DECEMBER 1973

RADIO COMMUNICATION

1973 LEICESTER EXHIBITION

Right: the RSGB bookstall attracted a steady flow of visitors.

Below, l to r: the talk-in station operated by Leicester Radio Society; R. F. Stevens, G2BVN, and Skip Tenney of *Ham Radio Magazine* with a pre-publication specimen of the *Teleprinter Handbook;* G. R. Jessop, Executive Vice-President of RSGB, examines a copy of *Ham Notebook*

RSGB Diamond Jubilee Year

1913 – 1973

Journal of the Radio Society of Great Britain

DECEMBER 1973

RADIO COMMUNICATION

Volume 49 No 12 Price 40p

CONTENTS

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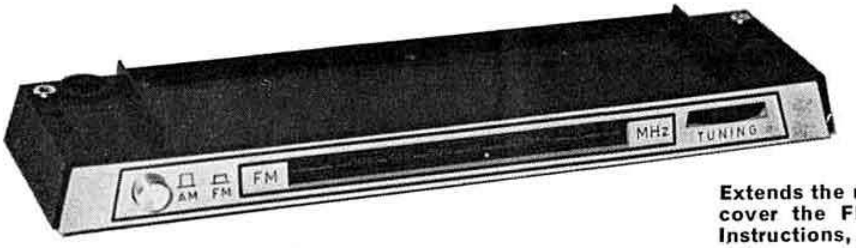

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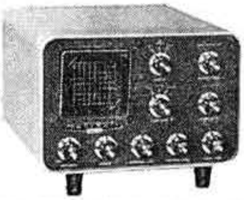

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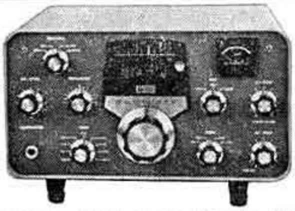

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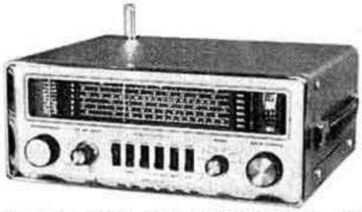

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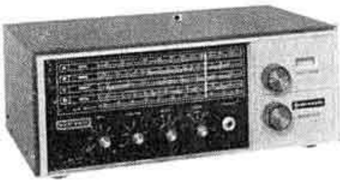

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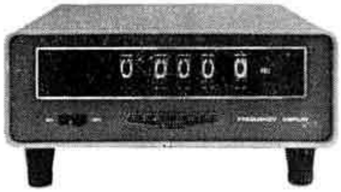

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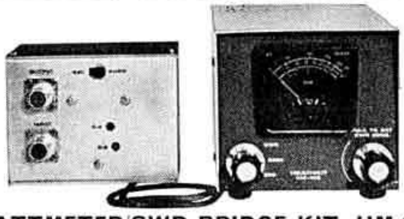

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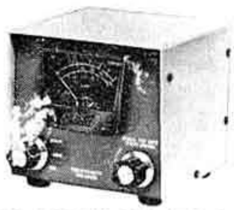

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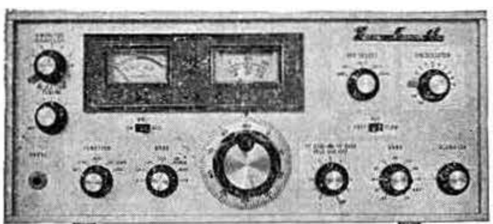
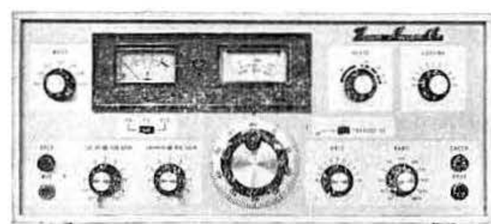


FR400



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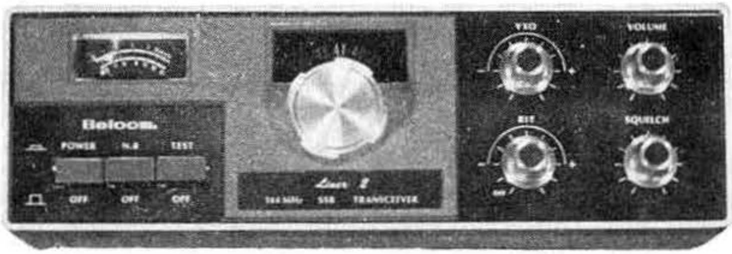

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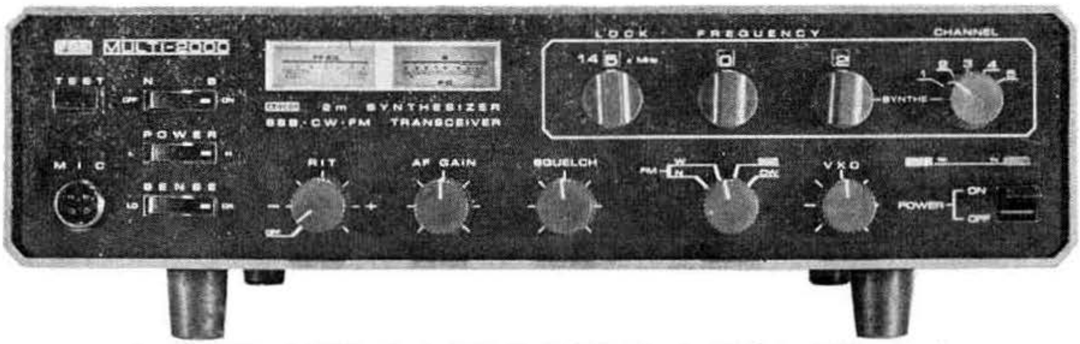

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A Seasonal Message From The President

It is a pleasure for me once again to have the opportunity as President of addressing a Christmas message to members of the Society. Our Diamond Jubilee Year will soon be coming to an end: it has given us pause to reflect on the amateur achievements of the past and I believe we were right to concentrate our celebrations in the regions, for it is locally where the real strength of the Society lies. But we must now look forward to maintaining the viability of amateur radio in the future.

We may find the times ahead more difficult than the past, but that should be a spur to greater vigour and not a cause for despondency. We have no indisputable right to our frequency allocations and it is our duty to justify our use of increasingly valuable spectrum space. That we can do this, given the will, I have no doubt.

I therefore confidently extend my best wishes for Christmas and the New Year to all members of the Society.

J. A. Saxton

QTC AMATEUR RADIO NEWS

Licence news

The Ministry of Posts and Telecommunications advises that the following numbers of amateur licences were in force at 30 September 1973:

Class A	14,866	Class B/M	1,117
Class B	4,272	Television	253
Class A/M	3,059		

The latest callsigns in the G4 and G8 series at 9 November 1973 were G4COY and G8IDU.

Referring to the information given on page 680 of the October issue of *Radio Communication*, the Danish administration has confirmed that it will normally accept a copy of the British licence if it is certified by the amateur himself. There is, therefore, no requirement for the completed application forms to be sent to the MPT for onward transmission.

The period for which UK reciprocal licences (G5AAA series) are issued has now been increased to six months from the previous period of three months.

In July 1973 the number of amateur radio licences in the Federal Republic of Germany for the first time exceeded 20,000. The total of 20,068 includes 4,463 vhf only licences, 15,600 all band licences, 553 club stations and 874 alien licences (286 civilians and 588 military personnel).

RSGB lecture

The Faraday Room at the Institution of Electrical Engineers was completely full for the lecture by Mr Leslie Moxon, G6XN, on 8 November, entitled *Aerial facts and fallacies*.

The speaker dealt with many types of aerial used by amateur radio operators, describing the factors that affect performance, and went on to destroy many of the fallacies which by constant repetition had come to be accepted as facts. Mr Moxon showed that there is no universal height at which a triband beam will give maximum performance, and gave considerable attention to the G6CJ modification of the frequently-used Zepp feeder.

The lecture, which was illustrated by many slides, was enthusiastically received by the large number of members and friends present.

GB3GEC

The 70cm beacon GB3GEC, located at the works of the M-O Valve Co Ltd, has not been operational for a considerable period and we are sorry to advise members that it is not to be reactivated.

Our thanks are extended to the M-O Valve Co Ltd for having made this facility available to 70cm band enthusiasts in the past.

"Radio probing of the atmosphere"

This is the title of the ninth Appleton Lecture which will be given by Dr J. A. Saxton, director of the Appleton Laboratory (formerly the Radio and Space Research Station) and this year's President of RSGB, at the Institution of Electrical Engineers, 2 Savoy Place, London WC2, on 3 January 1974. The lecture, commencing at 5.30pm, will be preceded by tea at 5pm.

Installation of President 1974

Mr G. R. Jessop, CEng, MIERE, G6JP, will be installed as the fortieth President of the Society during the course of a social evening on

Friday 4 January 1974

at the

Bonnington Hotel

Southampton Row, London WC1

commencing at 7.30pm

All members and friends are cordially invited to this social occasion. Tickets are not required but members are asked to notify headquarters if they will be attending so that catering arrangements can be made accordingly.

AMSAT-Oscar 6 users

The following table shows the number of AMSAT-Oscar 6 users on a per-amateur-capita basis as at 15 October 1973. The information has been supplied by K3JTE, President of AMSAT.

Country	Total amateurs	Oscar 6 users	Percentage of amateurs using Oscar 6
New Zealand	4,641	70	1·5
Australia	6,461	85	1·3
Finland	2,000	23	1·15
France	7,500	81	1·1
Sweden	4,400	44	1·0
Czechoslovakia	2,070	20	0·97
West Germany	20,380	168	0·82
UK	16,837	113	0·67
Japan	14,576	90	0·61
Canada	12,892	57	0·44
Italy	6,000	24	0·40
USA	282,850	737	0·26
USSR	15,085	30	0·20
Argentina	17,500	22	0·13
		1,564	

The total number of stations using Oscar 6 is 1,816 and the country listing above represents 86 per cent of all users. The total outside the USA was 1,079, representing 60 per cent of all users. Total of countries from which Oscar users reported was 74.

Pen-pals wanted

Miss Yumi Thukahara, TDXC, PO Box 108, Shitaya, Tokyo, Japan, who is a 17-year-old student interested in amateur radio, would like to correspond with others in the 17-20 age group with similar interests.

Apology corner

On page 761 of the November issue, errors occurred in the caption to the photograph: the daughter of GM3KPD was incorrectly described as xyl of G3WAO; and the midshipman seated on the right was G3WAO, G3AGL was standing behind him.

Lost at Leicester

An rf signal generator, type number TE16A, was lost at the recent Leicester Exhibition. The occurrence is particularly unfortunate as the amateur who had just bought it is blind, and the loss occurred while he was being assisted out of the exhibition. Any information to G. R. Newland, at RSGB HQ.

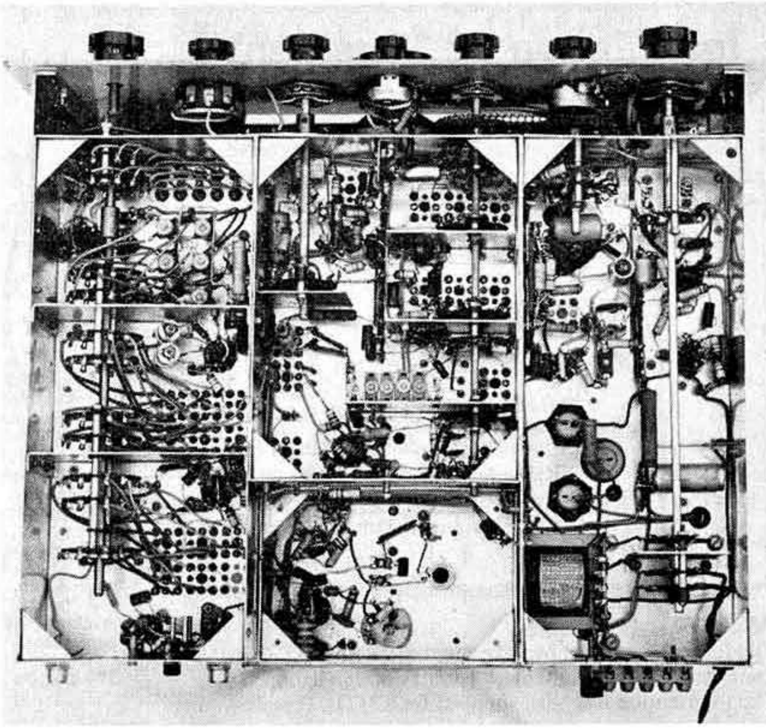
Racal ARC Giant 1973 Junk Sale

Sunshine plus the promise of cheap radio gear and components resulted in a record turn-out of nearly 400 radio amateurs and enthusiasts from all over the UK and even, in one case, from Paris, at the Racal Amateur Radio Club's Junk Sale at Crowthorne, Berks on 27 October. At opening time the scene resembled that of the January sales in Oxford Street with a long queue of bargain-hunters, some of whom had waited over three hours, rapidly descending upon the counters and eagerly sorting through components, assemblies and old test-gear.

American Callbook

An advance delivery by air of the 1974 American Callbooks was due as this issue went to press. Prices: USA listings –£4·70; Foreign listings–£4·30, inc p & p, from RSGB Publications Section.

The G2DAF Mark 2 receiver



A high-performance double conversion design covering six amateur bands

by G. R. B. THORNLEY, G2DAF*

Part 2

CIRCUIT DESCRIPTION

A block diagram of the receiver is shown in Fig 4 and a complete circuit diagram in Figs 5a, b, c, d.

It will be noted that two Collins mechanical filters are used for ssb reception. The F455Z-4 is a high sideband filter and the F455Z-5 a low sideband filter, either side of the same 455kHz carrier frequency. This enables sideband switching to be undertaken without error caused by shift of carrier frequency. At the time the Mark 2 receiver was being constructed, the author was developing a phasing exciter and required a selectable sideband receiver that could be used as a precision measuring instrument to determine the degree of sideband suppression obtained by various experimental phasing units.

The two Collins F455Z-4 and F455Z-5 filters initially cost £61 and are very likely more expensive now. For normal communication use, sideband switching filters are an extravagance and not necessary, so an alternative i.f. circuit using the relatively inexpensive Kokusai filter is also included. CW operators may wish to use the filter switching facility for a second narrow-band Kokusai unit. The receiver will be described as it was built, because the two Collins filters and associated i.f. transformers are clearly visible in the photographs.

Chassis section A (Fig 5a)

Push-pull rf amplifier V1 (PCC189) is operated at unity gain (or less) and is therefore completely stable on all bands. Valve type PCC189 was chosen because it has variable-mu characteristics and can be controlled from the agc line; additionally the RF GAIN variable resistor in the cathode return circuit enables the valve to be used as a variable aerial attenuator—a useful feature under very heavy commercial interference conditions. Although the rated heater voltage is 7·6V, in this application the PCC189 is completely satisfactory when connected to the common 6·3V heater supply.

Primary windings on T6 to T10 provide the correct impedance load; the secondaries feeding the grids of the first converter valve V2 (ECC88). Signal input to the converter is in push-pull and oscillator injection in parallel.

When switched to the 3·5MHz or 7MHz band, the swing of the signal frequency tuning capacitor will resonate the front end circuits to the tunable i.f. of 5 to 5·5MHz. Under these conditions the converter V2 will behave as a tuned-anode tuned-grid oscillator. To maintain stability the valve is cross-neutralized by the two 2 to 8pF trimmers.

Conversion oscillator V3 (ECC85) is a Butler circuit operating as a fundamental or overtone oscillator.

All signal frequency and oscillator coils, and the required crystal, are selected by the 11-bank, single-pole, 8-way RANGE switch S1 to S11. T5 and T10 each cover the 21MHz band and the three sections of the 28MHz band, therefore the last four contacts of S1, 2, 3, 4, 5, 6 and 7 are linked together. In regard to T11, 12, 13, 14, 15, 16 and 17, each coil is pre-tuned with its own fixed mica capacitor and dust core. One coil is fitted for each band from 1·5MHz to 21MHz, one coil for 28MHz and one coil for 28·5MHz; the eighth position of the RANGE switch allows an additional oscillator coil and crystal to be used if 29 to 29·5MHz coverage is required.

The secondary centre taps of T1, 2, 3, 4, and 5 are connected together and taken to the 100kΩ grid resistor;

* 5 Janice Drive, Fulwood, Preston, Lancs PR2 4YE

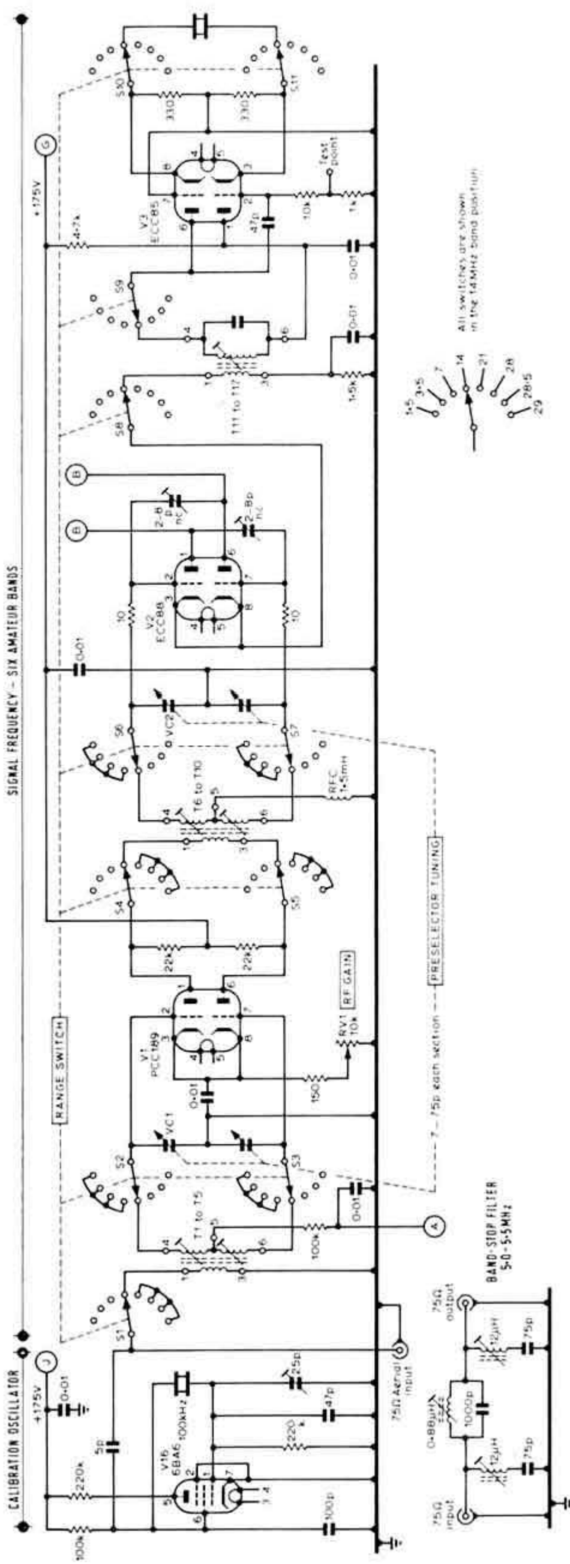


Fig 5a. Circuit diagram, chassis section A

secondary centre-taps of T6, 7, 8, 9 and 10 are connected together and taken to the rfc; cold ends of T11, 12, 13, 14, 15, 16 and 17 primary are taken to the 1·5kΩ resistor and 0·01μF by-pass capacitor; and cold ends of T11 to T17 secondaries are connected together and taken to the 0·01μF by-pass capacitor and 4·7kΩ ht feed.

Signal frequency tuning is affected by the 4-gang 7 to 75pF variable capacitor. The centre-tap of the push-pull signal frequency coils must not be by-passed to rf but allowed to "float", circuit balance being obtained by the equal sections of the split stator tuning capacitors.

Chassis section B (Fig 5b)

Output of the first converter is fed into T18 and T19, and in push-pull to the grids of the second converter V4 (ECC85). Oscillator injection to the two cathodes strapped in parallel is derived from cathode follower V6 (6BA6) driven by vfo V5 (6BA6).

These three stages constitute the tunable i.f. covering the range 5 to 5·5MHz and resonated by a 5-gang variable capacitor of 3 to 35pF each section—KILOHERTZ main tuning (VC3, 4 and 5).

The vfo is arranged as a Colpitts parallel-tuned oscillator to obtain a high frequency stability, together with a level amplitude of output voltage across the 500kHz range, and tunes on the high side (ie 5-5·5MHz plus 455kHz) 5·455 to 5·955MHz.

T18 and T19 are coupled by a low impedance link around the electrical and mechanical centre of each main winding. The centre tap of each coil is allowed to "float" and must not under any circumstance be by-passed to rf.

The tunable i.f. of 5 to 5·5MHz is converted by V4 to the second i.f. of 455kHz. Switch banks S12, 13 and 14 select the appropriate mechanical filter, or top-coupled i.f. transformers, for high sideband—low sideband—a.m. reception.

Q multiplier V7 (12AX7) is connected to points "C" "C" by 75Ω coaxial cable, thus forming the connecting link between the pole of S14 and the grid of V8.

I.F. amplifier V8 (6BA6) is capacitance coupled to the second i.f. amplifier V9 (6BA6), both valves being agc controlled. The S-meter is connected to G2 of V9 instead of the customary cathode position, in order to obtain better S-meter scale linearity. Both i.f. amplifiers have negative current feedback in order to reduce Miller effect due to agc action. Additional i.f. transformers T22, 23 and T25, 26 were incorporated in order to avoid the possibility of distorting the F455Z-4 and F455Z-5 response curves.

A proportion of the 455kHz i.f. is fed to the agc amplifier V10 (6BA6) whose output feeds the OA5 rectifier and the OA5 gate circuit. AGC release time is selected by the OFF-FAST-SLOW switch S19a and S19b. The envelope detector V11 (EA50) is fed from the i.f. transformer T27. S17 selects high or low sideband output and feeds the ring demodulator.

Chassis section C (Fig 5c)

Audio output of V11 feeds through the 100kΩ variable resistor, NL SET, into the 47kΩ diode load. V12 (6AL5) is a conventional Dickerts twin-diode envelope-following a.m. noise limiter. This is very effective against Loran interference when operating in the top section of the 1·5MHz band. The noise limiter is switched in or out of circuit by S20, part of the OPERATION switch.

Carrier insertion oscillator V13 (6BA6) is operated in a modified Colpitts circuit to allow the valve cathode to be

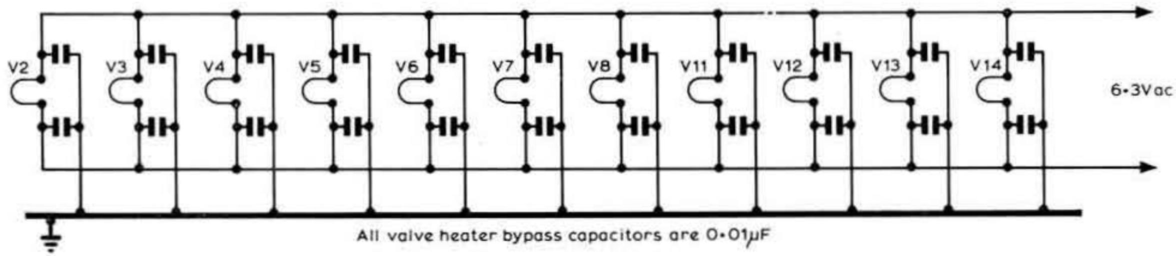
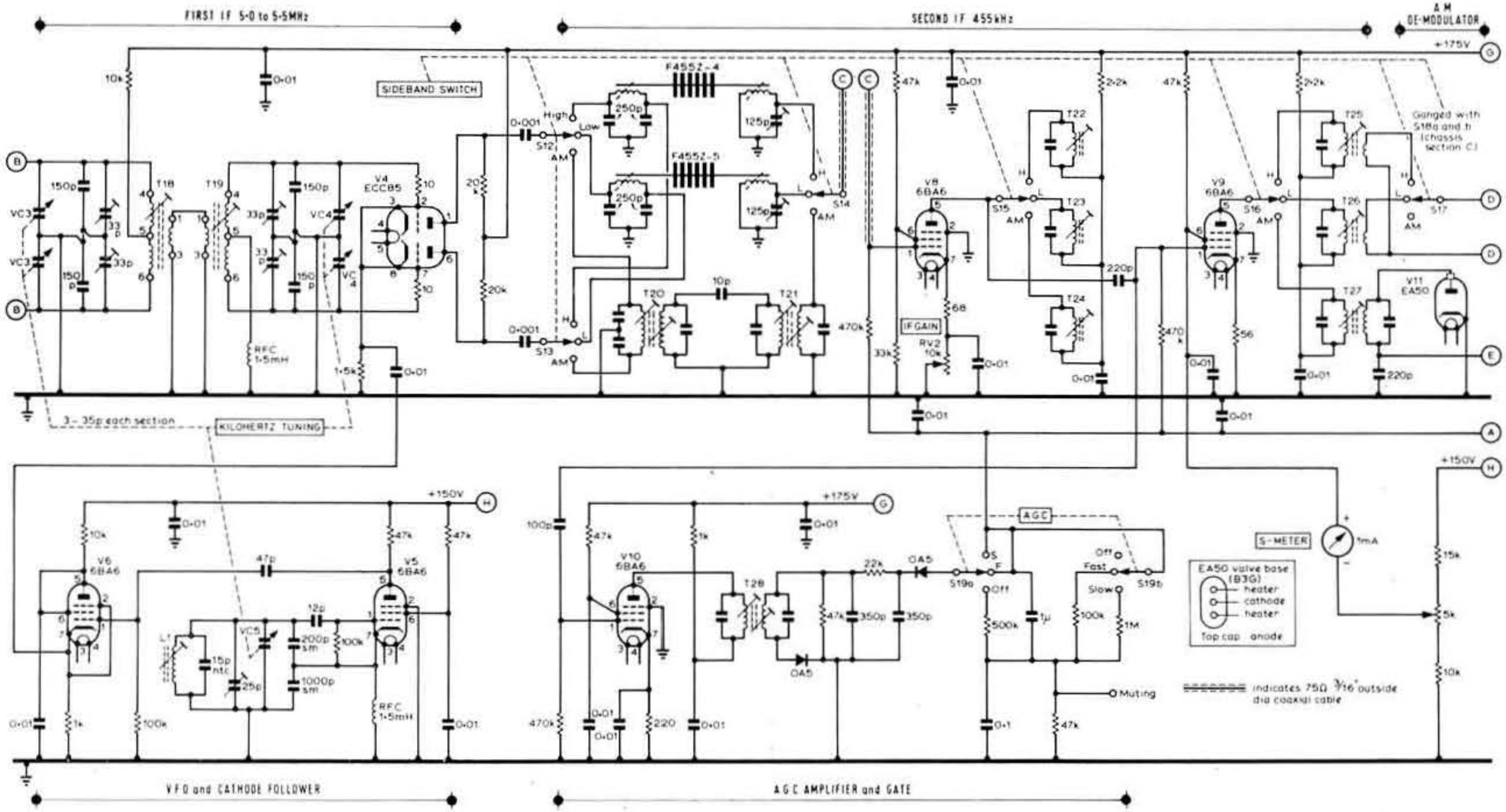


Fig 5d. Valve heater by-pass capacitors

Fig 5b. Circuit diagram, chassis section B



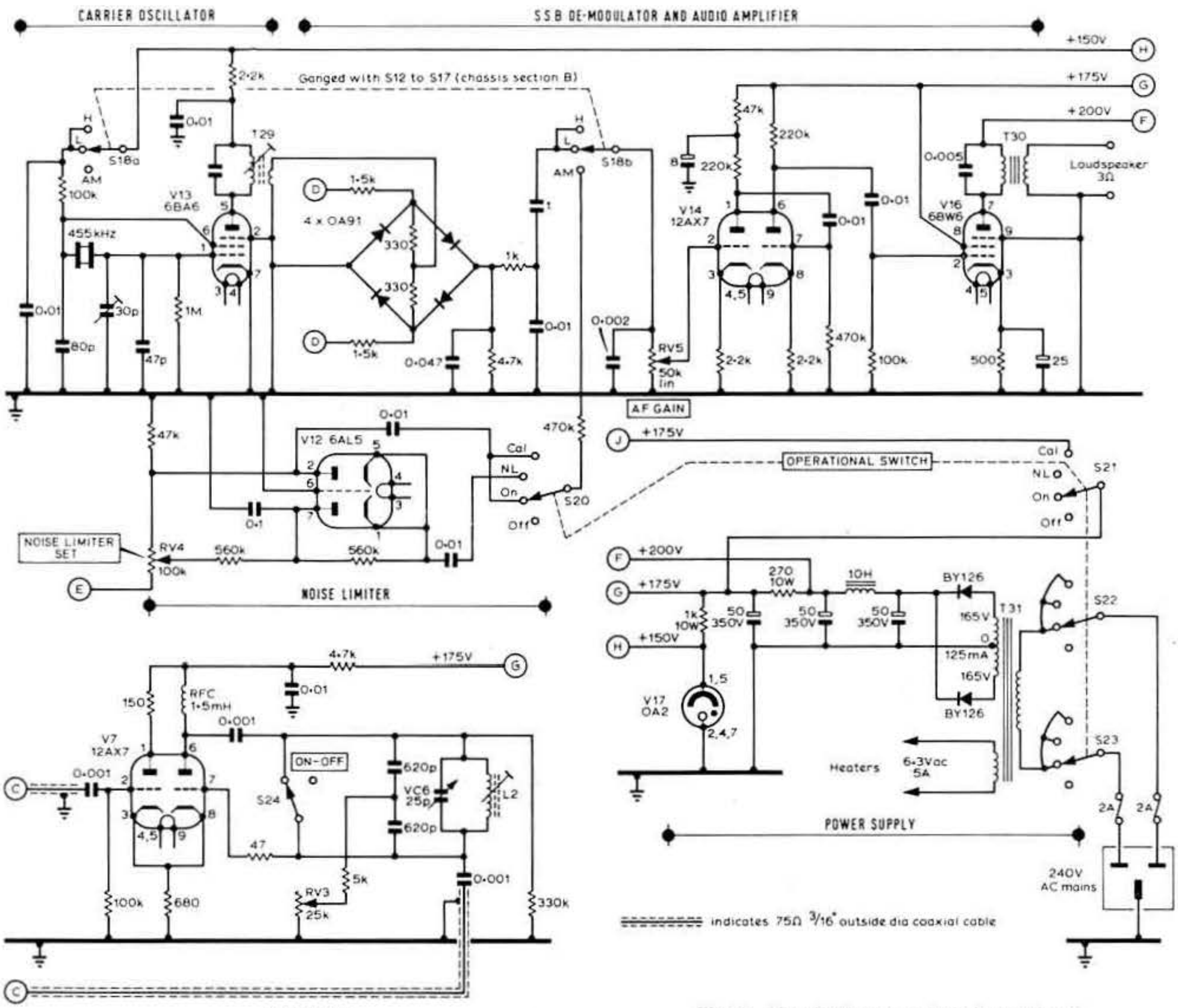


Fig 5c. Circuit diagram, chassis section C

grounded to r.f. and eliminate the possibility of carrier leakage along the 6·3V heater rail getting back into the i.f. amplifier and agc amplifier stages. Oscillator operation is controlled by S18a—part of the main A.M.-L-H sideband switch.

Amplitude modulated output from V12 circuitry, or sideband output from the ring demodulator, is selected by S18b and feeds via the AF GAIN control into the two-stage audio amplifier V14 (12AX7) and finally to the output valve V15 (6BW6). Output transformer T30 matches the required 5kΩ anode load of V15 to a standard 3Ω loudspeaker.

The calibration oscillator V16 (6BA6) uses a 100kHz crystal in a conventional circuit arrangement, and is switched on or off as required by S21–part of the OPERATION switch.

Power supply provides ht outputs of 200 and 175V, and 150V regulated by V17 (OA2) stabilizer valve, using silicon diodes in a full-wave circuit, and provides 6·3V ac for all valve heaters. The receiver is switched ON or OFF by S22 and S23 sections of the OPERATION switch.

I.F. rejection filter

The receiver i.f. breakthrough rejection will be at its lowest level when using 3·5MHz or 7MHz, the amateur bands nearest to the tunable i.f. range. With the receiver tuned to 3·75MHz or 7MHz, the measured i.f. rejection is in fact 62dB. Under good propagation conditions the level of the commercial teleprinter transmissions in the 5 to 5·5MHz range can be very high and the author is of the opinion that 62dB rejection is not good enough. This in fact was the reason for stipulating in "required specification": "i.f. breakthrough rejection not less than 80dB". To obtain this figure with a margin in hand, a band-stop filter is included with the theoretical circuit shown in Fig 5a.

The filter is constructed as an outboard unit, intended to be connected between the 75Ω aerial feeder and the 75Ω receiver input terminal, so as to allow the filter to be taken out of circuit and the aerial to be connected directly when it is desired to receive MSF on 5MHz for vfo stability checks or to set the 100kHz calibration oscillator on frequency.

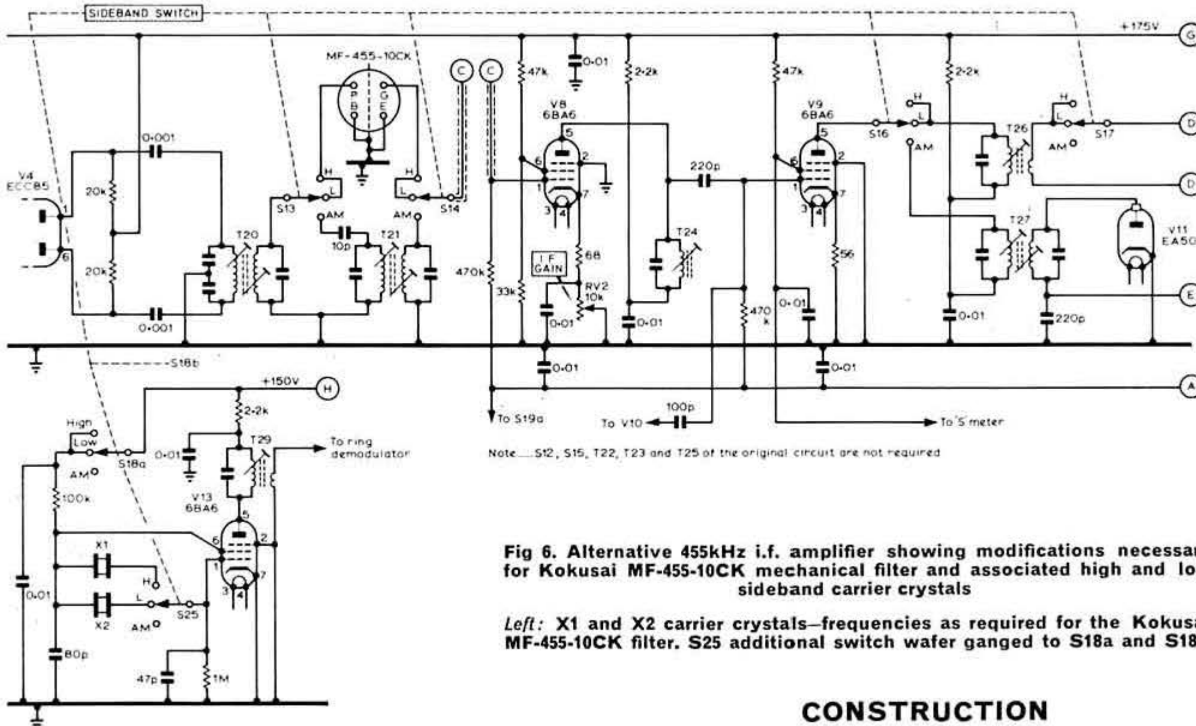


Fig 6. Alternative 455kHz i.f. amplifier showing modifications necessary for Kokusai MF-455-10CK mechanical filter and associated high and low sideband carrier crystals

Left: **X1 and X2 carrier crystals—frequencies as required for the Kokusai MF-455-10CK filter. S25 additional switch wafer ganged to S18a and S18b**

Table 1. First conversion crystal frequencies

Band (MHz)	Crystal freq. (MHz)	Mode	Output freq. (MHz)
1·5	7·0	Fundamental	7·0
3·5	9·0	Fundamental	9·0
7·0	12·5	Fundamental	12·5
14·0	19·5	3rd overtone	19·5
21·0	26·5	3rd overtone	26·5
28·0	33·5	3rd overtone	33·5
28·5	34·0	3rd overtone	34·0

All crystals must be ordered for series resonance operation stating mode of operation.

Alternative i.f. amplifier

An alternative simplified i.f. amplifier using a Kokusai MF-455-10CK mechanical filter is shown in Fig 6. To avoid confusion the switch banks and i.f. transformers used are given the same identification letters and numbers as the original circuit.

Switch banks S12 and S15 and i.f. transformers T22, T23 and T25 are no longer required. For sideband switching, the Kokusai filter requires two carrier crystals—nominally 300Hz either side of the filter 6dB points—and this requires an additional switch wafer in the input circuit of the carrier oscillator V13, to automatically select the correct carrier frequency when the A.M.-LOW-HIGH sideband switch is operated.

As the carrier crystals will have been ordered for parallel resonance with the usual 30pF shunt capacitance, the 30pF trimmer capacitor can also be omitted.

The Kokusai MF-450-10CK filter together with matching carrier crystals are obtainable from KW Electronics Limited, Dartford, Kent.

CONSTRUCTION

The chassis is made up of four separate box sections of 16 swg aluminium to give a total size of 16in by 12in by 2½in deep, with a 17½in by 9in front panel. The box sections are machine pressings, true to size, having sharp radius corners, and are available from North West Electrics, 769 Stockport Road, Levenshulme, Manchester.

The Eddystone 898 dial drive assembly has the driving boss almost central behind the panel cut-out, and in order to bring the shaft of VC5 into line the complete vfo assembly is built into the 6in by 3in "box" and this unit is raised 2in above the normal chassis top face. The tunable i.f. capacitors VC3 and VC4 are driven from this shaft by means of two 1½in diameter drive pulleys and a spring tensioned nylon cord.

In order to clear the lead flywheel of the Eddystone 898 drive, the panel is set 1½in away from the chassis front apron—this space also gives clearance for the selector plate of the main RANGE switch S1 to S11, the i.f. and af gain variable resistors, and the sprocket pulleys and chain drive ganging the sideband and a.m. switch S12–17 to S18. Chassis layout is shown in detail in Fig 8, and panel layout in Fig 9.

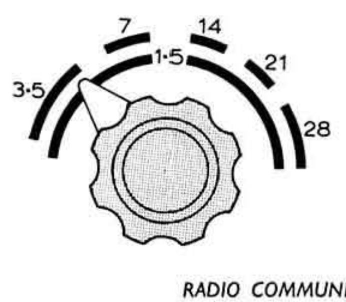


Fig 7. Preselector tuning control, showing how the receiver panel should be engraved to show the control knob positions for each of the amateur bands. This illustration assumes that clockwise rotation reduces the tuning capacitance value

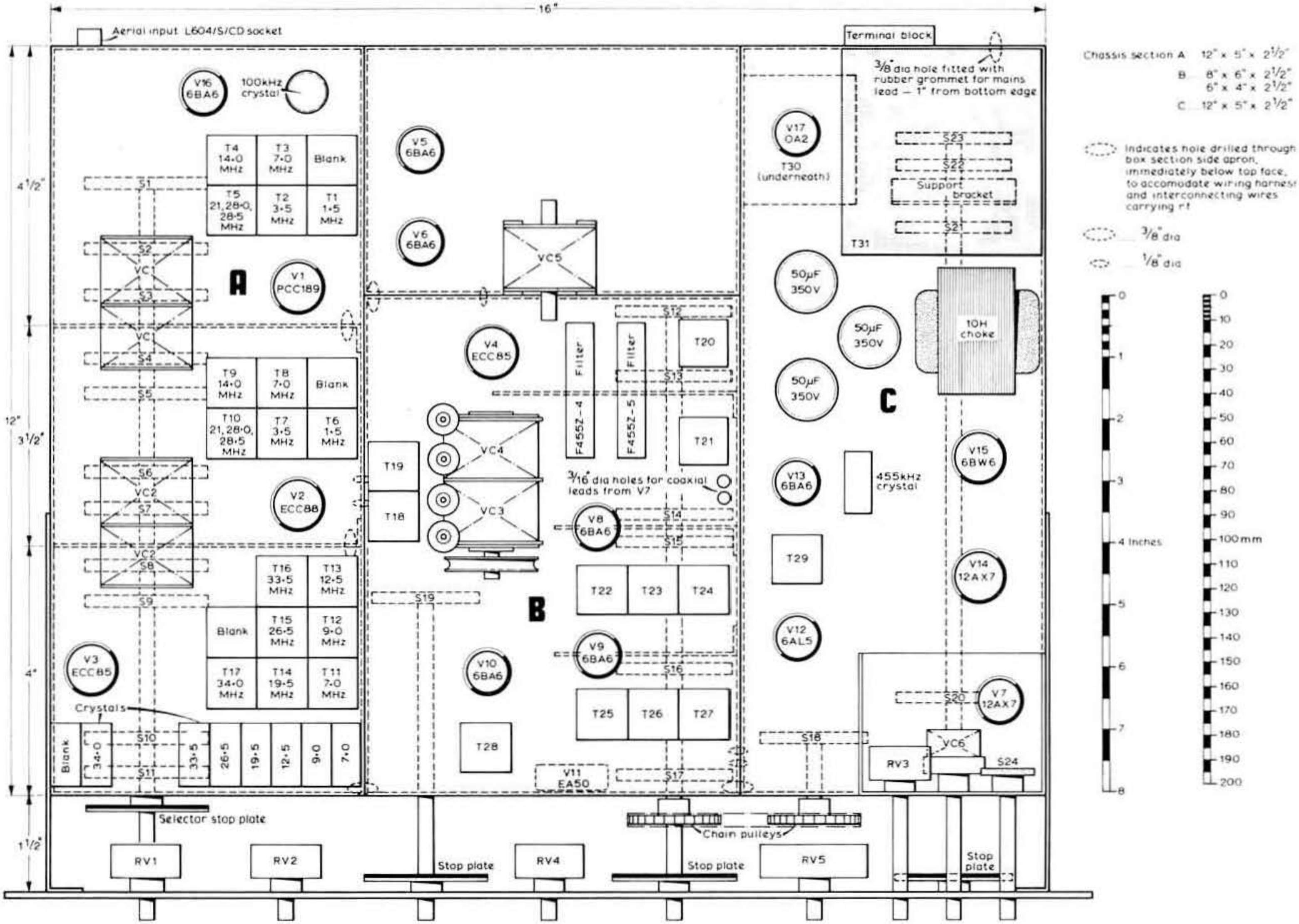


Fig 8. Chassis layout showing principal components

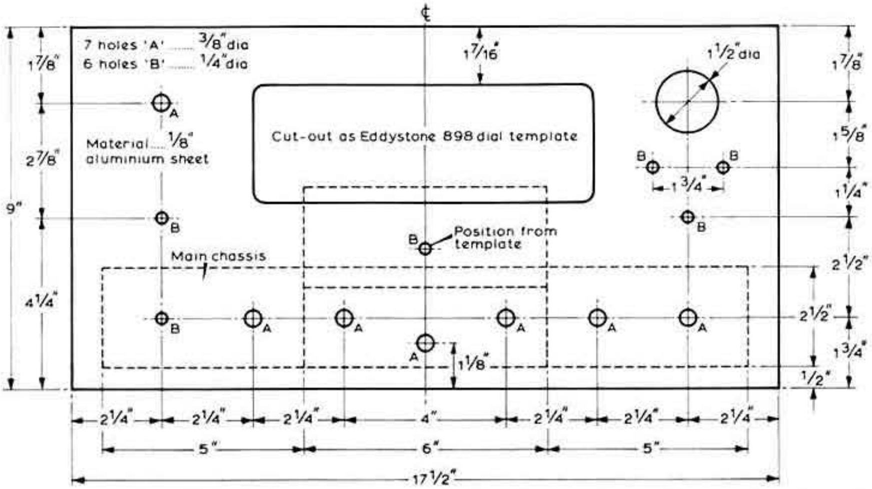


Fig 9. Panel layout. Dotted line shows the relative position of the main chassis and the raised rear centre section to bring the vfo tuning capacitor in line with the driving boss of the Eddystone 898 dial

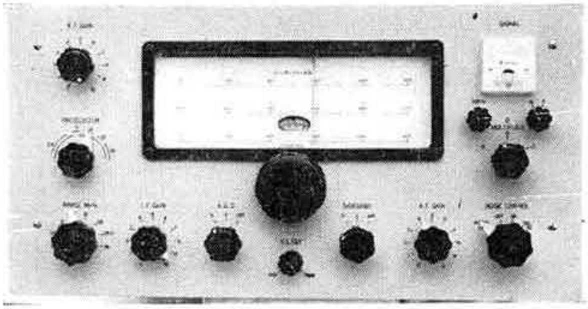
TABLE 2. RESONANT CIRCUIT COMPONENT DETAILS

Component	Freq or Band (MHz)	Primary Winding	Secondary Winding
T1	1·5	4t 38swg enam	100t-ct-100t 38swg enam scramble wound in 2 bobbins (see Fig 10)
T2	3·5	2·75t 24swg enam	62t-ct-62t 38swg enam
T3	7·0	1·75t 24swg enam	35t-ct-35t 32swg enam
T4	14·0	1·75t 24swg enam	20t-ct-20t 24swg enam
T5	21 to 28·5	1·25t 24swg enam	10t-ct-10t 24swg enam
T6	1·5	7t 38swg enam	As T1
T7	3·5	2·25t 24swg enam	As T2
T8	7·0	2·25t 24swg enam	As T3
T9	14·0	3·75t 24swg enam	As T4
T10	21 to 28·5	1·75t 24swg enam	As T5
T11	7·0	9t 36swg enam	36t 36swg enam with 65pF sm capacitor across winding.
T12	9·0	6t 28swg enam	24t 28swg enam with 65pF sm capacitor across winding
T13	12·5	4·5t 24swg enam	18t 24swg enam with 50pF sm capacitor across winding
T14	19·5	3t 24swg enam	12t 24swg enam with 35pF sm capacitor across winding
T15	26·5	2·5t 24swg enam	10t 24swg enam with 20pF sm capacitor across winding
T16	33·5	2·5t 24swg enam	8t 24swg enam with 10pF sm capacitor across winding
T17	34·0	2·5t 24swg enam	8t 24swg enam with 10pF sm capacitor across winding
T18	5 to 5·5	32t-ct-32t 32swg enam	5t 32swg enam
T19	5 to 5·5	5t 32swg enam	32t-ct-32t 32swg enam
Band-stop filter	5 to 5·5	12μH coil. 45t 36swg enam 0·88μH coil. 10t 24swg enam spaced to ⅜in long	Electroniques or similar 0·3in dia former 1¼in long with 0BA dust core.

