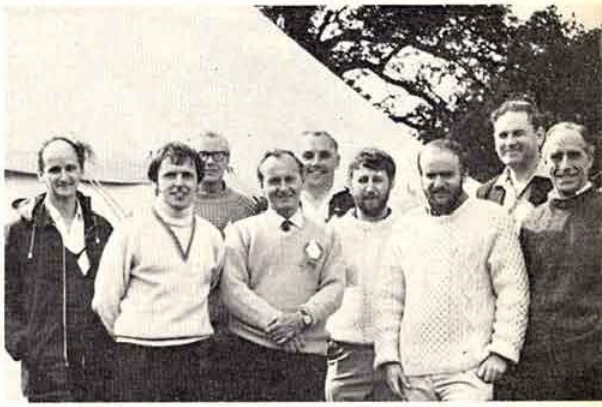
radio communication

August 1971

Journal of the Radio Society of Great Britain

THE MOBILE RALLY SEASON



Top left: Mrs C. M. Abbott, G3XDQ, at the Longleat Rally

Top right: Members of Bristol Group Committee at the Longleat Rally

Centre left: G2CVV, President of RSGB, drawing the winning ticket at the Elvaston Mobile Rally

Centre right: Two budding amateurs, Stephen Grand and Stephen Clements at the Longleat Rally, with a significant number plate in the background

Bottom left: The "Radio Derby" radio car was one of the attractions at the Elvaston Rally

August 1971

radio communication

Volume 47 No 8 Price 30p

CONTENTS

Radio Communication **(incorporating** *The RSGB Bulletin***) is published by The Radio Society of Great Britain as its official journal and is posted to all members of the Society on the first Tuesday of each month**

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Closing date for contributions, unless otherwise notified: 7th of month preceding month of publication.

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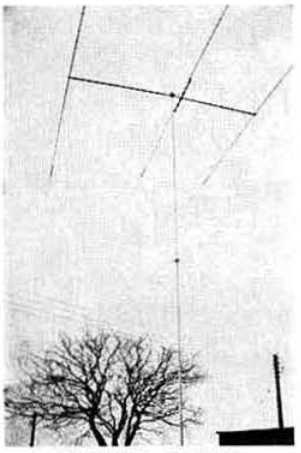

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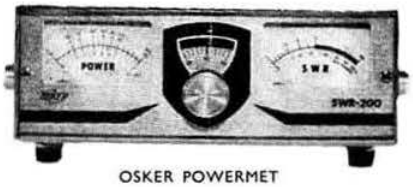

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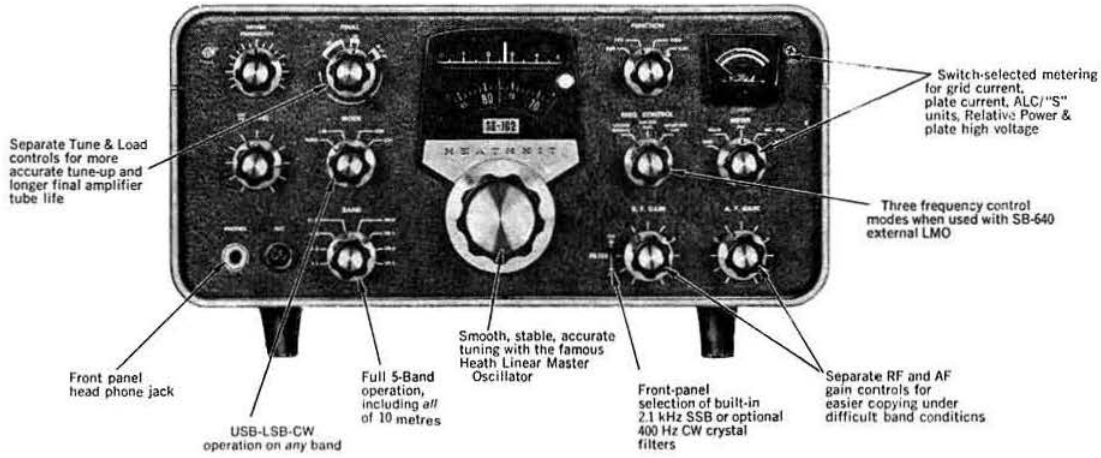

SB-102 SPECIFICATION—RECEIVER SECTION: Sensitivity: Better than 0·35 microvolt for 10 dB signal-plus-noise-to-noise ratio. **SSB selectivity:** 2·1 kHz minimum of 6 dB down, 5 kHz maximum at 60 dB down—2/1; 1 nominal shape factor 6 : 60 dB. **CW Selectivity:** (With optional CW filter SBA-301-2 installed) 400 Hz minimum at 6 dB down, 2·0 kHz maximum at 60 dB down. **Power output:** 2 watts into 8 ohms. **Image and IF rejection:** Better than 50 dB. **TRANSMITTER SECTION: DC power input:** SSB; 180 watts P.E.P. continuous voice; CW 170 watts—50% duty cycle. **RF power output:** 100 watts on 80 through 15 metres; 80 watts on 10 metres (50 ohm non-reactive load). **Output impedance:** 50 ohms to 75 ohms with less than 2 : 1 SWR. **Oscillator feed-through or mixer products:** 55 dB below rated output. **Harmonic radiation:** 45 dB below rated output. **Transmit—receive operation: SSB:** Push-to-talk or VOX. **CW side-tone:** internally switched to speaker in CW mode. Approx. 1000 Hz tone. **Microphone input impedance:** High impedance. **Carrier suppression:** 50 dB down from single-tone output. **Unwanted sideband suppression:** 55 dB down from single-tone output at 1000 Hz reference. **Third order distortion:** 30 dB down from two-tone output. **Noise level:** At least 40 dB below single-tone carrier. **RF Compression (TALC*):** 10 dB or greater at 0·1 mA final grid current. **GENERAL: Frequency coverage:** 3·5 to 4·0; 7·0 to 7·3; 14·0 to 14·5; 21·0 to 21·5; 28·0 to 28·5; 28·5 to 29·0; 29·0 to 29·5; 29·5 to 30·0 (megahertz). **Frequency stability:** Less than 100 Hz per hour after 10 minutes warm-up from normal ambient conditions. Less than 100 Hz for ± 10% line voltage variations. **Modes:** Upper or lower sideband (suppressed carrier) and CW. **Visual dial accuracy—"Resettability":** Within 200 Hz on all bands. **Electrical dial accuracy:** Within 400 Hz after calibration at nearest 100 kHz point. **Dial mechanism backlash:** Less than 50 Hz. **Audio frequency response:** 350 to 2450 Hz ± 3 dB. **Front panel controls:** Main (LMO) tuning dial; Driver tuning and Preselector; Final tuning; Final loading; Mic and CW Level Control; Mode switch; Band switch; Function switch; Freq. Control switch; Meter switch; RF gain control; SSB-CW filter switch. Audio Gain control. All other controls internal. **Rear Apron Connections:** CW Key jack; 8 ohm output; Spare A; Spare B; Phone patch input; ALC input; Power and accessory plug; RF output; Antenna switch; Receiver Antenna. **Power requirements:** 700 to 800 volts at 250 mA; 300 volts at 150 mA; —115 volts at 10 mA; 12 volts at 4·76 amps. **Cabinet Dimensions:** 14¼" W × 6½" H × 13¾" D.

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QTC AMATEUR RADIO NEWS

Space Conference

The Space WARC which ended on 17 July agreed to proposals to allow the amateur satellite service in the bands 7, 14, 21, 28, 144, 435MHz and 24GHz.

Generally, however, the attitude of the conference to amateur radio was unsatisfactory. A full report will appear in the September issue of *Radio Communication*.

"Telecommunication Journal"

The May number of the *Telecommunication Journal*, the monthly review of the ITU, is an exceptional issue devoted to space radio communications and techniques. Including the supplement, this issue contains more than 600 pages. A special number published during the ITU Space Telecommunication Conference, it covers all aspects of this technique and includes an article "Satellites in the amateur radio service", by G. Jacobs and P. I. Klein. In addition to the 32 articles, the special number contains, in the form of a supplement, a complete list of artificial satellites launched between 1957 and 1970. Another supplement is a map showing the position of satellite earth stations throughout the world.

The May number of the *Telecommunication Journal* will be a valuable work of reference to all those concerned with space telecommunications. The journal may be obtained from the ITU, Place des Nations 1211, Geneva 20, Switzerland. The annual subscription for the English language edition is 25 Sw.Fr. (£2·50). The price for a single copy of the special issue is 15 Sw.Fr. (£1·50).

RAE, 6 December 1971

The RSGB will provide a centre at University College, Gower Street, London WC1, for this examination, which will take place between 6.30 and 9.30pm on Monday 6 December.

Applications to sit the examination at this centre must be sent to RSGB HQ with a remittance of £2 for members or £2·50 for non-members.

Closing date for acceptance: 31 October 1971. Late entries CANNOT be accepted.

Importation of transmitting equipment into the UK

An order made in January 1968 under Section 7 of the Wireless Telegraphy Act 1967 requires importers and manufacturers to seek the authority of the MPT to import certain types of apparatus capable of transmitting between 26·1 and 29·7MHz and 88 to 108MHz. The usual multi-band transmitting equipment invariably covers part of the first mentioned band. At the time when the order was made it was specifically stated that amateur equipment would be exempted from any restriction.

However, it is recommended that where the apparatus is capable of transmitting between 26·1 and 29·7MHz (ie including the 10m band) an "Authority to Import" issuable by the Minister of Posts & Telecommunications should be requested as well as the licence, and visitors are strongly recommended to have this "Authority" mailed to their home address before departure so that it can be shown to the Customs officials on entry into the UK.

Applications for both the licence and the Authority to Import should be made at least 30 days before they are required. The address of the Telecommunications and Radio Regulatory Division of the MPT is now *Waterloo Bridge House, Waterloo Road, London SE1.*

Licence figures

The Ministry of Posts & Telecommunications advises that the following numbers of amateur licences were in force at the end of May 1971:

Class A	13,842
Class B	2,690
Class A/M	2,651
Class B/M	432
Television	205
Model Control	19,923

Looking ahead

19 September—Region 9 ORM.
3 October—Scottish VHF Convention.
23–24 October—Region 12 ORM.
26 October—RSGB Lecture at the IEE.

RSGB NATIONAL MOBILE RALLY

Woburn Abbey, Bedfordshire

Sunday 8 August 1971

Talk-in stations GB2VHF, G3VHF and GB3RS on 2m, 4m and 160m.

Attractions will include a large trade exhibition, tv demonstration, Raynet get-together, grand raffle, and bring-and-buy sale. Please price equipment for sale before putting it on display; a deduction of 10 per cent will go towards rally funds.

Woburn Abbey park opens at 11am and its grounds of over 3,000 acres include the Wild Animal Kingdom with more than 2,000 animals; children's playground; pets corner; boating lake; amusement park and fun-fair. There will also be children's sports and lucky dip. Visits may also be made to Woburn Abbey's state apartments, and there are restaurants and snack bars.

Car parking in a specially reserved car park

Organized by the Radio Society of Great Britain.

Use of Woburn Abbey by kind permission of His Grace the Duke of Bedford.

QSL Bureau

Holders of G4-plus-three-letters callsigns are advised that their sub-manager has moved from Market Harborough to Derby. In future they should send their cards to Mr R. I. Buckby, 23 Hazel Drive, Spondon, Derby DE2 7DS.

As G8 licensees tend to send more cards to other G8s than to other prefixes, it would ease the work of the QSL Bureau if cards intended for Class B licence holders were sent direct to the sub-manager, G6QM, and not to G2MI.

Holders of British reciprocal Class C and D licences are requested to note that their sub-manager is Mr E. G. Allen, G3DRN, 65A Melbury Gardens, London SW20. Holders of all reciprocal licences regardless of prefix should send their cards to Mr Allen.

All other cards should be sent to G2MI. Please do not send QSL cards to RSGB headquarters.

Can you help?

LRW Electronics Ltd, No 10 Unit, Forgehammer Industrial Estate, Cwmbran, Mon, are manufacturing a marine radiotelephone for the 2MHz band and would like to enlist the services of an amateur who is also a boat owner and who would be interested in assisting with range trials.

The Wolverhampton Radio Society will celebrate its 50th anniversary in 1972, and Bill Moorwood, G3CAQ, and Roger Jennings, G3SOE, are writing a history of the society.

A considerable amount of written and pictorial material has been located but any member having information on the society's history is requested to contact G3CAQ.

The Star Short Wave Club will hold a grand junk sale in aid of RAIBC funds at 7.30pm on 15 September at the New Inn Hotel, Bramley Town Street, Bramley, Leeds 13. Junk of any description is urgently needed and will be collected within a 25-mile radius of Leeds—offers, please, to Mr T. Leeman, G8BUU, 115 Asket Drive, Leeds LS14 1HX.

Accommodation for 70 visitors has been booked and refreshments will be available. Invitations have been sent to all clubs in the area.

Scottish VHF Convention

Carlton Hotel, North Bridge, Edinburgh

Sunday 3 October 1971

The convention, organized by the Lothians Radio Society, will commence at 3pm. An exhibition of equipment built by amateurs in the area will open at 2.15pm and members attending the convention are invited to bring additional items of equipment for display.

Main speakers will be Mr T. Douglas, G3BA, and the RSGB VHF Manager, Mr G. M. C. Stone, G3FZL.

It is hoped to operate a talk-in station using the call GM3HAM/A on 2m.

Light refreshments during afternoon.
Dinner at 6.45pm, approximately.

Tickets will be available from Mr V. W. Stewart, GM3OWU, 9 Juniper Avenue, Juniper Green, Midlothian, EH14 5AJ, in September.

Convention and dinner: £1.75

Convention only: 40p

RAE Courses, 1971-2

Bath, Somerset. City of Bath Technical College. Enrolment 9–10 September. Commences third week in September. Tutor, Mr P. A. Bubb, G3UWJ. Fee £4·20.

Glasgow. Glasgow College of Nautical Studies, 21 Thistle Street, Glasgow C5. Enrolment 7pm 14 September. On Tuesdays and Thursdays, 7–9.30pm, commencing Tuesday 14 September. Fee £3. No fee for students under 18 on 1 August.

Harlow, Essex. Harlow Technical College. For details contact the college or Mr E. P. Essary, G3KFE, 17 Ascot Close, Parsonage Lane, Bishop's Stortford, Herts. (Tel: 2501).

Harpenden. Manland School, Harpenden. On Wednesdays at 7.15pm, commencing 15 September. For details contact Mr G. T. Chaplin, G3UTW, 5 Brewhouse Hill, Wheathampstead, Herts.

Leicester. School of Electronic & Electrical Engineering, City of Leicester Polytechnic. Enrolment 9.30–12.30, 1800–2000 14 September. On Wednesdays commencing 22 September; 1800–1915, morse; 1915–2115, radio theory. Fee £4. No fee for students still at school, subject to headmaster's consent to attend. Instructor, Mr R. G. Titterington, G3ORY.

London Borough of Merton. Merton Technical College, Morden Park, London Road, Morden, Surrey. Enrolment 13–15 September. On Thursdays 7–9.30pm, commencing 23 September. Enquiries to Head of Electrical Engineering Department (tel: 01-542 2442).

London N19. Whittington School, Highgate Hill, London N19. Enrolment 6pm 20 September. Commences 7pm Monday 27 September. Instructor, Mr B. Bond, G3ZKE. Further details from Mr T. W. Coleman, G3EEI, 14 Norman Court, Stapleton Hall Road, London N4 4QP, (tel: 01-340 9542).

Northwood. Northwood Adult Education Centre. Enrolment 10a.m.–3pm Saturday 11 September and 6.30–8.30pm Monday 13 September. Commences 7.15pm Monday 20 September.

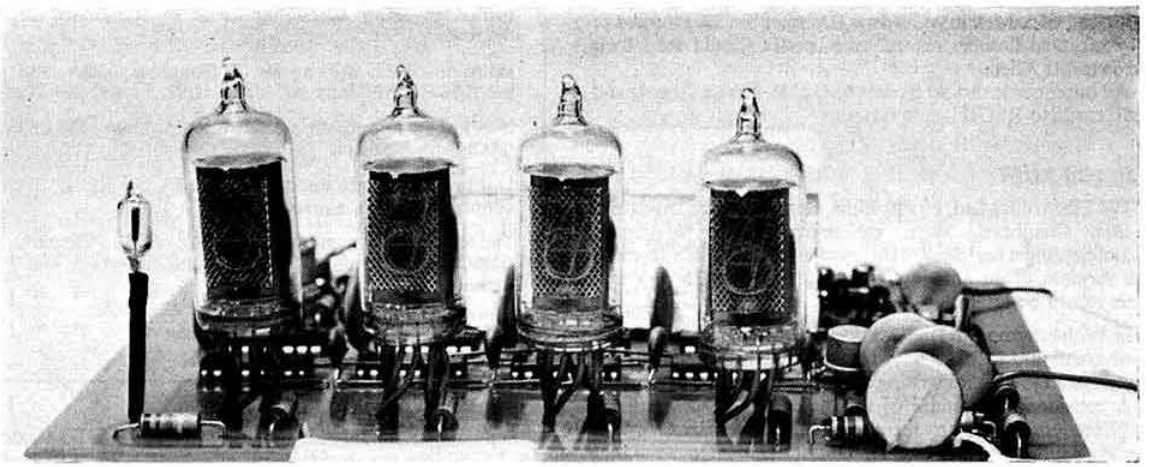
Portsmouth. Central Further Education Centre, Drayton Road, North End, Portsmouth. Enrolment 6–10 September, or on course evenings Tuesdays and Thursdays 6.30–8.30pm. Commences Tuesday 21 September. Further details from G6NZ, QTHR.

Plymouth. Plymouth College of Further Education. 6.30–9pm Mondays and Wednesdays, commencing 13 September. Lecturer Mr D. M. Webber, G3ENX. For further details telephone 68000 (day) or 73238 (evening).

Welwyn Garden City. Mid-Herts College of Further Education, Welwyn Garden City. Enrolment 13–16 September. Further details from Mr R. Stringer, G3IOZ, 88 Pentley Park, Welwyn Garden City.

A 20MHz digital frequency meter using ttl integrated circuits

(Part 2)



by I. D. BROWN, BEng, AMIEE, G3TVU*, and S. L. NORMAN, BTech, AMIEE, G8BDO

Construction

The complete frequency meter as described is built on one printed circuit board. Power supplies are separate. Fig 8 shows a full-size component layout superimposed on the printed circuit. Care must be taken to ensure that all integrated circuit packages are inserted with their keys as shown, pin 1 being at the key end. Transistors T2, T3 and T5 need to have their base leads cranked and insulated to pass between the collector and emitter leads. The original layout was for plastic encapsulated transistors.

Disc ceramic capacitors are mounted adjacent to all integrated circuit packages. These provide local decoupling of power supply current spikes generated by the integrated circuit output stages.

The numerical indicator tubes used were wire ended. After insulation, these wires were soldered directly on to the printed circuit and the tubes cranked forward to be vertical and flush with the front edge of the board. The quartz crystal was mounted in an expanded polystyrene box to provide an insulated enclosure at the centre of the board.

Testing

As was stated earlier, the typical maximum counting rate for the 7490 is 18MHz. The manufacturers only guarantee 10MHz, but this is no problem as six 7490s are required in the instrument and only one is critical. If the input frequency to P3 is 20MHz, its output will be at 2MHz, well within the counting speed specification for the devices.

If the following procedure is adopted, the fastest 7490 can be selected to act in position P3. Firstly, all discrete components excepting C27 (220pF) are mounted on the board and all signal and power supply links connected. Secondly, integrated circuits P1, P2, P8, P9, P10 and P11 are inserted taking care to observe the correct key position on the packages. Seven ICs should now remain, six 7490s and the 7473.

Fourteen stiff wires about 1in long are then soldered into P3 position, and the first 7490 tacked to their tips, care being taken to prevent short circuits between the wires.

It can be seen from Fig 7 that the removal of C27 from

* 47 Peak View Drive, Ashbourne, Derbyshire.

circuit will remove all clear pulses from the display counter. As P7B is not fitted, the signal gate P2A has its control input open circuit. The gate sees this as a high condition and thus, from Fig 2, any signal on its second input will appear inverted at its output.

Power supplies should now be connected to P1. The +12V and −6V supply currents being less than 10mA, the +5V logic supply may now be connected; its current being less than 200mA. An input may now be connected to the instrument using a two turn link and a calibrated grid dip meter covering 2 to 30MHz.

To check that P3 is in fact dividing, connect a voltmeter between P3 output (Pin 11) and ground (Pin 10). Check with an input frequency of 2MHz that the output is approximately 1V. Removing the signal source will cause the output to become zero or about 3·5V, showing that the 7490 has stopped dividing. Re-applying the input signal, its frequency should be increased until the voltmeter reading is no longer steady or has moved to zero or 3·5V. Check that the input coupling is sufficient, as the gdo output may fall at high frequencies.

A note of the frequency at which the 7490 ceased to operate should be made, and the test repeated with the other five ICs. As all that is required from this test is the ic operating at the highest frequency, the calibration accuracy of the gdo is unimportant.

The selected 7490 is now inserted in P3 position and the other ICs soldered into their respective positions. C27 is also connected, as are the numerical indicator tubes and the crystal.

Power is connected to the crystal oscillator (+12V about 15mA) and its frequency set by adjustment of C18 to give a zero beat harmonic with a broadcast frequency standard. It may be necessary to fit a capacitor in parallel with C18 in order to obtain this condition.

All power supplies can now be connected, and any input frequency should be displayed in kilohertz with a reading rate of about one per second. If the instrument fails to operate, a check should be made firstly on T7 collector with a voltmeter to earth. The reading rate is easily seen at the one per second rate. Once T7 collector has been seen to be pulsing, a check can be made at P2C output on Pin 6. This output rests low and pulses high for between 1 and 2ms, but a definite kick can be seen on a voltmeter. If the output remains low the bistable is not being set via C10, remaining high shows no reset from P7B. Check P7B output Pin 9; this ought to pulse high for 1ms, resetting P2D on the negative-going edge. Failure of the clock input to P7B would stop it operating, so a check of the output voltage of P12 and P13 is in order. The instrument should now be working.

The input frequency to the instrument should be increased to above 10MHz, when the half digit neon should light. Increasing the input frequency to above 20MHz will cause the half digit neon to blink at the start of each cycle. This is quite noticeable. Maximum usable frequency of the frequency meter is shown when a random count is displayed. This is very sensitive to input level.

With no input to the frequency meter, a display of all zeros would be expected. In practice, the display may be 0 or 1kHz, but in either case any input frequency is displayed correctly. P1, the 710 input comparator, has its + and − inputs referred to earth via 10kΩ. If the − input takes more current than the + input it will take up a more negative potential, causing the output to become high.

When P2A receives its gating pulse, both inputs become high for 1ms, causing the output to pulse low for 1ms. The negative going edge of P2A's output is recognised by the display counter, which counts 1. This effect can be completely eliminated by increasing R3 to, say, 15kΩ or reducing R2. The former is to be preferred as the latter will reduce the instrument's sensitivity.

It is just possible that with a fast 710 and 7490, that an operating frequency of 30MHz may be reached. In this case the half digit neon stays on as for an indication of 10MHz. This should cause little embarrassment in practice as most frequencies are known to within 5MHz before measurement.

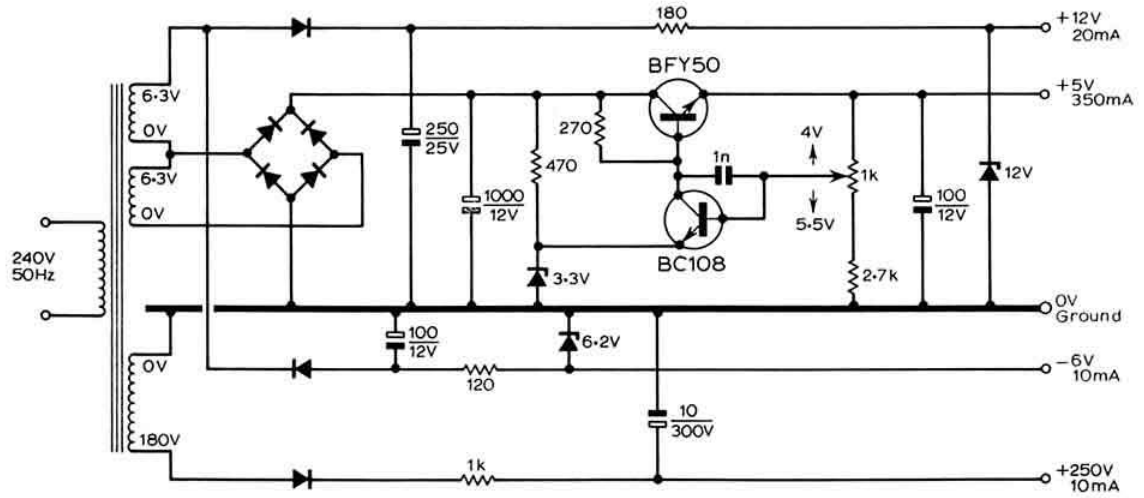


Fig 9. Power supply

Three of these frequency meters have been built to date, and all have operated to above 25MHz.

Power supplies

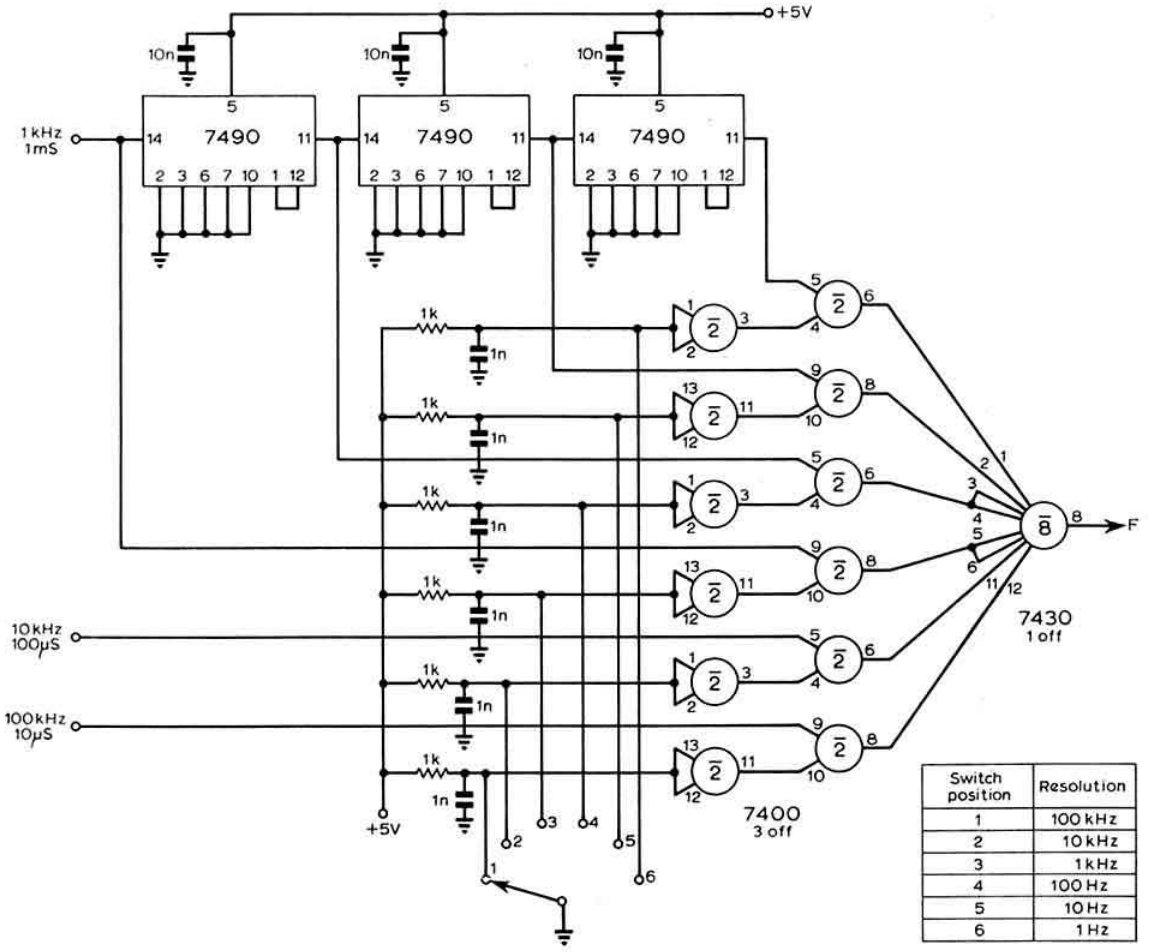
The instrument's power requirements are quite modest: (a) +12V at 20mA stabilized, (b) −6V at 10mA stabilized, (c) +5V at 350 mA stabilized, and (d) +250V at 10mA; (a) and (b) may be derived from a simple zener stabilizer, but (c) requires some sort of series stabilizer. A suitable power supply for mains use is shown in Fig 9. It is proposed that an inverter running from 12V dc will be developed in the near future for mobile use.

Extensions of the basic frequency meter

The time standard oscillator and divider chain in the frequency meter produce 100kHz, 10kHz and 1kHz fast rise time pulses. These may be used as a station frequency standard by routing to an external socket via a capacitor and switch. It is possible to generate a symmetrical waveform at the 7490 output A by routing input pulses to "BD in" and connecting D to "A in". The device then counts in a 1245 code rather than 1248. This was avoided on purpose as a precise square wave contains only odd harmonics. In practice the even harmonics are at very low level indeed, and difficult to distinguish on a receiver.

If during testing the frequency meter is found to operate well into the 20MHz region, it might be found beneficial to route link F over a switch so either P12 or P13 output may be selected. This will give an option of 10kHz or 1kHz resolution respectively, the former being useful to determine the tens of megahertz digit.

An extension of this provides an audio frequency meter with a resolution of 1Hz, full scale being 20kHz. Three additional 7490s wired as P12 and P13 are inserted outboard



Switch position	Resolution
1	100 kHz
2	10 kHz
3	1 kHz
4	100 Hz
5	10 Hz
6	1 Hz

Fig 10. Extended timebase selection

between the output of P13 and link F to provide a gating period of 1s. As the read rate astable is at present set for 1s, its period must be adjusted to about 2s by increasing C34 to, say, 20μF. In action the meter will count up for 1s followed by a 1s hold period, its accuracy being ±1Hz in 20kHz. Fig 10 shows a full time period control scheme which may be applied.

The modifications given above also enable the instruments to give a resolution of 1Hz up to 20MHz by overflowing the counter chain. To operate in the overflow mode, an input frequency of, say, 14·256391MHz is first read with 1kHz resolution giving a reading of 14,256. Secondly, the frequency is read with 1Hz resolution giving a reading of 16,391. In this case the half digit neon only indicates an overflow and should not be used as a digit readout. It is stressed, however, that the above provides ±1Hz resolution but not ±1Hz absolute accuracy. To obtain short-term accuracy of this order, an accurately adjusted 15MHz crystal oscillator should be measured with 1Hz resolution. The time standard oscillator should then be adjusted to give a readout of all zeros with this input prior to making a frequency measurement.

With a vfo controlled transmitter using frequency multiplying stages, the output frequency may be too high for direct measurement; for instance, a 2m transmitter utilizing an 8MHz vxo multiplied by 18. In this case it is possible to modify the time gate period so that the frequency displayed is 144MHz although generated from an 8MHz input. In practice, the output period from P12 (100μs) would be taken to an external divide by 18 circuit. This would generate 1·8ms on its output instead of the standard 1ms. The new period is then fed back to the control circuits (at link F) causing the instrument to count 8MHz input pulses for 1·8 ms. The total count then will be 8,000 by 1·8, giving a result of 14,000—a resolution of 10kHz at 2m.

One topic which has not been covered is indication of receiver input frequency. This could be carried out indirectly by measuring the frequency of a local zero beat oscillator. However, more elegant methods are available involving measurement of local oscillator frequency.

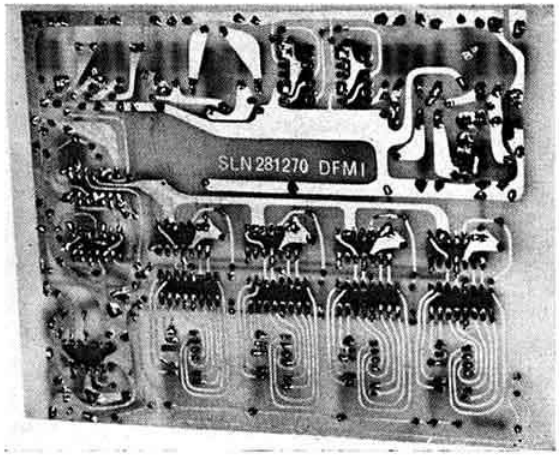
(*a*) The simplest case to be considered is where a receiver has the local oscillator running below signal frequency, and contains a carrier insertion oscillator. In this case the control circuits are modified firstly to clear the display counter and set the set-reset bistable P2C, P2D. Secondly, a JK bistable is added to gate out a 1ms period. This is used to control a second input 710 and signal gate looking at the cio. At the end of this 1ms period JK bistable P7B is controlled via a second set-reset bistable to take a measurement of the local oscillator frequency. Thus the display counter now holds the sum of the cio and local oscillator frequencies. This is the signal frequency.

(*b*) A second method of providing this result is to produce digitally the precise number of pulses corresponding to the intermediate frequency, and route these into the display counter at a convenient rate. This is followed by a measurement of local oscillator frequency to provide the sum signal frequency in the display counter. One advantage of this digitally more complicated solution is that it is applicable to double conversion vhf receivers where no single oscillator is present at the difference frequency.

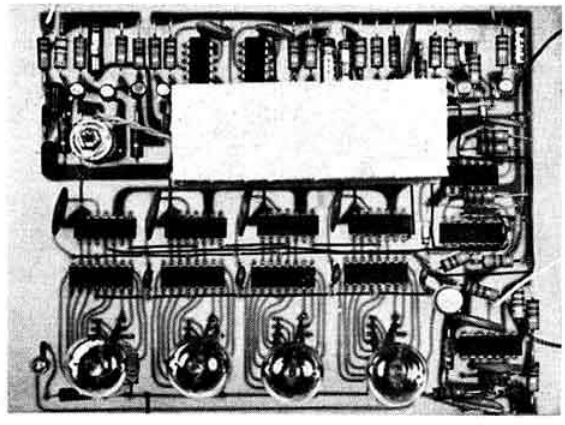
(*c*) The case where the local oscillator is higher than the signal frequency is more complicated, as a digital subtraction is required. This may be obtained by leaving the present control logic as it stands, but breaking the link between the signal gate (P2A) output and display counter (P3). Pulses are initially routed to an external counter which upon receipt of an i.f. count routes the remaining pulses into the display counter.

(*d*) The proposed methods of addition and subtraction are thought to be the cheapest realizable. An arithmetic unit could have been built to insert in the BCD lines between the display counter and display decoders, but this becomes rather complicated in BCD and thus expensive. A second method would be to use up/down BCD decades with their associated control for the display counter, but this was not in line with the concepts of the simple instrument described.

One limitation of the instrument is its 20MHz upper frequency limit, but this can readily be overcome by use of a



Underside of pc board



Top view of pc board

Components list

CAPACITORS

Item number	Value	Quantity used	Item number	Value	Quantity used
1C	3-30pF	1	6C	0·1μF	2
2C	100pF	2	7C	2·2μF	2
3C	220pF	1	8C	4μF	1
4C	1nF disc	1	9C	10μF	1
5C	10nF disc	16			

RESISTORS

Item number	Value	Quantity used	Item number	Value	Quantity used
1R	10Ω	1	10R	6·8kΩ	2
2R	220Ω	1	11R	8·2kΩ	1
3R	820Ω	2	12R	10kΩ	6
4R	1kΩ	7	13R	15kΩ	1
5R	1·5kΩ	1	14R	27kΩ	2
6R	1·8kΩ	2	15R	33kΩ	1
7R	2·2kΩ	1	16R	120kΩ	1
8R	2·7kΩ	1	17R	180kΩ	4
9R	5·6kΩ	4	18R	560kΩ	1

DIODES

Item number	Type	Quantity used
1D	IN914	3
2D	10V zener 400mW	1

TRANSISTORS

Item number	Type	Quantity used
1T	BF259	1
2T	BC108	8
3T	BCY70	1

INTEGRATED CIRCUITS

Item number	Type	Quantity used
1P	710	1
2P	7400	1
3P	7490	6
4P	7473	1
5P	7441	4

ADDITIONAL COMPONENTS

Item	Quantity used
Quartz crystal 100kHz	1
Numerical indicator tubes	4
1in neon indicator	1
Printed circuit board	1

Components are all given in the circuit diagrams in the form 4R39, where 4 is the item number in the component table and R39 is a circuit reference number.

high-speed decade prescaler. A logic family is at present available which in its standard form will count at 85MHz. Thus a decade of this family would produce an output frequency of 8·5MHz maximum, which is well within the capabilities of the instrument. An experimental decade divider has been built and tested to 50MHz (limited by the available pulse generators), and at present work is being carried out on a suitable input amplifier for use to 85MHz. This will probably consist of a discrete component/integrated circuit hybrid, enabling a low-level sine-wave oscillator to be used in further tests.

A rather more ambitious instrument is at present under construction as a group project by the Nunsfield House Community Association Amateur Radio Group, Derby. Six instruments are under construction, two by the authors. These will provide six digit readout with stored display and selectable gating time. Initially these will provide frequency measurement with similar control circuits to those described above. Later the control circuits will be modified to provide full frequency/period and multi-period measurement capability.

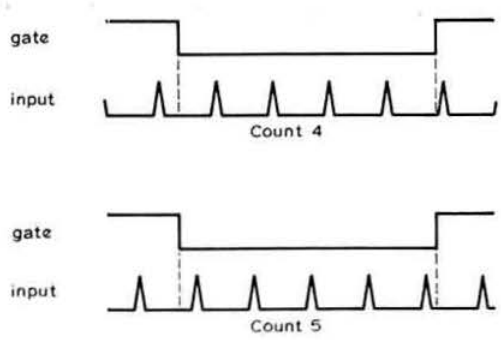


Fig 11. Signal gate error generation

Measurement errors

The first error to be considered is due to the action of the signal gate. An error of +1 count may be generated every time the signal gate opens and closes with the passage of n pulses. This is illustrated in Fig 11. It is due to the lack of synchronism of the gating signal with the input signal being counted.

The second error is caused by the quartz crystal oscillator, as this directly determines the time during which pulses of unknown frequency are counted. If an error of ±1 count in 20,000 is acceptable, ie ±1kHz in 20MHz, this is of the same order as the gating error mentioned above. Thus the crystal oscillator has to be accurate to 2 parts in 20,000 or 1 part in 10^4. The accepted stability for a series-mode crystal oscillator is 5 parts in 10^6 per °C. So 1 part in 10^4 will be obtained within a 20°C range. To prevent short-term drift in the frequency meter, the quartz crystal is mounted in an expanded polystyrene box as an insulant against draughts.

Printed circuit boards

The number of interconnections required in an instrument of this type make printed circuit board construction almost essential. It is possible to hand-paint a board for etching as in the prototype unit, but with tracks to ic pins 0·1in apart this is rather difficult. The authors are willing to have some printed circuit boards manufactured if demand is high enough. All enquiries should be addressed to G3TVU and enclose a stamped, self-addressed envelope.

Acknowledgement

The authors would like to thank Mr D. L. Lynas, Research Manager of the Electronics & Instrumentation Group, Rolls-Royce Limited, for permission to use equipment which made the development of this instrument possible.

Development of an all-band vertical

by H. S. BROWN, G3RFG*

ON arriving at his present QTH the author found that the ground space available for the erection of aerials measured only 30ft by 10ft and another restriction was that nothing that looked like a tv aerial was allowed. In order to get on the air a self-supporting mast that could be raised or lowered easily by one person was erected and it has since been used during many aerial experiments. As a result of these experiments it became obvious that what was required was an all-band vertical that produced low impedance at its base for all bands, and the result is shown in Fig 1.

