The SHORT WAVE Magazine

2/6

VOL. XV DECEMBER, 1957 NUMBER 10

FOR THE RADIO AMATEUR AND AMATEUR RADIO

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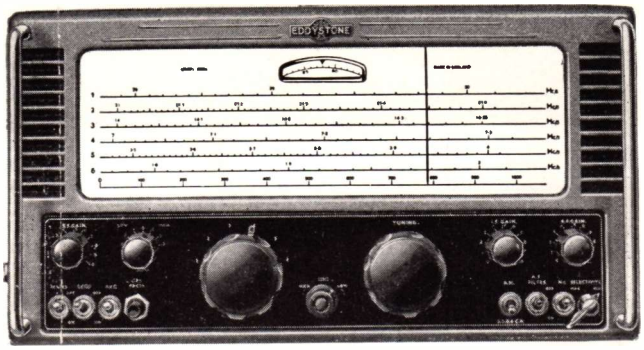

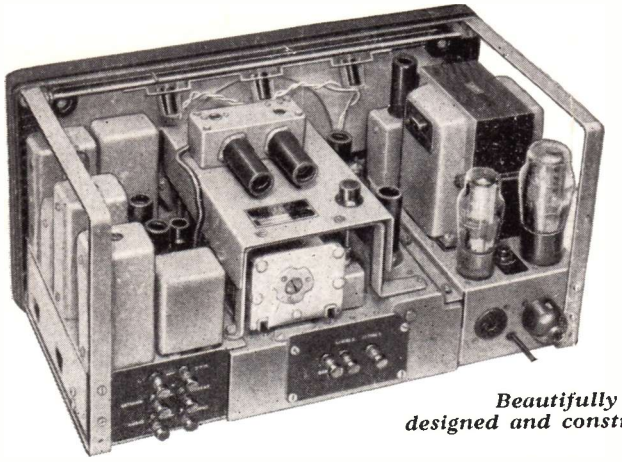

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SELECTIVITY variable from 30 dB to 60 dB down, 5 kc/s off resonance. Audio filter attenuates 32 dB for signal only 250 cycles off resonance.

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SHORT WAVE MAGAZINE

VOL XV DECEMBER, 1957 No. 172

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Managing Editor: AUSTIN FORSYTH, O.B.E. (G6FO)

Advertisement Manager: P. H. FALKNER

Published the Friday following the first Wednesday each month at 55 Victoria Street, London, S.W.1. *Telephone: Abbey 5341/2*

Annual Subscription: Home and Overseas 30s. post paid.

AUTHORS' MSS

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FOR THE RADIO AMATEUR AND AMATEUR RADIO

The SHORT WAVE Magazine

Christmas

It has been truly said that we live in stirring times. Even in our comparatively small world of Amateur Radio, there have been happenings of intense interest during the past year — and even within the last few weeks. The pattern is always changing, though the driving force remains the same.

With the re-opening of the bands, there has been an upsurge of radio amateur activity all over the world. With not less than a quarter of a million individual, privately owned and operated radio stations capable of virtually world-wide communication, Amateur Radio is now potentially one of the greatest international forces for the spread of goodwill and the propagation of peace among all peoples. Would that the forces of Amateur Radio could be mobilised for these ends, for it is in this realm of Amateur Radio that the true spirit of Christmas still lives.

At this season, we are glad once again to have the opportunity of offering our good wishes for their happiness and prosperity and our thanks for their support to all our readers, at home and all over the world. Many will not see these lines until well into the New Year, so to them we also say every good wish for 1958.

From the Managing Editor and Staff of

SHORT WAVE MAGAZINE

Calibrated Audio Oscillator

FOR DOPPLER SHIFT MEASUREMENT AND AF TEST WORK

G. C. FOX, A.M.I.E.E. (G3AEX)

Apart from the application of this instrument for audio shift measurement in connection with ranging a satellite by Doppler observation, it will be found a very useful piece of equipment for general AF work on the bench. Like the GDO, the real value of an audio oscillator cannot be fully appreciated until it has been built, calibrated and put into operation. The author suggests several methods of calibration within amateur scope, including the use, in the instrument itself, of a standard potentiometer which enables his own calibration to be transferred, with a reasonable degree of accuracy, to any instrument built to the specification given here.—Editor.

THE present activities in connection with the International Geophysical Year have shown the need for a simple yet reliable, accurately calibrated, audio frequency generator for the purpose of measuring the small frequency differences involved in calculating the range of a space satellite by the Doppler shift method.

A suitable design is presented in the following article. While primarily intended for the purpose mentioned it can, of course, also be used for setting up modulators and other audio equipment; furthermore, in conjunction with a 100 kc crystal oscillator and multivibrator, and the station receiver, carrier frequencies can be very accurately measured by the interpolation method.

Circuitry

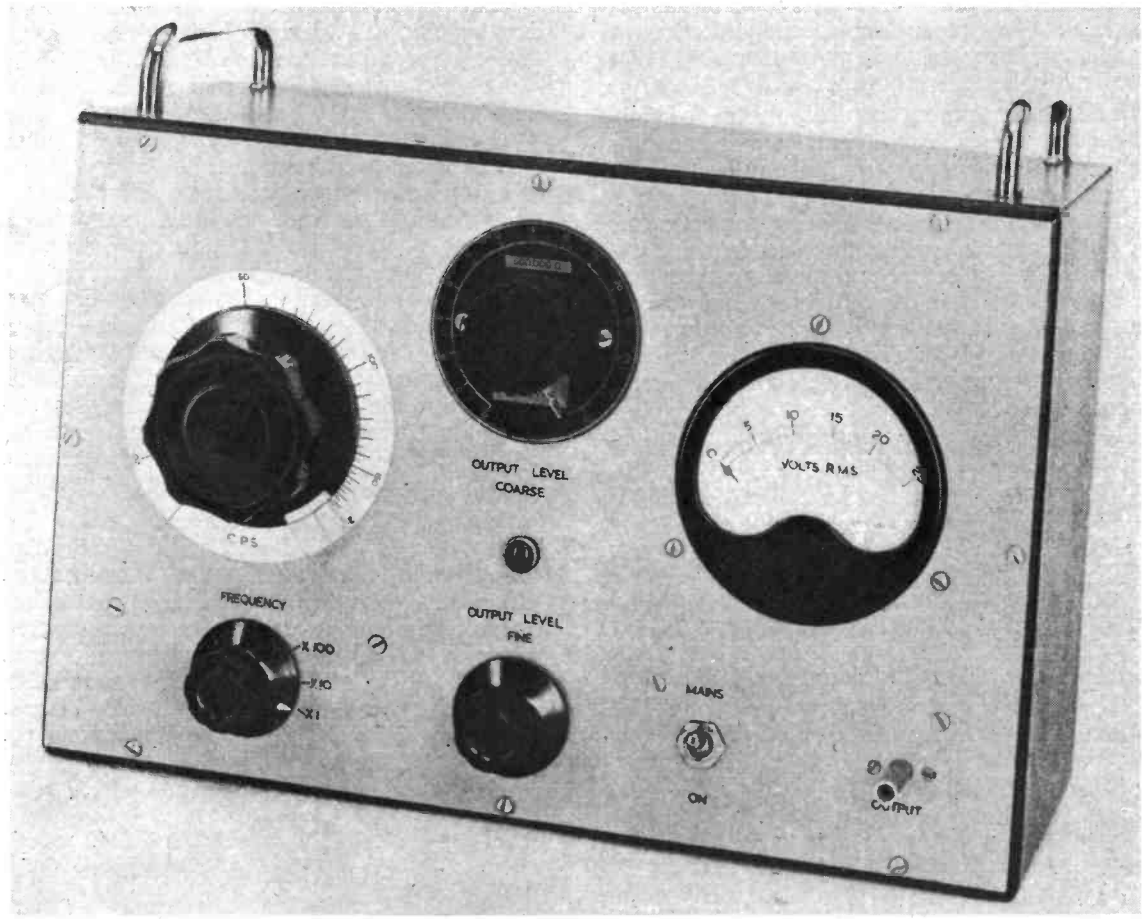
The classical approach to audio frequency generation is by having a beat-frequency oscillator, comprising two RF oscillators whose outputs are mixed, the resulting beat frequency being selected, filtered and amplified. This method is too complex and expensive for the amateur, and here the alternative method of using a resistance-capacitance tuned oscillator is adopted. Basically, the circuit consists of a two-stage audio amplifier, the output of which is fed back to the input *via* a frequency-selective network providing positive feedback of correct amplitude and phase, so that the circuit oscillates at a frequency determined by the constants of the frequency selective network, which is a variant of the well-known Wien bridge. In addition, negative feedback is applied to the circuit by means of a temperature-sensitive resistor or thermistor, which maintains the output level constant over the frequency range of the oscillator and also ensures that the output waveform is sinusoidal.

In order to isolate the oscillator from the load circuit, and also, incidentally, to avoid the necessity for an expensive output transformer, a cathode follower output stage is used having an output impedance of the order of 500 ohms. Either variable resistance or variable capacity may be employed for the frequency-determining circuit, but variable resistance offers advantages in compactness and ease of shielding and was therefore adopted for this design.

The output frequency is continuously variable from 20 to 20,000 cycles in three switched decade ranges and a coarse and fine output control permits the output to be varied from zero to 25 volts RMS. A rectifier voltmeter connected across the output monitors the output level. The general appearance of the instrument is shown in the photographs, and the circuit with component values is given in the diagram, Fig. 1.

Layout and Construction

The instrument is built on a conventional chassis and panel of 18 SWG duralumin and housed in a sheet steel case approximately 14 in. x 9 in. x 5 in. deep. The inside dimensions of the chassis are 12½ in. x 4¾ in. x 2⅜ in. deep. Only the rear edge of the chassis is bent to the full depth of 2⅜ in., the front edge having a depth of ¾ in. only, sufficient to take the 4 BA



Panel layout of the Audio Oscillator. If the specified potentiometer is used, with the scale shown at Fig. 2., the accuracy of the calibration can be checked by reference to standard-frequency signals ; both MSF and WWV radiate audio tones as part of their standard frequency programme. An instrument of the sort described here has many useful applications apart from measuring Doppler shift (for satellite tracking). The output meter has a home-constructed scale, calibrated as explained in the text.

countersunk screws holding it to the panel. However, the layout is not very critical and any suitable chassis and cabinet can be used.

The only components not normally available from amateur sources are the two-gang wire-wound potentiometer RV1a - 1b and the thermistor, TH1. A value of 80K + 80K is specified for the potentiometer, of inverse semi-log law, which produces a logarithmic frequency scale having constant reading and resetting accuracy at all frequencies. The potentiometer is of 15-watt rating, this large size having been chosen because it gives better angular discrimination and tracking of the two ganged sections ; if purchased to specification it will cost in the region of £2-£3. For the sake of producing a good instrument, the cost is worth it.

The manufacturers of the specified potentiometer are Reliance Manufacturing Co. (Southwark), Ltd., Sutherland Road, Highams Hill, London, E.17.

It is, however, possible to use one of the 50K + 50K units available on the "surplus" market for a few shillings—but the calibration will be affected and the constancy of output with frequency will be lost at the high frequency end of the scale. The thermistor is readily obtainable from Standard Telephones and Cables, Ltd., at Footscray, Kent.

The condensers used in the Wien bridge network (C1 to C6) should be of good quality and they should also be accurately matched in pairs on a capacity bridge, if possible. It is convenient to select lower values than those stated and to build them out to the correct capacity

by means of low value mica condensers in parallel. To obtain true decade switching, a maximum error of not more than 1%, and preferably less, is required.

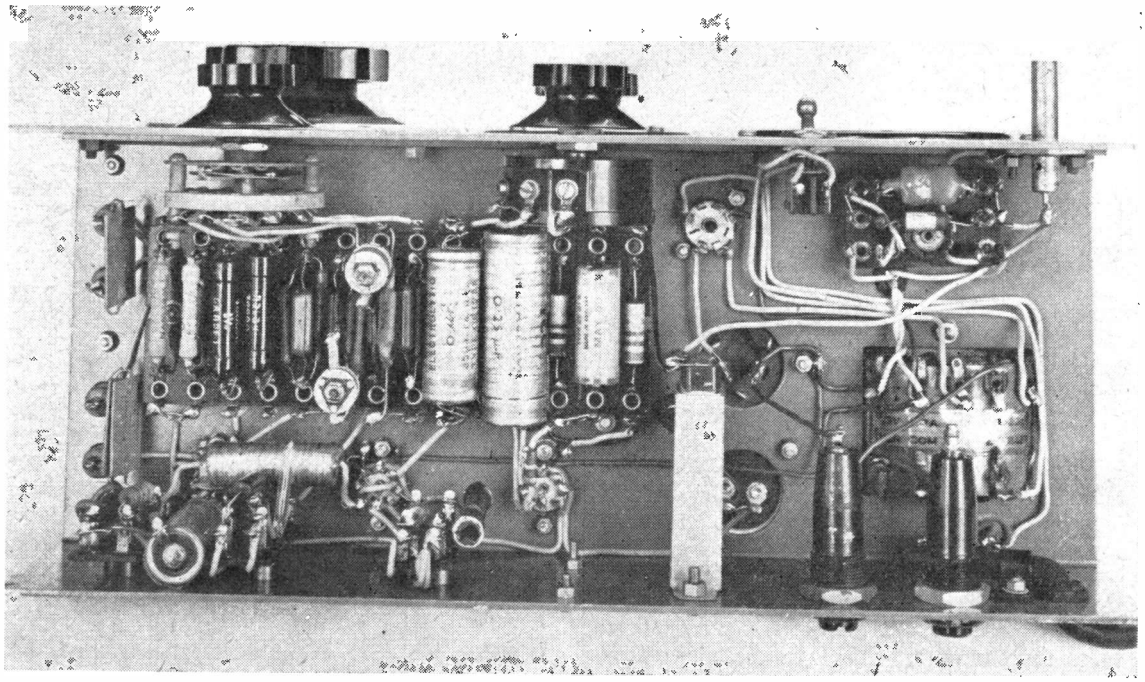
The coarse output control on the original oscillator was of a type usually employed for faders on commercial broadcasting equipment, which accounts for its large size, but the standard type of 500,000-ohm linear potentiometer is quite suitable and is specified in the components list. The output metering circuit is useful when making quantative measurements on amplifiers in conjunction with an attenuator but may be omitted if desired without unduly detracting from the usefulness of the instrument.

Most of the smaller components are mounted on tag-boards on the underside and rear edge of the chassis, as shown in the underside view. This gives an orderly and neat appearance and assists in servicing. The power unit components are mounted away from the bridge network and if the original layout is not adhered to it is desirable that these two parts of the circuit be kept as far away from each other as possible to avoid hum pick-up.

The scale plate for the frequency control of the oscillator consists of a disc of white ivorine 4 inches in diameter fixed to the panel by two countersunk 6BA screws beneath the control knob. The calibration points and figures are drawn in Indian ink with the aid of a set of Uno stencils, but other methods can be used with equal success. The 3 in. skirted knob has a slot cut in the skirt to take the cursor (made of 1/16th in. thick perspex) and is screwed to the underside of the knob by 6BA countersunk screws. A type of output connector known as a Musa plug and socket was used for the output in the original model, but a conventional 2-point jack or two insulated terminals are preferable for general use. Like most amateurs, the author prefers to ferret round for what is available in the junk box and the somewhat unorthodox components used in some instances on the original model came from this source.

Voltage Check

Having built the oscillator and checked the wiring, power can be applied and the valve socket voltages checked prior to calibration. A table of voltages to be expected at various points is given herewith. These were measured with a 2000 ohms/volt meter and will vary slightly with different instruments and also due to component tolerances—but they should not be in violent disagreement with those given.



Neat layout under-chassis of the Audio Oscillator constructed by G3AEX, as described. Tag boards are used for grouping resistors and condensers; the decade (range-multiplier) switch is top left, and the fine-control potentiometer RV3 at the centre of the panel drop. As explained in the text, the condensers around the bridge network must be of the close-tolerance type if true decade switching is to be achieved.

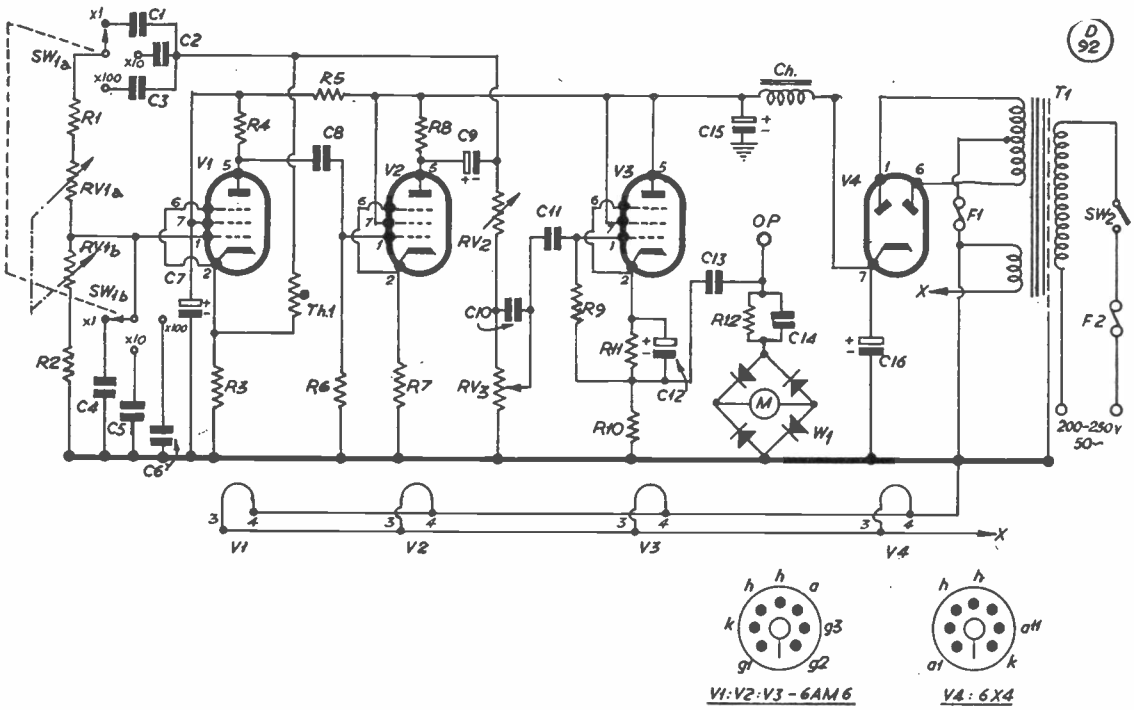


Fig. 1. Circuit of the Audio Oscillator designed and described by G3AEX. By using the specified potentiometer for RV1A-RV1B, the scale calibration given at Fig. 2 could be put on with a reasonable degree of certainty that the output frequencies would be near-enough as marked; alternatively, any suitable linear twin-gang potentiometer can be substituted, in which case the instrument will have to be independently calibrated.

Table of Values

Fig. 1. Circuit of the Audio Oscillator designed by G3AEX

C1, C4 = .1 μF ±1% 250v. wkg. paper
C2, C5 = .01 μF ±1% 350v. wkg. mica
C3, C6 = .001 μF ±1% 350v. wkg. mica
C7 = 4 μF 350v. wkg. electrolytic
C8 = 0.1 μF 350v. wkg. paper
C9 = 8 μF 350v. wkg. electrolytic
C10 = 30 μμF ±10% mica
C11 = 0.25 μF ±20% 350v. wkg. paper
C12 = 25 μF 12v. wkg. electrolytic
C13 = 1 μF 250v. wkg. paper
C14 = 300 μμF ±10% mica
C15 = 32 μF 350v. wkg. electrolytic
C16 = 8 μF 450v. wkg. electrolytic
R1, R2 = 7,500 ohms ±1% ½ watt high stability
R3 = 6,800 ohms ±10% ½ watt
R4 = 100,000 ohms ±10% ½ watt
R5 = 50,000 ohms ±20% ½ watt
R6 = 1 megohm ±10% ½ watt
R7 = 270 ohms ±10% ½ watt
R8 = 10,000 ohms ±10% 1 watt
R9 = 470,000 ohms ±10% ½ watt
R10 = 8,200 ohms ±10% ½ watt
R11 = 150 ohms ±10% ½ watt
R12 = 45,000 ohms nominal value (*see text*)

RV1a-b 80,000 + 80,000 ohm inverse semi-log, wire-wound dual-gang, 15 watts per section Reliance Type P.I.W. (*see text*)
RV2 50,000 ohm linear, carbon 2-watt (Reliance Manufacturing Co.)
RV3 500,000 ohm linear, carbon 2-watt (Reliance Manufacturing Co.)

SW1a-b two-pole 3-way wafer (N.S.F. type H)
SW2 SPST toggle, 250v. 2A.

F1 150mA
F2 1A

T1 = 235-0-235V 50 mA DC, 6.3 volts 1.5 amps, primary 205-225-245 volts 50 cycles, with electrostatic screen.

Ch = 10 Henry 50mA DC
V1, V2, V3 6AM6, Brimar
V4 6X4, Brimar
M1 500 μA FSD, m/c.
W1 1mA meter rectifier, Westinghouse
TH1 Thermistor, type A5513/100, S.T.C.

TABLE OF VOLTAGE READINGS

Valve	Vk	Vg₂	Va
V1 6AM6	3.0	220	170
V2 6AM6	3.0	265	175
V3 6AM6	110	265	265

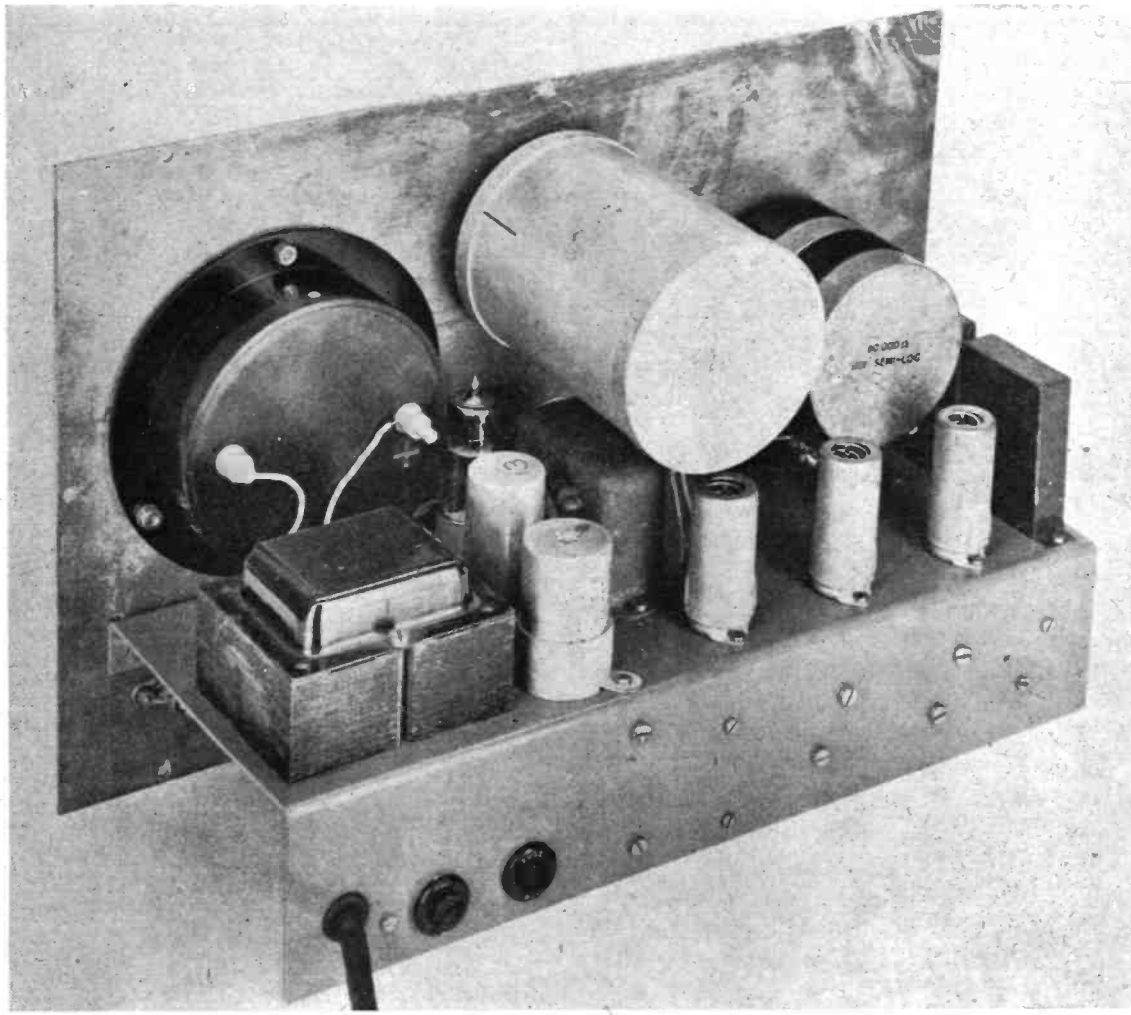
Calibration

The output meter is calibrated at 50 cycles by comparison with a suitable AC voltmeter. The rectifier series resistor R12 is adjusted by shunting a 47,000-ohm resistor with a second resistor of 470,000 ohms or so till the meter reads 25 volts RMS at full scale deflection. The calibration will be found to hold reasonably well up to 20 kc, but the condenser C14 was found necessary to correct a slight droop in the meter circuit frequency

characteristic at the high frequency end of Range 3. Similarly, C10 across the slider and high potential end of RV3 provides a measure of compensation for loss of high frequencies due to wiring strays and the input capacity of V3. The value of C10 selected is a compromise only, since a different value is required for each setting of RV3.

The calibration of the frequency dial is relatively simple if the constructor has access to an accurate audio frequency source and a cathode ray oscilloscope, when the standard and oscillator frequencies can be compared by means of Lissajou's figures. Alternatively, the standard frequency transmissions from MSF at Rugby on 2·5 mc and 5·0 mc are modulated with an accurate 1000 cycle tone which may be used as a reference frequency. WWV also radiates 440 and 600 cycle tones, and is a strong signal on 15 and 20 mc. In addition, the 50-cycle mains can be taken as a frequency standard for calibration of points up to 500 cycles with little error, as the mains frequency is quite constant during the hours which most people are likely to be using it as a frequency standard.

