RSGB

BULLETIN

JANUARY 1964

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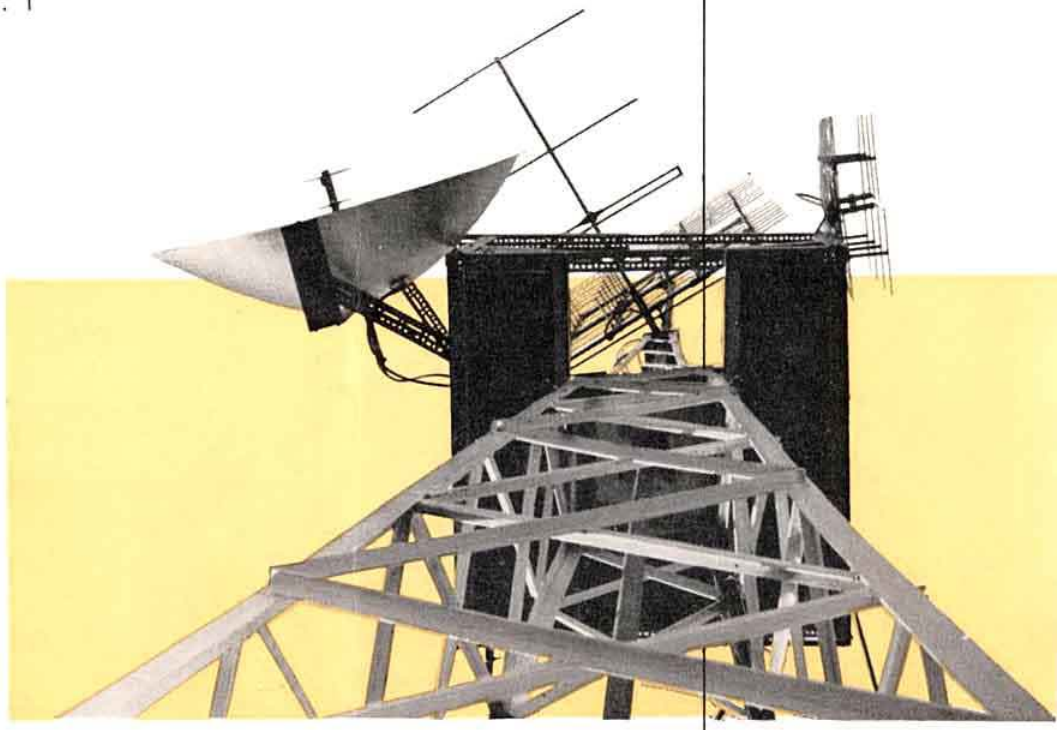

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CONTENTS

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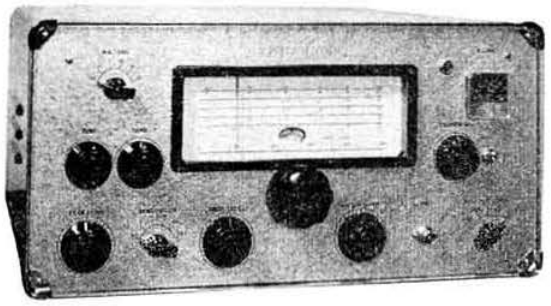

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Current Comment

discusses topics of the day

Collective Responsibility

WITH the Geneva Conference on Space Radiocommunication now behind us, this seems an appropriate moment to comment, once again, on that most important aspect of Amateur Radio, namely, the protection of amateur frequencies.

On this page, in the October, 1960 issue, *Current Comment* drew attention—for the first time in any Amateur Radio periodical—to the marked effect on the " balance of power " that had recently emerged at the United Nations due to the votes of newly-admitted African and Asian states. It was predicted that most, if not all, of those newly-admitted countries would eventually seek and obtain membership of the International Telecommunication Union and that they would in due time use their votes at International Radio Conferences, perhaps to the disadvantage of the more experienced nations.

The recent Space Conference, as the report in our December issue showed, provided ample evidence that the prediction made more than three years ago had proved correct. Throughout the Geneva Conference the representatives of the newly-admitted Member Nations lost no opportunity in making their voices heard and, when roll-call time came round, of recording their votes, often strongly in opposition to the votes of the major nations. Even on the comparatively simple question of the use by amateurs of frequencies in the band 144-146 Mc/s for space research purposes, the votes of new nations helped to defeat proposals sponsored by the United Kingdom, the United States and the Soviet Union.

At a recent count the International Telecommunication Union comprised 119 Full and two Associate Members and of that number more than 40 had been admitted to membership during the last few years. Consider just a few—Burundi, Cameroon, Chad, Cyprus, Dahomey, Gabon, Ghana, Ivory Coast, Kuwait, Malagasy, Mali, Mauritania, Niger, Rwanda, Senegal, Somali. The DX enthusiast may know precisely where all of these countries are to be found in an atlas but to the average member the very existence of some of them was unknown up to a moment ago! Yet each one of those countries is entitled to a vote at ITU Conferences and each vote is of precisely the same value as the vote of, say, the United Kingdom or France or the Soviet Union. Every new nation is anxious " to keep up with the Jones's " and to show to the world at large that in technical matters its engineers and scientists are as forward-thinking as are those of the more established nations. The new nations are anxious to " reflect their national image " in the political, economic and technical fields by every modern means open to them and in particular through the medium of short wave broadcasting. And therein lies one of the great dangers for the future of Amateur Radio.

It must be obvious to all who can read the signs and portents that many of the new and developing countries are already seeking to establish broadcasting stations in those parts of the crowded h.f. spectrum which are in popular demand by the major nations. If the pressure becomes too great they " intrude." When the next Frequency Allocation Conference comes along they will press their claims for space in the adjoining bands.

No one can, at this time, prophesy when the next Frequency Conference will be held but it is within the bounds of possibility that such a Conference may take place as early as 1965—the Centenary Year of the ITU. If 1965 passes with no more than a Plenipotentiary Conference then it is almost certain that an Administrative Radio Conference will be held not later than 1968 to re-examine the Frequency Allocation Table drawn up at Geneva in 1959 and amended recently at the Space Conference.

During the next few years three tasks of major importance must be tackled vigorously if amateurs are to retain their present frequency allocations.

First, the International Amateur Radio Union must use its best endeavours to encourage the Member Societies in Regions II and III to establish Regional organizations similar to that which has operated so successfully since 1950 in Region I (Europe and Africa). If this is done a regular exchange of views at executive level will become possible through the medium of Regional Conferences and Regional Committees.

Second, the IARU must undertake the task of bringing home to every administration, and in particular the administrations of the new and developing countries, the value and importance of Amateur Radio,

both as a Service and as a Scientific Hobby. The publication of an attractively produced booklet, printed in several languages, and titled *What is Amateur Radio?* would provide a good start for this vitally important public relations campaign. Copies of the booklet would be brought to the attention of those likely to represent their country at International Radio Conferences.

Third, steps must be taken to ensure that the IARU is represented not only at Frequency Allocation Conferences but also at every International Radio Conference where its observers may be able to use their influence by interesting national delegates in the work done by radio amateurs. Such a Conference is to be held in Madrid during September, 1964, when an attempt will be made to resolve the many problems of low and medium frequency broadcasting on the African Continent. Upwards of 30 sovereign states, including many of those who have recently been admitted to ITU, will be represented at the Conference. The value of IARU representation at that particular Conference cannot be over-estimated because it is certain that many of the national delegates in attendance at Madrid will also be present at the next Frequency Allocation Conference whenever it is held. Spade work done by IARU observers next September could have an important bearing on the final voting in respect of amateur frequencies when they are next under review.

For the past eight years the licensed amateurs of IARU Region I Member Societies have each contributed 50 Swiss Centimes (about 10d) *annually* towards the cost of running IARU Region I Division. The contribution made by the RSGB last year was £215, roughly 1 per cent of the total expenditure of the Society. The contribution from the whole of the 20 Subscribing Member Societies in the Division was about £1,000 and of this amount less than £150 was spent on administration. It is worth bearing in mind that in 1950, when the idea of establishing an IARU Region I Bureau was first put forward by RSGB, the Council of that day estimated that it would cost the Society £500 a year to administer the organization. In point of fact the administration has, for nearly 14 years, been carried out almost entirely on a voluntary basis.

The protection of amateur frequencies is the collective responsibility of the 53 Member Societies forming the International Amateur Radio Union but it is the individual responsibility of every licensed amateur to ensure that the Union is placed in a position that will enable it to carry out its responsibilities in an effective manner. Let us make no mistake about it—the Amateur Radio movement would suffer a mortal blow if the frequencies at present assigned to us for h.f. communication purposes were drastically cut at the next Radio Conference.

J. C.

Epilogue

HAVING held office in the Society, continuously, for more than 36 years the writer of this brief note retired as General Secretary on December 31, 1963.

Much has happened since 1927 but the spirit of friendship—such an important feature of Society life in the early days—remains unchanged.

Ham Spirit has helped those who have been privileged to govern and administer the affairs of the Society to give of their best in solving the countless problems that have arisen in the past. That same spirit has been the driving force behind the many projects that have helped to raise the prestige of the Society. The good name of the Society has never been held in higher esteem than is the case today.

To my many friends in the Society at home and abroad I offer my grateful thanks for providing me with countless happy memories. To John Rouse I extend congratulations on his appointment to the office of General Manager and my best wishes for his future happiness. When the time comes for him, in his turn, to leave the helm, I hope he will be able to look back over his life and say, as I can do now, " Amateur Radio is the best of all hobbies."

Happy New Year to you all. J. C.

Progress in Region II

JUST before this issue closed for press news was received that at a State Convention of the American Radio Relay League to be held in Miami, Florida, on January 18-19, 1964, the opportunity will be taken for a preliminary, informal and unofficial meeting of representatives of Member Societies in Region II (North and South America) to agree on mutual aims and procedures in preparation for a Pan-American Congress of Radio Amateurs in Mexico City on April 14-18, 1964, when the formation of a Region II Division of IARU will be discussed.

Installation of President

Mr. G. M. C. Stone, A.M.I.E.E., A.M.Brit.I.R.E., G3FZL, will be installed as the 30th President of the Society during the course of a General Meeting and Social Evening to be held at the

Kingsley Hotel,

Bloomsbury Way, London, W.C.1

on

Friday, January 17, 1964

Commencing at 7 p.m.

Admission will be by ticket, available on request (with s.a.e.) from Headquarters. (Tickets restricted to two per member.)

Part 1

THE QUICKSTARTER

A Basic Converter for 144 Mc/s

By JACK HUM, G5UM *

IF you have ever built yourself a converter for 2m this article begins and ends at the present sentence. If you have not, then it is hoped that the notes to follow will help guide your inclinations towards sampling the delights of v.h.f.—which, once enjoyed, will assuredly become a permanent part of your Amateur Radio experience.

What follows takes the form more of notes on the *evolution* of a 2m converter rather than of its detailed construction, though the latter follows naturally upon the former. For this particular converter emerged to meet a need expressed by several members of an RSGB group for a basic design that would be built very largely from the contents of the spares box and would work as soon as power was supplied to it. No elaborate test equipment should be required to align it: the basic requirement was that it should be so simple to build that it would permit a quick start to be made to 2m listening. Hence its title " The Quickstarter."

Two Routes to the Mixer

Central to every 2m converter is the mixer. Either side of the mixer are two circuit chains, one coming in from the left to provide r.f. amplification, the other coming in from the right to provide a local oscillator voltage to mix with the r.f. voltage and thus to give the desired intermediate frequency.

In the design of " The Quickstarter " it was decided at the outset that the local oscillator voltage should be produced from a crystal-controlled chain of valve stages rather than by a self-excited oscillator in order to achieve automatic built-in stability to the system, and to facilitate calibration. For there are two ways of tuning on " Two ": either by varying the frequency of a local oscillator and maintaining the i.f. of the accepting receiver at a fixed frequency; or by holding the local oscillator frequency at a fixed value and varying the i.f. of the receiver.

The second method is almost universally employed nowadays, utilizing the main station receiver as a tunable i.f. strip. But what i.f.? Several natural "intermediates" suggest themselves,

The range " 4-5-6 Mc/s " is perhaps the most convenient there is, for it extrapolates " 144-145-146 Mc/s." In this case the local oscillator should come out at 140 Mc/s. Subtract 140 from 144 and there is your i.f. of 4 Mc/s, marking the lower limit of the 2m amateur band. Subtract 140 from 146 and there is your i.f. of 6 Mc/s, marking the *upper* limit of the 2m band.

But perhaps you would prefer to tune 14-15-16 representing 144-145-146? Perhaps your station receiver offers better bandspread or performance in that part of the spectrum. Once again do the little sum: deduct 14 from 144 and the answer is 130. Deduct 16 from 146 and the answer is, believe it or not, 130! So there is the required value of your local oscillator frequency.

Generating the Oscillator Frequency

An injection frequency of 130 Mc/s or 140 Mc/s can be obtained with a self-excited local oscillator, but the disadvantages of this arrangement have already been mentioned.

To obtain the injection frequency by crystal control is sure-fire; but only those members with deep pockets or the right contacts will get there with a crystal oscillating on the actual frequency or even at half the frequency.

The more popular course will be to " buy a five bob rock from the well-known emporium " having a much lower frequency, and to multiply it up by the aforementioned valve chain.

So to another simple sum:

Local oscillator frequency = 140 Mc/s
Before that a doubler from 70 Mc/s
Before that a tripler from 23·333 Mc/s
Before that a crystal oscillator-tripler from 7777·7 kc/s

Or if the 14-15-16 Mc/s tuning range is preferred the sum looks like this:

Local oscillator frequency = 130 Mc/s
Before that a doubler from 65 Mc/s
Before that a tripler from 21·666 Mc/s
Before that a crystal oscillator-tripler from 7222 kc/s

* " Wyldes," Burnham Green Lane, Bulls Green, Knebworth, Herts.

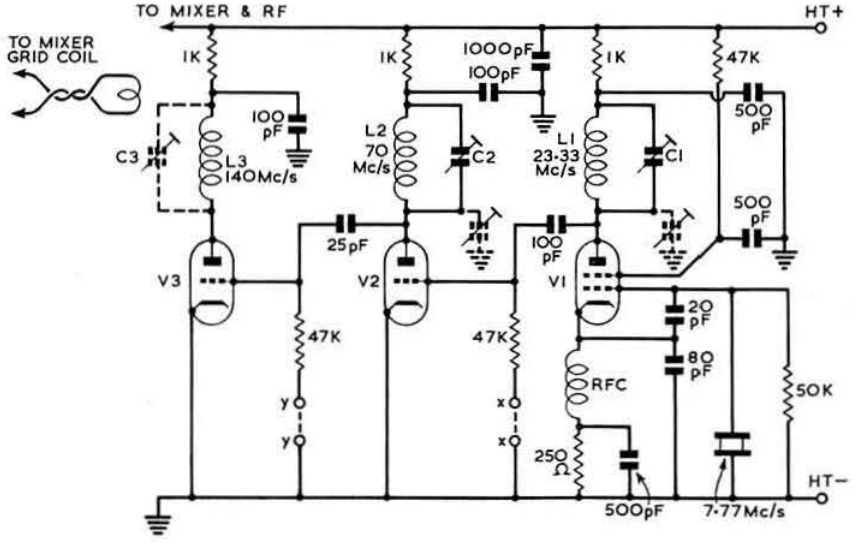
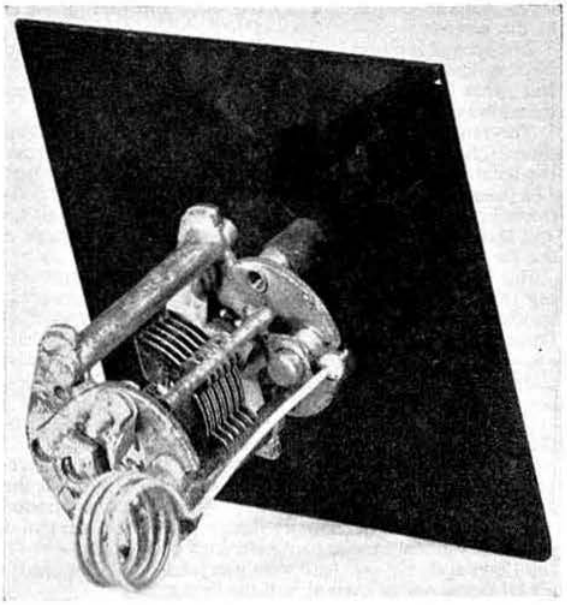


Fig. 1. The local oscillator section of " The Quickstarter " converter. All component values are given in this diagram with the exception of the following:

C1 Any small variable capacitor of about 50 pF (say 11 fixed and 10 moving plates).
C2 As C1 but approximately half the number of plates.
C3 Exists within the valve capacitance, *i.e.*, the inductance is tuned by " strays."
L1 50 turns 24-26 s.w.g. d.c.c. close-wound on ¼ in. diam. former.
L2 Six turns 18-24 s.w.g. enam. airspaced, wound on a ⅜ in. diameter pencil and then removed. Length not critical.
L3 Four turns airspaced as L2. A one-turn loop of insulated wire is inserted between the last two turns to link couple the output of V3 to the mixer.
V1 EF50, EF91 or equivalent.
V2, V3 ECC91, ECC81 or equivalents; or if desired two further EF91 (screen grid circuits not shown).



This is one of the absorption wavemeters built by members of the Welwyn Garden City group during the course of constructing " The Quickstarter " 2m converter. The capacitor is typical of what might be found in the average spares box, value unknown, but having seven moving plates and six fixed plates. With the four-turn ½ in. coil shown, the tuning range is 45-150 Mc/s. The device is also most useful for aligning 2m transmitters. The following are the calibration points: 48 Mc/s is at " 3 o'clock," 72 Mc/s at " 12 o'clock " and 144 Mc/s at " 10 o'clock."

Can you see the snag about using the second tuning range? The harmonic of 7222 kc/s comes out at 14444 kc/s which is right inside the i.f. tuning range of the main receiver! There will be permanent QRM on 144·4 Mc/s. Perhaps in your locality this will not matter: but bear it in mind nevertheless.

By now the sharp-witted reader will have said: " Why use a crystal oscillator circuit that produces a signal on 14444 kc/s? Go to an overtone circuit and you will eliminate this particular S9 birdie."

Go to an overtone circuit if you can afford the special overtone-mode crystal that you will need; but if you can afford no more than the " five bob rock," then don't!

All these considerations came into the picture during the evolution of " The Quickstarter," and very early on it was decided that a simple Colpitts crystal oscillator-cum-multiplier would best meet all needs.

And now the " right hand part " of our converter circuit is beginning to take shape—the oscillator chain—and what sort of shape may be seen from Fig. 1.

In the grid circuit of V1 is the basic source of our ultimate 140 Mc/s local oscillator voltage: the crystal for 7777·77 kc/s. A straight crystal oscillator would have in its anode circuit a coil to tune to 7777·77 kc/s—but this is not a straight crystal oscillator: it is a harmonic generator. By lifting the cathode above chassis potential to render the valve slightly regenerative, copious harmonic output becomes available in its anode circuit. The components that do the " lifting " are the r.f. choke and the two grid capacitors that constitute an r.f. " potentiometer " up which the cathode is tapped. Their value is not critical so long as a ratio of approximately four to one is achieved. The RFC can be any small choke that may be around: or a hundred turns of thin covered wire scramble wound on a ½ watt resistor of high value will serve.

To ascertain that the circuit is functioning tune the station receiver to 7777·77 kc/s when the crystal oscillating on its fundamental should be heard strongly. If it is not, a modicum of cathode bias—that 250 ohm resistor—will both help oscillation to start and limit the h.t. consumption of the valve.

Constructors who object to tuning capacitors which are " up in the air " electrically, as C1 is, and prefer them to be chassis-mounted should take care to provide spindle isolation with an insulating washer. Alternatively, secure the rotor to chassis, as indicated by the dotted variable capacitor from V1 anode—but remember that if the moving plates touch the fixed plates that 1,000 ohm feed resistor will " cook "!

Harmonic Selection and " Sucking Devices "

To say " Now rotate tuning capacitor C1 to 23·33 Mc/s and third harmonic output will be realized " would be a superficial statement to make that quite ignored the fact that this is not easy to do. How is the constructor to know that he is in fact obtaining third harmonic output in L1 and not second harmonic at 15555·5 kc/s or indeed fourth harmonic at 30 Mc/s? A good crystal oscillator harmonic generator will obligingly provide all of them!

This is where the experienced constructor will advocate the use of a grid dip oscillator and where the less experienced constructor will give up if he feels he is compelled to build one. Useful though a g.d.o. may be, the selection of harmonics in tuned circuits can be easily effected without its aid. All that is needed is a milliammeter reading 0-1mA and a couple of absorption wavemeters covering the frequencies to be selected.

Any reader who does not possess a 0-1mA meter is advised to go off and buy one now. Not only will it serve as the basis of a multirange test meter but it will enable him to complete his " Quickstarter " in record time.

As for those absorption wavemeters, his future success as a v.h.f. enthusiast will turn largely on his ability " to find the band " and the correct harmonics that lead up to it. For the alignment technique now to be advocated consists of nothing more than inserting the milliammeter in each grid return lead and rotating the preceding anode capacitor until the correct harmonic is obtained.

Easily said? Yes, and equally easily done. Let us delineate the procedure by stages.

The tuning procedure is then as follows: rotate C1 to produce third harmonic indicated by a current reading between points X. Rotate C2 to produce third harmonic indicated by a current reading between points Y. Compress or extend L3 until it resonates at 140 Mc/s (to be described in Part 2 of the article.)

When a harmonic is selected by the rotation of C1, drive will be applied to the following valve and grid current will flow in the 47K ohm grid leak. This current may be measured on the milliammeter when it is connected across points X. Similarly when the *next* inductance L2 is tuned by C2, the presence of a harmonic will be made known by a rise in current if the milliammeter is connected across points Y. Yes, but *which* harmonics? This is where our pair of absorption wavemeters prove their value. One of these must

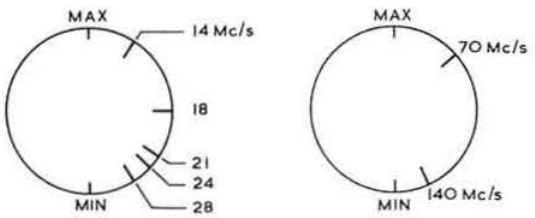


Fig. 2. Typical calibration points for the absorption wavemeters. Left, the " h.f. sucker "; right, the " v.h.f. sucker."

cover all harmonics liable to be generated by the first valve: call it the " h.f. sucker." The other must cover the higher order harmonics handled by the later stages: call it the " v.h.f. sucker." These colloquialisms arise from the technique of sucking r.f. energy out of an anode coil and watching the grid current in the following stage drop. This is an infallible and simple method of alignment which obviates the need for the more complex g.d.o. technique.

By now it will be quite evident to the reader that unless his two " sucking devices " are accurately calibrated he cannot know to which harmonics they may be resonating when they are held against an anode coil. To get them calibrated will necessitate a visit to the nearest v.h.f. operator who happens to have a converter or transmitter which he can upend in order to present its coils to your absorption wavemeters.*

The specification for the " h.f. sucker " used to tune up the " Quickstarter " is as follows:

Capacitor: 10 fixed and 9 moving plates.

Inductance: 17 turns on a $\frac{1}{2}$ in. former spaced to $\frac{3}{4}$ in. long.

* An alternative solution for the " v.h.f. sucker " is to build the v.h.f. absorption wavemeter described on page 467 of the *Amateur Radio Handbook*.

The specification for the " v.h.f. sucker " is as follows:

Capacitor: 10 fixed and 9 moving plates.

Inductance: 6 in. of wire bent into a hairpin 1 in. across.

The calibration points for both absorption wavemeters are shown in Fig. 2.

The calibration points shown are those actually recorded on the knob of each absorption wavemeter. If you do not know a nearby v.h.f. worker who can calibrate your wavemeters for you these " cal points " can be safely followed.

The value of the variable capacitor is intentionally not specified: the component came out of the spares box: if *you* have something like " 10 fixed and 9 moving " the calibration points given should hold. The type of capacitor we have in mind is shown in the photograph.

And now with the " h.f. sucker " to indicate third harmonic in L1, and the " v.h.f. sucker " third harmonic in L2, all that remains to determine is that second harmonic occurs in L3. By then the magic local oscillator frequency of 140 Mc/s will have become available—and this, mixed with the incoming 144 Mc/s signal, will produce the desired i.f. of 4 Mc/s.

To this operation—to the " left hand " part of our basic 2m converter—the next instalment of this narrative will be devoted.

(To be continued)

Are the Days of the Valve Numbered?

Some Thoughts on the use of Semiconductor Devices in the Amateur Station

TRANSISTORS have been in existence for not quite twenty years and of little more than laboratory interest for less time than that, yet the current literature amply demonstrates, in so far as receivers are concerned, that performance only marginally less than that obtainable from valves can be provided by fully transistorized equipment up to at least 1300 Mc/s. [1].

In commercial u.h.f. and s.h.f. equipment the parametric amplifier is successfully employed to give efficient r.f. amplification and may have applications in the amateur field [2]. Variable capacitance diodes are applicable to high efficiency frequency multiplication and are being so used commercially at very high frequencies indeed. Of direct amateur interest in this connection is the fact that both the American satellites *Oscar I* and *Oscar II*—flown in December, 1961, and June, 1962, respectively—contained transmitters operating on 145 Mc/s in which the stage feeding the aerial was a variable capacitance diode giving an output of 100 milliwatts and operating at an efficiency of around 70 per cent when driven by a transistor amplifying stage tuned to half that frequency [3].

Power supplies employing transistor inverters and silicon diodes as rectifiers have reached a high degree of development and can operate at overall efficiencies well exceeding that possible with valves, vibrators or rotary machines, and are becoming preferred equipment for portable and mobile applications in both the amateur and the commercial fields.

Test gear, including signal generators (r.f. and audio), electronic voltmeters, frequency sub-standards, " grid-dip " oscillators (a new term will have to be coined for these!) present no particular problems when transistors are substituted for valves and in fact may gain in performance or application by virtue of their non-dependence upon mains power.

On the audio side, modulators may be built [4] at reasonable cost which will satisfy at least medium power requirements without any sort of limitation on frequency response or flexibility as to type of microphone employed, combined with the real advantage of decreased susceptibility to hum pick-up. In fact, in the high fidelity reproduction field it can be demonstrated that transistor apparatus is as good as if not actually better than comparable valve apparatus, with a considerable saving in size, weight, power consumption and even cost.

R.F. Uses

Sadly lacking at the present time are transistors readily available at reasonable cost and capable of handling other than comparatively small quantities of r.f. for use in transmitter power amplifiers. That such devices are a practical proposition from the technical standpoint is proved by a recent mention in the BULLETIN [5] of fully transistorized s.s.b. transceivers for service use providing 15 watts p.e.p. output on any one of 10,000 channels between 2 and 12 Mc/s with the promise of a 100 watt linear transistor amplifier for use with them over a similar frequency range.

Trends in Amateur Equipment

It is interesting to speculate what will be the trend in the design of amateur equipment in the next few years. Bearing in mind what is being done in commercial circles, the indications are that transistors will take the place of valves in nearly every application save that of the higher power stages in transmitters and modulators. For the frequency determining and multiplying stages of transmitters there would appear to be distinct advantages to be gained from the use of transistors and variable capacitance diodes. Even with valve amplifiers and oscillators handling power measured only

in milliwatts, the necessity for a heater means the dissipation of many times the anode power in heat which has to be kept away from tuned circuits and other components, in the interests of frequency stability. At the power level at which a v.f.o. operates the transistor runs virtually cold and, without the necessity for ventilation, almost perfect screening can be arranged. There remains the fact that transistors are inherently susceptible to changes in their characteristics consequent upon variations in the ambient temperature, but circuit design is able, in most cases, to take care of this position.

The resulting development of hybrid equipment would parallel what occurred a few years ago in car-radio design when receivers appeared with valves (in that case operating under the distinct limit of 12 volts for the anode supply) in those stages for which transistors were not then available, but employing transistors in the i.f. amplifier and audio circuits where an acceptable standard of performance could be achieved.

Coming to the present day, a well-known manufacturer has on the market a range of s.s.b. equipment covering channels lying between 2 and 15 Mc/s and providing r.f. outputs of 100 watts for both fixed and mobile installations and having quick-heating valves in the transmitter power amplifiers and transistors in all other stages [6].

A reliable indication of the shape of things to come is a recent announcement [7] that Decca Radar are in production with a marine radar equipment in which transistors replace more than 30 valves. Operating on 9445 Mc/s and with a range of 24 nautical miles, this apparatus offers compactness, light weight, much lower power consumption than comparable conventional gear combined with better reliability, lower first cost and maintenance charges. In such an application, where reliability must be placed high among the operational requirements and, for want of a better description, the " sales gimmick " cannot be of prime importance, the decision to use transistors in place of valves must be assumed to have been made because they are capable of doing a better job in the circumstances.

So it seems that we are about to enter, in the amateur field, an era when the thermionic valve will start to take a back seat except in those applications mentioned.—W. H. A.

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Interference from an Electro-medical Apparatus

Regulations covering interference from electro-medical apparatus to radio and television have been laid before Parliament. The effect of these new regulations is to give the Postmaster-General power to control interference from certain types of electro-medical radio frequency apparatus. This class of equipment, particularly when in use in residential premises, can cause severe interference to neighbouring radio and television reception.

The regulations will come into force on November 29, 1964 and are based on the recommendations of the Postmaster-General's Advisory Committee on Wireless Interference from Industrial, Scientific and Medical (ISM) equipment. They require manufacturers, assemblers and importers of electro-medical apparatus to ensure that when it is used it does not exceed the prescribed limits of radiated field strength and terminal voltage. These limits correspond with those currently specified by the Ministry of Health for short wave diathermy units and are expected to ensure that, save in exceptional circumstances, the use of electro-medical apparatus will not cause interference.

To allow the enforcement machinery of the Wireless Telegraphy Act, 1949, to cover interference from such equipment, particularly where safety of life may be involved, the Postmaster-General has also prescribed limits for users for the purposes of Section 10 of the Act. In some cases it may be that equipment, which complies with the standards laid down for manufacturers, causes undue interference when used in close proximity to radio receiving apparatus. In such an event, the user would be required to take steps to eliminate the interference but he would not be asked to suppress his equipment to a lower level than was necessary to clear the interference, even though it still exceeds the " user " limit in the Regulations. It will be open to the user, if he wishes, to appeal against the decision of the Postmaster-General to an independent appeal tribunal.

Some Reflections on Standing Waves

By R. C. HILLS, B.Sc.(Eng.), A.M.I.E.E., A.M.Brit.I.R.E., G3HRH*

MOST articles on aerials and their associated feeder systems include some account of the behaviour of the voltage and current on a transmission line when the nature of the terminating load is varied. The approach to the problem is either presented by reference to the existence of a standing wave along the line or to the reflection of voltage, current, or power at the misterminated end of the line in question. Unfortunately, the relationship between the two approaches to the problem is often incompletely explained with resulting confusion to the reader, and these notes have been written in the hope of presenting a simple and physical description of the properties of mismatched feeders.

Let us assume initially that we have a " black box " with two terminals. This box delivers r.f. power at a specified frequency, but we have at the moment no knowledge of the transmitter inside. The terminals of this box are now connected to the input of a transmission line (a more accurate name for an aerial feeder). This line passes through a

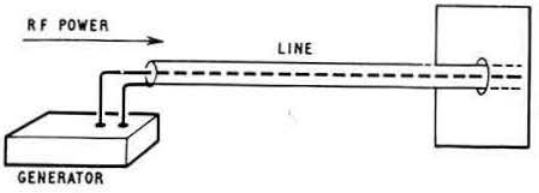

Fig. 1. Simplified representation of conditions at the instant of switching on the generator.

partition, so we are unable to see what is connected to the other end (Fig. 1). The box is switched on and commences to deliver power into the line. We shall, at the moment, assume that the line we are using is perfect, i.e. it has no loss, and no power can be dissipated in it.

The flow of power along the line can be interpreted as the progress along the line of a voltage wave and a current wave which are in phase, the product of which is the value of the power flowing.

If the voltage V at a point on the line is given by the expression:

$$V = V_0 \cos \omega t \qquad \ldots \text{(i)}$$

and the current at the same point by:

$$I = I_0 \cos \omega t \qquad \ldots \text{(ii)}$$

then the amount of power flowing is the product of the r.m.s. voltage and current:

$$P = 0{\cdot}707\ V_0 \times 0{\cdot}707\ I_0 = 0{\cdot}5\ V_0 I_0 \qquad \ldots \text{(iii)}$$

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and is independent of the time or position on the line, varying only as the peak amplitude of the voltage or current wave is altered. Since the voltage and current waves can be expressed in identical terms, it will be convenient to consider the current

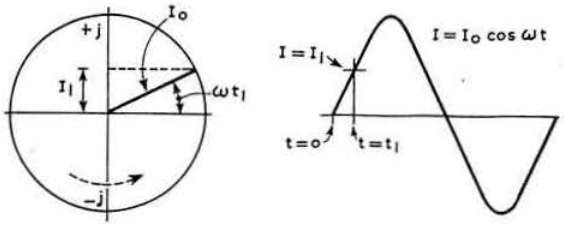


Fig. 2. Graphical interpretation of a sinusoidal wave represented by a vector.

wave, bearing in mind that the discussion is equally applicable to the voltage wave.

Expression (ii) shows that the current wave is one of a sinusoidal form, varying in amplitude at an angular rate $\omega = 2\pi f$ where f is the frequency at which the transmitter is generating the r.f. power. Such a wave may be represented graphically by a vector of constant magnitude (or length) rotating at an angular speed ω. The actual instantaneous value of the wave at any moment is obtained by projecting the length of the vector on to a line passing through the origin (Fig. 2). The nature of vectors is fully covered in any textbook dealing with a.c. waves.

Thus the distribution of current along the line *at a particular moment of time* due to the passage of the current wave, can be represented by a whole series of vectors, each appropriate to a particular physical point on the line. This illustrates, incidentally, the physical meaning of the statement

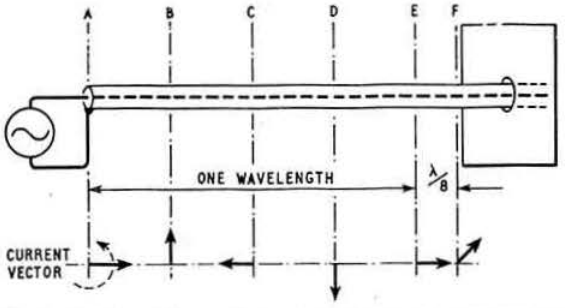


Fig. 3. Initial variation of incident current vector, according to position along the line at any instant of time.

that a piece of line is " one wavelength " long, since this is the distance between adjacent points along the line at which the current is equal in amplitude and phase, i.e. the vectors are identical (Fig. 3). Two points should be noted at this stage. Firstly, the vector is rotating in an anti-clockwise direction (by convention), as the current wave travels from the generator (inside the black box) towards the load. Secondly, as we and the current wave are unaware *as yet* what lies beyond the partition, the terminating load cannot influence the passage of the " forward " travelling wave.

Having established the travelling wave of current moving away from the generator along the line, we are now in a position to consider what is going on behind the partition. The current wave moving along the line will eventually reach the far end, and will then be influenced by the termination it meets. In order to establish the magnitude of this effect we must now look at the various loads that can exist. These may be divided broadly into three groups depending upon whether all, some, or none of the incident power is reflected:

(i) A resistive termination equal in value to the characteristic impedance of the transmission line. By definition there will be no reflection from such a termination, and all the current will flow into this load. Hence all the power delivered by the generator will be dissipated in this load (Fig. 4(a)).

(ii) A resistive termination of value other than in (i) above. This may or may not have a reactance associated with it. At such a termination, a reflection of the current wave will occur, the actual amount of the reflected current being dependent upon the relative values of the resistive part of the load and the characteristic impedance of the line. In general, the greater the difference between these two, the larger the proportion of current reflected. Also, if the load resistance is greater than the characteristic impedance, a phase reversal occurs, i.e. the reflected current wave is 180° out of phase with the incident wave. In the most general case where a reactance is also involved, a further phase shift will occur, the amount depending upon the ratio of load resistance to reactance. Thus some of the generator power is dissipated in the resistive part of the load and some is reflected back along the line (Fig. 4(b)).

(iii) An entirely reactive termination. This includes both the limiting cases of a short circuit and an open circuit. Since there is no resistive component in the load, no power can be dissipated, and must, therefore, be all reflected. This means that the whole of the incident current wave is reflected back down the line. There will be a phase change relative to the incident wave, the actual value of which will depend upon the reactance of the load.

In the limiting case of a short circuit, the current in the short circuit will have a maximum value and, therefore, the phase change is zero; in the case of an open circuit, no current can flow in the load, and hence the phase change is 180°, this being a special case of the more general condition covered in (i).

