RSGB

BULLETIN

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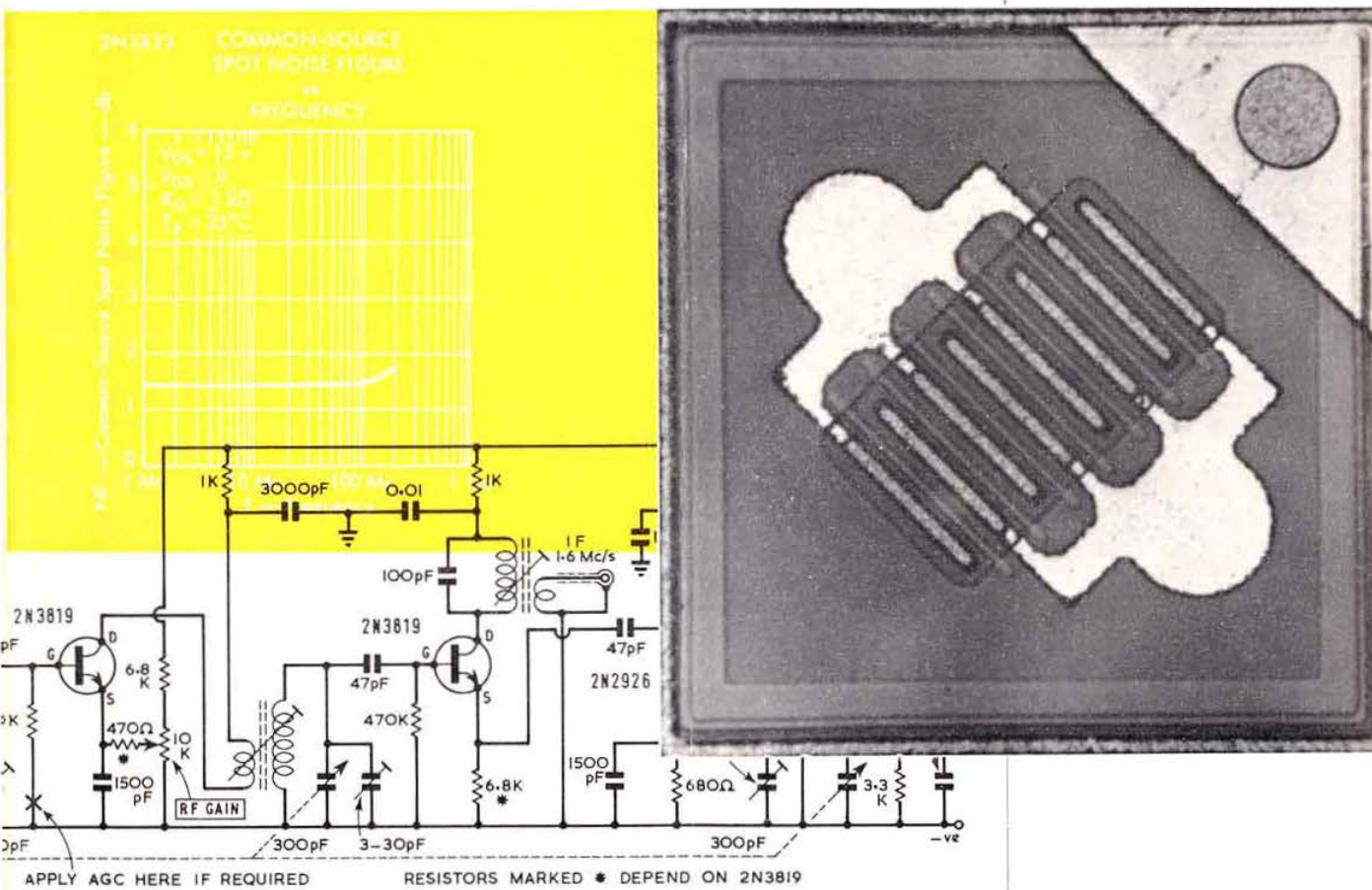

PAT HAWKER HIGHLIGHTS RECENT DEVELOPMENTS IN FIELD EFFECT TRANSISTOR CIRCUITRY ON PAGE 581

JOURNAL OF THE RADIO SOCIETY OF GREAT BRITAIN

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RSGB BULLETIN

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Front Cover Field effect transistors are beginning to show their superiority over conventional junction transistors in r.f. applications. Some of the latest developments of interest to the radio amateur are described in this month's "Technical Topics".

Photo and performance data reproduced by courtesy of Texas Instruments Ltd.

The RSGB Bulletin is published on the first Wednesday in each month by the Radio Society of Great Britain as its official journal and sent to all members.
The closing date for copy for the October issue is 9 September, and for the November issue 30 September.

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France: Vareduc-Comimex, 2 Rue Joseph-Riviere, Paris. Courbevoie, France.
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INCORPORATED 1926

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News from Headquarters

Headquarters Staff

D. W. (Bill) Robinson, A.M.P.O.A., G3FMT, has joined the Headquarters Staff as assistant to the General Manager. Following service in the RAF, Bill was on the administrative staff of the University of London for many years.

A keen exponent of the art of home construction, Bill may be heard frequently on 80, 40 and 20m.

The other amateurs at Headquarters are G2AHL and G3TRP. G2AHL is currently on 20 and 80m s.s.b., but is also equipped for most bands up to 144 Mc/s. G3TRP now operates mainly on 4m mobile, but also possesses fixed equipment for 80m RTTY and 4m a.m./RTTY. He is also in process of acquiring bits and pieces for 10,000 Mc/s.

John Adey, A4663, hopes to pass his RAE soon; meanwhile he is a keen shortwave listener on the h.f. and v.h.f. bands.

Area Representative

The following has been appointed Area Representative:

READING

Lt. Col. Norman I. Bower, G5HZ, Little Priory, Peppard Common, Near Reading, Berks.

Affiliation

The following societies are now affiliated to RSGB:

ASHTON-UNDER-LYNE AND DISTRICT AMATEUR RADIO SOCIETY

R. Higginbotham, G3VDS, 1 Bankfield Cottages, Woodlands Drive, Woodley, Stockport, Cheshire.

CHESHUNT AND DISTRICT RADIO CLUB

A. F. Webb, 3 Roseneath Walk, Enfield, Middlesex.

ELECTRICS SOCIETY

D. R. Coates, Student's Union, Royal College of Advanced Technology, Salford 5, Lancs.

Reciprocal Licensing

An amateur reciprocal licensing agreement is now in force between the United Kingdom and the Republic of South Africa. All enquiries should be made to The Postmaster-General, Post Office, Pretoria, South Africa.

Amateur Licences

On 30 June 1966, the number of amateur licences in force in the United Kingdom was as follows:

Amateur (Sound) Licences A: 11,744.
Amateur (Sound) Licences B: 397.
Amateur (Sound Mobile) Licences A: 2110.
Amateur (Sound Mobile) Licences B: 5.
Amateur (Television) Licences: 178.

More Pirates Fined

As a result of Post Office enquiries into the unlicensed use of wireless telegraphy transmitting equipment, the following convictions have been obtained.

On 12 July, at Bedford Borough Court, Keith Edward Napier of 42 Kempston Road, Bedford, pleaded guilty to a charge of using wireless telegraphy transmitting apparatus without the necessary licence, contrary to section 1 of the Wireless Telegraphy Act, 1949. He was fined £15.

On 21 July, at Bedford County Court, James Spavins of 9 Queens Crescent, Clapham, Bedford, John Peter Riley of 26 Littledale Street, Bedford, and Ernest Reginald Wiles of Streatham House, Wilden, Bedford, were each fined £10 for a similar offence and ordered to pay £2 2s. towards the costs.

Receipts

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

Election of Council, 1967

In accordance with Article 52 of the Society's Articles of Association the Council has nominated the following Corporate Members to fill the vacancies in the Council which will occur on 31 December next:

Ordinary Members:

Mr. L. E. Newnham, G6NZ.
Mr. E. W. Yeomanson, G3IIR.

Not later than **10 October** next any 10 Corporate Members may nominate any other Corporate Member to serve on the Council by delivering their nomination in writing in a single document to the General Manager and Secretary, together with the written consent of such nominee to accept office if elected, but each nominator shall be debarred from nominating any other person for this election.

Council Members elected by Zones

Not later than **10 October** next any 10 Corporate Members resident in Zone C (Regions 5, 7, 8 and 16), Zone D (Regions 6, 9 and 17) and Zone E (Regions 10 and 11), may nominate any other duly qualified Corporate Member resident in the Zone concerned to serve on the Council by delivering their nominations in writing in a single document to the General Manager and Secretary, together with the written consent of such nominees to accept office if elected but each such nominator shall be debarred from nominating any other person for this election.

Candidates for nomination as Council Members elected by Zone must be resident within the Zones for which they are nominated and the nominators must be resident in the same Zone.

The present Council Member for Zone C is Mr. J. C. Graham, G3TR, and for Zone D, Mr. G. Twist, G3LWH. There is no Council Member for Zone E at present.

Mr. Earl Thomas, W2MM

A welcome visitor to Headquarters recently was Earl Thomas, W2MM, secretary of the Quarter Century Wireless Association, who has been in the UK for six weeks visiting Amateur Radio friends. During World War 2, W2MM, then a colonel in USAF, spent much time in the United Kingdom and was awarded the OBE.

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
145·10 Mc/s	9.30 a.m.	Beaming north from London
	10.00 a.m.	Beaming west from London
145·8 Mc/s	10.15 a.m.	Beaming south from Belfast
145·30 Mc/s	10.30 a.m.	Beaming north west from Sutton Coldfield
	11.00 a.m.	Beaming south west from Sutton Coldfield
145·50 Mc/s	11.30 a.m.	Beaming north from Leeds
	12 noon	Beaming east from Leeds

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.

RSGB
INTERNATIONAL RADIO COMMUNICATIONS EXHIBITION

Wednesday, 26 October until Saturday, 29 October

Seymour Hall, London, W1
Open daily from 10 a.m. – 9 p.m.

For the 1966 Exhibition, the RSGB will have the biggest stand ever, and it is a commentary on the expanding activities of the Society that it is still impossible to find enough space to do everything which the RSGB would like to do. The Society's Exhibition Committee hopes, once again, for a record attendance.

RECEPTION AREA

The reception area, introduced at the 1965 exhibition, proved to be a most popular innovation, and the scheme will therefore be adopted again this year. As before, this area will be in the charge of Council Member John Graham, G3TR, assisted by Mrs Eileen Vaughan, BRS26612, Council and Committee members, and Headquarters Staff. Reception will attempt to answer all members' enquiries, take orders for badges, subscriptions to overseas periodicals, and accept new or renewed subscriptions for the RSGB. A most important part of the stand staff's duties will be to welcome, and assist in any way possible, the very many overseas visitors to the exhibition.

RECEPTION FOR FOREIGN AMATEURS

The Society is organizing an informal Reception for foreign amateurs, on the lines of that held in previous years, for Friday, 28 October, at 7.30 p.m. Between 7.30 and 8.30 p.m. entry will be restricted to foreign amateurs and invited guests, and after 8.30 p.m. the doors will be opened to all comers. The Society hopes that all visiting amateurs will make themselves known at the reception area, when arrangements will be made for them to attend the reception.

EXHIBITION STATION

Ron Vaughan, G3FRV, and his group of operators, have recovered their voices after the 1965 exhibition and will again be operating the Society's stations, GB3RS and GB2VHF, from the stand.

GB3RS will be operating on the 160 and 80m bands during exhibition hours, using c.w., a.m., and s.s.b. In line with experience gained in previous years, it has been decided not to operate on a fixed schedule owing to the difficulty of forecasting activity and conditions.

Generally, c.w. transmission will be on 160m during evening periods, and a.m./s.s.b. will be used at other times. The a.m. transmissions will be A3H (compatible sideband, i.e., one sideband and carrier) as last year.

Subject to the equipment available and activity, GB3RS will be pleased to make RTTY schedules, and stations wishing to make arrangements should call the exhibition station on telephony. RTTY transmissions will use 850 c/s shift at a speed of 50 bauds. GB3RS will also arrange 2m and 4m schedules for GB2VHF upon request.

Please note that the station will *not* answer " breakers," nor take part in multi-way or net QSOs.

GB2VHF will operate on the 2m or 4m bands, depending upon activity, using A3. The exhibition operators would like to explain, in advance, that the extremely high noise level at the exhibition makes the weaker signals difficult to read; don't blame the operator, he is doing his best!

GB2VHF will also be pleased to make RTTY schedules, subject to equipment availability, and transmissions will be on a.f.s.k./850 c/s shift at 50 bauds.

A special QSL card will be despatched automatically via the RSGB QSL Bureau for each contact with either station. Alternatively, visitors to the exhibition may claim their QSLs at the Headquarters station stand. Your own QSL should be sent via the Bureau clearly marked GB2VHF/GB3RS via G3FRV.

Visiting mobiles are asked not to operate for lengthy periods in the vicinity of the exhibition. Several cases of severe interference to GB3RS/GB2VHF occurred last year for this reason.

RADIO AMATEUR EMERGENCY NETWORK

Members of the Surrey RAEN Group will be showing a typical base station of the sort installed in many Police, Red Cross, and St. John's Ambulance Brigade establishments. The base station will actually be in operation during the exhibition on 70.375 Mc/s to communicate with other RAEN network stations: the call-sign in use will be G3NAT/A. John Kingston, G3VK, and his helpers will be pleased to give information on all aspects of RAEN to interested members. Supplies of RAEN literature, badges, etc., will also be available.

EDUCATION COMMITTEE EXHIBIT

A special feature of this display, to be organized by L. E. Newnham, G6NZ, and Tim Hughes, G3GVV, will be equipment that can be easily reproduced by the beginner. Full information will be available on a 160/80m transmitter, companion receiver, and a 2m transmitter.

HOME CONSTRUCTED EQUIPMENT

This year, because of shortage of space, the Society's Exhibition Committee has decided to restrict the number of items displayed and to exhibit only items of a high technical or constructional standard. To this end, the following are the arrangements for this exhibit:

(i) All items submitted for exhibition will be subject to acceptance by the Exhibition Committee.

(ii) Entries will be accepted as items which have been the subject of published articles in the RSGB BULLETIN during the period January 1965 to date. It should be made clear that only the member writing the original article will be allowed to enter.

In addition, entries will be accepted from members who are prepared, *if required,* to write a constructional article for publication in the RSGB BULLETIN featuring their entry, this article to be paid for at the normal rates.

(iii) Entrants will be required to certify that their entries were constructed entirely by themselves from commonly available materials and components.

(iv) RSGB members *only* will be eligible.

(v) The Horace Freeman trophy will be awarded for the most original piece of equipment on show.

(vi) Additional prizes may be awarded at the discretion of the judging Committee.

(vii) Members wishing to enter should send a brief description of their proposed entry to the organizer, Mr A. J. Worrall, G3IWA, 62 Gallants Farm Road, East Barnet, Herts., to arrive not later than Friday, 30 September, 1966.

COUNCIL MEMBERS AND COMMITTEES

A number of Members of Council and of the Society's various Committees will be available to receive members' enquiries. Please ask at Reception.

Accurate Frequency Measurement at V.H.F.

By W. BLANCHARD, G3JKV *

EASIER, perhaps, than practically any other measurement in electronics is the accurate measurement of frequency. Take the ordinary run-of-the-mill voltage or current measurement; what accuracy is usually possible? Five per cent? Two per cent? Well, perhaps 1 per cent, but not with a production multimeter! But applying this to frequencies on 160m, you get an accuracy of only 20 kc/s, and most amateurs can measure frequency better than that just by looking at the dial of their receiver. Moreover, where else is there a standard available, absolutely free to all comers, with an accuracy of one part in 10^{10} or so? Possibly because of these factors, frequency measuring contests have always had a certain following amongst the more technically minded of the amateur fraternity, and besides, it's a good way of finding out if the old BC221 is still up to scratch.

It has become traditional over the years for frequency measuring tests to be run from time to time, but they have always hitherto been on the h.f. bands, making things fairly easy for the owner of a well-maintained and well-calibrated BC221. The accuracy of all the usual frequency meters falls off as the frequency gets higher, however, mainly because harmonics are being used, and the accuracy of the basic crystal standard is insufficient. This is probably why, difficult as it is on the h.f. bands, it is almost impossible to get anyone on 4m or 2m to quote his frequency to better than 5 kc/s with any assurance. Simply multiplying up the crystal frequency will not do! In view of all this, when the RSGB announced a frequency measuring test to be held in May, 1965, to take place on the 2m band, it was apparent that it would pose much more of a challenge than the usual h.f. tests, and was that much more worth entering. No suitable equipment for accurate v.h.f. measurement was then in existence at G3JKV, although a BC221 had been pressed into service occasionally for approximate readings. Special equipment therefore had to be built, with very encouraging results, and with the increasing interest in accurate measurement because of the *OSCAR* and moonbounce, the following account of how a measurement was made which turned out to be within 2 c/s of the correct one may be found interesting. The method is equally applicable to any frequency, from d.c. upwards, as will be seen.

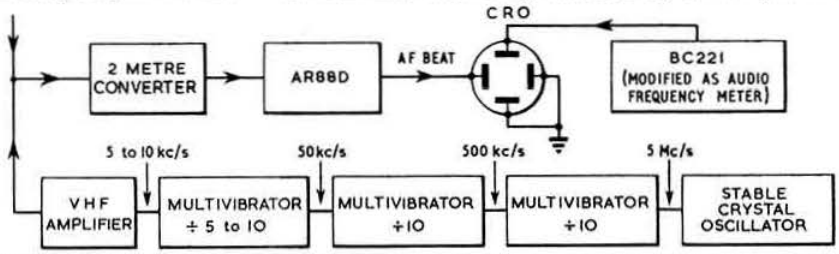


Fig. 1. The chain of units used by G3JKV to measure the frequencies of signals at 145 Mc/s with an accuracy of at least 2½ c/s. The output of the divider chain is mixed with the incoming signal at the input of a v.h.f. converter and the resultant audio tone is compared with the output of a modified BC221 on a cathode ray tube. The final multivibrator division ratio is variable in order to permit the beat note to be placed at a convenient point in the audio spectrum.

Selecting a Method of Measurement

There are two basic ways of measuring frequency accurately —apart from the possibility of borrowing the firm's expensive frequency counter—which can be broadly classified as digital and analogue. Digital methods count the actual number of cycles occurring in an accurately known length of time—an elegant, but expensive, way—while analogue methods are the classical ones known to all amateurs, where an accurately calibrated oscillator is zeroed with the unknown one, typified by the BC221. Both methods rely on having an accurate standard to start with, but the analogue system is simpler and easier for home construction purposes.

To enable the exact method to be determined, an estimate of the accuracy required had first to be made. Commercial v.h.f. frequency counters and meters have claimed accuracies as high as 10 cycles at 150 Mc/s and while that accuracy might not be realized in practice, it had to be assumed that someone would spend a little time on one and achieve it. The target at G3JKV, however, was set at 1 cycle—an order better—equivalent to one part in $1{\cdot}45 \times 10^8$, or better than ·000001 per cent! A review of possible methods followed, but it was soon realized that they all had one thing in common—a very accurate and stable basic oscillator. The BC221 method of using harmonics of a variable oscillator which is zeroed against a crystal standard at intervals is the only possible one where it is necessary to measure transmitter frequency without the use of an intermediate receiver, but where a receiver is going to be used anyway, i.e., for any transmitter other than a strictly local one, the method is the wrong way round, and ought to be to use harmonics of the crystal oscillator to produce a beat note with the unknown signal, the beat note then being measured by an interpolation oscillator. If sufficiently close " pips " are produced, by the use of dividers, the beat note can always be in the audio range, and the interpolation oscillator can be a limited coverage audio oscillator of very high accuracy and stability. Assuming that the crystal oscillator is exactly on frequency, the accuracy of measurement is then unaffected by actual radio frequency, the measurement made being always in the low audio range. This method was adopted, and a block diagram of the system is given in Fig. 1.

The Reference Oscillator

The basic oscillator thus became the crux of the matter, and, connected with this, the question of which ultimate standard to use. MSF or WWV appeared to be the obvious choices at first, but when the basic oscillator eventually started attaining real stability, the beat note with any of the h.f. transmissions of these stations became less than a cycle every few seconds and was extremely difficult to separate from ordinary fading. Although MSF is also available at 60 kc/s, this is only on for one hour each day during the afternoon. However, an enquiry at the NPL, Teddington, who are responsible for MSF, showed that MSF is actually deliberately set off the absolute standard (caesium resonator) by about 150 parts in 10^{10}. This is, incidentally, to allow for the difference between local and sidereal time. The BBC Droitwich transmitter would therefore be a better bet, being within five parts in 10^{10} of absolute, and is, of course, non-fading. Differentiating between these two accuracies may

* " Hilldean," Furnace Wood, East Grinstead, Sussex.

seem just a little finicky, until you work it out and find that it represents 2 c/s error at 150 Mc/s! Of course, it could always have been allowed for, but the 200 kc/s transmission was forthwith adopted as the ultimate standard as it eliminates the fading problem, and is available all day.

The stable oscillator then had to be made. As a first trial, the 1 Mc/s crystal oscillator in the BC221 was investigated to find out just how stable it really was, after allowing ample warm-up time (about six hours!). The trimmer was too coarse for really accurate setting, but a very small variable of about 2 pF connected across the existing trimmer solved that problem. With careful adjustment, the oscillator could be made to produce a beat of about 1 cycle in 60 seconds with Droitwich (using a divider to give a 200 kc/s output), but it would only maintain this for a few minutes before drifting off again. Some of this drift was tracked down to mains voltage variations, but as there was a neon stabilized

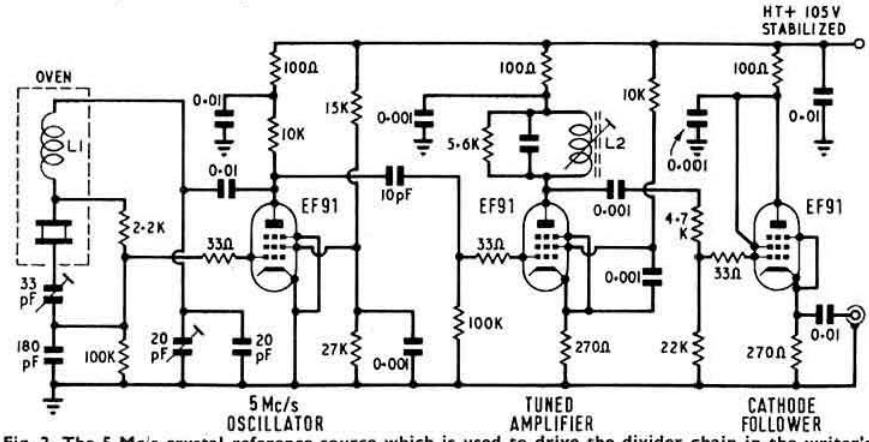


Fig. 2. The 5 Mc/s crystal reference source which is used to drive the divider chain in the writer's measuring unit. It utilizes an expensive 1 Mc/s fifth overtone crystal in a precision oven, but as these units are rarely found at realistic prices, constructors will probably prefer to substitute a conventional crystal. It is important to select one with known characteristics, however, and to operate it at its optimum temperature in an oven with negligible temperature "cycling." The inductance of L1 will be determined by the crystal used, while L2 should resonate with its parallel capacitor at 5 Mc/s.

105V h.t. line, presumably heater current variation was responsible. Steps were taken to try and eliminate this, but the results were not really good enough. Several other crystal oscillators were made up, using various configurations and crystals from 70 kc/s to 5 Mc/s, but none showed any better performance, and it seemed that the only way of improving matters was to obtain a crystal specially designed for high-stability oscillator work, plus the oven that probably went with it. Such a crystal and oven were eventually located, and the owner was induced to part with it for the usual consideration. This crystal was a 1 Mc/s unit designed to operate on its fifth overtone, contained in an oven which held it at its operating temperature within 0·1°, and when built up into a suitable circuit immediately showed excellent stability, maintaining a beat with Droitwich of about 1 cycle in 40 minutes, which is equivalent to one-third of a cycle per second at 145 Mc/s, for periods of several hours. This was very acceptable stability and solved the problem of the stable oscillator, but it cannot be pretended that such crystals can be picked up for a few shillings on the surplus market. However, the important considerations in a stable crystal oscillator are to run it at as low a power level as possible to eliminate undue crystal heating, and to keep the crystal at its turnover temperature—the temperature at which the frequency/temperature curve is flattest—so reducing drift due to temperature changes. The circuit actually used is given in Fig. 2, and it will be seen that the oscillator itself was followed by a tuned amplifier and cathode-follower to provide complete isolation, and a usable output.

Dividing the Oscillator Output

In order to provide the standard frequency " pips " around 145 Mc/s, the output of this oscillator had next to be divided down, and a v.h.f. amplifier added, but first the pip interval had to be decided. The closer they were, the smaller the range the audio frequency meter would have to cover, but also the greater the problems of ambiguity would be. These arise because a particular beat note could be made by a signal either side of the pip (just like the second channel problem in a superhet) and the selectivity of the receiver would have to be sufficient to be able to tell on which side of the pip the signal was. On the other hand, if the pips were too far apart not only would the audio frequency meter have to cover a wide range, but the audio beat note might never be produced owing to receiver selectivity cutting out one of the signals completely.

The maximum selectivity of the receiver used was of the order of 300 c/s, meaning that ambiguity would arise if the beat note were less than 150 c/s, and the only way of overcoming this was to arrange for the final divider to be variable so that two or more different beat notes could be produced. There was, however, little point in arranging the pips too close together, because measurement is just as easy over most of the audio spectrum, so finally a spacing of 10 kc/s, variable down to 5 kc/s, was used. This meant using two multivibrators each dividing by ten, and a third dividing by between ten to five, in order to get the 5 Mc/s oscillator output down to between 10 and 5 kc/s. Another reason for using a variable last divider was to produce very accurate standard audio frequencies for setting up the audio frequency meter—the broadcast tones were either not available when wanted, or of the wrong frequency. Direct output from this chain of multivibrators was insufficient to give recognizable pips at 145 Mc/s, but the addition of a broad-band v.h.f. amplifier was all that was needed to remedy the matter. The circuits used for the dividers and amplifier were quite standard, and those given by G3LTF in his article on v.h.f. frequency markers in the November, 1964 RSGB BULLETIN will be found quite satisfactory.

The effect of pumping the output from this amplifier straight into the station 2m converter (via a T junction to allow simultaneous reception of GB3VHF) was at first rather startling, to say the least, there being far too many pips present which were very obviously not at 10 kc/s intervals. By the use of appropriate tuned traps, however, the pips getting straight through into the main receiver at the convertor i.f. (24-26 Mc/s) were soon greatly reduced in strength, and relative order created out of chaos.

Audio Measurement and Calibration

There was now left an audio beat note between the nearest pip and GB3VHF itself, which had to be measured to within a cycle. The obvious way was to make a stable audio oscillator which could be accurately calibrated, and zeroed via some sort of null indicator. The station audio phase-shift oscillator was found to be far too unstable for this job, and efforts had to be bent towards making a suitably stable oscillator covering the range 0-5 kc/s. Several attempts at making RC and LC devices came to nothing, leading only to

rumination on why it was so relatively easy to make an h.f. oscillator stable to a few cycles, but so difficult to do it at very much lower frequencies.

Suddenly it became obvious that if the old BC221 was so stable at r.f., then the audio beat between its oscillators would also be as stable, and could be used as the standard. Unfortunately, as it stood, the change of audio beat note was much too fast for accurate calibration, but if the crystal oscillator were to be shifted down to 70 kc/s, for which a crystal was available, the v.f.o. could be made to tune 65 to 70 kc/s, by padding down the low frequency range, and furthermore, the 5000 cycles change would occupy nearly all the dial rotation of 5000 divisions, producing a beautifully slow change of frequency. This modification was made, entailing no drastic or permanent alterations—only the crystal and one capacitor were changed—and the resultant audio beat frequency oscillator lived up to all expectations. It was very stable, after allowing adequate warm-up time, and did not drift more than a few cycles over several hours' operation. The output waveform was rather poor at the lower frequencies, but proved no obstacle to obtaining accurate zero beats.

There just remained the problem of calibrating it. Unfortunately, a sheet of graph paper 10 in. × 8 in. would only be able to show about 100 cycles if one cycle represented a tenth of an inch, this meaning no less than 50 sheets of graphs to cover the whole range—and several weeks of work! Being a lazy character, an easier way had to be found, and eventually, after a few experiments, a solution became evident. It was found quite possible to get within 100 cycles of the right answer by just using one chart covering the whole range, and this being so, there seemed no reason why the frequency should not be measured by zeroing accurately, noting the dial reading, and performing a very accurate calibration *afterwards*. In the event, the beacon was shifted to a new frequency for the test some time beforehand, and the accurate calibration was done assuming that the beacon frequency would not be altered a second time, so the accurate chart was available at the actual time of the test. Calibration was made using the beat notes between successive pips from the 5 Mc/s oscillator, altering the division ratio from 10 to five, so that frequencies of 10, 8·333, 7·142, 6·250, 5·555, and 5 kc/s were obtained. The comparison was made by feeding the pip beat note from the receiver on to the X plates of a c.r.t., and the BC221 audio note on to the Y plates. Given equal amplitude of both inputs, zero beat was indicated by a stationary circle appearing, while zero beat using harmonics of either signal produced a stationary pattern but not a circle. This was useful in calibration, since various combinations of harmonics could be used to extend the number of check points, and in fact they were established at every few hundred cycles throughout the range. This method alone was easily accurate enough—the accuracy of the pip beat notes were better than ·0005 c/s—but to guard against gross errors, a second method acted as a check. This involved measuring the actual radio frequency both of the crystal and variable oscillators, and was done by using the 100th harmonic of the variable oscillator zeroed against successive 10 kc/s pips between 6500 and 7000 kc/s. Using such a high harmonic increased the accuracy of the check, and once the v.f.o. had been calibrated, it could be used to establish the crystal frequency. Separate graphs were drawn for each method, and when they were finally compared it was found that they agreed to within half a cycle! In order to make sure that no drift had occurred the BC221 was checked again after the test measurement had been made, and in fact no drift was found.

Accomplishing the Measurement

This left the last hurdle—making the actual measurement, which was not as simple as might at first appear. This was because of drift on the beacon, which amounted to between 20 and 30 cycles during each long dash between coding. If the measurement had been made at the wrong time, wrong by as little as 10 seconds, the error due to drift would have been greater than all other errors put together. A stopwatch synchronized with the time pips on MSF provided the time standard, and, of course, it was just plain unlucky that the beacon started coding at 15.5959 precisely, the measurement having to be made at 16.0000!

An assessment of possible inaccuracy showed that the 5 Mc/s oscillator was within a third of a cycle at 145 Mc/s with Droitwich, which in turn was within a tenth of a cycle of absolute, giving a total basic inaccuracy here of about half a cycle. The audio frequency meter calibration was thought to be within a cycle, and reading inaccuracies probably contributed another cycle error, making a total of 2½ cycles error overall. The actual measurement was 144, 502,335·8 c/s, and this compared with official figures of 144,502,335 c/s by Tatsfield, 144,502,334 c/s by G3PYE, and the same by G5FK, so that the estimated error seemed well founded. It is of interest that G4LU, using almost exactly the same method of frequency measurement, achieved a result with almost the same error!

As can be seen, any frequency from zero to the highest at which the pips can be heard can be measured with the same set-up, and for anyone with a bias towards knowing on just what frequency he really is transmitting some time spent setting up accurate frequency measuring apparatus is well worthwhile.

Dance Band for Amateur Socials

Clubs experiencing difficulty finding a dance band for an annual dinner and dance may be interested to know of the Frank Charles Band, 13 Landford Road, Putney, London, SW15. The leader of this four-piece combination is G3OGL —G3GHH is also a member of the band—and the instruments used are an organ, tenor saxophone, guitar and drums. All ages and tastes are catered for, and if required suitable background music can be supplied during the meal. Frank Charles, G3OGL, is always prepared to act as MC, and he guarantees to make the party " swing." Further details may be obtained from the above address, or VANdyke 2233 and PUTney 9534.

Rotarian Amateurs

G8ON is interested in forming a group of licensed radio amateurs who are also members of Rotary Clubs in Great Britain and Ireland. Those interested should contact H. S. Chadwick, 25 Raines Avenue, Worksop, Nottinghamshire.

Instructor Required for ATC

The Officer Commanding, 2307 Squadron Air Training Corps, is anxious to obtain the help of a London radio amateur as an instructor for the unit based in Fulham, South London. A large quantity of equipment is available for the class which will consist of boys and also girls, as there is a Girls Venture Corps Air Wing. An instructor would be able to claim fares to and from home to duty. Anyone who is interested in assisting should contact R. Kraft, Flight Lieutenant, Officer Commanding, 2307 (Henry Compton) Squadron, Air Training Corps, " Westlands ", The Rise, Amersham, Bucks.

Transistorized Dip Oscillator

The author of the article " A Transistorized Dip Oscillator," published in the April issue of the RSGB BULLETIN, has received several letters from members who have been unable to locate a supplier of the paxolin tubes used as coil formers for the oscillator. As it seems that the correct tubing is no longer available in reasonable quantities, G3HBW suggests, as an alternative, ⅜ in. o.d., ⅜ in. i.d. bakelite tubing which is marketed by Robust Plastics Ltd., 18 Parade Mews, Norwood Road, London SE27, in a minimum quantity of 4 ft. for £1.

The G3JJG S.S.B. Exciter

Part 3

By G. F. GEARING, G3JJG*

TWO units have been described so far which produce upper sideband s.s.b. signals in the range from 5·0 Mc/s to 5·5 Mc/s. To complete an h.f. amateur band exciter, a further unit is required which will heterodyne these signals with the output of a crystal oscillator and then amplify the selected signals, in the bands from 80m to 10m (part), to drive a Class AB1 output stage which uses a QV06-20 or 6146 valve. A three transistor/two valve circuit to perform these functions is the subject of this month's article. A block diagram is shown in Fig. 1, and the complete circuit in Fig. 2.

Band Switching

The crystal oscillator and amplifier stages are arranged in line from the front to the rear of the exciter so that all circuits may be selected by a common band switch. Nine separate wafers are used, on a shaft length of about 10 in.; Trolex

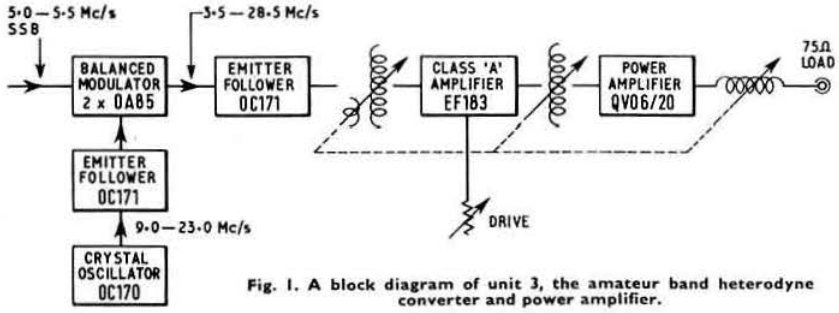


Fig. 1. A block diagram of unit 3, the amateur band heterodyne converter and power amplifier.

components are readily available from Electroniques and these have given satisfactory service in the original Princess transmitter.

Coils and transformers in the r.f. amplifier circuits are short-circuited when switched out of circuit so as to avoid unwanted resonances (suck-out). Only 500 kc/s of the 10m band is covered and may be either 28·0 Mc/s to 28·5 Mc/s or 28·5 Mc/s to 29·0 Mc/s, depending on the frequency of the crystal selected (X4).

Tuning

Wideband coupling transformers were considered for the driver tuned circuits but spurious products at unwanted frequencies, which must be produced in the successive heterodyning processes, may not be attentuated to a safe level. Similarly, single tuned circuits, with their response broadened by heavy resistive damping and with capacitive inter-stage coupling, would not give much protection against the spurii.

