M-11 repeat input ea. **£2.45.**

TM56B repeat sets 5 **£9.00.**

M-11 S24 pair **£4.90.**

1.6MHz 2700 shift ea. **£2.45.**

NOTE All the above crystals are high stability FDK types. Specials to order.

FDK TM56-B VHF Monitor

A complete 230V/12V VHF FM monitor receiver. 12 fixed channels and 4 auto-scan. 10 channels supplied. Amazing performance at an amazing price. **£84, 10 ch's fitted.**

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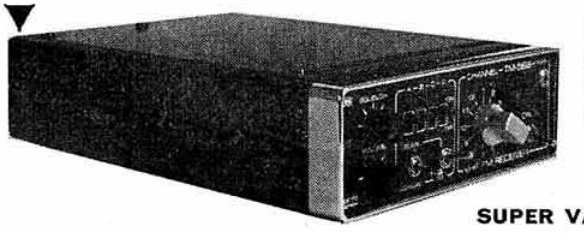
A complete station inc. vox, toneburst, OSCAR rx., variable power control, speech processor, 600kHz & 1.6MHz repeater shift, dual vfo, 15 watts output. SAE for leaflet. **£489 incl. carriage.**

FDK QUARTZ 16

This is the 2 metre FM transceiver for the man who wants a functional transceiver without any frills. Supplied complete with 10 channels, toneburst and all accessories no other transceiver can match its price. **£169, 10 ch's fitted.**



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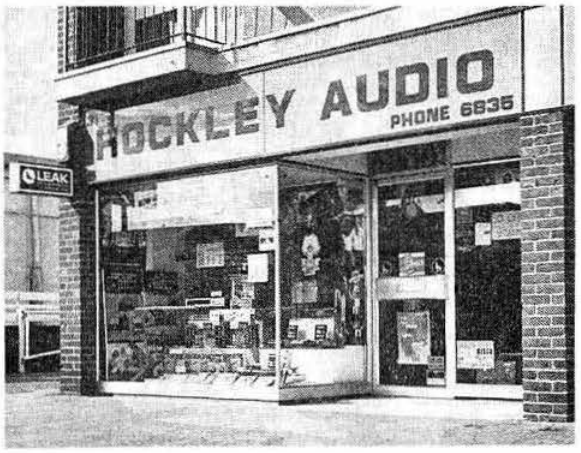

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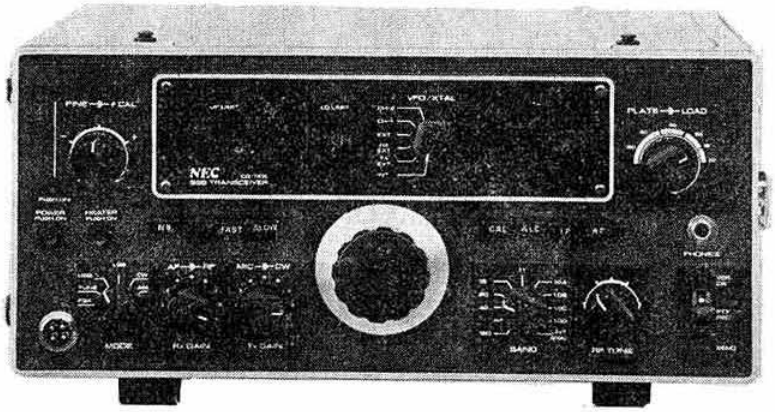
NEC  NEC

CQ110E Transceiver (Ex Stock) £645 plus VAT £80.63, Total £725.63

(Price includes Securicor Delivery)

Frequency Range	10m—15m—20m—40m—80m—160m and 11m and WWV 15MHz on receive only.
Mode	LSB—USB—CW—AM—FSK—FAX/SSTV
Power Requirements	100/110/117/200/220/234 Volts AC or 13.5 Volts DC
Input Power	280 watts PEP (240 watts on 28MHz)

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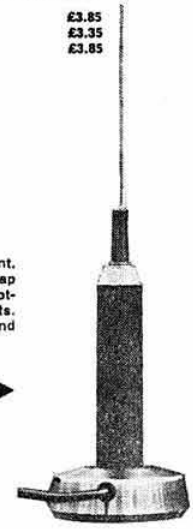

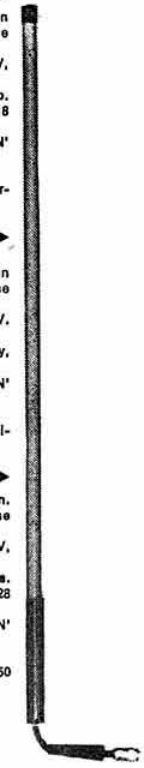

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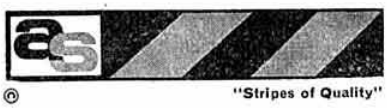

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2N5945	4w	8dB	12·5V 470MHz	£7.51
2N5946	10w	6dB	12·5V 470MHz	£9.46
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WHAT AMATEUR RADIO IS

The following foreword to the programme of the Longleat Mobile Rally held on 12 June is reproduced by courtesy of the Chairman, RSGB—Bristol Group

Amateur radio offers an opportunity for free speech and unlimited communication. It is essentially a hobby of communication and it should be encouraged more now than at any other time, for in this age of mass communication there is often little opportunity for man to communicate with his fellow man.

Mankind has created many artificial barriers which turn man against man, woman against woman, and child against child. There are no barriers in amateur radio. Russians talk to Americans, Catholics talk to Protestants, man talks to man. Amateurs talk to amateurs, they talk radio, they talk, they communicate.

There have been many changes since the early days, from crystal to valve and back again, and there are still many changes ahead. There is an exciting future, new bands, new techniques, a whole new era of communication. But do beware of anyone, any nation that tries to silence the talking, the communication, for it could be that once the talking stops the fighting begins.

Roger Sharland, G4EHE
Chairman, RSGB—Bristol Group

QTC
amateur radio news

Channel Islands subscriptions
Council decided at its meeting on 9 November 1976 to increase the overseas subscription rate to £8 with effect from January 1977; this increase being forced upon the Society by the extra cost of overseas postage.

However, the increase is not justified in respect of members in the Channel Islands who have the same postage rates as the UK.

As a measure of redress, therefore, the Society will, if required, make an annual refund to any Channel Islands member of a proportion of his subscription equal to the amount of Value Added Tax charged in the UK. This amount is at present 24p.

Any member requiring a refund should send a claim, together with a self-addressed envelope, to HQ marking it in the top left hand corner "Channel Islands refund". Members making refund requests should bear in mind the administrative cost involved.

G3DVV

Postage increases
As a result of postage increases effective from 13 June, the publication price list on the inside back cover has had to be revised. Always check the current price list before ordering books and other items from RSGB HQ.

Raynet
The Raynet Committee discussed at length the RB0, RB8 situation at the meeting on 14 May 1977. The view was expressed that owing to the large number of amateurs currently using SU8 as a simplex channel, the best interests of Raynet and the amateur population at large would be for RB0 to remain allocated as a Raynet repeater frequency. The view was also expressed that this would avoid Raynet causing difficulty to SU8 users on a wide scale.

A ballot was taken for "move to RB8" for Raynet repeater use or "RB0 to remain allocated for Raynet repeater use". With one abstention a motion was carried, "That in view of the stated problem, RB0 should remain allocated as a Raynet repeater channel". A rider was made that this should not preclude the use by Raynet of other channels for simplex purposes.

Facts and figures
The Home Office advises that the following numbers of amateur licences were in force at 31 May 1977:

Class A 16,078 Class B 6,385

At the same date the latest callsigns issued in the G4 and G8 series were G4GCA and G8NJM respectively.

Storno Viscount circuit diagrams
In the April 1974 issue of *Radio Communication*, an article "Conversion of Storno Viscount vhf radiotelephones for amateur service" was published. For those wishing to carry out this conversion, a 10-page set of circuit diagrams was printed and offered for sale.

The demand for the circuit diagrams has been such that a third printing has now been made, but because of increased printing and postage costs the price has had to be increased. The 10-page set now costs 60p including postage and packing and can be obtained by sending a remittance for that amount to: The Editor, RSGB, 35 Doughty Street, London WC1N 2AE.

Photocopies of the article can similarly be supplied at a cost of 80p including postage and packing.

Woburn Abbey Rally, 7 August
Details and information for trade stands available from Norman Miller, G3MVV, "Avon", Gardiners Lane, Crays Hill, Billericay, Essex.

Region 6 Regional Representative
At its meeting on 18 June the RSGB Council approved the appointment of Mr F. S. G. Rose, G2DRT, as representative for Region 6. Mr Rose was the sole nominee for this office.

The Appleton Laboratory
Dr Frederick Horner, DSc, CEng, FIEE, Deputy Director of the Appleton Laboratory, Slough, Berks, succeeded Dr J. A. Saxton, CBE, DSc, PhD, CEng, FIEE, FInstP, as Director with effect from 1 July 1977, following Dr Saxton's retirement.

Dr Horner joined the Radio Division of the National Physical Laboratory in 1941. After the war this became a separate organization and evolved into the present Appleton Laboratory of which he became Deputy Director in 1969.

Dr Horner's research has been concerned mainly with radio direction finding and with the study of radio emissions from thunderstorms. He has been active in international affairs in radio science since 1950, holding various offices in international organizations.

HM The Queen's Silver Jubilee Birthday Honours
The Society offers its congratulations to the following radio amateurs who received awards in HM The Queen's Silver Jubilee Birthday Honours List:

Mr. R. B. Peters, G3ZUF, who was appointed an MBE; Mr C. E. Godsmark, G3IWL, who was awarded the Queen's Jubilee Medal for services to Great Britain.

Who has the cup ?
Peterborough was noted in the past for its df contests (they were at national level) and a challenge cup was presented for annual competition by the late G3GCK. There are signs of renewed interest in this side of amateur radio at Peterborough, and efforts are being made to locate the lost cup.

It was last known to have been won by an amateur in the Midlands but there is no record of his name or callsign. It is possible that he was unaware that it was a challenge cup and could not be won outright. Should this note catch his eye, will he kindly communicate with Leslie Critchley, G3EEL, 36 Waterloo Road, Peterborough, who is hon sec of Peterborough Radio & Electronics Society.

Walsall Amateur Radio Club
The above club was formed on 3 May and will meet at 8.30pm at the "Hamemaker Inn", Blue Lane, Walsall, at fortnightly intervals from the above date. Details from Mr K. Boucher, G8KML, 2 Emery Close, Walsall, W Midlands.

RSGB NATIONAL MOBILE RALLY

Woburn Abbey, Bedfordshire

(Coach Park Site)

Sunday 7 August 1977

From 11am

Attractions will include a large trade exhibition, RSGB bookstall and enquiries stand, grand raffle, Raynet stand, BARTG stand, and a bring-and-buy stand. All will be under cover.

Bring-and-buy this year will be charged at **£1 per table per hour,** which will enable members to sell direct. Tables will be offered on a first-come first-served basis.

The RSGB makes no charge for entrance to the rally but all visitors must pay for entrance to Woburn Park, in which the rally takes place, at **50p** per car irrespective of the number of passengers.

All the normal Woburn attractions will be available at small extra charges. Various bars and cafes are available nearby.

How to get there:

From the south via the M1—Leave the M1 at intersection 13, **not 12 as signposted.** Turn left off motorway and follow signposts through Husborne Crawley to Woburn Abbey.

From the south via the A5—Turn right at Hockliffe and follow the A50 to Woburn.

From the north via the M1—Leave the M1 at intersection 14 and follow the A50 to Woburn.

From the north via the A5—Turn left at A418, five miles south of Fenny Stratford, and follow to Woburn.

From other directions make for the points indicated above and proceed as indicated.

Avoid routes signposted to "The Wild Animal Kingdom" or "Game Reserve". The rally takes place in Woburn Park and correct routes are signposted to "Woburn Park" or "The Abbey". Also watch for RSGB signs.

Usual **talk-in** facilities will be in operation by Dunstable Downs RC on 1·8, 70, 144 and 432MHz.

The DSB 1 Mk 2. A simple sideband transmitter for the beginner

by E. ELSLEY, G3YUQ*

AS a tutor of amateur radio the author is often asked how it is possible to start the hobby cheaply, as many beginners are faced with the high cost of modern ssb equipment or, alternatively, building an ssb rig. The majority will already be listeners and have a receiver, leaving the transmitter as the main problem—most amateurs will agree that building an ssb rig is not a project for the beginner, indeed it would not be attempted by many experienced amateurs. There is, therefore, a need for a simple sideband transmitter which could be built by almost anyone using simple tools and easily obtainable components, and the equipment to be described will fill that need.

To keep the rig simple and the cost as low as possible, double sideband suppressed carrier (dsb) has been adopted. This is often described as a step between a.m. and ssb, and indeed it is. Anyone who has built one of the popular 10W 1·8/3·5MHz a.m. rigs will find most of the circuitry and construction familiar. The signal is received as ssb by modern transceivers and selective sideband receivers and most operators do not realize that the signal is not ssb.

The Mk1 version and, more recently, the Mk2 have been in use at G3YUQ for about five years (with a break when the Home Office declared it illegal). While the output from the rig may seem low (12W p.e.p.) by today's general acceptance of linears, it is more than adequate to get around Europe and Scandinavia on 3·5MHz using a modest antenna.

Cost is kept to a minimum; most of the components are ex-junk-box, no crystals or filters are required and the rig needs only a simple unstabilized power supply. Valves have been used throughout; all are readily available types and many substitutes are possible. Total cost if some parts can be obtained from a junk box should be under **£5**; the author's cost less than 50p.

The circuit

The rf side.

V1 is the vfo using an EF91 in a "standard" Clapp oscillator tuning 1·75 to 2·0MHz. An alternative valve would be an EF80 (B9A base). Output from the anode is via a 100pF capacitor to V2, the buffer amplifier/frequency multiplier, again a "standard" circuit using an EF80. The band required is selected by L2, S2. An alternative valve here is the EF91 but the EF80 specified seems to provide better isolation. A link coupling from L2 is connected to L3, the pa grid coil, via a short length of coaxial cable earthed at one end. C17 across the pa grid coil tunes 3·5MHz at near maximum capacitance and 1·8MHz at near maximum capacitance. The rf now in push pull is passed on to the grids via 200pF capacitors. The pa valves

* 14 Studley Road, Wootton, Beds.

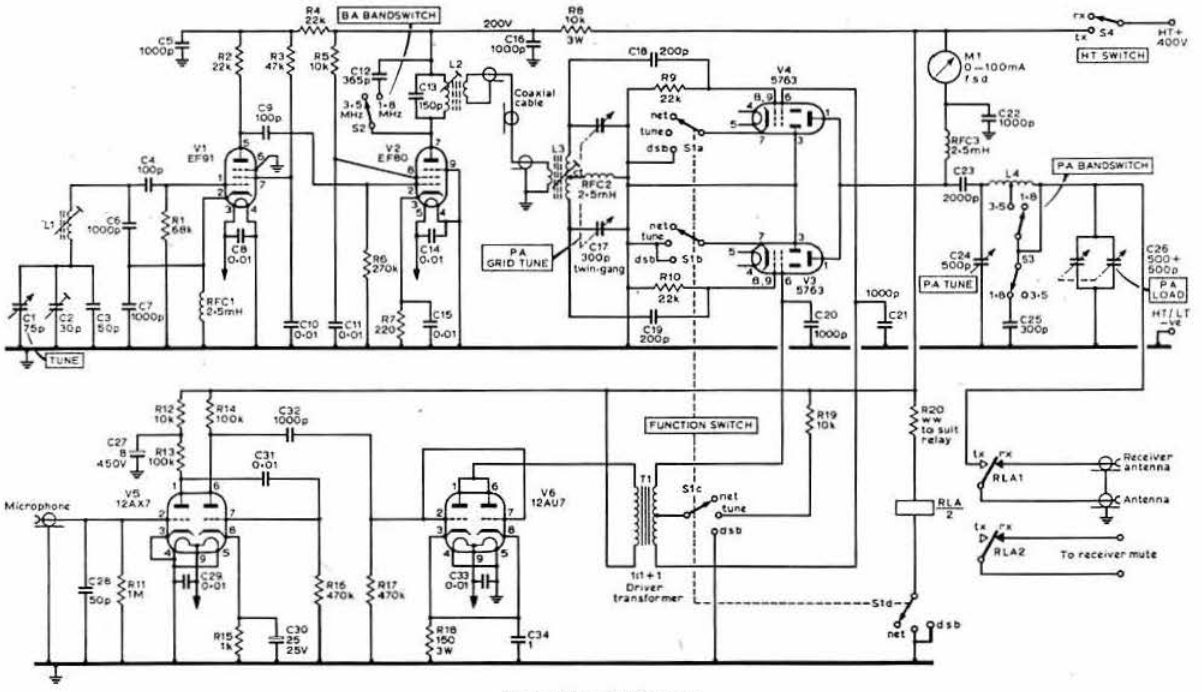


Fig 1. Circuit diagram

are 5763s, although any small receiving-type output valves should suit, eg EL84, 6BW6, 6V6 etc. For higher power the 6146, 807s etc could be tried. The anodes of the pa valves are connected together and pass via the tank network and relay to the antenna.

The audio side.

V5 is the speech amplifier using a 12AX7 twin triode, again in another "standard" circuit. Input is suitable for a crystal microphone. The output from V5b is via a 1,000pF capacitor to provide a little speech tailoring to the modulator, a 12AT7 (although a 12AU7 is also suitable). The modulator valve is connected in parallel to provide a more "beefy" valve. Output is passed through the primary of a 1-to-1+1 driver transformer, although any ratio up to 1-to-2+2 will be suitable. A small mains transformer, 250 in to 250-0-250 out, may be suitable but has not been tried. The outputs of the transformer now in push pull are corrected to the screen grids of the pa valves, which in turn are decoupled to earth via 1,000pF capacitors—*do not increase the value of these.* The audio output provides the *only* voltage on the pa screen grids, and a good whistle into the microphone will produce about 200V at that point.

The result of the rf and af in push pull is that the pa acts as a power-balanced modulator and phases out the carrier. The output to the pi-tank is double sideband suppressed carrier (dsb). The transmitter is controlled by a four-pole three-way function switch and a toggle switch for ht on/off.

Operation

Net

HT is applied to the vfo and ba via the ht switch. The relay is not energized and so leaves the receiver on and the antenna connected to the receiver.

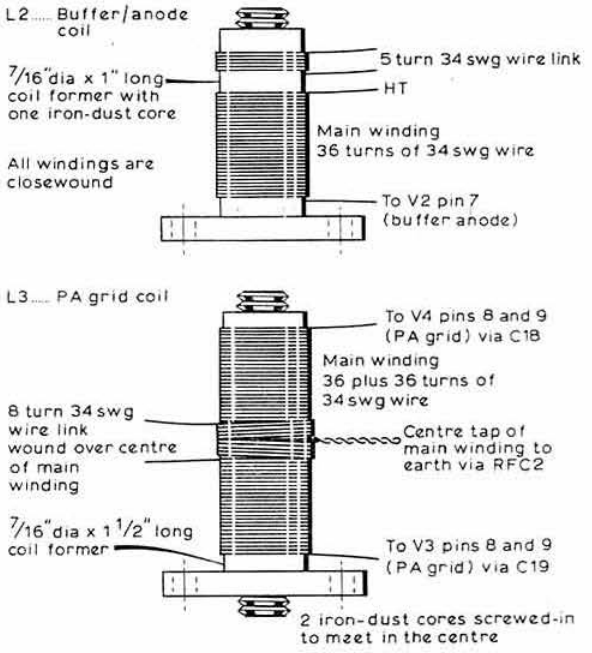


Fig. 2. Coil details, L2 and L3. L1, vfo coil, is 96t 34swg ¼in dia former plus core; note that a longer-than-average former is required to accommodate all the turns (closewound one layer). L4, PA pi-tank coil, is 39t 18swg closewound on 1·5in dia former, tap at 19t for 3·5MHz

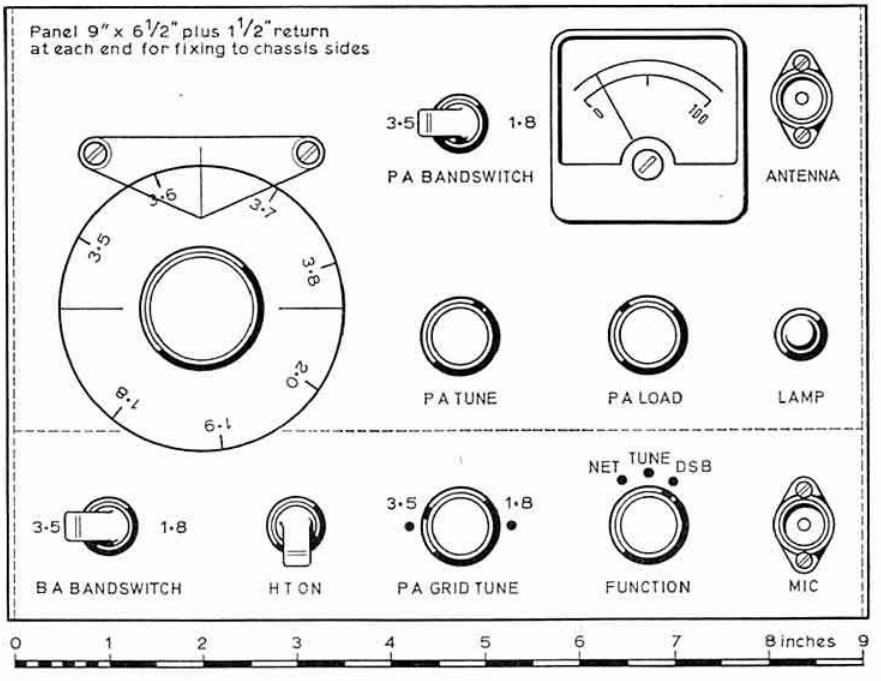


Fig 3. Front panel layout

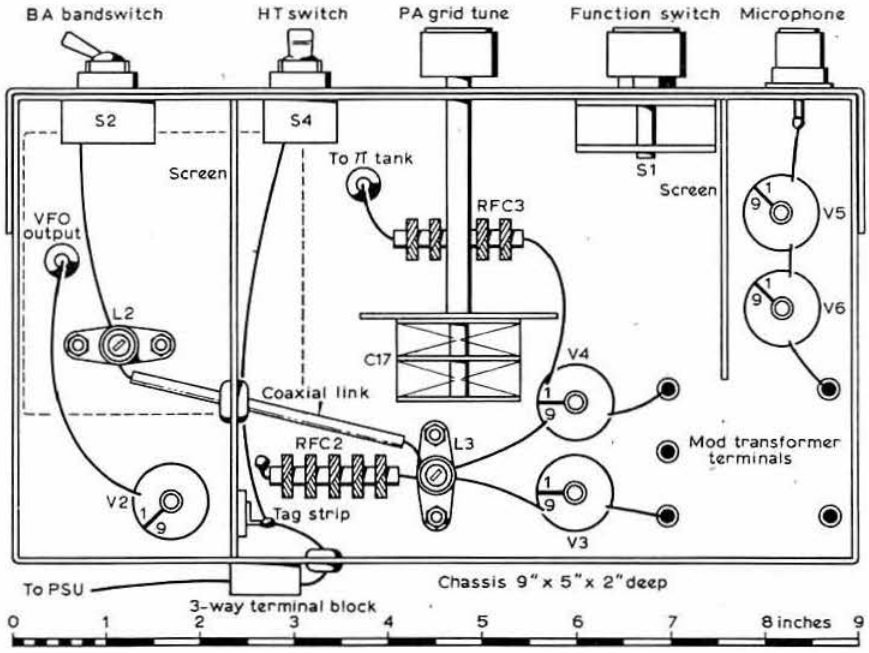


Fig 4. Chassis underside

Tune

All stages except one pa valve are operational when ht is switched on. The pa valve has ht applied to its screen grid via a 10kΩ 1W resistor. The rig can then be tuned in the normal way with the pi-tank network. The relay is energized and so the receiver is muted and the antenna is connected to the transmitter.

DSB

The transmit standby position. All stages are operational when ht is switched on. The ht switch is used as a transmit/receive switch.

Power requirements are also simple; 400V dc at about 80mA maximum and 6·3V for the heaters. A 350-0-350V transformer gives 400V when smoothed. The circuit can be any of the types shown [1] using either valve or silicon diode rectifier circuit. No stabilization has been found necessary.

Constructional details

The chassis used by the author was 9 by 5 by 2in deep. It is best to get all the components together first and, using the layout as a guide, adjust the size as necessary. Do not try to make it any smaller as it may be difficult to wire up.

The front panel is bent round at each end and fixed to the side of the chassis. This produces a strong neat job. The panel can be finished with cellulose paint spray and lettered up using Letraset or similar transfers.

Commence by building the vfo; the author used a 3 by 3 by 2in deep box. All components are inside, except the valve which is mounted on top and to which a screening can must be fitted. The unit is mounted on top of the chassis with leads brought out underneath for ht, lt and output. The vfo is adjusted by the slug on L1 and the 3-30pF trimmer to cover 1·75-2·0MHz.

The buffer anode coil L2 must be mounted on the main chassis before the vfo is fitted. Keep all leads short and direct. Do not omit any of the screening, or cans on the vfo, ba or speech amplifier. A screen lead must be used between the microphone socket and the speech amplifier. Earth the screen at one end only. If this is not done the speech amplifier may oscillate as it is a very high gain stage.

Alignment

The rig may be aligned in two ways:

1. Alignment using a grid dip oscillator

Adjust L1 to tune 1·75MHz with C1 vfo tune at maximum capacitance.

Check that the vfo covers 1·75MHz to 2·0MHz.

L2: set S2 bandwidth to 3·5MHz and C17 pa grid tune at minimum capacitance.

Adjust the core of L2 to tune 3·8MHz. Next set S2 bandswitch to 1·8MHz and C17 pa grid tune to maximum capacitance. Adjust the value of C12 (365pF) until L2 tunes 1·75MHz—*do not adjust the core of L2 as this will alter the 3·5MHz setting.*

If L3 is wound correctly with two cores screwed fully in to meet in the centre, the coil will tune to 3·8MHz with C17 pa grid tune at near minimum capacitance and S2 bandswitch at 3·5MHz, and 1·8MHz with C17 pa grid tune at near maximum capacitance and S2 bandswitch at 1·8MHz. Check that it does so by using the gdo near L3.

L4, the pa tank coil, requires no alignment at this stage.

Alignment without test equipment

With this method the rig is LIVE and care must be taken to avoid shock.

The vfo can be set up by listening on the station receiver. Set function switch S1 to NET. Switch on ht, S4.

Adjust the core of L1 and trimmer C2 until the vfo covers 1·75MHz to 2·0MHz. The vfo is now set up.

Connect a 15W lamp to the antenna socket to act as a dummy load.

Alignment for 3·5MHz
Set controls as follows:

BANDSWITCHES	to 3·5MHz
VFO TUNE	to 3·8MHz
PA GRID TUNE	to *minimum* capacitance
FUNCTION	to TUNE
PA TUNE	to maximum capacitance
PA LOAD	to maximum capacitance

Switch on ht. Quickly adjust PA TUNE for maximum dip. This should be quite low. Continue by adjusting the pi-tank network (PA TUNE/PA LOAD) in the normal way until the pa meter reads about 40mA. Next adjust the core of L2 for maximum output. The lamp should be glowing quite brightly by now.

Next, set FUNCTION switch to dsb. If all is well the meter will read zero but kick up to over 30mA, and the lamps will light, when speaking into the microphone. Monitor on the station receiver; the audio should sound clear with no hum, if so the rig is set up for 3·5MHz.

Alignment for 1·8MHz
Set controls as follows:

BANDSWITCHES	to 1·8MHz
VFO TUNE	to 1·8MHz
PA GRID TUNE	to *maximum* capacitance
FUNCTION	to TUNE
PA TUNE	to maximum capacitance
PA LOAD	to maximum capacitance

Switch on ht. Quickly adjust PA TUNE C24 for maximum dip. Next, adjust PA GRID TUNE to improve dip. Continue by adjusting the pi-tank as before until the pa meter reads about 40mA.

If difficulty is experienced in obtaining a good output at 1·8MHz it may be necessary to alter the value of C12. Set GRID TUNE to near maximum capacitance and alter the value of C12 by experiment until the rig is giving a good output at 1·8MHz and the pa meter reads about 40mA—*do not adjust the core of L2 as this will disturb the setting for 3·5MHz.*

Next, set FUNCTION switch to dsb and check as before. If all is well the rig is set up for 1·8MHz.

Operation

If using an atu, tune this for maximum strength of signal received on the required band, and it will be set up just about right for the transmitter. Connect the main antenna to the transmitter via the atu, and the receiver mute and receiver antenna connections as required.

Set BANDSWITCHES to required band; PA TUNE and PA LOAD to maximum capacitance; PA GRID TUNE to minimum for 3·5MHz or maximum for 1·8MHz.

To net on to another station: set FUNCTION switch to NET; switch on ht; tune the vfo to zero beat with the other station; switch off ht.

To tune the transmitter (this will be necessary when changing bands or moving more than 75kHz or so): set FUNCTION switch to TUNE; switch on ht; quickly adjust the pa tune for maximum dip in the pa meter reading; adjust the pa grid tuning to improve the dip in the pa meter reading; continue to tune the pa tune and pa load in the normal way for pi-tank networks until the pa meter reads about 40mA; check that the pa grid tune is set to give the best dip in the pa meter; adjust the atu if required to improve the output from the rig; switch off ht.

Once the atu and tx settings are found they should be noted for future use.

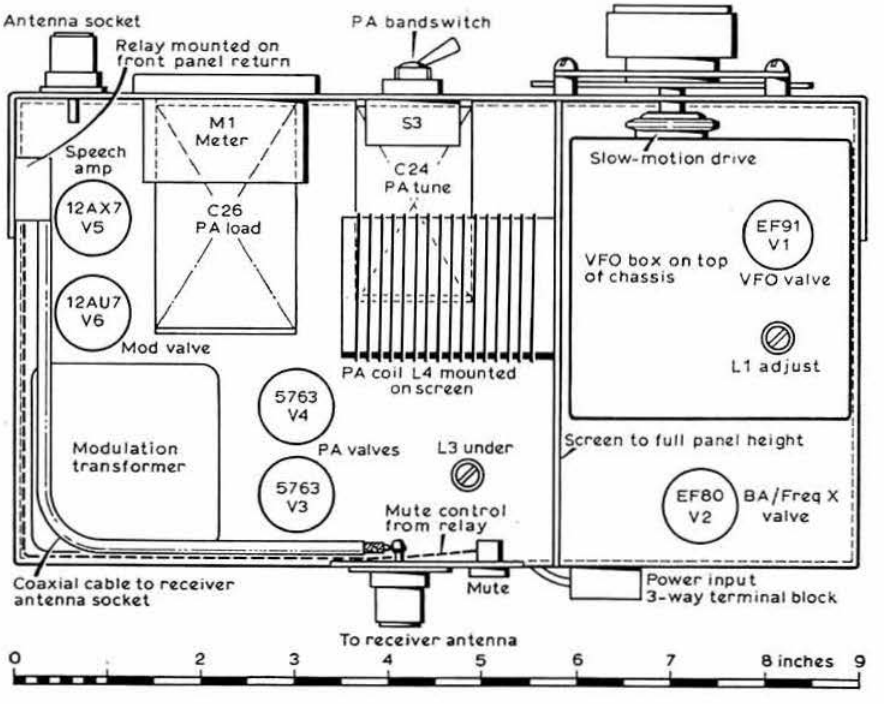


Fig 5. Chassis top layout

Components list

R1	68kΩ ¼W	**R11**	1MΩ ¼W
R2, R4, R9, R10	22kΩ ¼W	**R13, R14**	100kΩ ¼W
R3	47kΩ ¼W	**R15**	1kΩ ¼W
R5, R12	10kΩ ¼W	**R16, R17**	470kΩ ¼W
R6	270kΩ ¼W	**R18**	150Ω 3W
R7	220Ω ¼W	**R19**	10kΩ 1W
R8	10kΩ 3W	**R20**	Wirewound to suit relay RLA

C1	75pF variable (VFO TUNE)
C2	30pF trimmer (VFO TRIM)
C3, C28	50pF silver mica
C4, C9	100pF silver mica
C5, C6, C7, C16, C20, C21, C22, C32	1,000pF silver mica
C8, C10, C11, C14, C15, C29, C31, C33	0·01μF disc ceramic
C12	365pF silver mica (see text)
C13	150pF silver mica
C17	300pF twin gang variable (PA GRID TUNE)
C18, C19	200pF silver mica
C23	2,000pF silver mica. 1,000V type
C24	500pF variable. (PA TUNE)
C25	300pF silver mica
C26	1,000pF variable (500pF + 500pF) (PA LOAD)
C27	8μF 450V electrolytic
C30	25μF 25V electrolytic
C34	1μF paper 150V
V1	EF91
V2	EF80
V3, V4	5763 } See text for substitute types
V5	12AX7
V6	12AU7
S1	4-pole 3-way
S2, S4	1-pole 2-way toggle
S3	2-pole 2-way toggle
M1	0—100mA fsd moving-coil meter
RFC1, RFC2, RFC3	2·5mH
T1	1:1 + 1 driver transformer, valve type, see text for substitute types
RLA	2-pole change-over relay
Valve bases:	1 off B7G with screening can; 3 off B9A with screening can; 2 off B9A ceramic (PA valve bases).
Sundries:	1 off sm drive and dial for vfo; 3 off coaxial sockets (mic, rx antenna, tx antenna); 1 off phono socket (rx mute); 4 off medium knobs; 1 off large knob; 1 off panel light
Chassis	9 by 5 by 2in deep aluminium
Panel	13 by 6½in aluminium for front panel
	Sundry offcuts for screens as required

To transmit: switch to dsb; use ht switch as a transmit/receive switch, ie switch on to transmit and off to receive. PA meter will read zero but will kick up to about 30mA when speaking into the microphone.