It is now apparent that in every case, apart from that of a perfect termination, some proportion of the incident current is reflected at the far end of the transmission line, and commences to flow back along the line at the same rate as the

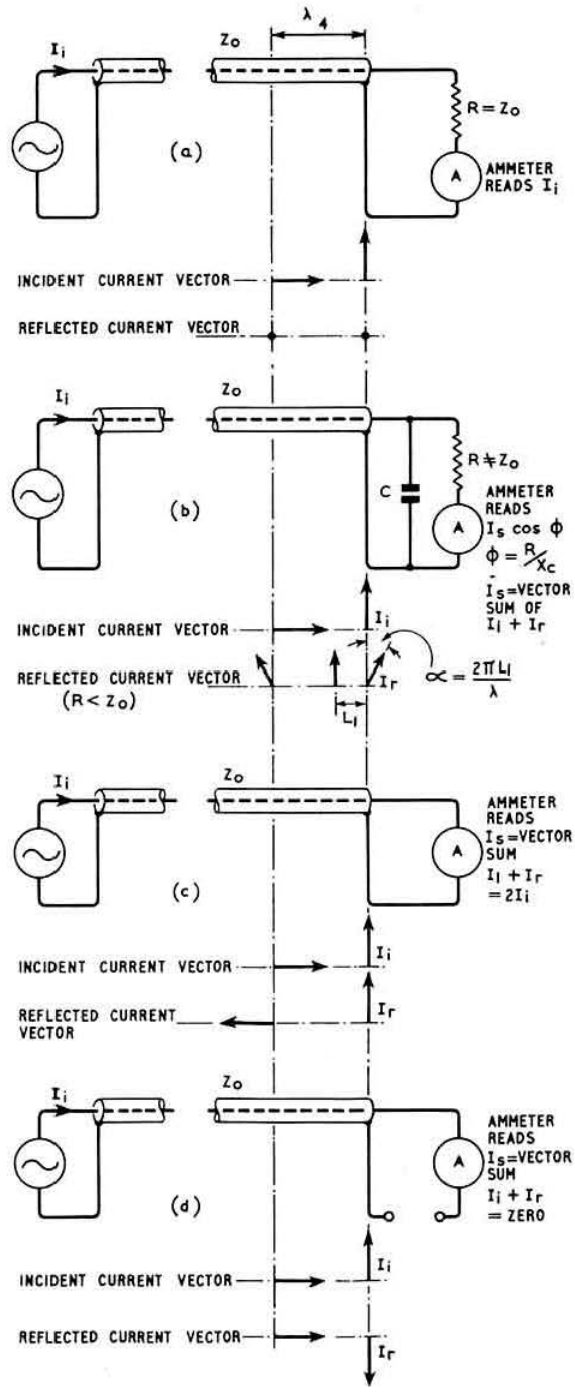


Fig. 4. (a) Arrangement of incident and reflected current vectors in the vicinity of a correctly terminated load. (b) Arrangement of incident and reflected current vectors in the vicinity of a mismatch load of complex impedance. (c) Arrangement of incident and reflected current vectors in the vicinity of a short-circuit. (d) Arrangement of incident and reflected current vectors in the vicinity of an open-circuit.

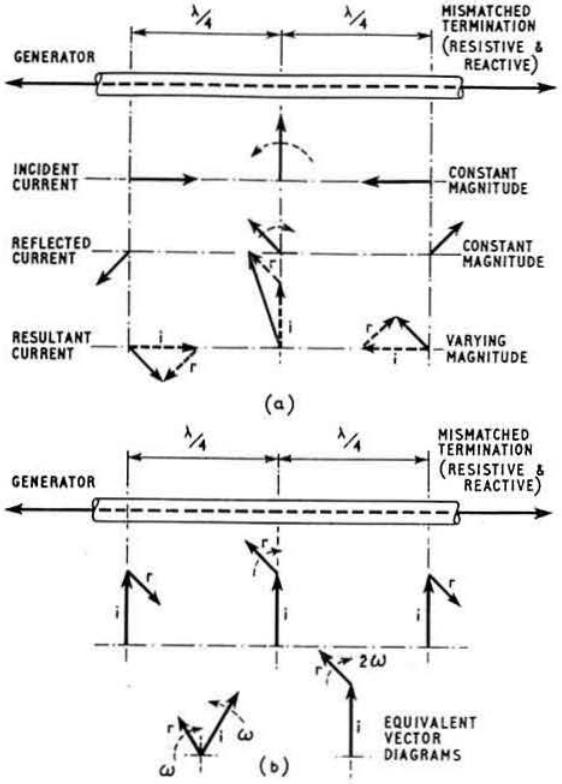


Fig. 5. (a) Combination of incident and reflected current salong a typical section of the line. (b) Effect on (a) of maintaining the incident current vector stationary. The reflected current vector effectively rotates at twice the speed, to produce maxima and minima of current which have a crest-to-crest distance of half a wavelength.

incident current flowing towards the end. This reflected current wave will, depending upon the circumstances of the termination, commence with an amplitude and phase both differing from the incident current wave. However, since the reflected wave is travelling back along the line, its value at any one moment in time may also be expressed in terms of a reflected current vector, which is rotating in a clockwise direction, opposite to the incident current vector (since the waves are travelling in opposite directions) but nevertheless rotating at the same angular rate, since the frequency of the wave remains unaltered at that frequency which we originally selected for our "black box" generator. This is illustrated in Fig. 4(a)-(d) where the incident and reflected current wave vectors are shown at a precise moment of time for both the end of the line and a point one quarter wavelength away from the end.

The reflected wave of current will now travel back along the line, passing through the partition, towards the generator supplying the power to the line. However, we are interested at the moment in the net effect of the passage of the incident and reflected waves upon the distribution of the current along the line. At any physical point on the line, the net current at any instant is merely the vector sum of the two waves, and the resultant vector gives the amplitude and phase of the total current at that physical point for the particular instant of time (Fig. 5(a)).

We have seen earlier, when considering the behaviour of the incident wave before it reaches the termination, that its value at a fixed point on the line varies sinusoidally with time, because $I = I_0 \cos \omega t$. This means that an observer standing at that point on the line would see a wave passing him, the actual value of current at his point of observation varying. If, however, the observer were to travel along the line at the same rate as the wave, he would see a constant value of incident current. This, in fact, corresponds to holding the incident current vector stationary. However, the incident and reflected current vectors are rotating in opposite directions at the same speed, so if we require to hold the incident current vector steady, then to obtain the net resultant current at any point, we must cause the reflected current vector to rotate at twice the speed, so that the relative angle between the two remains unaltered. (Fig. 5(b)). Having established this, it is now evident that we can describe the net r.m.s. effect of the incident and reflected waves at any point along the line by the resultant of the reflected current vector rotating at a constant rate equal to twice the generator frequency, about a fixed incident current vector. This can now be translated back to the equivalent wave, which exists *in space* along the transmission line (Fig. 6) and gives rise to the familiar standing wave pattern, having a maximum value equal to the sum of the incident and reflected wave vectors, and a minimum value equal to the difference. The variations with time have been eliminated by maintaining a constant incident current vector.

Now, by definition, the *standing wave ratio* (s.w.r.) k is

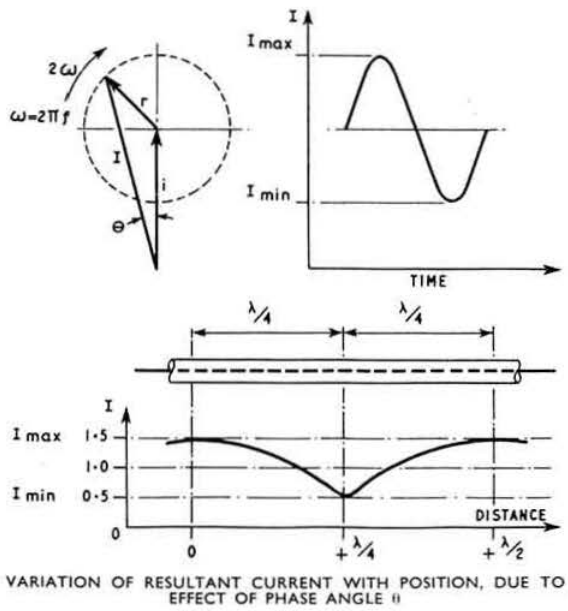


Fig. 6. Development of the standing wave pattern due to the resultant of the incident and reflected current vectors. The variation of the resultant line current with distance is derived directly from the variations of incident and reflected current with time; the time variation is effectively removed by maintaining a constant incident current vector.

the ratio of the maximum to minimum value of the standing or space wave existing along the line. Also, by definition, the *reflection coefficient* r is the ratio of the reflected current vector to the incident current vector. Thus the maximum value of the standing wave will be $(1 + r)$ and the minimum value of the standing wave will be $(1 - r)$. Hence we have obtained the familiar expression which relates standing wave ratio and reflection coefficients:

$$\text{S.W.R. } k = \frac{1 + r}{1 - r} \qquad \ldots \text{(iv)}$$

At this stage, we should again take note of the three particular points which emerge. Firstly, the shape of the standing wave curve is not a pure sine-wave, being generated by the resultant of two vectors. The shape is approximately sinusoidal for low values of s.w.r., but departs increasingly from this form as the s.w.r. increases, to an extent where in the limit of an open or short circuit termination it is close to half sine-waves (Fig. 7(a) and (b)). Secondly, because of the fact that in space the reflected current wave vector is effectively rotating at twice the generator frequency, the positions of successive maxima and minima occur at quarter-wavelength intervals along the line. The third point is that both standing wave ratio and reflection coefficient express ultimately the same conditions existing on a line, the former being an approach based upon the existence of the stationary variation of current, and the latter an approach based upon the resulting effect of two travelling waves of current. Since we commenced the discussion on the behaviour of this piece of transmission line by delivering power into the line from our, as yet, unidentified generator, we should at this stage just note the relationships which we have now established exist on the misterminated line, between the current and the impedance.

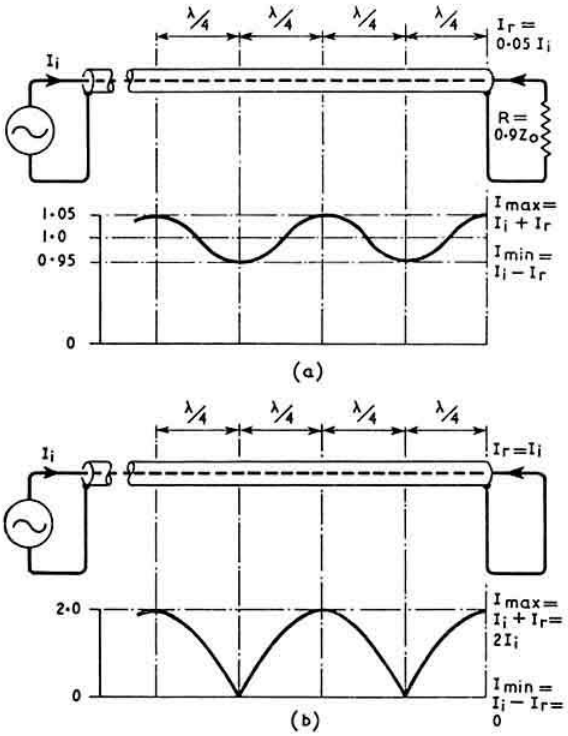


Fig. 7. (a) Standing wave pattern for a near-matched line (R = 0·9 Z_0). (b) Standing wave pattern for a completely mismatched line (R = s/cct.). The curve of Fig. 6 is typical of the transition at medium s.w.r., from the near-sinusoid of Fig. 7(a) to the rectified sinusoid of Fig. 7(b).

In the case of any travelling wave of current, we have seen that the r.m.s. value of the current remains unaltered during its passage along the line, changing only in phase at the rate of 2π radians, or 360° per electrical wavelength of line. We have already seen that the voltage wave behaves in an identical manner, and because of this there can be no power lost in the line during the passage of this travelling wave (recall that we have for the time being stipulated that the line has no losses). Since the incident wave can have no knowledge of any mis-termination on the line, then as far as *it* is concerned the line is matched, and, therefore, the incident power flowing along the line will be given by:

$$P_{in} = I^2_{in} \times Z_0 \qquad \ldots \text{(v)}$$

where I_{in} is the r.m.s. incident current and Z_0 the characteristic impedance of the line.

In an identical manner the reflected power represented by the backward travelling wave is given by:

$$P_{ref} = I^2_{ref} \times Z_0 \qquad \ldots \text{(vi)}$$

where I_{ref} is the r.m.s. reflected current.

Both these relationships deal with the flow of power, but do not relate what happens to the power distribution at the load. Clearly, the current flowing through the load will be the *vector* sum of the incident and reflected currents at the point of connection of the load. Then the power dissipated in the load will be:

$$P_L = (I_{in} + I_{ref})^2 \times R_L \qquad \ldots \text{(vii)}$$

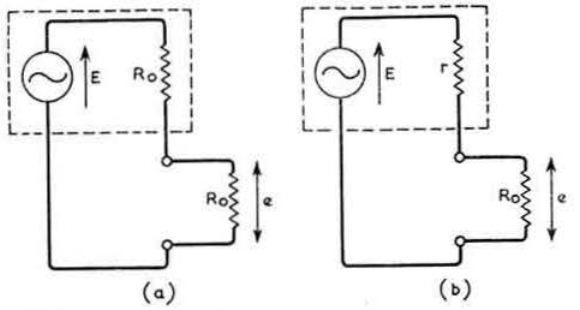
where I_{in} and I_{ref} are the r.m.s. values of incident and reflected current summed taking into account any phase difference between them, and R_L is the effective series resistance of the load.

We have seen that, in fact, the vector sum of incident and reflected currents is the standing wave of current which exists along the line. Since the power transmitted by the line is constant, one could reasonably deduce that there exists a standing wave of impedance along the line in a fashion identical to that of the standing wave of current. This is indeed the case in practice, and reference to any plot of the variation of input impedance with line length for a misterminated transmission line, will illustrate the point. The two are related (for a loss-less line) by the identity:

$$P = I^2_s \times R_e \qquad \ldots \text{(viii)}$$

where P is the constant transmitted power, I_s is the value of the current standing wave at any point along the line, and R_e is the resistive term of the series impedance existing at that point on the line.

Having examined in a fairly thorough manner the treatment received by the incident current wave initiated by our generator when it reached the misterminated end of the line, we can now move back along the line in the company of the backward travelling wave of reflected current, which has a constant magnitude but varying phase in exactly the same way as the incident current. Then to all intents and purposes the reflected wave is identical to a wave initiated by a generator connected to the line in place of the termination, and will behave in exactly the same way. It will pass down the line without modification, through the partition we had set up (Fig. 1) and eventually arrive back at the black box,



VOLTAGE ACROSS LINE = $E\left(\frac{R_o}{R_o + R_o}\right) = \frac{E}{2}$

WHEN GENERATOR IMPEDANCE EQUALS LINE IMPEDANCE

VOLTAGE ACROSS LINE = $E\left(\frac{R_o}{r + R_o}\right) = E$ WHEN $R_o \gg r$

I.E. WHEN GENERATOR IMPEDANCE IS VERY LOW

Fig. 8. Effect of generator impedance on voltage across the transmission line.

which contains our original generator still delivering its incident power to the line. However, as far as the reflected wave is concerned, the generator is merely another passive termination, the value of which is the internal impedance of the generator.

This is the key point at which most arguments regarding power loss in transmission lines fall down, because it is often incorrectly assumed that the reflected wave is absorbed by the generator. In practice, this is far from being the case; indeed, if it were, then this would pre-suppose that the generator internal impedance was equal to the characteristic impedance of the line. From this it would follow that the generator e.m.f. was divided equally between its own internal impedance and that of the line to which it was connected, and hence only 50 per cent of the available power would be passed to the line, the other 50 per cent being dissipated in the generator itself (Fig. 8). Practical transmitters achieve far better transfer efficiencies than this, and we find upon opening the box containing the generator that its internal impedance is very low, approaching a short circuit termination as far as the reflected current wave is concerned. Thus virtually all the reflected power returning from the load is re-reflected at the transmitter to continue flowing up the line again towards the load, in addition to the original incident wave. Since the vector representing the re-reflected current wave is now rotating once again in the same direction and at the same rate as the original incident current vector, having been reversed in direction at the short circuit termination, the net effect is to modify the original incident current by a constant amount, to give a new value to the incident current flowing up the line towards the load.

Now it will be obvious that this process of reflection at the load, and re-reflection at the generator will continue indefinitely provided that no power is being lost in the line during the passage of a travelling wave of current, i.e., the current is not attenuated by the line due to its ohmic resistance. Thus eventually all the power originally supplied by the generator will arrive at and be dissipated in the load. There will be finite intervals of time as each part of the output power arrives, those contributions which have made several journeys up and down the line being delayed behind the main contribution delivered to the load without reflection, by amount depending upon the electrical length of the line. When a transmission system conveying information by means of an audio modulation process is involved the time delays are so short that the ear cannot hear the "echo." When visible images or other pulse forms of transmission are being employed, however, the echo or ghost pulses delayed due to reflections along the line may well become visible to the naked eye as a second image or pulse delayed in time behind the main signal, and diminished in amplitude by an amount dependent upon the inherent loss in the line itself, and the magnitude of the reflection occurring at the load.

The argument developed above now illustrates one of the most important points of transmission line practice. We have seen that the net effect of the passage up and down the line of travelling waves of current is to modify in turn the value of the incident and reflected currents. However, each contribution to the incident current due to re-reflection at the generator is accompanied by a corresponding contribution to the reflected current, due to further reflection at the load. The overall effect of this is that the ratio of incident and reflected currents remains unaltered, and is dependent *only* upon the relative values of the characteristic impedance of the line and the impedance of the load. That is to say that the standing wave ratio along the line is dependent only upon the nature of the load at the far end, and no amount of alteration at the generator end can alter the magnitude of this standing wave.

It is also worthy of note at this point that since no power is lost in our loss-less line, the current waves are not attenuated during their passage along the line, and hence the s.w.r. remains at a constant value for the whole length of the line. In practice, lines are not entirely loss-free, and we can now go on to examine the modifications introduced to the previous case, when we substitute for our hypothetical loss-less feeder a more practical piece of transmission line.

Transmission Lines

In practice all transmission lines have associated with them some loss which is experienced when power is transmitted along them. This loss may be due to radiation (from balanced lines), resistive losses in the conductors, and leakage losses in the insulator; but however it arises, it is a function of the actual construction of the line and the materials employed. This is termed the matched loss of the line and is quoted in the manufacturers' published information usually as *n* db per 100 ft. It increases more or less in proportion to the square root of the frequency at which it is being used, i.e., a line having a quoted matched loss of 3db/100 ft. at 10 Mc/s will have a matched loss of approximately 9db/100 ft. at 100 Mc/s ($3db \times \sqrt{10}$). The effect of this loss is to attenuate the magnitude of the current and voltage waves as they flow along the line, and since the loss has no sense of direction, it will equally well attenuate the reflected wave of current as well as the incident wave. Consider now what happens in our previous example when the loss in the transmission line is taken into account, using the same electrical length of line as before.

When the generator is switched on, power again flows into the line and is propagated along the line as an incident wave of current (and voltage). The magnitude of the incident wave at the point of connection of the generator is the same as before (Fig. 3), but as the wave progresses along the line, due to the presence of the attenuation, its value is decreased, although its frequency and hence the rate of rotation of the vector representing it remains unaltered. When it arrives

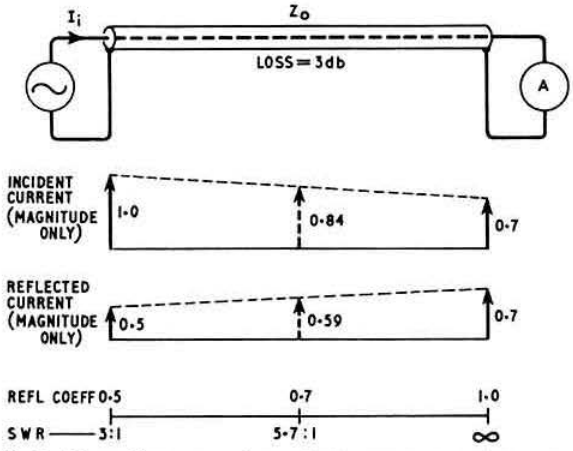


Fig. 9. Effect of line attenuation on incident and reflected currents.

at the termination it will have the same phase, but a smaller magnitude than in the example of the loss-less line, i.e., as far as the load is concerned it is equivalent to a reduced power flowing into the generator end of a loss-less line. At the point of connection of the load, a reflected wave will be set up as before, its value and phase being dependent upon the nature of the load, and also relative to the value of incident current *at the load.* This reflected wave then flows as before back along the line, experiencing attenuation during its passage, until it arrives back at the generator, in the same phase as in the loss-less case, but with a further reduction in magnitude (Fig. 9). Now we have previously

TABLE 1

Frequency	Line loss	S.W.R. at load	S.W.R. at transmitter
14 Mc/s	0·5db	1·22	1·20
140 Mc/s	1·6db	1·22	1·15
1400 Mc/s	5·0db	1·22	1·06

Effect of line attenuation on the s.w.r. presented at the transmitter, for a constant s.w.r. at the load.
Load S.W.R. = 1·22 = 10% reflection coefficient.

seen that the standing wave ratio is related to the reflection coefficient at any point on the line, and that the reflection coefficient is defined by the ratio of the incident and reflected currents at the point in question. Then applying this to the case of the line with a finite loss it becomes evident that the reflection coefficient and hence the s.w.r. are not the same at each end of the line, and indeed change constantly along the length of the line. The effect of the line attenuation is to cause an improvement in the s.w.r. as one approaches the generator. In other words, when feeding power to a mismatched load through a transmission line having a finite loss, the mismatch appears less severe at the transmitter.

In the case of practical lines, in which the whole object is to achieve as small an attenuation as possible, the improvement in the match presented to the transmitter is not great, and indeed for typical h.f. band installations, is negligible, since the matched feeder loss is only likely to be of the order of 0·5db, and hence the reflected current at the transmitter will only be reduced by 1db (go-and-return) or 10 per cent. Since the reflected current is typically only 10 per cent of the incident current anyway (corresponding to an s.w.r. of 1·22), the net effect of a line attenuation of 0·5db would be to reduce the reflected current to 9 per cent of the incident current (corresponding to an s.w.r. of 1·20). If we now consider the effect of a similar piece of line at v.h.f. (say ten times the frequency of the h.f. case), then the line loss will have increased by $\sqrt{10}$, or approximately a factor of 3, i.e., 1·5db (or 3db go-and-return). Then in this case, for an s.w.r. at the load of 1·22, the reflected current at the transmitter will be reduced to 7 per cent instead of 10 per cent, giving an effective s.w.r. at the transmitter of 1·15. Taking this a stage further to u.h.f., again by a factor of ten in frequency, the return line loss will have increased to 10db, giving an effective s.w.r. at the transmitter of 1·06. These results are tabulated in Table 1.

We have so far considered the net effect of line attenuation upon the s.w.r. presented to the transmitter. Of greater interest is the resultant additional loss of power in a practical line, with a finite matched loss, when it has upon it a standing wave. We have seen in the case of the loss-less line that all the power delivered to the line is eventually dissipated in the load, although a certain proportion is delayed in time due to multiple reflections. When the mistermination of the line is not gross, the amount of power returned from the first reflection at the load is not large.

Assuming that the generator completely misterminates the line at the sending end then the whole of the power from this first load reflection will reappear at the load after a journey back down the line and up again during which time it is attenuated by twice the matched line loss (go and return). At this stage the major proportion of this attenuated reflected power is then delivered to the load, and a small proportion is re-reflected, so that the net power delivered to the load after only one reflection represents an appreciable proportion of that delivered by the generator, and is only slightly less than that which would have been dissipated in the load, had there been no attenuation in the line. In other words, because the transmitter presents virtually a complete mistermination

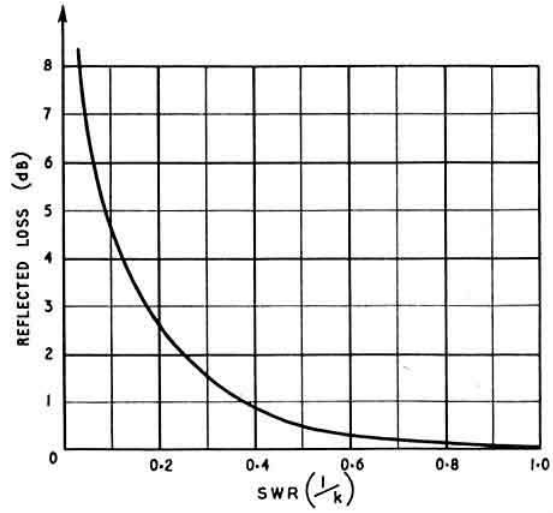


Fig. 10. Curve of mismatch loss, i.e. the amount of power reflected from a mismatch for a given s.w.r. This is also the curve of absolute power loss (when the generator terminates the line, and therefore absorbs the reflected power) for lines of zero matched loss.

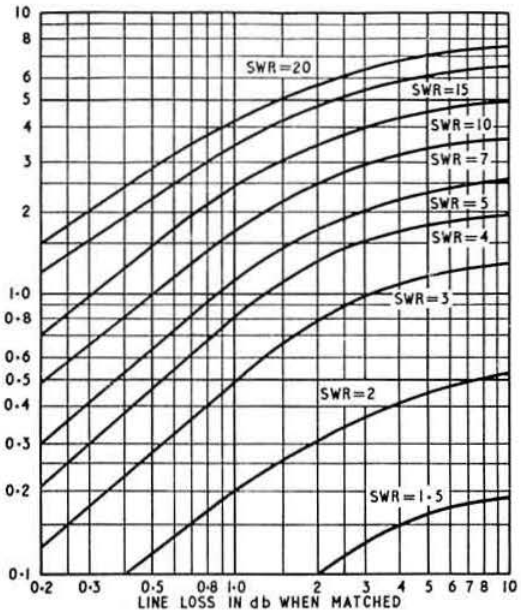


Fig. 11. Curves of absolute power loss for any given s.w.r. and matched line loss (assuming that the generator completely misterminates the line).

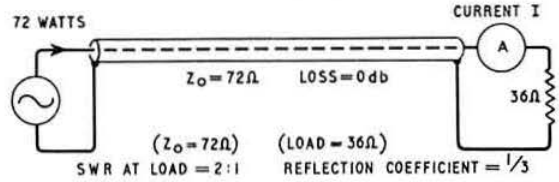
to the reflected power in the line, the additional power lost due to the presence of reflections from the load is relatively small, arising only from the attenuation of the reflected wave. This point is frequently misunderstood, and the reader is led to believe that once power has been reflected from a misterminating load this reflected power is lost. This case *only* occurs when the transmitter itself presents a perfect termination to the line and can absorb this reflected power: as we have seen this does not occur in practical transmitters, by the very nature of their design.

This power loss by mismatch is, however, important in the case of a receiving system. In such an arrangement, the input impedance of the first stage of the receiver is transformed to present as good a match as possible to the transmission line transferring power from the aerial. Thus the receiver becomes the load, and the aerial becomes the generator. In such a case, the load is adjusted to match the line by design, and by its very nature, the aerial is also a reasonable match to the line. In such circumstances, any signal power reflected from the receiver input is re-radiated by, or effectively dissipated in the radiation resistance of the aerial. This reflected power does not return to the receiver input to provide a contribution to the total signal received, but is lost. The extent of the additional power lost due to such a mismatch on a receiving aerial feeder is illustrated by Fig. 10. The difference between this case and that of the transmitter can be seen by comparing this graph with that of Fig. 11, which shows the additional loss due to a mismatch on a line in the transmitting case. It is, of course, true to say that in practice neither case is perfectly satisfied, i.e., the transmitter does absorb some of the reflected power in the one case, and the aerial does re-reflect some of the reflected power in the other case. The respective curves deal with the limiting conditions, and represent the maximum additional loss that can be experienced in each case.

To conclude these notes on the behaviour of transmission lines, a worked typical example has been prepared, in an attempt to illustrate exactly what happens when an aerial is used which presents a degree of mismatch to a transmission line. This is included in Appendix 1 and the writer hopes that readers of these notes will now have a clearer impression of this particular subject.

Appendix I

(*a*) Case when power is fed to a load presenting a mismatch to a perfect loss-free line by a transmitter which itself presents a short circuit to the line.



Order of reflection at load	Incident current at load	Reflected current at load	Current I in meter	Power in load
First	1 amp	$\frac{1}{3}$ amp	$1\frac{1}{3}$ amps	64 watts
Second	$\frac{1}{3}$ amp	1/9 amp	4/9 amp	7-1/9 watts
Third	1/9 amp	1/27 amp	4/27 amp	7/9 watt

Then after *three* reflections at the load:

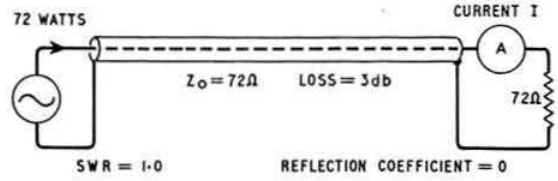
(i) Total power in load = $71\frac{7}{9}$ watts or 99·85 per cent of final value

(ii) Total incident current at load = $1\frac{1}{9}$ amps
Total reflected current at load = $\frac{1}{27}$ amp
Therefore reflection coefficient = $\frac{I_{ref}}{I_{in}} = \frac{1}{3}$ (as above)
i.e. the reflection coefficient (and hence v.s.w.r.) is constant irrespective of the number of reflections.

Particular note should be taken of the fact that, although the resultant current at the load is greater than the incident current, we are not in fact gaining something for nothing, because the incident and reflected currents must be referred to the line impedance to obtain the power flow, while the resultant current flows in the load and must be referred to the load impedance. For example, after one reflection at the load:

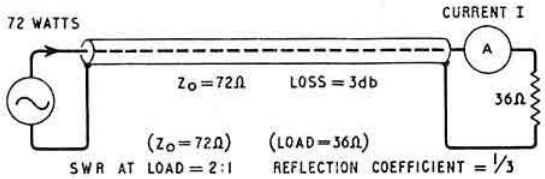
Incident current	= 1 amp	
Incident power	= $1^2 \times 72$	= 72 watts
Reflected current	= $\frac{1}{3}$ amp	
Reflected power	= $(\frac{1}{3})^2 \times 72$	= 8 watts
Load power	= $(1\frac{1}{3})^2 \times 36$	= 64 watts
		= difference between incident and reflected powers

(*b*) Case when power is fed to a load presenting a *match* to a line having a finite matched loss, by a transmitter which itself presents a short circuit to the line:



Generator power	= 72 watts
Loss	= 3db
Therefore, power in load	= 36 watts
Current in load	= 0·7 amp
Incident current at generator	= 1 amp
Incident current at load	= 0·7 amp
Reflected current at load	= 0

(*c*) Case when power is fed to a load presenting a *mismatch* to a line having a finite matched loss, by a transmitter which itself presents a short circuit to the line.



Incident current from Generator	Order of reflection at load	Incident current at load	Reflected current at load	Current I in meter	Power in load
1 amp	First	0·707 amp	0·236 amp	0·943 amp	32 watts
0·167 amp[1]	Second	0·118 amp[2]	0·039 amp	0·157 amp	0·887 watts
0·028 amp	Third	0·019 amp	0·006 amp	0·025 amp	negligible

[1] attenuated by one passage down feeder
[2] attenuated by two passages (return and forward) down feeder

Then after *three* reflections at the load:

(i) Total power in load = 32·89 watts = final value (approx.)

(ii) Total incident current at load = 0·844 amps
Total reflected current at load = 0·281 amps
Therefore, reflection coefficient at load

$$= \frac{I_{ref}}{I_{in}} = \frac{0{\cdot}281}{0{\cdot}844} = \tfrac{1}{3}, \text{ as above}$$

Note—Apparent reflection coefficient at generator, due to load $= \frac{I'_{ref}}{I'_{in}} = \frac{0{\cdot}167}{1} = \frac{1}{6} = 1{\cdot}4{:}1$ s.w.r.

From case (*b*) shown, with a perfectly matched line,

Power in	= 72 watts
Power out	= 36 watts
Therefore, loss	= 3db (as stipulated)

In this case, for a line with an s.w.r. at the load of 2:1,

Power in	= 72 watts
Power out	= 33 watts
Therefore, loss	= 3·39db

Therefore additional loss due to the s.w.r. of 2:1 = 0·39db

New BBC Television Relay Station at Eastbourne

The BBC has announced that its new television relay station at Butt's Brow, Eastbourne, was brought into service on December 16, 1963. It operates on Channel 5 (vision 66·75 Mc/s, sound 63·25 Mc/s) with vertical polarization.

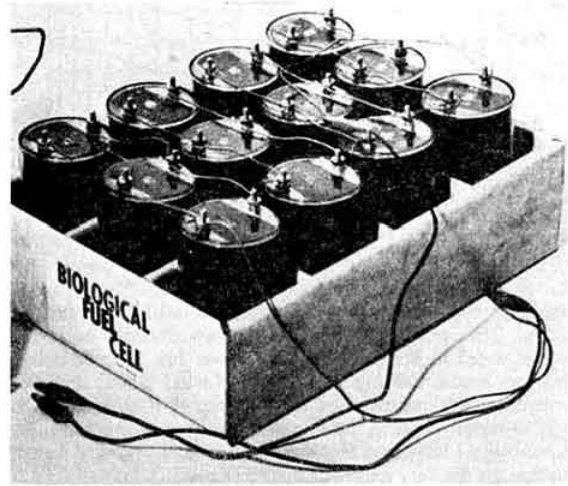
The new station is one of a number of low power relay stations being built by the BBC to extend and improve the coverage of its existing television service, and should provide improved reception in and around Eastbourne.

Electric Battery Draws Power from Bacteria

An electric battery which draws power inexpensively from harmless bacteria has been developed in the United States. Known as a biological fuel cell, it has a theoretical life expectancy of more than 50 years during which it produces electricity continuously. The cell harnesses the energy of thousands of bacteria inside it and makes this energy available in the form of electricity.

A pilot model of the cell—which produces enough energy to power a transistor radio, a small light bulb or a miniature motor—has been designed for educational and demonstration purposes in schools by the Electron Molecule Research Company of San Antonio, Texas. The firm is now designing a compact, easily portable, but more powerful model for use in areas which need inexpensive, long lasting power sources. Still other models are planned as private sources of electricity for homes, airports, railway signals, electrified fences, standby supply for business and industry, at isolated locations such as buoys, or for use on long space voyages.

The main components of the pilot model are 12 plastic



Biological fuel cell capable of running a transistor radio or miniature motor.
(Photo by courtesy of US Information Service)

containers, about the size of medicine pill bottles or small ink bottles, filled with brown powdered rice husks, and a bag full of bacteria similar to yeast or bread mould. The bacteria are mixed with water and the rice husks, which decompose as the bacteria "feed" on them. Electric energy resulting from this process is picked up by a strip of copper which serves as a positive connection, and a strip of aluminium which serves as a negative connection. These metal connections protrude from each plastic container and are joined by wire to the radio, light bulb or motor to be supplied with electricity.

The unit is self-contained, and needs no outside connections, but each cell container requires an opening for air intake.

Once assembled, the unit needs no attention except occasional refilling with rice husks and water for the thousands of industrious "worker" bacteria which reproduce themselves indefinitely.—*Science Horizons.*

Broadcast Receiving Licences

During October the number of combined television and sound licences throughout Great Britain and Northern Ireland increased by 67,491, bringing the total to 12,731,101. Sound only licences now total 3,151,927 including 561,965 for sets fitted in cars.

The W.S. No. 46 on Top Band

By DAVID NOBLE, G3MAW,* and
DAVID M. PRATT, G3KEP†

AS a result of a large release of Wireless Sets No. 46 to the surplus market, many amateurs have been able to obtain these sets for low power use on the 3·5 and 7 Mc/s bands. The writers have found that by a simple modification to the plug-in coil unit, the apparatus can be made to operate satisfactorily in the 1·8 Mc/s band. This makes the unit suitable for use on RAEN exercises and for low power field days and mobile operation.

The W.S. No. 46 walkie-talkie was described in the June, 1961, issue of the RSGB BULLETIN, and the circuit diagram of the aerial input and frequency changer stage is reproduced in Fig. 1 for reference. The unit operates on three crystal-controlled frequencies. Originally, four plug-in coil units were available covering the range 3·6 to 9·4 Mc/s, and two of these may be used on the 80 and 40m bands.

Circuit Description

The coil, L1, acts as the mixer grid coil on RECEIVE and the p.a. tank circuit on TRANSMIT. It operates as an acceptor circuit with C6 on RECEIVE and its core is adjusted to be series resonant on 1550 kc/s—the intermediate frequency. This acts as an i.f. filter, and it has been found essential in order to reject Third Programme breakthrough on 1546 kc/s. Tuning to the desired band is achieved by the capacitor C2, and one of the trimmers selected by S1a.

* "Heather Bank," Hillings Lane, Menston, Ilkley, Yorkshire.
† "Glenluce," Lyndale Road, Eldwick, Bingley, Yorkshire.

