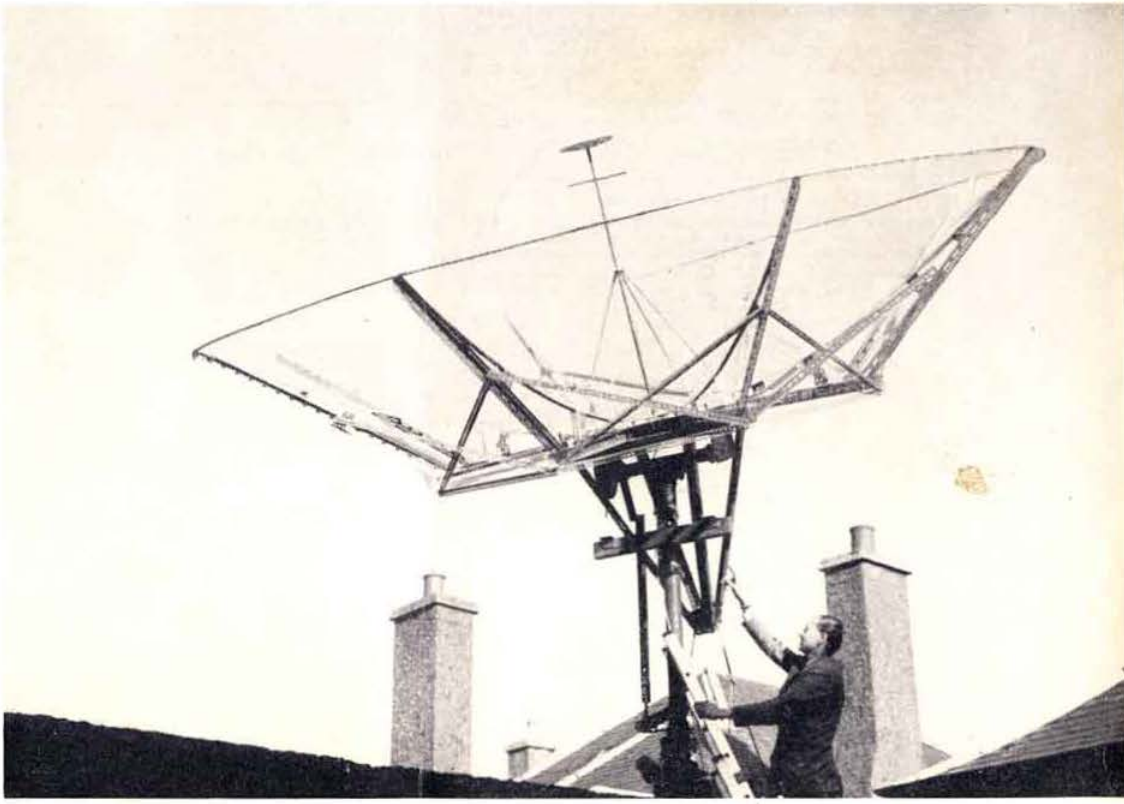
RSGB

BULLETIN

JUNE 1966
VOL. 42, No. 6



The parabolic aerial array at GM3FBY

JOURNAL OF THE RADIO SOCIETY OF GREAT BRITAIN

Mk 4 MULTIMINOR

The Mk. 4 MULTIMINOR, the latest version of this famous Avo instrument, supersedes all previous models. It is styled on modern lines, with new high standards of accuracy, improved internal assemblies, and incorporating panclimatic properties.

The instrument is supplied in a black carrying case, which also houses a pair of leads with interchangeable prods and clips, and an instruction booklet. Leather cases are available if required, in two sizes, one to take the instrument with leads, clips and prods, and the other for these and also a high voltage multiplier and a d.c. shunt.

D.C. CURRENT: 100μA f.s.d. — 1A f.s.d. in 5 ranges.
A.C. VOLTAGE: 10V f.s.d. — 1,000V f.s.d. in 5 ranges.
D.C. VOLTAGE: 2.5V f.s.d. — 1,000V f.s.d. in 6 ranges.
D.C. MILLIVOLT range: 0 — 100mV f.s.d.
RESISTANCE: 0—2MΩ in 2 ranges, using 1.5V cell.
SENSITIVITY: 10,000Ω/V on d.c. voltage ranges.
1,000Ω/V on a.c. voltage ranges.

For full details of this pocket size instrument, write for leaflet.

AVO INSTRUMENTS DIVISION is now at DOVER

Dimensions (including case):
7¾ × 4 × 1¾ in.
(197 × 102 × 41 mm.) } approx.

Weight (including case):
1¼ lb. (0.675 kg.) approx.

IMPROVED

STANDARDS OF **ACCURACY** AND **RELIABILITY**

Modern styling in light grey with legible black engraving.

Constructed to withstand adverse climatic conditions.

Ever ready case, including leads, prods and clips.

Improved internal assemblies.

Re-styled scale plate for easy rapid reading. 2 basic scales, each 2.5 inches in length.

New standards of accuracy, using an individually calibrated scale plate: d.c. ranges 2.25% of full scale deflection, a.c. ranges 2.75% of full scale deflection.

Available accessories include a 2500V d.c. multiplier and 5, 10 and 25A shunts for d.c. current measurements.

AVO LTD AVOCET HOUSE · ARCHCLIFFE ROAD · DOVER · KENT *Phone: Dover 2626*

MM16

Volume 42 No. 6

June 1966

4/- Monthly

RSGB BULLETIN

CONTENTS

Front Cover: The photo of GM3FYB's impressive parabolic aerial was taken by GM3ENJ.

EDITOR:
John A. Rouse, G2AHL

EDITORIAL ASSISTANTS:
Trevor R. Preece, G3TRP
John J. Adey, A4663

EDITORIAL OFFICE:
RSGB Headquarters, 28 Little Russell Street, London, W.C.1.
Telephones: HOLborn 7373
HOLborn 2444

ADVERTISEMENT MANAGER:
Mrs. P. D. Harvey, Sawell & Sons Ltd., Ludgate Circus, London, E.C.4.
Telephone: FLEet Street 4353

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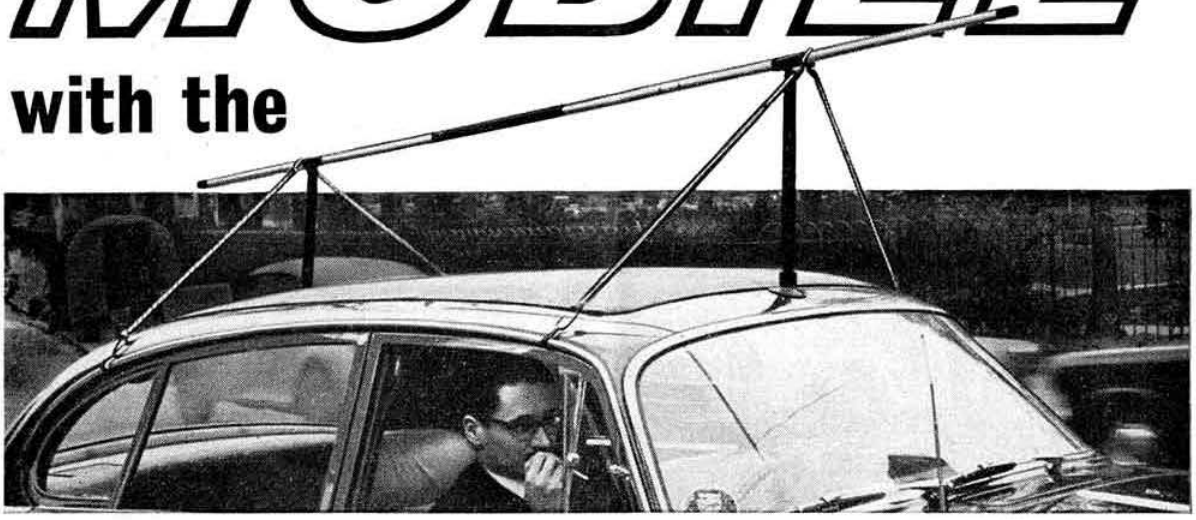
MOBILE

with the



Typical Mobile Joystick installation.

Joystick VFA

For car or caravan

Don't stop your car—CHANGE BAND AUTOMATICALLY

The Joystick VFA introduces a new freedom to mobile operators. There are no tiresome external adjustments to make—no coils to change. Just tune up and out goes a really steady and *omni-directional* signal. So simple to load—so simple to fit. Clip on supports, allow your Joystick to be fitted to the car 30 seconds after using it in the shack! No more drilling or spanner and wrench sessions! The System has to be tested for safety and rigidity at speeds of over 70 m.p.h.

Completely weatherproof, the elements are of light-weight materials. The single and very short feeder is moulded into the leading element and may run straight to the special Joystick mobile tuning unit located by the sun visor or under the dashboard.

Well over 5,000 Joystick Systems are already operating satisfactorily all over the world—it's going over BIG in the States! A constant flow of testimonials reaches our office by every post—many of these describing remarkable achievements you have seen in recent advertising.

Still sceptical? Go on—try a Joystick under our money-back guarantee—have a 10 DAYS' TRIAL! Please the YL or XYL—get out into the sun and country air.

GO MOBILE – GO JOYSTICK

G4HZ of Cheshire says: Very successful Mobile day with the Joystick—I ran well over 100 miles with it working stations all the way home—big advantage in that one could use it on any band by merely adjusting the ATU—system loaded perfectly!

The Mobile Joystick System is available now at **£9.19.6** (+ 5/- p & p)

Complete with Tuner, feeder, mounting harness and full instructions.

The range of Joystick Systems is described in our brochure—send for it right away!

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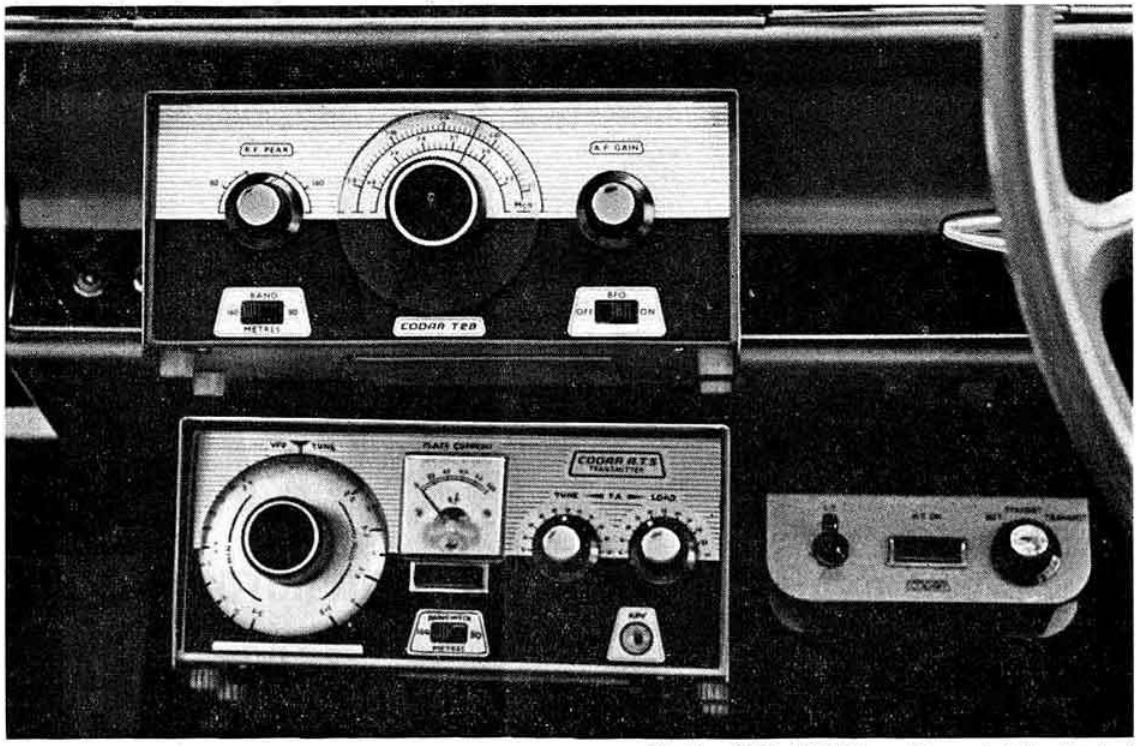
GO 'CODA- on 160 x 80 at the



The tiny CODA-MOBILE gear fits snugly below the dash

Here comes the sun! Get out in the fresh, clean air—go Coda-Mobile. Codar have really done it this time! No matter if you drive a giant Jag., a family jalopy or the mighty Mini, the Coda-Mobile units just slip in anywhere— you could stand the lot on this open magazine, power supplies included!

So £39 is still pricey? Not a bit. Look around—there's no equivalent to this outstanding offer. The special PACKAGE DEAL price of £39 brings you a complete Two Band mobile/home rig, ready for installation and connecting to any suitable antenna. You save almost £7 and we even pay the carriage!! In addition, CODAR would be pleased to buffer the blow to your budget with good H.P. terms.

While the XYL goes TV—you just creep out to the car, unplug the TX/RX and slip back to your armchair; she'll never notice you connect up the rather smart mains unit that lives in the bookcase—anyway the gunfire will drown your quiet CQ.

Hear what G6TQ (Leicester) *has to say about the AT5—"now installed mobile, going great guns!"*

MOBILE'

lowest-ever cost of

CODA-MOBILE Package Deal £39

Here's what you get and how you save

AT5 160 x 80 metre TX 12 watts input, high stability VFO, plate/screen mod. or cw. 6/12 volt heaters. Only 8½ in. x 5 in. x 4 in. Usual price £16 10s.

T28 160 x 80 metre RX. The CODAR T.28 is a fully transistorised receiver employing 9 Transistors plus one diode. Bandspread calibrated scales cover the 1·8-2·0 Mc/s and 3.5-4 Mc/s bands. Backflash free precision slow motion drive. Separate R.F. peak control. B.F.O. switch. 2-3 ohms output for external speaker. Mixer/I.F. and A.F. sections are printed circuit modules for maximum reliability. For 12 volts battery supply. Size 8 in. x 4½ in. x 3½ in. Usual price £15 10s.

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12 R/C Remote control switching Unit. Standby/Net/Transmit, HT/LT supplies. 5 in. x 2 in. x 1¾ in. Usual price £2 7s. 6d.

Meanwhile—Back at the Shack
The 250/S mains and control unit is just another £7. with the package deal (£8 on its own). Will it fit your bookcase? 8½ in. x 5½ in. x 4½ in.

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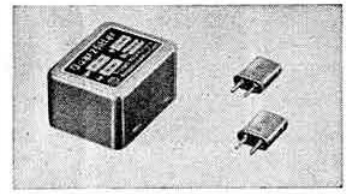

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Stop band attenuation	> 45 db	> 80 db
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* 200 watts PEP SSB/CW, 100 watts AM.
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Full data from

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HT-46

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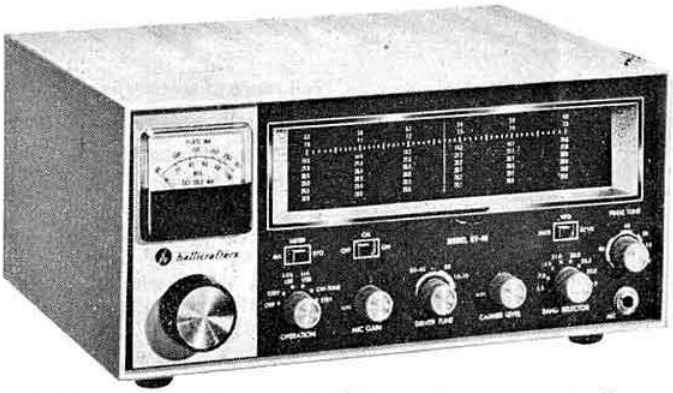

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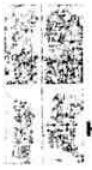

VERTICALS: RV-4. 10, 15, 20 & 40 Metres.
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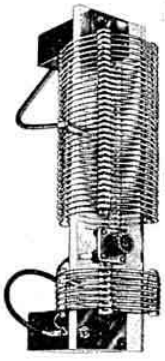
TD-3 Jr. 10, 15 & 20 Metres. Trapped Dipole.



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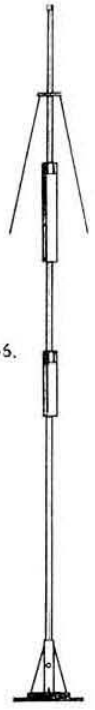

V-4-6.

Send for complete Catalogue, containing full details of Antennas and other technical information. 25 pages 1/-.

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RADIO SOCIETY OF GREAT BRITAIN

INCORPORATED
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A. O. Milne, G2MI, 29 Kechill Gardens, Bromley, Kent

An Appreciation

The Spirit of Amateur Radio

By A. C. W. BIDDELL, G3GNM *

IN February 1962, my daughter sailed for New York on what was, at that time, intended to be a stay of about six months.

The evening before she sailed, I thought it would have been nice to hook up with an amateur in New York with whom I could put her in touch and arrange an occasional sked for the purpose of keeping in closer contact with her than would otherwise be possible, but I realized I had left it rather late. However, on the off-chance, I fired up the rig on 20m c.w. and called " CQ NYC."

Here I must digress for a moment in order to introduce a strange coincidence: some weeks previously I had been asked by a neighbour to keep a lookout on the bands for a friend of his who had recently returned to the US after a tour of duty with the USAF in England, and had newly acquired his " ticket " with a WA2 call-sign.

My CQ was answered by a W2, the last three letters of whose call-sign were identical to those of my neighbour's friend. Unheeding the absence of the letter A in the prefix, I jumped to the conclusion that this was the WA2 who had also been asked to keep an ear peeled for me, and I accordingly greeted him by name. When the W2 came back again and announced his name, which differed from that of my neighbour's friend by one letter only, confusion was worse confounded and I began to doubt my ability to read the Morse code!

To return to the main theme, when we had finally sorted ourselves out, the W2, whom I will call M henceforth, said he would be delighted if my daughter would contact him on her arrival and he would be happy to give her any help in his power, including some useful introductions for employment if she needed them, and also that he would be happy to set up a sked, which we did.