The author uses a 90ft end-fed antenna at a height of 25ft with a modest earth system consisting of about 50ft buried around the garden, and has had good results around Europe.

Alternatives

The rig can be modified for other bands by changing L1, L2, L3 and L4.

Higher power is possible in a number of ways.

(a) Run the pa valves at a higher voltage. The author has run 5763s with 600V on the anodes with good results. Output is then about 25W p.e.p. If one tries this, keep the tuning of the rig down to periods not exceeding 10s or so.

(b) By using higher power valves in the pa, eg 6146s. This would require some re-designing of the chassis.

(c) By using the rig to drive a linear—there is plenty of power to do this.

The author suggests that the rig be tried "barefoot" first: he will be pleased to hear from anyone building and using the rig and the results they get.

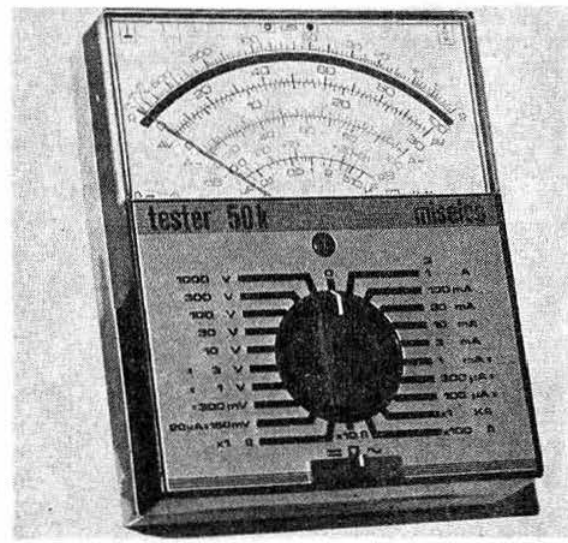
Reference

[1] *Radio Communication Handbook*, 3rd edition, page 333.

NEW PRODUCT

Tester 50k multimeter

A further instrument in the range offered by Alcon is a high impedance multimeter designed with the electronic technician/engineer in mind. The Tester 50k offers 50kΩ/V input impedance on both dc and ac. Thirty-nine ranges cover up to 1,000V and 3A on ac and dc. Four resistance ranges extend from 10kΩ fsd to 10MΩ fsd, and there are five power ranges covering from −10dB to +61dB. An optional extra is the universal signal injector providing harmonics detectable up to 500MHz and particularly useful for radio and tv servicing. The meter is of modular construction thus providing easy replacement of circuit boards or other sections. Size is 105 by 130 by 35mm and the weight (without batteries) is 300g.



One-off price with test leads, instruction manual and carrying case is £39.20 including VAT. Further information may be obtained from Alcon Instruments Ltd, 19 Mulberry Walk, London SW3 6DZ. Tel 01-352 1897.

EQUIPMENT REVIEW

The Heathkit SB-104 all-solid-state hf bands transceiver

by G. L. MILLS, BSc(Eng)(Hons), CEng, MIEE, MIERE, G3EDM*

THE transceiver which is the subject of this article was ordered in kit form, together with its associated electronically regulated mains power supply type HP1144, from the Gloucester factory of Heath Ltd in December 1974. Delivery was made early in February 1975. Approximately 100 hours were spent on a start-stop basis assembling the kit of the SB-104 and it was ready for testing in mid-March 1975. The reviewer has also been able to test an SB-104 owned by Colin Howard, G3WFB, and his help is acknowledged.

General description

This transceiver is completely solid-state except for the use of an antenna-changeover relay which is necessary to switch the high rf power from the output stage. The SB-104 is of an advanced design and contains some 2,800 parts, including 31 ICs, 75 transistors and 171 diodes. These devices are mounted mainly on 15 glass epoxy printed circuit boards. Eleven of the PCBs plug in, and seven of these may be extended out of the chassis while the transceiver is operational by means of the extender circuit board. This is useful and necessary for fault-finding, and for checking signal and voltage levels. Circuit boards are particularly useful when another SB-104 is available, for this enables any trouble to be quickly pin-pointed by interchanging boards (unless the problem exists with both transceivers). It is also an advantage when advances in the state-of-the-art are made and it then becomes convenient to change just a circuit board rather than buy a whole new transceiver.

Instant QSY is possible, especially if one has a broadband antenna such as a cubical quad, since none of the more common preselector, load and tune controls exist. This is achieved by broadbanding for both transmit and receive functions. A useful feature is the digital readout of frequency which achieves a 100Hz resolution using a maximum of six figures (only five figures are, of course, required for this resolution on the 3·5 and 7MHz bands); it indicates both transmit and receive frequencies which are always the same unless an external vfo is being used. There is no facility for independent tune of the receiver. The use of flat seven-segment gas-discharge display tubes for the frequency readout necessitates the use of a 5 to 180V dc-dc converter, operating at approximately 25kHz, to provide the ht for these tubes. However, their use is well worthwhile because of their clarity. The digital counting devices are largely 74 series ttl. A stable crystal oscillator operating at 1MHz provides the reference frequency for the time base, and six ICs form a divider string with outputs at 100, 50, 25 and 12·5Hz. The function of the counter is to count the premix signal (the difference frequency of the mixed hfo and vfo signals) and to produce the correct format for display. This is ingeniously achieved by using a false zero of 10,000·0kHz. The decade counters are preset to 10,000·0 minus the bfo frequency. The action is perhaps best understood from the example below shown for a signal frequency of 3·750MHz.

HFO for 3·5MHz band	12,395·0kHz
VFO	5,251·4
Premix	7,143·6kHz
False zero	10,000·0kHz
BFO for lsb	3,393·6
	6,606·4kHz
Preset frequency	6,606·4kHz
Counted frequency (Premix)	7,143·6
	13,750·0

The signal frequency will be displayed as 3,750·0kHz as the "1" is suppressed because there are insufficient devices to display it. On the 14, 21 and 28MHz bands the initial digit is controlled directly by the single-wafer bandswitch (S1B). The band selection is controlled by a wafer switch which selects the bandswitching diodes to be forward biassed at the input and output of the various broadband stages throughout the transceiver—a single wafer is used for this purpose, while a second wafer is used to switch in mechanically the appropriate harmonic filter between the pa, or driver, and the antenna socket. The transceiver operates from a nominal 13·8V dc supply (although see the results of the test). The manufacturer claims that it can operate directly from a +12V car electrical system (ie negative of battery earthed).

Optional extras are the noise blanker to reduce effects of impulse interference (not tested here) and the 400Hz crystal filter for cw working. Several auxiliary equipments are offered for use in conjunction with the SB-104; they are the SB104 loudspeaker, SB644 remote vfo, SB634 station console, SB614 station monitor and SB230 linear. The reviewer has used only the SB200 linear in conjunction with the SB-104 and it may be adequately driven from the transceiver.

The pa stage consisted of two push-pull amplifiers operated in parallel using four TRW transistors type 2N6456. In the reviewer's model alternative devices manufactured by CTC have now been fitted by the Gloucester factory after distortion problems were encountered after the factory fitted a second set of TRW devices. The pa is broadbanded and no tuning is required. Hybrid dividing and combining transformers are used to divide the input drive power between the push-pull pairs and to combine the output powers. The vfo is a fairly conventional fet circuit and basically similar to fet VFOs used in earlier Heath valve transceivers (eg the HW100).

* Tanglewood, The Ridge, Little Baddow, Chelmsford, Essex.

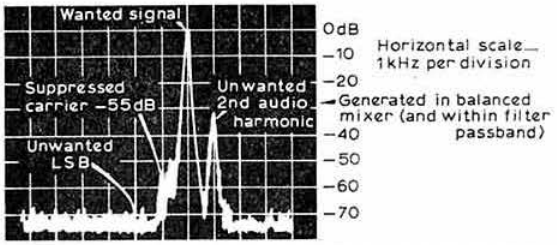


Fig 1. Output spectrum from driver stage ≃ 1W using 1,000Hz signal of 11mV at mic socket. Unwanted (lsb) at −70dB referred to wanted signal. Carrier level −55dB. Other spurii* > −50dB. (Compare Heath specification −55dB, −50dB and −50dB (± 3MHz of carrier) respectively). All figures are within specification—although admittedly the specification refers to pa stage output. Wanted signal frequency 14·128MHz.
**(Except for 2nd audio harmonic at −32dB)*

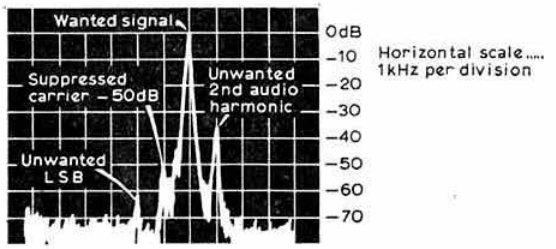


Fig 2. Output spectrum from pa stage ≃ 100W using 1,000Hz signal of 11mV at mic socket. Unwanted (lsb) at −62dB. Carrier level −50dB. Other spurii > −50dB except for 2nd audio harmonic (in-band)

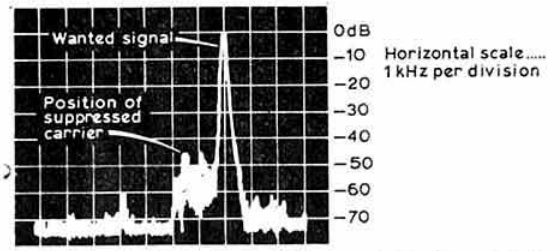


Fig 3. Spectrum of pa stage at full output (level control 9½ o'clock) with 2,000Hz drive at mic socket (input 11mV). Spurious responses better than −45dB

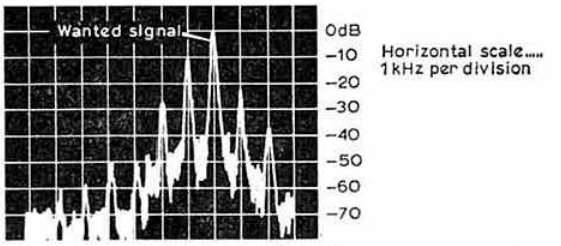


Fig 4. Spectrum of pa stage being overdriven (pwr at 12 on meter) and level control too high. Input at 2,000Hz at mic socket was 11mV. The worst in-band product is seen to be only 10dB down, and out-of-band products are considerably increased over those shown in Fig 3 for correct level control adjustment. This would result in poor speech quality and much adjacent-channel QRM

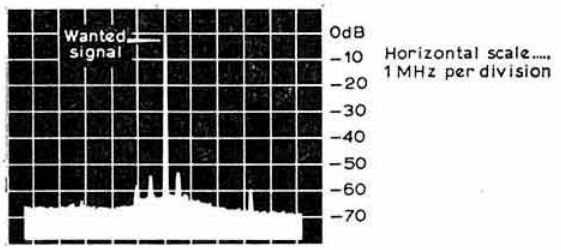


Fig 5. PA stage at full output when driven by 11mV at 2,000Hz at mic socket. Spurii within ±3MHz are > −50dB. Except for one at just above +3MHz the other spurii greater than ±3MHz are > −60dB. Thus all are within specification except that one just above +3MHz

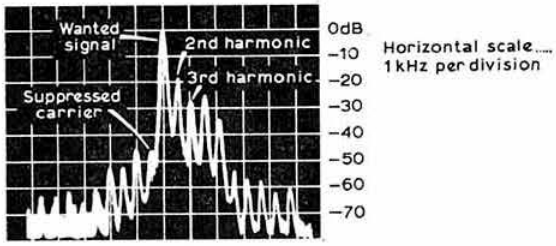


Fig 6. Output spectrum of balanced mixer measured at T601. Input to mic socket was 10mV at 500Hz. Note that 2nd, 3rd and 4th in-band harmonics are significant. Carrier suppression at −45dB is good and since the filter follows it will be further attenuated there

Bench tests

1. Tests of the 1st balanced modulator, which uses FH1100 hot-carrier diodes, shows the production of significant audio in-band harmonics, the 2nd and 3rd being respectively 17 and 26dB down on the wanted single-tone at 500Hz. No specification for such harmonics is given by Heath but good commercial practice would not accept a 2nd harmonic only 17dB down. Fig 6 shows the spectrum of the modulator output for a single-tone test as measured using an HP8552/3B analyser.

2. Initial tests before the pa transistors were changed for the first time showed considerable numbers of spurii out of band when the transceiver was tested at 4·00MHz. The following spurii, with levels measured relative to the wanted 1,000Hz side frequency (lsb), were found.

Frequency (approx) MHz	Level relative to 1,000Hz side frequency
0·8	−50dB
2·8	−48
5·7	−50
8·2	−32
11·6	−50
13·6	−14
16·8	−38

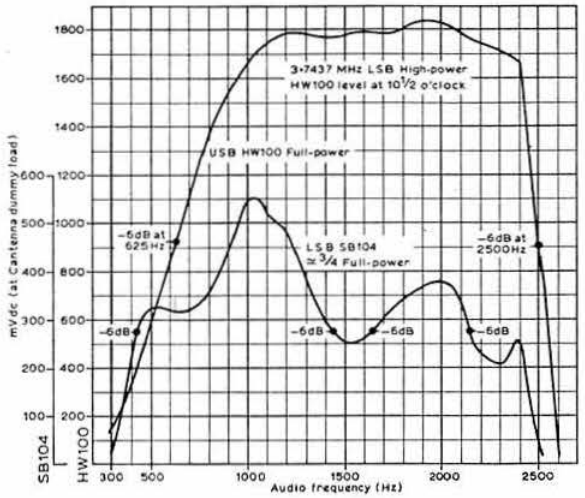


Fig 7. SB-104 rf output response (speech band only) when trouble was experienced with distortion of transmitted sideband. Believed due to instability. Cured by Heath changing pa transistors and adding decoupling (see manufacturer's modifications). HW100 response shown for comparison

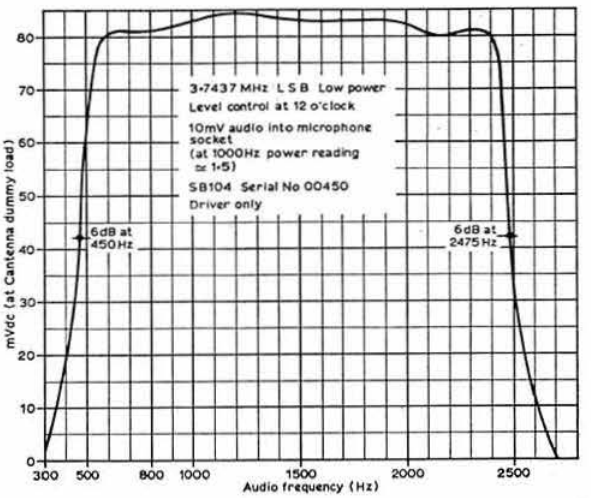


Fig 9. SB-104 rf output response (speech band only) from driver stage

When the third set of pa transistors was fitted by Heath, subsequent tests on the CTC pa transistors into a 50Ω Cantenna load produced spectrum under single-tone of 1,000Hz shown in Fig 2.

3. A frequency plot of the transceiver response was made by injecting approximately 10mV of audio frequency tone into the mic socket and monitoring the voltage across part of a 50Ω rf load with the transmitter pa stage operating at full power. The response showed that the If audio figure of 350 ±75Hz at −6dB was not up to the Heath specification in the transmit mode (see Fig 7). Comparison there is made against a similar plot for the older HW100 transceiver which uses a broader crystal filter. After the CTC pa transistors were fitted the test was repeated and Fig 8 shows what a superb response is possible with everything in the transceiver

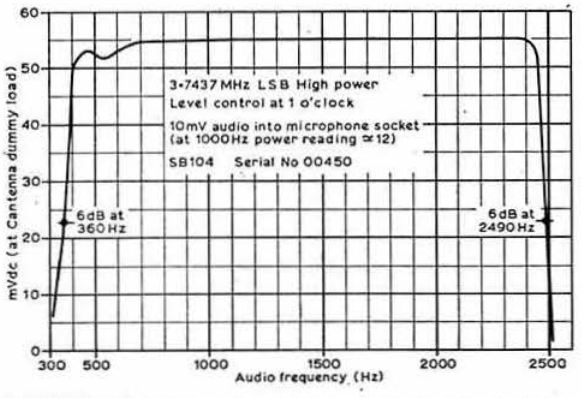


Fig 8. SB-104 rf output response (speech band only) after CTC pa transistors and further decoupling installed to cure distortion of transmitted sideband experienced earlier (cf Fig 7)

adjusted and working correctly. The 6dB frequencies are now as specified. Fig 9 shows the output response of the driver stage only. This stage is used as the final stage when running low power output and it too has an excellent response.

Results of frequency drift measurements on SB-104 using a TF1417/2 frequency counter (Table 1)

The figures in brackets are values after the factory modified the vfo because of its excessive drift. There is sufficient backlash in the tuning mechanism to shift the count by 200Hz. The absolute frequency change has not been measured although it is sufficient to modify the received voice signal when it becomes necessary to follow a slightly unstable incoming frequency.

The measurements show that in the first half-hour of the non-transmitting test the vfo before modification drifted +530Hz, and after factory overhaul (in which several components were changed) the drift was reduced to a commendable +8Hz. Heath do not specify drift in the first half-hour, but for those who operate their rigs for short periods it may not always be convenient to switch-on the rig 30min before use. The above figures show that the next 60min drift was reduced from +182 to −14Hz. At first the figure was

Table 1

Elapsed time (minutes)		Counter (TF1417/2) reading (MHz)	SB-104 readout (MHz)
0 (Start)	(0)	14·186570 (14·128045)	14.1858 (14·1271)
2·5	(7)	660 (008)	58 (71)
6	(12)	780 (14·127990)	59 (71)
10	(17)	850 (989)	60 (71)
15	(24)	940 (14·128039)	61 (72)
21	(29)	14·187040 (053)	62 (72)
26	(39)	110 (058)	63 (72)
31	(50)	160 (060)	63 (72)
35	(57)	195 (054)	64 (72)
45	(66)	256 (042)	65 (72)
60	(75)	302 (048)	65 (72)
77	(83)	330 (055)	66 (72)
90	(86)	342 (039)	66 (14·1273)

Table 2

Before		After	
Input (μV)	S-meter	Input (μV)	S-meter
1	0	14	0·5
2	0	18	1
4	0	25	2
8	1·5	32	3
16	4·8	43	4
32	9·0	54	5
64	9 + 20dB	75	6
128	9 + 30dB	110	7
256	9 + 38dB	165	8
512	9 + 45dB	256	9

outside the Heath specification of less than 100Hz per hour but again the final drift achieved is very low.

The S-meter readings (Table 2) were taken before and after the sensitivity modifications to the front-end of the receiver (a Heath modification). The input voltage is that at the receiver antenna terminals, at a frequency of 14·280MHz. Fig 10 shows the test circuit and the voltage measured. Note that the lower S-meter readings taken after the modifications do not necessarily indicate a lower sensitivity but simply that the S-meter calibration was re-adjusted.

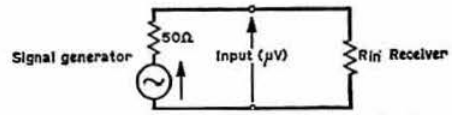


Fig 10. Circuit arrangement for S-meter calibration (see Table 2)

On-the-air use has shown that the S-meter calibration of the final two columns of Table 2 compares favourably with the reports received at the reviewer's station for his own signals when comparable power and antennas at each end are in use. However, this is at the expense of the S-meter moving hardly at all on quite readable signals on a quiet band. This appears to be a characteristic of transceivers of all types at the many dx stations contacted using the SB-104. The readings between S2 and S9 are approximately logarithmic and average around 3dB per S-point.

Table 3 shows the power output into a 4Ω resistor. AF gain at 12 o'clock and rf gain control fully clockwise. The noise output was 2mW into the loudspeaker with no signal. AGC in SLOW position.

Table 3

Input (μV)	Power into loudspeaker (mW)
1	10
2	40
4	120
8	220
16	280
32	320
64	350
128	370
256	390
512	410
1,024	420
2,000	440
4,000	450
8,000	470
16,000	480
32,000	460

Overall gain. The specification quotes less than 1μV for 0·5W audio output. With gains flat out (af and rf) 0·62μV produced 0·75W audio plus noise so that the receiver was well within specification.

Intermodulation distortion. With a 5·6μV signal at 14·304MHz a signal in excess of 100mV at 14·280MHz was required to produce a detectable signal at 14·256MHz of −85dB. Hence the claim of −60dB is very reasonable.

Table 4

3·7380MHz	S1½ Spurious carrier	28·9554	
3·6520	S3½ Spurious carrier	28·9996	
7·0744		29·0216	
7·0647	Carrier audible	29·0440	
14·0143		29·0639	
14·0656		29·0743	
14·0775		29·0850	
14·1992		29·2306	
14·2404	S1	29·2584	
14·2966		29·2829	
21·0644		29·3842	Morse breakthrough
21·1997	S1		
21·2590		29·4130	Morse breakthrough
21·4258			
28·0432		29·4299	Morse breakthrough
28·3886			
28·3943		29·4621	
28·4337		29·6432	
28·5440		29·6524	S1½
28·8096		29·6616	
28·8201	Teleprinter breakthrough	29·6712	
		29·7283	
28·8381		29·7304	Morse breakthrough
28·8457			
28·8728	Morse breakthrough	29·8448	Morse breakthrough
28·9127	Morse breakthrough	29·8736	Morse breakthrough
28·9325		29·9794	

Note: where no S-meter reading is shown the spurii were insufficient in level to produce a reading, but were nonetheless audible.

Table 4 shows frequencies at which spurious signals were detectable. Some of these are products of the digital counter and others are due to pick-up other than through the antenna (a screened dummy load was used to terminate the antenna socket throughout these measurements).

Table 5 gives the readings of output rf power measured using a Bird Model 43 Thru Line wattmeter into a 50Ω dummy load.

Table 5

Frequency (MHz)	Hi power (W)	Lo power (W)	Frequency (MHz)	Hi power (W)	Lo power (W)
28·7493	100	1·9	14·2489	110	2·2
28·2497	98	1·8	7·0500	95	2·0
29·2497	105	2·0	3·5482	50	1·3
29·7505	98	2·0	3·7500	92	1·6
21·2502	100	1·8			

Note: The low reading at the bottom end of the 3·5MHz band was due to the adjustment of L321, the 3·395MHz trap, and was subsequently corrected by re-adjustment.

On-the-air-tests

1. After Heath fitted the second set of pa transistors much adverse criticism of the audio quality was made. At first this was thought to be entirely due to the Heath GH-12A microphone being used despite a statement by Heath that it was suitable. Two separate GH-12As were tested to ensure this was not a characteristic of a single microphone. Reports when using this microphone were described variously as harsh and nasal sounding. Use of a Philips type N8210 microphone (as supplied with their N2203 and N2204 cassette recorders) proved more acceptable although quality was still not good. The Heath GH-12A is a piezo-ceramic microphone and is unsuitable for the input impedance of the SB-104 and if so used will result in severe attenuation of the

lower frequencies. Its unsuitability was confirmed in conversation with Angus McKenzie, G3OSS, a well-known audio consultant (but it is entirely suitable for use with the HW100 transceiver with which it has been used here for many years).

In May 1976 the transceiver was returned to Heath for the second time to determine the cause of the harsh audio quality when transmitting. It was then that the pa transistors were changed for the second time, that is to say to the third set, and this time the CTC devices were fitted. Heath said the pa transistors were changed although they were not proven to be at fault. However, this together with the following modifications affected a cure to the distortion. R954 and R956 were changed to ferrite beads. L952 and L953 were reduced from five to four turns. 0·01μF capacitors were added to pins C4 and C5, and ferrite beads to the lead from K5 to lug 8 of the relay. To prevent pa oscillations when using CTC transistors a 390Ω resistor was fitted across RFC902.

2. Very careful adjustment of the mic/cw level control is required and also very much care must be exercised in keeping the voice at the correct level so that the transmitter is not overdriven (see Fig 4). It is recommended that the meter with the switch in the PWR position is driven to between the 3-6 marks; the operations manual (p258) recommends alc meter reading should not increase by more than six units, but the reviewer's alc reading moves only very occasionally. Before the CTC devices and the modifications mentioned above had been carried out, tests over some 4-5 miles gave the distinct impression that the transmission was wider than when using a HW100 transceiver. Now, with the above modifications, the quality and spread is indistinguishable from the HW100 transceiver at this station.

Experiences and problems encountered in commissioning the SB-104 for operation

The SB-104 under review had the serial number 00450 and is an early model. In working and speaking to several dx stations the reviewer concludes that his experiences are not unique and hence describes these so that they may be of value to other amateurs. Other kit-builders have experienced different problems which the reviewer did not encounter. The standard of soldering required must be high since there are well over 6,000 soldered connections, any one of which could cause an incipient fault.

The most serious difficulty initially was the considerable frequency modulation experienced, and almost as soon as the reviewer had diagnosed the problem the first of the many modifications for the SB-104 arrived. The trouble was mainly in the lack of voltage stability with the vfo dc supply which itself was derived from the nominal 11V rail. Zener diode (ZD1201) was originally a 10·1V zener and was first changed to a 9·1V zener to be later changed to one working at 7·5V. However, before this latter modification had been received the reviewer had raised the dc input to the transceiver from the recommended value of 13·80V to a value of 14·50V to get the electronic stabilizer within the transceiver working correctly. When Heath subsequently modified R254 and R255 from 10 to 5 per cent components this allowed the reviewer to reduce the transceiver supply to 14V.

It was found essential to use a digital voltmeter to measure these voltages, and when so measured the 11 and 5V rails remained stable to four significant figures no matter what the rf output power. Heath have now changed R254 to 750Ω from the original 680Ω in order to raise the nominal 11V rail voltage. The ic controlling this rail voltage is a Motorola MFC 6030A which was unable to work with the manufacturer's specified 3V differential between input and output until the reviewer raised the transceiver supply to 14·50V originally (later 14V). It was this increased supply voltage which led to the excellent regulation figures quoted above. Having to keep the supply voltage at this level would seem to suggest a problem in connection with mobile operation when the car battery is not on charge. To date the SB-104 has not been tried from a 12V battery supply.

The WWV crystal in the SB-104 failed to oscillate, and changing the crystal did not make the circuit oscillate; only when the value of R414 was reduced from 15kΩ to 4·7kΩ did it do so. Some added difficulty in finding this fault was due to the fact that the HFO/PREMIXER schematic (fold-out from p 294) has a drafting error that has been perpetuated in the second issue of the *Operations Manual*. The designations Y403 and Y404 together with the crystal frequencies have been interchanged, as have circuit board outlets 12 and 13 (with their respective labels WWV and 14·0). The labelling of D419 and D420 should also be interchanged, as is obvious if the X-ray view (fold-out from p294) is consulted.

Criticism of the *Operations Manual* may also be made when it comes to fault-finding because insufficient test voltages, particularly for ac levels, are given. It is believed that *Troubleshooting Guides* are available on request and some were obtained by G3WFB on direct request to Benton Harbor, Michigan.

In the reviewer's transceiver some lack of drive on the 28MHz band was corrected when the bandpass filter components were checked and C472 was replaced.

The overall response of output versus frequency was checked by plotting the voltage obtained across a Cantenna dummy 50Ω load when an audio signal into the microphone socket was varied across the passband. The response, so obtained, in the LO PWR position is shown in Fig 9 and as such has a reasonably flat top. The response when the pa stage was tested produced the curve shown in Fig 7 and was far from flat for the TRW transistors. Heath were unable to comment on this response even though copies were sent to Benton Harbor and Gloucester, but it is thought to have been due to instability and oscillations occurring. A similar test carried out on the HW100 at this station produced a very good flat-topped response shown in Fig 8. The responses were also tested using a pseudo-random noise generator and a spectrum analyser which verified the hand-plotted reponses. Adjustment of the hfo oscillator coils posed some difficulties as the adjustment of L403 of one turn clockwise from the peak voltage position only resulted in the oscillation stopping. The table listing these adjustment is on p237 of the *Operation Manual* and it was found that the coil slug for L403 could only be turned a quarter turn from the peaked position. The output from the oscillators varied between 0·25V and 0·15V when measured at the tp near Q402 (as described on p236). The lower voltage is below the value required in the manual of 0·2V dc.

The alignment of the upper and lower sideband frequencies readout posed some problems in getting the readings to be similar but the vfo modifications seemed to have overcome this (except that from cold the discrepancy may be as high as 600Hz difference on the digital display).

Appearance and general construction*

Photo 1 shows the frontal appearance of the SB-104 with the tuning control centrally placed. The knob may be spun quickly using the finger-hole. No conventional tuning scale is provided as the digital display takes its place. It is useful to have the vox gain and delay controls brought out on the front panel although it is the reviewer's experience that they are less frequently adjusted than the corresponding controls on a valve transceiver. AGC may be switched off altogether or operated in a SLOW or FAST position. In each of the operational positions the attack time is 1ms and the release time is respectively 1s or 100ms. FAST or OFF positions are preferable for cw operation according to the preferences of the operator and the quality of the incoming signal.

Photo 2 shows how each of the main circuit boards, housed in its own compartment, is completely screened from the others. The vfo box can be seen immediately behind the main tuning knob which is on the right-hand side of this photograph. The pass transistors for the 11V and 5V supplies can be seen at bottom right. Their corresponding integrated circuits are on the second circuit board behind (to the left of) the vfo. The integrated circuits driving the digital display are mounted immediately behind the flat seven-segment gas-discharge display tubes and can be seen at the top right of the photograph. The long spindle is that of the wavechange switch and this spindle passes through the screened compartment containing the 5 to 180V dc to dc converter supplying the display tubes. The converter itself is in another screened box which is well decoupled to prevent the 25kHz and harmonic hash from its oscillator getting into the receiver section. The DRIVER circuit board is mounted in the next compartment (top left) and on its own heatsink which is fixed to the main chassis wall by the metal stand-off pillars. The pa stage hybrid transformers are visible to the left-hand side of this compartment, and the pa transistors are soldered to this circuit board and their lugs are bolted to the large heatsink seen on the extreme left. Also fixed to this heatsink is the biassing diode (D1)—its connection can just be seen in the rearmost compartment behind the main circuit boards.

Photo 3 shows how the outrigger board enables each of the main circuit boards to be positioned so that measurements may be made when fault-finding or adjusting. The transceiver works more or less normally with a board in the outrigger.

** See front cover for Photos 1, 2 and 3*

Photo 4 shows a typical circuit board with the connection sockets which mate with male plugs fixed to the chassis. There are 24 of these on each of the main boards. The board shown is that for the carrier generator and contains the crystal filters. At the time the photograph was taken only the ssb filter was fitted. Plastic straps at each top corner of each board enable it to be withdrawn from its compartment using a screwdriver through each strap. Each board fits into a pair of guides attached to the sides of its compartment, also serving to earth the board effectively. Where extra earthing is necessary, such as on the TX I.F. PREDRIVER circuit board, then the appropriate screening cover on the board is earthed directly to its adjacent compartment wall using a spring clip.