Component	Freq or Band (kHz)	Description
T20	455	Denco IFT11-465 i.f. transformer with 65pF primary capacitors removed and replaced with two 130pF sm capacitors
T21, T27, T28	455	Denco IFT11-465 i.f. transformer
T22, T23, T24	455	Denco IFT11-465 i.f. transformer with top pie and resonating capacitor removed
T25, T26, T29	455	Denco IFT11-465 i.f. transformer with top pie and capacitor removed and replaced with 75t 36swg enam scramble wound against primary pie
T30		Wharfedale output transformer type GP8 used on 36 : 1 ratio tappings
T31		Secondary: 165-0-165V 125mA Secondary: 6·3V 5A Primary 10-0–200-220-240V 50Hz ac.

All coils T1 to T19 wound on Neosid or Aladdin 0·3in dia formers with OBA dust cores (T1 to T10, T18 and T19 two dust cores in each former) and in 2¼ × 1¾ × 1¾in seamless aluminium cans. All windings close-wound single layer except T1 and T6. Primary of T2, 3, 4, 5, 7, 8, 9 and 10 wound over centre of secondary winding. Primary of T11 to T17 wound over cold end of secondary winding (see Fig 10). Secondary of T18 and primary of T19 wound over centre of main winding.

Component	Freq or Band (kHz)	Description
L1	5455 to 5955	14·5t 22swg enam close wound on ½in dia ceramic former, with dust core
L2	455	Standard pot core Q multiplier coil on 0·3in dia former, with dust core
S1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11		Yaxley Paxolin SP/8W 11-bank bandchange switch
S12, 13, 14, 15, 16, 17		Yaxley Paxolin SP/3W 6-bank sideband switch
S18a, S18b		Yaxley Paxolin 2P/3W 1-bank sideband switch
S19a, S19b		Yaxley Paxolin 2P/3W 1-bank agc switch
S20, 21, 22, 23		Yaxley Paxolin 1P/4W 4-bank operational switch
S24		1P/2W 1-bank rotary on/off switch (Q multiplier)
S25 (see Fig 6)		Yaxley Paxolin 1P/3W 1-bank (ganged to S18a and S18b)



Front panel

Table 3. Conversion oscillator output voltages

Output freq. (MHz)	Output volts (RMS)	Remarks
7·0	2·2	
9·0	1·8	
12·5	1·5	Measurement made at cathode of V2
19·5	1·65	
26·5	1·85	
33·5	1·65	
34·0	1·65	

The Q multiplier notch filter, V7 and associated components, is built on a small sub-chassis 3in by 2¼in, and are wired and tested before fitting into final position. This unit is connected to the main chassis by two 8in lengths of 3/16in outside diameter standard 75Ω television coaxial cable.

The signal frequency 4-gang tuning capacitor, VC1 and VC2, is in fact two Polar type C28-142 units coupled together after a rear shaft extension had been fitted to the unit nearest to the panel. Polar capacitors were used because they were available, but any standard 4-gang variable of either 75pF or 100pF maximum capacitance would be equally suitable. Both Polar capacitors are mounted on a piece of hardwood ¾in thick to lift the drive shaft and obtain a more pleasing panel layout.

It will be observed from the chassis underside photograph that holes were drilled for six aerial input coils and six converter input coils. In fact only five of the six positions for each stage were used, after experimental work had shown that it was possible to use one coil only to cover the 21MHz band and the three 500kHz sections of the 28MHz band without adversely affecting the receiver performance. To mount each coil it is necessary to drill nine holes through the chassis top face, and this work can be greatly eased by initially making a drilling jig. Alternatively, North West Electrics are prepared to supply chassis box sections ready drilled for all coils and valve holders if this is preferred.

The conversion crystals used were HC-6/U type with ½in pin spacing and are mounted on 2-pin holders. When ordering crystals it is important to state that the 7, 9, 12·5 and 19·5 MHz crystals are for fundamental operation, and the 26·5, 33·5 and 34MHz for third overtone operation, and all for *series* resonance operation.

Standard, Electroniques G2DAF Mark I Receiver oscillator coils were used for T11 to T17 and modified as required by the addition of a low impedance primary winding. As Electroniques coils are no longer in production,

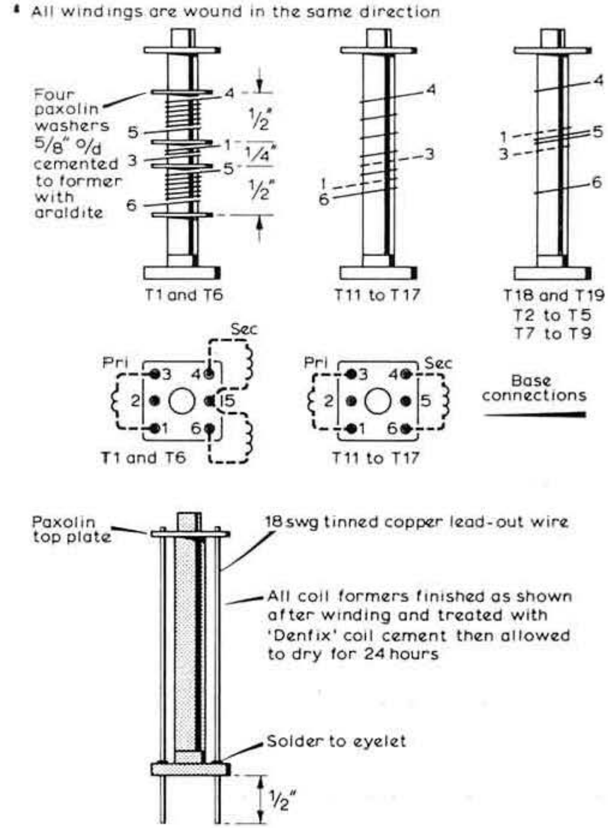


Fig 10. Coil assembly details, T11 to T17. All windings in the same direction. All coil formers are fitted with Aladdin Paxolin top plate. Made-up lead-out wires as shown of 18swg tinned copper wire pre-stretched and cut to 4in lengths. After soldering to eyelet, lead-out wires are trimmed flush with top plate and ¼in below base. Enamel covering is removed from ends of each winding—end looped round lead-out wire and soldered, as required

winding details are given for coils using Neosid or Aladdin 2¼in high cans and standard 0·3in diameter formers with 0BA dust cores.

The 5 to 5·5MHz i.f. section is tuned by a 4-gang 3–35pF variable capacitor VC3 and VC4. This is in fact a Polar type C28-142 2-gang of maximum capacitance 75pF modified to a 4-gang of 35pF each section, by sawing through the stator bars—in-between the ceramic support pillars—with a model makers' saw. Any other make of standard 4-gang variable can be used, provided only that it will fit into the available chassis space, and that it has the same law as the 35pF variable tuning the vfo (VC5) and that the constructor is prepared to accept a non-linear dial calibration.

It will be noted from the photograph that the four Philips beehive trimmers of 3–33pF are adjacent to the Polar C28-142 capacitor VC3 and VC4—they are in fact supported by soldering the trimmer support leg to the brass capacitor frame.

TABLE 4. DC VOLTAGE CHECK

Valve	Stage	Type	Pin No 1	2	3	4	5	6	7	8	9	
V1	RF amp	PCC189	85	—	1·7	H	H	85	—	1·7	—	
V2	1st conv	ECC88	140	—	5	H	H	140	—	5	—	
V3	Conv osc	ECC85	73	—	1·8	H	H	90	—	2	—	
V4	2nd conv	ECC85	125	—	2·2	H	H	125	—	2·2	—	
V5	VFO	6BA6	—1	—	H	H	30	60	2·2			
V6	cath foll	6BA6	8	6	H	H	100	100	6			
V7	Q mult	12AX7										
V8	1st i.f. amp	6BA6	—0·25	—	H	H	170	80	5			
V9	2nd i.f. amp	6BA6	—0·1	—	H	H	180	62	5·5			
V10	AGC amp	6BA6	0·2	—	H	H	175	70	1·75			
V11	A.M. de-mod	EA50	anode —0·4									
V12	Noise limiter	6AL5	—	—	H	H	—	—	—			
V13	Car osc	6BA6	—2·5	—	H	H	145	60	—			
V14	Audio amp	12AX7	80	—	0·7	H	H	100	—	0·8	H	
V15	Audio output	6BW6	—	—	9	H	H	—	190	182	—	Anode current = 24mA
V16	100kHz cal osc	6BA6	—3	—	H	H	45	90	—			
V17	Regulator	OA2		—			150					

(— in front of figure indicates negative reading)

Measuring instrument Avo Model 8

All measurements made with rf and i.f. gain controls at maximum. Range switch at 14MHz. Sideband switch on H. Q multiplier off. Aerial input disconnected

In order not to degrade the filter response, the input side must not be able to "see" the output side. A Kokusai filter must be mounted so that it straddles the 4in-long cross screen, with the input terminals on the S13 side, and the output terminals on the S14 side. A rectangular notch is cut into each of the two 3in long screens to clear the valveholders, and these are positioned so that a line drawn between pins 3–4 and pin 7 is parallel to the screen, and pin 1 is on the input side and pin 5 on the output side of the screen.

VFO tuning capacitor V5 is a Polar type C28-141 of 35pF maximum. Both the C28-142 and the C28-141 have a straight line capacitor law (semi-circular rotor plates) and this together with the LC ratio used over the vfo tuning range of 5,455 to 5,955kHz, will give almost a linear dial calibration without the need for tracking capacitors used in the Mark 1 receiver design.

The tuning capacitor should be of rugged construction with two rotor bearings, and the coil former ceramic with a dust core mounted on a screwed brass rod fitting into a pressure-loaded clutch or a bush with a locking nut to prevent end or side "float" within the winding.

Switch S18 is required to be screened from the 455kHz i.f. stages. It is therefore mounted in the chassis section C and ganged to the sideband selector switch S12-17 by sprocket pulleys and chain drive. The author was fortunate in having suitable sprockets drilled for a ¼in shaft available, but believes that standard Meccano items (normally drilled for ⅛in shafts) have sufficiently large centre bushes to accommodate opening out to ¼in.

In order to conserve space, the mains transformer T31 is assembled on a C core and was wound to the author's specification by R. F. Gilson Ltd, St George's Works, 11a St George's Road, Wimbledon, London SW19. Overall dimensions are 3$\frac{5}{16}$in by 3¼in by 3⅜in high. The two silicon rectifiers and the mains fuses are mounted on the transformer top plate.

Any small box with a close-fitting lid—of 18 or 16swg aluminium, brass, copper or tinned iron—large enough to accommodate the three coils, capacitors and the two Belling-Lee L604/S/CD coaxial sockets, is suitable for the construction of the 5 to 5·5MHz band-stop filter. In order not to degrade the filter performance it is important to fit two close-fitting cross-screens so that the coils and associated capacitors of each section cannot "see" each other. The filter is connected to the receiver by a short 75Ω coaxial fly lead with Belling-Lee L734/P/AL plugs at each end.

ALIGNMENT

A serviceman's signal generator is really the minimum requirement, and if an oscilloscope is also available each chassis section can be individually aligned before final assembly. Assuming that this has not been done and that the signal generator was only available for a short amount of time—after final construction was completed—the most satisfactory alignment procedure is to start at the back and finish at the front. That is from V9 to the aerial, with an Avo or similar test meter on the 100V ac range connected across the primary of the audio output transformer T30 as an output indicator. The loudspeaker should be left connected so that the audio quality can also be monitored.

The author assumes that anyone undertaking the construction of the G2DAF Mark 2 Receiver will have sufficient experience to make detailed alignment instructions unnecessary. However, should there be sufficient demand a step-by-step alignment procedure will be made available later.

A noise generator is the test instrument that will tell "the truth and nothing but the truth" about the receiver's performance [5]. It is simple to build, costs little money, and can be constructed by most amateurs with parts to a large extent already available in the junk box. With the noise generator connected to the aerial input terminal, it is very rewarding to watch the improvement possible by a little further "tweeking" of the front-end circuits on each range. It should be possible to obtain a 7 to 8dB noise factor on each of the six amateur bands. The noise generator will

TABLE 5. FINAL PERFORMANCE DATA

Band (MHz)	Input for 10dB S + N/N ratio (μV)	Input for 20dB S + N/N ratio (μV)	Noise Factor (dB)	Image rejection (dB)	I.F. break-through rejection (dB)	White noise output Preselector off resonance (volts rms)	White noise output Preselector on resonance (volts rms)
1·5–2·0	Less than 0·25μV on all bands, ssb operation	Less than 0·75μV on all bands, ssb operation	6·5	108	88	5V on all bands ssb reception	11V or more on all bands, ssb reception
3·5–4·0			7	112	94**		
7·0–7·5			7	98	94**		
14–14·5			7	92	95		
21–21·5			7	90	97		
28–28·5			7	88	98		
28·5–29			7	88	98		

Image rejection—second conversion process = >120dB (Receiver tuned to 3·75MHz with preselector correctly resonated. Input freq 2·84MHz)

Cross-modulation While receiving a wanted signal of 1μV, an interfering signal modulated 30 per cent at 400Hz of strength 100mV and 15kHz away, has no effect on the wanted signal, ssb reception.

Dynamic range Greater than 120dB, ssb operation

Stability After initial warm-up period of 10 to 15min, drift less than 100Hz/h under normal ambient conditions

Notes (1) ** Measurement made with band-stop filter in use.

(2) White noise measurements made with Avo meter on 100V ac range, connected across output transformer (T30) primary. No aerial input. All gain controls at maximum. Sideband switch in lsb position. Agc off.

also give a "figure of merit" that will enable the constructor to directly compare his results with those of the circuit designer, or to compare the performance of his home constructed "baby" with that of a comparable receiver made by a commercial manufacturer. The subject of noise generator measurement, detailed alignment procedure plus general fault-finding and construction hints, is covered in full in "Alignment of a G2DAF-type receiver, single sideband," *RSGB Bulletin*, February, March, April, June, August and November 1967.

Alignment to the band-stop filter is undertaken by adjusting the dust cores of the vertical legs for maximum attenuation at 5·5MHz, and the horizontal arms for maximum attenuation at 5MHz.

MUTING

Modern practice is to control a transmitter and receiver by means of a relay with either voice (vox) or press-to-talk operation. Breaking ht or cathode connections usually causes clicks and thumps, and the most satisfactory control method is a source of negative voltage applied to the grids of the controlled valves. In many cases there is already a source of negative voltage provided for the pa bias supply, and the available potential is usually suitable for muting requirements.

The control voltage can be any value from about 30 to 100V and is connected to the receiver MUTING terminal. During transmission periods the applied voltage carries the agc line negative to cut-off and disables the controlled rf and i.f. stages. As the gate circuit reservoir capacitance is returned to the muting line, the agc attack and release time constants remain unaffected.

CONCLUSION

For those amateurs who have a thermionic diode probe valve voltmeter, the conversion oscillator (V3) output volts are given in Table 3. The output voltage from the vfo should be approximately 1·4V rms, measured at the cathode pin of V6. DC voltage checks at each valve pin are given in Table 4. Every constructional project undertaken by the author has been concluded by measuring and recording final performance figures. These figures are invaluable for future reference or for future comparison, and are given in Table 5.

It is hardly likely that the construction of an ambitious receiver such as that described in this article will be undertaken lightly, but the effort will be found interesting and instructive and a refreshing change from the more usual radio activity.

Finally, it is undeniable that a receiver is the most used and the most important piece of apparatus in an amateur station. Its construction can be guaranteed to result in a pride of possession and a pleasure of operation that will give greater reward than that experienced with any previous amateur radio activity.

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Gains and losses in hf aerials

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

This article discusses the main factors which cause one aerial to be better than another.

Practical considerations dictate a gain figure of 5–6dB for most amateur hf beams but it is shown that, given a pair of comparable aerials, it is a simple matter to obtain about 3dB of extra gain by using both simultaneously.

Particular attention is paid to polarization and environmental differences, and the discussion has been extended to include the case of "lossy" aerials, leading to novel conclusions concerning the design of indoor, miniature and "invisible" aerials.

Part 1

As pointed out in an earlier article [1] the gain of close-spaced two-element beams depends mainly on the ratio of phase-shift to spacing, since this determines the shape of the radiation pattern. It was also explained that subject to the practical limitations usually applicable to amateur hf beams, little or no extra gain is obtainable from additional elements. On the face of it this appears to leave little foundation for the popular belief that some beams are better than others, but a number of minimum requirements have to be met; in particular it must be possible to obtain the correct phase shift without incurring large current inequalities, and not all designs of beam provide for this. In most cases, moreover, there are environmental constraints of one sort or another and these may have considerable effect on the relative merits of different types of aerial.

Environmental extremes generate a variety of interesting problems; restriction on the use of visible aerials, for example, may require the use of indoor aerials, or very thin wire! In either of these cases losses may be quite large and if normal design procedures are followed, two elements may be worse for transmission than a single element. Detailed analysis suggests, however, that two elements should always perform better than one, subject to correct choice of design parameters and possible acceptance of some conflict between transmitting and receiving requirements. At the other extreme, in the absence of restrictions it may be possible to erect, say, a pair of rotary beams each with a gain of 5-6dB and obtain an average additional gain of 3dB by phasing them together; the necessary phasing and matching adjustments are surprisingly non-critical, and the system has been found to work well in practice.

Losses have also been studied in the context of trying to make beams as small as possible, leading to prediction of a minimum turning circle in the region of 7ft 6in radius for a low-loss 14MHz beam.

Single-element aerials

The lowest gain theoretically possible is that of an isotropic aerial which by definition radiates equally in all directions. All practical aerials radiate more in some directions than others and assuming the same total amount of radiated power they must, therefore, have gain in at least one direction relative to an isotropic radiator. In the case of a half-wave dipole this gain is 2dB, which is the maximum amount by which it would be theoretically possible to degrade its performance other than by losses. A very short but efficient dipole is only 0·4dB down relative to a half-wave dipole but worse performance can result from bending; for example, a dipole bent in the centre and viewed end-on appears as two elements in antiphase so that an "8JK" mode of radiation is produced in this direction.

If the bending process is continued to the point where both modes produce equal field strength, 29 per cent of the power is radiated in the "8JK" mode at right angles to the normal directions thereby resulting in a loss of 1·5dB, and this seems to be about the worst that can be achieved assuming that use is made of whichever mode produces the bigger signal. Typical of the worst elements likely to be used in practice is an inverted-V with a 90° apex angle, Fig 1, and it is obvious that this produces a fairly strong endwise groundwave field; assuming a separation of $\lambda/6$ between the "centres of gravity" of the two halves of the current distribution, this will be only about 6dB down on the dipole mode but, allowing for the 4dB gain of the "8JK" mode [1], the energy loss comes to only 10 per cent and the wanted signal is reduced by a mere 0·4dB.

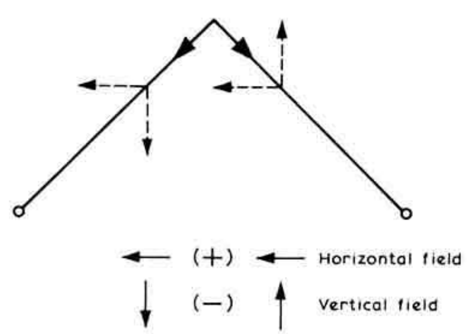

Fig 1. Inverted-V dipole showing resolution of field into horizontal and vertical components

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If two such elements are arranged as a beam, Fig 2(a), most of the endwise radiation will be cancelled and the performance will be virtually indistinguishable from that of straight (though somewhat shortened) dipoles. Similar figures apply to horizontal dipoles halved in length by bending the ends over at right angles.

The above examples give a broad general idea of what can be expected if one deliberately attempts to degrade the performance of a dipole by bending it into other shapes. The failure to achieve much success implies a high degree of freedom in the choice of element-shapes for coping with difficult mechanical or environmental problems, obviously a very important result.

To obtain appreciable gain relative to a dipole without using the antiphase (or "8JK") principle [1] it is necessary to have at least two separate concentrations of current separated by an appreciable fraction of a wavelength so that due to phase-differences the fields produced add more effectively in some directions than others. A single wire may be folded to form, for example, a collinear array of many elements, and the point at which it ceases to be regarded as a single element is an arbitrary choice, but for the present discussion an "element" is taken to be any radiator small enough to be generally useful as a 14MHz beam-element, although it may of course be used on its own.

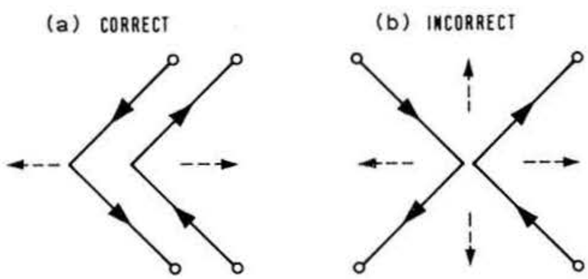


Fig 2. Two-element arrays using bent elements. Dotted arrows show directions of radiation with elements in antiphase. Gains with optimum phasing are roughly 5dB for *(a)* and 3dB for *(b)*

For this purpose the dipole has two main competitors, the quad and delta loops which can be considered together since the precise shape is of minor importance, though the operation of a quad loop is perhaps easier to visualize. In this case there are two concentrations of current separated by the width of the loop, usually a quarter-wavelength. It is usually reckoned that to obtain useful gain from two radiators they should be separated by at least half a wavelength, and it is more accurate to regard the quad loop as a *single* point source of radiation, more or less identical in performance with that of a dipole. Nevertheless this is only an approximation, and loops in fact provide an advantage of about 1dB over dipole elements; though insufficient in itself to have much effect on signal reports, this should not be discarded lightly since a major improvement in dx performance may be the result of several small improvements of this order.

Effect of ground

The discussion so far has ignored the presence of the ground. In the case of low-angle rays with horizontal polarization, all ground is virtually a perfect reflector. The aerial, with its image in the ground, can be treated as an "array" of two sources [2], and the radiation pattern in the vertical plane is obtained from the basic pattern for the aerial by multiplying it with the appropriate array factor which is *the same for all aerials at a given height and for a given angle of elevation*. The angle of elevation required for dx working is low enough to ensure that it would, in the absence of the ground, fall well within the vertical beam-width of practical amateur aerials so that the relevant part of the vertical-plane radiation pattern is *determined entirely by the array factor*; there is, therefore, no basis for the belief that one beam is better than another "because it lowers the angle of radiation".

At zero elevation above flat ground the direct wave and ground-reflected waves cancel each other since they are opposite in phase and have exactly the same distance to travel, but at any elevation-angle θ, the ground-reflected wave has to travel further by an amount 2h sin θ, or approximately $2h\theta$ since we are interested only in small values of θ. Corresponding phase-shift is given in radians by $\frac{4\pi h\theta}{\lambda}$ and field strength by $2F_D \sin\left(\frac{2\pi h\theta}{\lambda}\right)$ as demonstrated by Fig 3.

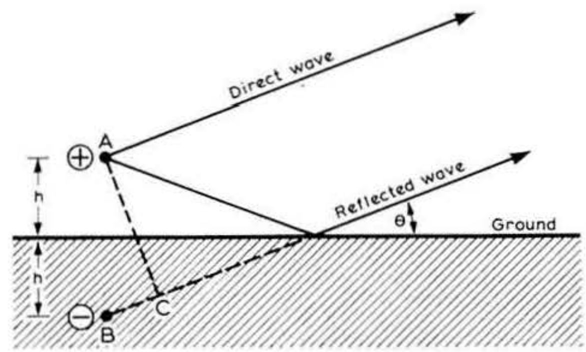


Fig 3. Derivation of array factor for horizontally polarized aerial and its image. The reflected wave has farther to travel, by the amount BC which is given approximately by $2h\theta$. The two waves arrive in phase at a distant point if $2h\theta = \lambda/2$, giving a field strength $2F_D$ where F_D is the corresponding free-space field

The appropriate value of θ depends on the particular dx path and the prevailing ionospheric conditions, any value up to 15° or so being likely, but there is some ground for regarding 6° as typical [3].

For this angle of radiation the array factor, and therefore the field strength for a given aerial current, is approximately proportional to height within the limits of normal amateur installations at frequencies up to 21MHz. There is a slight falling off from proportionality, to the extent of five per cent for a height of one wavelength and 10 per cent for 1·5 wavelengths. There are also slight variations, as plotted for the case of dipoles in Fig 4, which arise from changes in the mutual impedance between the aerial and its image; these in turn affect the radiation resistance and hence the aerial current.

With close-spaced beams the effect tends to be much reduced, as will be obvious for the case of two-element arrays in which each element "sees" a pair of images nearly opposite in sign and at almost the same distance. One result of this is

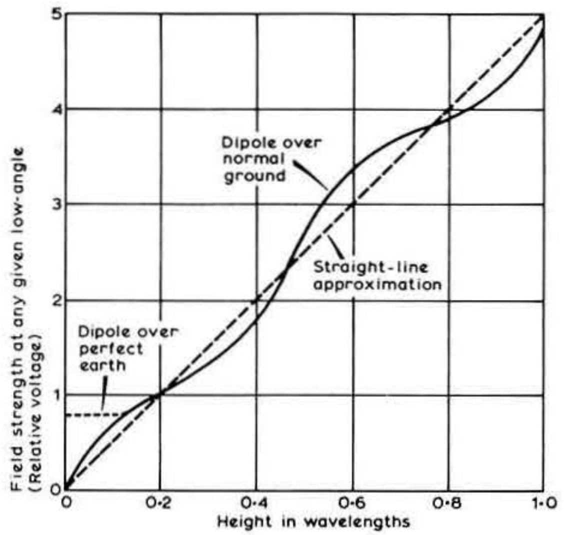
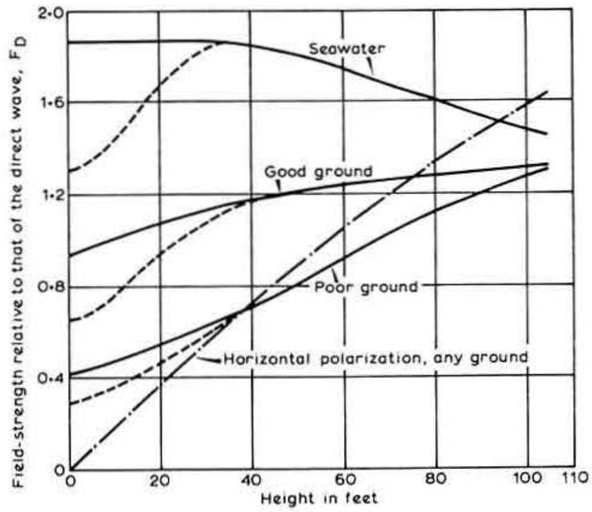


Fig 4. Effect of height on dx signal strength with horizontal dipoles. The ripples are attributable to variations in radiation resistance caused by mutual impedance between the aerial and its image, and are greatly reduced in the case of close-spaced beams



——— Vertical polarization, ground as indicated

Dotted curves indicate drop in signal-strength due to rise in radiation resistance of vertical elements at low heights above perfect ground. The drop may also be attributed to broadening of the vertical radiation pattern, the two effects being directly related.

Fig 5. Variation of field strength with height of aerial for 6° radiation angle at 14MHz

that the true gain of the beam relative to a dipole at the same height varies slightly with height, but it is, of course, the reference dipole, rather than the beam, which is varying.

In the case of vertical polarization with perfectly-conducting ground, the sign of the reflection coefficient is reversed so that the direct and reflected waves are in phase, and this has given rise to the belief that vertical aerials are good low-angle radiators. Unfortunately, in practice, losses in the ground cause the reflection coefficient to drop to a low value and change its phase at an angle of elevation known as the "pseudo-Brewster angle" from analogy with the behaviour of light waves. This angle varies between about 10° for "good" ground and 20° for "bad" ground, although it is much lower (about 3°) in the case of sea water.

For angles well below the Brewster angle there is little or no difference between horizontal and vertical polarization, but for an angle such as 6° the situation is rather more complicated. For this angle, Fig 5 provides a rough estimate of the likely variation of signal strength with aerial height for good ground, bad ground and over sea water, and also compares vertical with horizontal polarization. The solid curves assume a constant aerial current in a short vertical radiator and are based on data from [4] for the magnitude and phase of the reflection coefficient. The dotted curves take into account the rise in radiation resistance and consequent reduction of current due to the effect of the ground at low heights, assuming negligible loss resistance and perfectly-conducting earth.

The last assumption is an inconsistency, regrettably enforced by lack of data, but at worst the corrections will have been somewhat over-estimated. Curves for beam aerials can be expected to lie somewhere between the solid and the dotted lines. With lossy elements, eg a short inductively-loaded vertical whip, the solid line tends to indicate more closely the correct shape of the variation although the general level is reduced by the losses. The height is measured to the "centre of gravity" of the current distribution, or about one-twelfth of a wavelength above the feed point in the case of a ground-plane aerial with horizontal radials. The assumption of a "short element" is merely a device to allow the curves to be plotted down to zero height, instead of following the usual precedent of ignoring heights less than a quarter-wavelength. Important points to note include the following:

(a) At low heights for the stated angle of radiation, vertical aerials are always superior, though the claim that they are "good low-angle radiators" needs considerable qualification.

(b) The height below which vertical aerials are markedly superior at 14MHz varies from about 20ft with poor ground to 60ft with good ground.

(c) With increase of height from zero up to $\lambda/2$ the total change in performance with vertical aerials is only 3 to 6dB whereas the radiated field is almost directly proportional to height in the case of horizontal polarization.

(d) With poor earth the difference in performance between vertical and horizontal polarization is less than 2dB (or about half an S-unit) over a range of height from 20ft to 90ft.

With ground sloping in the desired direction it becomes much easier to achieve efficient low-angle radiation and possibilities arise of exploiting multiple reflections [3]. For gentle slopes there may be little to choose between horizontal and vertical polarization, but as the ground slope gets steeper the mirror image of a vertical aerial gets tilted back into the ground until at about 45° slope it becomes end-on to the required direction so that the field-strength is that of the unmodified direct wave F_D. In contrast, horizontal polarization provides nearly the maximum possible field-strength $2F_D$ with heights of the order of $\lambda/4$ only. In the case of hilltop sites an intermediate situation arises, with increase of height causing the point of reflection to slide further down the slope thereby producing a disproportionate increase of signal strength. The following table has been calculated for an 11° slope having a flat top, with aerials in various positions.

TABLE

Distance of mast in feet from top of slope	Required mast height in feet for $F > 1{\cdot}6F_D$ at 6° radiation angle (14MHz)
On slope	36
25	40
70	56
00 (equivalent to no slope)	105

Calculations have been simplified by assuming reflection from a point, thus ignoring the requirements for Fresnel zones [3], but suffice to indicate general tendencies. The advantage of a hilltop site for omnidirectional working is obvious but the desirability for a given direction of locating aerials on the hillside rather than on the hilltop is rather less so, although it becomes much greater with increasing steepness, as demonstrated by the previous example.

Small beam aerials

It has been shown [1] that a gain of 5 to 6dB can normally be expected from hf beam aerials small enough to meet typical amateur needs. Unfortunately gain is easily lost through errors of design or adjustment and the safest procedure is to restrict the number of elements to two, one of them being parasitically excited and tuned for maximum gain. In the case of loop elements, which provide the higher of the two gain figures, the parasitic element must be tuned as a reflector, not as a director, and in all cases the spacing must be within certain limits, one-eighth wavelength being a safe choice. Instead of tuning for maximum gain, it may be more convenient to tune for a null on signals coming from directions of about 130° relative to the beam heading, as explained in [1]. The common practice of tuning for maximum back-to-front ratio sacrifices just over 1dB of gain, the reduction in interference received from the back direction being offset by the higher levels received from the 130° directions so that any apparent advantage is illusory.

The gain of quad or delta loop arrays cannot be effectively increased by adding a director owing to the very low value of current in the parasitic director when it is tuned for correct phasing, as explained in [1]. The use of a director and reflector, or two directors, can bring the gain of a dipole array up to equality with that of a quad, but it may be cheaper and easier, and will certainly be just as good, to raise the height of the smaller array by 10 per cent.

With two-element beams the basic requirements [1] for realizing the full gain potential are

(a) Phase-difference, relative to the antiphase or "8JK" condition, should be equivalent to about half that due to the spacing between the elements.

(b) Currents should be equal within about 20 per cent.

These conditions are normally met, but only just, with dipole arrays adjusted as described above. With reflector-type loop arrays the currents are more or less equal, causing deeper nulls which can often be used for getting rid of interference by making perhaps a small change in the beam heading; the greater design-margin also allows more latitude in the choice of spacing and this can be helpful in the design of multiband arrays.

Driven arrays

There are several popular designs of two-element beams in which both elements are driven. In principle the advantage of driving is that phase and amplitude can be adjusted independently so that spacing is less critical and deep nulls are obtainable in back directions even with dipole elements. Unfortunately the usual methods of phasing are based on the false assumption that "one eighth wavelength of line equals 45° of phase shift" which is true only if a perfect match exists *at the elements*, whereas phasing, matching and current-ratio are all critically interdependent. Since the radiation resistance [1] is in the region of 15Ω, for maximum gain with dipole elements a matching device (eg T or gamma match) is essential, and this is usually not provided.

The best-known example of this type of array is probably the ZL Special, Fig 6, for which the *ARRL Antenna Book* [5] quotes a gain of 3-4dB, implying a phase shift somewhat greater than the "design target" of 45°, which is in any case excesssive as discussed above. (Alternatively the low gain could be the result of considerable current inequality but this seems less likely in view of the good back-to-front ratio usually experienced). Referring to the design curves, Fig 7, reproduced from [1], the characteristics of the ZL Special appear consistent with operation in the region $\phi/\phi_0 = 1{\cdot}2$ to $1{\cdot}6$, for which the adjustments are relatively non-critical and the variables tend to be largely self-compensating; thus an excessive value of phase shift increases the radiation resistance which brings the dipoles closer to a matched condition and reduces the phase shift.

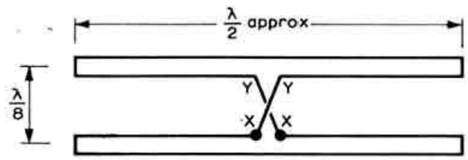


Fig 6. This illustrates the principle of the ZL Special. Open wire line may be used for the elements and for the phasing line XY. In one version the aerial is fed with low impedance twin line at XX. Variations include the use of 300Ω twin line throughout, and unequal element lengths

Other popular designs are based on the use of two separate feeders of equal length plus an additional length, usually $\lambda/8$, which is used as a phasing line. This permits operation at any desired point on the curves of Fig 7 but only if the feeders are matched at the elements or if the complete system is resonant, eg half-wave elements with an even number of half-wavelength of feeder between them inclusive of the phasing line. The importance of satisfying these requirements is not always appreciated and inspection of several popular designs suggests there will almost certainly be some loss additional to the usual decibel or so incurred by adjusting for maximum "nominal" front-to-back ratio. The matched-feeder procedure is often difficult to apply since any adjustment of the phasing line requires re-matching at the elements and all adjustments are interdependent; on the other hand, the resonance method ensures equal element currents since, looking into any point on the loop of feeder between the elements, any reactance visible when looking in one direction is equal but of opposite sign to the reactance visible in the other. It is assumed for the purpose of this explanation that the radiation resistances are equal, which is only true if the mutual impedance is non-reactive, ie for an element spacing of $\lambda/8$, but reactive effects can be compensated by alteration of feeder length.

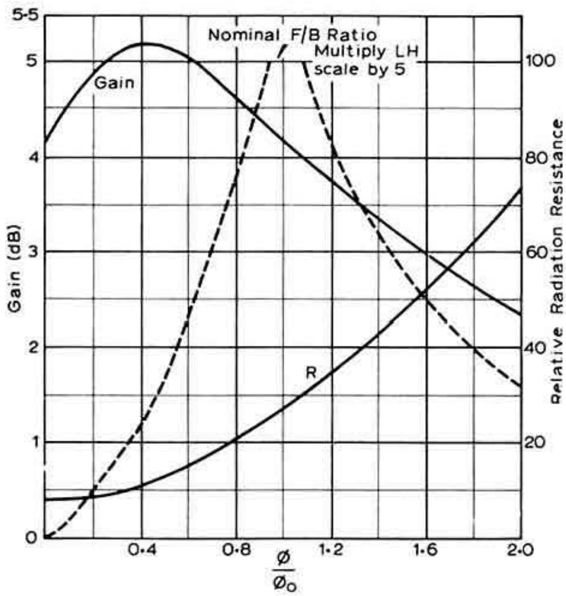


Fig 7. Variation of gain, radiation resistance and front/back ratio with $\phi/\phi o$. Resistance scale is correct in ohms for each of a pair of dipoles spaced $\lambda/8$ (equal currents are assumed)

In either case the phase-shift is different from the electrical length of the phasing line, and it will probably be obvious to the reader that this is the "$\pm X$" method of phasing which was assumed in the appendix to [1] for the purpose of simplifying the basic theory of close-spaced two-element beams in general. It lends itself particularly to the use of resonant feeders as shown in Fig 8; starting from resonance a small displacement of the feedpoint either side of centre is equivalent to the insertion of equal and opposite reactances of about $4f\Omega$/foot, where f is the frequency in megahertz. This arrangement allows multiband operation subject to adjustment of feeder length although, like other resonant-feeder systems, it is somewhat frequency sensitive; this tends to show up as current-inequality at the band edges but acceptable results have been obtained over the full width of the 14MHz phone band with folded-dipole elements and half-wave feeders. This aerial works equally well on 21MHz subject to shortening the feeders by about 42in, the feedpoint displacements being about 30in and 10in on 14 and 21MHz respectively relative to the centre of the system.

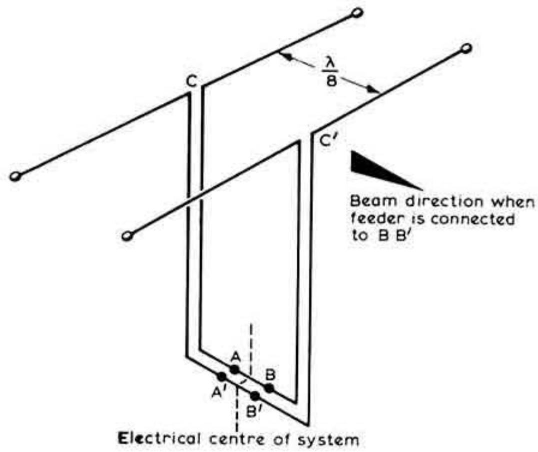


Fig 8. Two-element driven array with mismatched feeders. If the elements are resonant ($\lambda/2$) the length CABC′ must be an even number of half-wavelengths. AB is the phasing line and is much less than $\lambda/8$ if open-wire lines are used. Note that the feeders are crossed over as for the "8JK" aerial

An equivalent method of phasing is used in the "Swiss Quad", where it takes the form of differences in the loop sizes [6].

Compatability of element shape

When elements bent into "abnormal" shapes are assembled into a beam, particular care is needed to ensure that unwanted modes are suppressed and not reinforced. This is most likely to be achieved when the elements have similar shapes and orientation. Fig 2 shows two ways of arranging a pair of V-shaped elements with right-angled bends and it will be noticed that in case (a) with antiphase excitation, the endwise radiation is completely suppressed, whereas in case (b) there is complete symmetry, producing radiation of equal strength in all four directions. This implies a loss of exactly 3dB, although this is reduced to about 1dB with 45° of phase-difference, so that the maximum gain obtainable from an X-configuration appears to be in the region of 3dB. The loss of 2dB must, of course, be weighed against possible mechanical advantages, and will be fully recovered if these enable the mean height to be increased by 25 per cent. Similar arguments often apply to other methods of making beams smaller or more convenient to erect.

To be continued

Next month ....

Part 2 of this article continues the analysis of hf aerials and looks at:

★ **small beams**

★ **high-loss beams**

★ **measurement problems**

Plus "breaking the gain barrier"

UHF television interference

by IAN JACKSON, G3OHX*

THIS article is concerned with interference to uhf television from high frequency amateur transmissions. Special attention is drawn to the fact that in cases of tvi, a reduction of interference is unlikely to be achieved by obtaining a stronger television signal. The same may also be true for many cases for tvi from vhf and uhf amateur transmissions.

The article is not intended to convey an air of pessimism, but rather to indicate where the trouble may lie, so that preventative measures may be taken. The reasons for the tvi are discussed and some cures suggested.