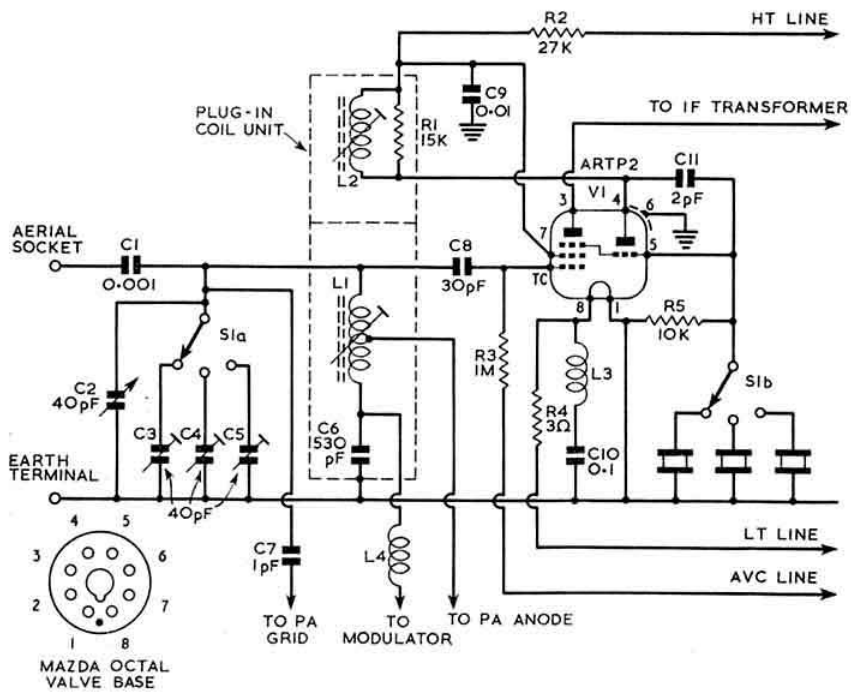


Fig. 1. Circuit diagram of the aerial input and frequency changer stage of the W.S. No. 46.

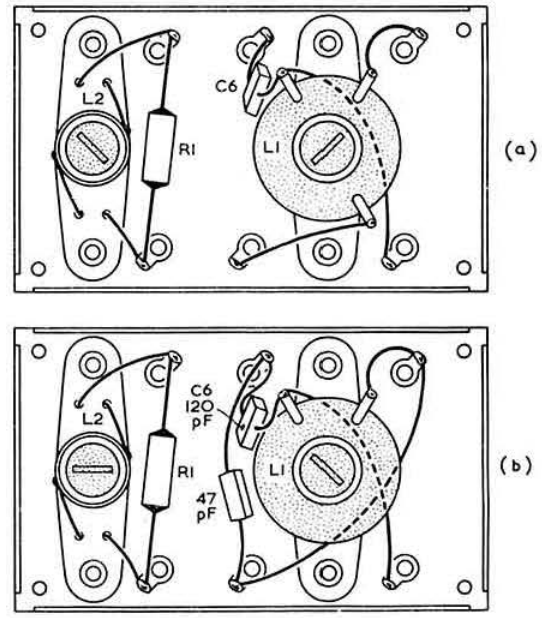


Fig. 2. The coil box. (a) Original wiring. (b) After modification.

Modification

For 1·8 Mc/s band operation, L1 should be re-wound with 134 turns of 40 s.w.g. single silk covered wire. C6 should be a 120 pF silvered mica capacitor to series tune the coil to the intermediate frequency; an additional capacitor of 47 pF is required to enable the circuit to be tuned to 1·9 Mc/s with the trimmers provided. The anode feed to the p.a. is now taken from the top of L1, thus obviating the need for a tapping on the coil.

The receiver local oscillator feedback coil, L2, is identical in the original 3·5 and 7 Mc/s coil boxes and need not be re-wound for the 1·8 Mc/s band as the circuit was found to oscillate readily with the original coil fitted with two iron dust cores.

Fig. 2 shows the inside of the plug-in coil boxes before and after modification.

The receiver local oscillator crystal should be on the transmitter frequency plus 1550 kc/s, i.e., for 1900 kc/s, a receiver crystal of 3450 kc/s would be required.

Results

The modified unit was found to fulfil its purpose admirably for local working on Top Band, using a whip aerial 6 ft. long. Crystal control of the receiver is not a major disadvantage since the i.f. bandwidth is fairly broad, and

(*Continued on page 24*)

Single Sideband

By G. R. B. THORNLEY, G2DAF*

AT the present time there is little activity on 15 and 10m and an exciter covering 80 and 20m only would cover the present most widely used bands and appeal to many constructors because of its simplicity.

If the initial sideband generation is on 9 Mc/s and this is heterodyned with a v.f.o. covering the range 5·0 to 5·5 Mc/s, the difference frequency converter output will be 3·5 to 4·0 Mc/s and the sum frequency converter output 14·0 to 14·5 Mc/s. It is therefore possible to cover the two bands, 80 and 20m, with only one conversion process.

This is the basis of the transmitter to be described which was designed and constructed by YO3GK who has kindly supplied the circuit and coil details. The transmitter has been in continuous use for a number of years, is stable, gives a good quality signal with acceptable carrier and sideband suppression and is easy to tune and adjust.

The circuit diagram is given in Fig. 1. V1a, V1b and V2a constitute a three-stage audio amplifier with sufficient gain for a crystal microphone. Transformer T1 may be a standard audio type of approximately 4 : 1 stepdown ratio to match the 500 ohm impedance of the Barker & Williamson audio phase shift network. This network is designed to give the required 90° phase shift over the range 300 to 3000 c/s and any frequencies entering the network outside these limits would not be in the correct phase relationship and the sideband suppression would suffer. Accordingly the audio amplifier is given a fairly steep roll-off to the lower register by using small values of coupling capacitors (1000 pF) and the higher frequencies are attenuated above 3000 c/s by the low pass filter consisting of the 45 mH choke and the two 0·1 μF capacitors. The two outputs from the phase shift network are further amplified by V3a and V3b. Transformers T2 and T3 are required to give a voltage stepdown into the grids of the balanced modulator. It is not thought that the ratio will be critical and the small potted output transformer from the surplus Command receiver or a standard replacement speaker output transformer of 30 : 1 or 35 : 1 ratio should be suitable.

V2b is a conventional Miller crystal oscillator with an anode circuit resonant at the crystal frequency and a stepdown secondary to feed the low impedance r.f. phase shift network comprising the two 353 pF capacitors and the two 50 ohm resistors. As the sideband suppression is dependent on the accuracy of this network maintaining the required 90° phase shift, the four associated components should be 1 per cent tolerance types. Capacitors of 1 per cent tolerance may be obtained from Radio Spares Ltd.—these are in preferred values, but it is easy to select a number in parallel to make up the required 353 pF value. The accuracy of an AVO Model 7 or Model 8 testmeter (or similar) should be sufficient to select from a number of standard 20 per cent tolerance, half or one watt *carbon* resistors, two of the required value of exactly 50 ohms.

The balanced modulator V4a, V4b and V5a, V5b has the anodes of each valve push-pull connected to the centre tapped primary winding of L2. It will be noted that the r.f. input to each valve is in parallel via the 100 pF grid feed capacitors and provided the current through the two halves of the valve is equal the carrier will balance out in L2. Current equality is obtained by VR4 and VR5 and these are the carrier balance controls. Output from the balanced modulator is fed via a coaxial cable into the heterodyning and output unit comprising V6, V7 and V8.

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A parallel tuned Hartley circuit is used in the v.f.o. covering the range 5·0 to 5·5 Mc/s and the output is fed via a 25 pF pre-set trimmer capacitor to heterodyne the 9 Mc/s single sideband input in the converter valve V6. Either the sum or the difference frequency output at the anode of V6 is selected by the tuning of the tank circuit—coil L5 may be a plug-in unit (the two windings for 80 and 20 are given in the coil winding details) or may be switched in the usual manner. The 807 p.a. output circuit is a conventional pi-tank circuit with the whole of the 30 turn winding used for 80m and the tap shorted across to the output end of the coil when it is used on 20m.

Socket CS1 marked "crystal" refers to a crystal microphone. The two r.f. chokes 0·5 mH may be standard 1·5 mH types, but the 1 mH anode feed choke to the p.a. should be the sectionalized low capacity type.

YO3GK states that a 150 volt stabilizer may be used instead of the VR105 indicated and that this will give more drive without decrease in stability. The 807 grid stopper may be reduced to 20 ohms 1 watt carbon. The 25 pF capacitor feeding the v.f.o. output to the converter is adjusted until the sideband drive into the p.a. is maximum.

COIL TABLE

L1 (anode of crystal oscillator), 20 turns 30 s.w.g. silk covered close wound on $\frac{1}{4}$ in. diam. dust-cored former.

L2, two by 12 turns 30 s.w.g. silk covered bifilar wound on $\frac{1}{4}$ in. diam. dust-cored former.

L3 (mixer input), 20 turns 30 s.w.g. silk covered close wound on $\frac{3}{8}$ in. diam. dust-cored former.

L4 (v.f.o. coil), 9 turns, tapped at $2\frac{1}{2}$ turns from earthy end, 22 s.w.g. enam. on $\frac{3}{4}$ in. diam. ceramic former, winding length $\frac{3}{16}$ in.

L5 (mixer output), 24 s.w.g. enam. wound on $\frac{3}{4}$ in. diam. former:
3·8 Mc/s 26 turns close wound.
14·3 Mc/s 6 turns spaced to $\frac{3}{8}$ in.

L6 (p.a. coil), 30 turns, tapped at 8 turns, 18 s.w.g. silvered, 3 in. winding length, on $1\frac{1}{2}$ in. diam. ceramic former.

The W.S. No. 46 on Top Band

(Continued from page 23)

stations slightly off the nominal frequency can be received without difficulty. When used on RAEN exercises, it is desirable to have all three crystal positions occupied so that frequency changing can be carried out if required. In such a case, one of the crystal frequencies should be 1980 kc/s, the RAEN calling frequency.

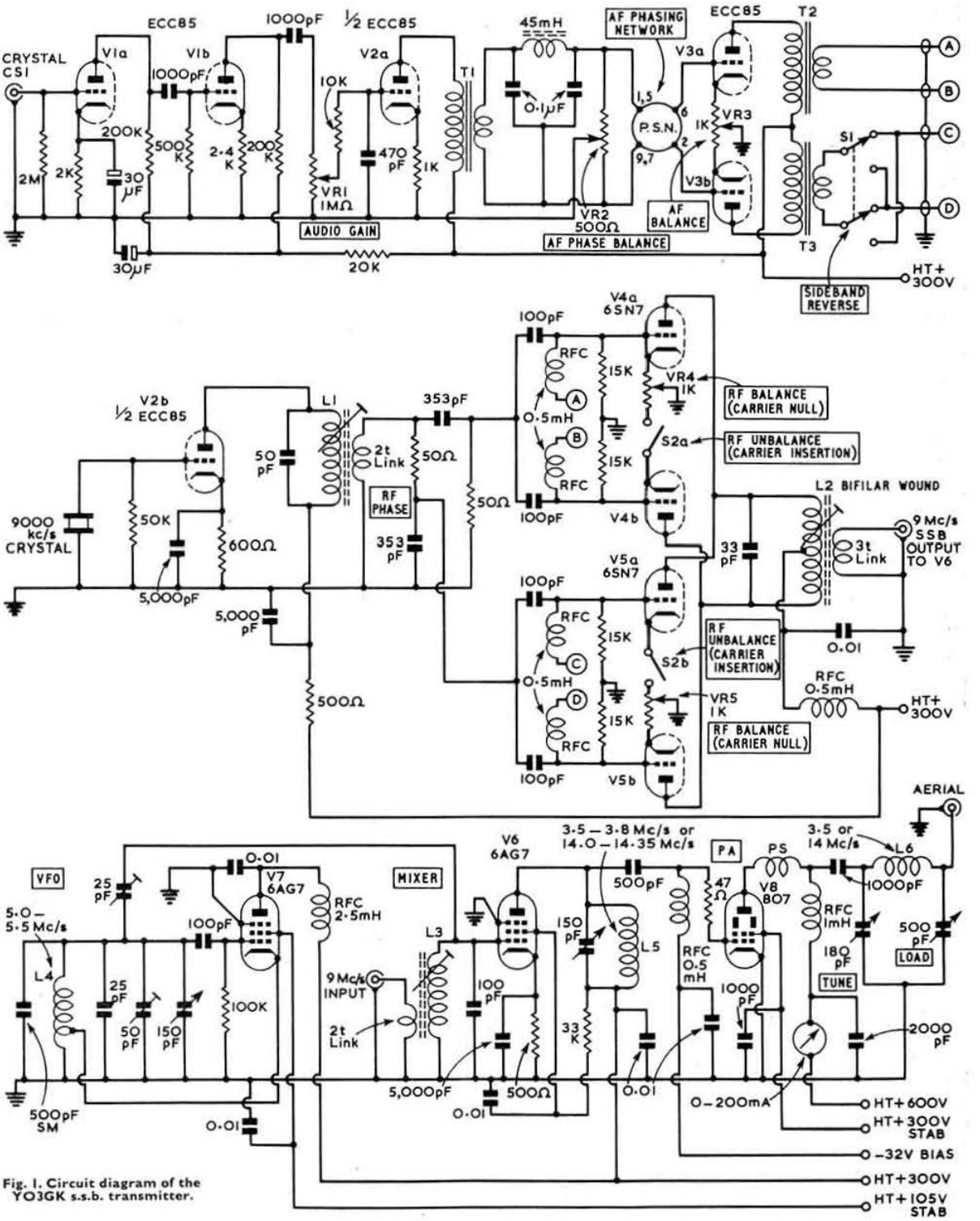

Fig. 1. Circuit diagram of the YO3GK s.s.b. transmitter.

More Thoughts on Verviers

By E. M. WAGNER, G3BID*

"WHAT is the difference between operating mobile in England and operating mobile in Holland and Belgium?" This is the question I have often been asked, and this is followed by "Surely, once the novelty has worn off there is nothing different in mobile operation in one country or another. Then why all the fuss?" At first sight this may be a justifiable attitude, but a little further thought, or better still actual experience, shows this is not the case.

I was quite surprised to see how different was the experience in operating in Holland, for example, and in England. The difference and the value of the experience can best be divided into two major categories: (i) Technical, (ii) Personal.

Technical Differences

Quite frankly I would not have expected there to be much difference technically between operating mobile at home and abroad.

First and quite surprisingly, there was a very great difference in the level of interference when operating on the roads of Holland. In Britain the law requires all new motor vehicles to be suppressed to a certain minimum standard, in order to avoid or reduce interference to television reception. While this standard is, of course, not satisfactory for mobile operation, it does mean that "other people's cars" have a certain amount of suppression. In Holland this is not the case. There is no compulsory standard of suppression and the majority of vehicles are, therefore, totally unsuppressed. It was a long time before I realized this. At first I thought the noise limiter on my receiver had developed a fault. But enquiries made amongst local amateurs produced the answer that there was no compulsory suppression. Without operating in Holland, it would have been difficult to believe that this could make so much difference.

Then the TVI problem is also one of interest. In Holland and Belgium most television transmissions are horizontally polarized which helps the mobile with his vertical aerial but gives additional difficulties to the fixed stations with usually horizontally polarized aerials.

The charging problem and the use of different types of power supply also present different problems when operating for long periods remote from one's base. In England I have charging facilities at home, so that by carrying a spare set of batteries, the other batteries can be recharged overnight. Taking a small mains charging set on the Verviers trip had been considered but I am glad I did not. The number of occasions when it would have been possible to connect the charger to the mains were relatively few. Far too often the car had to be parked outside the hotel or in a park where no mains connection was available. Instead I had fitted a switch, which transferred the whole car system, charging and all, from one battery to the other. Thus, as soon as the main car battery was fully charged (which can be seen roughly from the charging rate on the car ammeter) I transferred to the radio battery and charged that. In this way it was possible to keep the batteries fairly well charged during the two weeks' operation.

The power supplies also provide an interesting technical problem. Obviously transistor power supplies are far more economical of battery power than any other form. Unfortunately, experience suggests that they are not so reliable. Both a transistor power supply and an old fashioned rotary converter were therefore taken.

The transistor supply was used very happily for the first 11 or 12 days of the trip. But then it blew up. I felt I must be very unlucky or clumsy, till it was learnt that other people's transistor power supplies were also giving trouble after about ten days' hard use. A longish trip of this nature, away from one's base certainly tests the equipment far more effectively than short trips returning to base at frequent intervals.

Personal

Another very important way in which a Continental tour equipped with mobile equipment differs from a similar trip at home, or even from a Continental motor tour without the rig, is the people one meets. Being on the air it is possible to contact local amateurs and one is then talked into their homes. It is possible to see their equipment, often very different from that in one's own country.

Local residents are met who are able and usually most willing to show one the neighbourhood, the local sights, and restaurants, and so it is possible to see the district far better, far more intimately and far more personally than would be possible either by oneself or on an officially escorted tour.

Lastly, and this is perhaps the most important, one gets to know the people of another country in their homes, and discusses all manner of things in a way which would not otherwise be possible.

This personal contact with people living in another country, the meeting in their own homes cannot but improve international understanding and so create international goodwill in a way which can only do lasting good to all concerned.

* 5 Ferncroft Avenue, London, N.W.3.

Electronics—The Expanding Frontier

The possibility of creating electronic devices equivalent in size and complexity to the human brain was foreshadowed by Dr. R. C. G. Williams* in his Inaugural Address as Chairman of the Electronics Division of The Institution of Electrical Engineers, October 23, 1963.

Developments in electronic microminiaturization are closing the gap between the specialized body cells, which control the electrical impulses in our nervous system, and the comparatively clumsy computer of today, he said.

The advances made possible by electronics are as spectacular as those due to man's mastery of fire, and to the invention of the wheel, and of printing. Television has produced gains of a million to one in the size of the audiences which can be simultaneously reached. Half a million is a large audience, but if only this number of people is watching, television producers feel that everyone has switched off.

Dr. Williams, who has been urging the establishment of a television university since January, 1962, when he made his first public announcement of the idea in this country, called for the setting up of a "Televarsity" of 5000 students. This would provide education in the home by means of television and would require a special department to explore the best way of using television for education.

An opportunity for extending television educational broadcasting is given by the new Television Act, which authorizes the ITA to transmit experimental educational programmes that have not been originated by a programme contractor. This could enable universities to conduct early tests by radio channels which could later be augmented by wire relay links.

The next million to one gain in electronics is likely to come from the laser, a development able to produce extremely intense beams of light. This device could theoretically carry so many telephone conversations as to enable half the world's population to talk to the other half at the same time.

"We are living in a competitive world in which 90 per cent of the scientists who have ever lived are alive today, and the resulting concentration of invention is making industry out of date every decade," Dr. Williams concluded.

* Chief Engineer of Philips Electrical Industries.

A Beginner's Guide to DX Listening

BY J. DOUGLAS KAY, G3AAE*

AMATEUR Radio is not the prerogative of those who hold a transmitting licence; it is a hobby that is open to anyone who owns or can build a receiver covering one or more amateur bands. A broadcast receiver and a picture-rail aerial are sufficient to listen to the 20 and 40 metre transmissions of the fellow down the road, but if it is DX (long distance) you want then the receiving installation—receiver and aerial(s)—should be as efficient as that of the transmitting amateur: possibly more efficient as there is no transmitting equipment to worry about.

Equipment

Simple short wave receivers are not difficult to construct, and there are many two or three valve straight circuits

BRS 3789

75 ROUNDMEAD AVENUE, LOUGHTON, ESSEX

To Radio.....your.....Mc/s s.s.b./a.m./c.w.
signals received here at.....GMT on.....196...
You were calling/working.....and you were RST.....
QRM..... QRN..... Conditions.....
Other countries audible at time were.....
Receiver..... Aerial.....
Remarks .....
.....
I hope this report is useful. Do you need further reports?
Please QSL direct or via RSGB 73, J. Douglas Kay.

Fig. 1. Layout of a typical short wave listeners' card.

capable of giving excellent results. However, in these days of increased congestion on the amateur bands many advantages can be gained by using a superhet receiver, and while this type of receiver is not beyond the scope of many amateur constructors, it is considerably more difficult to build and adjust than a straight receiver. Let it be said though, that if you really want to get a good grounding and appreciation of Amateur Radio there is no better way than by building at least your first receiver.

Another method is to build an amateur band converter for use with an existing domestic radio receiver, but this has the disadvantage that it is not suitable for two of the most popular methods of transmission, single sideband and c.w. These transmissions require the addition of a beat frequency oscillator (b.f.o.) which can only be done by modifying the broadcast receiver.

For those who prefer the commercial product there are still plenty of good communications receivers available at reasonable prices, and every month the advertisement columns of the BULLETIN list a number of such receivers. Some of them will have seen a lot of service however, and may need new valves and re-aligning before being put into service. If there is a transmitting amateur in your district he may be willing to help by comparing the performance of your receiver with his own. Remember that some of these receivers need only a few pounds spending on them to bring them near to the manufacturers' specification. When purchasing choose with care though, and do not buy a receiver which has been maltreated or exposed to the weather: no technical knowledge is needed for this—just eyesight.

The choice of aerial(s) to be used depends largely on the location of the receiving station, and all the constructional articles on transmitting aerials apply equally well to receiving aerials. In fact most transmitting stations use the same aerial for both transmitting and receiving, using a change-over relay to switch the aerial from transmitter to receiver. One further and invaluable piece of equipment which will greatly add to the efficiency of any receiving station is a good quality frequency meter and it is fortunate that at the present time there exist several very suitable types of frequency meters which may be purchased quite inexpensively.

Monitoring the Amateur Bands

Having equipped your station you are ready to start monitoring amateur transmissions. Presuming that you have made the installation as efficient as possible the next thing is to learn how to get the most out of the receiver, when and where to listen. There is really no short cut to acquiring the art of listening, and the only way is to learn by experience. Patience and the skill gained by experience will open your shack to the far corners of the world. An approximate idea of when the various bands can be expected to be open to different parts of the world can be obtained by referring to the Frequency Prediction Tables published monthly in the BULLETIN, and a great deal can be learned by listening on the various bands and making notes on the stations heard. There are several types of transmitting type log-books on the amateur market, and these are quite suitable for use as listening logs.

On being elected to membership of RSGB you are given either a BRS (British Receiving Station), BCRS (British Commonwealth Receiving Station), FRS (Foreign Receiving Station) or A (Associate) number for identification purposes. It is usual to have cards printed bearing this number and other information so that you can send listener reports to the stations heard. It is all very well saying that you have heard so many countries, but it is far more satisfying if it can be proved by producing QSL cards verifying that you have done so. Additionally, by obtaining these cards you will be able to work for the special listening awards offered by the RSGB. The HBE (Heard British Empire) certificate awarded for proof of reception of stations in 50 Commonwealth call areas and the DX Listeners' Century Award for proving reception of at least 100 different countries are well known; the latter being a handsome certificate of contemporary design.

While the primary object of short wave listening is to enjoy the hobby, you can, at the same time, be of great assistance to amateurs all over the world by sending them really constructive reports on their transmissions. In sending reports always be sure that they include all the information that the transmitting stations will want to have. It is quite useless sending a listener report to a Brazilian station who is putting a very strong signal into England and working a string of British stations. Rather listen for the weak stations, who call CQ and get no replies—they will be thrilled to learn from your reports that their signals were reaching Europe, and the chance of getting their QSLs is consequently much better.

* Member of Council, 75 Roundmead Avenue, Loughton, Essex.

Reports to Amateur Stations

Fig. 1 shows the layout of a typical listener report card containing all the basic information that a transmitting station would need for the report to be of any use to him. The height of your location above sea level, or the barometric pressure, etc., may be included, though these details will probably be of no interest to the recipient.

There are always a few outstanding signals coming from each country, and of course the operators of these stations are invariably inundated with listener reports. The chance of receiving verification of reports to these stations is therefore slender, but there are several things you can do to increase it. Do not send a report based on a single transmission. Observe the station over a period of days, and at various times. Having taken observations on, say, 10 occasions prepare as useful a report as possible. You will obviously not be able to get all the information on a standard report card, and the system illustrated in Fig. 2 is therefore suggested. During the period covered by this report the station may have changed his equipment, and if he is using a rotary beam the signal strength reports when he is working different countries will give him useful information on the characteristics of his beam. He will also see that you have gone to some trouble in trying to be helpful, and he should certainly send a verification. On the whole though, try to concentrate more on the weaker signals and not only will your reports be more valuable, but the more exotic will be the DX heard.

The addresses of British amateurs can be found in the *RSGB Amateur Radio Call Book*, and those of amateurs throughout the world in the *Radio Amateur Call Book Magazine*. When sending reports it is a good idea to enclose a Commonwealth Reply Coupon (price 5d.) for use in the British Commonwealth, or an International Reply Coupon (price 1/-) for use anywhere in the world. An addressed envelope will save the other fellow time and make him more inclined to send his card. Best of all send him a stamped addressed envelope—the stamps can be obtained from a stamp shop, and the dealer will generally be pleased to advise on the face value of the stamps required for each country. Any amateur will be very hard-hearted if he does not acknowledge a useful report *and* a stamped addressed envelope.

RSGB members can, of course, send and receive their cards through the RSGB QSL Bureau, but these facilities are confined to cards, and exclude graphs, coupons and return envelopes. Report cards should be of standard size and not larger than 5½ in. × 3½ in. They can be forwarded to the Bureau in batches together with a supply of self-addressed stamped envelopes for any incoming cards.

Besides listening and reporting on stations heard the BRS member can render valuable service to amateurs in several other ways.

1. By contacting any fairly local stations who are keen on working DX, and by listening obtain data on the frequencies, times of operation, etc., of stations in any country they may be anxious to contact. You can easily arrange to let them know when you hear anything, and you will find that in co-operating with someone else your own listening will be all the more enjoyable.

2. By reporting any unusual propagation openings to RSGB Headquarters.

3. By immediately sending reports to any stations whose transmissions are defective. Such things as over-modulation, key clicks, rough notes, varying frequencies and poor quality should be reported frankly to the stations concerned. Any amateur worth his salt will appreciate helpful critical reports.

The majority of amateurs are usually building new equipment and trying out different types of aerial. They will be only too pleased to find someone who can give them reports on test transmissions, and probably delighted to find someone who can lend a hand at erecting a pole or mast. It is not all one sided either, for in helping the local amateur you may not only be gaining a friend for life, but opening the door leading to the obtaining of a transmitting licence and a new thrill in Amateur Radio.

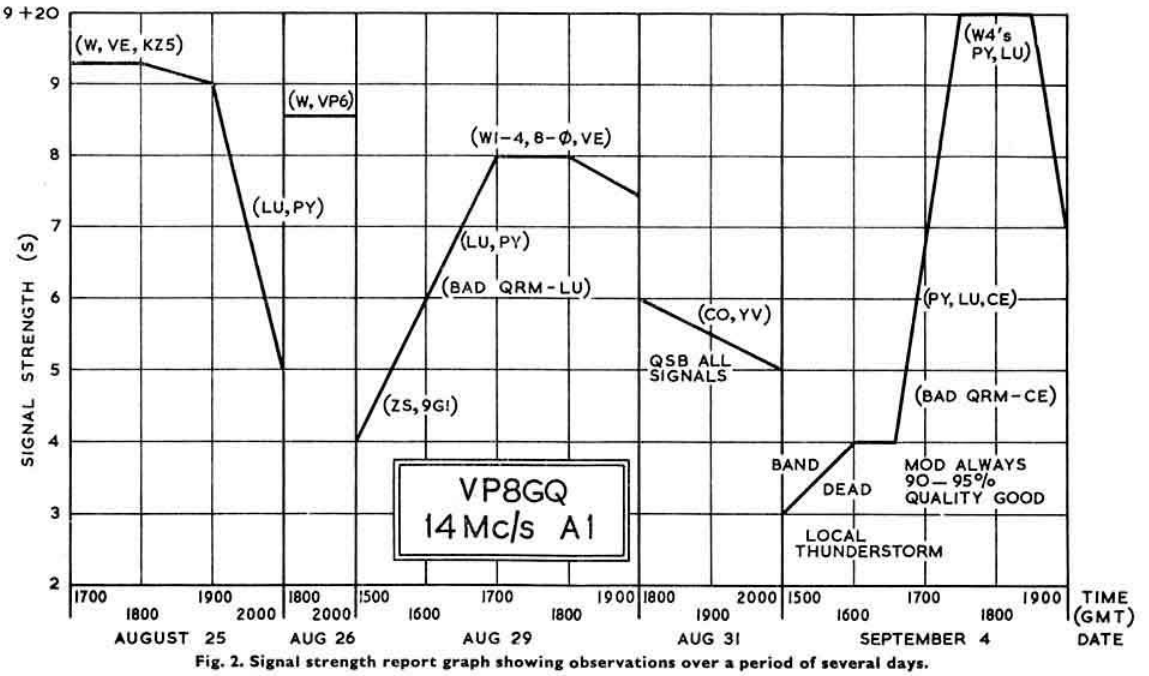

Fig. 2. Signal strength report graph showing observations over a period of several days.

Radio and Geology*

By Dr. D. E. T. BIDGOOD†

THE radio amateur has his main interest in the propagation of radio signals above the surface of the ground; in contrast the geologist is concerned with rocks and structures below ground so that they might appear to have little in common. This belief would be fostered by the usual assumption of the elementary radio text-book that the ground has a perfect reflecting surface for radio signals and what happens below the surface can be neglected. But in practice there is evidence that the propagation of radio signals can be influenced by the nature of the rocks below the surface and a study of these effects would be of interest to both the amateur and the geologist.

Records of radio signals penetrating below ground or water go back at least to the First World War when a French submarine reported the clear reception of signals when submerged in depths of up to 60 ft. In 1926, experiments were carried out in the Mount Royal Tunnel, Montreal [1], some 3½ miles long and overlain by up to 300 ft. of rock. At frequencies of 230 kc/s and 730 kc/s reception was possible throughout the tunnel, but a transmission on 7·5 Mc/s disappeared at a point only 1,500 ft. from the entrance where the thickness of rock above the tunnel was only 48 ft. These experiments were criticized on the grounds that pipes and cables running along the tunnel could have carried the signals.

Subsequently, experiments were carried out in natural limestone caves in Kentucky [2] which were free of pipes, cables and other possible conductors. Signals from broadcast stations up to 200 miles away were clearly received at points 300 ft. below the surface on frequencies between 650 and 820 kc/s. The long and winding nature of the cave system made it virtually certain that these signals had penetrated the solid rock. The rather primitive equipment of the time did not allow measurement of the actual field strength so that the experiments were only qualitative.

More recently in 1954 [3] natural limestone caves in New Mexico and Kentucky were used to make more detailed studies of propagation below the surface. The receiving equipment allowed field strength and the direction of maximum signal to be determined. Preliminary tests showed that a 1 kW broadcast station on 740 kc/s 20 miles away could be received at depths of 700 ft. below the surface. More detailed work was carried out using two small transmitters at the surface:

	Transmitter No. 1	*Transmitter No. 2*
Power	14 watts	0·25 watts
Frequency	1700 kc/s	1614 kc/s
Aerial	Two 125 ft. elements on ground	One 80 ft. element on ground

Measurements by the receiver in the cave showed maximum intensity at points in the cave nearest to the transmitting aerial, indicating a direct path through the rock. The orientation of the receiver loop for maximum signal was towards the transmitter for the more distant stations, but tended to be parallel to the transmitting aerial for the nearer stations.

These and other similar experiments show that radio signals can penetrate rock to depths of several hundreds of feet even when the transmitter is many miles from the receiver; and that the depth of penetration depends on the frequency.

* Based on a lecture given by the author at the South Wales Golden Jubilee Convention on September 14, 1963.

† Lecturer in Geology, University College, Cardiff.

Absorption in Rocks

The rate of absorption of energy from a radio wave passing through a rock depends on the resistivity: the greater the resistivity the less the absorption and hence the greater the penetration. For dry limestone with a resistivity of 1000 ohms/metre the thickness of rock required to reduce the energy by 50 per cent is:

Frequency	*Thickness for 50% absorption*
21 kc/s	250 ft.
43 kc/s	170 ft.
100 kc/s	110 ft.
1000 kc/s	35 ft.

These figures indicate that at 1·6 Mc/s a substantial penetration of the ground may be achieved, and in consequence the above-ground signal will be influenced by the nature of the rocks below the surface. The higher the resistivity of these rocks the greater will be the penetration and the signal strength at the surface will be reduced. From the standpoint of the amateur the best station site for the lower frequencies will be on rocks of low resistivity.

The measured resistivity of rocks varies greatly, but, in general, young, recently deposited material, such as river alluvium, has a low resistivity, while older rocks have higher resistivities. The resistivity of a rock is further reduced by the water content, and in our moist climate this can be of great importance. The depth below the ground of the water surface will vary with the season: in dry conditions this water table moves downwards to a greater depth, while after a prolonged spell of wet weather it will tend to approach the surface. The dry rock above the water level will be of higher resistance and allow the radio signal to penetrate through it with little attenuation; the wet rock below the water table will have a much lower resistivity so that penetration will be greatly reduced. The water surface thus forms an effective reflecting surface for radio signals.

Effect of the Water Table

Since the water table may be some distance below the actual ground surface, this will alter the characteristics of an aerial, such as the quarter wave Marconi, which uses ground reflection. The effect will be equivalent to using an aerial with its base above ground. The characteristics of such an aerial will depend on the effective distance between the base and the reflecting plane, Fig. 1. The shape of the curve may produce unexpected changes in aerial current in certain circumstances. If the water level is near the surface, then the seasonal variation from the dry season deepest

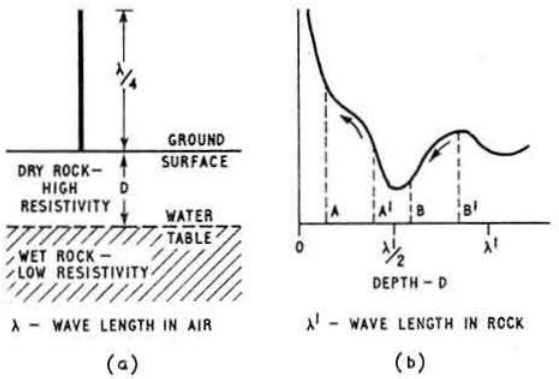

Fig. 1. Aerial current variation with the height of a quarter wave aerial above a reflecting surface.

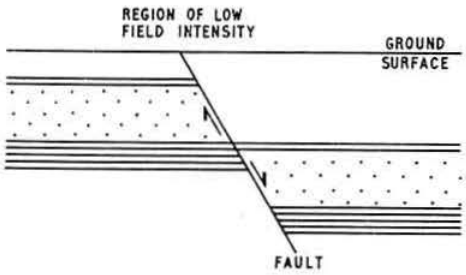

Fig. 2. A geological fault.

position A′ to the wet season shallowest position A will result in an increase in aerial current. However, if the water table lies deeper at B′ in the dry season, rising to B during the wet season, the result will be a decrease in the aerial current. This change in the effective position of the reflecting surface can alter the radiation pattern of the aerial in the absence of an effective counterpoise earth. Thus an aerial with a good low angle radiation pattern in a moist locality, where the reflecting surface is close to ground level, may give undesirable high angle radiation in another, drier locality.

From Fig. 1 it is evident that anomalous aerial current changes are to be expected if the depth to the water surface is of the order of half a wavelength. The wavelength in rock will differ from that in air and will depend on the properties of the rock. In particular, the wavelength decreases as the resistivity falls, so that the wavelength in a rock will be less than in air. For instance, a frequency of 1700 kc/s corresponds to a wavelength of 177m in air, but in dry limestone the corresponding wavelength would be about 55m.

Radio Field below the Surface

So far we have been considering the effects of rocks below the surface on a radio signal above the surface. I should now like to consider if it is possible to use measurements of the radio field at the surface of the ground to investigate the nature of the rocks below. Workers before the 1939-45 war made small-scale tests and reported evidence of a relation between changes in the field intensity apparently associated with geological features [4]. A local reduction in field strength was noted over a fault in the rocks below the surface (Fig. 2). This fall-off in signal is probably the result of the greater absorption of signal from the surface by the high resistivity material associated with the fault, although it could also be the result of the breaking of the conducting layers.

In 1953, workers in the USA published the results of a series of tests carried out to explore these effects [5]. They used a mobile receiver fed from a directional loop aerial mounted inside a wooden-bodied station wagon. The output from the receiver field strength meter circuit was fed to a potentiometer recorder. By coupling the chart drive of the recorder to the speedometer cable the trace was directly related to road distance travelled.

Initial tests with the vehicle stationary showed that in daylight hours ground wave signals from broadcast stations were received at almost constant intensity. Small, short period changes were caused by the modulation, longer-term changes were related to weather conditions in the area between the receiver and the transmitter, but both these effects were small. With the vehicle in motion, certain local disturbances were noted associated with conductors close to the road-side, such as electric light cables, lamp standards, metal bridges, streams and rivers. These effects were therefore discounted in subsequent work.