Conclusions

Clearly this transceiver is conceptually ahead of its time and a pleasure to use. It has been in use at this amateur station for well over 18 months although not without major problems during that time. However, it has now worked consistently for the last 10 months with only one integrated circuit driver failing in the digital display. This resulted in one segment of one digit lighting permanently, and some care had to be taken during the time a replacement was awaited in order to interpret the frequency display correctly.

Should the output stage see a mismatch into the antenna or other load a control voltage is automatically generated which reduces the drive level. Experience has shown that the transistor output stage is less tolerant of mismatch than valve stages but so long as the output stage sees a vswr of no more than 1·2 : 1 it seems perfectly happy. Such a vswr has been achieved on the reviewer's cubical quad, even at the band edges, so that the instant QSY facility is truly available.

The ability to switch out the pa stage and to use only the driver with its 1W p.e.p. is very useful, since it reduces QRM to others, when conditions are such that propagation allows the use of the lower power—this is more often than the reviewer is sure most operators realize. The ability to switch all tuned circuits using just a single-wafer switch must in the long term reduce the failures often associated with mechanical switches carrying many wafers. There is no independent tune facility on this transceiver, but to the reviewer this is no disadvantage since he is inclined to the opinion that the independent tune facility leads to poor netting. Admittedly the facility does allow one to follow a drifting received signal, but then this uses more than one

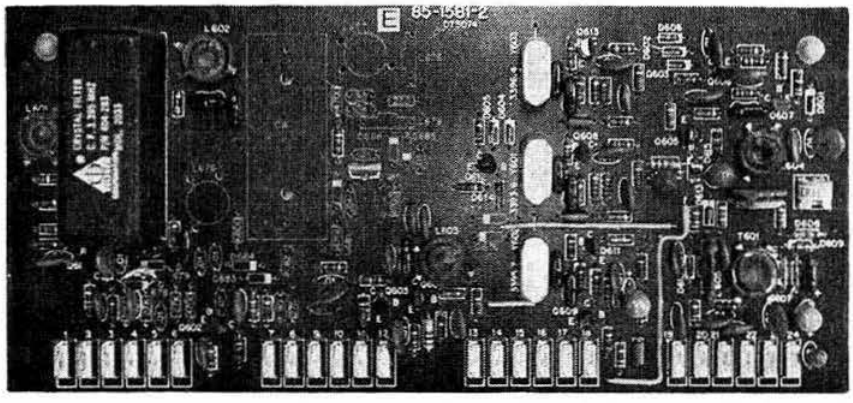


Photo 4. Typical circuit board

channel for two-way communication and no-one should use more bandwidth than necessary. For those wishing the facility, an external vfo is available, and additionally this allows split-frequency working which is perhaps a "must" for those working dx on 3·5MHz etc.

Since the CTC transistors and other modifications have been incorporated the audio quality has invoked much favourable comment from both local and dx stations. The receiver sensitivity is adequate for use with the antennas at this station but is outside the Heath specification. A signal of 1·8μV was required across the input terminals to produce a 10dB signal plus noise-to-noise ratio in the ssb mode. It would be a pity to have to introduce a pre-selector control to tune the receiver front-end but at times it is felt that it may be the only way to improve the sensitivity. The initial vfo drift was cured by the Gloucester factory changing many of the components, although when it was returned from the factory there was a discrepancy of some 600Hz when switching sidebands. This was cured by adjustment of the vfo after warm-up but even now the discrepancy can be 400Hz at switch-on in certain parts of the bands (it is not possible to compensate entirely with the present circuitry). Unlike previous SB-series transceivers the vfo is assembled by the kit-builder. The dial backlash although specified at 50Hz is often as much as twice this value.

The reviewer would criticize the lack of rf, ac and dc voltages available on the diagrams and in the handbook when fault-finding, but he understands that more information has been made available in the handbooks for such later transceivers as the HW-104. Also there has been no automatic follow up to advise purchasers of the modifications necessary to make the transceiver function correctly.

Many of the modifications only came to notice when speaking on the air to other amateurs. Even now the reviewer is not completely sure that the list of modifications he has compiled is exhaustive*. Having said that, whenever he requested the components to carry out these modifications they were always sent free of charge, so in that respect the Heath service remains as good as ever. Some of the minor "mods" have not yet been incorporated, such as the cure for the vox hang-up, since they have only recently been brought to the reviewer's attention.

Having had a series-pass transistor go short-circuit in the HP1144 power supply, which caused that rail voltage to go high, the reviewer can vouch that the transceiver will stand an over-voltage for a short period. Naturally he was quick to switch off when that happened.

If the vox gain is set too high then parasitics can occur on the tx audio board output. When the vox gain is set to a level compatible with the input signal the parasitics are not present. About 300mV p-p unclipped is required at terminal B11 for satisfactory audio.

Much dx is consistently worked with this transceiver and its cross-modulation performance has proved adequate under busy band conditions.

A project of this nature must not be undertaken lightly even by the experienced kit or homebrew expert unless he has rather more facilities available than average.

Acknowledgement

The author wishes to thank Mr E. Bell for taking the photographs used in this review. □

* Obtainable from the editor at RSGB HQ.

BOOK REVIEWS

Radio, TV & Audio Technical Reference Book, edited by S. W. Amos. 145 by 222mm; hard bound; price £24. Published by Newnes-Butterworths, Borough Green, Sevenoaks, Kent, TN15 8PH.

This is the fifth edition of this book, which was first published in 1954. It is intended to give an essentially practical account of modern developments in radio, audio and television. It is directed to the technical assistant, service engineer, radio amateur or audio enthusiast.

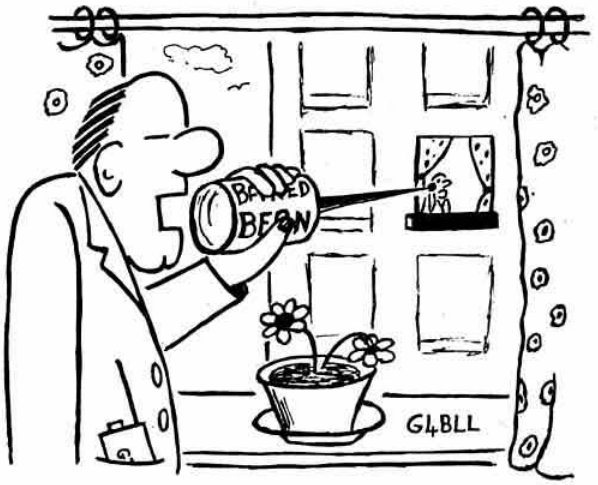
The material has been compiled with the help of 31 contributors, including B. J. Arnold, G3RHI, and three members of the Society's Technical and Publications Committee, ie Pat Hawker, G3VA; Robin Hewes, G3TDR; and Phil Horwood, G3FRB: all of them specialists in their particular fields. The 35 chapters cover the subjects indicated in the title, beginning from fundamentals. The editor, S. W. Amos, is well known for the books and articles he has written over a period of many years. Until his retirement in 1973 he was head of the Technical Publications Section of the BBC.

As one might expect from a book of this pedigree the layout and presentation of both text and diagrams are clear. The subject coverage is wide, and the book, within the limitation imposed by the price, will undoubtedly find a place on many bookshelves.

The International VHF-FM Guide by Julian Baldwin, G3UHK, and Kris Partridge, G8AUU.

Limp bound, saddle stitched, A5 size. Obtainable from the compilers at 41 Castle Drive, Maidenhead, Berks SL6 6DB. Price 90p including p and p. For European addresses the cost is nine IRCs, and outside Europe, 14 IRCs.

The new 1977 edition of this handy reference book runs to 65 pages. The format is basically the same as previous editions comprising a wealth of information regarding repeaters and reciprocal licensing. A problem experienced in the compilation of such a book is the constantly changing information but the editors have managed to produce a book that is up to date at this time.



Very effective, Fred . . . but I don't think you will get the CBers to accept it

technical topics

Pat Hawker, G3VA

ONE of the fascinations of radio and electronics is that, even now, almost a hundred years after it all began, it is very dangerous to be too certain or too dogmatic about almost any facet of design technique or mode of transmission. When I hear or read somebody laying down the law that such and such is the *right* way to do something or other I usually cringe. For it reminds me of those over-simplified beliefs of times past—"double-conversion superhets are better than single conversion" (nowadays you can be equally dogmatic in putting it the other way round), "you had better get your swr down or otherwise most of your rf power goes back into the transmitter" (what does it do there?), "fm or ssb or a.m. is better than a.m. or fm or ssb", "a frequency synthesizer is better than a free-running vfo" etcetera.

Even in the less controversial areas it is usually essential to qualify the statements—better than what? better for what? better at what cost? and better for how long? New devices and components can quickly swing the technical debates from one side to the other. What really matters is "does it work well under present-day conditions?"—and if so, why? The only thing certain in life is death; the only thing certain in radio is that we live in an age of uncertainty. And long may it remain so.

More on the Droitwich standard

The March *TT* presented a precision frequency standard using an extremely simple 200kHz receiver and signal processor, as described by G. van den Broek in the Dutch journal *Electron*. This design has attracted considerable interest and although it appears that there were some errors in the diagrams of the electronic switch (March Fig 2) and the divider chain (March Fig 3), the stunning simplicity of the receiver section (March Fig 1) remains unchallenged.

However, it is felt that the very brief description in March may have left some readers wondering how such a simple arrangement can not only receive Droitwich but can also perform the much more difficult task of stripping off the modulation so as to provide an effective, harmonic-rich, pulsed output.

This month, thanks to Harry Bradshaw, G3VTJ, some of the missing details can be filled in. For it so happens that G3VTJ has for some time been working along similar lines and had originally intended to "write-up" this work in detail, although this task was delayed by business commitments. He now feels that the Dutch unit is sufficiently close to his own work as to make a full-length article redundant, but that readers may be interested in some explanatory notes.

He stresses that much of the complexity in earlier Droitwich frequency standards stemmed from the need for some tricky signal processing to eliminate as much as possible of the original modulation on the broadcast station. This had led him to investigate the use of consumer ICs incorporating limiting amplifiers and intended for use in domestic fm broadcast receivers. Like the Dutch listener this had drawn him to the TBA120 series of devices: as described with circuit details by J. R. Hey, G3TDZ, in *Radio Communication* (September 1972, pages 592–594), these devices incorporate a series of high-gain limiting amplifiers based on long-tail pairs followed by a balanced coincidence detector. Available types include the TBA120A Siemens devices and the Mullard TBA120S series which have the advantage of extra limiting stages. He confirms the Dutch work that such devices will successfully process the signals and allow them to be used as a frequency standard.

The important thing is to make sure that the tuned circuit is really tuned to Droitwich (and not, for example, the strong Allouis French long-wave station on 164kHz). His receiver uses a preliminary rf stage in front of the TBA120 and uses a ferrite-rod taken from an old portable radio with the mf winding removed and a miniature ift padded up with a 500pF fixed capacitor to provide the coupling between the rf stage and the TBA120. In initial setting up it is useful (but not essential) to use a 200kHz signal generator or to use a diode detector probe with af amplifier to tune to Droitwich. At low signal levels audio appears at the output of the TBA120 although severe distortion will be noticed as soon as the limiters really begin to take effect. Whether an rf stage is likely to be needed probably depends mainly on the efficiency of the ferrite rod as an lf antenna and the location (it would, of course, be possible though less convenient to use a tuned circuit with an external wire antenna).

In his original plans, G3VTJ had intended to have a local marker oscillator at 10MHz by using a phase-locked-loop ic (NE562B), dividing the 10MHz output by 50 to 200kHz by using two SN7490 devices and then comparing this with the 200kHz Droitwich signal: with a further divide-by-two device so that he could have outputs at 100kHz, 1MHz and 10MHz. He considers that a hf marker is often an asset when setting up the clock of a digital frequency meter etc.

However, his efforts to obtain a solid lock at 10MHz proved unsuccessful despite the investigation of possible earth loops and the incorporation of isolation, decoupling etc. He soon realized that an alternative approach would be to extract the fifth or third harmonic of the output of TBA120 in successive operations, using further TBA120 devices and modified Toko IFTs for coupling, and so obtaining 1, 5 and 15MHz outputs. The TBA120 incorporates an "af amplifier" stage and this was found to provide gain at 200kHz; the IFTs for 5 and 15MHz were based on 10·7MHz transformers. Of course, for some applications the direct 200kHz output, as in Fig 1 of the March issue, is all that is needed to provide markers, so that even the simplest unit can provide the most accurate checkpoints ever likely to be needed!

On the general subject of precision frequency standards, interest is being shown both by professionals and amateurs in the USA in using television oscillators controlled by the bursts of colour sub-carrier of broadcast television signals, which in the USA are based on an atomic standard; for example see *Electronics* (11 November 1976, pages 114-115), *73* (February 1977) or the April issue of the *Cheltenham RSGB Group Newsletter*. I feel it should be said that in the UK (where the sub-carrier frequency is 4·43361875MHz and is maintained to better than ±1Hz except during relays of programme material from overseas) this technique is less

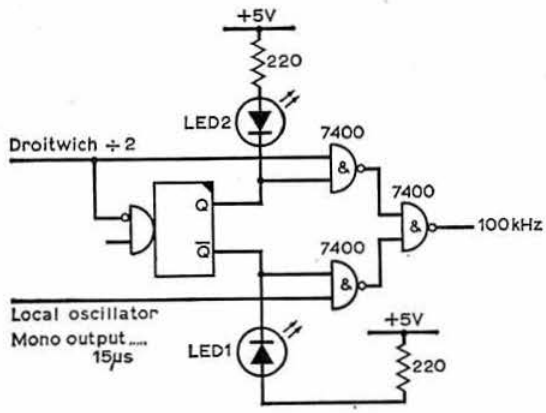


Fig 1. BRS37312 suggests this modified logic circuit for switching in the local 100kHz oscillator when Droitwich is off the air (see March *TT*). LED1 lights when output is from Droitwich; LED2 when output is derived from local oscillator

attractive than using Droitwich. This is partly because it is my understanding that the BBC use Droitwich to keep their sub-carrier accurate; so it is surely better to go straight to the original source without the need for a colour tv receiver, locked by bursts, from which to extract the signal! It is, of course, a valid system for those not having access to Droitwich.

It was mentioned earlier that Figs 2 and 3 of the March *TT*, although reproduced as in the original Dutch article, appear to contain errors. C. J. Bristow, BRS37312, writes:

"I think there must be some confusion over the logic elements in the electronic switch. In the presence of the 200kHz signal the gated mono output will be logic 0, ignoring positive spikes due to gate delay. Thus the upper NAND gate will be enabled via the inverter and the lower NAND gate will be inhibited and thus its output will be logic 1. However, this logic 1 will force the output of the NOR gate to logic 0 and the 100kHz signal will not be transmitted. The two led displays show slips of the pen. May I suggest Fig 1 as a means of overcoming the shortcomings and also reducing the pack count. The 74123 is re-triggerable, hence the 15μs output enables the Droitwich signal to be transmitted normally. Loss of signal allows the mono to relax, switching the local 100kHz oscillator to the output."

John Young, BRS33339, points out that in the divider chain of Fig 3 (March) the counter/dividers shown are used with the divide-by-five section preceding the divide-by-two section. Although the final result (1Hz) is the same, the intermediate outputs should be as shown in Fig 2.

On the subject of divide-by-n use of 7490 devices, BRS-33339 has also unearthed two errors in the table given in

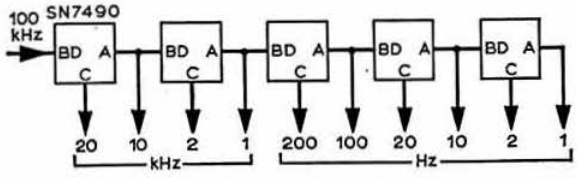


Fig 2. Corrected divider chain for precision frequency standard used with "huff and puff" stabilizer etc

November 1976 *TT*. One error was of my creating, the other appears in the original *Electronics* write-up and also affects the diagram. Briefly the connections for divide-by-eight should be: Pin 12 to 1; 11 to 2 and 3 and *not* Pin 12 to 1 and 2; 11 to 2 and 3. The divide-by-eight connections are correctly shown in the calibrator in the March 1976 issue.

However, the divide-by-seven arrangement in both the table and diagram of the *Electronics* article is wrong, as BRS33339 discovered by accident. What is shown as divide-by-seven is in fact an alternative arrangement for divide-by-six. BRS33339 gives the divide by seven connections as: input pin 1; output pin 11; pin 11 to 14; pin 12 to 2; and pin 8 to 3.

And more on that Russian mixer

In the April *TT*, attention was drawn to a novel mixer/product detector arrangement for use in direct-conversion receivers, originally described by V. Polyakov (Pliakov), RA3AAE, in *Radio* (December 1976). At the time I mentioned the problem presented by the Russian text and made it clear that my brief comments were written in more than the usual fog, relying on the circuit diagrams to tell the story.

Thanks to the valiant efforts of two RSGB members, Sid Dunn and J. Lekesys, G4BYW, I now have before me two excellent translations of this article. These make it clear that the operation of the circuit and its aim is by no means in accordance with my initial impressions. On the other hand, they do fully justify my belief that the Russian amateur has come up with a useful circuit that well merits further investigation, not only for its application as a product detector for direct-conversion receivers but also (as RA3AAE points out) as a mixer for vhf receivers (where the halving of the frequency of the local oscillator is particularly attractive) or possibly as a substitute for a balanced modulator in an ssb exciter.

RA3AAE considers that direct conversion receivers are extremely attractive for amateur use but have three main disadvantages: (1) double-sideband receiver (unless an ssb phasing demodulator is used); (2) direct envelope demodulation of powerful signals (often particularly troublesome on the 7MHz band); and (3) local oscillator radiation unless an rf stage is used. Both (2) and (3) can be minimized by the use of a good balanced or double-balanced mixer/product detector, but there are many factors that make it difficult for home constructors to achieve good balance over a wide frequency range (packaged double-balanced mixers of good performance are increasingly available as complete units but are still quite expensive in terms of direct-conversion receiver costs).

RA3AAE's detector then is intended to provide an alternative to a balanced mixer by using diodes providing the voltage-current characteristic shown by the solid line in April's Fig 1. This is, in effect, a symmetrical cubical parabola and can be achieved with two diodes, preferably selected for matching, connected back-to-back. Rather surprisingly RA3AAE uses silicon diodes, though as Sid Dunn points out this is odd at low signal levels unless the switching action of the local oscillator effectively removes the "dead" zone near the origin of a silicon diode characteristic.

The operation of the mixer is described by RA3AAE as follows: "When the local oscillator voltage goes through

zero both diodes are open circuit, and the circuit current vanishes. At the peaks of both positive and negative half-waves of this voltage, one or other of the diodes conducts and the signal source is connected to the load.

"In this way the mixer works like a switch closing the circuit at a frequency equal to twice that of the local oscillator. When the switching frequency ($2f_{LO}$) is close to that of the signal frequency (f_S), a beat appears in the circuit of the difference frequency ($2f_{LO}-f_S$) when the signal frequency is less than twice the local oscillator frequency; or (f_S-2f_{LO}) when the signal frequency is higher. This represents the lower and upper sidebands respectively.

"For mixers with cubic characteristics, two significant properties emerge: first, the local oscillator must be tuned to a frequency one half that of the signal; second, in the load circuit there is no direct current (ie signals from powerful interfering stations are not detected and consequently produce no noise). This clearly is only true for a strictly symmetrical characteristic . . . nevertheless in practice it appears simpler to guarantee 'ideal' characteristics for two back-to-back diodes than to achieve an accurate balance of a mixer having several elements. Radiation of the local oscillator voltage from a mixer is much attenuated with an input circuit tuned to twice the frequency of the local oscillator (although second harmonic content will not be similarly attenuated).

RA3AAE points out that the advantage of his Fig 3 (April) over the simpler scheme of Fig 2 (April) is that it overcomes the loss of signal power in the coupling to the local oscillator: this drawback is avoided by using the "balanced" arrangement using two cubic elements (ie the four diodes).

Yet a further practical advantage of having the oscillator operating at half the signal frequency is that the receiver input circuit does not "pull" the oscillator frequency when it is tuned: stability of the oscillator can be improved by the use of larger tuning capacitance, and in turn this will improve the note of cw signals and the reception of ssb stations.

Background to harmonic mixing

It has also become clear that the RA3AAE form of third-order, second-harmonic mixer/demodulator is not new—in fact readers have supplied references to harmonic mixing stretching back to a 1958 Russian article and provided evidence of current, very lively interest in this approach, particularly for microwave applications. For example, Tony Goacher, G3YBJ, has sent along a copy of a paper "Harmonic mixing with an antiparallel diode pair" by M. Cohn, J. E. Degenford and B. A. Newman (*IEEE Trans on Microwave Theory and Techniques*, Vol MTT-23, No 8, August 1975, pp 667-673), which not only provides a detailed mathematical analysis of this interesting circuit configuration but also reports on experimental microwave mixers for 4 and 12GHz. Fig 3 shows the basic principle. Apart from the useful feature that the local oscillator source for second harmonic mixing need be at only about half the signal frequency, the following features of this mixer are underlined:

(1) Reduced conversion loss to other harmonic mixers by suppressing the fundamental mixing products.

(2) Lower noise figure through suppression of local oscillator noise sidebands.

(3) Suppression of direct detection.

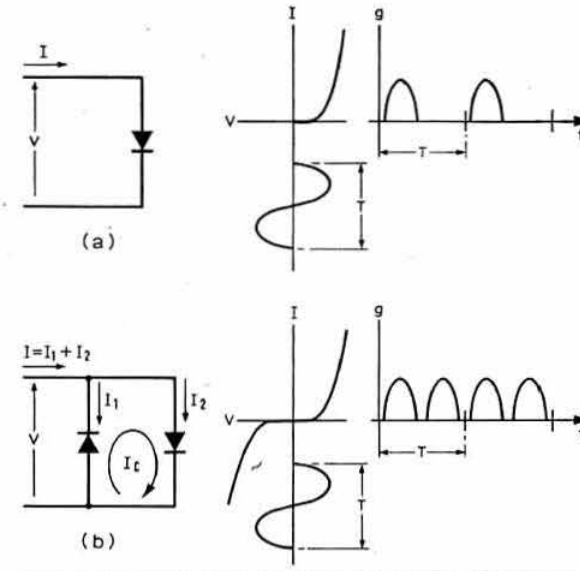


Fig 3. Basics of harmonic mixing: (a) shows the conventional diode mixer while (b) shows an anti-parallel diode pair mixer

(4) Inherent self-protection against large peak inverse voltage burnout.

These results are obtained at microwaves without the use of either filters or balanced circuits employing hybrid junctions. It is shown that conversion loss of this type of mixer can be approximately the same as when the same diodes are used for a conventional fundamental mixer. Schottky GaAs diodes are used in the experimental mixers and, for example, an 8dB total conversion loss was achieved at 12GHz, comparable to that obtained by fundamental mixing. These figures suggest, it seems to me, that this approach could not only be well worth investigating for amateur 10 or 24GHz receivers but also for the 12GHz receivers that one day may be part of the ordinary domestic scene for the direct reception of television programmes from synchronous satellites (in Europe these are planned to be located in the band 11·7-12·5GHz).

G. Franklin Montgomery, W3FQB, also draws attention to a number of early references to harmonic mixers but notes that relatively small attention has been paid to them. He considers the principal idea is that by arranging pairs of diode rectifiers properly, and by controlling the diode conduction angle at the heterodyne reference frequency, it is possible to emphasize the response to a signal at any chosen integral multiple of the reference frequency while suppressing responses to signals at other multiples. For instance, the circuit used by RA3AAE is responsive only to even multiples of the reference frequency; similar but balanced diode circuits can be made similarly responsive only to odd multiples of the reference, including the multiple unity. A mathematical analysis is given in "Phase-sensitive detection with multiple frequencies" by B. O. Pederson, *IRE Trans on Instrumentation*, vol 1-9, No 3, December 1960, pp 349-355.

He mentions that for a time in 1961 he used successfully a 7MHz direct-conversion receiver consisting of a demodulator essentially the same as Fig 2 (April) operating directly

from the antenna tuned circuit and followed by a three-stage valve amplifier with headphones. Particular advantages were a relatively small oscillator voltage appearing in the antenna circuit at 3·5MHz and, relatedly, little or no reaction on the reference frequency when making antenna adjustments, tuning the signal frequency circuit or from strong signals. No buffer was used between the local (reference) oscillator and demodulator. However, he adds:

"I see in the RA3AAE diagrams no direct-current loads for the diode rectifiers. In general, each diode needs a bypassed resistor in series with it to accommodate the steady back-bias generated in response to oscillator drive. This provision will make the circuit behaviour less sensitive to changes in reference level and probably less sensitive to small differences in diode characteristics (the dc loads also affect conduction angle in the event that one is trying to optimize for a particular frequency multiple as discussed by Pedersen). It is worth noting that if we had ideal diodes in the sense of their having zero forward resistance and zero reverse conductance, then omitting dc loads would make all such circuits completely inoperative."

The RA3AAE circuits also attracted the attention of Brian F. Rose, G3ULR, who promptly quizzed an English-speaking Russian amateur by rtty for further details of the original article, and one result was that he quickly modified a 7MHz direct-conversion receiver for the 14MHz band, achieving a receiver in every way as sensitive as the original, and attractive enough to be kept for portable QRP operation. In effect the receiver consists of the Fig 3 (April) demodulator followed by a CA3002 at low current, second CA3002 and CA3030 output ic. However, if no antenna filter is used he does find 7MHz signals are sometimes demodulated, although this can be overcome by using a preselector in front of the receiver.

Oscillators using 555 devices

Many circuits have been published using the well-known 555 timer ic as an oscillator, but Richard J. Harris, G3OTK, points out that nowhere has he seen any mention of the fact that under certain conditions 555 oscillators do not! He writes:

"Generally, this malfunction seems to occur when the supply is switched on, although once persuaded to oscillate they carry on quite happily. A couple of years ago, after a colleague and I had spent several days trying to get to the bottom of this problem, I telephoned the makers. They obviously knew about the problem, described the reason for the failure to oscillate, and suggested cures.

"The condition results from the design of one of the voltage comparators and could be changed by a single change in chip layout; in fact the LM555 from National Semiconductor appears to incorporate this change but apparently those from other manufacturers do not.

"The recommended cure by the makers was to put a diode or high-value resistor in series with the connection to pin 2 of the 8-lead dil pack. Although the timing error drift of the basic 555 is quoted as 50ppm/°C, adding such a diode ruins the otherwise good temperature stability; not the most helpful of suggestions!

"To retain the good stability and yet ensure a ready start, I have devised the circuit shown in Fig 4. To ensure that the oscillator starts every time, R2 and R3 are chosen so that the potential at pins 2 and 6 exceeds 0·5V even when the transistor connected to pin 7 is saturated. The formulae for frequency of oscillation and duty ratio are, however, rather more involved than the simple ones quoted for the conventional circuit."

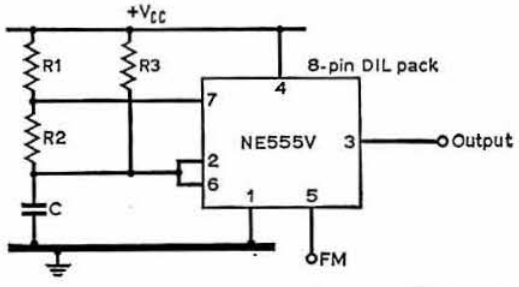


Fig 4. G3OTK's suggested "sure-start" 555 oscillator circuit

Receiver imd and crystal filters

Peter E. Chadwick, G3RZP, who has spent several years working on the design of high-performance professional receivers, adds some pertinent comment to the general question of dynamic range and mixers (see *TT* May 1977, pp 374-375). He points out that these days it is fairly easy to achieve the sort of intermodulation distortion (imd) performance you want—*until you add a crystal filter.*

He writes: "We all like to think that quartz crystal filters are passive, linear, reciprocal, two-port networks. In practice they are two-port and passive; but they are far from linear or reciprocal! Typically an hf ssb crystal filter will have an intercept point of +15 to +18dBm. Turning it round will often alter the intercept point. The imd products in the passband are more of a problem than those removed by 10 or 20kHz. About 15 to 18dBm is typical for a well-known 9MHz ssb filter at this spacing. One well-known manufacturer has found it necessary to select his roofing filters (about 30MHz) for their imd performance. It may be necessary to pay around £70, even in bulk quantities, for a filter with a specified imd performance.

"This means that it is not too difficult for a designer to end up with the filters (rather than the mixer or rf stage) proving a limiting factor for the overall imd performance. A

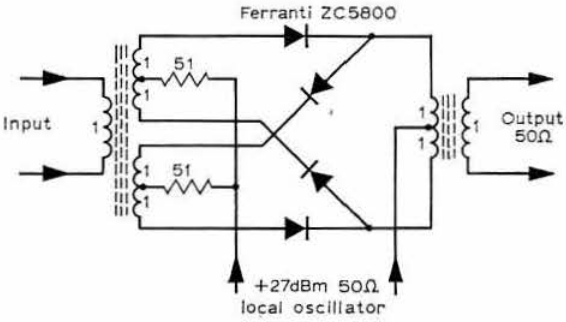


Fig 5. G3RZP notes that a Schottky quad-diode mixer of this type can, with 27dBm oscillator drive, give a +37dBm third-order input intercept for excellent imd performance. Any Schottky diode will work but G3RZP prefers the Ferranti ZC5800 devices. The transformers can consist of about five turns each winding marked 1 on FX2236 GEC MM621 red material or F8, although almost anything will work but might make 1 or 2dB difference

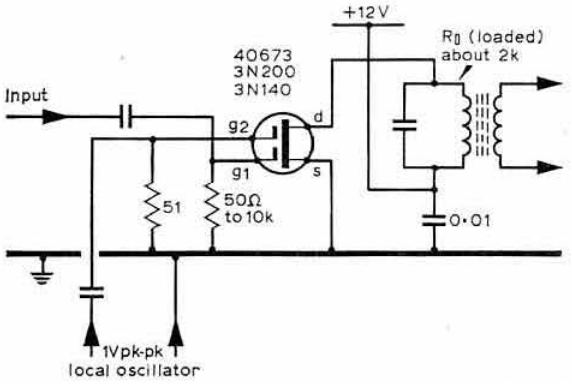


Fig 6. Dual-gate fet mixer can have a third-order input intercept point of about +25dBm, a gain of 0 to 1dB and a noise factor of around 6dB. However, it is very susceptible to a.m. noise on the local oscillator drive

good-quality Schottky-diode mixer such as that in Fig 5 can, with +27dBm of oscillator drive, provide a +37dBm third-order input intercept point. Even a dual-gate mosfet mixer (Fig 6) can give about +25dBm intercept but is *very* susceptible to amplitude-modulation noise on the output of the local oscillator.

"From my own experience I would recommend a low-noise bipolar transistor of the type developed for catv (wire-distribution television systems) as an rf amplifier: such as the 2N5019 or BFW17 or BFW17A. If this is run with about 20mA collector current, with some un-bypassed emitter resistance (about 22Ω) you can get adequate gain to allow you to use a Schottky-diode mixer, as in Fig 7.

"I have tried a quad-fet mixer basically similar to that used by ex-G3VBZ (May *TT*) and was unimpressed. One of my engineers spent two months working on it and we found it possible to get a good noise/gain figure or good imd performance, but not both at the same time. We did achieve about 2dB of conversion gain, 25dBm intercept point with about 7dB noise figure as a practical arrangement. The measurements reported by G3VBZ are a little better than I

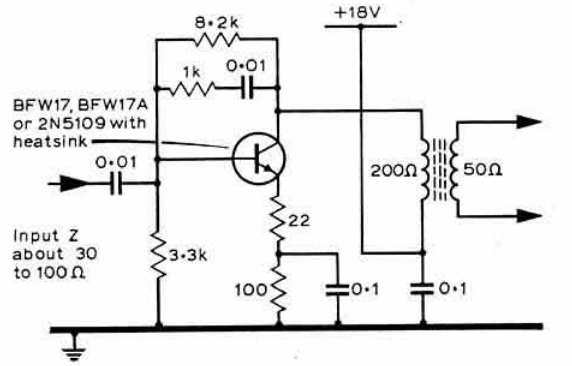


Fig 7. RF amplifier of wide dynamic range using a CATV-type rf power bipolar transistor which will provide enough gain to allow the use of a Schottky diode mixer without loss of sensitivity on the higher hf bands. Increasing the unbypassed 22Ω emitter resistor decreases gain but improves the imd characteristics. Note the requirement to use a heatsink since a collector current of around 25mA is desirable

would expect. My own HW101 has an input intercept point of about +4dBm (incidentally very much better than some FT101 or Atlas transceivers) and a noise floor of about —127dBm (—20dB on 1μV pd).