Eventually my daughter got into touch with M who proved a tower of strength to her in showing her the ropes and advising her on many points concerning her new life in a strange country, and it was a source of great comfort to me to know that she had a mature friend and adviser to whom she could turn if any problems arose.

The six months came and went and my daughter, who had found herself a job which she loves, and had also fallen in love with New York, decided to remain there. It was 2½ years before I saw her again when, after being sent on a trip to Geneva by her employers, the United Nations, she succumbed to home-sickness and the proximity of England and decided to return home. After only a few weeks in England the call of New York proved too strong and she returned there in October 1964, becoming fully reinstated at the UN.

During the whole of the 4 years since February 1962, M and I have maintained a regular weekly sked on 20m c.w. and occasionally on s.s.b. We have rarely missed a week, and this was only caused by absences from home on business or vacation, and more rarely, owing to poor band conditions. The tally to date is 190 QSOs in 212 weeks, which is not a bad record and one which says much for 20m as a band for regular year-round DX communication, sunspot minima notwithstanding.

In these 4 years M has been like a second father to my daughter, taking her into the bosom of his own family and lavishing hospitality and kindness upon her. Indeed, to list his many acts of kindness and generosity both to her and myself would occupy pages.

There can be few amateurs who have not formed a mental picture of someone they have worked over the air many times and then very often found, on meeting, that the mental image is very different from the reality. However, I came to know M so well over the air that when he recently visited this country with his charming XYL on a vacation trip and we met for the first time, there were no surprises, at least on my part. It was not in the least like meeting a stranger, but more like a reunion with an old friend. He is, in the idiom of his own country, a " great guy." I preserve his anonymity to spare his blushes!

This saga, if I may use the term, has all grown out of one chance QSO back in 1962, and is a shining exemplification of the true Spirit of Amateur Radio, and the brotherhood and friendship between nations that can be achieved through its medium.

* 114 Kingshill Avenue, Kenton, Middlesex

Pen Pals Wanted

The French society, REF, has informed us that several members wish to correspond with British radio amateurs or their families. The details are as follows:

(i) A member who has studied English for eight years would like to correspond in English with an amateur or the son of an amateur in the 19-20 age group.

(ii) A French amateur, living 50 km from Paris, wishes to obtain a pen-pal for his 14-year-old daughter who has studied English for three years.

(iii) A French short-wave listener, age 19, would like to correspond with students of similar age in the UK, Australia, New Zealand or Asia. He is prepared to exchange tapes, etc.

(iv) An 18-year-old member of REF would like to correspond with a British student of the same age.

All correspondence in connection with these requests should be addressed in the first instance to Reseau des Emetteurs Francais, 60 boulevard de Bercy, Paris 12°, France.

Mullard Film Meetings

Coming meetings are to be held during June at the following places: 7th, Randolf Hotel, Oxford; 8th, Great Western Hotel, Reading; 13th, Hotel Leofrec, Coventry; 14th, Norbreck Hydro, Blackpool; 15th, Town Hall, Blackburn; 21st, Queen's Hotel, Southend-on-Sea; 22nd, Grosvenor Restaurant, Glasgow; 23rd, Leith Town Hall, Edinburgh; 28th, Union Hall, Londonderry; 30th, King George VI Youth Centre, Belfast, RSGB members wishing to attend a meeting should write to Ian Nicholson, Films and Lectures Organisation, Mullard House, Torrington Place, London, WC1, for a formal invitation. All meetings commence at 7.45 p.m. and refreshments are served after the lecture.

PROFILE

A. D. Patterson, GI3KYP/EI4BC

PATTERSON, Alexander Davidson, born Dublin 1932, Graduated B.A.(Sc). University of Dublin (Trinity College) 1955. Moved to Belfast 1956 on appointment as an Electronics Engineer with Short Bros. and Harland. In 1955 married Miss Anne Rosborough, Belfast, a fellow graduate. Father of four children. Thus could read one description of A. D. Patterson. However, another apt description of "Barney," as he is widely known, the friend, councillor and helpmate to his very large and widespread circle of friends in Amateur Radio, is a much warmer catalogue—not easily condensed into a few paragraphs.

It is rare indeed to find a "back room boffin" not only gifted with "hands for anything" but with a dynamic personality and organizing ability which makes for natural leadership. Barney has all these qualities plus a warm friendly nature with a fund of native wit and humour.

Undoubtedly GI land has not been the same since Barney arrived in its midst. There is now much more organized effort under the banner of the RSGB both in the social and in the active sphere of the hobby. Barney does not, of course "run everything" but he has the knack of prodding others into action and getting results.

While still a student he obtained his first licence—EI4BC—to which he added GI3KYP on arrival in Northern Ireland. On becoming a member of the City of Belfast YMCA Radio Club he was soon elected to its Committee. In 1962 he became the first representative from Northern Ireland to sit on the RSGB Council following his election as representative for the then Zone F which at that time covered Scotland and Northern Ireland. In 1965 when GI became a separate RSGB Zone, Barney was re-elected to Council as its representative and is presently a member of the Membership and Representation Committee.

In 1959 Barney helped to organize a GI DXpedition to Rathlin Island off the North Antrim coast in commemoration of the Marconi Centenary. The tales of that adventure will be handed down from father to son. In 1961 and again in 1962 he joined the DXpedition organized by his EI friends to the Aran Islands off the west coast of Ireland. In 1964 the the first ever EI/GI Convention under the auspices of the RSGB and IRTS was held at Ballymascanlan near Dundalk. This convention was voted an outstanding success by the very large turn-out of GIs and EIs and no one did more than Barney Patterson to ensure that success.

Ever moving with the times, last year he organized an RSGB Teach-in at a Belfast hotel at which astronomer Patrick Moore and v.h.f. expert John Stace, G3CCH, lectured on the moon and moon-bounce respectively.

An expert on radio circuitry, Barney appears to spend more time "trouble shooting" for his friends than operating. Nevertheless, with Harry Wilson, EI2W, he made the first GI/EI contact on 70cm.

His home in Cyprus Avenue, Belfast, known locally as ZC4 Avenue, operates as the unofficial headquarters of his large circle of friends. All receive a ready witty welcome from Barney (and Anne). The coffee pot is never cold and his 70 Mc/s transceiver keeps ever listening watch in an area of high 70 Mc/s activity.

In spite of the many calls of Amateur Radio Barney found time to log the flying hours necessary to obtain in 1964 his Private Pilot's Licence, and from Newtownards Airport has piloted himself and friends across the Irish Sea on Amateur Radio Missions.

Undoubtedly Amateur Radio in general and in Northern Ireland in particular is the richer for Barney Patterson, the guide, philosopher and friend of all who know him.

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.

A Phase-Locked 2m V.F.O.

By R. SCRIVENS, G3LNM *

AS the 2m band becomes more popular, the problem of finding a transmitter crystal on a clear frequency becomes more difficult and the need for v.f.o. control more pressing. During periods of good conditions the ability to change frequency is almost essential to avoid interference on one's own signal.

All the v.h.f. v.f.o. systems in common use at present have some drawbacks: the v.x.o. circuit gives only a small frequency shift consistent with high stability and the transverter system (i.e., mixing a variable low frequency signal with the output of a crystal oscillator-multiplier chain), although it is capable of wide frequency coverage with good stability, may produce spurious out-of-band signals, unless great care is taken in design.

If it can be made sufficiently stable, a free-running oscillator driving the transmitter directly is obviously the best method.

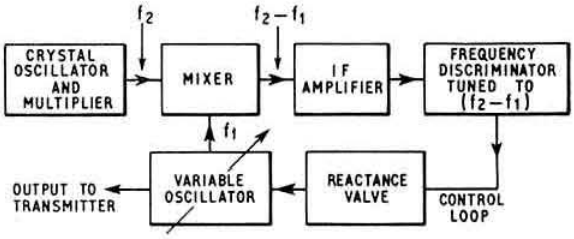


Fig. 1. A simple frequency control system using a frequency discriminator.

This led the author to consider whether some form of automatic frequency control system could be employed with a v.h.f. oscillator to improve its stability. The first idea was to use a.f.c. on the lines used in f.m. broadcast receivers (Fig. 1). Here the reactance valve adjusts the frequency of the tunable oscillator to give zero d.c. output from the discriminator. If the variable v.h.f. oscillator tries to drift, an error voltage is fed to the reactance valve to correct the frequency. There must, however, be an error in frequency before there is any output from the discriminator to provide correction. Hence this method will reduce oscillator drift but not completely eliminate it.

The frequency and phase of a wave are inseparable. A signal cannot change frequency without simultaneously changing its phase relationship with a fixed reference signal. Furthermore, even if two signals are only slightly different in frequency, their phase relationship will be varying continuously from in phase to completely out of phase. Therefore, if two signals can be made to maintain the same phase relationship between each other they must both be of exactly the same frequency. The discriminator of Fig. 1 may be replaced with a phase detector and reference oscillator to give Fig. 2; the output of the phase detector now controlling the v.h.f. oscillator frequency. This is known as a phase-locked loop system.

The Phase Detector

In the chosen circuit (Fig. 3(a)) the phase detector is a 6BN6 gated beam valve. This was selected because single-ended, untuned input circuits can be employed so enabling operation over a wide bandwidth to be easily achieved. In addition, provided the input signals well exceed 2 volts peak, the valve is self limiting, i.e., the output voltage amplitude is independent of the amplitude of the input signals. A simplified description of the operation of the circuit is as follows:

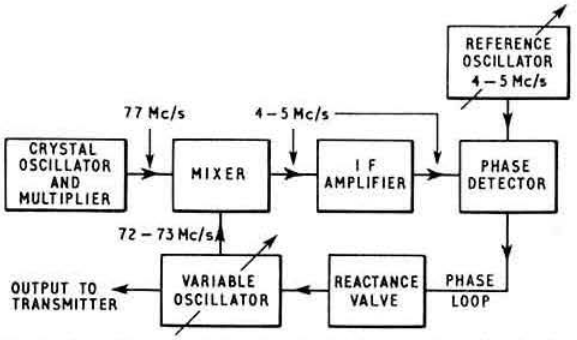


Fig. 2. Block diagram of the phase-locked system described in this article.

Anode current flows only when both input grids are positive and this current does not rise further than the value reached when both grids are at about +2 volts. Thus, if the input signals are of the same frequency but differing in phase by 90° and their amplitudes greatly exceed 2 volts peak, the anode current waveform consists ideally of square pulses as shown in Fig. 3(b). When the resulting anode voltage waveform is smoothed by R and C, a steady d.c. voltage is obtained dependent upon the average value of the anode current. If the phase difference is now reduced to zero (Fig. 3(c)), the duration of the anode current pulses is doubled and therefore the d.c. output voltage is also twice the previous value. Clearly, if the input signal phase difference is 180°, the output voltage is zero. Hence the output voltage of the circuit is dependent on the phase difference between the input signals. It should be noted that if the inputs are not quite the same in frequency, the output voltage varies at the difference frequency because the phase relationship between the signals is then constantly changing. Thus the circuit is merely a special form of multi-grid mixer. In fact, any mixer circuit can be considered to be a phase detector.

Design Considerations

The practical system operates at 72-73 Mc/s (i.e., half the desired output frequency) as it was thought unwise to generate the signal directly on 2m because of the possibility of the modulated signal from the associated transmitter breaking through and upsetting the phase lock. The output of the v.f.o. is doubled by conventional methods in the transmitter.

Let us assume that the required output frequency is 72 Mc/s. Using the system shown in Fig. 2, when the system is locked to give an output at this frequency, both signals to the phase detector must be at 5 Mc/s. If the frequency of the 72 Mc/s oscillator now tries to change, the phase relationship between the i.f. signal and the reference also changes. This produces a change in the voltage fed to the reactance valve so correcting the v.h.f. oscillator frequency. Even if the change in frequency is small, the phase detector can produce a large correction voltage. It is for this reason that the phase lock system generates a far more accurately controlled signal than that produced by the method shown in Fig. 1.

It can now be seen that if the reference oscillator frequency is varied, the v.h.f. oscillator varies with it, and what is more important, the v.h.f. signal has in effect the stability of the low frequency reference (assuming that the crystal oscillator is perfectly stable).

At the instant of switching on, the two inputs to the phase

* 8 Belland Drive, Charlton Kings, Cheltenham, Glos.

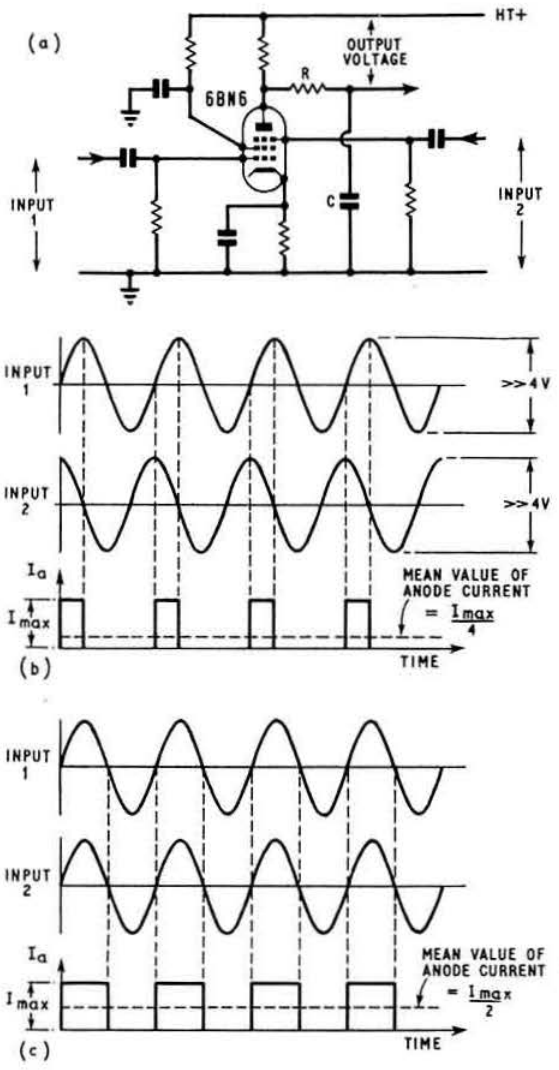


Fig. 3. (a) A 6BN6 valve connected as a phase detector; (b) waveforms at the phase detector with input signals 90° out of phase; (c) waveforms at the phase detector with input signals in phase.

detector are unlikely to be at the same frequency. This means that its output is an alternating voltage. If the phase loop has a rapid response (i.e., a wide bandwidth), the v.h.f. oscillator is pulled into lock. Unfortunately in practice it has been found that when using a wide bandwidth, spurious signals of around 500 kc/s appear on the phase detector output. These signals obviously frequency modulate the oscillator and produce sidebands spaced approximately 500 kc/s either side of the main output frequency. These spurious signals are probably caused by the phase lock " hunting." Once lock is achieved the phase detector output consists of a steady d.c. voltage together with a comparatively low frequency a.c. signal to correct any " burble " of the 72 Mc/s oscillator frequency. Thus, after the system is locked, the phase loop bandwidth may be reduced drastically to eliminate any spurious signals without affecting the frequency stabilization of the output. To do this a capacitor of suitable value is shunted across the phase detector output shortly after applying the h.t. This is done automatically by means of a relay whose coil is fed via a long time constant CR network from the h.t. supply. This additional capacitor also serves to eliminate any 4-5 Mc/s ripple that may be present on the detector output.

A Practical Arrangement

The actual design developed by the author consists of three separate units. The phase detector and its cathode follower output stage together with the power supply are on one chassis, Fig. 4; the r.f. circuitry is on a second chassis, Fig. 5; and the 4-5 Mc/s transistorized reference oscillator forms the third unit, Fig. 6. This splitting-up of the circuit allows greater flexibility. The phase detector can be used with oscillators for other frequencies and the reference oscillator can be kept away from the heat produced by other parts of the circuit to improve its stability. This arrangement does mean that extra circuitry is necessary to provide the low impedance outputs required for the interconnecting cables and hence some simplification would be possible if the whole circuit were built on one chassis.

Power Supply and Phase Detector

The power supply is a conventional full wave circuit with a two section choke input filter. V2 provides a low impedance +100V supply for the directly coupled stages V3, V4 and V8b. V4 is the cathode follower output stage for the phase detector V3. L1 and C5 form a trap circuit to attenuate the 4-5 Mc/s component in the detector output. Relay A is operated from a +12V d.c. supply via the TRANSMIT/RECEIVE switch. This relay switches on the whole circuit. Relay B operates about half-a-second after the application of the h.t. supply and, provided that S1 is closed, connects C4 across the phase loop to reduce its bandwidth. R1 allows C4 to charge to the d.c. output voltage of the phase detector before relay B operates. If this resistor is not fitted, the charging current of C4 causes the system to drop out of lock when B1 contacts close. The supply to the transmitter relays is fed via B2 contacts. By this method the transmitter is not switched on until the phase loop bandwidth has been reduced and the possibility of spurious signals eliminated. A 1mA meter is connected via R2 across the reactance valve input so that the d.c. control voltage can be observed.

R.F. Unit

V5a is the 72-73 Mc/s variable oscillator, the frequency of which can be adjusted manually by C2 and electronically by the reactance valve V8b. The output of V5a is amplified and isolated from the transmitter input by V5b. The anode ciruit of the crystal oscillator V9a is tuned to the third harmonic of the crystal frequency and V9b further doubles this to 77 Mc/s. The signal from the oscillator V5a is fed to the control grid of the mixer V6 and the output of V9b to the suppressor grid of this valve. The difference frequency is selected by the broad-band tuned circuit L4/C6 in the anode of V6. This signal is then further amplified by V7 before being transformed to a low output impedance by the cathode follower V8a.