The aerial is made up of three lengths of aluminium tubing 12ft long, with $\frac{1}{16}$in walls, and of 1in, $\frac{7}{8}$in and $\frac{3}{4}$in diameter respectively. One end of each of the two thicker tubes is slit down for several inches and the three lengths are then spliced together, the joints being secured by two Jubilee clips. A triangular piece of thick Perspex is fitted between the top two clips, and three lengths of thin nylon cord are connected to it as guys to prevent movement of the top section of the aerial. An 8ft 3in length (quarter wave on 10m) is cut from the lower 1in diameter section and the two resulting lengths are secured to the mast, one above the other and 2in apart, by stand-off insulators.

The 2in break in the aerial is then linked and a check made for resonance on the 40 and 15m bands. The link is then replaced by the coil and the taps adjusted for resonance on 20, 80 and Top Band. If an impedance bridge is used it will be found that it will indicate approximately 25Ω on 40m and 35Ω on 15m. It was decided to use two lengths of 75Ω coaxial cable in parallel to provide the best match on 15m because of the greater output power on 40m from the author's transmitter.

On 10m the aerial can be used as a normal vertical; by removing the base feeder and connecting a length of 75Ω coaxial cable to the junction it becomes a vertical dipole; and by earthing the lower section and feeding the junction with 50Ω coaxial cable it becomes an elevated-feed three-quarter-wave vertical.

The earthing system consists of as many earth rods as possible connected together with thick seven-stranded copper aerial wire. It was also found that tvi could be decreased if a length of this earth-wire was run parallel with the feeder from the base of the aerial right back to the Z Match. The author's feeder is run underground as far as is possible.

Over a period of two years this aerial has proved a winner and it is only necessary to stand on a step-ladder in order to change bands; by inserting the link or connecting the appropriate fly-leads from the coil which is attached to the mast by stand-off insulators.

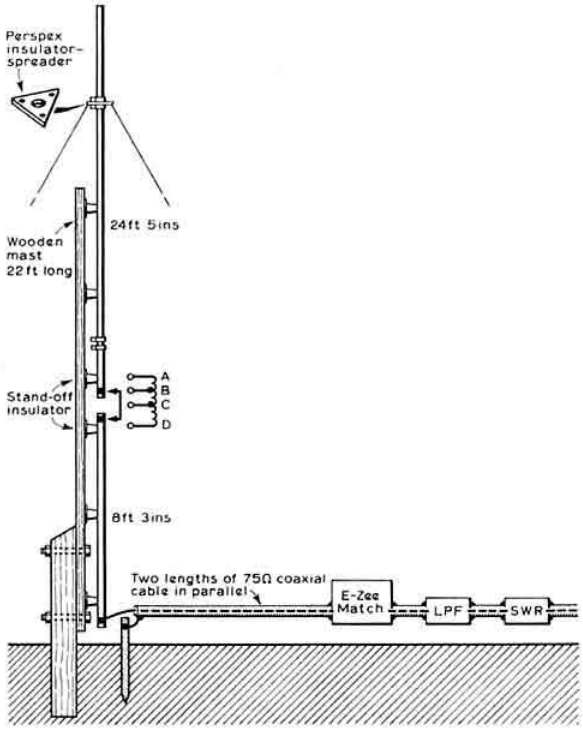
It is recommended that anyone who constructs this aerial should use a gdo to find the exact taps on their coils for resonance on the various bands, but the following coil construction details are supplied as a basis. A ribbed ceramic former of 2in diameter is wound with 55 turns of 20swg tinned copper wire. The first 40 turns are spaced $\frac{1}{10}$in apart, and the bottom 15 turns are close wound and enamel covered. Fly-leads are connected to the top, 22 turns down (for three-quarter wave on 20m), 29 turns down for 80m, and at the bottom for Top Band.

			SWR
Link out / Coil out	$\frac{\lambda}{4}$	on 10m*	1·6
Link in	$\frac{\lambda}{4}$	on 40m	1·1
Link in	$\frac{3\lambda}{4}$	on 15m	1·4
Coil in, A to B	$\frac{3\lambda}{4}$	on 20m	1·2
Coil in, A to C	$\frac{\lambda}{4}$	on 80m	1·4
Coil in, A to D	$\frac{\lambda}{4}$	on 160m	1·4

*On 10m the aerial can be used in two other ways:

(a) Disconnect the base-feeder and use a 75Ω feeder connected to the junction. This is now a vertical full-wave dipole. SWR 1·6.

(b) Earth the lower section and connect a 50Ω feeder to the junction to make an elevated-feed three-quarter-wave vertical. SWR 1·4.



* 36 Three Star Caravan Park, Lower Stondon, Beds.

Microwave diodes

by P. B. BRODRIBB, G3ONL*

JUST as the conventional valve suffers from severe limitations when used at microwave frequencies, so does the transistor suffer from similar defects. In the case of the transistor, the trouble lies largely with the mechanism of charge carrier flow across the semiconductor junction. Consider the operation of that ubiquitous device, the diode.

When the junction is forward biased, majority carriers cross the junction depletion layer and enter the opposite side to become minority carriers. They diffuse away from the junction and recombine. The time required for recombination rarely exceeds 10^{-8}s, and if the bias is suddenly reversed before all the charge carriers have recombined, the uncombined carriers will flow back across the junction and form a pulse of current in excess of the normal reverse bias leakage current. This is illustrated in Figure 1.

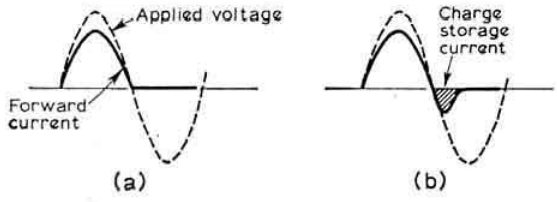


Fig 1. (a) Ideal junction with zero recombination time. (b) Typical junction showing effects of finite recombination time

This delay in recombination has the effect of capacitance and is called the diffusion or storage capacitance. Figure 2(b) shows an equivalent circuit. The junction is represented by a capacitance C_j and a resistance R_j in parallel. The bulk of the semiconductor is represented by the series resistance R_s. In combination with the bulk resistance, the capacitance constitutes the main reason why performance falls off at high frequencies. This dependence upon recombination time is similar in effect to the transit time phenomenon in a valve. Another capacitance effect occurs when the junction is reverse biased. In this case the effect is a useful one, as we shall see in the varactor diode.

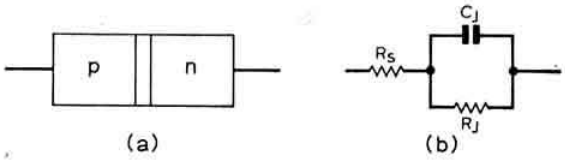


Fig 2. (a) Depletion layer between p-type material and n-type material. (b) Equivalent circuit

The transistor, bipolar and field effect, has still some way to go to reach the level of acceptance that it enjoys at lower frequencies. On the other hand, the diode in one form or another, is well established. The point-contact diode is one such device.

Point-contact diode

The point-contact diode removes some of the disadvantages of the junction diode and permits semiconductors to be used as detectors and mixers up to the highest microwave frequencies. Indeed, the point-contact diode has been used in this way since the earliest days of microwaves. It generally consists of a slab of n-type semiconductor onto which is pressed a pointed wire. This assembly is often mounted in a coaxial structure such as depicted in Fig 3. Since this is a junction between a semiconductor and a metal, the diffusion capacitance is less of a problem than with the junction diode, and the point-contact construction also reduces the reverse bias capacitance.

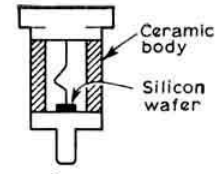


Fig 3. Point contact diode in coaxial mount

Varactor diode

The varactor diode makes use of the reverse bias capacitance referred to previously. When a junction is reversed biased, equal and opposite charges face each other across the depletion layer. This state of affairs is similar to that which obtains in a conventional capacitor, but in the varactor diode the junction capacitance varies with applied voltage, unlike the conventional capacitor in which capacitance is a function only of physical characteristics, size and permittivity. Increasing the reverse bias increases the effective width of the depletion layer and hence decreases the capacitance.

This voltage-variable capacitance is the basis of the parametric amplifier; that is, amplification by changing a parameter of the circuit, in this case, capacitance. Consider the circuit of Fig 4 supplied with a sine wave of constant amplitude. C is a capacitor that can be varied mechanically. When V is maximum the plate separation of the capacitor is increased. The charge on the capacitor, Q, is defined by the relation $Q = CV$, hence if C is decreased then V must

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increase. The plate separation is decreased back to normal when V is zero. Separation is against an attractive force while restoration is against zero force, hence energy is supplied to the circuit.

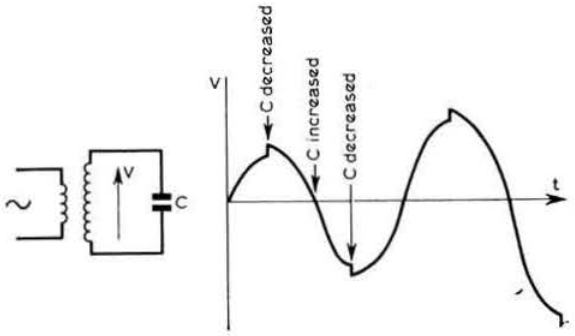

Fig 4. The effect of capacitance change at appropriate moments in the cycle

The energy required to build up the parametric amplification is obtained from the system that varies the capacitance, ie, the "pump". In practice the variable capacitor is a varactor and the pump is an oscillator. Parametric amplification at microwave frequencies is produced in waveguide and coaxial resonant circuits rather than in lumped LC circuits.

The parametric amplifier is a low-noise device since amplification is a function of reactance, and does not involve either reistance or an active device such as a valve or a transistor. Thus thermal (Johnson) noise is low and may be further reduced by cooling the diode. Liquid nitrogen is frequently used for this purpose.

But the usefulness of the varactor diode does not stop here. The reverse bias junction capacitance does not vary linearly with voltage. Capacitance, C, varies as $1/V^n$ where V is the reverse bias voltage, and n is approximately 1/2 for an abrupt junction and 1/3 for a graded junction. This non-linear voltage versus capacitance relationship of the varactor diode makes it a useful harmonic generator and this is the method of operation most used by amateurs.

It is well described in the *VHF-UHF Manual*, as is the step-recovery diode. This latter diode is a varactor in which the reverse current pulse, previously described, is exploited. The impurity gradation or "profile" is such that the uncombined charge carriers form an abrupt, or "step", reverse current that is rich in harmonics, see Fig 5.

Tunnel diode

The tunnel diode is yet another microwave semiconductor. It is an alloy junction in which the impurity level is several thousand times that in a conventional diode. This heavy doping reduces the width of the depletion layer to something of the order of 10 to 100 atom diameters. Electrons can pass through (tunnel) from one side to the other without going through the normal diffusion and recombination processes. This permits very fast response, but the junction area must be kept small in order to reduce junction capacitance which is higher, per unit area, than in normal junction diodes because the junction is narrower.

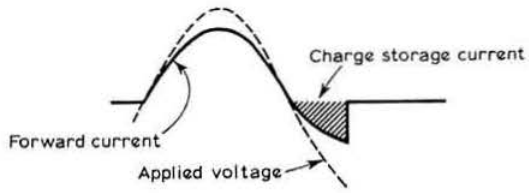

Fig 5. Rapid fall in reverse current is rich in harmonics

A typical tunnel diode characteristic is shown in Fig 6 along with the characteristic of a normal junction diode. The negative resistance region permits the diode to act as an oscillator. The simplicity of the device, (a typical circuit is shown in Fig 7), makes it ideal for use in stripline waveguide, but the device has not achieved the degree of popularity that was expected.

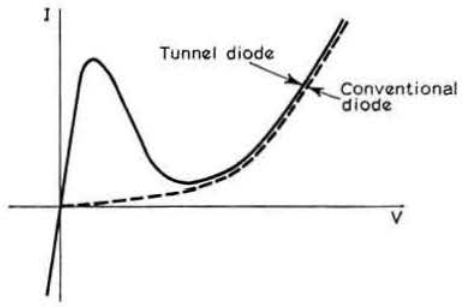

Fig 6. Tunnel diode characteristics

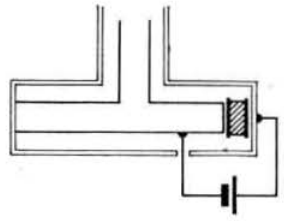

Fig 7. Tunnel diode mounted in coaxial resonator

Hot-carrier diode

Another diode that is becoming increasingly popular as a detector and mixer at microwave frequencies is the hot carrier or Schottky diode. This is a junction formed between a metal and a semiconductor and thus can be considered as the junction version of the point-contact diode. However, the construction is much more controllable. It consists of a planar area between the metal and the semiconductor which results in a low series resistance, lower noise factor, and greater resistance to burn-out.

Operation is based on majority carriers only, so there are no minority carrier storage problems. As the electrons are transported into the metal on forward bias, they acquire energy from the electrical field, and arrive at the metal with more energy than the other free electrons in the metal. Since

they have more kinetic energy they are said to be "hot" compared to the electrons at equilibrium in the metal.

PIN diode

The PIN diode consists of p-type and n-type regions that are separated by an intrinsic region; that is, a region in which there are negligible impurities or charge carriers. Charge carriers from the doped p and n regions have to cross this intrinsic region, and at frequencies below about 100MHz the diode acts as a rectifier. At frequencies above this level, the storage time in the intrinsic region is so great, ie the transit time is so long compared to the period of the signal, that the diode ceases to act as a rectifier and, instead, acts as a linear resistance and conducts in both directions. Its effective resistance is inversely proportional to the amount of charge in the intrinsic region, and this can be controlled by a dc bias. In this way the conductivity can be varied by several orders of magnitude.

PIN diodes are capable of controlling microwave power from microwatts to kilowatts, pulsed or cw operation. A typical PIN diode attenuator is shown in Fig 8. The wave impedance is matched to the diode impedance by the taper. The diode is placed in a position of maximum electric field and absorbs energy from the passing wave in the waveguide. How much energy it absorbs (and dissipates as heat) is determined by the resistance of the PIN diode, which in turn is determined by the bias.

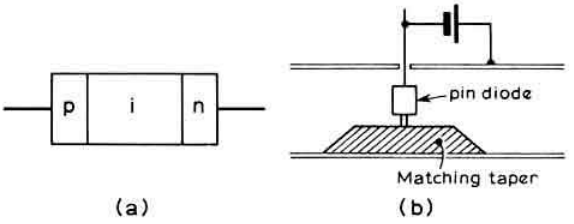

Fig 8. PIN diode mounted in waveguide

IMPATT diode

The IMPATT diode is one of a family of diodes that depends for its operation on two phenomena, avalanche breakdown and transit time. **IMPATT** stands for **IMP**act **A**valanche and **T**ransit **T**ime, and this describes the method of operation. A p-n junction is attached to a drift region, Fig 9(a), and the doping profile (map of impurity concentration) is shown in Fig 9(b). This profile results in a potential gradient that permits avalanche breakdown to occur in a very narrow region at the centre of the depletion layer, and provides a drift region of such low impurity concentration that no further avalanching occurs.

The diode may be operated as an amplifier or as an oscillator. Bias is applied to lift the potential gradient to just below breakdown level, Fig 9(c). In this condition the current that flows is normal reverse bias leakage current. The pulse to be amplified is applied to the diode and this lifts the field across the junction above the breakdown level. Avalanching occurs and large numbers of charge carriers are produced during the time that the field is above the breakdown level. The current pulse that results then travels

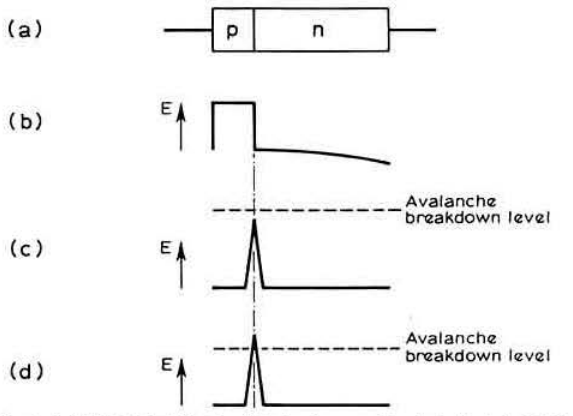

Fig 9. (a) IMPATT diode, (b) doping profile, (c) electric field distribution—diode biased to just below avalanche breakdown, (d) diode raised to just above avalanche breakdown by input signal

down the drift region. When this current pulse reaches the terminal a potential appears across the diode and current flows in the external circuit. Gain of the order of 25dB may be obtained if the period of the input signal is approximately the same as the time required for avalanche plus the delay in the drift region. If some of the output is fed back to the input, to supply the breakdown field, oscillation results.

IMPATT diodes are finding increasing use as amplifiers and oscillators in the microwave region up to 10GHz. A typical amplifier circuit is shown in Fig 10. Since a diode is a two-terminal device, a circulator must be used to separate the output from the input.

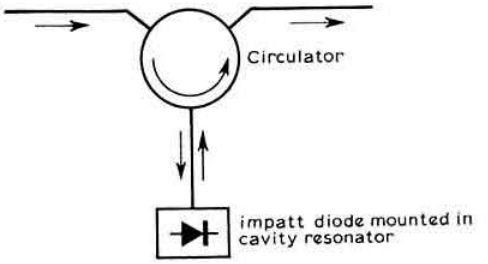

Fig 10. IMPATT diode as an amplifier

Gunn oscillator

All of the semiconductor devices previously mentioned have made use of the interaction at a forward biased or a reverse biased *junction*. Even the point-contact and Schottky diodes are junction devices albeit metal to semiconductor. The Gunn oscillator, on the other hand, makes use of the Gunn Effect, which is a *bulk* phenomenon. It is sometimes termed the Gunn "diode" since there are two connecting terminals, but these serve only to make contact with a specimen of gallium arsenide, see Fig 11.

If an emf is applied to the specimen, the resulting electric field will cause a current to flow as in any resistor. But when the emf is increased to a value that causes the electric field

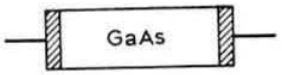

Fig 11. Gunn device

to reach a certain threshold value, some of the electrons will transfer to a higher energy level and become "hot". The effective mass of these hot electrons is increased, which results in a decrease in their mobility. If the field is high enough to cause some of the free electrons in the gallium arsenide to move into this higher energy state, the current through the device will fall since some of the electrons are now less mobile. The current versus field characteristic now has a negative resistance region, Fig 12, region 2.

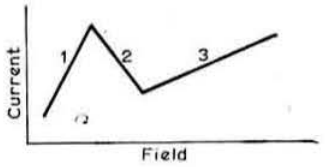

Fig 12. Current versus field characteristic

At this value of field the device is unstable. The field is no longer uniform across the specimen. The reduction in electron mobility has the effect of increased resistance and this in turn causes an increase in field which results in yet more free electrons being formed. But the emf applied across the device is constant, so an increase of field in one part must mean that the field in the remainder is reduced. Thus a cumulative effect builds up a concentration or "domain" of hot electrons in one part of the device. This domain forms at the negative end and then moves across to the positive end. Then, for a brief period, the specimen once again has a uniform electric field until another domain builds up and moves across.

Referring to Fig 12, region 1 is the normal low-field region where electronic mobility is high and resistance is low. Region 3 is the hot electron region resulting from a field above the threshold level. Electron mobility is less than in region 1 and the resistance is therefore higher. In region 2 some of the electrons are in the low energy state and some are in the high energy state. This is the unstable region. The Gunn oscillator is biased to operate in this unstable region by an applied field of between 3 and 12kV/cm. The speed of the domain, as it moves across the specimen, is approximately 10^8 mm/s, and if the gallium arsenide is 10 microns thick, (1 micron is 10^{-3}mm), then the transit time of one domain will be 10^{-10}s, corresponding to a frequency of 10GHz. The current waveform through the device is shown in Fig 13. If the device is placed in a high-Q resonant cavity, these current pulses will excite it into sinusoidal oscillation with an output in the milliwatt region.

Fig 13. Current waveform

A simple microwave transmitter incorporating a Gunn device is illustrated schematically in Fig 14. The device is matched into a length of waveguide that is terminated by a horn antenna, and supplied with a voltage sufficient to cause oscillation as outlined above.

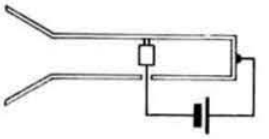

Fig 14. Schematic diagram of simple microwave transmitter incorporating a Gunn device

Summary

This has been a brief review of semiconductor diodes in modern microwave practice. Some of them are well established. Others have yet to come into widespread use. But the fact (a sad fact for the devotee of the valve) is that they have virtually replaced the valve in commercial microwave equipments of powers up to a few watts. Current development is aimed at raising both the frequency at which they will operate and their power handling capability. Some of them are well known to the radio amateur, especially at the lower frequencies. Perhaps they will soon become commonplace with amateurs at microwave frequencies.

The RSGB News Bulletin Service

The RSGB News Bulletin, callsign GB2RS, is broadcast every Sunday morning. This bulletin can be received on either vhf or hf, which gives almost complete coverage of the British Isles. It keeps radio amateurs up-to-date about happenings in the world of amateur radio and gives information on coming events, supplementing and bridging the gap between successive issues of *Radio Communication*.

SCHEDULE

Time (bst)	Frequency (MHz)	Location and coverage (hf) or beam heading (vhf) of station
0930	3·6	Bromley, Kent (SE England)
1000	3·6	Cheltenham (SW England)
	145·8	Aberdeen (NNW)
	145·095	Farnham, Surrey (NE)
1015	3·6	Belfast (N. Ireland)
	145·8	Bangor, Co Down (N)
1030	3·6	Derby (N. Midlands)
	145·8	Aberdeen (SW)
	145·89	Bishop Auckland (N)
	145·3	Sutton Coldfield (NW)
1045	145·89	Bishop Auckland (E)
	145·095	Farnham, Surrey (SW)
1100	3·6	Bridlington (NE England)
	3·6	Aberdeen (NE Scotland)
	144·3	Sutton Coldfield (SW)
1130	3·6	Motherwell (S Central Scotland)
	145·5	Bradford (NE)
1200	145·5	Bradford (SE)

Exhibitions — Beacons — Conventions — Contests — Local events
Rallies — Scientific projects — Meetings — Licensing — Clubs
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Modern filter design for the radio amateur

The following information has been obtained from an article, bearing the same title and written by Edward E. Wetherhold, W3NQN, which appeared in QST *in September* 1969. *We are indebted to the American Radio Relay League for permission to quote from that article.*

by W. H. ALLEN, MBE, G2UJ*

IN recent years new approaches to the design of filters for both audio and radio frequencies have been made which have resulted in either improved characteristics or greater simplicity, or both. One particular type of modern filter, the elliptic-function, is well suited to amateur applications, and the *QST* article shows how, with the absolute minimum of mathematics, efficient low-pass filters of either two or three sections may be designed.

The design data presentation enables the important parameters to be inspected and decided upon before any work is undertaken to ascertain the values of inductance and capacitance required for the filter.

When using modern design procedure, a "normalized" filter having the desired performance is chosen from a series of precalculated designs catalogued in a handbook. In the following presentation, "normalization" is to a cut-off frequency of 1Hz and termination resistances of 1Ω, and all that is required to ascertain the constants of a practical filter is to specify the actual cut-off frequency and termination resistance required and to scale the normalized filter data to these parameters.

Using the tables

There are two tables. The first three sections of Table 1 (1–1, 1–2 and 1–3) are for radio frequency, and the last three are for audio frequency applications. In Table 2 all six sections are suitable for the more stringent radio frequency filtering requirements where the performance of the simpler two-section design might not be adequate. It should be noted that for Figure 1 of Tables 1 or 2, the *top* column headings are referred to, while the bottom column "headings" refer to Figure 2. The general characteristics of the two or three section filters are depicted in the graphs associated with the two tables.

Referring to these graphs, the following abbreviations are employed:

- A = attenuation (dB),
- A_p = maximum attenuation in pass-band,
- f_1 = first attenuation peak,
- f_2 = second attentuation peak with 2-section filter or third attenuation peak with 3-section filter,
- f_6 = second attenuation peak with 3-section filter,
- f_{co} = frequency where the attenuation first exceeds that in the pass-band,
- A_s = minimum attenuation in stop-band.
- f_s = frequency where minimum stop-band attenuation is first reached.

The attenuation peaks f_1, f_6 or f_2 are associated with the resonant circuits L4/C4, L6/C6 and L2/C2 on the respective diagrams.

Designing a filter

After the desired cut-off frequency has been chosen, the frequencies of f_s and the attenuation peaks may be calculated by multiplying their corresponding tabular values by the required cut-off frequency (f_{co}). This simple procedure permits the important frequency parameters of the filter response to be determined immediately. If the first filter investigated does not have the desired placement of attenuation peaks, it is a simple matter to search among the tabular data until a satisfactory response is discovered.

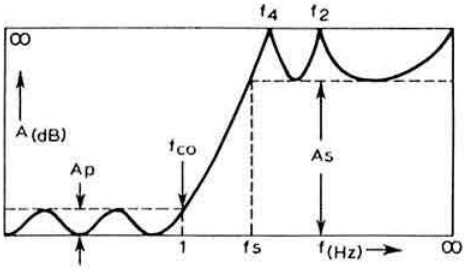
Applications

Because of their low values of reflection co-efficient (P) and vswr, the Table 1–1, 1–2 and 1–3 of the two-section filter catalogue and Tables 2–1 to 2–6 inclusive of the three-section catalogue are best suited for rf applications where power must be transmitted through the filter. The two-section filter has a relatively gradual attenuation slope and the stop-band attenuation level (A_s) is not achieved until a frequency (f_s) is reached, which is two to three times the cut-off frequency. If a more abrupt attenuation slope is desired, then one of the three-section filters (Tables 2–1 to 2–6) should be used. In these cases the stop-band attenuation level may be reached at a frequency only 1·25 to twice f_{co}.

Tables 1–4, 1–5 and 1–6 of the two-section filter catalogue are intended for af applications where transmission of appreciable power is not required, and consequently the filter response may have a much higher value of vswr and pass-band ripple without adversely affecting the filter performance. If the higher pass-band ripple is acceptable,

*"Cobbs", Challock Lees, Ashford, Kent.

Table 1. A catalogue of two-section elliptic-function filters normalized for a cut-off frequency of 1Hz and terminations of 1Ω



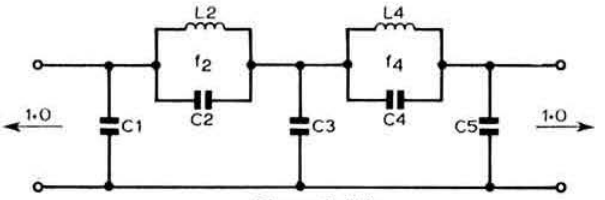


Figure 1 **

↓ REFLECTION COEFFICIENT, VSWR & Ap	As dB	fs Hz	f4 Hz	f2 Hz	C1 Farad	C3 Farad	C5 Farad	C2 Farad	L2 Henry	C4 Farad	L4 Henry
Table 1–1	70	3·24	3·39	5·42	110·4	235	103·5	4·34	199·0	11·72	187·5
p = 4%	65	2·92	3·07	4·88	109·6	233	101·0	5·39	197·9	14·67	183·7
VSWR = 1·08	60	2·56	2·68	4·24	108·2	229	96·9	7·20	195·8	19·88	177·3
Ap = 0·0069 dB	55	2·37	2·48	3·90	107·2	227	93·8	8·57	194·3	23·9	172·7
	50	2·13	2·23	3·48	105·5	223	88·6	10·88	192·0	31·0	164·7
Table 1–2	70	3·07	3·22	5·13	118·3	243	110·8	4·73	203	12·78	191·0
p = 5%	65	2·79	2·92	4·64	117·4	241	108·3	5·82	202	15·82	187·2
VSWR = 1·11	60	2·46	2·57	4·06	116·0	237	104·0	7·67	200	21·2	180·7
Ap = 0·011 dB	55	2·28	2·39	3·75	115·0	234	100·8	9·07	198·5	25·3	175·9
	50	2·06	2·16	3·36	113·2	230	95·6	11·43	196·0	32·4	168·1
Table 1–3	70	2·79	2·92	4·64	138·4	262	129·6	5·59	210	15·09	196·4
p = 8%	65	2·56	2·68	4·24	137·4	259	126·9	6·75	208	18·32	192·4
VSWR = 1·17	60	2·28	2·39	3·75	135·9	255	122·4	8·72	206	23·9	185·7
Ap = 0·028 dB	55	2·06	2·16	3·36	134·2	251	117·4	10·98	204	30·6	178·4
	50	1·887	1·970	3·05	132·2	245	111·8	13·55	201	38·4	170·3
Table 1–4	55	1·701	1·773	2·71	217	317	190·8	18·03	191·5	49·7	162·3
p = 25%	50	1·556	1·617	2·44	213	306	181·3	22·8	187·3	63·8	151·9
VSWR = 1·67	45	1·440	1·493	2·22	209	295	170·6	28·3	182·7	80·9	140·5
Ap = 0·28 dB	40	1·325	1·369	1·988	203	279	155·8	36·4	176·0	108·0	125·1
	35	1·236	1·273	1·802	195·9	262	139·2	46·4	168·2	144·3	108·3
Table 1–5	55	1·618	1·690	2·56	248	348	214	21·3	181·4	58·7	151·0
p = 33%	50	1·481	1·540	2·30	249	336	210	27·4	174·9	76·7	139·3
VSWR = 2·00	45	1·369	1·416	2·08	244	318	197·5	34·7	169·2	99·8	126·5
Ap = 0·50 dB	40	1·270	1·308	1·878	238	299	177·3	44·4	161·7	133·7	110·8
	35	1·186	1·222	1·700	229	280	163·3	57·0	153·9	177·6	95·5
Table 1–6	55	1·528	1·591	2·39	314	401	276	28·3	156·9	77·5	129·1
p = 45%	50	1·407	1·459	2·16	308	381	260	35·5	153·3	99·6	119·4
VSWR = 2·67	45	1·245	1·313	1·898	306	365	247	46·6	150·7	135·0	108·9
Ap = 1·00 dB	40	1·217	1·250	1·755	296	341	227	59·2	138·9	176·2	92·0
	35	1·145	1·174	1·597	284	315	203	75·4	131·6	237	77·7
	As dB	fs Hz	f4 Hz	f2 Hz	L1 Henry	L3 Henry	L5 Henry	L2 Henry	C2 Farad	L4 Henry	C4 Farad

* All tabulated data of C and L must be multiplied by 10^{-3}; for example, in Table 1–1, the normalized value of C1 is 110·4 x 10^{-3}, for A_S = 70dB

** In the above tabulation, the top column headings pertain to Figure 1 while the bottom column headings pertain to Figure 2

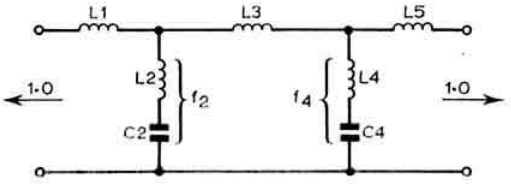
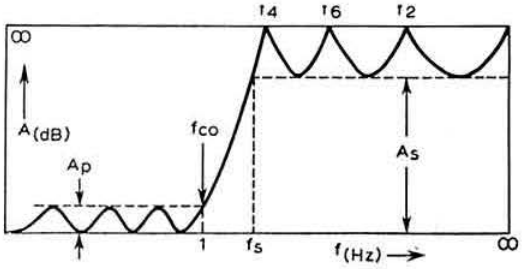


Figure 2 **

C

Table 2. A catalogue of three-section elliptic-function filters normalized for a cut-off frequency of 1Hz and terminations of 1Ω



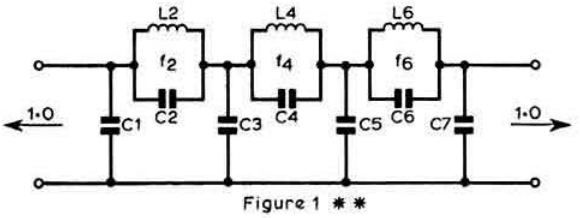


Figure 1 * *

REFLECTION COEFFICIENT, VSWR & Ap	As dB	fs Hz	f4 Hz	f6 Hz	f2 Hz	C1 Farad	C3 Farad	C5 Farad	C7 Farad	C2 Farad	L2 Henry	C4 Farad	L4 Henry	C6 Farad	L6 Henry
Table 2–1	70	2·00	2·04	2·49	4·35	79·6	209	201	63·1	7·42	180·2	30·9	196·4	26·3	155·2
p = 1%	64	1·836	1·876	2·27	3·95	78·3	204	194·8	58·2	9·10	178·4	38·4	187·6	33·0	148·3
VSWR = 1·02	60	1·743	1·780	2·15	3·72	77·3	200	190·3	54·5	10·35	177·1	44·1	181·4	38·2	143·5
Ap = 0·43 x 10^{-3}dB	55	1·624	1·657	1·990	3·41	75·8	194·2	183·5	48·5	12·42	175·2	53·8	171·4	47·2	135·6
	50	1·524	1·554	1·854	3·15	74·1	187·8	176·3	41·8	14·75	172·8	65·3	160·7	58·0	127·1
Table 2–2	70	1·836	1·876	2·27	3·95	93·8	222	212	75·7	8·34	194·8	35·8	201	29·4	167·0
p = 2%	64	1·701	1·737	2·09	3·61	92·5	216	205	70·7	10·08	193·1	43·8	191·6	36·2	160·0
VSWR = 1·04	60	1·624	1·657	1·990	3·41	91·5	212	200	67·1	11·35	191·6	49·8	185·1	41·3	154·8
Ap = 1·7 x 10^{-3}dB	55	1·524	1·554	1·854	3·15	89·9	206	192·7	61·1	13·47	189·4	60·0	174·8	50·2	146·7
	50	1·414	1·440	1·702	2·86	87·5	196·9	182·1	52·2	16·70	186·1	76·4	160·0	64·8	135·0
Table 2–3	70	1·743	1·780	2·15	3·72	104·2	230	219	84·7	9·06	203	39·7	201	31·8	172·5
p = 3%	65	1·624	1·657	1·990	3·41	102·8	224	211	79·7	10·84	201	48·1	191·8	38·7	165·4
VSWR = 1·06	60	1·524	1·554	1·854	3·15	101·2	217	203	74·1	12·86	198·3	57·8	181·6	46·8	157·5
Ap = 3·9 x 10^{-3}dB	55	1·440	1·466	1·737	2·92	99·5	211	194·8	67·9	15·12	195·9	69·0	170·8	56·3	149·1
	50	1·367	1·391	1·636	2·73	97·6	203	186·2	61·2	17·65	193·1	82·2	159·2	67·5	140·1
Table 2–4	70	1·701	1·737	2·09	3·61	113·0	236	224	93·0	9·37	208	41·6	202	32·7	177·0
p = 4%	65	1·589	1·621	1·942	3·32	111·6	230	217	88·0	11·18	205	50·2	192·3	39·6	170·0
VSWR = 1·08	60	1·494	1·523	1·813	3·07	110·0	224	208	82·4	13·20	203	60·0	181·9	47·6	161·9
Ap = 6·9 x 10^{-3}dB	55	1·414	1·440	1·702	2·86	108·3	217	199·6	76·3	15·47	201	71·4	171·1	57·0	153·4
	50	1·325	1·347	1·576	2·61	105·6	206	187·5	67·3	18·94	196·9	89·7	155·6	72·2	141·3
Table 2–5	70	1·662	1·696	2·04	3·51	120·6	242	229	99·9	9·77	211	43·9	201	33·9	179·4
p = 5%	65	1·556	1·586	1·897	3·23	119·2	235	221	94·9	11·61	209	52·7	191·1	40·9	172·0
VSWR = 1·11	60	1·466	1·494	1·774	3·00	117·6	228	212	89·3	13·67	206	62·8	180·8	49·0	164·1
Ap = 11 x 10^{-3}dB	55	1·367	1·391	1·636	2·73	115·2	219	199·7	81·0	16·81	203	78·8	166·2	61·9	152·7
	51·5	1·325	1·347	1·576	2·61	113·8	213	193·4	76·5	18·57	201	88·2	158·3	69·5	146·6
	50	1·305	1·327	1·548	2·55	113·1	211	190·2	74·1	19·51	199·7	93·2	154·4	73·7	143·5
Table 2–6	70	1·556	1·586	1·897	3·23	139·7	252	237	116·2	11·30	214	52·0	193·4	39·1	180·0
p = 8%	65	1·466	1·494	1·774	3·00	138·1	245	228	110·9	13·30	212	61·9	183·5	46·6	172·5
VSWR = 1·17	60	1·390	1·415	1·668	2·79	136·3	238	218	105·0	15·54	210	73·2	173·0	55·3	164·4
Ap = 28 x 10^{-3}dB	55	1·325	1·347	1·576	2·61	134·4	230	208	98·6	18·05	207	86·3	161·9	65·4	155·8
	50	1·252	1·271	1·471	2·39	131·4	218	193·9	89·2	21·9	202	107·3	146·1	81·6	143·4
	As dB	fs Hz	f4 Hz	f6 Hz	f2 Hz	L1 Henry	L3 Henry	L5 Henry	L7 Henry	L2 Henry	C2 Farad	L4 Henry	C4 Farad	L6 Henry	C6 Farad

* All tabulated data of C and L must be multiplied by 10^{-3}; for example, in Table 2–1, the normalized value of C1 is 79·6 x 10^{-3}, for As = 70dB

* * In the above tabulation, the top column headings pertain to Figure 1 while the bottom column headings pertain to Figure 2

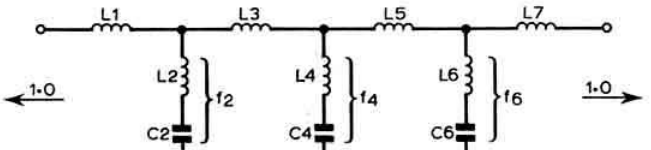


Figure 2 * *

a more abrupt attenuation slope is possible. This can be seen by comparing the different values of f_s at 50dB in Tables 1–4, 1–5 and 1–6 which have pass-band ripple peaks of 0·28, 0·50 and 1·0dB respectively. The values of A_s for the audio filters were selected to be between 35 and 55dB, as this range of stop-band attenuation was believed to be optimum for most audio filtering requirements.

It should be noted that *all* C and L tabular data *must be multiplied by a factor of* 10^{-3}.

With one exception, all the C and L tabulated data of each table have a consistent but unequal increase or decrease in value, a characteristic of most computer-derived filter tables. An exception will be noted in Table 1–5, $A_s = 50$, column C1. The original author points out that this is not an error but arose from a minor change necessitated in the original computer programme to eliminate unrealizable component values.

How to use the filter catalogue

Example 1

A low-pass audio filter to attenuate speech frequencies above 3kHz with a minimum attenuation of 40dB for all frequencies above 3·8kHz, and to be terminated in resistive loads of 1·63kΩ. (This odd value has been chosen merely for convenience in demonstrating the design procedure).

The circuit of Fig 1 is chosen because this has the minimum number of inductors, which are both more expensive and have higher losses than do capacitors.

The parameters are:

$A_s = 40$dB
$f_{co} = 3$kHz
$R = 1{\cdot}63$kΩ.

From Table 1–5, $A_s = 40$dB, calculate f'_s, f'_4 and f'_2. (Numbers with the prime (′) are the frequency and component values of the final design: numbers *without* the prime are from the filter catalogue).

(1) $f'_s = f_s(f_{co}) = 1{\cdot}27 \times 3\text{kHz} = 3{\cdot}81\text{kHz}$.
$f'_4 = f_4(f_{co}) = 1{\cdot}308 \times 3\text{kHz} = 3{\cdot}92\text{kHz}$.
$f'_2 = f_2(f_{co}) = 1{\cdot}878 \times 3\text{kHz} = 5{\cdot}63\text{kHz}$.