"For high-performance receivers one of the most important points after imd is the question of reciprocal mixing due to oscillator sideband noise, and here the trend towards frequency synthesizers does not help. I have heard one disillusioned developer refer to a synthesizer as 'a very powerful machine: produces all frequencies at least once, and generally more than twice—simultaneously'. So, for me, the phase-locked loop is treated with some suspicion and I seek from their advocates the answers to awkward questions such as their phase noise, noise floor, comparison frequency sideband levels and the like!

"One final point I would stress—do not be so carried away by the 'broadband' concept as to do without signal filtering at rf before the mixer. Some calculations by one firm indicated that a rhombic pointing towards Europe could provide *1W* output during the night! That figure comes from summing all the strong signals from 1 to 30MHz. Two or more tuned signal frequency circuits are still a good idea. Put some selectivity in front of Fig 4."

As we mentioned in May, there is still a lot of controversy in the area of receiver design and G3RZP's comments are well calculated to stir up some strong feelings! But from my reading of the situation they deserve to be taken very seriously indeed. I suspect that part of the problem with crystal filters are the ferrites used in the transformers of half-lattice filters.

Up the cycle

Few people listening on 21 and 28MHz during the latter part of May can have been left in much doubt that we are now at last heading quite rapidly towards the next sunspot maximum. What is still exercising many people is just how high that maximum is likely to be. In the April *TT* it was noted that after many pessimistic forecasts predicting a pretty low maximum for Cycle 21 an increasing number of experts are taking the opposite view and talking of a peak that could approach that of 1958.

Michael Faulkner, G3IZJ, has noticed that the "predicted" sunspot numbers issued by the American National Bureau of Standards have changed during the past few months (confirming my long-held view that predictions based on extrapolation of past data need constant up-dating and should always be taken with a pinch of salt). For example, in July 1976 the predicted sunspot number for January 1977 was given as 6·2 as shown as part of Cycle 20. But the February 1977 predictions gave the January figure as 15·2 and placed it firmly in Cycle 21. This bulletin indicates that we may reach a smoothed sunspot number of 50 by September this year and indicates a maximum of 141·4 by July 1979 (compared with a Cycle 20 maximum of 110 during 1968-9).

One result of these changes, as G3IZJ comments, is that many published predictions, including those in *Radio Communication*, are tending to underestimate significantly the number of openings per month and the duration of the dx openings on the higher hf bands. Certainly if you have taken your 28MHz antenna down in despair in recent years, now is the time to get busy. This autumn may well see 28MHz truly open and give us a taste of American cb activity these days on 27MHz.

Double-delta array

The April 1977 issue of *Old Man* reprints from *CQ Magazine* a short note by J. B. W. Jackman, ZF1MA, on a "ZF1MA Special" or double-delta beam. The antenna consists of two similar triangular loops each 69ft 9in in overall length: see Fig 8. It is stated that "both loops are coupled very closely by passing the loop of the driven side through the undriven side . . . The support boom can be made from any type of material: wood, bamboo, aluminium, pvc tubing etc. Nylon fishline was used for guying . . . On 28, 21 and 14MHz 75Ω cable provides a good match; however, on 7 and 3·5MHz a 'transmatch' is recommended."

ZF1MA makes strong claims for the effectiveness of this system. However, I am a little puzzled at his "boom" dimension of 20ft, as with the other dimensions indicated one would expect this to be 25ft, as shown in the redrawn diagram.

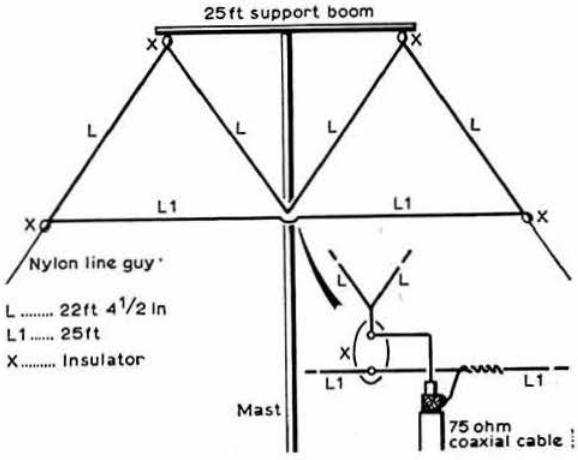


Fig 8. The "ZF Special"—a double-delta arrangement used by ZF1MA. See note in text on boom dimensions

Counters with receivers

While some of us have certain reservations on whether amateurs really *need* digital displays built into their receivers, there is no doubt that the technique is proving an attractive sales feature—and does have real value; for example, for those who listen on the hf broadcast bands. Of course what most of these digital displays indicate is the frequency to which the receiver is tuned, and it should be appreciated that for ssb and cw reception that is not quite the same thing as the frequency of the transmission; to arrive at this you need to take into account the question of usb/lsb or the beat note of the cw signal. For this reason there is little point in providing calibration displays with less than 1kHz steps.

When it comes to providing such displays the usual technique is to measure the frequency of the vfo, applying the necessary correction for the intermediate frequency. This is fine where the vfo tunes in the same direction as the signal frequency. But with many of the current generation of double-conversion receivers with crystal-controlled hf oscillator, reverse tuning is used; that is to say that as one tunes *up* the band, the vfo is in fact tuning *down* in frequency.

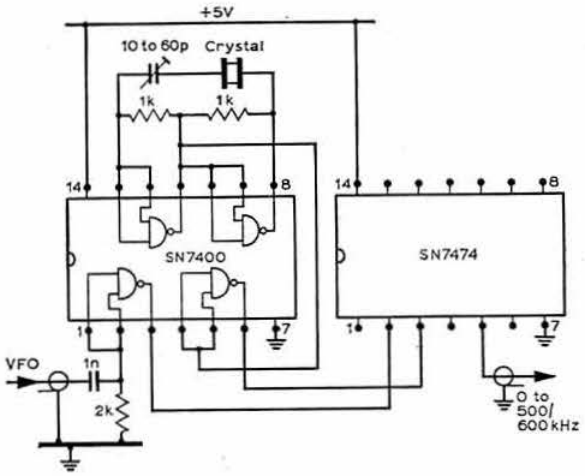


Fig 9. Subtractive (difference) digital mixer (SN7474) used as basis for a calibration read-out from an existing receiver in conjunction with a simple digital counter. This arrangement is suitable for use with receivers having a one-range vfo with reverse tuning

Is there any way in which an external frequency counter, now found in many shacks, can be connected up to one of these receivers and induced to provide a direct display of the kilohertz calibration in each band?

The answer, according to F. H. Flanter, ZS1FX, (*Radio-ZS*, March 1977, p8), who in turn acknowledges *CQ-DL* as his source of inspiration, is in the affirmative—at the cost only of two ttl integrated circuits, a crystal and a few resistors and capacitors. It is usually possible to obtain a few milliamps at a reasonably stable 5V from an existing supply, either directly or from a voltage-dropping resistor and suitable zener diode.

To put together the digital adaptor, which is in effect a subtractive digital mixer, it is necessary to know the vfo tuning range and to confirm that this is reverse tuned. For example, many Trio equipments use a reverse-tuning range of 5,955 to 5,355kHz or 5,500 to 4,900kHz; some Yaesu receivers use 8,900 to 8,400kHz and some 9,200 to 8,700kHz etc. The essential requirement is a crystal for the frequency of the vfo which tunes the receiver to 7,000, 14,000, 21,000-kHz etc.

One input to the digital mixer is taken from the vfo in the receiver; the other is provided by the crystal oscillator. When the two inputs are identical the subtractive mixer produces zero frequency output; tuning the receiver up the band results in an output from the digital mixer steadily increasing in frequency in step with the decreasing vfo frequency. If the vfo is tuned to receive on 14,300kHz the digital mixer provides a square-wave output of 300kHz which is fed to the counter to provide a display of 300 (the megahertz being indicated by the band to which the receiver is tuned).

Fig 9 shows the circuit arrangement. Two gates of a standard 7400 ic are used in a familiar crystal oscillator arrangement with the output passed through a third gate for shaping and isolation. This output then goes to the C1

(Continued on p541)

4-2-70

Graham Knight, GM8FFX*

"Firsts" and "longests"

The request for information under the above heading to be sent to G5UM did not go unheeded. From the Isle of Man GD2HDZ has come up with a list of no fewer than 40 firsts from the island, including the believed first-ever 144MHz contact made by GD3DA/P with G3GMX as long ago as July 1951. Of special interest are the uhf claims by GD2HDZ with GI, HB and PA in July 1976 and October 1975. Arthur modestly does not provide any news of "firsts" on 70MHz of which he must surely hold several; G5UM is writing for further information in respect of that band.

Who, during last year's phenomenal lifts, was the first to work Malta on 144MHz? Can anyone better the claim of G3CHN who worked 9H1CD on 23 June 1976? It is believed that GC8AAZ was the first Channel Islands station to work Malta (again 9H1CD) in the same month. Members who worked the super dx last year are asked to check logs in case they may have established either a "first" or a "longest". G3CHN is believed to have established the European record for an auroral contact (YK to LP locator squares) when he worked UP2BBC on 23 March 1976 at a distance of over 1,900km.

All claims for any mode on any band above 70MHz to Jack Hum, G5UM, QTHR.

Amplitude modulation for sporadic-E

A sporadic-E opening was noticed by GM8FVX in Aberdeen at noon on 26 May when stations from Portugal were heard on the 100MHz fm broadcast band. No 144MHz sporadic-E signals were heard in Scotland but DC1XC in Hamburg worked RB5EHT in QTH locator RI45D at 1649gmt. DK1KO worked UY5RQ (also in square RI) on cw at 1700gmt. DC1XC also monitored YO2IS calling SM3AKW at 1400gmt. Hartmut, DC1XC, says he was glad to be able to transmit on a.m. as this was the only mode available to RB5EHT in the Ukraine.

Amplitude modulation and the all-mode section

Many people have been forecasting the death of a.m. as a mode for 144MHz for a few years now, but judging from the number of correspondents who mention a.m. activity the mode refuses to die. If anything, the number of stations on a.m. is increasing—many are operating in the all-mode section between 144·525MHz and 144·900MHz. Malcolm Cummings, G8KPN, in Ealing agrees wholeheartedly with the VHF Committee recommendation that fixed stations use this section of the band. He mentions that there are over 500 G8 stations in the London area alone and he hopes that many of them will sometimes QSY into the all-mode section. There is a great deal of a.m. operation in the Edinburgh area with more than 30 operators equipped for the mode. GM4FFI is the callsign of the George Heriot's School Radio Club, and Ian McKenzie, GM4DXV, the club secretary, reports on many a.m. contacts. Recent QSOs from Scotland on a.m. include G4ATI/P in QTH square XK in Cornwall and several LA and PA0 stations.

John Tye, G4BYV, in Norfolk has worked 868 different stations on 144MHz using 15W of a.m. from the "2N4" transmitter described in the *Radio Communication Handbook*. Proof indeed that a.m. is still alive and still being used as a dx mode.

Repeaters

Four new proposals for 144MHz repeaters have been received by the RSGB and are presently being vetted by the Repeater Working Group and the VHF Committee. The callsigns requested are: GB3AR (Arfon, North Wales); GB3FR (Mavis Enderby, Lincolnshire); GB3HS (Humberside); and GB3WH (Abingdon, Oxfordshire). A further 144MHz proposal is awaited from the Perth & District Group.

The Grampian Repeater Group received the licence for GB3GN at the beginning of May. The repeater which will have an output frequency of 145·775MHz is expected to be on the air soon from the IBA site just south of Aberdeen. The Grampian Group has recently doubled its membership and further details about GB3GN can be obtained from the project manager GM3HAT. GB3GN is licensed for 40W erp to an omni-directional antenna.

Graham Smith, GM3SNO, sends details of improvements made to GB3CS—the Central Scotland 144MHz repeater. Experiments were carried out with a preamplifier in the repeater receiver using an SD306 transistor (as previously recommended by *4-2-70*). A 15V zener across the supply takes care of any spikes on the line and the rf input is diode protected. Tests showed a considerable increase in receiver sensitivity but also some slight intermodulation from strong local signals on 145·45MHz (third order). Extremely strong signals on 145·55MHz also caused some problem (fifth order). The level of the GB3CS carrier at the pre-amplifier output was 25μV and the intermodulation was occurring in the receiver mixer. This meant that notch filtering was not required before the preamplifier, only between it and the receiver; much more convenient as the filter could be fitted at ground level saving GM3SNO another 400ft climb!

Chris Morcom, G3VEH, gave a talk at Alexandra Palace Convention entitled "Repeaters—where are we going?"; surprisingly, only 27 enthusiasts attended. A lively and interesting discussion took place with emphasis being put on rtty and microwave repeaters. One operator spoke eloquently of future mobiles having video display units fitted to cars. Perhaps this is a trend as the "Data transmission at vhf" lecture attracted 90 people.

Simplex fm frequencies

As a calling frequency, 145·0MHz has been used for a long time, but with international agreement this is now a repeater input frequency and is widely used on the Continent. Recently there have been extended periods of lift conditions

►

This diagram shows the frequency bands that are allocated to the amateur service above 70MHz in the countries forming part of the Region 1 division of the IARU. In most cases the information has been provided by the national society of the country concerned. It should be noted that the only exclusive amateur bands are those at 144MHz and 24·0–24·05GHz

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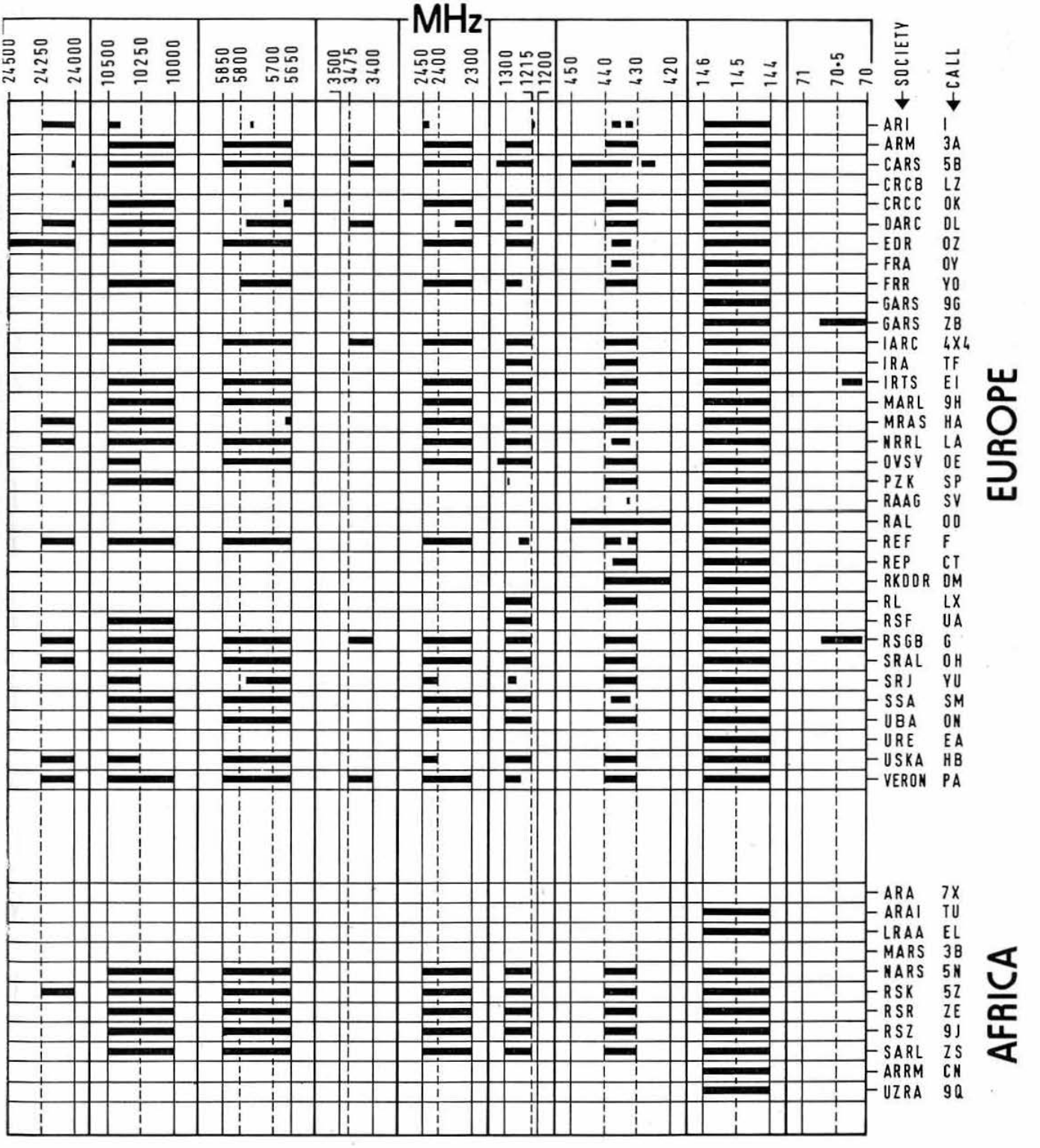
MHz
24500
24250
24000
10500
10250
10000
5850
5800
5700
5650
3500
3475
3400
2450
2400
2300
1300
1215
1200
450
440
430
420
146
145
144
71
70·5
70
SOCIETY
CALL
ARI I
ARM 3A
CARS 5B
CRCB LZ
CRCC OK
DARC DL
EDR OZ
FRA OY
FRR YO
GARS 9G
GARS ZB
IARC 4X4
IRA TF
IRTS EI
MARL 9H
MRAS HA
NRRL LA
OVSV OE
PZK SP
RAAG SV
RAL OD
REF F
REP CT
RKDDR DM
RL LX
RSF UA
RSGB G
SRAL OH
SRJ YU
SSA SM
UBA ON
URE EA
USKA HB
VERON PA
ARA 7X
ARAI TU
LRAA EL
MARS 3B
NARS 5N
RSK 5Z
RSR ZE
RSZ 9J
SARL ZS
ARRM CN
UZRA 9Q
EUROPE
AFRICA

and both mobile and fixed stations in the UK have caused problems to a number of European repeaters. British operators are advised by the VHF Committee that 145·0MHz should not be used as a simplex frequency. All of the fixed station contacts taking place on this frequency could easily move into the all-mode section.

An extremely popular fm simplex frequency in the UK is 433·2MHz, in particular many Raynet groups advocate the use of this frequency for local exercises and real emergencies. It may be allocated to transportable Raynet uhf repeaters, always assuming these can ultimately be licensed. The VHF Committee reminds all fm operators that the section 433·400 to 433·575MHz is allocated for simplex fm use. The calling frequency of 433·500MHz is used internationally and during the recent period of good conditions many operators were able to establish long-distance contacts on this frequency. Max Hanaghan, G8HPW, in Sunderland, noted the high level of activity from Holland on 433·550MHz.

Aurora

An auroral event which took place on 2 May was reported briefly last month. Richard Diamond, G4CVI, operating from the home of GM8FFX (YR8OJ) stayed exclusively on cw to work a total of 14 countries from 70 contacts. The first phase lasted from 1625gmt to 1945gmt and a second phase lasted from 2105gmt to 0225gmt. The beam heading was 050° for all contacts. DL7QY, Clause Neie, Berlin, was active during this event working many SM and LA stations. Clause writes that all signals faded out with him at 1700gmt, except GM4CVI who could be heard until 1830gmt. GM3JFG (XR4OC) worked several European stations but also remarks that GM4CVI could be heard working stations which could not be heard properly at Fortrose. Graham Kimbell, G3TCT, at Aldershot, worked GM4CXP on 70·2MHz cw during the same event but heard no other 70MHz signals. Graham's G3LTF auroral monitor receiver warned of another aurora on 11 May at 1840gmt. Several other operators also noticed signs of this aurora but signals were weak at Aberdeen although DL0PR was monitored for more than two hours from 1900gmt.

Expeditions

A group from the Chalmers University station SK6AB hope to be in the Faroe Islands from 29 July to 14 August. The callsign will be SK6JF/OY and operation will be on 144MHz and 432MHz with high power and good antennas. As the Glenrothes group will be using GM3YOR and GM3OLK/P from the Shetland Islands from 12 to 29 July it will be interesting to see if contact can be made from GM to OY on 29 July.

The Milton Keynes Group will be on 144MHz from the Isle of Man during the period 24 July to 4 August, using the callsign GD8MKC from Laxey. This includes the period of the QRP contest on 31 July. Between 30 July and 7 August the following stations will be portable from Powys, Clwyd and Gwynedd: 70MHz—GW4EQF/P and GW4EQK/P, 144MHz—GW8KPA and GW8KPB, 432MHz—GW8GDZ and GW8KOS. For skeds contact G8KPA, QTHR.

The Oxford University Group will be in the Isles of Scilly from 24 August to 6 September. Callsigns to be used are G3YGF/P on 70·240MHz, G3OUR/P on 144·280MHz, and G8HDR/P on 432·220MHz. Skeds can be arranged by contacting G8HDR/P, QTHR.

Tropo conditions

An extended period of lift conditions occurred between 17 May and 29 May. During these 12 days an area of high pressure hovered around the North Sea between the UK and Norway, sometimes moving slightly to the north and then back to the south. The 432MHz band was open from Scotland to the Continent every day during this period. Unfortunately on 18 and 19 May the 432MHz band was completely unusable as the whole band was being wiped out by radar interference. This pulse type transmission affected most of the European countries adjoining the North Sea. By checking and comparing beam headings, G3OSS, G4CVI, G3NWU, G3LQR, DB1XI, DC1XC and PA0VV came to the conclusion the interference was coming from the middle of the North Sea. The university station at SK6AB used their gigantic beam of eight bayed 46-element arrays to confirm the df bearings and noted on a spectrum analyser that the 700μV signal extended from 431 to 435MHz. Further checks with the Swedish authorities revealed that they were aware of the problem but could take no action. It seems the interference was due to long distance radar being used on a warship.

Despite the interference, Harold Meezra, BRS34348, at Chatham in Kent, using an 11-element antenna at 21ft, found the band good for dx. The OZ2UHF beacon on 432·450MHz has been an extremely strong signal at Chatham, as has PA0FMK on 432·950MHz which runs just 1W from QTH locator CM55J. SK6UHF on 432·925MHz, which runs 10W to a simple clover-leaf antenna, is another of the indicators used by Harold to forecast dx on 432MHz. Among the dx stations heard, PA0DBQ (CM72D), PA0TJD (CN69C), DB1XI (EN33C), F1DBJ (BJO2E), DC8TK (EN64G) and DC0LY (EO18H) were all outstanding signals well over S9. Harold also received a QSL which brings his confirmed score on 432MHz to 47 counties—a feat many of the transmitting members would like to equal.

During the extended period of the opening, G6NB, G3MCS, G3VPK, G8GML, G8BTX, G8FUF, G4CVI and GW8CFQ were all heard working stations at more than 600km. G8BTX had a long QSO with LA1FH for his first Norwegian station on 432MHz.

Unfortunately the 432MHz Open Contest took place earlier in May before the good conditions, nevertheless many stations still did well with several scores of more than 100 contacts being heard towards the end of the event. The 144MHz event on the weekend of 28 May did coincide with the lift and many of the entrants worked SM7AED, SM6XV, OZ3SW, LA8UU and many French stations. The team at GW8BHH were heard giving serial numbers in the 600 region some time before the end of the event.

During the lift many G 144MHz stations worked Norway and Sweden for the first time. Nigel Roberts, G8JEF, at Prescot, Merseyside, mentions the consistent signals from LA6HL, LA3EQ and LA8UU, all of whom were working G stations at a rate of about one per minute. It is significant that during the lift, conditions on 144MHz never equalled those on 432MHz. The ducting was definitely favouring the higher frequencies, and the large number of PA0 stations monitored on 432MHz working crossband to 1,296MHz confirms the fact. A further example is GM8CBQ/M driving around Aberdeen with a Liner 432 working Continental stations with ease with just a dipole on the roof while similar contacts were impossible on the lower band of 144MHz.

REAL DX 1977

70MHz	G4CVI-GM3ZBE	650km
144MHz	GW4CQT-SM2CKR	1,920km
432MHz	G3DAH-SM6HYG	1,090km

Maps and lists

Harold Meezra writes about his new wall decorations. First is a relief map of the British Isles (99p from W. H. Smith) which has the hills and mountains pushed up in plastic. He notices a distinct groove between Kent and the Isle of Man, which helps to explain the loud signals from GD2HDZ. Second is the large RSGB QTH locator map in soft ply—he uses different coloured mapping pins to show at a glance the squares he has heard on the different bands.

Completing the decoration are what Harold describes as "the marvellous RSGB computer read-outs"—RSGB beacons, IARU beacons, and RSGB repeater licences and proposals. Very keen vhf enthusiasts will want to get the updated read-outs about every three months at 19p each from RSGB HQ.

The grapevine

*M*uch *P*andemonium on MP when a GM station accessed it and GB3CS and LA5SR with one tone during the recent lift . . . Most interesting theories about auroras and eclipses from Ed Tilton, W1HDQ, at Alexandra Palace . . . G8FUF getting ready for moonbounce . . . G8JUK, G8BTX and their father, G3RXF, all operate on 432MHz from the same house in Lowestoft, and in a recent multi-way QSO with GM8FFX each claimed he owned a piece of equipment vital to the QSO. G3RJV claimed he owned the bottom third of the pump up mast, G8JUK owned the transverter, G8BTX owned the prime mover—an IC201 . . . To add further to this family venture at Lowestoft the cw expert at reading LA1UHF and SK6UHF was an unlicensed brother . . . Heard during lift on GB3HH "Will the mobiles go QRT and let the dx stations through" . . . With such a multiplicity of antennas no wonder G3OSS has crow trouble . . . G4CRC/P, the Cornish Radio Club, an outstanding signal in the 144-MHz contest.

Late news

GW4CQT and G4DGU both worked CT1WW on single sideband via meteor scatter—both contacts are possible firsts. G3POI and G3SEK are assisting the Society in preparing a paper on meteor scatter QSO procedure for the up-coming IARU conference; suggestions would be welcomed by both operators who are QTHR. Julian Moss operated G8ILO/P near Lancaster in the recent 144MHz Portable Contest; using 25W he worked 315 stations including PA0, F, ON and GU8IRF. GM3ZEM/P worked SP5ZN in square KM in the same event. ON6UG/C31 will be operating from Andorra during the first week of August; for further details write to 12 Olmstr, B9910, Mariakerke, Oost Vanderen.

Finally, thanks for the huge amount of mail this month. Please send all your news of 4-2-70 to Aberdeen, and all 1,296MHz and above items to G3RPE. □

oscar news

Oscar 6

The battery in Oscar 6 has deteriorated further and the end of the useful life of the satellite must now be imminent. Launched on 15 October 1972 it has long exceeded its planned lifetime. This is mainly due to the efforts of the command stations, including the University of Surrey, who have controlled the equipment on board, ensuring the best use of available resources.

A-O-D launch

Due to problems with the launch vehicle the lift-off has been put back until late February or early March 1978. However, A-O-D will probably be available before the Russian Oscar about which there is considerable speculation and little definite news. The Russian magazine has carried some news of ground tests of the transponder which will be of the Oscar 6 and Oscar 7 mode A type, ie 145MHz uplink and 29MHz downlink.

Oscar nets

For latest news of satellite activity there is an AMSAT-UK net on Sunday mornings at 1015 (local) on 3,780kHz with G3RWL as net control. The AMSAT international net is on Sundays at 1730ut on 14,280kHz. Between 1730 and 1800 there is an interchange of information between Oscar users, and at 1800 the AMSAT hq station radiates a news bulletin.

AMSAT-UK

Details of membership and other services can be obtained from G4EZN, QTHR, by sending an sae. □

"Antenna here is a collapsible quad" (With apologies to "The G8ENN instant beam", *Radio Communication* April 1976)

microwaves

Dain Evans, G3RPE*

The Sheffield microwave round table

The microwave round table held in Sheffield on 30 April attracted 21 amateurs, including two GMs. The main discussion of the afternoon centred around a review of activity and equipment for the bands 1·3 to 10GHz. SSB equipment for the 1·3 and 2·3GHz bands using the parametric upconverter principle was shown by G3ZIV, and this stimulated a long discussion on the relative merits of this system and the more common high- and low-level mixing techniques.

GM3FYB and GM8CSE then showed their crystal-controlled gear for the 2·3, 3·4 and 5·6GHz bands. This transmits on fm only, but can receive on all modes. G8AGN described the 3·4GHz beacon GB3UOS which is now operational from a site near Sheffield, and discussed the design of a crystal-controlled harmonic mixer monitor receiver. Wide-band equipment for 3·4GHz based on the polaplexer principle was shown by G8HAJ and G4DRX. An example of the latter equipment is also described in the current edition of the *VHF/UHF Manual*.

Wideband gear for 10GHz using either klystrons or Gunn diodes was described by G8HAJ, G8CZO and G3TQF. This was followed by a discussion on Gunn oscillator cavity designs and on crystal-controlled equipment for this band. Although no gear was shown for 24GHz, several people are busy collecting pieces.

It was agreed to hold another meeting in Sheffield, probably in the early autumn, and this will be well publicised in advance. The main topics for discussion suggested are antennas and path checking.

10GHz news

What may prove to be yet another significant step forward on this band comes from recent systematic tests by G8DEK and G3WDG. In these, attempts have been made deliberately to use the tropospheric scatter propagation mode to cover the 100km path between Winchester and Bristol, a path which has four to six obstructions depending on the value of K taken. In the transmitter, G8DEK is using a crystal-controlled driver to a twt which produces 3W of output on 10,368MHz, and this feeds a dish 4ft in diameter. On the receive side, G3WDG uses a standard 1N23 mixer fed from a dish also 4ft in diameter, with the local oscillator either a Gunn or a crystal-controlled oscillator. An EC10 is the tunable i.f. Out of 10 attempts so far, they have been successful on eight. On the two other occasions, there was rain about, and this might have had an effect. We look forward to the results of other tests.

G8DKU in Hartlepool is anxious to contact other 10GHz enthusiasts and potential enthusiasts in that area.

LA8TO, from the Akademisk Radioklubb in Trondheim, writes to say that there is growing interest in 10GHz locally and that they hope to get a special licence to operate. At present the Norwegians have to have special permission to operate at frequencies above 1,215MHz. A rough measurement shows that the shortest distance between the UK and Norway to be a mere 450km, which is an exciting prospect. Trondheim itself, unfortunately, is nearly as far as it is possible to get from the UK while still remaining in Norway.

W1CF reports that great interest has been shown, especially in Germany and the USA, in the Microwave Associates Gunnplexer which he has been responsible for developing. This transceiver was shown at the recent Alexandra Palace exhibition and attracted much attention. In the USA the interest in 10GHz so far seems mainly with tv and radio links to repeaters, whereas in the UK the emphasis has been mainly concentrated on the dx potential of the band. Early in May W1CF used a crystal-controlled version of the Gunnplexer for a 80km contact, which is a respectable "blooding" of the gear.

Visitors to the exhibition will have appreciated the demonstration of 10GHz tv put on by members of the Havering Club. Despite the difficulty of having to pipe-in 10GHz signals via 100ft of flexible waveguide with all its associated losses, pictures of reasonable quality were received over the 14km *grazing* path from Ilford throughout the exhibition. The transmitter used a standard Gunnplexer as referred to above, the video being applied directly to the varactor tuner/modulator built into the Gunn oscillator. A bandwidth of 18MHz was used. The tv receiver, which was due to G8IXC, used a home-made balanced mixer with a Gunn oscillator as the local oscillator, the i.f. being a standard tv receiver except that an fm detector was fitted. Dishes of 0·5m diameter were used at both ends.

Special mention must be made of the efforts of G8LLB and G8FJG who throughout the exhibition provided 22h of continuous lively tv pictures. These included views of Ilford, its railway and its traffic jams, dog fights using model aircraft against a live background of Ilford (which were surprisingly realistic) videotapes of 10GHz mobile tv, and even some glove puppetry. Well, *you* try generating lively pictures for 22h!

PA0KKZ is also active on 10GHz tv, and can operate not only /P but also /M. Best dx for the former so far is 2km, for the latter, 800m. Members of the Havering club and PA0KKZ hope to exchange tv signals between G and PA0 this summer by super-refraction.