Signal measurements were then made over areas where it was known that the underlying rock was uniform, but the overlying soil varied in resistivity by a factor of ten. No significant variations in signal intensity were observed when the vehicle passed from one soil type to another. On the other hand, measurements made over areas which were known to be underlain by different rocks showed variations related to the position of the rocks. In one area, an increase in intensity was noted when the receiver was above ancient volcanic rocks, even though these rocks were in places covered by a considerable thickness of sand and clay.

Attempts have been made to apply radio frequency methods to geological work, especially in North America; many of the techniques are secret or patented; and there has been controversy as to their validity. However, there seems to be strong evidence that radio signals, especially on the lower frequencies, can penetrate very considerable thicknesses of rock and that measurements of field strength and other characteristics at the surface can be used to give information about the rocks below the surface.

Siting of Amateur Stations

It follows that radio propagation over land areas is influenced by the rocks below the surface and this is greatest for frequencies below 2 Mc/s. Amateurs working on such frequencies may find it preferable to choose a low-level site on damp ground where the water table is near the surface, rather than risk strong absorption of signals and distortion of aerial radiation patterns which dry and highly resistant rocks near the surface can produce. It may also be expected that propagation conditions should be better on low frequencies in areas of younger rock such as east and south-east England, and that the older higher resistance rocks of central Wales and Northern Scotland will tend to give high absorption and poor propagation.

In this field of radio and geology there is a great need for more data and it would be quite possible for interested groups of amateurs to do original and useful work in making detailed surveys of field strength changes in their local areas using fixed and mobile equipment.

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THE MONTH ON THE AIR

A CHRONICLE OF EVENTS ON THE HF AMATEUR BANDS

By R. F. STEVENS, G2BVN *

WITH the present sunspot cycle likely to reach its minimum during 1964, the 14 Mc/s band is likely to carry most of the DX traffic of the world. QRM will become more intense but careful operating can help things considerably, so how about a few New Year resolutions which will help everybody to work that rare one:

(i) Avoid long CQ calls, and above all don't call CQ in the middle of a pileup.

(ii) Never make more than one QSO per band per mode.

(iii) Follow the instructions of the DX station: " 10 kc/s up " means just that and is not an invitation to call on the frequency of the DX station.

(iv) Don't call " blind "—ensure that you can hear the DX station before calling.

(v) If signal reports only are the order of the day, don't try to ragchew and avoid asking for name, QTH and QSL information in the middle of a pileup.

(vi) Short calls cause less QRM all round and give you a better chance of hearing the rare one.

(vii) Listen, note the tactics employed by the DX station; listen again, is he working into your part of the world? Then before calling, listen again. If selective calling to areas is being used, the fact that G9BF is not in ZS will be known to the rest of the world, and is hardly likely to make you top of the popularity poll. Good luck in 1964!

News from Overseas

The first **Transatlantic DX Test** on **1·8 Mc/s** was an unqualified success with many QSOs between Europe and North America. **W1BB** QSOd G3s GRL, PGN, PQA, RFS, RPM, PYI, RQX, RBP, RRF, RWL, PPZ, PU and TR; G5ZT and G6BQ. **W3GQF** worked four G stations but then had transmitter trouble. W1BB mentions that at this time last year he had contacted nine different DX stations, but the figure this year is 23. This may be partly accounted for by the new aerial system, but better conditions are also responsible. **W1WY** had one of his best nights on Top Band and the heard/worked listing includes:

DL1FF	1829 kc/s	04.30 RST559	Working VP8GQ
G3PU	1827 kc/s	05.47 RST559	First European this season
G3OUV	1829 kc/s	06.03 RST559	
G3GRL	1830 kc/s	06.12 RST569	
DL1FF	1829 kc/s	06.24 RST569	
G3RBP	1824 kc/s	06.50 RST449	
G6BQ	1825 kc/s	07.03 RST559	High noise level in UK
HR3HH	1827 kc/s	07.20 RST559	Heard calling to the West
G5ZT	1829 kc/s	07.27 RST459	Signals now fading.

VP8GQ was heard on 1802 kc/s suffering severe QRM from North American stations. The operating frequency of W1WY is usually 1804 kc/s, and Frank comments that he was working stations that he had never even heard on previous occasions. Your scribe will be pleased to receive reports on the subsequent Transatlantic Tests.

Severe weather conditions in the **Antarctic** area have prevented the relief ships from calling on their arranged schedule; at one time the *John Biscoe* was held fast in pack ice, and the *Shackleton* had to return to the Falkland Is. for renewal of fresh water supplies. HMS *Protector* is now in the Antarctic area but the bad weather has held up the survey work and it is not anticipated that the ship will call at the South Sandwich Is. before the first week in March. **VP8HF/MM** is now active on the 14 Mc/s band but if a landing is made on Candlemass Is. in the South Sandwich group, it is expected that activity will be restricted to 7 Mc/s. This fact probably accounts for the appearance of several of the leading DX stations on this band, and it is interesting to note that one station located about 120 miles from the London area pins the S meter on the writer's receiver.

Angus Murray-Stone, **HZ2AMS,** has succeeded in obtaining a genuine Yemen licence, which when translated gives him permission to use the call **4WIZ.** Angus intends to forward this document to ARRL and the repercussions should be interesting. A licence is also awaited from the Chinese People's Republic, which it is hoped will afford similar facilities for Tibet. Mrs. Doris Murray-Stone is now

Desi Georgeton who assists W4ECI with incoming QSL cards for W4BPD's dxpeditions is inundated every time Gus opens up in a new country.

* Please send all items to RSGB Headquarters to arrive not later than **January 10** for the **February** issue, and **February 7** for the **March** issue.

JTICA in Ulan Bator who is currently active on the DX bands using c.w. and s.s.b.

licensed as MP4s BYO, QYO, TYO and MYO, and also as HZ2YO.

A bulletin from the Hammarlund Manufacturing Co. gives the present position on the various stations on **Christmas Island. VK9MV** (Mathew) uses 40 watts on c.w. on most evenings between 13.00 and 15.00 GMT, usually around 14,062 and 14,103 kc/s. **VK9MD** (Alan) operates around 14,125 kc/s using the Hammarlund station. **VK9XI**, the new radio club station, operates on Mondays between 13.00 and 15.00 on both c.w. and a.m., and often on Saturdays and Sundays between 02.30 and 06.00, which times will not be suitable for the UK. **VK9DR** (Don) is active on 14,060 kc/s c.w. and expects to have higher power by the time that this is being read. The Hammarlund equipment will remain on the Island at least until the New Year and possibly later. Cards for VK9DR and VK9MD are being periodically despatched, and QSLs from VK9MV and VK9XI may be requested through Box 7388.

It is reported that **ZS2MI** on Marion Island will be QRT during March, 1964 as the relief operator is not interested in Amateur Radio. ZS2MI has often been heard recently on 14,022 and 14,062 kc/s around 18.00, and frequently at this time there are few other signals on the band. QSLs should go to ZS1OU, who provides a speedy service on receipt of s.a.e. and IRC.

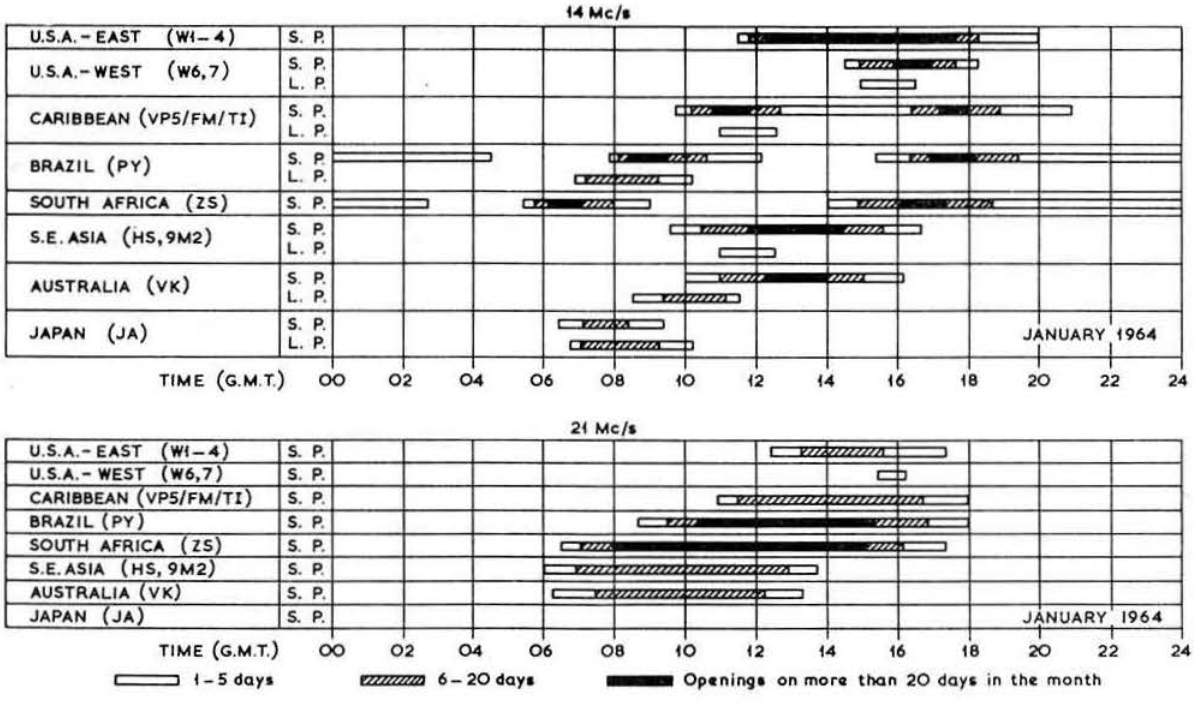
The Reciprocal Licensing Bill introduced by Senator Goldwater was passed and sent to the House of Representatives with only minor alterations. It is unlikely that it could become law in under a further six months.

Dxpeditions

After the Kuria Muria foray **W4BPD** promises activity from **AC3PT** whilst testing the new rig ordered for the King of Sikkim to be installed in the royal palace. There may also be return visits to other countries in this area, depending on the interest shown and the amount of finance available.

IT1ZGU has plans to activate **SMOM** (Sovereign Military Order of Malta) for ten days commencing on January 15. Operation will be mainly on c.w. with occasional sideband activity on 14,125 kc/s. It is not known if this will count

PROPAGATION PREDICTIONS



Conditions during the month of January will remain practically the same as those experienced during the preceding month. Towards the end of January the h.f. bands will remain open slightly later in the evening, otherwise the forecast will be very similar to that for December.

The provisional sunspot number for November 1963 was 21, with the period of greatest activity lying between the 20th and 25th of the month. The Zurich Solar Observatory predicts the following smoothed sunspot numbers for the following months: February, 18; March, 17 and April, 16.

for a new " country," or if the call will have prefix interest only.

HB9TL will probably visit **Liechtenstein** during February 14 to 16 for a spell of operation on c.w. and s.s.b. QSLs should go to WA2QNW (see *QTH Corner*).

VK0VK hopes to call at **Heard Island** on his way back to Australia from Antarctica, but it is not certain if he will be able to activate this rare spot, and, in any case, the period of operation will be between 24 and 48 hours.

The Hammarlund **Dxpedition of the Month,** January, 1964, is a joint venture between Hammarlund and the Award Hunters' Club International, OH2AH, and will take place from January 11 to 19 from the Äaland Islands. The calls used will be OH2YV/0 on 1·8 Mc/s, and OH2AH/0 on bands between 3·5 and 28 Mc/s. The operating frequency on Top Band will be 1832 kc/s, or as an alternative, 1823 kc/s; both c.w. and s.s.b. will be used on this and all other bands. Frequencies include 3505 kc/s (c.w.) and 3790 kc/s (s.s.b.); 7005 and 7090 kc/s; 14,050 and 14,125 kc/s. At least two stations will be in operation simultaneously. QSL cards should be sent to the Hammarlund Dxpedition of the Month QTH, and IRC are not necessary.

The dxpedition calendar at present reads as follows:
January (during the first week) **5U7,** Niger, by 5N2RSB.
January 3 to 7. **ZS8Z** by ZS6BBB.
January 8 to 13. **ZS6BBB/ZS9.**
January 11 to 19. **Äaland Is.** by OH2AH/0 and OH2YV/0.
January 15. **SMOM** by IT1ZGU and IT1TAI.
January. **Easter Island** by WA2WBH.
February (during the first week) **TY2,** Dahomey, by 5N2RSB.

Contests

During the period of the **CQ 160m Contest,** G3IGW and G3JML will operate **GM3IGW/A** in Wigtownshire for 36 hours continuously. The QTH has been specially picked, and the superb location, combined with several efficient aerials, should enable a potent signal to be radiated.

High *claimed* scores in the **Low Power Field Day 1963** are: G3LKH/P, 140; G3PIF/P, 117; G3CGD/P, 114, and G3BZM/P, 113.

High *claimed* scores in the **Second 1·8 Mc/s Contest 1963** are: GW3FSP, 572; G3LKH, 725; G6BQ, 723; G3JEQ, 686; G3GRL, 681; G3BMY, 672; GM3NYY, 664; GW3JI, 657; G3FM, 629; G3RSR, 587; GI3GAL, 570; G3OSW, 565; G3NHE, 558; G3RRU, 552, and GM3FXM, 507.

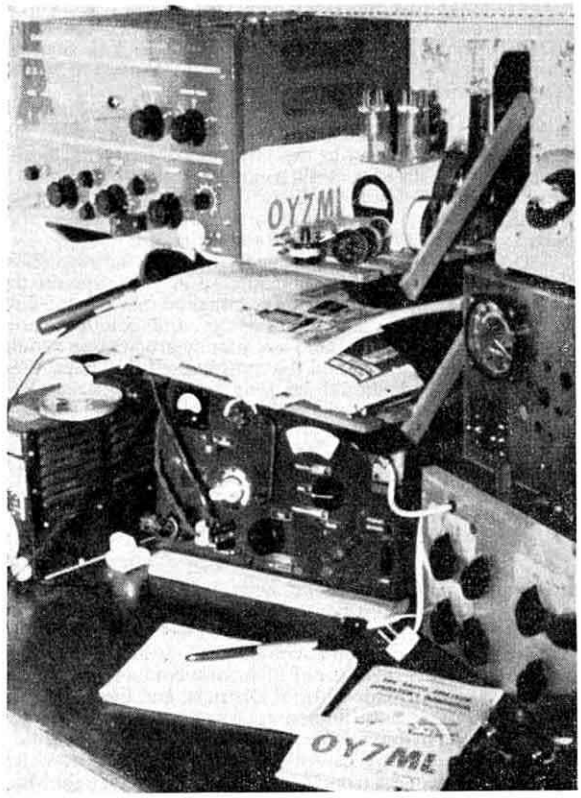
It is emphasized that the above listings are based on claimed scores only and do not represent the final placings.

G3JAG took part in the *CQ* WW DX Contest (c.w.) and on the whole found conditions only fair, although he worked all continents during one hour on the first morning, JA, W, VK, YV and M1. JT1CA was a welcome addition to the WAZ list, but VS9OC caused some impatience with a very slow QSO rate. It has been noted at other times that when VS9OC is often S7/8 in the UK incoming reports are usually S4/5.

The **1964 French Contest** (REF) is scheduled for:
C.w. January 25, 14,00 to January 26, 21.00.
Phone February 29, 14.00 to March 1, 21.00.
The number to be exchanged is the signal report and the number of the QSO. Each contact scores three points and there is a multiplier of 1 for each French department or DUF country, other than F or FC, on each band. Entries should be sent to the REF, B.P. 42-01, Paris, R.P., France. The French contest is an opportunity to work French departments for the DDFM Award, also DPF provinces and DUF countries.

A summary of the rules for the **1964 ARRL DX Contest** appears on page 49.

The results of the **OK DX Contest** 1962 show that G3HZL was top all band station with 3861 points, followed by



OY7ML of Torshavn, Faeroes Islands, hopes to obtain permission to operate on 160m during this year's Transatlantic Tests organized by W1BB. Equipment includes a Central Electronics 10B s.s.b. exciter driving a 6146 p.a.

(Photo via W1BB)

QTH Corner

CP1DJ	via K9PNV
EL2AD	via K5SGJ
ET3GC& ET3USA	APO 843, New York, NY, USA.
HS1L	via W7YG, c/o E.E.Lab., Montana State College, Bozeman, Montana, USA.
HB9TL/FL	via WA2QNW, 548 W.51st. St., New York, N.Y. 10019, USA.
M1M	A. Brogdon, H. R. B. Singer Company, State College, Penna., USA.
SL8HY/MM	via SM7CIR
VS1LV	via K8VDV (W/K only)
VQ4JG	P. A. C. Wilson, P.O. Box 15, Londiani, Kenya.
XZ2VK	Union of Burma Applied Research Institute, Kanke Road, Yankin P.O., Rangoon, Burma.
YK1AA	via K4RJN, 443 Grandview St., Memphis, Tenn. 38111, USA.
5B4CZ	via W2CTN
5H3JP	C. A. Allison, P.O. Box 207, Mbeya, Tanganyika.
5H3JL	H. V. Faust, Barabaig Lutheran Mission, P.O. Sigina, Tanganyika.
5H3JJ	D. P. Peham, Mission Hospital, P.O. Ofakara, Tanganyika.
5R8AK	B. Burdet, Sevima, B.P. 180, Tananarive, Malagasy Rep.
6YAAH	(also VP5AH), via K4UFE, S. Williams, 151 Wallace Road, Memphis 17, Tenn., USA.
9Q5AB	W2HMJ/4, 3326 Sergeant Drive, Charlotte, 8, North Carolina, USA.

* * *

RSGB QSL Bureau: G2MI Bromley, Kent

G3FTQ (1332 pts) and G3III (450 pts). Band leaders were G3EYN on 7 Mc/s with 1932 points, G3NSY (14 Mc/s, 867 pts), and G3JUL (3·5 Mc/s, 582 pts). Top Scottish station was GM3JDR with an all band score of 3350 points. (Tks G3JUL).

Although conditions were poor during the weekend of the **Sixth Boy Scout Jamboree-On-The-Air** more than 110 stations were operating in the UK, and these contacted 46 overseas scout stations in 19 countries, amongst them DU, EP, VK, VP9, W, ZL and XE. JOTA is not a contest and the organizers report that appreciation of this considerably enhanced the pleasure derived from the event.

The **CQ WW 160m Contest** will take place between 02.00 Saturday, January 25 and 14.00 Sunday 26. The rules are the same as last year and it will be remembered that this is a c.w. only contest. With additional states and countries now permitted operation on 160m last year's participation should be exceeded. Logs should be postmarked no later than February 17 and should be sent to **CQ Magazine,** 160 Contest, 300 West, 43rd. Street, New York, NY, 10036, USA.

W1WY, Contest Editor of *CQ Magazine*, points out that whilst the forms issued by CQ are desirable, they are not a must. Any entry form showing the required information is acceptable.

Awards

Due to increased mobile activity the Grafton Radio Society has imposed a limit upon the acceptable number of /M contacts in the total lists submitted in claiming the **Worked All London Town Award.** This award is issued to those who can furnish proof of having contacted amateurs in 65 of the 118 London Postal Districts, and the number of mobile QSOs is now limited to seven. To date only six certificates have been issued. Copies of the rules, with a map and a detailed list of London postal districts, are available on request from A. E. Bristow, 37 Tyndale Mansions, Upper St., London, N.1. Please enclose a s.a.e. or IRC.

Chapter 15 of the **Certificate Hunters' Club** offer the *CHC Chapter 15 Award* for DX stations who can contact five of the Chapter members: W7s CNL, CSW, DZB, NNF, NRB, OEB, UVR, YFO; K7s BJE, BVZ, NAG, RAM, UXN; K6s BX, UTO. A further seal is available for working another eight members. There is no charge for this award and a GCR list should be sent to W7NNF, 18150 N.E. 60th Place, Seattle 55, Washington, USA.

W4GD (left) with Bob White, W1WPO, member of the ARRL communications Dept., who personally scrutinises all DXCC applications.

(Photo via G2MI)

East Worcestershire Group operated GB3RSG from the headquarters of the First Astwood Bank Scout Troop during the Jamboree-on-the-Air on October 19-20, 1963.

Around the Bands†

Only one report has been received for the **1·8 Mc/s** band, and this was from our regular contributor **B.R.S.20317** (Bromley) who reports average conditions. The *CQ* Contest brought quite a few Europeans on to the band and OH3NY was well received at S7. The USA could be heard, but all were rather weak and confined to W1 and W2 stations. The 160m test on December 1, 1963, found fair conditions from 05.00 to 06.30 GMT. Six Ws and two VE2s were heard averaging S5 including W1BB/1 at S7, VE2UQ at S6 and VP8GQ at S4/6 (05.05-05.40 GMT) giving 559 to G stations making contact.

Conditions on **3·5 Mc/s** were good during the month, with plenty of DX about. **A.3543** (Pitea, Sweden) reports hearing s.s.b. from ZB1CR (20.16), OX3JV (22.38), I1DFD (23.38), M1M (22.12 and operator DJ0HZ), F9RY/FC (22.20), 4X4IX (22.29). **A.1798** (Winchester) found ZL1ATQ (07.08), VE3BOG (07.10) and 5A3CJ (10.11) and a lot of USA stations at strengths up to S6 around 07.00 GMT. **A.2114** (Richmond) also listened on s.s.b. and logged YV1KE (07.30), PY1VKL (07.40), 5A3CJ (20.15) and F9RY/RC (20.25). **B.R.S.20317** (Bromley) comments that conditions improved as expected, and produced UA9KQA (16.45) at S7, UA9VB (23.50) at S6 in Zone 18, UA9PP, UW9WB, UL7CH (18.30), UD6AM (18.30), UF6CM (00.10), OH0NI (16.40). Best DX heard from USA was K6BPR and W6VSS (06.50) received at 349. Other DX included YV5AJ (06.32), KP4AOO (07.22), ZL1IE very weak at 08.00, and 4X4 in QSO with UA0KFG, KR6ML and JA1BRK all during 16.50 to 17.40 GMT.

The **7 Mc/s** band is now coming into its own, and excellent DX is reported by many correspondents. The key to performance on this band is the aerial, and a vertical is undoubtedly the best because of its low angle radiation. **G3AAE** (Loughton) worked c.w. with 6W8DD (20.30), MP4TAS (20.20), VS9OC (23.00), 9Q5AB (22.30), VP8GQ (23.15), FB8ZZ (19.05), VQ4IV (20.15), VS9HAA (20.30), MP4BEE (20.45), KR6BQ (19.30), M1M (19.45), VK5NO (20.15), VU2PF (19.30), VK2AVA (20.00), VK2EO (19.50).

G3JAG (Rochdale) was disappointed with conditions but managed a QSO with JT1CA to give him his 37th zone on 7 Mc/s—only 19, 24 and 26 remain to be worked. Other stations contacted were VQ4IN/VS9H (00.05), EL2AD

† Compiled by J. G. Cottrell, G3PSY.

(01.15), ZS1A (03.05), VE8RG (05.50), YV5AJ, HK3AH, HI3PC, XE1OK, M1M, VE8JJ, JA1BRK, YN1CJ: all between 07.00 and 09.00 GMT. Also UA0KFG on Sakhalin Island, which lies north of Japan, SV0WAA (17.40), VP8GQ (23.20), 6YAXG (23.45), JT1CA (23.55) and KL7PI (23.45). **G3LPS** (Blackburn) had a good haul of DX including ZL4JP (07.42), 9Q5AB (22.00), ZD8HB (23.15), VP3YG (00.03), PY8DI (23.30), MP4QBF (03.17), ZD7BW (00.23), PX1CR (23.50), K6AHV (23.13), VK5KO (19.53), OX3DL (20.40), also JA6YG was heard at 15.00 and 9Q5TJ at 20.45 GMT. **A.3543** (Pitea, Sweden) logged 4X4DH (18.52), SV1YY (17.05), HZ1AB (18.29), UJ8KAA (21.50), TF3AB (20.33), VS9OC (23.05), JA6AK (21.50), and JA6COM/MM (20.29). **A.2114** (Richmond) heard s.s.b. from VY0AA at 07.30 and W4MZN/KL7 at 08.30 GMT.

G3PVS (Woking) worked the following stations during the *CQ* WW DX Contest: M1M (01.05), VY5ANT (01.17), CN8FW (heard constantly), PY7JVZ (03.58), HZ1AB (19.00 onwards), OD5LX (21.34) and VQ4IV (22.45). G3PVS uses a maximum input of 50 watts to a 14 Mc/s dipole which is located a foot or so beneath a 7 Mc/s dipole, varying in height between 15 ft. and 10 ft. This aerial has brought 1600 QSOs in 18 months in conditions that can only be described as deteriorating, and shows that DX can be worked with what might be assumed to be a poor aerial, and that one does not necessarily need a multi-element array.

Finally **B.R.S.20317** (Bromley) comments that QRM increased throughout the period, but nevertheless he found something of interest from every continent, as the following summary shows.

Europe: TF3AB (14.20), OH0NI (23.40) and M1M were all unusual stations to find on this band.

Asia: Improving conditions, with the path open from 12.30 through to 01.00, made possible UL7/UH8 at 13.40, UM/UJ by 15.00. Japan and the Far East have been coming in during afternoons: JA6ACZ (12.42), JA8BB (13.58), JA6AK and JA6YG (14.10), JA1LWI (15.30), UW0FW (13.34), VS1LP (14.00) and China, BY9SX (00.33) at S4-7 in QSO with BY8SC/BY1PK.

Oceania: DU6TY (15.51), DU7SV (15.47) and KC6BO (13.37) were all present. Australia was well represented at various times between 08.30 and 18.20, with VK3VX best at S7 (15.36) and VK5NO at S6 (15.20).

Africa: EL2AD was heard at 23.50, and a few ZS1/2/6s at 18.50 to 19.10. VK0VK was a surprise at 17.49 GMT.

North America: The usual range was present, the best heard being VE8RG (09.50) and K6KPS (09.30).

Central America: Early signals were heard from VP9BO at 19.17, 6YAXG (00.00) at S6, HI3PC (09.20), and rare HP1MN (01.15) at S7.

South America: Brazil was very good at midnight, as was HK7BE. PY8DI, a rare call, was S7 at 00.37, with VP8GQ the best at 00.23 (S7).

The **14 Mc/s** band now closes by 17.00/18.00 GMT, so that for most operators, activity has to be confined to the weekend. Nevertheless, plenty of reports have been submitted, and the general opinion is that DX contacts are difficult, but possible. Matters are complicated by considerable short skip European QRM. **G3LPS** (Blackburn) worked VP8GQ (18.26), VR2EK (heard only at 07.20), VK7SM (12.58), FB8XX (15.40) and VQ4IN/VS9H (16.16). **GM3ITN** (Clydebank) worked c.w. long path DX with HL9KH (09.00) and HM1AS (08.00), both in Seoul, Korea; UA0FF (08.15), UA0MX (08.30), and many VK, ZL and JAs. Other DX worked was FR7ZF (Reunion Is.), FS7MB (Fr. St. Martin), ZS2MI (Marion Is.), MP4DAH (Das Is.), TC3ZA (Turkey), VQ8BT, 7G1IX and 9L1TL. **A.3543** (Pitea, Sweden) reports KR6DD (10.38), UA0YE (10.10), in Zone 23 and UA9HN (07.40) on c.w. whilst s.s.b. from KZ5AX (11.32) was also logged. **G3YF** (Chingford) comments that conditions have been fair to poor but he managed to exchange c.w. with VQ8AI (18.15), FR7ZD (15.05), VS1LV (15.50), TN8BE (19.00), MP4TAS (10.30), KR6GF (10.40), FB8YY (10.55), VR2DK (09.50), AP5HQ (11.30), VP2AV (11.00), 6W8AC (10.00) and 9K2AN (09.55). Also s.s.b. from YU0AA (11.00), CR6BX (18.35), VP9BO (18.30), VQ1GDW (16.10), VK9DR (16.15), VK0VK (16.20), VS9MB (15.40), VP9BY (16.30), TT8AG (10.10) and VK4JQ (10.40). **G3AAE** (Loughton) contacted 9L1NH (16.30), JT1KAB (09.00), KG6AAY (09.20), 9L1TL (19.00), FR7ZD (17.40), VK9MD (15.00) and MP4QBG (13.45), all on c.w. **A.3699** (Renfrewshire) heard XW8AL (15.45), VU2RM (15.49), VK2JZ (16.45), WA6ROP/KC6 (16.47), ZS1KO (18.05), and 3A2CP (18.07). **A.2114** (Richmond) reports s.s.b. from many of the stations listed above and also 5U7AC (07.53), OA4CV (08.22), IT1TAI (08.30), PJ3LK (11.09), HZ2MS (11.40), HR1MD (13.25), 6O1WF (15.30), YA1AA (15.35), 9M2CR (15.47), CR7CI (16.10), and ET3USA (17.50). **A.3233** (Edinburgh) logged c.w. from 4U1ITU (15.40), VK5MS (13.00), ZL3NS (13.10), EA8EG (15.04), HK1MT (18.11), and HK1ZU (18.05), on s.s.b.

Dan Gray, **A.2498,** who is operating temporarily from the BBC Engineering training department with a long wire to an AR88, logged s.s.b. from CR7GF (18.30), HK3LZ (19.55), KG1FY (19.10), KG4AN (19.35), PJ2AA (20.20), PZ1BJ (18.00), VE3FKU/SU (17.30), ZP5CF (20.30) and many others. An unusual one was W4FQT/Aero Mobile, Flying at 30,000 ft. over Tennessee and working into W4 around 19.00 GMT.

G3PRI, now operating as **DL2PB** with the 10th Royal Hussars, reports from Germany that he is now active again and has been listening on 14 Mc/s a.m. He has logged VK3, VK4, ZL1, VS1, VS6, KH6, KL7, AP2, MP4, VQ2 etc., but cannot QSO during daylight hours owing to BCI.

OZ5S (Copenhagen) used this band to contact on c.w. VS1FZ (13.45), VE2UW (17.38), UA0BL (07.40), UH8DA (13.00), and MP4QBG (12.42), whilst s.s.b. yielded HZ1AB (14.55), K4SMJ/VO2 (16.12), 4X4LC (15.45), W2ZXM/MM, near Singapore (15.45), and 9M2EF (14.35).

G8JM Chingford used s.s.b. to work 6W8AE and 6W8CU (08.45), 9L1HX (17.35), ZD7BW (08.05), KR6OF (08.00) and Willis Island's VK4JQ (09.35), whilst c.w. accounted for 4S7WI (10.33), ZS8JJ (19.40) and ZS2MI (19.20).

The **21 Mc/s** band is still providing more east-west contacts, although close down occurs by early evening. The north-south path is still good during daylight hours, and there has been much activity. **G3RMF** (Worcester), operating from the College for the Blind, made a.m. QSOs with EA8CK (14.40), FB8XX (12.27), KP4AOO (12.55), TG9US (14.15), UD6DU (09.43), VE3BFW (14.25), VE2AFC (12.45), VQ4AA (08.50) on s.s.b. YV1DW (15.08), W6IWJ (15.30), and 59 each way, ZB1BX (14.25), 4X4MJ (08.39), 5N2JKO (09.50), 5N2HJA (13.40), 5N2RSB (14.28), 5H3IW (11.10), 6O1KH (12.30). S.s.b. was used with 6YALT (12.50) and 9Q5HF (15.14). G3RMF also worked many east coast American and Canadian stations between 12.00 and 18.00 GMT. **G3LPS** (Blackburn) exchanged a.m. with 9G1DM (14.04), 5N2RSB (14.10), 9Q5HF (14.30) and various Canadian stations. Listener **A.1798** (Winchester) logged many stations during the *CQ* contest including 5N2CKH (07.35), PY8OL (09.35), CR7FN (10.34), VK3MO (10.52), VK2AHM (11.20), VK3QV (11.31), VK3AC (11.32), VP7NX (12.24), ZE7JR (12.55), HS1S (10.05), all on a.m., whilst s.s.b. came from MP4QBF (11.52), VQ2BK (12.05), PZ1AX (15.00), VP9BY (14.40), VQ4AA (09.42), amongst others. **G2AAE** registered c.w. with VS6FC (09.45), JT1CA (08.15), FB8XX (09.45), VS9HAA (07.25), VS9HRK (08.20), FR7ZD (12.45) and KG6AAY (09.00). **A.2498** (Easington) reports a.m. from CO8RA (15.50), CR4AG (09.45), EL5D (11.45), HI8TC (18.45), KZ5JK (17.40), VP7NX (13.20), VP8DW (17.45), VP9BY (12.45), ZD3A (12.15 to 16.15) and

1963

DX PEDITION

By . . .

HALLANIYA ISLAND

KURIA MARIA ISLANDS

V S 9 H

ROYAL AIR FORCE AMATEUR RADIO SOCIETY

and

WORLD RADIO PROPAGATION STUDY ASSOCIATION

This beach was the site of RAF Amateur Radio Society DXpedition station VS9H on Hallaniya Island in the Kuria Maria Group. The expedition's QSL was attractively printed in black and gold. Distribution will begin shortly.

many others listed above. Lastly, but by no means least, **A.2114** (Richmond) heard s.s.b. from HC2JT (14.26), KV4AQ (14.05), SV1AB (11.25), HI8NSF (15.05), XE1MO (15.43), TI2VT (14.30) and confirms many stations reported by other correspondents.

OZ5S used c.w. to work CN8FW (10.55), UA9KDP (10.45), VQ8AM (13.15), YV5BMY (13.40), 5B4TJ (12.53) and W2CTN (15.06); wonder if the last mentioned station will QSL!

G3PVS (Woking) contacted CX2CO (14.45), ET3USA (13.46), ZS1XR (14.09), VQ2W (15.24), 4X4MP (15.33), PY7GV (15.44) and VE2NV (16.21).

Activity is still very limited on **28 Mc/s** although **A.2498** (Easington) heard 5N2JKO (10.15), UF6BB (09.30), three UA6s and several UB5s all early in the day.

DX Briefs

W2CTN now acts as QSL manager for 140 stations located in 80 DXCC countries.

Readers will no doubt have noticed the recent inclusion in US postal addresses of a five figure number following the state, e.g. *CQ Magazine*, 300 West, 43rd St., New York, NY 10036. This is known as the **ZIP** code and is designed to speed the US postal service.

A recent survey of **amateur licensing conditions** revealed that there are 17 countries where the maximum licensed input is 1 kW, ten countries where there is a 150 watt maximum and a further ten where 100 watts is the rule.

When sending QSL cards by registered post to ARRL, **G3AAE** received a *slip* showing the address as the American *Ladies'* Relay League, and suggested that this item should be included in *DX Briefs*.

FK8AU may often be heard on 14 Mc/s s.s.b. using a Viking II transmitter with a B & W sideband adapter, a SX111 receiver and a TA33 beam. Raoul often operates around 14,130 kc/s betweeh 12.30 and 14.30.

ZD6PBD, ex-G3PBD, is now installed at Zomba, and was contacted by G2HFD within 48 hours of his arrival.

TT8AN is now back in the USA, where his home call is **W0LYQ**, and will attend to QSL duties as soon as possible (G2HFD).

BERU CONTEST

FEBRUARY 15-16, 1964

For rules, see page 261, October, 1963

A full report on the **Kuria Muria** dxpedition by VS9AAA will appear next month, but a preliminary count shows that a total of 5256 QSOs were made with 131 different countries, 3931 QSOs on c.w. and 1325 on s.s.b. Of these 3593 were on the 14 Mc/s band.

Preliminary news on the trip by **VQ8BFA** comes from G8KS, who will be handling the QSL duties for the various countries that Harvey hopes to visit. VQ8BFA will leave for Chagos on February 14 afterwards proceeding to Rodriguez, Agalega, or St. Brandon. Operation will be confined to 21 and 14 Mc/s, with possibly 28 Mc/s if conditions allow. More news on this trip next month.

* * *

Correspondents are thanked for their co-operation and acknowledgements are made to the West Gulf DX Club *Bulletin* (W5IGJ), the LIDXA *Bulletin* (W2MES), *DX'press* (PA0FX), the *Florida DX Report* (K4IIF), the *DX'er* (WA6TGY) and *DX* (W4KVX). Please send all items to RSGB Headquarters to arrive not later than **January 10** for the **February** issue and **February 1** for the **March** issue.

Claims for RSGB Certificates

Members are reminded that claims for RSGB Certificates should be sent direct to Headquarters. Claims are acknowledged on arrival and passed to the Honorary Certificates Manager for attention.

Northern Heights Amateur Radio Society operated G3MVH during the Jamboree-on-the-Air in October. From left to right, H. H. Crewe, G8CB, Michael Smith and P. Ealham.
(Photo by courtesy of Yorkshire Post.)

Propagation Predictions for 1964–65

By Dr. G. LANGE-HESSE, DJ2BC*

IN 1964–65, sunspot activity will reach the minimum during its 11 years' cycle. The smoothed monthly mean sunspot number therefore will vary during this time between about twenty and almost zero. Vast eruptions on the sun's surface, responsible for sudden ionospheric disturbances (SID) and short wave fadeouts (SWF) will occur relatively seldom. The vertical incidence critical frequency of the *F*-layer, responsible for the m.u.f. (maximum usable frequency) in DX communication, will vary in middle latitudes at noon between about 4·5 Mc/s in midsummer and 6·0 Mc/s during autumn months. This means that 28 Mc/s will be open for long distance contacts with Africa and South America only on exceptional days during daylight hours.