(2) Calculate factors $/1Rf_{co}$ and R/f_{co} to determine the capacitor and inductor values.
$1/Rf_{co} = 1/(1{\cdot}63 \times 10^3)(3 \times 10^3)$
$= 1/(4{\cdot}89 \times 10^6)$
$= 0{\cdot}2045 \times 10^{-6}$
$R/f_{co} = (1{\cdot}63 \times 10^3)/(3 \times 10^3) = 0{\cdot}543$.

(3) Calculate the component values of the desired filter by multiplying all the catalogue tabular values of C by $1/Rf_{co}$ and L by R/f_{co} as shown below:
$C'1 = C1(1/Rf_{co}) = (238 \times 10^{-3})(0{\cdot}2045)10^{-6}$
$= 0{\cdot}0487\mu F$
$C'3 = C3(1/Rf_{co}) = (299 \times 10^{-3})(0{\cdot}2045)10^{-6}$
$= 0{\cdot}0612\mu F$
$C'5 = C5(1/Rf_{co}) = (177{\cdot}3 \times 10^{-3})(0{\cdot}2045)10^{-6}$
$= 0{\cdot}0363\mu F$
$C'2 = C2(1/Rf_{co}) = (44{\cdot}4 \times 10^{-3})(0{\cdot}2045)10^{-6}$
$= 0{\cdot}00908\mu F$
$C'4 = C4(1/Rf_{co}) = (133{\cdot}7 \times 10^{-3})(0{\cdot}2045)10^{-6}$
$= 0{\cdot}0273\mu F$
$L'2 = L2(R/f_{co}) = (161{\cdot}7 \times 10^{-3})(0{\cdot}543)$
$= 87{\cdot}8\text{mH}$
$L'4 = L4(R/f_{co}) = (110{\cdot}8 \times 10^{-3})(0{\cdot}543)$
$= 60{\cdot}1\text{mH}$

These calculations, which may conveniently be performed with a 10in slide rule, complete the design of the filter.

It should be noted that all the elliptic-function filter catalogue data is based on the use of lossless components and purely resistive terminations. Therefore, components of the highest possible Q should be used and precautions taken to insure that the filter is properly terminated.

It will be noticed that some rather curious values of both capacitance and inductance may emerge from the calculations, but these may be rationalized to the extent that the tolerance on the values of components need not be closer than some ±3 per cent.

Example 2

A three-section low-pass filter to suppress harmonics at the output of a transmitter covering the hf bands up to a frequency of 30MHz with a matching impedance of 50Ω and a minimum attenuation in the stop-band of 50dB.

The parameters are, from Table 2–2 (circuit Fig 2):

$A_s = 50$dB
$f_{co} = 30$MHz
$R = 50\Omega$.

From Table 2–2 (bottom line) calculate f'_s, f'_4, f'_6, f'_2.

(1) $f'_s = f_s(f_{co}) = 1{\cdot}414 \times 30\text{MHz} = 42{\cdot}4\text{MHz}$
$f'_4 = f_4(f_{co}) = 1{\cdot}440 \times 30\text{MHz} = 43{\cdot}2\text{MHz}$
$f'_6 = f_6(f_{co}) = 1{\cdot}702 \times 30\text{MHz} = 51\text{MHz}$
$f'_2 = f_2(f_{co}) = 2{\cdot}86 \times 30\text{MHz} = 85{\cdot}8\text{MHz}$.

(2) Calculate $1/Rf_{co}$ to determine capacitor values.
Calculate R/f_{co} to determine inductor values.
$1/Rf_{co} = 1/50(30 \times 10^6) = 66 \times 11^{-11}$
$R/f_{co} = 50/30 \times 10^6 = 1{\cdot}67 \times 10^{-6}$.

(3) Calculate component values of the desired filter by multiplying all catalogue tabular values of C by $1/Rf_{co}$ and L by R/f_{co}, remembering to multiply *all* catalogue values by 10^{-3}.
$C'2 = C2(66 \times 10^{-11})$
$= (186{\cdot}1 \times 10^{-3})(66 \times 10^{-11})$
$= 12{,}282{\cdot}6 \times 10^{-14}\text{F}$
$= 12{,}282{\cdot}6 \times 10^{-2}\text{pF}$
$= 122{\cdot}8\text{pF}$.
$C'4 = (160 \times 10^{-3})(66 \times 10^{-11})$
$= 105{\cdot}6\text{pF}$.
$C'6 = 89{\cdot}1\text{pF}$
$L'1 = L1(1{\cdot}67 \times 10^{-6})$
$= (87{\cdot}5 \times 10^{-3})(1{\cdot}67 \times 10^{-6})$
$= 146{\cdot}1 \times 10^{-9}\text{H}$
$= 0{\cdot}15\mu\text{H}$.
$L'3 = 0{\cdot}33\mu\text{H}$.
$L'5 = 0{\cdot}30\mu\text{H}$.
$L'7 = 0{\cdot}09\mu\text{H}$.
$L'2 = 0{\cdot}03\mu\text{H}$.
$L'4 = 0{\cdot}13\mu\text{H}$.
$L'6 = 0{\cdot}11\mu\text{H}$.

As a check, it will be found that the combination C4L4 tunes to 43·2MHz and that the other two series-tuned circuits tune to the other two points of maximum attenuation previously specified.

In order to convert the values in the filter just designed to match an impedance of 75Ω it is only necessary to multiply all values of capacitance by 2/3 and all values of inductance by 3/2. Thus C6 and L6 in a 75Ω filter become approximately 59·4pF and 0·17μH respectively.

The solar link

by R. A. HAM, FRAS*

Introduction

THE sun, like many other stars, is a nuclear furnace consuming enormous reserves of fuel and radiating energy in many forms. The apparent yellow disc on its surface, the photosphere, has a temperature of around six million degrees, and it is surrounded by a gaseous atmosphere, the corona, which extends a million miles into space and has a temperature of one million degrees. Periodically, dark patches appear on the photosphere; these are called sunspots and are some 2,000° cooler than the surrounding photosphere. Some sunspots are scarcely visible and have a short life, while others are measured in thousands of square miles and can survive a full 27-day solar rotation. Radio energy from the sun may be detected by a radio telescope; when the sun is "quiet" the radio noise detected is of thermal origin and will get stronger as the observational radio frequency is increased from 30 to 10,000MHz, and the sun is classified "active" when sunspots are present.

The latter are usually accompanied by solar flares that look like great arches of flame when seen through special optical instruments. Very large flares are called prominences, and in July 1946 an event like this raged across 500,000 miles of the sun. Solar flares can be heard on earth with radio instruments 8·3min after they originate on the sun, but the particles that are ejected at the time of the event can take up to 40 hours to reach our planet. The radio frequency for detecting solar bursts and noise storms is between 30 and 300MHz, with a peak around 150MHz.

The sun can develop a spot at any time and produce the activity which goes with it, and the prime object of this article is to show how the sun can disturb the earth's atmosphere and consequently the earth's radio communication. Another object is to emphasize the need to record the effect of natural manifestations which take place and to send reports on them to RSGB and other organizations.

Observing solar activity

The author's radio telescope was established on 1 June 1968 to observe the midday sun from 1130 to 1330gmt daily, using a frequency of 136MHz with a bandwidth around 10kHz. The observations are recorded at a high chart speed of 30in/hour so that detailed information can be gathered from the 5ft of chart used during a normal midday observation.

The radio telescope can observe the midday sun whether the sky is overcast or not, and the author's xyl checks the solar image for sunspots daily if the sky is clear by projecting the sun through a 7 by 50mm gunsight and producing drawings as shown in Fig 2. (**Warning** . . . never endanger your eyesight by viewing the sun directly through any optical instrument, always project the image).

*"Faraday", Greyfriars, Storrington, Sussex.

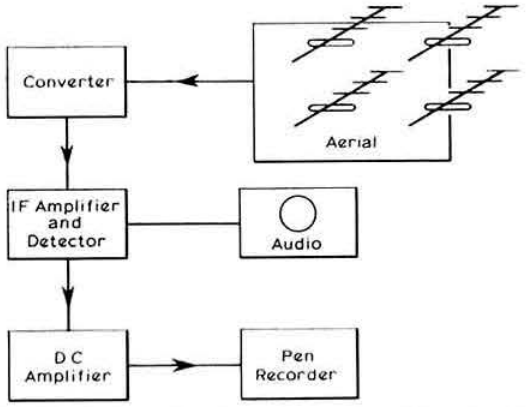


Fig 1. Block schematic of the author's radio telescope. The aerial is a home-built 4 by 4-element Yagi mounted on a 10ft by 6ft wood frame ⅛in wire mesh reflector.

The converter, mounted on the aerial reflector, is also home-built, transistorized, and operates from 12V supply. RF . . . BF180, mixer . . . AF139, xtal osc . . . 36.666MHz and multiplier to 110MHz, both AF139. IF output 26MHz.

The i.f. amplifier is an AR88 communication receiver tuned to 26MHz, which also provides detector and audio output.

The dc amplifier is a 709 integrated circuit, powered by 9-0-9V.

The pen recorder is an Evershed & Vignoles 0-5mA.

It was obvious from the very early recordings that the instrument would distinguish between the individual solar burst which may last a few minutes and the continuous noise storm lasting several days. As time went by this ability to separate and identify the two events proved most valuable when making reports to the British Astronomical Association and the RSGB.

An individual solar burst, illustrated in Fig 3, is less likely to strike the earth's atmosphere because of the time lapse between the origin of the event and the particles reaching the earth, by which time the earth has moved further along its orbital path. On the other hand a long series of individual bursts or a continuous noise storm lasting several days must bombard the earth's atmosphere somewhere. Contact with the earth's atmosphere by a huge stream of solar particles can cause an aurora at either of the earth's polar regions, and a particle stream can also disturb the Appleton layer of the ionosphere and cause a temporary total loss of hf band radio signals known as a Dellinger fade-out.

The author has observed many examples of solar activity and the consequent disturbance to the earth's atmosphere and has selected two of these examples from his records.

Solar recordings for 1 March 1970 showed several large individual bursts which sent the pen full scale, plus a slight increase in the general noise level. Solar recordings for the 2nd and 3rd were similar to those of the 1st but with a lower burst amplitude, by the 4th a full scale noise storm was in progress which died down on the 5th. Many individual low amplitude bursts were recorded on the 6th and 7th. The climax of this period of solar activity was the great aurora on 8 March which was fully reported by Ray Flavell in the September 1970 issue of *Radio Communication* and by the author in *Electronics Weekly* 29 April 1970.

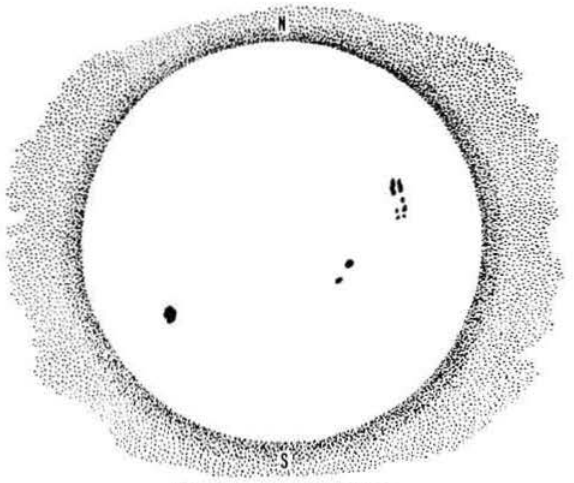


Fig 2. Sunspot drawing

The second example came when a mammoth sunspot appeared on the photosphere around 11 November 1970 and remained there until the solar rotation carried it out of view on the 21st. On the 12th the radio telescope showed a marked increase in the solar noise level and the polar diagram of the telescope aerial could be seen on the chart. By switch-on at 1130gmt on the 13th a noise storm was raging on the sun, getting stronger on the 14th and giving almost full scale deflection on the 15th. The solar noise was so strong on the 16th that the pen was at full-scale deflection for the whole period of the observation, and this was repeated on the 17th and 18th. On the 19th the noise was three-quarter scale; on the 20th down to half scale; and on the 21st a few tiny bursts above the receiver noise level. The earth's atmosphere was bathed for 10 days in solar ejected matter and according to reports there were three Dellinger fade-outs on the 15th and 16th—from the author's observations the atmospheric noise level was very high after sunset on the 16th.

Two examples do not do justice to the value of a solar radio telescope, but they will explain what happens at the time of solar activity and the events which can follow.

The Ionosphere and the Troposphere

Terrestrial radio communication relies upon two regions of the earth's atmosphere named the troposphere and the ionosphere, the former occupying the first 10 miles above the surface and the latter extending from 40 to 200 miles above the earth. (See propagation section of the *Radio Communication Handbook* for details of atmospheric reflection of radio signals). The Heavyside (E) layer of the ionosphere forms at sunrise and disperses at sunset, but sometimes solar activity will cause the E-layer to form or break up into patchy clouds of dense ionization. This latter phenomenon, called Sporadic-E, will be known to the users of the 4m band when its normal peace is disturbed by Continental broadcast stations which use the band nearly 1,000 miles away.

Although Sporadic-E is rarely evident above 100MHz, on 4 July 1965 an extensive cloud of dense ionization centred over Europe influenced the 2m band, and it was fortunate that a 2m contest had just started and many UK contestants were able to work the Hungarian station HG5DKQ/P and gain the points for a 900-mile contact. Had it not have been for the contest this rare Sporadic-E opening might have gone unrecorded.

A typical large Sporadic-E occurred on 6 July 1970 when at 0700gmt a considerable number of Continental stations could be heard between 30 and 50MHz. By midday the E-layer disturbance had spread its influence to the BBC fm broadcast band and at 1430gmt the author counted 14 Continental broadcast stations audible between 88 and 98MHz. At 1900gmt there was the usual interference to BBC Band 1 television and a large number of long distance sync pulses around 50MHz. The 4m UK amateur band was impossible to use owing to the strength and bandwidth of the Continental broadcast stations. At 2045gmt the reflecting E-layer made another change and the prevailing chaos stopped abruptly. Suspicious about this sudden end to an E-layer disturbance, the author turned his 4m beam north-west and for the following hour heard the 599 signal of the Icelandic beacon TF3VHF on 70·275MHz.

Line-of-sight vhf signals above 100MHz rely for their path on the prevailing conditions within the troposphere, which is the home of the earth's weather and this can be very hostile to vhf radio signals. Apart from the attenuating effect of the weather itself there is the thunder static which can ruin reception.

The accepted range of a vhf signal under normal tropospheric conditions is between 50 and 100 miles, but under abnormal tropospheric conditions this range can be multiplied by 10. The reason for this has been the subject of many articles in *Radio Communication*, and over the years the author has noticed that when the atmospheric pressure is above 30in and then rises again, there is a good chance of a tropo opening at the point when the pressure starts to fall. Typical examples of 2m openings coinciding with the pressure falling are the contests on 4–5 March 1967, when the band was open from GW to DJ, and on 20 November 1967, when a two-day opening brought signals from OZ to the

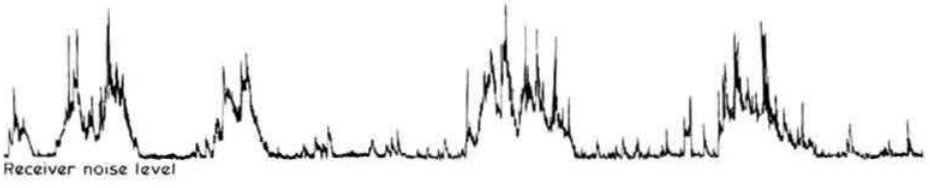
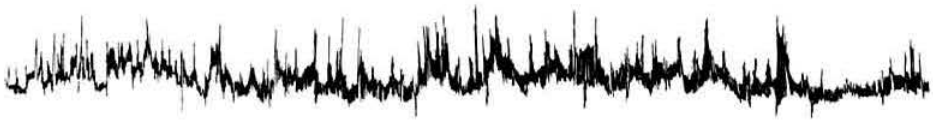


Fig 3. Isolated solar bursts



Receiver noise level

Fig 4. Continuous solar noise storm

south of England. There was a four-day tropo opening in March 1969. In May 1970 a sudden pressure drop in the final hour of a 2m contest brought up the signal of HB9AEN/P. Another large tropo opening took place in September 1970.

The author conducted a three-month experiment starting on 1 June 1969, during which the atmospheric pressure and the signal strength of GB3GW, 130 miles away, were recorded three times a day. A graph at the end of the observation showed that the signal strength of the RSGB Swansea beacon came up just before the pressure was due to fall.

The troposphere can change its condition at any time, so it is vital to have a permanent signal to observe, and the RSGB has fulfilled this need by providing several 2m beacons. With knowledge of the terrain between himself and the beacon an observer can tell the extent of the prevailing tropo openings, and without the beacons the vhf bands for some periods would be written off as unusable. Two-metre contests are very important to tropospheric studies; in addition to the personal satisfaction gained by the entrant, the contest logs are a record of vhf activity and when analysed can have considerable scientific value.

Solar activity and the weather

The routine work at the author's station includes checking the 4 and 6m bands for ionospheric disturbance, recording the atmospheric pressure, noting the prevailing weather and checking the 2m band for tropospheric openings. As the daily records of solar, atmospheric and weather events were accumulated it became apparent that a new factor was emerging from them. It was seen that a relationship existed between certain types of solar activity and severe weather conditions.

Until recently the author, like many other people, was sceptical about the sun disturbing the earth's weather, despite scientific literature quoting climatic changes at the time of peak sunspot activity. But general opinion suggested that a positive connection between the sun and the earth's erratic weather had yet to be found.

To look for this connection in the station's records it was necessary to extract the solar and weather information, and to get a definite meaning into the extracted data the author decided to classify both the daily solar and weather observations into two states, ACTIVE or INACTIVE, and make a comparative table from the results. The sun was classified as ACTIVE if some form of solar output appeared on the daily recording charts, while the weather was classified as follows:

INACTIVE . . . Sunny, cloud, overcast, fog, frost, mist.
ACTIVE . . . Wind, rain, gale, snow, blizzard, thunder.

The classified sun/weather log kept from 1 June 1968 to 30 April 1971 produced the following set of figures:

Observation period 1,064 days.
Sun ACTIVE 610 days.
Local weather ACTIVE 402 days.
Sun and weather ACTIVE 253 on the same day.

Taking a general view of this 1,064-day period one can see that the coincidence of the sun and weather being active on the same day is 253 out of 402 (62·9 per cent), which from these figures one could expect. It is obvious that when other factors, such as solar activity outside the author's observation time and national plus international weather reports, are taken into account the percentage scale would alter considerably. However, the author believes that the type of weather classified in his records as ACTIVE and observed from his station is representative of weather over a much larger area.

Major weather events reported by the national news media (not included in the station weather log) were noted when possible, and one can be sure that if they made national news they were something big. A closer study of the actual solar condition which coincided with these major weather upheavals revealed that a solar noise storm lasting several days was the main culprit, as the following four examples will show:

November 1970. A month of activity from both sun and weather. During the first five days many small bursts and a few large ones lasting several minutes were recorded, while the weather on the 2nd, 3rd and 4th was wind and rain. For the next six days both the sun and weather were intermittently active until the 12th when a severe solar noise storm started and carried on until the 21st. The local weather was wind and heavy rain from the 12th to the 19th, and the rainfall, checked by the xyl, was: 13th, 1·33in; 14th, 0·83in; 15th, 0.62in; 17th, 0·39in; 18th, 0·82in; and 19th, 0·11in, making a total of 4·1in for the six days which coincided with the solar storm. The national news carried the story of the severe flooding in East Pakistan, and this again coincided with the solar storm.

December 1970. The first 16 days saw little activity from the sun or weather; the radio telescope recorded a few bursts and the calm weather was interrupted by occasional rain. On the 17th a solar noise storm developed and lasted until the 23rd, and on the 17th the weather went ACTIVE. Wind and rain developed into a white Christmas with its snow, blizzards and extreme cold. The news media reported severe blizzards in Europe and that some countries had seen snow for the first time.

January 1971. The cold weather from December was carried into the new year. The end of the cold weather came on the 6–7th, and a few days of wind and rain prevailed. The thaw coincided with the start of a solar noise storm which lasted until the 13th. Around the peak of this solar storm the news reported freak mild weather on the 10th throughout the UK with record January temperatures. The sun and the weather were unsettled for the five days which followed the solar storm, and on the 19th another noise storm started and continued until the 25th. During this solar storm the weather developed, providing heavy wind and rain, severe gales, and a whirlwind in south-east England; and on the 21st the atmospheric pressure recorded by the writer was down to 973mb. A further solar noise storm broke on the 28th and ended on the 31st, and with it came very ACTIVE weather. A windy day on the 28th preceded a calm 29th, but on the 30th wind, rain and snow prevailed throughout England and Wales. The news services reported floods in Poland and severe floods in Mozambique; Australia had 9in of rain in one day, and the River Thames was in risk of flooding owing to severe gales in the North Sea.

April 1971. There were two solar noise storms during the month. The first started on the 9th and ended on the 17th during which period the new UK to China hf telephone link was delayed by "atmospheric disturbance". The news service announced on the 13th that the monsoon in East Pakistan had started a month early. A BBC news report on the 21st May about the Mount Everest expedition said that the weather on the 16–17th April on the mountain had been the worst for 72 years. From the 18th to the 24th there were a few solar bursts and the weather was mainly fine apart from rain on the 23rd. On the 25th the second solar noise storm started, and on the 26th there was rain, sleet and snow across southern England with roads blocked in the West Country. The news media reported the coldest April day since records started in 1940.

Acknowledgements

The author would like to make acknowledgement to the RSGB for the beacon service and to the beacon keepers who ensure that a permanent signal is transmitted 24 hours each day. A word of praise also for the members who enter the vhf contests, especially the portable stations that provide signals from exotic sites which are compared with prevailing atmospheric conditions; for the valuable work of members of the Scientific Studies Committee who ponder and advise on the observers' reports; and for Jack Hum who in *Four Metres and Down* in *Radio Communication*, reports on vhf activities.

R. F. Stevens, G2BVN, reports from Geneva on

TELECOM 71

THE first world telecommunications exhibition, Telecom 71, organized by the International Telecommunication Union (ITU) was opened on 17 June at the Palais des Expositions in Geneva, in the presence of 10 Ministers of Telecommunications of member countries of the ITU, and closed on 27 June. It was visited by some 70,000 persons comprising specialists taking part in the World Administra-

Part of Telecom 71. In the foreground is a large replica of a telephone handset forming part of the Federal German Post Office exhibit.

On the IARU stand at Telecom 71, l to r, R. F. Stevens, G2BVN, J. Huntoon, W1RW, T. Clarkson, ZL2AZ, B. Denniston W0DX, W. J. L. Dalmijn, PA0DD, N. Eaton, VE3CJ, and R. Baldwin, W1RU.

tive Radio Conference for Space Telecommunications convened by the member countries of the ITU, and thousands of other visitors from Switzerland, France and many other countries.

The exhibition welcomed many eminent personalities, especially in connection with the celebration of various national days: the Canadian Deputy Minister of Telecommunications, the French Minister of P & T, the Spanish Minister of the Interior, the PTT Minister of the Federal Republic of Germany, the PTT Minister of Italy and the Rt Hon C. Chataway, MP, the UK Minister of Posts and Telecommunications.

On the inauguration evening, a live round-the-world television programme entitled *Enfants du Monde* was produced thanks to close co-operation between the ITU and the European Broadcasting Union and was broadcast in 45 countries. One of the sequences of this programme was shot at Telecom 71.

The first "Golden Antenna" telecommunications film festival took place during the exhibition. The film, *Weather forecasting for tomorrow*, produced by the Japanese company Hitachi, was awarded the "Golden Antenna", the highest prize of the festival, and other awards were conferred at a gala evening held at the Grand Theatre in Geneva.

Symposia organized on weekdays while the exhibition was open attracted a large number of people who came to listen to international experts talk on many aspects of telecommunications.

The international technical press was represented by 100 periodicals displayed on a stand reserved for that purpose where visitors were able to obtain information about them. Among the publications shown were *Radio Communication* and the second edition of the *VHF-UHF Manual*.

The exhibitors' stands offered a wide variety of advanced, and in some instances completely new, equipment. Most of the exhibitors agreed that another Telecom exhibition should be held in two or three years' time, subject to approval by the ITU Administrative Council, concurrently with a future big conference of the ITU.

The only stand wholly devoted to amateur equipment was that of Sommerkamp who featured their complete range, including several items not normally seen in the UK. A new tuning unit for rtty, completely transistorized and with built-in oscilloscope, attracted considerable attention. A separate vfo, type FV101, basically intended for use with the FT101 transceiver, featured a digital readout and will apparently be available at extra cost in the near future.

The large and interesting stand of the German Democratic Republic contained many interesting items, including a complete all mode receiving unit covering from vlf to uhf and a meteorological satellite receiving system WES 2. The latter equipment used two crossed dipoles for reception of signals in the internationally allocated band of 135·5 to 138MHz. The equipment comprises two units, a two-channel receiving unit ZEA 1 and a picture tracing unit BAG 1. The size of the final picture is 220mm wide with length varying between 180 and 690mm. The equipment located in the exhibition hall was in constant use for the reproduction of weather maps and the quality of these was uniformly good. The complete system is of such a size as to be readily portable and could be employed on ships in addition to fixed locations.

The International Amateur Radio Union participated with a stand of 50m², the floor space having been generously donated by the ITU. The stand incorporated a model of the first OSCAR satellite, the latest REF beacon station F7THF, and examples of 10,000MHz equipment also from REF. Publications of national societies from all three regions were on display together with some of the attractive QSL cards received at 4U1ITU. DARC contributed models of a small transistorized df receiver for 3·5MHz, named the Gottinger-Baby. A FR50 receiver donated by Sommerkamp was the first prize in a draw in which all participants were licensed amateurs or short wave listeners under the age of 21.

More than 350 amateurs from 27 countries signed the visitors' book at the stand, which was located near the exhibition entrance and attracted a great deal of attention. The cost of the stand was borne by IARU Region 1 and IARU HQ, with the organization and manning undertaken by the Region 1 secretariat. The help of F8RU and HB9AJU in this project is gratefully acknowledged.

Telecom 71 was the first exhibition sponsored by the ITU and attained the highest international level. In the opinion of both exhibitors and visitors it was an outstanding success. Unfortunately it is probable that such an event could only be staged in the unique environment of Geneva and that we are unlikely to see an exhibition of this type in the UK.

TECHNICAL TOPICS

A monthly feature by PAT HAWKER, G3VA

ONE of the advertisements appearing regularly in *Radio Communication* contains a phrase that always pulls me up a bit sharply. It is the one for that excellent quarterly publication *VHF Communications* which proclaims "absolute state-of-the-art . . . because the authors are not only leading vhf amateurs but mostly professional engineers employed in industrial research and development". While we certainly have no quarrel with a publication aiming at "absolute state-of-the-art" (though we would hate to have to determine just what is and what is not in that category), it seems a curious paradox, to say the least, that *amateurs* should be told so bluntly to look for guidance primarily to the *professionals*. For it is surely a basic tenet of amateur radio that the non-professional can be his own R & D man and that there is something that only he can contribute: a freedom to swim against the engineering party-line, without worrying unduly if he should be proved wrong. With no professional reputation to lose, he can blithely and often rewardingly fly in the face of accepted beliefs. We are extremely fortunate that so many professional R & D types are also amateurs—but we are equally fortunate that so much is still contributed to the art by those whose basic training has often been in very different disciplines. Victorian dilettantism may be very much out of favour these days, but let us not write off the keen amateur quite so finally.

A look around ASWE

After that opening, it may look as though we are immediately contradicting ourselves by reporting briefly on a most interesting visit to the Admiralty Surface Weapons Establishment near Portsmouth. We have been to too many security-conscious establishments over the years to really expect on an "Open Day" to see the very latest work on public display. But certainly there were many interesting ideas—and demonstrations of the latest small satellite communications system which uses only a 3ft dish (and carries two teleprinter circuits).

We have suggested before in *TT* that naval radio communications—because of the enforced proximity of transmitters and receivers—have more in common with amateur radio problems than most other forms of professional communications. It was illuminating for example, to find the attention now given to the "rusty bolt" effect as a producer of unwanted spurii, to the extent that wherever possible stray wires are being replaced by the various types of plastic cord; similarly a glass-reinforced-plastics (ie Fibreglass-type) aerial lattice mast has been developed. Front-end performance of all-semiconductor receivers (see later) is still regarded as a formidable and by no means finally solved problem.

Several exhibits underlined the value of the cooling and insulation properties of inert fluorochemical liquids. By immersing components, such as resistors or transformer windings, in these liquids, they can safely dissipate many times their normal power; for example ASWE has developed a compact power transformer using 9,000A/in^2 current density, nine times the normal figure. Windings and resistors can in fact handle up to about 15 times normal current when immersed in fluorochemicals (we have previously reported in *TT* seeing some years ago a 1kW linear amplifier in a box about the size usually reserved for a vfo). Another item calculated to interest an amateur is the establishment's use of model aerial techniques: for example they build small copper models of the ships to find out whether the radiation pattern from a proposed aerial is likely to be affected by nearby masts and superstructure.

And, hardware apart, it was stimulating to find a genuine wish to evolve equipments which could be maintained as well as used by *operators*, to eliminate the need to carry large numbers of electronic technicians on board ship just to keep the gear working. This is resulting in the use of "throw-away" circuit modules combined with simple go/no-go test sets to allow the fault to be located down to the appropriate module. Faulty modules may then be jettisoned (one reason for this apparently is that naval paperwork can often make the cost of repairing a module far more than its original cost). The idea of an operator who keeps his own rig working is not without interest to amateurs. While a lot of blood gets spilt over the build or buy controversy, a more significant measure of amateur involvement might perhaps be whether or not there is sufficient understanding of the rig, whether built or bought, to repair the majority of faults!

An interesting place, an interesting day—and sure enough quite a few amateurs to be found in these highly professional R & D laboratories!

Semiconductor front-ends

Despite all the many articles on fully solid-state hf receivers, it remains difficult to put forward a really convincing case for using any of the common forms of device—bipolar, fet or integrated circuits—in the front-ends of home-based receivers. The best that one can usually say is that, with careful design and the liberal use of balanced stages, it should be possible now to achieve a front-end performance comparable with all but the best valve receivers. Even this, of course, is a tremendous improvement since the mid-sixties; it means that very acceptable all-semiconductor receivers are possible. But, as Peter Martin, G3PDM/W1, showed in his recent article, there is still a lot to be said for using beam-deflection tubes and conventional valves in the signal path of a high-performance receiver.

But, then, is there still no way of producing all-semiconductor rf amplifiers and mixers that can handle linearly not only microvolts and millivolts of signal but even volts?

From time to time we have referred in *TT* to the Comdel broadband hf amplifiers (eg HDR101 series) marketed in the USA for professional applications with a claimed dynamic range approaching 140dB, and offering a more or less flat gain over the full range 0·5 to 50MHz. These were designed to cope linearly with signals of up to 2V.

What we have never indicated in any detail is the type of device used to achieve these remarkable results. So this month we would like to explore this subject, and also to report that similar fet devices are now being used in balanced mixer configurations in such equipments as the Collins 51Y7 ADF (automatic direction finding) airborne receiver.

The secret was in fact hinted at long ago in a useful discussion on valve receivers by E. W. Pappenfus, W0SYF (*QST* January 1955). In explaining the increasing problem of cross-modulation in valve front-ends he wrote, "receiver designers laughingly suggest a 4-125A or similar for the receiver rf stage." In other words, the use of high-power devices of a type more commonly thought to be appropriate to transmitters than receivers as a means of coping adequately with the really strong local signals. This approach has been exploited as a means of overcoming small-signal bipolar transistor limitations in a number of Redifon receivers and also in the EMI-Cossor active loop aerial pre-amplifiers. These used overlay rf power transistors as the first rf stage.

So the logical continuation of this technique was to try high-power fet devices in rf amplifiers. This is what is done in the little Comdel packaged broadband amplifiers. They make use of a series of power FETS made by Teledyne Crystalonics (147 Sherman Street, Cambridge, Mass; or British agents, G. E. Electronics, Eardley House, 182-4 Campden Hill Road, London W8). A typical "Powrfet" (registered trade mark) recommended for high dynamic range hf applications is the CP640 silicon epitaxial junction n-channel fet. These have a peak drain current characteristic of no less than 1·2A and normally rf amplifiers are set up to run about 40mA at 15V supply. Fig 1 shows a recommended circuit for the CP640, using a 40mA constant current source in place of a source biasing resistor (this technique automatically sets the operating point regardless of I_{dss} (zero-gate-voltage current drain) or pinch-off voltage. If the constant current source is eliminated it is necessary to select the source resistor or to use a high negative supply voltage and a high source resistor value. Typical characteristics of this circuit are: noise figure 2·5dB from 50Ω source; gain 8 to 9dB from 0·5 to 60MHz; dynamic range equal to or better than 140dB; third order product equal to or better than 80dB down at 0dBm.

The Collins ADF receiver uses a CP626 rf amplifier followed by a balanced mixer using two CP625 units, then a 15MHz filter, followed by another CP626 as part of a pre-amplifier/attenuator stage in the i.f. strip. We have not been able to locate any claims for the dynamic range of a balanced mixer stage of this type, but it should be pretty potent. The CP625 and CP626 devices are selected CP651 units.

Here then is an all-semiconductor approach that would see off anything other than a beam-deflection mixer (and despite what G3PDM says there is still a lot to be said for an rf stage as a means of improving image rejection, etc).

Should then we all rush to put in CP devices in our receivers and making the milliamps flow? Technically, the answer would seem to be yes—if you really insist on using semiconductors. But it is necessary to point out that

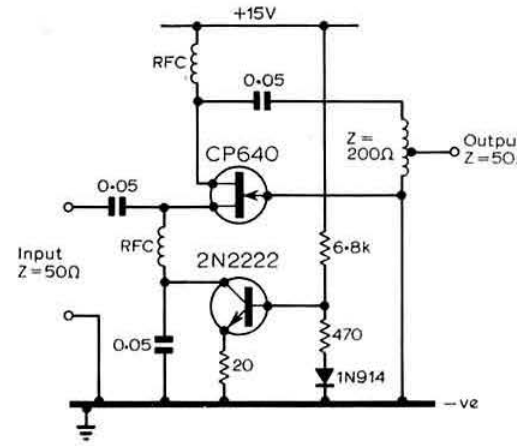


Fig 1. Basic grounded-gate broadband amplifier using CP640 power fet in conjunction with 40mA constant current source. Dynamic range better than 140dB. Gain 8 to 9dB over range 0·5 to 60MHz. The 2N2222 may be replaced by any npn transistor with reasonable beta at 40mA. The base voltage divider includes 1N914 diode to temperature compensate for V_{BE} and sets up about 1V at emitter (this voltage must be lower than the minimum V_{GS} at 40mA I_{DS}). The constant-current transistor and circuitry can be omitted if the source resistor is carefully selected for individual FETs

(in the USA) the CP640 sells at $15 in small quantities. This price means that while one could well contemplate a single rf stage using one, the idea of three or four devices as in the Collins design is really going to add quite a significant sum to the cost of even a high performance receiver. But we feel it is important for amateurs to know they exist, and how they can be used.

Originally this series of power FETS was developed for high level switching applications as the 2N4445. They have inter-electrode capacitances of the order of 15pF. A paper on the design of wide-band amplifiers using them has been written by Walter Schreuer, K1YZW/G3DCU. In this he suggests that best valves have a dynamic range of 90 to 100dB; low level FETS, 80–95dB; low-level bipolar transistors, 70–90dB. He believes that only a few special valves can approach the gain-bandwidth performance of these power FETS, usually with noise figures and dynamic range well below the CP devices. For valves, his vote goes to the 7788 (Mullard E810F) which has much the same gain and bandwidth, a noise figure of 6dB and dynamic range of about 100dB.

Power FETs in transmitters

Walter Schreuer also points out that the CP650 merits consideration as a linear amplifier in low power transmitter applications, with p.e.p. output of up to about 200mW. He suggests they could also be used for crystal oscillators of extremely high spectral purity.

Some readers may question the emphasis we have given to what are clearly still specialist devices which, unless prices fall, are not likely to come into widespread use just yet. But in putting together *TT*, we are constantly being impressed by the number of amateurs who are deeply interested in new techniques, provided these show a way of overcoming a real problem.

Further useful information on power FETs, including Siliconix U183, U222, U244, U266 and Crystalonics CP650/-CP653 types, is given in *Circuits and techniques* by Ed Noll, W3FQJ, (*Ham Radio* April 1971). W3FQJ concentrates mainly on their use in transmitter applications: Fig 2, for example, is a push-pull power oscillator for 1·8MHz capable of an *output* of 1W. My own feeling is that it is perhaps in the receiver applications and as linear ssb amplifiers that the power fet appears to have something unique to offer.

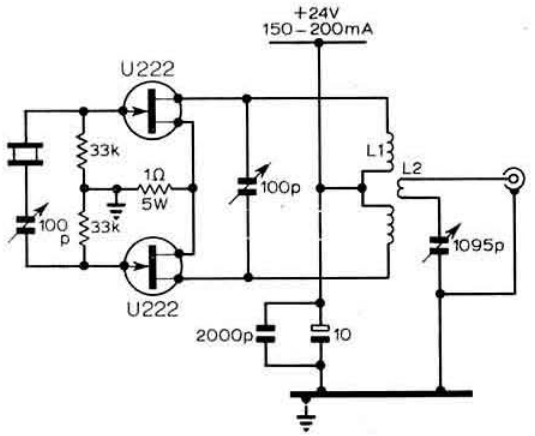


Fig 2. Push-pull power fet oscillator provides about 1W output on 1·8MHz using Silconix U222 devices. C1, 1,095pF (three-gang broadcast capacitor); L1, 60 turns No 26 enam close-wound on 1¼in former, centre-tapped. Space left for L2 at centre. L2, 15 turns closewound

Broad-band dipoles

While we were at ASWE, one of the items which came to our notice was the rigging of broadband dipoles for hf. These now often consist of about four or five spaced wires having an appearance very much like the traditional 600m mf shipborne T aerial. But we gathered that it has been found that the broadband characteristics of this type of aerial tend to vanish if the far ends of the dipole are joined together. Each wire is kept physically and electrically separate from the point it leaves the matching to the transmission line. It is thus significantly different from the more usual cage-type fat dipoles where all the wires come together again at the high-voltage ends.

So a few days later we were interested to find (*CQ* June 1971) an article "Broadband Antenna for Forty Metres" by Howard Phillips, WB5ACP, indicating somewhat similar ideas used to produce an aerial resonant across the entire American 7MHz band (7·0 right through to 7·3MHz, a spread that only pre-war British amateurs can still remember!). His design (Fig 3) uses four-wire tv rotor cable but with the last few feet separated and fanned out to enhance end effect and capacitance loading. One result is that the overall span of the dipole is about 48ft instead of the usual 66ft; another is a claimed swr of 1·3:1 or less (if that really means anything) across the full range. He points out that the aerial can be put up either in flat-top or inverted-V configuration. While few of us need such a broad-band aerial on 7MHz the idea is a useful one to know, apart from being handy if your garden span will not hold a conventional dipole span.

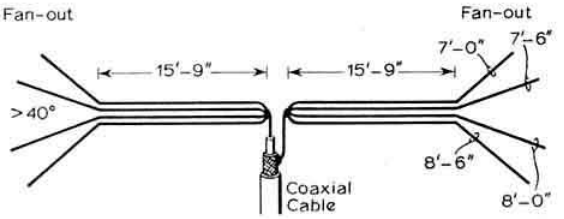


Fig 3. WB5ACP broadband 7MHz aerial using four-core cable with fan-out over last 7/8½ft

More on reed beam indicator

One reader who was most interested in the technique used by Rex Morrison, G3KGA, (*TT* May 1971) to indicate beam direction was Roy Schofield, G3YCI, of Liverpool. He feels, however, that the suggested use of multi-wire cables (9 cores needed for an 8-reed system or 17 for a 16-reed arrangement) might be a drawback in situations, such as his own, where the aerial system is located some distance from the shack.

He proposes therefore that in such circumstances a simple two-core cable could be used provided that the reed switches are arranged to switch in different values of fixed resistors mounted on the mast. Then instead of lamp indicators, a 1mA or similar meter could be calibrated to allow the direction angle to be read off directly. Fig 4 outlines the idea. There is obviously likely to be a cross-over point at which one or other of the two arrangements will prove the more economical—or it could depend on what is available in the junk box.