Reference Oscillator Unit

The oscillator itself, TR1, is an almost identical copy of W3JHR's " synthetic rock " circuit (" Technical Topics," RSGB BULLETIN, December 1963). TR2 is an emitter follower driving the directly coupled pair TR3 and TR4 which provides the required output voltage at a reasonably low impedance. One difficulty experienced with this circuit was pulling of the oscillator frequency with load variations. This effect is much more difficult to prevent than in valve circuits owing to the internal feedback in transistors. C7 was reduced to 10pF to minimize this. The NET switch S2 is mounted on this unit.

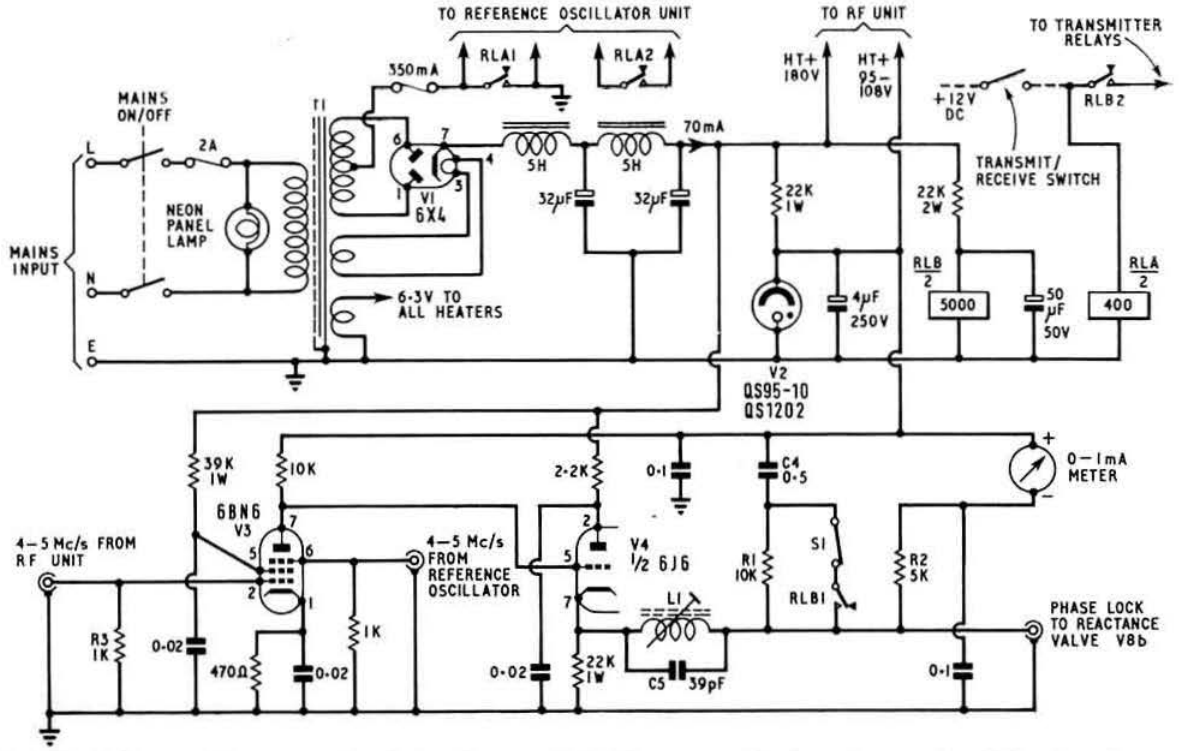


Fig. 4. Circuit diagram of the power supply and phase detector unit. L1, 34 s.w.g. enam., $\frac{7}{8}$ in. long, close wound on 0·3 in. diam. slug tuned former. T1, mains transformer,0-200/220/240 primary, 250-0-250 V, 80 mA, 6·3 V, 1A, and 6·3 V, 4 A secondaries.

S3 allows the v.f.o. to be run continuously for maximum stability if required.

It must be admitted that this unit could be improved. In particular, the output impedance is rather high, limiting the length of interconnecting cable that can be used to about 1 ft. Of course, any 4-5 Mc/s oscillator may be used provided it can supply around 4 volts peak-to-peak signal across a 1K ohm load.

Construction and Alignment

The construction of all the units is quite conventional. No special precautions need be taken to ensure high stability of the oscillator V5a but the grid connections to this valve should be kept as short as possible because of the rather high capacitive loading inherent in the circuit arrangement. The co-axial interconnecting cables should be kept fairly short (i.e., not much longer than 1 ft.) for although the various output impedances are quite low, no attempt has been made to match the corresponding input circuits to the cables. An exception to this is the 72-73 Mc/s output from V5b which can be coupled to a link winding on the input circuit of the transmitter by any reasonable length of cable. In the writer's transmitter the drive from the v.f.o. is amplified by a QV04-7 stage, then doubled in a second QV04-7 which drives a QQV03-20A p.a. running at 20 watts input.

Alignment is best carried out with the aid of a g.d.o. and

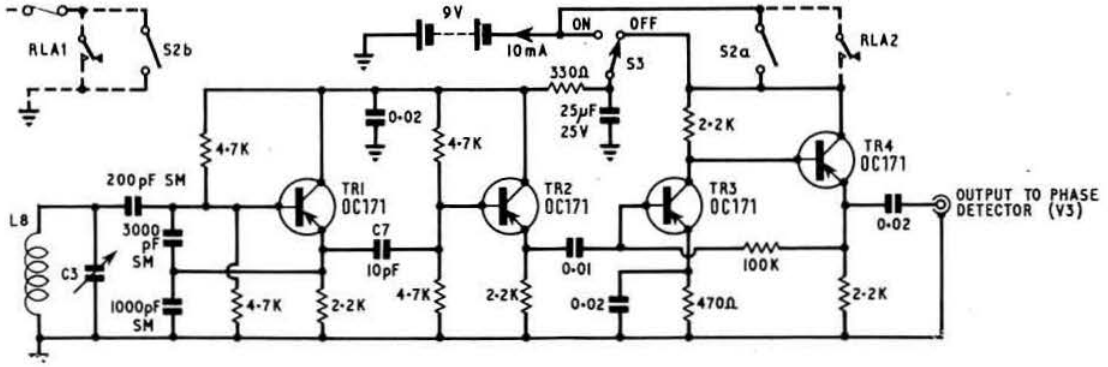


Fig. 6. Transistor 4 to 5 Mc/s reference oscillator. C3, 150pF max. (Wingrove and Rogers C28-142, 18/·015, with sections connected in parallel. This type can be found in the ex-government RF26 unit). L8, 30 s.w.g. enam., $\frac{1}{4}$ in. long, on 0·3 in. diam. air cored former with screening can.

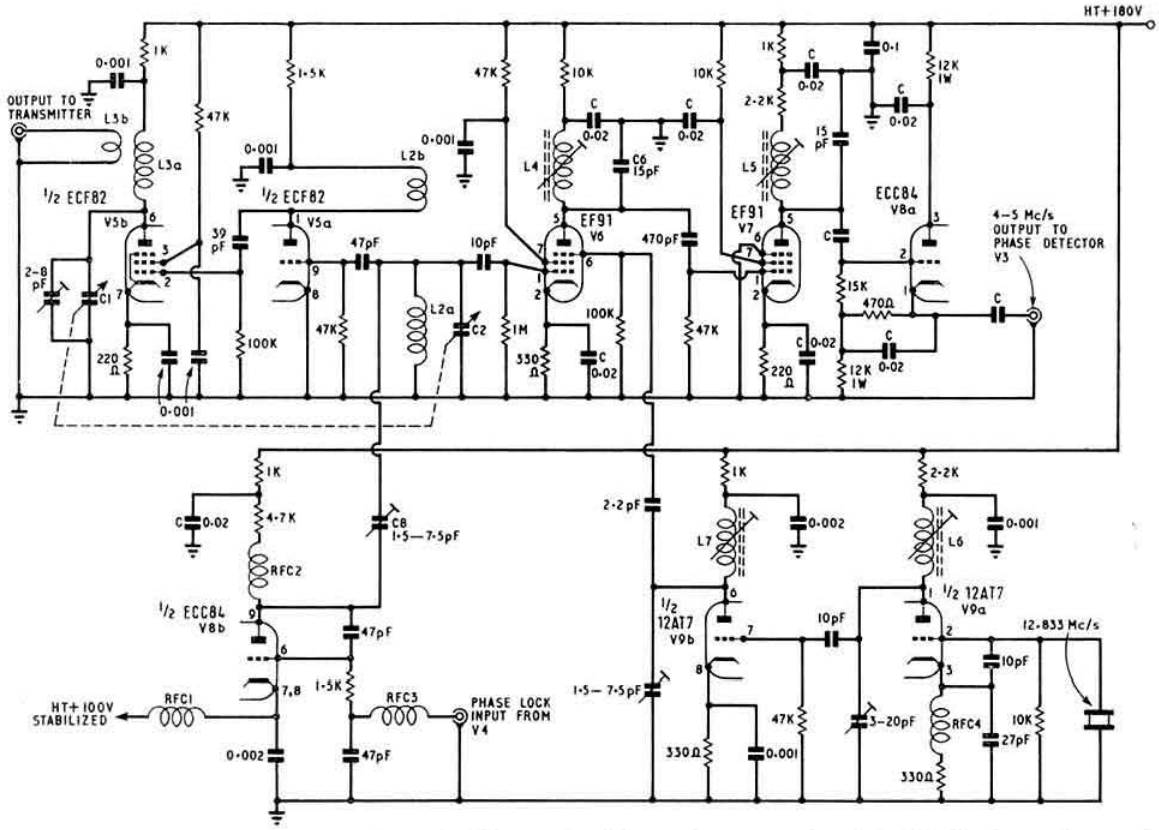


Fig. 5. Circuit diagram of the r.f. unit. C, 0·02μF ceramic; C1·2, ganged variable capacitors, approximately 8 + 8pF. L2a, 5 turns, 26 s.w.g., tinned copper, ¼ in. long, on 0·3 in. diam., former. L2b, 1 turn, 26 s.w.g., p.v.c. covered, wound over earthy end of L2a. L3a and L3b as L2a and L2b. L4, L5, 34 s.w.g. enam., 0·8 in. long, close wound, on 3/8 in. diam. slug tuned formers with screening cans. L6, 10 turns, 32 s.w.g. enam., close wound, on ¼in. diam. slug tuned former. L7, 6 turns, 24 s.w.g. enam., close wound, on ¼ in. diam. slug tuned former. RFC1, 2, 3, v.h.f. chokes, 40 in. 30 s.w.g. enam., close wound, on $\frac{1}{16}$ in. diam. rod. RFC4, 200μH choke.

absorption wave-meter. The crystal oscillator/multiplier chain is first tuned for maximum output at 77 Mc/s. C8 should then be set to about one quarter of its maximum capacity and the reactance valve disabled by short-circuiting its input socket. With the aid of a 2m receiver, C2 is tuned until the second harmonic of the oscillator V5a falls in the band. The input to the phase detector from V5a is then connected and the grid current of V3 in R3 measured. L4 and L5 are now adjusted to give a reasonably flat response as V5a is tuned across the band. The current in R3 should be of the order of 50μA. L1 and C5 in the phase loop can be resonated at 4·5 Mc/s with the aid of the g.d.o. The reference oscillator and phase loop may now be connected after removing the short circuit from V8b grid. C4 for the time being is disconnected by opening S1. C2 is now varied until the meter shows a fairly rapid swing from maximum to minimum (or vice-versa) with tuning. In this region the oscillator is phase locked and a steady, pure note should be heard in the 2m receiver at a frequency determined by the setting of the transistor oscillator. When correctly locked, variation in tuning of the reference oscillator causes the meter deflection to change; the reading increases as the frequency is moved in one direction and decreased when moved in the other. To increase the frequency range over which the system locks without the need for re-adjustment of C2, C8 may be increased (C2 will then also require adjustment because of the additional capacitive loading introduced). There is a maximum value for C8 beyond which violent oscillations occur round the feedback circuit.

Once the circuit has been set, S1 may be closed and the system should remain in lock. When using the v.f.o. to drive a transmitter, S1 must always be closed, otherwise there is a possibility of spurious signals being radiated.

Conclusions

In this arrangement the maximum frequency range which can be covered without re-adjustment of C2 is about 700 kc/s at 2m. This could be improved by more careful design to give better limiting before the phase detector, a wider bandwidth phase loop and wider frequency control capability by the reactance valve. A variable capacitance diode would possibly give better results than a reactance valve, but these devices are not easily obtainable. The whole of the 2m band can, of course, be covered with the circuit as shown but when making large frequency changes C2 needs slight re-adjustment to maintain phase lock.

It is admitted that this type of v.f.o. is rather complicated but it does pave the way to more interesting possibilities. There seems to be no reason why one could not construct a transmitter consisting simply of a free running oscillator controlled by a phase detector fed from the output of a crystal controlled converter and a reference oscillator at the

(Continued on page 373)

Overhauling the Marconi CR100

By B. HAYES, G3JBU *

THE CR100 was built by the Marconi Wireless Telegraph Company at Chelmsford for the Royal Navy and given the service No. B28. Although seven different models were produced, the circuitry is basically the same in each case, the minor differences being simply to satisfy the differing requirements of the various services. The different models were designated CR100, CR100/2, CR100/4, CR100/5, CR100/7 and CR100/8, all with a frequency coverage of 60 kc/s to 420 kc/s and 500 kc/s to 30 Mc/s in six bands. The basic circuit is shown in the form of a block diagram, Fig. 1, which is common to all CR100s produced.

The CR100 is still available on the surplus market in plentiful numbers, the condition being the principal factor which governs the price. The writer's CR100 was purchased in a very poor state, looking as though it had spent several months on the sea bed! The aim of this article is therefore to show that with a little time and patience, one can bring the receiver up to its original condition.

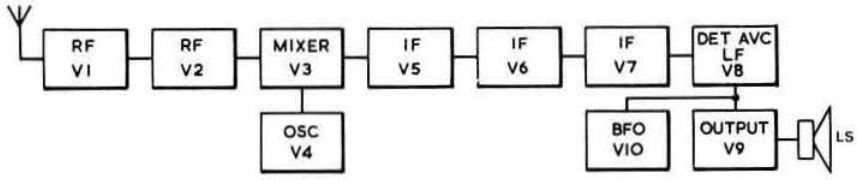


Fig. 1. Block diagram of the CR100 receiver.

Power Supply

One of the most important sections of any receiver is, of course, the power supply, and this has proved quite trouble free, apart from the occasional replacement of the rectifier valve, a U50. The replacement can be either a 5Z4G or 5Y3G. If the receiver has been standing unused for a considerable time, another component which is likely to fail is the electrolytic smoothing capacitor, which is an 8+8+8 μF 400V working wet electrolytic can type. This has a tendency to dry up after a few years' service, because the temperature in the cabinet soars owing to the eleven valves. A 120 mA fuse is used in the centre tap of the mains transformer, and should this have " blown " it is advisable to check the electrolytics before replacing this fuse. It is still possible to obtain this triple capacitor and the writer replaced it with a 450V working type. The mains transformer has a tapped primary, with taps at 200/215V, 220/230V and 240/250V, but with a nominal 240 volts a.c. supply, it is wiser to use the 220/230V tap on the transformer, otherwise the heaters of the valves will be under-run. A couple of 0·01 μF paper capacitors are fitted on each mains line, and the centre of these is taken to the chassis, which means that unless an efficient earth is connected to the receiver, it is possible to get quite a " tingle ". These capacitors are fitted on the mains side of the ON/OFF switch, so are permanently in circuit.

Audio Stage

The audio stage was the first to be tackled. The valve used by the manufacturer was a KT63, the nearest equivalent of which is the 6V6. This gives 2 watts of audio, which is adequate for the usual 3 ohms speaker. The multi-ratio output transformer incorporated in the CR100 and CR100/2 has a 3 ohm output, which is taken to two binding posts on the paxolin panel at the rear of the receiver. The output of the models /4, /5, /7 or /8, however, is intended to match into a 1000 ohm speaker, and it is therefore essential to replace the output transformer with an ordinary speaker transformer to match a 6V6 into 3 ohms. The two phone jacks on the front panel automatically mute the speaker on models CR100, /2 and /8 when a pair of high resistance headphones is plugged in. A very suitable pair of headphones is the " CHR " series which employs balanced armatures and is very sensitive. Also on the rear panel is a pair of terminals for 600 ohms output for use with a line or amplifier, and the output from these terminals is unaffected when a pair of headphones is connected to the receiver.

Detector and Noise Limiter

The second detector, a.v.c. and i.f. amplifier precede the output stage and the valve used for this is the DH63 or 6Q7. The triode section of this valve is resistance-capacity coupled to the grid of the output valve, a 6V6. If i.f. instability is heard on the speaker it is advisable to check the 500 pF capacitor connected to the anode of the DH63, as this has often been found to be leaky on the /8 model.

A noise limiter using an EB34 is fitted, but no variation of limiting is possible. This should therefore be replaced and a suitable circuit using an OA81 diode is shown in Fig. 2. The switch for this can be placed on the front panel between the R.F. GAIN control and the main tuning knob. Other circuits have been tried, but the one shown in Fig. 2 has proved most effective against Loran on Top Band and ignition QRM on 14 and 21 Mc/s.

I.F. Alignment

If one possesses the Service handbook or manufacturer's manual on the i.f. alignment, this can be a most fearsome task requiring a considerable amount of laboratory equipment. However, the alignment was successfully undertaken

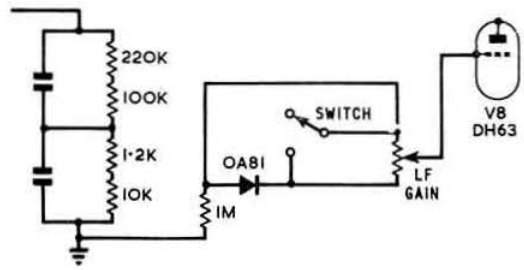


Fig. 2. A suitable noise limiter circuit. The only additional components required are an OA81 diode, a 1 Megohm resistor and a switch.