Some of the statements made in this article may seem to be at variance with ideas expressed in certain previous—and even current—publications on the subject of tvi, an apparent paradox that is due to the fact that these refer mainly to vhf television, even though they may not specifically state this fact. Although uhf tv has been in operation in the UK for 10 years, and tv design and constructional techniques have changed considerably during this time, little attention seems to have been paid to the associated problems which have themselves changed.

UHF tv (625-line standard, 470 to 850MHz) is much further removed in frequency from the hf amateur bands than is vhf tv (40 to 216MHz, transmitted on the obsolescent 405-line standard in the UK). The number of tvi cases brought to the attention of the RSGB Interference Committee indicates that although many hf enthusiasts have found a new freedom from tvi troubles (especially in areas of weak Band I tv signal), the incidence of uhf tvi from hf transmissions is by no means negligible.

Stronger tv signal... less tvi?

Often heard (especially on 80m) are such statements as "I'm getting some tvi at present, but the tv signal is just strong enough to give colour lock. Down the road there is a new tv 'fill-in' transmitter. When it starts operation I'll get a good strong signal, and all my troubles will be over."

Alas, this may not be true. There is every chance that the tvi will be just as bad, or even worse. It is a common fallacy that weak tv signals are responsible for the trouble, and so-called "inadequate aerial installations", such as loft and set-top aerials, are often blamed.

Why a stronger tv signal may not help

Before uhf tv appeared, the major problem for hf band operators was usually harmonics—either as spurious transmissions or as self-generated signals produced in the tv set rf and mixer stages—especially when receiving a Band I tv signal. Harmonics are unlikely to be the cause of tvi to uhf sets in the same way as to vhf. On 10m, the 16th harmonic at least is required, on 80m it is the 130th. While such interference is not impossible, the trouble is more likely to be caused by amateur signals which do not affect the tuner at all (or if they do, then by relatively indirect means). The interfering signals enter the tv set via the coaxial braid/mains lead connection or by direct pick-up, largely due to the use of modern components, open unscreened printed circuit, and generally poor "electromagnetic compatibility" (emc)† common to much modern domestic electronic equipment [1].

Although hf transmitter spurii may be negligible at uhf, this does not absolve the amateur from taking the usual precautions. It is good engineering practice to use good screening, filters, tuning units, and so on, and these may be essential to prevent unwanted radiation on frequencies which may affect the tv set i.f. (UK standard: sound 33·5MHz, vision 39·5MHz) or cause interference to other radio services.

It is worthwhile examining the effect of changing the tv signal level in relation to the level of interference which is affecting various stages in the tv set. The amateur signal may enter any stage, but the effect it causes is often dependent on the level of the tv signal in that stage, and on its dc operating conditions.

In all the cases considered below, it is assumed that the amateur transmission is adequately free from all spurious signals.

(a) When interference occurs after the agc stages

When interference is introduced in a stage after the agc has acted to maintain the tv signal at a virtually constant level, there will be no change in the tv signal-to-interference ratio if the tv signal is raised. An example of this is where the fundamental amateur signal enters the video or audio stages and causes interference by direct reproduction or detection. Colour decoder circuits often try to "decode" 80m signals (being close to the colour subcarrier frequency of 4·43MHz), with disastrous results. Harmonic generation may occur in the i.f. amplifier (eg 5 × 7MHz = 35MHz), and so on.

(b) When interference occurs before the agc stages

If the interference is caused by harmonic generation (such as above) an increase of television signal *will* improve the tv signal-to-interference ratio. When the cause is crossmodulation (which occurs usually in the i.f. stage) the situation is different. The percentage *depth* of modulation produced in a nonlinear amplifier by the process of crossmodulation does not depend *at all* on the level of the wanted (ie tv) signal, except in cases where the wanted signal is so strong that the amplifier is already being overdriven and its biassing conditions upset. Thus, regardless of the tv signal level, the interference will be the same.

It must be mentioned that if there is no tv signal (when the set is tuned off the tv channel, for example) there may appear to be no interference present, or just a slight modulation of the background noise. This does not mean that the crossmodulation *does* vary with tv signal level. The reason is that even 100 per cent modulation of "no carrier" produces zero output from the video detector.

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† EMC is a recent expression which indicates the ability of electronic equipment to operate satisfactorily in the presence of high field strengths from transmissions on frequencies other than those on which the equipment is designed to operate.

(c) When interference occurs in the agc stages

In modern tv sets, agc action is usually achieved by changing the gain of a stage (or stages) by varying a transistor collector current, and there are basically two methods of control. One is "reverse agc" where the gain is reduced by a *reduction* of collector current; the other is "forward agc" where the gain is reduced by an *increase* of collector current, often accompanied by a reduction of the supply voltage. In either case the stage is operating at best linearity at approximately maximum gain, ie when the tv signal is *weakest*.

With reverse agc, as the tv signal is increased the collector current is reduced and the stage becomes more nonlinear. The signal handling capacity is also reduced. Self-generated harmonics usually increase faster than the gain is reduced, and crossmodulation also increases.

Forward agc preserves the linearity somewhat better than reverse agc, although it is likely that the linearity will still become worse as the gain is reduced, at least over part of the control range. Fortunately this form of agc is becoming more widely used.

Why set-top aerials are often quite adequate

For vhf tv, an effective aerial installation, appropriate to the channels being received, is often helpful in obtaining freedom from tvi, and it is normal PO policy to require the use of such an aerial before tvi complaints are considered justified. The intention is to obtain the greatest tv signal-to-interfering signal ratio at the tv aerial.

A uhf aerial is physically so small compared with the wavelengths of the hf bands that it picks up little of the interfering signal. As already stated, most of the pick-up is via the coaxial braid/mains lead, and sometimes direct in the tv circuit.

If attempts are made to obtain a stronger tv signal by erecting a better tv aerial, the amateur may be doubly defeated. Firstly, the stronger signal may not reduce the tvi. Secondly, a "better aerial" is usually a high-gain beam in a well elevated position, so that a longer coaxial feeder will probably be required, thus increasing the risk of braid pick-up. This is not to say that a good tv aerial is totally undesirable. Interference which enters the set via the braid etc can usually be filtered out by simple means. However, if such filtering is not carried out, or if the pick-up is direct in the agc-controlled stages, the interference may be worse. In addition, a long coaxial feeder may increase "direct" pick-up by introducing a high level of interference into the vicinity of the tv set. This effectively bypasses and renders useless any braid filter on the tv set aerial input.

As such interference is probably due mainly to the interference *voltage* on the braid (rather than current), earthing the braid of the coaxial feeder near the set (maybe in conjunction with a braid breaker) is sometimes effective. However, where a good rf earth is not possible, the braid breaker should be inserted in the feeder at some distance from the tv set—perhaps 10ft—but not so far that interference is picked up between this filter and the set. Both coaxial and mains leads should leave the set as directly as possible, and any spare lead should be kept away from the set. TV-top lamps, electrical wiring, gas and water pipes etc, should all be treated as suspect sources of interference pick-up.

Provided that the viewer is satisfied with the picture quality, set-top and similar low efficiency aerial systems should not be "improved". This is vividly borne out in the way that many small portable tv sets, working on self-contained aerials, are clear of tvi, while in the same house the "family" set is badly affected. The use of such low-efficiency aerials, in areas where they have to be followed by a booster amplifier to obtain an adequate picture is, however, not recommended.

Masthead amplifiers and boosters

Masthead amplifiers often work wonders where the tv signal is not quite adequate, but they can also be very troublesome for radio amateurs. Many commercial amplifiers are very susceptible to interference, either by crossmodulation or self-generation of harmonics. One type, covering all vhf and uhf tv channels, has virtually constant gain from a few megahertz to 850MHz.

Unless the amplifier to be used is known to be tvi-proof, it is unwise to suggest to a neighbour that he have one fitted on his tv aerial mast to improve his tv signal. It is extremely difficult to deal with these amplifiers once mounted at chimney level.

Many fringe and shadow tv reception areas will eventually be served by low-power relay transmitters. It may be that the distant transmitters are received using masthead amplifiers, with no trouble at present, but the new tv signals may overload the amplifiers, so that not only may there be crossmodulation between the tv channels, but in this condition the amplifier may be more susceptible to crossmodulation from amateur transmissions. This may be less tolerable to the viewer than the sight of several tv pictures seen simultaneously on the screen.

In addition to causing tvi on the tv set to which it is connected, a masthead amplifier may generate and efficiently radiate uhf harmonics of the amateur signal, since it is connected to an efficient uhf aerial. As a result, other neighbours may also suffer tvi. Sometimes this is worse when the offending amplifier is switched off (ie when nobody is watching the tv set), because the amplifier input stage is more nonlinear without its dc voltages applied (*cf* varactor multipliers, which require no dc power).

What else can be done?

If stronger tv signals are not usually an aid to curing uhf tvi, what else can be done? Often, simple filters fitted to the tv set aerial input are completely successful (especially the braid-breaking variety). The author has it on good authority that interference which enters the set via the mains lead *alone* is unlikely, but may be stopped by winding several turns of the lead around a suitable ferrite ring core such as Mullard type FX1588.

Cases of direct pick-up in the tv set circuit are much more difficult to deal with, and regrettably seem to be becoming more common. Where standard external cures are not effective and the amateur is convinced that his station is not at fault, a co-operative complainant may be willing to take the matter up with his dealer, especially if the set is fairly new. Manufacturers are often willing to make good such emc deficiencies in their products, but obviously cannot do so unless complaints are made.

Attention is drawn to the usual warnings about tampering inside tv sets—especially other people's.

Fortunately, the amateur can often do a lot to help by taking measures which reduce his transmitted field strength in the vicinity of the neighbouring tv sets. It is often possible to site the transmitting aerial well away from the house, and to ensure that it is the aerial alone which radiates. The use of balanced aerials (such as dipoles) with balanced feeders, or coaxial lead with a balun transformer at the aerial feed point is often a great help and can also prevent rf energy from being fed into the mains wiring [2]. Users of unbalanced aerials (ground places etc) should also take similar steps to ensure that the feeder does not radiate.

When cures are elusive

Sometimes it may be difficult to cure the tvi. Technically, a cure is always possible, but there may be limits to which the tv set owner, dealer or manufacturer may feel obliged to go.

It must be realized that if transmissions which cause tvi continue, unco-operative neighbours are unlikely to become more understanding, and may take steps (including legal action) to make you stop transmissions. It is preferable to ask the neighbour to complain officially to the Post Office, who will then investigate the problem. It is to be expected that they will support the amateur when his station is proved to be free from fault, and may be instrumental in bringing about a cure.

An RSGB member who is threatened with any action to restrict his transmissions is strongly advised to notify the RSGB Interference Committee.

References and acknowledgements

[1] "Practical braid-breakers using stock materials", I. Jackson, G3OHX, *Radio Communication* November 1972.

[2] "Television interference—its causes and remedies", D. M. Thomas, GW3RWX, *Radio Communication* October 1969.

Information from G3BLE and G3OJV.

The G3XGP digital frequency meter, corrections and modifications

by W. H. BOND, G3XGP

The original device described under this title was literally made out of the junk box, using available materials, and the author should have been more aware of the problems that might arise when others tried to reproduce his design. This article is an apologia and an attempt to rectify the author's errors in reading proofs and diagrams, and also to suggest a simpler and more reliable input stage, using readily available and well-tried transistors.

The text is free of error, but mistakes appear in three of the illustrations. In Fig 4, pin numbers 5 and 7 should be transposed. In Fig 5, IC11 has no positive supply and pin 5 should be joined to the ht rail at a point on the pcb just below the legend "R23". In Fig 7, C9 is wrongly polarized and the connections should be reversed.

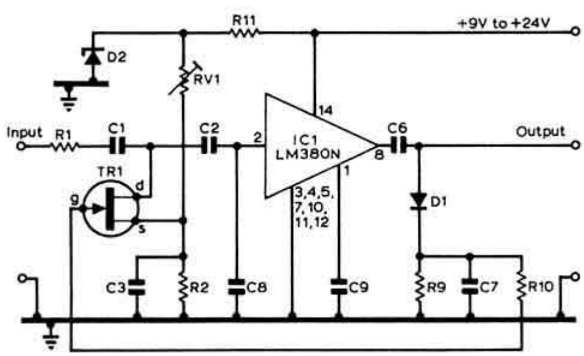
The suggested changes to the input stage are simple and inexpensive. Omit R15, it appears to make no contribution to stability or frequency response when a fully stabilized power supply is used. Change R7 for a 10kΩ resistor. Replace TR1, a GP25 no longer obtainable, for a 2N5245, R3a is not required and R3 suffices. Replace TRs 4, 5 and 6 by vhf transistors, 2N709 is preferred but 2N706a, 2N918 or BSX20, among many, would probably work satisfactorily. Finally the first divider should be a DM7490 (National Semiconductors) or an SN7490a, if over 32MHz is to be achieved.

The setting up procedure is unchanged, adjusting R3 until the LED just goes off, and making a final adjustment at the highest practical frequency. A meter in the supply (the input stage in Fig 2) should read 15mA in the absence of a signal and 25mA when one is injected.

An integrated circuit speech compressor, modification

by A. LANGTON

Since this article was published in the August issue of *Radio Communication* the author has learned that the PA237 is obsolete, and therefore offers a modified circuit using a currently available device, the National Semiconductor LM380N.



The LM380N has a fixed gain and all the required bias is built in, resulting in a reduced number of components. A zener is included in the fet circuit to stabilize source bias, as the ic will work from 9 to 24V. Pins 3, 4, 5, 10, 11 and 12 are used as heat sinks and can be earthed to pin 7.

Performance is slightly better as the gain is now 30dB before threshold and the fet saturation point now occurs at about +10dBm. Some improvement in performance can also be obtained by adjusting C7 to suit the voice characteristic of the speaker.

160m dx from suburban sites

by A. P. A. ASHTON, G3XAP*

IT is no secret that many dx contacts on 160m are a result of well-designed aerials and well-planned operating times, and *not* of power inputs above the permitted maximum. An increase in transmitted power from 10 to 1,000W represents an increase of 20dB at the receiving station, but is only a one-way benefit. If this 20dB improvement in distant receivers is obtained by careful design and tuning of the transmitting aerial, the "power increase" will also apply when the aerial is used for the *reception* of dx signals. Note, however, that this is not aerial gain in the sense that is normally meant, ie gain over a half-wave dipole, but gain of a "dx aerial" over the type of aerial that one would expect to find in a small garden.

The author's garden (counting the area occupied by the house and the small front garden) is about 100ft by 45ft, but dx has been worked from this site using aerials that occupy far less than this area.

The aerial

A horizontal aerial at heights less than a quarter wavelength from electrical ground radiates very little energy at low angles; most of the radiation goes straight upwards and is lost into space. This means that on 160m any horizontal aerial less than about 130ft from the ground is not likely to be too efficient for dx working, for which a low angle of radiation is necessary.

A half-wave dipole can be erected in the so-called inverted-V configuration with the apex considerably less than 130ft high, and produce very good dx results, although anyone with room to erect a full-sized half-wave dipole on 160m is hardly operating from a typical suburban site. The answer is to use a vertical aerial, or one which has its high-current portion vertical to the ground. As it is unlikely that the reader will be able to erect a full-sized quarter-wave vertical it will be necessary to load the aerial in some way to bring it into resonance.

Before considering the loading, it is useful to consider what height of aerial should be aimed at. To put the matter into perspective, consider an aerial with a 40ft vertical section, (which is equivalent to a vertical aerial about 2ft 6in high on 10m). It is obvious that the sort of height that the average amateur can achieve will still be very short for the frequency in use, but nevertheless the aim must be to have as high a vertical section as possible. The author has found from bitter experience that the difference between a 40ft and a 60ft vertical on 160m can be quite colossal! Even so, let it be said that he has successfully worked PY1DVG with a 40ft vertical.

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So, how to perform the loading? An aerial less than a quarter wavelength long has inductive reactance which can be removed by inserting an inductance somewhere along its length. The easiest place to insert it would be at the base of the aerial, which also makes for easy tuning, but it is certainly not advised. Bitter experience has shown that aerials so loaded do not perform too well, as the coil is being inserted in the high-current portion of the aerial, and coils are not good radiators. It is likewise not a good idea to put the coil at the top of the vertical as rf losses from coils so placed tend to be high, and in any case there are practical problems with adjusting the taps on a coil located 40ft above the ground. A nice compromise is to place a loading coil in the centre of the vertical, but this tends to raise engineering problems as it means having an insulated section between the top and bottom parts of the aerial.

So, where should the coil go? From experience gained mainly on 40m, the author's answer is that some other method of loading should be used. The only real alternative is to lengthen the aerial, so, since it is not practicable to lengthen it upwards, and bearing in mind the confines of suburban sites, the answer would appear to be a single wire taken from the top of the vertical section to a convenient point such as the roof of the house or a tree. This will almost certainly lead to a change in the polar diagram of the vertical, but on 160m the suburban vertical will be anything but omnidirectional anyway, as there will be a significant amount of metal within a wavelength or so. The loading wire need not be horizontal—it can slope considerably and can also be bent around the garden—the vertical section is the important part.

The next problem is what length to make the loading wire. There are a number of alternatives here, firstly the total aerial length could be about 130-140ft so that it is self-resonant at the desired frequency. Note, however, that the total length will be slightly greater than a horizontal aerial of the same frequency due to the capacitance between the vertical section and the loading wire. (It is the same phenomenon that leads to quad loops being bigger than they may be expected to be). Such an aerial will have a resistive feed-point and a vswr of about 1·5 or 2:1, but will also have one major disadvantage, namely that the point of maximum current is at ground level. DX QSOs will be possible, but the aim is to get as much rf as possible bouncing off the ionosphere, so an alternative is to make the loading wire a full quarter wavelength long, putting the high current portion of the aerial at the highest point. An additional advantage with this method is that there will be a great deal of horizontally-polarized radiation from the loading wire in addition to the lower-angled vertically-polarized radiation from the vertical, which means that the aerial will be very useful for inter-G working. In practice, the author has found that such aerials produce extremely good results at all distances.

This type of aerial displays capacitive reactance which is removed by simply inserting a variable capacitor at the feed point (Fig 1). Both of the alternatives mentioned so far give rise to feed-point impedances which will almost certainly not provide a perfect match for the feeder, although in both cases the vswr should be less than 2:1. The author considers this to be unimportant, but for those who require a better match, the aerials can be fed as shown in Figs 2a and 2b.

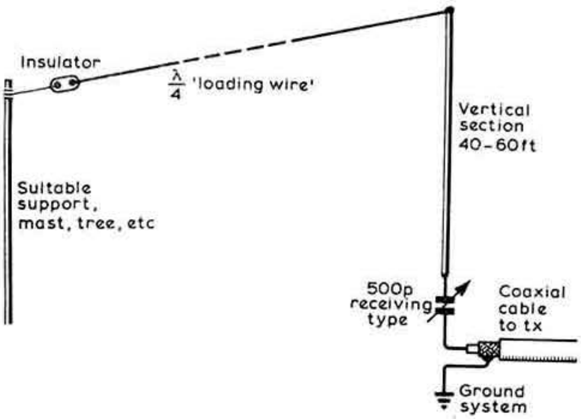
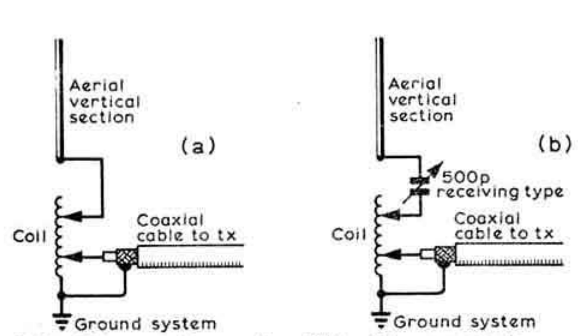


Fig 1. Layout and feed system for a 160m aerial with λ/4 "loading wire"

Surprisingly, tests have shown that the radiation from aerials that have been adjusted to low vswr is less than that obtained without the coil and with a vswr of 2:1. The assumption drawn here is that coils used in impedance-matching circuits of this type give rise to more loss of rf than having a higher vswr but no coil—certainly a coil that is efficient at 1·8MHz would be very large and the values quoted in Fig 2 are far from optimum. It must be remembered that the usual transmitter tank circuit has a Q of between 10 and 15, which will not give an acceptable attenuation of harmonics in the region of 3·65MHz. Although the aerial itself will offer a very high impedance to these spurii, they can be radiated from the feeder and cause considerable annoyance to nearby stations using the 3·6–3·7MHz portion of 80m. It is recommended, therefore, that some form of matching unit be used at the transmitter end of the feeder. (Such a matching unit was used by the author when comparing field strengths in the tests mentioned above, so the reduction in field strength noted was probably not due to a reduction of spurious emissions).



Coil.... 40 turns self-supporting, 3"dia, 6 turns per inch

Fig 2. Feed systems for minimum vswr (a) with a λ/4 resonant aerial, (b) with an aerial of length greater than λ/4

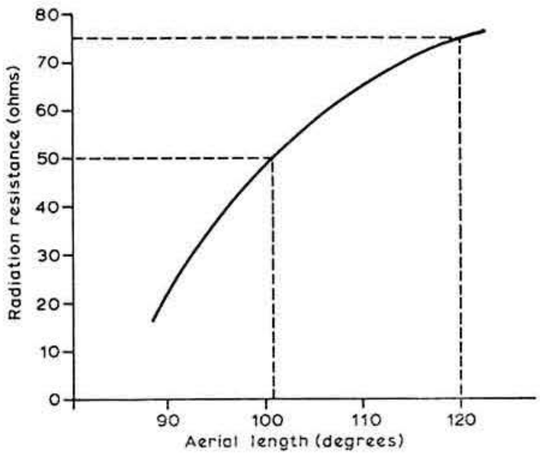


Fig 3. Graph showing relationship between aerial length and radiation resistance (based on assumption that reactance has been removed). The term "radiation resistance" must not be confused with the impedance of a non-resonant aerial

The final alternative is perhaps the most elegant technique of all, and makes use of the fact that the radiation resistance of an aerial varies with its length. So, if the aerial is lengthened sufficiently, a radiation resistance of 52 or 75Ω can be obtained, which will provide a perfect match for the particular feeder in use (Fig 3). In this case, the aerial will be reactive, so a series capacitor will be required to maintain resonance. Although the actual aerial length required to give a certain resistance varies considerably from one aerial to another, the approximate total lengths for radiation resistances of 52 and 75Ω are 160 and 175ft respectively. The aerial should be erected with somewhat more wire than is assumed to be necessary, as it is easier to remove the excess than to add more.

The earth system

Aerials of the type described above require good earth systems if they are to be efficient. A classic radial system would consist of at least 36 radials, each at least a quarter wave in length, but this is hardly realistic for a suburban site. The author has carried out much work on 7MHz with radials of various types, and long ago reached the conclusion that short radials can be reasonably efficient if there are enough of them. A system on 7MHz using 16 insulated radials grid-dipped in pairs and tuned to 7·005MHz did not seem to offer much advantage over a system that used about 20 radials of bare wire each about 10ft long and terminated by a 3ft ground stake. A 10ft radial on 7MHz is equivalent to a 40ft radial on 160m, and 40ft radials are not as difficult to accommodate as may be supposed.

Before going further into the practicalities of radial construction, it will be useful to have a close look at the object of the exercise, Simply stated, the aim is to provide a path along which a current can flow, and for maximum efficiency this current must be able to equal the current flow in the aerial.

Although not strictly applicable to this argument, the basic formula from Ohm's Law can be used to illustrate the principle:

$$I = \frac{E}{R}$$

It can be assumed that the voltage (E) is fixed, and that the current (I) must be maximized, so it is obvious that the resistance (R) must be reduced to a minimum. As the radial is likely to be less than a quarter-wave long, current must flow into it from the surrounding ground, so what must be considered is the resistance of the earth in the vicinity of the radial.

As the earth resistance of a particular site is a property of the location, and unlikely to be alterable except by expensive soil treatment, the only alternative is to change the approach to the problem, and see what else can be altered to improve the current flow. The answer would appear to be to lower the current that is needed, and this can be done by increasing the number of radials. Take the case of a resonant quarter-wave vertical aerial as an example, and assume that the rf current at its feedpoint is 10A. If only one radial were used, the current flow at the aerial end of the radial would need to be 10A for maximum efficiency. If 10 identical radials were used, they need only 1A each. Referring back to the Ohm's Law formula, it can be seen that if the voltage remains constant and the current is reduced, a higher value of resistance can be tolerated. This appears to be borne out in practice, as the author has noted that as the number of (inefficient) radials is increased, the current flow into the aerial also increases.

There appears to be little information available on the type of material to use for the construction of radials, and there is little doubt that inefficient vertical aerial operation on the lower-frequency bands can often be traced to inefficient radials. Probably the best method of construction is to use a bare copper wire, and to lay this in a trench about 3in deep that has been cut open with a spade. The far end of the radial is soldered or brazed to a ground stake which is then driven down vertically into the ground. Soil treatment chemicals can be laid in the trench prior to closing it up, but the advantages of such treatment will not last long—especially in well-drained soil. As many radials as possible should be used and they can be wrapped around the garden wherever they can be fitted in. At least one of the radials should be about 140ft in length if it is at all possible—even if it means laying it around the whole perimeter of the garden and over-lapping it at the end.

Finally, remember that the action of the ground system is twofold, because in addition to providing a current path for the aerial to work against, it also forms a reflective mat. Those diagrams showing a 34° angle of radiation from a quarter-wave vertical assume that the aerial is mounted over perfectly conducting ground, so it should be remembered that anything less than perfect will have the effect of increasing the angle of radiation. Anyone proposing to lay a lawn or alter their garden in any way would do well to consider the idea of burying as much metallic junk as possible prior to commencing work—the effects of this will be felt on all bands, not just on 160m. For a given vertical aerial, the strength of the signal at dx is proportional to the amount of effort that has been put into the ground system, and worthwhile increases in signal strength can only result from further effort in this direction.

Propagation

As with every other frequency, it is essential to understand the mode of propagation on 160m in order to achieve the greatest success. DX contacts on 160m are a result of ionospheric reflection—probably from the E and F layers, but unlike the hf bands, 160m signals will not tolerate high levels of ionization. The D layer will completely absorb signals at this frequency, and the E layer will attenuate them considerably, so as these two layers only exist to any extent while the sun's rays are actually striking the ionosphere, it is obvious that dx can only result while the transmission path is in darkness.

The most common path for 160m dx working for European stations is the transatlantic path to North America, and Fig 4 shows the situation over this path at European sunrise and at North American sunset—two very favourable times for 160m propagation over this path. With the European sunrise diagram, note that signals from Europe and North American aerials can strike the F layer ionization without passing through either the D or E layers, or they can be reflected from the E layer—again without encountering the D layer. As the earth rotates, the D layer ionization spreads out further over the Atlantic and absorbs any would-be 160m dx signals.

The same reasoning can be applied to the North America sunset diagram, although in this case the closing of the band is due to the collapse of the E and F layers after the sun's

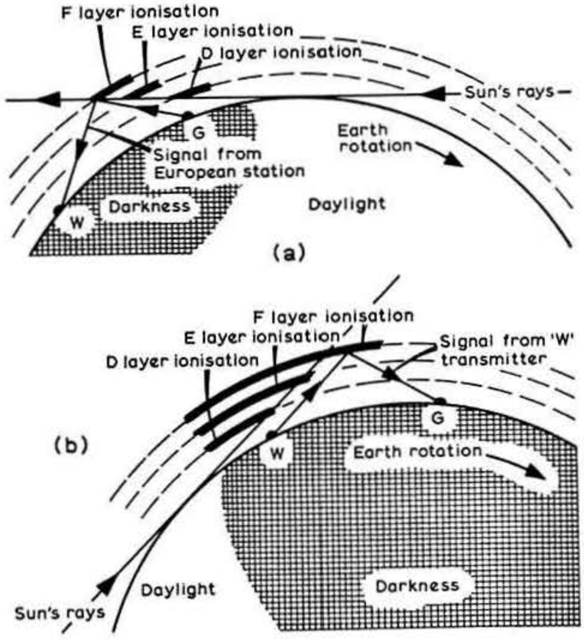


Fig 4. The North America—Europe path, (a) at European sunrise, ie just prior to sunrise in the UK, (b) at North American sunset—note that in this case the F layer ionization is persisting for a much longer period than the E and D layer ionization

rays have ceased striking them. Note that the sun's rays excite the E and F layers over the Atlantic before the sun actually rises in Europe—this accounts for the fact that the band opens before dawn. During the night there will be a period between sunset in North America and sunrise in Europe during which the sun's rays are not causing ionization over the Atlantic, resulting in a period of no activity. An experienced 160m operator can get a little sleep during this period. For other paths such as G—PY and G—VK the picture is obviously not so simple but the mechanics of propagation can still be worked out and likely times evaluated.

Operating data

It is obvious that if dx stations operated on the same frequency as European stations, dx working would be all but impossible. For this reason a type of bandplanning is employed—similar to that used ont he vhf bands. Referring again to the Europe-North America path, European stations use the portion 1,825—1,835kHz for transmitting, while the Americans use the portion 1,800—1,810kHz. Other European stations transmitting below 1,810kHz would cause great difficulties, so it is gratifying to note that European amateur operation in the bottom 10kHz of the band is virtually non-existent. It is a pleasure to be able to report that offending stations always QSY when asked to do so—after all they have every right to use that portion of the band if they so desire.

In order to give newcomers to 160m an idea of what to expect, and when and where to find it, Table 1 gives details of the more common 160m dx that is likely to be encountered.

The only remaining requirements for dx working are a reasonable amount of common sense, a sense of humour, an aptitude for staying awake, and above all the desire to work dx. This last item may seem obvious, but unlike on all the other commonly-used bands, the amateur is most unlikely to work dx by accident, and with a compromise aerial it will seldom be worked with ease. The failure rate will be very high and the list of "gotaways" will far outweigh the list of stations worked. It is necessary to be able to copy weak stations "in noise", and in the presence of severe QRM and QRN. The standard of cw must be absolutely impeccable whether at 2 or 20wpm, as dx stations always seem to copy the one callsign mistake that slips through!

One thing which is certain, however, is that success on 160m is more than adequate recompense for the effort involved. The author spent five years before finally making it across the Atlantic to work K1PBW, making this QSO by far the most memorable occasion in his experience of amateur radio.

Results

What can the 160m enthusiast expect to work from a surburban site? The author can only quote from his own experiences and the following summary will give an idea of what is possible.

The aerial at G3XAP has a 60ft vertical section with a 140ft "loading wire" and a series capacitor at the feedpoint to bring the vswr down to a tolerable level. There are four 140ft radials (much bent), 16 35ft radials, and a large number that vary in length from as little as 6ft up to 30ft. The total number of radials is probably around the 60—70 mark, at which stage it is difficult to see much improvement when more radials are added.

Table 1

THE MORE COMMON 160m DX

Country	Frequency (kHz)	Most likely time (gmt)
W	1800–1810	Nov-Feb 2300–0100
VE	1800–1810	and 0430–0730
KV4	1800–1810	
PY	1800–1810	
CX	1800–1810	June–July 0000–0200
LU	1800–1810	
5Z4	1800–1810	
ZS	around 1935	June–July 2300–0130
VK3	1800–1807	Dec–Jan 1845–1945
VK6	1800–1807	Dec–Jan 2100–2200

The transmitter runs a genuine 9W input and the coaxial feeder from the shack to the feedpoint is 65ft of uhf ultra low-loss type (which happened to be available). With this set-up the author cannot compete with the "big" European signals such as OK1ATP, EI9J and G3IGW, so has therefore become accustomed to taking second place. Despite this, the following list gives an idea of the dx that has been worked in the 18 months since the first G3XAP 160m dx contact: W1. W2, W3, W4, W8, VE1, KV4, PY1, ZP9, EL2, EP2, plus two "heard" reports from VK6 (only VK or ZL is required for a 9W 160m WAC from the author's suburban site).

Changes to the 2m, 70cm and 23cm band plans

by G. M. C. STONE, G3FZL, RSGB VHF Manager

AT a meeting of IARU Region 1 VHF Managers held in Baunatal, West Germany, on 13–14 October 1973 it was agreed to update the European 2m, 70cm and 23cm band plans with effect from 1 February 1974. Under the very able chairmanship of C. Van Dijk, PA0QC, the debate continued for many hours before agreement was reached with a remarkable spirit of compromise and mutual co-operation being shown. Roy Stevens, G2BVN, acted as secretary of the meeting. Eighteen countries were directly represented and several others communicated views by letter.

The revised UK band plans will conform exactly to those agreed internationally, and these will also be introduced on 1 February 1974, from which date UK geographical zoning will be abandoned.

Key features of the new plans are:

1. Similarity, as far as possible, of plans for 2m, 70cm and 23cm so that one mental image serves for all three bands.
2. Retention of a 150kHz cw segment at the lower end of each band although cw may, as in the past, be used elsewhere in the band.
3. Movement of ssb to the segment of band immediately above cw, with a flexible upper limit depending upon occupancy.
4. General encouragement of dx and semi-dx into the lower 1MHz of the band with, in the case of 2m and 70cm, local working and repeaters above this.
5. Designation of frequencies for space communications to allow for future developments in the field of amateur radio satellites.
6. Provision of sufficient channels to meet present and foreseeable future requirements for fm simplex and repeater working.
7. Replanning of European beacons, separating those designated "area coverage" from "local coverage" ones, with regional planning of area beacons only.

As in most countries of Europe band plans are entirely voluntary and can only succeed with the willing co-operation of all concerned, all vhf managers will give maximum publicity to the change.

The abandonment of the UK system of geographical zoning, which has been a particular feature of the 2m band plan, will release a wider spectrum of frequencies for general use. There will, however, be a certain degree of mode separation, recognizing the interests of all from extreme dx cw working, through ssb net channel operation, sstv, ordinary QSO working, channelized fm operation both simplex and through repeaters, rtty and space communication. As there is no co-ordinated emergency service throughout Europe, UK Raynet will be accommodated by national arrangements and these are discussed later.

The most significant change is to bring ssb to the lower part of 2m. This change was first mooted at the IARU Region 1 Conference held in May 1972 (see *Radio Communication* July 1972, pages 444–450). The original intention was to debate this at the 1975 triennial conference. However, demand for change has been growing and the only issue to present a serious problem was the extensive West German repeater scheme—the inputs of which are between 144·15 and 144·3MHz. However, DARC decided after the 1972 conference to adopt the newly-agreed Region 1 standard of 600kHz input/output spacing and will progressively move all repeaters during 1974. The main problem has therefore been resolved and DARC are to be congratulated on their example of generous mutual co-operation. During the changeover period, ssb workers are, however, requested to avoid unnecessary interference to specific input frequencies. In the UK some workers will need to obtain new crystals in order to use the new ssb allocation, and mobile operators should equip themselves as necessary for Region 1 fm simplex and repeater channels. Suppliers of equipment and crystals within the UK have already been alerted and asked to assist in achieving a smooth transition to the new plans.

Beacons

European area coverage beacons (50W erp or more) will be moved to the lower end of the bands during 1974: on 2m, 144·15MHz ± 25kHz, and on 70 and 23cm on and immediately below 432·05 and 1,296·05MHz respectively. RSGB will plan centrally for Region 1 the allocation of frequencies for area beacons in such a way as to minimize problems of mutual interference under normal or lift conditions. Local beacons (5W erp or less) will be administered by national societies as interference problems are not likely to exist.

Repeaters

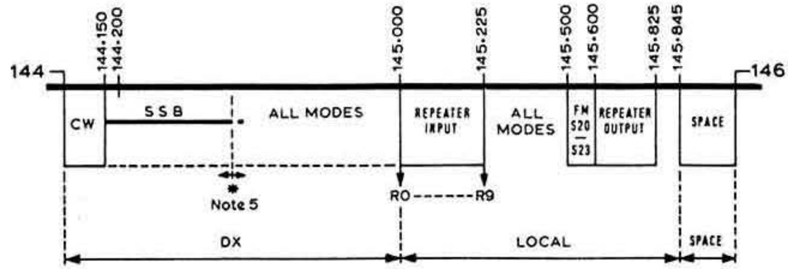
Several Region 1 member societies, especially in Scandinavia and West Germany, wished to have additional 2m repeater channels to those agreed at Scheveningen (R1 to R9). Other societies, including RSGB, felt that nine was an adequate number, especially if additional channels could be provided by interspersing 12·5kHz channels between the present 25kHz channels. However, a compromise was to add one additional channel, 145/145·6MHz, designated R0. It was also agreed that existing fm simplex channels located on repeater outputs may continue.

As the UK view is that no more than eight channels will be required for future repeater plans, therefore the R0 channel will not be allocated for repeater operation. 145MHz will have no special tag, and is expected therefore to continue as a popular working channel. Channel R8, 145·2/145·8MHz, similarly will not be allocated to repeater operation in the UK but will be reserved for special purposes, while 145·8MHz will continue as a national Raynet working channel, and R8 for Raynet repeaters, should these be required. Repeater channels R1 to R7 and R9 will be allocated according to need by reference to a national plan for the orderly and limited growth of repeaters already drawn up by the VHF Committee from ideas proposed by G3HWR and G3ZGO.

A new feature is that provision has been made for a UK 70cm repeater scheme, should this be authorized by the Ministry of Posts and Telecommunications, using a 1·8MHz spacing (three times 600kHz) with inputs 1·8MHz below

2m Band Plan

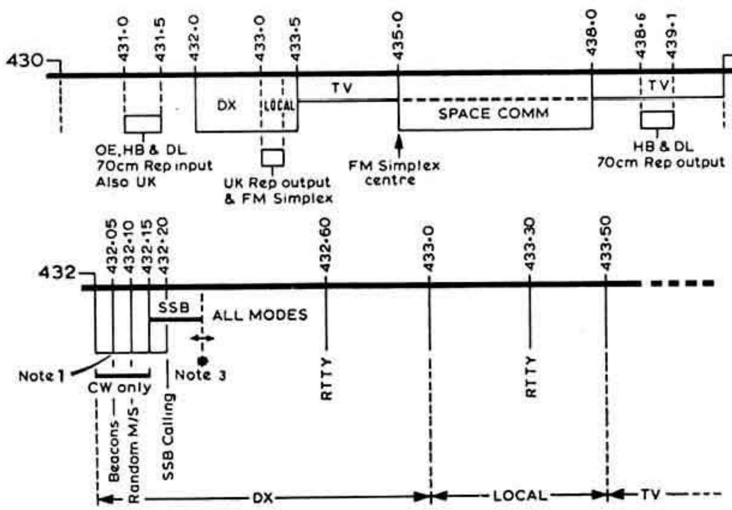
MHz	Allocation
144·000–144·010	E-M-E
144·100	Random ms
144·150	Centre frequency regional beacons
144·200	SSB calling
144·600	RTTY (dx)
145·000–145·225	Repeater input—R0 to R9
145·300	RTTY (local)
145·500	Mobile calling
145·500 (S20), 145·525 (S21)	FM simplex
145·550 (S22), 145·575 (S23)	FM simplex
145·600–145·825	Repeater output



Notes
1. Established simplex frequencies on repeater output channels may be retained.
2. The segment 145·25–145·5MHz may be allocated, if desired, to fm channels.
3. No regional planning for low power beacons (erp of 5W or less).
4. Area coverage by regional beacons (erp of 50W or greater).
5. The upper limit of ssb is flexible.

70cm Band Plan

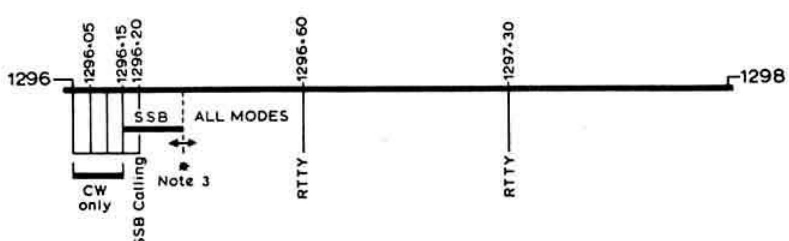
MHz	Allocation
432·000–432·010	E-M-E
432·100	Random ms
432·200	SSB calling
432·600	RTTY (dx)
433·300	RTTY (local)



Notes
1. Area coverage by regional beacons on 432·05MHz (and immediately below) having an erp of 50W or greater.
2. No regional planning for low power beacons (erp of 5W or less).
3. The upper limit of ssb is flexible.

23cm Band Plan

MHz	Allocation
1,296–1.296·15	CW
1,296–1,296·01	E-M-E
1,296·2	SSB calling
1,296·6	RTTY (dx)
1,297·3	RTTY (local)



Notes
1. Area coverage by regional beacons having an erp of 50W or greater.
2. No regional planning for low power beacons (erp of 5W or less).
3. The upper limit of ssb is flexible.

designated channels which are in 25kHz steps starting at 433MHz and continuing upwards probably to 433·3MHz. This scheme will be compatible with present fm simplex channels already designated, eg 433·2MHz. Actual channels for repeater working have yet to be decided. The thought is that additional repeater requirements, especially in larger cities, could well be met by the use of 70cm rather than 2m, thus helping to reduce overcrowding in the 2m band and to increase occupancy of 70cm.

FM simplex

The needs of channelized fm simplex operators will be met by the use of five channels: 145·5MHz, international and national mobile calling; 145·55MHz, international and national mobile working; and 145·525, 145·575 and 145·6MHz as alternative working channels. Former standard Japanese 2m channels, eg 144·48MHz, will no longer receive recognition in the new plans. FM simplex channel operators are therefore urged to equip themselves for the new channels as soon as possible. Many, of course, have already done so following publication of the Scheveningen conference decisions. Existing fm groups can help greatly by encouraging their members to move to the new channels and perhaps by making arrangements for the bulk purchase of crystals. Repeater output channels may also be used for fm simplex operation but operators are asked to avoid interference to repeater working in areas of coverage.

RTTY and sstv

In the UK, rtty has used 145·3MHz (North) and 144·6MHz (South), with the former channel being designated for international working. The revised band plan shows the lower channel for dx and the upper for local working, both now having received international recognition. Operators using other modes are specifically requested to avoid these rtty channels. No specific provision has been made for sstv at present, although it can be expected to be found near the ssb segment. Should the need arise, a channel will be designated for the purpose, leading in due course to international recognition.

Space satellites

A segment of the 2m band, 145·845 to 146MHz, has been reserved for space satellite working, an activity which will increase in future years. This has been done in conjunction with AMSAT, who were represented at the Region 1 meeting by AMSAT Deutschland e.v., including Karl Meinzner, DJ4ZC. This provides for the world-wide recognition of this sub-band, now well established from the successful operation of Oscar 6. IARU headquarters has yet to react to the European proposals but is confidently expected to endorse the recommendations. Space working is already covered in the 70cm band (435–438MHz) while up-links will depend to a large degree on specific Oscar systems. It was also agreed that no specific provision need be made for balloon-borne satellites of the ARTOB, ANJOU and MIRABEL types owing to their very short operating life.

Raynet

It is not considered practicable by the Raynet Committee to administer local group frequencies centrally other than to register them. Local Raynet groups are therefore free to find suitable net frequencies, observing the basic provisions of our national band plans, eg not to use phone in the cw segment. Furthermore, Raynet groups should be equipped for multi-channel operation as far as practicable and should in their own interests avoid common usage channels to minimize the risk of interference. In a genuine emergency all band users are expected to give overriding priority to the needs of Raynet and this can confidently be expected to be done.