G3YCI considers that suggestions like the one of G3KGA are most useful in indicating a novel and unusual application for reed switches—he expresses the hope that other amateurs will put forward other ideas for using these devices.

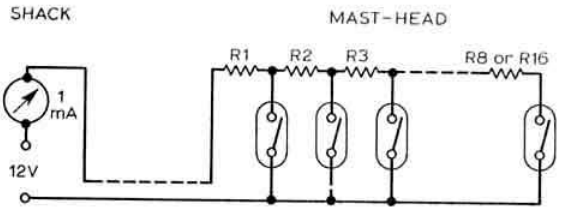


Fig 4. G3YCI's adaptation of the G3KGA remote-beam direction indicator using reed switches. Typically for 8 reeds; R1, 12kΩ; R2, 1·8kΩ; R3, 2·2kΩ, R4, 4·3kΩ; R5, 4·7kΩ; R6, 8·2kΩ; R7, 16kΩ; R8, 47kΩ. For 16 reeds: R1, 12kΩ; R2, 820Ω; R3, 910Ω; R4, 1kΩ; R5, 1·2kΩ; R6, 1·5kΩ; R7, 1·8kΩ; R8, 2kΩ; R9, 2·7kΩ; R10, 3·3kΩ; R11, 4·7kΩ; R12, 6·2kΩ; R13, 10kΩ; R14, 15kΩ; R15, 33kΩ; R16, 100kΩ

The 9M2CP Z-beam

A few days ago on 3·5MHz a British amateur gently chided me for admitting to using an end-fed long wire aerial. With all those exotic aerials in *TT*, he suggested, fancy using such an unexciting arrangement! The point was taken, though we have always stressed the value of the classic aerials, including the very ancient Zepp. Perhaps we should have claimed that

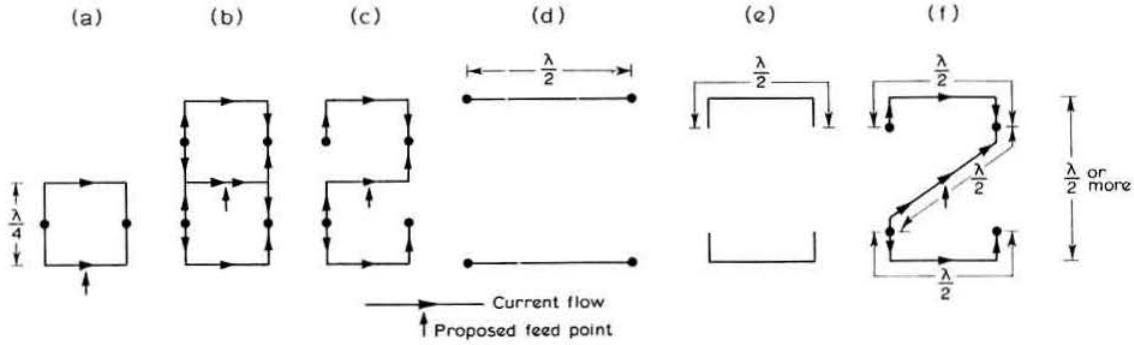


Fig 5. Development of the 9M2CP Z-beam : (a) conventional quad ; (b) double quad—difficult to tune and little apparent advantage over (a) ; (c) open-ended double quad developed to eliminate possibility of double currents in centre element—it gave improved results over (b) ; (d) half-wave dipoles spaced about half-wavelength apart vertically ; (e) as (d) but with ends bent inwards to permit joining diagonals with half-wave wire ; (f) the 9M2CP Z-beam as now evolved

the aerial was in accordance with the in-trend in American electronics—the "kiss" technique (for the uninitiated, "keep it simple stupid"). Fortunately, there are amateurs still prepared to tackle aerial configurations which would be difficult to erect in a small garden surrounded by anxious neighbours.

One of the most interesting of these to come along recently stems from Philip Zeid, 9M2CP, in Penang. This is a 14MHz Z-beam possessing good low-angle characteristics; he has combined this with a 21MHz double-delta beam.

9M2CP writes: "I have had the aerial in use for both 21 and 14MHz for about seven months. It is originally derived from the delta loop but has several advantages. The 21MHz section might be termed a double delta, whilst the 14MHz gradually developed from a quad: Fig 5. I tried double quad, phased arrays etc, and finally arrived at the present design which has proved better, so far, than any other beam I have had for this band.

"Both beams have optimum gain for the length of boom used, since both end-fire and broadside gain are used. The 14MHz beam has a portion having vertical polarization. Both beams, on the same boom, have excellent low-angle radiation, indicated by the vastly increased difference in signal strengths, compared to a standard dipole at 60ft, as dx signals start to come in. During the early mornings the difference is absolutely amazing.

"On 21MHz there is a standard delta loop, with a similar delta pair mounted below the boom, as a mirror image of the upper pair. A common gamma tuning capacitor is used and is better and easier to adjust than separate capacitors. The gamma arms are adjusted equally and matching is equal to that found with a single delta loop beam.

"For 14MHz, 5ft (or longer) wooden extensions are placed in the ends of the delta loop Vs to provide at least half-wavelength vertical spacing between upper and lower horizontals. The whole is laced round with nylon line, to form a framework for the 14MHz beam and also support for the lower Vs which tend to collapse inwards under their own weight. The radiator is made up of $1\frac{1}{2}\lambda$ of wire laced as shown in Fig 6, and fed with a gamma match at the centre. The length of wire is slightly shorter than $1\frac{1}{2}\lambda$ to account for two end effects only. A sliding loose noose of nylon is run round the vertical nylon and includes the radiator so that it can be adjusted to take up slack when in position. The reflector is cut to just under the full theoretical $1\frac{1}{2}\lambda$ and a tuning stub is put in the centre. This can readily be adjusted for maximum gain or best back-to-front ratio. The tuning is quite marked for best back-to-front ratio and also provides what appears to be best gain."

9M2CP adds that there is no reason why this system should not be extended to more than two elements (so long as they do not foul guy wires) or more than one vertical pair on higher frequencies. It would also appear quite feasible,

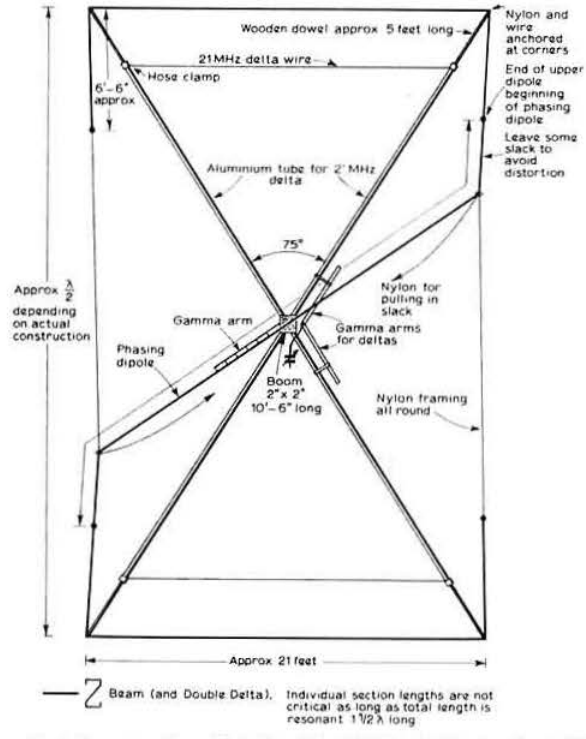


Fig 6. Constructional details of the 9M2CP 21MHz double-delta and 14MHz Z-beam

he suggests, to put the tuning in the lower horizontal member if this provides easier access for tuning. Phasing is accomplished automatically.

Interestingly enough, the double delta configuration for hf was investigated by the originator of the delta aerial—H. R. Habig, K8ANV, and for vhf and uhf by John Pegler, G3ENI. (see *ART3* page 183). For 14MHz, 9M2CP has arrived, under his own steam, at a configuration which appears to resemble closely the Aerialite "Supreme" aerial for uhf television reception (see *TT* April 1970). Interestingly enough, the Supreme is generally regarded as a very high gain array, although some people appear to worry at the possibility of mixed polarization which could increase co-channel interference on television stations. On the other hand, as we suggested in *TT* recently, mixed polarization may be a positive advantage for hf operation.

A 14MHz 9M2CP array clearly needs a lot of height, but on 21 and 28MHz would be much less formidable to construct. It certainly seems to be an arrangement which deserves to be widely known.

Dirty dc charging again

Joe Cropper, G3BY, adds a few helpful notes on his experiences with dirty dc charging of dry batteries (*TT* June 1971 and *ART*). He mentions that when he accidently left his torch switched on, the three U2 cells were discharged right down to the point where the bulb was only a dull red. He put the cells on charge immediately, and they were soon none the worse. But he does warn that the small layer-type batteries used for domestic transistor radio receivers do not respond too well to recharging. In his experience they develop high resistance and although, on charge, the voltage comes back to normal, it falls off badly on load. But he wonders if this may be because they are allowed to discharge too far in the first place—it is seldom that anyone takes a battery out of a radio until, as G3BY puts it, "it's flat on its face". But certainly for larger cells, including the U2, G3BY is still firmly convinced that dirty dc charging really works.

Two overtone oscillators

G3BY also sends along two oscillator circuits which he has been trying in 144MHz gear. That shown in Fig 7 stems from an article in *73* (June 1966) by veteran writer Frank Jones, W6AJF. The other, Fig 8, comes from the American JAN crystal list. Both enable crystals to oscillate in 3rd, 5th and 7th overtone modes. G3BY is using a 15MHz crystal (he uses surplus HC6 types) on its 9th overtone to form the local oscillator source for a 144MHz converter. In this way, with only one stage, he avoids all frequency multipliers and the resulting mass of unwanted frequencies. To get useful output on 140MHz, G3BY found it necessary to use a transistor with an F_t (gain-bandwidth product) of 900MHz; he points out that this is in line with the requirement that for optimum vhf performance a transistor's F_t should be at least five times the working frequency. For use up to about 90MHz, a 2N706 transistor can be used (with reverse supply polarities) but even so, a device with high F_t will tend to provide greater output.

Of the two arrangements, G3BY prefers the JAN circuit as it results in a more compact stage, and he suggests that the coil tap is not really worth the trouble.

Generally, for critical transistor circuits, G3BY recommends a tip given him by G3AYT: this is to use small pre-set potentiometers for careful setting of the biasing point. These can then either be left permanently in circuit, or once the optimum value is found for a given device, replaced by equivalent fixed resistors. He has found this tip well worth while, particularly in connection with oscillator circuits; often indeed making the difference between success and failure. Certainly, to achieve maximum output of an overtone arrangement, this approach is essential; pot values of 50kΩ and 100kΩ are usually suitable.

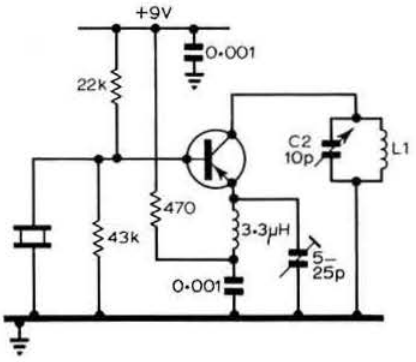


Fig 7. Overtone cum tritet oscillator—Frank Jones, W6AJF, *73* June 1966. L1/C2 to resonate at overtone frequency

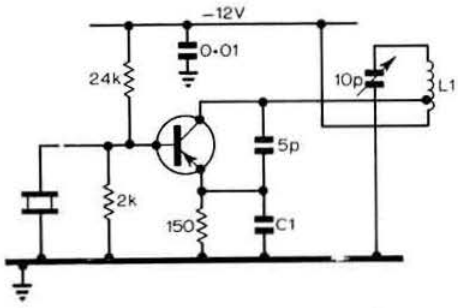


Fig 8. The JAN Crystals overtone circuit. L1/C2 to resonate at overtone frequency, tap one-third up. C1, 30pF for 50MHz, 12pF for 144MHz (conveniently a 30pF trimmer)

Anti-backlash mechanism

Ron Troughton, G8CRH, has sent along a clipping from what may appear to be a very unlikely source of an item for *TT*—the *Chartered Surveyor*, April 1971. This describes a rotary drive developed by NASA for use with optical measuring instruments. But G8CRH points out that it may well have possibilities for a backlash-free vfo tuning drive. Since many vfo designs restrict the swing of the tuning capacitor in the interests of linearity, the 90° swing of the mechanism (Fig 9) may well be less of a disadvantage than might at first appear. He suggests the lead-screw could be a flat-topped V thread as used for micrometers, with backlash in the nut taken up by means of the adjusting screws shown on the slotted side of the nut assembly. Axial spring loading would then take up end float in the lead-screw.

The following notes come from the journal: the nut assembly A, which traverses a lead-screw B, is connected to the platform member C of the instrument by two taut

flexible bands D of resilient material such as phosphor bronze. The platform C is mounted in a plane at right angles to that of the nut assembly which is supported in a bracket riding on the base of the mechanism. The nut assembly is fitted accurately to the precision ground lead-screw, and on turning the latter, the linear movement is translated to uniform angular rotation of the platform by the bands D.

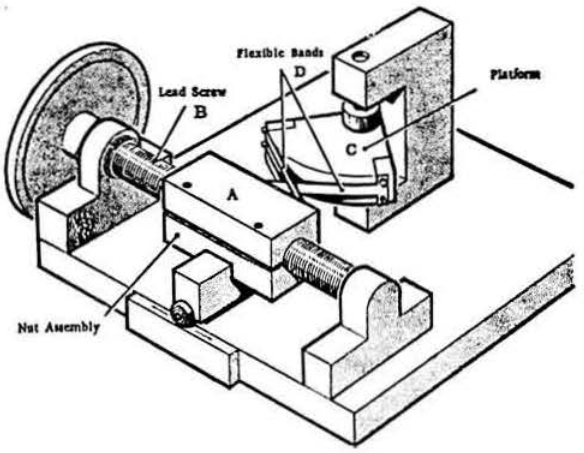


Fig 9. Anti-backlash rotary mechanism developed by NASA

Solid-state Deltahet receiver

Back in 1963, Ian Pogson, VK2AZN, a staff member of the Australian magazine then called *Radio, Television and Hobbies* (and subsequently renamed *Electronics Australia*) described the front end of a home-built receiver using the Wadley loop technique first made famous in the Racal RA17 receiver. This was called the Deltahet and the design aroused a lot of interest here as well as in Australia—despite the formidable problems involved in, for example, the construction of really effective 40MHz bandpass filters. The following year he presented a complete Deltahet receiver design based on valves.

We were, therefore, very interested to receive from Ian Pogson clippings of a new series of articles (*Electronics Australia*, January through to May 1971) in which he describes fully the construction of a Deltahet Mark 2; this time a fully solid-state receiver using FETs, bipolar transistors, four diode ring mixers, built-in aerial attenuator etc, and many, many other refinements, including the use of an Eddystone 898 dial. The text and illustrations run to almost 40 pages and we suspect that this must be about the most detailed account ever published of the construction and alignment of a high-performance solid-state communications receiver. It is not, we would stress, a project for the easily disheartened or for anyone other than a very experienced constructor. Indeed we suspect that a phase-locked partially frequency-synthesized approach might in some ways be simpler. But the Wadley loop remains attractive and I am glad to draw attention to these articles (*Electronics Australia*, Box 2728, GPO, Sydney, 2001, Australia). A truly Herculean effort.

Switchable audio filter

An integrated-circuit audio filter with bandwidths suitable for cw or phone reception has been developed recently by Ron Wheatland, G3SZW: see Fig 10. This operates from a single 9V supply and has a centre frequency of 800Hz. G3SZW points out that the 0·47μF capacitor across the output was added "to tame the beast" and that the 6·8kΩ resistor may need adjustment to avoid positive or negative clipping of the waveform. G3SZW has not measured the Q of the filter but suggests that it provides bandwidths of approximately 60Hz at 800Hz centre-frequency; 180Hz at 810Hz centre-frequency; and 300Hz to 3·5kHz in switch position 3.

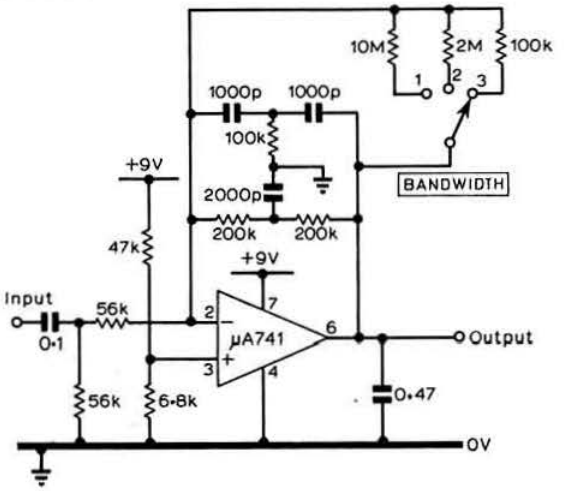


Fig 10. Switchable af filter developed by G3SZW. With switch in position 1, bandwidth about 60Hz at 800Hz centre-frequency; 2, 180Hz at 810Hz cf; 3, 300 to 3,500Hz

Here and there

John Pegler, G3ENI, whose interest in the ddrr Hula Hoop aerial was aroused by the original *Electronics* article of 11 January 1963, is still waiting for some spectacular explanation of how (or if) it really works. In particular he has never been sure just why the vertical section should be specified as precisely 2·5 electrical degrees; he would very much like to know how it performs compared with a $\frac{1}{4}\lambda$ vertical on a similar ground plane. Anyone prepared to endorse or contradict the original claims by W6UYH? The aerial is briefly described in *ART* as both a fixed station and mobile 28MHz aerial.

G. W. Tarbet in Oakville, Ontario, has sent along some information on the Type 80 lamp used in the Wien bridge oscillator in the March *TT*. This is a low-consumption 3V lamp, 0·008A $\pm$ 0·0015A (it also carries the USASI designation 7204). The company address is Los Angeles Miniature Products Inc, 19220 South Normandie Avenue, Torrance, California 90502, but it may be easier to use a thermistor as suggested by G3SSM.

Once again, space restrictions make it essential to hold over several interesting letters, including further detailed accounts of work carried out by R. W. Gilbert, G3UEZ, into digital ssb techniques, and by W. M. N. Burridge into integrated-circuit phase-lock-loop detection. We will do our best to include a write-up on them next month.

MICROWAVES–1,000MHz and up

by Dr D. S. EVANS, G3RPE*

A Yagi for 23cm

As an alternative to the parabolic dishes generally used on the 23cm band, a Yagi has obvious advantages in terms of ease of construction and particularly in mounting high on a mast. Added to this, there is a trend towards operating 23cm as a band in its own right; that is, without the use of 70cm talk-back, as in the coming VHF NFD contest. Under these conditions the high directivity of dishes may be a real disadvantage, and a Yagi, even if of lower overall gain, may be more successful.

G8AZM (Sidcup) has supplied details of a 23cm-long Yagi which is, therefore, most welcome. Although measurements of gain are difficult to make, the results of several tests against dishes suggest that the gain of this design is roughly equivalent to a 3ft dish.

The method of construction is straightforward and evident from the figures. The critical dimensions marked should be observed, but other dimensions may be varied somewhat to suit the materials to hand. The ends of the boom should first be crimped and soldered to exclude moisture, and the mast extension and support arms then soldered into place. Starting with the smallest, the directors are soldered to the boom using a large (250W) soldering iron. The elements are located in small grooves filed in the boom, and are initially cut slightly longer than required and filed to length after soldering in place. In this way the required accuracy of construction, within a few tenths of a millimetre, can be achieved. The director lengths are given in the table. The spacing between the reflector and radiator should be 73mm, and between the radiator and first director 42·2mm. The directors are all spaced 57·7mm apart.

The radiator and reflector may best be made by soldering together two L-shaped pieces of rod, one limb of each of which is accurately filed to length after bending. It may be found necessary to use small clamps to hold joints in place while others are soldered. The radiator clamp is fabricated from polythene or nylon. The hole to take the boom may be cut with a heated piece of the boom material. The 4BA nut used to secure this clamp is melted into place.

The balun assembly is constructed from a 7·6mm-bore tube 120mm long. Approximately 130mm of the outer protective covering is stripped from the full length of uhf low-loss coaxial cable to be employed, which is pushed into the tube. The outer braid is then soldered at both ends taking extreme care not to melt the dielectric. The $\lambda/4$ coaxial sleeve is made from 12·5mm bore tube; the inside length is the critical dimension and should be 57·5mm. After final assembly, the aerial may be painted with aluminium paint to reduce corrosion.

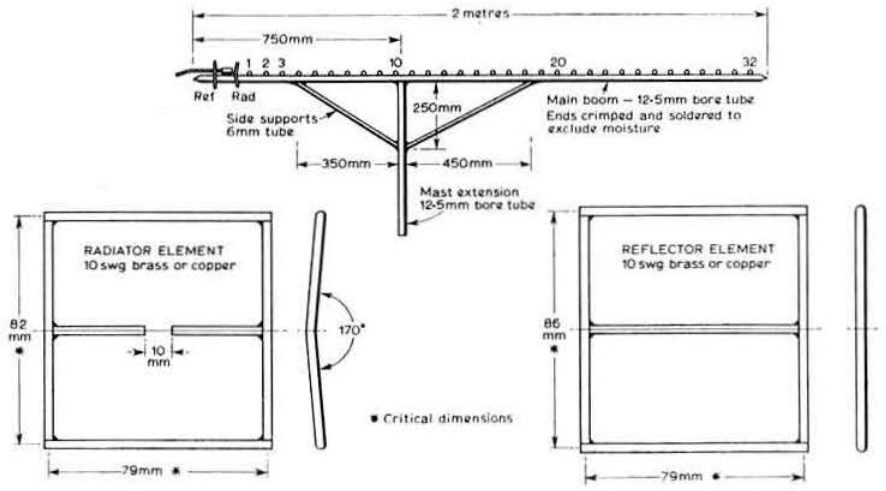
Director dimensions

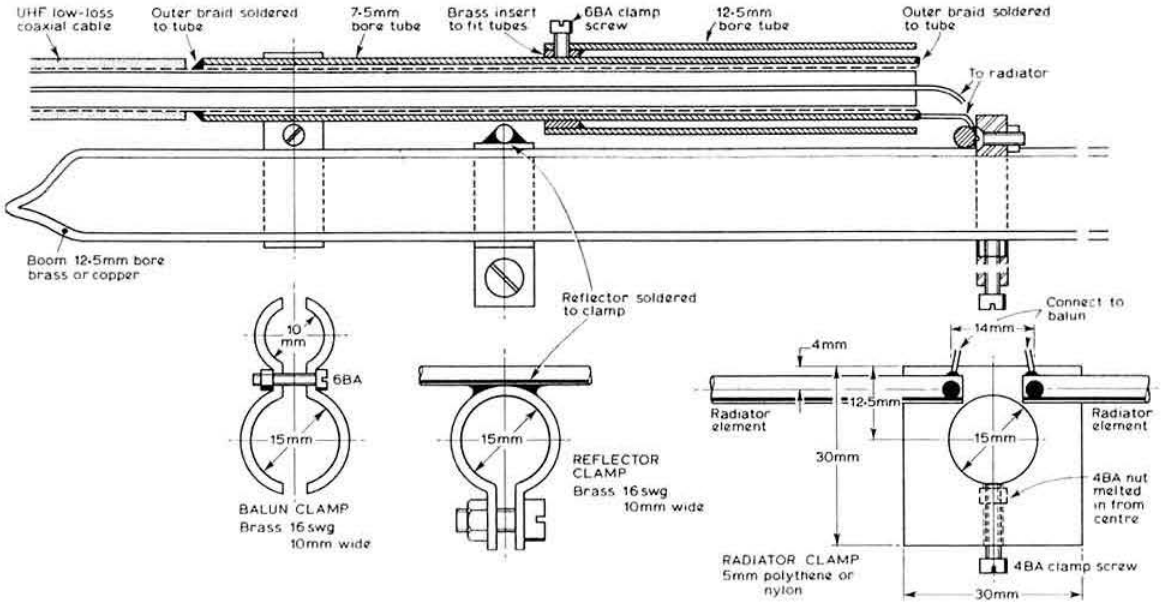
Material 12 or 14g brass rod

Director No	Length* (mm)	Director No	Length* (mm)	Director No	Length* No
1	101·7	12	88·9	23	76·2
2	100·5	13	87·7	24	75·1
3	99·4	14	86·6	25	74·0
4	98·2	15	85·5	26	72·8
5	97·1	16	84·3	27	71·6
6	95·9	17	83·2	28	70·5
7	94·8	18	82·0	29	69·4
8	93·5	19	80·9	30	68·2
9	92·4	20	79·7	31	66·9
10	91·2	21	78·5	32	64·8
11	90·1	22	77·4		

* element lengths should be accurate to within a few tenths of a millimetre.

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





June 1971 Microwave Contest

The first microwave contest of the season was held under typical contest conditions—lots of rain and high winds. This seems to have affected activity on 3cm in particular as people found it difficult to hold dishes in position within the few degrees required. Personal reactions indicated that the 13cm band seemed to have matured considerably: operation was in several cases as slick and controlled as on 23cm, and signals were almost as strong as those on 23cm. The main grumble was, as always, that there was insufficient time to work all the stations known to be on. My strongest resolution: to engineer the dish mount for the 3cm dish to make it windproof against even October gales.

Points from letters

In a recent letter, G3WDG (Bristol) reported much progress in his 3cm activities since last December. His equipment now consists of a transceiver in waveguide using 723A/B or 2K25 klystrons, and either 15 or 25dB horns or a 2½ft dish with a modified Cutler feed. The "surplus" mixer assembly uses a S1M5 diode, and was obtained from Birkett's. In early tests he has had contacts with G3BNL/P in Bath, G8AGT in Bristol and with G8DEK when at Winchester. He also reports that other 3cm stations in Bristol are G8CUS, G8ADP, G8CKK, G8CKJ, G3WJA and G3XOD, which makes Bristol probably the most densely populated 3cm area in the country.

G3OBD (Poole) has also supplied a list of people in his area having 3cm equipment in one form or another. These include G3VPF and G3RZG in Weymouth, G2RY in Bridport, G8BDF in Bournemouth and G3WDG (again!) in Southampton. And, of course, G3OBD himself.

FOUR METRES AND DOWN

A monthly account of vhf news compiled by JACK HUM, G5UM*

This decade

"Looking at vhf as it will develop in the 'seventies, the basic message is: 'We've got to be better at our business.' We need to compare our standards with those of the professionals and if possible do better."

The speaker was Geoff Stone, G3FZL, the Society's vhf manager. The occasion was the West Midlands VHF Convention organized by the Albright and Wilson Radio Society (G3OXD), at which 'FZL was the guest speaker at the afternoon tech-session.

Implicit in the G3FZL address was the need for all of us to remember that we are part of the Amateur Service, and that pointless natter-QSOs get us nowhere. Particularly was this evident where occupancy of our 70cm band was concerned. "We've got to use it for the benefit of the nation," declared Geoff Stone, and to emphasize the pressures that threaten it at the present time he needed to do no more than state that already there are 150,000 professional mobiles in this country, many of them operating near our 432MHz allocation, and that their rate of growth is no less than 15 per cent per annum. "In the face of these facts how do we defend 70cm if it continues to show low occupancy? Obviously, use it much more."

G3FZL left his listeners in no doubt that the RSGB continues to put in much strenuous work on its members' behalf—and the non-members', too—to defend all of our bands and 70cm in particular.

Developing his theme of "VHF in the 'seventies", he ventured the opinion that this decade will see vhf inter-continental contacts via satellite becoming a normal method of communication. This will demand its own form of self discipline: "Imagine the world-wide QRM that would result if large numbers of operators attempted simultaneously to interrogate a device like the forthcoming Moonray repeater on the calling frequency of 439·9MHz!"

Nearer at hand, added 'FZL, self-discipline was a must right now as variable frequency oscillators for vhf gained popularity. Present problems, he thought, would abate as members gained experience in the building and operation of VFOs. He then demonstrated a VXO using valves which, with four or five crystals, could be made to cover the whole of the 2m band. Another, using transistors, based on the well-known G3PDM design, had proved very successful as part of an all solid state transmitter.

At this point in the convention's lecture session G3FZL had most of his audience note taking as one device after another was described for the achieving of technically-sound frequency registration on "Two", with special reference to the pleasures and pains of ssb transverters and the spurious signals that such devices can generate.

Altogether, it was an afternoon to remember, in fact a convention to remember, with all the usual attractions of bring and buy, trade show and a superb dinner laid on by the catering staff that evening. As one of the after-dinner speakers observed: "The G3OXD crowd never do anything by halves."

Next band up

In developing Geoff Stone's discourse on the need to increase occupancy on the next band up, it seems to us that it is one thing to lead members to the delectable gates marked "432MHz" but quite another to persuade them to give a push and enter. Somehow the theory has got around in recent years that 70cm is "difficult", which perhaps it is to (may we dare say it?) the plug-in appliance operators, or those to whom technique stops at modifying ex-commercial taxi rigs.

Exploding the difficulty fallacy takes about an hour, plus a couple of 3in copper strips hitched across the anodes of a 3/20 and a butterfly across the remote ends, ht fed through a couple of quarter-wave chokes at the centre point of each line. Apply drive from a 2m source and, hey presto, there is 70cm rf energy. And a converter? Try the G2DD (page 5.35 in *Radio Communication Handbook*) with that simple AF139 pre-amp ahead of it (page 5.47). Suitable aerials are on the market in profusion, and inexpensive BBC2 coaxial cable is adequate to feed the skyhook to the operating point.

The foregoing represents a quickstart approach to the next band up. More ambitious equipment would be a subsequent follow-on. What needs to be done as a priority is to ease much of the local traffic and nets off "Two" and on to "Seventy". Their voices S9 plus on "Two" will sound indistinguishable when heard on 432.

Over now to G8ARM who has had such long experience of 70cm, and is a recent winner of the Senior Award for the

Two-day VHF Convention next year?

You say!

Members of the VHF Committee have had it expressed to them by many people who attended the VHF Convention at Whitton in April that next year's should be a two-day event. There has been so much to see and hear and so little time for discussion after the lectures that a case can be made for continuing the convention on the Sunday morning. If this were to be done, the Sunday session would comprise specialist discussion groups to encourage visitor participation.

How much extra this would cost in room hire and the like cannot be estimated at this stage, but some increase in the overall ticket price might need to be made.

It is for the membership to say whether they would like to see the 1972 VHF Convention extended to become a 1½-day event, or kept "Saturday only". Please say "Yes" or "No" on a postcard addressed either to G3FZL or G5UM so that a fully representative opinion may be obtained from the vhf fraternity generally. (A small dribble of opinion will clearly mean, "One day only, please"!)

* Houghton-on-the-Hill, Leicester LE7 9JJ

Post-prandial picture from the "G3OXD VHF Convention" at Oldbury. At left, two scribes, G5UM and G3DAH. Then: G3FZL; G3XHU; Pam Cross, Albright and Wilson's Jubilee Queen (the convention was arranged to coincide with the 50th year of the company's social club to which G3OXD belongs); G3BHT; WB2DEI (he is doing a round the world hitch-hike); G3NNG; G3NZS; G3BA; G2HIF and convention secretary Graham Badger, G3OHC

band. His views are, if anything, *more* than typical: "Several good openings have occurred this year, eg 13 May OZ9SW at RS57 and again on 3 June, while during the Dutch 70cm contest I worked six PAs." Then, as if to emphasize that this kind of dx is the exception, and to prove that "70" is primarily a short range band, 'ARM goes on to report that he notches 60–100 contacts a month ". . . some days bad, no QSOs, others good, yielding 12 contacts ranging from locals to G8EOP in Leeds."

No great site advantage gives G8ARM these results: he is 150ft asl in a densely packed area of south London with a 420ft rise to the east (Netherlands-wards!). Single-minded concentration on "Seventy" (the only other band he works is 23cm) piles up the experience and brings its own reward.

On "Four" to Malta

The Sporadic-E season wanes: 9H1BL leaves Malta on 16 August. These two facts together mean fewer opportunities for putting 70MHz signals into the island from the UK . . . just a fortnight left. Yet the attempt is worth making; as 9H1BL himself has said, openings as sensational as that of 13–14 June probably occurred before, but there was just no one about to take advantage of them.

Since 13–14 June, operators on "Four" have remained alert to the possibilities of further cross-band contacts with Malta. The talk-back frequency in use at 9H1BL is 14,150kHz and 28·5 in reserve. Results since the big opening of 13 June (12 worked, 11 heard including both beacons) were: 14 June seven heard, G3BA worked crossband; 15 June: two heard, G3VPS worked crossband, Sussex beacon 599 at 1815gmt; 17 June: G3JHM heard; 20 June: G3YHM heard, Sussex beacon again S9; 22 June: four heard including both beacons; 24 June: G3VPS again worked crossband, both SX and SU copied; 26 June: GB3SX down to 449; 28 June: G3VPS worked crossband but lost in welter of Continental broadcasters; 2 July: G3VPS, G3XUS and G3YZN/A all worked crossband at great strength, GB3SX still good.

Most of these Sporadic-E contacts occurred at the expected time of early evening in the UK, but noting that the events of 13 June were concentrated in the late morning suggests that several subsidiary openings develop at less traditional times.

'Tis a pity 9H1BL is leaving!

One-way stretch — on "23"

Sooner or later most vhf operators experience that peculiar sensation known as the one-way stretch, as described here a few months back by GI8AYZ. A wanted station persistently called fails to answer. A little later when you work him he gives you S9 and asks if your ears are made of cloth: he had been calling *you* persistently. Rate of tuning allied to QSB levels undoubtedly have something to do with it.

During the June 23cm contest G2WS of Weston-super-Mare reported several examples of one-way propagation. A good contact was made with G3OBD/P in Dorset, but G3NIL/P a few miles away from 'OBD although pounding in at S8 could not be raised. Conversely, G5QA down at Exeter copied G2WS solidly, but was not heard at all in Weston.

Obliteration of a distant signal by a local is sometimes adduced to explain the same phenomena on 2m but it is an unlikely event on "23". Which prompts some further thoughts . . .

Penetrating the QRM wall

"If you can hear them, you can work them" has always been a doubtful proposition. The one-way stretch makes it even more suspect. Operators in the remoter parts of the UK will tell you that much of what they hear, more particularly on "Two" where occupancy is high, is not workable simply because their own signals are so heavily overlaid by the QRM.

In Zone D this is most noticeable. The 145·5 to 146MHz slice of "Two" embraces a big geographical area full of phone stations in northern England whose occupancy obliterates the signals from the more distant Scottish stations who share it. So it is as well to dig beneath the layers to see who may be there—if you can hear anything through the mighty signal from the man in the next street (see below for answer).

The situation of being unworkably remote from centres of amateur population was experienced by the G3WRS/P group during the 4m portable contest of June. In spite of improved equipment, including a 3-over-3 on a 40ft mast that successfully bucked the gales and horizontal rain which spoilt the contest for many, the general opinion by the 'WRS team was that the site selected on the North Yorkshire moors was just too far north taking into account the prevailing conditions. "A bit more cw from the southern counties would have turned some of these weak carriers into points," observes G3WWF, Bob Firth, one of the operators.

And the answer? Getting your signal into remote places is best done, as 'WWF remarks, by means of a narrow band, highly penetrative mode such as cw. Single sideband will do the trick, too. Getting it *from* a remote area *into* a populous one calls for the same technique. Single sideband

can be read, bfo on, through all but the heaviest local interference. Telegraphy likewise. More of both will ease current congestion because they occupy so little space on the bands and at the same time greatly extend a station's service area.

Beaconry

It is now confirmed, and G3FZL was able to announce the good news at the "G3OXD VHF Convention", that the ITA has given formal permission for a 70cm beacon to be installed at the Burnhope site in County Durham. Much voluntary effort is being put in by RSGB members to commission the second GB3DM: opening date to be announced later.

* * *

The first ever 23cm beacon will be GB3LDN on a 420ft hill in SE London. Already involved are G8AOL, G8ARM and G8AXA on what is a major technical project. Present thinking is to use two phased Yagi aerials beaming NW and out east to the Netherlands (the PA0 are especially interested). In the transmitter multiplier chain performance of the beacon must in the words of G8ARM ". . . be exceptionally free of 'funnies'. The NE side of the hill on which it will be sited is a shadow area for television reception, which means that there are large numbers of high gain tv aerials pointing straight at the summit. Hence any output at 648 or 864MHz could be nasty indeed. Additionally, we did not wish to come up via 432 because of many local high performance converters in use on this band."

Come wind, come weather

For some, Sunday 20 June was microwave day, for others Iceland-beacon day. Few of those venturing out portable in the "23cm and down" contest expected much in the way of over-the-horizon results on a day producing gales of winter strength that did their own re-orientating of puny man-made parabola aerials. As it happened, some encouraging results were achieved by a big turnout of microwave men on several bands from 1,296MHz up (choice of sites helped no end). The results table will be awaited with more than usual interest. On "Four" it was over-the-horizon plus. All morning signs of Sporadic-E Continental broadcasters had been detected by most of us using the band that Sunday.

The sequence of events is vividly described by Ron Ham, BRS15744, as he heard them from his Sussex site: "At 0900 gmt the sync pulses from the USSR station on 49·75MHz which I monitor for Sporadic-E were very strong, and a host of signals had come up between 34 and 44MHz, carving up Channel 1 tv. The 4m band was full of fm signals up to 72MHz. By 1130gmt it was all over. For the rest of the day (as usual) I left the Sporadic-E detector running on 49·75 but no signals came up. An occasional check on the 7m and 4m bands confirmed that all was quiet. A check at 1645gmt confirmed it was time to join the wife for a cup of tea, but as I was taking a first sip at 1700 the phone rang and nearby G3JHM yells 'TF3VHF' in my ear. Off (with tea), back to the radio room and there all by itself at 599 plus TF3VHF".

The Iceland beacon on "Four" held in the UK from 1702 to 1804gmt. The phenomenon occurred also in July 1970, when Ron Ham detected Es all day from 30 to 90MHz, "with everything we ever heard via Es coming on the band. At 2045 when all went quiet TF3VHF came up 599 for about an hour. In view of these examples I think we must look northwest when the eastern signals go quiet, and see if this works again."

* * *

Ron Ham's correlation of weather and solar conditions with vhf radio conditions has been the subject of much discussion both at meetings of the Society's Scientific Studies Committee and among observers of long-term propagation changes on the metre-wavelengths. He and John Patrick, G3TWG, who as ZB2BO put theory into practice when he consistently worked the UK on "Four", have been exchanging data on their observations on both the 50MHz and 70MHz amateur bands.

Comparing the records over the last three years, 'TWG says: "I have done a comparison between solar activity and Sporadic-E on a daily basis, and the results would appear to give little or no support to the idea of a connection between them. The chance of Sporadic-E at both 50 and 70MHz was the same to within five per cent on active and quiet days and this appeared to hold for all three annual seasons, although they varied considerably in the amount of solar activity and Es. In 1970 the major Sporadic-E openings did tend to be associated with intense periods of solar activity. However, there were other periods of activity, notably between 21 and 27 July last year which were associated with little or no Es. Once again results appear inconclusive, except that it looks as though a large part of temperate latitude Sporadic-E is not associated with solar activity (or with its absence). Some may be, but it would appear to require some other factor at the same time, and it would be interesting to speculate as to what this may be.

"Meanwhile, all one can do is to keep up records, which may, given a large enough sample, provide a definite indication. In this comparison I looked at 280 days, all fairly near the sunspot maximum, and it will be a year or two yet before we have data at sunspot minimum to compare it with."

For further reading we recommend another look at John Patrick's article "The Gibraltar Story" in March 1971 *Radio Communication.*

Home and away

Last month we suggested that portable teams who encamp for a contest on private land without asking permission are likely to be confronted with summary eviction orders, expressed in terse and picturesque language. In a variation on this theme a well-known vhf man in an area of well-known vhf sites suggests to us that last month's paragraph could be rephrased thus: "You would hardly think in this day and age that any group on portable operations would be unthinking enough to use a distant /P site *without first inquiring if the local group required it*, preferably well ahead of the event."