* 31 Beverley Crescent, The Headlands, Northampton.

just using a simple r.f. generator and multimeter. If it is possible to borrow a wobbulator and oscilloscope, the job will be easier, but even if only a 'scope is available, a simple wobbulator (frequency modulated oscillator) can be constructed using a couple of valves. Circuits covering just standard intermediate frequencies have appeared in radio magazines, and with this, and an oscilloscope, alignment of any receiver will be made easier, and there are obvious advantages when constructing s.s.b. filters.

To return to the alignment of the CR100 receiver, before alignment can commence, a special ganging or aligning tool must be acquired. The correct tool was originally supplied by the Marconi Company, and is no longer available, but a suitable tool can be made quite easily. In the CR100 series, all trimmers have locknuts which have to be unscrewed before the appropriate trimmer can be turned, and after alignment, these locknuts must be tightened up. All that is required to accomplish this is an open-ended 6 BA box spanner and a piece of $\frac{1}{8}$ in. internal diameter copper or brass tube about 6 in. long. The end of the tube is formed into an oval to fit the trimmer, and is then passed down inside the box spanner. When aligning, unlock the nut with the box spanner, turn the trimmer with the tube and then lock the nut again with the box spanner.

The i.f. of all models is 465 kc/s. It must be stressed that alignment of a communications receiver must not be undertaken haphazardly, and if the owner has not lined up a receiver before, it would be wise to practise on an old broadcast receiver. It is advisable to check which of the three i.f. circuits is most off-tune, and then proceed to put this roughly into alignment first. The method of checking i.f. sensitivity is to disconnect the top cap from the X66 mixer valve and apply the 465 kc/s signal, with modulation, to this valve. The multimeter is connected to the loudspeaker output terminals at the rear of the receiver, the pass-band switch is set to 300 c/s and the r.f. and i.f. gain controls to maximum. Then by adjusting each trimmer in turn on the five i.f. cans, it is possible to find out which circuit is most out of tune. The procedure is then to roughly align this transformer first. The modulation on the signal generator is then switched off, the band-pass turned to 3 KC/S, the band-change switch to BAND 6, and the operational switch to MOD-MANUAL. Then starting with the i.f. transformer to the right of the r.f. gain control, tune for maximum output. The alignment is then proceeded through the i.f. section of the receiver in the usual manner, starting at the first i.f. transformer and ending at IFT5. If two peaks are observed on the meter when trimming the i.f. transformers, the correct one is when the core is furthest out of the coil. On IFT1 and 2, the trimmers are adjusted from the top of the can, but on the remaining i.f. transformers adjustment is made from both the top and bottom, so the best method is to operate the receiver on its side. Care must be taken not to touch the crystal neutralizing capacitor which is mounted in the bottom of the first i.f. transformer can. After going through the i.f. chain several times, each time reducing the output from the signal generator, and adjusting the r.f. and a.f. gain controls and sensitivity of the output meter, correct alignment should be achieved, or at least as perfect as one can expect without proper laboratory equipment.

Crystal Filter

A quick check on the alignment of the crystal filter should now be made and this can be done by rotating the band-pass switch, starting at the 1200 c/s position and switching through to the 6 kc/s position. If no difference is noticed in the audio it means the crystal filter is inoperative. The only true method of lining up the filter is with an oscilloscope in order to observe the correct resonance curve. However, the writer was able to line up the filter fairly accurately by tuning in two signals in one of the amateur bands (3·5 Mc/s band was found ideal) and then adjusting the crystal resonance

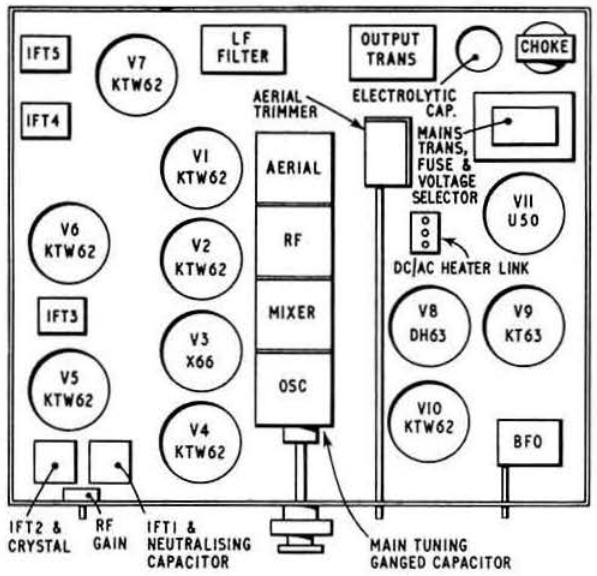


Fig. 3. The layout of the principal components in the CR100 viewed from above. Suitable alternative valves are as follows: V1, 2, 4, 5, 6, 7, 10, KTW61, 6K7G, or 6J7G; V3, X65 or 6K8G; V8, 6Q7G; V9, 6V6G or 6F6G; V11, U52, 5Y3G or 5Z4G.

trimmer in bottom of IFT1 can to cut the sideband of the interfering signal. This adjustment should be made with the bandpass switch in the 1200 c/s position. With some of the receivers handled by the writer the crystal has proved to be inactive owing to age, and it would be advisable to check on this point before attempting re-alignment of this section. The crystal is contained in the second i.f.t. can. The usual soap and water treatment has proved successful in all cases, but it is important not to handle the crystal after drying as the grease transferred is usually sufficient to " kill " even the most active crystal. If an oscilloscope and wobbulator are available, a check can be made to see that the peak of the crystal comes near the centre of the i.f. passband. After the crystal has been cleaned the i.f. should be peaked up once again.

Beat Frequency Oscillator

The b.f.o. is an electron-coupled Colpitts circuit and is coupled to the DH63 through a low value capacitor. This provides the right amount of b.f.o. injection for copying s.s.b. It was found that the oscillator (b.f.o.) did have a tendency to drift and so the anode and screen of this valve, a KTW62, or in the writer's case a 6K7, was connected to the 250V h.t. line via a VR150/30 voltage stabilizer and a suitable dropping resistor. The correct setting of the b.f.o. capacitor is dealt with in the section on i.f. alignment.

To copy s.s.b. easily it is essential that the oscillator can be adjusted by an equal amount above and below the i.f. pass-band centre frequency when the b.f.o. knob is turned. When it is working correctly the b.f.o. knob for copying s.s.b. (lower sideband) should be between 10 and 11 o'clock, and for s.s.b. (upper sideband) between 1 and 2 o'clock. To check that the b.f.o. is correct, put the pass-band switch to 1200 c/s and the operational switch to mod-manual. Set the b.f.o. knob to the 12 o'clock position, and note whether the pin through the b.f.o. spindle is vertical. If not, the b.f.o. is incorrect and must be adjusted. To carry this out, switch to c.w. which, of course, switches on the b.f.o., tune a signal to the centre of the pass-band, and vary the iron-dust

core in the b.f.o. coil until zero-beat is achieved with the capacitor half-meshed.

R.F. and Oscillator Sections

When attempting alignment of these sections a good stable r.f. signal generator is required, although the writer has aligned his receiver using a 100 kc/s-1 Mc/s crystal frequency standard on the lower ranges and a 5 Mc/s standard on the higher ranges. It is very difficult to attempt any alignment without some form of signal standard, especially on the higher ranges. With the excellent screening and strong construction employed in the r.f. and oscillator sections, frequency pulling when aligning is practically non-existent. For those who wish to align these sections, start on band one. Put both r.f. and i.f. gain controls to maximum, and connect the signal generator to the control grid of V3 (X66) and an output meter on speaker terminals. Alignment points on this band are 60 kc/s and 160 kc/s, while on the other bands the alignment points are as follows:

Band 2	160 kc/s and 400 kc/s
Band 3	500 kc/s and 1·4 Mc/s
Band 4	1·4 Mc/s and 4 Mc/s
Band 5	4 Mc/s and 11 Mc/s
Band 6	11 Mc/s and 30 Mc/s

The slug is adjusted at the l.f. end and the trimmer at the h.f. end of each band. Repeat these operations several times to obtain correct tracking and the extra time taken with this will be well-repaid in accurate calibration. One or two receivers that have been aligned have suffered from instability, noticeable on range 6 from about 24 Mc/s up to 30 Mc/s, in the form of i.f. "motor boating" when the r.f. gain is advanced to maximum. The only cure for this is the replacement of the de-coupling capacitors associated with the r.f. mixer and oscillator circuits. These capacitors are of the " paper " variety, which, owing to old age, tend to have a high leakage. If one is in possession of a capacity bridge, they can be checked for leakage and replaced, but failing that, complete replacement is advised. A type which has proved very suitable for this purpose is Hunts " Mold-seal " capacitors, which are obtainable from several of the mail order firms which advertise in radio magazines. All that remains is to peak up the r.f. trimmers, and if the receiver is to be used mainly for amateur band reception, this can be done on the amateur band section of ranges 4, 5 and 6. The various trimmers are shown in Fig. 4.

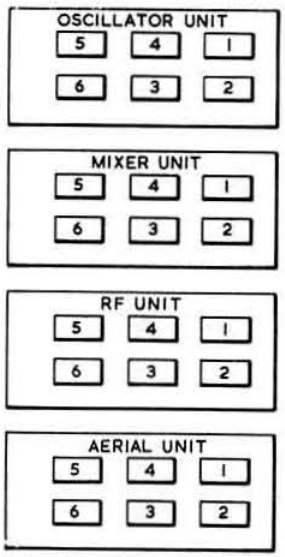


Fig. 4. The layout of trimmers in the coil compartment, viewed from below the chassis.

Receiver Assessment

When the r.f. and i.f. circuits are finally aligned, a receiver should be close to the original specification. In some receivers cleaning of the slow motion drive and gears has proved well worthwhile, and this necessitates removing the front panel, which is easily accomplished by unscrewing the PK self-tapping screws and removing the knobs. The drive and gears can be dismantled and cleaned in petrol or grease solvent; they can then be dried and re-lubricated with a light machine oil and grease. A lubricant which was found very suitable for this purpose is one of the molybdenum di-sulphide additives, which is used by car owners and supplied under trade names such as Moly-Slip. This has been used and does not tend to dry up as found with machine oil, and gives a much smoother slow motion reduction drive. In some cases it is worth stripping the enamel from front panel and case and either have it re-sprayed by a local car repairer or use one of the many aerosol paint sprays available. The lettering on the front panel can be renewed with Letraset or Panel Signs.

After the receiver has been re-aligned and brought up to standard, a log should be kept of the voltages present at the anodes and screens of the valves, and if one checks through the receiver every six months and measures the voltages and compares them with the log, it is easy to tell if the receiver performance is falling off, this not being apparent just by using the receiver daily. It must be remembered that it is possible to change valves in different positions, that is to say, using an r.f. valve in the place of one from off the i.f. strip, for instance. But as these valves are no longer in common use, it is possible to get a complete set of new valves for about £2 on the surplus market. Several years ago CR100 spares kits were available for about 55s. at some of the London surplus shops, and these were a really good buy, as they contained a complete set of replacement valves plus numerous resistors, capacitors and spare transformers, but these are no longer advertised.

Consideration was given to ideas on improving the r.f. gain by substitution of the existing r.f. stages which use KTW62s (6K7s or 6J7s) by 6SG7s which eliminates the top cap. The first r.f. stage did not seem worth the additional noise that the valve gave. No doubt by experimenting with some of the newer low noise r.f. valves the r.f. gain could be improved.

The CR100 has been in use at G3JBU's station for ten years as a standby receiver, and also as a tunable i.f. strip for use with a 2 metre converter. No doubt readers will have different or additional ideas for improvement of the design, but it will be hard to find another receiver (at the price) which is so stable after the customary warm-up period.

Phase-Locked V.F.O.

(Continued from page 370)

i.f. This could be of particular advantage on the v.h.f. bands as no transmitter multiplier chain would be required to achieve high stability. The difficulty is finding a means of electronically controlling the frequency of a comparatively high power oscillator. Possibly a varactor diode would provide the answer, but there would be some undesirable side effects to iron out, apart from cost. Taking the phase-lock idea a stage further, it might even be possible to frequency stabilize a klystron on, say, 3 cm with a very small amount of r.f. power from a crystal diode multiplier chain driven by a stable crystal oscillator (the frequency of a klystron can easily be varied by altering the reflector voltage). Amplitude modulation of an oscillator operating directly as a transmitter would almost certainly be impossible, but f.m. could be quite simply achieved by frequency modulating the reference oscillator. This could be done with the arrangement described but the value of C4 would probably need to be reduced.

Thus there are obviously many potential applications, all of which would rely entirely on the high-stability of a crystal oscillator, which is relatively easy to accomplish, and a low frequency variable oscillator which, if well designed and constructed, should not introduce significant drift. The increased complexity compared to a normal multiplication-type v.f.o. is surely justified.

On Bridge Building Kits

By D. V. NEWPORT, G3CHW*

HOW productive are you? Perhaps you are like me, full of ideas but somehow lacking the energy or incentive to carry them to fruition. The home shack is strewn with part finished items, ranging from tunnel diode amplifiers to v.h.f. transverters and perfectly good single sideband equipment needing just a linear and power supply. Is part of your problem the fact that you spend more time chasing around in the junk box for that elusive component that you know you have, than it takes to solder into place? If this is true of you then you are in good company, judging by increasing sales of commercial equipment.

Of course, some people genuinely have a lack of time. They spend half their lives commuting or even, as they grow older, have to accept more and more responsibility. You know, it is just not true that the higher up the tree one gets, the more free time exists.

No doubt too, you have finally succeeded in making some piece of test equipment only to wonder why you were ever able to do without it in the past. A recently completed v.s.w.r. bridge falls into that bracket. Stirring myself and girding my loins, I obtained a Heathkit Model HM-11U and settled down to produce. This was the easy way out.

It was thought that the exercise would perhaps be of value to others if a start was made on the assumption that the writer knew nothing. He doesn't anyway, so that part was easy, and the instruction manual was opened at page one and battle commenced.

A fit of depression descended; circuit diagrams hold no terrors but point to point wiring instructions complete with illustrations was unaccustomed luxury and with all the components on hand! A snag must exist somewhere. At this point it was decided that the next pass of *OSCAR III* was due and might be more profitable, but since no 144 Mc/s kilowatt was owned, that was a dead loss too, although the same few stations were heard.

Back to the Heathkit, and, quite remarkable, it all went together just as it said in the book. Even the correct way to strip the ends of co-axial cable was rediscovered but they didn't supply the necessary sharp pointed instrument with the kit, nevertheless, a few spare nuts and washers and even some solder and connecting wire were left over. The kit is indeed complete.

From all the foregoing you would be correct in deducing that G3CHW is not best known for speed of construction; a note was therefore kept of the total time involved, from unpacking to completed article, and all the while strictly following the instruction book, even to the extent of using a ruler to measure all component and connecting lead lengths. The total time involved, give or take a few minutes, was two and a half hours but not in one session. The work was spread over two nights and sandwiched between *OSCAR III* orbits and resulting inquest contacts on 144 Mc/s. At least one close neighbour would only have taken an hour flat whilst another acquaintance took four hours, but watched television the whole time!

The instrument was completed, but did not work; would there have to be lots of adjustment, re-soldering or re-positioning of load resistors or diodes? A transmitter was fired up and loaded though the s.w.r. bridge into a 100 watt power meter of 75 ohms impedance. This has a known and guaranteed flat frequency response from d.c. to 250 Mc/s, and uses a slab line technique. Frequencies from 3·5 Mc/s to 28 Mc/s were applied and as was hoped, a v.s.w.r. of 1 : 1 obtained. No adjustments whatever were made to the bridge other than normal setting of f.s.d. in the FORWARD position. The bridge was also reversed to compare the REFLECTED position and this agreed within about 2 per cent at f.s.d. Careful selection of diodes and judicious repositioning along the coupling lines would result in precise agreement but the point is purely academic.

The HM-11U has a very fine looking 200 microamp meter as an indicator. This incidentally, is of British manufacture, and is calibrated in s.w.r. up to 3 and reflected power to 25 per cent.

Since the object of using such a bridge is to reduce s.w.r. to a minimum, calibration is perhaps of secondary importance except as a guide, and as considerable mathematics dealing with complex networks are involved when considering v.s.w.r. calibration, the meter scale is best taken as read. Nevertheless, the writer, as brave—or stupid—as ever, attempted some evaluation, but would not draw swords with G3HRH on results to be expected.

A supply of 50 watt 75 ohm carbon resistors was available and first, two were connected in series and then three. The resulting readings were unexpectedly close to two and three v.s.w.r. respectively.

To confound the usefulness of such an experiment, the bridge was once more set up into the power meter, which is as perfect a load as can normally be obtained, and then transferred to a single 75 ohm resistor. These resistors are the tubular type favoured by amateurs as r.f. loads. Pains had been taken to preserve co-axial characteristics but for all that, the indicated v.s.w.r. was no longer 1 : 1, in fact it was about 1 : 1·2. This indicates the necessity to have loads of known "goodness" to make such tests (see RSGB *Amateur Radio Handbook*, Third Edition, page 483).

To delve into calibration problems is outside the scope of this article, but should interest exist, then it is strongly recommended that two published papers be read. In conjunction, probably all the information required is given, and an excellent understanding should result. The articles are by G3HRH in the RSGB BULLETIN, January 1964, and K1PLP in *QST*, November 1964.

It was found that an input power of about 10 watts on 80m and five on 10m produced full excitation although Heathkit suggest 20 watts for 80m, so there is plenty of leeway. The instrument is rated up to one kilowatt input. Insertion loss was not measurable up to 28 Mc/s and can therefore be ignored and the bridge left connected all the time. The instrument can also be used on 144 Mc/s but with a possible loss of 10 per cent. This has not been checked but would indicate that permanent connection on 2m is not advised.

The HM-11U is similar in operation to the reflectometer described on page 482 of the *Amateur Radio Handbook*, but a trough is used, not a strip line, and has been dimensioned to have a characteristic impedance of 75 ohms. Used unmodified, into a 50 ohm load, it showed a v.s.w.r. of 1·5. It is likely that a change of bridge resistor values would reduce this figure and the manufacturers should be able to advise. The writer did not make any adjustments at all and took it "straight from the book," so there is no doubt that you can do it too.