PA0 10GHz beacon

Since the beginning of March a 10GHz beacon has been operating from Zaandam, which is a few kilometres NW of Amsterdam. The beacon consists of an 80mW Gunn oscillator on 10,100MHz which feeds four horns of 16dB gain via three magic tees. The horns are mounted 52m agl (which is about the same as asl!) and are beamed, perhaps optimistically, at London and Scotland, and into Belgium and Germany. The signals are tone modulated and keyed once per minute with the callsign PA0HSM. PA0KKZ would welcome reports.

The construction of a high-power crystal-controlled beacon generating a few watts is understood to be well in hand. This will be sited at Noordwijk on the coast and will beam towards the UK.

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Checking microwave receiver performance

At a recent microwave round table, G3WDG demonstrated a simple way for checking the performance of receivers. This method tends to work rather better at the higher microwave frequencies, which is fortunate because conventional noise sources (for example, discharge tubes mounted across waveguide) are not usually part of the average amateur's test equipment.

The principle of the method involves recognizing that all poor conductors such as earth, trees and buildings, produce noise. The amount emitted is determined by their temperature and therefore they can be used as a "standard" noise source. By contrast, the level of noise coming in from space is virtually zero. So if a receiver antenna is pointed at a building, the noise output from the receiver will correspond to that from the receiver itself plus the "hot-body" noise, while only receiver noise should be heard when the antenna is pointing at the sky. If the ratio of the two can be measured, then the absolute value for the receiver noise can be calculated.

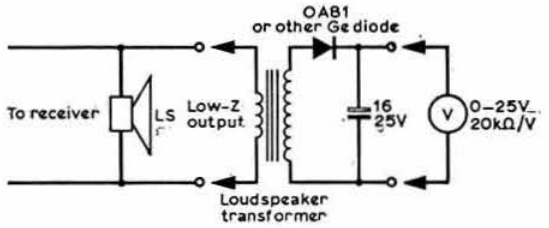

Fig 1. Simple noise level indicator

In applying these principles practically there are many potential qualifications but nevertheless the method is so obviously attractive that it is well worth exploring. A simple method for measuring the noise output is to use a circuit such as that shown in Fig 1, the af gain being set to produce an output of 10-20V. The antenna is first pointed at the sky and the mean voltage reading taken. Being careful not to change anything else, the antenna is then pointed at the ground or a building, when a significant increase in output voltage should be detected. This process should be repeated until constant differences are determined. The output voltage fluctuates by an amount which depends on the bandwidth of the receiver and the time constants of the indicating circuits, but with practice small percentage changes should be easily detected. This percentage increase can be converted to noise factor directly from Fig 2.

This method has the obvious advantages that it requires very little in the way of test equipment, it does not require well-matched components, and it can be used to check receivers actually on site. However, a few points need to be made:

(a) If the receiver is fitted with an fm detector, it is important that this does not limit on receiver noise. If an rf gain control is fitted, this can be turned down to check that the same percentage difference is obtained.
(b) The measurements do not depend on antenna gain, but one of moderate gain makes it easier to ensure that it sees *only* the hot body or *only* the cold sky and not something in between.
(c) The antenna should be kept at least a few metres from the hot body to avoid spurious effects such as due to reflection of stray local oscillator signals.
(d) If the receiver has no image suppression, noise can be picked up equally well via the second channel. In this case the noise factor will appear to be 3dB lower than the correct single channel value.

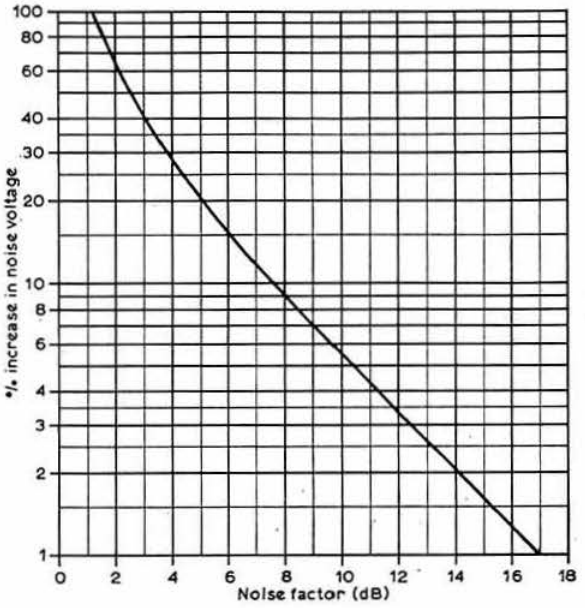

Fig 2. Conversion between noise increase and noise factor

Preliminary tests suggest that the noise factor estimated using this method with 10GHz equipment is consistent with measurement made by more formal techniques. G3WDG will be pleased to hear of others' experience. At the same meeting he also demonstrated the use of the sun as a standard noise source which, in principle, can be used to check the overall performance of both receiver and antenna. He is currently looking at this in more detail and will report at a later date. □

Technical Topics

(Continued from p535)

input of a 7474 device which forms the subtractive mixer. The signal from the vfo passes through the fourth gate of the 7400 device for shaping and then, as a near square wave passes to the D1 input of the 7474. Output from the mixer appears at Q1 as a square wave, ideal for feeding to a simple frequency counter.

ZS1FD reports that the adaptor unit can be built on a small piece of Veroboard (about 5cm by 7cm) and then usually readily accommodated either inside the receiver or the counter. To bring the system into operation, first check the band-edge receiver calibration with an internal or external calibrator; switch off the calibrator; observe the readout of the counter which should be 000; if this is not quite right adjust the crystal oscillator trimmer. Then, says ZS1FD, sit back and watch the digits flash past you as you tune the receiver. □

the month on the air

John Allaway, G3FKM *

A RECENT study revealed that *Radio Communication* is now being distributed to more than 120 countries, including the Chinese People's Republic. This is an excellent example of the true international aspect of our service and its unique ability to promote understanding and friendship. In the writer's opinion there is no other interest available to so many which does so much to bring together the peoples of the world and show them that language and politics are unimportant.

The announcement of the appointment of an IARU Information Officer appeared in *Radio Communication* a little while ago. It should perhaps be pointed out that IARU is synonymous with international amateur radio and not just the cold statistics of the administrative side of the subject. G3HCT will of course be pleased to hear from those who would like to locate speakers on the subject.

G3FKM would like to trace the operator of VS9ASC who was active during 1967 and whose name was Steve. Many enquiries are being received from those looking for confirmations for contacts with VS9 in the past and it would be very helpful if those readers who operated from Aden and are still able to supply QSLs would please supply details for reference purposes.

Mike Rogers, ZS1RZ/G3VOG, reports from Capetown, where he has been for the past three years, that his G3VOG callsign, which he still retains, is being pirated.

Please note that all times given in *MOTA* are gmt.

News from overseas

In a letter to your scribe, WA9YNE says that he acted as QSL manager for ZB2A for the period June 1970 to September 1972 only. At that time the operator was Gordon Kelly, who was with the RAF. He has received a large number of QSL requests and says that all those which he is able to answer will be sent out by August. WA9YNE's address is: K. Vanarsdall, 17 W 151 White Pine Rd, Bensenville, Ill, 60106, USA.

John Knight, W6YY, has returned home from a month's visit to Africa and he has sent along his observations on the current amateur radio situation in that area. He says that there are about 40 stations active in Kenya—mostly on 144MHz. 5Z4ERR has now retired and is not very active, but 5Z4LW and 5Z4RT (DK8RT) are often on the hf bands. There is only one amateur on the air from Uganda—this is 5X5NK who is only occasionally to be heard (QSL to DL1YW). In Egypt SU1IM is now recovering from surgery and has received the Swan 500 sent by the N California DX Foundation, but is unable to use it at present. SU1MI is Ibrahim's daughter. SU1MA is also fairly active. ET3FF (ex-ET3AH) was the only active and licensed Ethiopian amateur at the time of John's visit. He had been there 31 years but is not hopeful that he will be able to renew his licence.

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OK1DDL, Dagmar, has now contacted 32 countries on top band, and only Oceania is needed for WAC, which she hopes to complete this year. *(W1BB photo)*

Medical readers will be interested to learn that there is a net of German doctors, organized by Peter Hipp, DJ3FK, which meets on 3,705kHz at 2200 on Fridays and at 1000 on Sundays. Please note that the *AGCW-Bulletin* is transmitted every first Sunday in the month in English on 7,030kHz at 0900 on cw at about 14wpm.

DX news

It seems likely that there will be activity from the Kermadec Is in the early autumn, possibly coinciding with either the VK/ZL or CQWWDX contests. ZL1s AIC, AJL, AMN, AVR, BKL and BKX have been mentioned as possible participants but final details will not be available until next month. Government permission is awaited and, if given, the operation should last for about two weeks.

ZK1BA is reported to be erecting an antenna for 7MHz. There is a chance that he will visit Manihiki Is again sometime this month. In the same area 5W1AT may repeat his earlier visit to the Tokelau Is and be on the air again as ZM7AT for a two-week period during July/August.

The expected operation from Pitcairn Is by W6YO/VR6 was considerably curtailed and it is believed that he was only on the air for one day. However, en route for Pitcairn the ship called at Easter Is and new Atlas equipment was delivered to CE0AE.

A35DG is in Tonga and using an FT301D and dipole antenna. He has been heard on 14MHz ssb and should be on the islands for 18 months or so. The recent activity by WA7VVU/KW6 seems to have been not valid for DXCC credit as all operation took place from on board the container ship *American Charger*. However, the ship calls at Wake Is several times a year and in future the transmitter will be set up on land.

VK9ZM was believed to be due to leave Willis Is at the end of June. According to the *West Coast DX Bulletin*, VK2AKG and VK2BKE are located on Lord Howe Is, and there is currently a station on Cocos Keeling Is using the callsign VK9CW. Mention is made of possible activity from Heard Is in November.

XT2AS is PA0LUB who is working with the Netherlands Volunteer Corps in Upper Volta until the end of August. He is said to look for contacts with PA at 1630 on 14,320kHz. Harry, ex-VQ9HCS, now lives in Swaziland and has the callsign 3D6BP. 6W8FP has left Senegal and is in Sierra Leone but still awaiting a 9L1 licence.

Activity from Bangladesh by S21AB has been noted. He is JA6GDQ, and is crystal controlled on 14,198kHz and active after 1100.

VE1BFV has now left Sable Is for Western Canada and his replacement on the island is not an amateur operator.

The Stratford ARC and Palmerston & District ARC (of Ontario) are making an expedition to Pelee Is in Lake Erie for the period 23 July to 4 August. This will be the most southerly amateur station in Canada, and its callsign will be VE3PEL. Equipment will consist of Drake T4X and R2C and operation will be from the boat. Contacts with the UK will be specially welcomed and readers are advised to check the vicinity of 14,150kHz and 14,025kHz for the expedition.

G4EGZ advises that Canadian amateurs located in Newfoundland and Labrador have been authorized to use the prefixes XO1 and XO2 respectively during the period of the Canada Summer Games between 1 and 31 August. XO1CSG will operate at the site of the games in St Johns, Nfd.

Readers are asked to note that the information on the Gibraltar net given in June *MOTA* is no longer applicable. The net now meets only at 2100 on 3,770kHz on the first Saturday of each month. Most activity at present comes from ZB2BL and ZB2CF.

F6CWB will be visiting Andorra for the second week in July and will be active on 14 and 144MHz from QRA locator AC48C with the callsign C31NQ. QSLs should be sent to the address in "QTH Corner".

FM7WO is at present in Reunion and using the callsign FR0DGP. He is using a dipole aerial and is expected to be found around 14,025kHz and 7,020kHz, as well as in the ssb part of both bands.

Welcome

The following overseas amateurs joined the Society during May: CT4FB, DK4VW, EA1ME, EA1LQ, EA9FF, EI5AJ, F1AAG, F1BYU, F1DPT, K3ZDK, N3DF, K4GMJ, N6NW, SM0AVK, SM5CCY, VE3HSY, WA4FTJ, WB-2DWP, 5Z4IX, 6Y5HJ and 6Y5MR.

International beacons

Latest information about 28MHz beacons has been supplied by the IARU beacon co-ordinator, G3DME. **5B4CY** changed frequency from 28,180kHz to 28,220kHz at 0900 on 6 June. Reports should be sent to 5B4AP, PO Box 1267, Limassol, Cyprus. **A9XC** is now operating on 28,207·5kHz from the location of A9XBD with restricted hours (to avoid tvi)—2100 to 1400 approximately. Reports should be sent to Geoff Smith, A9XBD, c/o Cable & Wireless, PO Box 14, Bahrain. **N4RD** (ex-K4BRD) is operating on 28,207·5kHz and reports should be sent to R. W. Davis, 2845 North Beach Rd, Englewood, Fla, 33533, USA. **VP9BA**—Alan was informed recently that this would be returning to the air on its old frequency of 28,165kHz, but no reports of its operation have been received.

The moving of the beacon sub-band decided at the Warsaw Region 1 conference is now taking place and new frequencies will be "mirror images" of the old ones with 28,200kHz as the centre frequency. Spacing of 2·5kHz is now being adopted. EA2OJZ has been heard on 28,247·5kHz but no information is available.

Awards

Flanders Fields Award

European applicants require three contacts with ON7FF (the Ypres RC station) and other members of the club on hf, or 10 contacts on vhf. Send QSLs and 10 IRCs to: ON7FF, BP 32, Ypres 8900, Belgium.

Diploma Jadran

For contacts with 10 stations in at least five different places on the coast of (or on islands in) the Adriatic. They must have been made since 1 January 1970. Send list and QSLs plus eight IRCs to: Radio Klub "Ante Jonic", YU2AKL, PO Box 89, 58001 Split, Yugoslavia.

Worked YUDXC Members

For eight confirmed contacts with members of the YU DX Club since 1 Janaury 1970. Send certified list of contacts and seven IRCs to: YUDXC, PO Box 82, 62259 Ptuj, Yugoslavia.

The Rubens Award

For contacts with six Antwerp stations between 1 July and 30 September. Any mode/band. Send certified log extract and five IRCs to: ON6KC, Van Riet Robert, Beukenshofstraat 47, B 2060 Merksem, Belgium. Listeners may also apply. This celebrates the anniversary of Paul Rubens and special QSLs will be used.

The WAGM Award

Issued by the Aberdeen RC on receipt of proof of two-way communication with Scottish stations on any band. Contacts are required with one GM2, 15 GM3s, one GM4, one GM5, one GM6 and one GM8. Applications to the club secretary, GM4BKV, S. Sutherland, 67 Greenfern Rd, Aberdeen AB2 6TP. Applicants outside the UK do not need to send QSLs—a certified list will suffice. Cost to UK applicants is 60p and 10 IRCs to others.

The Sherlock Holmes Award

Issued by the International Police Association RC, German section, for contacts with members (since 1 March 1976). For basic award 50 points are needed. Contacts with members in one's own country count two points, in other countries in same continent five points, and elsewhere 10 points. IPARC club stations count twice on each band, and members can be worked once on each band. Send certified list of contacts and eight IRCs to: Adolf Vogel, DL3SZ, Ritter-von-Eyb-str.2, D8800 Ansbach, W Germany. (DL3SZ will supply a membership list etc in exchange for sae and an irc).

Contests

The European DX Contest (WAE)

0000 13 August to 2400 14 August (cw).
0000 10 September to 2400 11 September (phone).
0000 12 November to 2400 13 November (rtty).
All bands 3·5 to 28MHz. Single-operator—all band. Multi-operator single transmitter. Only 36 hours' operation by

single operators is allowed. The 12 hours rest may be taken in not more than three periods. Europeans contact non-Europeans and each contact counts one point. Exchanges consist of RS/T plus serial number (from 001), and a station may be worked on each band for credit. The multiplier for Europeans is ARRL DXCC countries worked, with the addition that each call area in JA, PY, VE, VO, VK, W/K, ZL, ZS and UA9, and UA0 also counts. In addition the multipliers on 3·5, 7, and 14/21/28MHz may be multiplied by four, three and two respectively. Final score is total QSO points plus QTC points multiplied by the sum total multipliers from all bands. QTCs are details of a previous QSO with a European passed by a non-European and consisting of time, call and number received. They may only be passed once and not back to the originating station. A maximum of 10 may be passed at one time, but more may be passed during later QSOs (which do not count for QSO points of course). DARC log sheets and summary sheets are available (large sae and IRCs please) from: WAEDC Committee, Postbox 262, D-895 Kaufbeuren, W Germany. Logs must reach this address by 15 September, 15 October and 1 December respectively. Note that in the rtty section other stations in the same continent may be worked, and countries include those peculiar to the WAE list as well as the DXCC (GM Shetland, Bear Is, Sicily). In accordance with IARU recommendations DARC suggests no contest activity above 3,550, 14,075, 21,100 and 28,100kHz in the cw section, and in the sections 3,650-3,750, 14,300-14,350, 21,400-21,450 and 28,700-29,700kHz in the phone contest.

SEANET WW DX Contest

0001 9 July-2359 10 July (cw).
0001 20 August-2359 21 August (phone).
1·8 to 28MHz. Single- or multi-band single-operator, and multi-band single- and multi-operator sections. No cross-band/mode contacts allowed. Exchange RS/T plus serial number (starting from 001 on each band). Stations may be worked on each band, and the multiplier is three for each country in the SEANET area contacted. The final score is the total of QSO points multiplied by the total of multipliers from each band added together. SEANET countries are: A4, A51, A6, A7, A9, AC3, AP, BV, CR9, DU, EP, HL/HM, HS, JA, JD1, JY, KA, KC6, KG6, KX6, P29, S21, S79, VK, VQ9, VS5, VS6, VS9K, VS9M/8Q6, VU, VU (Islands), XU, XV, XW, YB, YJ8, ZL, 3B6, 3B8, 3D2, 4S7, 4W1, 5Z4, 9K2, 9M2, 9M6, 9M8, 9N1 and 9V1. Contacts count as follows: 10 points on 1·8MHz (double if with HS, YB, DU, 9V, 9M), five on 3·5 or 7MHz (ditto), and two on 14/21/28MHz (ditto). Submit separate log for each band and include summary sheet showing QSO total, points, countries and multipliers on each band, plus the usual signed declaration. Entries must reach SEANET Contest Committee, Ismail Razak "Eshee", 9M2FK, 281-C, Jalan Pekeliling, Bukit Glugor, Penang, Malaysia, before 31 October.

Trinidad & Tobago 1st Anniversary QSO Party

0000 27 August-2400 28 August.
1·8 to 28MHz (plus Oscar). Phone and cw. Exchange RS/T plus serial number (from 001). A certificate will be awarded to those working at least five 9Y4 stations on the same mode. A certificate with endorsement sticker and QSL cards for contacts will be awarded to those contacting 9Y4 on five bands on the same mode. Logs should give time, number sent and received, and QSLs must be submitted for the five-band award. $1 or eight IRCs should be included and entries posted before 16 October to TTARS, PO Box 1167, Port of Spain, Trinidad.

QTH Corner

A35CR, A35DG	Box 147, Nukualofa, Tonga.
C31NQ	via F6CWB, J. J. Bernard, 87 Route de Corbeil, 91350 Grigny, France.
EJ0A	J. Casey, EI5BX, 10 Derravarragh Rd, Cakerclavin, Limerick, Eire.
EP2IK	via GW3IRK, A. C. Whitehill, Cwrt, Penrhyncoch, Aberystwyth.
FG0ST	via F6CWB (see C31NQ)
FM0BAH	BP 619 Fort de France, Martinique.
FR0DGP	via K5KEZ, Dr. V. Thompson, John Hopkins Hospital-Box 234, 601 N Broadway, Baltimore, Md, 21205, USA.
FY0ST	via F6CWB (see C31NQ).
HH2MC	Box 501, Port au Prince, Haiti.
KP6AL, KP6BD	via K9ECE, H. D. Wibel, 5115 Delaware Av, Fort Wayne, Ind, 46805, USA.
S21AB	via JA0ZG/1, Y. Moriyama, 3-18-9-306, Hon-amanuma, Suginami, Tokyo 167, Japan.
ST2JJ/ST0	via W4JBZ, 5912 Barbados Way W, W Palm Beach, Fla, 33407, USA.
TF5TP	via DL7MQ, D. Surmann, Olbersstr 6, 1000 Berlin 10,W Germany
TT8SM	WB5OOE, G. C. Fogg, Box 626, Allen, Texas, 75002, USA.
VE1BFV	W3HNK, Box 73, Edgemont, Pa, 19028, USA.
VP8OW	G4DSC, D. Boniface, 11 Holmefield Rd, Ripon, N Yorks HG41 1RZ.
XT2AS	J. H. Dekius, Hemonystraat 40 II, Amsterdam, Netherlands.
ZD8RD	via G3ZIY, 28 Hound Rd, Netley Abbey, Southampton SO3 5FX
ZF2AA	Box 688, Grand Cayman.
ZF2AB	Box 697, Grand Cayman.
ZF2AN	via W5UFF, B. A. Thompson, 6607 Pebble Beach Dr, Houston, Texas, 77069, USA.
3V8BZ	via DARC.
5N2QIR	WA7QIR, 261 N Hill St, Mesa, Ariz, 85203, USA.
9G1JX	via DL7SI, Benekendorffstr 13, 1000 Berlin 28, W Germany.
9L1MD	via G3TEJ, M. C. Dighton, 7 The Close, Godmanchester, Huntingdon.

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

Ten-metre Activity Contest

Results of the contest held on 1 May have been received from David Whitaker. There were 15 cw entries—the first three of whom were G2ADZ (40 points), G2PT (37) and G3ICH (28). Twenty entries were submitted in the phone section and the leading stations were G3OZF (103 points), G3UDR (71) and G3LBS (54). Twelve listeners sent in logs—BRS 32525 (114 points), BRS34348 (89), and BRS29909 (74) had the highest scores. Fifty-five reports were received but it was noted that over 460 different UK stations were active. Static seems to have been a problem in northern Britain, and most activity centred on the Midlands and southern counties. The most interesting time was around 1730 when there was a limited opening to the Middle East, the skip then moved into Africa (5Z4JE, EL7F, ZD8RR, 5T5CJ and SM2HLS/4U all being noted). From 1930 the band opened into S America (CE, CX, LU, PY and ZP). ZC4IO worked 15 UK stations as well as ZS, ZD7, ZD8, HA, UB, EA, PY and LU, and heard VK6HD and 9M8HG. David would like to thank all who took part and reminds us all that the 28MHz band is often open if we would only try calling "CQ" occasionally. It is hoped to continue these tests.

Band reports

The severe interference originating from the Soviet Union appears to have been less troublesome on amateur frequencies during the past month, although it has continued to play havoc with other legal occupants of the spectrum. Conditions on the hf bands have greatly improved and 14 MHz has been open 24 hours daily. On 21MHz propagation seems to have been better than predicted and openings into Japan (which were not predicted) have occurred. Very good conditions have also existed on 7MHz in the early mornings.

Many thanks to the following contributors to this column: G2s DHV, HKU; G4RZ; G5JL; G3s HCT, KDB, OKA, RCA, RZI; GM3LYY; GM4CHX; G4s DSE, EAN, FAM; G8KLO; BRSs 17567, 31301, 35608, 36928, 38280, 38709, 38876, and A8961.

Stations listed in italics were using cw.

1·8MHz. 0000 EA3TJ, *F8EX, K1PBW, PT2CW, PY1RO, PY9DM, VE1MX, ZP9AY.* 2300 *IS0LYN, 5Z4LW.*

3·5MHz. 0000 *HB0BLC, 9K2DR.* 2100 *UA9, UA0,* 2200 *CN8AD,* VP8PL. 2300 *EL2FY* (QSL to JA1NSA), 9Q5BG.

7MHz. 0500 *8P6GN.* 0600 *HC5EE, KH6AT, VKs, VK0AC, ZF2AB, W1-W0, ZL.* 0700 *YV4TI.* 1700 *VU2DH.* 1800 *JA.* 2100 *ZS6ME.* 2200 *FM0BAH, TU2DD, VS5MC.* 2300 *M1BS, TF5TP, VP2KF, ZD8RR, 9Q5QR.*

14MHz. 0100 WD4CQH/C6A, JY25HH. 0300 HH2MC. 0600 KH6, W6-W7. 0700 A35TT, AP5HQ, *FO8EI,* HK0CLS KL7, *VC9UM, VE7AXH* (2W input), ZK1DA, ZK1DR, ZL3OG/C, ZM7AT, 3D2DN. 0800 A35CR, FK8KAA, FO8AQ, ZK1BA, 3D2GA. 0900 5W1AU. 1000 VP2GCS (Box 447, St Georges, Grenada). 1100 KH6IJ, VS6HJ. 1200 KM6FC. 1300 CR9AJ. 1400 *JT1AN, JT1BF,* YB8ACK. 1500 SU1MA, VS5MC, XT2AE, 5V7AR. 1600 YB3AB, 9M6KT. 1700 HS1AKT (Mondays, 14,170kHz), VS5PM, 5Z4QC (QSL to SM0HWM). 1800 *UA0YAD.* 1900 *VP8PL.* 2000 HZ1TA, TT8SM, VP1APC, VP8HZ, 3D6A (QSL to W3HNK). 2100 *JW1SO* (Bear Is), *VK3MR,* ZF1MA (QSL to VE3BWY), 3V8BD (QSL to DARC), *9A1AD.* 2200 *JA,* ST2SA. 2300 CE0AE.

21MHz. 0000 W1-W4. 0800 JA, P29JS, ZS. 0900 TR8WR. 1000 JA. 1100 *EA9FH, HM3LR,* JA, *VS5MC, WA6EGL/VQ9, 3B8CV,* 3D6BP (QSL to K1AGB), 7P8BC. 1200 ZD8EW (BBC, Ascension Is). 1300 JA, JY25YJ, KG6JIH. 1400 D4CBC, VP8PL. 1500 *CE,* VP8OL, KH6JJD/VQ9, VU2LQA, 9V1SA. 1600 *K0WIQ/DU2,* JA, ZD7SD, 9X5TM. 1700 A9XBD, KC4AAC, TR8VE. 1800 *HZ1HZ.* 1900 SM0FHY/4U (QSL SM Bureau). 2000 *CE3BF, PY.* 2100 W6CPL, *SM1FPE/4U* (QSL SM Bureau). 2200 CE, HP, TI, W, *ZF2AN.*

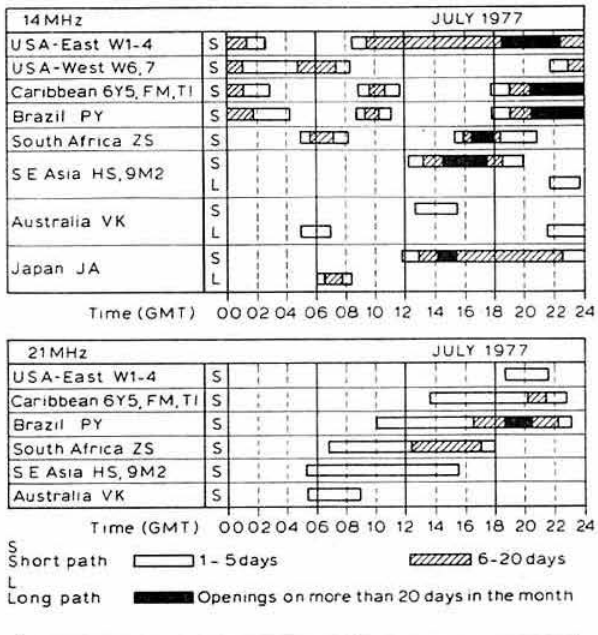
28MHz. Europeans between 0700 and 2300. 1200 A9XC. 1300 C31NG, JW9FD, 3B8CU. 1500 D2AFW, PP5AJ. 1600 *CE8AA,* OY5NS, *ST2SA, ZD8TM,* 5N2NAS, *9H1CH.* 1700 EA8, EL, *PY1ZAE,* TU2FW, 9G1JX. 1800 LU, PY, UK9-AAN, UL7, *W4DHZ, 5Z4LW, 6W8EX, 9Q5QR.* 1900 WB8FAG, ZD8RR, 5T5CJ. 2000 CX, LU, ZP. 2100 CE, PY. 2200 *YV1NX.* 2300 to 0100 *W1-W4, W8KPL, VE1CD.*

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

Please send all items for **August** issue **to reach G3FKM** by **7 July** and for **September** by **6 August.** □

Propagation predictions

Conditions this month will be much as those given for the previous month and all predictions given for June will hold good for July. Users of the tables will have noticed repeatedly that stations in the area indicated are not audible. This is especially the case when the time given does not correspond to the main working period of the dx countries. Contacts will be at their best if the time given in the predictions coincides with the main operating time of overseas stations. This particularly applies to countries with few amateurs.



HF Propagation Study

Predicted HPFs (MHz × 10) for July 1977

GMT →	00	02	04	06	08	10	12	14	16	18	20	22	24
Aden	136	139	172	223	268	253	255	260	261	274	168	145	136
Ascension	143	119	117	117	252	248	256	261	267	271	291	172	143
Bahrain	159	149	177	220	255	230	234	224	242	270	211	186	159
Bangkok	150	144	177	208	211	201	213	209	206	167	168	149	150
Barbados	199	153	145	133	143	204	214	215	215	215	242	251	199
Bermuda	191	147	136	120	133	187	205	204	205	205	208	208	191
Bogota	199	154	144	131	148	153	208	213	211	214	220	244	199
Buenos Aires	183	152	149	139	119	177	237	235	239	227	275	252	183
Cape Town	120	101	96	210	266	256	261	274	276	238	153	144	120
Colombo	138	147	180	219	244	220	228	220	238	263	221	195	138
Cyprus	162	140	161	202	235	229	218	210	224	251	232	196	162
Dakar	162	154	143	159	252	248	255	261	263	271	291	202	162
Denver	163	150	135	124	110	134	162	180	176	191	183	194	163
Fairbanks	157	161	157	159	163	181	181	181	181	181	182	177	157
Falklands	141	129	116	108	107	152	244	241	244	246	251	174	141
Gibraltar	124	101	100	120	162	162	152	152	155	152	186	164	124
Hongkong	147	143	174	200	194	195	205	201	196	196	154	172	147
Honolulu	157	155	152	159	163	181	144	141	147	181	185	177	157
Iceland	114	102	116	124	138	139	139	143	144	144	140	141	114
Jamaica	196	149	141	130	144	158	205	205	205	206	213	230	196
Lagos	150	139	133	200	263	252	261	272	275	279	257	183	150
Las Palmas	163	138	136	144	216	221	213	214	219	209	256	227	163
Lima	194	157	147	134	141	131	216	219	219	218	251	251	194
Los Angeles	155	147	135	138	108	105	135	176	178	191	188	186	155
Malta	140	117	122	161	195	195	181	177	186	195	215	173	148
Mauritius	108	107	172	223	266	256	255	261	261	204	172	155	100
Mexico	186	148	133	138	148	129	182	196	197	204	192	204	186
Moscow	124	121	144	168	172	168	177	174	181	185	169	158	124
Nairobi	125	122	164	220	267	257	255	263	263	277	169	144	125
New Delhi	153	144	178	213	220	210	216	214	229	205	192	161	153
New York	186	150	139	115	135	164	190	188	192	200	191	205	186
Osaka	154	162	172	188	190	192	191	190	172	168	167	164	154
Perth	162	147	180	218	243	219	194	144	140	136	119	102	162
Rio de Janeiro	178	153	126	120	116	237	244	241	244	243	281	251	178
Salisbury	140	124	125	216	268	267	261	271	274	285	218	178	140
Seychelles	139	130	172	225	255	249	249	249	257	237	168	152	139
Singapore	153	144	178	213	220	210	216	214	185	161	159	141	153
Suva(s)	162	169	164	173	181	182	161	140	121	138	178	172	162
Suva(l)	167	157	150	190	136	131	122	129	122	115	214	230	167
Sydney(s)	147	143	174	200	194	176	145	140	141	122	112	173	147
Sydney(l)	191	154	147	139	126	111	107	114	105	103	115	218	191
Teheran	163	147	180	219	244	220	228	220	238	263	215	192	163
Vancouver	159	155	145	153	144	150	161	172	163	174	177	177	159
Wellington(s)	162	161	168	183	178	143	139	143	136	121	183	163	162
Wellington(l)	174	171	155	121	103	97	100	108	102	102	163	213	174

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.

your opinion

GE FOR EVER!
The Editor
Radio Communication
Sir—The various countries which make up the UK are all equal partners, and should be seen to be so, not least within our hobby of amateur radio. To assist towards this end, I would propose that the simple "G" prefix for England be discontinued, and the prefix "GE" be substituted.