Another method of frequency comparison is to apply known and unknown frequencies to an audio amplifier and listen to the beats resulting in the output on a loudspeaker or pair



Layout of the Audio Oscillator behind the panel; this is not at all critical, and can be dictated by the parts used and the chassis assembly available. The canned items on the panel beside the meter are the control potentiometers, that on the far right being RV1A-RV1B (see circuit diagram); it is this potentiometer that determines the output frequency and the calibration accuracy of the instrument.

of headphones. The ear is usually sufficiently non-linear for beats to appear without any deliberate non-linearity being introduced into the amplifier, but the beats can be accentuated by passing both frequencies through a germanium diode or valve diode before applying them to the amplifier.

Fig. 2 shows the appearance of the scale on the original model and is drawn *half-size*. Assuming that the specified Reliance potentiometer is used for RV1a-1b, this scale could be traced off and transferred to the instrument; it would be fairly satisfactory if no other method of calibration is available.

The slight irregularities in the spacing of the points around the "90" calibration are due to the method of winding the potentiometer elements in discrete sections, and cannot be avoided unless a much more expensive construction is employed.

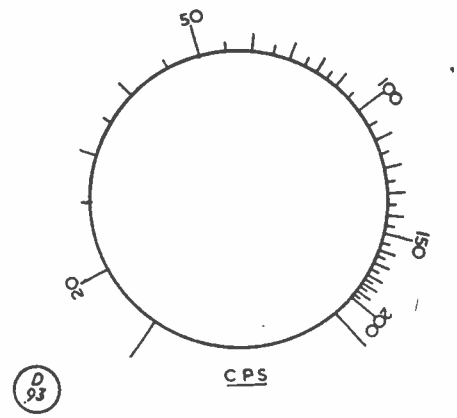


Fig. 2. Actual calibration (half-size scale) obtained by G3AEX on his Audio Oscillator as described in the article. If the specified potentiometer is used for RV1A-RV1B, this calibration can be taken as accurate within reasonable limits.

IMPROVING BAND-SPREAD ON THE R.107

SIMPLE MECHANICAL MODIFICATION

A. D. Taylor (G8PG)

WHEN properly lined up the R.107 is an excellent receiver, but its main failing is the rather poor dial scale and the lack of any kind of bandspread. While it would be possible to fit a better type of dial, this would be expensive and also difficult from a mechanical point of view. The most obvious choice, the HRO dial mechanism, is unsuitable, as it is designed to control a condenser assembly mounted at right-angles to the front panel. The only other suitable types of dial available in this country are so expensive that in most cases they would cost as much as the receiver itself!

When considering this problem, the writer hit on a solution which costs but a few pence and yet provides about 7 feet of logging scale. At the same time, only a very small external modification to the receiver is involved.

The scheme is to drill and tap a hole in the centre of the existing slow-motion tuning knob, then bolt a small bandspread dial directly on to this knob. The dial required must be slightly under 1½ inches in diameter (just smaller than the tuning knob) and should be scaled 1-60, or as desired, throughout the 360 degrees of its circumference. Such dials are not easy to come by, but a simple substitute can be contrived.

This additional scale provides 60 degrees of logging scale for each rotation of the slow-motion tuning knob, and as it takes some 44 rotations of this knob to move the tuning condenser through 180 degrees on the writer's R.107, some 2,600 "degrees of bandspread" are made available. In practice, the logging scale is used in conjunction with the 0-180 scale at the top of the existing dial to provide four-figure reference numbers for re-setting purposes. Due to the slight backlash on the main slow-motion drive, it was not felt worth while to fit a cursor, but, even without one, re-setting is quite accurate and the "feel" of the receiver is enormously improved—there is no doubt at all that some numbers on a previously blank knob have a very real psychological effect in this respect!

Apart from the simplicity of this modification, it should appeal very much to the man wishing to maintain the re-sale value of his R.107 by avoiding internal modifications. It might even be possible to stick the additional dial on with a suitable cement if no drilling and tapping tools are available, but this has not been tried in the writer's case.

BOOKS FOR CHRISTMAS

Of all the good things one can buy, and useful presents one can give, books are by far the best—particularly if they are well chosen. For a radio amateur, there is no difficulty about that; the titles listed in our advertisement in this issue cover the whole field. Almost obvious choices for those who may not have them are the ARRL *Handbook* and/or the *Radio Amateur Call Book*. These are the latest issues, available immediately from stock, and are essential for those with any active interest in Amateur Radio.

TV LICENCES STEADILY INCREASING

During September the number of combined Sound-TV licences throughout Britain increased by 66,978, bringing the total to 7,398,185. Sound only licences total 7,269,256, including 324,078 for sets fitted in cars. There are now 128.929 more combined licences than those issued for Sound only.

Radio Hobbies Exhibition

ROYAL HORTICULTURAL (OLD) HALL OCTOBER 23-26, 1957

AS most readers will already know, this year what used to be the Amateur Radio exhibition—not held since November, 1955—was transferred, under new management, to larger and more convenient accommodation. Furthermore, a determined attempt was made to attract the radio-interested public, with the result that 7,057 people paid for admission and all the catalogues printed for the Exhibition were sold.

This result, highly gratifying to the exhibitors (who, of course, pay for stand space and advertising) reflects great credit on P. A. Thorogood, G4KD, who was entirely responsible for the organisation and management of the Exhibition. What is still essentially an Amateur Radio show has been successfully removed from the atmosphere and proceedings of a convention, or gathering of the initiated.

Indeed, the hard-boiled, dyed-in-the-wool, ever-so-experienced and rather-critical-of-all-this-commercial-gear type—to whom nobody can ever sell anything, either because he knows it all, or has got everything—was very much in the minority at this year's Exhibition. For him, the convention atmosphere was certainly lacking, and since he also has an important part to play in the general pattern of Amateur Radio and is entitled to consideration, we should see to it that a convention programme is laid on in parallel with future Exhibitions.

Review of Exhibits

This is not a stand-by-stand survey, so much as a short discussion on some of the more interesting equipment on view. Indeed, a dozen or so of those items mentioned here would be worthy of a detailed technical article of several pages; but all we can do now is to draw the attention of readers to them, so that they will know where to get further information on apparatus of particular interest.

K.W. Electronics: The partnership of G5KW/G8KW—experienced both as operators and radio engineers—has produced the KW-50, a table-top transmitter of modern design, available as a kit of parts at a competitive price. This proposition should be investigated by all interested in the construction of a good transmitter from standard parts, to clear instructions. They also showed a GDO unit, VHF converters made up ready for operation, and a range of the well-known Geloso equipment.

Philpotts Metalworks: G4BI has been a regular exhibitor at all Amateur Radio exhibitions, and over the years has built up a sound reputation—in both commercial and amateur circles—for metal cabinet work and chassis elements of a high standard of design and finish. A very comprehensive range was shown, including the Philpotts enclosed rack assembly, designed for safety in view of the high voltages now often used in amateur-band transmitters.

Cossor Instruments: With the emphasis on kits (which cut out the high cost of labour for assembly and testing) the Cossor Valve VM/Ohmmeter and single- and double-beam Oscilloscopes are very attractive items for those wanting to build up really good test gear. These Cossor kits are complete to the last detail (including cable-forms and fastenings), embody the latest circuit techniques, and are beautifully put up; in particular, the instruction manual provided is clear, comprehensive and fully illustrated — it even includes check lists for the various sections of the assembly. The manual for the 4-inch single-beam CRO runs to more than 50 pages.

Labgear Ltd.: Many readers of SHORT WAVE MAGAZINE are already familiar with the Labgear LG.300, a modern band-switching transmitter capable of full-power operation on all bands from 80 to 10 metres; it is obtainable either separately, or with a matching power unit and modulator, making a neat and complete two-cabinet floor or table-top transmitter assembly. In the kit-of-parts field, Labgear now offer an oscilloscope, signal generator, multimeter and an AF power meter; under the heading of attractive items come their wide-band multiplier—the "tuning heart" of the LG.300—a 5-way coax switching unit, PA coil and turret assemblies, and an SWR meter. Labgear equipment includes Bi-Square beams for the 28 and 70 mc bands, with a useful range of high- and low-pass filters, aimed at the TVI problem.

Home Radio, Mitcham: This well-known agency is now doing a large business, home and overseas, with Eddystone and Panda equipment. Outstanding in the range of receivers they handle is the Eddystone 888, which has been reviewed in SHORT WAVE MAGAZINE and, on the transmitting side, the new Panda "Explorer," incorporating NBFM and running a pair of 6146's in the PA. Prominent among moderately-priced, lower powered transmitters is the Panda "Cub," which gives coverage of all amateur ranges from Top Band to 10 metres. Home Radio also handle a wide range of proprietary components, including Bulgin, Denco and Osmor, and the Jason home-constructor FM kits.

Measuring instruments of many types—including multi-range test sets, signal generators and oscilloscopes—were shown by *Pullin Ltd.* and *Taylor Electrical Instruments.* An interesting Pullin product is their Series 90 miniature test set, giving 19 AC/DC ranges from 200 μA to 1,000 volts, while Taylor have a 4-in. CRO with a time-base running from 2 c/s to 100 kc.

Minimitter Company: This was one of the most interesting of the stands, for on it were shown a new all-amateur-band transmitter, the "Mercury," and a matching communication receiver of advanced design, Minimitter's latest introduction to the market. These are handsome, well-engineered instruments, competitively priced, and together form a complete, harmonising station. These Minimitter products are well worth the close attention of those who wish to acquire modern amateur-band equipment, ready to go, with all the bugs eliminated. Another interesting item in the Minimitter range is their amateur-band converter, designed to operate as the front-end of (almost) any ordinary domestic BC receiver, which becomes the IF/AF amplifier for the converter—a logical arrangement, if ever there was one. Their new Multi-Q Unit is a unique add-on device which, with any existing receiver, gives controllable selectivity, BFO action and SSB reception; it is, in fact, the quick answer to the problem of SSB operation on the receiving side.

The valve and cathode-ray tube manufacturers were represented by *Mullard Ltd.*, with a big display which included some of their very nice transmitting types, and *Standard Telephones*, showing their new 90° electrostatic-focussing TV picture tubes (C17SM and C21SM) and the tuner valves ECC84 and ECF82; in addition to the wide range of Brimar types shown, the S.T.C. stand also displayed some interesting amateur-band equipment constructed round Brimar valves.

Education for the radionics industry is the particular activity and interest of *E.M.I. Institutes*, who offer comprehensive home-study courses; these are both theoretical and practical, in that the student is supplied with equipment for the construction of radio apparatus. These courses, with which E.M.I. Institutes have now had years of experience, have been the means of starting many a beginner on a career in radio.

Supporting Exhibitors

Other firms, groups or organisations represented by stands and displays were: The Radio Society of Great Britain, with a large stand; the R.A.F. Amateur Radio Society and the R.A.F. Amateur Television Society, on the Royal Air Force stand; the British Amateur Television Club, who staged a most impressive ATV demonstration; Whiteley Electrical, with speakers, output and mains transformers, and audio amplifiers; Enthoven Solders, with a demonstration and display of their "Superspeed" iron; Clyne Radio, showing AM/FM tuner kits and a selection of gear in the "surplus" category; the London UHF Group, operating a two-metre station and having on their stand some very well-designed and constructed UHF apparatus; Jason Electronic, specialising in FM receiver kits; our respected contemporaries, *Wireless World* and the *Electronic and Radio Engineer* (until lately the *Wireless Engineer*), the *RSGB Bulletin* and the *Radio Constructor* (Data Publications, Ltd.); the Admiralty, showing some Naval communications equipment; Pye, Ltd., with their industrial TV equipment; and British Callender with a pictorial display.

Competition Winners

The Constructor Competition, for the best piece of home-built apparatus, was won by S. A. Denney, G3CIM (Romford) for his Top Band mobile equipment—which will be described in an early issue of SHORT WAVE MAGAZINE.

For J. Smith, G2DUG (Cheltenham), the prize-draw produced the Eddystone 840A Communications Receiver. Readers will remember that entry cards for this draw were widely circulated; it was a condition of entry that these cards should be given up *through the turnstile* and, quite properly, they were not acceptable by the Exhibition management under any other conditions. However, this did not prevent a number of keen gamblers attempting to get their cards into the drum without attending the Exhibition!

At the SHORT WAVE MAGAZINE stand, we were happy to welcome a large number of readers, and the total of "personal interviews" ran into many hundreds. Certainly, there were more names in our visitors' book than for any previous Amateur Radio exhibition.

INTERNATIONAL AERADIO

It is announced that with effect from January 1st next Gp./Capt. G. R. Scott-Farnie will become managing director of International Aeradio, Ltd., which has world-wide commitments and responsibilities in the field of aviation telecommunications. Previously general manager of the undertaking, he is regularly active on the DX bands as G5FI, and a description of his station appeared in SHORT WAVE MAGAZINE for June 1956. We are sure readers will join us in congratulating G5FI on his appointment to one of the most important positions in the aviation industry. We would also hazard a guess that one of the reasons for the commercial success of I.A.R.L. is that so many of its employees are licensed radio amateurs.

SUBSCRIBER POSTAL SURCHARGE

As announced in the November issue of SHORT WAVE MAGAZINE, we have been compelled to surcharge direct subscribers 3s. with effect from January 1st to meet the heavy increase in postage charges, which actually came into force on October 1st. Between now and January 1st, however, all new direct subscribers, and subscription renewals, will be accepted at the present rate of 30s. for a year of twelve issues.

AMATEUR RADIO ON BBC TELEVISION

On December 9, shortly after publication of this issue, the BBC will be doing a TV feature of which the central theme will be Amateur Radio, with G3KEP (Bingley, Yorks.) as the main character. He will be shown operating a station, for which equipment is being generously lent by various manufacturers of amateur-band equipment. The programme is being planned in conjunction with Mr. G. R. Garratt, G5CS, of the Science Museum, and is intended to be of interest mainly to the younger generation.

Three-Band Cubical Quad

FOR 10, 15 AND 20 METRES

J. S. McCAIG (GM3BQA) *and* C. W. DAVIDSON, B.Sc. (GM3LAV)

The Cubical Quad has become well-established as a DX-worthy design for a directional beam array. As this article shows, a three-band system is quite practicable and has the important advantage of requiring only 20 ft. of ground width—it can therefore be installed in all but the most restricted of amateur locations. The particular design described here is obtainable as a kit manufactured under patents. This does not, however, prevent the GM3BQA version being copied by any individual provided it is only for his own personal use.—Editor.

BASICALLY, the "Cubical Quad" aerial consists of a driven element and reflector. Each element is in the form of a square loop with sides of length one quarter-wave. The current distribution is indicated in Fig. 1.

Radiation from the vertical sections of the loops will be negligible due to the current reversal which takes place in these sections. The radiation from the system is therefore essentially horizontally polarised.

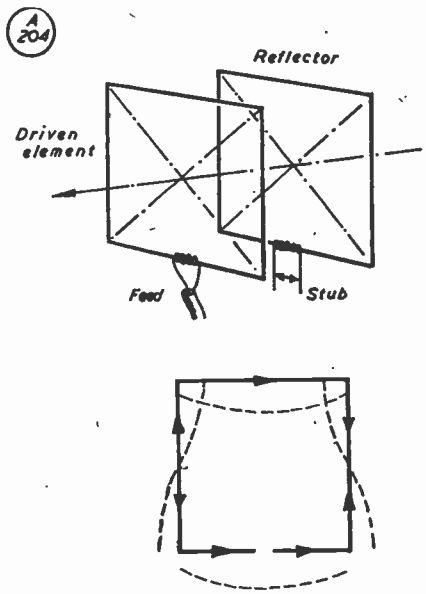


Fig. 1. Layout of the Cubical Quad, and the current distribution in the elements — see text for discussion.

Radiation Pattern

Polar diagrams can easily be calculated from the current distribution. For the driven element alone the horizontal polar diagram will be similar to that for a dipole, while the vertical polar diagram is an ellipse (Fig. 2). The radiation pattern for the complete aerial system is most easily obtained by comparison with the pattern for a two-element beam. The Quad can be considered as two two-element beams stacked one quarter-wavelength apart. The horizontal polar diagram is therefore similar to that for a two-element beam. The vertical polar diagram, on the other hand, will show increased radiation at low angles compared with the simple two-element beam.

Feed Point Impedance

The radiation resistance for the driven element alone is approximately 100 ohms and, as in the case of a dipole, resonance occurs for dimensions about 3% less than the theoretical value. This will, of course, depend upon the diameter of the conductor used. The impedance can be increased by a factor of 4 by using two turns for the driven element; this also tends to increase the bandwidth.

The addition of a reflector reduces the radiation resistance, and for a spacing of 0·18 wavelength it is around 80 ohms; it can therefore be connected directly to 72-ohm coaxial cable. The radiation resistance falls rapidly as the spacing is reduced (*cf.* a two-element parasitic beam) and at 0·1 wavelength spacing 52-ohm cable would provide a better match. The

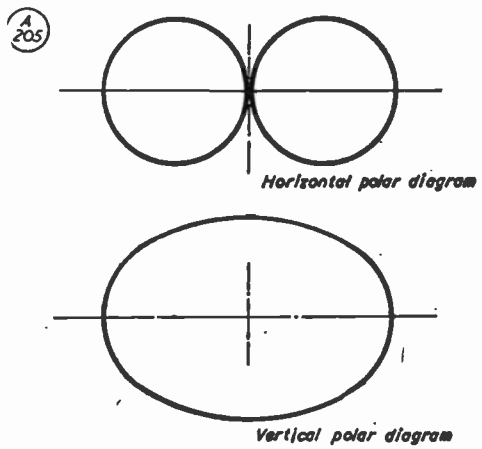


Fig. 2. Polar diagrams for the driven element alone of the Cubical Quad (in free space).

aerial described in this article is fed directly with coaxial cable, and although this is not strictly correct due to the balanced nature of the Quad, it will be found in practice that this is perfectly satisfactory. A balun, or matching transformer, could, of course, easily be added.

Reflector Tuning

The reflector can be made physically larger than the driven element, but this is not convenient since tuning of the reflector is difficult. Alternatively, a short-circuited stub can be added at the centre of one of the horizontal sections of the reflector. (Ideally, stubs should be inserted in both horizontal sections to maintain symmetry, but in practice this appears to have little effect.) The stub provides a convenient method of tuning the reflector to obtain maximum front-to-back ratio or forward gain, as required. It is only necessary to slide a short circuit along the stub to obtain the required result. It should be mentioned here that since the stub must produce a given impedance at its *open* end, the length of stub required will depend on the impedance of the line used.

The stub length could be reduced if, in addition, the reflector was made physically larger than the driven element, but this is an unnecessary complication as the stub will not reduce the efficiency of the system to any noticeable extent.

In practice, it is found that the forward gain varies only slowly with spacing, reaching a maximum at about 0·18 wavelength. However, for any given spacing the front-to-back ratio can be accurately adjusted by means of the stub.

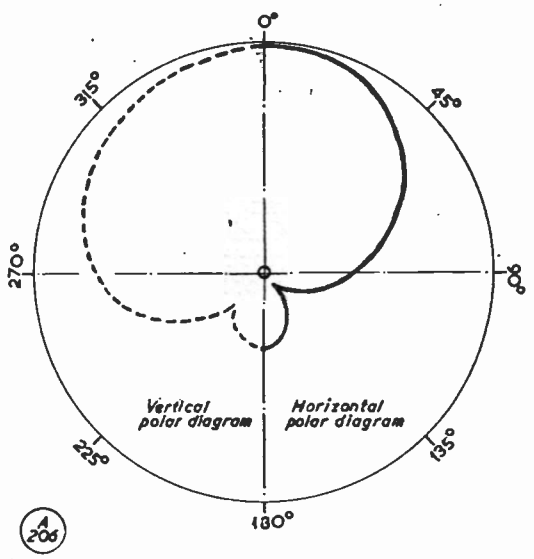
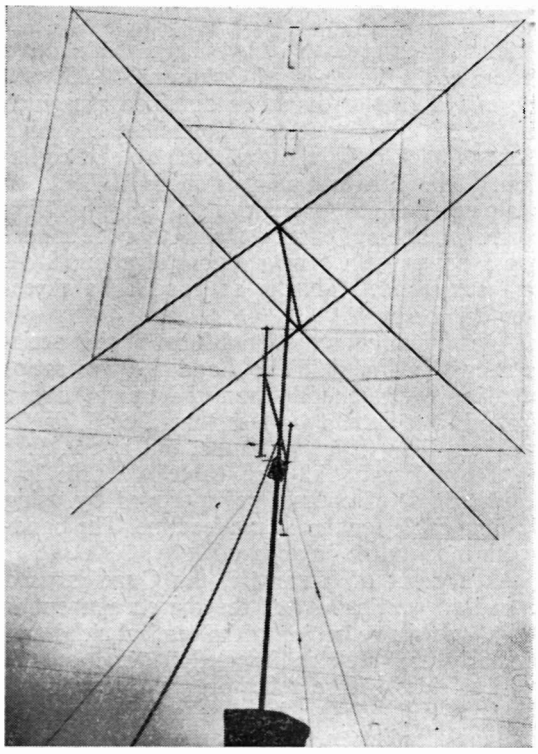


Fig. 3. Polar diagrams obtained on a model of the Cubical Quad for 300-450-600 mc. Only half of each diagram is shown, as they are all symmetrical about the main axis. A full-scale assembly should produce similar patterns.



Impression of the home-constructed three-band Cubical Quad as described in his article by GM3BQA. Dimensions are such that there is minimum reaction between sections (band-to-band) and, in fact, the system could be fed by a single RF line, with all driven elements in parallel; the section in use would then be selected merely by changing the transmitter output frequency. Any well-constructed Cubical Quad exhibits a good front-to-back ratio, with a forward gain equivalent to about 2 S-points over a dipole. Dimensions given (in Fig. 4) are for the 14-21-28 mc amateur bands.

The Three-Band Quad

Use can be made of the relatively small change in gain with spacing. It is possible to mount three Quads for 14-21-28 mc on a common boom using a spacing of 0·18 wavelength at 21 mc. The spacing on Ten is then 0·24 wavelength, which is perfectly satisfactory. On 14 mc the spacing becomes 0·12 wavelength and the impedance will be lower, but this is not important. If the current distribution for the unused elements is drawn for the three bands it will be found that they are not resonant, and so interaction should be negligible. It is probably best to feed each aerial separately, although the system should also operate if all the driven elements are connected in parallel, with a common feed line. *(over*

Experimental Measurements

Some measurements have been made on a model of the Three-Band Quad on 300-450-600 mc and the polar diagrams obtained are given in Fig 3. The important points are the high front-to-back ratio and the low angle of radiation. The forward gain is more difficult to evaluate due to the problem of providing correct matching, but it appears that the model has a power gain over a dipole of about 8 dB on each band. This is as good as a three-element beam.

A practical constructional form of this aerial is shown in Fig. 4. The standing-wave ratios obtained will depend upon the height above ground, but should be less than 1·5: 1 on 21 mc, less than 2: 1 on 28 mc and about 3: 1 on 14 mc (using 72-ohm cable). This last result could, of course, be improved by using 52-ohm cable for the 14 mc feedline. The bandwidth is adequate on all bands.

As a point of interest, if the Quad is used to radiate vertically, *i.e.*, the driven element is fed at the centre of one of its vertical sides and similarly the stub is inserted in one of the vertical sides of the reflector, then ground reflections will help to increase still further the low-angle radiation. This can give a considerable improvement if the aerial is close to the ground, although unfortunately it may also lead to swamp effects in nearby TV receivers.

Construction and Adjustment

The construction of the aerial is illustrated in Fig. 4, which gives all the dimensions for the 14-21-28 mc bands. The bamboo canes used to support the elements are bound to alloy castings (or welded angle-iron cross pieces). A 1½ in. alloy boom 8 ft. long supports these cross-pieces and a TV-type masthead bracket clamps the boom to a suitable mast. An additional 1 in. alloy tube is used to support the feeders and stubs, level with the 28 mc insulators, and it is clamped to the mast with a U-bolt and bracket.

The whole assembly should weigh around 30 lb. and the turning circle required is less than 20 ft. in diameter.

The aerial can be adjusted on each band by altering the appropriate tuning stub to obtain minimum back radiation or maximum gain, as required.

Conclusions

A lot has been written about various types of rotary beams—some of the information has been arrived at by assumption which looks impressive on paper, though in actual fact a good dipole would probably perform better! The Triple Quad described here has been compared with several other types of beam—including multi-band versions in the same location—and under similar conditions—and in all respects has been found to be superior, its most important advantages being forward gain on all bands and its good front-to-back ratio. Another important point, often overlooked, is less TVI. Furthermore, with the type of feed used it is possible to couple directly to the transmitter output without any intermediate type of tuning unit being necessary.

Results on all bands have been very satisfactory. The low angle of radiation and high forward gain are found to give exceptional signal reports and DX advantage when band conditions are not at their best. There is no doubt that the results obtained are superior to the performance of a three-element parasitic beam, and there is the additional factor that the Quad is easily tuned. Further, the overall width and boom length are less than half the corresponding dimensions for a conventional beam. Due to its small windage, the aerial described has withstood several gales without damage, and in this respect also it seems superior to the normal type of array.

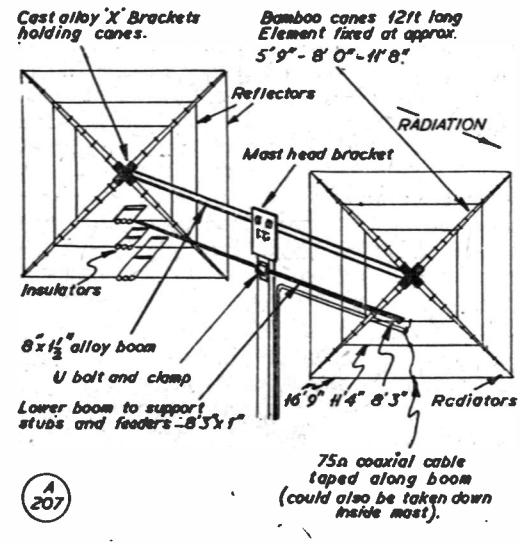


Fig. 4. Full constructional details for the three-band Cubical Quad designed and described by GM3BQA. 14g. wire is used throughout, and the element dimensions given are "each side"; the stub lengths are 25 ins. for 10 metres, 27 ins. for 15 metres, and 54 ins. for 20 metres, and the stubs should be tied back to the boom, out of the way. They can be adjusted to give maximum front-to-back ratio; the gain on each band for the design shown should be about 8 dB.

MORE ON THE SATELLITES

SOME FURTHER OBSERVATIONS AND GENERAL NOTES

HAVING obtained a good deal of practical experience, radio-wise, from the first Russian Satellite—*see* SHORT WAVE MAGAZINE, November, 1957—it was of intense interest to hear that S.II had been launched on November 3, operating on the same frequencies.