On 21 Mc/s reliable DX openings will occur only to South America and Africa, and to the other continents only on days with *F*2-layer critical frequencies higher than average. The optimum DX conditions are expected on this band in October and November. During midsummer 21 Mc/s will start with DX conditions in the early morning hours and will close about one to two hours before midnight. During midwinter the DX opening period will last from about 08.00 to 18.00 GMT. Contacts by sporadic *E* reflections (short skip) may be expected on 21 and 28 Mc/s (on isolated occasions also on 70 Mc/s but seldom on 144 Mc/s) in middle latitudes from May to the beginning of September over distances up to 1000 miles (about 1800 km). During the other months of the year this phenomenon will occur very seldom.

During periods of ionospheric and magnetic storms DX conditions, except for contacts to Africa and South America, will be very poor on 21 Mc/s and also on 14, 7 and 3·5 Mc/s, especially for contacts from Europe to North America. On the other hand these storms will produce auroral displays, acting as back-scattering centres for v.h.f. and h.f., in lower latitudes than normal. Radio amateurs in geomagnetic latitudes of the UK, Southern Scandinavia and the northern part of Central Europe will then be able to make use of auroral reflections by pointing their beam aerials in a northerly direction towards the Northern Lights. In this way communication will sometimes be established on 144, 70, 28 and 21 Mc/s between stations located some 600 miles (about 1100 km) or more apart.

During sunspot minimum conditions most of the ionospheric and magnetic storms are not caused by vast eruptions on the sun's surface, as is the case during maximum conditions, but by the so-called *M*-regions. These regions emitting solar particle radiation often have a relatively long life of up to several months. As the sun rotates in approximately 27 days, the ionospheric and magnetic storms and the accompanying effects on DX and auroral backscatter propagation show a pronounced 27 days recurrence tendency during sunspot minimum conditions. In addition to this the occurrence of ionospheric and geomagnetic storms shows a slight increase during the equinoctial month.

The 14 Mc/s band will remain the most consistent DX band during 1964–65. In midsummer this band will be open for DX nearly 24 hours a day. At midwinter the DX opening period will last from about 06.00 to 20.00 GMT. There is a possibility of contacts over the long path on 14 Mc/s in midsummer with South America and East Asia in the early evenings and with the West Coast of North America and Australia in the early mornings. In midwinter contacts with South America, East Asia and Australia will be possible in the mornings, and to the West Coast of North America in the afternoons. From May to the beginning of September DX on 14 Mc/s will often suffer from interference in middle latitudes, especially during afternoons and evenings, from stations about 300 to 1000 miles (500–1800 km) away getting through by short skips via sporadic *E*.

The 7 Mc/s band will come into increasing use for DX during the minimum stages of the sunspot cycle if it is free from sundry commercial QRM. The best possibilities for DX on this band and also on 3·5 Mc/s will be when most of the transmission path lies in darkness. This applies particularly to 3·5 Mc/s. The seasonal variation in atmospheric noise will favour DX working on 7 Mc/s and especially 3·5 Mc/s in the winter. During the summer months DX openings will occur, but the interference by atmospheric noise will often be high.

* Max-Planck-Institut für Aeronomie, 3411 Lindau über Northeim/Hann, West Germany.

Enquiries Regarding Bulletin Articles

Members who write to the authors of BULLETIN articles are asked to enclose stamped addressed envelopes if they require replies.

Bands Available

The following is a summary of the bands in which amateur operation is permitted. The table also shows the maximum power input and types of emission allowed to holders of Amateur (Sound) Licences. Holders of Amateur (Sound Mobile) Licences are permitted to operate under the same conditions.

Note No.	Frequency Bands (in Mc/s)	Classes of Emission	Maximum D.C. Input Power
1	1·8 — 2	A1, A2, A3, A3A, F1, F2 and F3	10 watts
2	3·5 — 3·8		150 watts
–	7·0 — 7·10		
–	14·0 — 14·35		
–	21·0 — 21·45		
–	28·0 — 29·7		
1 and 3	70·2 — 70·4		50 watts
1 and 4	144 — 145		150 watts
–	145 — 146		
1	420 — 450		
1	1215 — 1325		
1	2300 — 2450		
1	3400 — 3475		
1	5650 — 5850		
1	10000 — 10500		
–	21000 — 22000		
1	2350 — 2400	P1D, P2D, P2E, P3D and P3E	25 watts mean power and 2·5 kilowatts peak power.
1	5700 — 5800		
1	10050 — 10450		
–	21150 — 21850		

Notes

1. This band is allocated to stations in the Amateur Service on a secondary basis on condition that they shall not cause interference to other services.
2. This band is shared by other services.
3. This band is available to amateurs until further notice provided that frequencies between 70·2—70·3 Mc/s inclusive may not be used on the north-west side of the line Firth of Lorne to the Moray Firth.
4. The following spot aeronautical frequencies must be avoided: 144·0, 144·09, 144·18, 144·27, 144·36, 144·45, 144·54, 144·63, 144·72, 144·81 and 144·9 Mc/s.
5. The symbols used to designate the classes of emission have the meanings assigned to them in the Telecommunication Convention. (See pages 72-73 of the *Radio Data Reference Book*.)
6. The d.c. input power is the total direct current power input to the anode circuit of the valve(s) energizing the aerial.
7. Care should be taken not to operate too close to the edges of the bands, taking into account the stability and tolerance of the transmitter and frequency measuring equipment and the sidebands produced by modulation.

COUNTRIES LIST

AC3	Sikkim
AC4	Tibet
AC5	Bhutan
AP	East Pakistan
AP	West Pakistan
BV, (C3)	Formosa
BY, (C)	China
C9 (38)	Manchuria
CE	Chile
CE9, KC4, LU-Z, OR4, VKØ, VP8, ZL5, etc.	Antarctica
CE9 (see VP8)	
CEØA	Easter Island
CEØZ	Juan Fernandez arch.
CM, CO	Cuba
CN2 (1)	Tangier
CN2, 8, 9	Morocco
CP	Bolivia
CR4	Cape Verde Islands
CR5	Portuguese Guinea
CR5	Principe, Sao Thome
CR6	Angola
CR7	Mozambique
CR8 (2)	Damao, Diu
CR (3)	Goa
CR8, CR1Ø	Portuguese Timor
CR9	Macao
CT1	Portugal
CT2	Azores
CT3	Madeira Islands
CX	Uruguay
DJ, DL, DM	Germany
DU	Philippine Islands
EA	Spain
EA6	Balearic Islands
EA8	Canary Islands
EA9	Ifni
EA9	Rio de Oro
EA9	Spanish Morocco
EAØ	Spanish Guinea
EI	Republic of Ireland
EL	Liberia
EP	Iran
ET2 (4)	Eritrea
ET3	Ethiopia
F	France
FB8	Amsterdam & St. Paul Is.
FB8 (see FH8)	
FB8	Kerguelen Islands
FB8 (see 5R8)	
FB8	Tromelin Island
FC	Corsica
FD (see 5V)	
FE8 (see TJ)	
FF4 (see TU)	
FF7 (see 5T)	
FF8 (see TY)	
FF8 (see TZ)	
FF8 (see 5U7)	
FF8 (see XT)	
FF8 (see 6W8)	
FF8 (5)	French West Africa
FG7	Guadeloupe
FH8, FB8	Comoro Islands
FI8 (6)	French Indo-China
FK8	New Caledonia
FL8	French Somaliland
FM7	Martinique
FN (7)	French India
FO8	French Oceania
FO8	Clipperton Is.
FP8	St. Pierre & Miquelon Is.
FQ8 (see TL)	
FQ8 (see TT)	
FQ8 (see TN)	
FQ8 (see TR)	
FQ8 (8)	French Equatorial Africa
FR7 (9)	Glorioso Islands
FR7 (10)	Juan de Nova
FR7	Reunion
FS7	Saint Martin
FU8, YJ1	New Hebrides
FW8	Wallis & Futuna Islands
FY7	French Guiana & Inini
G	England
GC	Guernsey & Dependencies
GC	Jersey
GD	Isle of Man
GI	Northern Ireland
GM	Scotland
GW	Wales
HA	Hungary
HB	Switzerland
HC	Ecuador
HC8	Galapagos Islands
HE	Liechtenstein
HH	Haiti
HI	Dominican Republic
HK	Colombia
HKØ	Bajo Nuevo
HKØ	Malpelo Is.
HKØ	San Andres & Providencia
HL, HM	Korea
HP	Panama
HR	Honduras
HS	Thailand
HV	Vatican
HZ	Saudi Arabia
I1, IT1	Italy
I1 (11)	Trieste
I5 (12)	Italian Somaliland
IS1	Sardinia
JA, KA	Japan
JT1	Mongolia
JY	Jordan
JZØ (13)	Netherlands New Guinea
K, W	United States of America
KA (see JA)	
KB6	Baker, Howland & American Phoenix Islands
KC4 (see CE9)	
KC4	Navassa Island
KC6	Eastern Caroline Isls.
KC6	Western Caroline Isls.
KG1 (see OX)	
KG4	Guantanamo Bay
KG6	Guam
KG6	Marcus Island
KG6	Mariana Islands
KG6I	Bonin & Volcano Islands
KH6	Hawaiian Islands
KH6	Kure Island
KJ6	Johnston Island
KL7	Alaska
KM6	Midway Islands
KP4	Puerto Rico
KP6	Palmyra Group, Jarvis Is.
KR6	Ryukyu Islands
KS4B	Serrana Bank & Roncador Cay
KS4	Swan Islands
KS6	American Samoa
KV4	Virgin Islands
KW6	Wake Island
KX6	Marshall Islands
KZ5	Canal Zone
LA	Bouvet Island
LA/P	Jan Mayen
LA	Norway
LA	Svalbard
LH	Bouvet Island
LU	Argentina
LU-Z (see CE9)	
LX	Luxembourg
LZ	Bulgaria
M1, 9A1	San Marino
MP4B	Bahrein
MP4Q	Qatar
MP4M, VS9	Sultanate of Muscat & Oman
MP4T	Trucial Oman
OA	Peru
OD5	Lebanon
OE	Austria
OH	Finland
OHØ	Aland Islands
OK	Czechoslovakia
ON4, 5	Belgium
OQ5, Ø (see 9Q5)	
OR4 (see CE9)	
OX, KG1	Greenland
OY	Faroe Islands
OZ	Denmark
PAØ, PI1	Netherlands
PJ	Netherlands Antilles
PJ2M	Saint Maarten
PK (14)	Indonesia
PK1, 2, 3 (15)	Java
PK4 (15)	Sumatra
PK5 (15)	Netherlands Borneo
PK6 (15)	Celebes & Molucca Islands
PX	Andorra
PY	Brazil
PYØ	Fernando de Noronha
PYØ	Trindade & Martim Vaz Is.
PZ1	Surinam
SL, SM	Sweden
SP	Poland
ST2	Sudan
SU	Egypt
SV	Crete
SV	Dodecanese
SV	Greece
TA	Turkey
TF	Iceland
TG	Guatemala
TI	Costa Rica
TI9	Cocos Island
TJ	Cameroun
TL (16)	Central African Rep.
TN (17)	Congo Rep.
TR (18)	Gabon Rep.
TT (19)	Chad Rep.
TU (20)	Ivory Coast
TY (21)	Dahomey Rep.
TZ (22)	Mali Rep.
UA1-6, UN1	European Russian Socialist Federal Soviet Republic
UA1	Franz Josef Land
UA2	Kaliningradsk
UA9, Ø	Asiatic Russian S.F.S.R.
UB5, UT5	Ukraine
UC2	White Russian S.S.R.
UD6	Azerbaijan
UF6	Georgia
UG6	Armenia
UH8	Turkoman
UI8	Uzbek
UJ8	Tadzhik
UL7	Kazakh
UM8	Kirghiz
UN1 (23)	Karelo-Finnish Republic
UO5	Moldavia
UP2	Lithuania
UQ2	Latvia
UR2	Estonia
VE, VO	Canada
VK	Australia (inc. Tasmania)

VK	Lord Howe Island
VK4	Willis Islands
VK9, ZC3	Christmas Island
VK9	Cocos Islands
VK9	Nauru Island
VK9	Norfolk Island
VK9	Papua Territory
VK9	Territory of New Guinea
VKØ (see CE9)	
VKØ	Heard Island
VKØ	Macquarie Island
VO (24) (see VE)	
VP1	British Honduras
VP2 (25)	Anguilla
VP2 (25)	Antigua, Barbuda
VP2 (25)	British Virgin Islands
VP2 (25)	Dominica
VP2 (25)	Grenada & Dependencies
VP2 (25)	Montserrat
VP2 (25)	St. Kitts, Nevis
VP2 (25)	St. Lucia
VP2 (25)	St. Vincent & Dependencies
VP3	British Guiana
VP4	Trinidad & Tobago
VP5	Cayman Islands
VP5 (see 6Y)	
VP5	Turks & Caicos Islands
VP6	Barbados
VP7	Bahama Islands
VP8 (see CE9)	
VP8	Falkland Islands
VP8, LU-Z	So. Georgia Is.
VP8, LU-Z	So. Orkney Is.
VP8, LU-Z	So. Sandwich Is.
VP8, LU-Z, CE9	So. Shetland Is.
VP9	Bermuda Islands
VQ1	Zanzibar
VQ2	Northern Rhodesia
VQ3 (see 5H3)	
VQ4 (see 5Z4)	
VQ5	Uganda
VQ6 (26)	British Somaliland
VQ8	Cargados Carajos
VQ8	Chagos Islands
VQ8	Mauritius
VQ8	Rodriguez Island
VQ9	Aldabra Islands
VQ9	Seychelles
VR1	British Phoenix Islands
VR1	Gilbert & Ellice Islands & Ocean Islands
VR2	Fiji Islands
VR3	Fanning & Christmas Islands
VR4	Solomon Islands
VR5	Tonga Islands
VR6	Pitcairn Island
VS1 (36)	Singapore
VS2 (see 9M2)	
VS4 (37)	Sarawak
VS5	Brunei
VS6	Hong Kong
VS9	Aden & Socotra
VS9H	Kuria Muria Is.
VS9K	Kamaran Is.
VS9	Maldive Islands
VS9 (see MP4)	
VU	Andaman & Nicobar Isls.
VU	India
VU	Laccadive Islands
W (see K)	United States of America
XE, XF	Mexico
XE4	Revilla Gigedo
XT (27)	Voltaic Rep.
XV5 (see 3W8)	
XW8	Laos
XZ2	Burma
YA	Afghanistan
YI	Iraq
YJ (see FU8)	
YK	Syria
YN	Nicaragua
YO	Rumania
YS	Salvador
YU	Yugoslavia
YV	Venezuela
YVØ	Aves Island
ZA	Albania
ZB1	Malta
ZB2	Gibraltar
ZC3 (see VK9)	
ZC4 (see 5B4)	
ZC5 (37)	British North Borneo
ZC6	Palestine
ZD1 (see 9L1)	
ZD2 (see 5N2)	
ZD3	Gambia
ZD4 (see 9G1)	
ZD4 (28)	Gold Coast, Togoland
ZD6	Nyasaland
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Tristan da Cunha & Gough Island
ZE	Southern Rhodesia
ZK1	Cook Islands
ZK1	Manihiki Islands
ZK2	Niue
ZL	Auckland Is. & Campbell Is.
ZL	Chatham Islands
ZL	Kermadec Islands
ZL	New Zealand
ZL5 (see CE9)	
ZM6	Western Samoa
ZM7	Tokelau
ZP	Paraguay
ZS1, 2, 4, 5, 6	South Africa
ZS2	Prince Edward & Marion Is.
ZS3	Southwest Africa
ZS7	Swaziland
ZS8	Basutoland
ZS9	Bechuanaland
3A2	Monaco
3V8	Tunisia
3W8, XV5	Vietnam
4S7	Ceylon
4W1	Yemen
4X4	Israel
5A	Libya
5B4, ZC4	Cyprus
5H3, VQ3	Tanganyika
5N2, ZD2	Nigeria
5R8, FB8	Malagasy Rep.
5T (29)	Mauritania
5U7 30)	Niger Rep.
5V	Togo Rep.
5Z4, VQ4	Kenya
6O1, 2	Somali Rep.
6W8, FF8 (31)	Senegal Rep.
6Y, VP5	Jamaica
7G1	Rep. of Guinea
7X2, FA	Algeria
9A1 (see M1)	
9G1, ZD4 (32)	Ghana
9K2	Kuwait
9K3	Kuwait/Saudi Arabia Neutral Zone
9L1, ZD1	Sierra Leone
9M2 (36)	Malaya
9N1	Nepal
9Q5, OQ5, O	Rep. of the Congo
9S4 (33)	Saar
9U5 (34)	Burundi
9U5 (34)	Rwanda
9U5 (35)	Ruanda-Urundi
	Cambodia

DXCC Footnotes

(1) Only contacts dated before July 1, 1960 will count for this country.

(2) Only contacts dated before January 1, 1962 will count for this country.

(3) Only contacts dated before January 1, 1962 will count for this country.

(4) Only contacts dated November 14, 1962 or before will count for this country.

(5) Only contacts dated August 6, 1960 or before will count for this country.

(6) Only contacts dated before December 21, 1950 will count for this country.

(7) Only contacts dated before November 1, 1954 will count for this country.

(8) Only contacts dated August 16, 1960 or before will count for this country.

(9) Only contacts dated June 25, 1960 or after will count for this country.

(10) Only contacts dated June 25, 1960 or after will count for this country.

(11) Only contacts dated before April 1, 1957 will count for this country. April 1, 1957 and after count as Italy.

(12) Only contacts dated June 30, 1960 or before will count for this country.

(13) Only contacts dated before May 1, 1963 will count for this country.

(14) Only contacts made May 1, 1963 or later will count for this country.

(15) Only contacts made before May 1, 1963 will count for this country.

(16) Only contacts dated August 13, 1960 or later will count for this country.

(17) Only contacts dated August 15, 1960 or later will count for this country.

(18) Only contacts dated August 17, 1960 or later will count for this country.

(19) Only contacts dated August 11, 1960 or later will count for this country.

(20) Only contacts dated August 7, 1960 or later will count for this country.

(21) Only contacts dated August 1, 1960 or after will count for this country.

(22) Only contacts dated June 20, 1960 or later will count for this country.

(23) Only contacts dated June 30, 1960 or before will count for this country. July 1, 1960 and after count as European Russian S.F.S.R.

(24) Newfoundland/Labrador credit will be given if VO contact was made prior to April 1, 1949.

(25) See page 97, June 1958 *QST*.

(26) Only contacts dated June 30, 1960 or before will count for this country.

(27) Only contacts dated August 6, 1960 or later will count for this country.

(28) Only contacts dated March 5, 1957 or before will count for this country.

(29) Only contacts dated June 20, 1960 or later will count for this country.

(30) Only contacts dated August 3, 1960 or later will count for this country.

(31) Only contacts dated June 20, 1960 or after will count for this country.

(32) Only contacts dated March 5, 1957 or after will count for this country.

(33) Only contacts dated before April 1, 1957 will count for this country. April 1, 1957 and after count as Germany.

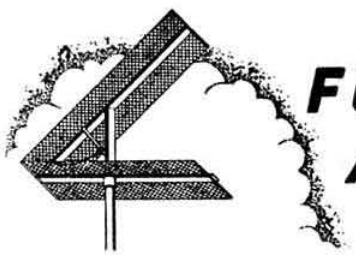
(34) Only contacts dated July 1, 1962 or after will count for this country.

(35) Only contacts made between July 1, 1960 and July 1, 1962 will count for this country.

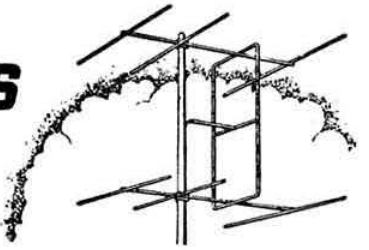
(36) Only contacts before September 16, 1963 will count for this country. On and after September 16, 1963 VS1 and 9M2 together count as Malaysia.

(37) Only contacts before September 16, 1963 will count for this country. On and after September 16, 1963, VS4 and VS5 together count as E. Malaysia.

(38) Only contacts dated October 30, 1963 or before will count for this country.



FOUR METRES AND DOWN



By F. G. LAMBETH, G2AIW *

THERE now seems to be a chance of making world-wide contacts on 2m c.w. via the Moon. This does not mean that it cannot be done on other v.h.f. or u.h.f. bands, but particular reference is intended here to the 2m band as it is thought that this is the only band, with perhaps the possible exception of 70cm, which is technically feasible for a reasonable proportion of the amateur population. Using conventional techniques it is virtually impossible for any one amateur to assemble suitable equipment; in particular the aerial size is a problem. When it is common to transmission and reception, 1db of aerial gain is equivalent to 2db of transmitter power or receiver noise figure, so every endeavour must be made to achieve maximum aerial gain.

G2HCJ, who is very actively engaged in preparation for Moonbounce with G3KCB on the constructional side and G2HCG on the aerial side, says that an exciter has been constructed by G3KCB, and that the p.a. proper is in a fairly advanced stage. The frequency to be used (possibly 145·8 Mc/s) is still under discussion.

Assistance, however, is required, and help is particularly solicited on the following points:

(i) Study of frequency and phase stability requirements of the whole system.
(ii) Design and/or construction of a phase-locked oscillator receiver suitable for use on a keyed signal with and without a local reference signal.
(iii) Aerial tracking mechanism.
(iv) Further references and amplification or correction of the present references.

It is unlikely that payment can be made for any equipment due to the totally unreasonable (considering it is a hobby) expenditure already incurred, but exchanges may be possible.

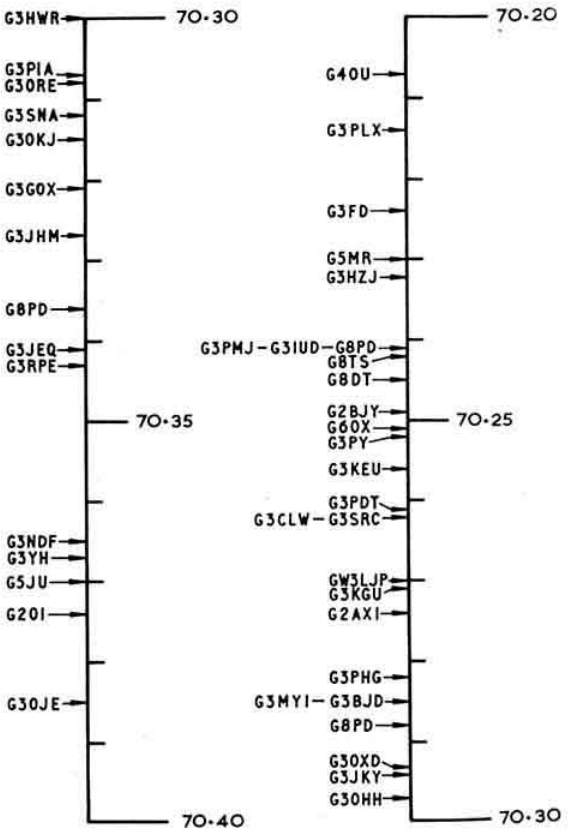
Moonbounce on 70cm is being actively pursued by G3CCH and G3LTF. No work is at present being carried out in this country on 23cm, as far as is known, but there may possibly be stations equipped for reception.

Four Metres

G8PD (Wembley) has prepared a very interesting band occupancy chart based on activity during the 4m C.W. Contest on December 1. The contest was excellent, although according to G8PD it was unfortunate that it was restricted to single operator stations in view of the relatively little activity on this band. Perhaps a more satisfactory system might have been to open the contest to all, with classified results under headings of single operation, multiple operation, fixed and portable. G8PD would be glad to hear from any v.h.f. listeners who heard his transmissions from Woodcote, South Oxfordshire, during this or the previous (June) contest.

Judging from comments expressed by other participants, however, the general criticism is that the contest is too long.

G3PLX (Liverpool, 12) reports on 4m activity in Liverpool. Due to the availability of surplus R220 receivers, which can be easily modified, there are upwards of 20 stations listening on the band. The transmitting stations to date are G3KRX, G3NEM, G3NLS, G3OSI, G3PLX and G3SKT, with more expected. A common frequency of 70·26 Mc/s for calling and net operation is being tried, and vertical polarization is being used, although all stations are equipped for horizontal polarization. G3PLX would like to know if anyone has been able to hear and identify a station which appears on about 70·33 Mc/s, due east from



Occupancy of the 70 Mc/s band during the C.W. Contest on December 1, 1963, based on the observations of G8PD/A. The frequencies are correct to within about ± 1 kc/s.

* 21 Bridge Way, Whitton, Twickenham, Middlesex. Please send all reports for the February issue to arrive by January 10, and for the March issue by February 8.

BOOK THE DATE—

TENTH INTERNATIONAL V.H.F./U.H.F. CONVENTION

Saturday, May 16, 1964

Kingsley Hotel, London

Liverpool, which is heard in very short bursts almost anytime of the day or night. It appears to be an f.m. broadcast station, and the language is apparently Russian, or similar. It is definitely not sporadic *E*. Several other stations have heard it, but none can identify the transmission.

G3FDW (Seascale, Cumberland) has been working 4m portable in the Cumberland mountains with the intention of giving some people a new county. Strange to relate, although stations were heard down to the London area, no one was worked beyond Lincolnshire. In four to five hours of operation on October 6, the following were worked: G3KMS, G3OHH, G3PMI, G3RNR, G4GM and G6AU, all in the Lancashire/Cheshire area. G3NJF was worked for Lincolnshire on c.w. There were also many phone carriers which were not resolvable. To try and find out what had happened to southern stations, as regards 4m, the gear was packed and taken by car on a business trip to Dorset. G3EHY was worked *en route* in Worcestershire. Many stations were heard from there, including GW3MDY, G3OHH and G3IUD, and also stations in the Manchester area. The aerial was a dipole at 8ft, and the location was on the Purbeck Hills.

This portable venture was greeted with an appalling silence nearly all the week commencing October 21, the only bright spots being G3PMJ and other consistent stations in the Manchester area. No station during a total of 12 hours operation was heard nearer than G3OHH (Macclesfield, 180 miles). On several occasions, whilst the dipole was in use, meteor pings were noted and signals jumped to S9+. The longest ping, or burst, was about 3 seconds.

Two Metres

The only 2m report this month comes from **G3OCB** (Nr. Truro) who echoes the thoughts that the very unsettled weather conditions recently have meant that little was being heard on the band in Cornwall. Local nets continued at 21.00 GMT each evening, with variable activity. G3XC, G3OCB and G2BHW are usually on the band, with G3NVJ, G5ZT and a few others from time to time.

Calls are welcomed any evening; usually the band seems open as far as Torquay, but little is heard from the Bristol Channel area.

Two metre operators are reminded that the 1964 **144 Mc/s C.W. Contest** will be taking place on Sunday, January 26, between 10.00 GMT and 22.00 GMT. The rules for this contest were published on page 321 of the November, 1963 issue of the BULLETIN.

Three Centimetres

G3PLX (Liverpool, 12) was interested to read in the November BULLETIN about G3GUD's activity on this band, and says he has also been experimenting recently. A Doppler radar system similar to G3GUD's was set up, but using a 2K25 in the transmitter and a superhet receiver incorporating another 2K25 as oscillator and a 1N23 mixer diode. The i.f. was 30 Mc/s. The system produced good results using a parabola for the receiver and a horn for the transmitter. It was possible to detect a moving person at about 200 yards, but the most interesting signals were from flying birds which could be detected at a distance of 150 yards. As **G3LIS** (near Ormskirk) is also building equipment for the band, some more interesting information, including possibly news of a QSO, is eagerly anticipated.

Weather Forecast

F. Maynard, **G4OU** (Sheerness) has received correspondence from Mr Trevor Baker (Meteorological forecaster for Southern Television) that in future when high pressure areas are present over the British Isles and Europe, with a possibility of temperature inversion effects upon v.h.f./u.h.f. reception, etc., he will announce this for the benefit of radio amateurs interested in the v.h.f./u.h.f. propagation from that part of the country. After consultation with amateurs on the staff of Southern Television, Mr Baker is now more fully informed of the requirements of amateurs in this respect (from MARTS *News Letter* December, 1963).

Low Barometer, High Activity

" You don't have to wait for a high barometer before you have an interesting time on Two " remarks **G5UM** in reporting how, on one wet and windy Monday evening recently, the Mid-Herts Net turned into almost a " Mid England Net."

G3DXI of Welwyn Garden City called G5UM on the net frequency of 145·1 Mc/s with the observation that " on a filthy night like this there won't be much about . . . but let's see what this call provokes."

This is what it *did* provoke:

Within 10 minutes a net had sprung into life extending from G3PTB in Cambridgeshire to G3BLP in Surrey, a span of 65 miles, with another seven stations lined up between, all on 145·1 Mc/s.

With stations operating in alphabetical order of callsigns the overs were kept speedy " to obviate those maddening *longeurs*," as G5UM puts it.

Although a record for coverage by this particular net this was not a record for numbers: on one occasion the Mid-Herts Net had eleven participants at one session.

Amateur Television

Interest in Amateur Television is becoming increasingly evident, but G3KKD/T (Ely) supposes that the lack of reports in the past has been largely due to the fact that people, like himself, have been too busy constructing apparatus to have had enough time to write about it.

He now reports activity in the Fens and East Anglia, somewhat north of the area covered in October. The following list is believed to be complete and up to date, although the following additional notes may help to provide a more comprehensive picture. The GB3GEC beacon is always receivable in Ely at about S2. This, together with BBC Channel 2 and ITA London, gives a good indication of propagation conditions. Of the 20 stations known to be on 70cm within 40 miles of Cambridge 15 are either holders of a /T licence or are active receiving stations for TV signals. These 15 are mentioned in the table. All stations listed operate between 432 and 435 Mc/s. There are two main skeds: (i) 18.00 to about 20.30 (clock time). Saturdays, with G3GDR/T, G2WJ/T, G3NOX/T and G3KKD/T. (ii) 11.00 to about 12.30 Sundays " The Fens Amateur TV Sked," between G3REH/T, G3RGX/T, G3PGF/T, G3OAT/T, and G3KKD/T. Finally there is sporadic activity between 20.00 and 23.59. London stations are often heard in QSO, and it is felt that a contact would be made if they would look north.

V.H.F. QSY

Members who wish to acquire or dispose of crystals in connection with the British Isles Two Metre Band Plan are invited to send details to " V.H.F. QSY," RSGB Bulletin.

Crystals Offered

By G3KBC, 5 Winfold Park, Waterbeach, Cambs., 8038, 8043, 8047, 12,003, 12,054 and 12,069 kc/s.

Crystals Required

By G3KBC, as above. Crystals between 12,091 and 12,108 kc/s or between 11,700 and 11,733 kc/s.

AMATEUR TELEVISION STATIONS IN EAST ANGLIA

Call-sign	Location	Input (watts)	E.R.P. (approx.)	Scanning Standard	Video Sources	Remarks
G3PGF/T	Borwell, Cambs.	40	800 W	405 interlaced	Videcon Telecine	Regularly transmits TV
G3PDO/T	Histon, Cambs.	40	800 W	405 interlaced	Videcon camera	
G3PEI/T	Cambridge	—	—	—	—	Temporarily QRT
G3BBY/T	Cambridge	—	—	405 interlaced	Videcon camera	Station being built
G3KKD/T	Ely	150	1·6 kW	405 interlaced	Videcon camera, Electronic test signals	Regularly transmits TV
G3RGX/T	March	6	16 W	—	—	Also operates club station G3RIZ/T E.R.P. 64 watts Building QRO TX
G3REH/T	Sutton St. James, Lincs.	6	64 W	—	—	Receives and reports pictures. Building QRP
G3NOX/T	5 miles west of Saffron Waldon	150	6·4 kW	405 interlaced	Image Iconoscope camera, Monoscope, Electronic test signals	Aerial 465 ft. a.s.l. Regularly transmits TV
G3OAT/T	RAF Marham, Norfolk	—	—	—	—	Station being built
G2DUS/T	Stotfold, Beds.	40	800 W	405 interlaced	Videcon camera, Telecine, Pattern generator	Temporarily QRT
G2FNW	Melton Mowbray	—	—	—	—	Receives TV and reports
G2WJ/T	near Dunmow	40	1·6 kW	405 interlaced	Videcon camera	Regularly transmits TV
G3GDR/T	Abbots Langley	—	—	405 interlaced	Videcon camera	
G3NJO/T	Diss, Norfolk	—	—	—	—	Station being built
G3OWB/T	Cambridge	—	—	—	—	

G3BA (Sutton Coldfield) reports that local TV is on the increase, and G3MXW/T is perhaps the most consistently active. His new camera is far superior to the flying spot caption scanner.

G3EJO is equipped to receive TV on 70cm, and hopes soon to be talking on 70cm with a new transmitter. The TV reception bug has also been nibbling at **G5BJ**, who has recently visited G2CIK/T and G3MXW/T.

Late News—Two Metres

G3FDW (Seascale) heard G3EHY and GM3FYB and several others at S4 on phone on December 8. G3RHE (Seascale) is now active using a 6-over-6 slot fed beam at 30 ft.

G2BJY (Walsall) reports that conditions improved in late November and there were some good openings for GDX to the South East. On December 2 the path extended to France and Belgium and G2BJY was very pleased to work ON5DK (Courtrai) 59 both ways for his first ON. Others heard were ON4LF (S8), ON4LO (57) F9MJ (59) and F8VQ (S8). The opening seemed limited in direction and lasted only a short time. Conditions since then have been above average for GDX in the same direction. An interesting QSO on December 9 was with G6UT on the eve of his 80th birthday!

Late News—Four Metres

G5ZN (Reedley, Burnley), reports that there is quite a lot of local activity on 4m and mentions G2CXW (Burnley), G6AU (Blackburn), G4GM (Accrington), G3PUO (Accrington), G3MAA (Clitheroe), G3RNR (Hapton), G3SLY (Nelson). **G3FDW** reported on the activities of G3BJD/P during the 70 Mc/s C.W. Contest on December 1. Despite failure of a valve in the r.f. amplifier, G3PIA/P and G8PD/A at 200 miles were both worked. In all, 16 stations were contacted, most of them in Lancashire and Cheshire. On December 8, G3FDW visited Dumfriesshire. From three miles north of Annan, GM3FDW worked G3OHH, G3IUD G3PLX and G3JYP. He hopes to visit Kirkcudbrightshire. The portable rig employs a QQV03-10 at 12 watts input in the p.a. while the front-end of the receiver uses a 6CW4 r.f. stage, 7587 mixer and 7586 triode oscillator and tripler.

G2BJY (Walsall) is now active on the band with a transmitter running 8 watts input. The best DX so far was during the contest with G3PIA/P (Wantage) and G8PD/A (Woodcote, Oxon). Also worked were G2ASL, G3BA, G3MYI (Leics.) G3PDT, G3OXD/A and G5JU. On December 9 G3OHH (Macclesfield) was heard. Skeds are needed and will be arranged for any time, including daytime on weekdays.

"Four Metres and Down" Certificates

These certificates, intended to mark successful v.h.f. and u.h.f. achievements, are available in eight categories.

	Qualifications	
Four Metre Award Four Metre Listener Award	20 Counties	3 Countries
Two Metre Award Two Metre Listener Award	30 Counties	5 Countries
Two Metre Senior Award Two Metre Senior Listener Award	60 Counties	15 Countries
Seventy Centimetre Award Seventy Centimetre Listener Award	20 Counties	3 Countries

The rules governing the award of the certificates are as follows:

(i) All claims must be fully supported by QSL cards.
(ii) All contacts must have been made on or after January 1, 1961.
(iii) Eligible counties are those of the United Kingdom of Great Britain and Northern Ireland, listed on the claim form available from Headquarters on request.
(iv) Stations are eligible for certificates in the following groups:
  (a) Fixed stations
  (b) Alternative address stations (—/A any address)
  (c) Portable stations (—/P any location)
  (d) Mobile stations (—/M any location)
  Categories cannot be mixed.
(v) All claims must be submitted to the V.H.F. Committee at RSGB Headquarters, 28 Little Russell Street, London, W.C.1.
(vi) All claims must be accompanied by a check list.
(vii) All cards will be returned by recorded delivery service and return envelopes are not required.

The following is a list of those to whom "Four Metres and Down" certificates have been awarded.