Summary

Band planning can only succeed with the voluntary and willing co-operation of all concerned; users, equipment suppliers and planners. The revised plans have the full endorsement of all European countries and are an example of international co-operation achieved through representation in IARU region 1. They also have the full endorsement in the UK of the following RSGB committees: Mobile and Exhibition, Raynet, VHF Contests and, of course, VHF; and of *Short Wave Magazine*. They have been formulated after much consultation at national level with clubs, groups and individual amateurs, and internationally after much debate and compromise. It is now up to the vhf/uhf band operators to ensure a smooth transition to the new arrangements and to help resolve any local problems that may arise.

BOOK REVIEW

FM and repeaters for the radio amateur by the ARRL headquarters staff; edited by Thomas McMullen, W1SL. 232 pages, copiously illustrated; *QST* format.

Obtainable from RSGB, 35 Doughty Street, London WC1N 2AE. Price £1.60 inclusive of postage and packing.

This new publication is designed to meet the need in the amateur field for accurate and detailed information about, in particular, the use, design and building of repeaters.

FM operation itself is not new, but the recent availability of surplus commercial fm equipment in the USA has resulted in a new facet to amateur radio activity, which manufacturers there were quick to notice. The growth of fm repeater operation in that country has been rapid and widespread, and there is a similar development in some other countries. It is still in the experimental stage in the UK.

A brief history of fm and consideration of the fm concept introduce a condensed coverage of receiver technique, with descriptions of detector designs such as the crystal discriminator, the Kubo and the Travis transformerless discriminators, the bridge type, and the phase-locked loop using a single ic; practical squelch circuits also get coverage. There are fm receiving adaptors for 455kHz using valves and solid-state devices; an fm receiver for 29MHz; a tunable 440MHz receiver; and a single conversion 2m receiver.

The same space of 31 pages is devoted to transmitters for fm; designs are given for a 146MHz transmitter, a varactor tripler for 420MHz, and various power amplifiers. There is a design for a frequency synthesizer of the phase-locked-loop type, which is quite a project.

Chapters on mobile and portable equipment, and aerials, lead to one on repeaters; then to another on repeater controls and accessories—here encoders and decoders and solid-state morse code identifiers will require some close study for readers not familiar with digital circuits. Repeater technical problems and cures are described, and the chapter on the testing of fm gear gives designs in detail of many test instruments.

The book ends with advice on the use of surplus gear and tips on buying it, repeater club organization, and operating practices.

Just as fm is a more sophisticated mode with complex circuits and concepts, so this book is technically more demanding of the reader than other ARRL publications. The wide coverage makes for a conciseness in treatment which is perhaps unavoidable, but the reader who has a reasonable basic knowledge, and is not afraid of mental application, will be amply repaid by its study. *T.P.A.*

Amateur radio—the preservation of its right to operate

by T. R. CLARKSON, ZL2AZ

> The author was a member of the IARU team at the 1971 Space Conference. His comments on the existence and the future of the amateur service apply throughout the world. This article was first published in *IARU Region 1 News*, December 1972.

Present significance

Radio amateurs operating today commenced their operations in an era of stability as regards their right to operate. Even in the early days, over half a century ago, there were rules and regulations, and within them there was scope for what amateurs wanted to do and were able to do at that time. Later, things expanded and became more complicated, but the general framework was the same, reasonable opportunities with official approval and encouragement. There naturally developed a kind of trusting attitude, a general belief among amateurs that things would go along satisfactorily, and that amateur operations would continue into the indefinite future.

This happy state of mind is engendered by the slowness of the controlling changes which can alter the general situation, and the remoteness of influence that may be at work to our disadvantage. Amateurs may be all right today, and next year—but there is not the slightest doubt that every five to ten years decisions are made which shape this subject, a relentless control, on which the more distant future of amateur radio is directly dependent. The present structure was mainly identified with decisions made in Washington in 1927 and in Cairo in 1938—amateur radio for the rest of this century at least, will stand or fall, grow or decline, in terms of what is done in this present decade.

So these remarks are to draw attention to the present situation, and make some suggestions as to how amateurs' interests should be safeguarded. Things have changed in the world of radio since the last major changes in operating conditions were introduced in 1947—demands by other services have increased, and so have amateur ambitions.

The ionospheric era has declined, with the ascendency of space, and rules and practices prior to space technique are out-dated, with vhf and higher frequencies being pre-eminent now. Changes in the world at large act to our detriment. At the Atlantic City Conference in 1947 policies were pushed through by the radio advanced nations, who had an enlightened self-interest in amateur radio prosperity.

But now the international influence of less developed nations is discernible as opposing proper amateur radio development. The special message of the Space Radio Conference at Geneva in 1971 was that "in the world today, there is no majority opinion favourable towards the advancement of the amateur service". Individual and corporate action is needed to remove amateur radio from its position of weakness.

What amateurs' needs are

These remarks will conform to the principle adopted in international and national regulations that amateur radio constitutes a "radio service" in which the participants have motives only of personal interest and no pecuniary purpose.

Amateurs know of the many compelling reasons that justify amateur radio, in the community, the nation, and the world, and they are excellently documented in our literature (eg Stanford Institute Research Report). Sometimes there is insufficient attention given to the "superior" position of amateurs compared with other radio work by virtue of its being "voluntary" Its unique character arises from spontaneous motivation in the individual—the urge to communicate, with similarly imbued fellows, using skills and resources within their sole proprietorship.

When practising this kind of self-expression there are numerous desirable secondary products, community value, self training, research and development, etc, which are the obvious justification for a nation to support its amateur radio. The essentially personal nature of our thoughts and actions entitle them to recognition as a human right, which should not be denied by others. Nevertheless, practical politics bring the secondary effects into prominence, and for the present at least our welfare has to be thought of in the pattern of existing kinds of regulations.

Amateur radio needs the opportunity to use representative parts of the radio frequency spectrum. But in general the parts for practical use are those where equipment limitations do not prevent individual ownership and operation.

Radio communications use frequencies as low as 14kHz, but throughout its ascendency amateur radio has used frequencies higher than 1,500kHz. The author is not aware that there has ever been a need expressed for amateur transmissions at, say, 100kHz. So there has been adequate scope for amateurs in the higher parts of the spectrum, and this has exploited the vhf and higher bands. Now very much higher frequencies are coming into use for various services and the international regulations foresee allocations as high as 275GHz. There is provision for amateur work in bands extending up to 24GHz.

During the next few years, services will be making claims to get future assignments in the higher gigahertz part of the spectrum. Many of the needs are for intercommunication in space beyond earth's atmosphere and other earthly effects. The question will come up as to whether the amateur service should seek allocations for the future at frequencies above 24GHz.

Present technical approaches to communications in space involve plant and equipment far removed in nature from the modest resources of amateurs giving satisfactory scope for earth-bound activities. Beyond the realm of the geostationary orbit, radio intercommunications seem to fall outside normal amateur aspirations. So the very high part of the spectrum seems to be of little practical interest, in the same way as the very low part.

These considerations lead to the idea that **amateurs need access to parts of the spectrum, say, between 1,500kHz and 24GHz**; that is where techniques are attractive for operating individual links of communications. Amateurs should be free to explore parts of this spectrum having different characteristics, using both earth and space techniques. What the author is suggesting is that amateurs should concentrate their interests primarily on earth-bound links, but using space techniques to distances as far as the geo-stationary orbit. Those of the fraternity who wish to extend their interests further out in space may well find scope in some other radio service, for example radio astronomy.

By defining their interests to a **part** of the total spectrum, amateurs should be able to strengthen the claims they have for it. They should also concentrate on having access, to operate, in representative bands from 1,500kHz, to 24GHz, both on earth and in space.

The squeeze on amateur bands

It is only natural that in the progress of radio, the use of the spectrum should become more economical, with tighter standards and closer scrutiny among all users to avoid wastage of frequency space. Even so, amateur bands have been compressed unduly, and the same effects can be expected, particularly at vhf and higher. It has been a continuous process since some of our popular bands had their origin at the Washington Conference of 1927.

Then there was world-wide access of 500kHz at 3,500kHz, 300kHz at 7MHz, 400kHz at 14MHz—the latter two being exclusive. At Cairo in 1938 some broadcasting came into the 7MHz band and in Europe amateurs lost access to 3,950–4,000kHz. At Atlantic City 1947, regions were introduced: Region 1, Europe and Africa; Region 2 the Americas; Region 3 the rest.

At 3,500kHz, the amateur access became: Region 1, 300kHz; Region 2, 500kHz; Region 3, 400kHz. At 7MHz it continued 300kHz in Region 2 exclusively for amateurs, but only 100kHz in Regions 1 and 3 and sharing with broadcasting in another 50kHz. In those regions broadcasting took 150kHz of the original amateur band.

In the higher amateur band at 14MHz, the USSR claimed the use of 100kHz of a reduced amateur band for fixed services. The overall amateur band became 14,000 to 14,350kHz. At Geneva in 1959 the general table at 3,500kHz remained the same, except that amateur access was reduced in Australia to 200kHz and in India to 10kHz. At 7MHz in Regions 1 and 3 amateurs were reduced to the exclusive part only, ie 100kHz, that is one-fifth of what it once was.

Despite the losses in this period of 30 years there was an important indirect gain—the fact that amateur radio became recognized as a "service" in the international negotiations concerned with the control of radio.

How do amateurs stand in world opinion?

Leadership in the use of the radio spectrum used to be taken by the leading countries in science and technology. They pushed through the international legislation necessary, and in general amateur radio received reasonable provision. There was not much actual voting, policies being advanced largely by "force of character" at the international conferences. The last example of this was in 1947 at Atlantic City where the main decisions were contributed by the USA, USSR, France and China. There were 72 signatories at Atlantic City, but at the 1971 Space Conference there were 96, an increase of one-third.

The new countries that have built up the membership of the ITU and contribute to the decisions of its conferences include many that do not have a background of technology, or a national climate favourable to amateur radio. Some other services, such as broadcasting, are favoured. In some developing countries there is not just a lack of understanding about amateur radio, leading to indifference towards its interests, but an actual antagonism to the moves made by enlightened countries. The altruism of such moves is also brought into question.

Some advanced countries use their influence against amateur interests. This is probably because of economic, political and military reasons, and only a moderate degree of support within the particular countries.

In this unfavourable situation there are only very few countries in the world today who will come out boldly and advocate a helpful progressive attitude when matters concerning amateur radio come into prominence, and when support is weak there is a readiness to vote quickly and dispose of the matter.

Spectrum demands and changing techniques

The world of radio that amateurs have mostly been concerned with has come about during the era of the ionosphere, and they have experienced the good and bad features of ionospheric propagation. In negotiating the spectrum space, the peculiarities of the ionosphere have had to be dealt with. While this kind of rado communication will now decline in importance and occupy a subsidiary role, it has meant that valuable experience has been gained, not only in operations, but in meeting the difficulties of obtaining satisfactory spectrum space for amateur activities. Valuable techniques of sharing have been developed.

Now major interest is in vhf and higher frequencies. This applies to all radio services, brought about by improved equipment, the vast frequency width available, and most notably the improved types of services available by using space techniques.

One of the great changes due to space technique is that frequency bands once considered as of local or national use are now international. This has prevented the higher amateur bands from being readily available for space use. It is also found that in many countries bands that were thought to be available for amateur use are actually in operation for other terrestrial services. So new problems are coming to light.

The allocation table is rather complicated—at Atlantic City 1947 it had 120 footnotes detailing irregular use and these had increased at Geneva 1959 to 240 for a similar spectrum width. At the 1971 Space Conference more were added. It becomes increasingly difficult to get anything in the nature of an exclusive world-wide allocation on any frequency whatsoever.

The Space Radio Conference, Geneva 1971

Proposals were put before the Space Conference by a number of friendly countries to lead to amateurs being able to use all their existing bands in space as well as terrestrially. There were pious hopes that there would not be much objection to this.

The result was the opposite. There was intense opposition, with a categorical denial for space operations in any of the shared bands. Space work was approved in exclusive bands, the only important ones of these being at 144MHz and 24GHz. There was a very special exception for 3MHz at 435MHz to be used on a sharing basis with special restrictions, but apart from this there is no availability of space amateur transmissions all the way from there up to 24GHz. The allocation at 435MHz was only approved after the most exceptional actions by supporters at the conference.

The failure to get proper provision for amateurs in space was accompanied by another failure. That is the obvious general lack of support for amateurs and their requests made through their respective governments.

This condition can be expected to continue at more general administrative radio conferences, when other bands also will be under scrutiny.

The following example illustrates the atmosphere met at the Space Conference.

In the principal allocation committee, there were proposals for the five shared amateur bands starting at 1,215MHz to be approved for use in space. The chairman proposed that all five bands should be dealt with together. New Zealand disagreed and proposed that each band should be considered **separately**, and statements in support of this action were made by Israel, USA, UK, Philippines, Denmark, Canada, Italy. Statements against were made by Sweden, Syria and Cuba.

The chairman called for a vote on the New Zealand proposal and it was lost, 38 to 26 with 6 abstentions. So it was clear that of the participants, a majority favoured a summary package deal, rather than a close study that might well have found some little slice of a band that would have met amateur needs. So the chairman called for a vote on the use of the bands by amateurs, the result being:

Against amateur use	46
For amateur use	18
Abstentions	6

So it was not only the result, but the approach to it, that contains a lesson. There were numerous other somewhat similar examples.

How to influence the situation

The first thing is to deserve and retain the understanding and goodwill of the official government administration. This is not only to promote good operating arrangements within national boundaries, but also to try and have each country take its place for amateur radio at large when engaged in international negotiations. Obviously amateurs' influence will only be the best if all their activities are pursued to the highest possible standard.

If all amateur radio national societies in all countries gained support from their governments, affairs would be very different, and the kind of thing that occurred at the Space Conference would be unknown.

IARU headquarters has a continual policy of promoting liaison between national societies and their respective governments. The regional IARU organizations work along the same lines. However, the road is by no means easy.

IARU has access to ITU conferences, as an observer, and this is a great advantage. In addition to what might be done through administrations by societies, it gives direct contact with the scene of action, when matters affecting amateurs are being decided. In big international conferences dealing with all aspects of radio usage the official delegations have little time to spare for concentrating on amateur matters. Here is where an international society can assist, in adding an element of continuity, performing useful functions on the side lines of the meetings. Moreover, this is the only way to find out details of what really happens to questions that are vital to amateurs.

Experience has shown that the presence of observers can make the difference between success and failure in some of the outcome.

Amateur radio differs from all other radio services in that it is, by regulation, voluntary. It has, therefore, no backup of income to meet expenses. Attendance at conferences is an expensive business. It devolves on societies to see that the IARU is present in effective strength at these critical times.

A time of opportunity

Now is a unique time for amateur radio to use all its resources to advance its interests for the future, not only because of the importance of the present challenge, but also because the world organization of amateur radio is in pretty good shape.

Despite the known weaknesses in many countries, IARU and its set up, including organizations in the three ITU regions, provides machinery through which proper actions can be taken. This has been proved in connection with the 1971 Space Conference, which conference was better prepared for in regard to amateur interests than any other in history.

Moreover, such degree of success as was achieved can be linked very directly to the efforts of national societies and IARU headquarters.

The radio frequency spectrum is in the process of being expanded right up to 275GHz and it is opportune for amateur radio to declare its ambitions, with a view to asserting its needs for spectrum space and sampling. Claims have been made in the past for amateurs to be able to apply their talents to small sections through the whole spectrum.

The present is a time of vast change in communications technique in which vhf and higher is becoming the principal important part of the spectrum. Old concepts of frequency allocation and regulation need to be scrutinized and perhaps changed in the light of this new order; amateur radio needs to be in the formative stages of new methods to ensure its rights are not missed out. (There is an opportunity here to wield influence through the ITU Radio Consultative Committee, CCIR).

Countries who do not support the advance of amateur radio seem only recently to have been showing up definitely in this role. So it is opportune for amateur radio to identify its friends and marshal support as widely as possible while there may yet be a bit of flexibility in some of the attitudes.

It is important for all amateurs to be aware of this subject, and to have it in mind, whatever branch of amateur radio they may specialize in.

The author is of the opinion that amateurs' strength will continue to be in pursuing amateur radio vigorously, and enthusiastically, and concentrating on the characteristics in which it is unique, and which cannot be usurped by others. If they continue to aspire to excellence in these, their position is secure.

TECHNICAL TOPICS

by PAT HAWKER, G3VA

A NUMBER of the experimental projects suggested in *TT* over the past few months have evoked a good deal of comment and evidence that soldering irons are being put to good use. Polyphase ssb and huff and puff stabilization of oscillators are among the topics we take another look at this month—but we also include a number of fresh topics. Several items have to be held over, including some detailed information from GW3ZTH and G8ANQ on the PA0EPS system of phase-lock ssb for vhf, and more on the cocktail party effect.

But certainly it is refreshing to find so many amateurs who are prepared to tackle new ideas, even when—as for polyphase ssb—it means really digging into the theory as well as the implementation.

More on polyphase ssb

Peter Martinez, G3PLX, has done a valiant and valuable follow-up to the recent item (*TT* October 1973) on the polyphase system for ssb generation. Although he has not had time to build a complete ssb exciter, he has gone back to the original paper by M. J. Gingell and translated the mathematics into practical terms, and has built several polyphase networks with results well in line with expectations.

He sees the polyphase network as, in effect, a new way of making a wide-band audio phase-shift network—but with the advantage of being much more tolerant of component values than the well-known approaches. With a six-stage network, which can be realized using readily available components, he believes that 10 per cent tolerance can be used in the first five stages and two per cent in the final stage, yet this should be capable of providing some 40dB sideband suppression. Such a phase-shift network would be constructed as indicated in Fig 7 of the October *TT* (page 699) using capacitors and resistors.

To quote from G3PLX's letter:

"Referring to Fig 7 (page 699), and labelling the inputs 1, 2, 3 and 4 and the outputs *a*, *b*, *c* and *d*, if we feed af into 1 and 2 at 0° and into 3 and 4 at 180° (for example by using a phase splitter) then the outputs from *a*, *b*, *c* and *d* will be in the sequence 0°, 90°, 180°, 270° over quite a wide range of frequencies provided that the right component values have been chosen.

"Consider one section on its own with inputs at 0°, 0°, 180°, 180° and what happens to the output at different audio frequencies. At very low frequencies, where we can ignore the capacitors, outputs will remain 0°, 0°, 180°, 180°; at very high frequencies, where we can ignore the resistors, outputs will be 180°, 0°, 0°, 180°. But at the frequency where $f = 1/(2\pi CR)$, the sequence will be 270°, 0°, 90°, 180°—the desired sequence. This is at only *one* frequency, but after only *one* section of the network.

"However, it is not too difficult to show that if the sequence 270°, 0°, 90°, 180° is fed to the next section, the output from this second section will be in the sequence 0°, 90°, 180°, 270° *regardless of the values of the capacitors and resistors of this second section*. Thus, if one connects a number of sections in cascade, each with different values represented by $1/(2\pi CR)$, then the output from the complete network will be exactly 0°, 90°, 180°, 270° at each of the design frequencies of the various sections, and fairly close to this in between. Thus, for a four-section network, as shown in the October *TT*, the response curve will be as shown in Fig 8 (page 699) if you think of the Y axis as representing the 'goodness' of the sequence.

"Then, to complete the ssb generator, Michael Gingell feeds the *a*, *b*, *c* and *d* outputs to four modulators, and combines the outputs; each modulator being fed with rf carriers in the sequence 0°, 90°, 180°, 270°. This has the

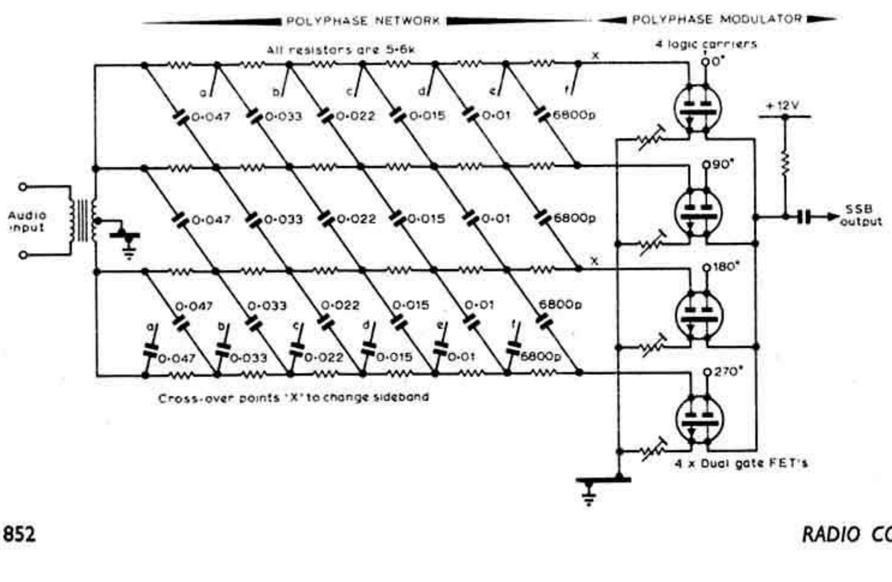


Fig 1. G3PLX's suggested implementation of polyphase ssb generator including component values for the six-stage polyphase audio-shift network using preferred-value capacitors and resistors

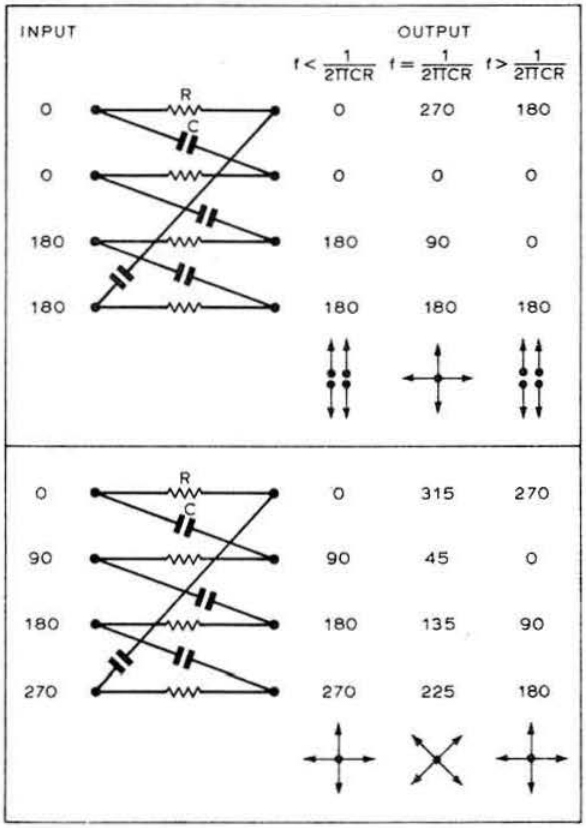


Fig 2. Diagram showing how the polyphase network creates the right phase relationships at various audio frequencies

advantage of cancelling out harmonic sidebands which occur on each side of the harmonics of the carrier frequency. But a simpler arrangement would be just to feed *a* and *b* to two balanced modulators fed with carriers at 0° and 90°. In practice there may be a good reason for not ignoring the *c* and *d* outputs, in which case *a* and *b* ought to be fed in push-pull to a balanced modulator with a balanced input, and similarly with *b* and *d*.

"To establish practical results I built a couple of polyphase networks after calculating the required component values. The results are very promising. I found however, that a four-section network (of the type shown in Fig 7 of page 699) with design frequencies equally spaced between 300 and 3,000Hz required some rather odd values, all falling between normal preferred values. A much neater solution results from using a six-section network, with frequencies of each section chosen in the same ratio as preferred value components. This ensures that the values come out exactly at preferred values. Fig 1 shows the network which I would recommend. In accordance with Mr Gingell's suggestion that only the final section needs high tolerance components, I have placed the lowest value capacitors at that end since closer tolerance capacitors are easier to obtain in lower values. With 10 per cent components in the first five stages and two per cent in the final stage, I would guess that 40dB sideband suppression would be possible.

"I have shown also the circuit of what I believe Mr Gingell has in mind for the polyphase modulator. The four rf carrier signals are taken directly from the logic outputs of a 7473 integrated circuit (as in the arrangement used by G3UFP for his third-method ssb generator outlined in Fig 10 of page 699) in the sequence X1, X2, $\overline{X1}$, $\overline{X2}$. All four preset potentiometers affect both carrier balance and sideband balance, and the easiest way to find their correct setting would be to adjust them all in turn for minimum modulation on the ssb output, using a 1kHz sine-wave input—a technique which has been described before."

Unfortunately G3PLX has not had time to complete the project, as he is moving QTH, but intends to do so when possible. Meanwhile he feels (I am sure rightly) that his information may be of interest to others, and that we shall soon be hearing polyphase ssb on the amateur bands—and so beat the commercials to it!

As we attempted to make clear in October, polyphase ssb generation appears to offer the promise of becoming an effective and practical system, capable of giving the performance of a good filter system at the appreciably lower costs associated with phasing systems. We should be most grateful to G3PLX for tackling the rather "difficult" paper by Michael Gingell and providing this very practical commentary.

VXO ideas

Recently we mentioned that some good ideas appear to remain buried for many years in little-known patents before their value is recognized. A notable example of this is the variable crystal oscillator (vxo) which today is almost always based on the principles outlined in a patent taken out by STC and L. F. Koerner as long ago as April 1940 (British patent No 537,167). As far as I am aware this particular patent has never been acknowledged in any amateur account of the development of the vxo. In a slightly different form the vxo was rediscovered independently in the late 'forties by two British Post Office engineers—Stanesby and Fryer—and some details of their system were published in at least two amateur journals (*Amateur Radio* and *RSGB Bulletin*). But it was not until a decade later, following the publication of a design by W3BWK in *QST* (January 1958), that the idea really attracted attention, and then only slowly. All these systems have depended upon

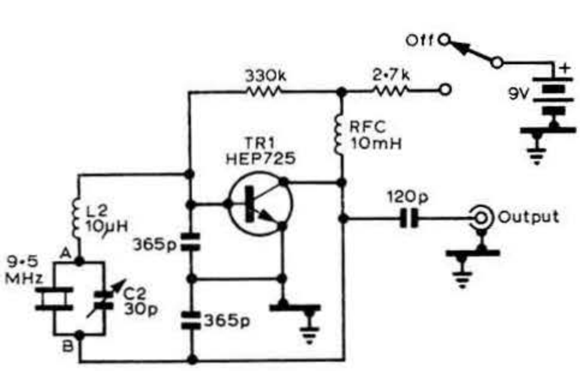


Fig 3. K9KZT's Clapp-oscillator version of the vxo. The frequency in this case was chosen to triple into the 28MHz band but the circuit could be adapted to other bands

adding external capacitance and/or inductance to modify the electrical equivalent of the piezo-electric crystal.

Even today, as noted by Larry Lisle, K9KZT, in "The tunable crystal oscillator" *QST* October 1973: "The field of variable-frequency crystal oscillators is still wide open for experimentation. Among the things needed are a single circuit for operation both above and below the crystal frequency, a linear tuning system, and a thorough mathematical treatment".

Among the information provided in this latest article is a Clapp-oscillator version; see Fig 3. He notes that if difficulty is experienced in obtaining adequate frequency deviation below the crystal frequency, the first thing to suspect is that L2 is too small. He suggests that crystals mounted in FT243 pressure-type holders work rather poorly compared with plated crystals. For maximum stability all voltages should be regulated, temperature compensation should be used, and the vxo isolated as much as possible from the load; it should be operated at a low power level.

Wide-band noise generator

The application of zener diodes to noise generators for the adjustment and checking of receiver front-ends was described in *TT* several years ago and is included in *ART*. But we were interested to find a useful-looking noise source of this general type (using a transistor operated in the avalanche mode to provide the noise) in *Electronic Engineering* (October 1973) and stemming from Prof G. Sinigaglia, I4BBE, and Dr G. Tomassetti, I4BER. It is claimed that this unit (Fig 4) is virtually temperature independent, a most important characteristic when the source is to be used from time to time to check that there has been no deterioration in receiver performance.

The zener diode is formed from an inversely polarized emitter/base junction of a 2N918 hf silicon transistor which was found to provide "incredibly high" noise generation right up into the gigahertz region. The 2N3819 fet forms a current generator largely independent of temperature changes.

The noise output is stated to remain within about one per cent over the temperature range of 0° to 50°C, and as a noise source the only drawback is that it needs to be calibrated against a primary source unless it is intended to be used just as a sensitivity check rather than to measure quantitively the noise factor of a receiver. The designers include an output pad to vary the output by known amounts and also to provide an output source matched to 50 or 72Ω.

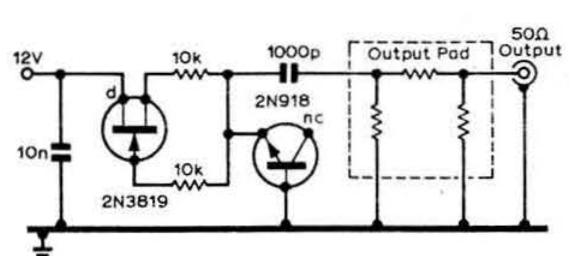


Fig 4. Temperature independent solid-state wide-band noise generator suitable for use up to the gizahertz region using avalanche multiplication processes in the base-emitter junction of a silicon hf transistor as the noise source, and with a fet current regulator

Batteries in parallel

A tip in *Radio-Electronics* (July 1973) notes that when connecting batteries in parallel it is advantageous to do so through diodes: see Fig 5. The reasons are that two batteries seldom have exactly the same voltage and with a straight parallel connection one may discharge through the other; further, the diodes offer protection against connecting them the wrong way round, and also provide protection to an external circuit. There will be a voltage drop across the diodes, equal to their potential hill; this will be lower with germanium diodes than silicon diodes.

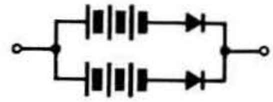


Fig 5. Use of diodes in connection with batteries in parallel (*Radio–Electronics*)

Parametric up-conversion

Several years ago, thanks to Walter Schreuer, K1YZW/G3DCU, we presented in *TT* what was probably the first down-to-earth description to appear in any British publication of the use of diode parametric up-converters as the first mixer of hf receivers. This technique has been used in a number of American military receivers although (since the system is most attractive for receivers having a very high first i.f. over about 100MHz) it has possibly limited application at present to amateur receivers. Still, the following extracts from a recent article in *Electrical Communication* (Vol 48, No 3, 1973) on new military equipment made by the French company Le Matériel Téléphonique (an ITT associate company) suggest that the technique should not be forgotten entirely.

"Until now the input circuits of a good receiver have traditionally used high selectivity and a degree of amplification before the first frequency changer . . . Latest methods use mixers with a low noise factor, low insertion loss and very high linearity, even for high input signal levels. This enables the whole of the selectivity problem to be dealt with in the fixed intermediate frequency stages using high performance crystal filters.

"In this range of hf equipments, frequency conversion at the receiver input is of the parametric type; it is achieved with variable capacitance diodes for which the capacitance C characteristic, as a function of the applied voltage V, is very sharp and of the constant CV^n type, where n is greater than 1.

"Although the maximum usable gain of this type of frequency changer is equal to the ratio of output frequency to input frequency (Manley-Rowe law), it is possible to stabilize this gain over the 1·5 to 30MHz range to about 6dB using suitable adaption circuits. With sufficient synthesizer output level, excellent frequency changing linearity is obtained up to input signal levels approaching 5mW, with a very high receiver signal-to-noise ratio.

"Although this technique appears to be complicated in principle, in practice it is both simple and economic. Other methods using hot carrier diodes or field effect transistors connected in a bridge give similar results, but are technically rather more complicated.

"In fact, the success of modern wide-band mixers is limited only by the spectrum quality of the frequency synthesizer (local oscillator) signal, which has to be carefully considered from this point of view."

In these equipments the i.f. is above 100MHz, and it is interesting to find in the same issue of *Electrical Communication* a description of the Swedish CR300-series receivers which have a first i.f. at about 140MHz, based on the belief that with front-end selectivity largely abandoned, "theoretical studies and tests on conversion circuits showed that the i.f. had to be higher than at least the third and preferably the fifth harmonic of the input frequency." The receivers use low-pass filters and fixed tuned sub-octave filters. In this range the first and second mixers use matched hot carrier diodes. With the i.f. at 139·3MHz, more than 100dB of i.f. and image rejection; the rf amplifier provides only just enough gain to overcome the loss in the first mixer and agc is applied with a pin diode.

AGC-controlled aerial attenuators

The subject of receiver front-end performance in the presence of strong signals is also discussed in a detailed article by Th Moliere, DL7AV, in *CQ-DL* (No 8, 1973). This includes a pin-diode attenuator with constant impedance (Fig 6), apparently derived from a Hewlett Packard application note and using two BA379 pin diodes to provide up to 40 to 50dB of control working directly from the receiver agc line at the 50Ω input impedance socket of the receiver (we have discussed the advantages of such attenuators on a number of occasions). Pin diodes have tended to be rather costly for hf applications but it would appear that the BA379 from Siemens or the Philips group is more reasonably priced.

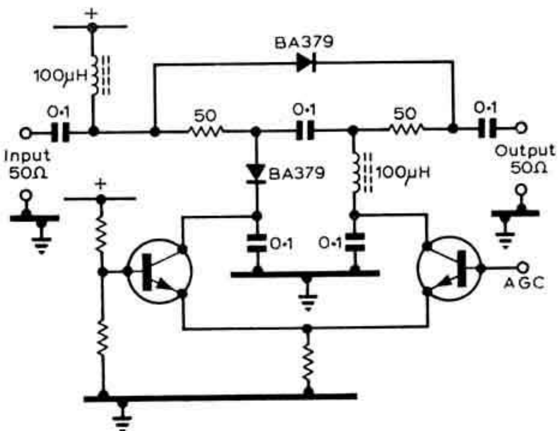


Fig 6. Use of pin-diodes to provide agc-controlled aerial attenuator for hf receivers

For vhf applications a rather different technique has been described by D. S. Walters and Prof W. Gosling of Swansea University: "Helical filters with pin diode Q-control for pre-converter agc" (*Radio Receivers 1972 conference book*). The use of a high-Q tuned filter in front of a vhf receiver provides the further advantage of attenuating all out-of-band signals, such as those from local vhf/fm broadcasting or television or vhf/mobile base stations. The four-section

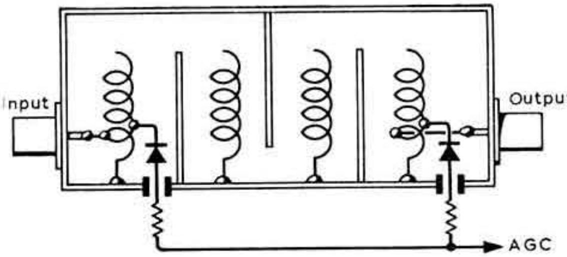


Fig 7. Four-section helical filter with pin-diode Q control to provide agc-controlled attenuator for vhf, and to increase front-end discrimination of the receiver

helical filter (Fig 7) provides a passband of about ±2MHz at 100MHz, some 50dB attenuation beyond about 5MHz out-of-band, and a controlled range of some 40dB in the passband, depending upon the control current (from 0 to about 400μA). The original design used four pin diodes but it was found to be better to use the diodes only on the two outer sections. One always hesitates to recommend the inclusion of non-linear devices in the signal path, but the published results indicate that intermodulation products produced by this filter are well over 50dB down relative to two frequencies 50kHz apart centred on 100MHz, and are too small to be significant. The system thus provides at least 40dB of agc control range in front of a vhf converter, for control currents measured in microamperes.

Reducing receiver drift with FETs

When field effect transistors began appearing around 1966, several items were included in *TT* on their possible use for the conversion of old valve receivers to solid-state. Generally today, however, few amateurs would want to modify a receiver so drastically. This is partly from fear of ruining any remaining resale value, and partly because it is now recognized that the signal handling capacity of simple fet stages, although better than that of bipolar transistors, is usually no better than, if as good as, that of well-designed valve amplifiers.

But there is one exception to this—as Hector Cole, G3OHK, points out. A fet can prove a very worthwhile improvement over a drift-prone valve oscillator. So if you have an old hf receiver that drifts, it may well be worth modifying, either by substituting a fet in the oscillator stage or by adapting the receiver for use with an external vfo.

G3OHK writes: "Valves are *not* 'old hat' but FETs can be a worthwhile substitute for drifting oscillators, though clearly 'messing about' with a valuable or good receiver would be crazy. Its second-hand value would disappear and the experiment might not come off; but that old job, which drifts like mad, might be much improved. Fig 8 shows a typical modification to a receiver using an ECH81 frequency converter.

"Another idea is to build an external vfo which can give good results if properly built (solid, rigid etc). The only snags are that a toggle switch may have to be mounted on the receiver to cut ht from the internal oscillator when using the external vfo, and a socket will be needed to couple into the receiver the output from the vfo. But one of the possibilities is that the external vfo can be made to cover just one or

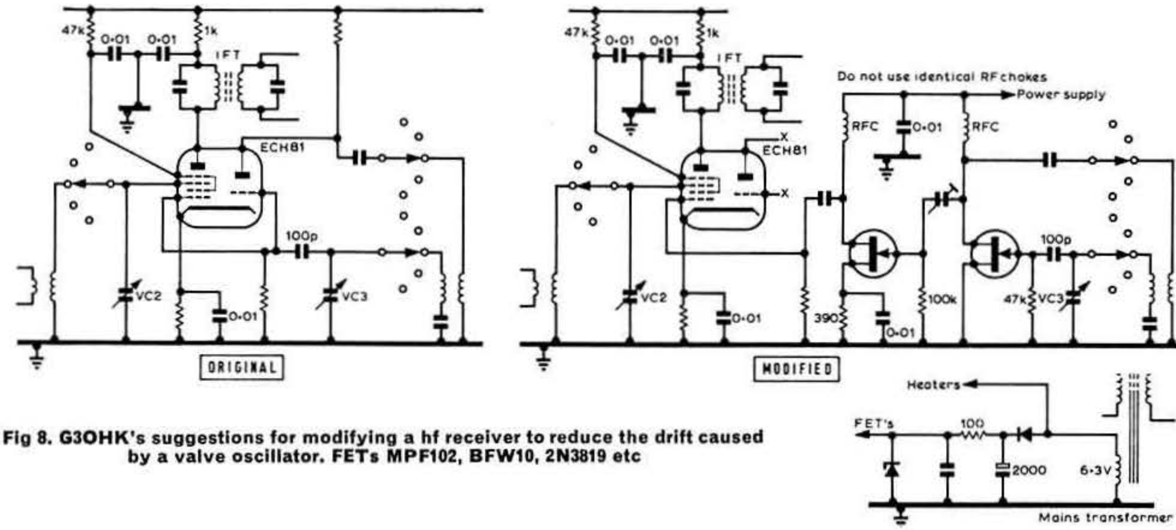


Fig 8. G3OHK's suggestions for modifying a hf receiver to reduce the drift caused by a valve oscillator. FETs MPF102, BFW10, 2N3819 etc

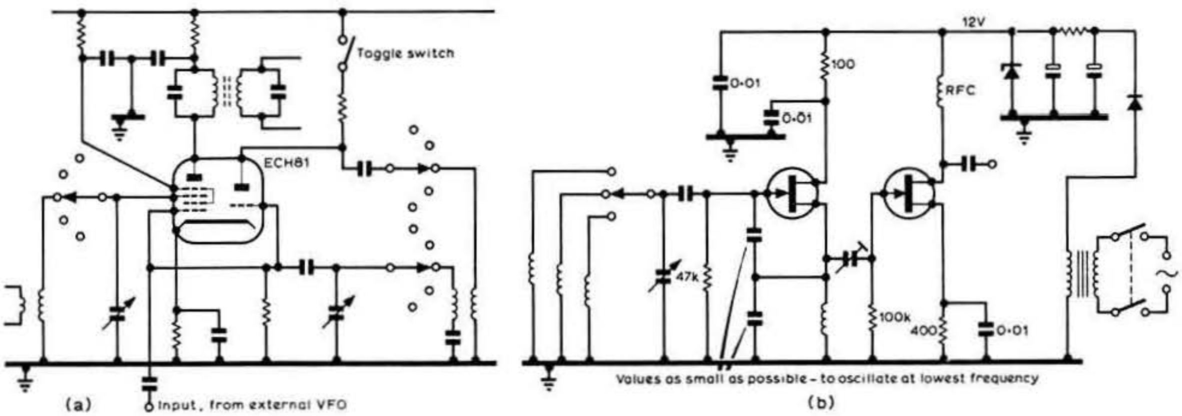


Fig 9. Use of an external fet-vfo with a valve receiver

several amateur bands to give any required bandspread to a general coverage receiver: Fig 9.

"Another point to remember when attempting to improve the stability of a receiver is that the bfo can also drift—do not blame the vfo until you have checked the bfo. I have been using three external VFOS; two with ssb transmitters and one with a receiver: all three work well."

Snappy trapies

R. Kell, A6817, faced with the problem of sealing and waterproofing a trap for a multiband vertical aerial, has found an answer in using "Snappies" a widely available form of cling film used for cooking. He says this can be tightly stretched and clings very effectively to the outside of trap. One wonders what the rf insulating properties are like, but the idea seems worth trying.

He also points out that the caps off old toothpaste tubes make excellent cabinet feet and drawer handles: Fig 10.

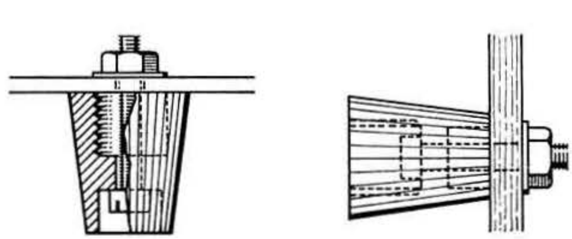


Fig 10. A6817's suggestions for using toothpaste tube tops for cabinet feet and/or drawer handles

The Climie repeater

In *TT* (November 1972) we included some details of the 144MHz Climie hand-held portable transceiver designed by Fred Johnson, ZL2AMJ, as one of the ambitious Upper Hutt Branch of NZART kit projects. We mentioned at the time that the name was derived from the 2,823ft high Mount Climie where a local fm repeater had been put in operation.

Readers may like to know that a detailed 14-page description by ZL2AMJ of this Climie repeater, presented as a constructional project for clubs, appears in *Break-In* August 1973. This is a well-designed all-semiconductor unit designed for 700kHz spacing (receiver 146·3MHz and transmitter 145·6 MHz in the New Zealand 144MHz band).

ZL2AMJ, who is the current President of NZART, comments that "this repeater has been one of the most interesting amateur projects that I have ever been connected with, and certainly an asset to our branch. It has been a club effort involving countless man-hours by many people."

We draw attention to this useful article, covering all technical aspects of the repeater, even though at present such a project is not open to groups in the UK where only three experimental repeaters have been authorized. If the position changes, this is an article to note. The rf output from a 2N5994 transistor is about 7W, and simple telemetry indicates when the equipment is running on batteries due to a mains power failure.

Huff and puff comments

Useful comments continue to come in on the implementation of huff and puff vfo stabilization (*TT* July, October, November) though this month we must keep them fairly short.

Keith Taylor, G3NNW, agrees with G3RUZ about the internal resistors in the SN74121N. He writes: "The SN74121N has an internal timing resistor of about 2kΩ obtained by strapping P9 to P14. Using this it is possible to obtain pulse-widths between 30ns and 10ms for values of timing capacitor (between P10 and P11) between 10pF and 10μF. The internal resistor is subject to normal ic manufacturing tolerances and does not give accurate, repeatable pulse-widths. A more accurate pulse-width is obtained by connecting an external resistor of between 1kΩ and 40kΩ between P11 and P14, P9 being left open-circuited. Making this resistor variable allows the pulse-width to be adjusted. The values used by G3BY (10nF and 22kΩ) give a pulse-width of about 170μs. The same result could be obtained by strapping P9 to P14 and making the timing capacitor equal to 0·1μF. Finally it is not necessary to use an inverter from P6 of the last SN74121N to reset the SN74191N, as an inverted output is available at P1 of the SN74121N."