Individual tuned circuits are therefore provided for each band in the grid circuits of V1 and V2, but the tuning capacitors are mechanically ganged and driven by one knob.

An additional refinement is provided by ganging the p.a. tuning with the previous stages and using a pi-network tank with fixed loading capacitance, calculated and adjusted to work into an impedance of 75 ohms. Thus only one panel control is necessary for tuning all circuits and, as the coverage of this control is restricted to about 700 kc/s on each band, no calibration is required because it is not possible to tune to any spurious product.

It is appreciated that this refinement may be regarded as an over-complication but, for compatibility with the layout of the Princess front panel, it is unavoidable. However, with alteration of layout, conventional p.a. tuning and loading controls may be used.

Control

A station is only as efficient as its control arrangements, particularly when operating on s.s.b. Voice-control could be used, but, generally speaking, single switch control will meet most requirements with a minimum of circuitry. On the exciter, one control gives the following possibilities: OFF, TUNE, NET, RECEIVE, TRANSMIT. When switched to TRANSMIT, telephony is transmitted unless a Morse key is inserted in the jack to give c.w. operation. One additional wafer should be available on the switch so as to control the associated linear amplifier and station receiver.

Layout of the Exciter

Layout of the first two units in conjunction with the remainder of the exciter may be varied to suit individual requirements. The writer's system demanded that units 1 and 2 be mounted side by side on top of a 10⅜ in. × 5 in. × 18 s.w.g. aluminium plate, with the third diecast box mounted immediately below them and the plate, and the p.a. located at the rear of the exciter, above and below the chassis. The overall height does not exceed 7½ in.

A suitable power supply can be built on a similar sized plate and the two assemblies may be assembled as a low power self-contained transmitter, with external dimensions of about 13 in. × 6 in. × 11 in. deep.

Crystal Oscillator

TR1 is connected as a Colpitts-type oscillator, with the selected crystal connected between base and earth and the a.c. feedback path provided by C1 and C2. The correct output frequency is selected by L1 and the capacitors which are switched into circuit by wafer S1b. For each band, the frequencies are:

Band	Crystal	Frequency at TR2
3·5-4·0 Mc/s	9·0 Mc/s	9·0 Mc/s
7·0-7·5 Mc/s	12·5 Mc/s	12·5 Mc/s
14·0-14·5 Mc/s	9·0 Mc/s	9·0 Mc/s
21·0-21·5 Mc/s	8·0 Mc/s	16·0 Mc/s
28·0-28·5 Mc/s	11·5 Mc/s	23·0 Mc/s
or		
28·5-29·0 Mc/s	11·75 Mc/s	23·5 Mc/s

The core of L1 is adjusted with the bandswitch at 80m or 20m; C8, C10 and C11 are adjusted on 40m, 15m and 10m respectively.

TR2 is connected as an emitter-follower, matching the oscillator signal into the primary winding of T1. R24, in series with the collector, gives some protection to the transistor if the emitter is shorted to earth during testing. This happened to the prototype and the dead bodies were sad to behold.

* 65 Ringwood Close, Furnace Green, Crawley, Sussex.

† Parts 1 and 2 were published in the July and August, 1966 issues of the RSGB BULLETIN.

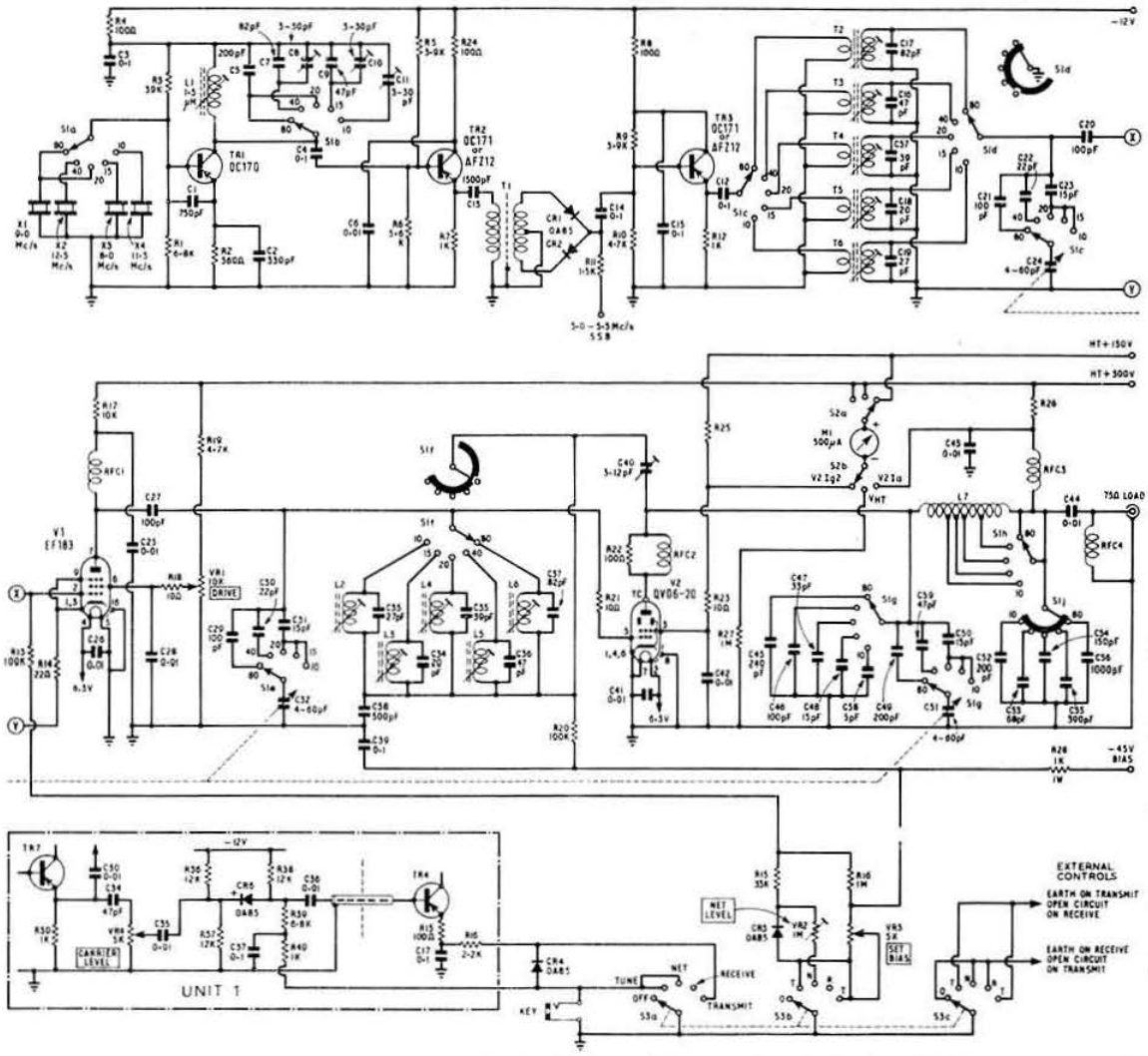


Fig. 2. The circuit of unit 3. Circuitry for carrier re-insertion is added to unit 1 to complete the function-switching arrangements. The single-tone r.f. output delivered by the prototype was 7 watts into 75 ohms.

Balanced Mixer

Following the policy pursued in the earlier units, the final conversion process to the signal output frequencies uses a diode balanced mixer. Thus the level of the heterodyning signal beyond the mixer is reduced by at least 12db, facilitating initial alignment of the exciter and making the stage performance more predictable.

T1 is a home-made balun transformer wound on a conventional $\frac{1}{0.1}$ in. former and this component maintains approximate balance over the full range of heterodyning signals from 9 Mc/s to 23 Mc/s. The secondary is centre-tapped and connected to earth; modulator balance may be improved with a standard 1K ohms potentiometer across the secondary, but this seemed to reduce the drive level on 10m and so is not shown on the circuit.

The output of the balanced modulator is at low impedance and could possibly be matched into link windings on the driver grid transformers. However, these link windings are common to the 5·0 to 5·5 Mc/s s.s.b. input signals and at these frequencies (away from resonance of the tuned circuits), they appear as a very low impedance; thus most of the s.s.b. signal is lost across the potential divider formed by R11 and this impedance.

Inclusion of the emitter follower TR3 eases this problem because it presents a reasonable impedance to the s.s.b. input signal; the following transformers use a 1 : 4 turns ratio, which is a standard figure in the Electroniques range of small coils. Typically, the drive to V1 grid is about 20V r.m.s. with TR3 in circuit and about 300 mV if it is bypassed.

Driver Stage

Transformers T2 to T6 are selected by wafers S1c and S1d; a shorting ring shorts out the secondaries of all unused coils. The values of C16 to C19 and C57 are based on the

layout of the prototype and may vary slightly from model to model. The circuits are tuned finally by C24 in series with C21 to C23 (which restrict the frequency coverage).

An EF183 high-slope r.f. pentode is used as the driver valve, with fixed negative bias stabilizing the d.c. working point. A small amount of negative feedback is applied across R14, otherwise the stage input capacitance would vary with the instantaneous value of anode current and consequently the drive level, detuning the grid circuits on speech and worsening stage linearity.

The grid bias when on TRANSMIT is about − 1·6V, and is derived from the bias line through a potential divider formed by R15, R16 and CR3. V1 anode voltage should be about + 200V when the screen voltage is 90V (with VR1 at maximum drive setting). R19 and VR1 form a potential divider which has a greater bleed current than V1 I_{g2} so that the source impedance of the screen supply does not vary too much over the travel of VR1. R18 is mounted touching the valveholder pin to deter parasitic oscillations.

Final Amplifier

V2 grid circuits are tuned to signal frequency by L2 to L6 and the associated capacitors; C32 is mechanically coupled to C24 and these tuned circuits must be adjusted to track with the driver grid circuits. The remote end of each coil is connected to earth through C38, part of the neutralizing circuit; when connecting the shorting ring, be certain to return it to this point and not direct to earth.

The circuit arrangement of V2 is standard, with a pi-network tank circuit and the h.t. to the anode passing through L7; the screen grid is fed from a stabilized + 150V source, R21, R23 and R22/RFC2 are parasitic stopping components; C40 and C38 complete a conventional bridge neutralizing circuit, C51 is coupled mechanically to C24 and C32 and fixed tuning capacitors C45 to C50, C58 and C59 are switched by S1g. The taps of L7 are selected by S1h and an inversely shorting wafer at S1j reduces the total loading capacitance in circuit as the frequency is increased.

L7 is an air-spaced, polystyrene rod supported coil manufactured by Codar, with the last six turns double spaced so as to reduce the end turn effect of the shorted portion of the coil at high frequencies. If conventional p.a. tuning and loading capacitors are to be used, an Eddystone 817 (250 pF) is more than adequate for tuning and a twin-gang 500 pF variable is satisfactory for loading, with an extra 1000 pF, C56, switched in circuit on 80m only.

Provision is made to monitor V2 screen and anode currents and the h.t. voltage; M1 may be any 500 μA meter but to calculate the 10 mA and 100 mA shunts, R25 and R26 respectively, the meter resistance must be known. R25 must be $\frac{1}{10}$ of this value and R26 must be $\frac{1}{100}$ or there-

Components List

C1	750 pF 1% silvered mica
C2	330 pF 1% silvered mica
C3, 4, 12, 14, 15	0·1μF 30V miniature foil
C5	200 pF 1% silvered mica
C6	0·01μF 30V miniature foil
C7, 17, 37	82 pF 1% silvered mica
C8, 10, 11	3-30 pF trimmers
C9, 16, 36	47 pF 1% silvered mica
C13	1500 pF 5% silvered mica
C18, 34	20 pF 1% silvered mica
C19, 33	27 pF 1% silvered mica
C20, 21, 27, 29	100 pF 1% silvered mica
C22, 30	22 pF 1% silvered mica
C23, 31	15 pF 1% silvered mica
C24, 32, 51	4-60 pF Eddystone type 582
C25, 26, 28, 41, 42, 43, 44	0·01μF 350V disc ceramic
C35, 57	39 pF 1% silvered mica
C38	500 pF 1% silvered mica
C39	0·1μF 150V polyester
C40	3-12 pF trimmer 500V d.c. (neutralizing)
C45	240 pF ceramic*
C46	100 pF ceramic*
C47	33 pF ceramic*
C48, 50	15 pF ceramic*
C49, 52	200 pF ceramic*
C53	68 pF ceramic*
C54	150 pF ceramic*
C55	390 pF ceramic*
C56	1000 pF ceramic*
C58	5 pF ceramic*
C59	47 pF ceramic*
	*Hunts type CDP are suitable
CR1, 2, 3, 4	OA85
L1	14 turns, 38 s.w.g. enam., close-spaced, wound on $\frac{19}{64}$ in. diam. former, fitted with 0·5 in. iron-dust core
L2	Nominal inductance 0·6μH. Electroniques type 27MZ
L3	Nominal inductance 1·0μH. Electroniques type 26MZ
L4	Nominal inductance 2·0μH. Electroniques type 25MZ
L5	Nominal inductance 6·9μH. Electroniques type 24MZ
L6	Nominal inductance 14·5μH. Electroniques type 3MZ
L7	Codar air-spaced tank coil, $1\frac{1}{2}$ in. diam. 2 in. long, 20 turns, 20 s.w.g., with end $6\frac{1}{2}$ turns double spaced. Total inductance 9·2μH. Tap at $4\frac{1}{2}$ turns (10m), $5\frac{3}{4}$ turns (15m), $8\frac{1}{2}$ turns (20m) and $12\frac{1}{2}$ turns (40m) type JJG/10 Note that the link windings on L2 to L6 are not used.
R1	6·8K ohms
R2	560 ohms
R3	39K ohms
R4, 8, 24	100 ohms
R5, 9	3·9K ohms
R6	5·6K ohms
R7, 12	1K ohm
R10	4·7K ohms
R11	1·5K ohms
R13, 20	100K ohms
R14	22 ohms
R15	33K ohms 1% high stability
R16	1M ohm 1% high stability
R17	10K ohms 1W 5%
R18, 21, 23	10 ohms
R19	4·7K ohms 3W 5%
R22	100 ohms $\frac{1}{2}$W
R25	10 mA meter shunt
R26	100 mA meter shunt
R27	1M ohm 1W 1% high stability
R28	1K ohm 1W 10%
	All resistors are $\frac{1}{4}$W rating, 10% tolerance except where stated otherwise
RFC1, 3, 4	2·5 mH 100 mA r.f. chokes
RFC2	Parasitic stopper: 7 turns, 22 s.w.g. enam., wound on body of R22
S1	Band selection switch: 9 Trolex wafers on 10 in. (see text) shaft assembly. S1a, 1 pole 5 way; S1b, 1 pole 5 way; S1c, 2 pole 5 way; S1d, 1 pole 5 way fitted with internal shorting ring; S1e, 1 pole 5 way; S1f, 1 pole 5 way fitted with internal shorting ring; S1g, 2 pole 5 way; S1h, 1 pole 5 way; S1j, 5 way inverse shorting ring (all five connections joined on 80m, four on 40m, three on 20m, etc.).
S2	Metering: 2 pole 3 way break-before-make
S3	Control: 2 bank, 2 pole 5 way.
T1	Balun transformer: *Primary* 30 turns, 36 s.w.g. enam., close spaced; cover with insulating paper or generously coat with polystyrene cement. Form Faraday screen from thin copper sheet, $\frac{3}{4}$ in. wide, into $\frac{15}{16}$ turn (the ends must not be joined) and make screen connection with 18 s.w.g. tinned copper wire soldered down one edge of copper. Insulate the screen. *Secondary* 30 turns, 38 s.w.g. enam., centre tapped. Bring out all connections to end of former remote to fixings. Wound on $\frac{19}{64}$ in. diam. former without dust core.
T2 to T6	As L6 to L2 but with link windings utilized.
TR1	OC170
TR2, 3	OC171 or AFZ12
V1	EF183. Use a p.t.f.e. valveholder
V2	QV05-20 or 6146
VR1	10K ohms 3W wire wound, with long spindle
VR2	1M ohm carbon track, with long spindle
VR3	5K ohms 3W preset
X1	9 Mc/s, style D
X2	12·5 Mc/s, style D
X3	8 Mc/s, style D
X4	11·5 Mc/s or 11·75 Mc/s depending on range required. Style D

abouts! When switched to read h.t., the series resistor R27 must have a value of 2000 ohms for every volt at full scale, e.g. for 500V f.s.d., R27 = 1M ohm. Note that the positive pole of the meter is switched to the 150V line when reading screen current.

System Control

With S3 at RECEIVE, the emitter circuit of TR4 (unit 1) is lifted above earth, both V1 and V2 are over-biased and the receiver is operational. The exciter will generate an extremely low level of quiescent noise at this time, allowing an electronic aerial changeover switch of the cathode follower type to be used if required.

At NET, R40 (unit 1) is connected to earth so that the diode switch CR6 (unit 1) conducts and a controlled amount of carrier signal is injected after the sideband filter to the base of TR4 (unit 1). The earth at S3a also allows CR4 to conduct so that the 455 kc/s amplifier in unit 1 (TR4) is operating and a full amplitude carrier signal is passed through unit 2 to V1 grid. The degree of over-bias applied to V1 only is reduced by the setting of VR2, which is earthed through S3b, to give a convenient netting level.

At TUNE, the conditions at S3a are the same as above, but S3b earths CR3 and VR3 so that all stages of the exciter are operational. S3c mutes the receiver and switches the aerial changeover relay. A single tone is transmitted at carrier frequency so that all circuits may be peaked by the TUNE EXCITER control.

At TRANSMIT, the conditions are similar to the TUNE position but CR4 is now reverse biased and the carrier is not reinserted. However, under these conditions, a key may be used to earth R40 and so give c.w. transmission at carrier frequency. Note that the microphone should be removed when using c.w. because it is not desensitized.

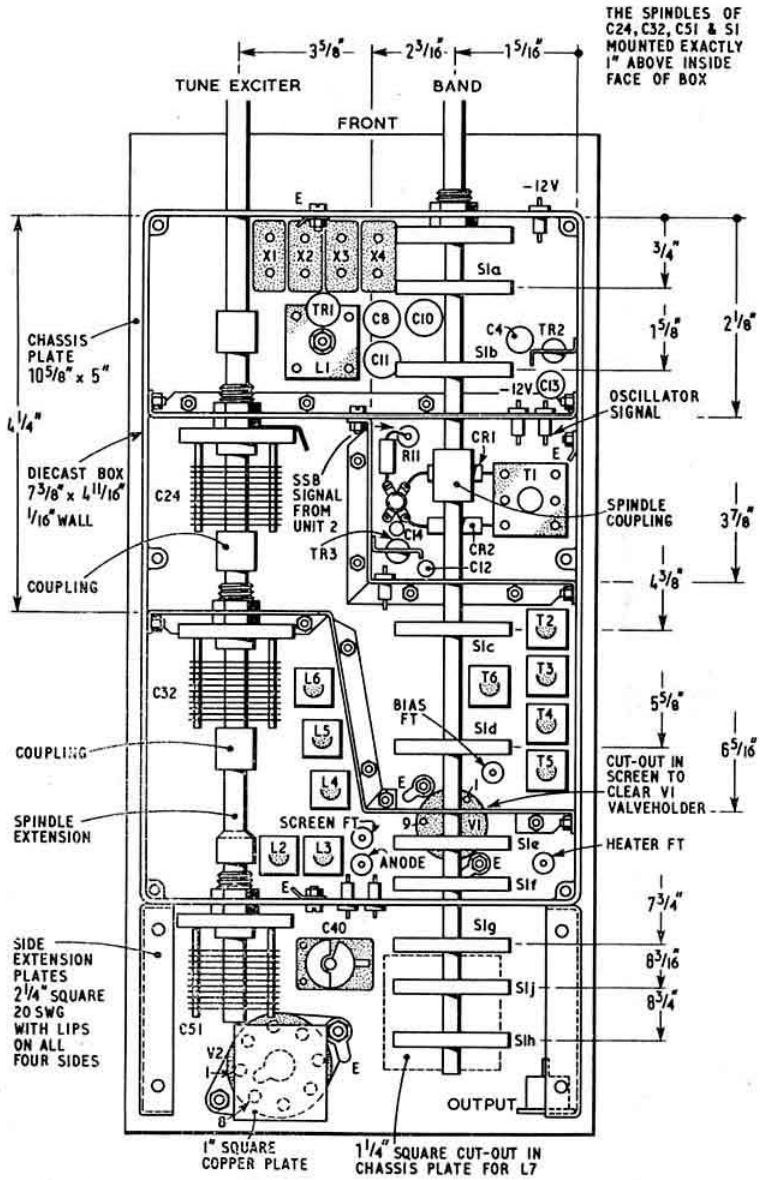


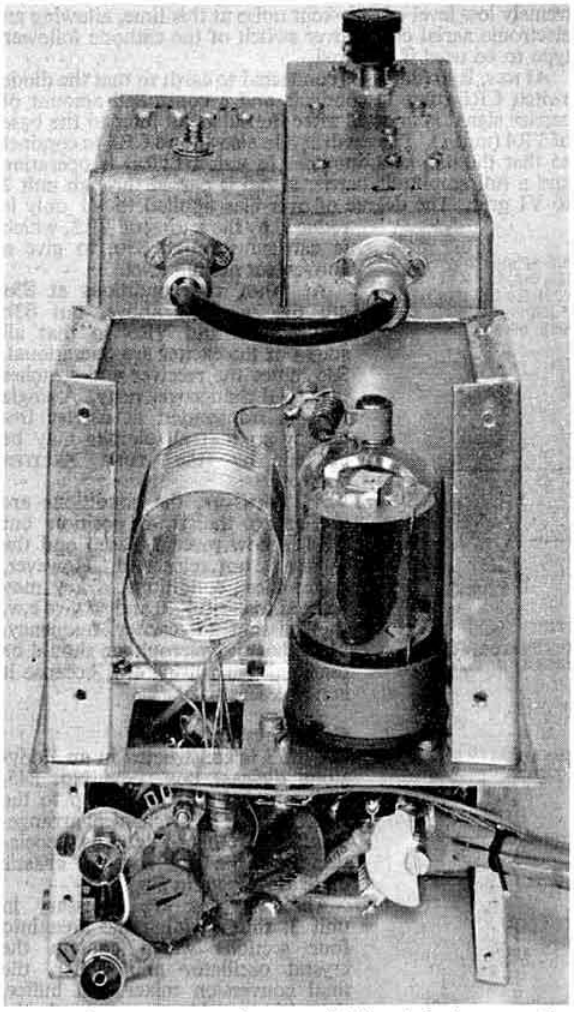
Fig. 3. It is advisable to adhere to this component layout to avoid the possibility of instability, particularly with regard to V1. The measurements indicate positions of screens and S1 wafers. The positions of smaller components may be estimated by reference to the under-chassis photograph on page 579.

Construction

Unit 3 is constructed in an Eddystone die-cast box, type No. 845, and contains all circuitry up to the grid of V2. The mechanical arrangements inside this box and its association with the p.a. and the chassis plate are shown in Fig. 3.

Three screens are necessary in unit 3, thus dividing the area into four sections which contain the crystal oscillator and buffer, the final conversion mixer and buffer, the driver grid circuits and the p.a. grid (driver anode) tuned circuits. The essential lateral dimensions of these screens are shown in Fig. 3; each one is 2 in. high, with $\frac{3}{8}$ in. fixing lips as shown, and cut from 20 s.w.g. aluminium. Standard 6 BA fixings are used to bolt the screens to the box, using countersunk head screws where necessary.

Holes for the fixing bush of S1 and for the clearance of the extension spindle on C24 must be drilled in the front face of the box with similar holes for the other end of S1 and C51 on the rear face. These holes are repeated in the screens, so that, when the unit is assembled, the switch and capacitors will be correctly aligned. It is worthwhile to trial-fit the screens and check this alignment before proceeding further. When it is satisfactory, drill all screen fixing holes and also $\frac{5}{32}$ in. holes in each screen and the rear of the box for the



The complete prototype exciter assembled ready for incorporation in the Princess transmitter.

switch rods (6 BA threaded rod which should be ordered with the switches). Note that the rods must lie above and below the switch spindle, and *not* in the horizontal plane.

Oscillator Compartment

Cut the spindle of S1 at a point about 2½ in. behind the indexing mechanism and cut two pieces of the 6 BA switch rod to about the same length. Assemble the mechanism and wafers S1a and S1b to the front face of screen 1, using appropriately cut spacers to place the wafers according to the dimensions given (each wafer is $\frac{5}{32}$ in. thick). Mount C24 on the rear face of the screen and fit two feed-through insulators. Check that the fixing holes for screen 2 in the centre of screen 1 have been drilled, offer this sub-assembly to the box and finally bolt it in place.

Major components in the oscillator compartment can now be fitted, with TR2 on a small screen on the side wall of the box (a mounting similar to TR4, unit 2) and L1 mounted as near as possible to C24 shaft and spindle coupler. The four crystals are located, side by side and upside down, beside the indexing mechanism for S1 and TR1 is wired above them, using spare pins on the insulating plate of L1 for support. C8, C10 and C11 are suspended by the 18 s.w.g. tinned copper wiring.

Mixer Compartment

Drill a $\frac{3}{8}$ in. diameter hole in the bottom of the box to accept the output of unit 2, place a stand-off insulator about 1 in. from this hole and mount T1 near the side wall of the box (remember the coupler on the switch shaft). After fixing the small screen for TR3, and one feed-through insulator, bolt screen 2 into place.

Driver Grid Compartment

The remainder of S1 must be assembled into unit 3 before proceeding further. Place each switch wafer in its correct compartment, loosely position screen 3 (which must have a cut-out to clear V1 valveholder) and than pass about 6¼ in. length of spindle through them, starting from the rear of the box and so leaving an overlap which will be used for the p.a. wafers. Ensure that all wafers have been assembled on the shaft with the same correct orientation; this can be very confusing and it may be wise to check with an AVO before assembly is completed. When satisfied, thread the two 5½ in. lengths of switch fixing rod through the wafers, adding spacers as necessary to leave each wafer in the correct position. Bolt screen 3 into the box, tighten the switch rods and couple the two parts of the switch spindle.

Mount transformers T2 to T6 in the approximate positions shown, with T6 between S1c and S1d. Drill a $\frac{3}{4}$ in. hole for the valveholder for V1 and mount the holder so that all pins except 1, 2 and that from the centre spigot are on the anode side of screen 3. Insert the feed-through in the bottom of the box for the bias feed.

Driver Anode Compartment

Mount C32 and couple its spindle to the back of C24; drill and trial-fit L2, L3, L4, L5 and L6 but do not fit until V1 has been wired. Mount feed-through insulators for the anode, screen and heater connections of V1 (in the bottom of the box) and for the r.f. feed to V2 grid and the neutralizing return to C38 (on the rear face of the box).

Wiring of Unit 3

The unit should now be wired and the oscillator circuits may be quickly tested, as described later. In fact, by supplying an s.s.b. signal from unit 2 and with the station receiver closely coupled to the output of the mixer, signals should be detected in each band, providing a fillip to one's confidence.

In the vicinity of V1, the layout is critical; pins 1, 3 and 9 are joined to R14 which is earthed, with the centre tag, to the earth of the grid circuit. R13 is wired from pin 2 to the bias feed-through insulator. RFC1 and R18 are wired inside the box from pins 7 and 8 respectively of V1 to the feed-through insulators; C25 and C28 are returned to the common earth of the anode circuit. Pins 5 and 6 are strapped to the tag in the corner of the box. After the valveholder wiring is completed, L2 to L6 are mounted and wired into circuit; C38 is mounted between the neutralizing feed-through and the anode circuit earth tag and C32 is earthed to this same tag.

Power Amplifier

After checking and completion of the wiring to the external feed-through tags, unit 3 is mounted on the chassis plate, using ¼ in. spacers so that the wiring is not crushed. Two side extension pieces, each about 2¼ in. square and with

fixing lips, are added so as to enclose the p.a. grid area. A 1¼ in. square is cut out of the chassis plate immediately below S1h and S1j and the valveholder is mounted as shown in Fig. 3. Do not mount C51 until the p.a. wiring is nearly completed.

The p.a. coil and V2 are contained above the chassis in a three-sided screen measuring 4¾ in. wide, 3½ in. high and 2 in. from front to back. L7 is mounted in the horizontal plane so that the tap connections can be dropped through the chassis to wafer S1h. A stand-off insulator holds the parasitic components to V2 anode and from this point, the neutralizing feed is taken to C40 and then via the feed-through to C38.

A piece of copper sheet about 1 in. square is cut, cleaned and held by wiring about ⅛ in. above V2 connections; pins 1, 4, 6, 7 and 8 are soldered to it and the sheet is earthed once, to the earth tag shown. All r.f. connections are returned to it, including those from C41, C42, C43 and the tank circuit, thus giving truly common cathode operation. The remaining r.f. components are added in the space around the switch wafers and the d.c. components are located below C51 and on the adjacent side extension piece. C51 is added on completion of wiring and is coupled to the back of C32. Covers for the p.a. compartments above and below chassis are made from perforated zinc and secured with self-tapping screws.

Alignment

The essential items of test equipment for the alignment of the completed exciter are a good receiver with general coverage to 30 Mc/s, a 10,000 ohms per volt (or better) multi-meter and a 75 ohm r.f. output load with means of displaying power with reasonable accuracy up to 10 watts. If a valve-voltmeter with an r.f. probe is also available, then this will prove of great value in conjunction with the quoted measurements on the prototype.

Crystal Oscillator

Apply — 12V d.c., 6·3V a.c. and bias supplies to the exciter; switch to RECEIVE and measure d.c. voltages as follows:

TR1	e	— 1·5	TR2	e	— 7·8	TR3	e	— 5·6
	b	— 1·8		b	— 7·1		b	— 5·8
	c	— 11·8		c	— 11·8		c	— 11·8

Couple the station receiver loosely into the balun transformer, T1, tune it to 9 Mc/s and switch the exciter to 80m. Adjust the core of L1 until the signal is at maximum amplitude consistent with stability; listen to the same signal with the exciter switched to 20m. Switch to 40m and retune the receiver to 12·5 Mc/s; adjust C8. Switch to 15m, retune the receiver to 16·0 Mc/s; adjust C10. Switch to 10m, retune the receiver to 23·0 Mc/s; adjust C11.

V1 Grid

Switch to TUNE, thus reinserting the carrier and so providing an output signal from unit 2. Set the V.F.O. TUNING control to minimum capacity, monitor 5·5 Mc/s and increase the setting of the CARRIER LEVEL control, VR4 (unit 1), to a point just below the onset of limiting (turn off the receiver a.g.c. for this!).

Select 80m on the exciter and transfer the receiver coupling loop to V1 grid. Set the TUNE EXCITER control so that the ganged capacitors are all at about 95 per cent of maximum capacity. With the receiver tuned to 3·5 Mc/s, the exciter signal should be heard and peaked by adjusting the core of T2; move the v.f.o. and receiver to give a frequency of 3·8 Mc/s and peak the signal on the swing of the TUNE EXCITER control, which should then be about 5 per cent away from minimum.

This process should then be repeated on all bands, setting the v.f.o. and receiver as follows:

Band	Limits (kc/s)	Output of Unit 2 (kc/s)	Adjust	Swing of C24, etc.
80	3500-3800	5500-5200	T2	95%-5%
40	7000-7100	5500-5400	T3	20%-50%
20	14000-14350	5000-5350	T4	10%-80%
15	21000-21450	5000-5450	T5	30%-70%
10	28000-28500	5000-5500	T6	30%-60%

At this stage, it will be possible to switch to TRANSMIT, thus removing the tone, and to modulate the exciter. Signals on all bands should be clean, with no audible distortion.

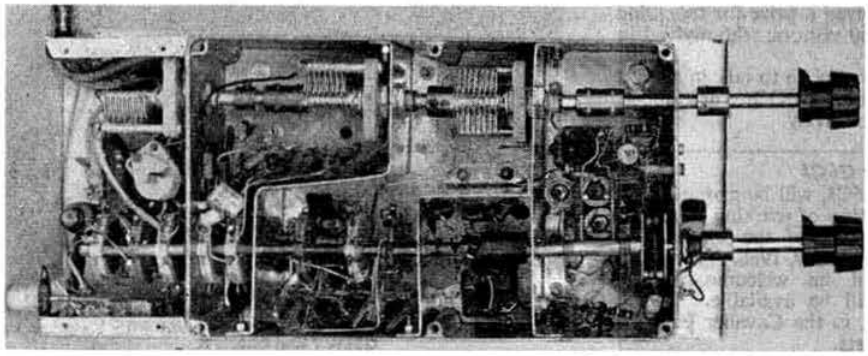
P.A. Grid

Switch off and connect the p.a. anode and screen supplies. Select 80m and monitor anode current, setting the TUNE EXCITER and V.F.O. TUNING controls for the l.f. end of 80m. Roughly preset C40 so that it represents about 5 pF. Set the NET LEVEL control to give maximum signal, the DRIVE control to maximum and select NET on the SYSTEM switch.

Under these conditions, the carrier is re-inserted and the complete exciter, with the exception of the p.a., is operational. Couple the receiver very loosely into the p.a. grid circuit and, monitoring each band in turn, adjust L6 to L2 for maximum audible signal. A definite sharp peak should be found each time, but take care not to tune to unwanted signals, particularly when switched to 40m where the 5·5 Mc/s signal may be within the range of adjustment of the core of L5. If necessary, slightly alter the values of C33 to C37. When all these circuits have been tuned, p.a. alignment may be attempted.

Power Amplifier

Switch to TRANSMIT, thus placing the correct bias on the p.a. but without the carrier. Adjust the SET BIAS control so that the quiescent anode current is 20 mA; at this time, the screen current should be about 1 mA. Plug a 75 ohm resistive load into the r.f. output socket and, commencing at the l.f. end of 80m, switch to TUNE and peak the TUNE EXCITER control for maximum. The anode current should rise to about 65 mA, V2 I_{g2} to about 6 mA and the r.f. output to 7 watts. This is the idealized case and it is probable that C45 will have to be selected at a value within 10 pF of the quoted figure. However,



An under-chassis view of the heterodyne band converter and amplifier, unit 3.

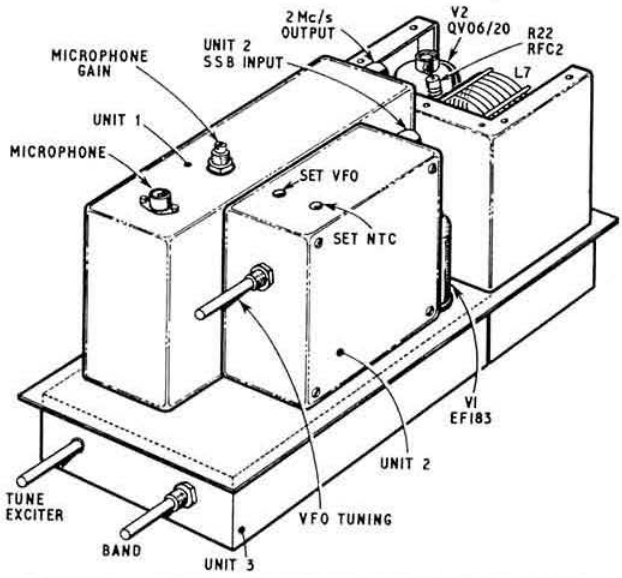


Fig. 4. Units 1, 2 and 3 may be assembled in this form if it is desired to incorporate the exciter into the Princess transmitter.

once the correct value is found, the r.f. output should remain sensibly constant across the band.

Each band is aligned into the 75 ohm load, altering the taps on L7 or adding or removing 5 pF across C46, C47, C48 and C58 until about 7 watts output is obtained at all frequencies covered by the exciter. When this is completed and the grid circuits have been finally peaked, switch back to TRANSMIT, select 15m and remove the load.