The use of "G" with GM, GW etc for the rest of the UK seems to imply that Scotland, Wales etc are *English* dependancies, a situation perhaps true in the distant past but now no longer so.

The changes to "GE" as the English prefix would, I am sure, be welcomed by most of us, as a legitimate rationalization of UK prefixes.

Do any other amateurs think as I do?

Brian Jenkinson, G(E)3JHC

CONTESTS
The Editor
Radio Communication
Sir—I am in favour of avoiding unnecessary and useless work. As a small contribution to this, could we abolish the mandatory declaration in RSGB and many other contests? Those who cheat are unlikely to be inhibited from signing a declaration that they have obeyed the rules, and it is superfluous to the vast majority.

The legal reservation of decision to the organizers can be met by a general rule on the lines: "Submission of an entry, whether valid or accepted or not, means that the entrant agrees that the decision of the Council of the RSGB is final in all cases of dispute".

Perhaps others who enter contests would care to comment.

A. A. H. Moss, G8VF

The Editor
Radio Communication
Sir—Would it be wrong to asume that the majority of amateur radio operators are unable to operate during daytime hours on weekdays due to their absence at work? If this assumption is correct, it follows that the weekend is their only opportunity, apart from holidays—and there is the rub. Practically every weekend brings a chaotic state of affairs on the bands due to contest traffic, which leaves no room for the ordinary individual who wishes just to communicate and does not regard the exchange of serial numbers accompanied by an inevitable 59(9) report as being communication.

Even if a contact is established, it often happens that contest stations disrupt the QSO, calling a dx station while he is transmitting, operating key down or switching-in a powerful linear to drown out the non-contest operator until he, or the dx station, gives up in disgust. I have almost reached the conclusion that weekend operation with fairly modest equipment and simple antenna systems is becoming quite impossible. I am sure that very few non-contest operators have the space, or the depth of pocket, to be heard amidst contest shambles.

However, unlike some of the contest operators I do not wish to spoil their enjoyment of our hobby as they are spoiling mine. I would propose an extension of existing band planning so that contest operation is limited to a sector of each band, leaving the rest of the bands free for other operators to compete only with the normal hazards of our limited frequency allocations. Surely it is not beyond the wits of the various national societies to reach some such agreement? Furthermore, if international contest rules were amended so that it became obligatory to give names and locations as well as serial numbers and RST reports, I would not be surprised if more operators took part. At least such exchanges could be regarded as communication with a fellow human-being and not with an automatic device which bellows 59(9)099999, when it is not engaged in yelling "CQ Contest" on top of an established QSO!

Although I believe that the RSGB is predominately contest-orientated, I would venture to suggest that this may not be true of the majority of its members and I would not be surprised if quite a large number of overseas amateurs shared this opinion.

C. J. Teece, G4DBR

PHANTOM AT ALLY PALLY
The Editor
Radio Communication
Sir—I would be obliged if you could publicise that a "phantom" G4BBH has been active in the London area recently, both via GB3LO and /A or /M. In fact I was unable to make it to "Ally Pally" this year, but I hear a "G4BBH" was talked in and listed as being present at the exhibition on 7 May. I wish I had known I was there, and I hope I enjoyed myself! If anyone is unsure, please contact me and I will be pleased to confirm whether any call was genuine or not.

R. C. Ferryman, G4BBH
249 Folkstone Road,
Dover, Kent CT17 9LL

STUCK
The Editor
Radio Communication
Sir—With reference to GM3OXX's letter in your April issue. While he has my deepest sympathies I cannot let the matter go without saying "What about MY PROBLEM?"

I am part of a family team (om and xyl) but as the label on the *Radio Communication* wrapper does not extend the courtesy of my existence, being addressed only to my husband, I can but assume that the RSGB do not want to acknowledge the existence of xyl operators or members!

Potential grounds for divorce loom on the horizon!

To enable me to purchase books at a discount from the RSGB, do I have to ask the om's permission or do I lighten the housekeeping still more?

Can't I sell my gear by advertising in *Radio Communication*?

May I claim an RSGB Award?

Isn't there a **law** about such things?

Ruth Uwins, G3TNN

obituaries

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

Mr J. Chapman, G3NUT
Jack Chapman died in a car accident at the age of 42 on 28 May. His main interest lay in construction, dxing and cw operation; and some years ago he made slow morse transmissions from the Wirral.

Mr J. Court, G3KKF
Jack Court died in early April aged 64. He was first licensed in 1955 and was well known on all bands, particularly the early-morning "Shaving Club". His interest in radio started with war service, and he was a telecommunications technical officer with British Rail for 30 years.

Mr P. R. Solder, G5FA
Percy Solder died on 9 April. He was first licensed in 1921 as 6JS and had held G5FA since 1937. He was a keen member of Southgate RC, and G5FA/P had been in almost full use for NFD since 1947 in which year the club won the event using that call. He was also a member of FOC, RSARS and RAOTA, and held many awards.

The Society has also been advised of the deaths of:

Mr R. Cave, G2KQI, on 17 May;
Mr A. G. Cole, GJ3GS;
Mr A. D. George, ex VP2LG, on 30 May;
Mr W. F. Howlett, G3VUA, on 29 April;
Mr N. C. Kirby, G6FV;
Mr J. A. North, G2KO;
Mr "Siggi" Mansnerus, OH0NI;
Mr J. Scholefield, GJ2TR; and
Col Bader Zaza, JY1/B.

contest news

April 1977 144MHz CW Contest results

This contest was held under poor-to-average conditions but nevertheless a very good entry was recorded. A check log from RSGB member ON5UN contained a potential score, subject to checking, of 731 and he could well have been the winner had he entered. It is worth reminding other RSGB members outside the UK that they can enter our contests unless a specific rule limiting entries to the British Isles only is included. One reminder is, however, that as a general rule RSGB vhf contests require an exchange of QTH as well as QTH locator, which is not common practice outside the UK. This was a point on which several entrants commented, preferring a QTH locator-only exchange.

Certificates will be awarded to the overall winner, and to G3POI as leading fixed station. *G3FZL*

Posn	Callsign	Points	QSOs	Best dx	Km
1	GM4DMZ/P	727	56	G3DAH	540
2	GW3WRA/P	683	92	PA0CSL	
3	G3POI	679	91	GM4CVI/P	495
4	GM4CVI/P	661	55	PA0CSL	605
5	G3LCH/P	599	84	DK4TG	590
6	G3CHN	585	55	G3XXQ	540
7	G3GQC/P	545	81	DK4TG	570
8	G3WSN	499	77	GM4CXP	483
9	G3UDA/P	475	65	ON5UN	470
10	G4CZP	443	51	G3CHN	440
11	G4ERP/P	434	74	PA0LSC	443
12	G3BDQ	389	69	G4CZP	412
13	G3JEQ/P	346	78	GM4DMZ/P	525
14	G3JXN	336	66	DJ5BV	520
15	G3FJE/P	335	75	GM4DMZ/P	414
16	G3YYF/P	326	56	G3CHN	320
17	G3DAO	323	41	DJ5BV	530
18	G4DZW	319	51	GM4CVI	475
19	G4APL	283	64	GM4DMZ/P	485
20	GW4EAI	216	34	ON5UN	475
21	G4BBA	211	35	GM4DMZ/P	380
22	G3YMD/A	202	30	DJ5BV	402
23	G3ILO	191	41	ON5UN	385
	G3FIJ	191	31	G3CHN	365
25	G3GGL/P	186	25	ON5UN	420
26	G4FDX	176	43	GM4CVI/P	420
27	G2BLA	171	53	PA0WWM	308
28	G5HD	158	36	G3LCH/P	240
29	G3YHG	143	39	GM4CVI/P	468
30	G3PBA	134	25	GM4DMZ	
31	G3JEI	124	27	G3CHN	
32	G4EVI/P	120	26	G3DAH	260
	GW3VKL/A	120	24	ON5UN	475
34	G2HH	102	21	G3YYF/P	
35	G3GC	78	38	ON5UN	275
36	G3BTO	65	17	G3CHN	220
37	G4ATV	34	11	G3CHN	

DF Qualifying Event, Stratford-upon-Avon

Date: 24 July 1977.
Map: OS Sheet 150, Worcester and The Malverns.
Assembly: 1300bst for start at 1320bst.
Location: Lay-by on A4104 at Upton-on-Severn NGR 849402.
Intending competitors requiring tea are asked to notify Mr G. Foster, 6 Halford Road, Stratford-upon-Avon, Warwickshire CV37 9BD (Tel 0789 66402—recorded answering service) not later than 14 July.

DF Qualifying Event, Chelmsford

Date: 7 August 1977.
Map: OS Sheet 167 Chelmsford and Harlow.
Assembly: 1300bst for start at 1320bst.
Location: Lay-by on A130 between Ford End and Howe St NGR 689162.
Intending competitors requiring tea are asked to notify Mr W. Petchey, Forge Cottage, Good Easter, Chelmsford CMI 4RS (Tel 024531 612) not later than 28 July.

High Wycombe DF Qualifying Event results

Twenty-one teams assembled at Maidenhead Thicket on 1 May, to compete in the first df qualifying event to be organized by the newly-formed Mid-Thames Radio Direction Finding Club (RS38663) on OS map No 175—Reading and Windsor.

Transmitter "A", situated in a heavily-camouflaged hide in a beech wood near Beaconsfield (NGR 944877) and manned by Paul Hawes, G4CKW, assisted by Mike Moore, was seven miles from the starting point (NGR 055815).

Transmitter "B" was located only 2·5 miles away at Shottesbrooke (NGR 835783) but Chris Marsden, G3XSO, and Graham Dore were well hidden in one of the thickest bramble patches ever seen by df fanatics. The excellence of the concealment, however, did not prevent Mike Hawkins, G3WMM, from locating both stations in 1h 27min to win the event, the High Wycombe Cup, and to become the first to qualify for the 1977 National Final.

Posn	Name	Club	Time of arrival Station "A"	Station "B"
1	M. P. Hawkins	Chelmsford	1420	1457
2	I. Butson	Chelmsford	1418	1510
3	P. M. Lisle	Mid-Thames	1416	1510½
4	A. Simmons	Mid-Thames	1419	1511
5	C. M. Wells	Mid-Thames	1415	1545
6	G. Whenham	Coventry	1546	1458½
7	P. T. Tyler	Mid-Thames	1550	1451
8	B. M. Bristow	Mid-Thames	1550½	1506
9	E. L. Mollart	Mid-Thames	1552	1449½
10	R. Parsons	Oxford	1554	1500
11	C. D. Plummer	Medway	1559	1511
12	D. Newman	Rugby	1601	1449
13	J. R. Vickers	Stratford	1431	1602
14	W. North	Mid-Thames	1606	1458
15	D. Holland	S Manchester	1509	1611
16	A. C. A. Newman	Salisbury	1432	1617
17	D. W. Sergeant	Bracknell	—	1503
18	E. Treloggen	Oxford	1506	—
19	C. T. Oliver	Dartford Heath	1611	—
20	M. Wright	Salisbury	—	—
21	A. R. Davis	Bridgwater	—	—

M. P. Hawkins and I. Butson qualify for the National Final event in September.

Region 1 (RSGB) VHF Contest rules

0900-1700gmt 14 August 1977

Bands. 70, 144 and 432MHz.

Section 1. Multi-operator, fixed or /P. Separate callsign on each band, simultaneous operation.

Section 2. Single-operator, fixed or /P. Any or all bands. /P entrants may go up to 20 miles outside the region. **ALL** operators must say that they are in or from Region 1.

Section 3. Operators outside Region 1 are invited to enter logs. Score **ONLY** for Region 1 QSOs.

Rules. The following general rules, published in the January 1977 issue of *Radio Communication*, will apply: 2, 3, 5a, 6a, 9a, 10a, 11 to 16, 18, 19.

Scoring. A As above rules No 7a followed by B, C and D in that order.
B Multiply 70MHz score by 3, and 432MHz score by 4.
C According to aerial height asl. Multiply band totals as below:
0-100ft by 2, 100-200ft by 1·8, 200-300ft by 1·6, 300-400ft by 1·4, 400-500ft by 1·2, 500-600ft by 1·1, 600ft and over by 1.
D Add 10 points bonus for each contact with a Region 1 station.

Logs. Separate sheets for each band. On 70MHz, national open contest serial numbers may be used. One cover sheet to include NGR and aerial heights asl.

Awards. 1, the G3SMM Shield; 2, the G2CIP Shield; both to be held for a year. Certificates of merit to band leaders in 1 and 2, and best log in 3.

Entries to G2CUZ, 34 Sandbrook Road, Ainsdale, Southport PR8 3JE.

Errata

7MHz Contest 1977

An error occurred in the rules for this contest published in the June issue. The date of the **cw** contest is 5-6 November, not 15-16 November as shown.

RSGB 21/28MHz Telephone Contest 1977

The time of this contest is from 0700 to 1900gmt, not to 1800gmt as published in the rules in the June issue.

Special event station

16 July, Sutton Manor High School Silver Jubilee Fete
This station will be operated by the school's amateur radio and electronics society. On 3·5 and 21MHz, G4AVV/A and G4BWG/A; on 144 and 432MHz, G8LZA/A and G8JUG/A. Special QSL cards.

16 July, Joseph Rowntree School, New Earswick
The station will be operated by York ARS using G3HWW/A.

12-14 July, Great Yorkshire Show, Harrogate
This station will also be operated by York ARS using G3HWW/A.

21-24 July Teignbridge Council Jubilee Trade Fair
The Torbay ARS will operate this station at Newton Abbot racecourse on all bands 3·5 to 28MHz using the callsign G3NJA/A.

27 July-5 August, Welsh Scout Jamboree
This will be held at Llanover, near Abergavenny, when it is expected that up to 5,000 Scouts from 16 nations will be in the camp. Operation under callsign GW3KAF/P will be on bands 3·5-28MHz ssb/sstv and 144MHz fm. Details from G3KAF, QTHR. tel 061-439 4952.

13 August, Tollerton Show
The station will be operated by York ARS using G3HWW/A.

27-29 August, National Town & Country Festival
To be held at the National Agricultural Centre, Stonleigh, Warwickshire. The station will be organized and operated by nine Midlands amateur radio societies. G3GEI/A on 1·8MHz, G3UVW/A on 3·5 MHz, G2ASF/A on 14MHz, and G3UDN/A on 144MHz. Talk-in on 1·8 and 144MHz. Special QSL cards. It is hoped to demonstrate fast and slow scan tv, rtty, radio astronomy and aurora, and a microwave repeater on the amateur radio stand. Details from G8HRH, QTHR. tel 0926 24465.

Looking ahead

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.

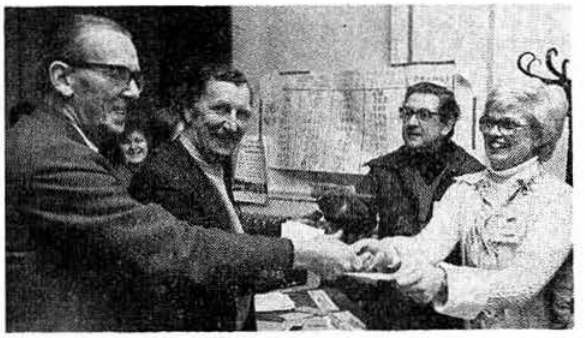
15-16 October—Jamboree on the Air.

27-29 October—ARRA Exhibition, Granby Halls, Leicester.

2 December—RSGB AGM, IEE, Savoy Place, London WC2.

Mobile rallies calendar

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.
24 July	Anglian Mobile Rally, 9am to 6pm, Stanway School, Colchester. Talk-in on 2 and 80m, G3CRC and G4CRA. Usual attractions. Details from G3YAI, tel 0255-21664.
7 August	**RSGB National Mobile Rally, Woburn Abbey.**
14 August	Derby Mobile Rally, Lower Bemrose School (Rykneld School), Bedford Street, Derby. Talk-in on 144MHz by G3ERD/A and G2DJ/A. Gates open noon. Free admission and parking. Usual attractions. Grand prize draw (over 40 prizes) 3.30pm. Flea market. Brass band concert. Children's competitions. Details from G3FGY, QTHR.



Bert Grayson, G3EVP, and Miles Salmon, G2CKM, try their luck at the White Rose Rally club raffle stand manned by Geoff Denby, G3FCW and his xyl Margaret

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, on A38 near Exeter. Talk-in on 3·774MHz G3NJA/A, 145·00MHz fm S22 G8NJA/A from 9.30am. Usual attractions. Used (not junk) equipment stall. Demonstration by Brixham Coastguard. 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

Contests calendar

10 July	DF Qualifying Event Salisbury (Rules in June issue)
17 July	3·5MHz FD (Rules in June issue)
17 July	10GHz Cumulative (Rules in May issue)
24 July	DF Qualifying Event Stratford (Rules in July issue)
31 July	144MHz QRP (Rules in June issue)
7 August	DF Qualifying Event Chelmsford (Rules in July issue)
13-14 August	70MHz Open (trophy) and SWL (Rules in June issue)
14 August	Region 1 (RSGB) VHF (Rules in July issue)
21 August	DF Qualifying Event Slade (Birmingham)
21 August	10GHz Cumulative (Rules in May issue)
3-4 September	SSB FD (Rules in April issue)
3-4 September	144MHz Open (trophy) and SWL (Rules in June issue)
18 September	DF Final South Manchester
18 September	10GHz Cumulative (Rules in May issue)
1-2 October	UHF (432MHz–2·3GHz)
8-9 October	21/28MHz (Rules in June issue)
15-16 October	7MHz Phone (Rules in June issue)
23 October	70MHz Fixed
October–November	432MHz Cumulative
5-6 November	7MHz CW (Rules in June/July issue)
5-6 November	144MHz CW
12-13 November	2nd 1·8MHz
4 December	144MHz Fixed

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 24 July for the September issue.

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

Ainsdale (AARC)—Thursdays fortnightly. 14, 28 July; 11, 25 August. 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)—First Monday in the month. Phone G5ND (Blackpool 64508) for details of venue.

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. New venue is "Keppel Hotel", Craig-na-Baa, Near Onchan. For details contact sec GD4-FWC (ex GD8FLA), tel Douglas 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—callsings G3OUL/G8JUL. Details from hon sec, c/o Students' Union or c/o GW4FJK.

Manchester (South Manchester RC)—8 July (Special mini df contest), 15 July ("Introduction to electronic computers, Part 1" by J. W. Selwood, G8KGM), 22 July ("An advanced home-constructed hf receiver" by T. Winter, G4AOK), 29 July ("Feedback" by M. Readman), 5 Aug ("Introduction to electronic computers, Part 2" by J. W. Selwood, G8KGM), 12 Aug ("Design and construction of a 2m transceiver" by C. McKenzie, G8LQO), 19 Aug ("Dahlias—propagation and culture" by J. Hines), 26 Aug ("RSGB activities" by RR G3SMM). 8pm. Sale Moor Community Centre, Norris Road, Sale. Informal meetings, Monday evenings at "Greeba", Shady Lane, Baguley. Full particulars from sec G3VIW, tel 061-973 3355.

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

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 G4FZN.

Preston (PARS)—Thursdays fortnightly commencing 14 July. 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)—13 July ("Microwaves" by G4DRX), 27 July (Film show/talk on the Himalayas by Miss Lowe; ladies welcome), 10 Aug (Visit and demonstration by CB Electronics), 24 Aug (Natter night). 8pm. Blossoms Hotel, Buxton Road, Stockport. Details from 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.

The stand of Stockport RS, which won second prize in the club stand competition at the NRSA Convention in April, featured the 20ft long quad loop Yagi with which they have won several contests, including the 432MHz section of 1976 VHF NFD. Members of Stockport RS, XYLs and friends also manned the RSGB bookstall

UK FM Group (Western)—7 July, 1 Sept (Informal meetings). 8.30pm. Legh Arms, Knutsford. Visitors most welcome. 19 Sept (AGM). 8pm. Wirral Mercury Motor Inn, Backford Cross, Chester. Details of group from sec G3LEQ, tel Knutsford 4040.
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.

REGION 1 VHF Contest. 0900-1700gmt 14 August-details on p547.
1977 North West Amateur Radio Convention—17-18 September at Lancaster University. See advertisement in this issue.

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 RR)—Wednesdays, 7.30pm. (Lectures start 8pm). 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 G8DFZ.
Scarborough (SARS)—Fridays, 7.30pm. Scarborough Technical College, Corby Road, Scarborough. 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. We would like to pass a vote of thanks to the RSGB for a fine exhibition at "Ally Pally" also to our Region 2 Rep for a fine evening visit to Hull College of Further Education, Marine Radio/Radar Section.

Note: Would all secs in the region please write to RR Region 2, QTHR, for inclusion in Sept "Club News".

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

Birmingham (Birmingham University RS)—Every Tuesday during term, 7pm. Students' Union. G3IUB. Sec G4CKK.
Birmingham (Midland ARS)—26 July, 23 Aug. 8pm. Room 110, University of Aston, Gosta Green, Birmingham. G3ZKQ.
Birmingham (Slade RS)—Alternate Fridays, commencing 8 July. 8pm. The Committee Room, Church House, Erdington, Birmingham. G4FGF.
Birmingham (South Birmingham RS)—Shack night Fridays, 7.30pm. 3 Aug (Open discussion), 7 Sept. 8pm. Hampstead House, Fairfax Road, West Heath, Birmingham B31 3QY. G8KPA.
Bromsgrove (B&DARC)—12 Aug, 9 Sept (Surplus sale). 8pm. Avoncroft Art Centre, Bromsgrove. G8JTK.
Cannock Chase (CCARS)—First Thursday in each month (Business meeting), other Thursdays (HF and vhf club stations, natter-nites, morse classes, talks etc.) Visitors welcome. 9pm. Bridgtown Social Club, Walsall Road, Cannock. 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. 8pm. 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. New members and swls welcome. Sunday net noon, 21·150MHz. Sec Ted Bowen, RS33003, Tel Tamworth 68756.
Lichfield (Chad RC)—Alternate Wednesdays, commencing 6 July 8pm. The Naval Club, Burton Old Road, Lichfield. G4ESK.
Mid-Warwickshire (MWARS)—First and third Mondays in each month, 8pm. 61 Enscote 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, Shrewbury SY2 6HU, and Dave Doody, 56 Ellesmere Road, Shrewsbury SY1 2QP.
Solihull (SARS)—19 July (Film show), 16 Aug (Lecture). 7.30pm. The Manor House, High Street, Solihull. G4EQF.
Stourbridge (StARS)—Informals on the first Tuesday in each month, 9pm. "Shrubbery Cottage" public house, Heath Lane, Oldswinford, Stourbridge. 18 July (Post-mortem on NFD and Jubilee), no formal meeting in Aug—a barbecue will be arranged—see sec. 7.45pm. Longlands School, Brook Street, Stourbridge. G4CLX.
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.
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. 13 July (Social outing—trip by horse-drawn canal boat—see sec). G8MXS. Tel Much Wenlock 357.
Willenhall (W&DARS)—Alternate Wednesdays. Morse classes available at the end of each meeting. "The Three Crowns", Stafford Street, Willenhall. G3YHN, XYL.
Wolverhampton (WARS)—11 July (Natter-nite), 18 July (Discussion—df hunts on vhf), 1 Aug ("Early vhf experiences" by Bob Riding, G3JZG), 8 Aug (Natter-nite), 15 Aug (vhf/uhf night on the air), 5 Sept ("Sporadic E—hf and vhf" by Martin Harrison, G3USF). 8pm. Neachells Cottage, Danescourt Road, Stockwell End, Tettenhall, Wolverhampton WV9 9PH. G8EDG.
Worcester (W&DARC)—11 July ("VHF radio in the highlands and islands" by Ron Payne, GM4AWA), 16 July (no meeting), 1 Aug ("Teleprinters and their use with radio" by Brian Jones, G8ASO), 20 Aug ("The aerials available at the club shack" by Roger Avery, G3TQD), 5 Sept. 8pm. The Old Pheasant, New Street, Worcester. G4DXE.

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

Derby (DADARS)—Wednesdays, 7.30pm. Morse classes Tuesdays and Fridays at 7pm when arranged. 119 Green Lane Derby. 14 August from 12 noon: Derby Mobile Radio Rally, Lower Bemrose School, St Albans Rd, Derby. All the usual attractions and a bigger and better flea market.

Derby (NHARG)—Fridays, 7.30pm. Nunsfield House, Boulton Lane, Alvaston, Derby.
Grimsby (GARC)—First and third Thursdays in each month. 8pm. Alexandra Social Club, Cleethorpes.
Leicester (LRS)—Mondays, 7.30pm. Club House, Gilrose Estate Cottage, off Groby Road Leicester.
Mansfield (MARS)—First Friday in each month, 7.30pm. "The New Inn", Westgate, Mansfield.
Melton Mowbray (MMARS)—7.30pm. St John Ambulance Hall, Asfordby Hill, Melton Mowbray.
Nottingham (NURS)—Alternate Wednesdays during term time. Details from Roger Dixon, G4BVY, c/o Students' Union, or QTHR.
Nottingham (ARCON)—7 July (Forum), 14 July ("Logic" by G3WFV), 21 July ("Activity night"). 7.30pm. Sherwood Community Centre, Mansfield Road, Nottingham. 6, 7 Aug "Rail EX 1977" at Gregory's Rose Gardens, Stapleford; exhibition station on the air.
Scunthorpe (SARC)—Tuesdays, 7.30pm. The Shack, Grange Farm Hobbies Centre, Franklin Crescent, Scunthorpe, South Humberside.

L to r: G4FTA, G8OX, G3JLE and G2HMY

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

Bedford (B&DARC)—7 July (Treasure hunt), 14 July (Analysis of VHF NFD), 21 July (Pub games), 28 July, 4, 11, 18 August (Informal), 25 August (2m df hunt). 8pm. United Services Club, Broadway. 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)—Thursdays, 8pm. Spencer Dallington Community Centre, Tintern Avenue, off Gladstone Road. Sec G8LHR.
Peterborough (GPARC)—Fourth Thursday in each month, 7.30pm. Southfields School. Sec G4BBA, tel 65213.
Peterborough (PR&SS)—Third Friday in each month, 7.30pm. Scout Hut, Occupation Road. Sec G3EEL.
Shefford (S&DARS)—Thursdays, 8pm. Church Hall. Sec G8HHO.

REGION 6—RR F.S.G. Rose, G2DRT, 84 Cock Lane, High Wycombe, Bucks HP13 7EA.

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. Sec G4FRL.
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)—11 July ("Slow scan television" by G3ZPA), 8 August ("Tele-bashing" by G8HUH), 12 Sept(AGM). 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.

The annual construction contest of the Oxford and D ARS was held on 27 April. The 12 entries ranged from an electronic egg-timer to an oscilloscope and digital frequency meter.

The winner was Jeff A. Jefferies, G8PX, chairman of the society, who received the Ben Farmer Cup from the president, Robin Pearce-Boby, G3JLE. There was a tie for second place between Tony Earle, G4FTA, and Dick Priday, G2HMY.

Reading (RARC)—5 July ("WARC 1979" by G2BVN), 19 July (TBA), 2 August (Demonstration of GB3BK), 23 August (Brewery visit!), 6 Sept (Junk sale). 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, 8pm. St Mary's Institute, 2 North Cray Road, Bexley. Sec G4ARQ.
Coulsdon (CATS)—7 July (Activity night and club projects), 18 July (Talk and film on Raynet by Sid Law, G3PAZ), 4 August (Surplus sale), 15 August (Activity night), 1 September (Construction contest), 19 September (Inter-club quiz). 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. Sec G4DLD, tel Burgh Heath 59956.
Cray Valley (CVRS)—21 July (Natter nite), 4 August (To be arranged), 18 August (Natter nite), 1 September (Surplus sale). 8pm. Eltham United Reform Church Hall, 1 Court Road, Eltham, London SE9 (*except 4 August* when the meeting will be held at the Christchurch Centre, High Street, Eltham, London SE9). Sec 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)—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)—19 July (Talk on Repeater GB3SN by G4CTE). First Tuesday, 8pm. (Natter nights), Marquis of Granby, Hooley Lane, Redhill. Third Tuesday, 8pm. Constitutional Centre, Warwick Road, Redhill. Sec G3XSZ.
Sutton and Cheam (S&CRS)—Third Thursday in each month, 7.30pm. Sutton College of Liberal Arts, Cheam Road, Sutton. Sec G2DMR.
Thames Ditton (Thames Valley ARTS)—2 August (Natter night), 6 September (talk by representative of the UK FM Group). 8pm. Giggs Hill Green Library, Giggs Hill Road, Thames Ditton. Sec G3ZNW.
Wimbledon (W&DRAS)—Second and last Fridays in each month, 8pm. St John Ambulance HQ, 124 Kingston Road, Wimbledon SW19. Sec G3XTC, tel 01-644 3698.

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

Burgess Hill (Mid-Sussex ARS)—14 July ("My aerials" by members), 28 July ("Modifying the Cambridge and Pocketfones" by Brian Fenwick, G8BTC). 7.45pm. Marle Place, Burgess Hill. Details from G3PEQ.

Canterbury (East Kent RS)—As we have had to give up our venue, details of future place and meetings from hon sec G8GHH, QTHR.

Chichester (C&DARC)—First Tuesday and third Thursday in each month. Lancastrian Boys School. Details of future events 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)—Details of future events from G8KEN, 14 Victoria Rd, Capel-le-Ferne, Folkestone.

Eastbourne (Southdown ARS)—4 July (Open-air meeting at Butts Brow, 4km NW of Eastbourne. Usual QTH if wet), 1 August (Quiz—more details later). All meetings at Chassely, South Cliff, Eastbourne. Details from sec G8CVV, pro G3LFZ.

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

Hastings (HERC) (ITT(H)S&AC)—Details of future events for both units from G8DNO, QTHR.

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

Maidstone (MYMCAARS)—First and third Fridays devoted to the beginner. RAE and morse tuition. 7.30pm. Melrose Close, Loose, Maidstone. Alternate Fridays, a wide range 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 P. J. Poole, G4EVY, 5 River Drive, Strood, Rochester, Kent.

Ramsgate (Kent Coast ARC)—Details of meetings from G4DTA, QTHR.

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

Worthing (W&DARC)—Details of future meetings from P. J. Robinson, G8MSQ, QTHR. Tuesdays, 8pm. Adult Education Centre, Union Place, Worthing.

Kent Repeater Group—Details of membership and events from G3XDV, 5 Lambs Walk, Whitstable, Kent.

Sussex Repeater Group—Information available from G8HVV, QTHR.

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

Camborne (Cornish RAC)—7 July ("Standard frequencies and time signals" by G2ABC), 17 July (Mobile rally at Truro), 4 Aug ("2m propagation" by G8HTE), 1 Sept ("An introduction to rtty" by G4CVY). 7.30pm. SWEB Clubroom, Pool, Camborne. Cornish net every Sunday 11am on 3·685MHz. Visitors to club meetings most 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)—First and third Fridays in each month. 19 Aug (River trip to Calstock). 7.30pm. Burraton Toc-H Hall, Saltash. Sec G8LLR, tel Plymouth 771135.

Torbay (TARS)—Every Friday with special meeting on last Saturday of each month. 30 July (Come and see, night!), Aug 20 (Final preparations for mobile rally). This meeting is a week early because of the rally on 28 August. 7.30pm, rear of 94, Belgrave Road, Torquay. Torbay net, weekdays on 3·765MHz, 10.30am. Visitors to club meetings always welcome. Full details from G3UIQ.

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

(No information received—*Ed*)

REGION 11—RR P. H. Hudson, GW3IEQ, "Silhill", Dinas Dinlle, Caernarvon LL54 5TW.

(No information received—*Ed*)

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

Aberdeen (ARS)—The club has now vacated the Crown Street premises and meets every Friday evening at the Cowdray Club, 5 Fonthill Road, Aberdeen. During the holiday period the club will be closed from 1 to 22 July. At a recent meeting a large number attended from all over Zone G to discuss the Aberdeen vhf repeater project. This repeater, GB3GN, is now licensed but no date has yet been fixed for commissioning. The Grampian Repeater Group chairman and project manager have thanked the club for their assistance. Sec GM4BKV.

Dundee (Kingsway Technical College ARC)—Wednesdays, 6.30pm. Kingsway Technical College. The club will be closed during the holiday period from June until mid-September. During the past year many talks have been given on all aspects of radio. Other subjects have been photography, awards, and communications during the 1939-45 war. Speakers are required for the winter period. 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, Pittencreiff School, Maitland Street, Dunfermline. Details GM3MGX, tel Limekilns 313.