However, S.II failed to fulfil its early promise, transmissions from it ceasing after the 8.30 a.m. transit (over the U.K.) on November 9. Quite good signals were heard on 20.005 mc during the first two revolutions on November 3, with a very much better transmission on the 40 mc channel; on this, particularly good results were obtained during 1340-1352 GMT on November 6, and again at 0640-0652 on November 7. In general, however, signals from S.II were a good deal weaker than from S.I; as in the case of the latter, S.II's 40 mc transmissions were stronger than on 20 mc, where the signal was not much above noise level, and subject to severe interference.

Field strength computations made by the Cambridge Radio Observatory suggested a radiated power of 100-200 milliwatts for S.I.; the figure mentioned by Russian sources was one watt RF radiated. Certainly, the S.II signal was very much down on this.

Interference also applied to some extent to S.II on 40 mc because, with the high MUF, all sorts of odd Trans-Atlantic noises broke in on that band—such as sideband splash from American police cars. The Satellite signal was, however, always found when expected, and at good (but by no means paralysing) strength when within range. Comparatively, S.I's 40 mc signal was much better than this, as G3CGQ's curves show.

A very interesting point brought out by the Cambridge observations was that whereas S.I had a useful 2nd harmonic on 80 mc, S.II had none. The importance of this lies in the fact that the higher the frequency, the more pronounced the Faraday rotation effect. The Cambridge team had intended to run observations on S.II to take advantage of this. Since rotation on 40 mc is × 4 that on 20 mc, and × 4 again on 80 mc, comparison between these three channels could produce important information about the ionosphere. For the very first time, the satellites provided radio sources which, literally, went in and out of the ionosphere during periods when the heights of the reflecting layers could be calculated by the normal methods of ionospheric sounding.

Notes on Equipment

Fortunately for SHORT WAVE MAGAZINE record purposes, suitable 40 mc receiving equipment was ready for S.II. G3HMO has an RF-26 Unit (tuning 50-60 mc) modified by putting slugs into the coil formers to lower the frequency to 40 mc. This converter works with a folded dipole made throughout of 300-ohm ribbon, the aerial being in the clear above roof level; the 40th harmonic of a 1 mc bar produces a steady beat at the correct frequency for measuring Doppler shift, when the 1 mc CO is tightly coupled to the receiving aerial.

This set-up, used in conjunction with a tape recorder, gave very good ranging results on S.II, by the method discussed on pp. 459-462 of the November issue. For instance, during the early-morning transit of S.II it was found at heights of about 150 miles, whereas on the afternoon run it had gone out to around 450 miles. Experience has shown that it is infinitely better to tape the event, rather than to try to go quickly through all the necessary motions of taking readings while the signal is passing. The tape can be examined and re-examined at leisure, with a great improvement in accuracy.

The equipment at G6FO—built for the purpose and used only for observing the orbits and checking signal characteristics—consists of a CC converter (RF - mixer - 3rd harmonic CO) which covers 39.5-41.5 mc and has the RF and mixer stages separately tuned, so that they can be peaked up on any signal in this range. (An incidental dividend is that the converter is effective on Channel 1 TV sound, which by itself often has more entertainment value than one might expect !). The 40 mc channel can be accurately located by the 40th harmonic of a 1 mc bar and, again, as at G3HMO, tape recorder is also available. With a separate receiver tuned to the 20 mc channel, both could be monitored or recorded simultaneously. On the two best 40 mc runs heard from S.II, its 20 mc signal was almost inaudible.

Future Possibilities

It is pointed out by G3HMO that there is a good deal more information on the tape than can be extracted merely by making the audio beat frequency measurement. If the presentation could be slowed down sufficiently—say, for the time taken for a single cycle—the frequency at any given moment could be measured to within that degree of accuracy. Experiments are under consideration involving a pen-recorder and a mighty length of paper tape !

Another promising line of investigation is to use—on the 40 mc channel, where the aerial system can be of quite reasonable dimensions—an interferometer array, similar in principle to that in operation at the Cambridge Radio Observatory. For amateur purposes, this could consist essentially of two 40 mc dipoles separated by a finite number of wavelengths, with the electrical centre of the array taken to the receiver. The full details of such a system are outside the immediate scope of this article—but they will be discussed in an early issue of SHORT WAVE MAGAZINE if the method is found feasible in the purely amateur context. (Such a set-up could also be used for simple observations in the field of radio astronomy, the rotation of the earth producing the scan).

Lissajou figures as presented on an oscilloscope have also been examined by G3HMO, for audio frequency matching; this was found to be very

effective when the Satellite signal was really strong, well above the noise, but for weak signals the audio-beat method was better.

For really accurate work in connection with the determination of the orbit, correct timing is essential; exact times from MSF (or WWV) should be put on the tape before and after each run. In thinking of orbit time—or the period of one revolution—it is important to realise that this is not exactly the same as the interval between the nearest approaches on successive revolutions; this is because the time of nearest approach will not occur at the same latitude on each revolution. The interval will, therefore, be slightly more or less than the time taken for one revolution.

An easy way of grasping the complications of the orbit—which is not quite as simple as it seems because of the elliptical path traced by the Satellite and its angle with the equator—is to form a length of stiff wire to the shape of the orbit and put it over a globe at the correct inclination to the equator. By running the satellite, as it were, along the wire as the globe is rotated (both moving at the correct relative speeds and in the right directions) some of the apparent variations of the orbit with respect to a fixed point on the earth's surface can be appreciated.

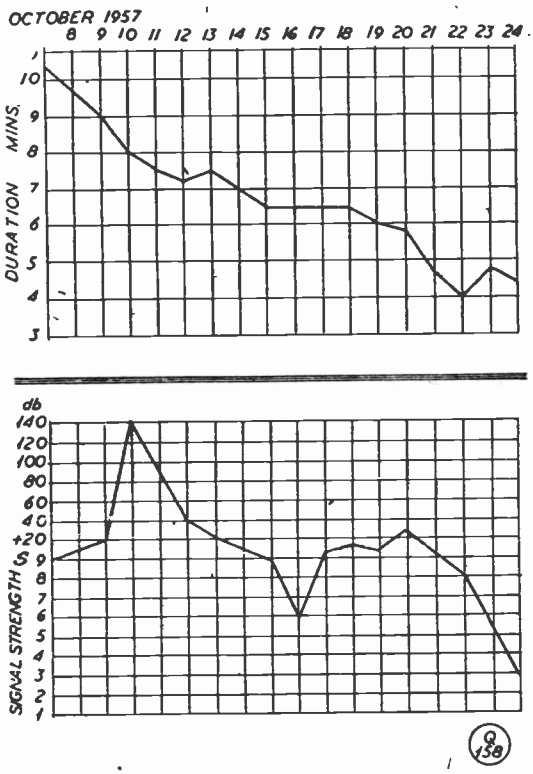
With the certain prospect of further Satellite activity, and the probability of signals on 108 mc (the official IGY channel) as well as on 20, 40 and (perhaps) 80 mc, readers interested in pursuing the subject would be well advised to be ready with CC converters for 40 and 108 mc in order to make the most of the possibilities. It could be that at our latitude we shall not hear anything, on 108 mc, of an American satellite launched into an equatorial orbit—but it is not at all unlikely that one of the Russian satellites, in an orbit more favourable for us, will be radiating on 108 mc.

Lectures and Meetings

The keen professional interest in the information to be derived from the satellite radio transmissions is reflected by the attendances at a lecture given by Mr. Martin Ryle (Cambridge Radio Observatory) before the Radar Association on November 13, and at a meeting of the Radio and Telecommunications Section of the I.E.E. on November 22. These were followed by a convention organised by the Royal Society on November 29. The discussions at these latter meetings will be reported in the proceedings of the respective Institutions.

In his lecture to the Radar Association, of absorbing interest and admirable in scope and lucidity, Martin Ryle showed how his team at Cambridge adapted their interferometer technique to tracking the satellites, and the results they have obtained. He also disclosed much detailed information about their successes in the field of radio astronomy, which is the main commitment of his Observatory. The range and accuracy of the interferometer technique, as developed at Cambridge, are such that radio stars can be detected at distances up to 300 million light years, while incidents in sky areas which are hardly within visible range of the world's largest optical telescopes can be accurately located. In a context of such magnitude, artificial satellites reduce to local manifestations of no more than incidental interest!

A.J.F./J.M.O.



In his observations of the first Satellite, S.I, on its 40 mc channel, G3GGQ obtained these interesting readings. The curves show clearly how the signal level fell off as the batteries ran down. S.II did not last long enough for any useful observations to be made.

RECORD SUNSPOT COUNT

It is announced that the number of sunspots noted during the autumn was the greatest ever recorded since observation of this phenomenon started more than 200 years ago. The count for October 1957 is given as 263; the previous high was 239 in May—of the year 1778! Conditions recently on the HF bands have certainly reflected this activity—DX has never been better, with the MUF going high enough to bring in *West Coast* W's on the 50 mc (6-metre) band.

"APPLICATIONS OF LOW-POWER ULTRASONICS"

This is the title of a lecture, with two short films, which is to be given in the Lecture Hall of the Science Museum at 6.00 p.m. on Tuesday, December 10. Non-members of the Science Museum Radio Society who may wish to attend should get in touch with G. C. Voller, G3JUL, The Science Museum, London, S.W.7 (or ring *KENsington 6371*—Extn. 237).

Meter Protective Circuit

SWITCHING THE CURRENT RANGES IN A MULTIMETER

J. B. MACDONALD

ONE of the more costly items possessed by most radio constructors is the low current meter, and as such (coupled with the fact that it is a very delicate instrument) it is worthy of careful treatment and protection. Such meters find their widest application in multimeter circuits, in which, by suitable switching of external components, various ranges of current and voltage can be measured.

This article describes a simple device which will in all ways protect the meter from switch contact faults when it is used as a current meter shunted by switched external resistances.

The normal or basic switching system is shown below in Fig. 1, in a typical circuit.

If we switch from, say, the 5A. to the 1 amp. range on load, and there is a momentary break in the shunt circuit—or if, in the extreme case, the switch failed to make proper contact—all the current would pass through the meter. While a momentary current would not be likely to burn out the coil, the impulsive jar is very likely to damage the movement and its bearings.

The universal shunt overcomes the difficulty by opening the whole circuit (*see* Fig. 2), but suffers from the disadvantage that there is always a resistance connected across the meter, and hence the meter FSD current cannot be read directly. Apart from that, the mathematics of the universal shunt and the odd values of resistances required are always inclined to induce headaches !

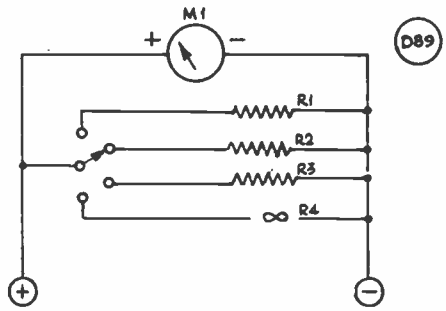


Fig. 1. The usual (and basic) multi-meter circuit, in which R1-R3 are suitalbe current shunts, R4 gives meter FSD alone, and the meter is a low-current moving coil instrument.

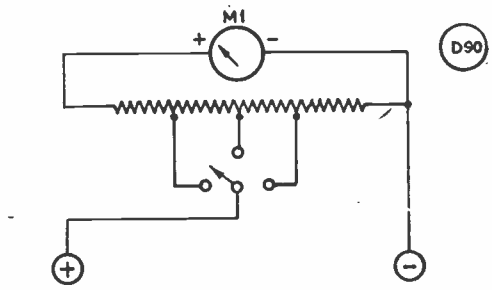


Fig. 2. This shunt arrangement protects the meter but is open to the objections mentioned in the text.

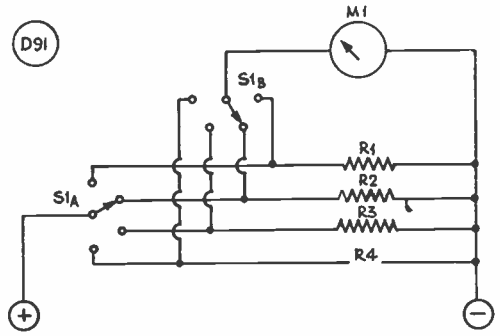


Fig. 3. The meter protective circuit which gives the required shunt facilities without exposing the meter to overload risk.

Application of the circuit shown above completely overcomes all the disadvantages previously involved, at negligible extra cost and with almost no increase in component bulk ; the additional parts comprise a little more wire, and a double—instead of a single—pole switch.

Whatever switch faults occur, it can be seen that load current cannot pass through the meter, as either the meter circuit or load circuit will open. At first sight, it may be thought that having two switches might give inferior performance owing to the increased total switch contact resistance, but on examination it will be seen that although full load current passes through A, only contact resistance at B will affect the accuracy of the reading, and as this will in any event be small compared with the meter resistance (in all except very extreme cases) no disadvantage ensues.

The protective circuit can easily be incorporated in a full multimeter, and it is hoped that application of this idea may provide an additional degree of protection to the basic meter in home-built instruments.

Can you Shut Down with One Switch?

DX COMMENTARY

L. H. THOMAS, M.B.E. (G6QB)

GW5BI

WE have now been doing this Commentary through a complete eleven-year sunspot cycle (the writer started in October, 1946!), and are beginning to feel that we have stuck by the bands through thick and thin, with conditions varying through every possible degree of goodness and badness.

This is probably the very first month since 1947 in which it is possible to report a complete period (roughly October 15-November 15) over which conditions have been *uniformly good.* There has not been a single blackout, nor any day when one could really find conditions below standard. Day after day the HF bands have conformed to the expected pattern.

It is true that the DX has been more or less dominated by our W friends—and what a good thing that they *are* friends, apart from having such good signals and being such capable operators. If the bands were equally over-run by some of the those chaps from . . . and our wobbly T4 friends from . . ., to say nothing of the well-known gaggle of Klots down in . . ., then we should not have spent much time on the air.

Rare DX has been—well, rare. JT1AA has added his fill to the gaiety of nations (yes, we worked him!); stuff of the calibre of KP6, KW6, ZC5 and VKØ has been around; but generally speaking what one has encountered is a band full of W's, laced with KH6, KL7, KP4 and a few others. W6 and 7 have been putting in phenomenal signals on Ten, Fifteen and Twenty, both phone and CW, and at all times. We have heard them on Ten as early as 1400 and as late as midnight; and on Twenty from early morning right through until late at night, with only a mid-morning break when they were inaudible.

VK's and ZL's have not done too well — mornings on Twenty have been best for them; ZS's are there most evenings; and the Far East crops up from time to time if you happen to be listening at the right moment.

In short, a Pretty Good Month, and at least as good as anything that 1946 or 1947 had to offer. Already we hear voices lamenting that conditions are *too good* and that the DX will be easier when they fall off a bit. Don't you believe them! For good and plentiful DX, you must have good conditions.

CALLS HEARD, WORKED and QSL'd

DX Gossip

JT1AA now has a satellite—a Thing signing JT1KAA, giving name as Eugene and power as 3 kW. Signals no stronger than JT1AA's 100 watts . . . OH2YV and 2XK were all set for an expedition to OHØ from November 24 onwards, but they have probably gone QRT by now . . . VS5ET is a new recruit to the SSB boys . . . W8GZ, Loren G. Windom (yes, *the* Windom) was the first station in the world to make DXCC on SSB . . . KAØIJ (Iwojima) is on 14200 kc phone . . . HE9LAC has been very active on 21 and 14 mc.

SVØWQ's record from Crete was 3502 contacts, 119 countries, 40 Zones. He ran 500 watts on all bands and the aerial was 140 feet long—but only ten feet high.

Korea has been removed from the FCC's "black list"—so, with every W wanting to contact Korea we might possibly see some activity starting up there . . . KS6AD has been on Twenty CW and KS6AF on phone. The latter is a YL (Evelyn) and will be leaving the island pretty soon.

"AC4HN" has been heard on 14020 kc—probably NG . . . ZM6AS is still on CW but a modulator is on the way, so grab him quickly, you brass-pounders (if you can!) . . . YK1AT, despite the terrific signal with the T7 note, *is* genuine . . . XW8AB has now left Laos; those who still need his card will be interested in his movements, of which we will try to keep track.

The very first genuine station in the Vatican City has been on the

air. HV1CN was running 300 watts of phone in mid-October, using a BC-610 and a dipole. During a QSO with CN8MM, an I1 amateur dropped in to make sure that all was above-board, and it was—he is operating with full official permission.

Latest news of the PYØCV expedition (Trinidad Island) was that he would start up on November 18. Up to the time of writing we had not heard him.

Yet another Funny Fellow—XM1AB, who claims to be in Uranchi, Sinkiang. Someone asked him who he was kidding, and he disappeared . . . VE3AHU/SU, who operated from the Gaza Strip, has left there, but has been replaced by VE3BQL (not heard on the air yet).

Just as we were thinking that all PK's seemed to have disappeared for good, we read in the JDXRC *Bulletin* that JA1CC had worked PK1AQ (14 CW). Other J's also report him. Interesting DX worked out there includes VR4JB, KP6AL, HS1WR, KC6KG, ZC5RF, VR3B, VS4BZ, FK8's, and quite a big batch of VK9's. Ah, well—nice to know that they are on, anyway!

VS9AC writes personally to say that he is on Twenty CW. He was licensed on October 10, and runs an 807 final and an AR88 receiver. In his first two weeks he worked JA, KH6 and VS1 with only 15 watts, but he hopes to be going "QRO" when he gets hold of a 500-volt power-pack. He will QSL 100 per cent., and signs off "73 from one who *devours* your Magazine." We wish him continued Good Eating! (C. J. Dempster, c/o Aden Airways, Aden.)

San Marino is on the air again, with M1H active on 21075 kc every day around 0900 GMT; he also works 28 mc. QSL to Aure Casali, Box 80, San Marino. (Thanks to GC3HFE for this one.)

European (WAE) DX Contest

We now have the full rules for the WAEDC, 1958, which will take place over two periods: January 3, 1800 GMT to January 5, 2359 GMT *(CW)*; and April 4, 1800 GMT to April 6, 2359 GMT *(Phone)*.

The CW event covers all bands 3.5 to 28 mc; the Phone half only 14, 21 and 28 mc. Contacts are between European and non-European stations, exchanging the usual six- or five-figure number embracing the report and the serial number of the contact, starting at 001.

Confirmed exchange of numbers will count one point (two points on 3.5 mc). The multiplier for European stations corresponds to the official DXCC Country List, with additional "country" status for all W, VE, PY, CE, VK, ZL, ZS, VO and JA *districts*.

For non-European stations, the multiplier corresponds to the WAE Country List. The total multiplier, as always, is the addition of all countries on all bands.

Also as before, the CW section carries "QTC Traffic" for an extra gain in points. A "QTC" comprises a report of any confirmed QSO which has taken place during the contest, and can be transmitted only from a non-European station to a European station. It must contain the time (GMT), call of station worked, and received serial number (three figures, not RST).

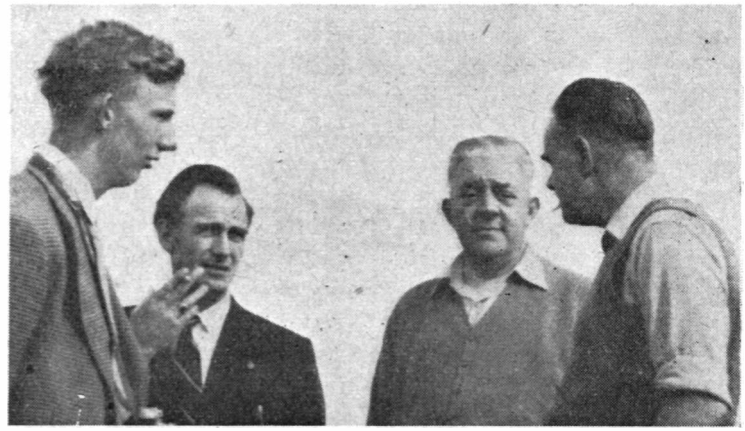
A maximum of ten QTC's per station, per band, in one series, is allowed. QTC's transmitted *or received* count one point each. QTC points are added to the QSO points before applying the multiplier.

Log sheets are obtainable from DARC for one IRC (or five IRC's for airmail) and are available immediately from DARC DX Bureau, Fuchsienweg 51, Berlin-Rudow, Germany. Closing dates for logs are February 28 and May 31 for the two halves of the Contest. Anyone entering for this interesting European event is advised to get those log sheets.

Around the DX Bands

Ten has been wide open practically all the time, with Far East and Oceania stations sometimes reaching good strengths in the early mornings, but *always* with the W's there in force from noon onwards. G3JWQ (Ripley) normally works on Two and Ten only; this month he explored the latter, and so writes to "DX Commentary" for the first time—A.J.D. doesn't know yet! With 50 watts to an 807 and a 3-element rotary he raised AP, CE, CN, CO, CR7 and 9, CX, FB8, HP, HK, KG6, KP4, LU, OA, OQ, PY, VE1-7, VK, VP1, VP2, VP5, VP6, VP7, VP9, VQ2, VQ4, VS6, YV, ZC4, ZD8, ZE and ZL. He doesn't say so, but we imagine all these were on phone.

G3FXB (Southwick) raised OA4ED, OQØDZ, UR2BU and ZD2FNX, but spent most of his time working cross-band between Ten and Six. This way he worked 33 stations including W5's. He heard W7ACD (Idaho) on Six at



This photograph would not be so very unusual if it had not been taken on the Isle of Mull, when the following happened to meet together (left to right): SWL Newbould, GM3EZO, GM3GCH and GM3GZC; the photograph was taken by GM3JZK. This is not quite the whole population of the Island, but very nearly!

599, but apparently not tuning Ten. G3FXB says that when the MUF is above 50 mc (and it has been up to 53 mc on occasions) *Ten* is rather patchy.

G2BVN (Romford) worked all districts cross-band except W9 and Ø, on November 4 and 5; this included Arizona at S9 *plus!* G3XC (Farnham) worked 22 W's and VE's the same way. He heard a couple of W6's and a Ø, but didn't work them.

This cross-band business Ten/Six is getting quite a Thing these days and, of course, it will not remain possible for too long a period—so if you are keen on it, get your six-metre receiver going quickly. G3FXB put up a three-element wire beam for reception on Six and was toying with the idea of Lazy-H's.

G2DC, now in a new QTH at Ringwood, Hants., is back on the bands again. He has a Minibeam and a 275-ft. Zepp., but warns us that he has 1½ acres and other things may happen later on! Ten he finds "as finicky as ever"; he worked W7CKY/KL7 for a new one, also VE6KJ, VE8PB, VK7RU and VK9XK.

G3ABG (Cannock) worked three KL7's (rare birds on this band), also KH6, UB5, ON4 and GD—the latter a phone/CW contact. On phone G3ABG collected ZD6, OQ5, ZD2, FQ8, TF, TG9AD and 9DP, CR6 and 7, VP9 and many lesser fry.

G5BZ (Croydon) has a new tri-band Quad which seems to be performing very well. Ten gave him Crete (SVØWQ), OA, TI, KH6's, KL7, VE and all W.

G2YS (Filey) collected VU2EJ and PY1AA on CW, OQ5RS on phone; PY1AA was on for their "Radio Amateur Day", and promised a special QSL. G3GGS (Preston) raised CR7IT and all W districts on phone. G3JJG (Mitcham) started up again on Ten, and raised PY, VS9, ZB1, ZD6 and ZE3, plus VE and W. New ones for G3DNR (Broadstairs) were SV and YU, but activity was curtailed when his beam came down in the gale.

G2BLA (Mitcham) raised SVØWR for a new one, and other Europeans who were new for this band; new States for the WAS collection were also rolled in.

G3DO (Sutton Coldfield) raised several new ones for the band, such as CT3, CN2, HA, HI8BE, PJ2AA, TF, UR, VP5BL and ZS9G—all phone during the Contest. KW6CJ was also worked. New for G6VC (Northfleet) were SVØWR, VP6GT and CN2AQ.

Fifteen Metres

G3IOR (Norwich) protests and says we were doing VK3AZY an injustice with our talk of "12 watts"—he only uses that when he is very QRO! G3IOR has worked him when he has been using from 4 watts to a dipole up to 10 watts to his long wire or 2-element rotary. Even so, he is the most consistent VK on 21 mc. By the way, he is only 16 years old and still at school . . . ! G3IOR has raised lots of new ones on 21 mc, bringing his total to 172 worked, 138 QSL'd. Worth mention are XW8AG, FO8AC, FK8AT, HR, VP1, TG and FE8. W7PQA on phone gave him his WAS at last.

G3FPK (London, E.10) has rebuilt and now spends a fair time on this band. He amassed 22 new countries in a few days, best being EL1P, VE8PB and XE1PJ. G3LET (Westcliff) covered the band between 1815 and 1900 on Sundays, working VS6DO, a KL7 and sundry W's. G6TC (Wolverhampton) collected CE3RE, VE4 and 8, KH6CL and 6AYG, HE9LAC, VP8CI and 8CC.

G5BZ's bag included PJ5CA (G5RV), SVØWQ, CX1FB, KL7's, VE7 and all of W. G3ABG's CW fetched in OA7I, VP3AD, ZS4 and all W/VE; phone raised CO, KG1, SVØ, VK's, ZB1, ZC4, VO1 and SV1AB. New ones for G3DNR were 5A, SP, OE and LA; also worked, ZB1, ZC4, CN8 and W's.