He makes the point that while not suggesting that the "locals" have automatic priority to the district's high spots, it only seems good manners to inform them first, via the secretary of the club, or vhf group, of your wish to operate there and also extend to the "locals" an invitation to join in where this is practicable.

Today the vhf movement is at a stage where increasing numbers of portable teams (or even soloists on holiday) are competing for a finite number of desirable vhf sites. The lengthy lists of contestants in portable contests illustrate the trend. Ask before parking, then the local landowner's favourable image of amateur radio is preserved. So is the local vhf club's good will; what is more, by indicating if

someone else has already booked the site, they can save later-comers from wasting their time and effort.

From site occupancy to site identification: over next to. . . .

Cover your contest tracks

Most of us who go in for vhf/uhf contests know in advance that several prizeworthy sites will be in use throughout the event for the very good reason that they have produced excellent results in the past, so that it is a "natural" that they should be occupied again.

Anything which appears in an RSGB contest log sheet must have been taken down during contest exchanges and not be the result of an inspired guess. So it is a good plan to disguise the actual site details as transmitted over the air by refraining from stating that the station is on Snowdon Summit or Lawther Hill or Dunstable Downs or wherever. Plenty of readily identifiable places can be used instead as datum points for stating "So and so many kilometres east of Macclesfield" or whatever well-known map feature is preferred.

It makes the VHF Contests Committee's task rather more difficult if the choice happens to be "96½ kilometres south-south-west of Potters Bar", only to be capped by another group claiming to be "412 kilometres south of Edinburgh"! The committee could be forgiven the thought that ". . . this entry is hardly to be taken seriously".

In choosing the wording of a location to be sent under the heavy QRM conditions of a contest have a thought for the man at the other end who is going to have to copy it. It is *he* who will be penalized if he gets the details wrong, not the sender. And having to send repeats wastes time and points.

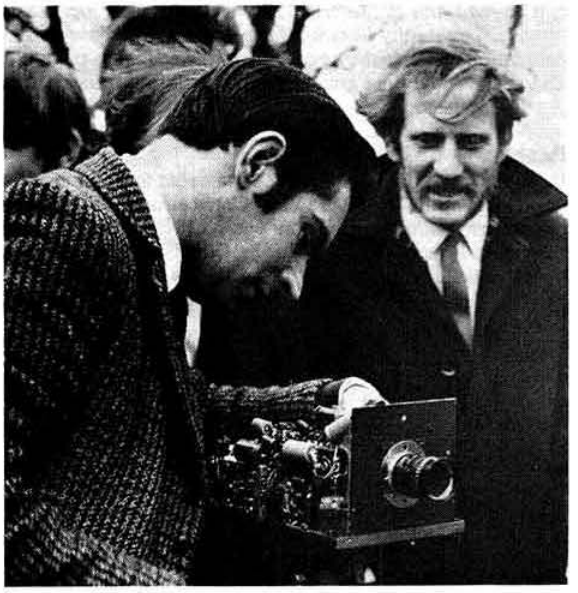
Two more "Seniors"

Two more Senior Four Metres and Down awards were approved at the June meeting of the Society's VHF Committee. Much devoted work done on 70cm over the years by G8ARM of South London earned him the eleventh "Senior" for this band. There were even more years behind G3JYP's claim for the 2m Senior (it is No. 32): some of the cards submitted dated back to 1961, the starting year for claiming an FMD certificate.

It was the arrival of the QSL from SM6AEK for an Ar contact in April 1971 that gave Bill Capstick the required verification for his 18th country. A check of his cards reads like a conspectus of 2m activity over the last decade, recalling memories of the big Tone A openings of October 1961, through '67 to '71: 10 of the cards were for auroral contacts. Another 23 represented A1 and a bare two were with Class B stations. On many of the cards appears the comment: "You are my first Westmorland". Back in 1961 two GMs wrote: "You are my first G". And all this from a site at the bottom of a valley hemmed in by 2 000ft hills three miles away. At last 'JYP can say, "I feel I may now manage to devote some effort to 70MHz and 432MHz for a change."

* * *

For many operators the verification received from the GM8AGU/GM3JFG expedition has either put them in the running for an FMD certificate claim or, as in the case of G3VNQ of Southport, actually past the post. Getting the AGU/JFG card for 15 Scottish counties put Malcolm Pritchard well over the required 30. Now certificate No 216 is on its way to him.



Amateur television plays an important part in the activities of the Dunstable Downs Radio club. Many members are equipped to receive video on 70cm, and the club has several Stroke T licensees. Here is one of them, Arthur Turner, G6AFK/T, also known as G8AYB, making adjustments to a home-constructed transistor vidicon camera during a recent outdoor demonstration

"This seemed to be a first-class expedition and the two operators are to be congratulated on their effort," he says, speaking for many.

Expeditionaries

First of all under this heading, a note from Paul Widger, GM8AGU, one of the duo that made such a great success of the memorable "15 Scottish Counties Expedition" of May (GM3JFG handled the cw side of it): "We made over 200 contacts on cw and 970 on ssb/a.m. If anyone has any doubts about the superiority of ssb and cw over a.m./fm when conditions are poor they should have come with us!" All cards received without SAEs are being acknowledged via the Bureau.

* * *

Now under development by a group of Essex members is a low-cost 2m transceiver. It is to be evaluated from a number of locations throughout the UK during August and September. Look for G8CYK/M/P; all contacts will be QSLd, says W. S. Poel.

* * *

In Ireland now is G8CHC under his visitor's callsign EI2VEJ, fixed and mobile. Look for him until 18 August on the primary channel of 145·02 with 144·15, 144·75 and 145·93MHz also available. Equipment is all solid-state giving 5W of rf from a BLY83. Cards may be sent to Brian King's home QTH, 36 Upper Park, Harlow.

* * *

The Luxembourg expedition of G3BA-G3BHT-G3URV will concentrate on 2m, active throughout VHF NFD (and that means the IARU parallel event), and on the Monday after

will maintain the following schedule with the express purpose of working UK stations: 1800gmt 145·4 sideband, 1815gmt 144·1 cw, 1830gmt 144·2 a.m., repeating for four hours. Sked requests to G3BA, QTHR. All contacts will be QSLd.

Callsigns will be G3BHT portable LX during VHF NFD, and G3BA portable LX on the Monday.

Says Tom Douglas: "Operation will only take place on the weekend and the Monday . . . the rest of the time we will be travelling on holiday with talk-back to Sutton Coldfield at 0700gmt on 7,055kHz 1–9 September."

Excessive deviation

With reference to reports of excessive deviation from transceivers, IC2F owners will be interested to learn that members of the Glamorgan Raynet Group who use IC2Fs have, with the aid of sophisticated test equipment, formulated a simple method of ensuring deviation within acceptable limits without circuit modification and using simple instruments already available in most shacks.

Full details are obtainable from GW3ZFG, QTHR, sae required.

Keep a special watch for . . .

GI3HCG who puts out a CQ on 4m telegraphy nightly on the hour and half-hour, 70·096MHz. He also offers 144·034 cw.

* * *

GM3ZVB, Robert Dalgleish of 5 Craiglockhart Park, Edinburgh EH14 1ER, active on "Two" nightly until 2300gmt beaming west, with GI contacts specially in mind (skeds with GI welcome).

* * *

G3SEK, now moved semi-permanently from Blackpool to London (89 Arthur Road, SW19 7DP), is operational on "Four" after a silence of almost five years: requests schedules any evening or 7–8am breakfast spot, cw or sideband ("Sheffield beacon audible most of the time but where is the activity?")

* * *

The Dunstable Downs Radio Club's special /P tv sessions up on the Downs every alternate Thursday (which means that during the present month they will be there on the 12th and 26th). Times of operating: 1830 to 2030gmt. Video frequency 437MHz at 405 lines positive modulation using callsigns either G6AFK/T or G6AGX/T. Sound accompaniment 3·5MHz below, using club callsign G8DDC/P. Straight phone to phone contacts on 70cm will also be welcomed. Says 'AGX/T: "We are hoping by this venture to get regular amateur tv sessions going on 70cm."

* * *

The March and District Club's three-band foray to Rutland as a rehearsal for VHF NFD. They will be on 4m a.m., 2m a.m. and ssb, and 70cm, from 1800gmt Friday 20 August until 1400gmt Sunday 22 August, callsign G3PMH/P.

* * *

GW4ABR/P, callsign of the Golden Valley VHF Contest Group, which in the words of Hon Sec R. C. Harvey, "plans to compete in all 4m, 2m and 70cm contests and generally to raise the interest and competition in these events." A hand-picked site in East GW-land (not to compromise its exact location or QRA!) has been found. So has a co-operative farmer with a tractor to lug equipment to the summit.

* * *

G8PY, yet another of the self-evident callsigns allotted to Pye, it is to be heard from the company's Nottingham depot on 2m most lunchtimes. Licensee is G3RWP. (The other self-evidents are G3PYE and G5PI).

* * *

GC8BCL/P from 16-26 August. Howard Bottomley has acquired a fine site on the northern tip of the Island of Jersey, and will be active nightly on 144·25MHz during his stay.

Moonbounce to the Midwest

A further successful intercontinental contact on 1,296MHz by the earth-moon-earth path was achieved by G3LTF of Chelmsford on 13 July with W9WCD, when the lunar position was optimum for both stations.

The American station is at De Kalb in Illinois, and uses a 16ft moon-following dish fed with 400W of rf at 23cm, the whole lot home built, as is Peter Blair's at Chelmsford. His report to 'LTF was RST329; the American was 339 at Chelmsford, for what was his second e-m-e contact (the first was with W2NFA, whom G3LTF has worked a number of times via the e-m-e path).

And next day? Says G3LTF: "On 14 July I was getting my echoes 13 minutes after moonrise, which means they would also be good in ZL if there were any takers".

This year so far G3LTF has worked W2NFA on 19 May, 28 June and 29 June via e-m-e on 1,296MHz. On 29 June the QSO was monitored by W3KE using a 150ft dish, and OZ9CR was heard.

* * *

In a different area of "signal-bounce" communication, G3LTF reports that the 11 July ascent of the German ARTOB repeater balloon was "best yet", yielding 39 contacts in six countries from OE to OZ, all ssb except for three on the key. Not far away G3LQR had 20 contacts via ARTOB, and G8BGQ also used it to good effect. By way of bonus 70cm opened up for tropo later the same day; both 'LQR and 'LTF worked SM on two-way ssb.

Late news

"Four" Opens to Iceland. Short skip by Sporadic-E on the hf bands and a high noise level from the sun suggested that there might be E-openings on "Four" during the middle of July. On Saturday afternoon 17 July a big opening developed and TF3EA was worked on 70·245MHz by G3JHM, G3BA, G3OHH and G3WIC, and heard by many others, including G3SNA/M motoring in Oldham at the time. Fade-out for most was before 1800gmt but EI6AS continued to hear the companion TF3VHF beacon for an hour longer.

25 YEARS BACK

"The Postmaster-General is now prepared, as in pre-war days, to grant portable facilities to licensed amateurs, on application, subject to the payment of an additional 10s per year. The licensee will be permitted to work within a 10 miles radius of his station, or within 10 miles of a point named by him . . . the Council wish to point out that for the past nine months they have been endeavouring to persuade the GPO and other interested parties that much administrative expense would be saved if every licensed amateur were authorized to operate portable provided he notifies the GPO in advance"—*RSGB Bulletin*, August 1946, a news item under the title "Portable Permits".

THE MONTH ON THE AIR

A monthly feature by John Allaway, G3FKM*

MANY readers will already have discovered that the price of IRCs has risen (by 66 per cent) to 10p since 1 July. This has been accompanied by increases in postal rates in many other countries as well as our own, but it has been pointed out by G3WNT that the number of coupons asked for by a number of dx stations now costs a considerable sum of money. A request is made for them to temper their demand with mercy! This change also means that the generally accepted practice of accepting eight coupons in place of $1 (eg for certificates) should be revised without delay—the purchase price of that number of coupons in the UK now equals nearly $2.

Your scribe would like to place on record his gratitude for the very cordial welcome which he received from the Cyprus Amateur Radio Society when he had the privilege of visiting Cyprus last month. It is on these occasions that the true meaning of international friendship through amateur radio makes itself evident.

Top Band news

First-class dx is being worked on 160m at the time of writing and although the writer has no direct reports understands that G3IGW worked PY1DVG (0135), ZD8AY (0033) and ZP9AY during June. Mike now has 50 countries worked on the band. KL7CL has worked several VKs, has heard PY1DVG's signals, and has been heard by George Allen in Perth. VK3ATN has fixed skeds with the Brazilian stations which will continue until 10 August during the period 0920–0945. VK6s HD, NK and CW will be on 1,813kHz and the PY2 around 1,832kHz.

News from overseas

Don Radley, formerly 9G1GE (and also licensed as G4ABI), is now in Zambia and has the callsign 9J2GE. He has a KW Atlanta, FT DX400, and home-made quad for 10, 15 and 20m, and is often to be found on 15m cw. Contacts with the London area are always welcome as Don is a former member of the Paddington and District ARS. Records of the 9G1GE operations were lost in transit between Ghana and Zambia but QSLs for 9G1GE may be obtained via 9J2GE (see *QTH Corner*).

Robin Francis, G3RWU/MP4MAW/MP4BFH, is leaving for a two-year stay on Turks Is (VP5) in July and expects to be on the air on most bands depending on what aerials he is able to erect. The equipment will consist of a KW2000A and a special effort will be made to contact UK stations on cw and ssb.

Chris, VS5CB, would like readers to know that he is often on 14,175kHz ssb at 1745 on Saturdays. He has a good signal and would like to give Brunei contacts to as many as possible.

There is more activity to be anticipated from the Gilbert Is following the arrival in April last of Dan Lockyer (one time MD1D, LI2CL, ZC1CL, 3A2AE, 9M2LO, 9M6CL and G3HCL). Danny has the call VR1AA and in a letter dated 16 June says that he became separated from his equipment when the ship on which it was travelling dumped it on the dockside at Apia and disappeared over the horizon! When and if the gear arrives it is probable that activity will be mostly cw with an emphasis on 40 and 80m operation; however, some rubber-stamp type QSOs for those needing VR1 contacts will be made on the hf bands. A tour of duty to Fanning and Christmas Is (VR3) is scheduled.

G3ZST has been on the air from Ascension Is as ZD8TS for the past six months and will be there for a further year and a half, with a short break at Christmas which he is spending in the UK. Trevor uses a Sommerkamp FT250 and a 14AVQ aerial which he modifies into an inverted-L for use on 80m. He favours 28,560, 21,300, 14,175, 7,095 and 3,750–3,800kHz ssb. Four-metre receiving equipment and a birdcage quad is available; a transverter may materialize if anything is heard!

J. T. Worrall (DL2AH/G3XBA) has taken over the running of the QSL bureau for all NATO forces in Germany except those from the USA. Cards for DL2, DL5, DA1, DC0 and DC1 calls should be sent to him at 3090 Verden Aller, Am Alten Pulvershuppen 80, Germany.

Bill Johnson, VE3APZ, (who is also one of the operators of VE3OSC) is now back in the UK. He says that VE8RCS, club station of the Polar Amateur Radio Club which is located 400 miles from the North Pole, has a sked with VE3NO on 14,165kHz at 1800 daily and is pleased to work all callers when this contact is completed.

Hal Jackson, K7PMY, reports excellent service from G3LQP, acting in his capacity as 5X5NA's QSL manager. Hal worked 5X5NA (his 100th country) on 19 June and received his card from 3LQP on the 26th; as he says, we could all use more QSL managers of this calibre.

Eric Trebilock, BRS195, writes from Australia to say that he has confirmed with the keeper of Heard Is licence records that any amateur transmissions from the island in 1971 (to date) were unauthorized. Eric now has over 300 countries confirmed—a very fine performance by one of the Commonwealth's leading listeners.

Pirates

Leslie Graham, VK3AIW, wishes to make it known that someone is using his GI3WDC callsign illegally as has become evident by the number of QSL cards received for contacts not made.

G3VIP is receiving cards from stations who have worked "6Z2AT", who seems to have nominated him as his QSL manager. 6Z2AT is an obvious bootlegger and G3VIP asks that no more cards be sent to him. G3ZDD reports that his callsign is being pirated on all bands.

*10 Knightlow Road, Birmingham B17 8QB

DX news

It is understood that the ARRL is not accepting QSLs for contacts with VK0HM (Heard Is) during the period that the call was used by F2JD. There seems to have been some misunderstanding over the use of what was a personal call —it is the custom in the French antarctic islands for the station to be given the call (eg FB8ZZ) and for all operators to use that call. There is no reciprocal licence arrangement between Australia and France in force yet.

The JE prefix is now in use in Japan. WL2NAS was used by the amateur station at NAS, Lakehurst, NJ, which was celebrating the 50th anniversary of lighter than air aircraft. 4J1CR is reputed to be an icebreaker which works in the White and Barents Seas and the operator is thought to be UA2CR.

ZK1MA, Manihiki Is, is on the air once more and K6UFT (and others) are trying to help him by making "lists" on 14,204kHz at 0400 on Mondays, Wednesdays and Thursdays. On Tuesdays and Fridays ZL2AS tries to assist at the same time on 14,170kHz. Tuatai is only able to be on the air for about one hour each time on account of the fact that he operates with battery power.

VE7YH is now in Togo and has been worked on 14MHz ssb. His callsign is 5VZYH and his address is in *QTH Corner*.

More unusual prefixes have been heard during the past month. KF4SJ came on the air on 1 July and will be active for the rest of the year. The call commemorates the 450th anniversary of the founding of the city of San Juan and special QSLs will be sent out from PO Box 1871, Ponce, Puerto Rico. Stations in Peru are using the OB prefix to celebrate their country's 150th independence anniversary. It is understood that the ITU has issued the 3DN-3DZ callsign block to Fiji.

KB6CT has been reported on 14MHz ssb. He is said to have been heard in the Micronesia Net which takes place at 0800 on Tuesdays, Thursdays and Saturdays on 14,335-kHz. ZM7AG has been home to New Zealand on leave and hoped to take a tri-band beam back to the Tokelau Is on his return. Larry, K2IXP/VK9NP, whose attempt to visit Mellish Reef failed in June, is in Australia and may possibly stay in the VK4 area until September in the hope that another attempt may be possible. Carl, VE8RA, who failed in his attempts to get to ZM7 earlier in the year, is now said to have hopes of ZM7AH operation in mid-July. In view of the very frequent delays involved in travel in this part of the world this may still not have materialized by the time this reaches readers.

Dxpeditions

9J2WS was scheduled to be on the air from Sierra Leone as 9L1WS for a two-month period starting 1 July and should be heard on 14, 21 and 28MHz cw and ssb. He is thought to prefer working around 14,050 21,050 and 28,050kHz on cw. A one-week visit to Gambia (ZD3) may take place during this month.

Darlene, WA6FSC, expects to spend the next two years travelling and hopes to visit about a dozen countries. She has already been active as 3B8DK and 3B9DK and QSLs for these contacts will be sent out via VE6AKV. Available equipment is a Swan 500CX and four-band inverted-V aerial.

HK0BKX and W9FIU are rumoured to be planning a visit to Bajo Nuevo (HK0) in September.

Stephen Cole, 1 David Walk, Rogerstone, Newport, Monmouthshire. SWL A6148. Member of SWL/CHC, interested in dx work, in particular on 80m, with 126 countries on that band in two years. The receiver is a Trio JR60 (covering Top Band to 2m). Also interested in tape recording. Nineteen years of age employed by the MPT

Kelly, formerly 6O1KM, is at present in the USA and is planning a few weeks' activity from Fanning Is (VR3). If his plans materialize the QSLs will be made out by WA3HUP.

The VK9NP/Mellish Reef expedition which should have taken place during June had to be cancelled due to the weather and the condition of the boat in which the team was travelling. *West Coast DX Bulletin* says that K2IXP is mentioning September as a possible time for another attempt but no definite plans have been made yet.

F5QQ and others are hoping to visit Jabel at Tair late in August but it is not known whether ET3ZU will be visiting the island again in the near future or not. Aldo suffered so much from the heat and unpleasant remarks during his 38 hours on the air from there in May that he is reluctant to repeat the experience. Ron (F5QQ) points out that Aldo is not interested in dx and was only able to operate in the transceive position, the fact that he managed about 1,000 QSOs is a tribute to his patience and courtesy in spite of the quite appalling behaviour by some of the other stations on his frequency.

W7VRO and others are planning a visit to the Caribbean area during September. Their schedule commences on 7 September from Barbados (8P6DM) and continues with Grenada (VP2GBG) on the 12th, St Lucia (VP2LAM) on the 17th, and Martinique (FM0IX) on 18 September.

5Z4KL has been heard discussing possible visits to the Indian Ocean islands in the VQ9 area. He already has a licence and present plans envisage operation from Aldabra as VQ9KL/A commencing 22 August. Darlene, VQ9DK, is expected to accompany Andre as well as another friend. Desroches and Farquhar Is are in mind for future action but transport is a problem. Harvey Brain (ex-VQ9HB), who now lives in New Zealand, is reported to be returning to the Seychelles about now to collect a new boat, and an attempt will be made to solicit his help.

Don, 9J2GE (formerly G8EBN) is often to be found on 21MHz cw, using this neat station, from Lusaka, Zambia

"DX News Sheet"

The increased overseas postage rates which came into effect on 1 July have resulted in some increases in subscription rates to this dx aid. Airmail rates to Europe are now £1 for 13 issues, or £4 a year. For America, Asia and Africa it is now £1 for 15 issues or £3 for 46 (55 for $9). All other areas are the same as for Europe. UK rates are unaffected and may be obtained from the author (Geoff Watts, 62 Belmore Rd, Norwich, NOR 72T).

Expeditions

G3SGH and G3ZOT will be commencing a two-week stay on the Isle of Skye on 22 August and will be on the air /P and /M using a Codar AT5 on the cw portions of 1·8 and 3·5MHz.

GM4AFF and some friends will be visiting NE Scotland between 14 and 21 August with the intention of activating as many WAB areas as possible. Callsigns will be GM4AFF/A, GM4AFF/P, GM8EVV/A, GM8EVV/P, and another GM4 operator (who has not received his callsign at the time of writing) will be using his call /A and /P. August 15 to 17 will be spent in Area NJ93 with cw on 20 and 15m during daytime, a.m. on 80m and a.m. and cw on 160m during the evening. On the 18th from 1730 to 1830 on the WAB net (from NK02), 1900–2000 from NK03, 2030–2130 from NK13. On the 19th, operation will be from NK04, NK14 and NK15 at the same times around WAB frequencies, and on the 10th from 1730 to 1830 from NK05 and 1900–2000 from NK06. All these will be on a.m. All QSOs will be QSLd via RSGB, please send all QSLs via GM3RHK. All correspondence should be sent to Stewart Cooper, GM4AFF, 41 Cranford Rd, Aberdeen.

Marco

The Medical Amateur Radio Council was founded in April 1966 and its fifth annual meeting was held in Atlantic City on 24 June. It now has some 500 members distributed throughout the world. Regular nets are maintained on 3,750kHz at 0830 on Sundays and 2100 on Wednesdays, and a worldwide net takes place on 14,280kHz at 2000 every Sunday. Membership is open to operators who are qualified in medicine, dentistry, veterinary surgery, or allied professions, and to students working for degrees in these subjects. Amateurs interested in membership are invited to write direct to the secretary, WA6CRN, W. L. Sprague, MD, 433 N 4th St, Montabello, Calif, 90640, or to G3SOI who is responsible for the UK memberships. Enquiries from Europe should be sent to G3WOD; from Africa to G3CDE; from Australia and New Zealand to GM3VAR; and G3TMN is responsible for activities elsewhere outside North and South America.

Contests

Results of the **1971 WAB Contests** are now available. The first six entrants in each section are as follows:

	HF Phone		HF CW	
7Q7BC	13,500 points	G3WPF	14,060 points
G3ABG	9,180 ,,	G3ABG	13,650 ,,
G3XNE	8,360 ,,	OK2BPF	5,940 ,,
G3YHB	4,220 ,,	G8KU	5,280 ,,
GW3ZQN	3,100 ,,	G2ZR	2,800 ,,
G3ZSS	2,415 ,,	OK2BMF	2,530 ,,
	LF Phone		**LF CW**
G3ABG	227,500 points	G3ABG	100,620 points
G3RDC	172,125 ,,	G3WPF	82,500 ,,
G3VLX	160,135 ,,	G3HS	64,260 ,,
G3ILO	148,005 ,,	G3HZL	58,050 ,,
G3VLL	143,520 ,,	G8KU	24,400 ,,
G3TSY	92,710 ,,	G2ZR	21,280 ,,

S. Lowe, G13503, won the HF Phone listener's section. **Tim Thornton, A7120,** was top of the LF CW section, and in the LF Phone contest **Stephen Cole, A6148,** was top with 275,280 points and was followed by S. Lowe (220,080) and R. Treacher, BRS32525 with 203,200 points.

The 1971 Delta QSO Party

2000 28 August to 0200 30 August, phone and cw.

Amateurs outside Arkansas, Louisiana, Mississippi and Tennessee contact as many as possible in those states. Exchanges consist of QSO number, RS/T and QTH. A station may be worked on each band/mode and each QSO counts one point. The multiplier is the number of counties worked (maximum 316). Suggested frequencies are 3,550, 7,050, 14,050, 14,290, 21,050, 21,390, 28,050 and 28,590kHz. Post logs before 27 September to Malcolm Keown, W5RUB, 213 Moonmist, Vicksburg, Miss. 39180, USA.

The Scandinavian Activity Contest 1971.

1500 18 September to 1800 19 September, cw.

1500 25 September to 1800 26 September, phone.

All bands 3·5 to 28MHz. Non-Scandinavians work Scandinavians, and stations may be worked once on each band, each QSO counting one point. Exchanges consist of RS/T plus serial QSO number (starting from 001). The multipliers are LA, JW, JX, OH, OH0 (Aaland Is), OH0 (Market Reef), OX, OY, OZ and SK/SL/SM—a maximum of 10 per band. There are single-operator, multi-operator/single-transmitter and multi-operator/multi-transmitter classes, all are multi-band. The last class should use separate serial numbers on each band. Logs should show: date, gmt, station worked, number sent, number received, band, note if new multiplier, and should be accompanied by a summary sheet clearly indicating name, callsign and address. A signed declaration that rules have been adhered to should also be submitted. They should be sent to SRAL, Box 306, Helsinki 10, Finland, no later than 15 October.

* * *

Thanks to the kindness of W1WY, preliminary results of the **1970 CQ WW DX Contests** have been received. Certificate winners in the UK are as follows: Phone: G3LNS, GM3BCL, GW3NWV (multi-band). 1·8MHz, GM3YCB (World top score). 3·8MHz, GM3VTB. 7MHz, GM3WOJ. 14MHz, G3FXB and GM3VEY. 28MHz, G3YBM, GC3YIZ and GI3RXV. Multi-band multi-op single-transmitter, G3WYX.

CW: G3FXB, GD3AIM (multi-band). 1·8MHz G3NT, GM3YCB (World second). 3·5MHz G5ATD. 7MHz G3KDB and GM3JDR. 14MHz, G3JKY. 21MHz, G3HCT (World fourth), GM3CFS, GW3NJW. Multi-band multi-op single-transmitter, G3KWK. Fuller details will be given when available.

Awards

The Arabian Knights Certificate

This award is obtained by working at least 10 Arab countries since 1 January 1971. At present there is activity from CN8, HZ/7Z3, JY, MP4B, MP4Q, MP4T, OD5, ST2, SU, 7X, 9K2, YK, 3V8 and 4W1/VS9, and FL8 is an associate net member. One of the contacts must have been with HM King Hussein, JY1. Applications (certified by two other amateurs) should be sent, together with seven IRCs, to HM King Hussein, JY1, PO Box 1055, Amman, Jordan. Members of the Arabian Net meet on Thursdays at 1400 on 14,198kHz, on Mondays at 1430 on the same frequency, and on Saturdays at 1800 on 14,295kHz.

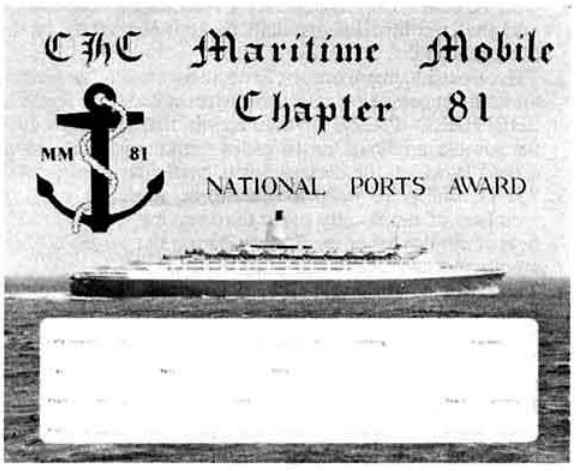
Worked Scandinavia RTTY Award—WSRY

SARTG Contest & Awards Manager, Bo V. Ohlsson, Box 1258, S–710 41 Fellingsbro, Sweden.

For stations who have worked the following numbers of Scandinavians on two way rtty—Scandinavians 25, other Europeans 16, others eight. All QSOs to have been since 1 May 1970, on any bands. A certified list plus 10 IRCs should be sent to SM4CMG (as above) giving full QSO details. Prefixes valid for the award are LA, JW, JX, OH, OH0, OX, OY, OZ, SK/SL/SM, TF.

The National Ports Award

Issued by CHC International Maritime Mobile Chapter 81 —custodian G3WAX, D. J. Paterson, 99 Shepherd Road, St Annes on Sea, FY8 5HJ, Lancs.



QTH Corner

C31AZ	F9UX, Henri Lafon, 47 La Plaine-Agnac, France.
C31BZ	G3JIJ, 29 Chesham Avenue, Castleton, Rochdale, Lancs.
F0WV/FC	ON4TJ, 61 Breughellaan, B-9720 de Pinte, OV, Belgium.
JD1ABX	(7 to 24 March only) JH1HWM, 2236-33 Zamairiya, Zama, Koza, Kanagawa, Japan.
JD1ACH	JA3GZN, Masonobu Katsusai, 1-6-3-Nanamatsu Amagasaki, Hyogo 660, Japan.
JY6RS	Box 2353, Amman, Jordan.
JY9XL	FG7XL, 64 Rue Frebault, Pointe a Pitre, Guadeloupe.
MP4MBC	G3XEC, G. Grundy, Thrift Cottage, W. Wickham Rd, Balsham, Cambridge.
MP4TDS	see VP1DW.
OJ0SUF	OH2BHU, B. Ahinas, 07930, Pernaja, Finland.
VP1BH	P.O. Box 27, Stann Creek, British Honduras.
VP1CP	P.O. Box 616, Belize, British Honduras.
VP1DW	R. S. Galpin, 633 Signal Troop, Caribbean, BFPO 12.
VP1EJ	via K7DVK, 9999 SE French Acres Drive, Portland, Ore, 97266, USA.
VP1ST	P.O. Box 35, Belize, British Honduras.
VP1TB	P.O. Box 212, Belize, British Honduras.
VQ9DK	via VE6AKV, 7612 23rd St SE, Calgary, Alberta, Canada.
VQ9R	P.O. Box 193, Mahe, Seychelles.
VR1AA	D. Lockyer, P & T Dept, Betio, Tarawa, Gilbert Is, Central Pacific.
VS5CB	c/o WWH Ltd, Berakas Camp, Brunei.
VU2JA	now via W5VA, P.O. Box 840, Corpus Christi, Texas, 78403, USA.
YJ8BG	P.O. Box 138, Vila, New Hebrides.
YJ8BL	via W6NJU, 7164 Rock Ridge Terrace, Canoga Park, Calif, 91304, USA
YS2CEN	via WA8TDY, 3528 Craig Drive, Flint, Mich, 48506, USA.
ZD8CW	via W2MUM, 41 Silversmith Lane, Levittown, NY, 11756, USA.
ZD8TS	G3WDV, 36 Low Green, Gainford, Darlington, Co. Durham.
5VZYH	P.O. Box 2233, Lome, Togo.
9J2GE	Ron Radley, P.O. Box 1586, Lusaka, Zambia (or via W2GA).

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

For contacts with stations located in the following ports: London, Grimsby, Grangemouth, Glasgow, St Helier, Lancaster, Birkenhead, Swansea, Bristol, Southampton, Middlesbrough, Newcastle, Dundee, Barrow, Douglas IOM, Preston, Llandudno, Cardiff, Plymouth, Portsmouth, Hull, Leith, Aberdeen, Belfast, Fleetwood, Liverpool, Milford Haven, Gloucester, Falmouth and Dover. There are four classes, "Special" for working all 30 ports, "First" for 25, "Second" for 20, and "Third" for 10 ports. The award is available to all amateurs and listeners and is free to blind/paralysed applicants. A certified list of QSOs (*no QSLs needed*) should be accompanied by 25p or eight IRCs and sent to G3WAX.

Band reports

Mid-summer conditions have meant that 14MHz has been open continuously during the last month but 28MHz has been very poor indeed with no worthwhile dx reported.

Many thanks to all correspondents and especially to the following: G2FYT, G2HDR, G2HKU, G3GVV, G3UKH, G3WNT, G3YHB, G3ZBA, G5JL, G6GH, G8VG, BRS-2098, BRS17567, BRS19682, BRS32799, A6148, A6966, A7056 and A7437.

Callsigns given in italics were stations on cw, the rest were on ssb unless otherwise stated.

1·8MHz. 1100 PA0PN. **2000** GW3XGP/A. **2200** GB3SKY, GM3XXN/P, GW3XQB/A, *OK2RGA*.

3·5MHz. 2100 CR6IS, HB0XUO, YA1OS, ZS5LB, 3B8CR, 9Q5RD. **2200** WA6GDX/P/LX, OJ0SUF, PY7BFN. **2300** CR7IC, 3C1EG, 6W8DY. **2400** VE/VO, ZSs 1MH, 5XA.

7MHz. 0100 YV1KZ. **0500** PY1DB, ZL3KB. **2000** VS9MT. **2100** HV1CC, ZS5LB, 9Q5KJ. **2300** *KV4FZ, YN1CW*.

14MHz. 0300 *ZL4OL/A*, **0500** *VP2KT, ZB2AV*. **0600** HC4BS. **0700** HB0XUO (QSL via DK4SL), VR6TC, 5B4ES. **0800** F0WV/FC (QSL via Belgian bureau), W0DAD/KH6, VR2CC. **1000** *OH2XM/OH0*. **1100** C31DZ. **1400** LG5LG,

OX3JV. **1500** JY6RS (HQ, Royal Signal School, Amman), YB5AAQ, 3B9DK. **1600** *XW8DZ* (QSL via K8SNA), 9M2CR. **1700** VQ9AB (PO Box 191, Mahe). **1800** FP8CZ (Box 16, TSF, St Pierre), HZ1SH (Box 2108, Jeddah), TY1ABE. **1900** *KX6DC*, ZD7SD, 9M8SPD. **2000** JY9EL, 5VZYH. **2100** KC6WS (QSL via W9DP), "*3X1CG*" (requesting QSL via I1ZSQ)—further information requested) **2200** DU1DBT, ET3ZU, JY1, OA6CA, PZ6AA, VP2SAB, 7Z1AB.

Propagation Predictions

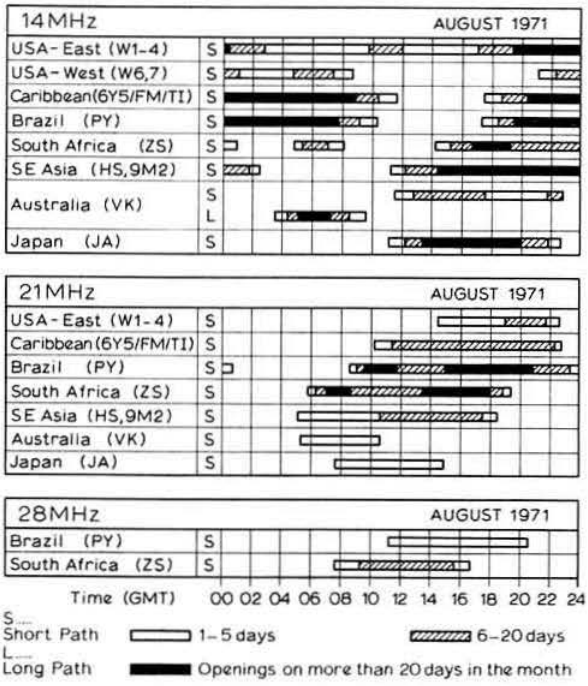
August will be the last month with poor summertime conditions, which will be specially noticeable on **28** and **21MHz.** These bands will then improve to reach their best conditions in late October and November. Only Africa and, in isolated cases, also South America, will be heard on 28MHz under favourable conditions. Because of the decrease in solar activity compared with the previous year, a marked worsening of conditions on 28MHz will be noticeable.

On **21MHz,** only South America and Africa will be heard with certainty, the rest of the dx regions being heard only under favourable conditions. Summertime sporadic short-skip conditions will continue throughout the month and will liven up the bands with Continental traffic. This should be fully utilized, as the season for short-skip comes slowly to its end in September.

14MHz will continue as the main dx band, on which all continents should be heard. Conditions will be similar to those of the previous month, but the approach of the equinox will mean that traffic on the indirect path will worsen.

On **7** and **3·5MHz** the summertime conditions will remain almost the same as those of the previous three months. In the latter half of the night the dead zone will only interrupt local traffic on rare occasions on **3·5MHz.**

The provisional sunspot number for June 1971 from the Swiss Federal Observatory was 47·1. Activity varied greatly during the month with high sunspot numbers occurring during the last week. The predicted smoothed sunspot numbers for October, November and December are 52, 50 and 48 respectively.



1971 Countries Table

	1·8 MHz	3·5 MHz	7 MHz	14 MHz	21 MHz	28 MHz	Total
G3YHB	—	9	24	86	91	29	239
G8VG	1	16	36	29	52	23	157
G3YWX	—	12	17	56	20	—	105
BRS27263	—	83	64	176	126	88	539
BRS27880	1	36	40	87	81	39	284
BRS30694	5	9	17	69	60	35	195

21MHz. 1100 HB0LL, HV1CC, 3B9DK. **1300** *HM5BF*, *HS4AFL*, VK9AC (Box 5122, Boroko, Papua), *ZD8CW*. **1400** KR8MR, MP4TDT (QSL via DL9WY). **1500** EA0B, ZD9BE, 3C1EG, 3C0AN. **1600** TY1ABE, 4W1AF, 7P8AB, 9N1MM. **1700** A2CAO, ET3JBP, *JY6RS*, 9G1WW. **1800** MP4MBC, VS9MT. **1900** VQ9R, 9K2CI, 9M2WM, 9Q5ITU. **2000** *HC6HL*, *OJ0SUF*, JY9XL, PZ9AA (Box 1810, Moengo, Surinam), W7GVA (Nev.)

28MHz. 1500 EA6BJ, **1600** C31BZ. **1700** 9J2TF. **2000** LUs 2UL, 3DTV.

Many thanks to the following for supplying their publications and for items reproduced from them: **Long Skip** (*Nick Sawchuk*), the **West Coast DX Bulletin** (*WA6AUD*), the **Ex-G Radio Club Bulletin** (*W3HQO*), **DX'press** (*PA0TO*), **DX News Sheet** (*Geoff Watts*), the **29 DX Club Newsletter** (*VK6PG*), **QUAX** (*G3DME*), the **DX'ers Magazine** (*W4BPD*) and **NARS Newsletter** (*5N2ABG*).

Please send all items for the **September** issue **to reach G3FKM no later than 14 August,** for **October** issue by **8 September,** and for **November** issue by **11 October.**

THE FRASER SHEPHERD PRIZE

The late J. Fraser Shepherd, GM3EGW, who died on 30 April 1970, bequeathed to the RSGB a legacy of £300 and expressed the wish that "the interest on the said sum shall be used for an annual award to be fixed at the discretion of the governing body of the Society."