Just think, no more r.f. floating around in the shack, and no excuse for that matter, either. Incidentally, if you don't know how to solder, the instruction manual tells you how to do that too.

* 38 Huckford Road, Winterbourne, Bristol.

Marconi Booklets

Marconi Instruments have published three books which will undoubtedly be of interest to many readers. These are: *The Sig Gen Book 1; A.F. Book 1* and *Impedance measurements with a Q Meter*. Requests for copies should be addressed to Marconi Instruments Ltd., St. Albans, Herts.

The Ground Beneath Us

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

IT is possible in these days of proliferate journals devoted to Amateur Radio to read at least once a month of the particular attributes of someone's pet aerial system, or of the general characteristics of aerials for varying parts of the frequency spectrum. Many hundreds of thousands of words are written, to be assimilated, on the subject of radiators of energy, but in nearly every case the author devotes himself to a study of what is up in the air, and completely ignores the effects of the ground beneath his feet.

Any aerial system, and any mode of propagation, is affected by the physical constants of the earth to some degree, and it is the purpose of this article to consider under what circumstances the earth can play a significant part in the determination of the overall characteristics of radiation and propagation. The effect of the earth's presence and its varying physical properties comes into such widely divergent problems as the ohmic losses of a v.l.f. aerial system, the reflection loss at the intermediate ground points of multi-hop ionospheric propagation at h.f., and the variation of field strength close to the ground at v.h.f. In practice, it is possible to classify these effects into three main groups:

(i) ohmic losses as a conductor of current,
(ii) skin losses as a conductor supporting propagation of a surface wave,
(iii) reflection losses as a mirror to incident wavefronts

and each group will subsequently be considered in more detail. Those familiar with the detailed physics of electromagnetic radiation over a finite non-perfect earth will quickly detect a degree of simplification of the problems, but this article is intended to be a simple survey and by no means exhaustive. The author, therefore, begs the indulgence of those "in the trade," and refers those seeking a more rigorous explanation to the references given at the end of the article.

Although classified into three groups by virtue of the part played by the earth in each case, the effects of the earth can always be related in every case to its behaviour basically as a conductor of radio frequency currents, and before considering each group, we should stop to examine the physical properties of the wide variety of soils, stones and water which go to make up the earth's surface. Everyone who has played with electricity will know that the classification of materials into conductors and insulators is rather hypothetical. All materials are in fact conductors of electricity, although some are very much better than others, and it is that group which are very poor conductors to which the misleading name of insulators is applied. The earth is no exception to this rule, and it is possible to classify various geological types into grades of conductor, and to assign to them values of conductivity and also of permittivity in the same way that any other physical material can be classified.

When current flows in the earth's surface, at radio frequencies, there arises the well known "skin" effect, met more often by amateurs at v.h.f. In simple terms the current tends to concentrate near the surface of the conductor, and the depth of penetration at which the current has fallen to some arbitrarily low fraction of its surface value, varies as a function of frequency, being less at higher frequencies. Normally the conductors are homogeneous or at best plated with a good conductor to sufficient thickness that most of the current flows in the plating layer. In the case of the earth, the geological formation of its crust resembles a multiple sandwich of layers of rock and soil of widely varying inherent conductivities (Fig. 1). Consequently, the effective conductivity of the ground in any region will depend upon the depth of penetration of the radio frequency currents, and will, therefore, be a function of frequency in its own right. For example, a typical area might consist of a layer of alluvial soil some 10 ft. thick over a deep rift of older rock. At relatively high frequencies (>2 Mc/s), most of the current will flow in the upper layer of good conductivity soil, and the effective conductivity will be high. At lower frequencies, however, the penetration will be such that substantial amounts of current will flow in the underlying rock and the effective conductivity will be greatly reduced.

The depth of current penetration is also a function of the conductivity itself, being greater for poorer conductivities, and this factor must also be taken into account when assessing effective conductivities. The expression for the depth of penetration is given by:

$$i_d/i_s = e^{-pd} \qquad \ldots\ldots\ldots\text{(i)}$$

where i_d = current at depth d (cms)
i_s = current at surface
p = constant—see expression (ii)

The constant p is a function of frequency and conductivity, and for frequencies below 2 Mc/s is given approximately by:

$$p = \sqrt{(4\pi^2 \times f \times \sigma \times 10^6)} \qquad \ldots\ldots\ldots\text{(ii)}$$

where f = frequency in Mc/s
σ = conductivity in e.m.u.

From equation (i) it is clear that for any given frequency the depth of penetration is much less in ground of good conductivity, and in our previous example is largely affected by the upper layer of alluvial soil which has a good inherent conductivity. Table I shows how the penetration depth varies with frequency and with the value of conductivity at the surface.

The map in Fig. 2 gives a general guide to the variation of

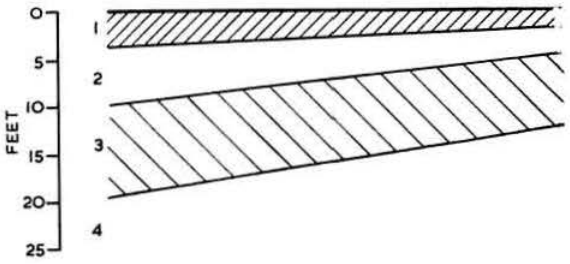


Fig. 1. Typical section of earth's crust showing geological strata.

Region	Nature	Conductivity (e.m.u.)
1	alluvial soil	20×10^{-14}
2	sandy soil	4×10^{-14}
3	chalk	10×10^{-14}
4	young rock	1×10^{-14}

* 73, Warren Way, Digswell, Welwyn, Herts.

TABLE 1
Depth of penetration in feet (Current density = 10 per cent that at surface)

Surface Constants	0·2 Mc/s	1 Mc/s	1·5 Mc/s
Sea Water = 4×10^{-11} e.m.u.	4·3	1·9	1·6
Good Soil = 10^{-13} e.m.u.	85	38	31
Poor Soil = 10^{-14} e.m.u.	270	121	99

effective conductivity over the UK. The figures quoted are for frequencies up to 1·5 Mc/s, but the general trend can be assumed for higher frequencies. Generally speaking, conductivity is moderate to good over the central and south-eastern part of England, and poor to moderate in the west and north-west. In Scotland, it is poor except in the Lowland areas where it improves slightly and in Northern Ireland it is moderate, with a deterioration towards the north-west.

Little has been said so far about permittivity of the earth as a dielectric. For frequencies below 2 Mc/s, it is unimportant, but at increasing frequencies it assumes a greater role, when the effectiveness of the earth's surface as a reflector is considered. In general, a higher permittivity can be associated with higher conductivities, and it is convenient to discuss the earth's behaviour at these higher frequencies again in terms of conductivity, which can be more readily assessed empirically, although the earth's behaviour at such frequencies must really be, in physical terms, a measure of its ability to accept an electric charge, and hence its permittivity. A more detailed explanation of the relationship between permittivity, conductivity and frequency is given in Section 16.01 [1].

Ohmic Losses and Earth Returns

The first classification of earth effects concerns those applications for which the ground acts as the return path for the flow of r.f. currents. This is most commonly met at frequencies up to 2 Mc/s when the aerial system in use comprises an unbalanced radiator, often wholly or partly vertical, with an effective length up to a maximum of a quarter-wavelength or just over. In such cases the aerial is driven by a generator connected between the bottom of the radiator and the ground (Fig. 3).

The current distribution along the radiator is such as to be at a maximum value at or near the ground, decreasing approximately sinusoidally to the end of the radiator at which point it must be zero. Because of the current in the radiator, charges are induced in the earth surrounding it, to give rise to a conduction or circulating current which flows back to the generator. This current flows in the ground at a penetration which, as already mentioned, varies with

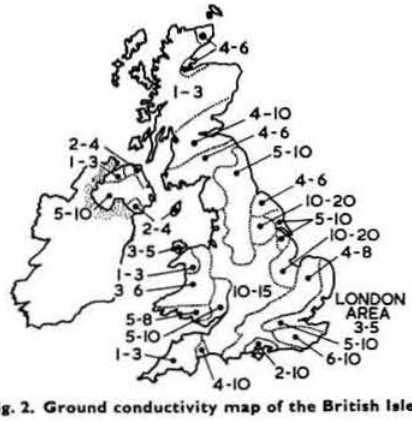


Fig. 2. Ground conductivity map of the British Isles.

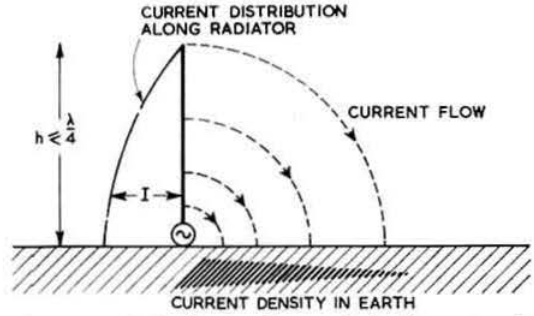


Fig. 3. Current distribution on a short vertical radiator over a plane earth.

frequency and near-surface conductivity, decreasing as both increase. The net effect is to include in the series circuit representing the aerial system, a resistive loss term through which the aerial current flows, and which is dependent upon the near-surface conductivity in the neighbourhood of the aerial.

In order to determine the aerial efficiency we need to compare the power dissipated in the various resistive elements of the circuit: reactive elements can be ignored, the only losses associated with them being the small ohmic losses of practical inductors, and the equally small dielectric loss of

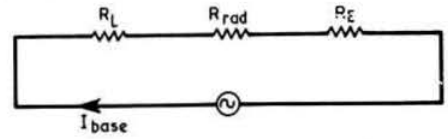


Fig. 4. Equivalent circuit for a short vertical aerial over a plane earth.
R_L = ohmic losses
R_{rad} = radiation resistance
R_E = effective earth resistance

practical capacitors. Fig. 4 shows the overall circuit losses, which comprise the ohmic loss R_L of the aerial tuning components and the aerial conductor itself, the radiation resistance R_{rad}, and the earth loss resistance R_E.

A word about radiation resistance: this is a fictitious resistance which is included to account for the power dissipated by radiation, i.e. its value is determined by the useful radiated power and the current flowing in the aerial at the feed point. It does not exist as a physical resistance in the same way that R_L and R_E do. Of the three resistive elements dissipating power (by I^2R), only that in R_{rad} can be considered useful: that in R_L and R_E is totally wasted as heat, although it still has to be supplied by the transmitter. Since the same current flows through all resistances, the efficiency of the aerial system is given by:

$$\textit{Efficiency } \eta = \frac{\textit{power radiated}}{\textit{power supplied}} = \frac{R_{rad}}{R_L + R_E + R_{rad}} \quad \text{..(iii)}$$

To all intents and purposes R_L can be neglected, being typically a fraction of an ohm. Thus any increase in R_E or decrease in R_{rad} will degrade the aerial efficiency as a radiator. The value of R_{rad} is fixed for a particular aerial by its physical size and shape, being typically 35 ohms for a vertical quarter-wave wire, and as low as 9 ohms for a vertical sixth-wave wire. Hence the shorter the aerial (electrically) the better is the earth system required to maintain a given efficiency. This can also be expressed by saying that for a given input power, the shorter aerial with lower radiation resistance gives rise to a larger feed current, and hence the

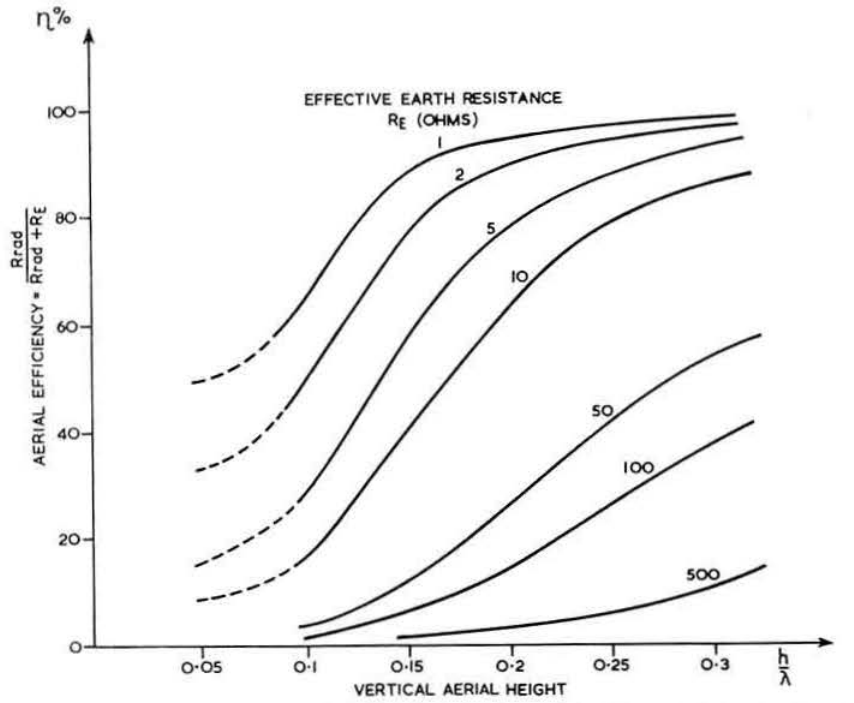


Fig. 5. Variation in efficiency of a vertical aerial over a finite earth, for different heights of aerial and various effective earth resistances.

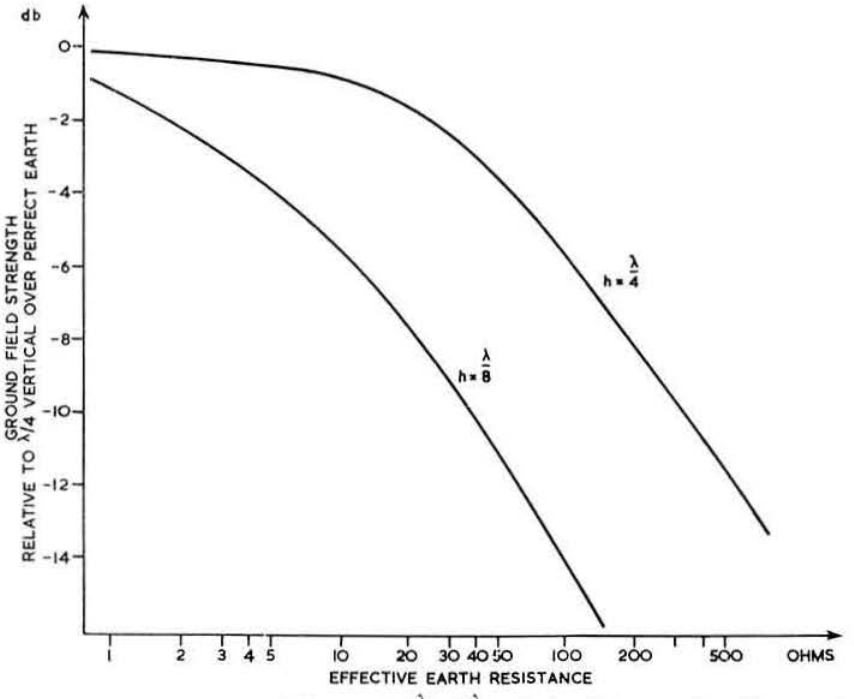


Fig. 6. Comparative ground wave field strength of $\frac{\lambda}{8}$ and $\frac{\lambda}{4}$ vertical aerials over an imperfect ground (neglecting ground wave attenuation.)

earth loss must be reduced to compensate. The value of R_E varies widely, from as much as 300 ohms for sandy soil, to as low as 2-3 ohms for a comprehensive earth system in good soil.

Fig. 5 shows how the aerial efficiency varies with effective electrical height for differing values of earth loss resistance. It is interesting to note that with a very good earth system ($R_E \leq 2$ ohms), an eighth wave vertical radiator is almost as efficient as a quarter wave radiator over the same earth, the figures being 66 per cent and 95 per cent respectively, or 1·6 db. Allowing for the difference in field strength due to the shape of the radiation patterns, the eighth-wave aerial would be 1·7db down on the quarter wave version at a distant point. If the earth loss were that of a simple "spike in the ground," typically 100 ohms, the field strength from the shorter aerial would be 8·5db down on the quarter wave aerial, which itself would be only 27 per cent efficient. Fig. 6 shows the variation in field strength relative to a quarter-wave vertical aerial over a perfect earth, for varying values of effective earth resistance, and for two different aerial heights, neglecting ground wave losses.

From what has been said it is clear that attention to the earth system of a base-fed radiator will pay large dividends, but the question now arises how the effective earth loss can in practice be reduced. The figure of 100 ohms for a single spike in sandy soil is not unrealistic, and to reduce this figure to the 2-3 ohms of a near perfect earth is beyond the scope of most amateurs, requiring as it would a massive system of radial earth wires, in excess of 120 in number and extending far out up to a wavelength from the base of the aerial—and all this in best quality agricultural ground as well! In practice, the best rule of thumb is to get as much copper wire into the ground as possible in the immediate vicinity of the aerial base, concentrating it near the aerial at the expense of the edges of the garden. The radial wires should be at least 16 s.w.g. and buried as near the surface as possible consistent with their remaining undisturbed by gardening activities. The reason

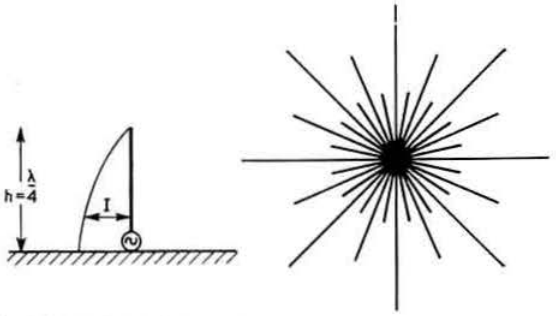


Fig. 7. Typical radial earth system for a short vertical aerial. The earth currents are concentrated near the base.

for keeping the wires near the surface is evident from Table I in the introduction, where it is seen that the depths of current penetration is a function of the near-surface resistivity. The inner ends of the wires should be joined to a heavy copper circular bus-bar (say 6 s.w.g. wire in a 12 in. diameter loop). Brazing is to be preferred for resistance to corrosion, although soft soldering is adequate provided the joints are painted with a bitumen paint to seal out moisture. The connection from the bus-ring to the earth terminal of the aerial tuning unit should also be by heavy gauge wire or wide strip to keep down both the resistance and the series inductance of this connection. It is permissible but not essential to join the outer ends of the wires, but too much interconnection will result in large circulating currents being induced in the buried loops with a consequent increase in losses—the opposite in fact of the desired result.