To check the neutralizing, monitor the p.a. anode current and reduce C40 to minimum capacitance; swing the TUNE EXCITER control across the band. The anode current will probably rise suddenly to about 50 mA as the stage goes into tuned grid/tuned anode oscillation. Slowly increase the setting of C40 until the unwanted signal is just damped; at this point, C40 should have returned close to the original preset point. Check each band in turn across the swing of the control; no trace of instability should be seen.

The exciter is now aligned but it may be wise to check the settings of the balanced mixer controls in the earlier units and also the setting of the CARRIER LEVEL control RV4 (unit 1). This must be just below the limiting point of the exciter.

Measurements

The following measurements have been made on the prototype, using a Marconi TF1041 valve-voltmeter, with the exciter switched to TUNE:

TR1 collector or primary of T1	3·0V r.m.s., falling to 2·5V r.m.s. on 10m
T1 secondary	1·2V approximately
Input at R11 from unit 2	0·7V r.m.s. average
V1 grid	0·5V average
V2 grid	20V r.m.s. approximately with VR1 at maximum
V2 anode current	65 mA at V_a = 320V
V2 screen current	6 mA at V_{g2} = 150V
R.F. Output	7 watts single tone into 75 ohm resistive load.

Results

At the time of writing, the exciter has been used without a following linear amplifier on all bands with excellent results. The Brush Clevite filter has been thoroughly tried and the characteristics appear to have remained constant and do give very good speech quality for this mode. Similarly, the c.w. note is very pleasing and no clicks are present.

It has proved better to have the NET LEVEL control on the front panel because this may need adjustment when switching from band to band.

The alternative of fitting the exciter inside the Princess or building it into a self-contained unit has proved a difficult decision because of a natural reluctance to disturb the large transmitter. Modern trends are towards the small exciter and companion linear amplifier and this policy will be adopted. In any case, the original aims were met and this is a matter for individual choice.

Acknowledgments

The author wishes to acknowledge the valuable assistance given by the Brush Clevite Company Limited, A. H. Hunt (Capacitors) Ltd., Electroniques Ltd. and the Codar Radio Company.

Worcester Mobile Picnic

The Worcester and District Amateur Radio Club second annual Mobile Picnic was held at the Hill County Secondary School, Upton-on-Severn, on 17 July. Some potential visitors may have been deterred by the wet weather of the day, but G. T. Allen, G3JTK/M, made the trip from Havant, near Portsmouth, Hants. and received a prize for travelling the farthest. There were about 160 visitors, who arrived in 61 vehicles.

Prizes were awarded for farthest mobile to talk-in station QSOs on 160m and 2m to Mike Webb, G3OOQ/M at 21 miles, and Fred Ridgway at 30 miles respectively.

"Aerials," by G6CJ

F. J. H. Charman, BEM, G6CJ, will be giving his famous lecture and demonstration of working small-scale model aerials at a meeting of the Verulam Amateur Radio Club on 21 September, 1966. Visitors from neighbouring areas will be welcome, and refreshments for over 150 will be available. The meeting will start at 7.30 p.m. in the Cavalier Hall, Watford Road, St. Albans, Herts.

The farthest 160m contact achieved by the talk-in station at the Worcester Mobile Picnic and a visiting mobile was with G3OOQ/M. He is seen in this photograph being presented with his prize by G3SWT and G3NUE.

TECHNICAL TOPICS By PAT HAWKER, G3VA

Field Effect Transistors . Davco DR30 receiver . FET Front-ends . One-FET Receiver . Transistor Mixers . 10 kc/s calibrator . F.M./P.M. Detector . Oscillator with balanced outputs . DX on Milliwatts . Anode Modulation of Tetrodes . Sensitive R.F. Meter . More on the Vackar

SOMETIMES, to judge by the lively *Letters* in the BULLETIN and other radio journals, one might be excused for thinking that Amateur Radio must ultimately fragment into a whole series of separate sub-circles—groups who would give houseroom only to a Morse key, or only to a microphone, or only to s.s.b. or to " ancient modulation," or who would never enter the dog-fight of an h.f. contest, or join the chatter on v.h.f. or on Top Band, or scorn semiconductors, or valves, or fixed, or mobile operation.

Such enthusiastic rallying around one's own particular interest is natural enough and ensures that each branch of the hobby gains adherents and is pursued vigorously. But, unfortunately, such advocacy seems often to be as much concerned with finding fault with the other fellow, as with pressing one's own view. Even this can add to the general liveliness, so long as no one takes it too seriously. The strong point about Amateur Radio is that there is room for so much diversity, and remarkably little direct incompatibility between these various interests. There is thus really very little reason why any deep feeling of " them " and " us " need develop in operating, or technical or even general Society interests. And an overall sense of unity is certainly going to be needed in the years ahead if frequency and other privileges are going to be retained.

The Field Effect Transistor

About once in a decade there appears on the scene some device or technique which sooner or later results in a complete revolution to equipment practices. The multi-electrode valve of the late '20s, the beam tetrode power amplifier valve of the '30s, amateur s.s.b. in the '40s, the semiconductor upset which got under way in the '50s. And, now, it may not be altogether too extreme to suggest that the contribution of the '60s may turn out to be the emergence of the unipolar semiconductor devices, including field effect transistors and the offshoots of the MOST/IGFET category (see *TT*, September 1965).

This does not mean that everyone is going to be using FETs this year—or next—but sooner or later everyone will have to be aware of their potentialities and applications. And we make no apologies for devoting a fair proportion of our space this time to these interesting devices.

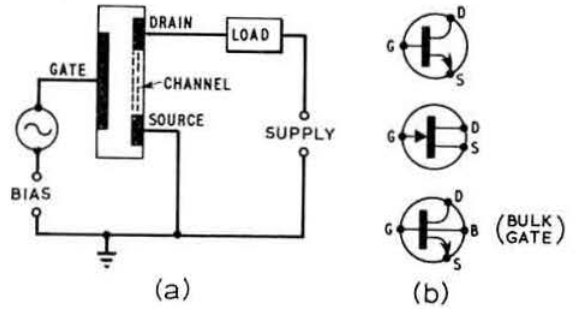


Fig. 1. (a) Diagrammatic representation of the h.f. junction FET in a common source amplifier. (b) Some of the varied symbols used for the FET. See also *TT*, September, 1965, for insulated gate symbols and circuits. With *n*-channel devices the bias and supply polarities are the same as for valves.

First of all there is nothing new about the FET unipolar transistor. The original Heil and Lilienfeld patents date back to 1935, well before the practical development of the now conventional bipolar transistor. Unipolar means that only one kind of majority carrier is involved (in contradiction to the bipolar devices in which the basic action depends upon both majority and minority carriers—holes and electrons—in a given device). Fig. 1 shows the basic details, from which it will be noted that the carriers flow in a narrow *channel* between *source* (s) and *drain* (d) with the flow determined by the field (that is voltage) applied to the *gate* (g). The action is thus voltage controlled and is closely analagous to the valve, but since the carriers can be either holes or electrons the control voltage may be positively or negatively biased according to whether the device is a *p*-channel or *n*-channel device (rather like the difference between a *p-n-p* and *n-p-n* transistor). For those who think in terms of valves, the gate corresponds to the grid, the source to the cathode and the drain to the anode. The device forms in effect a voltage controlled variable resistor with a nearly infinite input resistance at the control terminals. It can be used in circuits which are almost exact low-voltage equivalents to those for valves. As an amplifier on h.f. to u.h.f. the FET can be used in the common-source configuration (similar to the normal grounded-cathode valve circuit) or as common-gate (similar to the grounded-grid circuit), and there are in fact a number of advantages to using the common-gate arrangement, particularly on u.h.f.

Although FETs have been around for some time, it is only in the last few years that the h.f. FET and the allied IGFET/MOST (which have an additional insulated layer interposed between gate and the channel) have really emerged. We are in fact only just arriving at the interesting stage where prices are really beginning to slide downwards. But enough for the moment of basic principles, let us have a look at a few typical applications.

FET Applications

Since the short note on FET front-ends appeared in the July *TT*, a number of other instances of their use have come my way. First I was able to see an extremely neat little 27 Mc/s fixed frequency receiver, using *n*-channel FETs for the mixer, developed for oceanography telemetry by J. B. Gurney, BRS10548, of S. & G. Bradley (see *Electronics Weekly*, 10 August); then G2AHL came up with the circuit diagram of the new miniature amateur communications receiver, Davco DR30, which has been converted to front-end FETs since it was first introduced; next G3UMF sent along a detailed account of his own work on h.f. receiver front-ends; and finally I was able to get hold of a mass of information on the use of FETs as u.h.f. amplifiers, TV tuners, v.h.f./f.m. tuners and mixers from Texas Instruments Ltd, of Bedford.

First, a few general points underlined by J. B. Gurney. In the first place he confirmed the *TT* remarks last year that the h.f. FETs (particularly the IGFET variety) are very susceptible to damage from static charges building up on the high impedance gate *up to the time they are safely wired into circuit*, and that when out of use the leads should be short-circuited by means of a crocodile or other clip.

Then there is the importance of their virtually " square

This extremely compact amateur bands communication receiver manufactured by Davco Electronics Inc., USA, employs FETs in the r.f. stages. It measures only 7⅛ in. wide, 6 in. deep and 4 in. high, and makes use of modern construction methods such as nine-plug-in glass epoxy modules on a $\frac{1}{16}$ in. thick aluminium chassis to maintain small dimensions and stability without sacrificing easy access for servicing. The front-end is crystal controlled, a Collins mechanical filter is provided for s.s.b. reception, the b.f.o. is crystal controlled, and a crystal calibrator is incorporated. Thirty-eight semiconductors are used. The market price in America is $389.50.

law characteristics " which makes them near ideal mixers on a.g.c.-controlled amplifiers. It means effectively that the noise factor of the FET mixer is almost as good as when it is used as a straight amplifier. Remember that the silicon 2N3823 can have a noise figure of less than 2·5db at 100 Mc/s and the germanium TIXM301 is down to 1·8db at this frequency; practical figures from 2N3823 literature includes a 6·5db noise figure at 575 Mc/s for a *single* FET (as mixer) in a TV tuner; and 4·5db as a straight amplifier at 500 Mc/s.

On the other hand, the devices have relatively low slope values of much the same order as a triode such as the 6J5, so that an all-FET receiver would need a lot of stages, while some of the advantages of the FET can be lost in going from FET to transistor stages. In view of the slope, the FET cascode circuit is highly attractive, though with current prices this might seem a luxury. The actual slope depends on the operating point as in a vari-mu valve. Square-law characteristics means that the slope varies linearly with bias, gradually decreasing as the device goes towards cut-off bias (in this case called the *pinch-off* voltage) rather like the vari-mu pentode.

On the question of cost, this point is largely covered by G3UMF below, but it is worth adding that a new plastic encapsulated germanium high frequency *p*-channel FET (type TIXM12) has already been announced by Texas Instruments in the States at around the one-dollar mark for large quantities—and this really makes the FET a device worth studying.

Davco DR30 Receiver

The Davco DR30 h.f. communications receiver demands attention in being one of the very first all-semiconductor receivers which, to judge from the paper specifications, appears to hold the promise of high-performance at a cost comparable to valve sets (under £140 factory price in the States). The proof of a receiver is, of course, to be found only on the operating bench, where its combined electrical and mechanical qualities can be put to the test. But we note that an extremely favourable review has been published by WA1CCH in *73* (May, 1966) based on the original transistor front-end. In the latest version there is a K1504 FET r.f. amplifier and an FET mixer in this interesting set with its host of new tricks.

We must admit to being puzzled why, in view of the emphasis put on its cross-modulation characteristics, the selective filters are placed well along the i.f. strip, following several stages in which ceramic filters are used; this clearly makes the characteristics of these ceramic filters of importance if full advantage is to be taken of the low cross-modulation characteristics of the FETs. The set uses the tunable i.f./crystal-controlled oscillator technique. High *Q* toroidal coils are used in the transistor v.f.o.

In the firm's advertising material the following remarks on the change to FETs appear: " The FET is characterized by a high operating impedance, and is voltage-operated . . . this allows maximum preselector selectivity, since no compromise between power transfer and *Q* is necessary as would be the case with bipolar transistors. Additionally, the transfer characteristics of the FET approach very closely the theoretical square-law configuration. Performance under conditions which lead to cross-modulation and overloading in other devices is markedly superior. Since the FET is a majority-carrier device, the shot-noise in bipolar transistors is absent, allowing extremely low-noise operation even to the u.h.f. region."

Practical Results with FETs

After this impressive build-up on the virtues of FETs, it is fortunate that we can include a down-to-earth report on amateur experimental work by Alan Simpson, G3UMF, of

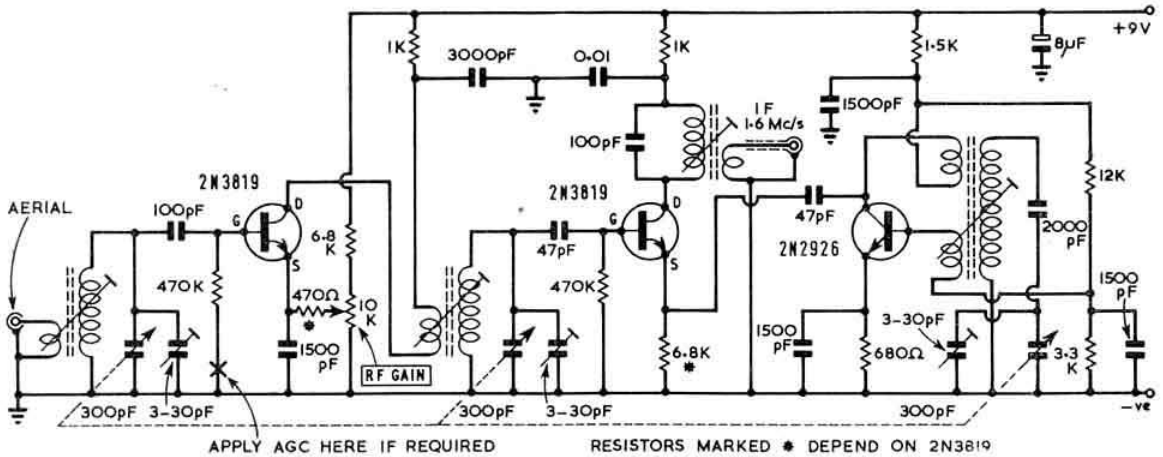


Fig. 2. Circuit of the G3UMF FET front-end.

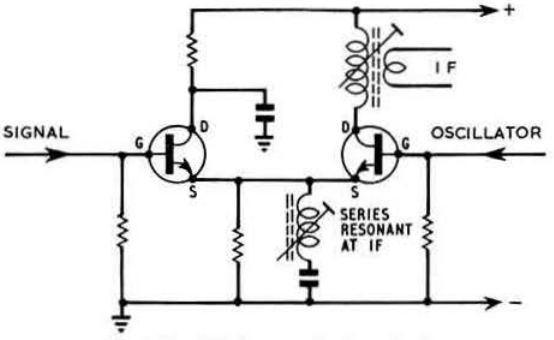


Fig. 3. Possible improved mixer circuit.

Wirral. In view of the importance of this subject, we are quoting at unusual length from his letter:

" Your comments in the July *TT* prompt me to describe my own experience with FET front-ends. From what I had read FETs seemed to have possibilities for a front-end up to 30 Mc/s. The 2N3823 appeared ideal save for its price, which six months ago was £7 16s.! (now just under £4—*G3VA*). I thus settled for a pair of TI Silect range 2N3819s. These are not as hot as the 2N3823 but from the data sheets appeared to have useful performance at 30 Mc/s and then cost a " mere " £1 0s. 5d.

" To assess these I have built a front-end tuning from 10 Mc/s to 30 Mc/s in a single range providing an i.f. of about 1·6 Mc/s into the existing home-brew transistor receiver: Fig. 2. I have been using this for six months and am quite pleased with results. Aerial noise over-rides receiver noise all the way to 30 Mc/s. The chief shortcoming is that between 25 Mc/s and 30 Mc/s slight pulling of the local oscillator occurs, but this is hardly surprising since at present there is no isolation between oscillator and mixer. The pulling is no worse than with my HRO, and is noticeable only during alignment.

" I intend to try an improved mixer circuit (Fig. 3) when I can afford the extra FET. The oscillator is also probably not the best circuit, but the components were to hand and the large tuning range was required for initial tests. Eventually, the transistorized Vackar (*TT*, July 1966) might well be ideal. The existing oscillator circuit should work with any *n-p-n* transistor having an f_T of 100 Mc/s or so.

" Later I intend to rebuild the front-end as part of a semiconductor receiver for amateur bands only, possibly using 2N3823s if the price comes down further, with 2N3819s throughout the i.f. amplifier as these should be suitable for use with conventional double-tuned i.f. transformers. A.g.c. can be applied through a gate resistor in the same manner as with the grid resistor of a valve. The a.g.c. voltage could cover several stages without a d.c. amplifier as in a valve receiver, and FETs would seem to have the ideal vari-mu characteristics for a.g.c.

" One minor snag with FETs is that the wide production spread in characteristics of devices with the same type number means that biasing has to be set up for each specimen individually (this point has also been made by others—*G3VA*), and this may be partly responsible for the fairly slow commercial acceptance of the devices. However it presents no real problem to the amateur constructor who is building only one-off units anyway. My method is to start with a 10K pot. at maximum resistance in the source lead and a meter in the drain supply. Power is applied and the source resistance gradually reduced to give the desired drain current. The pot. can then be measured and replaced by a fixed resistor of corresponding value. My r.f. amplifier and mixer are both set to 5 mA drain current, but this requires 470 ohms in one case and 6·8K in the other, giving some idea of the spread. Value of drain current is a compromise between gain and consumption, since gain is proportional to I_D (hence the a.g.c. action). Maximum I_D for the 2N3819 is limited by permissible dissipation of 200 mW at 25° C."

G3UMF rather disputes the idea of fragility, considering that the junction-gate FET (as opposed to the IGFET) is as robust as any normal transistor. But I still feel that care should be taken while the device is out of circuit, for instance from leakage currents from a mains operated soldering iron or from static caused by friction. He points out that the value of the MOST/IGFET category to the amateur may not be so high as for the junction type; with their higher input resistance offset by higher noise, lower voltage gain, easier breakdown and higher price.

Among other possible applications for the FET he mentions the " gate dip oscillator." He has also tried one out as a " leaky-gate detector " 0-V-0 receiver which worked every bit as well as an 0-V-0 valve set, and could prove very popular with beginners when the five-bob FET really comes along: Fig. 4.

In fact a number of circuits are now appearing for the lower cost FETs such as those being offered by Siliconix in the States at between one and two dollars apiece (these are not specifically h.f. types).

The July *73* features an FET audio compressor using two Siliconix units plus two transistors; there are also a couple in an elaborate transistor analyzer; and two in an FET voltmeter with 22 Megohm input impedance (K3LCU says " after you've tried this FET voltmeter, you'll never want to use a valve voltmeter again ").

So one way and another it really looks as though the beginning of another semiconductor breakthrough is making itself felt. The FET seems an ideal complement to the normal bipolar transistor—and just the device for those of us who still feel happier with valve circuits than the usual low-impedance transistor circuits.

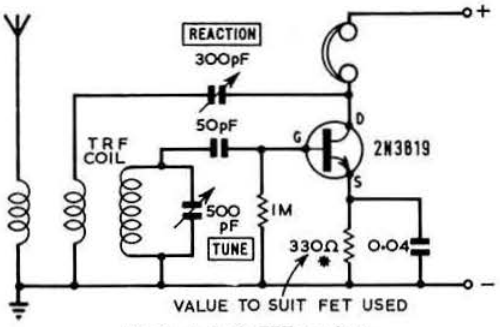


Fig. 4. A single-FET receiver.

Transistor Mixers

In connection with cross-modulation in receivers using bipolar transistors, we were interested to see the comments by a Mullard engineer in the " Aspect on Mobile Radio " (*Electronics Weekly*, 27 July) disputing that diode mixers are less susceptible than transistors and adding " we favour the transistor." He commented:

" If worked at a high local oscillator level, the diode has an insertion loss which must be paid for by extra low-noise amplification elsewhere. The transistor mixer has inherent gain and will work on a local oscillator injection of 100 mV. We have found that the blocking problem is solved by a higher injection voltage—typically 700 mV. This retains all the advantages of a transistor mixer with none of the disadvantages of the diode."

This is an interesting viewpoint, although, as we have mentioned before, some other engineers prefer the use of the

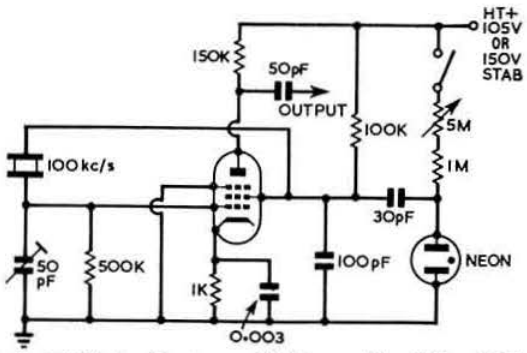


Fig. 5. A 100 kc/s calibrator modified to provide additional 10 kc/s points when required. The valve used in the *DL-QTC* design is an EF94, but similar types would be suitable. For details of the neon, see text.

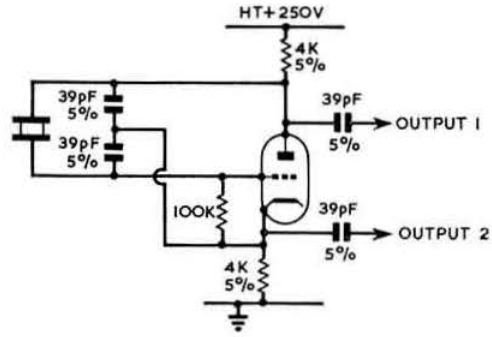


Fig. 7. G3JGO's Colpitts crystal oscillator providing a two phase output for use with a balanced mixer.

four diode ring modulator mixer (*TTfiRA*, page 26). My guess is that the FET has a good chance of displacing both of these alternative approaches.

Single-valve 10 kc/s Calibrator

Although the transistorized frequency standard is a more modern approach than to use valves for this application, there are still a large number of valves providing useful 100 kc/s calibration pips either as separate units or built into receivers.

A novel means of modifying such circuits to provide 10 kc/s as well as 100 kc/s pips was noted in *DL-QTC* (August, 1966): see Fig. 5. This incorporates a neon bulb relaxation oscillator which can be synchronized from the basic 100 kc/s oscillator. The original article does not specify the type of neon but the Hivac 3L or 7L series (similar to NE2, NE51) would almost certainly be suitable.

When setting up the device it will be necessary to make certain that the correct order of division is achieved by counting the pips between two 100 kc/s points.

Detector for F.M./P.M. Signals

Amateurs have never made as much use of narrow band frequency modulation and the closely related phase modulation systems as would seem to be warranted by the experiences of other radio services. The military, for example, are still keen on p.m. for h.f. packsets and for some vehicle sets. In phase modulation, unlike true f.m., the amount of frequency deviation depends not only on the amplitude of the modulating signal but also on its frequency, but can in effect be converted to f.m. by tone correction.

The snag, it would seem, has always been that the use of slope detection (that is slightly off-tuning an f.m. signal) does not do justice to the system; similarly broadcast-type 10·7 Mc/s ratio detectors are not suitable for narrow deviations. New ideas for f.m. detection therefore would seem to be of considerable potential value and B. Priestley, G3JGO, has sent along some interesting comments on the modification of a 6BN6 product detector for the reception of phase or frequency modulated signals.

He writes: " Some time ago the 6BN6 product detector was described in *TT* (*TTfiRA*, page 35) but I made a modification to it on the lines of Norgaard's article (*QST*, July 1948) by adding a Miller valve to phase lock the b.f.o. and so permitting the reception of p.m. or f.m. signals.

" This is markedly superior to skirt detection when tried on the p.m. signal from my SB10, and no doubt by adding another 6BN6 as per Norgaard one could also receive A3 with exalted carrier and a.f.c. This might be better as the 6BN6 needs much more signal drive to limit for p.m. than for s.s.b. but the circuit (Fig. 6) may be of interest to anyone who wants f.m. capability as a more or less free extra. The values shown may not be optimum but give me a hold-in range of about $\pm$ 1·5 kc/s.

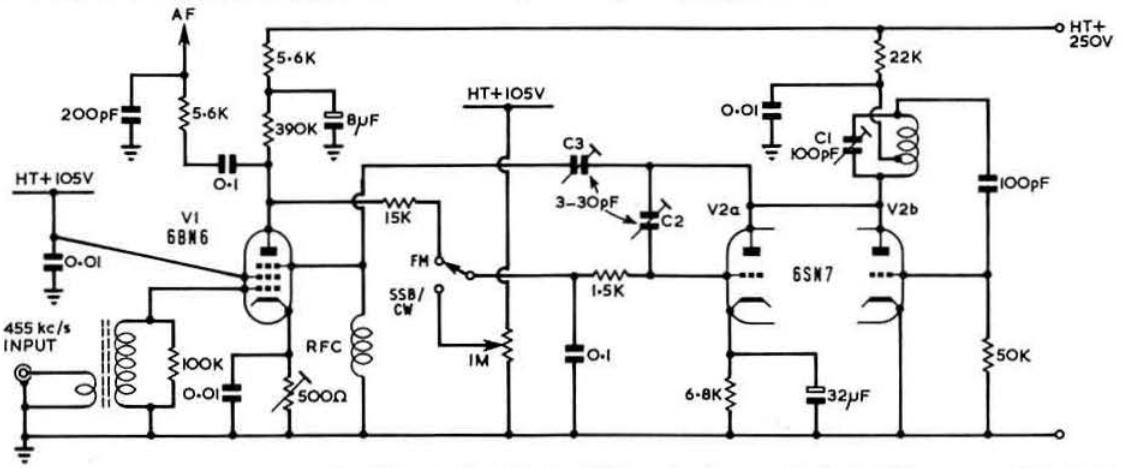


Fig. 6. A 6BN6 product detector modified by G3JGO for f.m. V1 is the 6BN6 product detector; V2a is the Miller stage, and V2b the b.f.o.

Setting up consists of measuring the cathode voltage of the Miller valve (approximately 50 volts) in the f.m. position with no signal, and then switching to s.s.b./c.w. and setting the frequency potentiometer for the same voltage. A signal is tuned in, and the trimmer C1 adjusted to zero beat the b.f.o. On switching to f.m. and tuning across a strong signal the beat note will suddenly " squawk " and then lock-in over a fair range adjustable by C2. C3 is set for compromise between sufficient injection for locking, and loss of gain due to excess drive for s.s.b."

G3JGO also draws attention to the simple phase detector of the " Designer's Notebook " section of *Electronics* (4 October, 1965) of possible interest to those experimenting with phase lock systems. His circuit of Fig. 7 is a modified Colpitts used to obtain two more or less balanced inputs to a mixer; if accurate balance was needed one or other of the capacitors could be a trimmer, but G3JGO finds 5 per cent tolerance components adequate.

The Ultimate in QRP

Some time ago (*TT*, November 1964) we made a brief reference to an RCA project using 100 milliwatt pocket transmitters for long distance communication at very low information rates—intended for such applications as allowing a crashed pilot to report his position. At the time the only information was from a press release which did not go into many technical details.

Now, however, a much fuller account of this QRP work has been published in *RCA Review* (March, 1966) showing the techniques adopted—including sweeping the miniature transmitter over a 20 c/s bandwidth—to cope with the extreme stability problems imposed by the bandwidth. The receiver noise bandwidth is in fact only 0·75 c/s (yes, cycles not kilocycles).

To achieve this selectivity in a modified communications receiver using crystal control in place of the v.f.o., the 500 kc/s i.f. was extracted and converted down to 20 kc/s and passed through a fairly conventional crystal filter: see Fig. 8. Even with the transmitter sweep technique, the stability requirement remains high for a pocket set; and this was achieved by placing the crystal, specially cut for a zero-temperature-coefficient turn-over at 99° F, in a small enclosure held under the armpit, as a substitute for a crystal oven.

The message capacity was limited to only three bits per minute (that is, it would take two minutes to send the

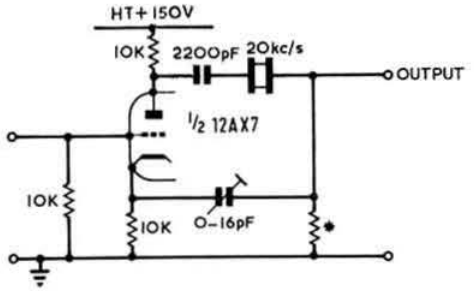


Fig. 8. The narrow-band filter used in the RCA milliwatt experiments. The value of the resistor marked * was not shown in the original article.

equivalent of a single S consisting of three marks and three spaces!); " messages " were indicated visually on neon indicators.

With this type of set-up, messages were sent with great reliability at distances up to about 2,000 miles across the States in the band 13 to 16 Mc/s. Not exactly amateur equipment, but the lesson which can be learned is the improvement possible in signal-to-noise ratios which derive from high selectivity. Noise power is of course proportional to receiver bandwidth, and noise voltage to the square root of bandwidth. For long-distance c.w. operation we ought to be able to screw our selectivity down to around 50 c/s.

Also of amateur interest is that various forms of resonant aerials were tried but, to quote from the report: " the most successful, yet most simple, was a quarter-wave vertical radiator with a driven quarter-wave element laid in the direction of desired transmission " (that is a dipole bent so as to form a vertical element with a single ground plane element). A tree was used to support the vertical of thin, light wire.

The report states: " these tests demonstrated the effectiveness of the narrow-band milliwatt system for long-distance communications, since message transmission was essentially perfect."

QRP vindicated!

Anode Modulating a Tetrode

The technique of amplitude modulating a tetrode valve without using anode-and-screen modulation must surely have come up in the BULLETIN some time or other—certainly it is referred to in more than one book. But reference to the *Handbook* and racking the memory suggest that perhaps this idea may not be widely known after all.

One of the places where it appears is in the STC Application Report on the 5B/243M series of power tetrodes (often known as miniature 807s): see Fig. 9. It is pointed out that the inclusion of a 30 Henry choke enables the screen to be " floating " to a.f. while at the same time fixed to d.c. The reactance of the choke governs the lowest a.f. to be handled, and should be equal to the ratio of the d.c. screen voltage divided by d.c. screen current.

It is claimed that the arrangement provides a higher degree of modulation fidelity and makes the power amplifier less affected by

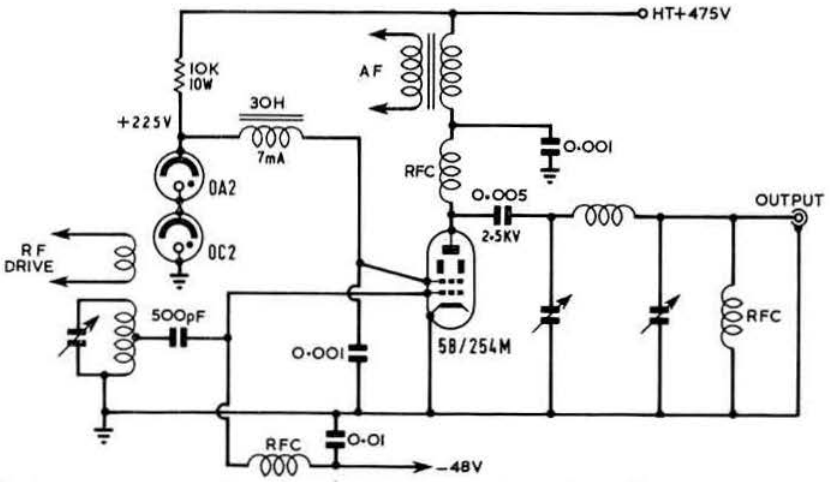


Fig. 9. An anode modulated tetrode power amplifier showing use of an audio choke to allow the screen grid to be floating to a.f.

overdriving. The same booklet also underlines the importance of driving class C power amplifiers from a low impedance source, as otherwise the r.f. wave is flattened leading to poor modulation characteristics, higher harmonic output and lower efficiency.

Sensitive R.F. Meter

The sensitive absorption type frequency meter cum harmonic detector shown in Fig. 10 comes from an article on the tracing of TVI in 144 Mc/s transmitters (*Funkamateur*,

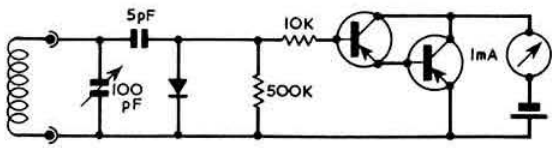


Fig. 10. A sensitive absorption frequency meter (or harmonic indicator) by DM2BJL.

Nr 12, 1965) by DM2BJL. The use of a diode detector with d.c. amplifier is quite common, but an interesting feature of this design is the use of two transistors in the super-alpha pair (Darlington or compound) configuration to form the amplifier. Almost any pair of a.f. or small-signal transistors should work in this arrangement; and a similar amplifier arrangement could be used in any of the transistorized " grid dip " meters where the r.f. output across the tuned circuit is monitored and amplified. Effectively, the only additional component over the usual one-stage amplifier is the second transistor.

With transistors now so plentiful, the attraction of the super-alpha pair, resulting in higher input impedance and extra gain, is even more striking than when the transistor was reckoned an expensive item.

Here and There

The BRS25769 Vackar oscillator (*TT*, July 1966) seems to have aroused considerable interest, some of which is spilling over into the correspondence columns. One very practical use to which G3RAE has already put the circuit is that of a b.f.o. for his mobile receiver. He writes: " Having had difficulty in producing a suitable b.f.o. for the transistor receiver used in my mobile gear, I was interested in the Vackar circuit. By a few simple modifications I have now got a first class b.f.o. for mobile use. I have not checked long term stability accurately as it was not considered to be of importance in this application. The modifications were to increase L to about 460 microhenries (200 turns of 48 s.w.g. 24 strand Litz wire wound on 0·3 in. diameter Aladdin former No PP5938/6 (short); tuning capacitor 100 pF, with 270 pF fixed capacitor in parallel. At 465 kc/s the variable capacitor is approximately half-mesh." Otherwise G3RAE is using identical component values to those shown by BRS25769.

A note recently in *Break-In* by ZL2AKD pointed out that the type of interference-suppression car h.t. ignition cable with built-in resistance of the carbonized " string " variety, although it will work well at first, sometimes gives trouble after a few thousand miles by going high resistance. This cable has a nominal resistance of about 5000 ohms per foot but ZL2AKD reports measuring up to 75K ohms per foot after some use. Another hint he gives is " always remember to remove spark plug leads by grasping the terminal not the cable, as this is the most frequent cause of early cable failure."

Miniature Nuvistor valves have several obvious attractions for low power v.h.f. transmitters. We note that a new development type announced recently in the States (type A15526) will put out some 5 watts at 1000 Mc/s, and would probably do pretty well on 23 cm. On 1000 Mc/s the 5 watts output with a power gain of 7db can be obtained with a *total* d.c. input of 12·2 watts, including just over 2 watts for the low consumption heater. In terms of efficiency and size for portable gear this should be pretty competitive even with the best semiconductors. Price is not known.

GM3VBB comments on the broad-band balun (*TT*, May 1966) saying: " I use a simpler version of this, consisting merely of coiling the coax close to the connection to the aerial. Electrically this looks like an ideal 1 : 1 isolating transformer with an inductance connecting one side of the primary to one side of the secondary. This inductance, which is that of the coil, can easily be made high enough to make the unbalancing effect negligible over a wide range of frequency. In the two coil balun, this unbalancing effect is cancelled out, but I doubt whether the further improvement justifies the extra coil and waterproof connections."

Test Report

The Marlison " Dual-Tone " Test Oscillator

IN order to set up an s.s.b. transmitter or linear amplifier correctly it is essential to have three items of test equipment: a dummy load (see June 1966, BULLETIN, page 397) a simple r.f. oscilloscope and a two tone oscillator. The oscillator, which is the subject of this report, is manufactured and sold by John Williams Electronics Ltd., 176 Hagley Road, Halesowen, Birmingham.