At a meeting of the Council of the RSGB on 7 June 1971 it was resolved:

1. THAT the said legacy shall be invested in accordance with Article 88 of the Society's Articles of Association and that the investments shall be kept separately in the Society's books.
2. THAT the income from the investments will be expended annually in providing a prize or prizes called the FRASER SHEPHERD PRIZE in connection with research into microwave applications to radio communication, being a field in which the deceased was particularly interested.
3. THAT the prize or prizes shall be awarded only to members of the Society other than serving Council members or employees of the Society during the period of their employment.
4. THAT the conditions shall be determined by the Council from time to time and shall be advertised in *Radio Communication.*
5. THAT these resolutions shall remain in force until such time as they may be altered by the Council of the Society for the time being, the legacy being unconditional but it being the Council's wish that the deceased's wishes should be carried out so long as circumstances permit.

SOCIETY AFFAIRS

A brief report of the Council meeting held at Society HQ on 7 June 1971

Present: *Mr F. C. Ward (President, in the Chair), Dr E. J. Allaway, Messrs B. D. A. Armstrong, J. Bazley, R. J. Hughes, E. G. Ingram, G. R. Jessop, W. F. McGonigle, L. E. Newnham, C. H. Parsons, J. R. Petty, W. A. Scarr, A. W. Smith, E. W. Yeomanson (members of Council), D. A. Findlay, general manager.*

Mr J. O. Brown, Director, Lambda Investment Co Ltd, attended the meeting by invitation to advise Council on financial matters.

Apologies for absence were received from Dr J. A. Saxton, Messrs A. C. Morris, R. F. Stevens, G. M. C. Stone and A. W. Hutchinson (editor).

Accounts
The report of the Honorary Treasurer together with the financial statistics for the nine months to 31 March 1971 were considered.

Membership and affiliation
It was resolved:
(i) to elect 145 corporate members and 41 associates;
(ii) to waive the subscriptions of nine members on the grounds of blindness or other disability;
(iii) to accept reduced subscriptions from seven members;
(iv) to grant life membership to one member;
(v) to grant affiliation to the Kingsway Technical College, Dundee.

Operating certificates
Council noted a proposal that a booklet setting out the important operating awards of national societies should be prepared, and it approved in principle the production and sale of this booklet.

"Radio Communication Handbook"
It was reported that the reprint of 10,000 copies of the *Radio Communication Handbook* was now on sale, and a substantial overseas order for copies had already been received.

3·5–3·8MHz band—interference
Letters from the Norwegian National Society (NRRL) and the Bangor and District Amateur Radio Society were considered. Both letters complained of the deliberate interference that was experienced on the 3·5–3·8MHz band. The President said that this matter had been brought to the notice of MPT and was being dealt with.

Committees of Council
The invitations to members to serve on committees have been dealt with in the past at the January Council meeting. The general manager suggested that there would be more continuity and it would ease the HQ administration if this matter could be dealt with at the November meeting.

It was agreed that the appointment of members should be made at the November meeting but that the procedure be reviewed before the end of 1972.

Presidential Installation, 1972
It was reported that a provisional booking of the Derby Room at the Bonnington Hotel had been made for Friday 7 January 1972.

RSGB Scottish VHF Convention
It was reported that the RSGB Scottish VHF Convention would be held in Edinburgh on Sunday 3 October 1971. It was noted that Mr Stone had been invited to attend the convention and to give a talk on vhf matters.

Region 12 ORM
Authority was given for an ORM to be held in Aberdeen (Region 12) on Saturday 23 October 1971. It was noted that the President and Mr Ingram had been invited to attend the ORM.

Proposed Zone G meetings
Mr Smith asked if authority could be given for two Zone G meetings to be held.

Council agreed that one meeting should be held and if possible it should coincide with the date of the VHF Convention in Edinburgh.

Fraser Shepherd Bequest
A letter had now been received from the Society's solicitors explaining requirements in connection with the Fraser Shepherd Bequest. (Details of this bequest and Council resolutions concerning it appear on page 558—Ed).

President's visits
The President reported that he had attended the NRSA Convention at Belle Vue, Manchester; the general meeting of REF at Rheims; and that he would be attending the Convention in Geneva on Saturday 26 June 1971.

Committee minutes
Council received the minutes of the following committees: Membership & Representation Committee (3.5.71), Technical Committee (20.4.71), Mobile Committee (27.4.71), Education Committee (24.4.71) and VHF Contests Committee (5.5.71).

YOUR OPINION

The Editor
Radio Communication
Sir—Approximately 18 months of interference, frustration and annoyance at having QSOs ruined has prompted me to write my first letter to this column.

The problem is basically a local one, although the same type of incident may happen the length of the country. A few local stations, one in particular, transmit every night between 9 and 10.30pm on the 1,875±10kHz section of top band. They always engage in local QSOs on a part of the band exceptionally favourable for working around the UK and parts of Europe. When it is tactfully pointed out that they are sitting on top of an expedition station the usual reply is, "Wait till we've finished". All well and good, but this could mean waiting on a channel for 1½hours and in that time the required station may go QRT.

Is it not possible that stations who wish to contact locals with S9 signals please work just inside Loran so as to relieve the only clear parts of the band for stations who would like to contact stations further afield, and so enable us to use 160m to its utmost limitations.

Could the RSGB lay down some kind of band plan for 160m to help alleviate this problem and so insure the spirit of amateur radio is maintained.

Yours faithfully,
D. I. Court, G3SDL

The Editor
Radio Communication
Sir—I am seriously concerned with current tendency in the USA towards fixed frequency 2m amateur activity. It appears fashionable now for USA operators to work on fixed channels on their receive and transmit spots giving rise to nets of stations all having crystals to the same frequencies. Remote repeater stations are favoured to provide the nets with increased coverage. This practice may well find favour in the UK, especially if the amateur market supplies equipment for its use—for example, transceivers with switched receive channels and no vfo. Whereas in the USA it is unlikely that national vhf coverage will be secured for many years, repeaters notwithstanding, in the UK the situation is totally different. Here, a comparatively small number of repeaters could cover large areas and make vhf attractive to many amateurs at present in poor locations.

If such an arrangement became widespread in the UK, and if the fixed channel mode of operation became popular, there is a danger that in this country we would use a certain small number of frequencies, leaving vacant substantial portions of the 2m band. The then empty parts would eventually be occupied by other interests and we should find that we would have only a number of channels on 2m instead of the present band allocation.

I am in no way hostile to the concept of nets—when properly disciplined they are very useful—but I consider that UK amateurs should look carefully ahead before giving too much thought to the presently popular style of 2m operation in the USA.

Yours faithfully,
J. G Evans, G3WET

The Editor
Radio Communication

Sir—May I make use of your "Opinion" column to express the view that the change in postal rates has had a most unfortunate effect upon the work of the QSL sub-bureaux. Even at the previous low rate a considerable number of operators were unwilling to provide envelopes more than once a year despite the obvious fact that about one third of their contacts would send them a QSL.

It has now got to the ridiculous situation that out of the latest parcel from G2MI more than half of the cards have joined those apparently "unwanted" in my storage boxes.

Many pleas have been made in the past for people to say that they do not want QSLs (perhaps they would prefer to communicate privately with their sub-manager)—in which case the cards can go at once on to the bonfire instead of waiting for 5 November.

Yours faithfully,
D. H. Dell, G3PQF
Sub-manager G3R, G3U and G3V

The Editor
Radio Communication

Sir—I must disagree with Mr Broadbent, G3AAJ, regarding the view put forward by Mr Blanchard, G3JKV, at the 44th AGM. I also feel that the present preoccupation with ssb does deter the newcomer to amateur radio. It is so easy for an established amateur to say that it is simple to overcome difficulties of resolving ssb. After all, all one needs to do is add on a bfo. But a few years ago, when I was roaming the short waves on a broadcast receiver, I had never heard of ssb or BFOs. What I *did* hear were a.m. signals that I listened to, instead of passing over an unintelligible jumble. Had they been ssb signals I might never had "got the bug" of amateur radio.

But that is only half the problem. A few years ago the new licensee could build a simple cw rig, and then in time add on a vfo and later still a simple modulator. The magazines used to abound with the circuits. The circuits are still published, but what is the point of building an a.m. rig today? The trouble with ssb gear is its vast complexity compared with a.m. rigs, at least to someone like me with no formal training in electronics.

When I get my ticket the gear will be home built, but I feel that the glut of ssb will deter a few altogether and will turn most of the rest into "plug-in appliance operators". The answer was suggested by Mr Blanchard—an a.m. segment in the bands. After all, we have cw segments already.

Yours faithfully,
P. Woode, BRS27906

The Editor
Radio Communication

Sir—Referring to the letter from Mr G. R. Ward, G3BOB, in the March issue I would like to give some more data in connection with the improvement obtained by speech clipping. While the use of rf envelope clipping and filtering is better than the use of trapezoid modulation, the improvements are not as great as G3BOB says.

Let us consider the audio frequency band which has the same sideband power as the rf signal. If we are comparing the power ratio in the two cases the improvement for rf clipping is

$$\frac{\text{P average trapezoid}}{\text{P average rf clipping}} = 1{\cdot}66 \text{ at } 20\text{dB clipping.}$$

This result was measured by calorimetric method and was also calculated by a computer. More about this problem can be read in the IEE Conference Publication Nr 64 (p 97-101 B. Farkas and A. Gschwindt—An Investigation on Dynamic Compression for the Transmission of Speech and in the Rundfunktechnishe Mitteilungen (Von E. Belger und H. Jakubonski-Möglichkeiten zur Erhölung der Spracherständ-lichkeit bei Mittelwellen-Fernempfang. 11. 1967).

Our comparison of readability in heavy noise and interference conditions resulted in slight improvement for rf clipping. The same result was obtained by Von E. Belger and H. Jakubonski in Germany.

The use of the limiter produced by G3BOB will not give the maximum possible improvement if used as a single unit before the input of the transmitters. In most amateur transmitters the audio phase response is bad, especially at lower audio frequencies. The non-linearity in the phase response results in an increase of the dynamic range of the modulating signal. To eliminate the danger of overmodulation at the increased dynamic range, lower modulation must be used at a given transmitter. This effect decreases the improvement obtained by clipping.

In the trapezoid modulator I used a corrector to eliminate the undesirable dynamic increasing for the clipped wave. I am sure that the limiter produced by G3BOB will give better results in most of the transmitters by the use of a phase corrector.

Finally I think that the price of a unit for rf clipping is higher than for trapezoid modulation.

Yours faithfully,
Dr. A. Gschwindt, HA8WH

The Editor
Radio Communication

Sir—May I propose a vote of thanks to G3OLN for the way he has done the job of G3R – – QSL sub-Manager? For nine years we G3Rs have been receiving our cards from him and I, for one, am very grateful for his efforts.

I hope time will not lie heavy on his hands now that he has relinquished the task!

Yours faithfully,
C. F. Peers, G3REA

OBITUARIES

Mr H. Aitchison, G3FZM
Hayden Aitchison died on 11 July. He had been a member of Sheffield ARC for many years.

Mr J. Bakewell, G3YNZ
John (Skipper) Bakewell, who died on 12 June at the age of 29, was an almost complete paraplegic who was dedicated to amateur radio. His courage in overcoming his handicap was an inspiration to his many contacts on the RAIBC net.

Mr T. A. Fachtor, G8RB
Tom Fachtor, a native of Derby and a former member of Derby Radio Club, died on 7 June. He moved to Newcastle on Tyne some 10 years ago and was active in that area until about a year before his death.

Mr T. Shaw, G3WOU
Tommy Shaw, who was well known in the Teesside area, died on 2 June. He was active on all bands 160–10 until shortly before his death, and operated mobile a great deal on the WAB net.

We have also been advised of the deaths of:
Ernest George Styles, G3JSE, on 11 June aged 57.
Mr R. O. Wallis, G2MO, early in June.

Mobile Rallies Calendar

8 August	Woburn Abbey.
15 August	Derby.
15 August	Torbay, Newton Abbot Rugby Ground.
22 August	Bromsgrove.
22 August	Swindon, Wroughton Aerodrome.
25 August	Mobile gathering, Hogs Back.
29 August	Preston.
29 August	Stratford-on-Avon.
26 September	Peterborough.

CONTEST NEWS

MAY 432MHz Open Contest Results

With 19 entries in Section A and 22 entries in section C, the total number of contestants in this year's 432MHz Open was just one less than in 1970. In spite of atrocious weather over most of the country, there were more portable stations in the field, but again, as last year, the leading stations in this section gained only a marginal advantage over the better sited fixed stations. Section B, as usual, was badly supported, and in this event at least it is becoming increasingly doubtful whether the moderate scores and few entries continue to justify the separate section.

The high standard of log keeping which is always apparent on 432MHz was maintained by the majority of competitors, but the variety of make-shift 427s had to be seen to be believed. Fortunately, everyone who submitted an entry on these cover sheets remembered to write in and sign a declaration so that it was not necessary to "gong" anyone on this occasion. However, contestants are reminded that 427 cover sheets are necessary, and that it is only because there is still some hangover from the postal strike that allowances have been made.

Roger Taylor, G8BBB, and Arthur Russell, G8AWS/P, are to be congratulated on retaining their positions as leaders in Section A and Section C respectively, while J. P. Billingham, G8AAC/A, made a welcome first appearance as the winner of Section B. K. A. Jason, G8BGQ, climbed 11 places on last year's showing to take second place among the fixed stations, and as a multi-operator entry using the callsign G8AWR/P (not listed in the 1970 results), M. J. Probert returned a score that earned for his group the position of runner-up in Section C.

There were the usual divers comments on propagation conditions, but as almost a two to one majority agreed that they were poor or downright bad it is fairly safe to assume that they were, in fact, below average.

G8AWS commented upon the increase in co-channel working, and attributes much of his success to a versatile frequency synthesizer.

G8AWQ and GI8AYZ both made favourable noises about the time and duration of the contest, while G8BBB is anxious to have more dual-band events. G8BWO thought the contest much too long.

GI8AYZ summed up the weather and conditions very succinctly by saying that someone must have pulled the "plug" over Birmingham, and that 70cm disappeared down the waste pipe. As G3NNG put it; "Conditions!!! . . . What conditions?"

G8AAC/A suffered from severe xyl QRM in the early stages of the contest. Later, he discovered that he had to check the feeder every hour or so as it kept filling up with water.

G3NWU/A, who was one of the more northerly stations active, complained that so far as the southern stations were concerned the north seemed to stop at Sheffield.

Certificates will be awarded to the leading stations in each section and also to the runners-up in Sections A and C. The Council Cup which is awarded to the highest scoring station in any section, goes to G8AWS/P.

SECTION A

Posn	Callsign	Score	QSOs	County	Best dx	km	Pwr	Aerial
1	G8BBB	327	66	CE	GD2HDZ	365	150w*	2 x 46el
2	G8BGQ	193	71	HF	PA0EZ	395	150w*	46el
3	G3ZYC	182	53	DY	GD2HDZ	212	63w	46el
4	G3KMS	130	34	LE	G8AWQ/P	300	100w	4 x 4el
5	G3OHH	118	44	SD	GD2HDZ	290	10w	18el
6	G5DF	109	39	BE	—	—	100w	46el
7	G8BIL	101	34	WK	—	—	38w	14el
8	GD2HDZ	94	13	IM	—	—	40w	—
9	G8AVX	89	21	WK	—	—	60w	18el
10	G8CIT	86	47	MX	G8DDC/P	185	25w	18el + 8/8
11	G2RD	83	42	SY	—	—	25w	46el
12	G8BWO	78	29	SD	—	—	32w	18el
13	G8BQH	77	45	BS	—	—	55w	—
14	G8ECR	44	16	SX	—	—	10w	46el
15	G2WS	35	15	ST	G8DDC/P	112	70w	11el
16	G8BKR	26	16	GR	G8DDC/P	98	8w	46el
17	G8AAY	22	10	—	G5DF	103	28w	18el Bi.Sq.
18	G8BVF	20	10	LE	GW8AZU/P	105	14w	46el
19	G3VHL	19	9	WR	G3NNG/P	101	8w	9el

* indicates ssb and a.m. in use.

SECTION B

Posn	Callsign	Score	QSOs	County	Best dx	km	Pwr	Aeria
1	G8AAC/A	214	51	YK	G8AZM/P	257	90w	46e
2	G3XEB	122	52	HF	—	—	26w	18e
3	G3NWU/A	87	13	DM	—	—	70w	—
4	G8AWZ/A	10	6	NK	G8BBB	90	20w	46el

SECTION C

Posn	Callsign	Score	QSOs	County	Best dx	km	Pwr	Aeria
1	G8AWS/P	345	90	DY	G8AZM/P	241	10w	46e
2	G8AWR/P	324	79	WR	G3NWU/A	318	8w	18e
3	G3NNG/P	307	73	BE	PA0EZ	471	5w	2 x 46e
4	G8DDC/P	218	52	SH	G8AZM/P	210	100w	4 x 46e
5	G3VER/P	217	75	BS	—	—	35w	46e
6	G8ADC/P	214	70	BD	G8AAC/A	190	14w	18e
7	G8BGC/P	183	53	BE	G3KMS	239	7½w	4 x 8/8
8	GW8AZU/P	166	38	MR	GI8AYZ	275	2½w	18el
9	G3CMH/P	165	45	WE	—	—	20w	2 x 46el
10	G8AZM/P	157	63	SY	G8AAC/A	269	10w	36el
11	G8AWQ/P	143	45	HE	—	—	25w	—
12	GW8TA/P	144	34	MR	GI8AYZ/P	273	20w	18el
13	G8BCG/P	123	38	SD	—	—	20w	2 x 46el
14	G8AEV/P	122	42	SE	G8BBB	170	50w	16el
15	G3EEZ/P	120	39	WE	G3NWU/A	260	25w	46el
16	G8AWM/P	98	41	—	G3BNL/P	160	30w	2 x 46el
17	G8ATD/P	93	43	BD	G8AWS/P	199	24w	18el
18	G8CHW/P	87	36	SD	G8BGC/P	165	5w	46el + 15el
19	G3JQA/P	84	32	LE	GD2HDZ	135	40w	14el
20	GI8AYZ/P	35	4	AM	GW8AZU/P	275	15w	18el
21	G8AJC/P	31	7	KT	G8BGC/P	182	25w	18el
22	G8ADP/M	10	6	—	G3NIL/P	65		halo

Check logs from G8PX/P, G8AQZ and G8ABI are acknowledged with thanks.

Rugby DF Qualifying Event

No less than 25 teams assembled near Husbands Bosworth Aerodrome to take part in the second qualifying round on Sunday 16 May.

Transmitter "A" was located in a complex of locks, canals and lakes at Watford Locks about nine miles from the start and proved very difficult to locate. The aerial was at least 500ft long rising to a height of 100ft at one end, and the strong signals resulting persuaded a number of competitors that the transmitter was close to the start. As was intended by the organizers, a number of parties hiked for several miles in their endeavours to close up on the transmitter. No attempt was made to disguise the main aerial, but a cunningly placed dummy caused difficulties and led one competitor (who shall be nameless) to launch himself waist deep into mud and water. The first team arrived in the area as early as 1415 and passed within a few yards of the transmitter; several other teams followed, but the transmitter was not located until 1449.

Transmitter "B" was situated at the junction of the Grand Union Canal and a bridle path from Welton to Norton. It was only just over two miles from transmitter "A" and 11 miles from the start and was approachable from four directions none of which was less than a half-mile walk (or run). A quarter-wave aerial well above the ground was used giving good signals at the start. Mike Hawkins arrived in great spirits at 1525 only to find that Robin Pearce-Boby had beaten him by eight minutes. The detailed results are given below and show that sixteen teams successfully located both transmitters, five found only one and four teams did not succeed in locating either.

After the event, 54 happy but weary people sat down to tea at the Swiss Cottage at Daventry where prizes were presented to the successful competitors. On behalf of the RSGB Mr G. T. Peck thanked the organizers, Derrick Newman, G3AAQ and G8BBY, and the transmitter operators, G3NDM, G3RPJ and G3MDC, for an excellent and well-run contest.

Posn	Name	Club	Time of Arrival "A" Stn	"B" Stn
1	R. Pearce-Boby	Oxford	1458	1517
2	M. Hawkins	Chelmsford	1449	1525
3	R. Vickers	Stratford	1500	1526
4	P. M. Williams	Slade	1453½	1537
5	I. Butson	Chelmsford	1501½	1540
6	J. Drakley	Slade	1501	1540½
7	W. North	Chilterns	1502½	1541
8	P. Tyler	Oxford	1457½	1541½
9	G. Whenham	Coventry	1503	1547
10	E. Mollart	Oxford	1518	1550
11	A. Roberts	Derby	1516	1554
12	T. Gage	Oxford	1528	1557
13	G. Peck	Chilterns	1523½	1605
14	A. Simmonds	Oxford	1519½	1608
15	M. Easterbrook	Dartford Heath	1521½	1622
16	O. L. Harding	Lincoln	1520½	1627

South Manchester DF Qualifying Event

Thirteen teams assembled at the start near "The Romper" public house (some were noticed visiting the same!) in wet weather on 13 June. Good signals from both stations were received at the start, and most teams decided to choose the "A" station first.

This station, G3FVA/P, was located on Alderley Edge, a large national trust area, about five miles from the start. The transmitter, operated by G3WFT and G3XDS, was so located that competitors had to struggle uphill or slide down it, and a week's heavy rain had made the maze of tracks very muddy. The use of a half-wave dipole gave some teams strange sense bearings when they were near the transmitter. It is thought that Eric Mollart slid down the hill either going to or coming from the transmitter and complained that there were no tree roots etc to stop him. The transmitter crew noticed several people wandering round for quite a while before finding the transmitter, some walked right under the aerial. It so happened that an orienteering contest was taking place at the same time with people wandering through the woods with map and compass. One df competitor followed one of these people for quite a while until he realised that what he thought was a micro-miniature df set was in fact a compass, while Eric Mollart tried to persuade two orienteers to help him up the slippery slopes (without success).

Station "B", G3UHF/P, was located about nine miles from the start and was operated from Pickmere Lake by G3MXV and G4AFT disguised as anglers (complete with rod and basket). It was hoped that competitors would approach along the lake (via a marshy bog), but all but one of the teams went along a brook, so missing a very muddy "path". The station was located in a small backwater under trees, with G3MXV and G4AFT trying to catch roach with 20swg wire! One competitor, upon arriving at the station with a rush, was told to be quiet and not disturb the fish. He then apologized to the "anglers" and promptly went further up the bank. Fortunately it did not take him long to realise he had been "conned".

Tea was served at a restaurant in Sale, and after talks by the winners (Eric Mollart had twice his normal natter) there was a short rag chew on previous df events.

The South Manchester Radio Club would like to thank all those who took part, especially those who came a long way, for making the event a success.

Posn	Name	Club	Time of arrival "A" Stn	"B" Stn
1	E. L. Mollart	Oxford	1421	1510
2	J. R. Vickers	Stratford	1537	1432
3	W. J. North	Chilterns	1444	1544
4	P. M. Williams	Slade	1448	1546
5	T. C. Gage	Oxford/Chilterns	1420	1551
6	B. J. Mahony	Rugby	1623	1420
7	D. E. Newman	Rugby	1624	1458
8	J. Drakeley	Slade	1508	—
9	G. Clarke	South Manchester	1538	—
10	G. C. Simmonds	Slade	1540	—
11	G. Whenham	Coventry	1546	—
12	P. Woollett	Dartford Heath	1557	—
13	J. P. Fletcher	South Manchester	—	—

1971 BARTG Contest

Congratulations to I1CGE on gaining top position this year with 139 contacts, most of them being made on the 15, 20 and 80m bands. I1CAQ was runner-up, followed by ON4CK with a fine tally of countries on 80m. A very welcome newcomer to the BARTG contests was IT1ZWS who was able to give Sicily as a country to many operators. The activity from Germany and Italy was very high this year, and six "G" stations were active during the contest. The entry of SM0FO deserves special mention as he only runs 75W and is only 16 years old! Mention must also be made of the very fine SWL Section logs this year and these will be valid for the 3rd World RTTY Championship.

Dealing with band conditions, it soon became obvious that these were not ideal due to poor propagation conditions between Europe and the USA. European stations were able to work South Africa, Asia and Australia fairly readily, while the W and VE stations worked mainly into Oceania and South America. One W station with well over 100 contacts worked no European stations at all! With conditions such as these, WAC did not come easily and in fact only seven stations managed to do so. Asia and Africa, normally two difficult continents, were well represented this year. JA1ACB, JA1FFX and a very rare 4X4MR provided Asian contacts and ZS3B, ZS6BBK and ZS6BKX kept the flag flying for Africa. Two rare ones for Europe put in an appearance in the form of EA7PZ and YO2AFB. The arrival of rtty signals from YB0AAO in Indonesia also caused quite a stir on the 15m band.

Sixty-two competitive logs were received compared with 55 last year, and once again several stations were exchanging high contact numbers but have not submitted logs. Several stations have automatically qualified for the Quarter Century Award but have not put in claims. A number of scores were up-rated as we have classified IT1 and DM as separate countries.

Rules for VHF/UHF Championship '71/'72

1. Eligible entrants. The championship is open to all non-licensed fully paid-up members of the RSGB. Only the entrant may operate his receiving station. Logs will be accepted from members who were unlicensed at the time of their first entry, provided also that no transmitter has been used on a band for which an entry is subsequently submitted.

2. Location of stations. The station may be moved during the course of the championship, but only one location must be used during a given contest. An exception is that, in events on 1,296 MHz or higher, the station may be moved within a 10km radius.

3. Duration. The championship will commence on VHF NFD 1971 and will end on the last contest preceding VHF NFD 1972. Dates and times will coincide with RSGB VHF/UHF contests, with the exception of cumulative events which will not count for points.

4. Entries. Entries should be sent to the adjudicators of the appropriate transmitting contests at the addresses given in the rules, and within the stated time limits. All entries will be collated at the end of the championship. After band multipliers have been applied (see Rule 6), an entrant's best six logs, of which only four may be for vhf events, will count for points.

5. Logs. Logs must use either RSGB contest logsheets, foolscap or A4 paper, divided in columns as follows: (a) Date/time gmt, (b) Callsign of station heard, (c) My report on his signals (including any defects such as overmodulation or key clicks), (d) Report and serial number sent by station heard, (e) Callsign of station being worked, (f) Location given by station heard, (g) Points claimed.

A given callsign may appear only once per contest in column (b). Multiband events are treated as separate contests on each band and separate logs are required. CQ or test calls will not count for points and should not be logged.

6. Scoring. Scoring for each event will be on the same basis as the appropriate transmitting contest. Band multipliers will be applied *by the adjudicator* as follows: 70MHz X2; 432MHz X3; 1,296 MHz X8; higher frequencies X25.

7. Awards. The Hanson Trophy will be awarded at the discretion of Council to the overall winner. Certificates of merit will be awarded to the runner-up and to entrants who submit individual logs of particular merit.

Amendments to rules for VHF and UHF Field Days

Logs for both contests should now be sent to: VHF Contests Committee, c/o G3SEK, 89 Arthur Road, London SW19 7DP.

To encourage the maximum number of entries in the IARU VHF Contest, the duration of VHF NFD will be extended to 24 hours. The contest will now run from 1900gmt on 4 September to 1900gmt on 5 September.

Rules for 80m Field Day 1971

1. The **General Rules for RSGB Contests,** published in the January 1971 edition of *Radio Communication*, will apply.

2. When. 0900gmt to 1600gmt on Sunday 12 September 1971.

3. Eligible entrants. Multi-operator entries will be accepted. A maximum of two operators per station will be allowed.

4. Contacts. CW (A1) only in the 3·5–3·6MHz band. The location of the station must be sent.

5. Scoring. 15 points for a contact with another portable or mobile station; 5 points for a contact with a fixed station.

6. Power. The maximum power input to the pa stage must not exceed 10W. The power for all parts of the station must be derived entirely from dry batteries or accumulators, the practice of "float" charging the batteries or accumulators is not permitted.

7. Trophy. The Houston Fergus Trophy will be awarded to the winning station.

8. Logs. Column (5) should be headed "Location of station contacted".

9. Entries must be addressed to: The HF Contests Committee, c/o D. Thom, G3NKS, 6 Bracken Close, Copthorne, Crawley, Sussex RH10 3QE.

70MHz Cumulative Activity Contest

2000 to 2200 clock time on the following dates: 13 and 27 October, 17 November, 8 and 29 December.

Each of these dates is a Wednesday, to coincide with the 70MHz activity evening.

All entries and check logs should be sent to the adjudicator addressed to: VHF Contests Committee, c/o M. J. Street, G3JKX, 8 Devon Close, RAF Benson, Oxfordshire.

The following General Rules, published in the January issue of *Radio Communication*, will apply: 1, 2, 3, 4b, 5a, 6a, 7a, 8d, 9a, 10b, 11-24.

Correction

March 1971 144/432MHz Fixed Station Contest

In the results published in the June issue, G3ILO should have been listed in Section B. Certificates of merit go to G8BCL and G8AVC as winner and runner-up, respectively, in Section A, and to G3OXD/A and G3XEP/A as winner and runner-up, respectively, in Section B.

BARTG VHF RTTY Contest 1971

When. 1700–2300gmt Saturday 11 September and 0600–1200gmt Sunday 19 September.

Entrants. Licensed amateur radio stations within Zones 14 and 15 who are permitted to use rtty as a mode of operation. Portable operation will be permitted, but must be from one location for the duration of the contest. Short wave listeners may also enter.

Bands. 144MHz and 432MHz amateur bands.
70MHz amateur band for UK stations. (This will be considered as a separate contest during the same period.)

Stations may not be contacted more than once on any one band. Additional points can be claimed from the same station if a different band is used.

Messages will consist of: (a) Message number, (b) Time gmt, (c) RST report, (d) QRA Locator (Standard 5 Symbol Locator) or QTH given either as a town or as a bearing and distance in kilometres from a town. The town MUST be identifiable on a normal tourist road map.

Points. (a) All two-way rtty contacts will score in accordance with the distance chart below.
(b) All stations will receive a bonus of 200 points per country worked including their own.
(c) Band multipliers as follows: 70MHz and 144MHz band score X 1, 432MHz band score X 10.

Distance	Points	Distance	Points
0-50km	1	500-600km	22
50-100km	3	600-700km	26
100-200km	6	700-800km	30
200-300km	10	800-900km	34
300-400km	14	900-1,000km	38
400-500km	18		

Scoring. (a) Two-way exchange points X countries worked per band.
(b) Country points X band multiplier.
(c) Total score = (a) + (b).

Logs. Use one log per band. Logs to contain message number, time gmt, callsign of station worked, RST of his signals, QRA or QTH received. Estimated distance and points claimed. Send your logs to Ted Double, G8CDW, BARTG Contest Manager, 89 Linden Gardens, Enfield, Middlesex, England. **All logs must be received by 21 October 1971 to qualify.**

Awards. Certificates will be awarded to the top scorers, fixed and portable, on each band in each country. The judge's decision will be final and no correspondence can be entered into in respect of incorrect entries.

Contests calendar

7–8 August—WAE CW
8 August—DF Qualifying Round—Salisbury (Rules in June issue)
9 August—144MHz SSB (Rules in June issue)
15 August—70MHz CW (Rules in June issue)
28–29 August—All-Asian CW
2 September—DF Qualifying Round—Dartford Heath (Rules in June issue)
4–5 September—VHF NFD (Rules in March issue)
4–5 September—IARU Region 1 VHF/UHF
11 September—BARTG VHF RTTY Contest (Rules in this issue)
11–12 September—WAE phone
12 September—80m FD (Rules in this issue)
19 September—DF Contest Final
19 September—BARTG VHF RTTY Contest (Rules in this issue)
2–3 October—UHF/SHF NFD (Rules in June issue)
2–3 October—VK/ZL/Oceania phone
2–3 October—IARU Region 1 UHF/SHF
9–10 October—21-28MHz Telephony (Rules in May issue)
9–10 October—VK/ZL Oceania CW
13 & 27 Oct—70MHz Cumulative (Rules in this issue)
23–24 October—7MHz (cw)
30–31 October—432MHz Fixed
30–31 October—CQ WW DX phone
6–7 November—144/432MHz CW
6–7 November—7MHz (phone)
6–8 November—CHC/FHC (phone and cw)
7 November—OK Contest
13–14 November—2nd 1·8MHz
27–28 November—CQ WW DX CW
5 December—144MHz Fixed

SPECIAL EVENT STATIONS

Crawley ARC

The above club is holding a special events station and exhibition at the Martletts, Crawley, from 10am to 4pm on Saturday, 14 August. Live station G3WSC on all bands, 80–10m ssb and probably vhf also.

Friern Barnet Summer Show

Southgate ARC will be on 160 and 2m from this show on 13 and 14 August at Friary Park, Friern Barnet Lane, London N11. Other bands according to conditions.

Quexpo 71

Thanet ARS will have an exhibition station at Quexpo 71 from 28-30 August at Birchington, Kent. They will operate an ssb station on all hf bands and a 2m station. Quexpo 71 is a weekend of family entertainment including a horse show and gymkhana, steam engine rally, concours d'elegance for vintage and veteran cars, displays by the Royal Marines, Sea Cadets and Army Cadets, and sheepdog demonstrations.

Hurst Annual Flower Show

Members of Loddon Valley ARC will be holding a demonstration of amateur radio at this event on 30 August. Talk-in on 160m. All bands 160–10m will be in use during the day. Any amateurs and friends welcome.

Flint Squadron Air Training Corps Open Day

The date of the Open Day is 11 September and the venue the disused wartime RAF camp, Hawarden. The callsign for the occasion will be GB3ATC and the squadron will also be working its own ATC network as VQ5X49 using 4·925MHz. Special QSL cards have been printed.

Battle of Britain, RAF Finningley

The RAF station at Finningley, near Doncaster, will be open to the public on 18 September to commemorate the Battle of Britain. Among the exhibits will be a special station using a standard aircraft installation under the call GB3FTS. Frequencies will be 14·200 and 21·250MHz, operating from 9am to 9pm. 40 and 80m may also be used. A special QSL card will be issued on request only at time of QSO.

RADIO AMATEURS' EMERGENCY NETWORK

by S. W. LAW, G3PAZ*

A BEAUTIFULLY laid-out report of the AGM of the Cumbria group shows that the membership of 40 are both keen and businesslike. They are fortunate in their able hon secretary and treasurer, Mrs Christine Mullineaux, to whom we tender our thanks for the report. The area is widespread and is divided into north and south sections. Controller G3XEN obviously has matters well in hand but could obviously absorb any interested amateurs who would like to contact him (QTHR). Police liaison appears to be excellent and we expect to hear more of the Cumbria group in the future.

The group report net is held on Mondays at 2000bst on 145·44MHz. This frequency is subject to revision in due course and it has been proposed that the primary Cumbria frequency of 145·75 be employed.

British Red Cross Society
There was a large attendance at the BRCS exhibition at the Town Hall, High Wycombe, on Saturday 26 June. The Duchess of Kent, who opened the exhibition, showed great interest in the Mid-Thames Raynet stand, and controller G3FSN should be congratulated on the effort put into demonstrating the liaison that exists in the area with this important user service.

Your correspondent had the pleasure of attending this event on behalf of the Raynet Committee and thanks G3FSN and the BRCS officials for making his visit so enjoyable and instructive.

West Sussex
Despite the fact that G3LQI maintains that members are "thin on the ground", this group appears to keep very busy one way and another. What with the picnic (complete with talk-in stations on 4m and 2m) at Houghton Bridge, Arundel, on 20 June, and the Westergate County Fayre on Fontwell Park Racecourse on 1 August (again complete with talk-in), the flag is being well and truly flown down there. All this in addition to the usual exercises and even a slow morse session each weekday at 2200 on 145·8MHz, plus the production of their own Raynet publicity leaflet and extra window stickers. No lack of activity here!

Woburn Rally
At a meeting of the Raynet Committee on 10 July, arrangements were finalized for the Raynet representation at Woburn on 8 August. In particular, groups who propose to bring caravans are asked to send details immediately to G3GJW (QTHR) in order that the site may be laid out in an orderly manner. All caravans will be parked together and are requested to arrive at Woburn between 0800 and 0900bst on Sunday 8 August and not before. For security reasons caravans will not be permitted to enter before this time, so please make suitable arrangements for parking en route if travelling on Saturday. (G3GJW's telephone number is 01-407 4367).

All Raynet vehicles will be met on arrival by a Raynet steward who will report to the site by walkie-talkie to facilitate parking arrangements and will issue a Raynet pennant for the vehicle. Raynet talk-in will be on 70·375MHz and 70·26MHz and drivers are asked to make it clear on arrival at the gate checkpoint that they are Raynet. This should also be emphasized on radio call-in. This applies also to 2m call-in to the RSGB talk-in on 145·00MHz Please report to the Raynet tent when parked and note that there will be a members' raffle with attractive prizes. Armbands, window stickers and badges will be on sale at the tent.

Honorary registrations secretary: **Mrs Jane Balestrini, "Merrivale", Willow Walk, Culverstone, Gravesend, Kent.**

Honorary secretary, RAEN Committee; **Mr. E. R. L. Bassett, 57 Upper St Helen's Road, Hedge End, Southampton, SO3 4LG. Tel Botley 4462**

* 130 Alexandra Road, Croydon, Surrey CRO 6EW.

RAEN Group of the Month

by P. Balestrini, G3BPT, (Chairman, Raynet Committee)

(East) Glamorgan Raynet Group
Group Controller: A. G. Blackmore, GW3FKO, 9 Upper Cliff Drive, Penarth, Glamorgan.

This group now has an active list of 10 members and has recently changed to the fm mode of transmission with receivers adapted for both a.m. and fm. Arrangements are currently being made to obtain access to a number of fixed sites for emergency use.

A recent group communications and call-out exercise provided satisfactory results from north of Bath, the Severn Bridge, Cardiff, and as far west as Bridgend and Porthcawl. Regular inter-group contacts are maintained with neighbouring groups.

Tony Blackmore is a professional communicator and has an active and enthusiastic group, but more members are required. Contact is being made with the Chief Constable of Gwent to enable the group to participate in any official emergency exercises.

Present group channels: First, 144·350MHz; second, 144·480 MHz; with a third channel of 144·6MHz.

MOBILE RALLY NEWS

Derby Mobile Rally, 15 August
At Rykneld School, Bedford Street, Derby, between Uttoxeter Road and Burton Road on Derby Ring Road. Talk-in on 160m, G3ERD/A, and 2 and 4m, G8DBY. Band concert, junk sale and other usual attractions. Admission and parking free. Covered accommodation if wet.

Swindon Mobile Rally, 22 August
At No 15 MU, RAF Wroughton, 2 miles south of Swindon off A361. Talk-in on Top Band, G3YNX, and 2m, G8DPV. Usual attractions plus a df hunt organized by the Oxford Club. Further details from G3LTZ, 3 Westhill Close, Highworth, Swindon, Wilts. Tel: Highworth 559.

Mobile Gathering, 25 August
Taking place on the Hogs Back lay-bye, south side. Mobile stations on 4 and 2m from 7pm. All are welcome to this informal get-together.

Preston ARS Mobile Rally, 29 August
This annual event will take place at Kimberley Barracks, Preston, Talk-in stations for Top Band and 2m, trade stalls, bring and buy. junk sale, a bar and refreshments are among the usual attractions.

Anglian Mobile Rally report
Although there were many local activities within a few miles of the Suffolk Show Ground, the attendance was extremely good and the number of cars was an increase over last year. Support was very scattered—Kent in the South, Yorkshire in the North and two amateurs from North Wales, GW3VAZ and GW3YCD, but there was less support from the locals.

Sports were organized for the family and enjoyed by the crowd. The local naval training school really helped in the races, and were the subject of good humour and vocal support. It appears that all functions for the amateur these days have to be organized so as to allow the family to enjoy them as well. Due to the reduction in the size of modern equipment more amateurs are becoming "sideboard" operators and many install their equipment in their cars, so that the family is becoming more and more an important part of the hobby.

Trade stands were well represented, and any piece of new equipment could be tried on the air. This is an essential feature—the days of gazing and knob twiddling are rapidly vanishing.