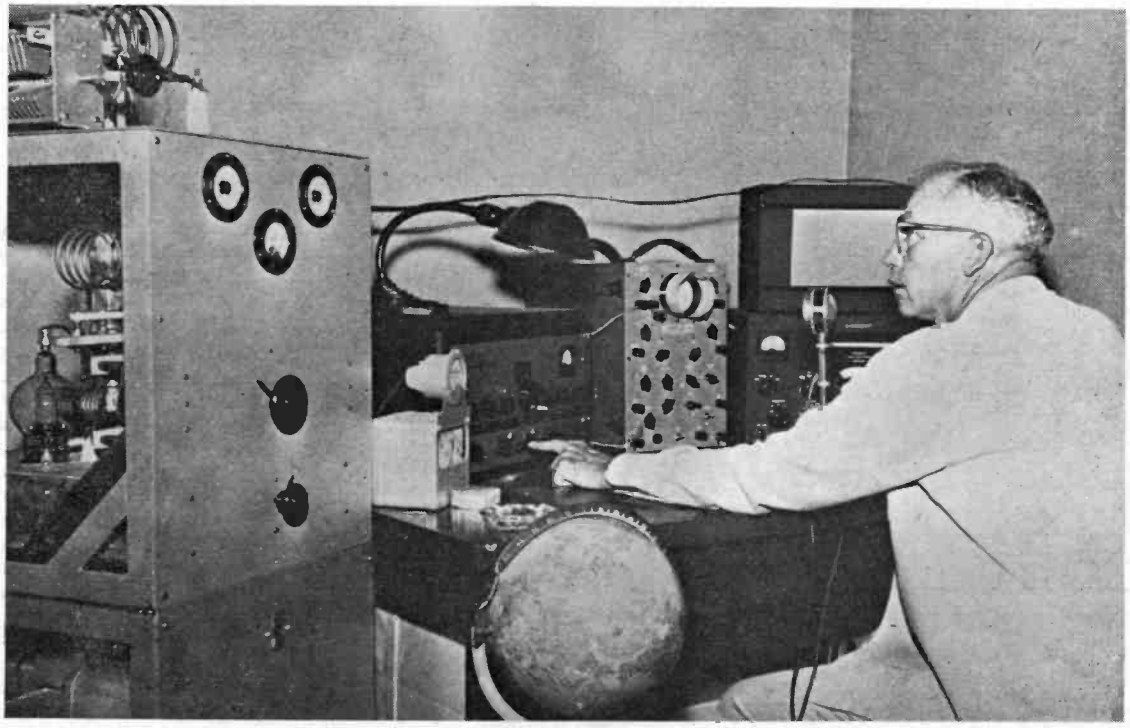
G2DC remarks that Fifteen allows one to *enjoy* a DX QSO, which is almost impossible nowadays on Twenty. New ones for him were HC1LE, HE9LAC, UJ8KAA, SVØWQ and PJ5CA, others being JA's, KH6's, VE7 and 8, UAØ, VK9SP and 9XK.

G3JJG's CW accounted for EL1P, I1YCZ/Trieste, JA, KL7, ZC4, VK's and W's. G3GGS worked UAØOM (quite notorious now through being three miles outside Mongolia and Zone 23!),

FIVE BAND DX TABLE
(POST-WAR)

Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries
DL7AA	841	110	167	234	178	152	247
W8KIA	745	68	148	265	151	113	265
G3FXB	721	72	129	208	183	129	232
G5BZ	709	64	118	241	170	116	247
G3FPQ	647	66	91	194	175	121	215
G3DO	614	24	46	230	151	163	247
G2DC	606	70	92	198	122	124	208
W2EQS	539	79	114	161	104	81	177
W6AM	504	30	58	273	86	57	273
G3ABG	461	45	83	169	89	75	185
G2YS	454	65	85	149	101	54	166
G3WL	450	39	77	146	115	73	177
G3BHW	422	15	32	154	126	95	190
GM2DBX (Phone)	417	34	31	158	100	94	173
G6VC	353	33	45	138	79	58	153
JA1CR	348	19	49	174	70	36	176
W6AM (Phone)	347	13	32	242	39	21	242
G3GZJ	307	18	60	96	91	42	133
G3JWZ	282	50	61	72	66	33	116
G3IGW	282	42	65	83	64	28	116
G3JLB	270	41	43	67	64	55	110
G6TC	269	17	63	120	42	27	134
G3JZK	248	15	48	52	86	47	127
G2BLA	224	26	45	60	56	37	99
G3HQX	217	12	37	74	45	49	103
G3JJG	213	36	42	86	37	12	104
G3DNR	183	10	21	79	39	37	93
G3LET	153	10	38	89	15	1	95
GW3DNF	142	21	30	49	33	7	58
G3IDG	100	11	15	22	22	30	42

(Failure to report for three months entails removal from this Table. New claims can be made at any time).



One of the interesting DX stations to be on Top Band this winter season is OA4G, Lima, Peru, who has already worked W1BB and other U.S. 160-metre operators. He would certainly be a nice QSO for any U.K. Top Band station!

EA8 and 9, SVØWQ and KP4. G2YS raised UAØGF, said to be in Zone 19, and KH6CEX.

G3GZJ (London, S.E.23) reports QSO's with FP8AS, W7GS (Wyoming), ET2US, DU, OQ5, UD6 and UO5. G2BLA worked ZL5AA (Antarctica), TI2LA, a KP4 and an ON4 for new ones on the band.

G6VC raised PJ2ME and CR6AI, both new for this band.

Twenty Metres

And so to this exasperating region, which is simultaneously all that a DX band should and should not be. Last time round the cycle we didn't suffer from all this short skip, but the most probable reason is that not many Europeans were active at that time. Happy days! As G2DC comments: "What a band—super DX all mixed up with short-skip QRM, clottery very rife; in fact, everything that is good and bad in amateur radio operating." Despite this, he worked UPOL7 (North Pole), VKØAB (Davis Bay), UAØKAR (Dickson Is.), ZM6AS (so someone did raise him!), UL7LA, VK8BK and W9NTJ/KG6. The latter said that KW6CM and 6CO are both active on 14 CW.

G3ABG, on CW, worked FB8XX and UAØKAR. G5BZ made merry with his new Quad to the extent of CR8AC, ZK2AD, HL2AJ, VQ8AM and VQ8AS (Rodrigues Island). Most of them came back first time; others included nearly everything, the best being KG6, loads of KL7's, KH6's, VU, VS9's, FK8AH, UAØ's and the rest! G5BZ comments on an increasing and pernicious habit—that of raising a station on CW and asking him to listen for phone on the same spot—in the CW portion of the band. Two F8's recently did this while G5BZ was QRX for the DX stations they were working.

G6TC's bag comprises VS6DV, JA6TA, VE8NM, XE1A and LA2JE/P (Hopen Island). G3LET mentions TI2PZ, UAØRK (Zone 19), VQ4, UI8, KL7's, ZC4's and our old friend, "ZY2AA," who used to be in a satellite and is now on the "Soviet expedition to the planet Mars." He will sure QSL *via* Box 88. This odd character was 599 and was getting the same from the U.S.A., so he's no flea-power pirate.

G3FPK says LA2JE/P told him that he will be on Hopen until July '58. JA2AT was a new Zone and country, and W5DRU (New Mexico) a new State. Others were two SM1's, ZP5HK, UL7 and UAØ.

G2BLA raised TI2PZ, KG1DQ and ZB2A for new ones; G3GZI added FF8, HE9LAC, UI8, UAØ, CO and OY; G2YS worked the "JT1KAA" character (same as ZY2AA?); G3GGS welcomed FK8AH for an all-time new one, *plus* UO5, VS6 and ZL. G3JJG offers OQ5JZ, VS9AD, VE7 and 8, UL7, UA9, ZL, ZS's and a W7 in Montana.

Forty Metres

Forty is still a DX band and—note this—for late-to-bedders and

early-risers it provides plenty of interest with rather less QRM than Twenty. G3JJG worked W1 and W3; G3GGS got 3A2BT (G3FPK) for a new one; G3GZJ raised HE9LAC, SVØWQ, 3A2BT and CN8.

G3FPK complains about the G9BF-type rock-crusher spreading from 6920 to 7000 kc, which sometimes overlaps into the band and churns out an incessant "VBT." DX worked was PJ2CK (0230), UI8AP and UAØOM, and heard were UD6FA, UJ8AG and EA6AF.

G3LET fled to Forty in desperation after a session on Twenty, and was delighted to have W's back to his CQ. After that he stayed there and worked KZ5RF and UA9OK (0130) together with many W's—all on his 14 mc ground-plane!

W A Z MARATHON, 1957

All Bands

Station	Zones	Countries
G3HLY	40	189
G3FKM	39	189
G3DO	39	177
G3FXB	39	175
G3BHW	39	172
G5BZ	39	159
G3BDQ	39	145
G3JKF	38	117
GM3EOJ	37	122
G2DC	37	113
G3FPK	37	98
G3HCU (Phone)	36	98
G3LET	36	95
G3GGS	35	106
G3KMA	35	105
G3GZJ	34	111
G2BLA	34	92
G5FA	34	92
GM2DBX (Phone)	33	91
G3HQX	32	98
G3JWZ	32	88
G6PJ	32	86
G3JJG	31	92
G3DNR	26	78
ZL3CP	24	52

G3LNR (Nottingham), with 15 watts, worked a W2 at 0800, also YO, UA3 and UB5. DX heard included 4X, ZC4, CN8, UL7—a VK5 was being worked by Europeans, although G3LNR couldn't hear him.

G6TC, an old hand on Forty, worked W6VUP and most other districts, VE2 and 3, KZ5RF, PY6FI and JA3MC. G2DC raised all W districts except W7, as well as PY, LU, VQ4, ZL and UG6.

G3BST (Bletchley) spent all his time on 40 metres and was well rewarded with UA9CM, TF5TP, IT1TAI, IS1MM, KZ5RF, UD6DD and ZB2A. ZA1KB was heard—but one wonders. G3BST says the W's were very good in the evenings between October 24 and November 3, since when they have not been so hot.

Eighty Metres

Quite a lot goes on on Eighty, but most of it is not DX! However, we have a few words on the band from some our our truly five-band-minded 'chasers. G2DC, for example, worked W1, 2, 3, 4, 8 and 9 on 3.5 mc. And then, for a change, he went real QRP with an input of 0.7 watt and made 76 U.K. contacts as well as working DL and LA.

G2BLA got UA3BS at midnight, and W1FRR at 0250; and G3JJG, having raised a W1 on Forty, was asked to QSY to Eighty, where they easily made contact at 0020. This was followed up with another W1 and a K2 before QRT at 0050.

If you have anything remotely resembling a suitable aerial for Eighty, you will find W contacts not only possible but *quite easy* from about 2330 onwards; much of the neglect of this band for DX is due to a feeling that it can't be done. Late at night, and early in the morning, it is possible to make more solid contacts with W and VE than it is on Twenty during the day.

Miscellany

Last month we mentioned that W3DDV/1 would be in Vermont for a while—for the benefit of WAS-chasers. SWL T. W. Moss, an old-timer down in Exeter, tells us that he has heard the following Vermont stations on ten-metre phone: W1BXT, 1CML, 1EKU, 1HFN, 1OJO, 1SIO, 1UES, 1VSA, 1WYG and 1ZWB. Some of them date back a bit, but others were heard in the last month or so. So there are plenty of active ones to look out for.

G3QC (Luton) has just been relicensed after an interval of four years and hopes to be back on the bands with a temporary rig. He looks forward to meeting a lot of old friends, particularly on Forty.

GM2DBX (Methilhill) tells us that he has to take it easy, on doctor's orders, but he is still wielding the mike to some effect. He was not allowed to compete in the *CQ* DX Contest, but he has four firsts and one second for Scotland, as well as one first, two seconds, a third and a fourth for the U.K. All on phone, of course. Certainly no one can beat *this* record.

GW3LLU (Llanelly) did enter the phone section of the Contest, with SSB for 90 per cent. of the time and AM for the rest. He made 185 contacts in 23 Zones and 39 Countries, giving a total of 25,978 points. He tells us that all the usual DX faults were being perpetrated, with stations calling "CQ DX" right on top of rare DX stations; but he adds that he did pick up much operating technique, and that a good time and a sore throat was had by all! G3DO made 406 contacts, 30 Zones and 79 countries, working Ten only.

G3FPK says the 3A2BT cards are now being printed, and he thinks that by the time this appears, all those who sent IRC's or envelopes will have had their card despatched.

G6TC more or less confirms our opening sentences by saying that this has been the best month he has ever known in the twenty years he has been licensed.

Correction of one of last month's items: VQ3GC is at Songea Airport, Southern *Tanganyika*. For some reason this crep' in as Rhodesia! His father, G3CVG, keeps daily skeds with Neville, as he has done while he has been VS6CE, VQ4GC and VQ5GC; he tells us that VQ3GC runs a Minimitter and a "rather

battered super-Pro," both powered by petrol engine, and that his aerial is a 960-ft. long wire, end-on to England. A nice father-and-son DX combination, this.

G3KIK, who recently went out to Christmas Island, now holds the call VR3L, and will be operating on 14 mc only (thanks to G3LEV for this note). We shall hope to hear in due course how his results compare with those of VR3G — *see* November issue.

Setting yourself a target is always a good thing (even if you never hit it), and G3ABG set up the following target for the *CQ* DX Contest: CR8AC, YK1AT, JTIAA, ZM6AS, LA2JE/P, KS6AD, ZK1BS, ZK2AD, XW8AG, HL9KT, VK9XK, ZC5AL, HI8BE, W4FCB/KS4 and FK8AT. The point about this is that all these stations are known to be very active at present —if you can find them in an unburied state. Good luck, G3ABG . . . if you only get 20 per cent. accuracy you should be quite pleased!

The Rat-Race

Our little dissertation on Pile-Ups, last month, awakened quite a bit of interest from fellow-sufferers, one of whom (GC3HFE) exists at the business end of one of them for most of his time! He says that even in these days 75 per cent. of his contacts are with chaps who say "first GC." He asks for calls "ten high" or "ten low," but it doesn't make much difference; when things are really hectic the only answer is to work the one with the strongest signal *so as to get rid of him*—an angle that most of us had not thought of before.

He adds that "Clot 1" is the type to whom you give a 599, who stays on the frequency and calls "CQ DX" straight after the QSO; "Clot 2" gets a 599 report but sends everything twice; "Clot 3" insists on a ragchew in spite of the queue waiting, of which he must be well aware. Another pest is the type (already mentioned elsewhere) who comes up on phone on the same frequency after a CW QSO.

GC3HFE says that the short, snappy QSO *(a là* SVØWQ) is the *only* answer, and it helps the DX operator out of a situation which really takes a lot of handling. For every five ethical stations you meet fifty unethical types, and there's not a thing you can do about them (they are usually so dim, for one reason!)

Meanwhile, we listen with sorrow to CR8AC, night after night, giving his full QTH and name in every QSO, usually twice, even to contacts who call him and say "Your QTH OK" and address him by name. Of course, some rare DX stations may want to keep the number of contacts *down*—and when one thinks of the QSL business, who can blame them?

G2YS also commends the SVØWQ technique, but suggests that more use of QHM, QMH and so on, is necessary. He wants us to join him in a WAE Expedition to Linosa, for the purpose of trying out new DX operating ideas; we could certainly guarantee to make some of the 'chasers "Hopping Mad" by springing a few surprises on them . . .

Thanks to all the others who have made comments on this problem; no one has a solution to offer, and we, personally, regard it as insoluble.

Top Band Topics

G3LBQ (Brentford) collected Oxford, Radnor and Dorset; GW3HFG (Pembroke Dock) made his WABC with 66 confirmed, 80 worked, and is active on phone as well. Until February next he will be on from Morayshire as GM3HFG/A.

G3LNR winkled out five new ones, and heard OK's, HB9, DL2, GI and GD on the band. G2DF (Warrington) is active again on One-Sixty—with an indoor aerial. His PA is a Type 46—and it takes an OT to remember that one! His main worry is how to get contacts confirmed, short of collecting them personally — and his bike is too old for that . . . Out of 33 worked, he can only produce 15 cards so far.

Stop Press: Just as this issue was going down, G5JU reported that Top Band opened in fine style for W/VE on the morning of November 24, 0530-0630. W1BB, W1PPN, W3RGQ and K2BWR were good signals and several G's got across — and DL1FF worked W1BB. So that makes it *all* bands wide open! Next T/B Test days are December 8, 22; January 5.

SWL Corner

J. W. Cave (Parkstone) has for many years specialised in ten-metre goings-on, and he compares present conditions with the peak years of 1947 and 1936. He finds there are fewer days when the band is closed to the U.S.A. but wide open to the Far East and Pacific; European stations come in more often on short-skip (like Twenty); there are peculiar but frequent openings to KH6 and KL7. Interesting ones heard have been EAØAB (1410), FQ8UF (0645), KH6ZA (1730), KL7AZI

Short Wave Magazine

DX CERTIFICATES

The following have been awarded since the publication of our last list, in the September 1957 issue:

WFE
No. 30 W2GT (Rochelle Park, N.J.)

FBA
No. 96 G8DR (London, N.W.2)
97 G2HPF (Chelmsford)
98 LA5HE (Oslo)
99 W4HYW (Atlanta, Ga.)
100 OH5PX (Atti)
101 W6GPB (San Rafael)
102 HA5BI (Budapest)
103 G5MN (Hull)

WNACA
No. 153 G2HPF (Chelmsford)

WABC
No. 157 G6XA (Leamington Spa)
158 G3KYF (Enderby)
159 G2HPF (Chelmsford)
160 G8CO (Grays)
161 GW3HFG (Pembroke Dock)

WBC
No. 81 DL2CH (BAOR)
82 SP3PL (Poznan)
83 SP6BZ (Wroclaw)
84 PAØTZ (Waddinxveen)
85 DL2ZO (BAOR)
86 ZL1AH (Tauranga)
87 OK3EA (Bratislava)
88 I1CCO (Rome)
89 CO2WD (Marianao)

Details of MAGAZINE DX AWARDS and CERTIFICATES, and the claims required for them, appeared in full on p. 253 of the July, 1957 issue.

Overseas claimants (only) may send either (*a*) A check list, without cards, duly certified by the Hq. of their national Amateur Radio society, or (*b*) An uncertified check list, from which any or all cards may be called in by us. Claimants from the U.K. should send the relevant cards for each award.

A complete list of the U.K. Counties (for WBC) was published on p. 20 of the March, 1956 issue.

(1905), PJ5CA (1720) and UR2BU (0950). For "rare" States he mentions W1EKU (Vermont), W7GS (Wyoming) and W7PEY (Arizona).

M. J. Prestidge (Birmingham) logged 100 countries on phone during the DX Contest, covering Ten, Fifteen and Twenty. On Twenty CW he found FB8CD, Comoro (1735) and FP8AP (2005). Best phone DX was KS6AF in the mornings.

P. Day (Sheffield) logged HV1CN at 2230 on October 16, RS-59. This is, of course, the genuine and only Vatican station up to date. 3A1W was less reliable and a most peculiar call! Ten phone yielded ZS3G, ZD1FO, HI8BE, HP2ON and KH6AQJ, among many others.

M. J. Edwards (Carterton) logged HK1JO and KA2CU on Fifteen phone; also IT1SMO, VP9DM and two VS6's on Ten. V. Porter (Loughton) was puzzled by "Mickey Mouse," operated by a YL—but this must surely have been CN8MM (Casablanca), especially as she was heard working HV1CN, with whom she is known to have skeds.

WAZ Marathon

We are rapidly nearing the end of the year, and G3HLY (Godalming) heads the WAZ Ladder both by virtue of his score of 40 Zones and his country total, which, at 189, is equal to that of the runner-up, G3FKM. G3HLY, during the past month, added ZK2AD, VP8BS, OQØDZ, CR9AK, ZD8SC, BV1US, YS2AG, HZ1AB and HL2AJ to his already formidable score.

The *CQ* DX Contest (CW section), which will be over by the time you read this, will doubtless give everyone the opportunity for a large increase in country totals, and we shall be surprised if no one scores the double century by the end of December. JT1AA will probably be active, as usual, but he has a knack of disappearing at week-ends, which has doubtless kept down the numbers of G's who have raised him thus far.

Final entries for the Marathon will not come in, of course, until our mid-January post-bag arrives, which means that the eventual results will appear in the February issue.

Late Arrivals

G5FA (London, N.11) raised EA8, EA9 and Crete, all on 21 mc, for new 1957 countries, also W9NLJ/VE1 for a long-awaited Prince Edward Island contact. He worked UAØKAR on Forty, too.

G2NJ (Peterborough) says that DL2ZO and DL1FZ have both been on Top Band—also that VK3NV, now on 21 mc, was formerly G5NX of Peterborough.

G3JZK (Cambridge) was mostly active on Ten, where he collected CN2BK, UN1AB, TG9MB (1800), HK7AB, IT and CE—all phone—for new ones. CR9AK was worked several times. New on Fifteen were TF and OD5AJ. G3JZK says that a period of ultra-short skip saddened him by showing up more bad notes and bad operating from G's than he ever suspected . . . some of it, he says, was worse than anything heard from Europe! Dear, dear—and tut, tut!

Although the annual "MX" and "Merri Xmas" have not yet begun to make themselves heard on the bands, it is time once more for us to wish all readers the season's compliments. With all the personal wishes that will soon be flying round on the air, let us mingle our own message to all our regular readers — a Merry Christmas, a Happy and Prosperous New Year, and may all the DX you wish for come your way.

And now, over that little matter of the deadline, we have to remind you that closing date for the January issue will be **Friday, December 13.** It is horribly early in the month, but the calendar dictates it and there's nothing we can do about it. So . . . *Post Early*, not only for Christmas but for our next issue.

Until we see you again, then, Good Hunting, very 73 and MX!

SMALL ADVERTISEMENTS

Our small advertisement columns continue to be the recognised market—and to establish the value of the "attractive items"—for those who like to buy and sell used gear. If you have any good equipment for disposal, you cannot do better than offer it through Readers' Small Advertisements in SHORT WAVE MAGAZINE. There are authenticated cases of readers who have had eager buyers arriving from long distances, and telegrams and telephone calls from all over the country, on the Friday that their advertisement appeared.

IDEA FOR HAMFEST

The October issue of the Radio Society of East Africa's *Circular Letter* (which is produced by VQ4EV, ex-G3GBO) reports a very successful social event held by the Society recently—a barbecue. A vast quantity of sausages and steak was cooked over an open fire by the XYL's of VQ4CW, VQ4FB and VQ4GM, while about forty R.S.E.A. members and their friends consumed RF from (pint) bottles. The evening did not end until the last of the RF had gone and the fire had died down, around midnight. This is the sort of party that could be laid on (but not until the early summer!) by almost any Club group in the U.K.

THE "NEW QTH" PAGE

Due to the large number of new licences issued in the last few months, we already had a pageful of callsign/addresses in hand for the *January* SHORT WAVE MAGAZINE before this issue went to press. This means that notifications received after about November 20 cannot appear in print before February. We could catch up the back-log by taking more space for "New QTH's," but feel that readers will agree that the usual one page is a fair allowance for this feature. In any event, those who may have to wait for appearance of their callsign in these pages are assured that this does *not* in any way delay publication in the *Radio Amateur Call Book*. But it does mean that new callsign/addresses should continue to be notified to us without delay.

SSB Topics

GETTING GOING ON SSB—THE G2NH EXCITER

Conducted by **R. L. GLAISHER, G6LX**

This feature takes on a rather different appearance this month, in order to present practical information for those wishing to get started on Single-Sideband working. We are sure that readers who, already active on SSB, are more interested in the operating side and the DX angle will not mind, on this occasion, finding their space used to encourage new activity on SSB. The exciter unit described is that designed and constructed by G2NH, a well-known operator who has been on Sideband ever since this method of phone working was first suggested.—Editor.

DURING the eighteen months or so that "SSB Topics" has appeared in these pages, a large volume of correspondence has been received covering all aspects of SSB operation and technicalities. In the main, the subject matter of these letters falls into one of three categories: technical information or queries; operating news, including DX; and requests for help. A recurring plea in the latter context concerns the dearth of published information of a practical and constructional nature aimed specifically at the newcomer to amateur single-sideband. In particular, the demand for information is centred on the transmitting aspect rather than receiving equipment or techniques.

It is rather difficult for someone who has been on SSB for several years to visualise the problems that confront the newcomer and the standard reaction to the questions, "How can I get started on SSB?" "Is phasing better than filter?" "Which is the best exciter to build?" and so on, is usually "It's all in the Sideband book, OM." Your scribe, for one, has been guilty of adopting this rather unhelpful attitude and, in consequence, has had several minor skirmishes with the Editor, who has been pressing for "SSB Topics" to include more information for readers who, although interested in SSB, have not yet taken the plunge.

During the early days of amateur SSB activity the majority of stations were using equipment based on the work of a small band of pioneers which included W1JEO, W2KUJ, W2UNJ and others. It is significant that these designs are the basis of nearly all the present-day commercial equipment which is so plentiful on the other side of the Atlantic. Their original descriptive articles have been reprinted in the SSB handbooks, and the techniques described are just as good now as they were when first published seven or eight years ago. Yes, the basic information is there all right, but, even at that, how does the embryo sidebander get going? Does he scrap his present CW or AM transmitter and start again from scratch, or does he attempt to use some form of SSB adaptor in conjunction with available equipment? Let us take a look at some of the problems.

It is a prime requirement that transmitting equipment for amateur use must be capable of operating on any desired frequency within any or all of the HF amateur bands. Consideration of the problems involved in generating a clean SSB signal for variable frequency or multi-band use leads to the conclusion that the optimum design for the exciter is one in which the SSB signal is generated at a fixed frequency. The sideband output is then mixed with excitation from a VFO or crystal oscillator to provide output in the desired amateur band. This technique is necessary with filter-type exciters, as conventional filter elements will only work over a small band of frequencies which is dependent on the design parameters. With phasing-type exciters, generation of the sideband signal at a fixed frequency permits the critical carrier and sideband adjustments to be made under optimum conditions, and the performance will not be degraded by a change of output frequency.

It is possible to design satisfactory SSB adaptor units which can be driven at low level from the VFO and multiplier section of an existing CW or AM transmitter. This method does, however, require that the phasing be carried out at the output frequency. In consequence, adaptors of this type are usually very frequency-conscious and difficult to adjust unless very sophisticated monitoring facilities are incorporated. For this reason, the adaptor type of SSB generator has gradually fallen from favour and the newcomer is likely to obtain better results from the fixed-frequency generator and conversion arrangement.

The next point, which often causes confusion, concerns the advantages of phasing-type sideband generators over the filter circuit or *vice versa*. The technicalities of both methods are fully described in the SSB handbooks, and from the performance standpoint there is little to choose between the two systems. For multi-band operation, the complexity and number of valves required are similar, although the phasing type does allow more flexibility in the choice of the generator frequency. The availability of surplus quartz-crystals at a reasonable price has tended to reduce the cost differential, and a multi-band IF type crystal-filter exciter can be built for approximately the same cost as a phasing unit of similar performance.