144 Mc/s Transmitting Section

1 A. L. Mynett, G3HBW
2 J. Haydon, G3BLP
3 A. D. Smith, G3MTI
4 H. Beaumont, G5YV
5 L. Sharrock, G3BNL
6 W. R. Hawthorne, G3MCS
7 N. A. Ross, G3LAR
8 J. B. Kay, G3CO
9 T. P. Douglas, G3BA
10 W. M. Lee, GW3MFY
11 G. C. Hill, G3DFL

12 G. H. Grayer, G3NAQ
13 C. L. Desborough, G3NNG
14 A. M. Laidler, G3OJY
15 G. V. Farrance, G3KPT
16 W. B. Capstick, G3JYP
17 R. J. Thomas, G3KMT
18 H. W. Darvill, G3OHD
19 K. J. Wheatley, G3BBR/A
20 R. C. Hills, G3HRH
21 J. F. Shepherd, GM3EGW
22 P. G. Bower, GI3OFT
23 P. Dutfield, G3OBD/P
24 C. Sharpe, G2HIF
25 P. D. Lucas, G3JDN
26 J. Redrup, G8VZ
27 S. J. Harden, G2AXI
28 F. Jeanmonod, G3JYT
29 J. Hum, G5UM
30 W. Bates, G3EJO
31 W. D. Sellars, G3PBV
32 R. G. Morris, G3FDG
33 M. Hall, G3OSA
34 A. E. Latham, G3JLA
35 W. E. Butt, GC2FZC
36 H. M. Synge, G3BOC
37 A. D. Smith, G3MTI/M
38 A. M. Laidler, G3OJY (New QTH)
39 B. A. Maycock, G3JWQ
40 G. Eddowes, G3NOH
41 G. Harvey, G3PSL
42 R. T. Greenwood, G3LBA
43 F. K. Parker, G3FUR
44 G. Johnson, G2BJY
45 M. G. Campbell, G3MRA
46 C. J. Curtis, G3AGN
47 P. A. L. Shoosmith, G3MDH/P
48 F. E. A. Green, G3GMY
49 P. J. Simpson, G3GGK
50 P. A. L. Shoosmith, G3MDH
51 O. Heggs, G3NLR
52 R. Ballantyne, GM3LDU
53 B. C. Oldham, G3CKQ

144 Mc/s Receiving Section

1 D. A. S. Drybrough, B.R.S.22550
2 E. J. Boys, B.R.S.22322

144 Mc/s Senior Transmitting Section

1 J. Stace, G3CCH
2 A. W. S. Fowler, G3FAN
3 N. H. R. Munday, G5MA
4 G. W. J. Haydon, G3BLP
5 J. B. Kay, G3CO
6 T. P. Douglas, G3BA

420 Mc/s Transmitting Section

1 C. L. Desborough, G3NNG
2 G. V. Farrance, G3KPT

70 Mc/s Transmitting Section

1 L. Boedo-Yanez, G3EHY
2 J. V. Mee, G3PJK
3 N. G. Hyde, G2AIH
4 R. A. Hargreaves, G3OHH
5 T. Leighfield, G3KEU/P
6 G. W. Tibbetts, G3NUE

RTTY

By ARTHUR C. GEE, G2UK*

THOSE RTTY enthusiasts who visited the RSGB Radio Communications Exhibition will have been gratified at the crowds of spectators gathered around the 2m live RTTY station, installed and operated by Eric Yeomanson, G3IIR. To judge from the numbers of folk always to be seen around the exhibit, many visitors to the Exhibiton must have found it one of the most interesting in the Show.

The writer, in his capacity as Honorary Secretary of the British Amateur Radio Teleprinter Group, has received many enquiries about RTTY from those who saw this exhibit, and it is quite obvious that more and more people are becoming interested in this mode of Amateur Radio communication.

RTTY Contest

The Annual RTTY Sweepstakes Contest run by the American RTTY Society, was a little slow for European contestants, due to poor conditions on the DX bands. Held in November, 1963, this was a world wide contest and provided a wonderful opportunity for working a few new countries. A good deal of DL activity was heard on the bands and of course plenty of W's, but British activity was conspicuous by its absence. It was just too bad that conditions were so poor that weekend. It is of interest to note, however, that RTTY activity in this country does appear to be becoming more and more confined to 2m. This is a pity, as the characteristics of this band will inevitably lead to RTTY activity becoming confined to local nets. A wider association between all those interested in RTTY than this, particularly between the various European countries, would be advantageous. In this connection, it is good to hear that RTTY activity in France is about to commence, that two stations in Northern Ireland are looking for suitable gear and that a station in Eire hopes to be on very soon. Let's hope these stations all make their debut on 80m, then we can all enjoy working them.

As is customary, the AGM of the BARTG was held in a venue nearby the Exhibition, on the Saturday evening of the Show week. This year's get-together produced as usual a lively meeting, with 20 or so of the group's 120 members in very vocal mood with suggestions for improving the facilities for RTTY enthusiasts in the country. The highlight of the evening was when the Chairman, Len Newnham, G6NZ, announced that the RSGB had successfully negotiated with the GPO for authority for RTTY test transmissions to be broadcast. The Society has been trying for some time to get facilities similar to those which the Dutch Amateur Radio Organisation VERON has for its station PA0AA for broadcasting a RTTY News Bulletin. The authorities felt they could not go quite as far as this, but could permit RTTY transmissions for test purposes. This will enable experiments on a.f.s.k., different printer speeds, etc., to be carried out and will enable the beginner to line up his equipment on scheduled Amateur RTTY activity in this country as at present it is difficult to find amateur signals to line up on, and these test transmissions will serve a most useful purpose.

BARTG

May the writer once again be forgiven for reminding readers of the advantages to new RTTY enthusiasts of joining the British Amateur Radio Teleprinter Group. Not only will they be supporting the organisation which is sponsoring RTTY activity in this country, but there are practical advantages to themselves. The Group is able to supply all those " difficult-to-get " components such as polarised relays, toroid coils, centre reading meters and so on. It has spares for teleprinters and supplies such necessities as printer paper, tape and ink rollers. A good advisory service is available, and the Group is the clearing house for information on the availability of teleprinters and other such items of equipment. A news sheet is circulated regularly giving news of Group activities, schedules, members' requirements and sales, and so on. Now is the time to join, as the Annual Subscription of 10s. is payable for the year in January and the list of members for the year is issued in February. So if you are interested join now, and help us to help you.

* " East Keal," Romany Road, Oulton Broad, Lowestoft, Suffolk.

Society News

New U.H.F. Phone-only Licence to be Issued

As a result of talks between the RSGB and the Post Office, a new phone-only licence to permit operation on amateur frequencies above 420 Mc/s is to be introduced. Applicants will have to pass the Radio Amateurs' Examination but not the GPO Morse Test.

No applications can yet be considered but a further announcement will be made as soon as possible.

Region 11 Representative

After the December issue closed for press Mr. K. Schofield, GW3KYT, of Rhos-on-Sea notified Headquarters that he wished to withdraw his nomination for the office of Region 11 Representative. Mr. J. Thornton Lawrence, GW3JGA, who was the other candidate, therefore succeeds Mr. R. Jones, GW3JI, in that office as from January 1, 1964.

Region 1 Visit to USA

In view of the announcement by John Brodzky, G3HQX, regarding his proposed visit to the USA in 1964, the committee organizing the Region 1 trip to the USA has decided that it would be better to postpone its visit until 1965. The timing of the trip will be arranged to coincide with the New York World's Fair, and all other details including the cost will be much the same as already published. Further announcements will be made as more details become available.

MULLARD AWARD FOR 1963
NOMINATIONS INVITED

The terms and conditions governing the Mullard Award, are as follows:

(1) *The Award is offered annually by Mullard Limited during the pleasure of the Directors of that Company.*

(2) *The Award will take the form of a gift in kind (preferably electronic or electrical apparatus and/or books) to the value of £25, and a plaque.*

(3) *The Award will be made to the member of the Radio Society of Great Britain resident in the United Kingdom who (in the opinion of a Committee consisting of three representatives of Mullard Limited and three representatives of the Council of the Radio Society of Great Britain) has, through the medium of Amateur Radio during the preceding calendar year, rendered outstanding personal service to the community by his own endeavour or by his own example of fortitude and courage.*

(4) *The presentation of the Award will take place during the month of April each year on a date and at a place to be decided by the Committee.*

(5) *In January of each year, the Radio Society of Great Britain shall, through its official journal, invite nominations for the Award. Each such nomination shall be supported by at least three Corporate Members of the Society and shall be accompanied by a brief factual account of the personal service rendered by the nominee.*

In accordance with Rule 5, the Council invites nominations for consideration for the Mullard Award for 1963. Such nominations should be sent in writing to the General Manager at RSGB Headquarters to arrive not later than February 10, 1964.

The Gerald Marcuse Memorial Award

At the 1962 Reunion of the Radio Amateur Old Timers' Association it was decided to establish an Annual Prize Award in memory of the late Gerald Marcuse, G2NM.

The terms of the award are as follows:

(i) The Award will be made annually in May to the United Kingdom licensed radio amateur under 21 years of age on December 31 previously, who shall have submitted to the Radio Amateur Old Timers' Association the most meritorious article describing a piece of equipment which he shall have constructed and used in his station, or a journey which he shall have made during the previous twelve months to a Commonwealth or foreign country where he met and visited other licensed radio amateurs. Entrants must be Corporate members of the Radio Society of Great Britain.

(ii) The manuscript of the article shall be either typed, using double spacing, or written legibly on lined foolscap.

(iii) All manuscripts will be judged by a panel consisting of three members of the Association.

(iv) The closing date for entries shall be February 28.

(v) The winner of the Award will be invited to attend the Annual Reunion of the Association as a guest of the Association.

(vi) The Award will take the form of books or book tokens to a value of not less than two pounds.

(vii) The winning manuscript will be offered to the Editor of the RSGB BULLETIN for publication.

Entries should be sent to the Founder-Secretary, RAOTA, 16 Ashridge Gardens, London, N.13.

Last year's winner of the Award was Mr. A. J. Shepherd, G3RKK, whose description of his Amateur Bands receiver in the July 1963 issue of the RSGB BULLETIN earned well deserved praise. At the time Mr. Shepherd was 17 years of age.

Appeals for Rare Drugs

Members are reminded that the policy of the British Red Cross Society is not to accept requests for rare drugs from individual radio amateurs even when such requests are passed on to them via the police authorities. The British Red Cross Society recommend that when a United Kingdom amateur is asked by a foreign amateur to accept a message for a rare drug he should advise the sender to contact his National Red Cross Society.

Only requests from, or through, National Red Cross Societies, can be dealt with by the British Red Cross Society and any drugs obtained would be sent to the National Red Cross Society concerned.

International Red Cross Tests

On January 13, 15 and 17, the Red Cross will be conducting tests on 7210 kc/s at 06.30, 12.00, 15.30 and 21.30 GMT. Reports on the reception of signals will be welcome and should be sent to G. A. Allcock, G3ION, 71 Bassett Green Close, Southampton. Reports on adjacent channel interference will also be welcome.

Another Pirate Fined

On September 18, 1963, at Blackpool Borough Police Court, Michael Eric Jackson, pleaded guilty to a charge of using wireless telegraphy transmitting apparatus without the necessary licence. He was fined £5 5s. and ordered to pay an Advocate's fee of £3 3s.

LONDON LECTURE MEETINGS

Friday, March 13, 1964
"RADIO ASTRONOMY"
By Frank Hyde, F.R.S.A., F.R.A.S.

Friday, May 1, 1964
"AERIALS"
By H. V. Sims (Head of Engineering Maintenance Section, BBC)

at the

Institution of Electrical Engineers
Savoy Place, Victoria Embankment, London, W.C.2.

Buffet tea 6 p.m. **Lecture 6.30 p.m.**

RSGB QSL Bureau Sub-Managers

The following is a list of the RSGB QSL Bureau Sub-Managers showing the call-sign groups for which they are responsible:

G2:	S. Marsh, G2CZU, 10 Vernham Grove, Odd Down, Bath, Somerset.
G3, 4 and 5 two-letter calls & GC	E. G. Allen, G3DRN, 65A Melbury Gardens, London, S.W.20.
G6 and G8:	A. J. Mathews, G6QM, 62 Ashlands Road, Hesters Way Estate, Cheltenham.
G3AAA-BZZ;	C. C. Olley, G3AIZ, 157 Wanstead Park Road, Ilford, Essex.
G3CAA-DZZ:	C. A. Bradbury, B.R.S. 1066, 13 Salisbury Avenue, Cheltenham.
G3EAA-HZZ:	W. J. Green, G3FBA, 790 Rochester Way, Sidcup, Kent.
G3IAA-KZZ, B.R.S. and A numbers:	T. D. J. Miles, G3NXR, 7 Hampden Road, Wantage, Berks.
G3LAA-MZZ:	C. Harrington, B.R.S. 2292, 91 Brabazon Road, Hounslow, Middlesex.
G3NAA-NZZ:	C. R. Emary, G5GH, 133 Fairlands Road, Thornton Heath, Surrey.
G3OAA-PZZ:	J. H. Brazzill, G3WP, 43 Forest Drive, Chelmsford, Essex.
G3RAA-RZZ:	K. Walden, G3OLN, 250 Gloucester Road, Cheltenham, Gloucestershire.
G3SAA-SZZ	E. G. Allen, G3DRN, 65A Melbury Gardens, London, S.W.20.
GD:	T. R. Moore, GD3ENK, "Glyn Moar," St. John's, Isle of Man.
GI:	R. R. Parsons, GI3HXV, 45 Erinvale Avenue, Finaghy, Belfast.
GM:	D. Macadie, GM6MD, 154 Kingsacre Road, Glasgow, S.4.
GW:	J. L. Reid, GW3ANU, 28 Waterston Road, Gabalfa, Cardiff.
DL2:	4027469 C/T Griffiths, DL2OX, 212 Hohenzollen Str., Munchen Gladbach, Germany.

Cards must be sent to G2MI but envelopes may be sent to the appropriate Sub-Manager or to G2MI. Printed and gummed labels are obtainable from G2MI by sending an s.a.e.

The address of the QSL Bureau Manager (Mr. A. O. Milne, G2MI) is 29 Kechill Gardens, Bromley, Kent.

Bulletin Contributors

Members who are prepared to contribute articles to the Society's Journal are reminded that some notes are available to help them prepare manuscripts in a form that will assist in securing uniformity of presentation, simplify the work of the Society's printers and draughtsmen and help ensure that their instructions are easily understood. A copy of *Hints to Contributors* can be obtained on application to the Editor.

All contributions to the Society's Journal including those for the *Clubroom* and *Forthcoming Events* features should be typed with double spacing between lines using one side of the paper only. Information for the RSGB BULLETIN should not be included on the same sheet of paper as material for news bulletins.

Photographs should be clear and sharply focused. Prints should preferably be glossy and should contain information of general interest to members. Captions should be written on a separate sheet of paper.

The amount of the copyright fee paid to contributors to the RSGB BULLETIN ranges from £2 2s. to £5 5s. per 1,000 words.

Notes on U.H.F. Transmission and Reception

The Television Society recently ran a most successful course of lectures on u.h.f. television transmission and reception. Copies of the lecture notes are now available price 10s. each from the Administrative Secretary at 166 Shaftesbury Avenue, London, W.C.2.

Representation

The following is an addition to the list of Area Representatives published in the December issue.

REGION 7—LONDON EAST
EAST HAM
R. F. Hammond, B.R.S.24879, 40 Watson Avenue, East Ham, London, E.6.

LONDON U.H.F. GROUP
will meet at the
Bull and Mouth Tavern
corner of Bloomsbury Way and
Bury Place, London, W.C.1,
at 7.30 p.m. on Thursday, January 2 and on February 6, 1964
All v.h.f. and u.h.f. enthusiasts welcome

Society Affairs

A digest of the business discussed at the October, 1963, meeting of the Council

THE October meeting of the Council was held on October 28, 1963, and was attended by Messrs. N. Caws (President), J. C. Graham, R. C. Hills, E. G. Ingram, J. Douglas Kay, L. E. Newnham, F. K. Parker, R. F. Stevens, G. M. C. Stone, J. W. Swinnerton, E. W. Yeomanson (Members of the Council), John Clarricoats (General Secretary), John A. Rouse (Editor), and A. J. Reynolds (Secretary-accountant).

Apologies for absence were submitted on behalf of Major-General E. S. Cole, Mr. H. A. Bartlett, Mr. A. O. Milne, Mr. L. N. Goldsbrough, Mr. A. D. Patterson and Mr. A. C. Williams.

Membership

The Council approved 118 applications for membership (86 Corporate and 32 Associate). In addition, 10 applications for transfer from Associate to Corporate grade were approved. Life membership was granted to Mr. G. E. Ripley, G3KFW.

The Council granted affiliation to the Basildon and District Amateur Radio Society, Mansfield Amateur Radio Society, South London Mobile Club, and the University of North Wales Amateur Radio Society.

Nominations for Council

The Secretary reported on the nominations for the election to fill the vacancies which would occur in the Council as at December 31, 1963.

RSGB News Bulletin Service

It was agreed to accept an offer made by Mr. Dennis Wardle, G3EWZ, to join the list of News Readers in the North of England.

V.H.F. Manager's Trophy

The Council accepted the draft rules for the V.H.F. Manager's Trophy presented by Mr. R. C. Hills. (The rules for this Trophy were published in the December, 1963, issue of the BULLETIN.)

RSGB Bulletin—New Volume

The Council accepted a suggestion that Volume 39 of the RSGB BULLETIN should end with the December, 1963, issue so that future issues cover the calendar year.

Braaten and Milne Trophies

The Council resolved to award the Braaten and Milne Trophies for the year 1963 to Mr. C. R. Perks, G4CP, and Mr. R. Jones, GW3JI, respectively.

Geneva Space Conference

The General Secretary reported on the proceedings at the Geneva Space Conference and drew particular attention to some of the problems that lie ahead as a consequence of the aspirations of the new and developing nations. He expressed the opinion that every effort should be made to enlist the interest and sympathy of such nations in Amateur Radio. Mr. Clarricoats stated that the next ITU Plenipotentiary Conference was scheduled for 1965, the centenary year of the ITU.

South West of Scotland

The Council discussed Society representation in the South West of Scotland.

Junior BERU Contest 1947

The Council agreed to purchase and send to Mr. Alan Frame, ZL4GA, a miniature replica of the BERU Junior Trophy to commemorate his success in the 1947 BERU Junior Contest. The replica had not previously been awarded to Mr. Frame due to technical points concerning his membership of the Society at the time.

Gift from the Swedish Society SSA

The President reported that on behalf of the Society he had accepted from Mr. Larson at the North Western V.H.F. Convention a piece of Swedish glass donated by the Swedish National Radio Society, SSA, to commemorate the Golden Jubilee of the Society.

Headquarters Accommodation

The President reported that consideration had been given to two further offers of accommodation but neither had proved to be suitable.

Reports of Committees

The Mobile Committee met on September 2 to make final arrangements for the Society's National Mobile Rally at Woburn Abbey on September 22.

At the meeting of the Scientific Studies Committee on September 23, BULLETIN articles, the experimental station in Lerwick, the IQSY programme, and matters relating to *Oscar III* and *Echo A12*, were discussed.

The Exhibition Committee met on September 27 to continue work on the arrangements for the RSGB Radio Communications Exhibition.

The Finance and Staff Committee met on September 30 to interview a prospective member of the editorial staff. On October 14 designs for new Headquarters notepaper were again considered. Recommendations regarding honoraria to be awarded in connection with the QSL Bureau, and other outstanding voluntary work during the year were also made. The Committee also considered the drawing up of budgets for 1964 by the Committees of the Council and the advertising of Society publications.

The Contests Committee met on October 3 to discuss matters relating to the D/F National Final and the 1250 Mc/s Tests.

The V.H.F. Committee at its meeting on October 7 discussed matters relating to the Band Plans, the 1964 International V.H.F./U.H.F. Convention, V.H.F. Operating Awards, V.H.F. Distance Records and Beacon Stations.

At its meeting on October 10, the Technical Committee discussed the BULLETIN articles programme, RSGB Constructional leaflets and the London Lecture Programme.

The Council received the Minutes of all these Committee meetings and studied each in turn.

* * *

The Council was in session from 6 p.m. to 10 p.m.

GB2RS SCHEDULE

RSGB News Bulletins are transmitted on Sundays in accordance with the following schedule:

Frequency	Time	Location of Station
3600 kc/s	9.30 a.m.	South East England
	10 a.m.	Severn Area
	10.15 a.m.	Belfast
	10.30 a.m.	North Midlands
	11 a.m.	North West England
	11.30 a.m.	South West Scotland
	12 noon	North East Scotland
145·30 Mc/s	10.30 a.m.	Beaming north west from Sutton Coldfield
	10.45 a.m.	Beaming south west from Sutton Coldfield
145·50 Mc/s	11.00 a.m.	Beaming north from Leeds
	11.15 a.m.	Beaming east from Leeds
145·8 Mc/s	11.30 a.m.	Beaming west from Belfast
	11.45 a.m.	Beaming north east from Belfast
145·10 Mc/s	12 noon	Beaming north from London area
	12.15 p.m.	Beaming west from London area

News items for inclusion in the bulletins should reach Headquarters not later than first post on the Thursday preceding transmission. Reports from Affiliated Societies and from non-affiliated societies in process of formation will be welcome.

1250 Mc/s Tests 1963

ACTIVITY last year in the 1250 Mc/s Tests held on June 22-23, 1963, was higher than in 1962; six reports were received recording 15 stations on the band. Although once again the Midlands and Home Counties produced distinct groups of stations a serious attempt was made to establish links between the two areas.

Taking the stations in alphabetical order, G2RD of Wallington, Surrey, after a brief period at Reigate, went to a point on the Chilterns near Watlington, seven miles north-west of Henley-on-Thames and 754 ft. a.s.l. He was assisted by G3IAS. G3HBW of Bushey, Herts., went to the Worcester Beacon near Malvern at 1395 ft. a.s.l. where he was much helped by G3MTI. G3KPT, normally at West Bromwich, operated /A with the assistance of G2CIW, G3HZZ and G3NCX, at a point 600 ft. a.s.l. in Walsall, while G3LTF of Galleywood, operated /A at Shenley, Herts., where he had the help of G3JMA, G3LIT and G3MCS.

Two fixed stations sent in reports, G3FP at Thornton Heath, Surrey, and G3KFD of Kingswinford, Staffs., who had the help of G3OAD.

Successful contacts were made between G3KPT/A, G3KFD and G3HBW/P, though the contact between G3KPT/A and G3KFD produced reports of R5 S8/9, which the operators thought to be low for an optical path of only five miles. G3KFD suggests that as there was a difference of nearly 400 ft. in the heights of the two stations the weak signals could be due to the small beam width in elevation of the aerials used. Neither operator was able to train the aerials in elevation to check this. For this path the angle of elevation is about 48 seconds; the theoretical beam width of a 6 ft. paraboloid at 1300 Mc/s is 8·8° at 3db points with a first null at 10·2°, this therefore does not account for the weak signals. Perhaps some interference due to ground reflections would be an explanation. Comments or further experiments would be of interest.

The other three stations reporting were able to work each other without much difficulty over long but relatively easy paths.

The main interest in the tests lies in the attempts to establish contact between G3HBW/P, G3KFD and G3KPT/A on the one hand and G2RD/P and G3LTF/A on the other.

All stations were reported as unusually weak on 144 Mc/s and 432 Mc/s and no contacts over the long paths were possible on 1296 Mc/s though careful checks were made. The path profiles show three of these paths drawn for an effective earth's radius of R and 4/3 R. The latter is the value usually taken and corresponds to the slight assistance which can usually be expected from the troposphere. Occasionally, however, under extremely poor weather conditions little or no help is

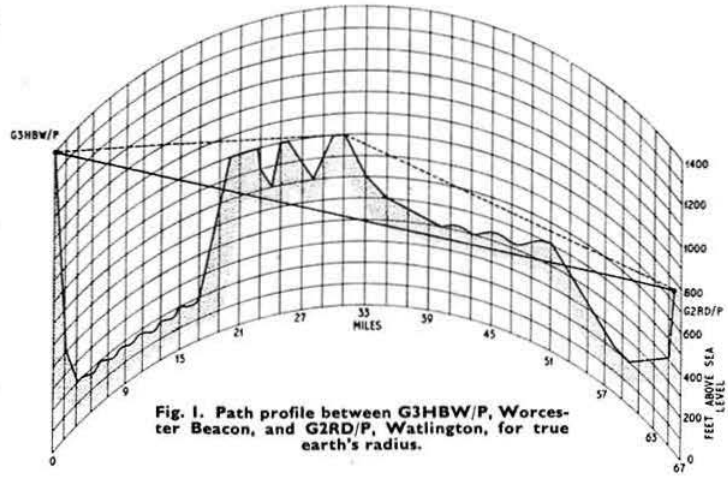


Fig. 1. Path profile between G3HBW/P, Worcester Beacon, and G2RD/P, Watlington, for true earth's radius.

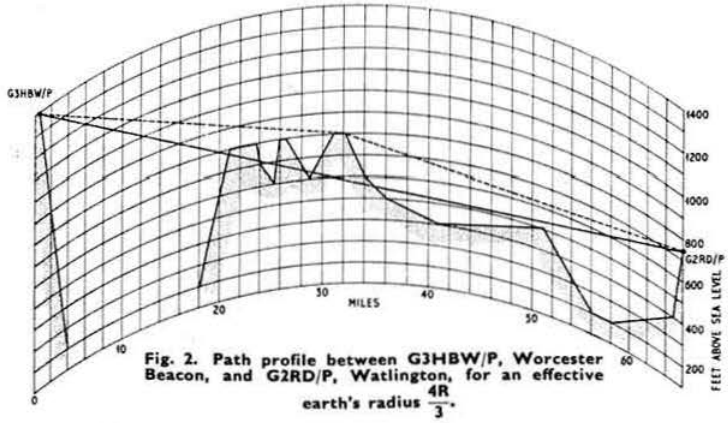


Fig. 2. Path profile between G3HBW/P, Worcester Beacon, and G2RD/P, Watlington, for an effective earth's radius $\frac{4R}{3}$.

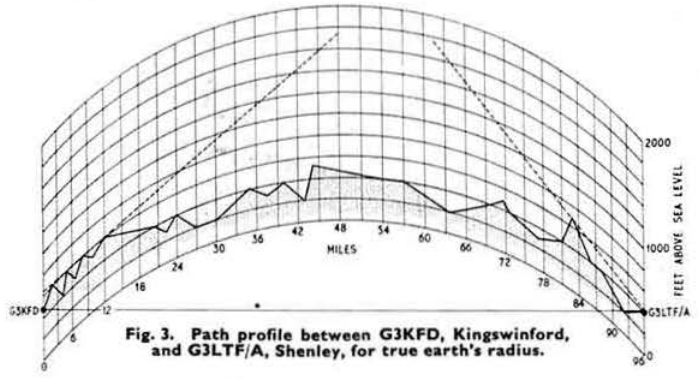


Fig. 3. Path profile between G3KFD, Kingswinford, and G3LTF/A, Shenley, for true earth's radius.

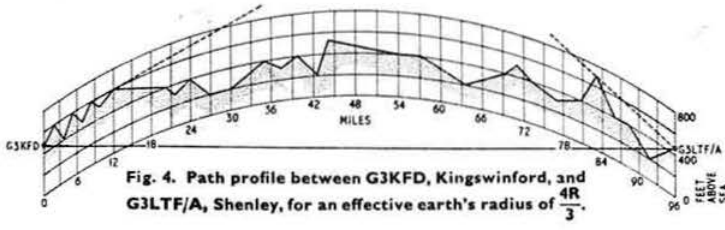


Fig. 4. Path profile between G3KFD, Kingswinford, and G3LTF/A, Shenley, for an effective earth's radius of $\frac{4R}{3}$.

obtained from this source and the effective earth's radius is its physical value.

As can be seen, if the above theory is correct the path between G3HBW/P and G2RD/P, though still not optical under normal conditions, is practicable, while that between G3KFD and G3LTF/A is a doubtful proposition even under normal conditions. The path between G3KPT/A and G2RD/P lies over three high points; when conditions are sub-normal all three hills obstruct the path but when conditions are better than normal the two stations have a common horizon at the path centre near Chipping Norton. It is possible that this particular path is very sensitive to propagation conditions. Since neither station is permanent, however, the matter must rest there. There does seem to be a dearth of information on normal propagation in amateur u.h.f. bands. Cases of exceptionally good or unexpectedly bad propagation are well recorded but information on regular contacts over non-line-of-sight paths is needed.

In the rules for the Tests comments were invited on results during the year between these Tests, and some very interesting information resulted. Contacts amongst 22 stations appear in the notes not counting repeats of a call-sign at different locations.

The highlight of the year 1962 of course was the opening on December 4, when 1296 Mc/s signals were exchanged between

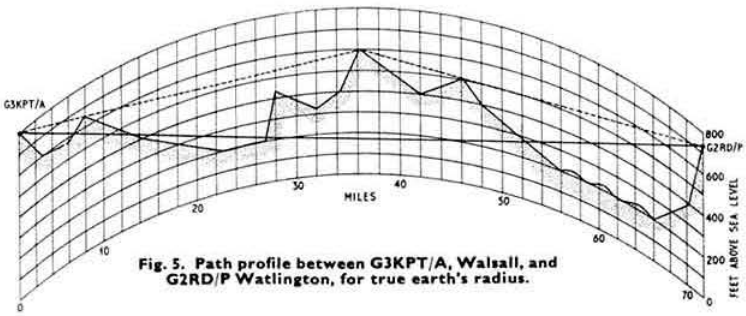


Fig. 5. Path profile between G3KPT/A, Walsall, and G2RD/P Watlington, for true earth's radius.

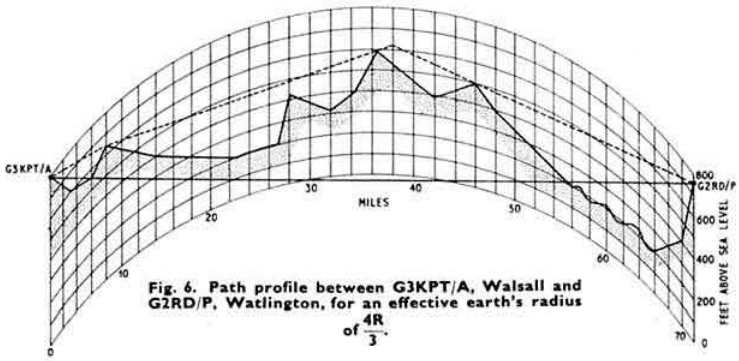


Fig. 6. Path profile between G3KPT/A, Walsall and G2RD/P, Watlington, for an effective earth's radius of $\frac{4R}{3}$.

G3KFD's aerial systems. From the top, 12 element 430 Mc/s collinear array, a trough corner reflector and a 6 ft. dish. On the ladder is G3OAD who helped during the 1250 Mc/s Tests.

G3KPT and G2RD, G2FN and G3FP. This event, the first tropospheric DX opening recorded in this country, was reported briefly in *Four Metres and Down* in January, 1963. G3KPT received G2FN at RS56/7, G2RD at RST4/549 and G3FP RST549; he was in turn received at RS57, RST4/54/59 and RST549.

On the following day G3KPT attempted to contact G3HBW and G8AL but conditions were deteriorating by then and though contacts were made on 70cm no signals could be received on 1296 Mc/s.

All stations concerned are to be congratulated in having u.h.f. equipment ready in working order to take advantage of the opening.

Equipment

The table shows the equipment used at the stations which have reported or have been reported on during the last four 1250 Mc/s tests. All the crystal controlled transmitters used tripling finals and, except for G5DT's parametric amplifier, all the receivers have crystal mixers as the first stage. It was hoped to give the transmitter frequencies in the table but this proved to be impractical due to the conflicting figures in the reports.

The following additional stations are known to have been on the band recently or to be actively building for the future: G2DD, G2WJ, G2CIW, G2FCA, G2HDJ, G3BNL, G3BVU, G3CGQ, G3EFX/P, G3EYV, G3GDR, G3IUL, G3NAE, G3NBQ, G3NOXT/T, G3OPB/T, G5CD, G5NF, G8JG, G8RW.

It would be interesting to get news of these people and their equipment. The list is incomplete of course!

The time of two weeks allowed for writing reports proved to be too short and it is proposed to allow four weeks this year. Members are asked to submit their entries within this time as late entries last year greatly complicated the

G2RD at his portable site during the 1250 Mc/s Tests 1963.

preparation of this report. If necessary photographs can be sent on later.

Conclusions

We probably now know how bad conditions can get on u.h.f.: this information while of great value might have been obtained on some other occasion. It is to be hoped that the band will be in better shape next year.

From the reports it would appear that frequency measurement and stability is not all that may be desired: discrepancies of 200 kc/s in calibration and drifts of 100 kc/s during each over make the use of narrow band receivers tricky to say the least.

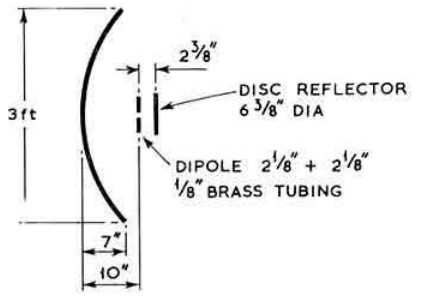
It is of interest that three stations reporting last year (compared with nil in 1962) gave figures for transmitter output power. As these would appear to be independent measurements the methods used might be interesting. No stations are now known to be using straight amplifiers on the band in the transmitter though input power to the triplers seems to be much higher than last year.

B. R. Arnold, G3FP, is to be awarded the Arthur Watts Trophy this year. He has been a regular exponent on the 1250 Mc/s Tests and is well known for his regular operation on the 1296 Mc/s band throughout the year.

Stations on 1300 Mc/s

Call-sign	Input	P.A.	Aerial	Receiver
G2FN	38W	2C39A‡	7-over-7 slot	
G2RD	3·5W	TD1/100A‡	3 ft. paraboloid	
G3FP	80W	2C39‡	3 ft. paraboloid	
G3FEX	45W			GEX66
G3FUL		703A†	½ wave stack	955
G3HAZ		DET24‡		
G3HBW	10W (1½W*)	DET24‡	corner reflector	CV2154
G3HWR			2 ft. paraboloid	CV2154
G3JQN		CV90‡		
G3KFD	3W*	DET24‡	6 ft. paraboloid	CV2154
G3KPT	4W	DET24‡	corner reflector	CV364
G3LTF	50W (10W*)	2C39‡	4 ft. paraboloid	1N23E
G3MPS	80W			
G5DT		2C39‡	3½ ft. paraboloid	Parametric
G6NF		CV90‡		R1294
G8AL	12W	2C39A‡	2 ft. paraboloid	IN23
G3GDR	2W*	DET24‡	2½ ft. paraboloid	

‡ tripler. † self excited oscillator. * power output.



Paraboloid feed arrangement used by G2RD. Similar arrangements are used by several other stations.

ARRL DX Contest 1964

The following is a summary of the rules for this year's ARRL DX Contest.

1. The contest periods are: **Telephony, February 8-9, and March 14-15; C.w., February 22-23, and March 28-29.**
2. The commencing time in each instance is **24.00 GMT Friday,** and the finishing time **24.00 GMT Sunday.**
3. **The object** is to work as many W-K-VE-VO-KH6-KL7 stations as possible in as many different call areas as possible **per band.**
4. **DX stations** will send the RS or RST report followed by a three-digit number representing power input. USA-Canada stations will send a number consisting of the RS or RST report followed by an abbreviation of the name of their state or province.
5. **Repeat contacts** on additional bands are permitted. The multiplier is the total call areas contacted on each band (maximum of 21 per band). Each completed QSO counts three points and an incompleted contact two points. The final score is the number of QSO points times the multiplier.
6. **Logs** should contain calls, dates, times (GMT), bands, exchanges and points. The summary sheet should indicate the sections of the contest, name, address and call-sign of the entrant, equipment used and power input, number of W/K/VE/VO call areas worked on each band, number of contacts on each band, number of hours' operation, names and call-signs of assisting persons, points claimed, multiplier and claimed score. A declaration stating " I certify, on my honour, that I have observed all competition rules as well as all regulations established for amateur radio in my country, and that my report is correct and true to the best of my belief. I agree to be bound by decisions of the ARRL Award Committee" is required. Logs and accompanying summary sheets should be sent to ARRL DX Contest, 225 Main St., Newington, Conn. 06111, U.S.A., and should be postmarked not later than **April 25, 1964.** Free log forms are available on request from ARRL.

CONTEST NEWS

RESULTS — REPORTS — RULES

Second 420 Mc/s Contest 1963

The Second 420 Mc/s Open Contest held on October 26-27, 1963, attracted fewer entries than the previous contest although the examination of the logs submitted shows that more than 70 stations were active during the period including five PA's, two F's, two DL/DJ and one ON.

The winner was again G3LTF who used 150 watts input to a 4X250 p.a. and a 96 element stack array comprising two-24-over-two-24 element arrays at 45 ft. centre height. G3LTF had one contact over 300 miles—DJ7HY (Osnabruk), at 332 miles and five contacts over 200 miles.

In second place was G3NNG/P who operated from the site of Uffingham Castle, six miles west of Wantage and who used a DET24 p.a. His best contact was with G3ILD, six miles north of Darlington at a distance of 219 miles. G3NNG reports his average mileage for contacts at 70 which is over 10 miles better than his average for the previous contest in which he was in third place.