Longleat Mobile Rally report
The Longleat Mobile Rally on 27 June attracted an attendance of well over 2,000 people in spite of inclement weather. There were 14 trade stands, RSGB bookstall, and a bring and buy stand. A variety of displays and demonstrations were put on by the Wiltshire Police, the Post Office television detector van, and the Royal Signals who were operational using their own callsign G4RS/P.

CLUB NEWS

Items for inclusion in this section should be sent to regional representatives on the first of each month for inclusion in the following month's issue. They should not be sent direct to the editor.

The date of publication of the following month's issue, first Tuesday in the month, should be borne in mind so that events are not, in fact, history when the details are published. While regional representatives are pleased to receive clubs' events calendars for several months ahead, they still require monthly events lists so that entries can be confirmed or amended.

REGION 1 **RR B. O'Brien, G2AMV**

Merseyside Luncheon Club—First Monday in each month, 1230 for 1245pm, HMS *Landfall*. Please advise G3VQT or G2AMV beforehand if you wish to attend.

Ainsdale (ARC)—Members should contact N. Horrocks, G2CUZ, QTHR, for details of the changed meeting arrangements.

Allerton (Liverpool) Scout ARS. North West Region. Thursdays, 8pm, 1st Allerton Group HQ, Aigburth Vale, Liverpool 17. All Scouts interested in amateur radio are welcome.

Blackburn (East Lancs ARC)—First Thursday in each month, 7.30pm, Edinburgh House, Shearbank Road, Blackburn. Further details from G4JS.

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

Bolton (B & DARS)—Third Wednesday in each month with a discussion night on the first Wednesday. The Clarence Hotel, 176 Bradshawgate, Bolton. Secretary, G3ZQS.

Bury (B & RRS)—10 August (Talk by G3BTO on tvi and the MPT), 14 September (Talk by Stan Parker on "heating"), 8pm, George Hotel, Market Street, Bury. Secretary, G3VVQ, 411 Holcombe Road, Greenmount, Bury.

Carlisle (C & DARS)—Mondays, 7.30pm, Currock House, Lediard Avenue, Currock. Secretary, G3FZG.

Cheshire (Mid-Cheshire ARC)—Wednesdays, 7pm, Technical Activities Centre, Winsford Verdin Grammar School, Grange Lane, Winsford. All meetings start with a morse class, main feature at 8pm.

Chester (C & DARS)—Tuesdays, except for the first Tuesday in the month which is net night, 8pm, YMCA, Chester. Further details from G8AYW.

Crewe—Local members continue to meet at the QTH of R. Owen, 10 Circle Avenue, Willaston, Nantwich, from whom further details may be obtained.

Douglas (IOM) (D & DARS)—Every Monday and Thursday, 7.30pm, rear of Douglas Holiday Centre, Victoria Road, Douglas. Club call is GD3ZCM. Secretary, J. Parnell, Cronkbane, Quines Hill, Port Soderick, IOM.

Eccles (E & DRC)—Tuesdays, 8pm, Bridgewater School, Worsley, Lancs. Thursdays—club top band net 2030gmt.

Leyland Hundred Amateur Radio Group—Net nights: Thursdays at 2000gmt on 1915kHz. Saturdays at 1900gmt on 145·8MHz.

Liverpool (L & DARS)—Tuesdays, 8pm, Conservative Association Rooms, Church Road, Wavertree. Secretary, K. Wood, G3WCS, 90 Childwall Valley Road, Liverpool 16.

Liverpool (NLRC)—13, 27 August, 10 September, 8pm, Labour Party HQ, 13 Crosby Road South, Liverpool 22. Secretary, M. Graham, G3XMG, 14 Albert Road, Waterloo, Liverpool 22.

Manchester (M & DRS)—Wednesdays, 7.30pm, 203 Droylesden Road, Newton Heath, Manchester 10. Secretary, G3IOA.

Manchester (SMRC)—Fridays. 6 August ("Top band dx", by P. Wilde, G3XDS), 13 August ("Radio astronomy techniques", by P. Stewart), 20 August ("The good old days", by D. Barber, G2AKR), 27 August (Surplus equipment sale (always lots of "goodies"), 8pm, Sale Moor Community Centre, Norris Road, Sale, Cheshire. The vhf section of the club (G3UHF), meets on Mondays at the club shack, "Greeba", Shady Lane, Manchester 23. Visitors welcome on both Mondays and Fridays.

Manchester University (ARS)—Please contact G3ZNS or G8BVF for details of activities. The shack is on the 3rd floor in the Union.

Preston (PARS)—5, 19 August, 2 September, 7.30pm, Windsor Castle (private room), St Paul's Square. Secretary, G. Windsor, 26 St Gregory's Road, Preston.

Salford (Dial House RS)—A society of MPT engineers who meet on Wednesdays, 6pm, 8th floor (river end) Dial House, Chapel Street, Salford 3. Further details from the secretary at same address.

Stockport (SRS)—Second Wednesday in each month—discussion night. Fourth Wednesday in each month—lecture night. 8pm, Blossoms Hotel, Buxton Road, Stockport. Secretary, G8BCG.

Thornton Cleveleys (TCARS)—First and third Wednesday in each month, 8pm, St John Ambulance Brigade Hall, Fleetwood Road North, Thornton, Blackpool. Secretary, G3YWH; ASR, G3ZBO.

Warrington (Culcheth) (CARC)—Fridays, 7.30pm, Chat Moss Hotel, Glazebury. All visitors welcome. Secretary, K. Bulgess, 32 Hendon Street, Leigh, Lancs.

Westmorland (WRS)—Members will be contacted when a new meeting place is arranged. Meetings are likely to be once a month New chairman is G3UEC; secretary, E. P. Goonan Jnr, "Longridge", Storth, Nr Milnthorpe, Westmorland.

Windscale (Cumberland) (WAR & ES)—Fridays, 7pm, c/o Falcon Club, Falcon Field, Egremont. Further details from N. Ramsden, G3RHE.

Wirral (WARS)—First and third Wednesdays in each month, 7.45pm, Boy Scouts HQ, Harding House, Park Road West, Claughton, Birkenhead. Secretary, G3WSD, 34 Glenmore Road, Oxton, Birkenhead.

Wirral (Wirral DX Association)—Last Thursday in each month at members' homes. The August meeting, however, is to be a social event and members will meet on the putting green at Arrow Park Golf Club. Visitors are welcome. Secretary G3OKA, 219 Prenton Dell Road, Prenton, Birkenhead.

REGION 2 **RR K. Sketheway, BRS20185**

Fulford (York) (FARS)—Tuesdays, 7.30pm, Scout HQ, 31 George Street, York. *G5KC*.

Hartlepool (HARC)—Mondays. 14–15 August (G3IDV/A exhibition station at the Hartlepool Annual Horticultural Show, Grayfields Recreation Ground, Hartlepool, working all bands). Club meets 7.30pm, Middlegate Room, Borough Buildings, Hartlepool. At a recent meeting J. Thompson, G3NWU, gave a talk on the "techniques of transmitting and receiving" using a Trio transceiver loaned by L. Foden, G3CHJ, and an aerial loaned by F. Feeley, G3UW. *BRS7323*.

Hull (H & DARS)—6 August ("Basic radio maths", by G8DZG), 13 August (Visit to Hull docks), 20 August (Film Show), 27 August (Short wave listeners). Club meets at 592 Hessle Road, Hull. During the past month the club welcomed Dr A. Goens, YS1AG, from El Salvador. Dr Goens is a very avid dx chaser and will be working in Hull for the next six months.

North Riding (NRARG)—Group meets alternate Tuesdays and Thursdays fortnightly, back room of the Ship Inn, Falsgrave Scarborough. Further details from the secretary, Jeff Jones, G3VLM, Bingley Private Hotel, Albermare Crescent, Scarborough. *G3VLM*.

Scarborough (SARS)—Thursdays, 7.30pm, c/o RAF Association, 3 Westover Road, Scarborough. Club callsign G4BP. The hon secretary is J. Cutler, G3VAN. *G8KU*.

South Shields (SS & DARC)—Fridays, 8pm, Trinity House Social Centre, Laygate, South Shields.
Sunderland (SARS)—Meetings on the first and third Tuesday in each month, 7pm, Sunderland Polytechnic. *G3XID.*
York (YARS)—Thursdays, 7.30pm, British Legion, 61 Micklegate, York. *J. A. Rainbow.*

REGION 3 **RR R. W. Fisher, G3PWJ**

Special regional events:
22 August, Bromsgrove ARC mobile picnic, Avoncroft Museum of Buildings, Stoke Prior, Bromsgrove.
29–30 August, GB3DAR operating from Halfpenny Green Air Display and Air Race, by Dudley ARC.
30–31 August, GB3WSF operating from Walsall Show Fete, by Wolverhampton ARS.

Birmingham (MARS)—17 August, 8pm, Midlands Institute, Margaret Street, Birmingham 3.
Bromsgrove (B & DARC)—13 August (Short talks by members), 22 August (Mobile picnic, Avoncroft), The Royal Oak, Barley Mow Lane, Catshill.
Cannock Chase (CCARS)—First Thursday in each month, 8pm, Bridgetown Social Club, Walsall Road.
Coventry (CARS)—6 August (Club df event), 13 August (Club night on the air), 20 August ("University Challenge" type quiz), 27 August (Club night on the air), 8pm, City of Coventry Scout HQ, 121 St Nicholas Street, Radford Road, Coventry.
Dudley (DARC)—3, 17 August, 8pm, Central Library, St James' Road. 29–30 August (GB3DAR at Halfpenny Green Aerodrome, Bobbington. Talk-in on 160–2m, ssb, 80–10m. *G3PWJ.*
Lichfield (LARS)—First Monday and third Tuesday in each month, The Swan Hotel, Lichfield. *G3UUN* and *G3ZIF.*
Nuneaton (NARS)—First Friday in each month and the Wednesday a fortnight later, Caldecote Grange. *G8ERM.*
Rugby (R & DAR & EC)—Every Tuesday, 8pm, 10 Drury Lane, Rugby. *G3YQC.*
Solihull (SARS)—17 August (Expedition to Isle of Skye by G3s IKR, VPE, XIP, ZXO), 7.30pm, The Manor House, High Street, Solihull. 7 September (Informal meeting), Malt Shovel, High Street, Solihull. *G3ZXO ex G8BYM.*
Stourbridge (STARS)—No meeting in August. 7 September (Talk), 7.45pm, Longlands School, Stourbridge.
Stratford (SoA & DARC)—Meetings held fortnightly, Halls Croft, Stratford. The following officers were elected at the AGM held 18 June: President, D. Flower, G8TO; chairman, I. Cobbold; treasurer, B. Searle; secretary M.Webb, G3OOQ.
Sutton Coldfield (SCRS)—9 August (Visit to ITV transmitter), 23 August (Natternight), 8pm, Clubhouse, Sutton Town Football Club, Coles Lane. *G8CZM.*
Telford (WARS)—Every Wednesday evening, 8pm, Ketley Bank Youth Club, Main Road, Ketley Bank, Telford. *G3UKV.*
Wolverhampton (WARS)—30–31 August (GB3WSF at Walsall Show Fete, 10am to 10pm, 160–2m. *G3CAQ.*
Worcester (W & DARC)—21 August (Club treasure hunt), Crown Hotel, Broad Street. *G3WUI.*

REGION 4 **RR T. Darn, G3FGY**

No reports or programmes have been received from any club or society in Region 4 during the past month.

Club secretaries are reminded that all items for inclusion in Region 4 News are to be received by the RR before the 5th of the month preceding each issue of *Radio Communication.*

REGION 5 **RR S. J. Granfield, G5BQ**

Bedford (B & DARC)—5 August (Aerial tape lecture by G3XDU, 8 August (RSGB national mobile rally—Woburn), 12 August (G3WTP on the air—160 and 2m), 19 August (DF hunt), 26 August (Brains Trust), 30 August (Summer holiday net, 10.30), 2 September (Speech compressors). Club meets at The Dolphin, Broadway, Bedford.
Cambridge (C & DARC)—Club meets on Fridays, 7.30pm, Club HQ, Corporation Yard, Victoria Road, Cambridge.
Dunstable Downs (DDRC)—Amateur television tests take place from Dunstable Downs at 8pm each Thursday. For skeds please contact G8AIB/G6AKF/T, QTHR. 13 August ("TV servicing", by G8CPX), 27 August (VHF NFD discussion—G3VZV). Club meets on Fridays, 8pm, Chew's House, High Street, Dunstable, Bedfordshire.
Luton (George Kent ARS)—Although 70 per cent of members were made redundant, the secretary and seven other members remain. They hope to be able to participate in field days, contests, and lay on exhibition stations. The hon. secretary is John Allen, G3DOT, 77 Rosslyn Crescent, Luton, Bedfordshire.
Shefford (S & DRS)—Club meets on Thursdays at the Church Hall Ampthill Road, Shefford, Bedfordshire. The hon secretary is Arthur Sullivan, G2DGF, 12 Glebe Road, Letchworth, Herts.
Stevenage (S & DARS)—Club meets on the first and third Thursdays in each month at Hawker-Siddeley Dynamics Ltd, Gunnels Wood Road, Stevenage, Herts.

REGION 6 **RR L. W. Lewis, G8ML**

Cheltenham (RSGB Group)—First Thursday in each month, 8pm, "Royal Crescent", Clarence Street, Cheltenham. *G2FWA.*
Oxford (O & DARS)—Second and fourth Wednesdays in each month, 7.30pm, Cherwell Hotel Clubroom, Watereaton Road, North Oxford. Contact the secretary, D. R. Ward, telephone Oxford 47771, for further details.
South Bucks VHF Club—7 September (Talk on radar), 8pm, Bassetsbury Manor, High Wycombe.

REGION 7 **RR P. A. Thorogood, G4KD**

See you all at Woburn Abbey National Rally. Opens 11am Sunday 8 April. Specially reserved car park—please make sure you come to our entrance.

Acton, Brentford & Chiswick (ABCRC)—17 August (Tests with G3CCD/F0UT in France), 7.30pm, Chiswick Trades & Social Club, 66 High Road, Chiswick.
Addiscombe (AARC)—Second and fourth Tuesdays, 7.30pm, Prince George Hotel, High Street, Thornton Heath.
Ashford, Echelford (ARS)—Second Monday and last Thursday in each month, 7.30pm, St Martin's Court, Kingston Crescent, Ashford, Middlesex.
Barking (BR & ES)—Thursdays, 7.30pm, Gascoigne Recreation Centre, Gascoigne School, Morley Road, Barking. Second copy of *Carrier* received with excellent articles, the only omission being the autumn programme.
Bexleyheath (NKRS)—Second and fourth Thursdays, 7.30pm, Congregational Church Hall, Chapel Road, Bexleyheath. A visitor from KW Electronics was well received at the last meeting, and it is hoped that he will give a further talk on rtty in the near future. Activity was down on NFD due to many troubles.
Cheshunt (CDRC)—First Friday in each month, 7.30pm, Methodist Church Hall, opp. Theobalds Station, Cheshunt.
Chingford (RSGB Group)—Fridays, telephone 01-524 0308.
Chingford (SRC)—Fridays, 7.30pm, Friday Hill House, Simmons Lane, Chingford E4.
Croydon (SRCC)—Third Tuesday in each month, 7.30pm, Swan & Sugarloaf, South Croydon.
Crystal Palace (CP & DRC)—Third Saturday in each month. 21 August ("Vhf/fm receivers", arranged by G3IIR), 8pm, Emmanuel Church Hall, Barry Road, SE22.
Dartford Heath DF Club—Now meets at 8pm, Broomhill Road, Dartford. 8 August (RSGB event, Salisbury), 13 August (Club night), 15 August (Grand Event), 22 August (Vange away hunt), 3 September (Club night), 5 September (RSGB event—Dartford Heath (qualifying RSGB round) 1300bst).
Dorking (DR & DRS)—Second and fourth Tuesdays, 8pm, "Wheatsheaf".
Ealing (E & DARS)—Tuesdays, 7.30pm, Northfields Community Centre, Northcroft Road, W13.
Edgware & Hendon (E & DRS)—Second and fourth Mondays in each month, 8pm, St George's Hall, 51 Flower Lane, Mill Hill, NW7.
Farnham, Bucks (Burnham Beeches RC)—Fortnightly on Mondays, Buffaloes Hall, Victoria Public House, Victoria Road, Farnham Common.
Gravesend (GRS)—Mondays, 8pm, Northfleet Recreation Centre, Springhead Road, Northfleet, Kent.
Greenford (GARS)—Second and fourth Fridays, Greenford Community Centre, Oldfield Lane.
Guildford (G & DRS)—Second and fourth Fridays, 8pm, Guildford Engineering Society, Stoke Park.
Hampton Court (TVARTS)—First Wednesday in each month, 8pm, The Three Pigeons, Portsmouth Road, Long Ditton.
Harlow (DRS)—Tuesdays (General and cw practice); Fridays (Junior), 8pm, Mark Hall Barn, First Avenue.

Harrow (RSH)—Every Friday. 6 August (Junk sale), 13 August (Practical), 20 August (Talk by R. J. Hughes, G3GVV, Executive Vice-President RSGB), 8pm, Harrow County School for Boys, Sheepcote Road, Harrow.
Havering (H & DARC)—Fortnightly, 8pm, British Legion House, Western Road, Romford.
Hemel Hempstead (HH & DARS)—First and third Fridays, 8pm, "Addmult" Sports Club, Hemel Hempstead.
Holloway (GRS)—Mondays (RAE), 7pm; Wednesdays (Morse), 7.30pm; Fridays (Club), 7.30pm, Whittington School, Archway School Annex, Highgate Hill, N19.
Ilford—Every Thursday, 8pm, 50 Mortlake Road, (off Ilford Lane), Ilford.
Kingston (K & DARS)—Second Wednesday in each month. 11 August ("Counters and clocks", a talk on digital counter techniques by R. Babbs, G3GVU), 8 September ("SSB", a talk by G. Alderman, G3JXA). 8pm, Penguin Lounge, 37 Brighton Road, Surbiton.
Loughton—Fortnightly on Fridays, Loughton Hall, Rectory Lane (near Debden station).
New Cross (CARS)—Club meets every Wednesday and Friday, 8pm, 225 New Cross Road, SE14.
Paddington (P & DARS)—Wednesdays, 7.30pm, Beauchamp Lodge, 2 Warwick Crescent, W2.
Purley (P & DRS)—First and third Fridays, 8pm, Railwaymen's Hall, side entrance, 58 Whytecliffe Road, Purley.
Reigate (RATS)—First Wednesday in each month, 7.45pm, George and Dragon, Cromwell Road, Redhill.
Romford (R & DRS)—Tuesdays, 8.15pm, RAFTA House, 18 Carlton Road.
Scouts (ARS)—Third Thursday in each month. 19 August (Opening evening), 7.30pm, Baden Powell House, Queensgate, South Kensington, SW7. At the recent AGM the following officers were elected: Chairman, Val Sedgley, G3YIC; secretary, Alf Watts; treasurer, Scott Nelson. Committee: Messrs. J. Bottom, D. Sheperd and N. Thrower. John Waters and Martin Milner will be attending the Japan World Jamboree from 1–10 August, callsign JH2BSJ. Scout net: Saturdays 0900, 3,740MHz.
Sidcup (CVRS)—First and third Thursdays. 5 August ("VHF in El land", by Colin Westwood, G3VFD), 19 August (Natter Nite), 2 September ("An anthology of radio signals", a tape recorded lecture by A. O. Milne, G2MI), 8pm, Congregational Church Hall, Court Road, Eltham, SE9.
Southgate (SRC)—Second Thursday in each month, 7.30pm, Civil Defence Hut, Bowes Road, N11.
St Albans (Verulam ARC)—4 August (Salisbury Hall), 18 August ("Test gear for the shack", by Rudd Thornton, G3PKV), 7.30pm, Town Hall, St Peter's Street, St Albans. At the last meeting Peter Ballestrini gave a talk on the wide coverage that PLA maintains on communications and navigation. His interesting life of 20 years with the authority, and his experiences as sailor, airman operator and engineer made an excellent meeting.
Sutton & Cheam (SCRS)—Third Tuesday in each month, 8pm, The Harrow Inn, High Street, Cheam.
Welwyn (Mid-Herts ARS)—Second Thursday in each month. 12 August (VHF NFD) planning), 9 September ("Moonbounce", by G3LTF), 8pm, Welwyn Civic Centre, Welwyn.
Wimbledon (W & DRS)—Second and last Fridays, 8pm, St John Hall, 124 Kingston Road, South Wimbledon, SW19.
Wembley (GECARS)—Thursdays, 7pm, Sports Club, St Augustin Avenue, North Wembley. (This club is open to non-GEC employees by invitation contact Dain Evans, G3RPE, telephone 01-904 1262, for details.)

REGION 8 — RR D. N. T. Williams, G3MDO

Canterbury (EKRS)—19 August ("Phase lock oscillators", by G8AJC), 23 September (Design of transistors), 21 October (Junk sale).
Dover (SEKYMCAARC)—Meetings held every Thursday, 7.30pm, YMCA Leybourne Road, Dover.
Eastbourne (SARS)—Meetings held on the first Monday in each month, Victoria Hotel, Latimer Road, Eastbourne.
Maidstone (MYMCAARS)—Starting 3 September, the club will be meeting on the first and third Fridays in each month, 7.30pm. CW practice under G3ORH, 8pm. Basic radio theory and practice by G3XUN and G3ORP. 10, 24 September ("Contest operating procedure", by G3ORP). Club shack nights, open most Tuesdays.
Mid-Sussex (MSARS)—During August informal members' evenings while Marle Place is closed—offers to G3WPO. 2 September (VHF NFD arrangements).
Worthing (W & DARC)—No meetings during August,—autumn season starts Tuesday 31 August, 8pm, Rose Wilmot Youth Centre, Littlehampton Road, Worthing. Full details from G6KFH/T.

REGION 9 — RR J. Thorn, G3PQE

An ORM will be held at the new Technical College on the sea front at Weston-super-Mare on Sunday 19 September 1971 at 2.30pm. Light refreshments will be available all day. Full details in the September issue, but make this a date for your diary. Weston-super-Mare is an ideal place for a day out for the family.

Bristol (BARC)—Tuesdays and Thursdays, Club HQ, 41 Ducie Road, Barton Hill, Bristol 5. Club callsign, G3TAD. *G3RKH.*
(RSGB Group)—23 August ("A 2m mobile rx", by G. Marshall, G3YRN), 7.30pm, Becket Hall, St Thomas Street, Bristol 1. Longleat was again a lovely day and was exceptionally well supported. The many people from around the region who visited the rally with their friends and families made it a very friendly gathering. *G3ULJ.*
(Shirehampton)—Every Friday at Twyford House. *G3SXY.*
(University)—Every Saturday afternoon, Dept of Physics, Royal Fort, Tyndall Park Road, Bristol 1. *G8ADP.*
Burnham-on-Sea (BOSARC)—Revival of meetings is suggested in this area, and amateurs are asked to contact Jack Robertson, G3ZOR, 31 Lynton Road, Burnham-on-Sea, Somerset. Telephone 2333.
Exeter (EARS)—Every second Tuesday in each month. 10 August ("History of radio", tape lecture), Club HQ, Community Centre, St David's Hill, Exeter. Secretary's address, 232 Exwick Road, Exeter.
North Devon (NDRC)—25 August (Natter Night), "Grinnis", High Wall, Sticklepath, Barnstaple. *G4CG.*
Plymouth (PRC)—First and third Tuesdays in each month. 22 August (Picnic at the Car Park Scenic, Yelverton. Talk-in station on 160 and 2m. Everyone welcome. Club meets at Virginia House, Batter Street, Bretonside, Plymouth. New secretary, S. E. Martin, 32 East Park Avenue, Mutley, Plymouth.
Saltash (S & DARC)—6 August (Barbecue on Caradon Hill, mobile activity), 20 August (Fox hunt—meet at Burraton Toc H, 7.30pm), 5 September (Mobile rally—Wearde School, Saltash. Talk-in stations). *G3XWA.*
Torbay (TARS)—Meets every Tuesday and Friday. 28 August ("TARS on film, our rally and NFD"), Club HQ, Bath Lane, rear of 94 Belgrave Road, Torquay. Mobile Rally on 15 August at Newton Abbot Rugby Ground, Kingsteignton Road, opposite the Race Course. Talk-in on 1,880kHz and 2m. *G3NQD.*
Weston-super-Mare (WSM RS)—6 August (Natter night—final arrangements for the ORM). *G3GNS.*
Yeovil (YARC)—Every Thursday. 5 August (Tape lecture, "World wide telecommunications", by G8PP), Park Lodge, Yeovil Youth Centre, Park Road. *G3NOF.*

REGION 10 — RR D. Thomas, GW3RWX

Blackwood (ARC)—Meetings now held, with the exception of during school holidays, on Fridays, 7.30pm, Oakdale Community Centre, where a warm welcome will be given to all members, old and new. *GW3TUG.*
Barry College of Further Education (ARS)—Details of summer programme and meeting places available from GW3VKL.
Cardiff (RSGB Group)—Monday 9 August, 7.30pm, BBC Social Club, Llandaff, nr Cardiff. *GW3GHC.*
Glamorgan Raynet Group—Exercise periods and meeting places available from GW3ZFG, tel. Cardiff 62411.
Haverfordwest (ARS)—Tuesdays, 7.30pm, HQ Rosemary Lane, Haverfordwest, Pembs. Club callsign is GW3XCT. *GW3YBB.*
Hoover (ARC)—Mondays, 7.30pm, Hoover Social Club, Hoover Works, Pentrebach, Nr Merthyr, Glam. Secretary, Mr F. E. Tribe, c/o Club HQ.
Port Talbot (ARC)—Second Tuesday in each month, 7.30pm, Trefelin Club & Institute, Trefelin, Port Talbot, Glam. *GW5VX.*
Pontypool (ARC)—Meetings during school vacation period from GW3JBH.
Pembroke (ARC)—Last Friday in each month, 7.30pm, Defensible Barracks, Pembroke Dock, Pembs. This club was recently visited by the zonal Council member, who was particularly impressed by the amount of equipment, all club property, which was available for use by members.
Sully & District Short Wave Club—Tuesdays, 7pm, The Annexe, Sully Bowls & Social Club, 59 South Road, Sully, Glam. Secretary, Mr Glyn Maggs, 3 Thorley Close, Cyncoed, Cardiff.

Mr L. W. Lewis, G8ML, RR Region 6, (left), and Mr C. H. Parsons, GW8NP, Council member, (right), with one of the country's oldest amateurs Mr G. C. Price, GW2OP

Rhondda (ARS)—Meetings at Rhondda Transport Employees Club & Institute, Porth, Rhondda, Glam. Details from GW3PHH. The society recently carried out tests in order to evaluate the possibility of using 28MHz for local working in this difficult area.
Swansea Telephone Area (ARS)—Tuesdays, 7.30pm, Telephone Engineering Centre, Gors Road, Swansea. Morse practice precedes the meetings, which start nominally at 8pm. The club station is operational at all times during meetings.
University College, Cardiff (ARS)—Activities suspended for summer vacation. Students entering college in October should contact the secretary, c/o Students Union, Dumfries Place, Cardiff.
University College, Swansea (ARS)—General considerations as for Cardiff above. Letters to secretary, c/o Students Union, University College, Singleton Park, Swansea, Glam.

REGION 11 **RR P. Hudson, GW3IEQ**
Bangor (B & DRC)—This club will be operating GB2EGC from 1–8 August. This special activity station is being activated in connection with the Welsh National Eisteddfod being held in Bangor during this period. Activity will be maintained on 160–10m and 2m with talk-in facilities if required on 160, 80 and 2m.
Bangor (UCNWARS)—Anyone interested in radio who is coming to the University for an interview is invited to get in touch with the secretary.
Conway Valley (CVARS)—Meetings held on the second Thursday in each month at the Parade Hotel, Llandudno.

REGION 12 **RR G. M. Grant, GM3UKG**
Special regional event—Region 12 Official Regional Meeting, 23–24 October, Beach Ballroom, Aberdeen, further details later.
Aberdeen (AARS)—Fridays, 7.30pm, 6 Blenheim Lane, Aberdeen. GM3HGA, telephone Aberdeen 33838.
Inverness (IRS)—No formal meetings until autumn but the clubroom is open most Thursdays. Clubroom at 4 Falcon Square (nr railway station). Inverness. Miss A. Veitch, telephone Drumnadrochit 266.
Lerwick (LRS)—Tuesdays and Thursdays, 8pm, Annsbrae House, Lerwick. GM3XPO, telephone Bixter 249.
Lhanbryde (MFARS)—Wednesdays, 7.45pm, St Andrews School, Nr Lhanbryde, Elgin, Morayshire. GM3UKG, telephone Clochan 225.
Thurso (CARS)—Second Tuesday in each month, 7.30pm, Thurso Technical College. *GM3JUD.*

REGION 14 **RR N. G. Cox, GM3MUY**
Ayrshire (AARG)—30 August, 7.30pm, YMCA, Howard Street, Kilmarnock.
Ayrshire (Ardeer Recreation ARC)—3, 5, 10, 12, 17, 19, 24, 26, 31 August, 7.30pm, Ardeer Recreation Club, Amateur Radio Section, Stevenston. Details from J. F. McCreight, GM3DJS, 10 Auchenharvie Road, Stevenston, Ayrshire.
Falkirk & District RSGB Group—Closed for summer months. Next meeting 10 September, 7.30pm, Temperance Cafe, Lint Riggs. Full syllabus to be issued at this meeting.
Glasgow University (GURC)—Closed for summer vacation. Next meeting October. Further details in September issue of *Radio Communication.*
Greenock & District (G & DARC)—6, 13, 20, 27 August, 7.30pm, James Watt Library, Union Street, Greenock.
Mid-Lanark RSGB Group—20 August, 7.30pm, YMCA, Brandon Street, Motherwell.
West Scotland (ARS)—6, 13, 20, 27 August, 7.30pm, 81 Virginia Street, Glasgow C2.

REGION 15 **RR J. Thompson, GI3UFH**
City of Belfast YMCA Radio Club—Meetings on Wednesdays and Saturdays, 8pm, City YMCA (3rd floor), 12 Wellington Place, Belfast, BT1 6GE. Information from YMCA General Office. A party of members and their friends recently visited Portpatrick Radio Station GPX. This was a repeat of a visit made some time ago and was enjoyed by all who took part.

REGION 16 **RR W. J. Green, G3FBA**
Club secretaries are requested to note that programmes for inclusion in Club News should reach the RR by the 1st of the month. Recently programmes have been arriving by the 5th of the month when a weekend has been included in the transmission time. It is requested that programmes be compiled as near as possible to the style used in *Radio Communication* in order to save the RR the task of transposing the copy before sending to the editor.

Chelmsford (CARS)—First Tuesday in each month, 7.30pm, Marconi College, Arbour Lane, Chelmsford. *G3VCF.*
Haverhill (HDRS)—Alternate Wednesdays, 7.30pm, Leiston Hall Community Centre, Clements Estate, Haverhill. *G3WQF.*
Ipswich (IRC)—Last Wednesday in each month, 7.45pm, Gippeswyk Hall, August meeting ("Sideband", by G3YWM). The secretary is Mr P. J. Hubert, 575 Bramford Lane, Ipswich.
Lowestoft (LDARC)—Wednesdays and Fridays, YMCA, Park Road, Lowestoft. On Tuesdays a 2m station is usually in operation. *G3GNK.*
Norwich (NARC)—Mondays, 7.30pm, The Brickmakers, Sprowston Road, Norwich. The secretary is J. L. Lockwood, G3XLL, tel Norwich 48685.

REGION 17 **RR C. Sharpe, G2HIF**
Basingstoke (BARC)—Meetings on the first Saturday in each month for morse practice, listening on the air and an informal gathering. 21 August (Informal discussion on setting up a station), 7pm, Chineham House, Shakespeare Road, Popley, Basingstoke, Hants. *G3CBU.*
Fareham (FDARC)—1 August (Club night and natter evening), 8 August (Assembly and testing of VHF NFD equipment in clubroom), 15 August (Dummy run for VHF NFD), 22 August (Committee meeting, final planning for VHF NFD) 29 August (No meeting), 7pm, Porchester Community Centre, Fareham, Hants. Visitors to G3VEF are most welcome any Sunday evening. *G3XIV.*
Maidenhead (MDARC)—Informal meetings only on 2 and 17 August, also on 6 September, 7.30pm, Victory Hall, Cox Green Lane, Maidenhead, Berks. *G3VMR.*
N Berks (AERE, Harwell, ARC)—No meetings during August. The usual junk sales and informal lunchtime gathering every Friday. *G3NNG.*
Reading (RDARC)—3 August ("Doldrums evening", the club station on the air), 17 August (Prize constructional test—open to visitors), 31 August (VHF contest evening). All meetings at the clubroom at 7.45pm, The Victory Public House, The Meadway Precinct, Tilehurst, Reading, Berks. The club net is on the air on Tuesdays between meetings. G3ULT on 144·24MHz from 8.30pm. *G3NBU.*
Swindon (SDARC)—13 August (Savernake Forest Picnic at 7pm), 22 August (Mobile rally at Wroughton aerodrome from 1100 onward) Club meets at 7.30pm, Penhill Junior School, Penhill, Swindon. *G3JAP.*

MEMBERS' ADS

These advertisements are accepted free of charge as a service to members of RSGB. They must be submitted on the Members' Ads order form printed on the penultimate page of each issue of *Radio Communication*, or on a postcard similarly laid out. Each **must** be accompanied by a **recent** *Radio Communication* wrapper addressed to the advertiser, as proof of membership.

The closing date for each issue is the 7th 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 and should not be resubmitted.

Trade or business advertisements, even from members, will not be accepted for Members' Ads but should be submitted as classified or display advertisements in the usual way. The RSGB reserves the right to refuse advertisements, and accepts no responsibility for errors or omissions or for the quality of goods offered for sale.

Members are advised to enclose a stamped addressed envelope when replying to advertisements.

No correspondence concerning this free service can be entered into.

See the current order form for further details.

FOR SALE

KW201 rx, as new, comp with Q mult and xtal calib, £85. Todd, 52 Trevor Crescent, St James, Northampton. Tel N/ton 51928 evenings

Linear amp, prof built with aerial c/over relay, 600W pep and psu, 2000V 500mA, spare 813, £50. Pair of Selsyns, £3. G3RUN, QTHR. Tel Deal 4276.

Mains trnsfmr 6·3V, 22A, wght 14lb; choke 60H, 130mA, 12kV insulation, wght 15lb, £2ea. G3KSU, QTHR. Tel Ryde 5551.

Property of late G6MO: Cossor 1035 scope+hndbk, £15. BC221 with chart, wooden case, £12. CR100+spkr, £12. Multimeter 1000Ω /V, £3. TA12B, modified, £6. All ono, buyer coll. G3OZA, QTHR.

Aerial rotator, suitable for med or heavy beam (cnvtd prop pitch motor) comp with trnsfrmr, £6 ono or exch for 2m gear. Wright, 34 Webbs Way, Stoney Stanton, Leics. tel Sapcote 3404.

GEC miniscope, gd order, comp with case, leads, £6. Xtal calib, £3. Trnsfrmr, 2000-0-2000 500mA, £3. AM trnscvr, £8. Marconi TF1020A rf power meter, £5. G3SDK, 27 Norton Crescent, Towcester, Northants.

DL6SW cnvtr, 2m, 28-30MHz, i.f. case, £7 or exch 70cm cnvtr same i.f. G3XTQ QTHR.

Marconi CR150 rx, £20 ono. Comp set of spare valves for Hallicrafter S27 rx, offers pse. G8DUI QTHR, tel 01-644-9162.

SB300, comp all fltrs, SB400, bth in first class cond, + G2DAF linear 2X4CX250s, £280, buyer coll. G3JNX QTHR, tel Brixham 3142.

Muirhead bridge, £9. Avo valve tester, £21. Avo coil winder, £16. 'scope 1035, req attn, £7. All above with manuals. Clearance 'scope tubes, standard meters, units etc, approx £2 ea. Sae list. Meek, 39 Horsebrook Lane, Brewood, Staffs, tel Brewood 760.

AR88, full wkg order, insp and coll, £18. VF1U, £5. G3EAG QTHR, tel Frodsham 2417.

Brush Clevite ladder fltrs, types TL16D932A; TL6D11A; TL42E6OC; £4 ea. G3SNV QTHR.

Mags; *Bul/Radio Communication* 1964-69, *SWM* 1961-68, *Radio Constructor* 1961-66, Heath manuals HM15, GD1U, RF1U, 052, V-7AU *QST* 1962-67. Offers, bulk or as req + postage. Taylor, 220 Tarrant Drive, Wareham, Dorset BH20 4EP.

Free to school club or young amateur! Quantity of junk with useful comps and valves. First to coll must remove all. Haylock, G3ADZ, Bowyers, Steepmarsh, Petersfield, Hants, tel Liss 3314.

Galvanized tower, Heathkit model HT1G, £30. TA33 jr, £15. Both in exc cond. Douglas, 8, Beechwood Road, Camphill, Nuneaton, tel Chapel End 2830.

19 set trnscvr, needs attn, £2.50. 88 set, 4 channel vhf/p trnscvr, £5. Also 19 and 62 sets for spares, £2 or exch lot for 2m trnscvr. Tonkyn, Tydd St, Mary, Eling Hill, Eling, Totton.

HRO b/s coils, 80/40/20/10 with psu, gd cond, £20. Home-brew Top-band tx, psu, mod, all grey cab, £5. Pye dashmount Ranger, £5. G3MGY QTHR.

1155N rx, 160m, psu and 1s, £10. 160-10m tx, 80W, a.m./cw, 50W mod, ht psu, £15. 28MHz, 10W, xtal cntrld tx, £6. CCTV, 1in prof Vidicon, £6. RF26 10m cnvtr, £2. Leak amp TL12, £6, carr extra. Chicken, 21 Townsend Cresc, Kirkhill, Morpeth, Northumberland, tel Morpeth 3994.

Goodman Axiette 8in hi-fi spkr, 6W, 15Ω, brand new, £3 inc post G8CPG QTHR, tel 0742 363927.

Spring '71 callbook (new) with dx listings. Cost £3.50, will exch for 4th edn *Radio Communication Handbook* in gd cond, pref recent, or offers? Wanted: G3HSC comp course. Barker, 26 Elliott Drive, Inkersall, Stavely, nr Chesterfield, Derbys, tel Stavely 2796.

EA12, £150. Solartron CD115 lab scope, £70. Heath V-7AU VVM with 309-CU rf probe, £15. All above in exc cond, del free, part exch welcome. Wanted: manual for above scope. GW3UCJ QTHR, tel Briton Ferry 2376.

Panadaptor and wobbulator. Eddystone EP20, unmarked and to spec, £50 or why. Wanted: Heathkit SB-610. G3AAJ, 94 Herongate Road, London E.12, tel 01-989-6741.

14 AVQ, fb, £11 inc carr. GI3YDO QTHR, tel Randalstown 208 (business hours).

Geloso tx, G212 TR, 10-80m a.m., 60W with psu, perfect wkg order, size 22in by 11in by 11in, £10. GW8CCA, 19 Pantycelin Road, Llandough, Penarth, S. Wales, tel Cardiff 44838.

Cossor scope 1035 Mk3, exc cond, £20, 58 set, £3. TR1986, 15W tx/rx on 2m, £5, 15m 'G' whip, £1. KW2000A psu, 12V dc input, £25. G3TTV QTHR.

BC342 N, 24OV input, manual, £12 ono, buyer coll. G3MCA QT HR tel Orpington 28790.

Sommerkamp FTDX150 trnscvr with built-in mains and /M psu, exc cond, offers. GM3YRK QTHR, tel 041-942-2767.

Samson ETM-2 keyer, £15.50. GM3POK, 123 Moubray Grove, South Queensferry, W. Lothian.

TW 2m rx, best offer secures. G3LZN QTHR.

KW2000, ac and dc psus, Shure mic, £145. GPO 6ft rack with 6 unused chassis panels and dust covers, £6. Wanted: KW2000B and remote VFO-4B. G2FUU QTHR, tel Nazeing 2274.