Low-frequency filter-type exciters using inductance-capacity elements can also be built for a low cost by using "surplus" components. Because of image considerations, such systems require double or triple conversion stages to heterodyne the generator

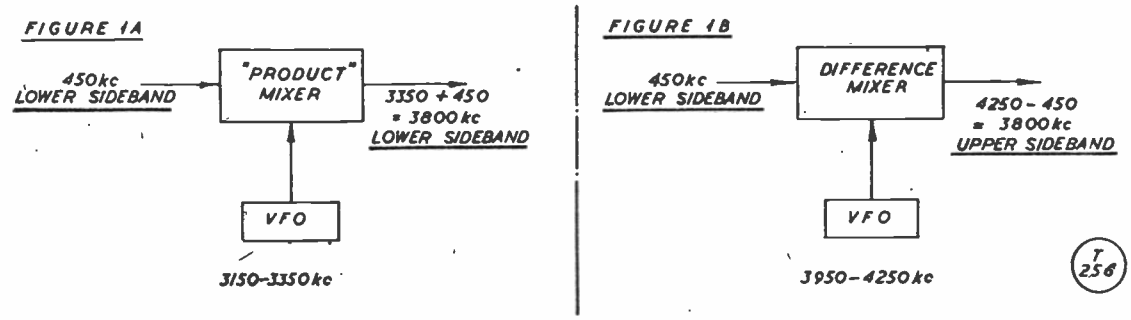


Fig. 1 (A), (B). Showing "product" and "difference" mixing in order to obtain inverted sidebands. The mixer element itself is exactly the same for both systems, the only difference being the VFO injection frequency.

frequency (usually in the range 15-100 kc) to the required variable output frequency. The G3BFP exciter described in the March 1957 issue of SHORT WAVE MAGAZINE falls in this category. Very careful consideration must be given to the choice of intermediate and heterodyne frequencies so as to avoid spurious mixer beats which fall within the pass-band of the amplifiers that follow the mixer stages.

The question of frequency conversion and the selection of the correct sideband is another point that is often queried. The current practice of using lower-sideband on the 1.8, 3.8 and 7.0 mc bands, and upper-sideband on the other amateur channels requires careful selection of the heterodyning frequencies, as the process of mixing can invert the sideband. It is a good rule always to remember that additive (or "product") mixing will leave the sideband relationship unchanged whilst subtractive (or "difference") mixing will invert the sideband. For example (Fig. 1A), a lower-sideband signal is fed to the mixer at 450 kc, and this must be "product" mixed with a VFO operating in the 3.3 range, so as to produce the correct lower-sideband output in the 3.8 mc band. If the 450 kc lower sideband signal is mixed with 4.2 mc, the "difference" frequency is again 3.8 mc, but the sideband has been inverted and upper-sideband output will result (Fig. 1B).

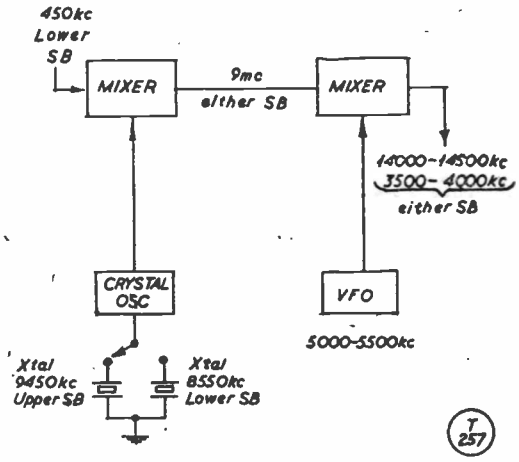


Fig. 2. The double-conversion technique with "product" or "difference" mixing to obtain selectable sideband output. A second IF of 9 mc combined with a 5 mc VFO also provides output on 3.8 or 14 mc, again by using "product" or "difference" mixing.

Selectable-sideband output can be obtained by the use of double conversion techniques, mixing first to, say, 9 mc, with the heterodyne voltage supplied from an oscillator having two switched crystals on the "product" and "difference" frequencies (Fig. 2). The upper and lower sideband output can then be mixed again with the VFO to give output in the required amateur band.

Crystal and inductance-capacity-type filters of the simpler type used in amateur SSB will attenuate only one sideband and are not reversible (a filter designed to pass lower-sideband will not be effective in passing upper-sideband, even if the carrier frequency is displaced by the correct amount, or *vice versa).* This limits the choice of heterodyning frequencies if the correct sideband output from the mixer-chain is to be obtained from each of the amateur bands. The double-conversion method mentioned above overcomes this difficulty and makes the filter-type generator almost as flexible as the phasing-type. This latter method still has the edge with respect to the basic generator frequency, as the RF phase-shift networks can be designed to work satisfactorily at any fixed frequency in the HF range. Furthermore, the process of generating a signal by the out-phasing method allows sideband inversion to be accomplished very simply by reversing the audio input to the balanced-modulators.

A brief mention should be made of the Collins and RCA mechanical filters, which provide a symmetrical band-pass output of the correct format and band-width for single-sideband. These filters will attenuate either sideband equally, depending on the frequency of the carrier-oscillator; thus sideband switching is simplified, as it is only necessary to move the carrier to the opposite side of the pass-band to invert the sideband. This type of filter is rather expensive and is not readily available in Europe.

The sideband generator is the heart of an SSB transmitter, and it is here that the newcomer must start. The output should be clean and free from

spurious signals and will require considerable amplification before it can be fed to the aerial. Because of the nature of the SSB signal, the amplifier-chain is required to operate in a strictly linear condition so as to avoid distortion and the generation of spurious signals in the amplifier itself. (The technicalities, practical circuits and adjustment procedure for linear amplifiers are fully covered in the SSB handbooks.)

Voice-controlled "break-in" with receiver muting and loud-speaker anti-trip facilities are the order of the day. Although these control circuits are closely tied to the speech-amplifier section and it is often convenient to include these circuits when first building a sideband exciter, they can be constructed as a separate unit and added later. Automatic aerial change-over by means of a fast-acting electronic T-R switch is another very useful accessory which can be used as an alternative to the slower (and noisier) conventional relay.

From time to time "SSB Topics" will include information specifically prepared for the prospective sideband. To start the ball rolling, G2NH has provided the details on his very successful crystal-filter exciter, which is capable of excellent performance and is simple to construct and adjust. Using this basic 3.8 mc exciter as a starting point, a range of accessories will be described in future issues which will include a linear-amplifier and outboard mixer units for multi-band operation.

The G2NH Single-Sideband Exciter

The exciter is of the simple band-pass, or half-lattice crystal-filter type, and provides a suppressed-carrier lower-sideband output in the 3.8 mc band. Carrier and unwanted sideband for a correctly-adjusted filter are attenuated more than 40 dB. No frills are included, as it is intended that the unit should be the keystone for a series of "building blocks" which can be added to as required.

Circuit Description. The circuit is shown in Figs. 3 and 4. The speech amplifier (V1, ½V3A) is designed to work with a crystal microphone of the normal medium output type. Low-level microphones may require a higher gain amplifier to provide the 3-4 volts needed to drive the first balanced-modulator, V2. This is of the "Motorola" or cathode-coupled type with the audio fed to one grid of the double-triode valve. The carrier generated by the crystal-oscillator (½V3B) is fed to the parallel cathodes (at a level of about 6 volts) and is largely balanced-out in the push-pull anode circuit. The resulting double-sideband reduced-carrier signal feeds the crystal-filter, which consists of two band-pass elements (X2 and X3), which greatly attenuate the unwanted upper-sideband, and a "brute-force" parallel-resonance crystal (X4) which removes the remaining carrier. (The frequencies of the crystals and other component considerations are discussed later.)

The SSB output from the filter is then mixed with the output from the external VFO in the second balanced-modulator (V4). The SSB signal is fed in push-pull to the grids and the VFO drive applied in phase across RFC1. The VFO operates in the region of 3.3 mc; the exact frequency range is determined by the filter design frequency. The VFO signal is balanced-out in the push-pull anode circuit of V4, and the resulting 3.8 mc SSB output is link or inductively coupled to a Class-A buffer amplifier (V5). The exciter and buffer provide 3 or 4 watts output power, which is more than sufficient to drive a linear final-amplifier to 150 watts indicated input.

Component Considerations. The only components that need special attention are the IF transformers and the crystal filter. IFT1 and IFT2 can be any good IF transformers tuning the range selected for the filter. Wearite-type 501, Denco IFT11 and Philips A.312447 components have all been used successfully, as have "surplus" types of U.S.A. manufacture. The windings are provided with an artificial centre-tap, as shown in the circuit diagram. In using permeability-tuned transformers, the fixed condenser normally connected across each winding should be removed and the same capacity made up by using two condensers of double the capacity in series to provide the centre-tap on all windings except IFT2 primary. It is necessary to fit a simple Faraday screen between the primary and secondary windings of IFT1. This can be done by making a scramble winding of 3 or 4 turns of 20g. DCC wire midway

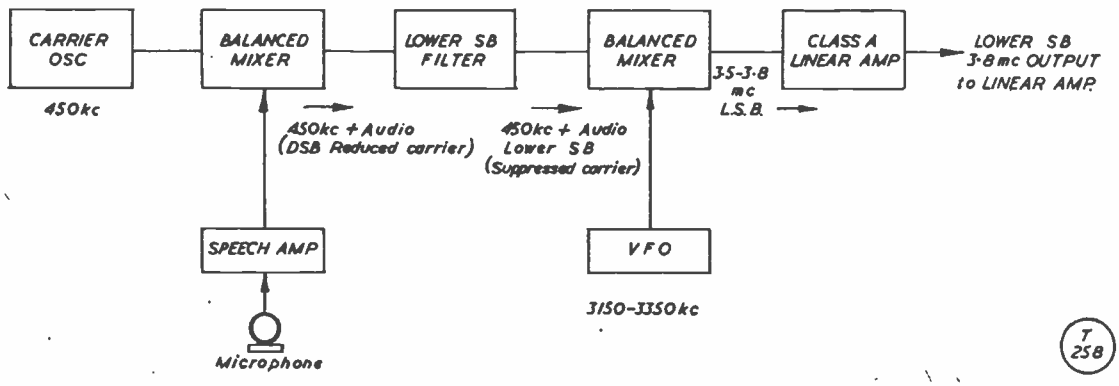


Fig. 3. Block schematic of the G2NH Crystal Filter SSB Exciter, fully discussed in the text. It should be noted that for the purpose of explanation the filter frequency has been taken as 450 kc.

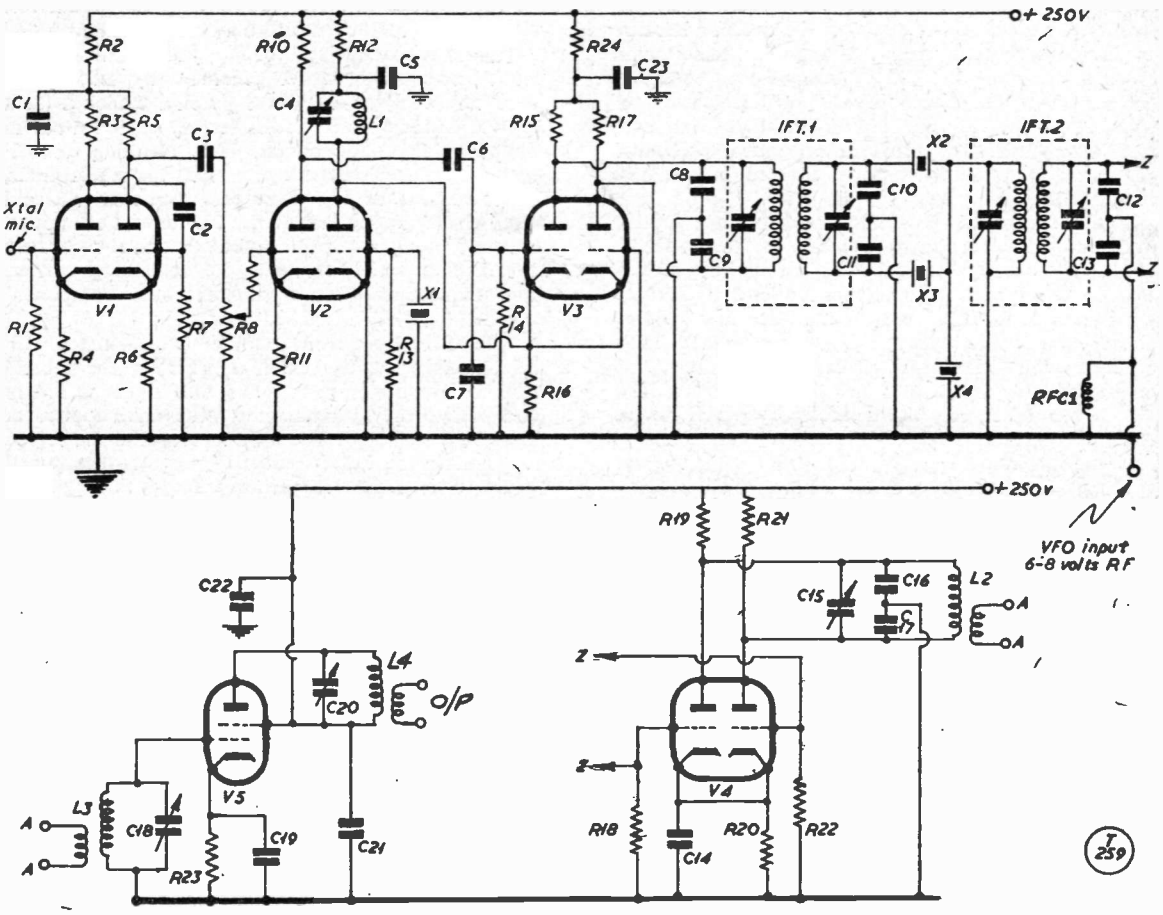


Fig. 4. Circuit complete of the G2NH SSB Exciter, for which all values are given in the table. This diagram should be read with Fig. 3. As mentioned in the article, arrangements have been made for the availability of sets of crystals, X1-X4, for operation with this particular Exciter ; suitable crystals from " surplus " sources may also be obtainable, for adjusting to the required frequencies.

Table of Values

Fig. 4. Circuit of the G2NH Sideband Exciter

C1	= 8 μF 450v. wkg.	R1	= 1 megohm
C2, C3	= 0.005 μF paper 350v. wkg.	R2, R16, R19, R21	= 10,000 ohms
C4	= 100 μμF pre-set variable	R3, R18, R22	= 100,000 ohms
C5, C14, C22	= 0.01 μF paper 350v. wkg.	R4, R6	= 2,200 ohms
C6	= 30 μμF ceramic	R5, R7	= 220,000 ohms
C7	= 500 μμF mica	R8	= 1 megohm potentiometer
C8, C9, C10, C11, C12, C13,		R9	= 47,000 ohms
C16, C17	= 100 μμF Silver-mica	R10	= 25,000 ohms
C15	= 200 μμF variable	R11	= 1,000 ohms
C18, C20	= 350 μμF variable	R12	= 20,000 ohms
C19, C21	= 0.001 μF mica	R13, R14	= 500,000 ohms
C23	= 0.2 μF	R15, R17	= 33,000 ohms
L1	= BFO coil, or similar, to suit filter frequency.	R20, R24	= 5,000 ohms
L2, L3, L4	= 3.8 mc tuned circuit, with link to suit high C/L ratio	R23	= 250 ohms
		V1	= 12AX7, Brimar
		V2	= 12AU7, Brimar
		V3, V4	= 12AT7, Brimar
		V5	= *See text*
		IFT1, IFT2	= *See text*
		X1, X2, X3, X4	= *See text*
		RFC1	= 2.5 mH RFC

between the two windings and earthing one end. The winding can be held in place by a touch of coil cement or cellulose glue.

The exciter is described and intended to reject the upper-sideband, and the filter and VFO frequencies have been tailored for this requirement. The exciter will work equally well if the filter is designed to reject lower-sideband and the VFO frequency is moved to the high-side of the signal frequency.

The crystals used in the original filter are Q.C.C. B7G types. but the FT.241 " surplus " types, which have a slightly lower Q, may be used with no noticeable difference in actual results. No specific filter frequencies are detailed other than for the purpose of examples *(see* Fig. 6), as the filter will operate within the range of 400-550 kc and the actual frequency selected will largely depend on the availability of the crystals at the time of construction. As the " surplus " market for IF-type crystals varies somewhat, the Quartz Crystal Company have agreed to manufacture sets of four matched crystals for this

exciter, and further details can be obtained on request from G2NH. The application, adjustment and frequency relationship to Channel numbers for "surplus" crystals is fully covered in the handbook, *SSB for the Radio Amateur.*

The Filter

The spacing between the filter crystals is shown in Fig. 5. This relationship is most important and must be maintained for optimum carrier and sideband rejection. The carrier frequency selected can be anywhere in the 400-550 kc range and does not alter the filter characteristics, provided that the correct spacing between the carrier and filter crystals is as specified. The filter removes the upper sideband and the attenuation is better than 40 dB at all points above 300 cycles. The pass-band of the filter is flat to within 2 dB over the audio-frequency range of 250-2800 cycles.

The carrier suppression crystal X4 is selected to work in the parallel-resonance mode so as to reject the residual carrier not removed by the first balanced modulator (V2).

By the use of a more sophisticated first balanced-modulator it should be possible to dispense with X4, leaving the balanced-modulator to do all the work of carrier suppression.

Chassis Layout

Most workers will have their own ideas as to how the exciter is to be constructed. A lot will depend on the final requirements, *e.g.* are voice control units, linear amplifier frequency conversion arrangements, or VFO to be included on the main chassis? At G2NH, the VFO is a BC221 frequency meter external to the main chassis, and this feeds an EF91 anode-tuned amplifier which is located close to V4. The Class-A buffer and parallel triode-connected 807 linear amplifier are also built in together with simple

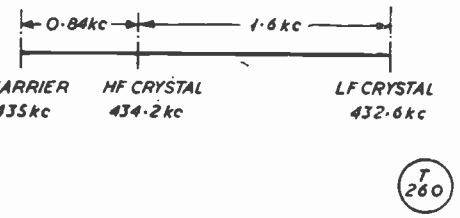


Fig. 5. Crystal spacing to obtain lower-sideband passing; the frequencies taken here are for illustration only — see text.

voice-control circuits.

The chassis layout is not critical, but care must be taken to ensure that there is no leakage round the filter, otherwise it will be impossible to eliminate the carrier and unwanted sideband. Simple screening is a useful safeguard and should be incorporated if there is any chance of filter leakage.

Choice of Valves

The original model was developed, using 6SN7 valves for the two balanced modulators. The 12AT7, 12AU7, 6J6 or ECC91 series are satisfactory replacements in the B7G and Noval range. The crystal-oscillator stage is combined with the third speech-amplifier in a 12AU7 double-triode valve. Separate triodes can be used if desired. Several different valves were tried in the Class-A buffer-amplifier position, and the 6AG7, 6CH6 and 6CL6 are suitable alternatives to the QVO4-7. This latter type was finally selected at G2NH on the basis of its stability factor, as the other types required considerable taming to prevent self-oscillation and parasite troubles. *(G6LX note:* 6AG7 and 6CH7 types are in use by many operators who have built the G2NH exciter. Reports indicate that little trouble is actually experienced, and this can be cured using normal anti-parasite measures.)

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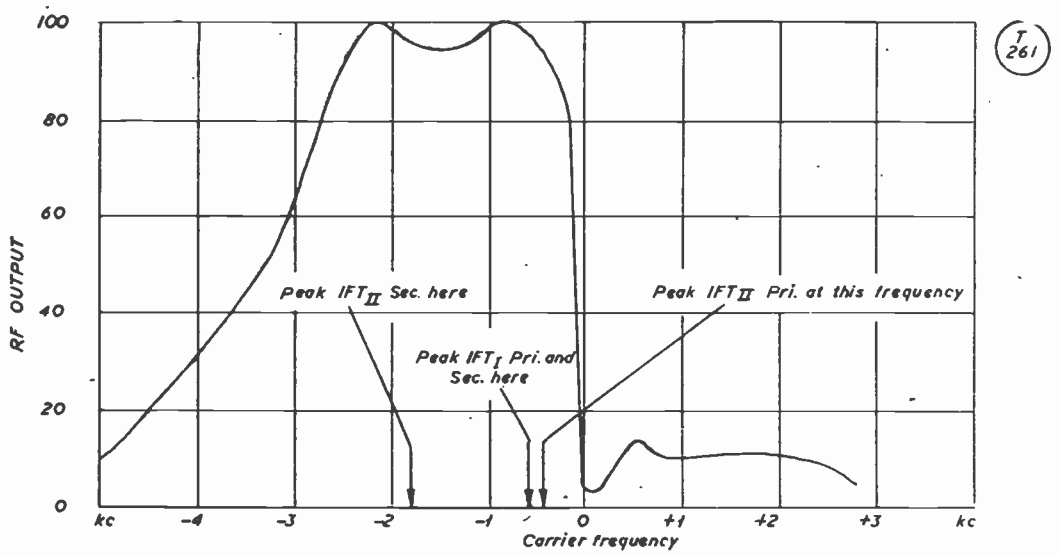

Fig. 6. Actual curve obtained with the original G2NH Crystal Filter SSB Exciter. Note that the frequencies given are for reference only — see text — and have been taken to be: Carrier, 435 kc; HF crystal, 434.2 kc; LF crystal, 432.6 kc.

Initial Adjustments

With all valves and crystals in circuit, apply HT to all stages up to and including the Class-A amplifier (V5).

Set the VFO frequency to produce output on 3800 kc. (For example, using a 435 kc filter, this will be 3800 *minus* 435 *equals* 3365 kc.) Apply a 1000 c/s signal from an audio-oscillator to G1 of the left-hand section of the first balanced-modulator (V2). The level should be 2 to 3 volts r.m.s. No matter how far out of adjustment all trimmers may happen to be, a signal of some sort will be heard on a local receiver tuned to 3800 kc.

Adjust primary and secondary trimmers of both IFT1 and IFT2 for maximum output as heard in the receiver. When the trimmers are aligned, it should be possible to obtain a reading on the S-meter of the receiver, and this will assist in peaking the trimmers accurately. Trim the anode circut of V4. and the grid and anode circuits of the Class-A amplifier (V5) for maximum output.

From this point onwards it will be more convenient to make adjustments by connecting a valve voltmeter to the anode of V5. (The valve voltmeter can be any type having an 0-100 volt range and need not be accurately calibrated.)

The filter is now ready for accurate alignment. For this purpose, a signal generator covering the range 420 to 440 kc is required. (The low-frequency range of the BC221 is ideal, and should be used if at all possible.) If not, it will be necessary to construct a VFO covering this range, and fitted with a band-spread condenser and dial so that the frequency can be read accurately within the range of the filter. The actual crystals in the filter can be used to calibrate the oscillator—but by the time this is done you will wish you had begged or borrowed or bought a BC221 !

Alignment of Filter

The procedure is as follows :

(1) Disconnect audio oscillator from audio input.

(2) Remove X1, and connect the output of the BC221 to the grid pin of the crystal socket (G1 or V3B).

(3) Set the frequency of the BC221 to the mid-point of the crystal pass-band. (For 435 kc carrier this will be 433.4 kc.)

(4) Realign both primary and secondary of IFT1 and IFT2 for maximum output.

(5) Set the BC221 to exactly the carrier frequency and carefully note the exact frequency of the sharp drop in output caused by the crevasse of the carrier rejection filter crystal X4. This may be anything up to 200 *cycles* either side of the nominal frequency. If the filter is correctly aligned, this point will be *very* sharply tuned. Make a note of the exact frequency for future reference.

(6) Set the frequency of the BC221 400 cycles lower than the carrier frequency, *e.g.* 435 − 0.4 = 434.6 kc. and peak IFT2 primary. Move BC221 frequency to 550 cycles lower than the carrier frequency, *e.g.* 435 − 0.550 c. = 434.45 kc, and peak both primary and secondary of IFT1. Move frequency of BC221 to carrier frequency minus 1800 cycles, *e.g.* 435 − 1.8 kc. = 433.2 kc, and peak IFT2 secondary. The filter is now aligned and it is advisable (and interesting) to plot a curve of the filter at, say, every 0.2 kc point and draw a graph. Fig. 6 shows such a curve taken at G2NH, and this curve has been repeated many times with different crystals and shows very little variation.

(7) Remove the BC221 and re-insert X1 in its socket. Carefully check the frequency of the crystal oscillator, and it should be found to be exactly on, or a little bit high in frequency of, the

SSB COUNTRIES-WORKED LADDER

(*Starting Date January 1st, 1954 — Two-Way SSB Only*)

STATION	3.5	7	14	21	28	Total
W2KR	0	0	91	0	0	91*
G3MY	17	0	83	27	0	87*
DL4SV	18	0	82	6	0	86
G6LX	17	4	80	47	14	83*
VE4NI	0	0	83	0	0	83*
K2AAA	0	0	81	0	0	81
W2CFT	0	0	81	0	0	81
ZS6KD	0	0	80	0	0	80
W3SW	0	0	80	0	0	80*
OH2OJ	1	0	80	0	0	80*
K2GMP	0	0	78	1	0	78*
ZL3IA	0	0	77	12	6	77*
ZL3PJ	0	0	76	0	0	76*
VK3AEE	0	0	76	0	0	76*
W3ZP	0	0	75	0	0	75
W4NQN	0	0	66	30	18	70*
HR2WC	0	0	70	45	0	70*
GW2DUR	4	0	69	0	0	69*
GW3LLU	0	0	64	0	0	64*
F7AF	0	0	60	23	7	62
VQ4EO	0	0	62	20	5	62
YU1AD	0	0	62	21	6	62
GW3EHN	6	1	56	3	2	56
GM3CIX	0	1	53	12	0	53
G3BXI	0	0	50	44	2	53
G3GKG	10	0	51	0	6	51
G3GKF	0	0	1	50	1	50
AP2BP	0	0	50	15	0	50
G3AOO	0	0	46	0	0	48
OZ3EA	0	0	48	0	0	48
G3COJ	12	2	41	5	0	46*
G3IRP	5	0	37	0	0	37

Table corrected to 2nd November, 1957
** = Reported this month*

calibration point noted in para. 5. If it is exactly on frequency, nothing more need be done. If it is slightly high in frequency, a small Philips 3-30 $\mu\mu$F trimmer should be connected across A1 crystal sockets and, starting from minimum capacity position, should be adjusted to bring the frequency of X1 exactly to resonance with the crevasse of X4 to ensure the absolute maximum carrier rejection.

If the crystal frequency is lower than the frequency of the calibration point, it will be necessary to treat the crystal by plating. This is not really a satisfactory answer, but will work if it's only a matter of a few kc. The procedure is fully described on page 79, *Single Sideband for the Radio Amateur.*

The above instructions look complicated, but remember we have assumed that everything is right out of adjustment. Once the job is done it is done for good, and, like a good commercial receiver, needs only a check every year or so for your own satisfaction.

Many of the SSB group on 3.8 mc are using variations of this exciter and have considerable experience in diagnosing troubles and incorrect filter operation. Do not hesitate to ask them for help if you run across a snag.

160-Metre SSB Net

The get-togethers on Top Band (2200 GMT Monday evenings) are now a regular feature. Some 12 stations are active most Mondays, and others are building equipment. A full report will appear in February "SSB Topics."