Malcolm M. Bibby, GW3NJY/W9, has also, like BRS33882, commented on the question of timing periods. He writes: "As you say, when the measuring period is 1s the resolution is 1Hz. Since the 74191 is a four-bit binary counter the locking range is 16Hz not 10Hz; thus PA0KSB's intervals become not 50Hz but 80Hz and not 25Hz but 40Hz. Actually, in *TT* the schematic pin 6 of the 74191 is Q_c (2^2) so that PA0KSB is checking whether the count is in the range 0-3 or 4-7. This provides him with a locking range of 8Hz so that now his 25Hz step is actually 20Hz. For base 16 pin 7 should be used.

"The 1MΩ/1,000μF time constant in conjunction with the varicap should be such that with the capacitor nominally at +2·5V the vfo drifts high with the resistor connected to +5V, and drifts low when connected to 0V. The better the basic vfo, the longer this time constant can (and probably should) be. The varicap should not be placed directly across the LC circuit but should be in series with a small capacitor. This will reduce the capacitance change but more importantly will help to prevent the diode being driven into its forward conduction mode (it might help if the cold end of the varicap is returned to the vfo power supply and the 1MΩ resistor connected to Q at pin 5 on the 7474 (pin 6 which is correct is shown as Q but should be $\bar{Q}$).

"The D input to the 7474 is not pin 1 but pin 2. G3BY is right in inserting the inverter to clear the 74191, but using the $\bar{Q}$ output on the 74121 at pin 1 would be just as good. Also the 74121 has its own timing resistor brought out to pin 9 provided that pin 9 is connected to +5V.

"I would certainly agree that this technique is not a cure for a bad vfo. It raises the interesting question of short-term versus long-term stability. A number of VFOs have acceptable long-term stability but examination with a frequency counter shows them often to have short-term instabilities in the region of kilohertz/sampling period (my KW2000A provides an example). I presently have a 19 to 21MHz vfo that is very good, but now I am going to see if it can be made excellent."

It is appreciated that several of the comments in November and in this issue cover similar points, but it is felt that all these various views will help those who find the digital techniques rather complicated to grasp.

Power meter

In *TT* of August 1972, details were given of a general-purpose power meter/dummy load used by Dick Halls, G3EIW/ON8KM. A slightly different approach, but said to be suitable also for home construction, appears in *C-QSO* the Belgian journal for September 1973. This provides circuit information (Fig 11) of the "ME 11 R" unit (presumably a kit). R1 represents virtually all the dummy load, and must be a suitable type for this application, but a small portion is provided by the 1Ω resistor R2. In effect the remainder of the unit represents the means of measuring the voltage developed across R2 with 15 and 60W ranges.

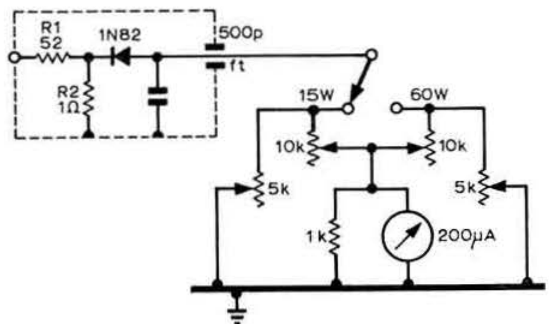


Fig 11. General purpose dummy load/power meter

Here and there

In the May *TT* we included details of the method recommended by Harry Habig, K8ANV, for the building of delta loop quad aerials. During a recent 14MHz contact he passed along an important additional detail: "I was wondering why that rubber tubing was holding up so fine and then I found out it was silicon rubber. I am told that if ordinary rubber is used it is unlikely to stay put for more than a year's exposure to the sun's ultra-violet rays". The rubber tubing concerned is that used in the construction of the gamma match section. When the notes were originally prepared, K8ANV was under the impression that he was using ordinary pure laboratory gum rubber heavy tubing.

MICROWAVES—1,000MHz and up

by DAIN EVANS, G3RPE*

Waveguides and wavelengths

In the design of microwave equipment, the dimensions of components can frequently be generalized in terms of fractions of a wavelength, for example a $\lambda/4$ choke. It has been the practice in this column to emphasize this where possible since it enables designs for one frequency of operation to be scaled to another frequency. However, nothing is simple, and wavelengths come in three sizes to prove it.

Firstly there is the wavelength in air (which for almost all practical purposes is the same as that *in vacuo*), which is used for the length of dipoles, the aperture of aerials, and for coaxial circuits. Its value is given by the relationship $\lambda = c/f$ where $c = 2{\cdot}99776 \times 10^{11}$mm/s and f is in hertz.

The second wavelength used is that in waveguide, λ_g. This differs significantly from the wavelength in air: for example, λ at 10GHz is 29·978mm whereas λ_g in WG16 is 39·703mm. In designing components such as chokes and cavities in waveguide, and *only* in waveguide, it is therefore important that λ_g is used. Its value depends on the dimensions of the waveguide and the mode of propagation of the wave. For the TE_{10} dominant mode generally utilized:

$$\lambda_g = \frac{\lambda}{\sqrt{1 - \left(\frac{\lambda}{2a}\right)^2}} = \frac{1}{\sqrt{\left(\frac{f}{c}\right)^2 - \left(\frac{1}{2a}\right)^2}}$$

Where a is the wide dimension of the rectangular waveguide. The table summarizes values of λ and λ_g for standard waveguides at frequencies corresponding to the amateur band edges and the centre of the crystal-controlled sub-bands. Within each set of figures, values at other frequencies can be obtained by interpolation with usually sufficient accuracy. Also included in the table is the cutoff frequency of each waveguide below which waves will not propagate without severe attenuation. A waveguide is not normally used above twice its cutoff frequency because of the risk of overmoding.

The third sort of wavelength used is that where the component operates in a dielectric other than air. In this case the wavelength, either λ or λ_g as appropriate, is reduced by a factor of $1/\sqrt{\mu}$ where μ is the dielectric constant. For most common microwave insulating materials such as ptfe, polythene and polystyrene (and Sellotape probably!), μ is in the range 2·2 to 2·7 so this factor is 0·6 to 0·7. An exception is mica, which has a dielectric constant of about 7, so the factor becomes 0·32.

Table. The dimensions, cutoff frequencies, λ and λ_g of standard waveguides

Waveguide number	Outside dia / Inside dia (in)	Cutoff freq (MHz)	Freq MHz	λ mm	λ_g mm
6	6·660 × 3·410	908	1,215	246·733	371·294
	6·500 × 3·250		1,297	231·133	323·654
			1,325	226·249	310·637
8	4·460 × 2·310	1,372	2,300	130·337	162·417
	4·300 × 2·150		2,305	130·056	161·878
			2,450	122·359	147·710
9A	3·560 × 1·860	1,736	2,300	130·337	198·635
	3·400 × 1·700		2,305	130·056	197·663
			2,450	122·359	173·361
10	3·000 × 1·500	2,078	3,400	88·169	111·391
	2·840 × 1·340		3,457	86·717	108·505
			3,475	86·266	107·626
12	2·000 × 1·000	3,152	5,650	53·058	63·933
	1·872 × 0·872		5,761	52·036	62·169
			5,850	51·244	60·831
14	1·500 × 0·750	4,301	5,650	53·058	81·821
	1·372 × 0·622		5,761	52·036	78·221
			5,850	51·244	75·601
15	1·250 × 0·625	5,259	10,000	29·978	35·246
	1·122 × 0·497		10,050	29·828	35·004
			10,369	28·911	33·547
			10,500	28·550	32·987
Old English	1·100 × 0·600*	5,901	10,000	29·978	37·133
	1·000 × 0·500		10,050	29·828	36·849
			10,369	29·911	35·161
			10,500	28·550	34·517
16	1·000 × 0·500	6,557	10,000	29·978	39·703
	0·900 × 0·400		10,050	29·828	39·383
			10,369	28·911	37·322
			10,500	28·550	36·553
20	0·500 × 0·250	14,047	24,400	12·491	15·407
	0·420 × 0·170		24,193	12·391	15·221
			24,250	12·362	15·167
22	0·360 × 0·220	21,075	24,000	12·491	26·109
	0·280 × 0·140		24,193	12·391	25·246
			24,250	12·362	24·991

* Approximate.

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

23cm equipment review

The "standard" 23cm equipment of today appears to be a transmitter generating a few watts of rf power, a receiver front-end using a point contact diode (or sometimes a Schottky diode), with a dish 4ft in diameter. It would be interesting to hear of the more sophisticated and powerful equipment that is in use, and the success achieved when using it.

A miniaturized history of VHF National Field Day

1962 (for 2m only and held in July): 39 entries, winners Wolverhampton Group, GW3KMT/P.

1963 45 entries, winners Surrey Radio Contact Club, G2RD/P-G3ODY/P, using 70, 144 and 432MHz. Three contestants used 1,296MHz.

1964 54 entries, winners Wolverhampton Group in conjunction with Severn Valley ARC, GW3KMT/P-G3SVR/P, using 70, 144, 432 and 1,296MHz. Ten contestants used 1,296MHz.

1965 54 entries, winners GB2GC Group, using 70, 144, 432 and 1,296MHz. Twelve contestants used 1,296MHz.

1966 57 entries, winners GB2GC Group, using 70, 144, 432 and 1,296MHz. Fourteen contestants used 1,296MHz.

1967 66 entries, winners GB2GC Group, using 70, 144, 432 and 1,296MHz. Sixteen contestants used 1,296MHz and one contact was reported on 2,300MHz.

1968 91 entries, winners Mid-Essex VHF/UHF Contest Group, G3VPK-G3ORL-G3LTF/P using 70, 144, 432 and 1,296MHz. Twenty contestants used 1,296MHz, three used 2,300MHz and one the 10GHz band.

1969 105 entries, winners Mid-Essex VHF/UHF Contest Group, G3VPK-G3ORL-G3LTF/P, using 70, 144, 432 and 1,296MHz. Twenty-three contestants used 1,296MHz, four used 2,300MHz and one the 10GHz band.

1970 123 entries, winners Mid-Essex VHF/UHF Contest Group, G3VPK-G3SKT-G3LTF/P, using 70, 144, 432 and 1,296MHz. Twenty-four contestants used 1,296MHz.

1971 129 entries, winners Mid-Essex VHF/UHF Contest Group, G3VPK-G3SKT-G3LTF/P using 70, 144, 432 and 1,296MHz. Twenty-seven contestants used 1,296MHz.

1972 140 entries, winners Mid-Essex and Mid-Severn VHF/UHF Contest Group, GW3VPK-GW3WRA-GW3LTF/P using 70, 144, 432 and 1,296MHz. Thirty-eight contestants used 1,296MHz.

FOUR METRES AND DOWN

by JACK HUM, G5UM*

Is your QSL card really necessary?

The time-worn phrase that a QSL is the final courtesy of a QSO seems to us to need some rethinking in the light of today's conditions. Granted that a QSL card—or some form of verification, be it a picture postcard or a letter—is indispensable where the checking of award claims is concerned, the automatic sending of a QSL following a QSO is a waste of the sender's money if the other man has no intention of replying, for any one of several reasons.

What reasons? Simply, "... because I no longer collect". Or "... QSLing is a luxury I'm not prepared to splash out on ... when my present stock has gone, that's it!" as a prominent Class B man from the south west wrote to us last month, typical comments frequently uttered.

Then there was the contest group who QSLd every contact made during VHF NFD, to stations who must have been worked on previous Field Days and had probably received a card already. Said one member of the group: "Contest exchanges should contain the phrases 'No QSL' or 'Pse QSL' to obviate the wasted expense of sending unwanted cards".

After any big metre-wave contest or expedition, QSL writers over-burdened with hundreds of cards to fill out and send off sometimes fail to include such vital information as band in use. This could invalidate a card submitted for an FMD Award, but fortunately seldom does, for other clues on the QSL suggest the QRG. Obviously, a card invalidated is a card wasted.

More generally, it seems from what people say that more selectivity in QSLing would be no bad thing to practise, at least where 70MHz and up is concerned.

Another "Supreme" with 23-content

Last month's piece asking "Where are all the 23cm FMD Certificate claims?" had barely gone to press when Roger Taylor sent one in—and a very important one at that, for it wins him a "Supreme" as well. Already he had earned, either under his present callsign G4BEL or his former one G8BBB, the Senior Award for 144MHz and for 432MHz Transmitting. And two "Seniors" plus one 23cm Standard equal the "Supreme"—only G3MCS has achieved the feat before. The other Gold Label winners earned theirs with three "Seniors" apiece.

Roger Taylor's site at Haddenham in north Cambridgeshire stands on a small 100ft ridge rising from the Fens. His best dx on 1,296MHz was an OZ at 720km who failed to QSL. Happily, F2TU, ON4HN and PA0AJR turned up trump cards to give him his three countries. Among the 20 counties which the 23cm claim requires, one singles out the G4ALN/P team for a special mention: they gave Roger Taylor BE, HN and RD during 1973.

Equipment at G4BEL uses a 3CX100A5 tripler to a pair of 3CX100A5s in the pa at 150W input feeding a 4ft dish at 35ft. On the receive side the line-up is an HP35821E first rf stage followed by a BFR90 second rf stage into a TIV35 hot-carrier mixer giving a tuning range of 28-30MHz.

And so to G4BEL the 1,296MHz Certificate No 2, and the "Supreme" No 5.

From Cambridge across to Bristol...

23cm again—and some "Seniors"

Certain callsigns are synonymous with microwaves. That of Charles Suckling, G3WDG, is one of them. And linked with the equipment he used to earn a 23cm Transmitting Award for G3WDG/P are others. For instance, the transmitter was a G2RD-type tripler driven by 12W from a 3/20A tripler. The receiver was a G8ARM-type ring mixer.

Most of the three-plus-20 collected by G3WDG/P (and the cards for them came in with commendable celerity) were worked from high spots in Wiltshire and Berkshire. A rather longer foray from the Bristol home base was required to collect Devon: Charles Suckling drove down to Dorset for this operation. A 23cm contact with G8ADP was the result—and so was Certificate No 3.

* * *

"Equip yourself for as many modes as possible" says paragraph 9 of the 2m code of practice. Joe Ludlow at Bridgend did just this: in fact, two years ago GW3ZTH was virtually a loner on A3J before sideband had spread to its present ubiquity. His 15-plus-60 turned in for the 144MHz Senior included a representative cross-section of a.m., fm, ssb and cw, tropo, aurora and ms, with such unusual delights as an Ar contact with GM3OXX when the latter was using only 4W in, and the time-consuming but rewarding ms two-ways with HG5AIR and I4BER, in which co-operation by G3CCH and G3WZT respectively is gratefully acknowledged. Now Senior No 49 is on the GW3ZTH wall.

Whoever said that 4m is little used should have a look at the activity analysis compiled by G3ZRH for the 1972–3 period during which he was collecting cards towards the six-plus-60 for the 70MHz "Senior". Tony Stokes worked 367 different callsigns spread over a total of 984 contacts that included 209 fixed, 119 portable, 25 mobile and 14 "Stroke A". Says he: "I think 18 months is as long as anyone should need to take for a 4m Senior. It seems to be only the not-so-active amateurs who complain of lack of activity on the band!" This concentrated endeavour sent Senior-cert No 15 to Brentwood. See later for some G3ZRH observations on 70MHz propagation.

What is dx?

In the opinion of G4BSN, Tom Barrett, of Portchester in Hampshire, investigation into metre-wave propagation and the pushing back of frontiers can be accomplished only with QRO. "When QRP can do what QRO does already then I

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will recant" he declares, adding that QRP, like "... that other craze, fm from a Japanese 'black box', takes little effort to get going".

The G4BSN equipment can give 200W p.e.p. vfo-controlled anywhere over the 2m band, and it certainly works the dx.

We have no doubt that plenty of people will be prepared to come back and reply that anyway dx is relative and, like the term "hi-fi", incapable of definition.

A house of many mansions, again. It all turns on the way the individual prefers to practise his amateur radio.

Further to the pushing back of frontiers . . .

Extra-terrestrial

Another success for G3LTF. On 13 October between 0200 and 0230gmt he made an e-m-e contact with K2UYH in New Jersey on 432MHz cw via the 15ft dish at the Chelmsford end, and a specially constructed 4578 pre-amp that gives the receive system a noise factor of 1·5dB.

On the ms frontier GW3ZTH near-missed UT5DL during the Orionids but once again worked I4BER on 2m. Nearby, GW3NJW enjoyed a 45s ms burst with OK1DW that boosted signals to S8.

Some sad news for ms men: TF3EA succumbed to a heart attack on 16 October. A silent key that will be truly missed, Einar was a keen constructor of some fine vhf equipment and a determined satellite operator. His Thursday night schedule with G3CCH via ms had reached a total of 51 contacts.

The fullness of 4m

Assessing a couple of years of G3ZRH activity on our 70MHz band, Tony Stokes of Brentwood observed nearly 1,000 amateur callsigns from eight countries and 75 counties (he worked six plus 61 of them to earn his 4m Senior). Non-amateur stations heard from three continents and more than 30 countries included all the scheduled broadcast stations in Europe. During the summer of 1973 over 50 different USSR broadcasters were noted in or around 70MHz. And a useful beacon in the direction of ZB2VHF is, says 'ZRH, the Voice of America station at Tangier on 70·4995MHz. As for the Gib-beacon itself, G4BEG logged it for almost 90h during the four mid-summer months, but never man-operated.

Much of the foregoing was via ionospheric propagation. No tropo was noted by G3ZRH beyond 600 miles, but sporadic-E was detected on 84 days during 1973, suggesting to Tony Stokes that a GM in the far north of Scotland could expect about 10 good sporadic-E openings to the SE in a twelvemonth.

What has also become evident is the frequency selective nature of some forms of sporadic-E, big signals on 4m being no indication that it is worth looking on 2m or 28MHz; on the latter band the peak of QRK may occur an hour or more after the 70MHz one.

A little lower down, at 50MHz, both G3ZRH and G4BEG have noticed strong openings into Cyprus from northern Europe on a number of occasions in the summer of 1973.

In Cyprus itself, we learn from Clifford Mapp (ORS32024) that the beacon on 50·50MHz (ZC4VHF) operates 24h a day beamed on ZS. Good reports have been received from Cape Town. On 144MHz a permanent opening in the summer months gives RS59 communication at any time with Beirut and Jerusalem at 400km. Back in the UK this 6m beacon has been logged S9 by G4BEG when "Six" was open to the USA (W1 and W2 also heard).

Mounting the 2C39: help offered

To the 23cm man the 2C39A valve is a "goes-without-saying". Even on 70cm people are beginning to use it as after-burner to an existing 432MHz sender to impart extra decibels at a distance. Unhappily, a deterrent to its greater use is the difficulty of obtaining the necessary contact fingering with which to mount it.

Now comes a generous offer from G8FPT. Shortly he will send off to Instrument Specialities in the USA for contact fingering for the anode, grid, cathode and heater rings for the 2C39A. He says:

"I would be only too pleased to offer my services and assistance to others requiring contact fingering for the 2C39A, and also the anode fingering for 4CX250B type valves plus the straight type as used in the ARRL design of 2C39A amplifier. I offer my assistance at no cost, but by ordering in bulk the prices are very much reduced, and can be as low as half price for quantities of 50 or more."

All enquiries *including sae* to A. Nehan, 53 Ingatestone Rd, Woodford Green, Essex.

Where to look for slow-scan

The *FMD* note about the slow-scan tv activities of G3WW prompted G3ZJO to look for the 2m signal from Richard Thurlow, and so another two-way sstv contact was made. Both recognize the need for a spot frequency where other slow-scanners can lie in wait, and they have settled on 145·468MHz. It is, as 'ZJO says, "related memory-wise to the 10m frequency of 28·680". And G3YQC has asked BATC to recommend to its members that they too use it.

Product of a slow-scan contact on 2m is this image of the G2BAR test card photographed from the Robot monitor screen at G3WW in Cambridgeshire 140 miles away, believed a record distance for an sstv contact on vhf. Exposure was 8s—and the blank white triangle in the bottom right-hand corner occurred because the Polaroid developing pack was pulled off too quickly in the excitement of the occasion

At G3ZJO there was no camera available, so tape recordings of sstv signals were put across to G3WW. Soon he will have a tape to give his station details and "CQ SSTV". Already G3WW has made half a dozen such tapes for slow-scan enthusiasts.

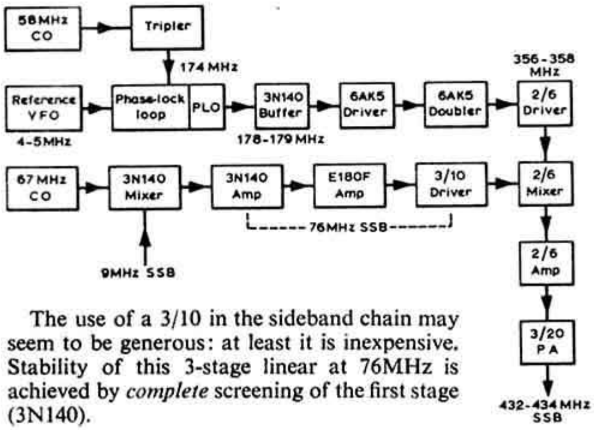
In turn G3WW seeks the advice of the technical video experts on the following:

His Robot camera is now equipped with means for withdrawing the tube from the lens to reduce the normal minimum focal length of 18in down to 11·3cm, so that the monitor screen can be filled with the image of something as small as a postage stamp. He wishes to experiment with a method of transmitting transparencies by projecting them on to a screen and aiming the sstv camera at it. Coloured pictures give illegible results. Black and white transparencies are needed, but are hard to get. Can any member provide a few on loan?

Tech Corner

From G8DCA (Mike Telkman, of Hassocks, Sussex).

Last Easter attention was concentrated on building a single-sideband transmitter for the 70cm band which, duly tamed with the aid of a 'scope, runs 20W p.e.p. The block diagram shows the system used. All units were built on a single pc board chassis except for the reference vfo. Drive from the 2/6 to the mixer is ample and screen volts on the driver may be kept low. The main ht line is 220V except for 300V for the 3/20 anode and 250V stabilized for the 3/20 screen.



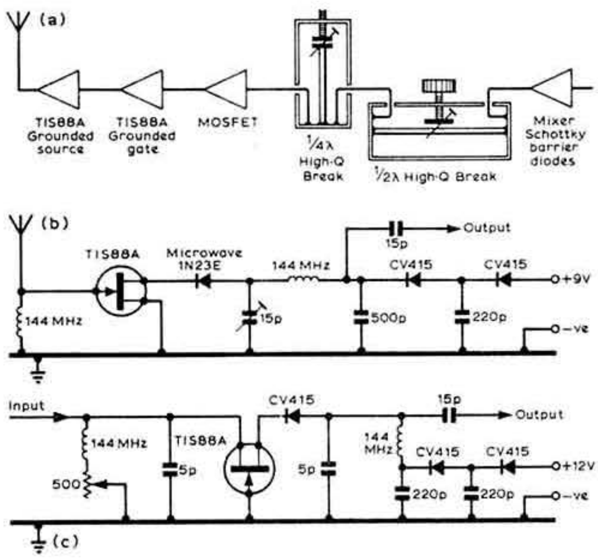
The use of a 3/10 in the sideband chain may seem to be generous: at least it is inexpensive. Stability of this 3-stage linear at 76MHz is achieved by *complete* screening of the first stage (3N140).

The 2/6 mixer accepts 356-358MHz coupled into its grids on quarter-wave lines and 76MHz into its cathode to produce A3J on the ssb calling channel at the low end of 70cm. An attempt to inject the 356MHz into the screen was abortive.

From G3IPV (P. W. Haylett, Bacton-on-Sea, Norfolk)

Work has been proceeding for some time at G3IPV to evolve a 2m front end of high selectivity peaked at the 100kHz telegraphy segment. In (a) a block diagram is given. The first two stages are diode decoupled and diode neutralized; the third rf stage is a standard mosfet from Solid State Modules Ltd, and the mixer a Burns converter without rf stage.

Fig (b) shows the circuit of the first rf stage, input circuit self-resonant and supply voltage slightly reduced. In the



second stage (c) omission of the diode was found to degrade the noise factor.

The high-Q breaks are 3in aluminium boxes, the first being 17in long to give a quarter-wave configuration, the second 34in long to be a half-wave at 2m. They are lightly loaded with coupling loops only ⅜in square.

Results have more than come up to expectations, and OZ has been copied when 2m otherwise appeared to be flat.

Look, no valves

Starting this item with a "QRP Corner" headline in mind to report the escalating activities of people building milliwatt transistor transmitters, one was reminded upon receiving a note from G3TPW that semiconductors do not necessarily mean QRP. (Steve Webb, by the way, is back in Oldham after four years in Cambridge.)

"My station is now all solid state running off 14V" says 'TPW. He has 40W output on 4m and no less than 120W on 2m from a pair of 544BLYs. For 430MHz a pa stage delivering 100W from a pair of CTC transistors with a 30W driver is on the way.

Steve Webb has hopes of getting atop Winter Hill to try and access GB3PI. Back at Cambridge he could do this with the 30mW sender, but from Lancashire he fears the 120W "machine" may be necessary—and that takes 15A at 13·8V!

A move of QTH for Bob McHenry (G3NSM) from Belfast to Oxford. There, after a four years' absence from the air, he decided to try some unmarked transistors which had been given to him to see if they would work at 144MHz. They did. A page of 2m contacts on telegraphy was filled with the help of the resultant one-watter. Best dx: PA0WLB.

Pocket size rigs are just the job for G8GQY of Ulverston for his regular climbs on to the Cumbrian fells. Getting on to the good sites is a sure guarantee of hearing QRP signals at a great distance: the 400mW sender at G8EPA in Wolverhampton was RS55 and the 60mW at G8FOZ in Sutton Coldfield produced a punchy S7. Both used 8-el Yagis.

Being gathered together . .

On Monday evenings at 9pm the White Horse Net meets on 144·41MHz. On the first Tuesday of each month it meets in person at "The Angel", Upper Scudamore, Westbury, Wilts, with an almost 100 per cent turnout of local vhf men. Film shows and other activities to promote interest in the metre waves are planned. At the October gathering a dozen full calls, four BRS men (all studying for the RAE) and one yl were represented. When this picture was taken they were passing round the personal transceiver of G8BMR (top left) and modified T28 receiver, held by G3TYJ (centre).

Other vhf group meetings of which we have information are:

West Midlands: 6 December at Meriden. Info from G8AHW. *Glamorgan VHF/UHF Group:* 18 December, talk and demonstration, 3cm equipment, by G8CKT. NCB Staff Members' Club, Tondu, near Bridgend. Details from GW3ZTH (Kenfig Hill 740561).

Skedspot

Want Westmorland on 2m? Look for G4AUP between 15 December and 7 January when he will back home at 12 Ryley Field Road, Milnthorpe, on 145·41 ssb. Write to Ian Suart for sked, stating preferred times.

And Bristol on 70cm or 23cm? The University Club Station G8CXH is operational again from a radio room 100ft agl on top of the Physics Block. Sked-requests to G3WDG QTHR.

"Where are the GMs?" ask the Gs. Every night GM4-BWT gives the answer. He is on 145·94 between 2000–2030-gmt looking for cw contacts. Crank beams on to Edinburgh.

What they say

". . . cannot condone *FMD* comment about pirates . . 'to deter rather than detect'. They can and do cause a great deal of damage to the image of the amateur fraternity. Only this week a major rescue was launched off the west coast due to an insistent 'Mayday' call from one of these louts. Far from passively ignoring these people (*FMD*, September) the amateur should do everything to locate and report their anti-social and illegal activities"—G4AVT.

"The IARU must consider some action to try to restore a bit of gentlemanly behaviour on 2m, otherwise I can see it degenerating into a number of fm fixed channels at 25kHz intervals . . . as for using 400W output on ssb, has the MPT ever withdrawn an amateur licence or even warned a licensee about using more power than is necessary?"—G3FPK.

"I am interested in contacts with members of the IPA, the International Police Association, a social organization to assist in holiday travel, friendship and the like. It has branches in most countries"—GM8BZX.

"I'm relieved to read (*FMD*, September) that at least G8ARM is not endeavouring to force the phone modes down the cw men's throats. What a pity a lot more phone-only men are not so minded . . . I for one am not trying to force cw down the throats of the phone men, although there are times when I am of the opinion that a gag would be far more effective and beneficial!"—G3DAO.

"Crowds of 2m operators seem content to have loads of QSOs with the new commercial ssb rigs. A design to transvert these to 70cm might be interesting"—G3ZOD.

Here and there

Leicester Show talk-in statistics: GB3ARE manned by members of Leicester Radio Society talked-in 11 stations on 1·8MHz, 15 on 3·5MHz and 225 on the 2m band. Of the latter, 33 were on ssb, 84 on a.m. and 108 on nbfm, these including one walking mobile, who called for nav-aid when he got off the train at London Rd station. Next year 2m only? Hardly seems worth setting up talk-in stations on other bands.

Listen out at lunchtimes on 70·26—nearly always someone there. At Stoke, G3HVI from his superb 700ft site often links Midlanders to Lancastrians—but under weak signal conditions be prepared to put that 4m sender on to A1.

Further to A1, Monday night is still telegraphy night on 2m . . . but where went the 100-plus telegraphists active during the November key-contest? The day-after-the-night-before only a tenth of them made a Monday appearance. Put it down to satiety. Put it down also (Monday, that is) in your radio room diary. Constant CQ calls in various beam directions from 2000gmt onwards should produce dx you hardly knew was there.

Did you think to get yourself two copies of the 1974 *Callbook* while you were at the Leicester Show? If you do any portable or mobile work it is valuable to be able to identify what you are hearing, especially if you are in strange territory, and a copy of *The Callbook* kept permanently in the car enhances the enjoyment of operating.

It was cold on "them thar hills" for the members of the Wakefield Radio Society when they put G3WWF/P, G3WRS/P and G4CLI/P on 4-2-70 during VHF NFD. In this picture, taken inside the G4CLI/P tent, G8HTB looks on while G4CLI talks into the 432-box

Last month's advice to mark QSL cards clearly "... hits the nail on the head" say Bert and Florrie Mathews, G6QM, who are sub-managers for four callsign blocks. "Add letters delta and oscar to the list of indecipherables—and persuade members to *print*", they add.

25 YEARS BACK

"... the Society informed by the G.P.O. that a number of new bands would be made available to U.K. amateurs as from January 1, 1949 ... 144-145Mc/s, 1,215-1,300Mc/s, 5,650-5,850Mc/s, 10,000-10,500Mc/s. The band 58·5-60Mc/s will contine to be assigned—probably until March 31st, 1949. On all of these bands an input power of 25 watts will be permitted."

RSGB Bulletin December 1948.

Four Metres and Down Certificates

70MHz Transmitting Section

1 G3EHY; 2 G3PJK; 3 G2AIH; 4 G3OHH; 5 G3KEU/P; 6 G3NUE; 7 G3IUD; 8 G6NB; 9 G8PD/A; 10 G5FK; 11 G3NDF; 12 G3IMV; 13 GI3HXV/P; 14 G3SKR; 15 G3OUF; 16 G3BNL; 17 G3PMJ; 18 G3PHG; 19 GC3OBM; 20 G3TLA/P; 21 GI3HXV; 22 G5UM; 23 G3OJE; 24 G3SEK; 25 G3RWM/P; 26 G3FDW/P; 27 G3PPG; 28 G3FIJ; 29 G3GGL; 30 G3RDQ; 31 G3NJF/P; 32 G3RWM/P; 33 G3NUE/P; 34 G3AZI; 35 G3PDW; 36 GI3HCG; 37 G3LAS; 38 G3HRH; 39 GM2UU; 40 GI3PGG; 41 G3VPK; 42 G3RLE; 43 G3UFS; 44 ZB2VHF; 45 G3OUL; 46 G3UUT; 47 G5NU; 48 G3OZJ; 49 GI3HCG/P; 50 GI3PGG/P; 51 G3UBX; 52 G3VSA; 53 G3NKL; 54 G3THQ/P; 55 G3JHM/A; 56 GI3VJS/P; 57 G3EKP; 58 G3JHM; 59 G3VOF; 60 ZB2BO; 61 G3JHM/P; 62 G3NNO; 63 G3WQP; 64 G3OXD/A; 65 GI3WEL; 66 G3OHC; 67 G2WS/P; 68 G3JEQ; 69 G3RZK; 70 G8LY; 71 G3TDH; 72 G3GZJ; 73 G3XLH/P; 74 G3HBG; 75 G3VNQ; 76 G3VPF/P; 77 G2WS; 78 G3VJR; 79 GW3OXD/P; 80 G5UM/P; 81 GM3UAG; 82 GW3UCB/P; 83 G5UM (new QTH); 84 G3REP/M; 85 G3NKS/P; 86 EI2VBE/P; 87 G3VFD; 88 G3DOR; 89 G3REP; 90 G3WOS; 91 GW4ABR/P; 92 G3KSU; 93 G5DF; 94 G3ZYC; 95 G3JXN; 96 G4BEG; 97 G(GW) 3VPS/P; 98 G3JFO; 99 G3ZRH; 100 G3YSK; 101 G3WKH; 102 G3JYP; 103 G3NYY/P.

70MHz Senior Transmitting Section

1 G3SKR; 2 G3RWM/P; 3 G3FDW; 4 G3TCT; 5 G5NU; 6 G6HD; 7 G3OHH; 8 G3VSA. 9 G3VFD/P; 10 G(GM)3KSU/P; 11 G3JHM/A; 12 G3COJ; 13 G3RDQ: 14 G5DF: 15 G3ZRH.

70MHz Receiving Section

1 BRS15744; 2 BRS15822; 3 BRS32036; 4 BRS24456.

144MHz Transmitting Section

1 G3HBW; 2 G3BLP; 3 G3MTI; 4 G5YV; 5 G3BNL, 6 G3MCS, 7 G3LAR; 8 G3CO; 9 G3BA, 10 GW3MFY; 11 G3DFL; 12 G3NAQ 13 G3NNG, 14 G3OJY 15 G3KPT; 16 G3JYP, 17 G3KMT; 18 G3OHD; 19 G3BBR/A; 20 G3HRH 21 GM3EGW, 22 GI3OFT; 23 G3OBD/P; 24 G2HIF; 25 G3JDN; 26 G8VZ. 27 G2AXI; 28 G3JYT; 29 G5UM, 30 G3EJO; 31 G3PBV. 32 G3FDG; 33 G3OSA; 34 G3JLA, 35 GC2FZC. 36 G3BOC; 37 G3MTI/M; 38 G3OJY (new QTH) 39 G3JWQ; 40 G3NOH, 41 G3PSL 42 G3LBA; 43 G3FUR: 44 G2BJY; 45 G3MRA; 46 G3AGN; 47 G3MDH/P: 48 G3GMY. 49 G3GGK; 50 G3MDH; 51 G3NLR; 52 GM3LDU; 53 G3CKQ; 54 G5HZ; 55 G3NNK 56 G6GN; 57 G5ZT 58 G2PL 59 G3FZL 60 G3SAR; 61 G3NUE. 62 PA0EZ; 63 G3AHB 64 G3PTM; 65 G3LAS; 66 G3RMJ; 67 G2CDX; 68 G3ORL; 69 G2DHV/P; 70 G3FIJ. 71 G3CXM; 72 G3HRH/P; 73 G3BDS; 74 G3FNM; 75 G3IMV: 76 G2BQ: 77 G3KHA. 78 G3OHC; 79 G3SHZ; 80 G3PKT; 81 G3UFA; 82 G3RST; 83 G5NU, 84 G2BHN; 85 G3OZP; 86 GW3KYT; 87 G3ICO 88 G3ETH; 89 G2WS; 90 G3NJF/P; 91 GW3CBY, 92 G3TLA/P; 93 G3JFO, 94 G3TDR, 95 G5UM/P; 96 GM2UU; 97 G3UUT, 98 G3BNC, 99 G3SZX; 100 G3UKV; 101 GC3OBM; 102 G3FVC; 103 G3BJD; 104 G3PWJ; 105 G2ATM; 106 G3ISX; 107 G3USF; 108 G3OUL; 109 G3UIK; 110 G3GZJ; 111 G3EJA; 112 G3JHM/A; 113 G8AAZ; 114 G3EHR; 115 G8ATK; 116 G3WW; 117 G8APZ; 118 G3TR; 119 G3WZT; 120 G2WS/P; 121 G3EHM; 122 G3WSN; 123 G3RZK; 124 G3ILO; 125 G3RQI; 126 G3OXD/P; 127 G3WQG; 128 G8APO/P; 129 G8BQX; 130 G8BJK; 131 G6LK; 132 G8AYN; 133 GI5ALP; 134 G8BHI; 135 G8ATK (new QTH); 136 G3UQK; 137 G8BSH; 138 G8BWW; 139 G8AUN; 140 G8AEJ; 141 G3WDG; 142 G8BCP; 143 G8ABA; 144 G3WUW; 145 G3YUA; 146 G8VN; 147 G8BCA; 148 G3OHC/P; 149 G8BEO; 150 G3WUW/P; 151 G8BQX/P; 152 G8BPY; 153 G8CMB/P; 154 G5UM (new QTH); 155 G8AEL; 156 G8CKG; 157 G3HCW; 158 G8CJV; 159 G8CKV; 160 G8CEZ; 161 G3SFV/P; 162 G8CEA/P; 163 G8BEW; 164 G3OHC/M; 165 G8CXM/A; 166 G8CMU; 167 G3YRH; 168 G3YDY; 169 G8BKR; 170 G8CVK; 171 G3PKV; 172 G6FI; 173 G8CUO; 174 GW3OXD/P; 175 GW3OXD/A; 176 G8DBB; 177 G8CCE; 178 G3ENY; 179 G8BQH; 180 G8BUJ; 181 G8ADP/A; 182 G8CVS; 183 G8BXX; 184 G8BGE; 185 G8CUT; 186 G8DLZ; 187 G8DBA-G3ZNW; 188 G8DJF; 189 G8DLP; 190 G8BCI/P; 191 GW3UCB/P; 192 G8APO; 193 G8DKV; 194 G8CBZ; 195 G8BXJ; 196 G3DOR; 197 G8CBU; 198 G8BKQ; 199 G8DMY; 200 G8DJM; 201 G8BCL; 202 G8CXV; 203 G3YED; 204 G8DJK; 205 G8CRN; 206 G8BRT; 207 G8BRT/P; 208 G3EFX/P; 209 GC3YIZ; 210 GM8BZX; 211 G8BYV; 212 G3WHK; 213 GM8BDX; 214 G8ANQ; 215 G8CXQ; 216 G3VNQ; 217 G8EAV; 218 G8CKX; 219 GM8BKE; 220 G8CJO; 221 G8DML; 222 G8DAW; 223 G8DKF; 224 G8EGS; 225 G8CKV/P; 226 G3ISX/M; 227 G8EBI; 228 G8ENL; 229 G3SRX; 230 GW8AZU/P; 231 G8CEX; 232 GM8BRM/P; 233 GW4ABR/P; 234 G8EBV; 235 G8BDJ; 236 G8BXC/P; 237 G8BCO; 238 G8ERW; 239 G3XEB; 240 GI8AYZ/P; 241 G8CPG; 242 G3NHE; 243 G3DAO; 244 G4ADE; 245 G8ABP; 246 G8DWC; 247 EI2VBD/P; 248 G8EJH; 249 G8AWA; 250 G3FRV; 251 G8EBJ; 252 G8DDC/P; 253 G8EBF; 254 G3XFW; 255 G3WZT; 256 G8CFI/P; 257 G8ENI; 258 G8AWV/P; 259 G8COG; 260 G3BW; 261 G8DWT; 262 G3ZNZ; 263 G3UCS; 264 G4AVX/G8CXC; 265 G3POF; 266 G8BPO; 267 GW8EQH; 268 G3XTQ; 269 G8FDE; 270 G8CKY; 271 G8DTQ; 272 G3PFR; 273 GW3ZSS/P; 274 G8DYC/P; 275 G3GBH; 276 G8BPN; 277 G8ERM; 278 G8CQW; 279 G8FFC; 280 G8FUI; 281 GM3EOJ; 282 G3XTT; 283 G3PJK; 284 GM3JFG; 285 GM3ZVB; 286 G8FNI; 287 G8FIH; 288 G8DHA; 289 G8CDW; 290 G8FBL; 291 G3FYX; 292 G8FIY; 293 G8FDV; 294 G8AMU; 295 G3HBG; 296 GM3UAG; 297 G3YZU; 298 G8ESY; 299 G8CLK; 300 G3MYY; 301 G8FAG; 302 G8EOP; 303 G3CMH/P; 304 G8FVZ; 305 G8DVS; 306 G8CDL/P; 307 GW3ZTH; 308 G8EZF; 309 G8FBF; 310 G8DKG; 311 GW3FEC/P; 312 GM3OXX/P; 313 GM3OXX; 314 GW8FOL; 315 G8BXC; 316 GM8CHR; 317 G/GW)8AOP/P; 318 GW8FKB; 319 GM3ZVL; 320 G8AOB/M; 321 GW8DUP; 322 G8FRX/G4BSW; 323 GW8BNJ/P; 324 GW8COP/P; 325 G4BBR; 326 G8CIB/P; 327 G4AEQ; 328 G8AIH/G3YNT; 329 GM4BHA; 330 GW8ERP/P; 331 G8DVD; 332 G3SEK; 333 G8GPR; 334 G8EUI; 335 GW8EHK; 336 G8ATY; 337 G4BAU; 338 G3TLV; 339 G8DXS; 340 G(GW) 8ACG/P; 341 GW8ACG; 342 G8FAL; 343 GW8FQF; 344 G4BBB; 345 G3FPK; 346 G8FEP; 347 G8GNE; 348 GW8FQF/P; 349 G8GMR; 350 G3ZOD; 351 G8HAC; 352 G8FRA; 353 G8GAU/P; 354 G8GMU; 355 G3XDY; 356 G8GVA; 357 G8FMK; 358 G3YSK; 359 GI8EWM; 360 F1CF; 361 G8GLV; 362 G3XWZ; 363 G8FUI/P; 364 G2HDT; 365 G8FQE/P; 367 G3NYY/P; 368 G3NYY.

144MHz Senior Transmitting Section

1 G3CCH; 2 G3FAN; 3 G5MA; 4 G3BLP 5 G3CO; 6 G3BA; 7 G6NB; 8 G3EDD; 9 G3HRH; 10 G8GP; 11 G3LAS; 12 G3IMV; 13 G3PTM; 14 G5NU; 15 G6GN; 16 G3KHA; 17 G3AOS; 18 G3MRA; 19 G3BHW; 20 GW3MFY; 21 G3DAH; 22 G3JEQ; 23 G6RH; 24 G3MCS; 25 G3GIM; 26 G2PL; 27 G2NH; 28 G3USB; 29 G6TA; 30 G2GZJ; 31 G3COJ; 32 G3JYP; 33 G8BBB; 34 G3OZP; 35 G3HCW; 36 G3DY; 37 G3KEQ; 38 G3WSN; 39 G3FIJ; 40 G3DKF; 41 G3JXN; 42 GC2FZC; 43 G8ENI; 44 G8CUT; 45 G3NHE; 46 G3ZYC; 47 G3EHM; 48 G5DF; 49 GW3ZTH.