2m cnvtr, BF180/40602, i.f., 26-28MHz, built on pc board, works well £4 post paid. Fitton, 29 Okus Grove, Swindon, Wilts.

Vol 4 of *Mullard Technical Handbook* (transistors, diodes, thyristors), 6 ring binders comp to April 1969 (last supplement), £2.50. Scollan, 50 Francis Way, Silver End, Essex.

19 set mk 3, gd wkg order, tatty psu to suit but comps ok. AE1/G2 rx, 3 units, 19in rack mounting 15-20kHz, 100-2,600kHz, 2·6-30MHz, metered psu and output stage, all matching units, offers? Marsh, 8 Cerise Road, Peckham, London SE15, tel 01-732 0668.

Linear amp, Sommerkamp FL1000, perfect cond, £50 ono. G3TDJ, 7 Glamorgan Road, Cheltenham, Glos, tel Cheltenham 26530.

AVO 8. little used, £12. G3AUB QTHR, tel Macclesfield 25910.

Wireless World Jan 1913-Dec 1950 (1920-1942 bound). Dale, 158 Lindley Moor Road, Huddersfield, Yorks, tel H'field 52453.

KW2000B tx/rx, used for few hours only, works, fitted 6146Bs, £175. Anglian 1000L linear plus 2 spare 4CX250Bs, £45. G3KDH QTHR, tel Tring 3505.

HW100, prof built, 6 mnths old, with ac psu and spkr, £130. G30LB QTHR tel Oldbury 4559.

Cannon ball ssb tx, new and unused, 80m, £22. Dx 40V with VF1U, £20, carr extra. G8WN QTHR.

Codar AT5 tx with control box and mint Codar T28 rx new and unused 160m whip and dc psu, all wkg cond, £40 ono, will separate, please ring w'ends. Mepham, 79 Woodland Drive, Hove 4, Sussex, tel Brighton 504088.

GEC BRT400E, matching spkr, spare valves, mint cond, 150kHz, 6 bands to 30MHz, built-in freq mr. Cost £245, selling £50 ono. G3JNY QTHR, tel Garforth 3058.

S27 VHF rx, 27-146MHz. Hamgear PM1 preselector, offers. MES batten holders, 3p ea, 34p per dozen. G3YQV QTHR, tel Brighton 735694.

Valves; V19, 866, 866 JR, TZ40, 805, 807, KT8, 12E1, PX4, FW4500, 954, 6AS6, and others. High speed relays, model OAP, test equipment, 6Hz 60 ABN wavemeter oscillator, cheap. G3DFS QTHR, tel 021-354 7769.

Plessey SL403A, £1.50, Motorola MC724P, 50p, standard coaxial plugs, 5p, Smiths 32-way edge connectors plug and socket, 50p, xtals 12004kHz, 49816·6kHz, 4500kHz. Roche, 66 Howard Road, Kings Heath, Birmingham B14 7PQ.

Lafayette rx HE30, 550kHz-30MHz, 4 bands and 7 bandspread, £19. HRO xtal filt unit, £2. Bargain comps sale for callers, xtals 9·48333 10·839286, 11·3625, 12.1625, 12·72214, 18·24375, 12·93333, 14·3625, 40p ea. G3VUT QTHR, tel 01 559 9300.

Minimitter rx, amateur bands in 3 units, 3·5-28MHz, hardly used, £25 ono. Class D No 1 mains input, £5. CTX4, 4m tx, £4.50. HW12. G6HG QTHR, tel 01-997 7495.

KW2000B, checked by KW, spotless, £180. Heathkit 'scope, 10-12U, prof built, little used, £35. Both items as new. G3YJI, 17 Meadowside, Walton on Thames, Surrey, tel W' on Thames 23228.

Vibroplex orig bug, £10. Joystick and type 4 tuner, £4. All as new. G8AXU, 5 Hitcham Road, Debenham, Stowmarket, Suffolk, tel Debenham 215.

CR100/7 rx, fully serviced and aligned, £17.50. Furze Hill VTVM 378B/2, £8. TF144G sig gen, 85kHz-25MHz, £17.50. Strobe unit, £10. RCA freq meter, 5Hz-50kHz, £25 carr extra. Homer, 32 Ironhill Lane, Crayford, Kent, tel Crayford 24625.

Xtals; HC6U, 16·0345, 16·0500, 16·070(4), 16·090(6), 16·202(3), 12·025, 12·0278, 12·030, 12·0375, 12·0492(4), 12·050, 12·05714, 12·067·85(3), 12·060(4), 12·0607, 12·1207, 12·120714, 75 p ea. G3DXI, 41 Sweet Briar, Welwyn Garden City, Herts.

Geiger counter, comp with probe carry handle, lead and a haversack for carrying the complete unit, exc cond. Sae or phone for info, first offer secures. Woollons, 12 Meadow Way Green, Letchworth, Herts tel Letchworth 5535.

FT DX 150 Sommerkamp trnscvr in full wkg order, /M or fixed station, £160 ono. G3IGP QTHR, tel Hatfield 65098.

Bird 50Ω dummy load, 30W continuous dc to 4GHz, max swr 1:1·4, perf cond, £8 inc postage. G8ANZ QTHR, tel Portishead 8289.

Heath HX20 sideband tx with HR20 companion rx, psu, mic and spkr, 5RV aerial, £85, G3HHZ QTHR,

R1155F rx, homebrew psu, earphones, ldspkr, hndbk, some spare valves, £12 ono. Will del up to 50 miles. Lodge, 24 Oakfield Road, Malvern Link, Worcs. Tel Malvern 4665.

Psu type 917-2·2kV at 60 mA, 600-450V at 500mA, 2x 5V at 3A, 4V at 2A, lp either 230V at 50Hz or 80V at 1,000Hz, £7.50 ono. G8BUO QTHR, (w/ends only).

Electroniques GC166/T, Eddystone 898 S meter, all on exc chassis, brand new, never used, £20 the lot. New 898 in maker's carton, sealed, £5. Bagley, 34 Oakcroft Avenue, Kirby Muxloe, Leicester LE9 9DG.

Grundig TK14L de-luxe tape recorder, £15 ono with xtal, stick mic and tape. G3MA, 40 Calton Road, Glos.

Koyo 8 waveband /P rx. Lw/mw, 1·6-22MHz in 3 bands. VHF 88-108/ 108-136/144-176MHz. Part exch Eddystone rx or sell for £30. G8CNV QTHR, tel Great Missenden 3405.

Heathkit SB301 with cw filtr, exc cond £100. KW Viceroy Mk 2, gd cond, £55. DAI electronic keyer, as new, £8. G3FXB, tel Brighton 593232.

Airmec wave analyser 853, like new, turret tuner, 30kHz-30MHz film strip dial meter, can be made into ham rx with little convn, re-valved, £20 inc carr UK. Hill, 19 Station Road, Tadcaster, Yorks, tel Tadcaster 2253.

This year's Heathkit HW30 2m trnscvr, 2 xtals and mic, exc cond, £18. 640kHz-30·5MHz Admiralty B40 rx with xtal calib, works well, £15. Insp and coll both. G3VPH QTHR, tel Droitwich 3089.

Katsumi speech compressor, £5. Sinclair IC10 amp, new, £2.50. Heathkit Mohican rx, 550kHz-30MHz bandspread amateur bands, cond as new, £20 all items, carr paid. G3MX, Zodiac House, Porthcurno, Penzance, Cornwall, tel St Buryan 331.

DX-100 with SB-10 adaptor and B40 rx, gd wkg cond, £75 comp or will split. G3YSO QTHR, tel Minehead 3343.

Xtals B7G, 1700, 2889, 6000, 7500, 7954·84, 8000, 8308·33, 8455, 8511, 8511·4, 9066·6, 40p ea or £1.75 the lot, post free. Mann, 45 Old School Lane, Milton, Cambridge.

Lafayette HA350 rx with calib and spkr, £50. KW Z match, mint, £10. KW 1pf BBC CH1 52Ω, Belling Lee sockets, £4. G3VMY QTHR, tel Twyford 5621 (w'ends).

Eddystone S.504 gen cov rx, £25, TW2 2m cnvtr, 4-6MHz i.f. with matching psu, £8. Buyer coll or carr extra. G3WHK, 279 Aragon Road, Morden, Surrey, tel 01 337 0117.

KW201 rx with xtal calib and Q mult, as new, £70 for quick sale. Todd, 52 Trevor Cresc, St James, Northampton NN55PF, tel N'hampton 51928, evng only.

Heathkit Mohican, £18. 2 and 5 chokes, 250mA oil filled, 75p. G3WZT, QTHR. Tel Partridge Green 565.

Valves 832, £1.50. QQV03-20A, £1.75. All + top cap connectors. CRT K1051P1 3in front, £2. Wanted: info on 46 set. Manuel, 1 Wilmington Avenue, Orpington, Kent, BR6 9BJ.

Lafayette KT-340 gen cov rx with bandspread on amateur bands, £20 carr pd. G3VRO, 20 Lorne Terrace, Sunderland, SR2 7BU.

Trio 9R59DE rx in vgc but less hndbk, £25 carr pd. Sherrard, 146 Irish Green Street, Limavady, Co Derry, N Ireland.

QRO linear, pair 4CX250Bs, 10, 15, 20m, gd cond, £40. 2m 90W tx, a.m., comp £10. G3VOF, 64 Station Road, Over, Cambridge. Tel Swavesey 588.

Brand new HC/6U xtals ± 10ppm: 8,010. 8,024, 8,048, 8,055, 7,806, 7,807, 7,814, 7,817, 7,828, 7,835, 7,856, 7,870, £1.40 ea, post inc. G3RZP, 37 High Street, Stanford-le-Hope, Essex. Tel Stanford-le-Hope 5664.

HE-50 comm rx, gd cond, 550kHz to 30MHz, £10 ono. G8ERO, Ashbank, Alexandra Road, Penrith, Cumberland.

Hallicrafters HT37 tx, 3·5-30MHz, 6146Bs in final, £70. Alternator, 500W Bosch, £12.50. CT53 sig gen, £5. AVO electronic test meter, £5. Model 7 AVO, £5. Labgear electronic fault tracer, £7.50. G5WG, QTHR. Tel 01-504 5499.

Oscilloscopes Cossor 1049 Mk 4 double beam, £22.50. Phillips GM3159, £12.50. EMI WM2, £10.50. Marconi valve voltmeter TF428, £2. Cooper, 45 Nightingale Crescent, Harmans Water, Bracknell, Berks. Tel Bracknell 4168.

Comps and gear: Lafayette tx HE30, £19. G2DAF tx, £40. Xtals 8·3444 (2); 8·9219 (4); 11·4125 (5); 13·6125 (2); 18·16825 (2); 18·24375 (2); 28·2375 (2); 28·3875 (2), 40p ea inc post. No lists, callers only. G3VUI, QTHR. Tel 01-550 9300.

Heathkit DX100 with SB10 sideband adaptor, 160 m, low power conversion, £60. Magnificent KW77 xtal cntrld hamband rx, £65. Heathkit 80m HW12A + dc psu, £65. All ono and in exc cond. G3VUW, QTHR, or contact G3SEL, Summerleaze Park School, Yeovil. Tel West Coker 712.

Lafayette HA350 rx, £45. KW Vanguard tx, £25. Both 160-10m in exc cond with hndbks etc. G3TTZ, QTHR. Tel 0272 73204.

Pye base for 2m, another for 4m. Pye Cambridge 6 channel low band. Murphy 5 channel hi band. Pye Ranger. Hi band transistor psu. Wanted: G2DAF tx or exch G2DAF rx for trnscvr, cash adjustment, offers for vhf equip. G3WR, 17 Tongdean Rise, Brighton.

Trio 9R59DE rx, £34. G & D "Falcon" 2m tx, 15W ac + dc psus, £24. EMSAC CN1 2m conv, i.f. 28-30MHz, £6. G3ZJF, 14 Martin Close, Windsor. Tel Windsor 68364.

Eddystone EC10 Mk 1, as new, £45. G3KEP, QTHR. Tel Bingley 3699.

Trio TS510 + psu, 6mths old, almost unused and absolutely mint cond, manufacturers packing, £128 carr pd. GM3NIG, QTHR. Tel 041-638 6766.

Eddystone 840C rx, req a gd home, £25. Cordingley, Oscar, Dorian Grove, Alresford, Hants.

Heathkit SB301E with all filtrs, £140 ono. Eddystone 940, £110 ono. Both in exc cond (Heathkit is nearly new). Cliffe, The Willows, Kings Bromley, Burton on Trent, Staffs. Tel Yoxall 241 (evenings).

Class D wavemeter, comp with charts and manual, built in psu, 250/12V ac dc. Offers. G300Q, QTHR. Tel Stratford on Avon 3190.

New boxed 12AVQ vertical aerial, £12.50. 4 xtals: FT241, 2X451·1, 2X453·1, not surplus, £2. KW low pass filtr, 75Ω, £3. Pref buyer coll. G3JDN, 2 Castle Drive, Reigate, Surrey.

Swan 500C trnscvr, 1st class cond, comp with Shure 444T mic, £250. G3ZKS, QTHR. Tel York 25798.

Small motor generators, 18V in 150V 100mA out, also 16V in 170V 90mA out, 20p ea. Ceramic coil formers EX-TU units 5in by 2in, 20p. 14 day clock timeswitch, 240V 10A, £1, post extra. Jones, 24 Walters Road, Llanelli, S. Wales.

Property of late G3YNZ: KW2000A, ac psu, Shure mic, trap dipole/balun/feeder, several spare 614Bs, overhauled KW recently, £150. M & G trnscvr, 160, 80, 20m, 6146B + spare, overhauled, £45. Universal Z match atu, £7. KW swr bridge, £5. No 10 calibrator, £4. Six vols electronic/radio course, £3. Quantity of *Rad Coms* and misc books, £1.25. Postage at cost. Sae with enquiries. G3TJY, "Little Russel", Lytchett Minster, Poole, Dorset. Tel 020-122 2142.

WANTED

Silence cover and base for Creed 7B teleprinter, will coll in London area. G8DDW, 95 Vanbrugh Hill, East Greenwich, SE10. Tel 01-858 3921.

Mohican in gd clean cond, will exch Eddystone 840C in mint cond. G8CEW, QTHR. Tel Littlehampton 5313.

S-meter for AR88, new or used, also 80m input coil and both tuning dials for AR88LF. Chisholm, 17-341 Westwood Drive, Winnipeg 22, Manitoba.

Mains psu for SR52T/R (not remote recr). Mains psu for SCR211 wavemeter. ATP 35 valve for 12 set. Webbing for CPRC 26. Info on MR 431 uhf t/r (Murphy, version of A43 Mk 1). Can possibly coll. Capt Buckley, 62 Ballards Way, South Croydon, CR2 7JN. Tel 01-657 4778.

KW trnscvr and accessories, ac psu for HRO. G4GJ, QTHR. Tel Bingley 2965.

FL8 audio filtr, HW12A, must be gd, exch homebrew 500W lin amp, psu 10–80m, fan, etc, or sell. Write det. GM3BQA, QTHR. Tel North Berwick 2519.

HRO bandspread coils for 80, 40, 15, 10m. Also O9J or O9D crt, must be in gd cond. Battersby, 20 Barrow Road, Cambridge. Tel Cambridge 63799.

TF144G, must be fully serviceable. G6QI, QTHR. Tel 01-284 3106.

Radio Communication Dec 1970, fair price paid. Cruickshank, 401 33rd Avenue, SW, Calgary 6, Alberta, Canada.

Bromsgrove ARC wishes to purchase at reasonable prices test apparatus, large soldering iron for club shack, gd cond pse. Sae to J. K. Harvey or tel Bromsgrove 76941.

Telescopic mast in gd cond, max height 35ft, minimum price £2, pse send details + sae. Also any unwanted radio mags eg *Practical Wireless, Wireless World, Radio Communication, QST, SWM*, etc. Wilson, 29 Tomatin Road, Hilton, Inverness, Scotland.

Collaro record deck type RC34. Rush, 77 Maryland Way, Sunbury on Thames. Tel 82262.

"Anglian" trnscvr + 455kHz xtal cw filtr. GC3XZC, QTHR. Tel 0534 24973.

Mullard DH3–91 1in crt. Must be in wkg order, if poss with MU-screen. Richardson, 4 Belgrave Road, Branksome Park, Poole, Dorset.

Buy or borrow circs and instrctns PTR 161F and TR1998 tx/rx. G3EIY QTHR, tel 0242 56716.

Recently formed school ARS would appreciate any free or cheap gear, 'junk' gratefully accptd. Normanton Grammar School ARS, c/o D. I. Lockwood, Sharlston Common, Wakefield, Yorks, Tel Crofton 458 (evngs).

Hallicrafter S27C vhf rx or similar in gd cond. Offers only consd if within 50 miles of Southampton. Phillips, 9 Furze Croft, New Milton, Hants, BH25 6NH, tel New Milton 615007.

DC psu for Yaesu FT200 or Sommerkamp FT250, also /M aerial. G3YHK QTHR.

4X150A valves, bases, chimneys, anything consd. G3WTA QTHR. Tel Morpeth (0670) 2541.

Eddystone 750 rx, any rsnble price paid. G8AVP QTHR.

Info concerning OC 'scope without type No, made by Testgear (Acton) Ltd, 3in tube type. Hingley, 4 Elmdale, Woodbury Road, Halesowen, Worcs.

Previous year's RAE exam papers, May/Dec pse. Payne, 159 Micklefield Road, High Wycombe, Bucks.

Radio News and other mags prior to 1944. E. H. Scott philharmonic rx, 1938-40 era, catalogues or manuals, state price and cond. McNeill, VE5RX, Box 472, Yorkton, Sask, Canada.

Buy or borrow to copy hndbk or any details of oscillator test no 1, nn CT212. Will refund all expenses, any help appreciated. G3SME QTHR. Tel St Neots 2513.

Eddystone S meter, Eddystone Vernier s/m dial, cat 843. Eddystone full-vision dial, cat 598. G3RAZ QTHR.

Radio and radar equip, vintage World War 2, for private collection, any cond consd, also info on rx type R1626. Ellison, 84 Duke Street, Windsor, Berks, tel Windsor 69015.

Base insulator for 7–8in diam pole from ex-gov aerial kit, state price. G3XZK, 1 Miserden Road, Cheltenham, Glos. Tel Ch'ham 59528.

Swop 4CX250F for 4CX250B. Offer for 4 PL500 + bases, also 240V –115 auto tx, 6A torroid wound. G3KPW, QTHR.

Info on B40 rx hndbk, mods and spares. Cw tx (eg DX40) cheap price pse. G3ZRD, 30 Merlin Grove, Beckenham, Kent. Tel 01 650 7801.

80m ssb /M equipment, tx/rx or trnscvr considered. G3XKV, 15 Avenue Road, Brentford, Middlesex.

Collins TCS tx, control box and mains psu. Pref unmodified, will pay carr or coll. Wooster, 123 Knights Road, Hoo, Rochester, Kent.

Vhf rx, eg Eddystone 990R or sim, to give gd gen cov of vhf bands 30–200MHz approx. G3YHC, QTHR. Tel Plumtree 3708.

FT241A xtal, CH24·4 or CH24·5. G3ZYW, 111 Penn Lea Road, Bath, Somerset. Tel 0225 23562.

Raysistors QTY 4, type CK1121, Pye part No PL23054 or name of manufacturer. G3MWV, QTHR. Tel Cromer, Norfolk, 2872.

2m convtr with i.f. of 6–4MHz, will pay up to £7. Also buy or borrow alignment details and hndbk for R107. Hubbard, 60 Mill Road, Billericay, Essex. Tel Billericay 3935.

Freq meter TS-175/U req with correct charts 85–1,000MHz. State details and price, can arrange coll in UK. EI2W, 23 Rathgar Road, Dublin 6. Tel Dublin 977879.

Heathkit /M psu HP–13A, cond not imptnt. GW3HAW, QTHR. Tel Barry 2133.

Eddystone 640, need not be immac if wkg, will coll within 75 miles radius Manchester. G2CST, The Ashes, Glossop, Derbyshire.

Schoolboy req AR88 or sim rx, about £20. Dickinson, 74 Boothferry Road, Hessle, Yorks. Tel Hull 641854.

HB166T, Electroniques front-end valve version will do. Also part finished G2DAF rx and MF455–15K Kokusai filt, state price. Price, 14A Eastgrove Avenue, Sharples, Bolton, Lancs. Tel Bolton 54351 (evenings).

RA17L, AR8516L, Collins 51J3/4 or similar high qual gen cov rx. B40 model D TCS rx, pref in orig cond, TW2 tx, all must be in 1st class cond. G3GUU QTHR.

Urgently req, valved 70cm tx eqpmnt, any gear in any cond consd. GW8EQH, Glendale, Mount Pleasant, Drury, Buckley, Flints, CH7 3ET.

Borrow or buy manual for R1475 set. Pay 30p + postage for Jan 1970 *Wireless World*. G8DAF, QTHR. Tel 040 22 23893.

Valve scan coils, type 7A/B955, for EMI mark 6 camera (1in videcon.) Other types of valve scan coils consd. G8AWN QTHR.

Coaxial rdctn drive for R107 mk 1/1 rx, your price paid if cond gd and suitable. Woollons, 12 Meadow Way, Letchworth, Herts. Tel Letchworth 5535.

HRO bandspread coils 160–10m, gen cov coils also welcome. Grainger, 1576 Pershore Rd, Stirchley, Birmingham B302NH. Tel 021 433 4748.

Eddystone 898 dial, tuning capacitor 250pF 3 or 4 gang. Xtal 31·25–31·32MHz. G8DML QTHR. Tel Seascale 512.

Codar T28 and impedance bridge, selling Tavasu whip, base 80, 40, 20, 15m coils, £7. Buyer coll. G3RFG QTHR.

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With 28-30MHz IIF. **£10.37**

6 METRE converter panel ready aligned, less crystal. **£6.25** inc. postage world wide S.M. & ins.

GAREX 70CM CONVERTER
2N708-2N708-2N3478-GM0290-GM0290. Post 20p **£14.87**
Size 4¼ × 3¼ × 2in, diecast box IF 28-30 MHz.

Prices include delivery UK unless otherwise stated.

GAREX ELECTRONICS **G3MMJ**
CHINNOR, OXON. **'Phone Day or Evenings Kingston Blount—51476 (0844)** **OX9 4BT**
Please note new STD number.

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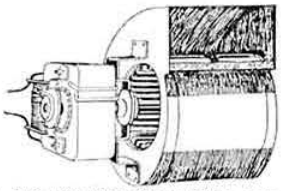
FOR SALE



BLOWERS. 240 volt AC shaded pole "Mycalex" motor, continuous rated very silent. Double air intake, single output of about 45 C.F.M. overall size 4¼" x 4¼" x 5¼". Ideal for cooling equipment, etc. Brand new. Our price owing to large purchase, **£2.25**, post **25p**, 2 for **£4.25**, post, **35p.**

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40 ASSORTED CRYSTALS including FT243 and 241A types, **£1.00**, post and packing, **25p.**

R.F. METERS. 2" round, in following range 250—350, 500 MA and 1 amp, **62p** each, post **10p.** 4 Meters for **£2.20**, post and packing, **27p.**

OSCILLATOR UNIT No 704 for R1933A receiver. 3 valves EF91, 7 miniature wire ended crystals, 2 ceramic yaxley switches, microswitch, variable condenser about 17PF, with slow motion dial, 2½" centre zero meter, 50 micro amps, cons res, plugs, sockets. In Aluminium case. Brand new with circuit diagram, **£1.50**, post, **35p.**

CATALOGUE No 18, **23p** post free.

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INTERNATIONAL TRANSISTOR DATA MANUAL now available from the publishers. See advertisement on page 573.

QSL CARDS. GPO approved log books, prompt delivery. Samples SAE Atkinson Bros., Printers, Looe, Cornwall, PL13-ILA.

QSL CARDS: for TX G8 SWL One to four colour designs. SAE for samples. Good selection. Pennington, 100 Ryden Ave., Leyland, Lancs. PR5 2ZL.

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Relays, Sealed, Co-Ax, Cooking, etc. Contactors, Timers, Thermal Delays. Potentiometers. Carbon and Wirewound from 5 ohm to 1 Megohm including some precision jobs. Grade 1 Carbon-film Resistors 1, 2, and 5%-1/2 to 3 watt practically full range over 10K in value. STC Silicon Avalanche Rectifiers 800 V 4 A. 25p each, etc., etc.

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9R59DE excellent order less handbook £25. G Whip Tri-bander 10, 15 and 20m with basemount £7. HP13A DC PSU £28. Last two items new and unused. Carriage paid.—R. T. Sherrard, 146 Irish Green St., Limavady, Co. Derry, N. Ireland.

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The **MSK—4** is **UNIQUE!!**

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- DOT INSERTION
- DOT MEMORY

for only **£25**

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HEATHKIT HX20 5-band SSB transmitter, matching HR20 receiver, HP20 power supply, microphone, aerial, loudspeaker, cables and handbooks. A complete SSB/CW station, seen working. 90 watts PEP. £75. G3HHZ.

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Required by the Posts and Telecommunications Department to be responsible for the implementation of the planning, the installation and maintenance of all telecommunications facilities, the control of stores and the technical training of local staff.

Candidates should possess the City and Guilds Full Technological Certificate (Telecoms.) or H.N.C. They should have at least 10 years relevant experience in the provisioning, installation and maintenance of HF, MF, and VHF communications installations in the AM, CW and SSB modes; both valve type and transistorised solid state radio beacons; radio teleprinter using both tone on/off and two tone keying; multi channel VHF equipment and manual CB telephone exchanges.

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Required by the Meteorological Department for the installation, operation and maintenance of their radio telecommunications, radio sounding and radar equipment.

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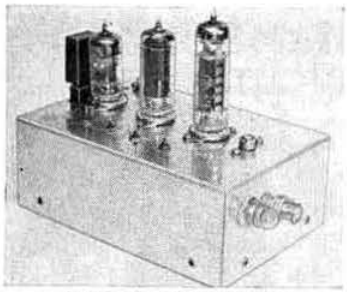

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THE 4MH 2 METRE TX

15 watts Input. XTAL Supplied.

Immediate delivery.

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Constructed from a simple, trouble free, effective circuit, using obtainable valves ECC81, 6CH6, QQV03/10. Each unit is air tested and requires 250V DC, modulated to PA. and 250V DC to supply the osc and multiplier. Size 6 × 4 × 2½.

Send SAE for further details to the

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PORTABLE PETROL ELECTRIC GENERATORS

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C.W.O. for IMMEDIATE DESPATCH. All equipment is new and GUARANTEED and CARRIAGE PAID U.K.

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Tavasu 100" whip with base	£2.88	Tavasu 160 metre Resonator	£2.75
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Tavasu packaged deal consisting of one of each of the items listed £13.75, plus 37p postage and packing.

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Several items of used equipment in stock too numerous to list.

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H.P. Terms available *Part exchanges*

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WANTED

WANTED: CRTs for magnetic deflection with a long afterglow screen (RADAR Surplus VCR-516 or similar).—W.-German Radio Amateur Wolf, DJ 4 WS, 44 Muenster, Postbox 1320.

WANTED: Public Address horn speakers. Will collect.—Ring Bob, Wakefield 55587, After 6.0pm.

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PROTOTYPE or short run turning/milling etc., and sheet metal work capacity available.—C. G. James Electronics (G3VVB), Staines Road, Feltham, Middx. 01-570 3127.

ELECTRONIC ASSEMBLIES. Prototypes, short and long runs undertaken. Reasonable rates. Elcon Assemblies. (G3XYD). 33 Douglas Avenue, Watford, Herts. Watford 43516.

MISCELLANEOUS

STAY AT THE CORNWALL HAM-RADIO HOLIDAY CENTRE. Self catering furnished accommodation. 6 element beam. 65ft tower. 90 awards. Full details G3XBR St. Tudy, Bodmin, Cornwall.

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G3JMG thanks all past customers for their support but regrets it was insufficient to maintain the service which is now closed.

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GOOD STOCKS OF TRIO, KW, YAESU, ETC.

Wightraps, pair	£2.50	Egg insulators	3p
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RCA IC manual	£1.30	Transistor/Valve data	40p
Chokes 50m/a 10H	15p	Halson mobile whip	£7.50
Mag. binders, SWM/Bull.	75p	Extra coils for Halson	£4.40
RCA valve (RX), manual	£1.25	RCA valve (TX), manual	£1.00

We are looking for good used communications receivers for cash. Holidays this year: 16th August to 3rd September.

28 HILLCREST AVENUE SCARBOROUGH YORKSHIRE

SHOWROOM: 5 COLUMBUS RAVINE, SCARBOROUGH

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New items include:—

LAFAYETTE HA 800 Amateur Bands receiver. 12V DC and mains powered **£57.50** post paid

Mains powered DC Stabilized PSU. Outputs 3V, 6V, 9V, 12V, and 1A max. Very nice job. **£7.50.** Post and packing 25p.

S/H items include:—

AR88 in good condition, with modern case, looks very smart. **£52.50** Post paid

CR100 in good condition. **£22.50** Post paid

KW E-Zee Match with S/M drive. **£11.50** P & P 30p

DAWE Transistor Millivoltmeter. **£20.00** P & P 50p

We still have some invertors as described last month. **£15.00** Post paid

S.A.E. for LISTS.

32, Feltham Hill Road, Ashford, Middlesex.

Tele: ASHford 55265.

THE SENATOR CRYSTAL BANK

G3UGY **CRYSTALS FROM STOCK AT KEEN PRICES** **Phone 01-769 1639**

SENATOR CRYSTALS proven record shows them to be the field-leaders in the art of catering for crystal requirements. Upon review, it becomes fairly obvious why this should be. At SENATOR, prior to despatch, every crystal is tested on internationally approved test-sets in conjunction with frequency counters, thereby eliminating error and assuring that every crystal unit is despatched in perfect working order.

55,000 BRAND NEW, modern crystals under our control and actually in our own stock-rooms, is sufficient reason for our customers, who range from amateurs to the Post Office, government departments, universities and leading electronics manufacturers, to order from SENATOR time and time again, particularly when they need crystals in a hurry.

Here are just a few of the popular frequencies actually in STOCK now:

100kHz in HC11/U	£2.50	26·500MHz in HC18/U*	£1.60
1·00MHz in HC6/U	£1.75	30·000MHz in HC6/U	£1.60
2·000MHz in HC6/U	£1.50	32·500MHz in HC18/U*	£1.60
3·500MHz in HC6/U	£1.75	34·000MHz in HC18/U*	£1.60
5·000MHz in HC25/U*	£1.50	34·500MHz in HC18/U*	£1.60
7·000MHz in HC6/U	£1.50	35·000MHz in HC18/U*	£1.75
9·000MHz in HC6/U	£1.50	35·500MHz in HC18/U*	£1.75
10·000MHz in HC6/U	£1.50	38·666MHz in HC18/U*	£1.35
11.000MHz in HC6/U	£1.50	40·000MHz in HC18/U*	£1.60
19·500MHz in HC6/U	£1.60	70·000MHz in HC18/U*	£2
24·500MHz in HC18/U*	£1.60	71·000MHz in HC18/U*	£2
25·000MHz in HC6/U	£1.60		

* = *Also available in HC6/U.*

And here's our STOCK range of BRAND NEW HC6/U 8MHz for 2M:

8·007 8·012 8·018 8·021 8·032 8·041 8·043 8·047 8·048 8·0555 8·058 8·061 8·070 8·081 8·092 8·100 8·104 8·107

ALL at £1.25 each, post free. These crystals will pull well if used in a VXO.

Here are some popular frequencies for VHF, home station, mobile channels and R.A.E.N., ALL IN STOCK:

8·0555MHz in HC6/U for TX x 18 to 145·000MHz 2M Mobile Channel .. £1.25

44·7666MHz in HC6/U for RX × 3 + 10·7MHz to 145·000MHz 2M Mobile Channel .. £1.80

8·100MHz in HC6/U for TX × 18 to 145·800MHz 2M RAEN Channel .. £1.25

45·0333MHz in HC6/U for RX × 3 + 10·7MHz to 145·800MHz 2M RAEN Channel .. £1.80

12·975MHz in HC6/U for RX × 12 — 10·7MHz to 145·000MHz 2M Mobile Channel .. £1.60

11·1916MHz in HC6/U for RX × 12 + 10·7MHz to 145·000MHz 2M Mobile Channel .. £1.50

12·0833MHz in HC6/U for TX × 12 to 145·000MHz 2M Mobile Channel .. £1.60

8·7825MHz in HC6/U for TX × 8 to 70·260MHz 4M Mobile Channel .. £1.60

You'll find the above frequencies may be suitable for your PYE Cambridge, Ranger, Vanguard and other makes of ex-commercial R/T gear for the now popular and well-used mobile call channels. Check up with crystal multiplication data in equipment manuals for suitability.

For 10M walkie-talkies with I.F. of 455kHz to transceive on 28·500MHz, we have in STOCK 28·500MHz (TX) and 28·045MHz (RX), at £1.60 each.

AVAILABLE SOON:

6746·667kHz for PYE Ranger to receive on 70·260MHz (4M Mobile Call Channel).

11·710MHz for transmitters multiplying × 6 to 70·260MHz.

72·500MHz for × 2 to 145·000MHz (useful for walkie-talkie projects, etc.).

CLUB and other GROUP projects: If your club or group is contemplating a constructional project requiring crystals, we can offer real keen prices for quantity orders.

Also, 200kHz, 500kHz, 8797·190kHz for R.A.E.N., most crystals for G2DAF and other designs, and crystals for every amateur band always in stock. There are so many 1,000's more useful frequencies in the Bank that to list them all would take too long.

Why not telephone or write your enquiry to us? Experience proves that we are sure to have something very close to—if not spot-on—the frequency you require from 50kHz thru 132MHz in stock.

When telephoning, you can be assured of a speedy answer to your enquiry. All our stock is recorded (no computers—just hard-working staff).

Should you require crystals made to order—no problem. We can supply as follows: (PLEASE NOTE however, our crystals can only be as accurate asy our specification)

3rd, 5th and 7th OVERTONE to an adjustment tolerance of ±0·005% will hold 50ppm from −20 to +70 deg. C). Available in HC6/U, 18/U and 25/U:

175MHz to 200·0MHz	£12.00	60MHz to 109·9MHz	£3.25
140MHz to 174·9MHz	£8.75	17MHz to 59·9MHz	£2.50
110MHz to 139·9MHz	£7.00		

FUNDAMENTAL MODE to an adjustment tolerance of ±0·005% available in HC6/U, 18/U and 25/U:

11·5MHz to 20·00MHz	£2.50	4·0MHz to 11·49MHz	£2.50

The following in HC6/U only ±0·005% tolerance:

1·4MHz to 3·9MHz	£3.00	1·0MHz to 1·39MHz	£3.20

The following to ±0·01% tolerance:

500kHz to 999kHz in HC1/U ..	£4.50	150kHz to 449kHz in HC6/U ..	£3.85
450kHz to 500kHz in HC6/U ..	£3.50	50kHz to 149kHz in HC13/U ..	£4.60

Below 50kHz and to closer tolerances, by quote.

Types available: Flexural Mode; NT Elements; J Plate; Duplex Elements.

SENATOR can supply crystal units to British and U.S.A. Defence specs.

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R.T.& I. offer the finest selection of first-class new and fully overhauled second-hand communications and electronics equipment in the U.K.

- *Constantly changing stocks of a vast range of equipment.*
- *Cash or Hire Purchase terms easily arranged.*
- *Part exchanges welcomed.*
- *We are 'spot cash' buyers for almost all electronic equipment.*

Send S.A.E for our latest list of over 50 receivers and many other interesting items.

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Ashville Old Hall, Ashville Road, London E.11 *Tel: 01-539 4986*

GM2FHH **L. HARDIE** GM3BCL

542 George Street
Tel. Aberdeen 20113.

Eddystone EA12 ...	£205.00	Trio 9R59DS ...	£42.50
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Eddystone 924 PSU ...	£7.75	Trio TS510	£180.00
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Stockist for Eagle, Jackson, Joysticks, KW, Shure, etc. RSGB Publications. SAE all enquiries please.

Please Use the Classified Advertisement order form from a previous issue.

MEMBERS' ADS

ORDER FORM

Please type or print in block letters

Tick classification

For Sale ☐

Wanted ☐

Callsign

or Name and address

Telephone number

QTHR

Date..... *Signed*..... *Callsign, BRS or A No*.....

The number of words in each advertisement must not exceed 32 not including name and address or callsign and QTHR or telephone number. Four pages of each issue are allocated to Members' Ads at present, and in order to include as many advertisements as possible licensed members are requested to give their callsign and QTHR instead of their name and address. (QTHR means: "My address in the current call book is correct"). Also to conserve space, please keep advertisements as brief as possible. They will be edited to conform to a set style of abbreviations, so it is unnecessary to submit them in abbreviated form.

Conditions under which Members' Ads are accepted are published on the first Members' Ads page of each issue. Do not forget to enclose a wrapper as proof of membership.

POST TO MEMBERS' ADS, RADIO COMMUNICATION, 35 DOUGHTY STREET, LONDON WC1N 2AE

INDEX TO ADVERTISERS

Radio Society of Great Britain

FOUNDED 1913
INCORPORATED 1926

PATRON H.R.H. THE PRINCE PHILIP
DUKE OF EDINBURGH, KG

APPLICATION FOR CORPORATE* OR ASSOCIATE* MEMBERSHIP

RADIO SOCIETY OF GREAT BRITAIN,
35 DOUGHTY STREET,
LONDON WC1N 2AE
Tel 01-837 8688
Giro A/C No 533 5256

* I hereby apply for election as a Corporate Member of the Society and enclose a remittance for £4 being the amount of my first annual subscription.

* Being under 21 years of age and not holding a current Amateur Radio Transmitting Licence I hereby apply for election as a Non-Corporate (Associate) Member of the Society and enclose herewith a remittance of £2 being the amount of my first annual subscription.

I, the undersigned, agree that in the event of my election to Membership of the Radio Society of Great Britain, I will be governed by the Memorandum and Articles of Association of the Society and the rules and regulations thereof as they now are or as they may hereafter be altered; and that I will advance the objects of the Society as far as may be in my power; providing that whenever I shall signify in writing to the Society addressed to the Secretary that I am desirous of withdrawing from the Society I shall at the end of one year thereafter after the payment of any arrears which may be due by me at that period be free from my undertaking to contribute to the assets of the Society in accordance with Clause 8 of the Memorandum of Association of the Society.

Date _____ Signed _____

PERSONAL DETAILS TO BE COMPLETED BY APPLICANT

SURNAME (BLOCK LETTERS) _____

CHRISTIAN NAMES (IN FULL, BLOCK LETTERS) _____

ADDRESS FOR ALL CORRESPONDENCE (BLOCK LETTERS) _____

_____

NATIONALITY _____ *AGE (IF UNDER 21)* _____

CURRENT CALLSIGN (IF ANY) _____

DETAILS OF PREVIOUS MEMBERSHIP (IF ANY) _____

DETAILS TO BE COMPLETED BY THE PROPOSER†

I WISH TO PROPOSE _____ *FOR *CORPORATE/*ASSOCIATE MEMBERSHIP*

PROPOSER'S NAME (BLOCK LETTERS) _____

ADDRESS (BLOCK LETTERS) _____

CALLSIGN (OR BRS NO.) _____

SIGNED _____

* Please delete where inapplicable.
† If the applicant is not acquainted with a Corporate Member willing to propose him for election he may submit a suitable reference in writing as to his interest in Amateur Radio.

The first subscription should be enclosed with this application to avoid delay.

FOR OFFICE USE ONLY

APPROVED BY COUNCIL _____ *BRS OR A No. ISSUED* _____ *FIRST SUB. PAID* _____

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RSGB Amateur Radio Call Book, 1971	52p
Radio Amateurs' Examination Manual	31p
Radio Communication Handbook (4th ed.)	£3·15
postage	35p *extra*
Radio Data Reference Book *(out of print)*	
SSB Equipment	19p
Service Valve and Semiconductor Equivalents	29p
VHF/UHF Manual (2nd ed.)	£1·80
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73

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