The transistorized oscillator is very simple and needs only a small 9V battery to put it into operation. All components, including a TV type outlet socket, are mounted on a printed board measuring 3¼ in. × 1½ in. The overall height is ⅞ in.

The two tones are 1 kc/s and 2·5 kc/s. The latter tone is too high for several sideband filters, e.g. the 2·1 kc/s Kokusai. No doubt the manufacturer could supply 1·8 kc/s as the upper tone to enable more universal use. Two plastic encapsulated silicon transistors are used and the l.t. to each is switched independently with slide switches. Two open potentiometers are provided; one is for balance to obtain equal tone amplitudes, while the other controls the combined output level. The battery connector is a standard polarised twin clip type on the end of a short lead.

Performance

Output With the tone outputs balanced, the maximum output was 180mV across 100Kohms. On single tone, with the balance control set for maximum output, 1·8 volts could be obtained. The manufacturer's claim is 100mV across 10Kohms.

Battery consumption 6mA at 9V.

Distortion 2·5 kc/s tone—3 per cent; 1 kc/s tone—6·7 per cent. The distortion did not change with level.

Frequency 2·500 kc/s and 1·021 kc/s measured.

Comments

The oscillator works well and does everything that is claimed for it. Although the distortion of the 1 kc/s tone was a little high, it is adequate for simple two tone tests. Perhaps the only adverse comment is that the flux had not been cleaned off after soldering. It is good value at 49s.

B.A.

Single Sideband

By G. R. B. Thornley, G2DAF *

PROBABLY the first fully transistorized general coverage communication receiver to be offered to the amateur is the National HRO-500. This is a highly sophisticated piece of equipment, offering performance claimed to be superior to a valved receiver, using a phase locked frequency synthesizer to provide all of the necessary oscillator injection signals to tune the 5 kc/s to 30 Mc/s frequency range, together with a 1 μV s.s.b. sensitivity, and an exceptionally stable v.f.o.

There is a continuing trend towards greater use of transistors for much of the equipment at present in use in an amateur station. Many constructors are ready to try their hand at perhaps the most exacting and difficult application—transistorizing a communication receiver—and have a particular interest in evaluating the methods used by the commercial designer, and seeing detailed analyses of circuits currently in use. This applies in particular to specialized applications such as frequency translation (mixers); crystal controlled oscillators; automatic gain control; S-meter bridges; v.f.o. stability; and last but by no means least the technique of frequency synthesization in which the output of a stable crystal controlled low-frequency oscillator is processed to provide a high-frequency harmonic spectrum that can be used in turn to phase lock a switched and tunable L/C heterodyne oscillator.

THE HRO-500 SOLID STATE RECEIVER

The HRO-500 receiver has been built to a high performance standard—some of the most important parameters being as follows:

Frequency Range: 5 kc/s to 30 Mc/s in sixty 500 kc/s bands, continuous coverage.

Modes: Upper Sideband, Lower Sideband, A.M., C.W.

Calibration Accuracy: Within 1 kc/s over entire 500 kc/s tuning range of interpolation oscillator (v.f.o.); within 250 c/s when zeroed to nearest 50 kc/s calibration point.

Synthesizer Accuracy: Within 250 c/s over entire tuning range when zeroed at 10 Mc/s.

Frequency Stability: Over-all stability from switch-on, not more than 100 c/s in any 10 minute period including 30° C change in ambient temperature, or ± 20 per cent a.c. mains voltage variation.

Receiver A.M. Sensitivity: 5 kc/s to 500 kc/s, 25-50 μV for 10db signal-to-noise ratio†; 500 kc/s to 30 Mc/s, better than 2 μV for 10db ratio.

Receiver S.S.B./C.W. Sensitivity: Better than 1 μV for 10db signal-to-noise ratio between 500 kc/s and 30 Mc/s. (Same figure between 5 kc/s and 500 kc/s using LF-10 v.l.f. preselector.)

Selectivity at 6db Points: 500 c/s; 2·5 kc/s; 5·0 kc/s; 8·0 kc/s.

Shape Factor of Filter: 2·5 : 1 at 2·5 kc/s bandwidth.

Passband Tuning Range of Filter: 6 kc/s.

Rejection Tuning Notch Depth: 50db.

Image Rejection: Minimum 60db between 500 kc/s and 30 Mc/s. Minimum 80db between 5 kc/s and 500 kc/s when using LF-10 preselector.

Spurious Responses: Internal spurious signals between 500 kc/s and 30 Mc/s all less then 1·0 μV equivalent signal except for two discrete responses at 2·75 Mc/s and 3·0 Mc/s.

A.G.C. Merit: Less than 10db change in output for input variation between 5 and 50,000 μV.

Tuning Ratio: Identical on all bands; 10 kc/s per revolution of tuning knob.

Basic Description

The basic block diagram of the HRO-500 receiver (Fig. 1) shows the major operational sections of the receiver and the signal and oscillator frequencies throughout the system. Between 5 kc/s and 4·0 Mc/s the receiver functions as a triple-conversion superhet. In this frequency range, the incoming signal frequency is first up-converted to 26 Mc/s plus the signal frequency. The resulting signal between 26·005 Mc/s and 30 Mc/s is mixed with the synthesizer output to produce the tunable i.f. of 3·25 Mc/s to 2·75 Mc/s. A tracked oscillator then converts this tunable i.f. signal to the final i.f. of 230 kc/s. Frequencies between 4 Mc/s and 30 Mc/s are directly converted to the tunable i.f. and in turn, to the final 230 kc/s i.f. The receiver functions as a double-conversion superheterodyne in the frequency range between 4 Mc/s and 30 Mc/s.

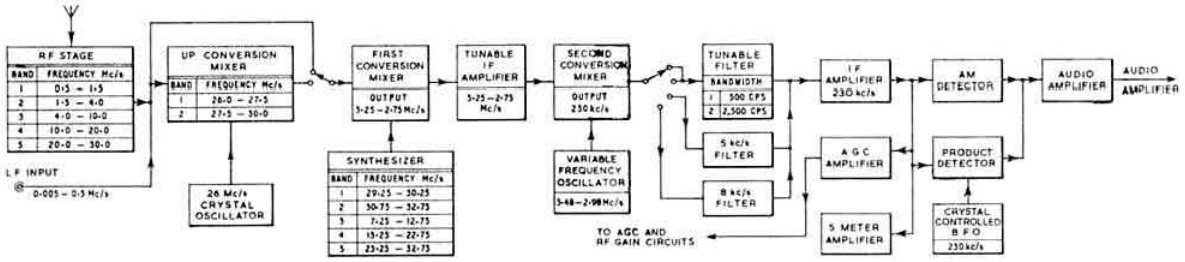


Fig. 1. Basic block diagram of the HRO-500 solid-state receiver.

Incoming signals between 500 kc/s and 30 Mc/s are fed through the r.f. stage, which is switched in five ranges. The output of the r.f. stage is coupled to the up-conversion mixer on bands 1 and 2 and is coupled directly to the first conversion mixer on bands 3, 4 and 5. The separate low-frequency input used between 5 kc/s and 500 kc/s by-passes the r.f. stage and is connected directly to the up-conversion mixer. A 26 Mc/s crystal oscillator provides injection to the up-conversion mixers. The resulting output on Bands 1 and 2 is coupled to the first conversion mixer.

The oscillator input to the first conversion mixer, a series of 52 discrete frequencies lying between 7·25 Mc/s and 32·75 Mc/s, is obtained from the synthesizer portion of the HRO-500 which will be described later. This series of frequencies will mix any desired 500 kc/s range of the h.f. spectrum to the tunable i.f. between 3·25 Mc/s and 2·75 Mc/s. To select a desired 500 kc/s segment of the h.f. spectrum, it is necessary to set the BANDSWITCH to the desired preselector range. Bandswitch sections in the r.f. stage, the up-conversion mixer, and the synthesizer connect these circuits for correct operation and selection of signals in the basic preselector

* 5 Janice Drive, Fulwood, Preston, Lancs.

† Sensitivity on this range, 5 kc/s to 500 kc/s, can be improved to better than 2 μV for 10db signal-to-noise ratio by the use of the LF-10 v.l.f. preselector—available as an additional accessory.

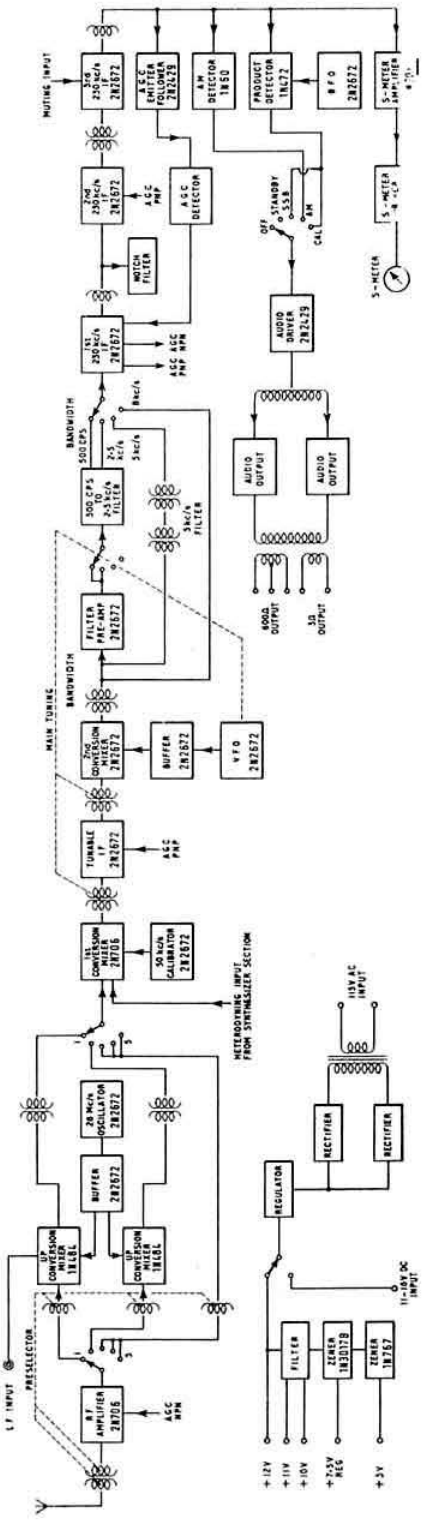


Fig. 2. HRO-500 detailed block diagram.

band. In the event that low-frequency reception is required, the BANDSWITCH must be placed in position 1 for proper up-conversion mixer and synthesizer operation even though the r.f. stage is not used.

The tunable i.f. output lying between 3·25 Mc/s and 2·75 Mc/s is coupled to the second conversion mixer together with the output of the variable frequency oscillator operating between 3·48 Mc/s and 2·98 Mc/s. The tunable i.f. amplifier and variable frequency oscillator are tracked. The output of the second conversion mixer is at 230 kc/s and this output is fed to the various i.f. filter circuits. The BANDWIDTH switch selects the tunable filter, the 5 kc/s filter, or the 8 kc/s filter, depending on the operator's preference. Output from each of these filters is coupled to the input of the 230 kc/s amplifier.

Output from this amplifier is fed to the a.m. detector, the product detector, the a.g.c. amplifier, and the S meter amplifier. The output of a crystal-controlled b.f.o. is also fed to the product detector. The front panel FUNCTION switch then selects either the a.m. or product detector as desired by the operator. The signal is finally processed through the audio amplifier and into a suitable speaker or line termination.

Detailed Description

The detailed block diagram shown in Fig. 2 indicates each individual receiver stage, functional transistor, and functional diode. It also indicates the elementary nature of BAND and FUNCTION switching and the number of tuned circuits associated with each coupling network.

Signal inputs between 500 kc/s and 30 Mc/s are coupled through two tuned circuits to the r.f. amplifier, the output containing an additional tuned circuit tracked to signal frequency. The BANDSWITCH and PRESELECTOR TUNE controls function in both the r.f. amplifier input and output to provide correct aerial matching, selectivity, and tuning throughout the h.f. spectrum.

When operating on band 1 and band 2 the BANDSWITCH connects the r.f. amplifier output to an up-conversion mixer whose output is a double tuned bandpass circuit operating in the frequency range 26·0 Mc/s to 27·5 Mc/s (band 1) and 27·5 Mc/s to 30 Mc/s (band 2). On both ranges, a 26 Mc/s crystal oscillator feeds through a buffer amplifier into each of the up-conversion mixers. A separate low-frequency input connection is provided to the up-conversion mixer used for band 1 operation, by-passing the r.f. amplifier to allow low-frequency signals to be directly converted to the frequency range between 26·0 Mc/s and 26·5 Mc/s.

When the BANDSWITCH is placed in positions 3, 4 or 5, the output of the r.f. amplifier is directly connected to the first conversion mixer. The synthesizer output is coupled to the first conversion mixer as the local oscillator signal. The frequency selected from the synthesizer is always such that the desired 500 kc/s segment of the h.f. spectrum will create a difference frequency between 3·25 Mc/s and 2·75 Mc/s (tunable i.f.).

The tunable i.f. amplifier contains four tuned circuits, two in its input and two in its output path. The amplifier i.f. signal is connected to the second conversion mixer together with an output from the v.f.o. operating between 3·48 Mc/s and 2·98 Mc/s. A v.f.o. buffer provides injection to the second conversion mixer and isolation of the oscillator.

Second conversion mixer output is coupled through two 8 kc/s wide tuned circuits to the filter preamplifier and six-pole tunable filter and to the 5 kc/s wide tuned circuits. When the BANDWIDTH switch is placed in the 500 cycle position or the 2·5 kc/s position, the input of the first 230 kc/s i.f. amplifier is coupled to the six-pole filter. When this switch is placed in the 5 kc/s position, the mixer output is coupled through four tuned circuits to the first 230 kc/s i.f. amplifier. In the 8 kc/s position the mixer is coupled through

(Continued on Page 594)

THE MONTH ON THE AIR

By JOHN ALLAWAY G3FKM

WITH the arrival of September we start to think of the longer nights and accompanying season of major contests. During 1966 your scribe has been privileged to see the full results of many of these events held last year, and has been very surprised to see how very few UK stations feature amongst the entrants. At the same time there has been very little interest indeed shown in the various leaflets concerning contests distributed *via* G3FKM. Why this should be is difficult to understand, as there is no better way of practising operating techniques, or collecting new countries, awards, or just QSL cards. Readers attention is particularly drawn to the *CQ* Worldwide DX Contests where anyone can work anyone else outside his own country for points or even just for fun! Their attention is also drawn to the most interesting summary of the proceedings of the recent IARU Conference in Yugoslavia published in last month's BULLETIN. With regard to contests the Conference made some very sensible recommendations. It is suggested that worldwide contests be limited to 48 hours, continental ones to 36 hours and national to 24 hours. The continuing usefulness of multi-band contests is queried; there is no doubt that their removal would make some events less of an endurance test! A very sensible suggestion is that national and " closed shop " type contests (such as BERU) should be restricted to certain segments of each band. In the writer's opinion this would also be a great step forward.

Gerry Smillie writes to say that he is being flooded with requests for **ZD7BW** QSL cards for contacts during December 1965. He points out that his St. Helena call was in use from 7 August to 23 November 1963 only, and that the recent " ZD7BW " is therefore a pirate.

From G2MI comes the news that G3PAG is no longer responsible for QSLs for contacts with **VP8GQ.** It seems that the logs were returned to Peter when he returned home about two years ago to become G3LET. There are still a number of cards waiting for G3LET's attention.

News from Overseas

Those who have contacted **ZB2AR/MM** will be interested to know that this is the call-sign of the Chief Radio Operator on HMS *Puma*. Bill, who at home holds the call-sign G3TIF (to whom QSLs should be sent), says that he has visited many places during the last year. One place where he met the local amateur population was Gambia, where it seems that Cecil Wiltshire, ZD3D, is the only licence holder at the present time. It seems that the ZB2/MM call was easier to obtain than the G/MM equivalent, and it is likely to be heard on the bands until Bill returns to the UK late in September.

News of the other ZB2's at present active comes from **ZB2AM.** He reports that both ZB2AG and ZB2AL have now returned to the UK, and that with the run down of the RAF ZB2s AJ, AN, AO, AQ and AS are also likely to be leaving soon. This will of course mean that the RAF Club station ZB2A is very uncertain to continue. Another /MM station is G3SGQ, who is operating from HMS *Fearless* using the call ZB2AV/MM. As most readers will already know, Lloyd and Iris Colvin are at the time of writing in Gibraltar, using the call ZB2AX. Mike says that as autumn and winter approach, ZB2AM will be more active and will be on Top Band once again. He also says that by February the expected amateur population of ZB2 will consist of ZB2s AP, AT and himself. By July when he is due to leave, it will have become a rare country.

Latest news from *DXpedition of the Month* is that all PX1YR QSL's have now been mailed, and that those from 3A0EB, DJ6QT/LX and LA1EE/P should all have been sent off by the end of August. Other items mentioned are a visit by Bob Lane, G5AAM, to CT2 and CT3 and also a possible trip by Gus, W4BPD, to the Indian Ocean area, both later this year. W2GHK asks that only requests for QSLs for one call should be sent with each s.a.e. as this considerably speeds up the handling of cards. It is regretted that the logs for ZD8AR between 23 and 25 October last, for 4M5A after 26 January this year, and for YV9AA during part of the 1965 *CQ* WW DX Contest (c.w.) are still missing.

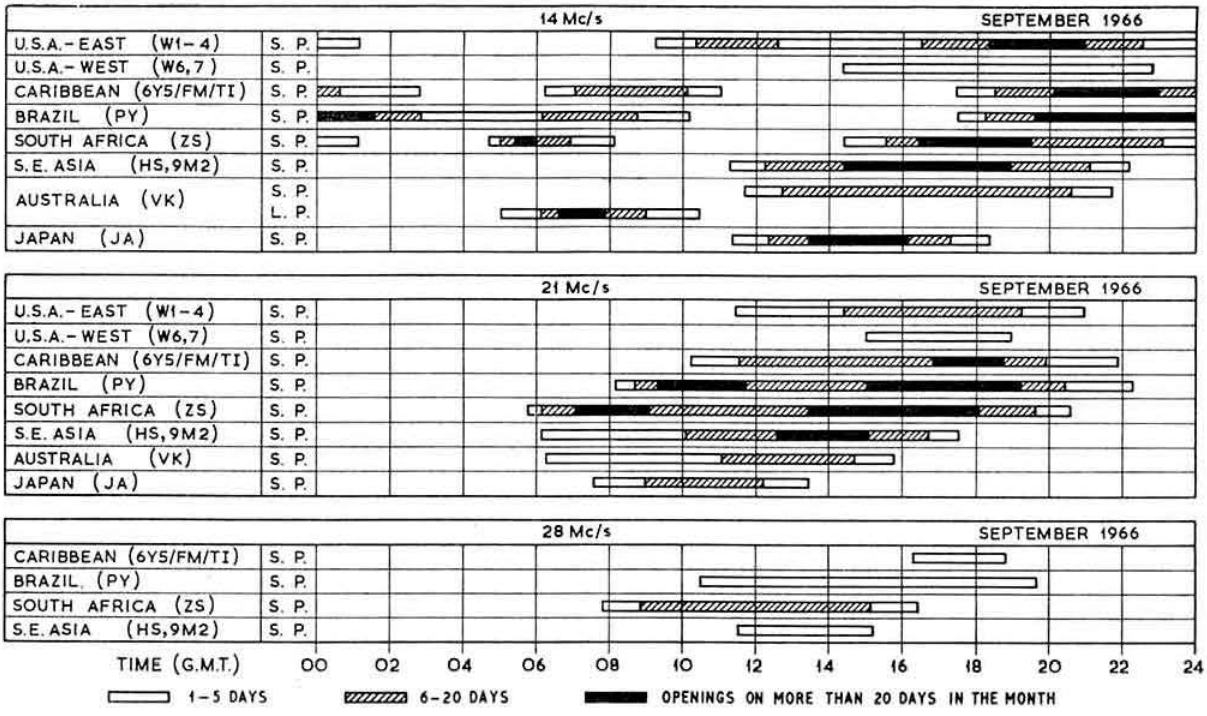
VO1FB will be on the air between 2 September and 5 September from St. Pierre using the call-sign FP8BD. He will be on all bands 80 to 15m inclusive, and all QSLs should be sent to his home address (see *QTH Corner*). Joe also says that he is now back on Top Band, although he has not been too active since April on account of two months leave in the UK and high power line noise from a 13kV overhead line only 100 ft. from his house. He is using a temporary aerial, 260 ft. long and only 20 ft. off the ground on which he has so far only had one QSO—with G3SJE at 00.34. VO1FB will be on 1804 kc/s every Sunday morning between 00.00 and 02.30 GMT, listening between 1825 and 1827 kc/s. By September it is hoped that the 700 ft. end fed wire aerial will be in commission again.

9J2BC writes to say that the l.f. bands are somewhat frustrating from the Zambian point of view. He hears large numbers of loud Europeans every evening from 16.00 onwards on 7 Mc/s, but has great difficulty in raising any of

There are not many YL'S on Top Band but here is one: Amy Jenk HB9YL. (*WIBB print*)

* 10 Knightlow Road, Birmingham 17. Please send all reports to arrive by **14 September** for the October issue, **5 October** for November, and **16 November** for December.

PROPAGATION PREDICTIONS



In the seasonal variations of the F2 m.u.f's, the summer months of June to August produce relatively low values. In the course of September, however, a gradual increase begins and for this reason the DX conditions on the 28 and 21 Mc/s bands will improve steadily during the month to reach their best in October and November. This seasonal improvement in conditions will be further strengthened by the present sharp increase in sunspot activity. On 28 Mc/s the improvement will be only slight at first, and will probably not become significant until towards the end of the month. In the course of October North America should come through on 28 Mc/s, but the season for short skip contacts on 28 and 21 Mc/s draws to a close in September. On 21 Mc/s there will be an improvement in conditions to North and Central America as well as to Japan and Australia, but again this will probably only become significant towards the end of the month. All continents will not yet be workable with certainty on 21 Mc/s. With the approach of autumn the daytime F2 m.u.f's will increase, though there will be a marked decrease in the night time F2 m.u.f's. For this reason the DX conditions on 14 Mc/s in the latter half of the night will show a marked decline, especially towards the end of the month, but local contacts during daytime will be possible over greater distances on 3·5 and 7 Mc/s. With the decrease in the usefulness of 14 Mc/s for DX in the latter half of the night, 7 Mc/s will become of increasing importance. Basically on this band DX contacts are possible, QRM permitting, when the greater part of the transmission path lies in darkness. In the latter half of the night on 3·5 Mc/s in the coming autumn and winter months, local contacts will frequently be interrupted by the dead zone.

The provisional sunspot number for July 1966 was 55·7 with activity uniformly distributed throughout the month. The predicted smoothed sunspot numbers for November, December and January are 58, 61 and 64 respectively.

them, however those he contacts give him good reports! (This could be the result of the old European custom of *not listening* for DX signals on l.f. bands—exemplified perfectly by a G and a GI station who insisted on carrying on a QSO on top of W0GTA/8F4 on 80m c.w. saying that 80m was a band for local contacts only, as the DX was more easily worked on the h.f. bands!) Top Band is very difficult in Zambia, and the only country 9J2BC has confirmed on 160m is ZS9. 80m is similar to 40, but 20, 15 and 10 are all open to Europe at some time during the day.

The **ARI** will be holding its 18th National Congress on 10-11 September at Forli. Anyone in the vicinity should contact ARI, PO Box 65, Forli, Italy, for further details.

Martin Blackstone, **KX6BQ**, says that the logs for his **VR3O** operations are now with Marcia, WA4SBK, who will henceforth be in charge of further QSL requests for that operation. Her address is: Marcia H. Guest, 1351 Tanglewood Parkway, Fort Myers, Fla. USA. Martin requests QSLs for his present KX6BQ activities to be sent direct to the address in *QTH Corner*—not via the Bureau.

Top Band News

Our old friend W1BB has sent in a bulletin of 160 metre news which he has compiled during the last few months. Stew says that from his own statistics the last " season " was not quite as good as the 64/65 one, largely because of a burst of solar activity at the end of February which messed things up for about six weeks. W1BB worked 138 stations in 28 countries, as opposed to 168 stations in 29 countries the year before. The " First Timer's " tests proved to be a great success, and there has been considerable demand for them to be repeated in the 66/67 season. It is hoped that this will also be quite a good one, in spite of the increasing sunspot numbers. As a matter of interest W2IU and W1BB managed to QSO G3IZU and G3SED on 10 July. For those interested in a QSO with VK, skeds are about to be held by VK5KO from 1 September to 15 October. He will make calls at five minute intervals on 1802 kc/s from 20.00 to 21.00 GMT and will listen between 1800 and 1860 kc/s.

W8DGP will be active from Alaska next winter, and ZD9BE is also hoping to give 160 a try later on in the year,

so 160m DXCC is drawing closer still. Japanese amateurs now have use of the band again, the portion between 1907·5 and 1912·5 now being open to them. It appears that they will be able to use up to 500 watts on the band if they hold a first class licence.

Contests

As mentioned in an earlier article, the third **VU2/4S7 DX Contest** will take place in October, the Telephony section being between 06.00 29 October and 06.00 30 October, and the c.w. section between 06.00 15 October and 06.00 16 October. SWLs may enter the SWL section. Serial numbers should be exchanged, consisting of RST or RS followed by the serial number of the QSO, starting from 001. Two points are gained from each VU or 4S7 contact, and one point for contacts with other stations. Only one contact per band with any one station is permitted for scoring purposes. Logs should show date, time, serial numbers sent and received and points claimed, and separate logs should be submitted for each band. The summary sheet should show call-sign, name and address of operator, details of equipment, score for each band, and total score for all bands, together with a signed declaration that all rules and regulations were observed. Entries should be postmarked no later than 30 November, and sent to: ARSI Contest Committee, Post Box 534, New Delhi 1, India.

This year's **CQ World Wide DX** contests will take place from 00.00 GMT 22 October to 24.00 on 23 October (Telephony) and 00.00 26 November to 24.00 on 27 November (c.w.). The rules are as before, briefly summarized as follows: All bands 1·8 to 28 Mc/s may be used. Contest exchange consisting of RS/RST plus Zone number. QSO points are three for QSOs with stations outside one's own continent, one for contacts with stations on same continent. No QSO points for QSOs with own country, but these may be counted for country multiplier. The multiplier consists of the total number of zones and countries worked on all bands. Entries may be single or multiband single operator; or multi-operator single or multi-transmitter in which case all bands must be entered. The sponsors wish to point out that a single transmitter station is one in which only one signal is on the air at any one time. In multi-transmitter operation all bands may be activated at the same time but only one signal may be put out per band. In order to encourage entries from Europe two new trophies have been donated by W3MSK and W4BVV for presentation to the top European single operator all band entrant in the Phone and C.W. sections respectively. It should be noted that duplicate contacts exceeding 3 per cent in a log will cause it to be disqualified. Entry forms should be available from G3FKM by the time they are needed. Entries should be sent to: *CQ* Worldwide Contest, 14 Vanderventer Avenue, Port Washington, LI NY USA 11050 postmarked not later than 1 December (for Phone) or 15 January (C.W. section).

Those who are interested in contacting USA counties will be interested in the news that the **Washington State QSO Party** starts at 23.00 17 September and ends at 05.00 on 19 September. Frequencies used by participants will be near 7060, 14,060, 21,060 and 28,100 (c.w.) and 14,290, 21,290, and 28,700 (s.s.b.). A.m. stations will be near 14,230, 21,310 and 28,600 kc/s. Exchanges consist of report plus QSO number and QTH. Similarly a **Pennsylvania QSO Party** will take place between 23.00 17 September and 03.00 19 September. Frequencies are given as 7075, 14,075, 14,275, 21,075, and 21,325 kc/s. Massachusetts counties will be available during the **Massachusetts QSO Party** (23.00 1 October to 05.00 3 October). Frequencies in this case are given as: 7060, 14,060, 14,230, 14,290, 21,060, 21,410 and 21,310 kc/s. Exchanges in the Pa. and Mass. affairs are the same as in the Washington one.

The **Royal Navy ARS Contest** will be held between 00.01 on 10 September and 23.59 GMT on 24 September. Either phone or c.w. may be used, and frequencies used will be: 1925, 3550, 3650, 7015, 7075, 14,050, 14,150, 14,250, 21,050, 21,250, 28,050 and 28,250, all plus or minus 10 kc/s. RNARS members call "*CQ de call/RNARS*," non-members "*CQ RNARS Test*." Exchanges consist of (members) RST, membership no. and QSO no. (non-members) RST, QTH, name, QSO no. Scoring is 5 points per member worked. Multiplier is no. of prefixes per band. Stations may be contacted on more than one band for extra points. Logs should reach: HQ Station RNARS, HMS *Mercury*, Leydene, Petersfield, Hants, before 15 October.

The IOTA Award issued to Dom, IT1TAI for his achievement in winning the 1965 IOTA Contest. This year's contest runs until 31 December.

Awards

The **Diplome de la Republique Democratique du Congo** (DRDC) is being issued by the Union Congolaise des Radio-Amateurs. It will be issued to all licensed amateurs who are able to produce evidence of contacting 20 9Q5 stations since 1 January, 1962. These contacts may have been in any or all modes, a readability 5 being the only specification. QSL cards or other proof of contact must be sent, together with a list of claimed QSOs showing date, time, band, and report received, plus 10 IRCs, to: UCRA BP 1459, Leopoldville, Congo.

Details of a number of awards issued by the Central Radio Club of the USSR have been received. The **R-6-K** is awarded for contacting all six continents, plus three European and three Asiatic USSR stations since 7 May 1962. The **R-15-K** for contacting all 15 Soviet republics *in 24 hours*. The **W-100-U** is given to those who have proof of contacting 100 different U stations (including 5 UA9/UW9s) on phone or on c.w. since 1 January 1959. The **R-10-R** is awarded for contacting all ten regions of the USSR in 24 hours. More complicated is the **R-100-0**, which is issued in three classes for contacts with 100 Oblasts—Class 1 on 3·5 Mc/s only, Class 2 on 7 Mc/s only, and Class 3 on any bands. All contacts for this one should have taken place since 1 January

1957. Finally, the **R-150-S** is for those who have contacted 150 countries of the world, including the 15 U republics, the starting date being 1 June 1956. The fee for each of the above is 14 IRCs, and they are available to SWLs as well as licensed amateurs. QSL cards, which must be submitted together with check list showing date, calls, mode, frequencies and reports of not less than RST 337 or RS 33, should be sent to: PO Box 88, Moscow, USSR. A small number of leaflets describing these awards are available from G3FKM.

DXpeditions

CR7GF was due to resume his expedition, interrupted a few weeks ago by equipment failure, by putting in an appearance from Bassas da India Island on or around 13 August for a two day stay. This time José has taken a KWM 1, and a TR3 transceiver with him, together with a two element tri-band beam. The call-sign was expected to be **CR7GF/FR7.** The next stage of the trip will take place around 23 September, when **CR7GF/FR7E** from Europa Island will be on for two or three days. At the end of October or early in November it is hoped that José, together with a W4 operator will set off for Comoro Island, Glorioso Island, Tromelin and Farquhar Islands, spending about four days at each place. The calls are expected to be FH8GF, CR7GF/FR7G, FR7ZO, and VQ9GF respectively.

During the period 30 August to 12 September, G2LU will be operating /P from Jersey. He will have a KW 2000A and a trap dipole aerial. His call will be **GC2LU/P,** and QSLs may be sent to W2GHK, or to his home QTH.

Your scribe recently had the great pleasure of meeting those two extremely well known and charming DXpeditioners, Iris and Lloyd Colvin, better known perhaps as GC5ACI/WB6QEP and GC5ACH/W6KG. During a most interesting slide show and talk about their recent travels in the Pacific it became very obvious to the onlookers that the life of a DXpeditioner is not all honey and contributions; in fact the very reverse would appear to be the case. It seems that there was a misunderstanding about the length of their stay on Ebon Atoll, and they ran out of food which made it necessary for them to live on a native diet consisting largely of bananas. Lloyd's personal record stood at 65 bananas consumed on one day! The logs show that since commencing operations on 1 September last year, over 30,000 QSOs have taken place from 11 different countries. After their present operation from Gibraltar as ZB2AX they will move to South Africa, and then are hoping to activate some African rare spots, and also some in the Indian Ocean, before returning home via the Pacific. It should perhaps be pointed out that this trip is being financed out of Iris and Lloyd's own pockets, and that contributions sent to "*YASME*" are being put aside with a possible view to purchasing equipment for use by future expeditions.

At the time of writing W9WNV was expected to appear on the air from St. Peter and Paul Rocks, in the South Atlantic, on about 19 August for a short stay. His call-sign was to be **PY0XA,** and according to W4ECI this operation was likely to be followed by visits to four more rare spots, unfortunately all unspecified. It is realized that there may be excellent reasons for definite details of Don's movements to be kept secret, but at the same time your scribe feels that the present veil of secrecy surrounding everything concerning W9WNV is a trifle unnecessary. The only positive result of this is that rumours take the place of facts.

The **Plymouth Radio Club** will be operating from Breconshire between 4 and 18 September. They will be on all bands, c.w. and s.s.b. They will be on the h.f. bands during the day, but will go on 160m for county chasers at 20.00. Their call-sign will be GW3UKI/P. Frequencies given are 1835, 1910, 3515, 3775, 7025, 7045, 14,025, 14,275, 21,050 and 21,400 kc/s. QSLs should be sent to G3UKI.

G3TWV and G3TWX will be operating from PA and ON between 16 and 20 September. They hope to be on all bands 160 to 10m and also 2m. They will be using a KW2000 and a TW for 2m.

CX3BH made 160m history on 26 June by making the first CX/W QSO. His gear includes an 850 watt transmitter and a half-wave aerial.

QSO QSL Wales Weekend

A special weekend of activity is being organized by GW3DZJ (27 Roe Parc, St. Asaph, Flints) for the benefit of those overseas stations needing contacts and QSL cards from Wales. This will take place during the weekend of 22/23 October. It is hoped that various operators will be on the air throughout the entire 48 hour period on 14,120, 21,390 and 28,550 kc/s s.s.b. and on 14,230 and 21,420 kc/s s.s.b. beaming to N. America. Volunteers who would like to join in should contact GW3DZJ, as the more Welsh stations there are on the band the more of a success the venture will be. It is suggested that next year a combined effort by all the non-G British call areas might be organized, and interested GC, GD, GI, GM, and GW stations are invited to contact Frank.

DXCC

The latest list received from W1WPO no longer contains listings for Ebon Atoll (HC8E) or Cormoran Reef (TI9C). Apparently their ownership is a matter of dispute.

Band Reports

Conditions during the past month have been quite good, openings to DX areas having been reported on all bands 160 to 10m. One or two transatlantic signals have been heard on Top Band, and 80 has produced the occasional reward for those who listen through the European QRM. Forty metres has also been delivering the goods from all over the world, one of the outstanding signals emanating from Bob Snyder, 9V1LP, who operated from Indonesia for the week-end of the *WAE Contest* under the call-sign W0GTA/8F4, who was S9 at times. Twenty has started to produce excellent long path openings to Australia in the early mornings, and continues to be open for most of the 24 hours. Fifteen seems to have been very patchy, although an outstanding feature of this band seems to be the very large number of Japanese amateurs on it who are running only 25 or 30 watts but have loud signals. Ten has been open occasionally, usually to 9J2 and other African areas but the occasional South American has appeared through the European short skip.

Your scribe wishes to thank everyone who sent in reports

and news items, and is particularly grateful to the following: G2BOZ, G2LB, GW3AX, G3HCT, G3HDA, G3KSH, G3NMH, G3SML, GM3SVK, G3TGK, G3TMA, G3UOL, G3VJG, G3VNC, G4MJ, G8API, G8JM, G8VG, BRS20317, BRS20439, BRS25605, A4038, A4431, A4568, A4609, A4713, A4886, A5025, A5105, A5125, and A5141.