Edinburgh (E&DARC)—Tuesdays, 7.30pm. City Observatory, Calton Hill, Edinburgh. Details from GM4BWT, tel 031 668 1119.

Edinburgh (Lothians RS)—Second and fourth Thursdays in each month, 7.30pm. Adult Education Centre, Riddles Court, High Street, Edinburgh. Details from GM4BYF, tel 031 447 3201.

Glenrothes (G&DARC)—First Sunday in each month and every Wednesday, 7.30pm. Old Primary School, Provosts Land, Leslie, Fife. Details from GM3YOR, tel Kirkcaldy 200335.

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

(No information received—*Ed*)

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. 2 Sept (AGM). 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 Wellington Place, Belfast.

Belfast (BRSGBG)—Third Wednesday in each month, 8pm. 90 Belmont Road, Belfast. Interesting spring programme arranged. Visitors most welcome. 21 Sept (AGM). 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. 4 Sept (AGM). Sec GI3WWY.

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 Ave, Harlow. Details from G3WUX.
Ipswich (IRC)—Details from G4BAV.
Loughton (L&DRS)—Second and fourth Fridays in each month, 8pm. Loughton Hall, near Debden station. Details from G8DZH.
Lowestoft (L&DARC)—Fridays, 7.30pm. Morse class every Tuesday. YMCA, Park Road, Lowestoft.
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.
Stowmarket (S&DARS)—First Monday in each month, Red Cross building near Stowmarket station. Details from G4ETC.
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.

(No information received—*Ed*)

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.
Easington (AR&EC)—Tuesdays and Thursdays, 7.30pm. Easington Village Workman'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)—Alternate Wednesdays 7.30pm. Great Lumley Community Centre. Assistance with RAE and morse if required. SWLs welcome. An excellent lecture on communication satellites was given on 12 April by Dr Triogga. It was suggested after the lecture that a course on satellites, including weather maps and Oscar, together with constructional work, be held in Newcastle at some later date. Anyone interested contact the sec G8JLQ.
Hartlepool (HRC)—Mondays, 7.30pm. Methodist Church Hall, Grange Road. Sec G3NWU, 73 Eamont Gardens, Hartlepool.
Middlesborough (POARC)—Sec G8CDP, 48 Grange Rd, Hartlepool, Cleveland.
Morpeth (Northumbria RC)—Now meets Thursdays, British Legion premises, Gambois, nr Blyth. Sec G4AVO.
Newcastle upon Tyne (Tyne and Wear Repeater Group)—First Wednesday in each month. Arts Common Room, University of Newcastle. Open to all interested amateurs. Sec G3URE.
South Shields (SS&DRS)—Fridays, 7.30pm. Trinity House, Old and new members welcome. Sec G8BQF, 67 Lauderdale Avenue, Kings Estate, Wallsend.
Teeside Repeater Group—Sec G8MBK. Group open to all amateurs.
Tyneside (TRS)—Mondays, 8pm. The Community Centre, Vine St, Wallsend. Sec Alex Frazer, 35 Percy St, Tynemouth.

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

Acton, Brentford & Chiswick (ABCRC)—19 July ("My first contact as a G" by G5FVE/VE6CBN), 16 August ("The disappearing inductance", discussion on the article by L. A. Moxon). 7.30pm. Chiswick Trades & Social Club, 66 High Road, Chiswick. Sec G3GEH.
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 N. Dowsett, 44 St Anne's, Barking.
Cheshunt (CDRC)—New premises—Church Room, Church Lane, Wormly, Herts. Wednesdays, 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. Northfield Community Centre, Northcroft Rd, London NW13. Newcomers and old-timers very welcome. Sec M. E. J. Cummings, G8KPN, tel 01-997 5947.
East London RSGB Group—Summer break until September. Do not forget "Small box of tricks competition". Build something into a 2oz tobacco tin. Rules from sec J. Bundock, G4CJQ.
Edgware & District RS—14 July (Informal with club station on air), 28 July ("TTL logic" by Godfrey Manning). No meetings August. Slow cw under club call G3ASR/A now on 144·175MHz at 2030 on Mondays and 1930 local time on 1st and 3rd Thursdays. Reports greatly appreciated. Sec P. Ling, G4BZY, tel 01-952 2495.
Harrow (RSH)—1 July (VHF NFD planning), 8 July (Astronomy talk), 15 July (Practical), 22 July ("Transverter design" by G4AUF), 29 July (Practical), 5 August (Practical), 12 August (Practical), 19 August (Summer mobile ramble). 8pm. The Roxeth Community Centre, Scott Crescent, West Harrow, Middx. Sec G4FBK, tel 01-864 1412.
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)—20 July ("Modern rf circuitry and construction" by G8DKK), 25 August (Talk and slides by G2YS). 8pm. Market Hall, St Albans. Informal meetings at Salisbury Hall, London Colney, on 2nd Thursday in month. Congratulations to G3TMA, Ian Buffan.
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 (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.
Bristol (BRSGBG)—25 July ("Amateur tv" by G8FNR, G8GLQ and G8KGH), 21 Aug (Bristol mobile picnic, Ashton Court), 22 Aug (Home-constructed equipment), 26 Sept (Brains trust). 7-9.30pm. Small lecture theatre, Queen's Buildings, University Walk, Clifton, Bristol 8. Sec G4FRG.
Cheltenham (CRSGBG)—First Thursday in each month, 8pm. The Old Bakery, Chester Walk, Cheltenham. Sec G3KII.
Cheltenham (CARS)—Wednesdays, 8pm. St Marks and Hestors Way Community Association, Brooklyn Road, Cheltenham. Visitors very welcome. Sec G8JAY.
Taunton (T&DARS)—Fridays, 7.30pm. Jelalabad Barracks, The Mount, Taunton. Sec G. Swetman, "Little Copse", Monkton Heathfield, Taunton. Tel West Monkton 298.
Western-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)—Thursdays, 7.30pm. New venue: Hut 101, Houndstone Camp, three miles W of Yeovil, off A3088, info at main gate. Sec G3NOF.

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 75p (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

Trio 7200G, 9ch fitted, first-class cond, not used mobile, comp with mic, power lead, car mount and manual, original carton, £140. Buyer collects please. G3KZU, QTHR. Tel Oxford 63000 evenings.

Standard C146A, 5ch, toneburst, base-master, nicads, flexi-whip, mic, £120 ono. Icom IC21, 10ch, ac/dc, external vfo, £150 ono. KW 2m tx, a.m./fm, £15 ono. G8HEB, QTHR. Tel 021-357 1924.

AR88D with S-meter and handbook, recently overhauled, £50. BC221 in table-top case with mains supply and calibrations, £25 ono. RCA 807s, £3 pair. Five-pin UX ceramic bases, 5R4GYs, 5U4Gs, 6V6, wide-range 6V octal valves. Tested. Any sensible offers. Tel 024-05 2533.

Green and Davis psu, 20W, 2m and 70cm, fixed or mobile, £50. Marconi Marine receiver 3873B, 500kHz-30MHz comp with manual, £50. G5SN, QTHR. Tel Southend 554846.

Liner 2 comp with mic, manual, leads, mobile mount, in original carton, £110 ono. G4BFJ, QTHR. Tel Burgh Heath 55196.

National Semiconductor SC/MP micro-processor introkit and keyboard kit, built and tested, £100. Univac terminal keyboard, 101 keys, suitable for rtty, micro-processors, vdu etc, £30. No offers. G8LLB, QTHR. Tel 01-478 7557 daytime, 01-531 0716 evenings.

Trio JR500S rx 80-10m, £40. Heathkit DX100U tx 160-10m, £30. G3VOK, QTHR. Tel 0582 413909 after 5pm.

TS 700G, £350, FRDX400, £165. Osker SWR-200 pwr/swr meter, £15. IC22 12ch, in use daily, £125. All exc cond. MBM 46-70cm, £10. G8ESK. Tel Bradford 45611.

Pye base tx, a.m./fm cw, 6ch, in cabinet, 640A in final, £25 ono. Buyer collects or carr extra. G4FDQ, QTHR. Tel Lancing 63673.

Storno base station, 240V 12W xtalled S20/SN/LO, control box, ASP670, £45. Storno Viscount, xtalled S20/21/22/S0/SN/LO, control box, ASP670, £45. Storno Viscount, xtalled 144·48, control box, ASP670, £30 any trial. Storno base station 240V 12W, xtalled 70·48, complete with control box, seen wkg. G3PQC, QTHR. Tel Farnborough 44268.

KP202, as new, vgc, fully xtalled inc R6 and R7 toneburst, helical telescopic whip, leather case, nicads, charger, antenna adapter, £120, or will exchange with cash adjustment for TR2200GX in similar cond. G8JKA, G4FYA, QTHR. Tel after 6pm.

Trio 9R-59DS all-bands communication receiver, exc cond and wkg order, voltage stabilized, handbook, £45. G3WMO, QTHR. Tel 01-363 5814.

Eddystone EC10 mk2, mint cond and in perf wkg order, mains and portable power packs, operating manual, Securicor delivery, £155 ono. Phil Hodson, 43 Thorpe Road, Melton Mowbray, Leics.

Telford TC10, showroom cond, £65. Buyer collects. G3EFP, QTHR.

KW2000B, exc cond, ac power supply, spkr, 20 spare valves and four 6146, just overhauled, £215. Datong rf clipper, hardly used, perfect, £30. G3HCU, QTHR. Tel 0306-730 215.

FT101E, £400. 2m Europa, £45. MMT 432/144 tx/rx, £115. 2m 5⅛8 whip and window clip, £5. 10m Flexiwhip with base and 80m coil, £8. Home-brew hf linear. Offers. GW4CBR, QTHR. Tel 064625534 evenings.

TR2200G with helical, S20, S22, R7, nicads, MB1A Modular Electronics FM15P amplifier, ASP 5⅛8 whip, magnetic base, 15 extra channels, the lot for £180. Microwave Modules 432MHz converter, 28MHz i.f., E18. T and T 144MHz preamp, £6. Codar dc psu, £10. G3ZXF, QTHR.

Standard C146A, 5ch fitted, toneburst, telescopic and helical whips, base charger, £95. FSM/audio monitor, £3. Last seven years *Radio Communication*, couple missing. Offers. Odds and ends. G4BJM, QTHR. Tel 0908 72463.

Eddystone 770R vhf rx, exc cond, £120 or offer. G4EOG, QTHR. Tel Lydd (0679) 20387.

KW2000A/B dc power supply, £25. Graham Down, 43 Cedar Drive, Sutton-at-Hone, Dartford, Kent. Tel Farningham (0322) 862736.

BRT400K rx, 160kHz 30MHz, £40. U450E tx, fitted toneburst, RB4 and SU8, £30. Sentinel 70cm converter, i.f. 28MHz, as new, £14. Cambridge U10B, fitted 6ch, RB2, RB4, RB6, RB10, RB14 and SU8, spare pa, £70. G8ABB, QTHR. Tel 0908 78102.

Hammarlund HQ180 rx, sell or exchange Hallicrafters SX122, HQ100, Sc828, Sc432, or why? G4AFY, QTHR. Tel Kidderminster 63358.

70cm 46-el Multibeam, immac, £10. R1155, 75kHz-18MHz continuous, with case, psu, audio amp and spkr, £15. JR500S, with matching spkr and headphones, good cond, £45. Pye Cambridge, low band comp, £6. G4CFA, QTHR. Tel Formby 77920.

Russian C1-5 oscilloscope 10MHz bandwidth, little used, as new, spare valves, leads, manual, £40. Buyer must collect. Consider exchange for 2m/70cm gear or rf sig gen. G8MES. Tel Sheffield 389229.

QTH: end terrace, partially modernized, two receps, kitchen, two large beds, bath, spacious loft, front and 70ft rear gardens inc outbuildings, 400ft asl, good amateur site, freehold, offers around £7,000. G4EUE, QTHR. Tel Tamworth 872159.

18AVT/WB vertical, 9 months old, £40. G4FMZ. Tel Titchfield (Hants) 43410.

KW Vespa mk2, tx, 160 to 10m ssb/cw/a.m., 6LQ6 pa, with spare valves, vgc, £85. IC202, vgc, £130. Preferably buyers inspect and collect. G4EAX, Tel. Long Eaton 69238 evenings.

Trio QR666 gen cov rx, good cond, £80. 2m 8-el XY with circular phasing, harness, £10. 70cm Multibeam, £8. Joystick and 500W atu, new, £20 ono. G4FDR. Tel Albrighton 3793.

HW17A with fm adapter; HG10B vfo; BC221E psu, charts, spare valves; CT471A electronic multimeter; Emsac 2m converter with psu; U450L tx and rx on 70cm; AM25Bs, 2m, one fm, other a.m.; Koyo tape recorder with fm. Reasonable offers, please. G4DEL, QTHR.

FT101, little used, manual, 10-160m. fan, £275. G4EJV, QTHR. Tel Worthing (0903) 65625.

Pye Cambridge U10B, ok 70cm mobile, £30. Technical Products TE15 dip oscillator, 440kHz-280MHz, £20. AR30 rotator, brand new, does not fit my 2in mast, £35 or exchange for AR40 etc with cash adjustment. G8IXK, QTHR. Tel Luton 23827.

Cossor 339 double-beam scope, £5. Various ht transformers. Cameras: Minolta 16mm, £8; Halina Super 8, £8. *Wanted*: Codar T28, wkg but any cond considered. M. Lang, 9 Kinver Terrace, Burnham-on-Sea, Somerset. Tel Burnham 785976 most tea-times.

Property of deceased amateur: Hammarlund HQ180 gen cov rx. BC221 freq meter. AR22 rotator. Codar PR30 rf pre-selector. Two 811A valves. 36 Douglas Street, Motherwell, Lanarkshire. Tel Motherwell 63732.

ASCII keyboard, data available, £10. AR20 rotator motor, new, £7.50. *Wanted*: 10-40 vertical (Atlas or similar), must be cheap. G8HGO, QTHR. Tel Thatcham 65617.

Storno base station CQF13, 10W, 6ch, R5, R6, R7 (tx only), S20, S21, S22, home-brew control unit, ptt mic, meter, vgc, £55 ono. G4FOY, Tel Alton (0420) 82855.

KW107, atu, swr, psu, 52Ω dummy load, £46. G3YWS, QTHR. Tel Newark 2413.

HP23A psu with handbook, £25. Carr extra. Command rx 1·3-3MHz, £5. G3RB, QTHR. Tel Whitley Bay 530504.

Heathkit comp station. Factory built SB401 tx, SB301 rx with all filters, Heath 2m converter, SB600 spkr, SB200 linear, SB610 monitorscope, all perfect with manuals and many new spare valves, £495 comp. May consider separating. G2ABX, QTHR. Tel Sambrook 531.

KW2000B, vgc, fitted new 6146B, about 50 spare valves incl two pairs 6146, sale to include ac psu, £195, no offers. Tel Hayling Island 4013.

Trio JR599CS rx, exc cond, £150 ono. Yaesu FL50B, FV50B, exc cond, £90 ono. Will not split Yaesu. G4EKS, QTHR. Tel Eastbourne 32777.

Trio TS700 tx/rx, fitted xtals S20, S21, S22, R6, £270. Belcom LA106 2m linear amplifier, 180W p.e.p., input power from 10W drive, £100, near offers considered. G4FYS ex G8KME, QTHR. Tel Yeovil 4773.

Trio 7200 2m rx/rx, five repeater, six simplex channels fitted, mobile mount, mic etc., £135. Vibrotrol 2m 12V solid-state amplifier, 100W o/p version, £75. G3OUF, QTHR. Tel Amersham 21573.

FM10B rx, comp, wkg R7, £25 ono. F450T tx, 5W, wkg, £25 ono. Cambridge solid-state osc boards tx/rx, 6ch, £3 each. Carr extra. G8HNN, QTHR. Tel Worcs (0905) 22704.

OS-2 scope, unused, £40. CT436, £70. Viscount 3 14+14W amp, exc cond, £17. 1025 deck, £8. APR4Y i.f. unit with tuning units, £100 ono. Radiotelephones for spares, from £1. TCS tx, £6. Black 88 set, £3. N. Hammersley, 410 Liverpool Road, Rufford, Lancs.

Pye PF1 comp with deacs and wkg on 433·2, two sets, one with charger, £35; one without, £30. S. Wheatley, tel Hurstpierpoint (Sussex) (0273) 832435 after 6pm.

IC202 ssb/cw hand portable rig, covering 144·0 to 144·4MHz, 3W output, exc cond, £130. FT221 forces sale. G8JSK, 18 Mayfair Ave, Ipstones, S-o-T, Staffs ST10 2QE.

Single meter swr bridge SWR10, £5. Pair Eagle FR65 10W 8Ω hi-fi spkr chassis, £10. Microwave Modules 70cm converter, 28MHz i.f., £10 ono. QQZ06-40, Mullard, unused, with base, anode connections and tuning sub-assembly, £4 ono. YL1130 driver, £1. G8KAX, QTHR.

Yaesu FT200 with FP200 psu, exc cond, £200. Trio JR310 rx, boxed, with spkr, a.m./ssb/cw 10Hz mech filter, £75. Eddystone 840C rx, little used, no mods, £50. All fine cond with manuals. G4FQP, QTHR. Tel Scunthorpe 720 794.

Heathkit HW32 20m ssb tx/rx without spkr or psu, £50 or, with HP23 mains psu, £65. Hudson AM108 4m radiotelephone with handset, £5. Pye Reporter PTC116 radiotelephone, rx on 70·375, no xtal in tx, without mic, £3. G3VSJ, QTHR. Tel Hodd (099-24) 68052 after 6pm.

Wharfdale Golden spkr, 10in, 3Ω, £3. Valves: 813, 2E26, £2 each. 5763, 6BW6, three for £1. Hundreds of unboxed valves, early and late, some new, specials. G3MBL, QTHR. Tel 01-445 4321.

726L press-button dialling telephones, £2.50. Wavemeter, £8. R208 rx battery or mains, £10. Storno Viscount controls/spkr, £4. Microwave burglar alarm, £25. Variac transformer, £10. Valve voltmeter, £10. Radiovisor Ray burglar alarm £15. W. H. Joyce, 41 Rochdale Road, London E17 8JF. Tel 01-539 5421.

MMT 432/28 transverter, over 10W output, low noise input, little used, £75 post paid. GW8AAP, QTHR. Tel 07456 2550 after 5pm.

Atlas 210X tx, six months old, unused, mains power pack, G-whip mobile antenna, 10-80m Yaesu, mic, £425. Marconi TF1100 valve voltmeter, £30. Creed 75RO, silent cover, wkg and in exc cond, £40. James. Tel Dereham (Norfolk) 2437.

Icom IC22A 2m mobile tx/rx, 11ch, mobile mount, good cond, surplus mains power supply, £140. Tel 061 431 3725.

Sensitive Collins TCS12 2m rx, SSM converter, S-meter, Q-multiplier, fm disc, noise limiter, remote spkr, psu, £25. AR20 rotator, 45ft cable, £25. Unused 70cm converter, 2m i.f., guarantee, £15. Garex 60W inverter psu, 250V, £3. AEC SWR20 power/swr meter, £4. Buyer collects or carr arranged. G8LKR, QTHR. Tel Hitchin 730 550.

Heathkit SW717, Gen cov, Heath constructed, as new, exc cond, £50 ono. Bob Downing, 50 Woodfield Road, Solihull, W Midlands. Tel 021 705 8451.

640A/320 bases, new, silver plated, ptfe inside, boxed, £1.75 each. Pair used 813s, useable bases, heater transformer, £5. Large eht transformer 2-0-2kV under rated 400mA, buyer to collect, £5. MF455-10CK, £10. HRO skeleton, 8 coils, psu, £7.50. G4AFS, QTHR.

Microwave Modules MMC 144/28 LO converter, BNC sockets, as new, £14. MMC 144/28 with 38·667MHz xtal, £8. G8AYY, QTHR.

14AVQ/WB with maker's 80m loading coil, used, £35. Heathkit HFW1 tv generator, mint, £30. Vanguard AM25B, 6ch, 2m, some xtals, internally excellent, £25. GW3GWA, QTHR. Tel 097 881 3891 ext 231 wkg hours.

Trio TS520 tx/rx, as new, £320. Cooper, 17 Castlepark Drive, Fairlie, Largs, Ayrshire.

Belcom Liner 2DX, later version of Liner 2, 144·05-144·625 ssb/cw, +5kHz shift to QSY, vxo, rit, af and rf gain, offers. Two MM 2m preamps, £10. MM 70cm/144 converter, as new with BNC, £16. Lamb, 51/3 Vineyard Rd, Northfield, Birmingham B31 1PJ. Tel 021-477 2029 after 5pm.

2m 8-over-8 slot beam, £8. R1155B, internal psu, £12. 300Ω tubular, 30ft, £2. Ferris signal generator, 85kHz to 25MHz, £12. Pi tank, 3·5-MHz, to 30MHz, pa 807, £3. Xtals, filters, transformers etc. SAE for list. G3CBU, QTHR. Tel 0256 58921.

Pye Vanguard fm tx, mic, control box, cables, plugs, S20 xtals, wkg well, £27 ono. R107, wkg, £6. R1392D with data, wks but needs aligning, £6. R7, tx xtal, 8MHz, new, £1.50. G8NAQ, 48 Stonor Rd, Hall Green, Birmingham. Tel 021 745 2750.

KW2000, vgc, ac/dc power supplies, service manual, Shure mic, £110. No offers, buyer collects. G3NEP, QTHR. Tel 0246 823347.

Calibrator No7, £3. PR813s, £4. Murphy 4m base station, £3. BC221, charts, £12.50. Teletype station, comp, wkg, £40. Hammond organ, £350. 2m and 4m beams, £3 each. G3PBQ, QTHR. 021 373 2282 evenings.

Atlas 210 with de luxe mobile mount and antenna matching transformer, few hours use only, £380. Hygain BN86 balun, £10. Drake TV3300LP low-pass filter, new, unused, £14. J. L. Barry, 13 Mill Rise, Bourton, Gillingham, Dorset.

Hallicrafters Hurricane SR2000 tx/rx 80 to 10m, 2kW p.e.p. Icom IC201 multimode 2m tx/rx, highest offers secure. *Wanted:* Drake C-line, R4C, T4XC, L4B or SB220. Will sell SR2000 only on purchase of Drake Line. G3XVF, QTHR. Tel Norwich 56782.

IC202, £128. TR2200G, 7ch, £80. MM 144MHz converter, 28MHz i.f., £11.50. MM 432MHz converter, 28MHz i.f., £13. Belcom 12V psu, £14. Commercially-made 432MHz tripler, £9. BC221, charts, psu, £13. Elderly HRO, works well, £14. G8DEE, QTHR. Tel Cambridge 64251.

3BP1 crt, brand new, £8. CBM 7919D calculator, 29 functions, with case and mains adapter, £12. Buyers collect. Martin Barson, 31 Aldbourne Road, Burnham, Bucks. Tel Burnham 3756 after 4pm.

SB303, exc cond, swop for good value hf rig. Creed 75 mk3 printer, £20. Lafayette HE40, £20. Electronic flash gun, replaces flip-flash bars, £7. Turner, 14 York Way, Thetford, Norfolk. Tel Thetford 61648 after 6pm or Thetford 2484 ext 40 9am to 5pm.

2m synthesizer, 5kHz steps, 144-148MHz, two independent selectors enable instant repeater/reverse or input listening, HW202, mic, bracket, all documents, £130 ono. C146A, fitted R6, R7, S0, S20, S21, helical whip, £85 ono. G8ITJ, QTHR. Tel Maidenhead 27460.

Teleton stereo cassette recorder, CR02, Dolby, counter, £40. Rank 300 slide projector, £12. Loudhailer, 10W, £15. Pye Westminster W15AM, tunes 144-146 a.m./fm, 3ch a.m. tx, mic, spkr, manuals, £50. Carr extra. G3XKA, QTHR. Tel Woking 73620.

Marconi mk3 tv studio camera, comp and wkg, viewfinder, monitor, etc, £75. 14in monitor, very clean inside, good picture, £14. Camera pan-and-tilt head with wedge plate, for cameras about 80lb wt, £12. 4½in IO yoke, £4. 3in IO camera, transistorized, £25. G8GQS. Tel Gainsborough 3940.

Yaesu FRG7 rx, vgc, £130 ono. Codar C70A rx, £28 ono. G8NHN, 10 Filey Road, St Annes-on-Sea, Lancs. Tel 0253 722652.

ACCU keyer, inc psu, case, latest Browns twin-lever paddle, solid-state output, £25. Spare pcb with ic holders, £3. G3RUG. Tel 061-439 7183 home, 061-483 2188 work.

KW Viceroy tx with psu, cct diagram, £40. Labgear Topbander with cct, modulator disconnected, £5. Incomplete vols of *Radio Communication* 1949–69, offers. Delivered 20 miles radius of Loughborough. G3XAZ, QTHR. Tel 0509 30957.

BC221 with psu, charts,, £15. RAE course (31 lessons), £10. E-Zee match, £12. KW swr meter, £4. G4CZD, QTHR. Tel Gravesend 61252.

FT401 QRO rig, with cw filter, vgc, £230. Heath SB303 superb rx, vgc, £135. Both ono. G4EGS, QTHR. Tel 051-427 1931.

FT200 plus FP200, vgc, £230. Slow scan tv, commercial pec, home-made case, spare 5FP7, £40. Buyer inspects. 2m to mw converter, £4. 2m 5⅛ antenna, £4. G4AWL, QTHR. Tel Cosham 79153.

Telford TC7 mk2, £45. Telford TL9, toneburst, £65. Withers Two-mobile, a.m., £30. G8AEV converter, 4·8-6·8 i.f., £10. Pye Reporter tuneable rx, tx on 2, a.m., £12. Pye Hand Ranger, £10. G8GAZ, QTHR. Tel 021-357 1924.

Farfisa VIP345 electronic organ, home use only, hardly used, comp with pedalboard, seven flute stops, piano and harpsichord presets, sustain, six percussion, syntheslalom, £280 ono or swap for 2m mobile or why? G3UZI, QTHR. Tel Horsham (0403) 66327.

Barlow Wadley XCR30, mk2, six months old, in original container, immac cond, white stick owner unable to tune bands accurately, £103. 136 South Street, Andover, Hants SP10 2BS.

Cossor 1035 scope with manuals, £15. Eagle FMT-640 fm tuner, £6. Mullard type-C tape preamp, never used, with cct, £5. Triang 12V dc transformer, £1.50. G8AZG, QTHR.

Eddystone 888A, vgc, tilt blocks, S-meter, manual, 985kHz xtals, five new spare valves. *Wanted:* FL50B, FR50B calibrator, mint cond, manuals. Garex 2m xtal converter, original cond, not wkg. Voltage stabilizer, 190/260 in, 230 out, 150W. Offers please. G3FK, QTHR. Tel Breamore 436.

QM70 2m solid-state transverter plus linear, £48. UHF Cambridge U10B, xtalled RB2/SU8, £35 ono. Starphone M5 multi-channel, fitted RB2/SU8, all solid state, approx 6W o/p, dashmount, £80. G3NPZ, QTHR. Tel Titchfield (Hants) 43894.

FT220 2m tx/rx, £220. Heathkit SB310 rx, gen cov, plus 80, 40, 20, 15m, £130. Both items in exc cond. G8HVI, QTHR. Tel Stadhampton 890910.

FT200 FP200, exc cond, full 10m coverage, new pa tubes, £240 ono. Swan xtal table mic, £8. Delivery may be arranged to UK mainland, my expense. Winch, Air Traffic Control, Belfast Aldergrove Airport, Antrim, N Ireland. Tel Antrim 5611.

Eddystone 898 dial, unmarked, £8. MM 28/144 converter, oscillator o/p, £15. Jaybeam, 2m 10-el plus 30ft UR67, £14. Two QQV0640A, second-hand, good cond, £1.50 each. G3JDN, QTHR. Tel Reigate 40646 after 6pm.

IC22A, R3, R4, R6, R7, RR7, S0, S20-S23, preamp mic, mobile mount, manual, £140. Liner 2, 144·1-144·33, mic, mobile mount, manual, psu, £125. G3TCG, QTHR. Tel Fairseat 822043.

Atlas 180 comp with ac consul, £300. M. Giles, 9 Napier Close, Fairstead Estate, Kings Lynn. Tel Terrington St John 401.

Pye Cambridge, boot mount, 2m, fm, 6ch, with control box and cable, £25. Pye fm base, 6ch, £18. GW8HDH, QTHR. Tel 0792 22287 after 6pm.

Heathkit SB102 tx/rx wih power supply, spkr and manual, in mint cond, £200. Firm, tel 051-677 5409.

Tower BX1, two sections, £75. 7200G, mint, £150. IC22A, mint, AR88LF, £30. FT560, £215. KW160, £15. 10-el 2m beam, £6. Junkers key, £14. Heathkit power supply, HW101 etc, £30. ROR 2-el beams, £8. KW103 swr meter. G4DYR, tel Wolverhampton 763504.

Liner 2, fitted preamp, exc cond, £100. G4DUE, 18A Spencer Close, Potton, Sandy, Beds. Tel Potton (0767) 260552.

Heathkit SW717, gen cov, well constructed, exc cond, manual, £35 ono. Jeff Jackson, 28 Church Rd, Newbury Park, Ilford, Essex. Tel 01-599 8852.

Trio 9R59DS rx, fitted voltage stabilizer, 100kHz and 1MHz xtal markers, manual, loudspeaker, vgc, £45. Microwave Modules converter, 2m, 2 to 4MHz i.f., almost new, £12. *Wanted:* vhf and audio sig gens. G8JTE, QTHR. Tel E Grinstead 22944.

Microwave Modules MMT144/28 transverter, works well, almost new, surplus, £60. G3REO. Tel Coniston 329.

AVO Model 7, £14. AVO Multiminor, £5. AVO Minor with leather case, £3. Each instrument in exc cond and full wkg order, comp with leads, prods and batteries. G8CCI, QTHR. Tel Oxford 880229 weekends or evenings after 7pm.

Storno CQF614 25W + 2m fm base station, 1,750Hz, control gear, vgc, £110 ono. Storno CQL600 4m fm mobile, vgc, £55. Pye MF5U 70cm mobile, SU8, SU20, RB14, £85. Pye PF5UH 70cm handheld, £55. RCA R17M20 2m fm 20W amplifiers, £10 each. G8BOY, QTHR.

ASP655 base station antenna, brand new and unused, £12 inc carriage. G8EPQ, QTHR. Tel Kings Lynn (0553) 61554 after 6pm.

Liner 2 144·10-144·33, fitted with PA3 preamp, exc cond, plus homebrew psu, £120. G8IDX, QTHR. Tel 0909 2180.

2000A, exc cond, £160. Homebuilt linear, from *SWM* Oct 68 design, £35 ono. Eddystone EC10 mains psu, £50. Buyer collects. G2VO. Tel Keighley 603021.

FT200, FP200, DC200, exc cond, with leads and manuals, £275 or offers. *Wanted:* G3ZVC ic tx/rx kit. G3SCU, QTHR. Tel Exeter 77714 after 6pm.

Heathkit Mohican, plus manual, £20 ono. G8LWD, 87 Alderson Road North, Sheffield S2 4UF. Tel 584586.

Heathkit SB303 hf rx, fitted with optional cw and a.m. filters plus SB600 matching spkr, £250 ono. G8JBK, QTHR. Tel Colchester 230318.

Trio JR310 rx, SP5DS spkr, exc cond, £66. AR88 rx, good cond, £35. DX40U tx, good cond, £15 ono. Homebrew 2m converter, 5·1, 7·1MHz i.f., £6. Buyers to collect. Gibson, 1 Tamar Gardens, Walney Island, Barrow-in-Furness, Cumbria.

FT101B, 2 years old, vgc, £320 ono. Microwave Modules 432MHz converter, MMC432/28, hardly used, £20. Modular Electronics rf padboard with design data, £2. Deliver locally, or buyer collects. G4CIK, QTHR. Tel 0223 66466 ext 356 (afternoons).

Two AR88Ds in fair cond, one wkg, £35, one with fault on voltage circuit, £25. Heathkit RA1, wkg order, £20. C. Fuller, 47 Cooper Road, Croydon, CR0 4DL. Tel 01-709 0280 9.30am-3.30pm.

Hallicrafters 2m tx/rx SR42A comp with vfo, £50 ono. G3BXI, QTHR. Tel Great Easton 235.