144MHz Receiving Section

1 BRS22550; 2 BRS22322; 3 BRS15822; 4 BRS15744; 5 NL667; 6 BRS20108; 7 A3470; 8 A4048; 9 BRS21667; 10 A4871; 11 BRS23140; 12 BRS7323; 13 A3942/P; 1. A3942; 15 BRS24550; 16 BRS30352; 17 A5032; 18 A6812; 19 BRS31172; 20 BRS31466; 21 A7929; 22 A6657; 23 A7683; 24 BRS33794; 25 BRS32751; 26 BRS33823.

144MHz Senior Receiving Section

1 BRS15744; 2 A5032.

432MHz Transmitting Section

1 G3NNG; 2 G3KPT; 3 G3LHA; 4 G3BNL; 5 G3MCS; 6 G8AAZ; 7 G8ABP; 8 G3AHB; 9 G5UM; 10 G8ACQ; 11 GW8ACG; 12 GW8ACG/P; 13 G8AHQ; 14 G8AEJ; 15 G8AGG; 16 G8AGU/P; 17 G3PTM; 18 G8AAY/A; 19 G8AGQ/A; 20 G3HRH; 21 G8AJU; 22 G8ARM; 23 G8ADP/P; 24 G8AUE; 25 G6GN; 26 G8AQA; 27 G8AWO; 28 G8AXP; 29 G8AHE/P; 30 G8AOD; 31 G8AWW; 32 G8AKT; 33 G8ANS; 34 G8ARD; 35 G8AIE; 36 G3PKT; 37 G8ATK; 38 G8ACP; 39 G8AQZ; 40 G8ARC; 41 G8AVL; 42 G8ART; 43 G5NU; 44 G3FIJ; 45 G3XEB; 46 GW8AHI; 47 G8AVX; 48 G8AKQ/P; 49 G8ABB; 50 G8ADC; 51 G8ADC/P; 52 G8ATL; 53 G3UBX; 54 G8AZO; 55 G2WS; 56 G8ALM; 57 G8AYN; 58 G8BGQ; 59 G8AWS; 60 G8AWS/P; 61 G8BYV; 62 G3UQK; 63 G8BAK; 64 G8BCA; 65 G8BIL; 66 G8APZ; 67 G8CKX; 68 G8AMU; 69 G3EHM; 70 G8DLP; 71 G3RZG/P; 72 G5UM (new QTH); 73 G3OBD/P; 74 GC2FZC; 75 G8BQH; 76 G3PBV (old QTH); 77 G8CKX/P; 78 G2WS/P; 79 G8AMU/P; 80 G3RZK; 81 G8BKR; 82 G8ERW; 83 G8AAC/A; 84 G8CIT; 85 G8ADP/A; 86 G3FRV; 87 GW8EQH; 88 G8FCK; 89 G8FUI; 90 G8DAW/G4BMM; 91 G8EOP; 92 G8AVC/G4AGE; 93 G8CUT, 94 G8AUM; 95, GW3UCB/P; 96 G3NHE; 97 GW8FQF/P; 98 G4BBB; 99 G8FMK.

432MHz Senior Transmitting Section

1 G3MCS; 2 G8AKE; 3 G3KEQ; 4 G2XV; 5 G8AWS/P; 6 G8AUE; 7 G8ACQ; 8 G8ATS 9 G8BBB. 10 G3COJ; 11 G8ARM; 12 G8BCA; 13 G3XEB; 14 G5NU; 15 G3ZYC; 16 G3DAH; 17 G5UM.

432MHz Receiving Section

1 BRS15744; 2 A5032; 3 A6812.

1,296MHz Transmitting Section

1 G3MCS; 2 G4BEL; 3 G3WDG/P.

Supreme Award

1 G3MCS; 2 G5NU; 3 G3ZYC; 4 G3COJ; 5 G4BEL.

Microwave Section: 3cm

1 GW3RPE/P; 2 G3ZGO/P; 3 G8APP/P; 4 G3ZKR/P; 5 G3WDG/P; 6 G3BNL/P; 7 GW3EEZ/P; 8 G8CVS/P; 9 G8AZU/P; 10 GW8CKT/P.

THE MONTH ON THE AIR

by JOHN ALLAWAY, G3FKM*

READERS who are having difficulty curing tvi in television receivers which have been designed with complete lack of consideration for possible interference problems will share the writer's enthusiasm for a recent European Commission draft directive which proposes that common interference standards should entirely replace national standards. Manufacturers would be responsible for ensuring that their receivers met these common standards, and all equipment which conformed could move freely throughout the EEC. The German Federal Republic is fortunate in already having an enlightened administration which takes a fair interest in the rights of the radio amateur as well as those of the electronics industry, and sets which do not meet reasonable standards are not allowed into the country.

Your scribe would like to take this opportunity to thank all those who have helped in the compilation of *MOTA* throughout the past year, and to wish all readers a happy and prosperous Christmas and New Year. The RSGB would also like to express its gratitude to Dr G. Lange-Hesse, DJ2BC, of the Lindau Ionospheric Institute in Germany, for his kindness in supplying the information which is used in compiling *Propagation Predictions*. Finally, a very special thank you to the editors of the various news sheets and magazines listed at the end of *MOTA* each month—without their help the writer's task would be impossible.

Apologies for an error in the frequency of the Cyprus beacon station, 5B4CY, as given on page 766 of November *MOTA*—this should have been 28,180kHz and not 28,120 kHz.

Top band news

The October issue of the *W1BB 160 Meter DX Bulletin* forecasts that the next two or three years will be excellent for propagation on the lf bands. The same publication lists QSOs by G3XVY with LU, ZP, CX, ZD9, ZX0VG, 5Z4KL and EP during the summer transequatorial tests—the contact with CX3BH is believed to be the first between the two countries. A one-page 160m worldwide sunrise/sunset timetable is available from Gordy Weightman, VE5XU, 3637 Victoria Ave, Regina, Sask, Canada, for 50c (or four IRCs); a special timetable for any particular area can be obtained for $1 or eight IRCs. Congratulations are extended to Stew, W1BB, on his recent marriage to his neighbour—a lady who has allowed him to run aerials and radials across her property for many years!

News from overseas

Norman Polan, 9H1BX, has written to express his apologies to those waiting for his QSL card for the delay in replying. Unfortunately Norman's wife has been ill and they have both been in the UK. They hope to be back in Malta at the end of November and an immediate start will be made then. Norman wishes to thank all who have sent kind letters which have done a great deal to cheer up his wife.

*10 Knightlow Road, Birmingham B17 5QB

Ed Hopper, W2GT, has kindly forwarded a cutting from the *Herald-News* dated 22 October. This announces the death of Paul Godley on 20 October at the age of 84. Godley was a co-worker with Marconi, and was sent to Scotland in 1921 to make amateur transatlantic tests. As a result he was the first recipient of a telegram sent across the Atlantic by radio.

The 10th Australian Scout Jamboree will be held at Woodhouse, Victoria, between 28 December and 6 January, and will be the meeting place for 10,000 scouts. During this time a special station—VK5BP—will be on the air from 0230 30 December to 1030 5 January, 24 hours daily. Frequencies will be: 1,819, 3,625, 7,050, 14,190, 21,190 and 28,190kHz. They will have three transmitters, two of which will be on the air simultaneously on different bands. Aerials will include quads, dipoles, and a long wire for 1·8 to 28MHz.

DX news

SY5MA has been reported on 14,010 and 21,010kHz, and on 7MHz cw on a number of occasions. It seems that he is living at Ouranoupolis in Greece but is able to visit Mt Athos fairly easily. It is not clear whether he has already operated from there. He will have ssb equipment soon and hopes to put Mt Athos on the air quite frequently.

JA3GZN now acts as QSL manager for the following stations: JD1ACH, JD1ACK, JD1ACM, JD1AFE, JD1AFF JD1AHN, JD1AIV, JD1ARR and JA3LWA/JD1. All these operated from Ogasawara Is, but in addition he can supply cards for contacts with JD1AJA, who was on Minami Torishima Is.

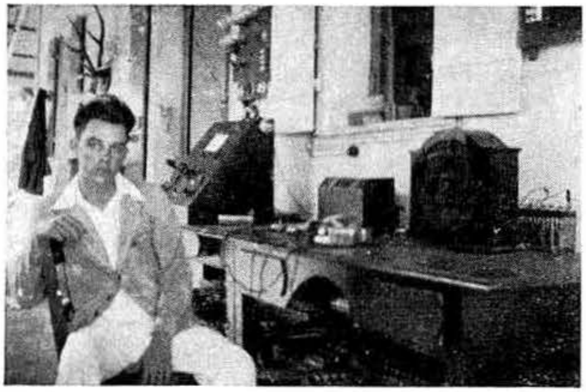
ZD9BM closed down on 9 October and has been replaced by Ian Anderson, ex-VP8GZ. Ian's call is ZD9BT. ZD8JD is Gerard, formerly of FB8XX, and is asking for QSLs via his home call (F2JD). FR7AX is Pierre, formerly 5R8AG and FM0XF. 3V8DM believes that it may be a long time before there is any more activity from Tunisia when he leaves to become VE6AIF once more. He is said to be fairly active between 1900 and 2100 on 14,180kHz.

VE3GCO is currently acting as QSL manager for VP2DAE, VP2LC/P, VP2MAC, VP2MF, VP2SM, 8P6CE and 9Y4VE.

ZF1JA's call has been pirated on cw but during the period 27 to 30 September 1973 some genuine cw operation took place while Richard Limebear was visiting and before he received his own ZF1WL call.

The British Commonwealth Net now meets on 14,170kHz at 1430 on Mondays, Wednesdays and Fridays. The Afrikaner Net meets at 1900 daily on 21,355kHz.

Interesting rumours appearing in *West Coast DX Bulletin* include news that the Iraq government has signed a contract with a USA firm for construction of oil exporting facilities in the Arabian Gulf. It is also mentioned that Burma has started to ease in its aloof attitude to the outside world and has invited bids from foreign countries to explore for oil. In both these instances such actions could be a prelude to amateur activity. There is apparently some activity from



Paul Caboche, 3B8AD, was the first amateur to come on the air from Chagos way back in 1936. His original equipment (left) consisted of a TPTG transmitter running off a 110V battery with the mains connected in series at night time! The receiver was a Philips 1-V-2. Paul, who is an electrical engineer, now has a KW2000A (right) plus linear with 12AVQ, G5RV and TA33Jr aerials, and puts out a good signal from Mauritius

another country where amateur radio stations have been very scarce for the past few years—DK3HA/6O1 has been worked on 14 and 21MHz and says that he is in Mogadishu, Somalia.

QSLs for contacts with K5LTH and KH6HDB from Kure Is are being sent out by WA3HUP, and KH6BZF says that all QSLs that were able to be matched with the available logs from the KH6EDY/Kure operation of a year ago have been sent out. Unfortunately up to 30 pages of the logs have been mislaid and QSLs obviously cannot be sent out for the contacts recorded on them.

Dxpeditions

Mention of a visit by WB5BID to Bouvet Is is still being made and he is said to have been heard talking to ZS2MI about the possibility of such a trip in February 1974.

"DX News Sheet"

A most suitable Christmas gift for anyone interested in dx is *DX News Sheet*. This is a single sheet news bulletin published weekly by Geoff Watts, 62 Belmore Rd, Norwich, NOR 72T, from whom full details may be obtained.

Northern Ireland activity periods

The City of Belfast YMCA Radio Club is organizing two periods during which there will be special activity on all bands 1·8 to 28MHz on cw and ssb by GI stations. GI6YM (QTHR) offers to try to meet schedule requirements if an sae is supplied. The periods of special activity will be the weekends of 12-13 and 19-20 January 1974.

Contests

The ARRL 10 Metre Contest

1200 15 December to 2359 16 December.

Stations may be worked once on cw and once on phone. USA and Canadian amateurs will transmit signal report and state or province, others will give report and serial QSO number starting from 001. Stations which are not land based transmit their ITU region number. Cross-mode contacts will not count but contacts via Oscar 6 will, and all cw contacts must take place below 28,500kHz (except for those via Oscar 6). Two points are scored for each contact, and four if made with a novice station. The multiplier consists of the number of different states, Canadian call areas (VE1–VE8, VO), ITU regions (as sent by non-land based stations), and DXCC countries contacted. A state or province may not be counted again as a country. All entries must be postmarked before 21 January 1974 and sent to ARRL, 225 Main St, Newington, Conn. 06111, USA. A limited supply of summary and log sheets should be available from G2BVN (sae, please).

The Hungarian Contest

0000 to 2400 23 December

All bands, phone and cw. Exchange RS/T plus ITU zone number. Contacts between stations on the same continent count one point, on different continents three points. Those with HA/HG5 count four points, and with HA5 five points. The multiplier is the number of different ITU zones contacted. A summary sheet and signed declaration should be sent with logs to: BRAL Contest Committee, PO Box 2, Budapest 134, Hungary, before 15 January.

The recent **AGCW/DL Summer QRP Contest** showed an increase of 60 per cent in entries compared with the winter contest held in January, logs being received from 10 European countries and three USA call areas. Overall winner was OH2BOR with 11,571 points. Leading G entries were **G8PG** (11th), G3DNF (19th—a fine effort with 2W on 14MHz only), and G4BVS (21st). The next contest will be held on 12 and 13 January 1974, and the rules will be published in December *MOTA*. They have been revised to include a section for QRO stations to compete in working QRP stations. G8PG has been appointed UK contest manager and will handle all UK logs in future. The success of the summer contest is further proof of the current boom in low power working on both sides of the Atlantic.

TOPS CW Club Contest

1800 8 December to 1800 9 December.

3·5—3·6MHz cw only. Call "CQ TAC" or "CQ QMF". Contacts with own country count one point, with other stations in same continent two points, and with other continents three points. Each call area in W/K, VE/VO, U and VK counts as a country. Total score is total points multiplied by the number of prefixes (as per the WPX) contacted. Entries (which may be single- or multi-operator) should be posted before 16 January 1974 to P. Lumb, G3IRM, 22 Hervey Rd, Bury St Edmunds, Suffolk, England, IP33 2DW. The 1972 event attracted 219 entries, only 14 of which came from the UK! Overall winner was OH1LX (102,912 points); top UK station (single-operator) was G3ESF (24,198 points) with G3PHW (14,219), GM3PIP (13,716) and G3XTT (11,172) following.

Due to the kindness of WA1PID, results of the **1973 ARRL DX Contests** have been received and are as follows:

Phone Section

G2QT	**476,952**	**points**	G3YTU	3,564	points
GW3NVW	**390,133**	"	**G4ANT (Multi-op)**	**1,821,232**	"
G2FNK	108,204	"	G3UBR (Multi-op)	1,177,344	"
G3YBH	53,694	"	G4ALE (Multi-op)	410,880	"
GM5AXO	**20,808**	"	**GM3ZRC (Multi-op)**	**24,960**	"
G5AWX	8,748	"	**GW3UCB (Multi-op)**		"

CW Section

G3KMO	**1,174,428**	**points**	G2AJB	27,900	points
G3MXJ	1,058,688	"	**GC5BAU/P**	**20,868**	"
G2QT	639,366	"	G3KSH	11,664	"
GW3JI	**535,068**	"	G3YBH	5,904	"
GW3SYL	369,438	"	G3CWL	4,599	"
GM6RV	**180,810**	"	**G4ALE (Multi-op)**	**993,147**	"
G3APN	158,598	"	G3TBK (Multi-op)	467,901	"
G2RO	127,019	"			
G3VDW	100,584	"	G4BTJ (Multi-op)	370,722	"
GM5AXO	54,441	"	**GW3UCB (Multi-op)**	**225,000**	"

Congratulations to the certificate winners (listed in bold type). The Braaten Trophy (for top G) is won by G3KMO, and the Milne Trophy (for leading non-G UK station) by GW3JI. G4ANT was leading European multi-operator single-transmitter entry.

Note that in the forthcoming CQ WW DX Contest (CW) a new award—the G2LB Memorial Trophy—will be given to the participant with the highest score in Europe on 14MHz. G2LB held the record 14MHz score for Europe for many years.

Awards

The Ten American Districts Award

This is available to all licensed amateurs and requires proof of contact with stations in all 10 USA call areas (1 to 0). Cross-band and cross-mode contacts are accepted and there are no band/mode endorsements. Applicants should send QSLs (which should show "bureau marking of postmark, or it must be accompanied by its original mailing envelope") plus $1 or eight IRCs to Lockheed ARC, 2814 Empire Avenue, Burbank, Cal, 91504, USA.

The Worked All Zones Certificate (WAZ)

Available to all licensed amateurs who have proof of contact with all 40 of the world zones as defined by *CQ* magazine. Contacts must have been made since 16 November 1945, and the award is issued for all-cw, all-phone, two-way ssb, and mixed modes. A zone map and application form may be obtained from G3FKM (sae, please) to whom completed forms and QSLs should be sent by UK amateurs for checking. Certified applications should be sent (accompanied by $1 or eight IRCs) to DX Editor, Postbox 205, Winter Haven, Fla, 33880, USA.

QTH Corner

AP2KS	via SM1CNS, PO Box 336, 62103 Visby 3, Sweden.
FG7AK/FS7	via F6AEV, P. Luizard, Hotel Digue, 50 Mont St Michel, France.
FG0AFA/FS7	J. Irwin, 578 Morris Av, Apt A-6, Elizabeth, NJ, 07208, USA.
FR7AX	P. Guannel, BP 109, 97420 Le Port, Reunion Is.
IH9AA	via I8AA, Dr R. Pentimalli, 28 Via Firenze, 89100 Reggio Calabria, Italy.
KA1BL	via K0SVW, 1100 14th St, Bettndorf, Iowa, 52722, USA.
KZ5PW	via WA6AHF, 17494 Via Alamitos, San Lorenzo, Cal, 94580, USA.
OX3YY	Rinn Hoffman, 3961 Umanak, Greenland.
PJ8DX/PJ7	via K2FJ, K. R. Palmer, RFD 3-Williston Rd, E Aurora, NY, 14052, USA.
PJ9AVN	PA0AVN, A. Verroen, Burg van Houtplein 33, Vlymen 4032, Netherlands.
PJ9GIW	via K4CDZ, F. Ashworth, RFD-2-Box 353, Lewisville, NC, 27023, USA.
SY5MA	via W4KA, L. Haijsman, 1044 SE 43rd St, Cape Coral, Fla, 33904, USA.
TR8SS	via DJ510, Max Haas, Nailaer Str 106, 8671 Lichtenberg/Obfr, Germany
TY8ABB	TU2BB, Felix Vieira, BP 298, Abidjan, Ivory Coast.
VP1SYL	R. Burt, 6353 Kingston Ct, New Orleans, La, 70114, USA.
VP2SU	A. Samuel, PO Box 142, Kingstown, St Vincent.
VP2SV	J. Caldwell, Palm Island, St Vincent.
VP2VAN	via K2FJ (see PJ8DX/PJ7).
VR1PC	via WA6KQB, G. H. Gabriel, 5917 Cobblestone Ct, El Sobrante, Cal, 94803, USA.
VS9FBS	via G3LQP, 56 Combe Rd, Tilehurst, Reading, Berks.
VK9MC	via K6ZDL, Box 1351, Torrance, Cal, 90505, USA.
VP2MDX	via W4PRO, 15 Willow Rd, Hampton, Va, 23364, USA.
VP2MYA	via W5MYA, 1505 Cedar Ridge Terrace, Euless, Texas, 76036, USA.
WB4BUQ/8R1	via WA6MWG, 4040 Via Opata, Palos Verd Est, Cal, 90274, USA.
W6LUV/KB6	via W6LUV, 424 NE St, Lompoc, Cal, 93436, USA.
WA5VKJ/OH0	via W3HNK, Box 14, Norwood, Pa, 19074, USA.
ZD3Z	via OH2NB, Lansipellontie 12, SF-00390 Helsinki 39, Finland.
ZD8JD	via F2JD, 17 Rue Couture, 58 La Machine, France.
4C9AA	via W2GHK, PO Box 7388, Newark, NJ, 07107, USA.
6Y5MA	via K4KA, Box 4025, Falls Church, Va, 22044, USA.
7P8AM	via G3SGK, Angling Spring Farm, Great Missenden, Bucks.

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

The Worked All Zones Certificate (Single band)

This version of the WAZ was introduced in 1973 and all contacts must have been made since 31 December 1972. Applications should be made as for the ordinary award but QSLs must clearly indicate on which band the contacts were made. Applications must be for all phone or all cw.

The Ockenden Award

G2FUX advises that due to loss of most of the interest in this certificate it will be discontinued after 31 December 1973. Certificates will be issued to all those with applications in the pipe-line. Ockenden are most grateful for the support which has been given over the years, and it is pleasing to note that over £100 has been collected.

The Curacao Certificate

This is normally issued for contacting three PJ2 stations and costs 10 IRCS. However, the award will be issued free of charge to those who contact three of the stations using the special PJ1 prefix during the month of December 1973. Applications, including QSO details, should be posted by airmail to reach VERONA, PO Box 383, Curacao, Netherlands Antilles, before 1 February 1974.

Odds and ends

The latest developments involving G3EPU, the pirating of whose call was mentioned in July *MOTA*, resulted in his callsign being omitted from the latest issue of the *Amateur Radio Callbook*. This was due to an error at the MPT and Ken wishes it to be known that he is still fully paid up and licensed, and that he is *not* a pirate! His full QTH is 32 Strathearn Rd, Wimbledon Park, London SW19 7LH, and his telephone number is 01 946 1390.

Brian King, G3SGK, now has the callsign 7P8AM, and says that he is at present using an FT101 transceiver and G5RV aerial. He is active mostly on 14 and 21MHz from 1500 to 1600 (weekdays) and 1300 to 1600 at weekends. Hospital work means that he may have to QRT suddenly on occasion, and also that he finds difficulty in trying to keep schedules. QSLs should go to the bureau under Brian's G3SGK call, or to the address in *QTH Corner*.

Allan Papworth, G3WUW etc, was in India in early November and hoping to obtain a VU licence for use during a short stay.

Band reports

G3RFG and others have drawn attention to the apparent 27-day cycle in periods of good propagation, and the former also points out the moon travels around the earth in 27 days 7 hours and 43 minutes. A rough check which he carried out seemed to show that the best conditions were during the five days after a new moon—further study seems to be indicated.

The CQ WW DX Contest (phone) seems to have coincided with excellent conditions, even on 28MHz, and GW6UW is reported to have worked all W districts during the event. One wonders whether there would have been any activity on the band had there been no contest taking place.

Very many thanks to the following for supplying information from which this section was compiled: G2BOZ, G2CDT, G2HKU, G3DO, G3HB, G4RZ, G5JL, G6GH, G8MY, G3AAE, G3GVV, G3LPS, G3NKQ, G3ORP, G3RFG, G3XYP, G3ZDF, G3ZUJ, GC4CHY, GW4BLE, BRS 17567, BRS17991, BRS31301, A8298, A8306 and A8312.

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

1·8MHz 0000 *W1AXA*. **0100** *W1BB*, *W2DEO*. **2300** *KV4FZ*.

3·5MHz. 0000 *WA5VKJ/OH0*. **0500** *DL1RK/HB0*, *VP2MDX*. **0600** *ZM3FZ*. **0700** KZ5CQ, ZL4s HJ, LT, NH. **2200** *UA0AG*, *UD6DFF*, XV5AC.

7MHz. 0000 EP2TW, 5U7BB. **0100** CR4BS, 9Y4T. **0300** *CI1AWM* (Canada), *CM8JH*, *CN8CF*, *CR7IZ*, *VP2s MAN*, *MDX*, *4K1F*, *8P6EU*. **0400** *KG4AA*, *G3MZV/VP9*. **0500** *KZ5PW*, *PYs*, *ZLs*. **0600** *CT2AK*, HC2VL, HR1RF, KS6DH, YN9MQ, ZK2BD, 5W1AU, 9H1HE. **0700** *EA9EW*, OJ0AM, TI2CF, VK7AZ, ZLs. **0800** *YV1AD*. **0900** HR1RF. **1600** UI8LAG. **1800** *OD5LX*. **2000** CR4BS, CR7IC, JA6YB, MP4BJS, VK6CT, VQ9s D, GP, 4S7AB. **2200** *CN8HD*. **2300** XV5AC.

Dick Allisette, GC4CHY, has been on the air since 14 July and expects to be active during the Christmas vacation from his home in Guernsey

14MHz. 0700 AX0CC, KA1BL, VK9FV, ZD3Z. **0800** *KL7MF*, *VA8CD*, VK9FH (New Britain), VK9s FV, LN, *3D2EK*. **0900** *A35FX*, *FK8BV*, JAs, KX6BU, *VK9RH* (Norfolk Is), ZLs. **1000** KV4IG, VP2MDX. **1100** *FK8s BU*, *BV*, VK9JK, VP2M. **1400** *KL7MF*, ZC4ASG. **1500** VS9MB, W6/W7, XV5AC. **1600** VK9XI, VQ9R/F, ZS2MI. **1700** CR3WB, WB6GPT/VQ9 (Chagos), VS9FBS, XT2AA. **1800** FG0AFA/FS7, KH6BB, VS9MS, 9M2CX 9X5NA. **1900** *FP8BR*, *VP2EN*, ZD7s FT, SD, *4K1D*, 4W1BC. **2000** F0ZZ/FS7, *TU4AG*, VP2s AZA, MJK, 8P6EX, 9Z4LO (=9Y4). **2100** PY0AO, VP8MS, *DL2GG/YV5*, ZD8RW. **2200** FL8BH, JAs, KM6BI, VP1SYL, VP2VBU, ZD3M. **2300** CR5AJ, *HC1FM*, *HK0BKX*, MP4BJS, VK6WC.

21MHz. 0800 KC4USP, *SY5MA*, 5N2ABG. **0900** KG6SW, VK9s, EM, MC, XV5AC, ZLs. **1000** *DL1RK/HB0*, *VS6AW*, 5B4ES, 9K2DC. **1100** *KA6BQ*, *KG6JAR*, VK9MC (Papua), *4L6A*. **1200** AP2ZR, *CR5AJ*, *FB8XA*, YB3BC, ZD7FT, *5X5NK*. **1300** HC5GL, *SQ5Z* (=SP). **1400** *FR7AG*, VQ9BP/F, *XW8BP*, *6Y5MA*. **1500** FL8BH, *FR7AX*, *TN8BI*, VQ9s GP, MI, 3E1KC (=HP1KC). **1600** *VP2Ms*, W6s, 3V8DM, *4W1BC*, *5T5FP*. **1700** VQ9HCS (Astove Is). **1800** HC8GI, ZF1GW/VP7, VP8KF, *W7SFA*, *4K1D*. **1900** K5QHS/CE3, FG0ZZ, XE1IIJ.

28MHz. Reported open into Europe after 2400 on 22 October. **0800** A2CCY, XV5AC, XW8AL, YB0ABB, 9M2CJ. **0900** UA9s, VK6s. **1000** A4s, A6s, JY6UMN, VK8OM, ZD3Z. **1100** *FR7AX*, PYs, ZSs, 3B8MS, 9J2s. **1200** FG7XT, TR8DG, VU2DK, W1,2,3s, ZD7FF. **1300** CP1EU, CT2GB, FY7AL, VP2s, ZF1GW/VP7, W1,2,3,4,8, 9s, ZSs. **1400** CR6s, CX8BE, FG0AFA/FS7, PJ8DX/PJ7, PZ1AC, *VP1SY*, 9Y4DWS. **1500** A2CJP, CR5AJ, FR7AH, ELs, ET3USE, PJ9GIW, TU2EF, 4C9AA (Mexico), 4W1BC, 9Z4LO. **1600** CE3PY, CR7s, EA9EJ, TJ1EJ, VP2VBU, VP8KF, YN1DS, ZSs. **1700** CE8AG, CR4BS, 5B4AP, 9L1JT. **1800** HK0BKX, LUs, PYs, W9JFE/VQ9 (Chagos). **1900** CE4KU, ZP5HZ.

Very many thanks to all correspondents and especially to the following for items obtained from their publications: **Long Skip** (*Nick Sawchuk*), the **West Coast DX Bulletin** (*WA6AUD*), **DX'press** (*PA0INA/PA0TO*), **DX News Sheet** (*Geoff Watts*), the **29 DX Club Newsletter** (*George Allen*), **World Radio News**, and the **DXers Magazine** (*W4BPD*).

Please send all items for **January** issue to reach G3FKM no later than **28 November**, and for **February** issue by **9 January**.

Propagation Predictions

Conditions will become worse in December compared to the two previous months. Short days mean shorter hours of communication on the hf bands and the f2 MUFs are lower than in October and November.

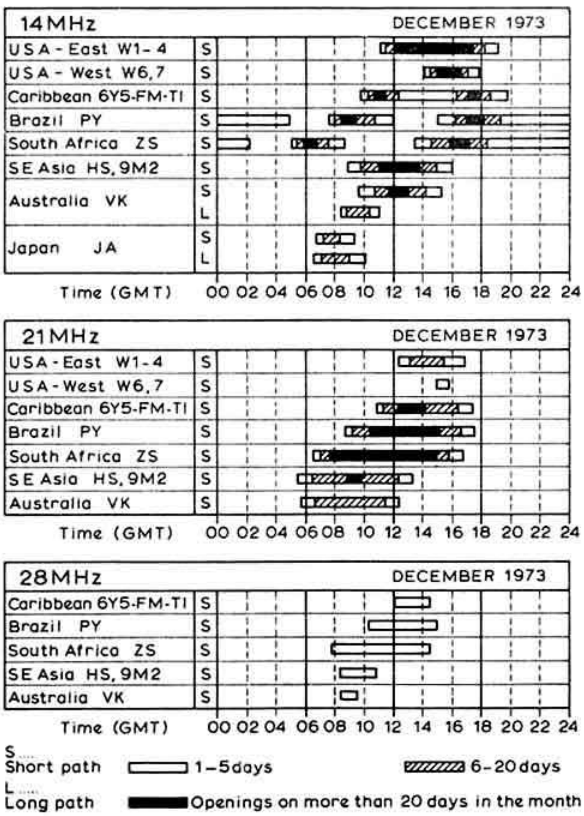
28MHz will be open very rarely for dx traffic, and short skip conditions will also be rare on this band compared to the summer months. Only South and Central America, Africa and south and south-east Asia will be heard with certainty on **21MHz**, but early sunset will mean the closing of dx around 1700gmt.

In contrast to 21MHz, **14MHz** will be open for traffic with all continents, but dx traffic will cease after 1930gmt. The best chance for WAC on this band will be between 0700 and 1200gmt. Seasonal conditions favour dx via the indirect path on 14MHz, and communication with South America and east Asia should be possible before noon. On favourable days traffic with Hawaii should be possible via the indirect path between 1600 and 1700gmt.

As 14MHz closes so early, **7MHz** will become more important for dx traffic. Basically, dx is possible on 7 and **3·5MHz** when most of the path lies in darkness. This is even more important for 3·5MHz than 7MHz: QRM permitting, it should be possible to reach eastern North America from about 2000gmt, South America from 2100gmt and Japan from about 1330gmt on 7MHz. During the latter part of the night, traffic with North America will be interrupted now and again as frequencies drop too low, the same might occur now and again in traffic with Japan after 1900gmt.

Local traffic will be interrupted by the dead zone on **3·5MHz** during the second half of the night.

The provisional sunspot number for October 1973 from the Swiss Federal Observatory was 33·0. Solar activity was concentrated at the beginning and end of this month with several days in the middle of October showing a total absence of solar activity. The predicted smoothed sunspot numbers for February, March and April 1974 are 26, 25 and 24 respectively.



The Leicester Exhibition

For the second consecutive year the Granby Halls, Leicester, were the scene of the Midland Amateur Radio and Electronics Exhibition organised by the Amateur Radio Retailers Association. The majority of the exhibitors were names familiar to the readers of *Radio Communication*.

The emphasis seemed to be on commercial equipment and few stands had any appreciable quantity of kits or components. There were exceptions and in the Heathkit range there are several new models including the HW-202 for 144MHz fm, which is currently under review by the Society.

Surplus mobile system radiotelephone equipment, both as complete units and as modules and components, was in evidence on a number of stands. In contrast, Burns Electronics displayed examples of their new communications modules (available as kits) and a great variety of components. Considerable interest was shown in the Scopex 4D-10 dual-trace solid-state oscilloscope with a bandwidth of dc to 10MHz. At a price in the region of £90 this appears to be bringing current production test equipment within the reach of the radio amateur. A unit such as this would be an asset to any club workshop. It is hoped to review this scope in *Radio Communication* in the near future.

A stand almost entirely devoted to new components was that of J. Birkett of Lincoln, and judging by the bulging pockets of the visitors the acquisition rate was high.

The RSGB stand, transported, assembled and manned by a team comprising G3MVV, G3ICI, G3GJW, G3VPK, G8AXA and G8GBM, together with other transitory helpers, conducted a brisk business in publications, particularly the new 1974 *RSGB Amateur Radio Callbook*. Prepublication copies of the new *Teleprinter Handbook* were on view and a number of orders were taken, including one of 500 copies from *Ham Radio Magazine*. Many new members were enrolled, subscriptions taken and a variety of queries dealt with. This was the first appearance of the Society at the Leicester Exhibition and, in the opinion of those present, the expenditure and effort was well worthwhile. The only grumbles aired were those heard after a long day on the concrete floor of the Granby Halls, which seemed to have an unyielding quality.

Overseas visitors to the show were *Ham Radio Magazine* and Venus Scientific Inc. Skip Tenney, who came over from the USA specially for the exhibition, was on hand to accept new subscriptions, deal with queries (mostly resulting from postal delays), and to sell *Ham Radio Magazine* easibinders and the new *Ham Radio Notebook*. Venus Scientific displayed their SS2 Slo-Scan Monitor and accessories. Slow scan is a growing interest within amateur radio and the SS2 monitor incorporates several new features in a compactly styled presentation. It is anticipated that the Venus equipment will be available in Europe in the near future.

Attendance at the exhibition was said to have been about 5,500 persons, with more than half of this number passing through the turnstiles on the Saturday. At the time of writing there is no information on the possibility of a similar event in 1974 but it would be a pity if the exhibition cannot be a permanent feature of the amateur radio calendar.

G2BVN

Radio amateurs as pioneers of progress in radio technology

Address delivered by Mr M. Mili, Secretary-General of the International Telecommunication Union on 10 June 1973, during a meeting of the International Amateur Radio Club.

"Thanks to radio amateurs, transatlantic hf communication will celebrate its first 50th anniversary this year. It was in the winter of 1921-22 that radio amateurs in the USA organized a series of transatlantic communication tests. They sent an experienced radio amateur, Paul Godley, with the most up-to-date receiving equipment of the time and with an aerial designed by another radio amateur, H. Beverage, to Ardrossan Moor in Scotland, where he was able to receive several amateur stations in the USA.

"At that time, the wavelength used corresponded to a very simple allocation table prepared by a preliminary conference in Washington:

Wavelengths above 6,000m	—transoceanic communication
Wavelengths between 3,300 and 6,000m	—continental communication
Wavelengths between 2,650 and 3,300m	—ships
Wavelengths between 2,050 and 2,650m	—government broadcasting
Wavelength of 1,550m	—aeronautical service
Wavelengths between 275 and 285m	—police
Wavelengths below 275m	—radio amateurs

"It will be seen that the enormous part of the spectrum below 275m was simply 'given' to the radio amateurs, as the professionals of the time were convinced that those waves were 'no use' and certainly could not be used for long distance communication.

"Nevertheless, the radio amateurs organized a new series of tests in the winter of 1923-4. On the memorable night of 28 November 1923 (27 November in the USA), the French radio amateur Leon Deloy, 8AB, of Nice was able to communicate on 110m with Fred Schnell, IMO, a radio amateur in the USA. That was the beginning of the epic era of radio amateur communication.

"During a series of propagation tests between 22 December 1923 and 10 January 1924, 96 amateurs in the USA heard 20 in the UK, 14 in France and 6 in the Netherlands. In 1924, the same Leon Deloy succeeded in getting into touch with the antipodes on 91m and communicated with the New Zealander Smith, who used a wavelength of 86m.

"That was also the beginning of the era of long-distance continental communications—more difficult than transoceanic communication—with a link established by Fedor Lbov, R1FL, between Nijni-Novgorod (now Gorki) and a station in what was formerly Mesopotamia. Three decades later, radio amateurs throughout the world performed a similar exploit by listening to the first signals of the Soviet Sputnik launched on 4 October 1957 and making the first observations on space to earth propagation.

"At the present time, some 500,000 radio amateurs keep voluntary watch all over the world, prepared at all times to lend their services to science and humanity. Let us take one of the most recent examples of this activity, which also concerns the IARC. Exceptional solar events took place early in August 1972 and the International Union of Radio Science (URSI) declared the period between 26 July and 14 August 1972 to be a 'Retrospective World Interval'.

"The International Amateur Radio Club took that opportunity to invite radio amateurs throughout the world to send it their observations, in connection with its contribution to the Propagation Research Competition. (CPR) The response was most encouraging: over 200 radio amateurs in 23 countries have so far sent over 5,000 observations, and this number continues to increase. During this meeting, IARC officials will announce the provisional results of the competition and will draw conclusions from the experiment.

"I wish to take this opportunity of congratulating all the participants in the competition and wishing them further success in an activity which has undeniably rendered services both to scientific progress and to humanity."

RAYNET

by S. W. LAW, G3PAZ*

The meeting of the Raynet Committee on 3 November was a little too close to our press deadline for a full report to be presented in this issue. However, it may be said that there was much ground to be covered in the few hours available and that Exercise Diamond reports were not the least of the matters to be covered, apart from other exercise reports from several of our very active groups. Correspondence from many quarters also has to be carefully considered and can often result in considerable debate if cogent points arise therefrom.

One main point stands out above all others: this jubilee year of 1973 has obviously had a particular significance attached to the two final digits! A very good year indeed, and as we approach the festive season the committee would like to convey to all our members its thanks for their support coupled with the traditional good wishes for a peaceful and happy Christmas uninterrupted by any call-outs. Our regards and good wishes are also extended to those of the user services who have so ably and willingly worked with us in liaison for the common good.

A look to the future

We have mentioned before that 1974 heralds the 21st birthday of the radio amateur(s') emergency network, originally conceived in 1953 due to the efforts of the **RSGB** and now generally known by the euphonym "Raynet" (our apologies to the purists who would rather we had used "raenet"; we think the deviation from exactitude conveys a little more punch and is of greater appeal to user services and the public alike). The avoidance of the transmission of the initials **RAEN** over the air has been explained before; for the benefit of new readers any four-letter combination such as this may form the type of callsign used in maritime operation and therefore is not permissible for use on the amateur frequencies.

The Raynet Committee is considering the possibility of some special event to mark our 1974 "coming of age" and suggestions from members are welcome. Possibly those members of the original committee who are still with us might have some ideas on the matter? We should be glad to honour our progenitors in some way by proving our continuing efforts to uphold the groundwork and concept laid down by these dedicated workers.

Dated?

We have noted that a certain publication for the amateur operator unfortunately contains some rather misleading information about Raynet frequencies in its 11th edition. This will be brought to the notice of the compilers in due course and we trust will be rectified in future editions.

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

VHF NFD, 1973 RESULTS

Despite a wide belt of inclement weather which swept across the country from the south-west, VHF NFD once again attracted more interest than any other event in the Society's contest calendar. The total number of groups taking part was not significantly lower than last year's record figure, although from the evidence provided by the 427 cover sheets it seems likely that the average number of operators per group was, in fact, slightly less than in 1972.

Different operational procedures, equipments and regularly occurring callsigns characterize the individual amateur bands to give each its own particular atmosphere. VHF National Field Days have, in the past, influenced these characteristics very little, and each section of the event has faithfully reflected the current trends and facets of their respective frequencies. VHF NFD 1973 followed this general pattern, at least so far as 70MHz, 432MHz and 1,296MHz were concerned, but on 144MHz the recent explosion in the number of stations with ssb transceivers has been so dramatic that operating on these frequencies in a major event has been revolutionized in less than 12 months.

Although approximately three-quarters of the groups taking part in this year's contest possessed facilities for sideband in one form or another, there remained a sizeable minority who could work 144MHz only with outdated equipment. It was not surprising, therefore, to find contestants who experienced difficulty in raising the Continental dx where an even higher proportion of the stations are solely ssb. It may be that when this revolution has stabilized, the minority will come to accept the handicap of a less fashionable mode of transmission with more equanimity, but while so many popular ssb transceivers lack the flexibility of the older type receiver it is inevitable that stations will not have their calls answered. The restricted tuning range of these transceivers tends to concentrate more than half the stations on the band into a few hundreds of kilohertz, thereby aggravating the interference problem and adding to the frustration of those who adhere to "rock-bound" frequencies outside the hallowed channels.

There were a few contacts made in the cw portion of 144MHz, and valuable points were scored on this mode, but the popularity of the key diminishes year by year. It is difficult to say if this is due to a steadily increasing number of Class B licences, or if the advent of ssb is the root cause, but the fact remains that VHF NFD 1973 had fewer cw QSOs to its credit than any previous VHF Field Day.

All these factors contributed to the many reports of poor propagation conditions prevailing throughout the contest, and while these were, at the best, only average, plenty of dx was worked from sites all over the country. Few leading stations failed to make contact with six or seven different countries, and almost all were more caustic about the weather than about the propagation.

Although 144MHz logs account for not more than 40 per cent of the entries submitted for VHF NFD, the 427 cover sheets which accompany them contain nearly all the comments regarding the event. It was not surprising, therefore, to find most of the criticisms regarding the abolition of the 25W power rule were confined to this band. The VHF Contests Committee was bracing itself to receive a deluge of complaints from contestants whose receivers had reacted unfavourably to an overdose of rf radiation, but as so often happens the anticipation proved far worse than reality. Several complaints of splatter, spreading and overmodulation were made against specific stations, but none were corroborated. In consequence, the signals radiated during VHF NFD 1973 proved to be the cleanest on record with every contestant taking extra care to ensure that he, and the station for which he was responsible, conformed to the vhf operators code of practice.

There were, in fact, only a small minority who took full advantage of the increased power limit, and even though those who would prefer to see the 25W rule re-imposed outnumber the advocates of high power by over two to one, the committee has yet to be presented with a really convincing argument in support of reinstating the 25W limit next year. The issue seems to be mainly one of personal preference, and indeed several contestants were convinced that their scores were in no way enhanced by the use of high power.

In a major contest, the 144MHz band is now seriously overpopulated throughout Europe, and if this section of VHF NFD is not to degenerate into an annual rat-race, steps will have to be taken to encourage an appreciable exodus to the less populated bands like 432MHz.

During this year's contest, 432MHz suffered more from conditions and circumstances than did any other band. Neither the weather, nor the propagation, proved to be particularly helpful, and the absence of Continental activity due to the opposing interests of the IARU 144MHz Contest contributed to the lower than average scores returned by most groups.

Some lifts did occur during the Sunday morning, and a few good dx contacts were made along a north-south path, but in general only mediocre conditions prevailed throughout the contest. The true level of activity was, in fact, not as low as most groups believed, and even though several stations found themselves scraping the bottom of the barrel long before the end, the logs entered for the 432MHz section compared quite favourably with previous years.

Most of the groups operated 1,296MHz and 432MHz under the same callsign, and it is very doubtful if those stations who elected to divorce the two bands gained any advantage from the extra time available for each frequency. Only six 432MHz stations used the maximum licensed power; the remainder being quite content to use equipment running a modest 10 to 30W input and high gain aerial systems.

The number of groups operating 1,296MHz increased again this year, and while only five additional stations entered logs in this section, the increase was the more significant because it was against the trend on the other bands. The strong winds which covered most parts of the country made the alignment of even the smallest dish difficult, and more than one group complained that their waveguide served only to fill up the pa cavity with rainwater.