1·8 Mc/s C.W.: DJ3UC (22.50), GI3FFF (21.10), OLs and OKs (21.15 to 00.00), VO1FB (00.34).

3·5 Mc/s C.W.: HB0AGH (22.21), PY1BTX (04.10), W0GTA/8F4 (22.35-23.10).

3·5 Mc/s S.S.B.: VO1HY (01.00).

7 Mc/s C.W.: CN8AW (20.20), CR6DX (20.48), EL3C (22.39), FG7XC (22.39), PY3BVH (22.50), UI8KBA (20.40), VK2AVA (21.03), VP6YF (22.36), YV4VU/9 (22.49), ZD7IP (19.40), W0GTA/8F4 (20.25), 9Q5CZ (20.05), 9Y4LY (22.16).

7 Mc/s S.S.B.: CE6EZ (23.23), CN8AW (22.00), CP9AO (23.39), CR6GO (21.00), EL2A (21.45), FP8YC (22.00), HK3BEM (05.30), LA1EE/P (Spitsbergen, 22.00), OX3BX (21.00), OY7ML (23.31), PX1IE (22.01), PY1-PY8 (21.00), UW9AF (22.00), VKs 2AVA, 2BKM, 2KM, 3VJ (21.00), VP8CW (23.30), ZD8ARP (21.00-? genuine), ZSs, 1BK, 1JA, 4PU, 5GU, 5VW (21.00), 5N2AAS (20.30), 5Z4AA (19.30), 7Q7LA (21.00), 9H1R (20.40), 9M2s DW, OV (21.00), 9Q5CZ (20.30), 9V1NT (21.00).

14 Mc/s C.W.: CP3CN (22.52), FL8HM (14.42), FO8BJ (06.10), FP8DA (20.48), HK0AI (21.30), HM8CG (18.24), HP2MD (22.23), IP1GAI/G5BZ (Pantellaria Is. 17.55), JY5AL (21.50), KL7BZO (20.15), KV4AA (22.20), LA5HE/P (Jan Mayen, 08.37), PJ2ME (21.15), SU1KH (20.32), UA1KED (Franz Josef Land, 15.45), VK8HA (18.10), VK9DR (Christmas Is. 05.55), VK9GW (13.40), VR2DK (11.45), VS5JC (16.40), VU2DIA (Andaman Is. 15.12), XU2HDE (Cambodia, 15.41), YN8FF (00.36), ZA1BB (17.47), ZD9BE (09.00), ZL4CH (Campbell Is. 06.40), 5W1AZ (07.10), W0GTA/8F4 (16.20), 9Y4TR (22.24), 9X5SA (21.25).

14 Mc/s S.S.B.: CP5AB (21.00), CP6FR (05.55), CR5SP (21.20), CT3AR (16.55), F0CH/FC (Corsica, 21.35), FB8YY (07.05), FH8CD (15.25), FH8GF (15.54), FO8AB (08.40), FO8AQ (07.27), FR7ZD (15.06), CR7GF/FR7 (Glorieuse Is. 16.56), FR7GF/FR7 (Juan de Nova, 05.55), FY7YM (23.02), JT2AX (05.25), KB6CZ (07.58), KC4USV (03.07), K6GAAY (18.10), KG6IF (15.45), KH6FMS (07.35), KJ6BZ (08.25), KJ6DB (09.17), KS6's BO, BT, W4LYY/KS6 (06.00-08.00), LA5HE/P (21.20), LH2BZ (? Bouvet Is. 15.35), PJ2MI (23.50), TG8IA (06.04), TG0AA (21.02), TI4JP (21.20), VK9AG (T.N.G. 14.20), W8HR/VP1 (16.35), VP2GR (07.29), VP2GT (21.35), VP2KX (22.40), VP3AA (21.44), VP8CW (20.30), VQ8AV, 8AZ (15.35), VQ9EF (19.36), VR6TC (07.15), VS6FO (13.45), XP1AA (Greenland, 19.30), XV5AA (15.51), XW8BG (20.45), YA1FV (16.30), ZB2AX (15.30), ZD8WO (18.33), ZD9BE (17.00), ZF1GC (22.55), 4S7YL (17.03), K3LZC/4X (18.21), 5R8AK (15.08), 5W1AZ (06.45), 9L1NM (22.37), 9X5GC (20.00), 9N1BG (16.38).

21 Mc/s C.W.: CE3ZW (22.05), CR6AL (18.18), CR8DZ (18.37), CR9AH (09.05), EA8FF (09.02), F5EP/P/FC (22.30), FG7XT (22.20), HK0AI (22.16), JA's (07.00-12.00), KB6CY (10.26), KG4CX (22.14), KG6s AAY, AQA (10.40), KL7FMW (21.59), LU2EZ (19.20), MP4BDF (21.34), TI2NO (21.03), VP2AZ (19.15), VP7NW (22.00), VQ9HB (17.05), VR2DK (10.35), VR6TC (21.15), ZD7IP (19.15), ZE1AS (09.08), ZL3UY (21.05), 6O6BW (10.30), 7Z3AB (17.35), W0GTA/8F4 (10.00), 9M2FS (16.45).

21 Mc/s A.M.: CR6AT (19.35), FM7WE (22.50), HK4AML (22.35), HP1AC (23.10), HR2AC (21.36), PY7ACQ/0 (Fernando de Noronha, 09.50), PZ1CF (23.00), TI2RKL (18.15), VP2KJ (21.34), Ws 1-0 (16.30-23.30), 5X5JK (18.13), 9G1FL (18.00).

21 Mc/s S.S.B.: CE3WZ (20.02), CP5AB (20.14), CR9AH (18.50), CX8PS (19.10), EP2BQ (14.00), ET3GB/M (18.33), FB8WW (11.00), FB8XX (11.22), FL8MC (17.33), HI8NGH (21.43), HK0AI (22.15), HZ1AB (15.50), KB6CZ (13.45), KR6CO (15.16), KV4EQ (12.40), KX6EQ (12.41), I1ARI/M1 (14.55), W9QQR/M1 (20.45), OA6AM (20.04), PX1IE (11.38), TN8AA (18.26), VK6CF (10.20), VQ9TC (08.25), VS6AJ (11.00), VU2JM (12.55), W6-W7s (20.00), XW8BJ (08.50), YA1DAN (12.50), ZF1GC (22.23), ZP5DA (22.15), ZS3JJ (19.07), ZS8L (10.09), 6O1PF (19.28), 9V1MY (15.00), 9X5VF (19.50).

28 Mc/s C.W.: CR7IZ (16.03), PY5ASN (19.35), ZC4GB (16.08), 9J2BC (18.04), 9Q5LJ (18.58).

28 Mc/s A.M.: CX1AA (19.10), CX8CZ (19.14), ZE2JA (14.48).

28 Mc/s S.S.B.: I1ARI/M1 (10.40), MP4TBO (14.26), ZB2AM (15.00), ZEs (14.20), ZS1JA (15.29), ZS6AYI (13.50), 7Q7RM (15.52), 9J2s (13.30), 9H1AB (18.15).

QTH Corner

CR7GF/FR7	via W4VPD, 8254 SW 37th Street, Miami, Fla, USA.
F0CH/P/FC	(Station in Corsica) Jakob Laib, Weinfelderstr. 29, Amriswil, TG, Switzerland.
FB8WW	(S.S.B. QSO's only) via K2MGE, 12 Elm St, Lynbrook, NY 11563, USA.
FO8BL	PO Box 45, Papeete, Tahiti.
FP8BD	Dr. J. C. Craig, General Hospital, St. John's, Newfoundland, Canada.
FP8DA	via VE1 QSL Bureau.
FY7YM	PO Box 63, St. Laurent, French Guiana.
GC5ACH/GC5ACI	via YASME.
IP1AA	via I1CSG, Via Villini Svizzeri 2, Reggio Calabria, Italy.
IP1GAI	via IT1GAI, Dr. Giudice, Via San Giovanni, Noto, Siracusa, Sicily.
KB6CY	via W2CTN.
KG6IF	via W6ANB, Larry Miller, 344 Calle Miramar, Redondo Beach, Calif. USA.
KX6BQ	Martin Blackstone, APO, San Francisco, California, USA. 96333.
I1ARI/M1	via I1ZJG, Michele Ferrigno, Via Tevere 68, Romiti di Forli, Italy.
PA6AA	(VERON Radio Camp) VERON QSL Bureau, PO Box 400, Rotterdam, Holland.
PX1IE	F9IE, 2 Rue des Paupliers, Cachan, Seine, France, or via REF.
PX1JS	F9JS, 21 Av. Jean Jaures, Cachan, Seine, France, or via REF.
PY0XA	via W4ECI, 3103 4th Avenue South, Birmingham 5, Alabama, USA.
TG0AA	TG9EP, Box 684, Guatemala City, Guatemala.
VK9AG	via W2CTN.
VP2GR	PO Box 201, Grenada, BWI.
VP2KX	(Station on Anguilla) via W2YTH, Thomas Winternitz, Yardley Rd. Mendham, NJ, USA.
ZB2AX	via YASME.
4S7EA	PO Box 235, Colombo, Ceylon.
K3LZC/4X	via K3WEI, Glenn Jacobs, 7825 Stenton Av. Philadelphia 30, PA, USA.
5R8AS	via W6ZPX, 2206 West Boulevard, Los Angeles, 16, Calif.
W0GTA/8F4	via W2CTN.
9X5MW	via ON4HK, Marcel Willems, 68 Donkstraat, Dendermonde, Ov, Belgium.

QSL Managers

W2CTN	156 Ketcham Avenue, Amityville, NY 11701, USA.
YASME	YASME Foundation, Box 2025, Castro Valley, Calif. USA.

* * *

RSGB QSL Bureau: G2MI, Bromley, Kent.

DX Briefs

Reciprocal licensing arrangements are now in force between the United States and India and Germany.

QSL cards received from I1RB for his recent **I0RB** operation show that this was from the International Centre for Advanced Technical and Vocational Training in Turin. Paul says that this 600,000 sq. ft. is a UN Trust Territory. No news is available concerning possible DXCC status.

FB8WW, Crozet Island, appears to have a regular schedule with other French speaking amateurs on 21,350 kc/s at 11.00 GMT on s.s.b.

It is reported that there are now two stations active on

South Georgia. These are reported to be **VP8AM** and **VP8HY**, and they have been heard on 14 Mc/s c.w.

Trevor, ZK1AR, has now returned to the Cook Islands, and hopes to be back on the air soon with s.s.b. and is also to be on 7 Mc/s.

New prefixes are now being used by stations in Jan Mayen and Svalbard, **JX** now being used by the former, and **JW** by the latter. JW3NI is said to be the only resident amateur in Svalbard.

Strong rumours are still circulating concerning a possible trip to Rio de Oro by EA7JG during mid-August. No sign of this having materialised had been evident at the time of writing.

1966 Countries Table

	1·8 Mc/s	3·5 Mc/s	7 Mc/s	14 Mc/s	21 Mc/s	28 Mc/s	Total
G3NMH	—	—	—	177	93	48	318
G8JM	5	—	14	206	108	17	350
G3UML	3	29	26	145	69	55	327
G8VG	5	22	28	83	64	41	243
5N2AAF	9	14	23	137	68	29	280
GM3SVK	5	4	37	24	92	3	155
GM3KLA	3	38	41	30	66	15	193
G3IAR	6	32	38	57	52	16	201
9J2BC	1	1	5	46	44	21	117
G3IGW	19	43	46	58	55	1	222
G3KSH	8	17	34	50	33	11	153
9V1LP	6	12	20	27	23	14	102
G3LHJ	5	20	20	75	28	4	152
G3PQF	—	24	55	18	6	19	122
G3MWZ	7	13	1	42	8	—	71
G3WZ	2	4	27	26	2	—	61
G3JVJ	15	9	16	6	2	—	48
G8API	2	17	47	161	138	56	422
A4038	6	11	23	217	113	70	440
A4568	3	17	15	187	118	34	374
BRS 26222	5	39	22	201	91	51	409
A4609	16	26	50	105	108	26	331
A4431	6	25	38	91	103	30	293
A4552	2	25	12	127	84	30	280
BRS 25605	9	39	47	113	71	24	303
A3699	7	24	27	76	63	16	213
A4048	7	37	36	117	60	16	273
A5105	2	16	14	133	52	8	225
A4311	—	15	13	115	37	23	203
A4182	4	19	13	117	35	20	208
A3942	12	36	59	94	45	1	247
A5025	11	17	30	50	22	14	144
A4370	4	22	5	139	27	1	198
A4489	21	59	76	157	25	1	339

This month's table is given in order of 21 plus 28 Mc/s scores.

All correspondents are thanked for their assistance, and particular thanks and acknowledgements are due to the *West Gulf DX Bulletin* (W5IGJ), the *L.I.D.X.A. Bulletin* (WA2EFN), *DX'press* (PA0FX), *The DX'er* (W6HVN), *Florida DX Report* (W4MVB), *DX News Sheet* (Geoff Watts), *The Ex-G Radio Club Bulletin* (W3HQO), and *K.A.R.L. News*. Please send all items for the **October** issue to arrive by **14 September,** for the **November** issue by **5 October,** and the **December** issue by **16 November. Please note the early deadline for the November issue.**

QSL Machine

Last year DARC announced their intention to develop an electronically controlled device to speed up the sorting of QSL cards. The machine is now in use and producing outstanding results. An illustrated description of the device appears in the July issue of *DL-QTC*.

Single Sideband

(Continued from page 588)

the two 8 kc/s wide tuned circuits directly to the i.f. amplifier.

A single tuned circuit and rejection notch filter are employed between the first and second i.f. amplifiers. A double tuned circuit provides selectivity between the second and third 230 kc/s amplifiers, and a single tuned circuit is used in the output of the third amplifier. This i.f. output is coupled to the a.g.c. emitter follower, the a.m. detector, the product detector, and the S meter amplifier. The FUNCTION switch connects the audio amplifier to either the a.m. detector or product detector as required. A separate crystal-controlled b.f.o. provides oscillator injection to the product detector at 230 kc/s. The audio driver feeds the push-pull audio output stages and in turn a 3 ohm loudspeaker or 600 ohm audio line.

The S-meter amplifier and driver directly feed the S-meter independently of the a.g.c. system action. The a.g.c. emitter follower feeds the a.g.c. detector and in turn, the first 230 kc/s i.f. amplifier. The first 230 kc/s i.f. stage also functions as an a.g.c. amplifier and phase inverter to give the required outputs for both *p-n-p* and *n-p-n* transistors. The *p-n-p* a.g.c. output is coupled to the tunable i.f. amplifier and the second 230 kc/s i.f. amplifier. The *n-p-n* a.g.c. information is coupled to the r.f. amplifier.

A separate 50 kc/s crystal calibrator is provided for calibration of the main v.f.o. dial. The 50 kc/s calibrator signal is fed to the first conversion mixer output and is heard in the tunable i.f. range on all bands.

The Frequency Synthesizer

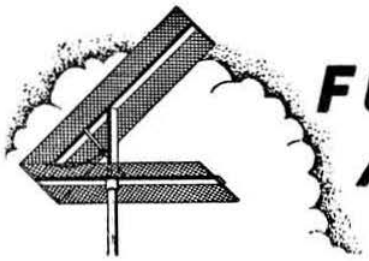
The " Synthesizer " block in Fig. 1 shows the heterodyning frequency range for each band—that is, the output of the tunable high frequency oscillator. This L/C oscillator is phase-locked to a 4·75 Mc/s crystal controlled oscillator by an ingenious arrangement whereby any one of 52 discrete frequencies (generated from the harmonics of a single, highly stable, crystal controlled oscillator operating at 500 kc/s) lying within a frequency spectrum covering the range 12·0 Mc/s to 37·5 Mc/s, is selected to give a difference frequency synthesizer mixer output of 4·75 Mc/s. The two outputs (i) the heterodyning L/C oscillator translated down to 4·75 Mc/s, and (ii) the stable crystal controlled oscillator on 4·75 Mc/s, are compared in the phase detector bridge. This bridge produces a d.c. control voltage fed to a Varactor associated with the tunable high frequency oscillator.

The detailed block diagram of Fig. 2 does not show any of the synthesizer and associated high frequency oscillator circuitry, and this is a deliberate omission. As would be expected the synthesizer section of this receiver is quite complex—using a total of 15 transistors and six diodes. Because of limitation of space it is necessary to hold over a detailed description of this unit. It is the intention to include this information in *Single Sideband* in the October issue of the BULLETIN.

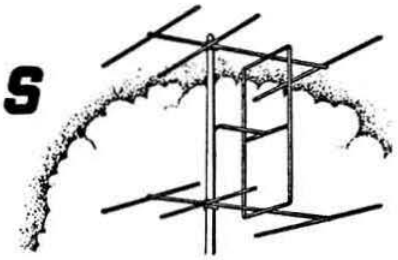
Can You Help?

● A. J. Peck, G5PK, 31 Reginald Road, Forest Gate, London, E7, who would like to hear from any member who can suggest a source of supply for the NET-OFF-POWER switch in the Tiger TR 100 transmitter?

● R. Marriott, G3LTN, 100 The Crescent, Andover, Hants, who wishes to know sources of 1-10 pF piston capacitors and 1000 pF button capacitors for u.h.f. work?



FOUR METRES AND DOWN



By JACK HUM, G5UM*

NEW HOME FOR 1967 CONVENTION

THERE are two major events in the v.h.f. man's annual calendar. One is V.H.F. National Field Day, which by the time these notes appear will be a few days behind us. The other is the International V.H.F./U.H.F. Convention—and *that* is a few months ahead of us.

We hinted in our BULLETIN report of the last V.H.F. Convention that the next one might be different, and we can now confirm that it *will* be. The biggest difference will be a change of venue. At last the Convention is to move out of central London. The new venue, a Thames-side hotel, is likely to be exceedingly attractive to all. Appropriately in some respects its name is The Winning Post, and its location Whitton near Twickenham in Middlesex.

Something else which will find favour, we imagine, is that the date is to be more than a month later than last time—and the thing to do now is to mark it on any 1967 calendar you happen to have already around: Saturday 13 May.

So there it is for the moment: date and place are fixed, and much else is in process of being arranged by your V.H.F. Committee. You will be kept in touch with Convention developments as they unfold.

BAND PLAN IN ACTION

One of the expected results flowing from the introduction of the revised British Isles Two Metre Band Plan was an increase in telegraphy activity in the new c.w.-only area of 144·0 to 144·1 Mc/s. Not many evenings pass without the appearance of at least a few stations on the key at the low end, though it will take some time for the habit of operating there and of using the key more often to become ingrained.

Properly used, the c.w. segment should open up the range of 2m considerably, especially in view of the fact that it is internationally recognised by most European countries as the telegraphy area. As soon as *their* operators come to expect more British operators to appear in it the results may surprise us all.

As for operation in the remainder of the band, it is not expected that single channel working will develop, except among the s.s.b. men, until the use of good v.f.o.'s becomes the general thing. Put another way, the new Band Plan is some way ahead of existing techniques—though it anticipates future ones.

The probable pattern of operation is likely to be inter-zone working on a crystal controlled basis for some time to come, but with an increasing amount of spot frequency activity developing in due course. How is this likely to sound in practice?

Let us assume that an operator in Zone 7 has put out a CQ. He should terminate it by sending one of the accepted groups such as " QHL " or " QLM " according to the direction in which he proposes to tune. If he intends to check his own frequency first he will indicate " QMF "—meaning " listening on my own frequency."

All nice and simple, and it has been going on for years (though maybe not " QMF "—much).

Now, if your CQ from Zone 7 is answered by a man in Zone 5 do not for goodness' sake v.f.o. on to his channel. If you do he will lose you: his receiver tuning will be set at the frequency where he first heard you. Answer him on *this* frequency. Then if you wish, having established contact, to initiate single channel working, tell him you are going to move on to his channel.

When the QSO is completed check first that nobody is calling you on that Zone 5 frequency. Then move back into your own Zone 7.

Just a final point about Zone 1—the c.w. zone. Do not confine your listening only to this area: people without l.f. end crystals may be calling you higher up the band. If you *do* wish to confine searching to the l.f. end, send " CQ LF."

And a final final: all the above applies also to the 70cm band, the new plan for which comes into effect on 1 October.

NO VALVES ON "TWO"

Quite a stir was caused in Yorkshire when G5ADU/DJ7OO appeared on " Two " using a 300 mW transistor transmitter and a 2-element aerial. During the two or three weeks he was centred on Barnsley he worked a score of stations at distances of up to 50 miles. Among those contacted was G6SN, and " Shack " pressed him to send along circuit details for publication here. They will appear next time.

POINT ABOUT ARTOBS

Last month's note about the German ARTOB balloon has brought this comment from G3NAO of Dewsbury:

" On 19 June I was operating my portable gear (2m) as the talk-in station for the Northern Mobile Rally at Harewood. Searching the band with the beam SE I came across an S7 amateur transmission, the operator speaking in a foreign language, possibly German. The transmission was very steady but disappeared suddenly after about 20 seconds. No call-signs were given, and though I covered the band dozens of times no further transmissions were received. The time, around midday, was just about right for sporadic *E*. No other DX was audible on the band. I am convinced after reading your paragraph that this was a transmission via the translator mentioned.

" Perhaps if advance information on the balloons could be published well ahead more interest would be created and more positive results achieved."

"FIXED" OR "PORTABLE" CAN GET FMD CERTIFICATES

An operator who was in great demand during the last 432 Mc/s Open Contest, G8AGQ, raises a point about the

* Bulls Green, Knebworth, Herts. Please send reports to arrive not later than 9 September for the October issue, and 7 October for the November issue.

eligibility of portable stations for the Society's *Four Metres and Down* award. From his /A location just outside Sheffield he and his team worked five countries and 99 stations during the contest.

The ruling is that G8AGQ/A rates as a separate station from G8AGQ. If Alan could get the QSLs in for three countries and 20 counties for both G8AGQ and G8AGQ/A he would qualify for an *FMD* certificate for each.

On all v.h.f. bands the same condition applies. If a man were perspicacious (or fortunate) enough to collect the needful cards for fixed, portable and mobile operation on 4, 2 and 70cm he could claim nine certificates! Categories cannot be mixed, *e.g.*, you could not include a /P card in a claim for a /M award.

It's a perfectly logical arrangement based on the concept of " one station—one award." And the award itself makes a handsome addition to the radio room wall.

* * *

Several Continental awards are available for v.h.f. performance. Perhaps one of the most difficult for UK operators to earn is that offered by SRAL of Finland, simply because OH contacts come but rarely on the metre waves. You earn one point per 10km for a contact with Finland on 144 Mc/s or above. Claims, with a minimum of 150 points, to SRAL, Box 306, Helsinki.

ABOUT DX

Very quickly the value of the Norwegian 2m beacons has become apparent. Knowing that they exist many operators now turn their beams north east more often than was their custom, with results towards the end of July which were most encouraging. For many, a contact with LA4FE was their first with Norway on 2m, and Holgar was handing them out at a fair rate.

Denizens of a country pub in Kent stood amazed at the sound of Europe from LA round to F booming forth from the " Mini " of G3PKT using nothing more than a 9 in. halo. (" Mind you, I was at 550 ft. a.s.l." adds Alan. He promises brief details of the mini-halo for the " Mini " for *Tech Corner*.)

How important it is to check the " ultra highs " when the " very highs " are producing DX was shown by the experience of G3LTF in working three OZ and an SM as well as a couple of DL stations on 70cm during that north easterly opening of July. But you haven't heard all: G3LTF managed to resolve signals from OZ7SP on 23cm as well as working him on 70cm. Although they were unable to make contact on " Twenty Three "—the path is 500 miles—success cannot be long delayed, we are sure.

At OZ7SP a 32 element stack is used for 23cm, and 20 watts to a 2C39 p.a. At G3LTF the receiver used for this feat had a 1N23E mixer (7·8db noise factor) and a 30 in. dish at 50 ft.

In the opposite direction from Scandinavia and during the same opening EI2W gave many a G and GW operator his first EI on 432 Mc/s, and the first EI to GD contact was recorded for " Seventy " on the night of 30 July (EI2W to GD8AGY/P). Two nights later GD8AEG/P was also worked. Both operators were on holiday on the Island at the time, and their foresight in taking 432 Mc/s equipment along with them really paid off.

Also from Ireland EI7AF makes a plea that more beams should be turned westwards during contests. In the Four Metre Portable event of July he heard many stations that could have been worked had their beams been shone his way. As it was, he did pretty well from his 1600 ft. site in the Slieve Bloom Mountains with a dozen GI contacts, a couple of EI plus two GWs. So don't forget, G-men, that there are QSOs aplenty across the water westwards, and it's well worth looking that way every contest-time (and other times, too, for that matter).

Talking about beam headings, a look in the direction of the out-on-a-limb members of Devon and Cornwall (south westerly to most of us) will pay off. Example: G3JGJ goes out portable on " Two " for almost every contest—and at other times as well—to a 1000 ft. site not far from his home QTH near Newton Abbott. People engaged in local QSOs would be surprised if they knew how often they are audible down Devon way.

BEACONRY

Good news comes from G3OCB about the Cornish beacon. Clive reports that GB3CTC has now received permission from the GPO to initiate a beacon for 70cm.

" It may be several months before this one becomes operational," adds G3OCB, " but it will probably sign GB3CTC on 432·1 Mc/s with a fairly broad beam and keying similar to the existing beacon."

And from Don Hayter, G3JHM, there is a report of plans to put a 4m beacon on the top of the Rock of Gibraltar, operating on 70·26 Mc/s with a 4 element Yagi donated by J-Beams. Says G3JHM:

" The gear has been made by the Plessey (West Leigh) Radio Club and will provide clipped a.m., f.s.k., as well as c.w. when operated manually. There will be an auto-keyer giving ' CQ de ZB2VHF ' on A1."

POINTS OF VIEW

" An f.b. idea, having a c.w. end to the 2m band." (G2DHV).

" A hint to the DX-peditions: please tell us who they hear but don't work. Operators who called them but failed to make contact would like to know if they were heard at any time." (G3EDD).

" I wish that more of those who are active on 23cm would describe their gear in print. Very little information is so far available and this must cause some reluctance to others to ' have a go ' on Twenty Three." (G2WS).

" Apropos the suggestion from G3PTO—Morse for the G8 plus threes—there is a case for permitting Class B licence holders to use Slow Morse on the 70cm and 23cm bands to help establish contacts over new and difficult paths." (G8AEJ).

" Results with the new 9-in. halo for ' Two ' fully justify the drastic step of drilling the ' Mini's ' roof to fit in permanently the support mast connector, with the 52 ohm co-ax tucked into the roof lining." (G3PKT).

"I welcome the new beacons on 4m, but please can we have one at Wrotham? A beacon to be useful should be at the centre of activity, not hundreds of miles away . . . I'm sure

V.H.F./U.H.F. BEACON STATIONS

Call-sign	Location	Nominal Frequency	Emission	Aerial Direction
GB3ANG	Craigowl Hill, Dundee	145·985 Mc/s	A1	S
GB3CTC	Redruth, Cornwall	144·10 Mc/s	A1	North-East
GB3GEC	Hammersmith, London	431·5 Mc/s	F1	
GB3GI	Strabane, N.I.	145·990 Mc/s	A1	
GB3LER	Lerwick	145·995 Mc/s	A1	S
GB3LER	Lerwick	70·305 Mc/s	A1	N/S
GB3LER	Lerwick	29·005 Mc/s	A1	N/S
GB3VHF	Wrotham, Kent	144·50 Mc/s	F1	North-West

RSGB V.H.F. BEACON STATION GB3VHF

The frequency of the Society's v.h.f. beacon transmitter at Wrotham, Kent, when measured by the BBC Frequency Checking Station, was as follows (nominal frequency 144·50 Mc/s):

Date	Time	Error
5 July	11.44 GMT	360 c/s low
13 July	09.23 GMT	290 c/s low
27 July	09.10 GMT	255 c/s low

the 2m beacon at GB3VHF has encouraged more people to try a CQ on 2m than any other factor . . . a dipole half way up the new Emley Moor television tower would cover the whole country with a 5 watt transmitter." (G3FDW).

TECH. CORNER

From G3LTF:

An increasing annoyance on 2m is the presence of sidebands from s.s.b. stations at plus or minus 465 kc/s. These are due to people using 465 kc/s sideband generation in their l.f. band transmitters and then heterodyning up to 2m. I have heard spurious transmissions from as far away as 100 miles. Close to, they are very annoying.

The only way to get *clean* s.s.b. on 2m is to start at a high frequency or to use a very good filter somewhere to cut out the spurious responses.

It should be noted that offending stations using 145·41 Mc/s will have a spurious transmission at 146·875, which is *outside the band.*

From G3BA:

I notice that the subject of v.f.o.s is being brought well to the fore, and high time too, I may add. The general thoughts on how a v.f.o. should be made solely for v.h.f. purposes seem to be directed towards providing a crystal substitute either at frequencies around 8 Mc/s or possibly 24 Mc/s, and then multiplying up as usual. This has certain obvious disadvantages with regard to stability and to breakthrough on the channel netted to. These can be got over, but generally speaking this is a job for the real expert with full facilities for mechanical work, and, what is more, plenty of time to spare to do it in.

There are the 72 Mc/s fundamental oscillator exponents too, but this method is not really to be considered seriously for anything simple and stable which can be made on the kitchen table.

Transverters, translators and whatever you want to call them are of course known and widely used by the s.s.b. devotees; but here again a complete translator does take up a bit of time in the making.

There is another way which seems very attractive and which should provide the answer to the drawbacks mentioned. It is fairly simple to build and commission, and uses existing transmitter gear without any heavy modifications being needed to convert from c.c. to v.f.o. The device could be called a " Variverter," short for Variable Frequency Converter Unit. It uses only three valves and can be self contained.

The fundamental idea behind the " Variverter " is to break into the r.f. line-up of the crystal controlled transmitter at the coupling point between the last multiplier anode and the first amplifier grid, and separate the two tuned circuits. A link coupling is taken from the multiplier anode coil to a socket at the transmitter rear. Another link is taken from the amplifier input grid coil to a second socket at the rear. Interconnecting these sockets will enable the transmitter to work as before.

The next step is to plug a 7225 kc/s crystal into the transmitter socket in place of the 8 Mc/s crystal usually employed, and to tune up the multipliers to give an output of 130 Mc/s instead of 145 Mc/s.

The link is now removed from the back of the transmitter and the output from the multiplier at 130 Mc/s is fed by a short co-ax connector to the input of the " Variverter." The output of the " Variverter," which is at 145 Mc/s, is connected to the amplifier input socket.

As will be evident, the " Variverter " is no more than a transverter but it has its own v.f.o. within the unit and derives its conversion frequency from the c.c. transmitter oscillator and multiplier circuits.

The advantage of this type of device is that there are no multiplication errors, as it is a mixer not a multiplier; hence the v.f.o. design need only be that which is common practice in receiver r.f. work, and need have no more stability than is considered necessary for c.w. or a.m. reception on 20m.

NOTE: Further details of the " Variverter " and a skeleton circuit diagram from G3BA will appear here next month. Acknowledgement is also made to G3FDW for details of a 2m v.f.o. in use at his station. Space precludes inclusion this month; watch *Tech Corner* next time.

THURSDAY IS MIDLAND MOBILE NIGHT

Most Thursday evenings Harold Turner of Leicester, G8VN, climbs into his " Anglia," and, with 4m quarter wave affixed to the rear wing and the Eddystone EC10 stowed in front of the gear lever, heads for Beacon Hill near Loughborough. His /M activities from that 800 ft. site, where he can be heard over a wide radius, have during the last few months galvanized what would otherwise be a pretty quiet 4m band, and have brought into being regular appearances by many other mobile men—and a not inconsiderable number of fixed stations besides.

And now " Thursday Nights are Midland Mobile Nights," and a special incentive to operators with vehicle equipment to use 4m without the fear of TVI.

We would be glad to see a great deal more fixed station operation in those areas where TVI hazards exist. Members who are plagued with this problem on " Four " would welcome some ideas from operators who have mastered it by the use of filters or special crystal frequencies.

Meanwhile, keep a look out for the mobileers between 18.30 and 21.00 GMT any Thursday.

LAST ROUND UP

The beacon station GB3GI is now in continuous operation on 145·990 Mc/s ± 300 c/s. The transmission is beamed 1¼ minutes North and 1½ minutes South-East alternately, with the call-sign repeated three times in each direction. Reports will be most welcome, and should be sent to the V.H.F. Committee at RSGB Headquarters.

* * *

Little has been heard about television activities on 70cm just lately. There is a great deal more of it going on up and down the country than might be thought, *e.g.*, G6ABI/T lays down a tremendous signal along the East Yorkshire coast from his QTH in Sunderland. (He is better known, perhaps, as G3TKB.) Send *Four Metres and Down* news of *your* work in the video line (405 or 625!)

* * *

Several members not within range of any beacon say they find " Skeds Operative " invaluable as a check that their converters are still working! Look up previous appearances of " Four Metres and Down " for schedules being regularly kept—and if *you* keep one send details of times and frequencies for inclusion here.

* * *

The 432–434 Mc/s bandplan starts 1 October. As they say on the motorways, " Get in Lane." Bit peremptory, but you know what we mean!

* * *

The expedition to Sark, which was still going strong when this issue closed for press, has enabled G5ZT (Plymouth) and the expedition operators to claim two firsts. He successfully completed two RTTY contacts with the island, one on 2m with GC3OUF (18 August), and another the next day on 4m with GC3OHH.

On 25 August **GB2GC** worked G3OBD/P for the first G–GC on 1296 Mc/s at 59 both ways. The first GC–GW on 432 Mc/s was made with GW3MFY at 559 each way on 28 August.

Book Reviews

BEAM ANTENNA HANDBOOK. By William I. Orr, W6SAI. Published by Radio Publications, Inc. Wilton, Conn., USA. 200 pages, 8½ in. x 5½ in. Available from RSGB Publications. Price 28/- post paid.

The first edition of the *Beam Antenna Handbook* which was published in 1955 contained 127 pages and the latest edition is therefore over half as large again. Additional chapters include sections on Multiband Beams; Wire Beams; 40m Compact Beams; the W6SAI Compact 20m Beam and an extensive Bibliography with Great Circle maps, the latter all unfortunately centred on US cities. Existing chapters have been enlarged and the section on Matching Devices now includes details of a broad band balun and information on T and Gamma matches. Chapter 14 covering Test Instruments has additional material on the Antennascope and Monimatch. Unfortunately there is no index although the Chapter analysis offsets this omission to a limited extent. The author needs no introduction to users of the h.f. bands as an expert in the field of aerials and the *Beam Antenna Handbook* is written in a clear concise style having many diagrams and photographs. A recommended buy for those who are interested in getting the maximum amount of r.f. in the right direction. R.F.S.

RADIO ASTRONOMY. By F. Graham Smith. Second Edition, 1962. Pelican Books No. A479. 261 pages plus 16 plates. 7s. 6d.

This is a clearly written, thoroughly informative book on all aspects of Radio Astronomy, and will appeal to anyone with the slightest curiosity about the universe we live in. Dr Smith starts by outlining the early experiments at the turn of the century as electronic techniques became useful tools—Edison winding several turns of wire supported by telephone poles around a mound of several million tons of iron ore to act as a giant electromagnet—to the classical work of Jansky in 1932 who was searching for radio noise from the sun. As 1932 was a Quiet Sun year, he found galactic noise instead. Grote Reber W9GFZ continued the work single-handed until the war years, during which interference to radar sets was tracked down to the sun. The post-war use of radar to track meteors, and to measure the rotation of the planets, and the extension of low noise receiver and new aerial techniques to extend the reach of the radio telescopes, are all described admirably in this book. Other chapters explain the importance of the Hydrogen line, the possible origin of radio stars, and the use of artificial satellites to increase our knowledge. Useful guide lines are included as to how the amateur may help by logging the sun and nearer radio stars, and the book includes a list of the more prominent radio observatories and their specialities. Written for the scientific layman or non-specialist, the book does not include details of electronics or mathematics, but is an excellent source of all kinds of technical titbits to stimulate the interest. Highly recommended. M.B.