The weather was reported from Wantage as dense cloud on the Saturday with everything wet and freezing cold. This did not deter G3NNG who reports conditions better than average. Farther east in the Colchester area conditions were reported as poor until late evening and then quite good on the Sunday.

G2XV voices a complaint shared by the Contests Committee when he says that many regular supporters of past contests were conspicuous by their absence—a pity! Thanks for check logs go to G2WS, G3AYC, and B.R.S.15744.

The best DX contacts logged by G3LTF were DJ7HY (Osnabruk) 332 miles, DL1JN (Kleinham) 270 miles, PA0TBE (Almelo) 274 miles, PA0EZ (Nijmegen) 236 miles, G3ICD (6 miles north of Darlington) 217 miles, and G2BDQ (7 miles west of Newcastle) 242 miles. G3NNG/P worked G3ILD at 219 miles, G3LQR worked PA0EZ at 200 miles and DL1JN at 230 miles. G3EGV/P also worked G3ILD at 221 miles.

The equipment in use has not been tabulated as it follows very closely that shown in the tabulation that appeared with the results of the first 1963 event.

Posn	Call-sign	Pts	Location		Power (watts)
*1	G3LTF	4766	3 miles S Chelmsford	S	150
†2	G3NNG/P	2521	6 miles W Wantage	S	10
3	G3LHA/P	2349	8 miles E Rugby 4 miles NE Coventry	S	25
4	G3LQR	2136	5 miles NE Colchester	S	150
5	G3JWQ	2070	10 miles N Derby	S	15
6	G3EGV/P	1967	6 miles S Swindon	M	100/5
7	G2XV	1869	3 miles S Cambridge	S	100
8	G2CIW	1842	4 miles SW Birmingham	S	60
9	G2RD	1358	2 miles W Croydon	S	28
10	G3OXD	1313	5 miles W Birmingham	M	12
11	GW3ATM/P	1295	4 miles NW Chepstow	S	5
12	G5DF	1095	3 miles W Reading	S	50
13	G3KEF/P	745	6 miles NW Coventry	S	25
14	G3EKP	388	4 miles S Blackburn	S	18
15	G3JDM/A	155	5 miles NW Wolverhampton	S	3
16	G3YH	101	Bristol	S	30
‡	G3MEH	214	5 miles S Croydon	M	
‡	G2HDJ	745	2 miles E Staines	S	

* denotes award of miniature cup. † certificate of merit. ‡ late entries. S single operator. M multi-operator station.

First 1·8 Mc/s Contest 1964

The rules for this year's First Top Band Contest are as follows:

1. **When:** 21.00 GMT on Saturday, March 14, to 03.00 GMT on Sunday, March 15, 1964.

2. **Eligible Entrants:** All fully paid-up members of the RSGB resident in G, GC, GD, GI, GM and GW.

3. The General Rules published in the January, 1964 issue of the RSGB BULLETIN relating to RSGB Contests will apply.

4. **Contacts:** C.W. (A1) only in the **1·8-2 Mc/s** band.

5. **Scoring:** Three points for contacts with stations in the entrant's own county and those counties having a common boundary with that of the entrant and five points for all other contacts.

6. **Contest Exchanges:** RST reports followed by the contact number starting with 001 and the county code letters given on page 52 of the January, 1964, issue of the BULLETIN, e.g. for a contact from Surrey 579005SY. All reports must be acknowledged with "R".

7. **Logs:** (a) Must be tabulated in columns headed (in this order): "Date/Time GMT," "Call-sign of station worked," "My report on his signals and serial number sent," "His report on my signals and serial number received," "County code letters received," "Points claimed." The county code letters as sent must be entered at the top of each log sheet.
(b) The cover sheet must be made out in accordance with RSGB Contest Rule 4. The declaration must be signed.
(c) Entries must be postmarked not later than **March 30, 1964.**

8. **Power Input:** The d.c. input to any stage of the transmitter shall not exceed **10 watts.**

9. **Awards:** At the discretion of the Council, the **Somerset Trophy** will be awarded to the winning station and certificates of merit to the stations placed second and third. In addition, the **Maitland Trophy** will be awarded to the Scottish member with the highest aggregate number of points in this contest combined with the Second 1·8 Mc/s Contest 1963.
A **certificate of merit** will also be awarded to the **non-transmitting member** submitting the best check log. Check logs submitted by non-transmitting members for consideration for the award of a certificate of merit should give in this order the following details: Date/Time (GMT); Band; Call-sign of station heard; Report and serial number sent by station heard; Call-sign of station being worked; any other information required by the above rules.

Claims for RSGB Certificates

Members are reminded that claims for RSGB Certificates should be sent direct to Headquarters. Claims are acknowledged on arrival and passed to the Honorary Certificates Manager for attention.

Correspondent Wanted

Seventeen year old Roland Gabanou (R.E.F.14084) of 29 Rue Brauhauban, Tarbes, (H.P.), France, would like to correspond with an RSGB Associate Member, about his own age, on Amateur Radio and electronic subjects.

As Roland's letter to Headquarters was written in French it would seem that his British correspondent should have some knowledge of the French language.

Owing to increased pressure of work it is proposed to enlarge the Contests Committee. Members who are prepared to attend meetings at Society Headquarters are invited to forward their names to the General Manager. The Committee usually meets at least monthly on Thursdays at 6.30 p.m.

General Rules for RSGB Contests 1964

The following rules apply to all RSGB Contests except where modified in individual events and are to be read in conjunction with the details for each contest published in the RSGB BULLETIN.

Rule 1. **Entrants** must operate in accordance with the terms of their licences. (N.B. /T stations are ineligible by the terms of their licence to take part in contests.)

Rule 2. **Unlicensed Stations.** Contacts with unlicensed stations will not count for points.

Rule 3. **Contacts.** Only one contact on each band may be made with a specific station, whether fixed, portable, mobile or alternate address. Mobile stations are stations installed in motor vehicles or vessels on inland waterways and so equipped that they are capable of operation in motion without any alteration. Duplicate contacts must be logged and clearly marked as duplicates without claim for points. Cross-band contacts may not be claimed. Proof of contact may be required.

Rule 4. **Entries** must be clearly written or typed ON ONE SIDE ONLY of RSGB contest log forms or on foolscap or quarto paper and must be set out in the form prescribed in the published details for the contest concerned. The **cover sheet** of an entry must be made out in the following form and all the information filled in:

Contest.....Date.....Claimed Score.....
Section (if any)..... Call-sign.....
Name .....
Home Address.....
.....
Address of station or Portable Location.....
(if other than home address above)
.....
QTH as transmitted.....
National Grid Six Figure Reference, County Code Letters or other co-ordinates (see contest details).....
Transmitter(s) .....
Receiver(s) .....
Aerial(s) .....

DECLARATION: I declare that this station was operated strictly in accordance with the rules and spirit of the contest, and I agree that the decision of the Council of the RSGB shall be final in all cases of dispute. I certify that the maximum input to the final stage of the transmitter was.....watt(s)

Date..... Signed.....

Failure to complete the cover sheet or sign the declaration will involve disqualification of the entry.

Rule 5. **Entries.** All entries become the property of the Radio Society of Great Britain. In the event of any dispute the ruling of the Council of the RSGB shall be final.

Rule 6. **Multiple Operator Entries.** Unless otherwise stated, single operator entries only will be accepted. A single operator station is one manned by an individual operator who receives no assistance from other persons during the contest periods. A multi-operator station is one which does not conform to this definition. In those contests where multiple operator entries are allowed, such entries will only be accepted provided that:

(a) The call-sign of the operator concerned is indicated for each contact.
(b) The declaration is signed by only one operator who will be regarded as the entrant.
(c) The names and call-signs of all operators are listed on the cover sheet.

Rule 7. **Portable stations** must operate from the same site for the duration of a contest and may not be located in a permanent building. Power must not be derived directly from public or private supply mains. No apparatus may be erected on the site prior to the day of the event.

Rule 8. The details relating to specific contests published in the RSGB BULLETIN shall be regarded together with these general rules as the rules of the contest.

* * *

Printed log sheets and cover sheets are available from RSGB Headquarters on request.

432-434 Mc/s ACTIVITY NIGHT
SATURDAYS at 7 p.m.

CONTESTS DIARY

January 25-26 - REF (c.w.)
January 25-26 - CQ WW 160m Contest.
January 26 - 144 Mc/s C.W. Contest. (See page 321, November 1963.)

February 1-2	— Affiliated Societies' Contest (see page 380, December, 1963).
February 8-9	— ARRL DX Contest (Phone) (see page 49).
February 15-16	— BERU. (For rules, see page 261, October, 1963.)
February 15-16	— QCWA Party.
February 22-23	— ARRL DX Contest (C.w.) (see page 49).
February 29-March 1	— REF (Phone)
February 29-March 1	— First 1·8 Mc/s Contest.
March 14-15	— ARRL DX Contest (Phone) (see page 49).
*March 7-8	— 144 Mc/s Open and Listeners' V.H.F. Contests.
March 28-29	— ARRL DX Contest (C.w.) (see page 49).
April 4-5	— PZK (C.w.).
April 4-5	— Helvetia 22 Contest.
April 5	— Low Power Contest.
April 11-12	— CQ WW DX SSB Contest.
April 12	— D/F Qualifying Event (Rugby).
April 18-19	— PZK (Phone).
April 18-19	— REF (Phone).
April 19	— D/F Qualifying Event.
April 25-26	— PACC (C.w.).
April 26	— D/F Qualifying Event (Newbury or Oxford).
*May 2-3	— First 144 Mc/s Portable Contest.
May 2-3	— PACC (Phone).
May 2-3	— USSR DX Contest (C.w.).
May 9-10	— OZ CCA (C.w.).
May 10	— D/F Qualifying Event (Manchester).
May 16-17	— OZ CCA (Phone).
May 30-31	— CHC/HTH Party.
*May 30-31	— First 420 Mc/s Contest.
June 6-7	— National Field Day.
June 14	— D/F Qualifying Event (High Wycombe).
June 20-21	— 70 Mc/s Contest.
June 28	— D/F Qualifying Event (Derby).
June 27-28	— RSGB 1250 Mc/s Tests.
*July 4-5	— Second 144 Mc/s Portable Contest.
July 12	— D/F Qualifying Event.
July 19	— D/F Qualifying Event (Wirral).
July 26	— D/F Qualifying Event.
*September 5-6	— V.H.F. National Field Day.
September 13	— D/F National Final.
September 19-20	— Low Power Field Day.
October 3-4	— RAEN Rally.
October 21-22	— Second 420 Mc/s Contest.
October 31-November 1	— RSGB 7 Mc/s DX Contest (Phone).
November 21-22	— RSGB 7 Mc/s Contest DX (C.W.).
November 28-29	— Second 1·8 Mc/s Contest.
December 5-6	— RSGB 21/28 Mc/s Telephony/Receiving Contests

* *To coincide with Region 1 IARU dates.*

List of United Kingdom Counties for RSGB Contests

County Code Letters	County	Code Letters of Adjacent Counties
AD	Alderney	
AG	Anglesey	CV
AL	Argyllshire	AY, BU, DU, IS, PH, RW
AM	Antrim	DW, LY
AN	Aberdeen	AS, BF, IS, KE, PH
AR	Armagh	DW, TE
AS	Angus	AN, KE, PH
AY	Ayrshire	AL, BU, DF, KB, LK, RW, WG
BD	Bedfordshire	BS, CE, HF, HN, NR
BE	Berkshire	BS, GR, HE, OX, SY, WE
BF	Banff	AN, IS, MY
BR	Brecknock	CA, CR, GN, HD, MR, RN
BS	Buckingham	BD, BE, HF, MX, NR, OX, SY
BU	Bute	AL, AY
BW	Berwick	EL, MN, ND, RH
CA	Cardigan	BR, CR, MG, MR, PK, RN
CD	Cumberland	DF, DH, LE, ND, RH, WD
CE	Cambridge	BD, EX, HF, HN, LN, NK, NR, SF
CH	Cheshire	DB, DY, FT, LE, SD, SE, YS
CL	Cornwall	DN
CN	Clackmannan	FE, KS, PH, SG
CR	Carmarthen	BR, CA, GN, PK
CT	Caithness	SU
CV	Caernarvon	AG, DB, MR
DB	Denbighshire	CH, CV, FT, MG, MR, SE
DF	Dumfries	AY, CD, KB, LK, PB, RH, SK
DH	Durham	CD, ND, WD, YS
DN	Devon	CL, DT, ST
DT	Dorset	DN, HE, ST, WE
DU	Dunbarton	AL, LK, PH, RW, SG
DW	Down	AM, AR
DY	Derby	CH, LR, NM, SD, YS
EL	East Lothian	BW, MN
EX	Essex	CE, HF, KT, LD, MX, SF
FE	Fife	CN, KS, PH
FH	Fermanagh	TE
FT	Flintshire	CH, DB, SE
GN	Glamorgan	BR, CR, MH
GR	Gloucester	BE, HD, OX, WK, WR
GY	Guernsey	
HD	Hereford	BR, GR, MH, SE, WR, RN
HE	Hampshire	BE, DT, SX, SY, WE
HF	Hertford	BD, BS, CE, EX, MX
HN	Huntingdon	BD, CE, NR
IM	Isle of Man	
IS	Inverness	AL, AN, BF, MY, NN, PH, RY
JY	Jersey	
KB	Kirkcudbright	AY, DF, WG
KE	Kincardine	AN, AS
KS	Kinross	CN, FE, PH
KT	Kent	EX, LD, SX, SY

County Code Letters	County	Code Letters of Adjacent Counties
LD	London	EX, KT, MX, SY
LE	Lancashire	CD, CH, WD, YS
LK	Lanark	AY, DF, DU, MN, PB, RW, SG, WN
LN	Lincoln	CE, LR, NK, NM, NR, RD, YS
LR	Leicester	DY, LN, NM, NR, RD, SD, WK
LY	Londonderry	AM, TE
MG	Montgomery	CA, DB, MR, RN, SE
MH	Monmouth	BR, GN, GR, HD
MN	Midlothian	BW, EL, LK, PB, RH, SK, WN
MR	Merioneth	CA, CV, DB, MG
MX	Middlesex	BS, EX, HF, LD, SY
MY	Moray	BF, IS, NN
ND	Northumberland	BW, CD, DH, RH
NK	Norfolk	CE, LN, SF
NM	Nottingham	DY, LN, LR, YS
NN	Nairn	IS, MY
NR	Northants	BD, BS, CE, HN, LN, LR, OX, RD, WK
OX	Oxford	BE, BS, GR, NR, WK
OY	Orkney	
PB	Peebles	DF, LK, MN, SK
PH	Perth	AL, AN, AS, CN, DU, FE, IS, KS, SG
PK	Pembroke	CA, CR
RD	Rutland	LN, LR, NR
RH	Roxburgh	BW, CD, DF, MN, ND, SK
RN	Radnor	BR, CA, HD, MG, SE
RW	Renfrew	AL, AY, DU, LK
RY	Ross & Cromarty	IS, SU
SD	Stafford	CH, DY, LR, SE, WK, WR
SE	Shropshire	CH, DB, FT, HF, MG, RN, SD, WR
SF	Suffolk	CE, EX, NK
SG	Stirling	CN, DU, LK, PH, WN
SK	Selkirk	DF, MN, PB, RH
SL	Shetland	
SR	Sark	
ST	Somerset	DN, DT, GR, WE
SU	Sutherland	CT, RY
SX	Sussex	HE, KT, SY
SY	Surrey	BE, BS, HE, KT, LD, MX, SX
TE	Tyrone	AR, FH, LY
WD	Westmorland	CD, DH, LE, YS
WE	Wiltshire	BE, DT, GR, HE, ST
WG	Wigtown	AY, KB
WK	Warwick	GR, LR, NR, OX, SD, WR
WN	West Lothian	LK, MN, SG
WR	Worcester	GR, HD, SD, SE, WK
YS	Yorkshire	CH, DH, DY, LE, LN, NM, WD

Letters to the Editor

Neither the Editor nor the Council of the Radio Society of Great Britain can accept responsibility for views expressed by correspondents. Letters for inclusion in this feature should be concise and preferably not more than 200 words in length.

The Late President Kennedy

DEAR SIR,—I was very pleased to read in the December "BULL" of the prompt message of sympathy sent to ARRL on the untimely death of President Kennedy. The late John Fitzgerald Kennedy set a high example of service and dedication to the cause of international understanding. His work for the removal of ignorance, predjudice, and the fear that divides nations must surely be an inspiration to those in the amateur radio movement who are seeking the same ideals through our international hobby. President Kennedy's whole life has been dedicated to public service, and it is important to note that it was through the medium of radio and television that he became such a popular figure throughout the world.

We in Ireland mourn him particularly as a good man who derived great spiritual strength from the land of his ancestors.

Yours faithfully,
HENRY L. WILSON, EI2W

Foxrock, Co. Dublin.

New Headquarters

DEAR SIR,—We wish to endorse the views of G3JTG et al in their letter published in the November BULLETIN.

In the past, two reasons have been given for the new Headquarters to be in London; first, that it is readily accessible to most parts of the country; second, that it is the home of the GPO Headquarters.

Quite apart from cost, the first excuse is untenable. Most of the larger towns in the Midlands are as easily reached as London, and by their own argument, easily reached by the London members. And they can be reached by a far larger number of members. We have heard that premises have been sought as far out as Wembley! Steady, chaps, native bearers are unreliable west of the Marble Arch!

So far as Post Office liaison is concerned, one thinks how hard life must be for the ARRL. But most Government Departments are to examine the possibility of moving their Headquarters out of London. It would be tragic to spend our last trouser-button on a London Headquarters and then find they had moved elsewhere!

Yours sincerely,
H. S. CHADWICK, G8ON; M. DANN, G3NHE; P. JACKSON G3OZM; J. WHITTINGTON, G3OZO; P. E. Chadwick, G3RZP; E. W. BADGER, G3OZN; R. ROBSON, G3RYJ; W. NILAN, G3PRD.

Worksop, Notts.

DEAR SIR,—It is interesting to note that a group of members has written concerning the location of a new Headquarters. This is all to the good although in my opinion they are "off the beam."

There are many factors which have been overlooked by them, including the all important one of personnel to do the behind-the-scenes work.

In the London area, which has the greatest concentration of members, we have had the greatest difficulty in finding sufficient back-room workers. One per cent, or less, of the area's membership can be identified as doing some work for the Society. Where in the country is there another concentration of members which could be relied upon to produce even the number we now have?

I write from experience—continual service with the Contests Committee since before the war (and we've always been short of workers), member of Council during and since the war, DR, RR, and ZR. Helpers are in such short supply that one member of the Contests Committee has calculated that in one year he has given the equivalent of one month's work calculated at normal working hours. Another estimated that the cost of his labour, at his rate of income, was about £420/450.

Can anyone imagine how the Exhibition Committee, which well pays for itself, could operate from anywhere but the London area?

Headquarters has all the records and there is often a need for immediate reference for information during a meeting; in addition, the Headquarters staff provides a large amount of supporting work, before, after and during meetings.

The Council, the Committees and Headquarters staff are all inseparable.

No, the London area is stuck with it, and there is unfortunately, no other area which could possibly cope.

As the prime mover in changing the Society from one run exclusively by London to the present arrangement, and as a firm supporter of a National Society and the Representative Regional scheme engendered by Mr. Arthur Watts, for many years our President, I would also support a scheme to place Headquarters outside London if there was a ghost of a chance of finding the necessary (voluntary) workers in any other area.

The question must not be put in a referendum because the opinions held could not be based on knowledge. The membership have already had their referendum in electing their Council, a National body, who alone have all the facts and must act accordingly.

Yours faithfully,
W. H. MATTHEWS, G2CD

Seven Kings, Essex.

Solar Radio Bursts

DEAR SIR,—With reference to Mr. M. P. Hughes' interesting paper in the November BULLETIN I feel I must correct him on one point, i.e. in regard to the discovery of such bursts. One becomes accustomed to professional journals and text books ignoring the early work done by radio amateurs some time before the 1939 war but when it comes to the RSGB BULLETIN also slipping up on the point that is too much to swallow! No doubt this is indicative of the fact that those of us that participated are fading into the category (all too soon) of "Old Timers"! I suppose it is about time I dusted the files and looked up our records of around 1937 and wrote up a short history for the BULLETIN.

Any way, to quote Dr. F. G. Smith of the Cavendish Laboratory, *New Scientist*, October, 1957. "We were well aware of the early observations made by Mr. Heightman and the radio amateurs on the reception of "hissing" atmospherics and have been much interested to read of the further correspondence summarized in the above letter; this correspondence probably gives the first suggestion that detectable radio waves from the Sun are associated with solar activity and we are very glad that this account has been published." The letter referred to was one by myself giving a short summary of the early work (commencing with a letter to the *Wireless World* on March 29, 1936.)

In those days the only other known work was that of Jansky on cosmic radio noise from the Milky Way.

Yours sincerely,
DENIS HEIGHTMAN, G6DH

Clacton-on-Sea.

The G2DAF Linear

DEAR SIR,—As one of the relatively old timers of sideband operation, I was very interested in the description of the G2DAF Linear amplifier in the April, 1963, issue of the BULLETIN and the subsequent correspondence in the September issue. It came as something of a surprise, however, when I read that the method of supplying screen grid power for the 813 or similar output valve by rectification of a part of the grid drive was an entirely new principle.

In 1956 and 1957 I had many discussions with GW2DUR on 20m who was actively interested in amplifiers which could be used in the zero bias condition, and was experimenting to find a way of driving both grids of an 813 without using the valve in the grounded grid configuration and without the necessity for conventional neutralization. He hit upon the idea of putting a diode between the screen and control grids, with a capacitor grounding the screen as far as r.f. was concerned, i.e. the exact circuit of Fig. 3 in Mr. Thornley's article. Many of the operators active at that time, including G2MA and myself, gave the circuit a trial and whilst it worked quite well, it had the disadvantage of producing only a limited screen grid voltage swing which could lead to the allowable dissipation of the control grid being exceeded under heavy drive conditions.

GW2DUR and G2MA both investigated the possibility of rectifying some of the output power of the amplifier as a source of screen grid supply, but both found the circuit to be too critically dependent on the loading conditions and under certain

circumstances a form of "thermal runaway" could occur. These disadvantages led GW2DUR to the idea of trying the Cockcroft-Walton type of voltage doubler and tripler as a means of increasing the available voltage for the screen grid of the valve but this naturally increased the grid drive requirements considerably and the idea was abandoned in favour of a system using a gating valve to supply screen voltage from a d.c. source. G2MA solved the same problem by using the clamp valve system.

I think it is true to say that all the principles and problems of this type of amplifier were thoroughly investigated by the two amateurs already mentioned and I personally had contacts with both of them on many occasions in 1956 and 1957 using linear amplifiers deriving screen power directly from the rectification of some of the r.f. drive.

Yours faithfully,
G. M. KING, B.Sc., M.D., F.F.R., G3MY

Bamford, nr. Sheffield.

Two Metre Band Plan

DEAR SIR,—At the recent V.H.F. Convention in Manchester, which was well attended by a cross section of the fraternity, the present Band Plan was debated at length, but few clear ideas emerged as to what was really wanted by the majority and it would seem that there is no simple solution to the problem of bringing the Plan up to date.

May I, in the light of those discussions and subsequent thought on the matter, offer the following suggestions for further comment by those interested and for consideration by the relative RSGB Committee?

(i) Let the planners arbitrarily re-plan the greater part of the band on a regional basis in the light of up to date information and past experience.
(ii) In the new Plan set aside 100 kc/s for the exclusive use of c.w. This band to be free for all, encouraging the use of single channel v.f.o. break-in techniques and to accommodate QRO DX working.
(iii) Set aside up to 40 kc/s for the exclusive general use of s.s.b.
(iv) On the "inside" edge of the s.s.b. allocation designate a mobile working channel of, say, 10 kc/s.

I fully realize that these suggestions represent Band Planning with a vengeance but there is something for everybody and I believe there are enough operators interested to make a plan like this work. With reference to the c.w. band, it is possible that some surprising DX would result.

Yours sincerely,
G. N. ROBERTS, G3ENY

Bridgnorth, Shropshire.

Aerials for 4m Mobile

DEAR SIR,—As an operator who has operated on 4m mobile (and fixed) ever since I received my licence and worked about 35 stations on four while mobile I think I may say I have a little first hand knowledge of that band.

I frequently work G3GVM who is situated in a fairly good location about 220 ft. a.s.l. when I drive from Worthing to the Chichester/Emsworth areas. I use a ¼ wave aerial, mounted on the vehicle roof whilst G3GVM has both a ¼ wave aerial mounted in his attic and a two element rotary beam mounted on a chimney. From 0-10 miles approximately the dipole is undoubtedly superior whilst from 10 miles to the maximum range of about 30 miles it is impossible to tell the difference between the two aerials. This range may not seem exceptional to some but there is considerable screening by hills.

On the basis of considerable operational experience of 4m mobile I should say that vertical aerials are a "must" for mobile and if possible aerials of both polarizations should be installed at the fixed station, a multi-element beam for DX, both to other fixed stations and mobile as cross-polarization attenuation at a distance is non-existent (it may actually be a gain!) and for local net working an omni-directional vertical aerial (either a ground plane or turnstile).

If the V.H.F. Committee is in need of further evidence in favour of vertical mobile aerials for four I would be pleased to give several other cases which gave results similar to the above, which in fact shows that as far as fixed stations go you put up whatever you like. Those who want to make their cars look hideous (i.e. like many low frequency mobiles) with massive halos are surely welcome to do so!

In conclusion I would like to say that all the above remarks concern only 4m, not having had much experience of 2m operation personally.

Yours faithfully,
BOB TARR, G3PUR

Worthing, Sussex.

Modulation of Solid State Devices

DEAR SIR,—Having been involved of late in the development of new techniques for utilizing solid state devices at u.h.f. it has occurred to me that they may well influence amateurs over the next five years or so.

There are, however, one or two basic difficulties. To face these now might make a great deal of difference in the future. While transistorized transmitters giving up to 10 watts output at 144 Mc/s are feasible, if expensive at present, I can vouch from hard experience that attempts to apply amplitude modulation can be disastrous unless the unmodulated carrier power is reduced to half the c.w. figure or less. This is a very wasteful practice and even then the modulation depth available without distortion is only 60 per cent or so.

There are however in existence Varactor multipliers giving overall efficiencies up to 80 per cent (there being no power supply requirements of course). However, any attempt at a.m. is defeated by the non-linear nature of the multiplication process. It has been suggested that the diode itself may be modulated but this is a wasteful method as the peak of the modulation cycle can never exceed the c.w. output of the device and the mean power is reduced. Distortion and the production of spurious sidebands would appear to be inevitable and this fear is amply borne out in practice.

In view of the foregoing, may I put forward a strong plea for f.m.? Both transistor output stages and Varactor multipliers are very difficult devices to match to a load when compared with valves but when using f.m. they at least operate in a steady condition and at maximum efficiency.

Marine mobile equipment on 150-170 Mc/s caters for maximum deviations of up ± 15 kc/s and I see no reason why amateurs should not have the same facilities. That receivers may need modification is true but as most amateurs use special tunable i.f.'s at v.h.f.-u.h.f. this is no great problem, especially as commercial 10·7 Mc/s components are so freely available. The transmitter end may well use Varactor diodes shifting crystal frequency—quite feasible at v.h.f. Finally, there is that boon, automatic frequency control, which is so easy to provide on an f.m. receiver and which overcomes so many problems due to frequency drift. The tuned converter, as opposed to crystal controlled, can be made quite cheaply from commercial TV bits and pieces and with a.f.c. can give every satisfaction when used on f.m. signals (I have never found a.f.c. to be so useful on a.m. where a high modulation index is used).

Once again, let's think again about f.m. In terms of watts output per £ it wins every time and would make v.h.f./u.h.f. transmitter designs much simpler above 144 Mc/s.

In particular, two push-pull Varactor multipliers can give useful output at 1296 Mc/s with 144 Mc/s drive and be mobile to boot but a.m. is out of the question. What do others think?

Yours faithfully,
J. B. GURNEY, B.R.S.10548

Twickenham, Middlesex.

A New Name for the Bulletin?

DEAR SIR,—W2BSR was joking, of course, when he suggests as a further consideration, that the "BULL" be referred to as the "Jour." Good grief! Imagine two veteran amateurs (for that matter any two amateurs) greeting each other with, "Hey, Charlie! Seen the Jour this month?"

In my dictionary the word bulletin appears as: "short official statement of public event of news or of invalid's condition." How appropriate, since the BULL publishes all of these.

Similarly, the word "Journal" has little bearing to the BULLETIN.

Let's leave well alone! The BULLETIN will always be the "BULL" to me, and I daresay countless others, no matter what fancy name is eventually stamped on the front page!

Yours sincerely,
JIM BRIGGS, 5N2RSB

Kaduna, Nigeria.

(5N2RSB's definition would seem to support those who wish to change the name rather than his own argument.—EDITOR)

CLUBROOM

A Monthly Survey of Group and Club Activities

Amateur Radio Clubs and Insurance

Quite a few enquiries have been received recently regarding the " public liability " of groups and clubs.

Any club or group which takes part in exhibitions, fetes, field-days or in any activities in which the general public may be involved should give serious consideration to taking out public liability insurance to cover their legal liability for damage or injury to third parties. Imagine where you would stand if, for example, a mast holding up your NFD aerial were to collapse and injure or even kill someone visiting the site. An officer of the club might be held legally liable for the accident and, without insurance, could be in a serious position.

A similar unlucky accident could occur at an exhibition—should your hanging sign " crown " a spectator for instance. If you had been prudent enough to insure your liability for injury to the public any subsequent action for damages brought against the club or group would be looked after by the insurance company and not become a financial as well as an actual calamity for the club.

Rates for such cover vary somewhat from company to company, and as this is a very specialized form of insurance it is strongly recommended that one of the larger, well established offices be approached, but in general a premium of around £2 should provide an indemnity of up to £100,000. Note that with public liability insurance premiums are not proportional to indemnity. It is customary nowadays for such policies to include the risk of " contingent fire," i.e. damage resulting from a fire caused by an accident insured under the policy, and care should be taken to see that this risk is not excluded.

Generally speaking, a member of a club would not be regarded as having a claim against the club in Common Law and hence no claim under the club's third party policy for injury he might suffer during club activities, so even if you are insured don't be too slap-happy when raising that aerial mast!

If your club is the proud possessor of valuable cups or other trophies it is well worth while insuring them against theft or other loss when they are either on the club premises or elsewhere.

News from the Newsletters

Budding radio astronomers are reminded by *The Cornish Link* that they do not need hundreds of pounds' worth of equipment to get going in this branch of science. The Cray Valley *Newsletter* presents an introduction to the mysteries of transistor circuitry and usage which should be useful to old timers and newcomers alike. What may unfortunately be an all too frequent state of affiairs is mentioned in the *Lea Valley Reflector*: do you support your club, or do you just complain that its activities are not in your particular line of interest? The MARTS *Newsletter* recently asked for controversial letters, and got several—all very controversial. The second issue also contains some useful information on the QQVO6-40A. *Radial*, the journal of the Radio Amateur Invalid and Bedfast Club, carries an interesting article on patient-operated selector mechanisms (" Possum ") for use by the disabled. The Reigate *Feedback* describes a versatile vertical aerial used by G3FM, though the burying of some 600 ft. of wire at a depth of 4 in. may be a trifle upsetting to existing garden arrangements. *Circular Letter No. 37* of WAMRAC, the World Association of Methodist Radio Amateurs and Clubs, reports a very successful get-together at the Radio Communications Exhibition, and gives details of their far flung activities. Stourbridge *Newsletter* wonders where all the amateurs go in the winter time, and suggests that if they are building new gear there should be some good signals about in the new year. The Radio Society of Ceylon's *4S7 Bulletin* describes 4S7NB's very successful one transistor modulated crystal oscillator transmitter on 40m and gives log extracts as proof for anyone who may doubt that you can go places with only a few milliwatts.

The *Lothians Radio Amateur* contains some useful information on the W3EDP multiband aerial and a description of a transistorized VOX unit, as well as some interesting comments on Lothians participation in last year's NFD. The first issue of Norfolk ARC's *Challenge* has articles on a simple electronic key, a two transistor Top Band rig and an aerial tuning unit and an item with the provocative title " A.M. is Outsville, Man! "

Jack Antony, G3KQF, and Fred Ward, G2CVV (Region 4 Representative) and Mr. Eley of the British Red Cross watch Brian Speakman, B.R.S.23256, ASR for Derby and District Radio Society, try the " kiss of life" on a dummy at a lecture on first aid.

(Photo by Martin Shardlow, A.1706)

Club Reports

British Amateur Radio Teleprinter Group. The AGM in London on November 1 was attended by 21 members. The Chairman, G6NZ, announced that the GPO had given permission for broadcast transmission of amateur RTTY signals—a very worthwhile concession. The Group now has 120 members. The Honorary Secretary is A. C. Gee, G2UK, " East Keal," Romany Road, Oulton Broad, Suffolk, who contributes the *RTTY* feature in the BULLETIN.

Cornish Radio & Television Club. At the November meeting G3OFN gave a demonstration of divining, or dowsing, using two copper rods. Several members took the opportunity to test their own divining powers. This method can apparently be used to find buried cables. The Honorary Secretary is W. J. Gilbert, 7 Poltair Road, Penryn, Falmouth.

Cray Valley RS. At the last AGM the Honorary Secretary (S. W. Coursey, G3JJC, 49 Dulverton Road, London, S.E.19), gave one year's notice of resignation. There are now about three months to go for the next holder of office to step forward!

Cotswold Radio Contest Club. A keen, small, but increasing, membership continues to take part in a variety of contests. Honorary Secretary: K. H. Walden, G3OLN, 1 Hawthorn Road. Cheltenham, Glos.

Crawley ARC. The November informal meeting was held at the QTH of Ken Franklin, G3JKF. Unfortunately Furnace Green is not yet on the Crawley map, and intending visitors may have had difficulty in finding this new QTH. Details may be obtained from the Honorary Secretary, R. G. B. Vaughan, G3FRV, 9 Hawkins Road, Tilgate, Crawley, Sussex.

Dorking and District RS. The annual film show was held in November; during a technical hitch G3OLM filled the gap with a talk on his new transistorized rig. Honorary Secretary: J. Greenwell, G3AEZ, Eastfield, Beare Green, near Dorking, Surrey.

East Kent Radio Society. A Contest Committee has been formed with G3SGH as the Chairman. The hall at the County Hotel, Canterbury, was packed to capacity for a recent lecture and film show given on behalf of Mullard Ltd., by Ian Nicholson. The lecture dealt with 625 line television. Honorary Secretary: D. N. T. Williams, G3MDO, Seletar, New House Lane, Thanington, Canterbury, Kent.

Enfield & District. Due to the change of the meeting day from Tuesday to Thursday, G3HRH was unable to give his talk, and a tape recording of " The Voice of America Amateur Radio Broadcasts " was played instead. Meetings now begin with a period of Morse practice. The Area Representative is John Gazeley, B.R.S.20533, 192 Haselbury Road, Edmonton, London, N.9.

East London Group. At the November meeting John Clarricoats, O.B.E., G6CL, gave a talk entitled " My Jubilee Year " which dealt with the growth and progress of the RSGB. Noel Ta'Bois, G3HWG, recorded the talk on tape, and this should soon be available for the enjoyment of other clubs. The Deputy R.R. for the area is M. McBrayne, G3KGU, 25 Purlieu Way, Theydon Bois, Essex.

First Class Operators' Club. Thirty-four members and their wives and friends attended the Sixteenth Annual Dinner which was held at the Shaftesbury Hotel on November 2. The dates for the FOC contests have been changed to a " Marathon " in May, and a " DX Marathon " in September. The Honorary Secretary is L. W. Belger, G3JLB, 103 Whitehill Road, Gravesend, Kent.

Lichfield ARS. A new committee was elected at the AGM held on November 4. Membership is increasing. XYL's recently held a jumble sale to augment club funds for the dinner/dance. Honorary Secretary: V. Hickman, G3LXR, 143 Main Street, Stonnall, Walsall, Staffs. Details of meetings are given in *Forthcoming Events.*

Lothians RS. On November 28 a visitors' night was held. This was a " standing-room-only " affair with a gathering of over 70 amateurs from as far afield as Glasgow, Fife, Lanarkshire, and Falkirk. This type of meeting is proving a great success, and the idea is fast catching on. The Honorary Secretary is L. R. Richardson, GM3AKM, 64 Wester Drylaw Place, Edinburgh, 4.

Medway Amateur Receiving and Transmitting Society. Gillingham ATC have asked G6NU for help in forming a radio section, and any assistance in the way of lectures would be much appreciated. Honorary Secretary Mrs J. D. Davis, 24 Trinity Road, Gillingham, Kent.

Mid-Warwickshire ARC. Meetings are held on alternate Mondays at the CD HQ, Leamington Spa. The Honorary Secretary is T. Inkester, 13 Dormer Place, Leamington Spa. The AGM is on January 13.