Good progress continues to be made in SSB Countries Worked, as the Table shows; we hope that, as time goes on, it will expand considerably.

Closing date for next "SSB Topics" is December 31 for appearance in the February issue — in the meantime, 73, GL and a Happy Christmas to all who follow this feature, *de G6LX.*

QSL BUREAU NOTE

To save us time and postage on reminders and hasteners, we would ask that any readers who are expecting QSL cards through our Bureau should maintain, at the Bureau, a small supply of stamped addressed envelopes, with name and callsign. The QTH is, simply: BCM/QSL, London, W.C.1, which is a full, complete and sufficient address from any part of the world. The invitation to non-direct subscribers to lay envelopes is to ensure our being able to clear any cards received for them. *Both-way* use of the Bureau, however, is reserved strictly for direct subscribers, *i.e.*, those who receive SHORT WAVE MAGAZINE by post from us by paying (direct to us) in advance a subscription of 30s.* for a year of 12 issues—or 15s.* for six months. This entitles the subscriber to send (to BCM/QSL) his own cards for distribution outwards by us, in packets of as many as he likes and as often as he may wish. It is this both-way handling which makes the QSL Bureau service so valuable to all who are interested in QSL cards. (**Note:* 33s. and 16s. 6d. from January 1st, 1958.)

STANDARD FREQUENCY TRANSMISSIONS — MSF

The National Physical Laboratory has just published a new edition of the pamphlet describing MSF — the Standard Frequency Service from the United Kingdom. These radio transmissions are on the air almost continuously from the Post Office Station at Rugby. They enable anyone needing precise frequency to check his apparatus against a standard which is known to one part in ten thousand million.

The pamphlet announces that the MSF frequencies are now based on the resonant frequency of the caesium atom. This frequency is a fundamental physical constant, free from the small corrections and uncertainties associated with astronomical time. The precise value of the frequency is based on the value of astronomical time for 1955. Some years must pass before the astronomical and atomic units can be compared to the full accuracy attained by the atomic clock, because astronomical time must be averaged over a long period to eliminate small errors and uncertainties of measurement. If any corrections prove necessary in years to come, they can readily be made and therefore will not restrict accuracy already available.

A pamphlet entitled *MSF—Standard Frequency Transmissions from the United Kingdom* is available free on application to: The Director, National Physical Laboratory, Teddington, Middlesex. This gives full technical details, as well as the transmission schedule and the frequencies radiated.

COMMERCIAL MOBILE RADIO

The growth of mobile working in the commercial field is well demonstrated by the G.P.O. statement that there are now well over 11,000 vehicles licensed for "business radio." A private (business) mobile licence costs £3 for each of the first two stations in the network and £2 for each additional station, per year. The biggest users are taxi services, but the listing includes mobiles of all types—including cranes! The Post Office has recently introduced a new limited-coverage commercial licence, available for 28 days only, costing £1. This is intended for show-ground and exhibition purposes.

TRANS-ATLANTIC ANNIVERSARY

September 25 saw the first anniversary of the opening for public service of the Trans-Atlantic telephone cable, one of the great feats of engineering in this telecommunications age. The high quality, loud both-way speech and the dependability of these cables (there are actually two of them, with underwater repeaters working in each direction) has doubled the telephone traffic to the States, and trebled it to Canada. So great has been the success of the undertaking that the Post Office is being compelled to plan for extra circuits long before it had been expected that the present link would be fully loaded.

VHF BANDS

A. J. DEVON

Late November Openings—

Note on Procedures—

EI2W Doing Well on 6 Metres—

Reports, Gossip and Comment—

UNTIL the very end of the period we now consider, things were relatively quiet on VHF, with conditions not-so-good and apparent activity low—as is usual when there is no DX about. Of course, the keen types come on regularly just the same, and the standing schedules are kept, but the band tends to sound dull and uninteresting.

This was the pattern until the week beginning November 18, when the weather people began talking about anti-cyclones. By the 20th, the barometer had gone high, and remained steady—in fact, it kept high and steady for a whole week, until at least November 27. The effect on tropospheric conditions was remarkable. By Friday, 22nd, GDX was starting to come in, and Sunday, 24th, saw excellent conditions all over the area from near-Europe to Northern Ireland; we do not yet know how the GM's were affected, as the barrier of the Cheviots always seems to "break the weather." They may have had good openings across Scotland, but they were not (as far as we know) getting over the hills into England. Conditions held up all through Monday, 25th, and that evening saw a high level of U.K. activity, many good GDX contacts being made.

Your A.J.D. had his ear to the Rx during these evenings of November 24 and 25, and altogether some 80 different stations were logged—the interesting thing being that about half of them were not on during the "other evening"; that is to say, only a few of the group active on the Sunday were heard again on Monday evening. We don't know the reason for this, but there it is . . . The two-metre band was open more or less all day on Sunday, 24th, but this was not the only day-time period during which conditions were very good. On the Wednesday previous, the 20th, G2HCG (Northampton) had a phone QSO with DL3VJ (Horn/Lippe) at 1330 GMT, and PE1PL also reported EDX heard and worked.

On the Sunday evening, 24th, GDX signals were not only good and loud, but remarkably steady, and both VHF bands were well open; we have as yet no exact information as to what happened on 70 centimetres, though several stations were heard making test assignations for that band—it is believed that G3HBW (Bushey, Herts.) worked G3GZM (Tenbury Wells) for Worcs. on 430 mc, for instance, and G2XV had a schedule with ON4CJ.

On two metres, G5MA worked GI5AJ on CW, G3KEQ was receiving GI5AJ and, later in the evening at 2355, G5MA had a solid phone QSO with GI3GXP. At 2325, G5YV worked ON4CJ, and other EU's were getting into the Midlands.

The next evening, Monday, 25th, activity was again good, and the proceedings were enlivened by the appearance of LX1SI — he was heard as far west as Bristol, by G3KHA, who worked DL3NQ for a fine EDX contact. Quite a number of Continentals were good signals in the Midlands area, notably ON4BZ, ON4DW, ON4IE, ON4TQ, ON4ZK and PAØGER. At about 2215, ON4DW let out a CQ (on CW, too) which was answered by at least six stations. As regards GDX results on the 25th, G3IBI (Southampton) was a loud and consistent signal in the Midlands all the evening, other very strong G's at well over the 100 miles being G4PS (Crookham) and G3HWJ (Surbiton), using 18w. only. G3KFX (Ipswich) was doing well for Suffolk, and quite a number of new call-signs could be heard all round the band—incidentally, GI3IJM on 144.2 mc is a new one, from Co. Antrim, and somebody was heard to say that there were no less than 11 Warwickshire stations working on the hot-spot around 144.7 mc. The QRM in the London area was pretty hot, too, and heterodyning was severe at times.

From the foregoing, therefore, it can be said that conditions were very good and activity high during November 24-25; we look forward to seeing many new claims for the Tables arising from all this happening right at the end of the period, when it was, of course, too late for reports to be sent in.

Operating Procedures

When the two-metre band is open and activity high, it would seem all the more desirable that operators should announce, clearly and often, not only their location but also their beam heading. These two items of information are always of great interest to anyone listening round the band, for they can very quickly give an indication of conditions; if a station, 100 miles to the west, is coming in strongly on the back of one's beam, then it is pretty obvious that the band is open in that direction. If beam headings are not mentioned, one can be misled into supposing that because old so-and-so is rather down in strength, conditions cannot be too good—but it might be only because his beam is 90° off which, under normal conditions, produces no signal at all.

Some operators are models in respect of letting you (as a listener, not in QSO) know where they are and exactly what they are doing, or hoping to do. Others merely call long CQ's without a hint of location, beam heading or whereabouts in the band they propose to listen. A good example of this was a certain mobile (who, of all people, should give some hint as

to location); he called CQ three times without giving the slightest clue as to where he was; it could have been the reason why nobody, as far as we heard, replied to his call.

Another point that we think wants watching arises from the use of FM phone on two metres—of course, as an anti-TVI measure. We are all for NBFM if it serves this particular purpose, but some of the FM now to be heard is not nearly as NB as it should be. The result is an almost unresolvable splurge. Most receivers can only cope with NBFM if it *is* narrow-band — and even then you always notice the difference when you tune across to a well-modulated AM phone station. It would be invidious, and unfair, to mention call-signs, one way or the other, at this stage, but we hope that all operators trying out NBFM will ask for, and receive, the sort of report that will help them to get the system working properly.

Six-Metre DX

Cross-band working Six/Ten comes within the terms of reference of colleague L.H.T., so that here we are concerned only with the 50 mc results obtained by EI2W, who is fortunate enough to be specially licensed for this band. His achievements to date are impressive: Having made the EI/W "First," as reported last month in this space, he raised VE3ARU on November 2 for the EI/VE "First" for 6 metres. During the period to November 17, Harry worked 84 different stations in 20 American States, including W5, W6, W7 and all other W call areas, with W7's in Nevada and Utah also heard. Nice going—and well done, lucky chap!

The EI2W transmitter is on 50.016 mc, CC, runs a maximum input of 40w, and all contacts are phone-only. The converter is a modified two-metre design, and three aerials are available: A ground-plane, a 3-ele flat-top and a 5-ele Yagi with a *tiltable* head; it was the latter, set at an angle of 60°, that fetched in 17 stations in the W5-W7 areas on November 17. Harry's logs show that with him the 50 mc band opens any time between about 1500 and 1700 GMT and does not last long after dark over here; a full daylight path is required for DX.

During peak-reception periods on 50 mc, EI2W has tried 70 mc but with no results so far—in fact, of all the W's worked on 50 mc, the only one encountered with a 70 mc receiver was W8SSD. It is a fair assumption that the MUF will go high enough to make contacts between the U.K. and East Coast W's possible on our much-neglected 4-metre band; W8SSD is in Akron, Ohio (QTHR), and though this is rather far inland, it would be worth it if those G's able to transmit on 70 mc were to try mid-afternoon schedules with him—say, 1530 - 1540 GMT on Saturdays and Sundays when the 50 mc band is open to the Pacific Coast. Once activity is started, there will be no lack of followers.

Note from VE2

In an interesting comment, VE2LI (ex-G5LI) reports that while he has been active on two metres during the summer, results have been disappointing, due to lack of any sort of band-planning, local interest mainly in cross-town phone-only operation, and a low level of activity at reasonable distances; the result is that when there is an opening, any DX there may be is blotted out by locals using equipment which, one gathers, is not

TWO METRES

COUNTRIES WORKED

Starting Figure, 8

16 ON4BZ, (DL, EI, F, G, GC, GI, GM, GW, HB, LA, LX, ON, OZ, PA, SM, 9S4)

16 G3GHO, G5YV, G6NB (DL, EI, F, G, GC, GD, GI, GM, GW, HB, LA, LX, ON, OZ, PA, SM)

15 G4MW

14 G2FJR, G2HDZ, G3IOO, G5BD, G5MA, G8OU

13 G2XV, G3BLP, G3CCH, G3DMU, G3GPT, G5DS, G6XM, G6XX

12 F8MX, G2HIF, G3FAN, G3GHI, G3JWQ, G3KEQ, G3WW, G6LI, G6RH

11 EI2W, G2AJ, G3ABA, G3DVK, G3GFD, G3HAZ, G4RO, G4SA, G5UD, GM3EGW

10 G2AHP, G2FQP, G2HOP, G3BK, G3BNC, G3DLU, G3EHY, G3GSE, G3JZN, G3KUH, G3WS, G5MR, G8IC, GW5MQ, PA0FB

9 G2CZS, G2DVD, G3DKF, G3FIJ, G3FUR, G3IUD, G3LHA, G5ML, GC3EBK

8 G2CIW, G2DDD, G2XC, G3AEP, G3AGS, G3BOC, G3GBO, G3HCU, G3HWJ, G3KHA, G3VM, G5BM, G5BY, G8SB, GC2FZC

TWO-METRE ACTIVITY REPORT

Lists of stations heard and worked are requested for this section, set out in the form shown below, with callsigns in strict alphabetical and numerical order.

G8VZ, Princes Risborough, Bucks.

WORKED: G2ATK, 2CDB, 3GSO, 3IOO, 3JWQ, 3KHA, 3KQF, 5DW, 5YV, GW8UH. (*Over 50 miles only; October 17-November 16*).

G3KQF, Derby.

WORKED: G2ANT, 2CDB, 2CRL, 2FMO, 2HDY, 3AGS, 3APY/M, 3DJJ, 3EGE, 3EKX, 3GGJ, 3GHI, 3GSO, 3GOZ, 3HA, 3HZJ, 3HZK, 3IRA, 3IUK, 3JWQ, 3KAG, 3KCB, 3KEQ, 3KUH, 3LCV, 3LDW, 3LHA, 3LHW, 3LIM, 3LKA, 3MAX, 4MK, 5CP/A, 5DS, 8SK, 8VZ, ON4BZ. (*October 1-November 19*).

SWL Woodhouse, Storrington, West Sussex.

G2ABD, 2AHP, 2AHY, 2ANT, 2ATK, 2AUD, 2BDP, 2BVW, 2CIW, 2DDD, 2DVD, 2FKX/A, 2FM, 2FNW, 2HCG, 2HDJ, 2JF, 2YB, 3AFN, 3BA, 3BEX, 3BII, 3CID, 3EJO, 3ENY, 3FAN, 3FEX, 3FIH, 3FQS, 3FZL, 3GDR, 3GHI, 3GHO, 3GOZ, 3HAZ, 3HBW, 3HCU, 3HZK, 3IAM, 3IUL, 3IZD, 3JEP, 3JHM, 3JTQ/M, 3JWQ, 3JZG, 3KHA, 3KQC, 3KQF, 3KQR, 3LHA, 3LOK, 3LTF, 3LTF/A, 3LVO, 3XC, 4KD, 4PS, 5CP/A, 5MA, 5NF, 5PR, 5US, 5WW, 5YV, 6AG, 6JK, 6LL, 6NB, 6OX, 6OX/M, 6WF, 6YU, 8SC, 8TS, 8VZ, GB2RS, ON4BZ. (*October 20-November 19*).

G2AHY, Crowthorne, Berks.

WORKED: G2AUD, 2HCG, 2HDJ, 2YB, 3BEX, 3EJO, 3JFR, 3KHA, 5BM, 5NF, 5WW, 6AG, 6OU, 8VZ. (*October 20-November 17*).

SWL Tomlin, Malvern, Worcs.

HEARD: G2AHY, 2ANT, 2ATK, 2AUD, 2BVW, 2CIW, 2DVD, 2FM, 2FMO, 2FNW, 2HCG, 2HDY, 2JZ, 2XV, 2YB, 3BA, 3BEX, 3BW, 3DF, 3DKF, 3DMU, 3EGV, 3EJO, 3ENY, 3FAN, 3FCQ, 3FIH, 3FTN, 3GFD, 3GHI, 3GHO, 3GKZ, 3GSO, 3GTN, 3GZM, 3HAZ, 3HBW, 3HWC, 3HXN, 3HXS, 3IBI, 3IER, 3IIT, 3IOO, 3IRA, 3IRS, 3IUL, 3IWJ, 3JTQ, 3JWQ, 3JYZ/A, 3JZG, 3JZN, 3JZW, 3KEQ, 3KFD, 3KMT, 3KNT, 3LAY, 3LHA, 3LHW, 3LKA, 3LOK, 3LTF, 4DC, 4HQ, 4MK, 4PS, 5BM, 5CP/A, 5DW, 5KG, 5MA, 5ML, 5OX, 5YV, 6AG, 6NB, 6NW, 6SN, 6WF, 6XM, 6YU, 8AL, 8RW, 8SK, 8VZ, GB2RS, GW8UH. (*October 1-31*).

SWL Winters, Melton Mowbray, Leics.

PHONE: G2BVW, 2CDB, 2CRL, 2FMO, 2FNW, 2HCG, 3ALC, 3BU, 3EKX, 3EVV, 3FAN, 3GSO, 3HBW, 3IOO, 3JWQ, 3JXN, 3JZN, 3KEF, 3KEQ, 3KQF, 3LHA, 3LHW, 3LKA/P, 4MK, 5CP/A, 5DS, 5MA, 5YV, 6NB, 6XM, 6YU, GB2RS.

CW: G3GSO, 3HBW, 3HZK, 5MA. (*October 12-November 12*).

TWO METRES

COUNTIES WORKED SINCE SEPTEMBER 1, 1957

Starting Figure, 14

From Home QTH Only

Worked	Station
43	G5MA
41	G3GHO
40	G3HBW
32	G8VZ
31	G2CIW
30	G3JWQ
27	GM3DIQ
25	G3KHA
20	G2AHY
17	G3DLU

This Annual Counties Worked Table opened on September 1st, 1957, and will run till August 31st, 1958. All operators who work 14 or more Counties on Two Metres in the year are eligible for entry in the Table. The first claim should show a list of counties, with stations worked for them, as soon as 14C have been achieved. Thereafter, the list can be added to as more counties accrue.

quite up to the standard of that to be found in the average VHF station in this country.

And, from back in the U.K., we have reports from G2AHY (Crowthorne, Berks.), who is on most evenings and found five more counties for the new Annual table, and from G8VZ (Princes Risborough), who tried a three-schedule-a-day routine with G3JWQ (Ripley, Derbs.) for one week; it was found that they could QSO consistently over their 100-mile path at 0900, 1330 and 1900, with signal strength tending to be better at 0900 than at the other times. G8VZ shows a good list of stations worked over 50 miles during the quiet period of the month.

G3KQF (Derby) has increased power and improved his take-off by felling a large tree which "blocked the view" to the south; he now offers a regular schedule around 1300 to anyone who may be interested. G3HBW (Bushey Heath) says that he has little DX to report, though at 2350 on November 12 he caught a weak signal from GM3EGW, signing off with G5YV. G3HAZ (Birmingham) has been worked on 70 centimetres, and two other counties added for that band.

SWL Winters (Melton Mowbray) has improved matters considerably with a new 6/6 slot-fed beam, and reports what for him is new GDX, with PE1PL also heard for his first Continental signal. SWL Woodhouse (Storrington, West Sussex) was hoping to get on 50 mc in time to hear EI2W working the Trans-Atlantic DX and, for two metres, reports G3JWQ, G3LHA and G5YV as his most consistent GDX stations heard, with G3KHA the only regular signal from the West Country.

VHFCC Election

This month, we add one more to the roll of those entitled to show the letters VHFCC on their QSL cards: D. Skirrow, G3GFD, of Bradford, gains VHF Century Club Certificate No. 220. He showed a total of 104 cards, of which 29 were for EDX worked; they break down as follows: 13 DL's, 5 OZ's and 11 PA's—which is not bad going from the North of England, especially as he has actually worked 44 different EU's, cards being awaited from the remainder. G3GFD started on two metres in April, 1956, and says that his QSL return averages 60%.

Rules and procedure for VHFCC applications appeared on p.376 of the September 1957 issue of SHORT WAVE MAGAZINE.

January Dead-Line——

The calendar says that we should be here again on January 3; this means that your report for that issue must be posted on **Tuesday, December 17**—addressed A. J. Devon, "VHF Bands," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1—if we are to get it in time through the pile-up of Christmas mail. As it is, there will be little respite for us over what is termed "The Holiday" — your A.J.D., liverish, bleary-eyed and full of nuts and port, will be cursing his way through page-proofs on Boxing Day. Never mind — have one for me with the turkey, and every good wish to you for Christmas and the New Year.

SEVENTY CENTIMETRES

ALL-TIME COUNTIES WORKED

Starting Figure, 4

Worked	Station
29	G2XV
26	GW2ADZ
23	G3BKQ, G6NB
22	G3HBW
19	G3KEQ
18	G3IOO
16	G2CIW, G6NF
15	G4RO, G5YV
14	G2HDZ
12	G5BD
10	G2OI, G3IRW
9	G2DDD, G5DS
7	G2HDY, G3JHM
6	G3FAN, G3JMA, G3KHA, G3WW
5	G3FUL, G3IRA, G3IUD, G5ML
4	G3JGY

On working four Counties or more on the 70-Centimetre band, a list showing stations and counties should be sent in for this Table, and thereafter new counties worked notified as they accrue

BRITISH ISLES TWO-METRE ZONE PLAN

(This is reproduced here for the attention of all concerned).

Zone A & B: 144.0 to 144.2 mc.	All Scotland.
Zone C: 144.2 to 144.4 mc.	All England from Lancs. Yorks., northward.
Zone D: 145.8 to 146 mc.	All Ireland.
Zone E: 144.4 to 144.65 mc.	Cheshire, Derby, Notts., Lincs., Rutland, Leics., Warwick and Staffs.
Zone F: 145.65 to 145.8 mc.	Flint, Denbigh, Shrops., Worcs., Hereford, Monmouth and West.
Zone G: 144.65 to 144.85 mc.	Northants., Bucks., Herts., Beds., Hunts., Cambs., Norfolk, Suffolk.
Zone H: 145.25 to 145.5 mc.	Dorset, Wilts., Glos., Oxon., Berks. and Hants
Zone I: 145.5 to 145.65 mc.	Cornwall, Devon, Somerset
Zone J: 144.85 to 145.25 mc.	London, Essex, Middlesex, Surrey, Kent, Sussex.

THE "G2IQ" TWO-METRE CONVERTER

PART II

NOTES ON LINING-UP AND ADJUSTMENT, WITH A CRYSTAL-CONTROLLED VERSION

The SEO version of the G2IQ two-metre converter—a design well known to many VHF operators—was discussed in our November issue, as a reprint. This article deals with the application of CC to the basic "G2IQ".—Editor.

IN general, all writers on VHF stress the need for short, direct wiring, and it is felt that this point requires very special emphasis. The advice is not given idly. In wiring up a two-metre circuit which you want to work, consider most carefully every step, decide how you can save a *quarter of an inch* here or a quarter there by careful arrangement of the components. Let this basic fact be engraved on your mind. Never forget it. Pay the most careful attention to the supply leads, particularly those carrying heater voltages. Keep these right up against the panelling and by-pass them to earth as close as possible to the valve holder tags. The low inductive T.C.C. "Micadiscs" and Plessey "Cascaps" are very useful in this connection. They provide at one and the same time a feed-through connection at chassis level and a low inductive capacity to earth. Bond all earth leads, valve holders and so on firmly to the chassis. A single earth lead fed through a bare hole in the chassis will cause untold trouble with unexplained and sudden alterations in oscillator frequency. Follow most carefully the advice given with regard to coil size and gauge of wire advised. To those accustomed to the more usual frequencies, these coils are microscopic in size and look utterly absurd!

Turning now specifically to the 6J6 converter in the G2IQ version, the oscillator gave little trouble once the above-mentioned points were firmly grasped. A snag was encountered in the first place due to obtaining oscillation which was beyond the range of the grid-dip instrument, but which showed up on Lecher wires to be within the range of 270-300 mc! A bit higher than expected! Tuning alteration made little difference, and, in fact, it was only when it was discovered that *shorting out* the inductance also made little difference that it was realised what was wrong. The wiring itself contained sufficient inductance to form its own oscillatory circuit at this much higher frequency! One of the first lessons was thereby learnt and a re-arrangement of the components cured this particular trouble.

The next trouble came, rather naturally, from self-oscillation of the RF stage. The exact neutralising condensers specified were not available and many were tried without success. Eventually success was attained by realigning the valve holder slightly in relation to the dividing screen so that the plate lead tags on the valve holder were completely screened from the remaining elements. The grid leads were fed through small grommetted holes in the dividing screen and tiny home-made neutralising condensers attached directly from these points to the opposite anode leads—that is to say, the cross-over takes place on the *mixer* side of the dividing screen. The home-made condensers each consisted of two lengths of No. 20 gauge enamelled wire overlapping each other to an extent of 1-in. pushed into a 1-in. length of systoflex sleeving from opposite ends. A certain amount of careful juggling is necessary to attain stability and in this connection some form of load should be applied to the grid coil — preferably the aerial! The grid coil was settled finally as a six-turn, with four aerial turns overwound in the centre. A 350-ohm resistor was fixed temporarily across the latter during neutralising operations, to form the load.

Approximate resonance of the RF anode coil and the local oscillator was checked by the aid of the grid-dip oscillator, the former as near as could be judged in the centre of the 144-146 mc band and the latter at 135 mc, to give the IF of 10 mc which was selected for this particular model; final touches were effected using the grid-dip oscillator as a signal generator on 145 mc and peaking up on the communications receiver S-meter.

Even then no signals could be heard from outside, and what was equally ominous was the complete lack of car ignition noise—with a main road not far away. Followed a period of intense cogitation to decide upon the next move. The only unknown factor left for investigation appeared to be the degree of injection from the local oscillator.

Injection Control

The original injection consisted of a quarter-inch overlap of bare wire air-spaced about 1/32-in. on each grid circuit. This was increased to an inch, using the same technique as was employed in the construction of the neutralising condensers and—Lo! ignition noises became apparent and signals rapidly followed.

Lastly, a word on the physical layout employed. The writer has departed, somewhat unwisely perhaps, from the original G2IQ layout, but the design appears to lend itself to neatness and a clean arrangement. The chassis is 6-in. in depth with 1-in. clearance below. A back vertical panel carries the three valves with their bases facing the front and the valves in a horizontal position. The two dividing screens are suitably disposed, and their front ends form supports for the front panel, which contains only the slow motion drive to the local oscillator. It is thus possible, by removing the front panel, to carry out innumerable adjustments without difficulty, with all RF wiring in full view. All feed leads drop straight down and through the chassis, suitably by-passed as recommended, and the IF transformer is located

under the chassis just below the mixer compartment, with a screened take-off to the co-axial socket for connection to the main receiver input. No IF break-through is experienced and only the barest trace of IF pick-up, and then only on very strong signals.

APPLYING CRYSTAL CONTROL TO THE G2IQ

The first consideration in the design of a crystal-controlled two-metre converter is the question of the IF range to tune on the main receiver, used as an IF/AF amplifier.

The obvious choice would be 4-6 mc, 14-16 mc or 24-26 mc, so that dial readings could be directly related to the actual signal frequency. On the count of IF break-through alone the two former were automatically ruled out, apart from other considerations. This left 24-26 mc and here again snags were quickly encountered. Using a crystal oscillating on its third overtone we have a choice of four fundamental frequencies to produce the necessary harmonic on 120 mc—5.00; 6.66; 8.00 and 10.00 mc. 5.00 is out because 3 × 15 equals Band I vision and 8 × 15 was too great a multiplication; 6.66 mc might have done but again it seemed unlikely that sufficient injection would be available. 8.00 mc is obviously out because 3 × 8 equals 24 which is the actual IF. 10.00 mc seemed rather an expensive way of trying to do it, so eventually (as is usually the case) a compromise was made and it was decided to select an IF *in the region* of 24-26 mc and to look through the crystal box for something suitable, calibration being effected by logging the clock-dial readings of the main receiver.