RADIO EXPLORATION OF THE PLANETARY SYSTEM. By Alex G. Smith and Thomas D. Carr. Van Nostrand, 1964. 144 pages and 15 plates. $1.50.

This book is somewhat complementary to *Radio Astronomy* by F. G. Smith. It is intended for students and others with some knowledge of electronics, and includes formulae and derivations to prove such things as the maximum range of a 1 MW transmitter used for space communication (about 8 light years with 85 ft. parabolas at each end). After discussing the tools and techniques of equipment and aerials, the book shows how the direct thermal radiation from the planets is measured, and what in turn this information can tell us about these planets. The curious pulse emissions from Jupiter around 20 Mc/s are shown to be from some mechanism with a peak pulse power of some 300,000 MW, and possible causes of this are given. Indirect methods of measurement using radar reflections are detailed, and it is of interest to note that the moon returns a signal about 1/1000th of that from an aircraft—but that a radar return from Mars is 1/100,000,000th of that returned by the moon! The technological improvements required to extend the range of telescopes and radar are outlined, and the many ingenious ways of abstracting the signals from noise of greatly excess level are described. It is this detective work, combined with the several lucky accidents which have helped the investigators, which makes for such interesting reading.

The authors have included a list of references at the end of each chapter, plus a bibliography. It should be noted that as the title implies this book deals only with the sun and its planets, and not with the galactic and extra-galactic sources. Highly recommended. M.B.

Tenth Northern Mobile Rally

The Northern Amateur Radio Mobile Society held its Tenth Northern Mobile Rally at Harewood Park, near Leeds, on Sunday, 19 June. Once again it was a great success, with an attendance approaching 2000. Visitors arrived at Harewood in brilliant sunshine and after signing-in, were able to look round the numerous trade stands or pick up bargains in the sale of surplus amateur gear. Those unfamiliar with the district were able to obtain directions from the three talk-in stations. G3NAO and G3GJV had only six contacts each on 2m and 4m respectively, while G3OGV was kept busy almost continuously between 11 a.m. and 3 p.m. on 160m. This year QSL cards were available for contacts with the rally stations. In addition to raffle prizes, a cake decorated with the society's badge, in icing, was presented to the lady guessing its correct weight, a prize for the mobile competition was won by G3UXO and the prize for the longest distance travelled was won by GM3RNI. The junior ops had free lucky dips and many of them won prizes in a series of potato and spoon races. A short sharp shower occurred as the raffles were being drawn, but everyone was able to get under cover until the sun returned a couple of minutes later. Next year's rally has been fixed for Sunday 21 May, 1967.

New IARU Member Societies

Czechoslovakia and Nicaragua are now represented through their national societies in the IARU. Central Radio Club of Czechoslovak Socialist Republic (CRC) and Club de Radio Experimentadores de Nicaragua (CREN) received the unanimous approval of the member societies participating in recent balloting. CRC, represented at the Opatija IARU Region 1 Conference by its President and one other Board member, has been invited to join Region 1 Division. CRC had about 7,660 members and CREN about 50 members at the time they applied for membership.

New Indian Magazine

The Indian Radio Amateur, Vol. 1, No. 1, dated June 1966 is the official organ of the Amateur Radio Society of India. Editor is O. P. Verma, VU2OP, PO Box 534, New Delhi 1. There are now about 450 licensed radio amateurs in India of which number about 40 per cent are members of ARSI. Total membership of ARSI is around 400 with the highest concentrations in Bombay (57), Bangalore (42) and Calcutta (39). Reciprocal licensing arrangements exist between India and the United Kingdom, Canada, Switzerland, the Sudan and West Germany.

Radio Amateurs' Examination

Courses of Instruction

Courses in preparation for the City and Guilds of London Institute Radio Amateurs' Examination will be held at the following centres during the session beginning in September 1966. A list also appeared on page 512, August 1966.

Ansdell. Ansdell Evening Institute (Ansdell County Secondary School), Worsley Road, Ansdell, Lytham St. Annes.
Enrolment 12-14 September. Thursdays, 7-9 p.m. (Theory); Morse classes to be arranged later. Mr A. Marsden (Principal), 3 Worsley Road, Ansdell.

Beckenham. Beckenham Evening Education Centre, 28 Beckenham Road, Beckenham, Kent.
Thursdays, 7-9 p.m. Morse tuition on Mondays. Fees will be graded according to age; maximum 40s. Further details from M. D. Bass, B.Sc., 42 Clevedon Road, London, SE20.

Birmingham. Lea Mason Evening Institute.
Enrolment during the week commencing 5 September. If there is sufficient response, it is hoped to organize a Morse Class and Basic Radio Class. Further particulars from M. A. Brett, G3HBE, telephone ERDington 3026.

Brighton. Brighton Technical College, Engineering Dept., Richmond Terrace, Brighton, 1.
Courses for the Radio Amateurs' Examination and the GPO Morse Test.

Bury St. Edmunds. West Suffolk College of Further Education, Out Risbygate, Bury St. Edmunds.
Enrolment 5-7 September.

Corbridge. Corbridge Evening Institute, Corbridge, Northumberland.
Enquiries to V. Allison, G3TNX, 14 Silverdale Drive, Winlaton, Co. Durham.

Coventry. Coventry Technical College, Butts, Coventry.
Enrolment 7-8 September. Wednesdays, 7-9 p.m. Morse tuition will continue to the end of the session in July. The fee is £1 16s.

Derby. Derby and District College of Technology, Kedleston Road, Derby.
Enrolment 15 and 19 September, 6-8 p.m. Tuesdays (Theory), Fridays (Practical) 7-9 p.m. Fees: one evening £3; two evenings £4. Late enrolment fee: 10s. Lecturer is F. C. Ward, G2CVV.

Glasgow. Allan Glens School, Cathedral Street, Glasgow.
Enrolment 5-8 September. Tuesdays (Theory), Thursdays (Morse instruction, GPO regulations), 7-9.30 p.m. Fee: £1. Instructors are GM3AXX and D. Rossi.

Leicester. Leicester Regional College of Technology.
Wednesday evenings, 6.30-7.15 p.m. (Morse), 7.15-9.15 p.m. (Theory). Lecturer is G2DSF.

Liverpool. Riversdale Technical College, Riversdale Road, Aigburth, Liverpool 19.

London.

E4. Chingford Community Centre, Friday Hill House, Simmons Lane, Chingford.
Enrolment during week commencing 19 September. Mondays, 7.30-9.30 p.m. Fees are 7s. 6d. per term plus a society affiliation fee (annual) 8s. 6d. for senior members and 3s. 6d. for junior members.

N7. Grafton Radio Society, Room 35, Montem School, Hornsey Road, Holloway, N7.
Enrolment during week commencing 19 September. Mondays, 7-10 p.m. (Theory). The instructor is G3MMC. Wednesdays, 7.30-9.30 p.m. (Morse). Further details from A. W. H. Wennell, G2CJN, 145 Uxendon Hill, Wembley Park, Middlesex.

N12. Northside School, Percy Road, Finchley, N12.
Enrolment 12-14 September, 2-4 p.m. and 6.30-9 p.m. at the school or contact G3MNK, 2 The Rye, Eaton Bray, Dunstable, Beds., telephone Eaton Bray 568. Wednesdays, 7.30-9.30 p.m.

Oldham. Oldham Technical College.
A course for the RAE will be organized if there is sufficient demand. Enquiries should be sent to A. B. Langfield, G3IOA, 201 St. Mary's Road, Moston, Manchester 10.

Openshaw. Openshaw College for Further Education, Whitworth Street, Openshaw, Manchester 11.
Enrolment 19-21 September. Instruction for RAE theory and Morse.

Peterborough. Peterborough Technical College, Eastfield Road, Peterborough.

Portsmouth. Portsmouth Evening Institute, Drayton End, Portsmouth.
Enquiries should be addressed to the Secretary, Eastney Modern School, Reginald Road, Southsea, Hants.

Wembley. Wembley Evening Institute, Copland School, High Road, Wembley, Middlesex.
Enrolment 12-15 September, 7-9 p.m. Mondays, 7-8 p.m. (Morse) and 8-10 p.m. (Theory). Classes will be conducted by G8PD.

Weybridge. Brooklands County Technical College, Heath Road, Weybridge.
Enrolment 12-13 September. Mondays, 6.30-9 p.m. Enquiries to the college or telephone 46485.

Portable Butane Gas Torch

A useful soldering tool which may find favour especially among constructors of miniature v.h.f./u.h.f. apparatus is the Flamidor Butane gas torch. This small tool—it measures 7¼ in. long overall with a diameter of 1⅛ in.—can be used for soft and hard soldering of small objects, such as chassis plates and screens. The flame is concentrated into a pencil sharp jet, with a temperature of 1500°C, and is unaffected by any operating position. Its versatility is increased by the provision of a detachable soldering bit, which can store sufficient heat at high temperature to solder a delicate component to $\frac{1}{16}$ in. brass sheet without prolonged application of the bit, even with the flame extinguished.

Screwing the burner unit tightly on to the Butane container opens a valve in the container permitting flow of gas. No adjustment of flow is required to obtain the correct flame. The Butane container is claimed to have a capacity of four hours, and can be replaced when exhausted by a new container which costs 6s.

The Flamidor gas torch is available from Southern Watch and Clock Supplies Ltd., 48 High Street, Orpington, Kent, price 38s. 6d. post paid.

"If you want an honest opinion I think the insert is the best..."

The Transistorized Vackar Oscillator

This is a tale with a sting in it!

Not wishing to belittle the splendid efforts of BRS25769 (*Technical Topics*, July, 1966), may I support his view that here is indeed an oscillator worthy of consideration. This observation is based on fact, having had one in service for more than a year with great success in my transistorized portable 8 watt 1·8/3·5 Mc/s transmitter. In the recent RSGB Low Power Contest, running at 0·9 watt maximum input, 48 daylight contacts were made on 3·5 Mc/s, including one with Poland. One contestant stated that my transistorized Vackar oscillator was the most stable transistorized oscillator he had heard, and likened it to a crystal oscillator. He even requested that I publish the details for all to share.

It can be keyed directly without chirp, and when properly constructed, can be left running without interference to reception.

The development of this v.f.o. was not, however, without

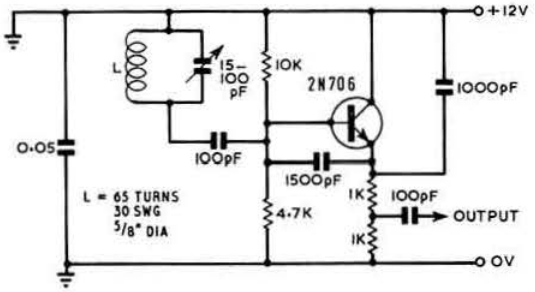


Fig. 1. G3BIK transistor oscillator.

snags, and it took four weeks of intensive work to produce an oscillator of stability equal to the main station valve Clapp v.f.o.

The ultimate G3BIK version utilizes a silicon *n-p-n* v.h.f. transistor, type 2N706, which is available in this country at less than 4s. 6d. The collector of this transistor is connected to the metal case, and it is capable of dissipating up to 1 watt. My version allows the case, and hence the collector, to be clamped directly to chassis, which incidentally, is at positive potential and very useful for connecting to the car battery system.

Output is taken from the emitter bias resistor. It can be either direct from the emitter, or as in my case, from a tapping half way down the resistor, with reduced output but increased freedom from succeeding stage loading effects on frequency stability.

The use of an un-decoupled emitter resistor, by providing negative feedback, has the distinct advantage of improving the wave-form and stability, plus the absence of squegging as encountered by G3VA.

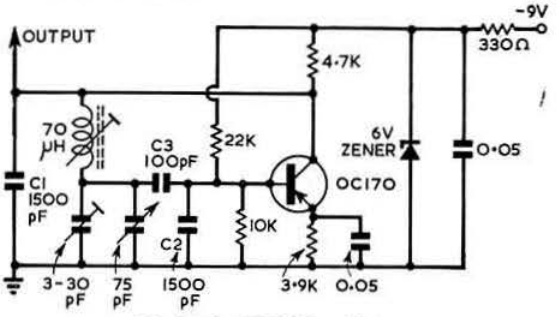


Fig. 2. The BRS25769 oscillator.

What then were the snags?

The original open air tag strip version drifted in frequency at an alarming rate under still air conditions, i.e., the performance was far worse than any valve type oscillator constructed by G3BIK. All stability observations were made by beating the v.f.o. against a standard 2 Mc/s crystal oscillator and listening on the main station receiver. The whole tag strip assembly was then mounted inside a tin box with a lid, the object being to shield the circuit from undue air disturbances. This move reduced the drift slightly, but it was still most unacceptable. Careful localized blowing on the individual components with a straw then proved that the main offenders were the miniature ceramic capacitors used in the feedback network. These were replaced by moulded mica samples with a marked improvement in stability, but still it drifted.

It is worth mentioning at this point that changing the supply voltage from 12 to 6 caused only about 100 c/s change in frequency, proving that the drift was not associated with the battery supply, i.e., the Zener diode is a refinement!

Different transistors were tried, including the OC170, but without success.

Further experiment proved that the ceramic high quality tuning capacitor had a *negative* temperature coefficient—contrary to popular belief! This capacitor was removed from circuit and the frequency restored to 2 Mc/s by adjustment of the coil, leaving only the coil, transistor, three bias resistors, and the three moulded mica capacitors—yes, and it still drifted.

Gentle blowing on the coil with the straw now proved that it alone was the last remaining temperature conscious component. This was a little surprising considering that this was a high quality, well constructed coil. At this stage, one could actually grip the transistor leads between the fingers with very little effect on frequency of oscillation, except, of course, for the original change as the fingers were brought into the field of influence.

The next step was to rebuild the complete oscillator within a

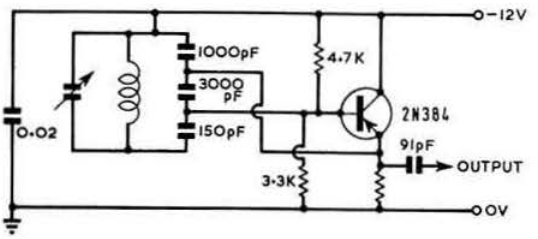


Fig. 3. The W3JHR synthetic rock transistor oscillator.

heavy gauge metal box with lid, to provide direct shielding from the external environmental changes, the box acting as a sort of heat sink in reverse, i.e., a body of high thermal mass. This move completely cured the long term frequency drift, and produced an oscillator well worth using. Short term stability is such that the box can be shaken violently or gently bumped while listening to the beat note set just off zero beat with the crystal oscillator, with almost imperceptible change in frequency. This, of course, is ideal for mobile working.

Long term stability is such that having switched off all the equipment in the just off zero-beat condition, switching on again after 24 hours produces only a few cycles difference in beat frequency.

Why then the totally unexpected susceptibility to temperature, to a degree rarely met, even in valve oscillators? This is explained by the hypothesis that valve equipment invariably produces a reproducible heating effect at each switch-on, causing an immediate short term drift, but rapidly achieving a steady temperature, and hence stability. Bear in mind, however, that they are normally built into enclosed metalwork anyway.

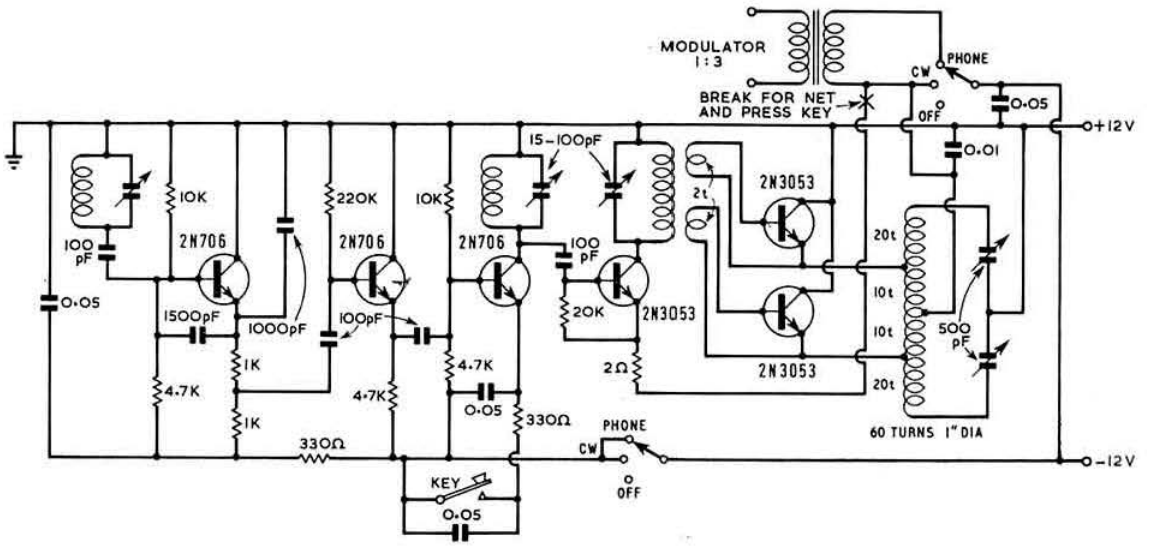


Fig. 4. The r.f. circuitry of an 8 watt c.w./6 watt phone. 1·8 and 3·5 transmitter designed by G3BIK.

whereas the transistorized version relies on the steady state temperature as determined by the shack environment. Motto —use a heavy gauge metal enclosed box, with feed-through capacitors for supply leads, and the usual techniques, such as high grade insulation, double bearing tuning capacitor, a mechanically sound and high *Q* coil, moulded mica capacitors for the feedback circuits, and preferably high stability resistors such as the Electrosil tin-oxide TR4.

The r.f. section circuit details of my completed transmitter are included here for general interest. It has a few novel features, e.g., by using *n-p-n* transistors throughout, it can be connected directly to a car battery system; the r.f. power transistors can draw up to 8 watts from the 12 volt (nominal) battery, and cost only 15s. each; it uses the G3BIK transistorized Vackar, of course, hi, and the modulator is a Newmarket type PC5+ packaged deal 3 watt output printed circuit job.

Now what about the " sting in the tale"?

Well, a careful study of this G3BIK/BRS25769/Vackar transistorized oscillator will show that, from the a.c. standpoint, this is identical to the so-called Synthetic Rock oscillator as published in your *Technical Topics* in the December 1963 issue!

Ah yes, I thought that I had produced an original too, until I rumbled, which is why I have never publicly disclosed the details of " my " design.

Nevertheless, I can thoroughly recommend the version as used by myself.

E. Chicken, C.Eng., A.M.I.E.R.E., G3BIK
52, Marlborough Avenue,
Grange Park, Gosforth,
Newcastle on Tyne, 3.

Pat Hawker, G3VA, comments:

G3BIK is to be congratulated on his " rumbling " that his own oscillator has a close affinity to W3JHR's synthetic rock, and that both are in many ways similar to the Vackar circuit—but I hope to show that whereas the BRS25769 circuit as given in *Technical Topics* is (with one important reservation) a reasonably true adaption of the valve Vackar, the other two circuits are *not* Vackars. They could more accurately be described as transistorized versions of an undeservedly little known oscillator circuit developed in 1940-41 by E. O. Seiler, W8PK, later W2EB.

This Seiler oscillator was incorporated in a 3·5 Mc/s keyed v.f.o. presented in *QST* of November, 1941 under the title of a " low-C electron coupled oscillator." The basic Seiler valve circuit is clearly recognized as a separate form of oscillator to the Vackar in one of the classic articles by J. K. Clapp (" Frequency Stable *LC* Oscillators," *Proc. IRE*, August, 1954). Clapp suggests that its high-stability characteristics extend over a tuning range of 1·8 : 1 compared with 2·5 : 1 for the later (1945) Vackar, which incidentally was also developed independently by Landini in Italy in 1948 before publication by Vackar in 1949. All are, of course, variations of the basic Colpitts, and in fact W8PK described his circuit as " essentially a Colpitts oscillator with the valve loosely coupled to the tank circuit by means of a capacitive voltage divider " (the exact point made by W3JHR 22 years later) and an alternative to the popular high-C Colpitts.

My Fig. 5 which I think proves my point—shows the basic configurations of the valve Vackar and Seiler as given by Clapp, while Fig. 6 shows the essentials of the practical Seiler oscillator

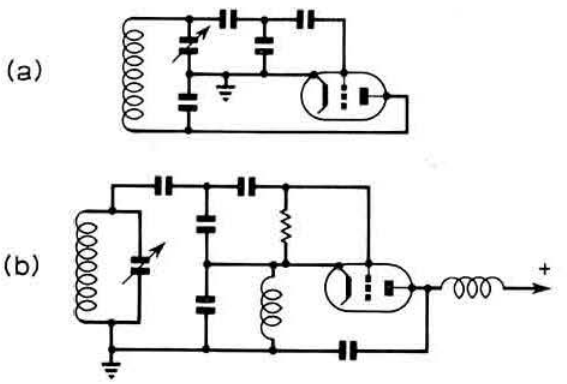


Fig. 5. Basic configurations of (a) Vackar and (b) Seiler (W8PK) oscillators as analysed by J. K. Clapp (*Proc. IRE*, August 1954).

from the *QST* article. To judge by the details given, this gave very good results by 1941 standards despite the use of a 6F6 valve which would today be regarded as quite unsuitable for this application, and the complete absence of any voltage regulation (the low susceptibility to voltage changes is borne out by G3BIK's experiences). The valve version might be very well worth looking at again, also—particularly for receiver applications.

Seiler modestly states that he developed the circuit from ideas

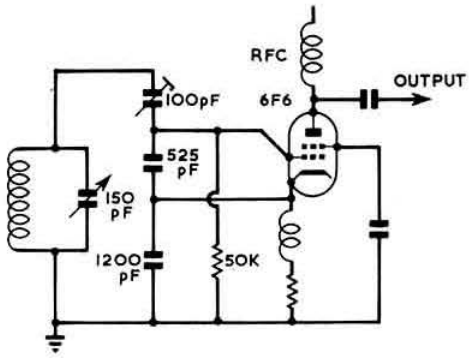


Fig. 6. Basic oscillator circuit in the two-stage v.f.o. described by E. O. Seiler (W8PK) in *QST*, November 1941.

propounded in an article by Walter Van Roberts ("The limits of inherent frequency stability," *RCA Review*, April 1940—still worth reading). But it is clear from reference to this article that the Seiler circuit is an original development and not a copy from any described by Roberts (W3CHO).

It seems to me to be a quirk of fate that a completely novel oscillator circuit, developed by an amateur and described for the first time in the amateur press, should have been so largely ignored by other amateurs in the following decades—unless one counts as vindication the arrival on the scene of the highly popular W3JHR "synthetic rock" transistor version.

If, as I hope, we can now all agree that the W3JHR/G3BIK circuits are transistorized Seilers, what is my reservation about BRS25769's Vackar?

It is simply that—as reference to the letter from G6HD in the March, 1965 BULLETIN will show—the original valve Vackar called for high-C tuning (unlike the W8PK arrangement designed specifically for low-C tuning), with the high C usually supplied by a large capacitance trimmer across the main tuning capacitor. This trimmer was over 1000 pF in the original analysis (for the mathematics see G6HD's letter or the Clapp article) whereas almost all of the published Vackar circuits (including that of BRS25769) fail to meet this requirement. It was for this reason that I added the not entirely ingenuous remark in *TT* that I had found (at least on my very rough breadboard model) that this circuit does oscillate with high capacitance added across the tuning capacitor, though I must admit that this may make it difficult to achieve a really wide tuning range with the usual 100 or 150 pF variable tuning capacitor.

I am not going to be so rash as to attempt to guess whether the transistorized Vackar is likely to prove better or worse than or equal to, the transistorized Seiler. For most purposes I suspect that they will be found very similar in performance, with some possible advantage to the Vackar for very wide tuning ranges, and some possible advantages to the Seiler when a low-C approach is adopted. Much more important are the general mechanical and thermal conditions—and in this respect the notes by G3BIK should prove most valuable.

I also suspect that there is still work to be done—as BRS25769 hinted—on the optimization of circuit values for the transistorized Vackar.

So I suggest that there is nothing in G3BIK's letter which disproves my tentative belief that the BRS25769 circuit in the July *TT* may well constitute the first publication of a transistorized Vackar—though this does not detract from the usefulness of his comments on taming a transistor oscillator. Where G3BIK is wrong is in his belief that he and W3JHR are using Vackars. Their circuits owe allegiance to the earlier Seiler (W8PK) oscillator!

First Class Operators' Club Dinner

The FOC Annual Dinner is to be held at the Shaftesbury Hotel, Monmouth Street, WC1, on Saturday, 29 October (last night of the RSGB Radio Communications Exhibition) at 6.30 p.m. for 7 p.m. Lounge suits. Few speeches. Reservations (30s.) to the Hon. Secretary, Leslie Belger, G3JLB, 103 Whitehill Road, Gravesend, Kent.

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.

Slow Morse Practice Transmission

May I appeal to listeners to any of the Slow Morse Practice transmissions to let the operator know that they listen regularly. When the list is next published* it will be apparent that many of the operators have withdrawn from the service. Almost without exception, the reason given has been the complete lack of response from SWLs to requests for reports on the transmissions. The inevitable conclusion from this has been that the demand has been met, or the interest lost. Of course neither conclusion is correct.

Whether by apathy, or sheer laziness, the listeners are killing the very service on which so many of them depend to overcome the obstacle of the Morse Test. The listener should not consider that he has a right to this service; those operators who are still giving up their free time to make these transmissions will only do so whilst they know that they have an audience.

M. McBRAYNE, G3KGU
Honorary Organizer,
RSGB Slow Morse Practice Transmissions

Theydon Bois, Essex.

* See page 604.—EDITOR.

QRA Locators—Contests

I wish to protest in the strongest possible terms against the exclusive use of QRA Locator reference as site identification for inter-G contacts in v.h.f. contests.

Whilst I accept the principle of a European Grid for exchanges between British and Continental stations where language and geographical difficulties might arise, I deprecate the use of the QRA Locator system in this country. My criticism of the Locator is based not only on the unsuitable and illogical method by which the areas bounded by latitude and longitude are sub-divided, but also upon the way its use removes the last vestige of personality from each contact. It reduces every QSO to a boring, and often meaningless, exchange of coded symbols.

The QRA Locator effectively disguises the geographical site of a station, and makes it impossible for the good operator to use his skill and equipment to the best advantage. He has no immediate means of knowing the areas from which incoming signals are being received, and even when a QSO has taken place, he is none the wiser until the reference has been decoded from the totally inadequate maps available.

There is absolutely no possibility of cross-checking upon the accuracy of any reference sent or received at the time of the contact, and both the operator and logger must accept the five meaningless symbols with implicit faith. Only later does any mistake become evident.

Stations regularly using frequencies "out of zone" are encouraged in their practice since any check on this mode of operation is neither obvious nor simple. SWLs and county chasers rapidly become disinterested when they find that they can identify neither the precise location nor even the county from which a station is operating. Even the contestant himself feels reduced to the status of an automaton since stations must be worked "as they come." There is no question of any operator leaving the more remote, or the more difficult contacts until a time when his experience tells him the propagation conditions will be more favourable. Valuable time can be lost in trying to contact a weak and unreadable call just over the adjacent hill in preference to working the stronger station believed to be local until the locator reference is deciphered.

It is not uncommon for a contest to be won or lost by less than 10 per cent of the winner's score. Therefore, if skill is to play its rightful part in the contest, not only must the better operator be allowed to use his ability freely, but also the distances must be measured to a degree of precision which is impossible on the recommended maps. Estimates of distance to this accuracy on the scale of 25 km to the centimetre require measurements to 0·4 mm; which is virtually impossible. It is asking too much of the hard-working Contests Committee to recalculate every QSO from the NGR, therefore contests using the QRA Locator must be won merely on the thickness of a division mark on a ruler. The 10m/in. OS map has served us very well in the past; why change now? Even if kilometres are to be preferred—and I will support the change when the metric system comes into general usage in this country—a quick slide rule computation of previously estimated mileages is not a particularly arduous undertaking.

One of the main objects of our hobby is to communicate. Let us do so in an intelligible manner, and if we are to exercise our skill in the field during a contest, let us devise rules which encourage the novice to improve his standards rather than discourage the experienced operator from using his. A return to the use of coded information is as retrograde a step in modern communications as is a return to c.w. from s.s.b.

Many other regular v.h.f. operators, including G3NNG and members of the G3PIA v.h.f. team wish to be associated with these views on the QRA Locator, and they join me in expressing the hope that other critics of the system will be equally vociferous in their demand to have the V.H.F. Contests Committee return to the more obvious and sensible way of identifying station sites at least so far as G QSO's are concerend.

CLIFF SHARPE, G2HIF
A R N. Berks. Chairman, AERE ARC

Wantage, Berks.

There appears to be a minority of opinion against the exchange of "QRA Locators" during contests. The V.H.F. Contests Committee does not wish to curtail or restrict the exchange of site locations or any other information for that matter between contestants; indeed, if for check purposes alone the full site address will be useful. However, for reasons discussed at length in these columns and elsewhere the QRA Locator as defined in the rules should be attached to report and serial number.

J. C. FOSTER, G2JF
Chairman,
V.H.F. Contests Committee

Wye College,
Ashford, Kent.

RSGB National Mobile Rally

Woburn Abbey, Bletchley, Buckinghamshire

by permission of His Grace the Duke of Bedford

SUNDAY, 11 SEPTEMBER, 1966

* Park opens 11 a.m.
* State Apartments open.
* More than 3,000 acres and 2,000 animals.
* Children's Playground, Pets Corner and Boating Lake.
* Restaurants and Snack Bars.
* Woburn Safari Service.
* Children's and Novelty Sports.
* Children's Lucky-dip.
* Surplus Sale and Trade Exhibition.
* Grand Raffle (Ladies and Gents).
* 160m Pedestrian D/F Hunt.
* Amusement Park and Funfair.

CAR PARKING—Specially reserved Rally Car Park.
(Entrance under RSGB Banner)

TALK-IN STATIONS—GB2VHF and GB3RS on 2m (144·86 Mc/s), 4m (70·26 Mc/s), 80m s.s.b. (3·75 Mc/s) and 160m (1940 kc/s).

Organized by the Radio Society of Great Britain

RSGB Slow Morse Practice Transmissions

The following Slow Morse Practice transmissions are sponsored by the RSGB. Alterations and additions to this list should be sent to the Honorary Organizer, M. McBrayne, G3KGU, 25 Purlieu Way, Theydon Bois, Essex.

Clock Time	Call-sign	kc/s	Town
Sundays			
09.30 †	G3KZZ / G3TNF	1920	South Shields, Co. Durham
09.30	G3HZL	1940	Isleworth, Middlesex
09.45	G3USK	1975	Mablethorpe, Lincs.
10.00	G3TTK	1860	Coalville, Leics.
10.15	G3CGD	1875	Cheltenham
10.30	GI3JEX	1860	Belfast
11.00	G2FXA	1900	Stockton-on-Tees
12.00	G3HVI	1890	Stoke-on-Trent
12.00	G3SVD	1870	Reading, Berks.
12.00	G3SZF	1825	Broxbourne, Herts.
21.00	G3PLQ	1892	Salisbury, Wilts.
Mondays			
18.00	G3SWR	1980	Middlesbro', Yorks.
18.30	G3NCZ	1920	Blackburn, Lancs.
19.00	G3JKY	29.5 Mc/s	Beckenham, Kent
19.30	G3VBI	1910	Goole, Yorks.
20.00	G3USK	1975	Mablethorpe, Lincs.
20.00	G3HJG	1980	Manchester
20.00	G3IBJ	1910	Southampton, Hants.
20.15	G3SAZ	1845	Ashford, Middx.
20.30	G3TOF	1915	Harlow, Essex
21.00	G3PLQ	1892	Salisbury, Wilts.
21.30	G3SVD	1870	Reading, Berks.
Tuesdays			
19.00 †	G3TKN / G3PPE	1875	Wallasey, Cheshire
20.00	G3TPV	1910	Hythe, Hants.
20.30	G2ABC	1915	Woodford, Essex
21.00	G3PLQ	1892	Salisbury, Wilts.

Clock Time	Call-sign	kc/s	Town
Wednesdays			
18.30	G2FXA	1900	Stockton-on-Tees
20.00	G8QU	1970	London N22
20.30	G3KGU	1915	Theydon Bois, Essex
21.00	G3HVI	1890	Stoke-on-Trent
21.00	G3PLQ	1892	Salisbury, Wilts.
21.00	G3RIS	1980	Cromer, Norfolk
Thursdays			
18.00	G3SWR	1980	Middlesbro', Yorks.
18.30	G3NC	1968	Swindon
20.30	G3RSF	1915	Harlow, Essex
20.30	G3HZL	1845	Isleworth, Middx.
21.00	G3PLQ	1892	Salisbury, Wilts.
Fridays			
18.30	G3NCZ	1920	Blackburn, Lancs.
20.15	G3SAZ	1845	Ashford, Middx.
20.30	G3TLF / G3TXI	1925	Harlow Nazing, Essex
21.00	G3PLQ	1892	Salisbury, Wilts.
21.00	G3RIS	1980	Cromer, Norfolk
21.30 †	G3UCZ / G3SUU	1915	Pudsey, Yorks. Bradford, Yorks.
Saturdays			
10.00	G3TTK	1860	Coalville, Leics.
13.00	G2FXA	1900	Stockton-on-Tees
14.00	GI3JEX	1860	Belfast
20.00	G3KPO	1980	Peterborough
20.30	G3TLJ	1925	Roydon, Essex
21.00	G3PLQ	1892	Salisbury, Wilts.

† *Alternately*

Channel Islands, Northern Ireland, Scotland and Wales are inadequately covered by this service to the SWL. The Hon. Organizer would be pleased to hear from any member in these areas, or any other part of the British Isles, who would be willing to make regular Slow Morse Practice transmissions.

Society Affairs

A Brief Report on the July, 1966 meeting of the Council

THE meeting was held on 11 July, 1966, and was attended by Messrs R. F. Stevens (President), N. Caws, J. Etherington, J. C. Foster, E. G. Ingram, L. E. Newnham, A. D. Patterson, G. M. C. Stone, J. W. Swinnerton, G. Twist, and E. W. Yeomanson (Members of the Council), John A. Rouse (General Manager and Secretary) and P. C. M. Smee (Assistant Secretary).

Apologies for Absence were submitted on behalf of Messrs L. N. Goldsbrough, J. C. Graham, W. A. Roberts, J. F. Shepherd and Louis Varney.

Mr F. K. Parker

The Council accepted with regret the resignation of Mr F. K. Parker from the office of Executive Vice-President and granted Mr Parker six months' leave of absence from meetings of the Council on the grounds of ill-health. (See page 508, RSGB BULLETIN, August 1966.—EDITOR.)

Executive Vice-President

Mr A. D. Patterson was appointed to the vacant office of Executive Vice-President.

Election of Council for 1967

The Council decided by ballot to nominate Mr L. E. Newnham and Mr E. W. Yeomanson, retiring members of the Council, to fill the two vacancies among the Ordinary Members of Council which will occur on 31 December, 1966. (A notice calling for nominations for these vacancies and for vacancies amongst the Council Members elected by Zones appears on page 569.—EDITOR.)

Recommendations of Committees

The Council accepted recommendations relating to the Thirteenth International V.H.F./U.H.F. Convention to be held at the "Winning Post," Whitton, Middlesex, on 13 May 1967, the revised 430 Mc/s band plan, the establishment of a 70 Mc/s beacon station at Dundee, subject to GPO approval, and the award of the European V.H.F. Trophy for 1965 (*V.H.F. Committee*), various matters relating to the Radio Amateur Emergency Network (*RAEN Committee*) and the results of the 144 Mc/s Listeners' Contest 1966 (*V.H.F. Contests Committee*).