Comments, other than those about the weather, were few, but some stations did express their annoyance at groups who went over to 1,296MHz only when they had exhausted 432MHz. Conditions had deteriorated by the Sunday afternoon, and in consequence valuable points were lost. At least two groups made a strong plea for more cw on 1,296MHz, but as more and more G8 calls are becoming interested in these frequencies, it is difficult to reconcile the call for more cw with the growing population.

In contrast to the operators of all other bands, the groups who are devoted to 70MHz comment little. They seem quite content to make the most of the increased activity which VHF NFD provides. This remains the one band where cw contacts are still considered essential to a good score, and where old standards and procedures are maintained year after year. The regular users of the band seem quite oblivious of the advantages of ssb and co-channel working, and although a few progressive groups now think in terms of elaborate, high-gain aerial arrays for VHF NFD, the basic receivers and transmitters would not have been regarded as anything sensational 10 to 15 years ago.

Nevertheless the 70MHz band always contributes its fair share of points to the grand totals, and few groups would ever contemplate reaching the top 20 places without a 70MHz contribution. Activity between field days and other contests, however, is abysmal; so much so that the VHF Contests Committee is compelled to ask if groups are really interested in 70MHz remaining a part of VHF NFD when their equipment is obviously taken off the shelf once a year, dusted down and used only for this one essential purpose annually.

The 70MHz section of VHF NFD 1973 ran true to form. Comments were almost non-existent; conditions were fair, and scores were slightly up on previous years.

Each year the VHF Contests Committee finds it necessary to remind competitors that the rules of the contest require the logs for each band to be accompanied by a separate 427 cover sheet, and that if the entries are to be included in the overall results table it is essential that a summary sheet is included so that the logs and callsigns of a group can be correlated after adjudication. This year more competitors than ever failed to provide the correct paperwork to cover their entries. In consequence, the committee regrets very much that some group entries may have been omitted from the overall results table.

All current 427 forms, log and summary sheets are printed on A4-size paper and are readily available from any member of the VHF Contests Committee, or from RSGB headquarters, upon the receipt of an sae. It is appreciated that occasions may arise in which a contestant is not able to obtain the correct entry forms before the last day of posting; in these circumstances, the committee will accept an entry provided some attempt has been made to write out the essential information on a separate sheet. A handwritten 427 should always contain a signed declaration, the name, address and callsign of the group, together with the claimed score. Summary sheets must list all the callsigns and claimed scores of all the stations whose logs are to be combined in the group entry. Logs which are posted under separate covers will be combined automatically only if accompanied by a summary sheet listing the stations comprising the group entry.

C.S.

OVERALL RESULTS

Posn	Group	Points	70MHz	144MHz	432MHz	1,296MHz
1	Pye-Telecommunications CG	10,794	GW5PI	GW3PYE	GW3SXK	GW3SXK
2	March & DARS	7,848	G3VCV	G3REH	G3PMH	G3PMH
3	Midland ARS	7,531	GW3MAR	GW3BA	GW3YJH	GW3HAZ
4	Surrey RC Club	7,171	G8TB	G3ODY	G2RD	G2RD
5	Albright & Wilson ARS and Caesaromagnus VHF/UHF CG	7,061	GW3YRJ	GW3OXD	GW3SLJ	GW3SLJ
6	Crawley ARC	6,936	G3TR	G3WSC	G3GRO	G3GRO
7	Golden Valley VHF CG	5,803	GW4ABR	GW4BBR	GW3RPQ	GW3RPQ
8	Marconi RC	5,577	G3ZLQ	G3JTW	G3WYT	G3WYT
9	Dunstable Downs RC	5,468	G3ZFP	G8DDC	G3VZV	G4ARD
10	North Liverpool RC	5,434	GW3TPF	GW3XMG	GW3VXK	GW3VXK
11	Verulam ARC	5,111	G3JKB	G3VER	G3YHY	G3YHY
12	Radio Society of Harrow	5,055	G3TUX	G3EFX	G3HBR	G3HBR
13	Horsham ARC	4,909	G3NPF	G3TNO	G3WZT	G3WZT
14	Salop ARS	4,908	G4AZS	G3SRT	G4AZV	G3UQH
15	Bournemouth/Poole VHF Gp	4,845	G3ZXD	G3PFM	G3OBD	G3OBD
16	South Dorset RS	4,842	G3VPF	G3SDS	G3RZG	G3EGV
17	AERE (Harwell) ARC	4,689	G3NNG	G3PIA	G2CXT	G2CXT
18	Southampton RSGB Gp	4,646	G3MRA	G8FAB	G3SOU	G3WDG
19	Cornish RAC VHF Gp	4,500	G4ADV	G3XC	G2BHW	—
20	Southdown ARS	4,480	G3XUS	G8BQX	G3WQK	G3WQK
21	Worthing DARC and Adur CG	4,477	G3YHM	G3WOR	G8BDJ	G8BDJ
22	Sutton Coldfield RS and VHF Gp	4,431	G3RSC	G8DMC	G8AVH	G3XXJ
23	South Coast VHF/UHF Gp	4,196	G3ZCI	G3JHM	G3NNW	G3JVL
24	Leicester RS and VHF Gp	4,186	G5UM	G3LRS	G3TQF	G8BMF
25	West Kent ARS	4,138	G3WKS	G4BKG	G4BOO	G4BOO
26	East Kent RS	4,126	G3XDV	G4ATX	G4AJC	G4AJC
27	Echelford ARS	4,089	G3TDR	G3UES	G3HZL	G2HDJ
28	Saltash DARC	3,983	G4CDU	G4AZY	G3WKF	—
29	Pennine VHF CG	3,856	G3VVT	G3JIJ	—	—
30	Crystal Palace DRC	3,816	G3XFT	G3FZL	G3VCP	G3VCP
31	East Notts CG	3,777	G3YCT	G3TBK	G3SHY	G3SHY
32	Mid-Herts ARS	3,689	G3AAZ	G4BWY	G3WGC	G3WGC
33	Addiscombe ARC	3,547	G3XJO	G4ALE	G3WRR	G3SJX
34	G8FIS/G3JFO CG	3,407	G3JFO	G8FIS	G3JFO	—
34	"Me and My Friends"	3,407	G3UHN	G3SHK	G8CLY	—
36	Southend DARS and G4KF CG	3,305	G4KF	G5QK	G3YOA	—
37	Wessex ARG	3,270	G3ZTZ	G3RZV	G3NIL	G3NIL
38	Slade R & SS	3,266	G3ZVK	G4BRT	G3SRS	G3JZF
39	Chichester DARS	3,223	G3ISO	G3IZD	G2DSP	—
40	Yeovil ARC	3,194	—	G3CMH	G8AFA	G8AFA
41	North Wales CG	2,999	GW4BBU	GW8COP	GW8AHI	—
42	Cray Valley RS	2,956	G3TAA	G3YGR	G3RCV	—
43	Norfolk ARC	2,851	G3ZIG	G4AUN	—	—
44	Blackpool & Fylde ARS	2,845	G3NJN	G3SEK	—	—
45	Hull & DARS	2,807	G3PQY	G3AMW	G8GBY	—
46	Pontypool RSGB Gp	2,687	GW3VXC	GW4BLE	GW3UUS	GW3UUS
47	Preston ARS	2,677	G3KUE	G8EJB	G3NKL	G3NKL
48	Grafton RS	2,581	G3ZKE	G3AFT	G8DWL	—
49	Shefford & DARS	2,438	G3XTQ	G3FJE	G8AKT	—
50	Solihull ARS	2,409	—	GW3GEI	—	—
51	Sealand & Wirral CG	2,405	GW3ITZ	GW3NWR	GW8AAP	GW3NTI
52	Luton VHF Gp	2,383	G3WOS	G8CDL	G8EIK	G8ATD
53	Wakefield & DRS	2,281	G3WWF	G3WRS	G4CLI	—
54	South of Scotland VHF/UHF CG	2,276	—	GM8DMZ	—	—
55	Swindon & DARC/Plessey Semiconductors CG	2,254	—	GW3FEC	—	—
56	Bury & Rossendale RS and Bolton DRS	2,220	G3BRS	G8WY	G3ZPL	G3ZPL
57	Mid-Severn Valley Raynet CG	2,217	—	GW3WRA	—	—
58	Kingston & DARS	2,198	G3ZYS	G4AKA	G3KIN	—
59	Colchester CG	2,154	G4YK	G8HOR	—	—
60	Medway ARTS	2,108	G2FJA	G8ECI	G8DLQ	—
61	Thames Valley ATS	2,088	G3JEQ	G3TVS	G3ZNW	—
62	Isle of Man ARS	2,086	—	GD3FLH	GD8DMA	—
63	Havering & DARC	2,047	G4CAF	G8HRC	G4ALN	G4ALN
64	West Cumberland VHF Gp	2,039	—	G3WIN	—	—
65	MAFIA CG	2,010	GI3FFF	GI6YM	GI8AYZ	—
66	Purley & DRC	1,989	—	G8DTQ	G8DLB	—
67	City & County of Bristol RSGB Gp	1,979	G3SXY	G6YB	G8BIY	—
68	Reigate ATS	1,967	G4ARO	G3REI	G3YQW	—
69	Nunsfield House Community Association AR Gp	1,966	—	G3EEO	G8BDO	G8BDO
70	Royal Signals ARS	1,944	G3ZKA	G4RS	G3VIR	—
71	Bedford & DARC VHF/UHF Gp	1,941	G3WTP	G4CBZ	G8FMG	—
72	Grimsby ARS	1,936	G3RPY	G3CNX	—	—
73	Maidenhead & DARC	1,850	G3RQI	G3WKX	G4CIJ	G3VCT
74	Clifton ARS VHF/UHF Gp "A"	1,842	G3GHN	G3FVG	G3JKY	G3JKY
75	G3TLK Gp	1,740	G3TLK	G3TLK	—	—
76	Plymouth CG	1,625	G3PRC	G3ULN	G3ZZS	—
77	Glenrothes & DARC	1,603	GM4BYF	GM3YOR	GM3OXX	—
78	Mid-Cheshire ARS	1,514	G3JWK	G3ZTT	G8CFY	—
79	Mexborough & DARS	1,509	G3VJR	G4ANP	G4BZD	—
80	Mid-Warwickshire ARS	1,482	G3EHA	G3VDN	—	—
81	Cheltenham ARS	1,460	G3XZK	G5BK	G4BRX	—
82	Clifton(New Cross, London) "B"	1,451	—	G8DDW	G8DIU	—
83	Basingstoke ARC	1,416	G3TCR	—	G8CKN	—
84	Guildford & DRC	1,368	G3PJX	G6GS	G3TLM	—
85	Liverpool & DARS	1,313	—	GW3AHD	—	—
86	South Manchester RC/NW VHF Gp	1,294	—	G3UHF	G3FVA	—
87	Cannock Chase ARS	1,256	—	G8GCC	G8BLM	—
88	Chippenham & DARC	1,191	G3UFW	G3UFW	—	—
89	Heriot Watt University ARS	1,189	GM4AOR	GM3WEE	GM8BJF	—
90	Woodmansterne Gp	1,184	G3KTA	G8CCK	—	—
91	Mid-Sussex ARS	1,152	—	G3ZMS	—	—
92	G8DJW/G8HVY CG	1,117	—	G8DJW	—	—
93	Cardiff RSGB Gp	1,100	—	GW3GHC	—	—
94	GW3NNF/GW8FOL CG	1,083	—	GW3NNF	—	—
95	GM3SAN Gp	1,074	—	GM3SAN	—	—
96	Gravesham CG	1,063	—	G8GGP	G3XPU	—
97	Swansea RS	981	GW4AHV	GW5ZL	—	—
98	G8AYY CG	930	—	—	G8AYY	—
99	Spalding & DARS	897	G3VPR	G3XBS	—	—
100	Doncaster College of Technology	894	—	G3UER	—	—
101	Sutton & Cheam RS	878	G4AAW	G4ADM	—	—
102	Banbury ARS	808	—	G3TUW	G3TUW	—
103	ARC of Nottingham	737	—	G3EKW	—	—
104	G3CDG Gp	654	G3CDG	—	—	—
105	Border ARS	619	—	GM8BDX	—	—
106	Edgware & DRS	562	—	G8ERS	—	—
107	Ipswich RC	549	—	G4CFI	—	—
108	Chad RC	538	—	G4CAR	—	—
108	Silverthorn RC	538	G3SRA	G8CSA	—	—
110	Tyneside ARS	521	—	G8GTE	—	—
111	Dial House RS	470	—	G3WDH	—	—
112	Carlisle & DARS	465	—	GM8DVD	—	—
113	G8FBQ CG	442	—	G8FBQ	—	—
114	G8ADP CG	326	—	—	—	G8ADP
115	Grampian FM Gp	314	—	GM4CKV	GM4CKV	—
116	G3WOA CG	295	—	G3WOA	—	—
117	Guernsey R & ES	243	—	GC3HFN	—	—
118	South Birmingham RS	236	—	G3OHM	—	—
119	Mansfield Gp	231	—	G8GFC	—	—
120	G8FMZ Gp	211	—	G8FMZ	—	—
121	GM4BIP CG	116	GM4BIP	GM4BIP	—	—

70MHz BAND RESULTS

Posn	Callsign (/P)	Points	QSOs	County	Best dx	Km
1	G4ADV	2,724	106	CL	GM4AOR/P	575
2	G3VVT	2,342	133	YS	G4ADV/P	465
3	GW5PI	2,210	139	DB	G3XDV/P	364
4	GW3TPF	2,192	101	CV	G3XDV/P	375
5	GW4ABR	2,112	134	RN	—	—
6	G3NJN	1,968	101	LE	G3XUS/P	420
7	G3JFO	1,900	98	YS	G4ADV/P	518
8	G3VPF	1,860	124	DT	G3WWF/P	420
9	GW3MAR	1,806	113	MG	GM4BYF/P	360
10	GW4BBU	1,642	100	FT	GM3KHH/P	425
11	G3ZIG	1,638	92	NK	G4ADV/P	530
12	G3UHN	1,630	78	YS	G4ADV/P	530
13	G3TLK	1,568	81	DN	GI3FFF/P	491
14	G3JEQ	1,562	99	SY	GD2HDZ	425
15	G3TUX	1,478	117	SX	GI3FFF/P	592
16	G3ZXD	1,466	116	WE	GD2HDZ	393
17	GW3YRJ	1,434	104	RN	GM4AOR/P	350
18	G3ZLQ	1,376	117	HE	GI3FFF/P	520
19	G3XUS	1,346	112	SX	GI3FFF/P	579
20	G3VCV	1,330	105	CE	GM4BYF/P	425
21	G3XDV	1,322	94	KT	G4ADV/P	450
	G3NNG	1,322	117	BE	GI3FFF/P	463
23	G3WWF	1,288	64	YS	G4ADV/P	525
24	G3PQY	1,268	73	YS	G4ADV/P	510
25	G3TR	1,238	109	SX	GD2HDZ	439
26	G3TAA	1,212	114	KT	GI3FFF/P	560
27	G8TB	1,208	108	SX	G3JYP	432
28	G4CDU	1,196	58	CL	G3JFO/P	450
29	G3ZTZ	1,184	92	DT	GD2HDZ	389
30	G4KF	1,168	105	EX	G4ADV/P	435
31	G3ZVK	1,144	100	WR	GI3FFF/P	362
32	GW3ITZ	1,142	83	FT	G4ADV/P	330
33	G3YHM	1,120	100	SX	G3NJN/P	412
34	GW3VXC	1,118	83	MH	—	—
	G4ARO	1,118	111	SX	G3NJN/P	390
36	GI3FFF	1,102	60	AM	G3TUX/P	580
37	G3PRC	1,072	58	DN	G3UHN/P	448
38	G3ZFP	1,024	104	BS	G4ADV/P	363
39	GW3XSN	1,006	63	DB	GM3UAG/P	436
40	G3ZYS	1,000	98	SY	GI3FFF/P	540
41	G3BRS	994	68	LE	G4ADV/P	425
	G5UM	986	92	LR	GI3FFF/P	400
42	G3TDR	986	96	HE	G3JYP	387
	G3NPF	986	97	SX	G3NJN/P	400
45	G3ULT	978	94	HE	G3WWF/P	330
46	G3XJO	976	97	SY	GI3FFF/P	515
47	G3YCT	968	64	LN	G4ADV/P	—
	G4AZS	968	84	SE	G4ADV/P	295
49	G3RSC	954	84	SD	G4ADV/P	308
50	G3TCR	948	91	HE	G3NJN/P	345
51	G3TDM	938	96	BS	GI3FFF/P	475
52	G3JKB	920	100	BS	G4ADV/P	363
53	G3WKS	900	81	KT	G3NJN/P	420
54	G3XTQ	892	82	BD	G4ADV/P	380
55	G3GHN	876	82	KT	—	—
56	G3RPY	870	60	LN	GI3FFF/P	—
57	G4YK	842	69	EX	G4ADV/P	460
58	G3WOS	828	95	BD	G4ADV/P	380
59	G3ISO	822	79	SX	G3NJN/P	375
60	G3PJX	786	84	SY	G3NJN/P	363
61	G3JWK	768	70	CH	G4ADV/P	355
62	G3EHA	764	72	WK	G4ADV/P	330
63	G3UFW	762	66	WE	G3NJN/P	320
	G2FJA	762	69	KT	—	—
65	G3XFT	756	82	SY	G3VVT/P	—
66	G3KUE	714	51	LE	G4ADV/P	435
	G3ZKE	714	86	OX	G4ADV/P	337
68	G4AAW	696	82	SY	—	—
69	G3ZCI	688	72	HE	G3UHN/P	362
70	G3VPR	670	50	LN	G4ADV/P	440
71	G3CDG	654	57	GR	G4ADV/P	295
72	G3AAZ	578	63	HF	G4ADV/P	402
	G3KTA	578	72	SY	G4ADV/P	372
74	G3RQI	564	71	BS	G4ADV/P	308
75	GM4BYF	536	26	SK	G3NNG/P	452
	G3SXY	536	48	ST	G3VVT/P	270
77	G3WTP	520	57	BD	G4ADV/P	400
78	G4BQH	508	42	ST	G3VVT/P	339
79	G3ZKA	506	48	DT	—	—
80	G4CAF	476	61	EX	G3VVT/P	300
81	G3VJR	424	41	YS	G4ADV/P	445
82	GM4AOR	478	27	LK	—	—
83	G3XZK	240	18	GR	G3ZBI/P	130
84	G3SRA/P	220	38	EX	GW5PI/P	270
85	GW4AHV	76	11	GN	G3ZLQ/P	250
86	GM4BIP	16	3	—	GM4AOR/P	—

Check log (no declaration) received from G3ZBI/P.

144MHz BAND RESULTS

Posn	Callsign (/P)	Points	QSOs	County	Best dx	Km
1	G3ODY	2,993	282	SX	F1BOH/P	752
2	G3TNO	2,950	279	SX	F6AZK/P	900
3	GW4BBR	2,924	366	RN	HB9AMH/P	920
4	G3WSC	2,850	277	SX	DJ0AY/P	745
5	GW3PYE	2,522	375	DB	DK0LE	690
6	GW3GEI	2,409	328	MG	DC6BB/P	704
7	GW3OXD	2,397	307	RN	OZ5TE	960
8	GW3BA	2,391	339	MG	PA0LPN/P	610
9	GM8DMZ	2,276	193	WG	PA0PRY/P	695
10	GW3FEC	2,254	252	CV	DC6BB/P	780
11	GW3WRA	2,217	311	BR	DL1GM/P	805
12	G3REH	2,152	233	CE	HB9RO/P	740
13	G8BQX	2,089	224	SX	F6KFL/P	670
14	G4BKG	2,067	243	KT	DL0TN	667
15	G3WIN	2,039	242	CD	F1BHL	595
16	G5QK	1,951	204	EX	DC8KT	710
17	G3SRT	1,941	290	SE	F9YR/P	825
18	G4AZY	1,929	165	CL	PA0THT	785
19	G3LRS	1,799	270	LR	F9YR/P	720
20	G3WOR	1,768	211	SX	F1BMP	690
21	G8FAB	1,763	243	WE	F1AUQ	660
22	GD3FLH	1,726	177	IM	F1CCP	610
23	G3SHK	1,723	146	YS	DC6XL/P	718
24	G8DDC	1,715	201	BE	DL8PCA	683
25	G3VER	1,637	239	BS	HB9AMH/P	740
26	G4ATX	1,614	176	KT	F1BMJ/P	618
27	G3JHM	1,562	180	HE	F8XT	640
28	G3IZD	1,537	192	SX	F1CIP/P	610
29	G3PFM	1,524	179	WE	DL2IX/P	797
30	G3JIJ	1,514	206	YS	DC6XL/P	768
31	G8DTQ	1,485	159	SX	DL0TN	690
32	GW3XMG	1,471	150	CV	PA0JOU/P	720
33	G3EFX	1,458	166	SX	HB9RO/P	653
34	G3CMH	1,440	166	ST	DC6BB/P	685
35	G3AFT	1,423	219	OX	HB9AMH/P	745
36	G3JTW	1,379	174	HE	F1AJD/P	595
37	G3UES	1,350	188	HE	DL6EK/P	695
38	G3SFG	1,345	220	BS	HB9AMH/P	745
39	G3FXB	1,333	163	SX	HB9AOF/P	650
40	G3SDS	1,329	204	DT	GI6YM/P	495
41	G8DMC	1,327	238	SD	F9FT	590
42	G4RS	1,318	147	DT	DL1GM/P	714
43	GW3AHD	1,313	208	DB	GM4CKV/P	448
44	G8HOR	1,312	134	EX	HB9AMH/P	688
45	G3XC	1,236	122	CL	G3AMW/P	495
46	G4AUN	1,213	133	NK	DC6XL/P	575
47	G8DDW	1,175	152	KT	DL0TN	655
48	G3ZMS	1,152	144	SX	HB9AMH/P	640
49	G3ZBY	1,137	199	LE	G3XC/P	395
50	G8FIS	1,135	131	YS	G4AZY/P	540
51	G4BRT	1,121	229	WR	PA0SKF	460
52	G8DJW	1,117	135	DT	DL1GM/P	738
53	G3FZL	1,111	167	SY	DJ0AY/P	680
54	GW3GHC	1,100	155	GN	PA0JOU/P	658
55	GW3NNF	1,083	131	AG	F1CCP	565
56	GM3SAN	1,074	103	KB	G3WSC/P	496
57	G3CNX	1,066	147	LN	F1BRM/P	550
58	GM3YOR	1,043	129	SK	G4AZY/P	558
59	G3UHF	1,042	156	YS	F1BRM/P	568
60	G4BEM	1,024	196	SD	F1BEG/P	414
61	G3YGR	1,024	187	KT	HB9AOF/P	660
62	G4ALE	1,019	167	SY	HB9AMH/P	675
63	G8EEO	1,017	181	DY	PA0ANS	520
64	G5BK	1,016	190	GR	PA0CKV/P	488
65	G4CCC	1,008	193	HE	GI6YM/P	500
66	GW8COP	1,006	160	FT	ON6DH	550
67	G4CBZ	923	115	BD	DL1GM/P	525
68	G3WRS	909	103	YS	D?6BB/P	637
69	GW5ZL	905	159	GN	F0AUN/M	410
70	G3PIA	901	160	BE	F9FT/A	546
71	G3UER	894	136	YS	PA0JOU/P	517
72	G8GCC	890	163	SD	F9FT/A	594
73	G3SEK	877	137	LE	G4AZY/P	410
74	G3TBK	859	128	LN	ON4PB/P	443
75	G6YB	837	155	ST	PA0ZAZ/P	520
76	G3AMW	831	124	YS	G3XC/P	510
77	G8EJB	830	126	LE	F1CCP	500
78	G4BWY	828	118	HF	HB9AMH/P	730
79	G8DHA	823	153	GR	GI6YM/P	410
80	GI6YM	812	80	AM	G3TNO/P	565
81	G3RZV	773	137	DT	G3SHK/P	402
82	G4AKA	760	153	SY	F1AGB/P	615
83	G3XZW	752	130	ST	F9FT/A	625
84	G3EKW	737	136	NM	PA25APD/P	475
85	G3UDN	718	130	WK	F9FT/A	570
86	G8ECI	686	118	KT	F2YT	640
87	GI4BZH	681	81	DW	G8FAB/P	480
88	G4ANP	641	114	YS	PA0JOU/P	537
89	GM3WEE	627	88	LK	G4AZY/P	560
90	G3ZTT	620	137	CH	GM8HEY/P	340
91	GM8BDX	619	75	BW	G8FAB/P	508

Posn	Callsign (/P)	Points	QSOs	County	Best dx	Km
92	G8CCK	606	136	SY	F6AXP/P	550
93	G3REI	603	141	SX	G3WIN/P	405
94	G8GGP	565	135	KT	F1AJD/P	675
95	G8ERS	562	129	MX	DL0RR/P	521
96	G4CFI	549	87	SF	G3XC/P	490
97	G3WKX	547	138	BS	G3WIN/P	340
98	G8CAR	538	98	SD	PA0JOU/P	560
99	GM8HEY	534	62	FE	G3UES/P	560
100	G3ULN	523	87	DN	GD3FLH/P	378
101	G8GTE	521	88	DM	G3ODY/P	430
102	G8CDL	473	101	BD	GM8DVD/P	387
103	G3WDH	470	80	LE	G3ODY/P	436
104	GM8DVD	465	65	DF	G3ODY/P	490
105	G3FVG	462	120	KT	G3WIN/P	385
106	G3FJE	460	93	BD	F1JZ	653
107	G8FBQ	442	101	WR	GI6YM/P	425
108	G3TUW	434	102	OX	ON5EW/A	525
109	G3UFW	429	94	WE	G4ARF/P	320
110	G8DIZ	426	100	HE	G3WIN/P	410
111	G8HRC	414	101	EX	G3XC/P	450
112	G8WY	324	92	LE	G3XC/P	425
113	G8CSA	318	81	EX	DK3IKA	510
114	GM4CKV	314	44	AN	G3REH/P	562
115	G3TVS	310	76	SY	GM8DMZ/P	480
116	G3WOA	295	63	HF	G8GTE/P	275
117	G6GS	270	101	SY	GW3PYE/P	290
118	GC3HFN	243	34	GY	F6KFL	530
119	G3OHM	236	59	WK	ON6DH	445
120	G8GFC	231	67	NM	G3IZD/P	240
121	G3XBS	227	44	LN	G3SDS/P	280
122	G8FMZ	211	71	SY	F6BZA	425
123	GW3NWR	207	58	FT	G4ARN/P	265
124	G3IXH	195	48	LN	GI6YM/P	400
125	G4ADM	182	72	SY	GW3GEI/P	245
126	G3TLK	172	24	DN	G6PG	420
127	GW4BLE	127	45	MH	G3REI/P	212
128	GM4BIP	100	44	AN	GW3AMD/P	380

Check logs from G3FPK, G8BKR, G8ECT, G8GHD and G8HVV.

432MHz BAND RESULTS

Posn	Callsign (/P)	Points	QSOs	County	Best dx	Km
1	GW3SXK	4,068	102	DB	G3DAH	348
2	GW3SLJ	2,826	77	RN	G3DAH	325
3	G3PMH	2,742	87	CE	F3LP	360
4	G3SHY	1,950	53	LN	G3WKF/P	420
5	G3HBR	1,722	63	SX	F1AZY	438
6	GW3YJH	1,698	55	MG	G2BHW/P	295
7	G2RD	1,578	57	SX	F1AZY	462
8	GW3VXK	1,566	27	CV	G3VCP/P	360
9	G2CXT	1,506	63	BE	G2BHW/P	294
10	G3WYT	1,446	65	HE	F8OD	405
11	G3GRO	1,428	65	SX	F8OD	403
12	G3SOU	1,416	53	WE	G2BHW/P	278
13	G3TTV	1,404	66	BS	F3LP	253
14	G8DOR	1,386	65	HE	G8GBY/P	275
15	G8AFA	1,374	39	ST	G3SHY/P	335
16	G3OBD	1,230	43	WE	F8OD	419
17	G3NNW	1,224	60	HE	G3SHY/P	265
18	G8BDJ	1,182	55	SX	F8OD	405
19	GW3UUS	1,164	44	MH	G3PMH/P	227
20	G8AKT	1,086	45	BD	GW3VXK/P	305
21	G3VCP	1,074	56	SY	GW3VXK/P	358
22	G3RZG	1,068	32	DT	F8OD	410
23	G3YHY	1,056	61	BS	GW3SXK/P	203
	G3WGC	1,056	48	HF	GW3VXK/P	318
25	G3VZV	1,050	59	BS	GW3SXK/P	220
26	G4AZV	1,020	46	SE	G8AFA/P	175
27	G8AVH	990	49	SD	GW3VXK/P	187
28	G4AJC	984	33	KT	F8OD	460
29	G8AYY	930	43	SD	G3OBD/P	232
30	G3TQF	900	44	LR	GW3VXK/P	240
31	G4BOO	870	43	KT	GW3SXK/P	370
32	G2DSP	864	48	SX	F8OD	410
33	G3WKF	858	19	CL	G3SHY/P	425
34	G3NIL	810	33	DT	GW3SXK/P	252
35	G3SRS	726	35	WR	G3RZG/P	186
36	G3RCV	720	50	KT	F3LP	190
37	G4ALN	714	41	EX	GW3SXK/P	269
	G3WZT	714	45	SX	F8OD	410
39	G8GBY	708	28	YS	G8DOR/P	280
40	G3HZL	702	46	HE	GW3SXK/P	254
41	G4CIJ	684	50	BS	G3NIL/P	130
42	G3WRR	672	44	SY	GW3SXK/P	282
43	G8DLQ	660	36	KT	GW3SXK/P	310
44	G3ZPL	648	34	LE	GW3SLJ/P	170
45	GW8AAP	636	32	FT	G8CRN	220
46	G3WQK	612	32	SX	F1AZY	450
47	G8BIY	606	29	ST	G2BHW/P	217
48	G3NKL	576	28	LE	G3PMH/P	247
49	G2BHW	540	12	CL	G2CXT/P	280

Posn	Callsign (/P)	Points	QSOs	County	Best dx	Km
50	G3JKY	504	30	KT	G8AWS/P	270
	G8EIK	504	36	BD	GW3SLJ/P	190
52	G8DLB	501	35	SX	F8OD	430
53	G3XPU	498	34	KT	G3WYT/P	
	G8FMG	498	24	BD	GW3SXK/P	205
55	G8CKN	468	31	HE	G3WKF/P	242
56	GW3RPQ	462	21	RN	G3NKL/P	160
57	G4BZD	444	21	YS	G8DOI/P	270
	G8DWL	444	28	OX	G3HBR/P	100
59	G3KIN	438	34	SY	G3PMH/P	125
60	G8BDO	432	30			
61	G3TUW	374	35	OX	G3KMS	120
62	G3JFO	372	18	YS	GW3SXK/P	195
63	G8BLM	366	27	SD	GW8FQF	120
64	GD8DMA	360	11	IM	G3FVA/P	175
65	GW8AHI	351	33	FT	G2CXT/P	
66	GW8CFM	318	16	DE	GD8DMA/P	138
67	G3TLM	312	28	SY	GW3UUS/P	183
68	G8DIU	276	16	KT	G3PMH/P	125
69	G3FVA	252	11	YS	GD8DMA/P	175
70	G3YQW	246	23	SX	G3WGC/P	104
71	G3ZNW	216	18	SY	G8ATK/P	198
72	G4BRX	204	14	GR	G8AWS/P	153
73	G3YOA	186	13	EX	G3YHY/P	80
74	G8CFY	126	13	CH	GW3SLJ/P	70
75	G3VIR	120	8	DT	G3GRO/P	88
76	GI8AYZ	96	2	AM	GW3SXK/P	260
77	G4CLI	84	4	YS	G3SHY/P	112
	GM8BJF	84	4	LK	GM6ZV	
79	G8DIZ	78	9	HE	G2RD	70
80	G8CLY	54	3	YS	G3SHY/P	125
81	G3ZZS	30	3	DN	G8EQL	72
82	GM3OXX	24	2	SK	GM8BKE	78

1,296MHz BAND RESULTS

Posn	Callsign (/P)	Points	QSOs	County	Best dx	Km	Aerial
1	GWSXK	1,994	19	DB	G3WGC/P	240	5ft dish
2	G4ARD	1,679	22	BD	GW3SXK/P	220	4ft dish
3	GW3HAZ	1,636					
4	G3PMH	1,624	17	CE	GW3SXK/P	238	4ft dish
5	G3YHY	1,498	20	BS	GW3SXK/P	215	34el Pb
6	G3WDG	1,467	19	WE	G3UQH/P	141	4ft dish
7	G3GRO	1,420	18	SX	F8OD	403	34el Yagi
8	G2RD	1,392	18	SX	F8OD	420	3ft dish
9	G3WYT	1,376	20	HE	G3PMH/P	172	4½ft dish
10	G3WGC	1,227	14	HF	GW3SXK/P	239	4ft dish
11	G3XXJ	1,160	17	SD	G3WGC/P	140	3ft dish
12	G3TTV	1,113	16	BS	G2RD/P	118	3ft dish
13	G2HDJ	1,051	20	HE	G8ATD/P	90	33el Yagi
14	G3UQH	979	13	SE	G3YHY/P	150	12ft dish
15	G2CXT	960	14	BE	G3WGC/P	116	3ft dish
16	G3SJX	880	16	SY	G3PMH/P	122	32el Yagi
17	G3VCP	875	18	SY	G3PMH/P	122	36el Yagi
18	G3JVL	722	15	HE	G3NIL/P	87	4 × 18el
19	G3OBD	613	10	WE	G3GRO/P	91	4ft dish
20	G3EGV	585	8	DT	G3WYT/P	132	3ft dish
21	G8ATD	578	11	BD	G3GRO/P	108	6ft dish
22	G3NKL	557	6	LE	G3UQH/P	153	8/8 slot
23	G8BDO	517	8		GW3SXK/P	88	
24	G3NIL	503	8	DT	G3GRO/P	102	4ft dish
25	G8BMF	501	8	LR	G4ARD/P	102	3ft dish
26	G4ALN/P	443	9	EX	G3YHY/P	66	4ft dish
27	G3WQK/P	433	9	SX	G3TTV/P	120	4ft dish
28	GW3NTI/P	420	7	FT	G3NKL/P	86	3ft dish
29	G3BDJ/P	407	9	SX	G4BOO/P	70	3ft dish
30	GW3SLJ/P	404	6	RN	G3KMS	145	4ft dish
31	G3HBR	397	9	SX	G2HDJ/P	74	4ft dish
32	G8AFA	380	6	ST	G3WDG/P	105	6ft dish
33	G8ADP	326	6	GR	G3TTV/P	103	3½ft dish
34	GW3RPQ/P	305	5	RN	GW3VXK/P	100	4ft dish
35	G4BOO/P	301	7	KT	G8BDJ/P	63	5ft dish
36	GW3UUS/P	278	4	MH	G3EGV/P	104	8/8 slot
37	G3JZF/P	275	5	WR	GW3SLJ/P	78	4ft dish
38	G3WZT	259	8	SX	G3VCP/P	56	22el Yagi
39	G3ZPL/P	254	3	LE	GW3HAZ/P	130	4ft dish
40	G4AJC/P	206	3	KT	G2RD/P	92	4ft dish
41	GW3VXK/P	205	2	CV	GW3RPQ/P	103	4ft dish
42	G3VCT	55	2	BS	G2HDJ/P	50	5ft dish
43	G3JKY	0	0	KT	—	—	Cnr refl

Mobile Rallies Calendar

19 May 1974—Northern Mobile Rally. Details later. Contact G8BZY, QTHR.

19 May 1974—Amateur Radio Mobile Society's Rally, RAF Cosford, Shropshire.

26 May 1974—Hull Mobile Rally, Bishops Burton.

7 July 1974—Longleat Mobile Rally.

CONTEST NEWS

Affiliated Societies Contest 1974 rules

1. The General Rules for RSGB HF Contests, as published in the January 1974 issue of *Radio Communication*, will apply.

2. When. From 1800gmt to 2200gmt on Saturday 12 January 1974 and from 1800gmt to 2200gmt on Sunday 13 January 1974.

3. Eligible entrants. All fully paid-up affiliated societies.

3.1 As the contest is to encourage club activity, it is not in the spirit of the contest that a competing station should be operated by only one operator for all, or nearly all, of the time. Entries which indicate this method of operation may be disallowed.

3.2 All entries will be classed as multi-operator.

3.3 Entries will only be accepted from stations operating within a 10-mile radius of the normal meeting or hq of the affiliated society.

3.4 Callsigns which have been issued to affiliated societies must be used.

3.5 More than one entry will be accepted from an affiliated society providing that where a club callsign has been issued, that callsign is used by the "A" station.

4. Contacts. CW (A1) only in the 1·8-2MHz band.
Competing stations only (as defined in Rule 3) must send AFS to identify themselves after the report-serial number group, eg 599001 AFS. Repeat contacts may be made during the second session.

5. Scoring. 15 points for each contact with an AFS station, and one point for all other contacts.

6. Logs. Column (5) must be headed "Enter AFS if received". Entries must be sent to the HF Contests Committee, c/o R. S. Biggs, 29 Lord Avenue, Clayhall, Ilford, Essex.

7. Trophy. The Edgeware Trophy will be awarded to the affiliated society submitting the highest checked score.

National DF Final, 1973

Although this event, the major direction finding event of 1973, was organized by members of the Stratford upon Avon Radio Club, the participants travelled on 23 September to the Shropshire Hills, to put their skills to the test in unfamiliar neutral territory. The magnificent views available from the start point on the Long Mynd, 1,500ft above sea level, were marred by overcast skies, but the weather remained dry throughout the contest.

Three healthy signals from the hidden stations were provided for the 15 finalists, who seemed to have difficulty in determining their strategy, since they were slow to leave the start when permission to disperse was given at 1300.

Most competitors set off first to find Station "B", nearest to the start, some 4½ miles to the west. The transmitter here was hidden among prickly conifer trees, and was teed into an aerial 500m long. The favourite technique adopted by the hunters was to follow the aerial, trying to locate the tee point, which meant that several parties had a long run downhill to the far end of the aerial, and then back up again.

Station "C" was 10½ miles south-west of the start, concealed among the earthworks of an ancient hill fort which were overgrown with brambles. The ancients who constructed these enormous mounds and ditches would be amazed to see them put to use in repelling the onslaught of a band of 20th century radio enthusiasts. The first invader here was M. P. Hawkins, closely followed by E. L. Mollart, arriving at 1442 and 1442½ respectively. These two had also been first to locate the "B" station only minutes apart, and were therefore in direct competition to pin-point the "A" Station and win.

The major obstacle at Station "A" was physical inaccessibility, as it could be reached only by climbing 500ft up an exceptionally steep hill, located 7½ miles south of the start. The energy required to do this may have been a factor in widening the gap between the two leading contestants, since the youthful M. P. Hawkins stormed to the top to find the transmitter and win the contest at 1518, some 13min ahead of E. L. Mollart. Evidently on this occasion youth triumphed over experience and guile.

The competitors, organizers and transmitter crews re-assembled for tea at an hotel in Church Stretton, after which the plans behind the contest were revealed. The event had been designed so that competitors would find it difficult to guess at the locations of the stations and would therefore need to make use of true direction finding skills. An ingredient of tricky navigation had been added, and the need for a measure of physical effort had been included. The exhausted state of some of those present testified to this latter feature of the contest.

Following announcement of the results (subject to confirmation), presentations were made by Mr D. A. Findlay, general manager of the RSGB. The victorious champion, M. P. Hawkins of Chelmsford, received the RSGB DF Trophy, and prizes were also presented to runners-up E. L. Mollart, of Oxford, and W. J. North, of Chiltern ARC.

Posn	Name	Club	Times of arrival		
			Station "A"	Station "B"	Station "C"
1	M. P. Hawkins	Chelmsford	1518	1353	1442
2	E. L. Mollart	Oxford	1531	1354½	1442½
3	W. J. North	Chiltern	1553	1406	1501½
4	G. W. Anderson	Dartford Heath	1608	1405½	1505
5	R. J. Parsons	Oxford	1611	1455½	1532
6	D. Holland	South Manchester	1617	1409	1532½
7	B. J. Mahony	Rugby	1429	1627	1534½
8	A. W. Butcher	Chelmsford	1629	1455	1535
9	T. C. Cage	Oxford	1630	1455½	1552
10	I. R. Butson	Chelmsford	0000	1406	—
11	R. Pearce-Boby	Oxford	1450	—	1543
12	G. A. Whenham	Coventry	—	1407½	1556
13	P. Tyler	Oxford	1455	—	1556½
14	B. M. Bristow	Oxford	1410	1628	—
15	R. Worbey	Dartford Heath	1425	—	—

BARTG 5th VHF/UHF RTTY Contest results

		144MHz	432MHz	Total
1	DJ8EA	84	0	84
2	DL8VX	56	0	56
3	DJ1IH	49	0	49
4	G3YKB	26	18	44
5	DL9SX	39	0	39
6	G3WMQ	10	24	34
7	OE1VKW/3	29	0	29
8	G8DJF	23	0	23
8	G3WJG	5	18	23
10	G3THQ	3	18	21
11	DC0XL	18	0	18
12	G8GOJ	8	0	8
13	EI5BH	7	0	7
14	HB9MDP/P	6	0	6
15	SM6EBM	2	0	2

Best dx. DJ8EA—DK4LI, 380km.

Points deducted. OE1VKW/3 worked same club station six times at five points per contact—deducted 25.

G3YKB and G8DJF worked same club station twice at one point per contact—deducted one each.

Check log received, with thanks, from G8LT and SM6COT.

Conditions in this country were poor and there appears to have been no activity outside SE England. Conditions in DL apparently somewhat better.

BARTG Spring RTTY Contest rules

When. 0200gmt 23 March until 0200 gmt 25 March 1974. The total contest period is 48 hours but not more than 36 hours of operation is permitted. Time spent in listening counts as operating time. The 12-hour non-operating period can be taken at any time during the contest, but off-periods may not be less than two hours at a time. Times on and off the air must be summarized on the log and score sheets. The contest is also open to short wave listeners.

Bands. 3·5, 7, 14, 21 and 28MHz.

Stations. Stations may not be contacted more than once on any one band, but additional contacts may be made with the same station if a different band is used.

Country status. ARRL Countries List, except that KL7, KH6 and VO to be considered as separate countries.

Messages. Messages exchanged will consist of: (a) Time gmt and (b) Message number and RST.

Points. (a) All two-way rtty contacts with stations within one's own country will earn **two** points. (b) All two-way rtty contacts with stations outside one's own country will earn **10** points. (c) All stations will receive a bonus of **200** points per country worked including their own. *NOTE* Any one country may be counted again if worked on another band but continents are counted once only.

Scoring. (a) Two-way exchange points multiplied by total countries worked. (b) Total country points multiplied by number of continents worked. (c) Add (a) and (b) together to obtain your final score.

Sample score.

Exchange points (302) × countries (10) =	3,020
Country points (2,000) × continents (3) =	6,000
(a) and (b) added to give a score of	9,020

Logs and score sheets. Use one log for each band and indicate any rest periods. Logs to contain: date, time gmt, message and RST numbers sent and received and exchange points claimed. *All Logs must be received by 31 May 1974 to qualify.*

Certificates will be awarded to the leading rtty stations and SWLs. The final positions in the results table will be valid for entry in the "World Champion of RTTY" Championship.

The Judges decision will be final and no correspondence can be entered into in respect of incorrect or late entries.

Send your contest logs to: Ted Double, G8CDW, 89 Linden Gardens, Enfield, Middlesex, England EN1 4DX.