The question of "birdies" is a very important one and it will suffice to say that a 7940 kc crystal working on 3rd overtone × 5 and producing an IF of 24.9—26.9 mc has proved very satisfactory, only one weak beat appearing in the tuning range of 144.0 to 146.0 mc. At the selected IF, break-through on the main receiver is much improved, but two other factors emerged. As is often the case the overall gain of the receiver is not so good at this end of the tuning range and in addition there is a relatively poor image-ratio. It was found on the trial lash-up that amateur stations giving reasonably strong signals on a frequency greater than 144.9 mc could be tuned in at readable strength on twice the 2nd IF, or approximately 900 kc lower, and therefore they appeared twice in the band.

These factors called for some modification in the original design and, it was felt, could be rectified by the inclusion of an RF pre-amplifier stage, at IF, to be run at full gain, any surplus to be reduced by control of the RF gain control of the main receiver. Finally, to give the *finis* to any residual break-through, and to provide a good match into the main receiver, a cathode follower was incorporated in the output. (See Fig. 2.)

Having decided finally upon the main circuitry the whole thing was set out to scale on paper and the chief components juggled into position. The result of this was the production of a chassis measuring 9-in. × 3¼-in. × 1½-in. into, or upon, which, with some care, everything could be fitted.

Design and Layout

From the circuit it will be seen that there is nothing revolutionary in the design. V1 is the 6J6 push-pull RF stage and V2 the push-push mixer as in the original G2IQ. V3 is the IF pre-amplifier. V4 the cathode follower and V5 the oscillator-multiplier stage. The total unit consumes 38 mA at 150 volts at which pressure it is absolutely docile and very quiet in operation. There are, however, a number of points to watch and snags to avoid if results are to be up to expectation and these will now be dealt with.

Over-riding consideration must at all times be given to sensible lay-out of the components to provide the shortest possible wiring—this is common to all VHF designs. In addition it is very desirable that symmetry should be observed as far as the mixer anode.

RF Stage. The aerial input is 300-ohm balanced feeder and this is coupled in at the front end to a 4-turn coil of insulated wire interwound into the centre of the grid coil. This coil is tuned with an 8 $\mu\mu$F concentric trimmer, C1. The grid coil consists of 8 turns 20 SWG tinned wire, ⅛-in. diameter × 1-in. long. The 6J6 valve chosen for this stage was decided upon somewhat reluctantly in view of the wide *Gm* range it is reputed to have, not only as between valves but also between each half, and from this point of view the 12AT7 would undoubetdly have been a better choice. The disposition of the 12AT7 valve pins, however, is such that no means of neutralising and at the same time preserving symmetry of design could be envisaged. Several 6J6 valves were therefore tried in turn in this stage and the most satisfactory one retained. A nylon-loaded bakelite holder was selected for this as well as the mixer stage, in preference to ceramic. Neutralisation is achieved without great difficulty in this manner: The screen is cut so that it makes a very exact fit with the valve holder leaving only the two anode pins projecting into the mixer compartment. Two ¼-in. holes are drilled in this bulkhead and blanked off with small squares of paxolin which in turn are drilled to receive tiny copper tubes ⅛-in. long and about 3/32-in. diameter made by rolling copper condenser foil (taken from a u/s. .01 mica condenser) round a suitable sized drill and running a thin touch of solder along the edge. Crossed leads are taken from these tubes which project into the mixer compartment to the two anode pins. It is then only necessary to push short lengths of insulated wire into each tube and solder these to the outside ends of the grid coil, adjusting for neutralisation in the usual manner by moving the wires in or out a trifle with the aid of a trimming tool. Much trouble was encountered with self-oscillation until the smaller stopper resistance R2 was inserted between the centre of the anode coil and the RFC connected to the HT line. After that everything was as simple as ABC.

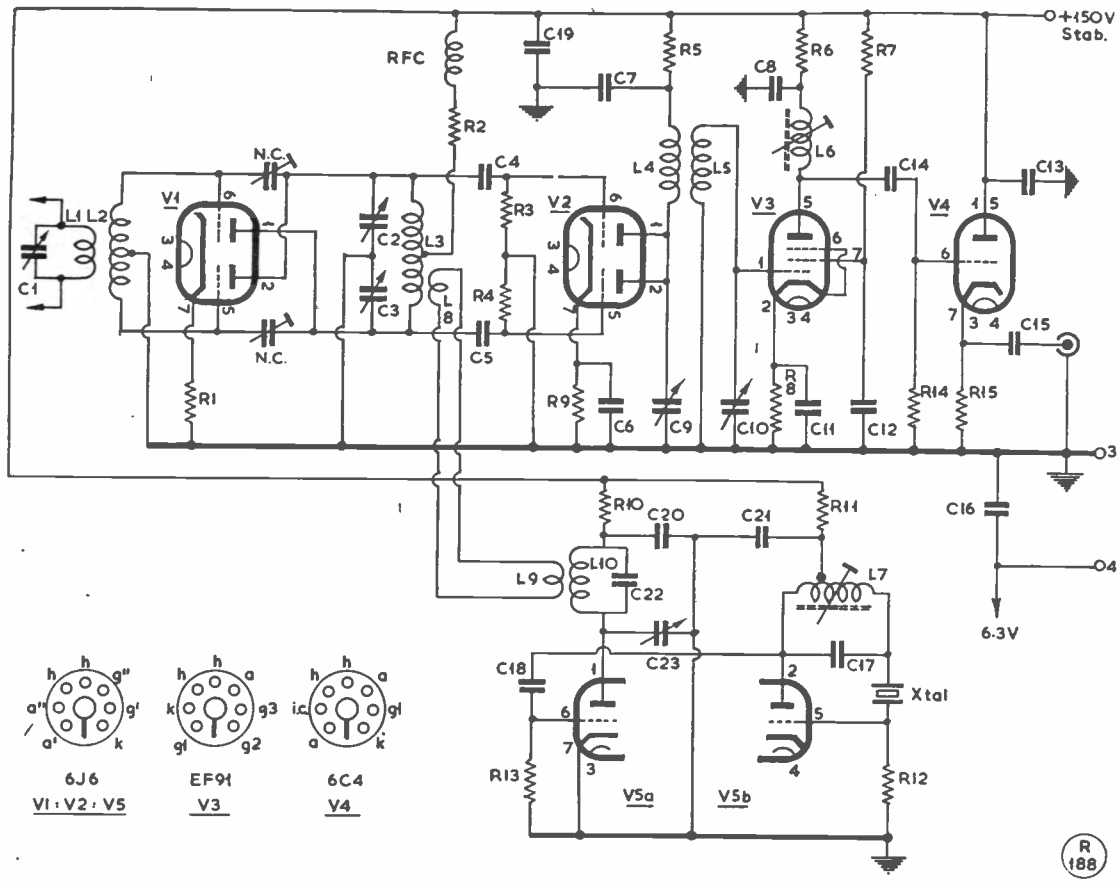

Fig. 2. A crystal-controlled version of the G2IQ converter, as described by G5RZ. It involves an IF amplifier stage V3, and a cathode follower V4. This circuit will not only give a pure T9 beat but also a very strong signal into the main receiver at the IF of 25-27 mc.

The anode coil L3 consists of six turns of approximately the same dimensions as the grid coil and is tuned by means of two 8 $\mu\mu$F concentric trimmers connected between earth and the ends of the coil (C2, C3). By this means electrical symmetry can be maintained. Tuning for optimum signal strength is quite sharp but once these capacities are correctly adjusted they need no further attention and the gain holds up quite well throughout the entire band width.

Mixer Stage. This is screened in a similar manner to the previous stage. A very important point to watch is the anode voltage to this stage. In the unit in question this is dropped to *only 30 volts* by means of the 56,000-ohm resistor R5. Although not very critical, anything over 40 volts causes a definite loss of conversion efficiency and a marked increase in noise.

Preamplifier. This stage, V3, follows normal practice and it was not found necessary to screen either

Table of Values

Fig. 2. Circuit complete of the crystal controlled G2IQ converter.

	C18 = 5 $\mu\mu$F ceramic	R1, R8	= 56 ohms
C1, C2,		R9	= 140 ohms
C3, C23	= 8 $\mu\mu$F concentric trimmers	R2	= 200 ohms
		R6, R15	= 1,600 ohms
C17, C22	= 9 $\mu\mu$F ceramic	R12	= 2,500 ohms
C4, C5	= 20 $\mu\mu$F ceramic	R10	= 3,900 ohms
C9, C10	= 50 $\mu\mu$F trimmers	R11	= 5,000 ohms
C14	= 250 $\mu\mu$F mica	R7	= 20,000 ohms
C7, C12, C20	= 400 $\mu\mu$F mica	R14	= 47,000 ohms
		R5	= 56,000 ohms
C6, C19, C21	= 500 $\mu\mu$F mica	R13	= 120,000 ohms
C15	= .001 μF mica	R3, R4	= 130,000 ohms
C11	= .005 μF mica	*All resistors* ½*-watt rating.*	
C8, C13, C16	= .01 μF mica	RFC	= 20ins. 30 SWG enamelled on resistor former
NC—*see text*		V3	= EF91 (6AM6)
V1, V2		V4	= 6C4
V5	= 6J6		

L1	4t 40 SWG PVC interwound L2
L2	8t 20 SWG tinned ⅛in. x 1in.
L3	6t 20 SWG tinned ⅛in. x 1in.
L4, L5	8t 30 SWG enamelled, close wound on ⅛in. slug former with ⅛in. gap between earthy ends
L6	6t 20 SWG tinned, spaced wire diam., on ⅛in. slug tunned former.
L7	8t 16 SWG enamelled, close wound on ⅛in. slug former with tap 3t from grid end
L8, L9	2-turn links 20 SWG PVC
L10	4t 16 SWG tinned ⅛in. x ⅛in.

of the two tuned circuits so long as the usual precaution was taken to separate them and to place them to present minimum coupling between L5, L6.

Cathode Follower. Here again this was quite straight-forward but too high a value for the grid resistor produced a curious form of oscillation; 47,000-ohms seemed quite satisfactory. The theoretical value for the cathode load resistor should be twice that of the input impedance of the main receiver—in this case, therefore, 600 omhs, but this value does not appear to be in the least critical and, in practice, a value of 1,600-ohms seemed quite satisfactory.

Oscillator-Multiplier. The particular circuit chosen for producing the third overtone mode of oscillation is quite conventional and most crystals tried went off without any difficulty. The fifth harmonic of the overtone frequency is picked out by resonating the second anode coil by means of a further 8 $\mu\mu$F concentric trimmer C23. This also serves as a means of varying the degree of injection into the mixer. It will be noted that all these trimmers, with the exception of the one across the input end of the converter, are connected across the "hot" end to earth, which makes for ease in construction and subsequent adjustment.

Injection. This is obtained by coupling a two-turn link (L8, L9) from the earthy end of the multiplier anode coil L10 *via* a length of twisted pair to a similar two-turn link into the centre of the RF anode coil L3. The twisted pair is routed as clear of obstructions as possible, suitable holes being drilled in the two intervening bulkheads to pass it.

Lining Up. This follows normal practice and few comments are needed here. With heaters and HT applied check that the crystal is operating correctly on its third overtone by tuning to the appropriate frequency on the main receiver. Make sure that it is, in fact, working in the third *overtone* mode, then tune in to the 2-metre band and proceed as usual, making use of a signal generator or a local oscillator for peaking the various circuits to the centre of the band. Adjust injection on a weak signal for best results. With the data given it is unlikely that injection will be excessive or greatly so. The converter is very quiet in operation provided neutralisation has been done correctly but an increase in "sharsh" should be observed as the aerial is switched into circuit. Ignition noises will also be heard if these are normally experienced.

In conclusion, it is not claimed that this converter is the last word, merely that the thought given to its layout and the care given to its construction have both yielded dividends and produced the results which had been aimed at. It is to be hoped that those readers who feel somewhat dissatisfied with their existing arrangements will take heart and find one or two useful and constructive ideas in what has been brought together in this article.

DX FROM THE ALAND ISLANDS

OH2OJ/OHØ ON SSB PHONE JULY 20—AUGUST 10, 1957

H. Granholm, OH2OJ

THE decision by the ARRL to consider the Aland Islands of Finland a "separate country" set every Finnish DX man thinking about a DXpedition to the spot, especially as it is quite easy to get there once you have decided to do so. It is not known who actually was the first to land there, but OH3RE and OH2HK borrowed the small OH2OJ CW/NBFM transmitter last February and went to the Islands for a few days. Others there that month were the club station OH2AA/Ø manned by 2MK, 2KH and 2LP; OH2WI also went to the Islands early in the year. Operation was mainly on CW, though OH2AA/Ø gave many AM contacts with their 150w. plate-and-screen modulated rig, but, even for their part, the greatest number of QSO's was on CW.

During the last summer there have been many expeditions to the beautiful group of islands, which are certainly very nice for a vacation.

We (that is, XYL OH2QJ and the writer) also began to plan in March a vacation/DXpedition to Aland for the duration of our summer holiday. Of course, the participation of the XYL was a bit uncertain because of the two youngsters; when the vacation got nearer, we were able to arrange for them to be taken care of safely.

Equipment

As transmitter, it was decided to build a phasing-type rig as described in *QST* (March, 1956) entitled "Cheap and Easy SSB." The whole transmitter is constructed on a BC-458 chassis without crowding. The VFO and two 1625's were retained, and the 1625's were run as the PA in Class-AB1, at 1000 volts.

For the receiving end, an old BC-453 was modified to include a product detector *plus* a crystal-controlled converter; the converter was built in a small box placed on top of the BC-453, to achieve matching size of the transmitter and receiver. No images were found in the receiver with two tuned circuits link-coupled to each other before the RF stage (a 6CB6) and one tuned circuit between the RF stage and the mixer (a 6BE6). The main tuning was on the BC-453 between 450 and 550 kc for the band of frequencies most used on SSB—14,250 to 14,350 kc. This receiver is, in fact, the best so far used for Sideband reception.

After having had excellent results with a ground-plane at the home QTH, the same type of aerial was the obvious choice for the expedition—also, it is so easy to erect and to transport.

The receiver and transmitter form a really portable combination, weighing not more than 14 pounds, excluding the power-supply; as in all portable rigs,

this is the heaviest part of the station, weighing about 50 pounds, including the aerial, tools and equipment spares. The gear was not ready for final testing until the last night before we left and, of course, there was something wrong in the transmitter.

We left on July 20 by the afternoon flight from Helsingfors to Mariehamn (the capital, and only, town on the Aland Islands), right after work, and arrived safely a couple of hours later at our destination. We settled down in a room hired to us by one of the radio operators of the Coast Guard radio station on the same hill as their station was located. This was a very fine radio site and not too distant from the town, either. Our meals were taken at a restaurant to keep the cooking burden off the XYL—so that she, too, could have a real holiday!

During July 20–August 10 this year an interesting station on 20-metre SSB phone was OH2OJ/OHØ, on holiday on the Aland Islands—Finnish territory at the mouth of the Gulf of Bothnia, in the Baltic Sea — designated a "country" for Amateur Radio purposes. OH2OJ was lucky in having with him his XYL, OH2QJ (above), licensed in her own right and a capable DX operator. Between them they kept OH2OJ/OHØ on the air while the band was open, making some 340 SSB contacts with 260 different stations in 37 countries, under rather poor DX conditions.

On the Air

After having located a dry solder joint and a faulty potentiometer in the transmitter, by the next evening we had the rig lined up in some way and the ground-plane erected. However, conditions were poor and no station could be worked that night; the first contact was made the following morning, with G3AOO. The report was not too good, indicating severe distortion, so more work had to be done. The first DX station worked was ZS6FN that evening. The band was almost dead during the day, so it was usually spent working on the rig, and in the evening we waited for the 14 mc phone band to open up, working a few Europeans meanwhile.

A couple of nights later, the W's began pounding through—but, of course, something happened again in the rig. A resistor in the converter slowly burnt out and the DX faded away. This was, however, the last of troubles with the gear. The next morning the XYL worked VK and ZL, and thereafter we QSO'd freely.

The "firsts" for each Continent were G3AOO, ZS6FN, VK3AEE, W2CFT, HS1A and PY2JU. We managed to squeeze a few more watts from the transmitter and now we could take life real easy, swimming and sun-bathing during the day and working in shifts, if so needed, during the night when the DX was there.

On July 31 the XYL had to leave to return home to the children; and that left me alone taking care of the "hungry wolves" when the band was open! I did my best to satisfy all Continents with different operating times, and hope I was able to make as many as possible happy with a new country. However, the band conditions were not as good as last year during the same period, as checked at the home QTH during July-August, 1956.

The Statistics

We worked 340 QSO's, all on SSB phone, with 260 different stations, the rest, of course, being repeat contacts. Out of these 260 stations, there were 85 W's, 20 G's, 16 DL's, 12 VE's, 4 VK's, 3 ZS's and 4 ZL's, in a total of 37 countries. We used only the one call, OH2OJ/OHØ, though we are both licensed separately. We did not want duplicate contacts with stations just out to work as many OHØ's as possible, but rather we wanted to give as many as we could a chance to work a new country. By the time this appears in print, all cards will have been sent out *via* the bureaux.

NEW QTH's

This space is available for the publication of the addresses of all holders of new U.K. callsigns, as issued, or changes of address of transmitters already licensed. All addresses published here are reprinted in the quarterly issue of the "RADIO AMATEUR CALL BOOK" in preparation. QTH's are inserted as they are received, up to the limit of the space allowance each month. Please write clearly and address on a separate slip to QTH Section.

G3JUX, J. McFarlane, Small Flat, Linton House, Linton, Cambs.

G3KTU, T. Ault, Lill Kurk, Clare Hill, Esher, Surrey.

G3KTU/A, T. Ault, c/o Mrs. E. Ruddlesden, 25 Chilwell Road, Beeston, Notts.

G3LAZ, R. L. Gerrard, 5 Westcott Road, Streatham, London, S.W.16.

G3LJI, W. L. A. Thomas, Wyncliffe, Meadow View Road, Whitchurch, Shropshire.

G3LLR, A. Berwick, 84 Tylney Road, Forest Gate, London, E.7.

G3LOX, B. M. Johnson, 4 Orchard Drive, Chorley Wood, Rickmansworth, Bucks. *(Tel.: Chorley Wood 3322).*

GW3LVI, Sgt. C. R. Barrett, R.A.F. Station, Folly, Roch, Haverfordwest, Pembs.

G3LVJ, F. Oliver, 18 Conway Crescent, Hurdsfield, Macclesfield, Cheshire.

G3LXF, A. F. Fell, 20 Kelshall Terrace, Great Horton, Bradford, 7, Yorkshire.

G3LXO, G. E. Southgate, 12 Theodore Place, Green Street, Gillingham, Kent.

G3LYH, R. Hardy, 3 Beech Avenue, Bracklesham Bay, nr. Chichester, Sussex.

GM3LYI, N. C. Henderson, 84 Old Inverkip Road, Greenock, Renfrewshire. *(Tel.: Greenock 24165).*

G3LYK, F/Lt. W. McLardy, Officers' Mess, R.A.F. Station, Tangmere, Sussex.

G3LYK/A, W. McLardy, 12 Broadview Avenue, Grays, Essex.

G3LYT, W. Fennell, North Lodge, The Moat, Berkswell, Nr. Coventry, Warks.

G3LZJ, Sgt. J. D. Fell, c/o Sgts.' Mess, R.A.F. Station, Hemswell, Lincs.

G3LZW, P. J. Barowitz, 9 Sherwood Grove, Shipley, Yorkshire.

G3LZZ, A. M. Pomfret, 1 Scarborough Road, Shipley, Yorkshire.

G3MAB, J. P. Stott, Bank House, Baildon Green, Shipley, Yorkshire.

G3MAD, A. Wakeley, 70 Arnold Road, Binstead, Nr. Ryde, Isle of Wight.

G3MAK, R. Roberts, 35 Kelbrook Crescent, Kidbrooke, London, S.E.3.

G3MAL, R. L. Hodgson, 24 Farfield Grove, Buttershaw, Bradford, 6, Yorkshire.

G3MAP, A. F. Pavis, 22 David Road, Bilton, Rugby, Warks.

G3MAW, D. Noble, 267 Bingley Road, Shipley, Yorkshire.

G3MBJ, M. Acton, 55 Elizabeth Road, New Oscott, Sutton Coldfield, Warks.

GW8PG/A, Wrexham, Denbighshire. *QSL to G8PG* (A. D. Taylor, 37 Pickerill Road, Greasby, Upton, Wirral, Cheshire. *Tel.: ARRowebrook 1818.)*

CHANGE OF ADDRESS

G2ART, F. H. P. Cawson, 2a Brocklebank Road, Southport, Lancs.

G2CGQ, P. B. Archer, Park View, Middleton Road, Middleton, Morecambe, Lancs. *(Tel.: Heysham 2529).*

G2WK, W. A. Hayes, 44 Beechwood Avenue, Earlsdon, Coventry, Warks.

G3AFT, Grafton Radio Society, Isledon School, Upper Hornsey Road, Holloway, London, N.7.

G3BEX, J. Short, Caravan, Winker's Farm, Denham Lane, Chalfont St. Peter, Bucks.

G3BGF, R. Winkworth, Linden Lea, Graces Lane, Chieveley, Newbury, Berks.

G3EHS, D. Cairns, 27 Arnside Crescent, Feniscowles, Nr. Blackburn, Lancs.

GM3FJP, J. S. Nicholson, 10 Hawkhead Crescent, Edinburgh, 9.

G3GPX, Sgt. P. J. Bartram, 220 A.M.Q., R.A.F. Station, Bruggen, 2nd T.A.F., B.F.P.O., 40, Germany.

GM3HLQ, C. P. Callanan, 140 Glasgow Road, Strathaven, Lanarks. *(Tel.: Strathaven 2117).*

G3HVO, J. Loader, c/o Panda Radio Company Ltd., The School House, Simonstone, Nr. Burnley, Lancs.

G3HVP, F. E. Goddard, Glandford, Spire Hollin, Glossop, Derbyshire.

G3IAJ, A. H. Paul, 30 Treadcroft Drive, Rusper Road, Horsham, Sussex.

GW3IAZ, A. H. Wickham *(ex-G3IAZ/GM3IAZ),* 2 Miskin Crescent, Miskin, Pontyclun, Glam.

G3ICO, G. W. Davis, 113 High Lea, Yeovil, Somerset.

G3IDA, D. J. A. Appleby, Reddynges, Southfield Road, Shepton Mallet, Somerset. *(Tel.: Shepton Mallet 2548).*

G3IES, B. S. Sutherland, 33 Sherlock Court, Swiss Cottage, London, N.W.8.

G3III, Sgt. G. P. Locklock *(ex-ZC4II),* c/o 65 Warwick Road, Scunthorpe, Lincs.

G3JED, G. A. Cunningham, 142 Mansion Lane, Iver, Bucks.

G3KAY/A, F/Sgt. R. J. Lang, c/o Sgts.' Mess, R.A.F. Station, Gaydon, Leamington Spa, Warks.

G3KDK, H. Dean, Chaddlewood House, Plympton, Devon.

G3KEF, T. J. Fishpool, 86 Halford Lane, Coventry, Warks.

G3KFB, K. Parkinson, B.E.M., 51 Welland Road, Longhill Estate, Hull, Yorkshire.

G3LIA, R. J. Rogers, 93 Bradshaws, Hatfield, Herts.

G3LOD, D. M. Rowse, Rodona, Camp End Road, St. George's Hill, Weybridge, Surrey. *(Tel.: Cobham 2762).*

G3QG, W. C. Green, 840 Dunstable Road, Luton, Beds.

G4UX, J. E. Fynn, Highfield, Bells Green, Knebworth, Herts.

G5LK, L. Knight, 89 London Road, Mitcham, Surrey.

G8RF, J. R. Raby, 38 Broadway, Codsall, Wolverhampton, Staffs. *(Tel.: Codsall 387).*

THE OTHER MAN'S STATION

G3FKH

THE photograph shows the station owned and operated by G3FKH, D. Roberts, 233 Chelmsford Road, Shenfield, Essex.

The receiver on the left is a CR150. The transmitter is at the right with the station control panel in front of the Eddystone speed key at the centre. The power supply for the station is housed in a locked and interlocked steel travelling trunk on the floor, and the modulator is contained in the desk cupboard.

The transmitter, which is built into a CR150 case, to match the receiver, consists of 6AM6 VFO into a Labgear wide-band multiplier using triode connected 6AM6's, into a 6146, and 813 PA. The last two stages incorporate Pi-network tuning and fixed bias, as described by G3BDQ in the November 1956 issue of SHORT WAVE MAGAZINE.

A built-in blower motor ensures cool operation, and as all components are rated for "continuous commercial service," the equipment really "idles" at 150 watts input, CW or phone. All leads cold to RF in the transmitter are neatly run in lossy rubber insulated lead-covered cable (as additional RF by-passing), and each lead that leaves the box does so *via* two feed-through condensers with associated RF chokes. A low-pass filter is fitted in the coaxial lead to the aerial coupling unit, and the station is TVI-proof on all bands, phone and CW—in fact, one can listen to the local TV station, on 42 and 45 mc, on the *station* receiver, whilst running the full licensed power on the transmitter, on any band.

The control box remotely switches the power supply, and using the well-known double-triode break-in circuit, changes the whole station from send to receive when the key is touched — there is no "send-receive" switch in the equipment.

Aerials in use are a 352 foot-per-leg Vee Beam N/S and a set of dipoles for all bands (described recently in *QST*), run E/W. The garden is 270 feet long (and 20 feet wide), but the Vee is installed in a field at the bottom of the garden and fed by 600-ohm open-wire feeder 300 feet long.

The station is entirely home-built, including the CR100 receiver that was in use at first, but a CR150 was recently practically presented to the owner, and the CR100 was sold (after a deluge of telephone calls) following the advertisement on p.336 of the August 1957 SHORT WAVE MAGAZINE.

The big interest at G3FKH is high-speed CW DX and contests; the latter are found to be the real test of how well one's signal compares with others in the country.

G3FKH was first licensed in 1948 as DL2NS, and a start was made with a CO-PA; the present is the third complete station built since then. The DX record so far stands at 140C, with DXCC and WAC held, cards being awaited for the SHORT WAVE MAGAZINE FBA and WNACA awards.

Our photograph shows how neatly and unobtrusively a CW/Phone station can be installed, capable of operation in both modes at full power.