Membership and Affiliation

The Council elected 144 new members (106 Corporate and 38 Associate) and approved 10 applications for transfer from Associate to Corporate grade.

The subscriptions of three members were waived on the grounds of blindness and disability.

The Council granted affiliation to the following clubs and societies:

Ashton-under-Lyne and District Amateur Radio Society;
Chippenham and District Amateur Radio Club;
Electrics Society of the Royal College of Advanced Technology.

National Field Day 1967

The revised wording of the rule governing power permitted was agreed. (The new rule was published on page 508 of the August issue of the RSGB BULLETIN.—EDITOR.)

National Field Day 1966

The Council placed on record a vote of thanks to the H.F. Contests Committee for its efforts in producing the results of this event in time for publication in the August issue of the RSGB BULLETIN.

Minutes of Committees

The Council accepted as reports the minutes of the following Committee Meetings: Membership and Representation (9.5.66), V.H.F. (16.5.66), Mobile (17.5.66), Finance and Staff (18.5.66), H.F. Contests (19.5.66 and 23.6.66), RAEN (21.5.66), V.H.F. Contests (25.5.66), Exhibition (26.5.66 and 17.6.66), Education (11.6.66), and Scientific Studies (13.6.66).

* * *

The meeting ended at 9.50 p.m.

RSGB Recorded Lecture Library

The address of the Honorary Curator of the RSGB Tape Library, Mr G. S. Milne, G3UMI, is now 23 Linacre Road, Eccleshall, Stafford, Staffs.

Obituaries

T. Hope, G3TIV

The death occurred on 21 June of Thomas ("Joe") Hope as the result of an accident at his work at Brentwood.

He was a founder member of the Bristol Amateur Radio Club for which he did much sterling work. He will be greatly missed by all who knew him.

Our deepest sympathy goes to his widow and Nigel at this sad time. H.W.L.

L. W. Gardner, G5GR

The quite unexpected and sudden death of Les Gardner, at the comparative early age of 60, came as a great shock to all of us who were privileged to know him.

A life-long member of RSGB, Les was never very active "on the air," but served Amateur Radio in many other ways. He was TR for Coventry before the war, a very active member of CARS, a founder member of RAOTA and a member of the newly formed Dynamics Radio Society.

He served as President of CARS for about five years and since then had been a valued Vice President attending club and committee meetings regularly. It is not selfish to say that CARS will miss Les most of all. He was a prolific lecturer at the meetings and could always be relied upon to give a lecture "off the cuff" as and when required. Always ready and willing to give help and advice, the writer, many "Old Timers" and young members of CARS will miss Les very much.

Amateur Radio, and CARS in particular, benefited greatly from Les, and we have lost much in his passing.

Our deepest sympathy is extended to his mother and all relations. H.J.C.

Per Gunderson, LA5LG
President, Norwegian Radio Relay League

It is with much sorrow and regret we record the sudden death, on 11 July, 1966, at the age of 53 years, of Mr Per Gunderson, LA5LG, President of the Norwegian Radio Relay League. LA5LG was licensed in 1958 and during the following year he was elected to the Board of the League, becoming President in 1962. He represented NRRL at the IARU Region I Conference in Malmoe during 1963 and throughout his association with the League he did much to further the interests of Amateur Radio in Norway. He was very active on the DX bands and was always ready to help newcomers. He will be very greatly missed by his Amateur Radio friends at home and throughout the world.

Heartfelt condolences and deepest sympathies are extended to Mrs Gunderson and to the Board of NRRL in the great loss they have suffered. P.A.K. J.C.

J. C. Downie, GM3LVS

The sudden passing of Jack Downie, GM3LVS, at his home on Monday 4 July came as a great shock.

Jack, since his retirement as Wing Commander, had been Secretary to the Leven Amateur Radio Club for a number of years and will be greatly missed by his Amateur and Service friends, particularly by those for whom he did so much helping them get their tickets.

Our deepest sympathy is extended to his widow and family.

CONTEST NEWS

RESULTS — REPORTS — RULES

Summer Top Band Contest 1966

The first Summer Top Band Contest held on 9 and 10 July, 1966, attracted 67 entries including four from overseas. The winners, a group entry operating under the call of G3IZU from Hartley, Kent, had 123 contacts for a score of 538 points. Operators were G3POI and G3RPB assisted by G3ANK and G3IZU who kept the logs.

Another multi-operator station, G3SSO, GCHQ Radio Club, Cheltenham, was second with 107 contacts for 505 points. The operators were G3FXA, G3PEO and G8KG. Mr. C. Whelan, GW3NJW operating from near Newport, Monmouthshire, was third and Mr. J. Duckworth, G3FM was fourth.

The runners-up were very close and considerable checks were needed before the final positions became clear. Judging by the large number of comments received the contest seems to have been enjoyed by all who took part, and most entrants were satisfied with the rules. Static levels during the contest were generally very low and this helped to offset the rather variable conditions, which put some of the more northerly stations at a disadvantage. As Top Band conditions vary so much from night to night during the summer months, it would be impossible to devise a scoring system which would give everybody an equal chance no matter where they live and whatever the conditions. It can only be hoped that at least the majority of entrants operate under reasonable rules.

Several entrants regretted that multi-operator entries were allowed to compete on equal terms with single operator stations. The decision to allow multi-operator stations in this contest was taken with a view to encouraging portable and club operation and a number of entrants took advantage of this. This was the only reason, and the H.F. Contests Committee are not considering at the present time allowing similar entries during the winter contests.

The number of newer call-signs appearing in the logs was commented on by a number of entrants. This seems to dispel the recent suggestions that c.w. is in any way a dying art.

It was pleasing to receive an entry from Mrs. J. H. Sinclair, G3TNN, the sole representative of the ladies. Grateful thanks are due to A. A. Goacher, A3942, and G2FHF for their check logs. We can imagine the frustration that L. Linkins, 9H1AE must have felt as he could hear plenty of G stations but only managed to work two, who presumably had better ears than anyone else. He receives a certificate which we hope will encourage activity during the winter contests when contacts between Malta and the UK should be much easier.

Position	Call-sign	Total points	County Code	Bonus Areas Worked
1 * †	G3IZU	538	KT	44
2 * †	G3SSO	505	GR	38
3	GW3NJW	499	MH	37
4	G3FM	495	SY	33
5	G3LIV	493	DH	41
6	G3CGD/P	471	GR	39
7	G3UBW	455	KT	34
8	G3RXO	442	BD	39
9	G3BFP	435	SY	36
10 *	GW3ITZ	432	FT	36
11 *	G3UNT	429	KT	33
12	G3BIK	425	ND	40
13	GM3KHH	421	BF	39
14	G3UJV	418	HF	32
15	G3BDQ	414	SX	33
16	G3IGW	410	YS	34
17	G3SIA	407	WK	34
18	G3TTK	397	LR	35
19	GW3NNF	393	AG	38
20 *	G3GIZ/A	383	CH	37
21	G3UKI/A	377	DN	35
22	G3LHJ	363	DN	30
23 *	G6UT	361	EX	29
24	G3SQX	357	WK	33
25	G2DC	353	HE	32
26	G6HD	346	KT	29
27 *	G3ITF	338	HE	28
28	G3UJI	330	SD	31
29	GM3KMR	325	MN	32
30 *	G3JVL/A	319	HE	30
31	GW3OAY/P	317	GN	29
32	G3TIK	314	HF	29
33	G3NTI	310	CH	29
34	GW3CDH	307	MH	30
35	G3TVW	304	SY	26
36	G3KSH	303	MX	27
37 *	G3KZG/A	300	SD	28
38	G3PVA	299	SY	25
	G3JVJ	299	SX	28
40 †	OL1ACJ	294		27
41	G3TIE	287	LD	28
42	G3BTU	286	NM	26
43	G3TNN	279	LE	29
	GW3GWX	279	CV	24
45	G3MGL/P	278	SX	27
46	GW3CW	271	DB	26
47	G3OVL	266	SY	27
48	G3USE	264	BD	25
49 *	G4OO/P	261	RD	27
50	G3KPU	260	NM	28
51	G3NEU	257	NR	25
52	G3ULF	252	NK	26
53	G3TAA	248	LD	22
54	G3PPE	242	CH	25
55	G3MCX	241	SY	23
56	G3VFD	213	KT	21
57	G3CWW	212	YS	23
58	G3OMU	193	HE	20
59	G3UJX	189	CH	19
60	GM3LHV	165	MN	18
61	G3UVT	160	NM	18
62	GM3SVK	151	SL	17
63	G2VV	117	MX	11
64	OK1APV	70		7
65	G3OFX	68	HE	7
66	OL1ACK	66		2
67 †	9H1AE	11		1

* Multi-operator stations. † Certificate winners.

D/F Event

The following are details of the **Hull D/F Event: Sunday, 11 September, 1966.**

Organizer: M. Ellis, G3PJR, 351 Willerby Road, Hull, Yorkshire.

Assembly: 14.00 BST, Church Hill, Holme on Spalding Moor, East Yorks (near Market Weighton).

Frequencies and Call-signs: To be announced at the start.

Entries and Tea: Entrance fee is 2s. per car. If ordered on arrival, tea price 5s. 6d. will be provided at Beehwood Cafe (between Holme on Spalding Moor and Market Weighton).

Fourth 70 Mc/s Contest (C.W.) 1966

At the suggestion of several members the duration has been reduced to eight hours, and the starting time made earlier.

1. **When:** 09.00 to 17.00 GMT, Sunday **4 December, 1966.**

2. The **General Rules** of RSGB contests published in the January 1966 issue of the RSGB BULLETIN will apply except as superseded by the rules of this contest.

3. **Sections** (A) Single operator, receiving no assistance during the contest, and operating from home.
(B) other stations.

4. **Contacts** may be made on A1 only.

5. **Scoring** will be on the basis of one point per kilometre.

6. **Contest Exchanges:** RST or RS reports followed by the contact number and location (e.g. RST 599001, 4 north Macclesfield, Cheshire). This location must be identifiable without ambiguity on the Ordnance Survey "Ten mile" map. Alternatively, five-figure QRA locators may be exchanged. It is the responsibility of the receiving operator to obtain the information necessary to calculate his distances correctly.

7. **Entries** (a) Logs should be tabulated in columns headed in this order: "Date/Time (GMT)"; "Call-sign of station contacted"; "My report on his signal and serial number sent"; "His report on my signal and serial number received"; "Location of station received"; "Call-sign of operator" (Multi-operator entries only); "Points claimed";

(b) The cover sheet must be made out in accordance with General Rule 4 and the declaration signed. Multi-operator entries should be so marked and the operators listed. The section for which entry is being made must be shown. The QTH as sent, QRA if used, and the NGR full six-figure reference should be recorded. Stations outside the area of the National Grid should show latitude and longitude.

(c) Entries must be post-marked not later than Monday, 19 December, 1966.

8. **Awards.** At the discretion of the Council Certificates of Merit will be awarded to the winner and to the runner-up in each section.

First 1296 Mc/s Contest 1966

An entry of 15 competitors is considered to be an excellent response for the first 23cm contest of the year held on 29 May. There appears, however, to be very definite views that six hours on a Sunday afternoon is not the best part of the day to hold this event. G3HWR suggests that it might be preferable if the contest were to follow the 432 Mc/s Contest on the following weekend and run for a period of 18 hours, e.g. 18.00 to 12.00 hours. This would then enable contestants to take advantages of any diurnal effects which may occur. G8AEJ would like the band extended to 1299 Mc/s to enable amateurs who use crystals on the lower v.h.f. bands to participate. G3LTF and G3NNG consider that the contest time was wrong.

Congratulations are due to the leader C. L. Desborough G3NNG, and to the runner up, W. R. Hawthorne, G3MCS.

	Call-sign	Location	Watts Input	P.A. Stage	Receiver	Aerial	No. of Contacts	Points
1.	G3NNG/P	Nr. Wantage	10	2C39A	Xtal cavity	6 ft. parabola	9	5925
2.	G3MCS	Aylesbury	28	3CX100A5	K6AXN	3 ft. parabola	15	5745
3.	G3FP	Nr. Croydon	20	2C39A	Xtal cavity	3 ft. parabola	15	4744
4.	G2RD	Nr. Croydon	30	TD1-100	Xtal mixer	3 ft. parabola	18	3820
5.	G3MPS	Nr. Bridgewater	100	2C39A	Radial cavity	8 ft. parabola	5	3410
6.	G3OBD/P	Shaftsbury	36	2C39A	Radial cavity	4 ft. dish	6	3245
7.	G8AL	Woodford, Essex	20	2C39A	1N23B	parabola	11	2835
8.	G5FK	Ruislip	30	2C39	SIM5	18 in. parabola	16	2545
9.	G3RPE	Nr. Tring	15	DET24	K6AXN	18 in. dish	6	2415
10.	G8AEJ	Nr. Croydon	28	2C39	Radial cavity	3 ft. dish	11	2210
11.	G8AJV	St. Albans	16	2C39A	—	8/8 element	9	2015
12.	G3TND/P	Dundry	20	2C39A	K6AXN	4 ft. dish	3	960
13.	G3ORL	Nr. Bristol	6	DET22	Trough line	48 element stack	3	565
14.	G3HWR	Potters Bar	35	2C39A	K6AXN	2 ft. 6 in. parabola	5	480
15.	G8AAY/A	Poole, Dorset	18	DET24	K6AXN	Corner reflector	2	305

Scout Jamboree-on-the-Air

The Ninth Annual Scout Jamboree-on-the-Air will take place during the weekend 22-23 October, 1966.

CONTESTS DIARY

10-11 September	-WAE Contest (Phone)
11 September	-80 Metre Field Day (see page 545, August 1966)
17-18 September	-Scandinavian Activity Contest (C.W.)
18 September	-D/F National Final
24-25 September	-Scandinavian Activity Contest (Phone)
1-2 October	-RAEN Rally
15-16 October	-VU/4S7 Contest (Phone)
15-16 October	-RSGB 21/28 Mc/s Telephony Contest
15-16 October	-Second 432 Mc/s Contest*
16 October	-Second 1296 Mc/s Contest*
29-30 October	-VU/4S7 Contest (C.W.)
29-30 October	-RSGB 7 Mc/s DX Contest (Phone)
12-13 November	—RSGB 7 Mc/s DX Contest (C.W.)
19-20 November	—Second Top Band Contest
4 December	—Fourth 70 Mc/s Contest (C.W.)*
	1967
14-15 January	—Affiliated Societies' Contest
29 January	—First 144 Mc/s Contest (C.W.)*
12 February	—First 70 Mc/s Contest (Open)*
18-19 February	—First 1·8 Mc/s Contest
4-5 March	—Second 144 Mc/s Contest (Open)* and 144 Mc/s Listeners' Contest*
2 April	—Low Power Contest
15-16 April	—Second 70 Mc/s Contest (Open)* and 70 Mc/s Listeners' Contest*
7 May	—Third 144 Mc/s Contest (Portable)*
27-28 May	—First 432 Mc/s Contest (Open)*
28 May	—First 1296 Mc/s Contest (Open)*
3-4 June	—National Field Day
2 July	—Fourth 144 Mc/s Contest (Portable)*
8-9 July	—1·8 Mc/s Summer Contest
23 July	—Third 70 Mc/s Contest (Portable)*
2-3 September	—V.H.F. NFD/IARU Contest*
10 September	—80 Metre Field Day
23-24 September	—RSGB 21-28 Mc/s Phone Contest
14-15 October	—Second 432 Mc/s Contest (Open)*
15 October	—Second 1296 Mc/s Contest (Open)*
28-29 October	—RSGB 7 Mc/s DX Contest (Phone)
11-12 November	—RSGB 7 Mc/s DX Contest (C.W.)
18-19 November	—Second Top Band Contest
3 December	—Fourth 70 Mc/s Contest (C.W.)*

*Qualifying contests for V.H.F./U.H.F. Listeners' Championship

Verulam (St. Albans) D/F Contest

Verulam club's first D/F contest on Sunday, 26 June, was a great success. Seven teams gathered at a rendezvous on the A6 north of St. Albans; all first timers in D/F hunting, the competitors made up in enthusiasm what they lacked in experience and despite the fact that the hidden station eluded all but two teams, they appear to have thoroughly enjoyed themselves. The transmitter, manned by G3RXA, and a youthful helper, was well hidden in thick undergrowth up a narrow muddy lane and it is greatly to the credit of J. Petersen, G3VAX, that he succeeded in crashing through the waist-high nettles to surprise the operators in only 59 minutes. " Pete " was followed ten minutes later by John Knowles, G3RPA. Members are grateful to Dickie Marshall, G3SBA, who loaned his now-famous Top Band transistorized transmitter for the event.

For some competitors, borrowed equipment or hastily constructed receivers proved their undoing, with one person misreading his " sense " indicator and going off 180° in the wrong direction, and another suffering the effects of a consistent but totally unsuspected 15° error!

The members are now eager to organize another D/F hunt as soon as possible, and feverish workshop activity is afoot to build or modify receivers. Eric Mollart, who began it all at Verulam by his fascinating talk and film show and also loaned some receivers for this first Verulam contest, just cannot know what he started.

Call Book Correction

In an amendment to the address for G6RS published in the April issue of the RSGB BULLETIN, the name of the road was mis-spelt " Bandmington." It should of course read " Badminton Road."

First 432 Mc/s Contest

The total entry for this contest is without doubt an all time record and indicates the extent of enthusiasm and interest which has been injected into a branch of Amateur Radio by the recently licensed G8 three-letter group. Needless to say, your V.H.F. Contests Committee is delighted with this sudden upward thrust in the number of contestants and will do everything possible to maintain the interest by creating, if possible, further events as suggested by a number of contestants who expressed this desire. In recent v.h.f./u.h.f. events it has been the policy to provide as much information as possible in the final analysis because it is felt that apart from deciding the leading stations there is other relevant information which appeals to the competitor further down the list.

Congratulations to the leading stations who made it all look so simple, but of course everyone knows what goes into the making and operation of equipment to command the leading positions. Recommendations for awards will be made for the winners.

Views of Competitors

All indications suggest that good propagation prevailed, especially during the early hours with ON4 and PA stations

figuring for many contacts. A number of operators think that the timing of the 23cm contest was ill conceived, a point with which your adjudicator would agree. Some thought will, therefore, have to be given to this comment. Also, it would appear that there are some rumblings between the /A station and the fixed station. This aspect will also be discussed in Committee. Mr R. A. Ham, BRS15744, shares the view of good conditions. G3KXA, for GW3RUF/P, deplores the lack of c.w. G3PBV would prefer QRA Locators to be made compulsory. G8ANY/G3UIT has doubts on his receiver, but hopes to go portable for the October contest. G8AAC would like the contest to run for the full 24 hours, which on reflection might be a good idea especially when the weather and propagation is kind. Comments on this point would be appreciated. This, incidentally, would bring the contest into line with continental practice. G3LTF remarks on Midland stations working the continent, yet he had difficulty in hearing the continentals although he is much nearer.

Check logs and listeners' logs are acknowledged with thanks from G2AUD, A4048, BRS15744, A4743, G3HWR, A3672.

To conclude, we welcome ON4HN and EI6HS to our final placing table. We would also like to inform all contestants that due to the terms of the licence, contacts with G6/T stations are not eligible for inclusion in score sheets.

FIRST 432 Mc/s CONTEST

		Location	P.A. stage	Input (watts)	Receiver	Aerial	Most distaut contact (km)	No. of contacts	Points
*1	G8AGQ/A	Sheffield	QQV03-20A	35	GM0290	14 ele Yagi	505	102	17389
2	G3NNG/P	Wantage	DET24	12	2 × M101	8/8	457	111	13551
3	G3KMS/P	Nr. Buxton	QQV03-20A	15	AF139	24 ele Yagi	512	91	12923
4	GW8ACG/P	Flint	DET24	27	AF139	6/6	600	63	12271
5	G3LTF	Nr. Chelmsford	4CX250B	150	2N241S	72 ele stack	345	85	12130
6	G3LQR	Framlingham	4X150A	150	AF139	16 ele stack	395	62	11886
*7	G8AKM/P	Nr. Hungerford	DET24	15	Transistor	8/8	296	98	11701
8	G8ACQ	Scunthorpe	QQV06-40A	80	AF139	corner reflector	394	63	11400
9	GW3BNL/P	Nr. Conway	QQV03-20A	24	AF186	14 ele Yagi	672	57	10375
10	G3EDD	Cambridge	4CX250B lin.	100	7077	9/9	306	76	9897
11	G3MCS	Aylesbury	4CX250B	100	GM0290	10 ele Yagi	390	96	9393
12	GW3RUF/P	Nr. Pandy, Mon.	QV02-6	5	6DS4	10 ele	300	74	9275
13	G8ADC/P	Dunstable Downs	QV02-6	7	AF139	10/10	350	58	9187
14	G8ABP	Birmingham	QQV06-40A	60	GM0290	14 ele Yagi	510	82	7832
*15	G8AHE/P	Broadway, Worcs.	QV02-6	8	AF139	14 ele Yagi	512	74	7753
16	G2XV	Cambridge	QQV06-40	100	AF186	40 ele stack	295	59	7326
17	G3REH	Nr. Spalding	4X150A	150	AF139	64 ele stack	306	48	6789
18	G8AKE	Melton Mowbray	4CX250B	150	AF186	14 ele Yagi	407	60	6642
19	G8AL	Woodford, Essex	QQV06-40	40	AF139	24 ele Yagi	305	72	6520
*20	G8AAZ/P	London, SW19	QQV03-20A	20	AF139	8/8	316	60	6219
21	G8AAC/A	Sheffield	QV02-6	9	AF139	8/8	505	36	6186
22	G3VGH	York	QQV03-10	26	AF139	14 ele Yagi	348	31	5663
*23	G3SRS/A	Birmingham 23	QQV03-20A	20	GM0290	14 ele Yagi	505	66	5571
24	G3OBD/P	Shaftsbury, Wilts.	QQV03-20A	24	GM0290	32 ele stack	348	46	5096
25	G3NEO	Sheffield	QQV03-20A	40	AF139	6/6 slot	460	32	5043
*26	G3EGV/P	Mere, Wilts.	ACT22	100	A2521	4 × 14 ele Yagi	335	39	4523
27	G8ACB	Wolverhampton	QQV03-20A	8	2N2J98	2 × 14 ele Yagi	239	50	4490
28	G8AEG	Ashby-de-la-Zouch	QQV03-20A	18	AF139	14/14	232	40	4139
29	G8AGS/A	Birmingham, SW	QQV02-6	7	GM0290	2 × 18 ele Yagi	237	53	3739
30	G2HDJ	Staines, Middx.	QQV06-40A	120	2 × TD03	4 × 11 ele Yagi	320	45	3650
31	G8AEJ	Croydon	QQV06-40A	30	GM0290	24 ele Yagi	296	47	3570
32	G2RD	Croydon	QQV03-20A	30	EC88	24 ele stack	251	53	3440
33	G8AAY/A	Poole, Dorset	QQV03-20A	25	A2521	14 ele Yagi	207	33	3417
34	G8ACI	Fareham, Hants.	QQV06-40A	60	AF139	14 ele Yagi	171	38	2898
35	G8ADP/A	Teignmouth	QQV06-40A	90	AF139	8/8 slot	390	17	2797
36	ON4HN	Lomergem	4X150A	125	AF139	64 ele stack	420	13	2790
*37	G3OUL/A	Liverpool	QQV06-40A	60	AF139	14 ele Yagi	257	24	2741
*38	G5FK	Ruislip	TT23	8	A2521	10 ele and 8/8	225	34	2663
39	G8AHZ	Didcot, Berks.	QQV06-40A	20	GM290	11 ele Yagi	268	25	2560
40	G8AJU	Ruislip	QQV03-20A	29	A2521	40 ele stack	207	53	2553
41	G3TND/P	Dundry, Som.	QQV03-20A	24	—	6/6 slot	241	28	2528
42	G8AJV	St. Albans	2C39A	21	A2521	8/8 slot	200	46	2518
43	G3ORL	Keynsham, Som.	4X150A	80	GM0290	24 ele stack	275	21	2517
44	G8AKI	Solihull	QV02-6	6	GM0290	8/8 slot	204	35	2463
*45	G3HRH	Welwyn	QQV03-20A	25	A2521	8/8 slot	300	30	2382
46	G8AAJ	Crystal Palace	QQV03-20A	23	AF186	10/10 stacks	249	38	2347
*47	G3UCU	London, EC1	QV02-6	6	6CW4	14 ele Yagi	267	40	2241
†48	G8ACL	Beacon Hill, Hants.	QQV06-40A	30	AF139	10 ele Yagi	211	26	2194
49	G8ADS/P	Dunstable, Beds.	QQV03-20A	12	AF139	10 ele Yagi	185	35	1937
†50	G8AOD		—	—	—	—	—	25	1889
51	G3PBV	Northampton	QQV03-20A	20	2N2415	14 ele Yagi	190	20	1715
52	G3EKP	Blackburn	QQV03-20A	20	AF139	16 and 20 ele stack	275	16	1656
‡53	G3OJE	Croydon	QQV06-40A	30	AF186	14 ele	246	23	1607
54	G8ADU	Malvern	QQV03-20A	30	6CW4	14 ele Yagi	185	26	1583
55	G3JDM/P	Gailoy, Staffs.	DET24	10	AF139	10 ele	214	18	1538
56	G8AJD	Potters Bar	QQV03-20A	22	A2521	8/8 slot	210	31	1492
57	G3RIN	Redhill, Surrey	QQV03-20A	25	AF186	10 ele Yagi	280	26	1423
†58	G8AHF	Cowes, I of W	—	—	—	—	284	23	1396
59	G3NJF/P	Claxby	QQV03-20A	20	AF139	16 ele stack	200	11	1275
60	G8AAF	Beaconsfield	QV02-6	9	AF139	10 ele Yagi	74	30	1044
61	G8ANS	Brookmans Park	QQV03-20A	26	PC88	6/6	211	30	1034
62	GM3FYB/A	Largoward, Fife	4CX250B	150	Transistor	15 ft. Dish	337	7	917
63	G8AKQ	Barnsley	QQV03-20A	35	AF139	9/9 + 2 × 9/9	243	13	812
64	G3RZG/P	Wareham, Dorset	QV02-6	6	Transistor	10 ele Yagi	99	13	685
65	EI6AS	Dublin	QV02-6	4	A2521	2 × 6/6 slots	150	4	500
66	G8ABZ	Rotherham	QQV03-20A	20	A2521	10 ele Yagi	233	8	458
†67	G8ANY/A		—	—	—	—	84	4	193
68	G8ACK	London, NW3	—	10	—	11/11	34	7	114

* Multi-operator station. † No signed declaration. ‡ Member of V.H.F. Contests Committee.

CLUBROOM

A Monthly Survey of Club and Group Activities

For further information on membership or the activities of a particular club, application should be made to the person whose call-sign is indicated at the end of the item. Full addresses may be obtained from the RSGB Amateur Call Book.

Cambridge and District ARC meets every Friday evening at 7.30 p.m. On 24 September, the club will have a stand at the Leisure and Opportunities Fair to be held at the Cambridge Guildhall. *G2CDX.*

Chesham and District RS is hoping to have a Field Day on the second Sunday in September, but as yet the date is not firmly fixed and may have to be shifted in view of the Woburn meeting. Main club meetings are on Fridays at 8 p.m. backed up by RAE classes on Wednesdays at 8 p.m. *G3CLJ.*

Clifton ARS will be holding its AGM on 16 September, to which all members are earnestly requested to make a special effort to attend. On the 30th a Junk Sale will take place. *G3JKY.*

Cornish RAC seems to be having difficulty in extracting the annual lolly contributions from some of its members. As is observed, no club can run on Faith, Hope and Charity even with the best will in the world. Let's hope that these few extra words help the clink of coins into the club funds, and that the visitor to the Mobile Rally from Helston who joined the Club, and paid his sub on the spot, creates an example followed by others. *G3OCB.*

Crawley ARC will be meeting on 28 September for a lecture on audio by Mr Birt who is known for his work on class D amplifiers. The local RAE course, conducted by G3PHG, secured a 66 per cent pass figure for the 1965/66 session. *G3FRV.*

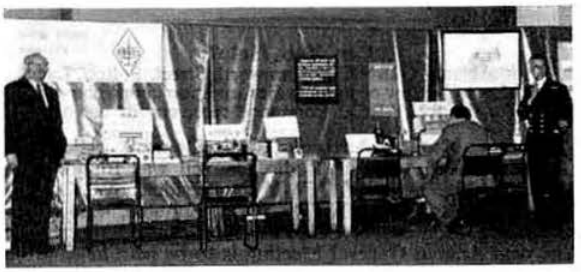
Cray Valley RS is glad to note a resurgence of interest in the Top Band Net and hopes that this is no mere flash-in-the-pan. In the current issue of *QUA* is a tongue-in-the-cheek Engineers' Vocabulary of which the definition of Expedite—to confound confusion with commotion—has more than a ring of truth. *G3DNC.*

Dorking RS will be reviewing its constructional programme for the Autumn months at the meeting to be held on 27 September. The work under the supervision of G3HXJ on the club's van is now virtually complete, and it is hoped that the mobile station will soon be on the air. *G3UJU.*

Durham City ARS is giving plenty of advance notice for its October meetings which will be on the 8th and 22nd of that month. The first beginner's meeting went with a real swing, and a simple constructional project is now under way. *G3KMG.*

East Worcestershire RS wil be having a lecture and demonstration by Daystrom Ltd on 8 September, and to which those who have yet to experience the camaraderie of club membership will be heartily welcome, so, if you do not " belong ", don't miss this opportunity for an informative evening in good company. *G3HCT.*

Echelford ARS of Ashford, Middlesex, will be meeting on 28 September for a lecture on soldering—that deceptively simple operation which is full of so many pitfalls for the unwary—by Mr Thwaites of the Tin Research Institute. Visitors will be welcome at the Links Hotel in time for the start at 8 p.m. *G3RHF.*



The talk-in station at the Royal Naval ARS Rally held at Lee-on-Solent on 25 June. The amateurs in the photograph are, left to right, G3AWY, G3ORR and G3ENI (Chairman).
(Courtesy of the Ministry of Defence)

Edgware and District RS commences its Autumn session with a talk by G3JPJ on construction techniques on the 12th followed by a D/F contest on the 25th and a lecture on RTTY on the 26th. The Club net takes place on Wednesdays on 1875 kc/s starting at 21.00. *G3RAA.*

Grafton RS starts its Autumn session on Friday 9 September and will meet every Friday thereafter at 7.30 p.m. in its usual venue, Room 35, Montem School, N7. Full details may be obtained from the acting Secretary, *G2CJN.*

Guildford and District RS will be operating the club station, G3TLM, at the Model Engineers' Show in Stoke Park, Guildford on the 17/18 September. On the 23rd a lecture is being given, to the Society on Electronic Components by Mr Child. *G3KMO.*

King's Lynn YMCA ARC reports that its activity enjoys considerable support at the Wednesday meetings with good progress on a number of constructional projects. In fact activity is so high that there is a talk of scheduling a second night for the Morse classes. *G3SZ.*

Midland ARS. The issue of *MARS Newsletter* under review contains some forthright " thinking out aloud " by the Editor G3SCG, prompted by a lecture " Further thoughts on Amateur Radio." Quote: " I see no reason why we should try to create a public image of a ham as a person who can twiddle the correct knob on a piece of equipment designed, built and serviced by someone else. Surely a better image would be of someone who has the intelligence to build his own gear. . . . We do not despise the efforts of the Amateur Gardener . . . nor of the Amateur Photographer. We accept that they find it an interesting and enjoyable way of spending their time." *G3JDJ.*

Mid-Warwickshire ARS starts its winter programme after a break of some two months. The first and third Mondays in each month will be rag-chew nights—bring your own rag—and on the third Monday the facilities of the workshop will be exclusively reserved for Junior Members. The second and fourth Monday evenings will be devoted to formal events. On 12 September, there will be a play-through of the RSGB Tape on Transmitters, and on the 26th a talk by G3BA " Going on V.H.F. with an H.F. transmitter and a Transverter." *G3EHA.*

Newark SWC is now issuing a certificate under the intriguing title of the Robin Hood Award. G3TWV has presented the club with a Cup to be awarded annually for the best piece of home constructed equipment, and it is hoped that this will stimulate both building and presentation. *G3TWV.*

Northern Heights ARS is pleased to report that a replacement tape and series of slides of the W1BB Top Band DX lecture is available. Applications by clubs for the loan of these should be made to G3MDW. The Society will be meeting on 14, 21 and 28 September for a visit, foxhunt and discussion respectively. *G3MWD.*

North Kent RS waxes futuristic in the issue of its Newsletter under review with the suggestion that it is about time that radio amateurs started experimenting with laser beam transmissions, pointing out that, as yet, frequencies in the upper microwave and infrared are unallocated. Perhaps some will see the light before long. *G3PUI.*

Peterborough ARS will be meeting every Friday throughout the Autumn and Winter at its HQ in the Old Mill behind the Peacock Inn, London Road. From 8 p.m. onwards the club station is in operation on 2m. The 8-over-8 beam is some 70 ft. high and rotated by the Armstrong method. Visitors are always welcome—especially those with strong arms. *G3KPO.*

Purley and District RC were meeting on 2 September for a Natter Night while on the 16th G3RKK will give a talk on receivers. A special note should be made of 21 October on which evening the Winter Junk Sale will take place. *G3FTQ.*

Reading ARC participated in the 3rd 70 Mc/s Portable Contest under the club call-sign G3ULT/P from a site 10 miles north of Andover. A good time was had by all despite having to haul down the beam in the pouring rain so as to reconnect the feeder. On 13 September, G3TOQ will be talking on s.s.b. equipment. *G2FQR.*

G3TDM, SWL Bruce and G3MBL in charge of Southgate Radio Club's demonstration station at the Finchley Carnival.

Reigate ATS will be meeting on 15 September for a talk "Coils and Q's" by G8AOD. Members are asked to bear in mind that a Junk Sale in aid of Club Funds will take place in the Autumn. *G3NKS.*

Salop ARS has now obtained a permanent room at the Old Post Office Hotel, and hopes to have a club station operational by September or October.

Saltash and District ARC starts off the issue of *Tamar Pegasus* with an Editor's Lament—what only one?—complaining that despite the efforts of G9BO, *TP* has always attracted some contributions from the members, but currently everybody seems to have gone on strike. So how about it—G9BO included? *G2DFH.*

Southampton Group will be holding its next meeting on 10 September at the Lanchester building of the University. The clubroom at 20 Carlton Road welcomes any visitors on Wednesday and Friday evenings. *G3HKT.*

Southgate RC will be having a Junk Sale in September, and seekers of bargains should not miss this event. *G3TDM.*

Stratford-upon-Avon and District RC cordially invites all local licensees who are not members to let the Secretary have a note of their names and addresses so that they can be kept posted of the clubs functions, and perhaps be persuaded to join the fold. *G3RPJ.*

Surrey Radio Contact Club had a "full house" for the talk by Ian Turner, G3DGN, on communication by light. The thought of communication by the reflection of a spot of light from a local cloud intrigued everybody. Members are reminded that the September Sale of Surplus is just around the corner, so now is the time to sort out some real bargains for inclusion in the sale. *G3KGA.*

South Birmingham RS will be meeting on 21 September for a talk on mobile by G3GBS. Sunday, 25 September, is the proposed date of the Birmingham/Sutton Coldfield Mobile Rally, an event which should not be missed. Advance notice, accompanied by a request to make a special effort to attend, is given of the AGM which will be held on 19 October. *G3OMG.*

South Dorset RS had a demonstration of an r.f. bridge given by G6SV at the August meeting. This showed how the most carefully laid plans and calculations can go astray when v.h.f. currents start circulating in aerials and feeders. Fingers are crossed that gales will not make things difficult for them during V.H.F. NFD. *G3EAT.*

South Manchester RC will be a hive of activity during September with five major activities on the books. On the 7th—which should be the day your BULLETIN arrives—a Special Events station will be in operation at the Altrincham Show. Sunday the 11th is Regional Field Day, while the 18th is the final of the D/F contests. On the 19th G3SVW will be talking about the construction and use of *Q* multipliers, and on the 23rd. G3SMT on modifications to the HA350. *G3SMM.*

South Shields and District ARC is holding its AGM on Friday, 16 September, at the club premises and hopes that all members will make a special effort to attend this meeting of decisions. The club took part in the South Shields Annual Flower Show and operated a demonstration station under the call-sign GB3SFS. *G3KZZ.*

South Wales V.H.F. Group. It is proposed to hold the annual meeting of this group at 20 Austin Avenue, Porthcawl, on 27 September commencing at 7.30 p.m. All interested licensees will be welcome, and further information may be obtained from GW4CG at the address given.