The remarks in the previous paragraph are particularly applicable to the majority of amateur aerials for the l.f. bands, where the length is less than a quarter-wave, and the current maximum is at the base of the aerial. For those few in the position to erect verticals (natural or loaded) with an effective length approaching a half-wave or even $\frac{5}{8}\lambda$, which is the optimum height of a vertical for maximum field strength along the ground (i.e. ground wave as distinct from sky wave), the radial earth system is more efficiently used and can consist of uniformly long wires in radial layout. There is no necessity to achieve a greater concentration of copper in the vicinity of the aerial than provided by such an arrangement. The reason for this is that with aerials in excess of a quarter-wave in length, the current maximum on the aerial moves up the wire away from the base, assuming in fact a position which is always electrically a quarter-wave from the remote end of the aerial. The current distribution in the ground is similarly modified, reaching a maximum value at a region away from the base of the aerial, and it is in this region rather than at the base itself where the maximum losses will occur. For any number of radial wires, the copper is then used more efficiently in such cases (Figs. 7 and 8).

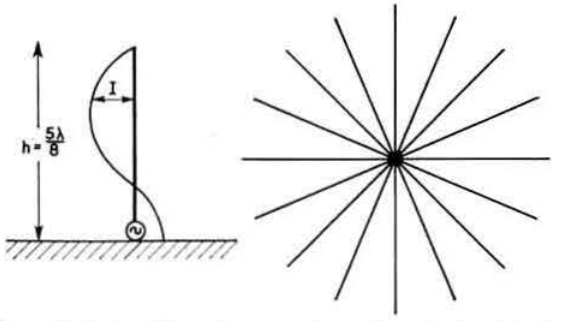


Fig. 8. Typical radial earth system for a tall vertical aerial. The distribution of earth current is more uniform.

Finally, a word of warning about ground connections. It is sometimes suggested both in writing and over the air that a rising water pipe is a good earth. This is most unlikely in practice since the amount of pipe in contact with the earth *in the vicinity of the aerial* is not large, and the contact resistance will be indefinite because of corrosion deposits on the outer surface of the pipe. There will probably be indifferent contact between lengths of pipe at the screwed unions because of the sealing compounds used, and in any case modern practice is to use a plastic tubing which will negate the whole exercise!

Many operators make the mistake of bringing a long "earth" lead into the shack, which is often some distance from the point of connection to true earth, being in the limit on the upper floors of a building. The result of this is that the long earth lead will necessarily radiate since it carries the aerial feed current, and in consequence the equipment in the shack will be up-in-the-air to r.f. with many consequent problems of filtering and feedback. A far better arrangement is to install the a.t.u. in a box at ground level immediately adjacent to the earth mat connection, and to connect back to the shack with a low impedance co-axial line matched into the a.t.u. This will not only isolate the shack from the radiating part of the aerial system, but will permit the vital vertical section of the aerial to be installed clear of obstructions, which could otherwise well affect its performance.

Attenuation of the Ground Wave

A receiving aerial will respond to radiated fields originating as waves arriving from different sources. It can receive waves which descend from the ionosphere after reflection, waves which descend from the troposphere by refraction and waves which arrive directly from the transmitting aerial. The first two classes are unaffected by the presence of the earth (except as discussed later), and it is the third group of nominally direct waves which are subject to modification by the earth's presence, and is normally known as the *ground wave*.

The first part is the field resulting from the sum of the wave arriving directly at the receiving aerial, and that arriving after reflection at the ground at an intermediate point. This part is generally called the *space wave* (Fig. 9). The other part of the ground wave is in fact a *surface wave* which is guided along the boundary formed by the earth's surface in much the same way that a transmission line guides an electromagnetic wave which propagates along it. As this wavefront passes over the earth's surface, energy is extracted from it to supply losses in the ground and it, therefore, suffers attenuation which is a direct function of the physical constants of the ground over which it is propagated. For aerials which are electrically close to, or, in the case of verticals, at the earth's surface, the path geometry is such that the direct and indirect components of the space wave virtually cancel out at the receiving aerial, and the major

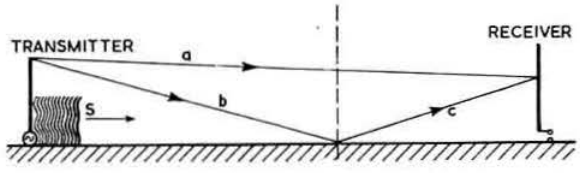


Fig. 9. Space waves and surface wave, together making up the ground wave.
S = surface wave (wavefront is normal to plane of paper).
a = b = c = space wave { direct component; incident component; reflected component

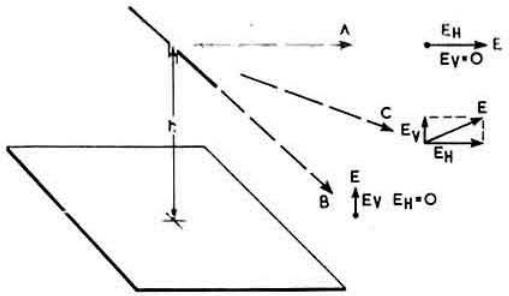


Fig. 10. Variation of polarization of the ground wave field with angle of azimuth around a horizontally polarized dipole.
h = height of horizontal dipole above reflecting plane
In direction A, field is entirely horizontally polarised
In direction B, field is entirely vertically polarised.
In direction C, field is elliptically polarized.

contribution to the received field is from the surface wave. The cancellation of the space wave arises from the 180° phase shift which the indirect component receives at the point of ground reflection—this is considered in more detail later.

The expressions for the value of the space and surface waves are very complex, even in the simplified form derived by Norton from the original Summerfeld equations. A detailed explanation is given in Section 16.03 [1], but it will suffice here to say that the surface wave expression differs for the case of vertically and horizontally polarized aerials. In the case of vertically polarized aerials, the surface wave is entirely vertically polarized in all directions of azimuth, and is reduced by an attenuation factor F, which is a function of distance, and of the ground conductivity, and generally increases with decreasing ground conductivity. At near-in points, F varies exponentially with distance but at greater distances varies inversely as the square of the distance. In the case of nominally horizontally polarized aerials, close to the earth's surface, the surface wave varies in polarization with the direction in azimuth, being horizontally polarized in the directions at right-angles to the aerial, elliptically polarized at intermediate directions, and completely vertically polarized off the ends of the aerial! The actual magnitude of the wave will, of course, vary with the horizontal radiation pattern of the aerial, and in general will be a maximum in the direction in which it is horizontally polarized, and decrease to a low value in the direction in which it is entirely vertically polarized.

These variations of polarization arise from the fact that the surface wave from the horizontal aerial is made up of two components, one vertically polarized and one horizontally polarized, and varying in value differentially with the angle of azimuth, the one being zero at right-angles to the aerial, and the other zero in the line of the aerial (Fig. 10).

How does the ground come into this already complicated arrangement? The vertically polarized term is subject to the same attenuation factor F as before, but the horizontally polarized term is subject to an attenuation factor G which is related to F by the expression:

$$G = \frac{F}{(\varepsilon_r + jx)^2} \qquad \text{.....(iv)}$$

where εr = permittivity of earth in e.s.u.

$x = \dfrac{18 \times 10^9 \sigma}{f}$

σ = conductivity of earth in e.m.u.

f = frequency in Mc/s.

Thus for lower frequencies, or for greater conductivities, G will be very much smaller than F, with the result that the horizontally polarized surface wave will attenuate much more rapidly with distance than the vertically polarized one. This is generally the case at frequencies below 2 Mc/s and normal ground conductivities.

So far we have been rather technical about the surface wave, but I make no excuses for this. Ground wave propagation is a very complicated subject, and even the foregoing explanations only skim the surface. It is, however, possible to summarize in a crude way what this means in practice—simply expressed it is this:

(i) A vertical aerial fed against ground will radiate equally in all directions a vertically polarized signal which will go further the better the earth over which it travels and the lower the frequency used. This will in fact be the best ground wave achievable.

(ii) A horizontally polarized aerial will radiate at right-angles to itself a large horizontally polarized signal which attenuates very rapidly, and off its ends a small vertically polarized signal which attenuates as in

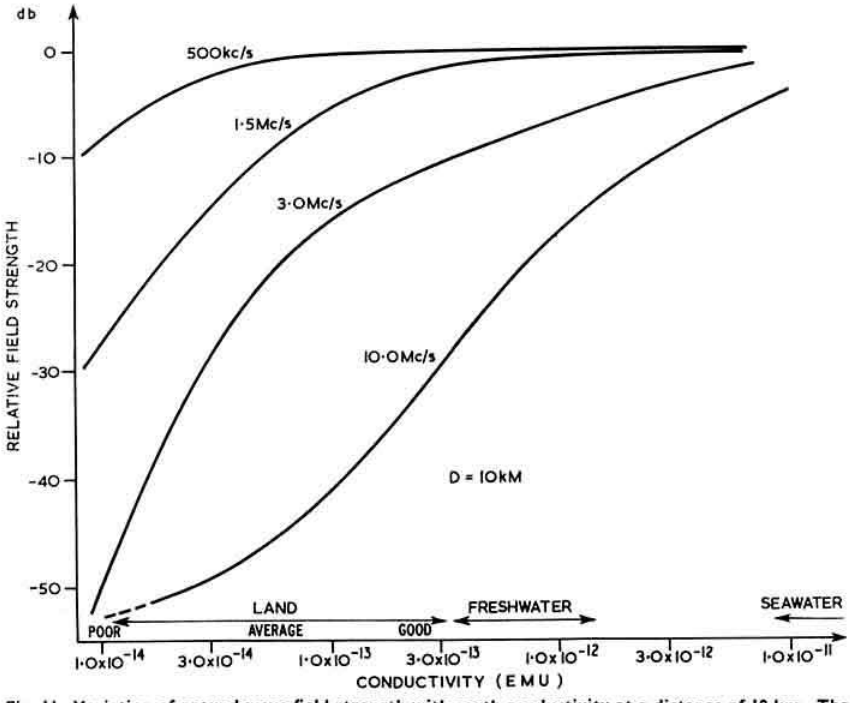


Fig. 11. Variation of ground wave field strength with earth conductivity at a distance of 10 km. The reference field is that radiated over a perfect earth.

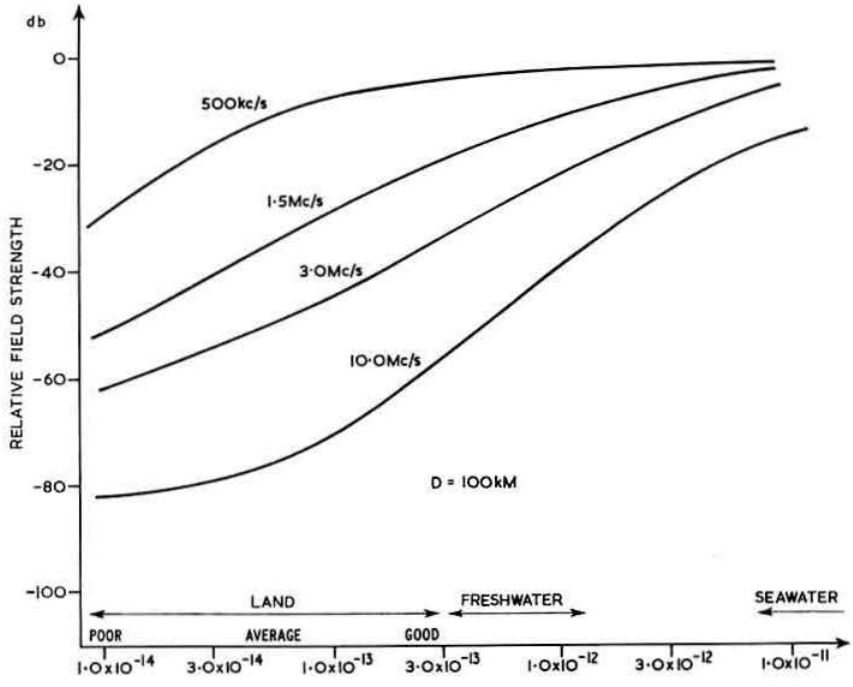


Fig. 12. Variation of ground wave field strength with earth conductivity at a distance of 100 km. The reference field is that radiated over a perfect earth.

(i). For good ground wave propagation, therefore, the horizontally polarized aerial is a non-starter in any direction.

Moral: a vertical aerial will get you further for daylight DX on 160m. (For moonlight DX the ionosphere plays a part—see vertical radiation patterns in Fig. 17.)

Further Moral: for round-the-country natters on 10m (or any other h.f. band) use a vertical for best results.

Having disposed of the horizontal aerial for ground wave working, it remains to examine to what extent in practice the physical nature of the ground between the transmitting and receiving aerials affects the attenuation of the vertically polarized ground wave. As already stated, the signal will propagate better over ground of good conductivity, being at its best over sea water, and at its worst over old rock layers. For a given path and radiated power the signal will be stronger at lower frequencies. In Figs. 11 and 12 the variation of field strength at distances of 10 km and 100 km is plotted as a function of ground conductivity for frequencies of 500 kc/s, 1·5 Mc/s, 3 Mc/s and 10 Mc/s. The value of the field strength is in db relative to the unattenuated field strength from a short vertical aerial ($<\lambda/4$) at the same distance over a perfect earth. In practice, the path is rarely of uniform conductivity throughout its length, and due allowances must be made for mixed path propagation. The worst examples of this are mixed land/sea paths. A fuller set of curves for various conductivities is given in [4]. It will be seen from these that at very low frequencies the attenuation with distance is almost independent of conductivity, whose effect becomes more marked as the frequency rises.

There is, of course, nothing which can be done either at the receiving or transmitting aerials to combat directly the path losses for ground wave propagation. The only solution is to move to an area of generally better conductivity, or to live on a boat at sea. It is not surprising that the signals received from the m.f. " pirate " radio stations are so good, when one considers the advantages of the sea (a) as a return conductor contributing to aerial efficiency, (b) as the first part of the propagation path to the listener.

Although nothing can be done about path losses by the amateur, there is even more reason why attention to the earth system as outlined earlier will pay dividends by radiating as large a signal as possible before the earth starts to attenuate it on its way to the receiving aerial.

Mirrors and Images

Reference was made earlier to the propagation of radio waves by ionospheric reflection. This is the usual means of propagation employed by amateurs using the h.f. bands, or indeed the l.f. bands after dark when the *D*-layer absorption is no longer present at low frequencies. The object in such cases is to work long-haul DX, and if one considers the ionosphere as a perfect curved mirror, then the geometry of the ray path to and from the ionosphere is such that the longest distance is covered by rays having the lowest angle of radiation above earth at the transmitting aerial. This is, of course, a gross over-simplification of the physics of ionospheric propagation, taking no account of variations of ionospheric density, refraction effects, convergence gain, etc. It is, however, basically true to say that the angles of radiation for longest distance communication lie in the range 0-10° above the horizontal, for single or multi-hop paths.

In order to make most effective use of an aerial for such purposes it is, therefore, advantageous to try to achieve a vertical polar diagram which concentrates most of the radiated energy within that range of angles of elevation. To achieve a narrow beam in the vertical plane is a function of the aerial itself, being typically obtained either by the use of parasitic elements (Yagi aerials) or multiple stacked driven elements (vertical curtain). Any of these aerials will *in free space* provide a horizontally aimed narrow beam, i.e. one whose maximum is at the optimum angle of 0° in simple ray theory. In practice, however, all such aerials must be installed at some finite distance above the ground, and this gives rise to an upward tilt of this narrow beam or " main lobe " as it is usually known. This upward tilt arises from the fact that radiation from the aerial at angles below the horizontal is reflected by the surface of the ground in front of the aerial and travels upwards towards the ionosphere.

The signal radiated at any particular angle of elevation is then the vector sum of the direct upward radiation from the aerial, and the reflected component from the ground. Fig. 13 shows the path for two typical rays from the aerial. They can be assumed parallel to one another after reflection because the distance to the ionosphere is far greater than the other dimensions involved, i.e. the height of the aerial above ground, which determines, by laws analagous to those of optics, the distance to the point of reflection at the ground. The impor-

tant thing to note is that the reflected ray is obliged to travel a greater physical distance than the direct ray, is delayed in phase as a result, and the resultant radiation is the sum of the two rays taking this phase difference into account. From Fig. 13 it is also clear that the phase angle (or difference in path length) will vary according to the height of the aerial above the reflecting plane, and the angle of elevation being considered. This gives rise to the modifications to the vertical polar diagram of the free-space aerial referred to above.

Since these modifications arise from the presence of the earth immediately in front of the aerial, we must first of all consider what happens to the vertical radiation pattern in the presence of a perfectly conducting earth plane, and then modify this result for the imperfect nature of the earth in practice.

The expressions for the vertical polar diagrams *over a perfectly conducting earth*, of single horizontally and vertically polarized half-wave dipoles are derived in full in Appendix 1.

(a) *For horizontal polarization*

$$E'_0 = 2 \cdot E_{0h} \cdot \sin\left(\frac{2\pi h}{\lambda} \cdot \sin \theta\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\text{(v)}$$

(b) *For vertical polarization*

$$E'_0 = 2 \cdot E_{0v} \cdot \cos\left(\frac{2\pi h}{\lambda} \cdot \sin \theta\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\text{(vi)}$$

where E'_0 = resultant field at distant point.
E_{0h} = field at same point in free space for a horizontal half-wave dipole.
E_{0v} = field at same point in free space for a vertical half-wave dipole.
θ = angle of elevation of point above horizontal.
h = height of centre of half-wave dipole above ground.