Additional notes. (a) If a contestant manages to contact 25 or more different countries on two-way rtty during this contest a claim may be made for the Quarter Century Award issued by the British Amateur Radio Teleprinter Group and for which a charge of US$2 or 8 IRCs is made. Make your claim at the same time as you send in a contest log. Holders of existing QC Awards will automatically have any additional new countries added to their records. (b) If any contestant manages to contact stations on two-way rtty with all six continents, and the BARTG Contest Manager receives contest logs from the operators in those six continents, a claim may be made for the WAC Award issued by the *RTTY Journal*. The necessary information will be sent on to the *RTTY Journal* who will issue the WAC Award free of charge.

Contests calendar

9 December	—144MHz Fixed
8-9 December	—TOPS
15-16 December	—ARRL 28MHz
1974	
12-13 January	—AFS (Rules in December issue)
12-13 January	—DL QRP CW
20 January	—432MHz SSB
25-27 January	—CQ WW 160m CW
26-27 January	—70MHz Fixed
26-27 January	—REF CW
2-3 February	—ARRL DX Phone
3 February	—144MHz Fixed CW
9-10 February	—First 1·8MHz
16-17 February	—ARRL DX CW
23-24 February	—REF Phone
2-3 March	—144MHz Open & SWL
2-3 March	—ARRL DX Phone
9-10 March	—BERU (Rules in November 1973 issue)
16-17 March	—ARRL DX CW
30-13 March	—CQ WW WPX SSB
23-25 March	—BARTG Spring RTTY Contest (Rules in December issue
30-31 March	—432MHz Open
7 April	—80m Low Power
21 April	—70MHz Open
4-5 May	—144MHz Open & SWL
25 May	—1,296MHz Open
26 May	—432MHz Open
1-2 June	—NFD
9 June	—70MHz Portable
15-16 June	—Microwave Field Day
22-23 June	—Summer 1·8MHz
6-7 July	—"Jubilee" VHF/UHF & SWL
13-14 July	—SSB Field Day
21 July	—432MHz Open
28 July	—70MHz Open
18 August	—144MHz QRP
7-8 September	—VHF NFD & SWL
15 September	—80m Field Day
5-6 October	—UHF NFD & SWL
5 October	—Start of 70MHz Cumulative
5 October	—Start of 432MHz Cumulative
19-20 October	—7MHz CW
2-3 November	—7MHz Phone
2-3 November	—144MHz CW
9-10 November	—Second 1·8MHz
8 December	—144MHz Fixed

For December and January **70MHz Cumulative Contest** rules see September issue.

YOUR OPINION

The Editor
Radio Communication
Sir—I agree with G3HKL (July issue) it is becoming increasingly difficult to find suppliers of the one-off component constructors often need. Are we gullible, as G3XTF says, or is it just that we would rather pay for a transceiver than spend months hunting for components to build it.

However, readers may like to know that I sent an order to W. S. Poel, G8CYK (Amateur Radio Bulk Buying Group), and also asked for various other components if available. A small parcel arrived soon after with a letter apologizing for the solder on two diodes, but as these were not normal stock they had come out of his own personal supply! If all suppliers showed such consideration their trade would double and so would the speed of our construction.

M. J. Cooper, BRS33780

The Editor
Radio Communication
Sir—**Raynet**
As much as the work done in producing *Radio Communication* each month, in return for part of members' modest subscriptions, is greatly appreciated, I do feel that in the case of activities of Raynet, much of the work that is done by members of it is not portrayed in the best and most interesting means.

With due respect to the column of G3PAZ, often referring to much detail concerning his personal opinions, I must point out that it would be of greater value to have regular reports from the controllers of the active groups which would help recruitment and tell an ignorant majority of radio amateurs, and even affiliated clubs, what we Raynet people are trying to achieve.

Remarks such as those recommending chairmen of groups to be more strongminded to settle apparent impasses, in my opinion, fail to take account of many of the problems which challenge the principles of Raynet procedure. It is only by discussion that one can improve the procedure to be adopted.

To run an emergency call-out system and to run the necessary exercises are complex procedures and need tolerance, goodwill, and a good deal of give and take, even if they do affect some controllers listening to the 9pm news!

Many Raynet groups have disbanded regular activity because of these problems and I feel that basic group rules such as the calling and working channels, and certain known frequencies to be kept clear for night emergency standby, are excellent, even though some people do not observe the procedure laid down clearly by their local group.

The centre of each Raynet group is the controller—a rule laid down by the RSGB Raynet Committee is that controllers must be members of the RSGB—may this be extended that they should also hold Class A licences—since if people have time to be controllers, they have time to practice for the morse test. Adopting this suggestion, all controllers could join in the activities on 4m, 80m and Top Band, all available for Raynet use.

May we hope that Raynet activities will spread, although the recent Exercise Diamond seems to have had little impact on the local and national press. Nevertheless, many dedicated followers and pilgrims of Raynet took part, and will still do their best to support the basic concept of an efficient emergency network.

D. M. J. P. Manley, PhD, BSc, CEng, MIEE, G3OWF
Area Controller's Assistant for NE Hants, Surrey Raynet Group

The Editor
Radio Communication
Sir—I thank you for the opportunity to reply to Dr Manley's letter.

G3PAZ, as contributor of the Raynet column, has, in common with his fellow contributors, freedom of expression within broad guidelines. More often than not, the information value of any column is in direct proportion to information received. G3PAZ cannot write without an inflow of information, and is, in any case, constrained by space limitations.

The Raynet Committee does not seek to have direct rule over individual controllers or groups; again, within the framework of the Raynet rule book they are autonomous . . . surely any advice that stirs up comment can do no harm! Lack of activity in many cases is directly due to licensing restrictions limiting us to the three user services. Without a user service we are only carrying out an academic exercise in communications.

To change our rules to allow only Class A licensees to be controllers would I feel lose many good operators from our network, and be an inequitable infringement on a person's right, not in keeping with the spirit of Raynet . . . after all Raynet is still the only way in which an amateur can contribute his skill and expertise as a service to the community.

In conclusion, sir, thank you for your letter, the committee always welcome criticism as well as praise.

P. Balestrini, G3BPT
Chairman, Raynet Committee

The Editor
Radio Communication
Sir—In July Mr Cheadle, G3NUG, drew readers' attention to problems he experienced after ordering a 60ft telescopic tilt-over tower. I would like to place on record my experience.

After I ordered a similar tower the manufacturers followed to the letter requests I made regarding delivery. Under the guidance of the lorry driver, two of us had the base and tower unloaded in 15 minutes and placed exactly where they were required to enable the remainder of the erection work to be carried out single handed.

I have nothing but praise for the efficient way in which this was handled.

J. Bazley, G3HCT

The Editor
Radio Communication
Sir—It is with great interest that I have been following the various arguments with regard to the phasing out of a.m. operation on the 1·8 and 3·5MHz bands. I can see both sides of the argument, but cannot help feeling that possibly Council are "reasoning right from the wrong premises".

If we are to change to ssb merely because the maritime service is doing the same, then surely there is no reason for not allowing A3H operation instead of A3, just as the maritime service is doing. This gives the advantage of a.m. where it is required, while allowing the spectrum saving from ssb to be realized.

But there would seem to be no good reason for changing to ssb on our present standards. The maritime service operates only on upper sideband; the majority of commercial ssb is usb, and indeed, the CCIR standards are now to use usb. If we are going to change so abruptly the mode of operation, it would appear that there would be a distinct compatability advantage in changing all amateur ssb operation to usb. This may well help the argument of G3XTF in cheapening amateur equipment, if only by a pound or so.

I do not see that the space saving advantages in terms of frequency usage by using ssb in the maritime service will be seen for some considerable time, especially as the current marine specifications do not allow the splitting in two of current a.m. channels, But the use of usb by amateurs may well allow more economic stacking of amateurs and coast stations.

P. E. Chadwick, G3RZP

The Editor
Radio Communication
Sir—Reading Pat Hawker's fascinating account of the original work done by G6CJ on subjective selectivity of hearing, I was at once struck by the parallel provided by our simulation of stereoscopic vision, where, if we provide the brain with two flat photographs of a scene, in a stereoscope, a view in a third dimension is obtained.

There is even a visual parallel with the "time delay" of the aural signal, as conceived by G6CJ, in an effect called the Pulfrich phenomenon where if a tinted lens is held in front of one eye while viewing a swinging pendulum, the pendulum bob appears to describe a circle, not an arc—once again a third dimension, the tinted lens presumably being the visual equivalent of G6CJ's delay circuit.

G. J. Jones, FBOA, HD, GW2HMO

The Editor
Radio Communication
Sir—**Repeaters**
May I add views derived from a perhaps not unique but at least unusual experience. With an IC20 transceiver, loaned by W2JKN, a reciprocal licence, a ¼-wave aerial screwed to a door handle of a hired car, I drove from Atlanta, Georgia, through 18 states, west to Niagara, north to Bennington, Vermont, west to Boston and Plymouth Rock, to New York City. Out of 128 contacts there was only one not through a repeater.

Discounting the obvious attraction of G3CDK/W4/W3/W2/W1, I believe politeness and good manners are engendered by repeater usage.

Apart from the obvious interest, the convenience of very small equipment (which plugged into the car cigar lighter socket), and the fascination of strange airways, there were many occasions when access through the many repeaters was extremely useful; such as being talked in to K4YYM for a delightful welcome and lunch; being advised to take the Mohawk Trail instead of the Express Way in Massachussetts; and perhaps most of all, detailed and continued instructions on how to drive from the Connecticut Thruway over the various Manhattan Bridges to the Drake Hotel in 5th Avenue NYC—and being directed to a delightful weekend in the home of Buddy Robbins who lent me the IC20.

May I submit the following:

1. Repeater facilities in the UK would give considerable pleasure to the majority of our membership.
2. Operating discipline would inevitably improve. This lines up with the self-training requirement in our licence.
3. The technical problems facing the groups who operate the repeaters will be extremely educational.
4. The need for action by individuals in getting together and carrying out the installation and operation is socially desirable.

Congratulations to G3LWM for his letter (page 561 August *Radio Communication*).

Finally, may I reply to G5CS whose attitude, I submit, can be summed up "I am not *yet* saying to hell with repeaters but that is what I really believe".

Repeater operation goes back to at least 1932 (W1AWW/W1HMO Springfield, Mass) in the USA, where there are now hundreds of repeaters and where a vast amount of experience has been gained. Channel spacing on 2m is almost always 600kHz; for mobile and hand-held portable operation the arrangements are superb—I worked 10 stations from the garden of W2JKN with a 1W Handie Talkie.

May I submit the standards to be adopted here need no further discussion. Repeaters are springing up all over the world to the great satisfaction of all amateurs near them; they economize in band usage and improve efficiency and good manners, and make mobile operations and portable operation a real pleasure. They provide an emergency system second to none and if we in the UK do not hurry up we shall be the laughing stock of the amateur world.

Roderick Clews, G3CDK

OBITUARIES

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

Mr P. Godley, ex 2ZE
Paul Godley died on 20 October at the age of 84.

In 1921 Paul Godley became the first person to receive in the UK amateur signals originating from the USA. Using a 1,300ft Beverage aerial at Ardrossan, near Glasgow, Paul picked up on 230m a transmission from the Radio Club of America, at Greenwich, Connecticut, being sent as part of the Transatlantic Tests. These tests showed clearly the advantages of cw over the then-favoured spark transmissions.

Mr R. A. Delahunt, G4QD, of Newcastle, Staffs, on 12 October 1973;

Mr L. F. Masters, OBE, G3YDJ, of Chandler's Ford, Hants, on 17 September;

Mr W. Miles, G3GCK, of Peterborough, on 26 October.

Looking ahead

4 January 1974—RSGB Presidential Installation, Bonnington Hotel, Southampton Row, London WC1.

Present at the meeting of Council on 3 September 1973

Standing (l to r): Messrs G. M. C. Stone, C. H. Parsons, R. F. Stevens, A. W. Smith, J. R. Petty, F. C. Ward, W. F. McGonigle, (Council members); A. W. Hutchinson (editor). Seated (l to r): Messrs W. A. Scarr, E. G. Ingram, (Council members); Mr G. R. Jessop (Executive Vice-President); Dr J. A. Saxton (President); Mr D. A. Findlay (general manager); Messrs R. W. Fisher and W. J. Green, (Council members). *Photo: P. Fletcher*

The Appleton Laboratory

Change of name for the RSRS

On 7 November the Secretary of State for Education and Science, Mrs Margaret Thatcher, visited the Radio and Space Research Station at Slough, Bucks, and renamed it The Appleton Laboratory. The new name was chosen to mark the long and close connection with the work of the station of the distinguished physicist, the late Sir Edward Appleton, CBE, KCB, FRS.

After the renaming ceremony, during which she unveiled a plaque and portrait of Sir Edward Appleton, Mrs Thatcher, and other guests, toured the laboratory and saw some of the work which it is undertaking. Escorting Mrs Thatcher was Dr J. A. Saxton, director of the laboratory and this year's RSGB President.

The genesis of the laboratory lies in the former Radio Research Station of the Department of Scientific and Industrial Research and, before that, in the Radio Division of the National Physical Laboratory, to go back no further. In the early days, beginning some 50 years ago, the role of the laboratory was clearly defined as the conducting of fundamental research in radio wave propagation to provide basic information *widely* needed by a range of users to assist the development of radio communications in the broadest sense; including point-to-point communication, broadcasting, navigation, etc. The development of radar techniques was an important outcome of this work in the 'thirties.

The study of propagation necessarily involved geophysical research to understand a range of solar-terrestrial relationships, the formation and characteristics of the ionosphere and the nature of the troposphere as a medium for the transmission of radio waves involving the interdisciplinary field of radio-meteorology.

Among several projects at present being undertaken by the laboratory, those of particular interest to radio amateurs include research into the scattering of metric radio waves by the ionosphere, the scattering of centimetric radio waves by rain, cloud and clear-air inhomogeneities, and the earth's ionized and neutral atmosphere. Satellite data analysis and computing is also undertaken, including orbit predictions for satellites such as Oscar.

The laboratory continues to be an effective source of independent advice on the application of wave propagation knowledge to communications, radio astronomy, space science, frequency allocation and radio interference problems.

The research programme on the propagation of radio waves at very short wavelengths includes two main topics. The first is the effect of heavy rain on terrestrial and earth-space paths in the waveband 0·3–3cm. This information is required in the planning of microwave communication systems. Secondly, basic investigations of atmospheric absorption, especially that caused by water vapour, are in progress in the waveband 0·3–3mm. In this region of the spectrum, existing theories of absorption show significant discrepancies when compared with measurements. This result is attributed to the presence of multimeric molecules of water formed by hydrogen bonding, a feature not yet included in the theory.

The laboratory participates with Canada and the USA in a programme for sounding the ionosphere by use of instruments in satellites. Information, particularly over the oceans, is needed to improve the models of the ionosphere which are used in predicting the behaviour of long-distance hf radio communications circuits. These investigations have given rise to theoretical investigations of neutral-air winds at altitudes above 100km, which cause ionization to move along the geomagnetic field lines and may explain features of the ionosphere which have long been regarded as anomalous.

More recently some evidence has been detected that the geomagnetic field, and possibly the solar wind, can influence the large-scale average distribution of pressure in the lower atmosphere. No physical explanation yet exists for this exciting possibility of relationships between the weather and geophysical phenomena at much greater heights in the earth's atmosphere.

Platform party at the re-naming ceremony. L to r: Dr J. A. Saxton; Mrs Margaret Thatcher; Professor S. F. Edwards, FRS, Chairman of the Science Research Council; Lady Appleton; and Sir Eric Eastwood, FRS, chairman of the Astronomy, Space and Radio Board of the SRC

MEMBERS' ADS

These low-cost flat-rate advertisements are accepted as a service to members of RSGB. They must be submitted on the Members' Ads order form printed on the last 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, and a remittance by postal order or cheque for 25p (stamps not accepted). They will not be acknowledged. Those not clearly worded or punctuated will be returned. No other correspondence concerning this service can be entered into.

The closing date for each issue is the 4th of the preceding month but no guarantee of inclusion in a specific issue can be given. Valid advertisements not published in the issue following receipt will be held over until the next issue.

Trade or business advertisements, even from members, will not be accepted for Members' Ads but should be submitted as classified or display advertisements in the usual way. 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.

See the current order form on the last page for further details.

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

FOR SALE

New unused 30ft Telomast complete with accessory pack, instructions and coaxial stand-off arms, £14.50 ono. N. Hingley, 4 Elmdale, Halesowen, Worcs B62 9AJ.

Heathkit HW17A with commercial fet pre-amp fitted, (otherwise as new) plus mobile psu, mint condition, plus both manuals, four xtals, spare set of valves, £65 ono secures. W. D. Whatmore, "Hollybank", Sellicks Green, Blagdon Hill, Taunton, Somerset. Tel 082342-253.

CR100/8 £12; as new GEC Miniscope, 1in tube, £5; HA500 Lafayette, ham bands only, £15, double superhet, buyer collects. G8CZH, QTHR.

Camera, 625-line, Ikegami TK204VD4, converts 405, focusing lens; spare Vidicon £25; monitor Murphy, 23in, automatic 625-405-525 line selection, £25; audio generator, Nombrex 40, sine/square, brand new, List £27.15, only £20. G3MHS, QTHR. Tel Sedgley 73465.

Codar AT5 T28, complete mobile installation, inc mic, speaker, Halcon aerial, 160/80 loading coils, also base station power supplies, £35. G4AKJ, QTHR. Tel Bristol 46612.

Pye Vanguard boot mounting 4m, 70·26 and 70·375 crystals, complete with console for car interior and whip, all ready to go, £35. G3ZLO, QTHR. Tel Horley 3123.

Eddystone 680X, immaculate condition, £55; HW17A £45; Emsac 2m converter £8; Class D MkII wavemeter £9, buyer collects. G8FSM, QTHR. Tel 0272-655012.

C53-TX QRO a.m. cw, complete with four spare 813s, vfo, manual, offers?; SB-10U mint, leads, mic, manual, £20 ono; Top-7 tx, rebuilt with homebrew control box, perfect, £10 ono; matching inverter, modified, working, £5 ono; R-107, £2.50. P. Russell, 13 New Road, Bolter End, High Wycombe, Bucks, MP14 3NA. Tel 28682.

DX100U, fb cond, also some Nos *Rad Comm, Practical Wireless, Practical Electronics* etc sae. *Wanted* Heath DX40U with vfo, or purchase separately; workable 2 or 4m rig. GI3YMT, QTHR. Tel 644688.

Oscilloscope, Cossor 2100 double beam, 6MHz, 100mV/cm, with preamps (two) 1mv/cm, excellent performance, manual, £50. Tel Cobham (Surrey) 3117 evening.

GR286/STR28 marine vhf band style HC6/U crystals, tx/rx channels 1-5, 7-9, 18-22, rx channels 12-14, £1.25 each; Racal 1·4MHz ssb crystal filter (usb) £8; vhf/fm base station, high band, 10W £12. G3JMJ, QTHR. Tel 073-271 3467.

Eddystone 840C gen cov rx, very nice cond, £40. G3WEX, QTHR. Tel 021-354 4265.

Pye Cambridge AM10B, 12V, complete with cradle, control box, spkr, microphone, cables, vgc, aligned, 145MHz, less xtals, £30, carriage by arrangement. G8CDJ, QTHR.

Sifam 100-0-100μA meter, scaled 10-0-10, 3½ by 3in, £1.50; tacho generator, Servo-Tek type SB-740B-1, 20V per 1,000rpm, brand new, £5. G4BEZ, QTHR. Tel Cheltenham 57595.

AR88D, new, boxed, £48; JXK 2m converter with tunable i.f., 28/30, £10; 2m tx, QQV0640A, UM2, 2-KT88s, £18; QQVO310, driver/QRP a.m./fm, £12; QQVO320A/P trans mod, £10; 50ft Telomast £16; 2m Parabeam £12; 339 d/b scope £12, gone ssb, buyer collects. Pugh, 360 Hihley Road, L Gornal, Dudley, Worcs. Tel Dudley 55816.

5Z3(2) 6V types, various QVO4-7(3), 1600-1500-0-1500-1600 about 750mA; xtals, HRO, 456kHz; 10x 5MHz(2), 500kHz(2), hdbks Hallicrafter S36, BC221, AE, AF, AH; Dumont 5in cro, type 208, see other advt, all rsnble. G2BPC, QTHR.

813(2), 815(2), 866A(2) 829B(3), 832A, QQZO4-15(2), 6L6 (6), 807(4), UM3, UM1, 6B4G(4), 1,100-0-1,100 ex T1131, VCR139A and 2 bases, 5CP1 with transformer, 240V prim, 2kV/5mA out, plus 2X2/879 and hv/lt wkg xtals FT241(21), FT243(24), mostly 7MHz ±, sae. G2BPC, QTHR.

Garex Twomobile a.m./fm tx/rx, mint cond, cost £110 accept £75, less than 10 hours use, buyer collect, rx fully tunable, 3 xtals. G3KNB, QTHR. Tel Stafford 62105.

Solartron CD513 scope with manual £40; probes, Bird thruline 25W 25-60MHz and 10W 100-250MHz, £12.50 the pair; Heathkit 100MHz counter, IB1101, £95; complete 144MHz ssb station including Heath HW32A, £120. C. R. Jenner, 27 Buchan Road, London SE15 3HQ. Tel 01-732 6918.

Lafayette KT390 tx kit £27; Heathkit GD-1U £8; 19 set MkIII mains psu, £10; rf amp No 2 £3; two No46 sets complete £5; BTH P58 rx, 280-680MHz continuous, £25, all good condition, buyer collects. P. Lowenstein, 3 Kelman Close, London SW4 6JE. Tel 01-622 9549 evenings.

Louve 105 freq meter and charts, faulty, £5; BC221 freq meter and charts, psu, £9; LM14 freq meter and charts, psu, £14; BC312 rx, rebuilt, with min valves in i.f., S-meter, product detector, psu, £16. J. Martin, 114 Briggs Fold Road, Egerton, Bolton, Lancs. Tel Bolton 57775.

KW Vanguard with 160m, Eddystone mains filter, h/b 4m tx/converter, Heathkit Q Multiplier, h/b i.f. strip, ideal for 2m but needs alignment. No reasonable offer refused. Buyer collects. G3THC, QTHR.

160m transverter, 7MHz input, 40W p.e.p., built for FT200 but suit any rig, £20.00; AM10D, 145·80MHz, £25; TS174U, complete, 240V ac, charts, £20; 2m ⅝λ whip, £3; 813 and base £100, part exchange for KW2000. G4BXD/G8ESY, QTHR.

Eddystone 730/4 rx, see Sept 73 *SWM*, as new; G3MXO. Tel 021-772 5409.

KW2000A, complete, speaker, ac psu, Shure 201 microphone, instruction manual, very clean condition, little used, £135, also Universal Avometer. G3DFS, QTHR. Tel 021-354 7769.

R206MkII with psu £20; G3HBW 2m convertor, Eddystone box, mains psu, i.f. 4·5 to 2·5MHz, £8; Sony TC160 cassette £70; Ultra packset fm, xtals 144·48 and 145MHz, £40; Solartron oscillator, 25Hz to 500kHz, 50 and 600Ω, £20. G8DDM, QTHR. Tel Penn 4483.

Microwave modules 144MHz rx, 12V pos or neg earth, as new, £30, V. M. Rowlands, 37 Hampton Road, Oswestry, Shrops. Tel 3764.

1132A vhf rx, working but requires attention, W8356 300V 19in rack mounting psu, £2 each; SCR522 modulator section, STC, mains transformer, 0–750V 215mA, 6·3V 2A, £1 each; Mullard 510 amplifier £5 ono, buyer collects. G8DLT, QTHR. Tel Broadstone 5370.

Trio 9R-59DS, rx, exc cond with volt stab, hndbk and original box; £38 plus carr. R. Mortimore, 20 Windermere Ave, Cardiff. Tel 0222-754588.

"Radio Communication" complete Jan 1969-June 1973, nearest £3, also Hamgear preselector PM1, mains operated, £2.50, both plus carriage, items vgc. Stephenson, 82 Morris Lane, Leeds LS5 3EN, Yorkshire.

Racal TR109C mobile ssb transceiver 4 channels 160 to 40 complete with 11 crystals, handbook and aerial, usb, lsb and a.m.,exchange for Vespa Viceroy HW12A or JR310. G3OQC, 1 Baker Avenue, RAF Benson, Oxon OX9-6EQ.

WS62 tx/rx, 1·6–8MHz, cw & a.m., internal 12V psu, mic/headphone connector modified to panel sockets, surplus to my requirements, offers to GM3KHH, QTHR. Tel Clochan 247.
Racal RA17L £170 ono; Racal RA66 panoramic viewer £40 ono; Racal RA63 sideband adaptor £30; Drake DSRI digital, cost £1,133 4 months ago, £800 ono; 2 new Eddystone panoramic adaptors, EP17R, EP20, £40 ea. GW3NWS, QTHR. Tel Tides Reach 232 (home) or Newport 71751 (office).
"Knight" star-roamer general coverage receiver, ideal young swl, very good condition, £15 ovno, inspect most evenings and weekends, please phone first. A. Jackson, 6 Shepherd's Close, Bartley, Southampton, SO4 2LJ. Tel Cadnam 2640.
HW17A complete with dc psu, £45; T28 rx, AT5 tx, with ac & dc PSUs, £35; Heathkit transistor tester, offers? G4AIV, QTHR. Tel 0536-710519.
HW101 with (sb series) delux ssb filter plus psu, prof built, excellent, £140 ono; digital freq meter (homebrew), 8-digit readout, Heathkit cabinet, time and freq measurement 0-30+MHz, £40 ono, carriage extra or collect. Bradley, 32 Barley Farm Rd, St Thomas, Exeter. Tel Exeter 51646.
Joystick de luxe aerial and Joymatch 4RF £7; Testgear (Acton) signal generator £4; Heath beam switch S-3U £10; Weemegger (500V) £7; Valves QQVO640A(2) £1 each, 832(2) 50p, 829B £1 etc; many components and books. G2FCA, QTHR. Tel 01-952-6566.
2m /m /p valved a.m. tx, pa QQVO2-6, integrated 12V dc inverter (positive or negative earth) and control box for single switch control, metered, perforated steel case, £17.50. G3TYJ, QTHR.
New unused 5B/254M (3), 6146 (2), £1.10 each; E88CC 50p, QQVO3-10 (2) 60p each; Goldring stereo CS90 with spare unused diamond stylus £2.50. G3KZC, QTHR. Tel 0272-673026.
Swan 500c, as new, £155. G3KNA, QTHR. Tel 097-623122.
Pocketphone compact uhf transceiver brand new with xtals on 433·20, Deacs, copy of handbook, 25kHz channel spacing, £65 no offers. G8EAO, 28 Hertford Road, Clare, Suffolk. Tel Glemsford 770 or Clare 7163 (evenings)
Shack clearance: Collins KWM-1 51NO594, 316-1 psu, mint cond, offers; Hallicrafters SX101, manual, £75; National NCX5 mkII, psu etc, £175; Drake R4A, MS4 spkr, 1·6-30MHz, £125; Trio JR599 rx, 1·6–30MHz, 144MHz, as new, complete, £145. GI3ZIA, QTHR. Tel Enniskillen 2188 N. Ireland.
TW communicator, 2m, £30, or exchange for rx. G4BHM, QTHR. Tel Leeds 664833.
KW2000 ac psu, £85; /m psu £15; 24V t/p psu, £4; valve tester, £7, property late G3DMN; HW100, believed ok, immac, no psu, £65; G2DAF tx, no psu, believed ok, £12, buyers collect weekends. G3DCS, QTHR.
Automatic digital keyer, 256 bit memory, programed with diode matrix, 2 auto stops and repeat capability 10–45wpm, built-in monitor, ideal for CQ, station ident etc, £20; RCA 16561 20p; til 209 LEDs 12p; BF240 7p. G3WZT, QTHR. Tel 0403 710565.
KW Valiant tx, 160–10m, £20; BC221AH with orig charts, no psu, £15; B44MK3, unmod, no xtals, offers, buyer collects; B&W 2Q4 £2. G3HWH, QTHR. Tel Nelson 65080.
Radiovision Commander gc/ham band rx, £21; T/band h/brew a.m./cw tx, £7, (buyers test, collect); 436kHz lsb xtal filter with tx cct, £3 pp; HC6U, 11,155kHz (mix10·7/455) 75p, pp, all ono. G3CDR, QTHR. Tel Dartford 26976.
FR400SDX receiver in mint condition, complete with instruction manual and circuit, £150 ono. G4AXO, QTHR.
Waveform generator type 51, £10; crt unit type 2 £6; 45MHz i.f.amp, £2; 30MHz i.f. amp, £2; vhf rf amp £1; vhf osc £1; 20MHz i.f. amp £2; af amp unit £1; Foster Seeley discriminator £1, post extra. SAE with enquiries. R. Hayward "Sunnyfields", Lighthouse Rd, St Margarets Bay, Dover, Kent, CT15 6EJ.
HW-17A Minor, (removeable) mods, homebrew mobile transistor psu and cables, £50 ono; HG-10B vfo 80-2m, £25 ono, both with manuals, carriage extra. *Wanted* compact ssb tx/rx, internal psu, 80/20m, 160/80m, why, replies 100%. GM3SYD, QTHR.
Calibrator unit type 1 with 250V ac power unit useful for conversion as transmitter or receiver or test instrument. Carriage extra, sae with enquiries. R. Hayward, "Sunnyfields", Lighthouse Rd, St Margarets Bay, Dover, Kent.
KW Geloso amateur band converter, 6 bands; £10 or exchange. J. Coles MacGregor, 166 Ellenborough Road, Sidcup, Kent.
Trio JR-500SE, vgc, extremely stable, vg 2m, £45; 2m converter, 27·7 to 29·7MHz, suitable above, brand new, £12 or exch 2m gear (tx-rx). G8ESK, QTHR. Tel Bradford 45611.
BCC69 tx/rx, high/low band with 12V psu, £5; mains stabilizer (variac type) £6; Brenell tape recorder with accessories £25; Grundig GMU3 mixer £3; teak hi-fi cabinet £15; microphone on floor stand £5. G3WMQ, QTHR. Tel 01-903 4363.
Hallicrafters RXs SX-96 £58; S27c £22; Trio TR-2200 6ch fm tx/rx £60; Pye Vanguard AM25T, tuned 2m, complete, £24; Telford/8AEV 2m cnvtr Mk2, new, £10. *Wanted* SX-122, 888A, exch, why. Bob, G4AFY, QTHR. Tel 61752, 6-8pm.
Property late G3JCQ: Drake TR4C still under guarantee, with psu and speaker unit, £270 ono; also other items. Details from G3KKJ. Tel Ulverston 53685 (evenings) or write for lists.
Yaesu FR400SDX £140; Drake R-4C, brand new, £230; KW204 tx £100; DA-1 Keyer £10; Hallicrafters HA-1 Keyer £30; KW Eza match £9; Drake W-4 £20, all excellent condition. *Wanted* P-60 Versatower. GW3YGH, QTHR.
CW tx, 80-10, pair 807s pa, £10; Parmeko 620V 200mA, 375V 250mA, 5V6A, £4; Gardner 350V 250mA plus lots heaters £2; Parmeko swinging choke, 3·6–20H 250mA, £1; Gardner chokes 50p, buyers collect. G2HLU, QTHR. Tel Reading 61622.
KW Ezee Match with separate band switching £14; 18AVQ hi-gain vertical aerial £14; AVO electronic test meter £14; prefer buyers collect. G3MIX, QTHR. Tel Teignmouth 4480.
FM Vanguard 24V, switched power, QQVO640, on 144MHz, good clean condition, mains psu, sell or exchange, EC10, test equipment etc, £30, buyer collects. G8BTI, QTHR.
Garex 2m a.m./fm tx/rx, as new, transmitter has 6 channels with trimmers, 145·00 crystal included, £80 ono; 8MHz crystals on 145·15, 145·45, 145·65, 145·80, 145·925, £1 each. G3UKM, QTHR. Tel 061-439 5756.
Collins KWM2, factory fitted i.f. noise blanker, late serial number, complete with ac psu, first reasonable offer accepted. G3ENG, QTHR. Tel after 7pm, Burgh Heath 56645.
Two Williamson amplifiers, Woden potted output transformers, transistor stereo pre-amp, power pack, twin 450V and 20V, £20. G3BYY, QTHR. Tel Wraysbury 2007.
Owner emigrating: Creed 7B £10; 85 printing reperforator £8; 25 punch £9; 92 reader £4; 80–0–80V psu £3; Marconi 60W 2m a.m. base station £18; No 7 crystal calibrator £2. G. W. Newsome, 11 London Lane, Bromley, Kent. Tel 01-460 2592.
Chinon 809, 8x zoom cine camera in excellent condition complete with case, lens hood, instruction manual, £55; will exchange for EC10 Mk2 or Heath GR78 or FL50B. M. S. Soo, 30 Manbey Grove, Stratford, London E15. Tel 01-242 4433 ext 313.
B40A rx, complete with manual, £15; EK9X electronic key, new, £8; Joystick UFA, 1971 model, £4, assortment electromechanical relays and uniselectors £5 box. A. Neilson, 78 Ackers Hall Ave, Liverpool, L14 2EA. Tel 051-220 5470; after 6pm or weekends.
Microwave Modules 2m 5W transistor a.m. tx; 40W a.m. mains operated 2m tx, offers. G8GMR, QTHR. Tel Luton 35806.
SCR522 vhf tx, 2m xtal, needs tidying, £3; type 8N 100W vhf pa with 2 spare 8019s, £5; TU7B tuning unit, £1; two 3ft high 19in racks, £2 each. G3YBJ, 85 Downland Drive, Southgate, West Crawley, Sussex. Tel Crawley 36147.
DC psu for Yaesu FT200, perfect, offers; Top Band a.m. tx in working cond, suit mobile operation, £4; 70MHz converter, solid state, i.f. 3·3 to 4MHz, £5 ono. G3ZUL, QTHR. Tel Droitwich 4510.
BCC-21T, psu, charts, £15; Advanced G3HSC record, 45wpm, £1.50; two telephone handsets 50p; Voltmeter 0-100V0-5V, leads, £1; transistors, 2N2102 35p each; books: *Short-wave Listening* 75p; *Build your Amateur Station* £1, new. A. West, 29 Halfmoon Lane, Herne Hill, London SE24 9JX.
Pair Z-match caps £6; Vitavox 100kΩ mic £1; 50μA meter £1; 600Ω phones £1; transformers 24V at 500mA, 350–0–350 and 20H choke £1.20; 2N3553 and 2N706 £1; crystals 44MHz and 45·7MHz 50p ea; hi-pass filter 50p; mic pre-amp 50p; EF86s(6) £1; EL96 25p; 6BE6(4) 70p; E88CC(3) £1; E180F(2) 75p; ECF80 25p; transistors, OC170 (5) £1; 2N918 (2) 50p, 2N2021 (11) £1; 2N4124 (10) £1; AF186 (1) 40p; postage extra. G4AWJ, QTHR. Tel Heathfield 2454.
FTdx401, immaculate condition, £215 ono; Yaesu YD844 table mic £7, free with 401; TW Topmobile 160m tx/rx, 12V dc, £20; Tx/rxs sent free by Securicor, write or phone (evenings). G4BVH, 73 Dudley Road, Brighton, Sussex. Tel 0273 504634.
Large potentiometric chart recorder, 25mV, 25μA fsd, £40; unstabilized dc supply, 70–0–70V, 20A, £4; Grundig Reporter tape recorder £3, all items buyer collects. Newton, 7 Little Pynchons, Harlow CM18 7DB. Tel Harlow 28969.
RTTY Creed model 47R teleprinters £15 each; Creed 86R reperforators, £15 each; Creed 6S6 tape readers £10 each; Creed 7PN/4 Punch 75R, Model 92 and psu, ok for spares, offers? sae enquiries. G8EPI, QTHR.
BRT402E, rack mounting rx, £60 ono; antique tv/radio, 15in, circa 1938, offers? Dekatrons, octal valves, meters, transformers sae list. F. W. Mulford, 10 Stanford Way, London SW18. Tel 01-764 6207.
TTL xtal standard, outputs 1MHz, 100kHz, 10kHz, integral psu, £10; 2m Hi-Q break £2; Labgear speech pre-amp clipper £1.25; 2m pre-amp £1; 100kHz xtal B7G £0.75, post extra all items. G8CEX, QTHR.

Shack clearance, many items for sale including EA12 £125; Vanguard AM25T, converted, with all accessories, xtal and car battery, £20; many valves, transformers, Painton resistors etc, sae with requirements or call evenings. R. Phipps, 26 Spinney Hill Crescent, Parklands, N'pton.

Viceroy Mk IV, vgc, £50 ono; rx, KW77, vgc, £50 ono. G3FVB, QTHR. Tel Buxted 3356.

FRdx400 £100; FL2500 £90; BCC21, correct charts, £15; KW2000A plus psu £120; 70cm cavity with 4CX250B and base £6; QQVO6/40A £4.25 new; 6146B £2.25 new; QQVO3/20A £2; Hudson 4m tx/rx £8; 4m aerial £1; postage extra. G3KHU, QTHR.

SSM mf converter £15; UR203 coaxial cable 10p/m; Desk mic £2. G3ZNW, QTHR. Tel 01-432 2343 (8-4 weekdays only).

Offers invited for BC348Q S-meter, built-in psu; Pye base tx; Pye Cambridge; Solatron CD513 with handbook; B2 rx and psu; 2m converter & psu, buyers inspect and collect. G3LYU, QTHR. Tel Leicester 876459.

FT-2F with accessories, as new in box, also 5/8 G-whip, £75 plus post; Dartronic scope model 510, lacking eht, gift £15 plus post, 3 figure list price; quantity Celestion speakers, 8 by 5in unboxed, £1.50 each. GW3TMP, QTHR.

Frequency meter W1191A, mains psu, data, £5; tv, Philco 1019, 17in, vhf, overhauled, £7; ic skt pins, lengths of 100, 50p; 8-track stereo tape player, little used, spkrs new; VR150s, unused, 25p. G8CLG, QTHR. Tel 01-778 2739.

FTdx401, 7 months old, as new, in makers carton, little used, £215. GM3DJT, QTHR. Tel 031-334 2672.

Heathkit rx, model GR78, 12 months old, aligned and serviced by Heathkit, in immaculate condition, a good standby receiver, can be used mobile; buyer collects, £50. 50 Sherbourne Close, Hove, Sussex BN38BE. Tel 0273-414244 ext 37.

House, "Californian" style open-plan lounge/diner, kitchen, 3 beds, warm air c/htng, fitted carpets, d/g, conservatory, greenhouse, "shack", garage, 300ft asl, large garden, £12,300. QRA Canterbury. G3RHL, QTHR. Tel 0227-60334.

Trio 9R59DE rx, superb condition, calibrator circuit, audio filter, cathode follower fitted, many extras, £30. M. J. Cawood, 10 Fitzgerald Rd, Thames Ditton, Surrey. Tel 01-398 4727.

Heathkit HWA17-1 mobile psu £8. G3ZJF, QTHR. Tel Windsor 68364.

Storno CQM13C Hi-band £10, B44 Mk III, tx on 4m, 2 xtals £5; LG300 tx £10; Canadian No 9 receiver, offers? Will deliver London area. G4BOW, QTHR. Tel 01-980 2074.

HQ170A receiver, plus 2m converter, £70 ono; Pye Ranger with transistor psu, rx modified to tune 28 to 30MHz, £5; homebuilt 2m transistorized rx, £10. G3LYP, QTHR. Tel High Wycombe 881298.

Exchange Eddystone EA12 rx for wide band double beam oscilloscope, example CD1400; KW Vanguard tx, 160-10, £20. Livermore, 1 Roe Green Lane, Hatfield, Herts.

"Radio Constructor" 4m tx £6; 2m tx £12; "Diode circuits handbook" by R. P. Turner 75p; "Electromagnetism" by Slater and Frank £1.50; "Elementary Technical Electricity" by Huck 60p, books as new, sae list. H. H. Seymour, 74 Harold Estate, Pages walk, London SE1 4HW.

Collins F455-J-3.1 mechanical, McCoy 9MHz Golden Guardian filters, many crystals; 23cm radial cavity; many small items (listed). G2CPM, 10 Wyndham Road, Shaw, Newbury, Berks. Tel Newbury 464.

Koyo 1770, 11-band, month old, cost £60, sell £54 or exch for EC10 Mk2 Lafayette 600 or 800, Trio 310 or 9R59DS or other good small short-wave rx, cash adjustment. L. D. Ireland, Carnhell, Camborne, Cornwall, Tel Praze 236.

Unused 70cm gear: Microwave Modules converter £14; 28-30 i.f. Tronilex systems 8W tripler/pa with stab psu £15, £25 the lot. *Wanted* QRO audio pa equipment. G4ADN, QTHR. Tel Bolton 55051.

FT200 Yaesu tx/rx, FP200 speaker, psu, mint condition, quite outstanding, £155 ono; Heathkit SB101, SB600 speaker, psu, as new condition, £155 ono, view and test. G3WY, QTHR. Tel Evesham 45497.

HW12A 80m tx/rx, ac psu, fb condition, any sensible offer, only 30h use. GM3SBC, QTHR. Tel 031-336 7288.

Redifon GR286 tx/rx, 156-157MHz, easily converted to 2m, exc condition, some crystals and handbook, £30 ono, Husk, 3 The Crescent, Common Moor, Liskeard.

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Heathkit GR78, 150kHz-30MHz rx, factory aligned, mint, ideal mobile rx, sensible offers please. *Wanted* Radionic electronic kit; Ezee match. Baxter, 251 Harrogate Road, Eccleshill, Bradford, Yorks. Tel 0274 639823.

WANTED

SSB rx adaptor for 455kHz receiver. J. Coles MacGregor, 166 Ellenborough Road, Sidcup, Kent.

Teenage swl would like to work on GB station from 21 Dec to 6 Jan in London or around St Albans/Watford area, willing to work any hours. R. G. A. Tearle, "Pathside", Frithsden Copse, Berkhamsted, Hertfordshire. Tel Berkhamsted 3853 after 6 pm.

Radio books/booklets, old/new, why; *Radcom* 60/70; info on second world war p.o.w. RXs/Stalag Communications; radios 1900-1935: A. A. Coutts, 31 Alloa Rd, Ilford IG3 9SW Essex. Tel 590-5042.

Transistor rx suitable for 2m, as tunable i.f. (28-30MHz) or direct 2m rx. G8FMS, QTHR.

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Indicator unit or case for AR22 rotator. G3JBU, QTHR. Tel 0604-43020.

Information on Phillips 411 intercom, Dynatron type RA30; buy or borrow CR100 manual. M. Green, 12A West Road, Weaverham, Northwich, Ches CW8 3HQ.

Buy or borrow manual, circuit diagram, alignment details, for SX28. D. King, 34 Crawshay Drive, Emmer Green, Reading RG4 8SY. Tel Reading 477048.

Minimitter MR44/II manual, beg, borrow or buy. D. J. Fernie, 78 Broadacres, Guildford, Surrey. Tel Guildford 75627.

Heathkit RA1 receiver with crystal calibrator if possible, also 2m converter for use with the former. J. L. Fryer, 13 Chantry Close, Newark, NG24 4JZ.

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AR88; HW100 or SB101 with pu; 75Ω vhf coaxial relay; 5R4 and 5U4 valves; 1972 Call Book. *For sale* Ozalid photocopier. J. R. R. Baker, Bontenwydd, Cards. Tel Bronant 608.

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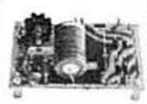

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Journal of the Radio Society of Great Britain

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