Verulam (St Albans) ARC is looking forward to the visit by F. J. H. Charman, G6CJ, on 21 September when he will be giving his lecture on aerials. Amateurs who are not members of the club will be very welcome at the meeting as visitors, and Verulam expect that there will be a bumper turn-out for this deservedly renowned lecture. *G3PAO.*

Wakefield and District RS reports that three out of four of its members who sat the RAE secured passes. The Autumn session commences on 13 September and meetings are fortnightly thereafter. On this date a Mullard Film Show will be screened. The society is always pleased to welcome prospective members and visitors. *G3TQV.*

Wimbledon and District RS will be meeting on 9 September for a talk by G3LXN on his mobile equipment. This, we gather, will be highly educational. In the July issue of *QRK5* under review we notice a c.w. tip which we have not seen before. This is to record some of the commercial operators who normally run in the region of 36 w.p.m. with the b.f.o. set high pitched and then replay at half speed, and, presto, good stuff at 18 comes out. *G3EPU.*

Yeovil ARC is visiting Yeovilton RN Air Station on 14 September. On 1 October the club station G3CMH will be operated at the Yeovil Youth Centre for the Michelmas Fair. *G3NOF.*

Late Copy

Plymouth RC hopes that the Technical College will be running an RAE course again this year. This depends on the number of applicants, and those interested should either apply directly to the college or notify G3SGV as soon as possible. Plans are being made for a public lecture in the lecture theatre of the Plymouth Central Library on 4 November under the title "An introduction to Amateur Radio" the object of which is to publicize Amateur Radio and the club. *G3SGV.*

Crystal Palace and District RC will be meeting on 17 September for an informal technical natter. All being well the club will have run three stations on 4m, 2m, 70cm respectively during V.H.F. NFD. *G3FZL.*

Stockport RS will be meeting on 7 September for a sale of surplus gear, and on the 21st for a talk on v.h.f. aerials by G3AYT. Visitors and prospective members are always welcome. *G3FYE.*

Coventry ARS is back at its HQ after a bomb scare, the package suspected of being virtually in the back garden. The AGM will be held on 30 September and it is hoped that all members will make a very special effort to attend. *G3UOL.*

Wirral ARS will be meeting on 7 and 21 September.

* * *

Items for inclusion in this feature are being received without an associated call-sign, although this month there is only one such entry. There can be no doubt that entries without a call-sign do not have the same potential advantage to the club as with a call-sign. Can we make it 100 per cent for the next issue?

Deadline for the **October** issue will be **9 September**, and for the **November** issue **30 September**. To be absolutely sure of inclusion, contributions for this feature should be despatched three days prior to the dates given. Normally contributions arriving after the deadline dates cannot be included no matter how much we would like to do so.

Can You Help?

● D. Markland, G2BNZ, 29 Rumworth Street, Bolton, Lancs., who wishes to borrow or purchase information giving conversion details for the R28/ARC-5 Command receivers for use on 2m!

Medical Amateur Radio Council

The Medical Amateur Radio Council was founded on 19 April, 1966 with WA1FMY as President, W2KDI as Treasurer and WA6CRN (Dr W. L. Sprague, 433 North 4th Street, Montebello, Calif) as Corresponding Secretary. The next Annual General Meeting is to be held in Atlantic City, New Jersey, in June 1967. The organization—unique in Amateur Radio—is looking forward to an upsurge in interest from doctor/amateurs world wide. Amateurs in the medical profession are invited to contact Dr Sprague.

RSGB Publications

28 LITTLE RUSSELL STREET, LONDON, WC1

	Post Paid
RSGB PUBLICATIONS	
Amateur Radio Handbook	36/6
Radio Data Reference Book	14/–
Technical Topics for the Radio Amateur	10/8
Amateur Radio Call Book	6/6
A Guide to Amateur Radio	5/7
S.S.B. Equipment	3/–
Communications Receivers (Second Edition)	3/–
The Morse Code for Radio Amateurs (Third Edition)	2/–
Log Book (RSGB)	7/–
ARRL PUBLICATIONS	
Radio Amateur's Handbook 1966 Edition	42/6
Buckram Bound	50/–
Antenna Book, 10th Edition	18/6
A Course in Radio Fundamentals	10/–
Hints and Kinks, Volume 6 or 7	10/–
Mobile Manual for Radio Amateurs	23/6
Radio Amateur's V.H.F. Manual	18/6
Single Sideband for the Amateur (Fourth Edition)	23/6
Understanding Amateur Radio	18/6
USA Licence Manual	5/–
CQ PUBLICATIONS	
Antenna Roundup	23/6
Antenna Roundup Vol. 2.	30/–
CQ Anthology, 1952–59	23/6
CQ Anthology, 1945–52	16/–
CQ Mobile Handbook	23/–
CQ New Sideband Handbook	24/–
RTTY Handbook	30/–
Shop and Shack Shortcuts	29/6
73 MAGAZINE PUBLICATIONS	
Care and Feeding of a Ham Club	8/–
Index to Surplus	12/–
Parametric Amplifiers	15/–
Simplified Maths for the Hamshack	4/6
Test Equipment Handbook	4/6
V.H.F. Antenna Handbook	15/–
RADIO PUBLICATIONS INC.	
Beam Antenna Handbook	28/–
Better Short-wave Reception	22/6
Cubical Quad Antennas	22/–
Electronic Construction Handbook	22/6
S-9 Signals	8/6
EDITORS AND ENGINEERS	
Radio Handbook (16th Edition)	75/–
Transistor Radio Handbook	42/–
AMERICAN MAGAZINE SUBSCRIPTIONS‡†	
CQ (*Cowan*) Monthly (p.a.)	44/–
†*QST* (*ARRL*) Monthly (p.a.)	43/6
Institutions, groups, etc. (p.a.)	50/–
†*73 Magazine* Monthly (p.a.)	30/–
† *Sample Copy 2/6*	
‡ *Mailed Direct from USA*	
MISCELLANEOUS PUBLICATIONS	
Foundations of Wireless (*Iliffe*)	22/3

	Post Paid
Ham's Interpreter (5th Edition)	8/6
How to Listen to the World	20/–
Log Book, 150 pages, opens flat (*Martins*)	21/9
Manual of Transistor Circuits (*Mullard*)	13/6
Radio Amateur Operator's Handbook (*Data*)	5/6
Semaphore to Satellite (I.T.U.)	70/–
Short Wave Radio and the Ionosphere (*Iliffe*)	12/–
Short Wave Receivers for the Beginner (*Data*)	6/6
Transistor Radios, Circuitry and Servicing (*Mullard*)	5/9
Understanding Television (*Data*)	40/–
World Radio-TV Handbook (1966)	29/–
MORSE COURSES	
G3HSC Rhythm Method of Morse Tuition	
Complete Course with three 3 speed L.P. records + books	84/–
Beginner's Course with two 3 speed L.P. records + books	60/6
Beginner's L.P. (0-15 w.p.m.) + book	50/–
Advanced L.P. (9-42 w.p.m.) + book	50/–
Three speed simulated GPO test. 7 in. d.s. E.P. record	11/6
RSGB Morse Instruction Tape (900 ft.)	35/–
RSGB Morse Practice Tape (450 ft.) (both at 3¾ i.p.s., up to 14 w.p.m.)	20/–
SHACK AIDS	
Easibinders, round backed, gold blocked, for RSGB Bulletin	16/6
Easibinder Year Stickers (1965 or 1966)	1/6
Admiralty Great Circle Map (In Postal Tube)	8/–
QRA Locator, Western Europe	5/6
RSGB Countries List	1/–
Panel Signs, transfers (*Data*)	
Set 3: White Wording	4/9
Set 4: Black Wording	4/9
Set 5: Dials (Clear Background)	4/9
Set 6: Dials (Black Background)	4/9
Decalet Panel Lettering Transfers (Black or White)	1/–
Blick Dry Print Lettering (Letters and Numerals, Black)	2/6
RSGB MEMBERS ONLY	
Car Badge (De Luxe with call-sign)* (*Postage on overseas orders 5/6 extra*)	25/–
Car Badge (RSGB Emblem with call-sign)*	18/–
Car Badge (RSGB or RAEN Emblem)	9/–
RSGB Terylene Tie (Maroon or Dark Blue)	16/–
RSGB Blazer Badge (Black or Dark Navy Blue)	8/-
Stereo Block (RSGB or RAEN Emblem)	10/–
Area Representatives Badge (ARs only)	10/–
Members Headed Qto. Paper (100 sheets)	10/6
Call-sign Lapel Badge (with RSGB or RAEN Emblem, pin or stud fitting)*	7/6
Call-sign Lapel Bar*	6/–
Tie Clips (with RSGB Emblem)	5/–
RSGB Lapel Badge (½ in. size) stud or pin fitting	2/–
Plastic Window Sticker (RSGB or RAEN Emblem)	1/3

**Delivery 6-8 weeks*

(Stamps and Book Tokens cannot be accepted)

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. Standing instructions cannot be accepted.

REGION 1

Ainsdale (ARS).—7 September (Receivers for Juniors), 21 September (Test Gear), 5 October, 8 p.m., 77 Clifton Road, Southport.

Allerton (Liverpool) (SRHS).—Thursdays, 8 p.m., 3rd Allerton Scout Group Headquarters, Church Road, Woolton, Liverpool.

Ashton-under-Lyne (AUL & DARS).—9, 23, September, 7 October, 8 p.m., Ashton-under-Lyne Technical College.

Blackburn (ELARC).—6 October (Film Show), 7.30 p.m., YMCA, Limbrick, Blackburn.

Blackpool (B & FARS).—Mondays, 8 p.m., Pontins Holiday Camp, Squires Gate. Morse tuition from 7.30 p.m.

Bury (B & RRS).—13 September (Film Show), 11 October (Constructional Competition), 8 p.m., Old Boars Head Hotel (private room), Crompton Street.

Chester.—Tuesdays, 8 p.m., YMCA. Except first Tuesday in each month.

Crewe & District.—3 October, 8 p.m., Earl of Crewe Hotel, Nantwich Road.

Eccles (E & DRC).—Tuesdays, 8 p.m., Patricroft Congregational Schools, Shakespeare Crescent, Patricroft, Eccles. Every Thursday Club Top Band net at 20.30.

Liverpool (L & DARS).—Tuesdays, 8 p.m., Conservative Association Rooms, Church Road, Wavertree.

(ULARS).—12, 26 September, 10 October, 7.30 p.m., Students' Union, 2 Bedford Street North, Liverpool 7.

Macclesfield.—13, 27 September, 11 October, 8 p.m., The George Hotel, 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, Daine Avenue, Northenden.

Morecambe.—7 September, 5 October, 125 Regent Road.

Preston.—13 September (Visit by Regional Representative), 11 October, 7.30 p.m., St. Paul's School, Pole Street, Preston.

Southport (SRS).—Wednesdays, 8 p.m., and Sundays 4 p.m., Sea Cadets Camp, The Esplanade.

Stockport.—7, 21 September, 5 October, The Blossoms Hotel, Buxton Road, Stockport.

Wirral.—7, 21 September, 5 October, 8 p.m., Harding House, Park Road West, Claughton, Birkenhead.

REGION 2

Northern Heights.—14 September (Visit to Process Units, Halifax, Mytholmroyd), 18 September (D/F Foxhunt), 21 September (Discussion on the Scout Jamboree), 28 September (Simple 2m Gear with demonstration by H. Crewe, G8CB), 7.45 p.m., Sportsman Inn, Ogden, Halifax.

South Shields (SS & DARC).—16 September (AGM), 8 p.m., Trinity House Social Centre, Laygate, South Shields.

York (YARS).—Thursdays, 8 p.m., 61 Micklegate, York.

REGION 3

Birmingham (SBRS).—21 September (Lecture by M. Sandoz, G3GBS, on "Mobile"), 8 p.m., The Scouts Hut, Pershore Road, Selly Park, Birmingham. 25 September (Annual Mobile Rally with the Sutton Coldfield Amateur Radio Society).

Redditch (EWARG).—8 September (Daystrom Demonstration), 14 October ("KW2000A," by G3OOQ), 8 p.m., Old People's Centre, Park Road, Redditch.

Salop (SARS).—8 September (Junk Sale), Clubroom, 10 September (Shrewsbury Carnival), 13 October (AGM), 7.30 p.m., Old Post Office Hotel, 10 November (Demonstration by Daystrom Ltd.), 7.30 p.m., Clubroom, Morris Hall, Bellstone, Shrewsbury.

REGION 4

Derby (D & DARS).—7 September (Surplus Sale), 10 September (Exhibition Stations G2DJ-G3ERD), Scout Headquarters, Browning Street, 14 September (Film Show), 21 September (D/F Practice Night—Open evening), 28 September (Social Evening at West Hallam), 2 October (President's Trophy Contest—D/F Event), 7.30 p.m., Room 4, 119 Green Lane, Derby.

Heanor (H & DARS).—13 September, 7.30 p.m., Room R1, Heanor Technical College, Ilkeston Road, Heanor, Derbys.

Leicester (LRS).—Mondays, 7.30 p.m., (Slow Morse Practice), Sundays, 10.30 a.m., Old Hall Farm, Braunstone Lane, Braunstone, Leics.

Loughborough (LARC).—Fridays, 8 p.m., Club Room, Bleach Yard, Wards End, Loughborough.

Newark (NSWC).—Mondays, Thursdays, 7.30 p.m., The Hall, Guildhall Street, Newark, Notts.

Nottingham (ARCN).—Tuesdays, Thursdays, Room 3, Sherwood Community Centre, Woodthorpe House, Mansfield Road, Nottingham.

Peterborough (P & DARS).—Fridays, 8 p.m., Old Mill behind the Peacock Inn, London Road, Peterborough, (Opposite Murkitts Garage). Club Station G3GQW calling on 2m, as well as other bands. RAE classes now starting at Peterborough Technical College.

Worksop (NNARS).—Tuesdays (RAE Class), Thursdays (Lecture Night), 7.30 p.m., Club Room, 13 Gateford Road, Worksop.

REGION 5

Cambridge (CADARC).—9 September (Informal), 16 September (My Problem is), 23 September (Informal), 30 September (Briefing the Regional Representative), 7 October (Informal), 7.30 p.m., Club Headquarters, Corporation Yard, Victoria Road, Cambridge.

Hull (H & DARS).—Alternate Fridays, 9 September (Tape Lecture on "Aerials"), 7 October (Mullard Film Show). Contact M. Ellis, G3PJR, 351 Willerby Road, Hull.

REGION 6

Cheltenham Group.—First Thursday each month, 8 p.m., Great Western Hotel, Clarence Street, Cheltenham.

REGION 7

Acton, Brentford & Chiswick (ABCRC).—20 September (New All-Band TX by G3PZK), 7.30 p.m., AEU Club, 66 High Road, Chiswick.

Ashford (Mddx) Echelford (ARS).—14, 28 September, 7.30 p.m., Links Hotel, Ashford.

Bexley Heath (NKRS).—8 September (Open Evening), 7.30 p.m., 22 September (Junk Sale), 8 p.m., Congregational Church Hall, Chapel Road, Bexley Heath.

Chingford (SRC).—Fridays (except first in month), 8 p.m., Hill House, Simmons Lane, Chingford, E4.

Croydon (SRCC).—13 September, 7.30 p.m., Blacksmiths Arms, South End.

Dorking (D & DRS).—13 September, (Informal Meeting), 8 p.m., Wheatsheaf. 27 September (Club Constructional programme and mobile equipment), 8 p.m., Star & Garter, Dorking.

Ealing (E & DARS).—Tuesdays, 7.30 p.m., Northfields Community Centre, Northcroft Road, Ealing, London, W13.

East Ham.—First & third Tuesdays from September, 7.30 p.m., Leigh High Road, East Ham.

East London Group.—Third Sunday in each month, 3 p.m., Wanstead House, The Green, London, E11. 18 September (Talk on the new Post Office Tower by D. Penny, G3PEN).

East Moseley (TVARTS).—7 September ("Power Supplies," by G3FXC), 5 October (A Further instalment of "Nuclear Power," by T. Taylor), Prince of Wales, Bridge Road, East Moseley.

Edgware & Hendon (EADRS).—12 September (Construction Technique by G3JPJ), 25 September (D/F Contest), 26 September ("RTTY" by G3STE), 8 p.m., John Keble Hall, Church Close, Dean Lane, Edgware.

Gravesend (GRS).—21 September, 7.30 p.m., RAFTA Club, 17 Overcliffe Road.

Greenford (GARS).—Alternate Fridays, 9 September, 8 p.m., Greenford Community Centre, Oldfield Lane, Greenford, Middlesex.

Guildford (G & DRS).—9, 23 September, 8 p.m., Guildford Model Engineering Society in Stoke Park.

Harlow (DRS).—Tuesdays & Thursdays, 7.30 p.m., Mark Hall Barn, First Avenue.

Harrow (RSH).—9 September ("Hearing and Working DX"), 16 September (Junk Sale), 23 September (Practical), 30 September ("Opatija," by G3FZL), 7 October (Practical), 8 p.m., Roxeth Manor School, Eastcote Lane.

Havering (H & DARC).—14, 28 September, Romford.

Holloway (GRS).—Mondays, Wednesdays (RAE & Morse), 7.30 p.m., (Friday Club), 7.30 p.m.

Hounslow (HADRS).—5, 19 September, Canteen, Mogden Main Drainage Department, Mogden Works, Isleworth.

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

Kingston.—15, 29 September, fortnightly, 8 p.m., YMCA, Eden Street, Fridays, weekly Morse classes, 2 Sunray Avenue, Tolworth.

Leyton & Walthamstow.—6, 20 September, 7.30 p.m., Leyton Senior Institute, Essex Road, London, E10.

London U.H.F. Group.—18 September (J-Beams on 70 cm Parabeam), 7.30 p.m., Bull & Mouth, Bloomsbury Way, Holborn. 6 October (P. Blair, G3LTF on "70 cm Noise"), 7.30 p.m.

Loughton.—9, 23 September, 7.30 p.m., Meetings alternate Fridays, Loughton Hall, (Nr. Debden Station).

Maidenhead (M & DARC).—Meetings, third Tuesday each month, 19 September (W1BB lecture "Top-Band DX"), 7.30 p.m., East Berkshire College, Boyn Hill Avenue, Maidenhead.

New Cross.—Wednesdays & Fridays, 8 p.m., 225 New Cross Road, SE14.

Norwood & South London (CP & DRS).—17 September, CD Centre, Catford, London, SE6.

Paddington (P & DARS).—7.30 p.m., Beauchamp Lodge, 2a Warwick Crescent, W2.

Purley (P & DRC).—16 September (A. Shepherd, G3RKK on Receivers), 7 October (Natter on 4 metre TX), 8 p.m., Railwaymen's Hall, Side Entrance, 58 Whytecliffe Road, Purley.

Reigate (RATS).—15 September (Talk on Coils & Q's by Reg Wadie, G8AOD), 7.30 p.m., George & Dragon, Cromwell Road, Redhill.

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

Scout ARS.—15 September (Junk Sale), 7.15 p.m., Baden Powell House, Queens Gate, South Kensington, SW7.

Science Museum.—20 September (Surprise Night!), 6 p.m., Science Museum, South Kensington.

Sidcup (CVRS).—17 September (Annual Dinner & Dance), Bulls Head Hotel. Book NOW from G3TCC.

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

South London Mobile Club.—10 September (Pre-weekend camp meeting and ragchew), 24 September (Discussion night), 8 p.m., Clapham Manor Baths, SW4.

Southgate & District.—8 September, 7.30 p.m., Parkwood Girls School (behind Wood Green Town Hall).

St. Albans (Verulam ARC).—21 September (F. J. H. Charman, G6CJ. Demonstration of aerials at work and lecture. ALL neighbour Clubs invited), 7.30 p.m., Cavalier Hall, Watford Road, St. Albans.
Sutton & Cheam (SCRS).—16 September, 8 p.m., The Harrow Inn, High Street, Cheam.
Welwyn Garden City.—8 September, 8 p.m. (American Visit by R. C. Hills, G3HRH), Vineyard Barn, Digswell Road.
Wimbledon (W & DRS).—9 September, 8 p.m., Community Centre, St. George's Road, Wimbledon, SW19.
Wembley (GECARS).—Meetings every Thursday, 7 p.m., Telephone H. W. Rees, ARNold 1262 first.

REGION 8

Crawley (CARC).—14 September (Informal, for details contact G3FRV), 28 September, 8 p.m., Trinity Congregational Church Hall, Ifield.
Clifton (ARS).—16 September (AGM), 30 September (Junk Sale).

REGION 9

Bath.—16 September, 7.30 p.m., RNR Training Centre, James Street West, Bath.
Bristol.—23 September, 7.15 p.m., New Lecture Theatre G44, Royal Fort, Bristol University, Woodland Road, Bristol 8.
Bristol (BARC).—Mondays and Thursdays 7.30 p.m., 43 Ducie Road, Barton Hill, Bristol 5.
Burnham-on-Sea (BoSARS).—Second Tuesday in each month, 8 p.m., Crown Hotel, Oxford Street.
Camborne (CRAC).—First Thursday in each month, Staff Recreation Hall, SWEB Headquarters, Pool, Nr. Camborne.
(CRAC V.H.F. Group).—First Thursday in each month, 7.30 p.m., The Coach and Horses, Ryder Street, Truro.
Exeter.—First Tuesday in each month, 7.30 p.m., George and Dragon Inn, Blackboy Road, Exeter.
Plymouth (PRC).—Tuesdays, 7.30 p.m., Virginia House, Bretonside, Plymouth.
Saltash (S & DARC).—9 September ("Top-Band Aerials," by S. Rance, G3WL), 23 September (Visit to BBC Television Studios Plymouth), 7.30 p.m., Burraton Toc H Hall, Warrington Road, Saltash.
South Dorset (SDRS).—First Friday in each month, 7.30 p.m., Labour Rooms, West Walks, Dorchester.
Taunton.—Group in process of formation. Please contact G3AUU.
Torquay (TARS).—24 September ("Meters" by Sifam Ltd. Rep.), 7.30 p.m., Club HQ, Belgrave Road, Torquay.
Wells (WARS).—Mondays, 8 p.m., EMIE (Wells) Sports & Social Club, Chamberlain Street, Wells, Somerset.
Weston-super-Mare.—First Friday in each month, 7.15 p.m., New Engineering Block, Technical College, Weston-super-Mare.
Yeovil (YARC).—Wednesdays, 7.30 p.m., Park Lodge, The Park, Yeovil.

REGION 11

Llandudno (CVARC).—15 September ("V.H.F. Operation" by R. Jones, GW3MDK), 7.30 p.m., Cross Keys Hotel, Madoc Street, Llandudno.

REGION 13

Edinburgh (LRS).—22 September (Presidential Address, by R. I. Pryde, GM3LGU), 7.30 p.m., YMCA, South St. Andrew Street, Edinburgh.

REGION 15

Belfast and District RSGB Group.—Third Friday in each month, 8 p.m., Ulster Tape Recording Society Clubroom, 44 Dublin Road, Belfast.

REGION 16

Basildon (BDARS).—6 September (Social), 27 September (AGM), Mayflower Restaurant. (Details from G3IJB).
Chelmsford (CARS).—6 September (AGM Film Show), 7.30 p.m., Marconi College, Arbour Lane, Chelmsford.
Great Yarmouth (GYRC).—Fridays, 7.30 p.m., The Manager's Office, The Old Power Station, Swanstons Road, Great Yarmouth.
Ipswich (IRC).—28 September, 7.30 p.m., Red Cross HQ, Gippeswyk Hall, Ipswich.
Norwich (NARC).—12 September (Junk Sale), 26 September (Demonstration evening), Old Lakenham Hall, Mansfield Lane, Norwich.

LOOKING AHEAD

11 September.—RSGB National Mobile Rally, Woburn Abbey, Bedford.
25 September.—Dundalk Convention.
2 October.—Region 9 ORM.
26-29 October.—RSGB International Radio Communications Exhibition.
9 December.—RSGB Annual General Meeting.
13 May, 1967.—RSGB Annual V.H.F. Convention.

Mullard Meetings

The Mullard Films and Lectures Organization has arranged meetings during September as follows: 6th, Greenford (Railway Hotel); 13th, Cleethorpes (Winter Garden); 14th, Northampton (Guildhall); 20th, Dundee (Angus Hotel); 21st, Inverness (Cummings Hotel); 22nd, Aberdeen (Treetops Hotel); 27th, Harpenden (Civic Hall); 29th, Derby (Derbyshire Yeoman Hotel). The meetings are open to RSGB members who should notify Mr Ian Nicholson, Films and Lectures Organization, Mullard House, Torrington Place, London, WC1, in advance of their intention to attend.

REGION 9 OFFICIAL REGIONAL MEETING

Royal Hotel, Weymouth, Sunday, 2 October 1966

Talk-in Stations, G3TTC 1875 kc/s, G3OAP 70·38 Mc/s.

10.15 a.m.	Conducted tour of BBC Short Wave Station Rampisham	3.00 p.m.	Official Regional Meeting
		5.00 p.m.	Tea
1.15 a.m.	Lunch	6.15 p.m.	Lecture

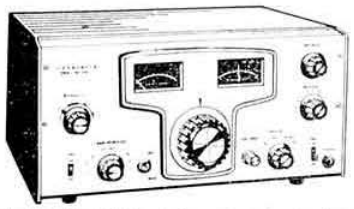
Tickets are available from:-

W. H. Burden, G3EAT,
102 Westhill Road,
Wyke Regis,
Weymouth.

Lunch, Tea and ORM **£1 5s. 0d.**

Tea and ORM **10s. 0d.**

LAFAYETTE 10-80 Metre SSB/AM/CW Amateur Receiver



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100 kc/s xtal 35/-
Speaker Mate 55/-

5 HAM BANDS PLUS WWV

3·5–4·0 Mc/s
7·0–7·5 Mc/s
14·0–14·5 Mc/s
21·0–21·5 Mc/s
28·0–29·7 Mc/s
WWV at 15 Mc/s

- Mechanical Filter for Exception Selectivity
- 12 Valves Dual Conversion
- Automatic Noise Limiter
- Product Detector for Selectable Upper and Lower Sideband Reception
- Complete with Crystals for 80, 40, 20, 15 and 10 Metres
- 100 kc/s Crystal Calibrator and Crystal BFO
- "S" Meter-Calibrated in "S" Units 1-9 and to +40 db

MODEL HA.350 Lafayette's newest and most advanced communications receiver. Dual conversion circuitry features an image and IF rejection of more than 40 db. A product detector, providing selectable upper or lower sideband, solves the problems in SSB reception. Tuneable preselector circuit gives sensitivity of less than 1 microvolt for 10 db signal-to-noise ratio. Selectivity: Bandwidth of 2 kc/s at 6 db down and 6 kc/s at 60 db down using mechanical filter. Front panel 100 kc/s crystal calibrator reset control used in conjunction with the 15 Mc/s WWV station assures accurate calibration. CHECK THESE SPECIFICATIONS. Audio output: 1-watt maximum. Speaker impedance: 8; 500 ohms (speaker not supplied). Front panel controls: Preselector; Cal—On off; Band Selector; Receive Send /Tuning Cal Reset; Function—Off AM SSB1-CW/SSB2; RF gain; AF gain; ANL; Phone jack. Valves: 6BZ6—RF amp; 6BL8—Xtal controlled 1st mixer; 6BE6—2nd mixer; 6BA6—VFO, 6BA6—1M amp.; 6BA6—1F amp; 6AL5—AVC rectifier and AM noise limiter; 6AQ8—product detector and crystal calibrator; 6AV6—1st audio amplifier; 6AQ5—audio output; 6BA6—BFO; 0B2—regulator. Silicon Full Wave rectifier. Size: 15in. wide by 7¼in. high by 10in. deep. For 230v. 50/60 cps AC. Wt., 25 lb. Less Calibrator Crystal.

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SEMI-KIT

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			200mA ..	22/6	100V DC .. 22/6
			200mA ..	22/6	150V DC .. 22/6
			300mA ..	22/6	300V DC .. 22/6
			500mA ..	22/6	500V DC .. 22/6
"S" Meter	29/6	500-0-500μA	29/6	750mA .. 22/6	15V AC .. 22/6
50μA ..	32/6	1mA ..	22/6	1-0-1m A .. 22/6	50V AC .. 22/6
100μA ..	29/6	2mA ..	22/6	1A DC .. 22/6	150V AC .. 22/6
200μA ..	27/6	5mA ..	22/6	2A DC .. 22/6	300V AC .. 22/6
500μA ..	25/-	10mA ..	22/6	5A DC .. 22/6	500V AC .. 22/6
50-0-50μA	29/6	20mA ..	22/6	3V DC .. 22/6	"S" Meter
100-0-100μA	27/6	50mA ..	22/6	10V DC .. 22/6	1mA .. 29/6

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Nuvistor Grid Dip Meters 1.7-180 Mc/s	£12.10.0
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Transistorised Grid Dip Meters 440 Kc/s-280 Mc/s	£11.11.0
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Partridge Joystick Aerials in Stock.	
Field Strength Meters 1-250 Mc/s	£3.12.6
Transistorised Field Strength Meters 2.5-55 Mc/s	£4.19.6
Coaxial Aerial Change Over Relays, 2 for	£1.19.6
H.R.O. Dials	£1.7.6
H.R.O. Coils. Full set of 9 G.C. Coils	£10.10.0
1 Amp R.F. Meters	10.6
PCR. Receivers. As new LW-MW-SW.	£8.19.6
PCR. 12 VDC P.S.U.	19.6
PCR. Mains P.S.U.	£1.15.0
AR.88D Receivers	£45.0.0
AR.88LF Receivers from	£39.0.0
R.209 MKII Receiver, 6VDC 1-20 Mc/s	£22.10.0
Lafayette Aircraft Receivers 108-136 Mc/s	£19.7.6
Lafayette F.M. Receivers 154-172 Mc/s	£20.0.0
Nombrex Transistorised Test Equipment in Stock.	
KW. SWR. Bridge	£8.10.0
KW. Low Pass Filter	£4.4.0
KW. High Pass Filter	18.6
K.W. Balun	£1.15.0
KW. Multiband Trap Dipoles. 97 ft.	£9.0.0
75 ft.	£8.10.0
Denco Components in Stock.	
CODAR EQUIPMENT	
CR.70A Receiver	£19.10.0
CR.45 Receiver Kit	£9.19.6
CR.45 Ready Built	£11.4.0

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PR.30 Preselector	£5.10.0
PR. 30X, Self Powered	£7.4.0
RQ.10, Q. Multiplier	£6.15.0
RQ.10X, Self Powered	£8.8.0
A.T.5, Amateur TX	£16.10.0
A.T.5, Mains P.S.U.	£8.0.0
A.T.5, 12 volt P.S.U.	£11.5.0
A.T.5, Remote control and Aerial Switching Unit	£2.7.6
T.28, 2 Band Receiver	£15.10.0
CC.40, Station Control Unit	£6.10.0
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TMR5, Receiver	£35.0.0
Speaker and D.C. Unit	£6.0.0
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MK5 Convertor 4M.	£10.0.0
MK5 Convertor 2M.	£12.0.0
MK5 Convertor 70cm.	£18.0.0
T. WITHERS EQUIPMENT	
TW-2, 10W 2M. TX	£29.0.0
TW-2, Mobile P.S.U.	£15.0.0
TW-2, Mains P.S.U.	£15.0.0
TW Twomobile 2M Receiver	£34.0.0
TW Top Mobile Receiver	£23.9.0
TW Communicator 2.	£75.0.0
TW Communicator 4.	£75.0.0
Communicator Mains P.S.U.	£12.0.0
Nuvistor 2 or 4M Convertor	£13.13.0
Or with Mains P.S.U.	£18.0.0
TW 70CM Convertor	£18.0.0
TW Transistor Convertors for 2 or 4 Metres	£9.9.0

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400 P.I.V. 3 amp (S.A.C.R.) ..	10/-
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1,000v. P.I.V. 650 mA	7/6
800v. P.I.V. 500 mA	5/6
400v. P.I.V. 500 mA	3/6
800v. P.I.V. 5 amp	7/6
70v. P.I.V. 1 amp.	3/6
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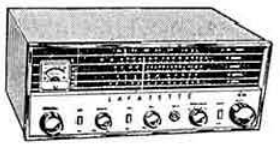

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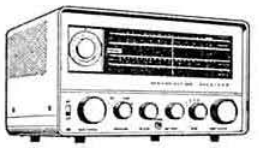

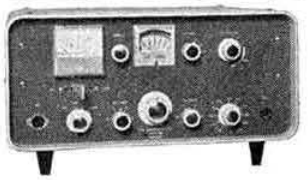

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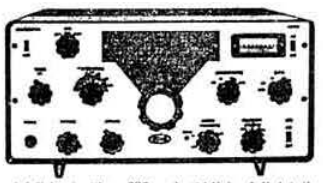

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VALVES

Fully guaranteed
Individually packed

AC/HL	4/6	EBF89	6/9	GM4	45/-	QP25	5/-	UL84	5/6	3A/108A	20/-	6C4	2/-	12A6	2/6	717A	3/-
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AZ31	9/-	ECC91	4/-	KT32	8/-	SP2	8/6	VR105/30	5/-	4C27	35/-	6F5GT	5/9	12J7GT	6/6	866A	14/-
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B84	8/-	ECH81	5/-	KT66	16/-	SP210	6/6	VU39	6/-	5A/174G	5/-	6F8G	6/6	12Q7GT	3/3	955	2/6
B85	20/-	ECH83	7/6	KT67	15/-	STV280/40	12/6	VX3256	4/-	5B251M	25/-	6F12	4/6	12SA7	7/-	956	2/-
B884	37/6	ECL80	6/-	KY76	8/6	SU2150A	10/-	VX8122	5/-	5B/253M	15/-	6F13	5/-	12SC7	4/-	957	5/-
B2134	16/-	ECL82	7/6	KT88	22/-	S11G12	10/-	VX8124	5/-	5B254M	40/-	6F14	5/-	12SG7	3/-	958A	4/-
BT19	25/-	ECL83	10/-	KTW61	4/6			W21	5/-	5B255M	35/-	6F32	4/-	12SH7	3/-	1612	5/-
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CV4049	6/-	EF85	4/6	OC3	5/-							6K8G	3/-	21B6	9/-	6065	6/-
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DET20	2/-	EL32	3/9	PCF84	6/-							6N7G	5/9	30FL1	10/6	9006	2/6
DET25	15/-	EL34	10/-	PCF86	9/-							6P25	12/6	30P12	10/-		
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DF91	3/-	EL38	17/6	PCL81	9/-							6R7	5/6	30PL1	8/-	C.R. Tubes	
DF92	3/-	EL41	8/-	PCL82	7/-							6SA7	7/-	3516GT	7/-		
DF96	6/-	EL42	8/-	PCL83	8/6							6SA7GT	6/6	35T	17/6	CV1596	
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DK92	8/-	EL81	8/-	PCL85	8/6							6SC7	7/-	35Z3	10/-	E4504/B/16	28/-
DK96	6/6	EL84	5/-	PCL86	9/-							6SG7GT	5/-	35Z4GT	6/-	VCR97	28/-
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