2m to 70cm varactor tripler, £15. 70cm solid-state converter, i.f. 28-30MHz, £15. G8IRJ, QTHR. Tel Steyning 814089.

IC22A, mint cond, fitted preamp, 145·000, 144·600, 145·300, S13, S20, S21, S22, S23, R3, R5, R6, R7, must sell due to purchase of TS700G, £135 ono. Buyer to inspect and collect. G8DZH, QTHR. Tel 01-508 3434 after 6.30pm.

Pye Vanguard FM25B, S20, S21, S22, S23, R6, R7, preamp, auto toneburst, exc cond, £50. Lowe Monitor 1420 rx, S20, S21, S22, R6, R7, £20. BC221 with charts, £12. G4DTR, QTHR. Tel 061-439 8422.

Trio QR666 gen cov rx 150kHz-30MHz (22-30MHz dual conversion) a.m./ssb with bandspread, hardly used, £100 ono. Tel Buckland Newton (030 05) 223.

KW107, mint, will exchange for 109 or similar with cash adjustment. G4GJ, QTHR. Tel Bingley (097 66) 2965.

Subminiature 4-pole changeover relays, 700Ω, max current 1A dc, pcb mounting, fitted with dust-proof covers and sockets, ex-equipment, exc cond, £1 each, postage 10p per relay. J. W. Henderson, 53 Dumyat Drive, Falkirk FK1 5PA.

Trio TS520, virtually unused, mint cond, still under guarantee, £310. Midy VN 80-10m trap dipole, unused and boxed, £25. G3POQ, QTHR. Tel Hailsham (0323) 840379.

Xtals: XF901, 1MHz, B7G, £1 each; wire-ended 80MHz, 72·687MHz, 73MHz, 50p each; HCU, 30MHz, 40 MHz, 75p each; 2N3632, £1 each; BLY36, 50p each; SG1495D, £1 each; QQV03-20A, £1.50 each; R1475 rx, ac/dc psu, handbook, £15 ono. G4AJC, 21 Northcroft Road, Ewell, Surrey. Tel 01-393 1876.

Solatron 513 scope, £35. Nombrex sig gen, 220kHz to 230MHz, £7.50. Carr can be arranged. G8LCQ, QTHR. Tel 0783 842350.

Microwave Modules 144/28 transverter, only few months old, £75 ono. G4FHX. Tel 01-428 7039 after 7pm.

Stabilized mains power supplies, suitable for Liner 2 or fm equipment, adjustable from 8 to 18V dc, 3·5A, £20. New transformers oil filled, 1,185·0-0-1,185V, 360mA, £8.50. New mains transformer, 0·465V, 350mA, 50V, 50mA, 6·3V, 6A, £5. 813 base, 60p. SAE enquiries. Carr extra. G4DFE, QTHR.

Trio 7200G, fitted S0, S20, S21, S22, R3, R6, R7, SU8 xtals, SSM rf amp, xtal toneburst, performs well, £145. Matching VFO309, £35. Discount for both. G4DCQ, QTHR.

4CX250B valve, new, with uhf base, £7 ono. Will separate. G3VWO, QTHR. Tel Fencehouses 2301.

Yaesu FR50B communication rx, mint cond, amateur bands, xtal calibrator, manual, £70. Lees, 450 Castle Lane West, Bournemouth. Tel 517200.

Property of deceased amateur. KW station comprising KW200E, KW107, KW spkr and KW Q-multiplier units, £375 the lot. Prefer not to split. Buyer views and collects from A. H. Othen, G8FSZ, QTHR. Contact via RSGB HQ or tel Byfleet 48307 evenings.

Two homebrew ATUs with roller coasters, etc, £4, £3. Aircooled 50Ω dummy, £4. Antenna switch, 6-way, S0239, £3. AEC swr meter, as new, £7. Joystick vfa, £5. Heathkit Mohican, vgc, mains psu, £40. G4EAQ, QTHR. Tel 01-327 5989.

18AVQ with guys and insulators. *Wanted:* Bird 43 hf inserts for 2-30MHz. G3SLI. Tel Reading 479850.

Stolle semi-auto rotator, 8/8-el Yagi, 2 by 20ft pole, 2 by 24in brackets, buyer dismantles, very reasonable. Will exchange. G3EOF. Tel 01-650 5129.

R1155 rx, wkg order, with lash-up psu if required, fitted output stage, £17.50. *Wanted:* beam rotator suitable for 10m Monobander. G4FMO. Tel Ashby de la Zouch, (05304) 3973.

FDK Multi 2000, tx/rx, fm/ssb, fitted T + T preamp, toneburst, manual, £150. GM4DNM, QTHR. Tel 0592 720224.

KW Atlanta, ac psu, handbook, new pa valves, exc cond, with Shure mic, £170. Lionel J36 bug key, £5. Ribbon desk mic, hi/lo Z, £6. Collect or carr extra. Crisp, Rame Barton, Rame, Penryn, Cornwall TR10 9DY. Tel Stithians 516.

KW2000E, mains psu, KW110 Q-multiplier, £325. G4CFF, QTHR. Tel Thetford (0842) 2957 after 6pm.

FR101DD digital rx with all optional extras, perfect cond, £410 ono. BSA/Dake four-stroke petrol generator, 500W at 240V dc, £45. 5FP7 crt, £6. Creed 75RU teleprinter, synchronous motor, Murray code, £20. *Wanted*: Icom PL-VI vfo. M. Watson. Tel 01-903 4363.

Pye Vanguard, modified 4m, five tx ch, leads, control box, mic, instruction book, spares, £18. G8AEH 4m converter, to 29MHz, £7. Both for £22. Buyer collects or transport agreed. G2YS, QTHR. Tel Rickmansworth 76864.

SSM Europa 2, transverter, in exc cond, comp with internal antenna c/o relay, preamp and fitted new knobs, 12V transformer for heaters, £65 ono. G3URE, QTHR. Tel 089-426 5311 (work), 3044 (home).

CR100/B28, manual, valves, £20. Buyer collects. Liner 2, mains psu, £120. Carr paid or exchange for FTV260 transverter or similar equipment.

Two linear QY4-250s plus transformers, £20. Buyer collects (Yeovil). G3WPB, QTHR.

Fine QTH, 5 miles Carlisle (A69), 4 beds, dining room, kitchen, large lounge, hall, garage/shack, gardens, access to Lakes and Scotland, offers around £13,550. G8IHV, QTHR, or Tiffen, 1 The Crescent, Carlisle.

Liner 2 fitted with 2m rx preamp and 10m preamp (for use with QM70 70cm transverter), QM70 28/432 transverter, 10W output, plugs, cables, manuals as supplied, buyer collects, £170 ono. G4FAZ, QTHR. Tele 030-57 71053 evenings.

Icom IC202, 1-hour use only, nicads charger etc, maker's box, £150. T. Watts. Tel 01-485 2231, working hours.

KW500 linear for tx, BC221 and psu, £15. KW202 and KW204 for tx/rx. Sell or exchange all with cash adjustments. *Wanted:* atu 160-10 or 160-20 (1kW). G4FYW, 13 Elmstead Road, Erith, Kent.

IC22A, 11½ch, mosfet preamp, all frequencies, just aligned, first-class cond, xtal toneburst, mobile mount and all accessories £145 ono. G3OOS, QTHR. Tel Bristol 44922.

Storno Viscount, comp multichannel 2m, toneburst, Burns preamp, xtals for S0, S20, S22, R3, R4, R5, xtals interchangeable without retuning, £60, or £65 with 5⅛ Antec whip. G8KLW, 57 Austhorpe Road, Cross Gates, Leeds LS15 8EQ.

Speech amplifier, four inputs, vu meter, 600Ω output, with robust psu, £15. External psu for BC221, £3. Tape recorder with Wearite deck, professional preamp, £40. RF ammeters, 0-5A, new, £3, many other meters. Leach relays, 220V ac, tpdt, £1. Many others. Micalex polystyrene. Filament transformers, 6·3V, 6A, 2,000V, £2. 75Ω heavy coaxial cable. Offers. Postage extra. Moving house. SAE for list. GD3TIU, QTHR. Tel Marown (0624) 85442.

Barlow Wadley XCR30 mk 2, fm tuner, TR801, manual, exc cond, £100. G8ASJ, QTHR. Tel Worcester 820882.

Storno boot-mounted tx/rx (CQMD), xtalled for 144·48 and 145·0, £20. Pye PTC703/704 base station, needs attention, £7. B. Lambert, 58 Broadmead Road, Woodford Green, Essex. Tel 504 6157.

IC21XT, good cond, £125. KW2000 dc psu, £25. G3UKE, 65 Brook Road, Stansted, Essex. Tel 0279 814889.

Xtals for Storno Viscount: R5, R6, 144·48. Xtals for TR2200: R6, R7, £3 per channel. RTTY tu, plus printer. G4ALG, QTHR. Tel Reading 345046.

Heathkit amateur band rx, 80-10m, vgc, £50 ono. Four-drawer all-metal desk, 45in wide, 34in deep, 31in high, buyer collects, £15. EMI Q/D101 oscilloscope and manual (small), needs attention, £5. Xtals 99kHz B7G, 19·2kHz HC6/U, wire ends, £1 each. Shaw, 16 Deansfield, Four Spires, Cricklade, Wiltshire.

Mosley Mustang triband beam, high power, 2kW version, brand new and totally unused, still in original packing case, new price £98, will accept £80 ono. Genuine reason for sale. G4ERD. Tel 0509 212583 (Midlands) or 01 561 7903 (London) after 5pm.

Redifon GR289 2m tx/rx, 10W output, 12V wkg, fitted R7 and tone, S22, 12ch available, remote control unit and handbook, £60. G3YNP, QTHR. Tel 01-399 2097.

KVG XF9B filter, new, never used, with xtals and holders, best offer over £25. G3RUG. Tel 061 439 7183.

QRT 2m Icom 240, three months old. Liner 2 preamp, nine months old. Both with mobile mounts 5⅛-whip mobile antenna. 5-el X-Yagi. Electronic T0, keyer with vibroplex key. Offers for all or separate. *Wanted:* heavy-duty key. Tel Polmont 711414 or 62770.

IC22A, S0, S20, S21, S22, S23, GB3LO, all accessories as supplied, £130. G3GOG, QTHR.

Property of late G3CFT. Heathkit DX100u tx, exc cond, £40. Marconi TF340 op/m, £15. TF144G sig gen, £10. TF329G Q-meter, £20. TF886A, £10. BC221M, ac charts, recalibrated, mint cond, £25. Solartron VF252 ac millivoltmeter, £20. Ferris N and FSM 32A, £10. Unipivot microammeter, 0-60μA, mint, £20. AVO CT146 transistor tester, mint, £90. AVO CT160 valve tester, mint, £65. All prices ono. G4EJO, QTHR.

Belcom Liner 2, built-in mosfet preamp, Pye mic insert, comp with matching Belcom stabilized power supply, £135 ono or swop for fm handheld or mobile gear. Tel 051 722 4669 or 051 227 1919 day.

Trio R300, perf cond, new Dec 1976, £155. G4FQZ. Tel Derby 831724 after 6pm.

Yaesu FT101E, mint, little used, still under guarantee, £400. Prefer buyer collects, will pay half Securicor. GM3GJB, QTHR. Tel Falkirk 23608.

FRDX400, vgc, £140. Liner 2, £90. TE149 RCA wavemeter, £8. Redifon GR289, £15. 2m Parabeam, 4-el, £10. G3XNX, QTHR. Tel 08045 4504.

FT101E, £390. FTV250, £100. 18AVT/WB, £35. Emoto 102LBX, £65. IC22A, £100. G-whip 80/10, £10. Magnetic mount with 5⅛ whip, £12. 160MHz digital frequency counter, £55. Elbug, £10. Osker swr meter, £12. All new in 1976. G3KNJ. Tel Watford 44069 after 6pm.

8-el sm beam, £5. Sentinel MF 2m converter, £14. Xtals: HC6U 37·3125 (2), 9·028(2), 8·0555(2), 44·7666(2), 8·021, 8·07, 8·092, 24·11, HC25U 44·766. £1.50 each. G4DOV, QTHR. Tel Walsall 27738 after 5.30pm week.

Atlanta, recently serviced by KW, no mic, £210. Zeiss Super Contaflex camera, with 0·2, 0·5, 35, 50, 85m lens, carrying case, tripod, £105. Weston light meter, £8. G4BLB, QTHR. Tel Deal 3538.

Digital 11 with toneburst, brand new, in original packing with mic and accessories, covers all channels, repeater shifts etc, exactly as SMC specification, used 10 hours as base station, cost £275, accept £225 ono. D/D. G5FH, QTHR. Tel Highcliffe 04252 5974.

Yaesu FTDX401, 560W p.e.p., immac cond, very little used, with mic, plugs, manual and box as supplied, £250. Sphinx ssb tx, 70W p.e.p., 160-80-20, £30. Pye base tx/rx, 4m low band, £25. UM3 mod transformer, £4. 1kVA transformer, 1,000-0-1,000, £4. R220 4m, £5. G3XLT, QTHR. Tel Rochdale 57383 evenings.

Sommerkamp FT250, £190. G3WWH, QTHR. Tel Bayston Hill 3383.

FRG7 in mint cond, few months old, in maker's carton with ac and dc leads, all plugs, manual, surplus to requirements, £140 carr paid. Stewart, White House, Harris, Western Isles, Scotland. Tel 085 983 223.

Drake R4C, mint, £300. G4EVS, QTHR. Tel 028 73 2426 after 6pm.

ST715A marine solid-state exciter, 1·6-26MHz, 30ch xtals, emission A1/A2/A3, suitable multi-frequency signal source, £18. Valves: 6146 £2.50. 5B254M and holder, £2. RCA 1625s (12V 807), £1. *Wanted:* Manual Alpha 7711 linear. G3JMJ, QTHR. Tel 073 271 3467.

Hear what you can work with your pa—fit a mosfet preamp, more than 15dB gain, 3dB noise figure, pcb size 1¾ by 1⅜in, £3.50. Cmos toneburst, adjustable, built-in stabilizer, pcb 2 by 1¼in, £2.50. G4EBI, 99 St James' Road, London SE16 4RA. Tel 01-231 0879 evenings.

Complete station: Versatower P60, two years old, £160. Moseley Mustang 3-el beam, one year old, £55. Ham-M rotator, as new, £70. Latest FTDX401 tx/rx with a.m. facility, cw filter fitted, £325. SB610 Monitorscope, £55. G4BLP. Tel 0242 42601 after 6pm.

Eddystone 840A with ext spkr, £20 ono. 8Y/2m, 22yds 75Ω coaxial, 15yds UR57/75Ω coaxial, £8. AR40 rotator, 15m control cable, £35. 20ft by 2in by 3/16in ali, £4. 8ft by 2in by 3/16in ali, £1. 5ft by 1¼in by ¼in ali, 50p. Two 2 by 2in scaffold swivel clips, £1. Two one-piece insulators, 50p. Buyers collect after 5pm Mon-Fri; after 1230 pm Saturday. D. Wooller, 13 Cavalry Crescent, Eastbourne, East Sussex.

Hickock USA vom, 20kΩ/V, comp leads, case, mint, £25. US Navy straight key, leads, plug, new, £5. Manuals: RA17, RA63, RA117, 880/2, 75S3, 51S1, 13A scope, etc. SAE list. AVO sig gen, lf, 100MHz, exc cond, £25 plus carr. G3GUU QTHR.

Drake T4XC, R4C, 160-10m, WWV, AC4, 4NB, MS4, Magnum Six, Shure 444, £850. G4DJC, QTHR. Tel 0245 69034.

40ft 2-section telescopic Versatower (Western Electronics) complete with ground post for swivel mounting, head unit, 40ft tubular pole with pulley and two braked winches. CDR TR44 rotator complete with meter. 2-el Gem quad antenna complete with all accessories. Unused. Offers to: Mrs V. Nairn, G4BML, Cherryfield House, Cane End, Reading, Berks.

A REMINDER

The flat rate for Members' Ads was increased to 75p for 40 words or less from 2 July 1977

WANTED

KW VFO-4B, top price paid for clean unit, KW 50Ω dummy load. G4LY, QTHR. Tel East Bridgford 349 evenings.

RTTY tape reperforator, type 7TR or similar, for making punched tapes. Carr arranged. G4FAJ, QTHR. Tel 05433 2169.

Reliable modulation meter. HF beam for 10, 15 and 20m. Will collect up to 100 miles. Spot cash. G3NNY, QTHR. Tel. 0582 412513.

WW2 radio set, type T-5 (also called BP5). Urgently require following original anciliaries: mains power pack; converter 500V; converter 250V; external modulator/mic. Also require WW2 German hf gen cov rx in exc wkg cond. G3UCT. Tel Fleet (02514) 6998.

Copy of circuit diagram of Codar T28 rx. G3HQW, QTHR.

Pre-war copies of *Guide to Amateur Radio*. Pre-war *RSGB Handbook* G2BUJ, 32 Pound Lane, Pinehurst, Swindon. Wilts SN2 1PS.

16mm Ampro model UA projector, all sound head parts, discarded projector for parts considered, any information or manual on this model appreciated. Cheap 16mm camera, splicer, rewinder, spools, films, or any 16mm equipment. Restarting in hobby. G4BPW, QTHR. Tel 0283 813395.

Manual, mods, control box plug for Storno CQM39/23. Buy or borrow and copy and return. EI8CZ, QTHR.

Circuit, handbook for army BP413 (ZA22773) rx. Coils for B2 tx. Q-max gdo or winding details. Besford, 49 Blake Rd, Great Yarmouth

24V dc motor with reduction gear. G3GAD, QTHR.

Main tuning dial for AR88LF. G8KMS, QTHR. Tel 08045 6708.

Circuit diagram or manual for Cossor CC303 Commando tx/rx. Will buy or copy and return for reasonable price. C. Shermon, 89 Novers Park Drive, Bristol BS4 1RH. Tel BS 668945 after 6pm.

Transformer for Cossor scope model 2100, also circuit or manual to buy or borrow to copy. Elliott. Tel Dunstable 69783 evenings or weekends.

Low-band Pye W15AM, dash mount, any cond. Pyecall mobile decoder MD1, encoder PC90/960 and PG1 AM, high or low band, any cond. Reeds for P61 and tone filters for MD1. J. Griffiths, The Grange, Gladstone Street, Abertillery, Gwent. Tel 049 532 3111 any time.

Accommodation in Bristol area. Monday to Thursday each week, agreement to use own modern hf cw equipment would be appreciated. G3IEW, QTHR. Tel Wedmore 712007.

UHF M5 Starphone tx output board, working or faulty if complete with covers, screens etc. G8CBE, QTHR.

Aspiring cw addict urgently requires Vibroflex bug key in good cond. Please give price. All letters answered. R. D. Elliott, 484 Barking Road, Plaistow, London E13. Tel 01 476 8274.

Pair Pye Pocketphones, type PFI, for conversion or converted to 70cm, with or without batteries and/or cases, but must be in wkg order and with circuit. All replies answered. G4ANW, 16 Chestnut Drive, Broadstairs, Kent.

4m transverter, also antenna. G3XXQ, QTHR. Tel Newcastle 746723.

Circuit and information on miniature oscilloscope type CT52. Borrow or purchase. GW4EVJ, QTHR. Tel Clydach 843948.

Manual for Pye W30FM Westminster (boot mount) including noise blanker and tone lock modules if possible. To buy or copy. G8KBZ, QTHR. Tel 01-743 8000, ext 4409/10 (work), 01-579 3958 (home 6-7pm).

KW E-Zee match atu mk2. Longbottom, Sapeli Lawns Road, Baynards, Rudgwick West, Sussex.

Modification details to enable fm reception on valve "twoer" (Heathkit HW30). Your postage costs refunded. G3WDS, QTHR.

Pre-war RABWS components, valves and books *needed* by collector enthusiast. Civilian equipment only after 1929. Complete collections purchased. Christopher Sawyer, 210 Gordon Avenue, Camberley, Surrey. Tel Camberley (0276) 29460.

Power attenuator, 20dB 10W or higher rating, preferably N or BNC type connectors, must be 50Ω. HP power meter, type 431 or 432, not wkg or head blown or missing ok. G8BXH, QTHR. Tel 01 959 6799 after 7pm.

KW2000 or KW2000A with mains psu, spkr unit and manual, must be perfect cond and wkg fb. KW107. Cash waiting for right rig at right price. Urgent! G3UCY, QTHR.

Vertical antenna in good cond, 18AVT, 14AVQ, G-whip or why? KW E-Zee match. Foster, 14 Audley Close, Lytham St Annes, Lancs FY8 4RT.

Service manual and/or circuit diagram for Eddystone 770R vhf rx. Buy or borrow. Reasonable price paid. GI3ZTG, QTHR.

KW2000/A/B with psu, Joystick Joymatch A/J, 2m beam, rotator, pair Goodmans Magnum spkrs. Kai Chandler, 2 Argentan Close, Abingdon OX14 SQW.

Blind yl swl needs gen cov rx and stereo record player for small room. Regret cannot collect. Contact G3XKM, QTHR. Tel Stourbridge 5546.

Potentiometer for indicator in black round moulded cover about 2¾in diameter, connections marked 1,2,3, +6, —7. 12,077·5kHz xtal for KW2000 HC6/U. 12·125MHz xtal for 2m mobile. G3MBL, QTHR. Tel 01 445 4321.

5FP7 tube for slow scan tv. G3PMC, QTHR. Tel Aldershot 23497 9.30am to 5.30pm. Fleet 3916 after 6pm.

Yaesu FV401 or FV101 mk2 vfo. YO-100 scope, 1 Lovelace Road, Oxford.

Two QV08-100 pa valves, or four 6HF5s. Willing to exchange for two unused RCA 813s with cash difference. G3VCA, QTHR. Tel 01 848 8185.

SWL requires Trio JR599 rx, good cond, custom special preferred, but basic version better than nothing. Will collect good distance. Preferably tel Amersham (02403) 5670, or write to P. Q. Armitage, 2 Longfield Drive, Amersham, Bucks.

Drake R4A or R4, top price paid. GI3OTV, QTHR. Tel Dublin (0001) 512436.

I.F. chassis or set of i.f. transformers, including bfo and xtal, for BC348, scrap or non-working rx would be acceptable. Manual or circuit for Airmec 712 valve voltmeter and Airmec 858 oscillator. G3LYU, QTHR. Tel Leicester 876459.

Remote vfo for Swan 500C. Electroniques amateur band front-end (valve version). Furness. Tel Aberdeen 323808 or leave your number at Aberdeen 53553.

Redifon GR410 ssb tx/rx (military type SRC14 version) badly requires complete realignment. Grateful to hear from anyone with experience of this set, who has necessary test equipment and prepared to offer help. G3UCT, 27 Glen Rd, Fleet, Hants. Tel Fleet 6998.

Early books by John Scott-Taggart. Also original Scott-Taggart rx ST100, Ediswan ES2 and ES4 valves. Radio gear from WW1 to 1929. G3SYX, Fir Glen, Beesby Road, Maltby-le-Marsh, Lincs LN13 0JJ.

MEMBERS' AD ORDER FORM

FOR SALE ☐ WANTED ☐ (Tick as appropriate)

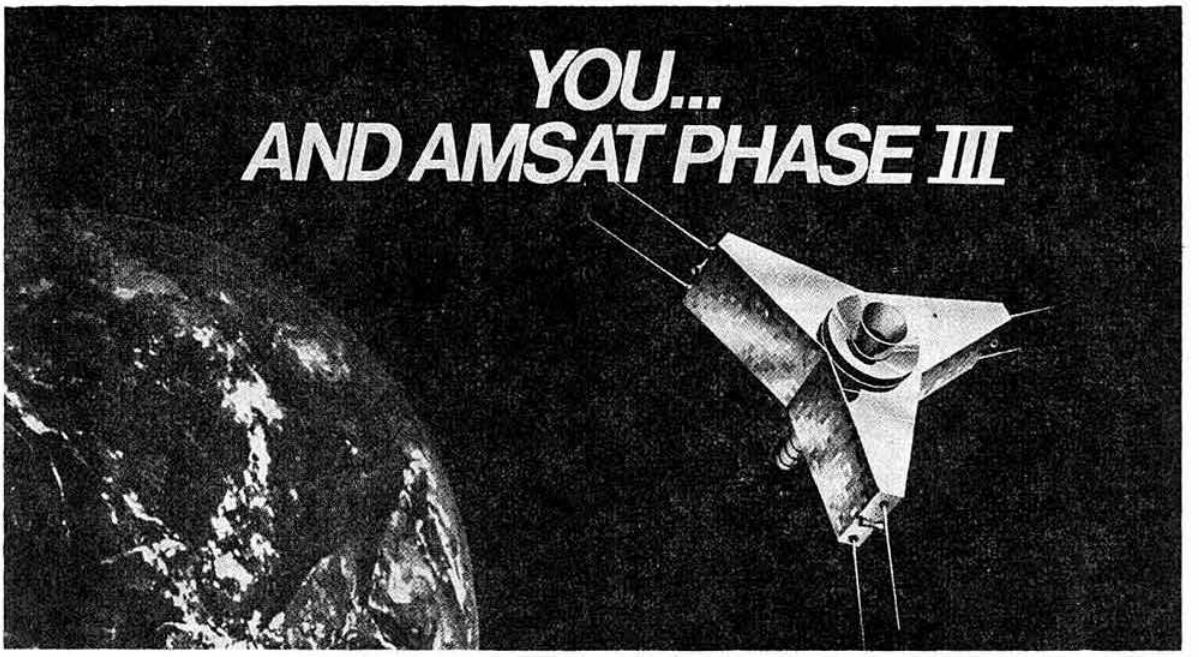
- **See Members' Ads page for conditions of acceptance.**
- **Not more than 40 words, including name, address, etc.**
- **Do not forget 75p remittance plus wrapper.**
- **Please write in block capitals, or type.**

Licensed members are asked to use their callsign and QTHR, meaning that their address in the current call book is correct. BRS and A members will, of course, have to provide their name and address.

I enclose cheque/PO for **75p** to cover the cost of this advertisement.

Signed .....

Date .....



An exciting new era in amateur radio is about to begin . . . the era of AMSAT Phase 3 Oscar satellites.

Many of you are familiar with the benefits of the AMSAT Oscar satellites, notably Oscars 6 and 7. These satellites, with a combined total of over eight years in orbit, have provided communications between amateurs throughout the world. They have also provided a capability for an educational programme in space sciences and many interesting experiments.

AMSAT, with members and national groups worldwide, and headquarters in Washington, DC, has been responsible for our current satellite programme. Many people feel that perhaps the greatest value of the amateur satellite programme is the dramatic demonstration of amateur resourcefulness and technical capability to radio spectrum policy makers around the world.

The value of this aspect of amateur radio as we prepare for the 1979 World Administrative Radio Conference (WARC) is enormous.

The AMSAT Phase 3 satellite programme promises a continuing demonstration that amateur radio is at the forefront of modern technology. Phase 3 satellites will routinely provide reliable communications over paths of up to 11,000 miles (17,600km) for 17 hours each day. You can think of them as a resource equivalent to a new band.

The cost of these Phase 3 satellites is a projected £150,000. Commercial satellites of similar performance would cost nearly £6m.

Your help is needed to put these Phase 3 Oscar satellites in orbit.

Your valued contribution can be as small as one of the 5,000+ solar cells needed. A handsome certificate will acknowledge the numbered cells you sponsor for £6 each. Larger components of the satellites may also be sponsored with contribution acknowledgements ranging to a plaque carrying your name aboard the satellite. Write to AMSAT UK for the opportunities available.

Your membership of AMSAT is important to the satellite programme, and will give AMSAT the support it requires and deserves. At £6 per year or £60 for life, you will be making a most significant contribution to the satellite programme and the future of amateur radio. You will also receive the quarterly AMSAT newsletter.

Cut out the AMSAT Phase 3 coupon below and send it with your support today.

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HARROW, MIDDX HA3 6HS

Yes, I want to support AMSAT Phase 3 Oscar satellites. Enclosed is:

☐ *£.... in sponsorship of.... solar cells (@ £6 each).*
☐ *£6 annual membership.* ☐ *£60 life membership.*
☐ *Send information on sponsoring larger satellite components.*

Name .....

Callsign ..... *AMSAT Member?* .....

Address .....

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NORTH WEST AMATEUR RADIO CONVENTION

TO BE HELD AT

LANCASTER UNIVERSITY ON SEPTEMBER 17-18th, 1977

LECTURES:

25 years as a regional representative	Basil O'Brien G2AMV
Integrated circuits	Dr. I. Saunders
Elementary OSCAR	P. J. A. Gowen G3IOR
Advanced OSCAR	P. J. A. Gowen G3IOR
Interference forum	Home office/R.S.G.B.

Also other lectures to be arranged

Further attractions include:

FILMS	CONSTRUCTORS COMPETITION
BRING AND BUY STALL	TRADE EXHIBITION STANDS
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It's no secret, though, that we have recently expanded our entire production capacity enabling us not to just manufacture our standard range of first class VHF/UHF converters and varactor triplers, which have gained world wide acclaim over several years, but to arouse new interest by launching on to the market certain new products such as our 50MHz and 500MHz frequency counters, ÷ 10 500MHz prescaler and our latest range of all-mode linear transverters for 144MHz and 432MHz.
This month we are briefly reviewing this wide range, but please do not hesitate to contact us either by post or telephone for any technical details, or to request detailed data sheets for any of the products mentioned below.

144MHz.

MMT144/28 : 144MHz all-mode linear transverter.
Features: 10 watts RMS output power.
30dB receive gain.
2·5dB noise figure.
Aerial changeover achieved by a pin diode switch.
I.F. : 20–30MHz.
Price : **£88.88 inc. VAT**

MMC144/28 : Single conversion 144MHz receive converter with protected dual gate MOSFETs.
Typical gain: 30dB. Noise figure: 2·5dB.
I.F.'s : 12–14, 14–16, 18–20, 24–26, 28–30MHz.
Price : £20.25 inc. VAT

MMC144/28LO : As above unit but has an extra buffer amplifier at 116MHz for use in transverters.
Provides 5mW at 116MHz.
Price : **£22.50 inc. VAT**

MMC144/2 : Double conversion 144MHz receive converter which achieves good image rejection at low intermediate frequencies.
I.F.'s : 2–4, 4–6MHz.
Price : **£20.25 inc. VAT**

MMA144 : Low noise preamplifier with two independent outputs.
Typical gain: 18dB. Noise figure: 2·5dB.
ALSO AVAILABLE for 70 and 136MHz.
Price : **£14.63 inc. VAT**

1,296MHz.

MMC1296/28 : 1,296MHz receive converter utilizing a hybrid ring mixer, with a matched pair of schottky diodes driving a MOSFET I.F. amplifier
Typical gain: 25dB.
I.F.'s : 28–30, 144–146MHz.
Price : **£28.13 inc. VAT**

MMV1296 : 1,296MHz varactor tripler.
Will accept up to 30 watts of 432MHz drive and achieves 60% efficiency.
Price : **£33.75 inc. VAT**

432MHz.

MMT432/28 : 432MHz all-mode linear transverter.
Features: 10 watts RMS output power.
30dB receive gain.
3·0dB noise figure.
Aerial changeover achieved by a pin diode switch.
I.F. : 28–30MHz.
Price : **£109.13 inc. VAT**

MMT432/144 : 432MHz DOUBLE CONVERSION all-mode linear transverter.
Features: 10 watts RMS output power for 10 watts 144MHz input.
10dB receive gain.
3·0dB noise figure.
Aerial changeover achieved by a pin diode switch.
I.F. : 144–146MHz.
Price : **£149.63 inc. VAT**

MMC432/28 : 432MHz receive converter featuring 2 RF amplifiers and a MOSFET mixer.
Typical gain: 30dB. Noise figure: 3·8dB.
I.F.'s : 14–16, 18–20, 28–30, 144–146MHz.
Price : **£24.75 inc. VAT**

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MMD500P : Divide by 10 prescaler to give 500MHz capability when used with MMD050.
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70MHz.

MMC70/28 : Receive converter for 70MHz.
Similar to MMC144/28.
I.F.'s : 4–4·7, 14–14·7, 18–18·7, 28–28·7MHz.
Price : **£20.25 inc. VAT**

MMC70/28LO : Similar to MMC144/28LO.
Features buffered local oscillator facility at 42MHz for transverter use.
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THE UP-CONVERTER—MODEL UC/1

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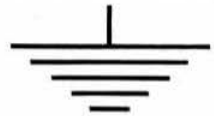

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