Mitcham & District RS. At a recent meeting, G3HQX explained the basic ideas of s.s.b. using his G2DAF transmitter to illustrate his talk. A Junk Sale is scheduled for January 17.

Norfolk ARC. Meetings of this newly formed club are held twice a month on Monday evenings. Details may be obtained from S. A. Kerrison, G3MFQ, 32 Tiercel Avenue, Norwich, NOR 76R.

Northern Heights ARS. A party of members visited London for the Radio Communications Exhibition. The club has been presented with a large quantity of surplus equipment in aid of club funds. The Honorary Secretary, A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorks., will be pleased to give information on activities.

North Kent RS. The society operated GB3ENT at Crownwoods School Radio Club at Eltham which was particularly successful from the point of view of gathering several potential new members. Honorary Secretary: B. J. Reynolds, G3ONR, 49 Station Road, Crayford, Kent.

Peterborough and District Amateur Radio Society. At the December meeting a " Brains Trust " on TVI was held. G3KPO presided, and the panel consisted of G3ARS, G3HXR, G2BYI, G3RDZ, G3RED, and W. Taylor. Honorary Secretary: D. Byrne, G3KPO, Jersey House, Eye, Peterborough, Northants.

Poplar. Members interested in forming a local RSGB group are asked to get in touch with W. A. Parmenter, B.R.S. 22445, 41 David's House, St. Leonards Road, Poplar, London, E.14.

Radio Amateur Invalid and Bedfast Club. Data Publications have donated a large parcel of Panel Sign Transfers for which members have only to ask. As the result of the raffle of a " Joystick " aerial presented by G3CED, the club has been sent £2 2s. by the RSGB Region 8 Representative. Honorary Secretary: Frances Woolley, G3LWY, 10 Sturton Road, Saxilby, Lincoln.

AFFILIATED SOCIETIES' CONTEST

FEBRUARY 1-2, 1964

For rules, see page 380, December, 1963

At the November 1963 meeting of the London Members' Luncheon Frank Fletcher was presented with a table lamp in recognition of 10 years' service as Honorary Secretary. In this picture, left to right, are W. E. F. Corsham, G2UV, Deputy Chairman of the Club, Mrs Fletcher and Mr Fletcher.

(Photo by G3NMR)

Reigate Amateur Transmitting Society. The annual film show and ladies' night was held in November, when members and their wives enjoyed a travel talk by Nell Corry, G2YL, on her recent African tour. The AGM is to be held on January 18 and Annual Dinner/Dance at the Mill House, Salfords, on February 15. The Honorary Secretary is F. D. Thom, G3NKT, 12 Willow Road, Redhill, Surrey.

South Dorset Radio Society. At the December meeting a lecture was given on aerial theory. Members visited the *Dorset Evening Echo* printing plant at Weymouth on November 30. Honorary Secretary: C. E. Biggs, G2TZ, 54 Prince of Wales Road, Dorchester, Dorset.

Stourbridge & District Amateur Radio Society. Membership is increasing steadily. Anyone who has any bright ideas for future meetings is asked to get in touch with G3BMY. Honorary Secretary: R. A. G. MacIntosh, B.R.S.20894, 50 Field Lane, Oldswinford, Stourbridge, Worcs.

Surrey Radio Contact Club. A recent talk on colour television was enjoyed by a gathering of 40. Thanks are due to Mr. P. S. Carnt for his lucid explanation of the system, and also to G2AJS, G3PAZ, and J. North for providing the projection facilities. Honorary Secretary: S. A. Morley, G3FWR, 22 Old Farleigh Road, Selsdon, South Croydon, Surrey.

Torbay Amateur Radio Society. At the December meeting about 20 members were given a film/slide show featuring the GPO station at Goonhilly in Cornwall. Commentaries were by D. Hyde and D. Webber, G3LHJ. Honorary Secretary: Mrs. G. L. Western, G3NQD, 118 Salisbury Avenue, Torquay, Devon.

Wirral Amateur Radio Society. Recent activities have included visits by members to both the Ainsdale and Liverpool clubs. The latest junk sale was far more successful than some of its predecessors. The construction programme continues with much enthusiasm. Honorary Secretary: A. Seed, G3FOO, 8 Withert Avenue, Bebington, Cheshire.

Wolverton & District RC. A very interesting lecture on the Racal receiver was given by G3OBY, and demonstrations of its stability were particularly convincing. The club is believed to have operated the first ever s.s.b. station from Rutland using the call-sign G3OBY/P on 160m. Honorary Secretary: D. A. Shepherd, G3LCS, 35 The Crescent, Haversham, Wolverton, Bucks.

Club of the Month

BARNSLEY AND DISTRICT AMATEUR RADIO CLUB

On October 12, 1963, the Barnsley and District Amateur Radio Club held their Golden Jubilee dinner-dance at the Royal Hotel, Barnsley. This was quite an occasion, for it is understood that it is the oldest established club in continuous existence in the country. The guest of honour was Jack Petty, G4JW, Region 2

The President of the Barnsley and District Amateur Radio Club, C. T. Malkin, G5IV, with the Honorary Secretary, Peter Carbutt, G2AFV, and the Chairman, J. Walker, G3GNK, at the Golden Jubilee Dinner.

Representative of the RSGB, and his address was listened to with great interest. Other speakers were G3GNK (Chairman), G5IV (President), G5KM (Vice-President), and G3KEL who travelled from Morecambe for the event. The evening was arranged by G2AFV (Honorary Secretary) and G3RKQ (Honorary Treasurer), and was a great success.

The club was formed on August 21, 1913, by eight enthusiasts including the late G2BH who was President until his death in 1963. On April 23, 1914 a transmitting licence was granted; call-sign AXR. With 50 watts on 200m the club made its first QSO's. Just before the outbreak of the 1914 war the first attempt at a field day took place at Shaw Lane cricket ground and incorporated an exhibition of members' equipment. In the summer of 1914 all equipment was stored by the government, but during the war meetings were held at the homes of members whenever possible.

In 1921 a great renewal meeting took place and by 1923 a new clubroom was established. A new call-sign, G6AJ, was also obtained. By 1928 the club was affiliated to the RSGB, and activity flourished until the outbreak of war in 1939. By that time such call-signs as G2WX, G3PG, G3YA, G4JJ, G5IV, G5KM, G5DW, G5UA, G6LZ, G6PY, G6UF, G6XG, G8NM, G8WF, G8TZ, G8IJ and G8PK had become well known. Subsequent meetings were held in much the same way as during the First World War, and in 1946 the club resumed its meetings in the accustomed way.

Since that date activities and support have continued. Field days and exhibitions have taken place, and many new call-signs have been obtained.

Today there are 19 licensed members together with as many listener members, and the club now looks forward to another fifty years of continuous support.

Can You Help?

● L. Parker, G5LP, 22 Second Avenue, Wellingborough, Northants, who wishes to borrow the theoretical circuit or manual for the Wavementer Type W1191 AM?

● Martin A. Ellis, A.3338, Little Hill, Brownlow Road, Croydon, Surrey, who requires the manual and/or circuit details of the R.109 receiver?

● W. A. Yeomans, B.R.S.19618, 13 Council Street, Walton, Peterborough, Northants, who requires the circuit diagram and valve line-up of the BEME D/F receiver Model No. BL50A made by Electronic and Marine Equipment Ltd., Southampton, and the manual for the Bendix RA1B receiver?

● H. F. Smith, B.R.S.20899, 22 Brunwins Close, Wickford, Essex, who requires the circuit of the Cossor 339A oscilloscope.

Forthcoming Events

Details for inclusion in this feature should be sent to the appropriate Regional Representatives by the first of the month preceding publication. A.R.s and club secretaries are reminded that the information submitted must include the date, time and venue of the meeting and, whenever possible, details of the lecture or other event being arranged. Regional Representatives are requested to set out the copy, preferably typed double spaced, in the style used below. Standing instructions for more than three months ahead cannot be accepted.

REGION 1

Ainsdale (ARS).—January 8, 22, Russell Road Methodist Church Hall, Southport.
Blackburn.—Fridays, 8 p.m., West View Hotel, Revidge Road.
Blackpool (B & FARS).—Mondays, 8 p.m., Pontins Holiday Camp, Squires Gate.
Bury (BRS).—January 14, 8 p.m., Knowsley Hotel, Kay Gardens.
Chester.—Tuesdays, 8 p.m., YMCA.
Eccles (E & DAC).—Tuesdays, 8 p.m., The Congregational Mission Church, King Street.
Liverpool (L & DARS).—Tuesdays, 8 p.m., Gladstone Mission Hall, Queens Drive, Stoneycroft.
Macclesfield.—January 7, 21, February 4, 42 Jordongate.
Manchester (M & DARS).—Wednesdays, 7.30 p.m., 203 Droylsden Road, Newton Heath, Manchester 10.
Manchester (SMRC).—Fridays, 7.45 p.m., Rackhouse Community Centre, Rackhouse, Daine Avenue, Northenden.
Morecambe.—January 1, February 5, 125 Regent Road.
Preston.—January 14 and 28 (all meetings start with a Morse practice at 7.30 p.m.), St. Paul's School, Pole Street.
Southport (SRS).—Wednesdays, 8.30 p.m., Sea Cadets Camp, The Esplanade.
Stockport.—January 1, 15, 29, 8 p.m., The Blossoms Hotel, Buxton Road.
Wirral.—January 1, 15, February 5, 7.45 p.m., Harding House, Park Road West, Claughton.

REGION 2

Bradford.—January 7 (Visit to N.S.F. Ltd., Keighley), January 9 (Display of Members' Gear, and a visit to Spen Valley ARS), January 21 (Informal Evening with Halifax and DRS, 7.30 p.m., Beehive and Cross Keys Hotel, Halifax), January 28 ("Inexpensive Sound Fidelity," by D. M. Pratt, G3KEP), 7.30 p.m., 66 Little Horton Lane, Bradford.
Catterick (RSARS).—Tuesdays and Thursdays, 7.30 p.m., Club Room, Vimy Road.
Halifax (H & DARS).—January 7 ("Our National Society," by J. Petty, G4JW), January 21 (Visit of Bradford Radio Society), February 4 (Sale of Members' Surplus Equipment, and visit from Spen Valley ARS), 7.30 p.m., Beehive and Cross Keys Hotel, Halifax. **(Northern Heights).**—January 1 ("Building a 10 to 80m Transmitter using a Geloso V.F.O.," by H. Makin), January 15 (Informal), January 29 (Film Show), 7.30 p.m., Sportsman Inn, Ogden.
Scarborough.—Thursdays, 7.30 p.m., Chapman's Yard, North Street.
Spen Valley.—January 9 (Display of Members' Gear attended by members of Leeds, Bradford, Halifax and Northern Heights Radio Societies), January 23 ("Modern Methods of Weather Forecasting" by the Meteorological Office, RAF Church Fenton), 7.15 p.m., Heckmondwike Grammar School.
York.—Thursdays, 8 p.m., British Legion Club, 61 Micklegate.

REGION 3

Birmingham (MARS).—January 21 (Demonstrations of Eight Modern Communications Receivers), 7.30 p.m., Midland Institute, Paradise Street, Birmingham. **(MRCC).**—February 7, 7.30 p.m., Windmill House, Weatheroak, Wythall, Birmingham. **(Slade).**—January 10, 7.45 p.m., The Church House, High Street, Erdington.
Cannock (CCARS).—February 6, 8 p.m., The Tavern, Bridgetown.
Coventry (CARS).—Mondays, 8 p.m., Westfield House, Radford Road, Coventry.
East Worcestershire.—January 9 ("TVI," by B. Summers, G5SS), 8 p.m., Old People's Centre, Redditch.
Lichfield (LARS).—January 21, 7.30 p.m., Swann Inn, Lichfield.
Salop (SARS).—January 9, 7.30 p.m., The Tennis Club, Harlescott Crescent, Harlescott Lane, Harlescott, Shrewsbury.
Stourbridge (STARS).—January 14 ("V.H.F. Hi-Fi," by G. Woolfenden), 7.45 p.m., Foley College, Stourbridge.
Stratford-on-Avon (ARS).—Fridays, 7.30 p.m., Flat 1, Birds Commercial Motors, Stratford-on-Avon.
Sutton Coldfield (ARS).—January 10, 7.30 p.m., 92 The Parade, Sutton Coldfield.
Wolverhampton (WARS).—January 13 (New Year Party), January 20 (RAE and Morse), Neachells Cottage, Stockwell End, Tettenhall.

REGION 4

Burton-on-Trent (ARS).—Wednesdays, 7.30 p.m., Club Room, Stapenhill Institute, Burton-on-Trent.
Chesterfield (C & DARS).—January 8, February 12, 7.30 p.m., Newbold Observatory, Newbold Road, Chesterfield.
Derby (D & DARS).—January 8 (Open Evening), January 15 (Film Show), January 22 (Practical Hints for the Beginner), January 28 (Constructors' Exhibition and Contest for Founder Members' Trophy), February 5 (AGM), 7.30 p.m., Room No. 4, 119 Green Lane, Derby. **(DSW Exp. S).**—Fridays, 7.30 p.m., Sundays, 10.30 a.m., Club Rooms, Nunsfield House, Boulton Lane, Alvaston, Derby.
Grantham (G & DARS).—Mondays, 7.30 p.m., Club Room, rear of Manners Arms Hotel, London Road, Grantham.
Grimsby (ARS).—January 16 (Discussion—Affiliated Societies' Contest), January 20 (Open), January 23 (Committee), 8 p.m., Grimsby Model Engineers Club Room, Fletchers Yard, Wellowgate, Grimsby.
Heanor (H & DRS).—January 7 ("Introduction to the CRO," by E. West, G3KTP), January 14 (Surplus Sale), January 21 ("Receiver Alignment," by E. West, G3KTP), January 28 (Films), February 4 (AGM), 7.30 p.m., Room No. 5 Heanor Technical College, Ilkeston Road, Heanor, Derbyshire.
Leicester (LRS).—Mondays, 7.30 p.m., Club Room, Old Hall Farm, Braunstone Lane, Leicester.
Lincoln (LSWC).—First Wednesday in each month, 7.30 p.m., Lincoln Technical College, Cathedral Street, Lincoln.
Loughborough (RCL).—Fridays, 7.30 p.m., Corporation Hotel, Wharncliffe Road, Loughborough.
Mansfield (MRC).—Fridays, 7.30 p.m., Hope & Anchor Hotel, Union Street, Mansfield.
Melton Mowbray (ARS).—January 23 ("Photographic Evening," colour slides and cine films by D. Fisher and D. W. Lilley), 7.30 p.m., St. John's Ambulance Hall, Asfordby Hill.
Northampton (NSWC).—Thursdays, 7 p.m., Allen's Pram Works, 8 Duke Street, Northampton.
Nottingham (ARCN).—Tuesdays, Thursdays, Room No. 3, Sherwood Community Centre, Woodthorpe House, Mansfield Road, Sherwood.
Peterborough (P & DARS).—First Friday in each month, 7 p.m., Room No. 13, Electronics Block, Peterborough Technical College, Eastfield Road.
Worksop (NNARS).—Tuesdays (Beginners), Thursdays (Informal), 7.30 p.m., Club Rooms, Victoria Institute, Eastgate, Worksop, Notts.

REGION 5

Cambridge (C & DARC).—Fridays, 7.30 p.m., Club Headquarters, Corporation Yard, Victoria Road, Cambridge.
Cambridge University (CUWS).—Tuesdays, 8.15 p.m., Psychology Department Lecture Room, on Downing Site, during University Term.
Luton.—Mondays, 7.30 p.m., Surrey Street Schools, Luton, Beds.
March (M & DRAS).—January 14 (Film Show and Social Evening), Tuesdays, 7.30 p.m., rear of Police Headquarters, High Street.
Royston (R & DARC).—January 8 (Annual General Meeting), January 15 (Social Evening, YL's & XYL's), January 29 ("Television"), 8 p.m., Manor House Social Club, Melbourn Street, Royston.
Shefford (S & DARS).—Thursdays, 7.45 p.m., Digswell House, Hitchin Road.

REGION 6

Cheltenham.—First Thursday in each month, 8 p.m., Great Western Hotel, Clarence Street.
Wolverton (WDRC).—February 7 ("V.H.F. Aerials"), Wolverton College of Further Education.

REGION 7

Acton, Brentford & Chiswick (ABCRC).—January 21 (AGM), 7.30 p.m., AEU Club, 66 High Road, Chiswick.
Bexleyheath (NKRS).—January 9, 7.30 p.m., Congregational Hall, Chapel Road, Bexleyheath.
Barnet (BRC).—January 28, 8 p.m., Red Lion Hotel, Barnet.
Chingford (Group).—January 12, contact G3NQT, Loughton 2397. **(SC).**—Fridays (except first), 8 p.m., Chingford Community Centre, Enday Hill.
Croydon (SRCC).—January 14, 7.30 p.m., Blacksmiths Arms, South End, Croydon.
Dorking (D & DRS).—January 14 (Informal Meeting), 8 p.m., "Wheatsheaf," Dorking. January 28 (AGM), 8 p.m., Star & Garter, Dorking.
East Ham.—January 14, 28, Tuesdays fortnightly, 7.30 p.m., 12 Leigh Road, East Ham.
East London District.—January 19 ("Mobile Operation"), 2.30 p.m., Ilford Town Hall, High Road, Ilford.
East Molesey (TVARTS).—January 1 (AGM), Carnarvon Castle Hotel, Hampton Court.
Edgware & Hendon (EARDS).—January 13, 27, 8 p.m., John Keble Hall, Church Close, Deans Lane, Edgware.
Enfield.—January 16, 7.30 p.m., George Spicer School, Southbury Road, Enfield.
Gravesend (GRS).—January 15, 7.30 p.m., RAFA Club, 17 Overcliffe, Gravesend.
Guildford (G & DRS).—Second and fourth Friday in each month, 8 p.m., City Cafe, Onslow Street, Guildford.
Harlow.—Tuesdays, 7.30 p.m., rear of G3ERN (G. E. Read), High Street, Harlow. **(SRC).**—Wednesdays, 7 p.m., Edinburgh Way, Harlow.
Harrow (RSH).—Fridays, 8 p.m., Roxeth Manor County School, Eastcote Lane, Harrow.
Holloway (GRS).—Mondays and Wednesdays, 7 p.m. (RAE and Morse), Fridays (Club), 7.30 p.m., Montem School, Hornsey, N.7.

LOOKING AHEAD

January 17.—Installation of President, Kingsley Hotel, London. See page 10.
March 13.—London Lecture Meeting at IEE.
March 18-24.—Electrical Engineers Exhibition, Earls Court, London.
April 5, 1964.—RSGB National Mobile Rally, Texas Instruments Ltd., Bedford.
May 1.—London Lecture Meeting at IEE.
May 24, 1964.—RSGB National Mobile Rally, USAF, Wethersfield.
May 24, 1964.—Northern Mobile Rally.
June 21, 1964.—Longleat Mobile Rally.
July 5, 1964.—South Shields Mobile Rally.
August 16, 1964.—Derby Mobile Rally.
August, 1964.—International Mobile Rally, Belgium.
September 13, 1964.—RSGB National Mobile Rally, Woburn Abbey.

LONDON MEMBERS' LUNCHEON CLUB

will meet at the Bedford Corner Hotel, Bayley Street, Tottenham Court Road,

at 12.30 p.m. on Fridays, January 17, and February 21, 1964

Telephone table reservations to HOL 7373 prior to day of luncheon. Visiting amateurs especially welcome.

Hounslow (HADRS).—Mondays, 7.30 p.m., Canteen, Mogden Main Drainage Dept., Mogden Works, Isleworth.

Ilford.—Thursdays, 8 p.m., 579 High Road, Ilford (nr. Seven Kings Station).

Kingston.—January 9, 8 p.m., YMCA, Eden Street, Kingston. (Morse Classes weekly on Fridays at 2 Sunray Avenue, Tolworth).

Leyton & Walthamstow.—January 28, 7.30 p.m., Leyton Senior Institute, Essex Road, E.10.

Loughton.—January 3, 17, 7.30 p.m., Loughton Hall, nr. Debden Station.

Mitcham (M & DRS).—January 17 (Junk Sale), 7 p.m., "The Canons," Madeira Road, Mitcham.

New Cross (CARS).—January 3 (Green & Davis demonstration), January 24 (Junk Sale), Wednesdays and Fridays, 8 p.m., 225 New Cross Road, S.E.14.

Norwood & South London (CP & DRC).—January 18, CD Training Centre, Bromley Road, Catford.

Paddington (P & DARS).—Wednesdays, 7.30 p.m., Beauchamp Lodge, 2 Warwick Crescent, W.2.

Purley (P & DRC).—January 10, 24, 8 p.m., Railwaymen's Hall (Side Entrance), Whytecliffe Road, Purley.

Reigate (RATS).—January 18 (AGM), 7.30 p.m., The Tower, High Street, Redhill. February 15 (Annual Dinner), Mill House, Salfords.

Romford (R & DRS).—Tuesdays, 8.15 p.m., RAFTA House, 18 Carlton Road, Romford.

Science Museum (CSRS).—Mondays, 6.30 p.m., January 6 ("Worldwide Communication using V.H.F. Radio Links," by GPO), January 20 (Informal Meeting, RSGB Tape Recording "Two Metres" by W. H. Allen, G2UJ), Science Museum, South Kensington.

Sidcup (CVRS).—January 2, 7.30 p.m., Congregational Church Hall, Court Road, Eltham.

Slough (SARS).—First Wednesday in each month, 8 p.m., United Services Club, Wellington Street, Slough.

Southgate & District.—January 9, 8 p.m., Atlasta Lodge, Tottenhall Road, N.13.

St. Albans (Verulam ARC).—January 15 (AGM), 7.30 p.m., Hedley Road, St. Albans.

Sutton & Cheam (SCRS).—January 21, 7.30 p.m., The Harrow, High Street, Cheam.

Uxbridge (UDRS).—January 6, 13 (AGM), 8 p.m., St. Andrews Church Scout Hut, Uxbridge Road.

Welwyn Garden City.—January 9 (Lecture and demonstration by Green & Davis), 8 p.m., Conference Room, Murphy Radio, Bessemer Road.

Wimbledon (W & DRS).—January 10, 8 p.m., Community Centre, St. George's Road, Wimbledon, S.W.19.

REGION 8

Crawley (ARC).—January 8, 22 (Constructional Contest and "Crystal Grinding"). For details, phone G3FRV, Crawley 23359.

West Kent (WKARS).—January 10 (Audio Night), January 24 ("100 Years of Wireless—Part III, Broadcasting and Television," by H. F. Richards), second and fourth Fridays of each month, Culverden Park Road, St. Johns, Tunbridge Wells.

Worthing and District (W & DARC).—January 13 (Lecture and demonstration on "Four Metres" by G3GVM and G3KFH/T), 8 p.m., Adult Education Centre, Union Place, Worthing.

REGION 9

Bath.—January 8, 7.30 p.m., Committee Room, Technical College, Lower Borough Walls, Bath.

Bristol.—January 24, 7.15 p.m., Small Physics Theatre, Royal Fort, Bristol University, Woodland Road, Bristol 8.

Burnham-on-Sea.—Second Tuesday in each month, 8 p.m., Crown Hotel, Oxford Street, Burnham-on-Sea.

Camborne (CR & TC).—First Thursday in each month, Staff Recreation Hall, SWEB Headquarters, Pool, near Camborne.

Exeter.—First Tuesday in each month, 7.30 p.m., The George and Dragon Inn, Blackboy Road, Exeter.

Plymouth (PRC).—First Tuesday in each month, 7.30 p.m., Guild of Social Service Building, Plymouth. Other Tuesdays, Virginia House Settlement, St. Andrews Cross, Plymouth.

South Dorset (SDRS).—First Friday in each month, 7.30 p.m., alternately at Waverley Hotel, Westham, Weymouth and Labour Rooms, West Walks, Dorchester. January meeting at Dorchester.

Torquay (TARS).—January 4, Club HQ, Belgrave Road, Torquay.

Weston-super-Mare.—First Tuesday in each month, 7.15 p.m., Technical College, Lower Church Road.

Yeovil (YARC).—Wednesdays, 7.30 p.m., Park Lodge, The Park, Yeovil.

REGION 10

Cardiff.—January 13 ("S.S.B.," by D. N. Thomas, GW3RXW), 7.30 p.m., TA Centre, Park Street, Cardiff. January 31, Annual Dinner, details from GW3GHC.

Port Talbot.—January 14 ("NFD"), 7.30 p.m., Workmen's Institute, 8-10 Jersey Street, Port Talbot.

REGION 11

Llandudno (CVARS).—January 9 (Junk Sale, and a talk by R. Jones, GW3MDK), 7.30 p.m., Albert Hotel, Madoc Street, Llandudno.

Prestatyn (FRS).—January 27 (AGM), 8 p.m., Railway Hotel, Prestatyn.

REGION 13

Edinburgh (LRS).—January 16 ("DX from Two Continents," by J. S. Nicholson, GM3FJP), January 30 ("TVI Proofing Simplified," by A. T. Lawrie, GM3PQU), YMCA, South St. Andrew Street, Edinburgh.

REGION 15

Belfast.—Third Friday in each month, 8 p.m., Toc H Room, 73 Lisburn Road, Belfast. January 24, ("Constructional Methods" by A. D. Patterson, GI3KYP).

REGION 16

Basildon (BDARS).—Details from G3RQT, 59 Walgrave, Basildon.

Chelmsford (CARS).—First Tuesday in each month, 7.30 p.m., Marconi College, Arbour Lane, Chelmsford.

Great Yarmouth (GYRC).—Fridays, 7.30 p.m., The Old Power Station (Manager's Office), South Quay, Swanstons Road, Great Yarmouth.

Norwich (Norfolk ARC).—"The Branford Stores," Branford Road, Norwich. Details from G3NJQ, 50 Vicarage Road, Norwich.

Southend (SDARS).—Fridays (fortnightly), 8 p.m., in the Executives' Canteen of E. K. Cole Ltd., Priory Crescent, Southend-on-Sea.

Aluminium cored solder, previously only available from the manufacturers, Enthoven Solders Ltd., Upper Ordnance Wharf, Rotherhithe Street, London, S.E.16, is now stocked by Webb's Radio, 14 Soho Street, London, W.1. The solder is packed in celluloid containers, each costing 2s.

Aluminium foil capacitors containing solid electrolyte have recently been introduced by Mullard Ltd., Mullard House, Torrington Place, London, W.C.1. In place of the usual liquid electrolyte, manganese dioxide is used, which is claimed to effect an improvement in internal impedance at high frequencies. Capacities between 12μF at 40 volts d.c. to 100 μF at 4 volts d.c. are currently available, in four insulated aluminium can sizes, the largest measuring 21mm × 10·3mm.

Greenpar Engineering Ltd., who specialize in the manufacture of coaxial connectors of all types, have produced a set of assembly instructions for their **Series C, UHF and BNC coaxial connectors.** Copies of these leaflets may be obtained on application to the company at Station Works, Cambridge Road, Harlow, Essex.

Receipts

Receipts for subscriptions paid by cheque, bankers' order or postal order are not now issued unless specially requested.

Can You Help?

● C. Moore, B.R.S.24560, 16 St. John Grove, Upper Holloway, London, N.19, who requires the instruction manual for the Emmerson receiver type GFR-520?

● K. Harrison, VE1QV, 926 Mollins Drive, Lancaster, New Brunswick, Canada, who wishes to obtain details of the pre-war Trophy 8 receiver?

Bulletin Stencil Plates

Stencil plates used for the preparation of BULLETIN wrappers occasionally become worn or lose ink, with the result that the Post Office experience difficulty in tracing the address.

Members who notice that the address on the wrapper used for their copy of the BULLETIN is indistinct, or in any way faulty, are asked to advise Headquarters.

Closing date for the February issue

January 10

Closing date for the March issue

February 7

Copy received after these dates may be held over to the following issue if still topical

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENT RATES. Members' Private Advertisements 3d. per word, minimum charge **5s. Trade Advertisements 9d. per word.** minimum charge **12s.** All capitals **1s.** per word, minimum charge **18s.** Write clearly. No responsibility accepted for errors. Use of Box number **1s. 6d.** extra. Send copy to **Sawell & Sons Ltd., 4 Ludgate Circus, London, E.C.4.**

OFFICIAL APPOINTMENTS

VACANCIES IN
THE COMPOSITE SIGNALS ORGANISATION

A number of vacancies, offering good career prospects, exist for:—

RADIO OPERATORS (MALE)

Write, giving details of Education, Qualifications and Experience to:—
Recruitment Officer (CSO/43), Government Communications Headquarters,
'A' Block, Priors Road, Cheltenham, Glos.

AIR MINISTRY have vacancies for CIVILIAN RADIO TECHNICIANS at R.A.F. Sealand, Cheshire, for the servicing, repair, modification, and testing of air and ground radio and radar equipment. Commencing salary according to age is £701 to £902 p.a., maximum salary £1036 p.a. Houses may be available for renting at West Kirby some 15 miles from Sealand. Apply to Air Ministry C.E.3h, Sentinel House, Southampton Row, W.C.1, or to any Employment Exchange.

SITUATIONS VACANT

SEMICONDUCTOR MEASUREMENTS

Junior Engineers qualified in electronics or physics are required for the above work in the Thorn-AEI Applications Laboratory. Experience of circuitry and measurements at R.F. desirable, preferably with semi-conductors.

Starting salary range £900-1,200. Contributory Pension Scheme. *Please write to Mr. C. L. Hirsham, c/o The Personnel Manager (Ref. R.107),*

THORN-AEI RADIO VALVES & TUBES LIMITED
Brimsdown, Enfield, Middlesex

WANTED

TOP BAND TRANSMITTER, Horsley G3NWI. Lanchester Hall, The College of Aeronautics, Cranfield, Bletchley, Bucks.

COLLECTING FOR PRIVATE MUSEUM.—Early Marconi tuners, detectors, spark coils, high voltage transformers, Leyden jar and plate condensers, keys, spark gaps, oscillation transformers. Commercial gear and commercially made amateur gear before 1920 especially tubes, magazines, catalogues and *QSTs*. RSGB BULLETINS before 1937. Old Post Office manual morse telegraph equipment including needle systems. All letters answered.—E. W. Freeman, K0MOA, Box 57, Yankton, South Dakota, U.S.A.

WANTED.—All types of communication receivers, test equipment, tape recorders, amplifiers, etc. Prompt cash payment.—Details to R. T. & I. Electronics Ltd., Ashville Old Hall, Ashville Road, London E.11. (LEYton 4986).

888A WANTED, cash waiting for set in perfect order. State price, etc., to Box No. U.7110, c/o RSGB BULLETIN, 4 Ludgate Circus, London, E.C.4.

WANTED (continued)

WANTED. SSB TX and Transceiver. Viceroy Invader KWM2 or similar, for use in DX location. **FOR SALE.** SWM's volumes 9 to 16 1951-1959. 15/- per volume. RSGB BULLETINS volumes 36, 37, 38 1960-1963, 12/6d. per volume. —G3HPW, 21 Brooklyn Way, West Drayton, Middlesex. Phone West Drayton 4192.

WANTED: Heavy Post Office or Marconi type straight morse key; state price and condition. A.3214, 18A Botwell Lane, Hayes, Middlesex.

WANTED: Two and Four Metre Converters, also HRO Coil 1·7 to 4 Mc/s; G8UA, 406 Brunshaw Road, Burnley, Lancs.

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STEEL CABINETS. 8½ in. high, 17½ in. breadth, 8 in. deep, grey enamel finish and pair of handles to match, 7/6, carriage extra. G3PSB, 5 Endcliffe Way, Wheatley Hills, Doncaster.

ELECTRONIQUES QP 166 " Qoilpax " built into complete converter with Eddystone 898 dial; unused; £12 or near offer.—A. R. Gillman, " Wedgwood," Portesbery Road, Camberley, Surrey. (Telephone 3811).

ALL TYPES of modern and obsolete valves at low prices. S.a.e. lists/enquiries. Radio/Television books. Service sheets.—Hamilton Radio (B), Western Road, St. Leonards, Sussex.

BAMBOO POLES FOR CUBICAL QUAD ANTENNAS, ETC. ALL SIZES. S.A.E. BRINGS LIST.—WHINES & EDGELER, BAMBOO PEOPLE, GODMANSTON, DORCHESTER, DORSET.

METALWORK.—All types of cabinets, chassis, racks, etc., to your own specifications.—Philpott's Metalworks Ltd. (G4BI), Chapman Street, Loughborough.

EDDYSTONE 888A receiver for sale. Mint condition. Very little used; £75 o.n.o.—Buttar, 6 Bracks Road, Bishop Auckland. (Tel. No. 48).

SALE: R1155B, excellent condition, 6V6 output stage, S-meter, 160m coverage, £10.—R. Perrin, 30 Franchise Street, Kidderminster, Worcs.

S.S.B. TRANSMITTER, model HT37 Hallicrafter, spotless condition, £140 o.n.o.—G3BXI, Farlow, 49 Mount Pleasant Road, Chigwell, Essex. HAInault 4546.

AR88D with " S " meter £30, top band TX CW/phone £10, Testgear 3 in. scope and Wobbulator £15, Pye mobile reporter TX/RX £10, Police mobile TX/RX £5, BC453 Q-Fiver £2/10/-, Receiver 1584 30/-, 3API 30/-, Command TX/RX's (not 160m) large selection transformers, meters, radio and TV valves, crystals. Carriage extra.—G3IDW, Orchard Cottage, Hook, Swindon.

FOR SALE—contd.

CATALOGUE No. 15.—Government Surplus Electrical and Radio equipment. Hundreds of items at bargain prices for the experimenter and research engineer, 2/6 post free: catalogue cost refunded on purchase of 50/-.—Arthur Sallis Radio Control Ltd., 93B North Road, Brighton.

G3LOK DOUBLE SUPERHET RX. Components comprising: coils, I.F.s, wafers, tuning capacitor, B.F.O., etc. All by Electroniques (need aligning). Eddystone 898 dial, and Douglas mains transformer. Cost over £20. Sell for £13. Also 715B, U19, valves, offers? Box No. U.7109, c/o RSGB BULLETIN, 4 Ludgate Circus, London, E.C.4.

LG50 TX £29. K.W. 160 TX £16. Both immaculate.—Hornchurch 46035 after 7.30 p.m.

EDDYSTONE 888, Speaker, "S" Meter—mint condition, £65. Eddystone 358 type RX, some coils, requires attention, £6/10/-. Minimitter 150 watt TX. Mint condition, £50. Two power packs 350 volts 250 ma. 90 volts regulated bias, £5 each. TZ40 Modulator relay rack mounted, £5. Buyer collects.—G2COP, Chesterfield Grange, Lichfield, Staffs. Tel.: Shenstone 230.

FOR SALE. MOHICAN, in good order, with manual, £29.

WANTED. Eddystone 888 or Hammarlund HQ range RX. Also cheap AR88 wreck considered.—Woodhouse, "Trenoweth," Porthpean, St. Austell, Cornwall.

888A, late model, speaker, "S" meter, manual, £62. DX100U plus SBIU for SSB TVI free, £58. SBIOU professionally aligned with own PSU, £34. AR88D speaker, spare valves, knobs, dial, manual, £36. CR200 new VLF RX with PSU, £17. Accept £195 for all this first-class gear. —Craw, 117 Sea Lane, Rustington, Sussex. Tel.: Rustington 3953. 8-10 p.m.

GONSET TRANSCEIVER. S.76—6 band with mobile power supply, ideal for desk or mobile. Cost £350, accept £160. Eastell, 9 Prod Lane, Baildon, Yorks.

VICEROY SERIES II, with xtal mike and DOW COAX C.O. Switch. DRAKE 2B with Calibrator—Q Multiplier and Speaker. Complete station in mint condition £200—going QRT. G4BL, 48 White Street, Derby.

EDDYSTONE 840A RECEIVER, 840 Kc/s 30 Mc/s. New 1961, excellent condition. Owner lost interest. £40 o.n.o. Putney 6955 after 6.30 p.m.—Box No. U.7111, c/o RSGB BULLETIN, 4 Ludgate Circus, London, E.C.4.

The classified advertisement section of the February issue of the "Bulletin" closes for press on JANUARY 20

AVO VALVE TESTER, latest bases £10. Carriage paid. Manual, instructions, circuit checked. Apply, G3OIB, Drax Grammar School, Drax, Selby, Yorks.

PERSONAL

QSL CARDS. G.P.O. approved log books, cheapest, best, prompt delivery. Samples.—Atkinson Bros., Printers, Looe, Cornwall.

PATENTS and TRADE MARKS. Booklet on request. Kings Patent Agency Ltd. (B. T. King, G5TA, Mem. R.S.G.B., Reg. Pat. Agent).—146a Queen Victoria Street, London, E.C.4. (Phone: City 6161.) 60 years' refs.

SERVICES OFFERED

GO ONE BETTER. Have your cabinets, panels, etc., stove-enamelled and lettered to your own or original specification. —For by-return quotations, contact: The Universal Productions (Enamellers) Ltd., 22 Aston Road North, Birmingham 6. Tel.: Aston Cross 2987.

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