Expressions (v) and (vi) are basically of the same form, and the difference between them arises because, in the case of vertical polarization the wave is reflected from the surface with zero phase shift whereas for horizontal polarization there is a phase shift of 180° at the point of reflection. The reason for this phase shift is bound up with the behaviour of the electric and magnetic vectors of the incident wavefront at the reflecting surface, but an analysis of this point is beyond the scope of this article, and the reader is asked to accept the existence of this as a fact: a more rigorous explanation is given in Section 12.08 [1]. Two interesting points emerge from an examination of expressions (v) and (vi).

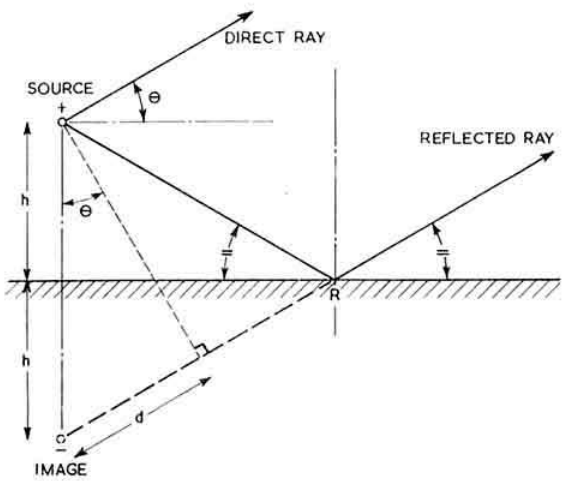


Fig. 13. Variation of field strength with angle of elevation due to the phase difference between the direct and ground reflected rays.
h = height of radiating source above reflecting plane.
d = difference in path length between direct and reflected rays.
θ = electrical phase = $\frac{2\pi d}{\lambda}$

Firstly, in the case of the vertically polarized aerial, the field strength at low angles of radiation (θ small) is large, approaching twice the free space value, and this is to a first order independent of the height above ground. In the horizontally polarized case, the field strength is zero in a horizontal direction ($\theta = 0°$) and increases as θ increases, reaching a maximum value of twice the free space value at the angle of elevation given by:

$$\sin \theta = \frac{\lambda}{4h} \quad \ldots\ldots\ldots\ldots\ldots\text{(vii)}$$

From expression (vii) there is obviously a particular height which will give a maximum value of field at any desired angle of radiation, and so by making h sufficiently large, the low angle field strength can be made very similar to that from the vertically polarized aerial.

Moral: For best low angle radiation from a horizontal dipole, get it up as high as possible. For a vertical dipole (or quarter-wave ground plane) it does not matter so long as it is in the clear. (For the perfect earth, h should be restricted *below* a wavelength in the vertically polarized case, to avoid a null at low angles: in practice this null is blurred over by the effect of the earth's presence, as will be described later.)

The second interesting point to emerge from a consideration of expressions (v) and (vi) is that, at the angle of elevation appropriate to the maximum radiated field, the value of that field is twice what it would have been in free space, i.e. a gain of 6db. Don't get too excited about this because in practice you can't remove the earth and so the free space case is never with us (except we get close to it at v.h.f.). Everybody's aerial possesses this 6db gain and it is still important to aim this maximum radiation at the correct angles of elevation to achieve better performance than your neighbours'.

Having examined what happens to a half-wave dipole over a perfectly reflecting earth, and bearing in mind the earlier assertion that for longest DX by ionospheric propagation we require radiation at angles of elevation between 0°–10°, it would now seem obvious that the easiest way of achieving this is by means of a vertically polarized aerial, which has a maximum of radiation actually at zero elevation ($\theta = 0°$), whereas the horizontal aerial has zero radiation at this angle, and increases only at the rate of sin θ for a given height. Unfortunately the case is not as clear cut as this because of the very point about which this article is concerned, the imperfections of the earth.

The phenomenon by which the earth, as an imperfect conductor, is able differentially to affect vertically and horizontally polarized electromagnetic waves owes its origin to some experimental work in the field of optics carried out by Sir David Brewster (1781–1868) who, as Professor of Physics at the University of St. Andrews, investigated the behaviour of non-polarized light when it was partially reflected and partially refracted at a plane surface bounded by media of different refractive indices, e.g. air and glass. He discovered that there is a critical angle of incidence of the light waves to the surface, at which the reflected wave is totally plane polarized. The original light can be considered non-polarized and, therefore, resolvable into two plane polarized components at the point of reflection. Only one of these is reflected at this critical angle: the other is suppressed (Fig. 14). At this critical angle, the *reflected* ray and the *refracted* ray are also exactly 90° apart. Since the angle of the refracted ray depends upon the relative refractive index of the materials, so will the critical angle vary: for ordinary glass it is approximately 57°. This critical angle is known in optics as the *Brewster Angle*: it is curious that, dependent as it is upon the wave theory of light for its justification, Sir David himself always opposed that theory during his lifetime.

It is a known and accepted fact nowadays that light is

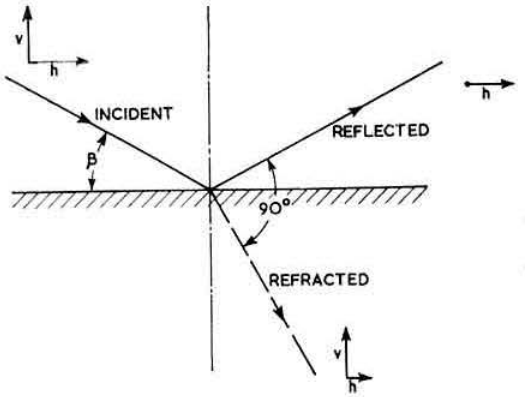


Fig. 14. The Brewster effect at an optical interface
β = Brewster angle (= 33° for glass)

merely one form of electromagnetic radiation at very short wavelengths, and that the refractive index of optics is analogous to the dielectric constant of electric physics. This being so, the phenomenon of the Brewster Angle must be, and is equally applicable to electromagnetic waves at radio frequencies being reflected at dielectric surfaces. In such cases, it is the wave which has its electric component normal to the surface, which is suppressed: we usually refer to this as vertically polarized when the surface under consideration is that of the earth, since it is radiated from a vertically orientated aerial. Were the earth then to behave as a pure dielectric, there would be some critical angle of incidence at which a vertically polarized radiation would be totally suppressed instead of being reflected upwards again as in Fig. 13. This critical angle is approximately 15° (measured above the horizontal) for such a case, which is approached at very high frequencies when the earth tends to behave as though it were a perfect dielectric. There is also a phase shift of 180° at this critical angle, the incident and reflected waves being 180° out of phase at angles below the Brewster Angle, and in phase at angles above. Therefore, the incident wave can be said to be subject to a complex reflection coefficient which varies both in magnitude and phase with the angle of incidence:

$$\textit{Reflection Coefficient} = \frac{\textit{reflected wave}}{\textit{incident wave}} = k \angle \phi \quad \ldots \text{(viii)}$$

where k = magnitude of the reflection coefficient
ϕ = phase shift between the reflected and incident waves.

In practice, as we have already seen, the earth is not a perfect conductor or dielectric; neither, therefore, is it a perfect reflector, and energy will be lost at the point of reflection from the reflected wavefront, into the earth. Additionally, because the effective permittivity of the earth is a complex function involving the conductivity and frequency of the reflected wave, there will be a modification to the phase shift at the point of reflection at any particular angle of incidence. Similarly, there will be a modification to the magnitude of the reflection coefficient.

The important thing to note is that, although the reflection coefficient is modified by the varying physical constants of the earth be the polarization vertical or horizontal, the Brewster effect can still be detected for vertically polarized waves, which suffer a limited degree of reflection at a critical angle called the *pseudo-Brewster Angle*, and undergo a rapid change of phase as the angle of incidence passes through this region, from an in-phase condition at larger angles, to a totally out-of-phase condition at lower angles. In the horizontally polarized case the reflection is almost perfect at all angles of incidence, and the phase shift remains approximately 180°. Figs. 15 and 16 show how the magnitude and phase of the reflection coefficient vary for vertical/horizontal polarization, and for differing frequencies and

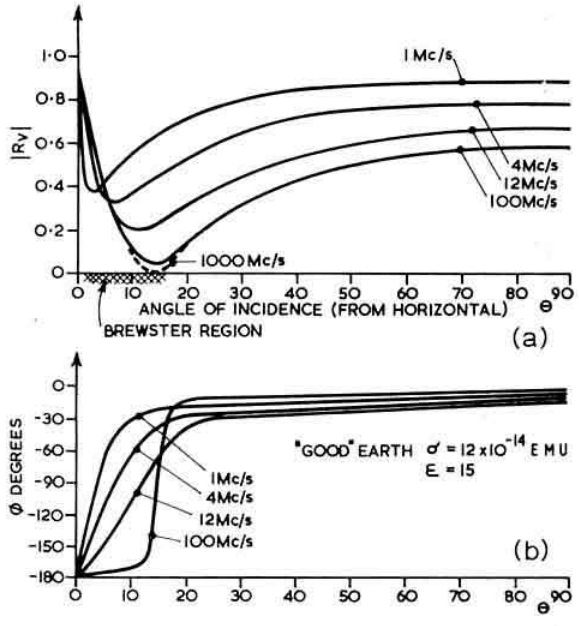


Fig. 15. Phase and amplitude of the ground reflection coefficient for varying angle of incidence of a *vertically* polarized wave. The curves for higher frequencies may also be taken as the trend for poorer conductivity at lower frequencies.

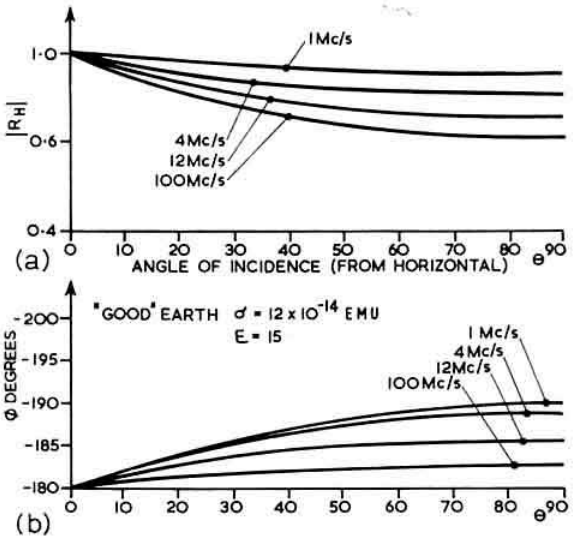


Fig. 16. Phase and amplitude of the ground reflection coefficient for varying angle of incidence of a *horizontally* polarized wave. The curves for higher frequencies may also be taken as the trend for poorer conductivity at lower frequencies.

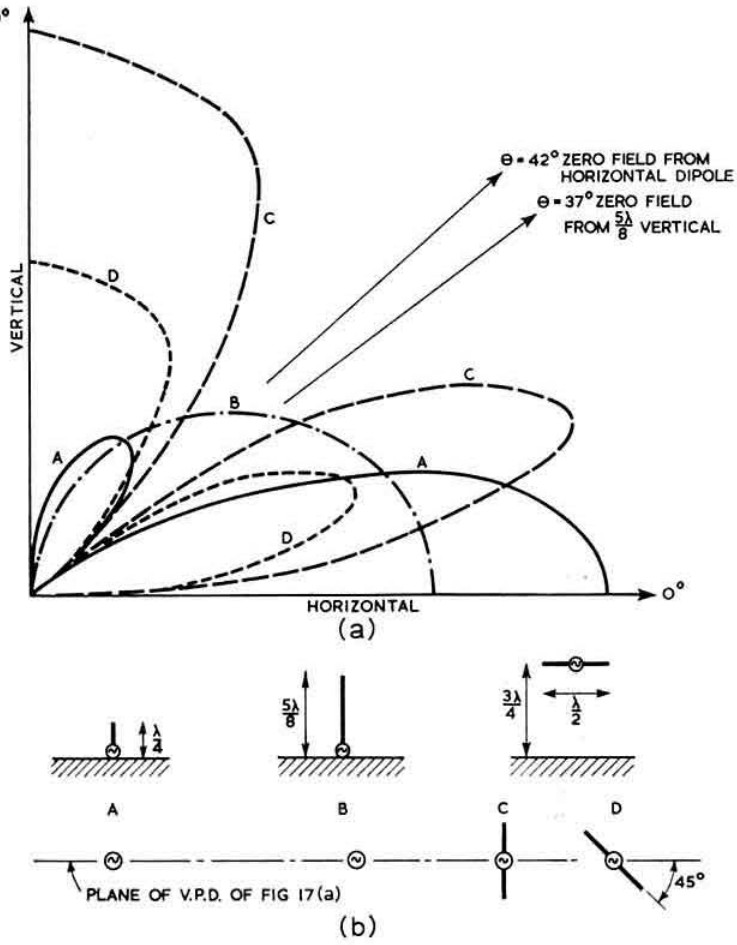


Fig. 17. Vertical polar diagrams of vertically and horizontally polarised aerials over a perfectly conducting earth. All patterns are to the same scale of relative field strength.
a ——— $\frac{5\lambda}{8}$ vertical b —·—· $\frac{\lambda}{4}$ vertical c — — — — $\frac{\lambda}{2}$ dipole at $\frac{3\lambda}{4}$ above earth (in direction of maximum azimuthal radiation) d - - - - - as c, but at 45° azimuthal bearing.

conductivities of the earth. It has already been said that these two are interdependent in determining the complex permittivity of the earth, and hence increasing frequency or lower conductivity will have the same result. The net effect is that the higher the frequency or the poorer the conductivity, the more pronounced does the Brewster effect become.

So much then for the theory of ground reflection and its modification by finite constants. How does all this affect the original practical aim—to get the best long haul ionospheric DX? Going back to the consideration of the perfectly conducting earth we came to the conclusion that the best aerial was the vertical because it radiated maximum energy in the low angle region irrespective of its position (within reason) whereas the horizontal aerial required to be well up in the sky to achieve the same result. But here is the catch. At those very angles at which the vertical ought to be excelling with maximum radiation, what happens? The Brewster effect is at its most pronounced, the ground reflection component which was going to aid the direct ray (Fig. 13) is almost totally suppressed, and the net radiation is 6db less than expected! The horizontal aerial meanwhile is virtually unaffected, and goes a long way to establishing superiority over the vertical, being nearly 9db better if it is approximately one wavelength high and the ground is poor and equal only if a half-wavelength high and the ground is good. The performance of the vertical-aerial can be improved by approximately 1db by increasing its length from 0·25 to 0·625λ—nearly a threefold increase in height and not really practicable at frequencies below 21 Mc/s for the average amateur, and in any case a poor return in improved signal for the additional mechanical problems involved.

There are, of course, one or two fundamental advantages in using a short vertical radiator on the h.f. bands—there must be, or so many people would not use them.

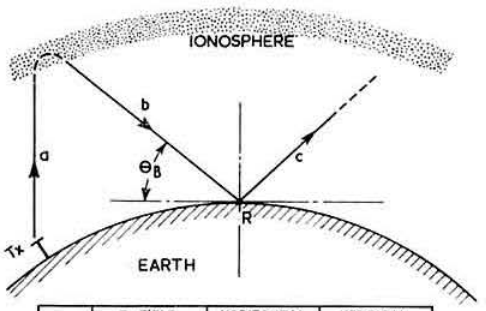
The first advantage is that, in the presence of a perfectly reflecting earth, the mechanical problems are less with the vertical aerial, than with the equivalent horizontal aerial. The vertical need only be a quarter-wave above the ground at its highest point (33 ft. for the 7 Mc/s band, 8 ft. for 28 Mc/s), whereas the horizontal dipole must be supported at least a half-wavelength above the ground (66 ft. at 7 Mc/s, 16 ft. at 28 Mc/s) to achieve the same radiated field at angles of the order of 10° elevation, in the direction of maximum radiation at right-angles to the dipole. The second advantage arises directly from the previous sentence. The comparisons of field made earlier between vertical and horizontal aerials are all in terms solely of the direction at right-angles to the horizontal dipole. As the direction of aximuth departs from this, the field from the horizontal aerial will fall off from its maximum value by the *E*-plane polar diagram factor of a half-wave dipole:

$$E = E_{max} \cdot \frac{\cos\left(\frac{\pi}{2} \cdot \cos\alpha\right)}{\sin\alpha} \quad \ldots\ldots\ldots\ldots\ldots\ldots\text{(ix)}$$

where α = angle in azimuth measured from a normal to the dipole.

reaching very low values off the ends of the dipole (it is *not* zero off the ends in the presence of the earth because the combination of the aerial and its image gives rise to a small amount of vertically polarized radiation off the ends. This point was discussed when dealing with ground wave attenuation).

The field from the vertical aerial is, of course, the same in all directions of azimuth, being omni-directional in that plane, and consequently begins to show an advantage over the horizontal aerial as soon as the direction of interest



RAY	E-FIELD VECTOR	HORIZONTAL COMPONENT	VERTICAL COMPONENT
a	E_H	1·0	ZERO
b	E_V, E, E_H	0·7	0·7
c	E_H	0·7	ZERO

Fig. 18. Loss at an intermediate earth reflection point due to the Brewster effect. The ground reflection coefficient is assumed zero for vertical polarization and unity for horizontal polarization, i.e. idealised poor earth.
Tx = horizontally polarized aerial.
R = intermediate ground reflection point.
θ_B = Brewster angle.

ceases to be advantageous to the latter. Conversely, in order to keep ahead of the vertical aerial in terms of radiated field, the horizontal aerial must be rotated to point always a maximum on the required great circle bearing.