THE MONTH WITH THE CLUBS

By *"Club Secretary"*

(Deadline for February Issue : JANUARY 17)

BEFORE these notes appear in print the Twelfth "MCC" will be over, and we hope that all the logs will have been subjected at least to the preliminary scrutiny. We give notice that any logs not received by the time you read this will now be too late for acceptance—the closing date was December 4 (*see* Rule 8, p.441, October issue). During the first week-end, activity seemed to be at a very satisfactory level, and upwards of thirty Clubs were heard on the Saturday and Sunday evenings; the congestion in the few kc around 1830 kc was *terrific*! From what we heard, we still think there is a chance that this year's entry may prove to be a record.

Club Secretaries are asked to note that this space, in the next issue, will be given up, as always, to a detailed analysis of the MCC Results. **No Club notes should therefore be sent in** for the January issue, and the next applicable deadline—for the February issue —will be **Friday, January 17.** These notes should contain details of meetings from *February 8* onwards.

And so to this month's Activity Reports . . . To which your scribe would like to add Season's Greetings to all Club members, and their hard-working honorary secretaries.

From **Wrexham,** they report that meetings are held fortnightly, in the sequence Social, Practical and Technical; members are encouraged to take the R.A.E., and Morse practice can be given by arrangement. Junior members and full-time students are accepted without subscription.

Members of **Bailleul** report a most interesting visit to the Racal Engineering Works, to see "that receiver." G3IHH was putting out a good signal during MCC.

Bury meet at 8 p.m. on Tuesday, December 10, for their AGM. This will be held at the George Hotel, Kay Gardens, Bury, and will be followed by a Junk Sale. **Cardiff** continue to meet on the second Monday of the month at The British Volunteer, The Hayes, Cardiff; at the December meeting GW3GHC will talk on his transmitter with remotely-tuned VFO, and in January there will be a lecture on receivers.

One of the "non-meeting Clubs" is the *British Amateur Tape-Recording Society,* membership of which is open to any tape-recorder enthusiast. They issue a B.A.T.R.S. *Tape Bulletin* monthly (on tape, naturally), and foster tape exchanges and a tape-to-tape dubbing service. Full details from the hon. sec. (*see* panel).

Purley visited the Crystal Palace TV station late in October, and on November 1 they held their usual Club Activity Night. On the 15th G3GKF, the secretary, gave a talk on The Elements of SSB.

Roch Valley is a new Club just recently formed in Rochdale. They will meet every Tuesday, 8 p.m., in the Windmill Hotel, Sudden, Rochdale, and all interested visitors will be made welcome.

Slade recently held their Annual Dinner, in the presence of the Presidents of MARS, CARS and the Rugby Radio Society. They report a very prosperous state of affairs, with a membership of 112, including no less than 42 new enrolments during the year.

Spen Valley are now in new headquarters at the George Hotel, Cleckheaton. On December 5 they hold a joint meeting with Leeds University Union Radio Club (at Leeds) and on December 18 they meet at their own Hq. They give preliminary notice of a Northern Mobile Rally, centred on the West Riding. A suitable location is now being sought, and offers of support for the event will be welcomed from neighbouring Clubs.

Tees-Side will be holding a "semi-annual dinner" on December 14 at 7 p.m. They extend an invitation

NAMES AND ADDRESSES OF CLUB SECRETARIES REPORTING IN THIS ISSUE:

ABERDEEN: A. G. Knight, 108 Rosemount Place, Aberdeen.
ALDERSHOT: S. E. Hume, 25 Kingsway, Aldershot.
BAILLEUL: G. Seeney, 3 Trng. Bn. R.E.M.E., Bailleul Camp, Aborfield, Berks.
BRITISH AMATEUR TAPE-RECORDING SOCIETY: E. Yates, G3ITY, 210 Stamford Road, Blacon, near Chester.
BURY: L. Robinson, 56 Avondale Avenue, Bury.
CARDIFF: R. Morris, GW3HJR, The Shack, St. Cenydd Road, Caerphilly.
CHELMSFORD: R. D. May, G3KTF, 46 Stansted Close, Chelmsford.
EDINBURGH: M. Darke, GM3KGK, 44 Howe Street, Edinburgh 3.
LEICESTER: R. Parry, G3HDG, 71 Braunstone Avenue, Leicester.
NORTHAMPTON: S. F. Berridge, G3ITW, 20 Ethel Street, Northampton.
PURLEY: E. R. Honeywood, G3GKF, 105 Whytecliffe Road, Purley.
ROCH VALLEY: D. J. Power, 2 Clement Street, Rochdale.
SLADE: C. N. Smart, 110 Woolmore Road, Birmingham 23.
SOUTH SHIELDS: K. Sketheway, 51 Baret Road, Walkergate, Newcastle-on-Tyne 6.
SPEN VALLEY: F. Pearson, 24 Fenton Road, Lockwood, Huddersfield.
STOCKPORT: G. R. Phillips, G3FYE, 7 Germans Buildings, Buxton Road, Stockport.
TORBAY: G. Western, G3LFL, 118 Salisbury Avenue, Barton, Torquay.
WELLINGBOROUGH: P. E. B. Butler, 84 Wellingborough Road, Rushden, Northants.
WIRRAL: H. V. Young, G3LCI, 9 Eastcroft Road, Wallasey.
WREXHAM: T. Corcoran, 3 Lea Road, Wrexham, Denbs.

to anyone who can attend, and will make arrangements for the entertainment of out-of-town visitors on that afternoon. Club Hq. are at 132 Newport Road, Middlesbrough, and G3LXG/A will be on Top Band for the benefit of any visiting Mobiles. Intending visitors are asked to contact the secretary *(see* panel).

Aberdeen held their Eleventh AGM, at which they elected GM3ALZ president, GM3DWX vice-president and Mr. A. G. Knight secretary *(see* panel for address).

Aldershot meets on alternative Wednesdays at The Cannon, Victoria Road, the next being on December 11. Morse classes are proceeding, and new members and interested visitors are always welcome. They were fighting a "local-Derby" with Bailleul in MCC !

Edinburgh meets every Wednesday at Unity House, Hillside Crescent, where the December lecture will be on TV Cameras (A. Henderson) and a review of a radio subject by M. Darke. During January a Tape Lecture is proposed.

Leicester will meet on December 9 for a visit to the City Police C.I.D. (members only). On the 16th they will hear a Tape Lecture on Radio in the Antarctic, after which they close until January. The recent Junk Sale was successful, as was G2DSF's lecture on Operating for DX. New members will be welcome—and so will information from other secretaries, and any manufacturers, regarding *lecture material.*

Photograph taken at Hq. 21 Corps Signal Regt. (T.A.) at Derby, showing G3JXL operating the unit Amateur Radio station, G3LTL. Standing in this group, left to right, are: Capt. W. James (G6XM, the well-known VHF operator); Capt. C. D. Didcot, M.B.E. (G2FHF); and Capt. F. E. Wyer (G8RY). There are at least eight licensed Amateur Radio operators in this very keen and active T.A. unit.

Northampton elected G2HCG president, Mr. I. C. Millar chairman and G3ITW secretary at their recent AGM. Meetings will be held every Friday at the Clubroom, Allen's Pram Works, 8 Duke Street, from 7 p.m. The Club Tx, G3GWB, is active on Eighty and Forty CW, low-power, pending the completion of power supply and modulator units for the final scheme.

South Shields had a lecture in November from G2BCY and G3JDO on Getting Started on Top Band. On December 18 the meeting will take the form of the Annual Christmas Dinner, at which the winner of a five-band contest, which has been running for the last six months, will be announced. A monthly bulletin called *Spectrum* is now circulated to members, and produced by G3KZZ.

Stockport report a good attendance at their recent Hot-Pot Supper; sixty members and guests sat down to the meal. G2AMV and G3ERB, from Wirral, were visitors, and the chairman and vice-chairman of South Manchester also attended. Future meetings, at Blossoms Hotel, Buxton Road, are on December 18 and January 15—no meeting on January 1.

Torbay awarded their Construction Cup to R. Ashby for his Tape Recorder. Entries were judged by their president, G5SY in the presence of twenty-two members, and visitors from Exeter. Next meeting is on December 14 at the YMCA, Torquay.

Wirral have now moved their headquarters and changed their meeting day. In future they will assemble on the first and third Fridays, 8 p.m., at 4 Hamilton Square, Birkenhead, commencing on December 6. The Wirral Top Band Net will be on the air in force on Christmas morning, and as many transmitters and SWL's as possible are invited to join in the fun.

Wellingborough meet on December 12 to decide, in debate, whether The Days of Radio are Numbered ! Having settled this, they then hold their Annual Christmas Party on December 19 at the Party Room, Peacock Inn, Wellingborough. There will be no meeting on December 26.

Chelmsford will be meeting on January 7 for a talk and discussion on the GPO Station at Rugby, by G3KWD, and on February 4 for G2HPF's talk on DX Operating at the Marconi College.

SIMPLIFYING CIRCUIT CONSTRUCTION

Rapikon is a new electronics chassis constructional system, which departs entirely from the concept of the conventional box chassis. The Rapikon system exploits the fundamentals in chassis construction, eliminating all preparatory metal work. The component parts of the assembly—which are firmly held on a rack—require only to be screwed together, a matter of minutes. Pre-punched holder plates take focal components such as valves. These plates can be individually placed where required. One end is pronged so that they can be slipped into position behind tag panels and components—and just as easily moved if necessary. Wiring can consequently be kept short. The slotted plates and girders are mounted vertically on the rack to any required layout.

Because of this vertical layout, open back and front, components are always accessible for wiring, replacement or measurement. Layouts can be modified easily and rapidly. Several chassis or circuits can be simply connected to one another without taking up bench space and with no flying leads.

The Rapikon system is a carefully designed method for the experimental construction of complete electronics assemblies, with each chassis forming a part of the block diagram. A modified version of any block can be constructed and inserted when ready—without disrupting work on the system as a whole.

PANDA RADIO PERSONNEL

The appointments of J. Elliott, G3IUU, to the sales staff of Panda Radio Co., Ltd., and of J. Loader, G3HVO, to their technical department, are announced.

NEW PLESSEY SUPPRESSION BROCHURE

To provide design and service enginneers with a source of current information on radio and television suppression components, Plessey's have now published an illustrated brochure on this subject. Outlining the principal causes of radio and television interference, and explaining the legal requirements in the United Kingdom for the suppression of TVI, the brochure also indicates the most suitable component to provide effective suppression over the band of frequencies normally encountered in radio and television equipment.

The brochure, which is divided into four main sections, provides complete specification details of suppression components. These include a range of condensers for radio and television interference, wire ended, tag ended and flexible ended television inductors, radio inductors and composite filters for radio and television interference. Copies of the booklet are obtainable from the Sales Department, Chemical and Metallurgical Division, Wood Burcote Way, Towcester, Northants.

SMALL ADVERTISEMENTS

9d. per word, minimum charge 12/-. No series discount; all charges payable with order. Insertions of radio interest only accepted. Add 25% for Bold Face (Heavy Type). No responsibility accepted for errors. Replies to Box Numbers should be addressed to The Short Wave Magazine, 55 Victoria Street, S.W.1.

SITUATIONS VACANT

ROYAL AIRCRAFT ESTABLISHMENT, BEDFORD, requires ELECTRONIC MECHANICS to serve as Research and Developmen Craftsmen Special on the repair and maintenance of aircraft or airfield Radio/Radar installations. Applicants should be familiar with modern VHF, UHF and Micro-Wave techniques. Appropriate Service experience would be an advantage. Houses will be made available for successful married applicants coming from outside the district. Starting rate 182/4 + 38/- merit lead for 44-hour 5-day week. Rates are re-assessed within three months, and any increase awarded is back-dated to date of entry. TWO WEEKS' (88 hours) PAID ANNUAL LEAVE. PAID SICK LEAVE SCHEME. — Applications, giving full particulars of apprenticeship, training (including Forces Service) and experience to Personnel Officer (S.W.M.), Royal Aircraft Establishment, Bedford.

URGENTLY REQUIRED: Qualified Radio and Television Engineer; good working conditions in expanding service department. Top salary for efficiency.—R. J. Stratton, Ltd., 15 Broad Street, Lyme Regis, Dorset.

TRADE

TELEVISION INTERFERENCE. — Receiver Filters: High-pass E.5037, 27/6; Low-pass E.5031, 27/6; Composite Band I/III, 47/6. Transmitter Filter E.5034, 80 dB, 1 kW, £6. — Labgear Ltd., Willow Place, Cambridge.

G3CGD QSL's. Fixed and mobile samples on request. Printing enquiries welcomed.—30 St. Luke's Road, Cheltenham, Glos.

AMATEUR SELLING UP: Useful bargains for beginners and veterans. Tx's, Rx's, etc.; also TV CRT's; s.a.e. for lists.—152 West Street, Crewe, Cheshire.

MULLARD High-Speed Valve Tester with basic test card pack, dust-proof cover and adaptors; as new, £60.—Box No. 1939, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

COAX Relays, 24-volt, 15/-; 72-ohm S.A.S. Coax, 8d. yd.; s.a.e. Converter details 14-50 mc.—G3FXB, 86 Cross Road, Southwick, Sussex.

FOR DISPOSAL: 1,000 Television and Radio Valves, new, 10/-; S/H, 5/-. Discount for bulk. TV spares. S.a.e. with requirements.—G3JGY, 208 Worcester Road, Malvern Link, Worcs.

QSL CARDS AND LOG BOOKS, G.P.O. APPROVED. CHEAPEST, BEST. PROMPT DELIVERY. SAMPLES. — ATKINSON BROS., PRINTERS, LOOE, CORNWALL.

SMALL ADVERTISEMENTS, TRADE—*continued*

QSL's and Logs by Minerva. The best there are.—Samples from Minerva Press, 2 New Road, Brentwood, Essex.

WANTED: BC610 Hallicrafters, ET-4336 Transmitters. BC-312 Receivers, BC-221 Frequency Meters and spare parts for all above. Best cash prices.—P.C.A. Radio, Beavor Lane, Hammersmith, W.6.

READERS' ADVERTISEMENTS

3d. per word, min. charge 5/-, payable with order. Please write clearly, using full punctuation and recognised abbreviations. No responsibility accepted for transcription errors. Box Numbers 1/6 extra. Replies to Box Numbers should be addressed to The Short Wave Magazine, 55 Victoria Street, S.W.1.

EXCHANGE latest model Super Baldina, f:2.8, 500th, Synchro-Compur with light values, D/A, coupled r/f, meter, accessories. WANTED: AR88, etc., BC-221 or Panda Cub.—G3FCV, 2 Palace Court, Chatham, Kent.

WRITER and lecturer prepares scripts, articles and notes on scientific and general subjects.—G4XB, 19 Woodfield Avenue, Farlington, Cosham, Hants.

WANTED: Marconi Mobile Tx TV10, in good working condition. Please state price. — J. Adshead, 34 Lord Street, Walsall, Staffs.

EXCHANGE: Dekko Cinécamera, F.1.9, Dallmeyer, perfect condition, for CR-100 or similar S/W Receiver.—10 Hobert Road, Ilford, Essex.

SALE: Compact PH/CW Rig, Basis Geloso VFO and PA Coil; also 160/80/40 PH/CW Rig.—Details: G3KNA, 5 Manor Street, Hartshead Moor, Cleckheaton, Yorkshire.

TWO-METRE SPECIALIST STATION moving.—Well-built units; screened, valved YU1AD-type converter, 6AF4, Xtal, cathode follower, NF 3.8, £5. Ten-valve Double-Superhet, 9-11 mc, speaker, power unit needs assembly, £5. 829B, £5. GEC 7B, complete TVI-proof CW, 25w. Tx, circuit, spare valves, £6. 829B power unit, 500v., 300 mA, 7.5v. 6 a., bias to 120w., £4. *Short Wave Magazine* 807 Clipper Modulator, metered, UM2, separate amplifier, £5. Power-Pack, 300v., 250 mA, 6v. 6 a., 4kV, £3. Pair 60v. Magslips, 25/-. (Please allow carriage.)—G3DLU, 9 Adastral Avenue, Gleadless, Sheffield.

HRO COMMUNICATIONS RECEIVER Power-Pack, 5 coils, perfect, £12. — 44 Wentworth Road, Barnet, Herts.

EDDYSTONE 750 with mains filter; only very occasionally used since new; £40, plus carriage. —Shattock, 35 Lonsdale Avenue, Cosham, Hants.

AR-77 with speaker and handbook, full £20 Webb overhaul, £35. Preferably buyer collects—Box No. 1936, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

RA 10DB, complete with cables and control unit for 12v. operation; SCR522 manual. Offers or exchanges, all considered.—Box No. 1938, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SMALL ADVERTISEMENTS, READERS—*continued*

WANTED TO PURCHASE, or on Loan: Six issues *Short Wave Magazine* from November 1955 to April 1956.—Danny Meehan, EI9AC, Castle Street, Donegal, Eire.

EDDYSTONE 640, mint condition, little used, one owner; instruction book; Brown's "A" headphones; Webb's absorption wavemeter; octal chassis punch; Adcola soldering iron, 350v. power supply; unused logbook; 150 mA meter, key; 7017 kc crystal; unused twin feeder cable. Other smaller items. £21 the lot.—12, Sussex Gardens, Herne Bay, Kent.

AR88D required. No quibble *re* price, but must be a perfectly sound instrument, fully checked and with fitted S-meter.—Slight, 18 Ewelme Road, Forest Hill, London, S.E.23.

CR300, excellent condition, AC, £14; 19 Set, Mk. II, new, in sealed carton, 55/-; spare set of new valves for same (15), 35/-. Carriage extra. —L. Grout, 68 The Drive, W. Worthing, Sussex.

HI-FI Connoisseur Turn-Table, Mk. II; arm with diamond and sapphire heads. Leak Point-one and TL/10, Hartley 215 in Baffle, almost unused, perfect, cost £110, accept £80 (o.n.o.). — Riverside, Tawview Estate, Fremington, Barnstaple, N. Devon.

CR100, 60 kc - 30 mc, noise limiter, excellent condition, £16. Delivered 30 miles.—Greenacre, 25 The Street, Corton, Lowestoft, Suffolk.

FOR SALE: Eddystone Receiver, Type 840A; Brown's Type "A"; perfect condition; £45. Buyer collects.—Box No. 1937, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SALE: CNY Tx/Rx, covers 160m., 80m., 40m.; Rx BFO requires attention; mic., key, manual; £12 10s. 0d. R.1116 double S/Het. battery receiver, 125 kc - 1500 kc, 2 - 20 mc, and mains p/pack, £6 10s. 0d.—G3KCC, 9 The Oval, Brough, E. Yorks.

PANDA CUB in mint condition, worked 115 countries, £45 cash. Going QRO. — G3JLB, 103 Whitehill Road, Gravesend, Kent. *(Phone 4694).* Carriage London area.

OSCILLOSCOPE: G.E.C. "Miniscope," completely overhauled recently by manufacturers, together with Double Beam Unit, and complete with 74-page instruction and servicing manual.—Offers to: Watts, 62 Belmore Road, Thorpe, Norwich.

GELOSO Tx G210/TR with low-pass filter, xtal mike, as new, £55. BC-221, £18. Eddystone S640, non-standard mains transformer, £17. HRO Senior with six coils, £18.—Lamb, 3 Queen's Crescent, Bawtry, Nr. Doncaster, Yorks.

EXCHANGE: 250-watt Phone/CW Tx for good Tape Recorder, SX-28, AR88. Offers? — 65 Woodstock Gardens, Blackpool, Lancs.

FOR SALE: GEC Miniscope, £10; 2-metre 6-over-6 slot beam, £5; TA12B, £4; TA12 modulator, £2; BC455, 30/-; SCR522 Tx, £5; 12v. Vibrator, 17/6; 12v. motor generator, 25/-. Or offers?—G2BRR, 87 Dunnington Road, Wootton Bassett, Wilts.

SMALL ADVERTISEMENTS, READERS—*continued*

NEW XTAL, controlled 21 mc converter, IF 3.5 - 4 mc, Tetcraft (U.S.A.), £1 (or nearest offer?)—31 Franklin Road, Birmingham, 30.

HIGH-VOLTAGE Power Supply, 1000v. and LT's for 2 HV. Rects. and TZ40's; mounted on steel chassis with 19-inch panel; £10. Chassis, matches above, fitted two TZ40's, with driver xformer P/P, 6L6's, UM3 Mod. Trans., £10. (Carriage extra, both items.) Potted xformer, 500v., 275 mA, 375v. 80 mA, 6.3v. 1.5a., 6.3v. 5a., 5v. 3a., 6.3v. 1a. twice; new; £5. (Carriage extra.) Complete power supply: 1500-volt MV rectifier, cast chassis, lot of Mills, £8. Bendix TA12C and TA12 Mod., ready for working, 40/80 metres, £8. (Carriage extra.) Rx 312, external power unit and original 12v. gene., xtal, £15. (Carriage extra.) German Rx E52B, Top to 28 mc, AC or 12v., no mods., spare valves. Offers? (Will export.) Brand-new QVO2/60's, 35/- each, plus post.; sealed cartons. From G2FNQ, 19 South Street, Farnham, Surrey.

AR88D, excellent condition, S-meter and manual, £50; Pandapter, 3 - 45 mc input, with manual, £22 10s. 0d.; latest Geloso 207DR, unused and guaranteed, Vy FB Rx, snip, £75; M.S.S. disc recorder, 33/45/78 r.p.m., complete with amplifier, ready to use, £50. Morse records (L.P. 33-1/3), Beginners' or Advanced Course, 45/- each. Various Vortexion amplifiers, cheap. Details, s.a.e.; carriage extra.—G3HSC, 45 Green Lane, Purley, Surrey. *(Uplands 2896)*

BAIRD TAPE RECORDER, fair condition, replay perfect, record needs attention, £13 10s.; 14in. Television table cabinet, 15/-. View by appointment.—Phone Victor, *STR. 1388*, between 6.30 p.m. and 7.30 p.m.

R1132 with manual, working, 50/-; VCR529 (E4412/E/9), E1824, 30/-; CV90, VCR522, 3GPI, 27/6; 8012, GEC 2.5 mc crystal, 5/-; EF50, SP61, 954, 2/-. Post extra.—V. A. Cedar, 9 North Drive, London, S.W.16.

BC348R, in mint condition, with internal power supply; no other modifications; £13 (carriage extra). — Heslop, 41 Parkhead Crescent, Edinburgh, 11.

BC342 F17A, 1st RF, 3 IF's, S-meter, NL, 100 kc cal.; xformer re-wound for 230 volts; excellent condition; £18 (o.n.o.). — Sevrer, Hillview Cottage, Humber Street, Bloxham, Nr. Banbury, Oxon.

SELL: 75w. Modulator, zero bias 807's, int. 300v. P/Pack, 200 mA meter, complete, £6 10s. 0d. Matching P/Unit, 750v. 150 mA, 450v. and 310v. at 70 mA, 3 x 6v., 100 mA meter, complete, £4 10s. 0d. Both the above have black crackle panels; £10 the pair in rack. Ronette xtal mic. desk stand, £2 10s. 0d. IF Strip 373, 5/-. Axtals: (FT243), 7000, 7083, 7220 and 7520 kc, 15/- the lot. RF Unit 24B, 10/-. Labgear wide-band couplers, 3.5, 7, 14 and 28 mc, 15/- the lot. HRO general coverage coil, 14 - 30 mc, 10/-.—G3JKX, 277 King's Road, Harrow, Middx. *(Pinner 4295).*

SMALL ADVERTISEMENTS, READERS—*continued*.

WANTED: Converters, approx. 50 - 100 mc, and 100 - 150 mc; built-in power-pack, 250v. AC; reasonable. — J. Patterson, 23 Surrey Avenue, Wallsend, Northumberland.

WANTED: Eddystone S640 or similar; must be in mint condition.—J. Stonestreet, G2JN, Bossingham Street, Canterbury, Kent.

BX49 CASE containing 24 crystals (FT-243 type) and 24 coils for Handie-Talkie Sets BC611/721, £5. Also loose xtals, coils and lids for BC611/721. Manual for BC728 press-button Rx, 5/-. Xtals 2105 kc (B7G base), 7212 kc (Q.C.C.) with certificate, 1815 kc (BC610 type), all 7/6; 1889 kc (Q.C.C.) with cert., 10/-. Xtal deaf-aid earphone with cord, 10/-. 832 ceramic base, new, 3/6. RBZ miniature receiver (U.S. Navy), spares, new in cartons (nearly 2 complete Rx's), £2, or individually. TCS carbon hand microphone, 5/-. ZBX (ARR-1) plugs, control-box, 7/6. — G3IEE, 96 Latchmere Road, Kingston, Surrey.

EDDYSTONE S740 (needs attention) and matching S-meter, £17 (o.n.o.?). S.a.e. full details.—Bygraves, 15 Lindsell Crescent, Biggleswade, Beds.

SALE: Receiver R208, £5; Q-Max VFO, £10.—All in perfect working order.—G3BXI, Farlow, 55 Mount Pleasant Road, Chigwell, Essex.

WANTED URGENTLY: 3rd IF transformer of R1155. Your price paid if in good working condition.—Yeo, 35 Nelson Street, Rosyth, Fife.

AMATEUR clearing surplus Tx and Rx components, valves, condensers, switches, chokes, etc.; s.a.e. list. WANTED: transformers, type UM2 and DTI.—Box No. 1926, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

CAN ANYONE SELL U.S.A. bug key to sea-going operator? Leonard or similar preferred.—Box No. 1941, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

FOR SALE: Panda Cub, as new, £40; Panda PR120-V, in good condition, £70; ATU, £8 10s.; Low-pass filter, £2 10s.; CR-100, in good order, £15. All delivered 50 miles of London. WANTED: AR88 in mint condition.—Box No. 1942, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SX25: Built-in 1 mc xtal marker, manual, £15. R1155, with power unit, 10in. speaker, 6V6 output, £8.—G3BOI, 35 Yovell Avenue, Gorleston, Norfolk.

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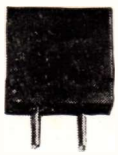

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1579	1780	2118.25	3850	10,534	11,587
1588.68	1815	2196	3920	10,545	11,751
1613.25	1870	2261	3960	10,557	11,788
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Printed by The Courier Printing Co. Ltd., Tunbridge Wells, for the Proprietors and Publishers, The Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1. The *Short Wave Magazine* is obtainable abroad through the following : Continental Publishers & Distributors, Ltd., William Dawson & Son, Ltd. ; AUSTRALIA AND NEW ZEALAND—Gordon & Gotch, Ltd. ; AMERICA—International News Company, 131 Varick Street, NEW YORK. Registered for transmission to Canada by Magazine Post. *December* 1957.