The third advantage of vertical aerials over their horizontal counterparts lies in the nature of the respective vertical radiation patterns (Fig. 17). In order to throw up a lobe of maximum radiation at the desired low angles, the horizontal aerial has to be elevated to such a height above ground level that a minimum in the vertical polar diagram is created. For the case of the half-wave dipole at three-quarters of a wavelength above ground, this minimum occurs at 42°, falling to 30° at $h = \lambda$. The corresponding vertical polar diagram for the quarter-wave vertical aerial over a perfect earth is smooth, falling to zero only directly overhead, and radiating a field only 3db down on the maximum at the angles at which the null occurs in the horizontally polarized case. The net result is that the ionosphere is more evenly illuminated by the vertically polarized aerial at all angles of elevation below 60°, and the possible limits of coverage of distance for any particular state of the ionosphere are wide, whereas in the horizontally polarized case, short skip transmissions are greatly reduced because of the lack of power radiated in the region of 20°-40° elevation. To obtain more even illumination at all angles from the horizontal aerial it would be necessary to drop its height above ground to a half wavelength or less, and in doing this the very low angle radiation would be greatly reduced, with a degradation of the long-distance performance of the aerial at the expense of better short skip.

Time for a *Moral:* with a half-wave horizontal aerial you must choose between short skip or long DX: with a quarter-wave vertical aerial you can have a good attempt at both simultaneously.

The foregoing advantages are very real, but come back in all cases to the basic point of this part of the article. To achieve them in practice the vertical aerial *must* be allowed to operate over a very good earth. For the horizontal aerial it doesn't really matter, but any reduction in earth conductivity will result in failure to realize the advantages of the short vertical aerial, and prevent it from outperforming the horizontal one in all but the directions approaching off-the-end radiation from the latter.

We saw earlier in considering the earth as a conductor that the effective conductivity could be greatly improved by a system of earth wires concentrated in the most significant region. In considering the losses due to circulating currents, the most significant region is in the immediate vicinity of the aerial base connection. When we come to consider the effect of the earth on the vertical radiation pattern, as we now need to do, the region is determined by the geometry of the aerial and earth, and the angles of elevation at which the undesirable Brewster effect is most pronounced (Fig. 15).

The radiating current in the vertical is roughly sinusoidally distributed, from a maximum at the base to zero at the top. Consequently rays from the predominant radiating source towards the base of the aerial, in the region of the Brewster angle, will strike the ground fairly close in to the aerial, in which region the conductivity must, therefore, be very good. Rays from the weaker part of the radiating current towards the top of the aerial will, at the same angle, strike the ground further away, but since they contribute less to the complete radiation anyway, can afford to be subjected to a larger earth attenuation, and, therefore, the conductivity need not be so well reinforced at these distances from the aerial. The limiting distance is clearly that subtended by an angle of some 5° (Brewster over good ground) from the tip of the aerial a quarter-wave high, and is approximately 2·5λ radius: beyond this there is little to be gained. Because of this inverse sine-law effect, the required earth mat is well met by a simple system of radials originating at the base of the aerial, and spreading out with distance, being preferably 2·5λ long, or as many as possible of that length. If length restrictions are serious, each radial may be terminated with advantage at an earth spike or plate to improve the far end earth connection. Bearing in mind that the depth of penetration is inversely proportional to frequency, such a system of wires will have a more marked effect on the h.f. bands than they do as an earth mat on the l.f. bands, and pay better dividends in aerial efficiency as well.

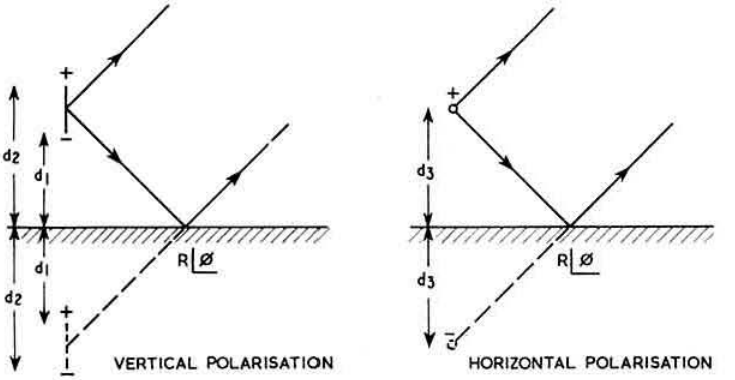


Fig. 19. Phase angle incurred at the point of ground reflection of vertically and horizontally polarised waves. Each charge of the aerial will induce an image charge of opposite sign, symetrically about the reflecting surface. This results in the v.p. image appearing in the same phase as the v.p. radiator, whereas the h.p. image is of opposite sign, i.e. a phase reversal of 180°.

What then of the ground-plane? Let no one be deceived that the conventional four radials takes care of the Brewster effect! The radial system of the normal elevated ground-plane does little more than provide a convenient connection for the unbalanced side of the feeder. It is electrically very transparent and the ground below the radials is well illuminated by the vertical radiator, so the presence of a good earth system is just as important as if the aerial were fed against ground. The one advantage of the ground-plane is that the whole aerial can be elevated into the clear, to avoid local obstructions to radiation, while still remaining a simple two-terminal device to which an unbalanced cable can be connected. To those who doubt the inefficiency of the four radials, the measure of their transparency can be seen from their effect on the feed impedance of the vertical radiator. This is of the order of 60–70 ohms when the radials droop significantly, falling to 50 ohms when they are approximately horizontal: if they were a complete ground-plane this latter value would be much nearer 35 ohms. This explanation is not, of course, rigorous but serves to illustrate the point.

The finest possible general purpose simple radiator for the h.f. bands is a quarter-wave vertical erected in the centre of a salt-water lake of 2·5 to 3 wavelengths radius!

Finally in dealing with the earth as a mirror, there is an interesting aspect of the Brewster effect, which is entirely beyond the amateur's control. It arises in ionospheric propagation paths of more than one hop, e.g. to W/VE, VU, VS, VK, etc. Such multi-hop paths necessitate one or more intermediate reflections at the ground, at points remotely distant from the transmitter. Irrespective of the polarization of the original transmitted signal, the waves will undergo polarization shift in the ionosphere, and will come down to earth in more or less random polarization. There will thus be a vertically polarized component on average constituting half of the available signal when the wavefront strikes the earth to be reflected upwards again (Fig. 19). This vertical component will be subject to the Brewster effect as usual and, in the extreme case, can be almost completely attenuated, giving rise to a potential 3db loss of signal at each intermediate point of earth reflection along the multi-hop path. The amateur can do nothing about the conductivity of the earth at the points of reflection, so the fact remains that circuits which reflect in the sea will in general be a better bet than those which reflect in mountains or desert.

Conclusions

This article has been a long and exhaustive discussion of the ways in which the presence of the earth affects electromagnetic radiation and has illustrated the different aspects of these effects in different cases. At the beginning it was stated that this did not set out to be a rigorous explanation. This is still the case—a rigorous explanation of all the aspects would take a year's issues of the BULLETIN. I hope, however, that I have shed a little light on the subject and suggested one or two profitable avenues of exploration in the search for stronger signals at all times.

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Appendix

Derivation of the vertical polar diagram of half-wave vertically and horizontally polarized dipoles over a plane perfectly conducting earth.

From Fig. 13, the difference in phase between the field contributions at a distant point, from the direct and indirect rays is given by:

$$\phi = d.\frac{2\pi}{\lambda} = 2h.\sin\,\theta.\frac{2\pi}{\lambda} \qquad \ldots\ (i)$$

This is fundamental to either polarization and derives from the geometry of the ray diagram. To this basic phase angle must be added any phase shift α experienced by the reflected ray at the point of reflection.

(*a*) *For horizontal polarization*

$\alpha = -180°$ (see Fig. 19)

$\therefore$ Total phase difference between field vectors is given by:

$$\phi' = \frac{4\pi h}{\lambda}.\sin\,\theta + \pi \qquad \ldots\ (ii)$$

If the magnitude of each contribution (direct and indirect) is identical and equal to E_{0h}, then the resultant field is given by:

$$E'_0 = 2.E_{0h}.\cos\frac{\phi'}{2}$$

$$= 2.E_{0h}\cos\left(\frac{2\pi h}{\lambda}.\sin\,\theta + \frac{\pi}{2}\right) \quad \text{from (ii)}$$

$$= 2.E_{0h}\left[\cos\left(\frac{2\pi h}{\lambda}.\sin\,\theta\right).\cos\frac{\pi}{2} - \sin\left(\frac{2\pi h}{\lambda}.\sin\,\theta\right).\sin\frac{\pi}{2}\right]$$

$$= -\,2.E_{0h}.\sin\left(\frac{2\pi h}{\lambda}.\sin\,\theta\right) \qquad \ldots\ (I)$$

The negative sign arises from the fact that the phase angle between the vectors is greater than 180°. It has no significance in the physical problem of determining the magnitude of the resultant field.

(*b*) *For vertical polarization*

$\alpha = 0°$ (see Fig. 19) $\therefore\ \phi' = \phi$ from (i).

Then as in (*a*) above:

$$E'_0 = 2.E_{0v}.\cos\frac{\phi'}{2}$$

$$= 2.E_{0v}.\cos\left(\frac{2\pi h}{\lambda}.\sin\,\theta\right) \qquad \ldots\ (II)$$

RAOTA Reunion

Roy Stevens, G2BVN, Guest of Honour

ROY STEVENS, G2BVN, first holder of a pre-war artificial aerial licence to become President of the RSGB, was the guest of honour at the eighth reunion of the Radio Amateur Old Timers' Association held at The Horse Shoe Hotel, Tottenham Court Road, London, W1, on Friday, 6 May, 1966.

Eric Martin, G6MN, of Worksop, Notts (vintage 1927) was in the chair—supported by Past Presidents Ernest Gardiner, G6GR (1944-46), Vic Desmond, G5VM (1948-49), Bill Scarr, G2WS (1950-51) and " Dud " Charman, B.E.M., G6CJ (1952). Vice-Presidents Bert Allen, M.B.E., G2UJ, David Corfield, G5CD, Jimmy Mathews, G6LL, with Council Members Jim Foster, G2JF and Louis Varney, G5RV, were also present. Messages conveying good wishes were received from Past Presidents Leslie Cooper, G5LC (1953), on business abroad, Arthur Milne, G2MI (1954) on holiday abroad, Herb Bartlett, G5QA (1955), indisposed, Eric Cole, G2EC (1961) and from more than 30 other members who were unable to attend.

Nostalgia—a feature of every RAOTA Reunion—was introduced by Kenneth Alford, G2DX, who spoke of his friendship with the late Ernest Simmonds, G2OD. It was Simmonds who made the first two-way contact on short-waves between Europe and Australia in 1924 and his signals were the first to be heard in New Zealand, a few days before Frank Bell, Z4AA and Cecil Goyder, G2SZ, made the first two-way contact. Alford related how he had been associated with Simmonds in the development of the superheterodyne receiver and told of Simmonds' pioneering achievements in the use of a quartz crystal as a means for controlling the frequency of a short-wave transmitter. G2DX showed an example of a crystal holder which had been made by G2OD more than 40 years ago. He also referred to Simmonds great love of music and to the fact that just after the first war Simmonds had made a most beautiful organ which he (Alford) had been privileged to hear being played over the air to him during a telephony contact in 1921. G2OD had also been an expert clock maker having built a high-precision synchronous mechanism for controlling all the clocks in his home.

Earlier in the evening, while conveying greetings from absent members, the Founder-Secretary had displayed two menu cards of great historic interest. The first, dated 14 April, 1925, commemorated a dinner given to Hiram Percy Maxim, President of the ARRL on his visit to London after the formation of the International Amateur Radio Union (Hugh Pocock and Kenneth Alford, whose signatures appeared one beneath the other on the card, found themselves seated next to one another at the Reunion, 41 years later). The second, dated 18 September, 1926, had been printed to mark the occasion of the luncheon given to the T & R Committee on the opening day of the first Convention. G6CL recalled that he and G6LL were among the " young squirts " who had enjoyed a very noisy luncheon party that day at Lyons Corner House in The Strand while the hierarchy were at the Hotel Cecil. The reading of a letter from A. W. Gamage & Co. to Frank Townsend, G2TO (who had loaned the souvenirs) was listened to with nostalgic amusement.

Guest of Honour

Introducing Roy Stevens as one of " The Early Birds," the Secretary of the Association spoke of the contribution made by 2BVN (as he then was) and other young radio amateurs (all of whom were members of the RAF Civilian Wireless Reserve) during the early stages of the war and subsequently. G6CL also referred to the great interest Mr Stevens had shown, over a period of many years, in the administration of the Society and in particular of his interest in the field of International Amateur Radio.

Mr Stevens reminisced on the activities of " The Early Birds " in France and Belgium during the first few months of the war and recalled many interesting and entertaining incidents. He referred to the forthcoming Region I Division Conference to be held in Opatija, Yugoslavia and to the important effects which decisions reached at that Conference are likely to have on Amateur Radio throughout the world.

Association Growth

In his annual survey of Association affairs G6CL reported that G2WS, 2RF, 2TO, 2VF, 2TA, 3WP, 4FN, 4JW, 4OU, 5BQ, 5NU, 5WG, 6BS, 6YP, 8KP and GM8AT had become members during the year and that membership now stood at 194. During the year Leslie Shersby, G2GZ, " Jerry " Walker, G5JU, Rowley Maidment, G5MM, and B. P. D. Challis, G8UT, became " Silent Keys." Visits had been made to the widows of Ernest Simmonds, G2OD, " Pim " Bradley, G2AX, and Harold Wilkins, G6WN, and parcels had been sent at Christmas time to the widows of eight old timers. As no entries had been received for the Marcuse Memorial Prize, the balance of the Fund would be transferred to the Benevolent Fund. The Secretary regretted that not even one young amateur had shown sufficient interest to submit an article in accordance with the simple rules published in the December 1965 issue of the RSGB BULLETIN.

New Honorary Member

A proposal by the Secretary that Mr Roy Stevens be elected an Honorary Member of the Association met with the unanimous approval of the members present and was adopted with acclamation. Mr Stevens expressed his appreciation of the distinction conferred upon him.

Scope Widened

The Secretary proposed, and it was agreed, that in future United Kingdom amateurs who had held an artificial aerial licence issued by the British Postmaster General at the outbreak of war in September 1939 and who had obtained a full licence as soon as licences were reissued after the war (and in no case later than 31 December, 1946) and who had retained that licence without a break since that date shall be eligible to apply for membership of the Association.

The Secretary, in bringing forward his proposal, explained that a number of pre-war AA licence holders had now been fully licensed for 20 years and would without doubt have been fully licensed for more than 25 years if the war had not intervened. The Secretary explained that it was not proposed to change the requirement that all other applicants for membership shall have been fully licensed for an unbroken period of 25 years, including the war years.

Roll Call

The following were present at the Reunion: G2AK, DX, HP, IY, JF, KI, KJ, MR, NH, NN, OA, PU, UJ, UV, VB, WS, XV, YL, GW2HQ, G2BVN, G3FG, HT, WW, G5BQ, BZ, CD, CV, DJ, JO, LJ, MA, NU, PP, RS, RV, TN, UM, VM, WG, WP, XB, XW, YY, G6CJ, CL, DP, FI, GR, HR, LL, LQ, MN, NR, OX, PA, QB, QM, RJ, YP, G8DF, DT, KW, NY, QO, TY, May Gadsden and Hugh Pocock.

G6CL

A High Performance Nuvistor Converter for 70 Mc/s

employing the "in-line mixer" technique

By M. GIBBINGS, G3FDW *

THE converter to be described was evolved primarily for 70 Mc/s contest work, and has proved its worth in over a year of use with the Cumberland and Westmorland V.H.F. Group.

The principal object in the design was to produce a converter which, as far as signal-to-noise ratio was concerned, was only limited by aerial noise. This requirement was achieved, and the converter produces an increase of between one and two S points of noise when connected to a four element Yagi, as compared to that which is produced when the aerial socket is terminated by an 80 ohm carbon resistor.

The frequency stability achieved is such that on c.w. and s.s.b. and using BK and VOX operation, there is none of the annoying initial drift experienced with some converters, and which makes the first few characters or words unintelligible.

Being concerned in the main with portable operation, economy of both h.t. and l.t. supplies was essential, and for this reason, Nuvistor valves were selected. The Nuvistors did in fact not only achieve the required economy, but in addition, when compared to a converter of similar design using a more conventional valve, gave a marked increase in gain.

Circuit Description

The circuit diagram of the converter is shown in Fig. 1.

The r.f stage employs a 6CW4 Nuvistor in a conventional inductively neutralized configuration, and which arrangement, when correctly neutralized, accounts for the excellent noise factor of the converter. The anode circuit of this valve forms one of the in-line circuits as may be seen from the arrangement of L3, L4 and L5 on the diagram.

In-line circuits have a number of advantages, and these may be summarized as: low noise, high gain, and a simplification of construction, and although they have found favour commercially, they are rarely seen in amateur equipment.

The mixer employs a 7587 Nuvistor in a straightforward arrangement, a small fixed bias being developed across the cathode resistor. The crystal controlled injection oscillator uses a 7586 Nuvistor in a somewhat unusual circuit configuration. Feedback to sustain oscillation is provided by a circuit tuned to the fundamental frequency fitted in the cathode circuit of the valve. Oscillation is independent of the anode circuit tuning, thus the arrangement displays a high order of stability.

The crystal employed was of the "surplus" variety, type number 10XAC, and a frequency of 20·09 Mc/s. Actually this unit is a small glass envelope with wire ends containing two crystals in the region of 20 Mc/s, but of course only one of the crystals is used. The crystal employed produces a tunable i.f. in the range 9·65 Mc/s to 10·25 Mc/s for coverage of the 70·7-70·1 Mc/s allocation.

Construction

The converter is constructed in a 3½ in. × 4½ in. Eddystone die-cast box type 650. The layout is shown in Fig. 2.

The actual chassis employs Lektrokit perforated chassis plate cut down to a size which fits inside the lid of the die-cast box. In the final assembly, this chassis is mounted to the lid by 6BA bolts and stand-off pillars. This form of sandwich construction results in all the h.t. and l.t. wiring being contained within a screened area, and allows this wiring to be run to the required point by the shortest possible route without it passing through any of the signal circuit compartments. Supplies to the various compartments are taken through p.t.f.e. feedthroughs pushed through the nearest convenient hole in the chassis plate.

Each of the circuits employed in the converter, that is the r.f. stage, mixer stage, and local oscillator, are contained

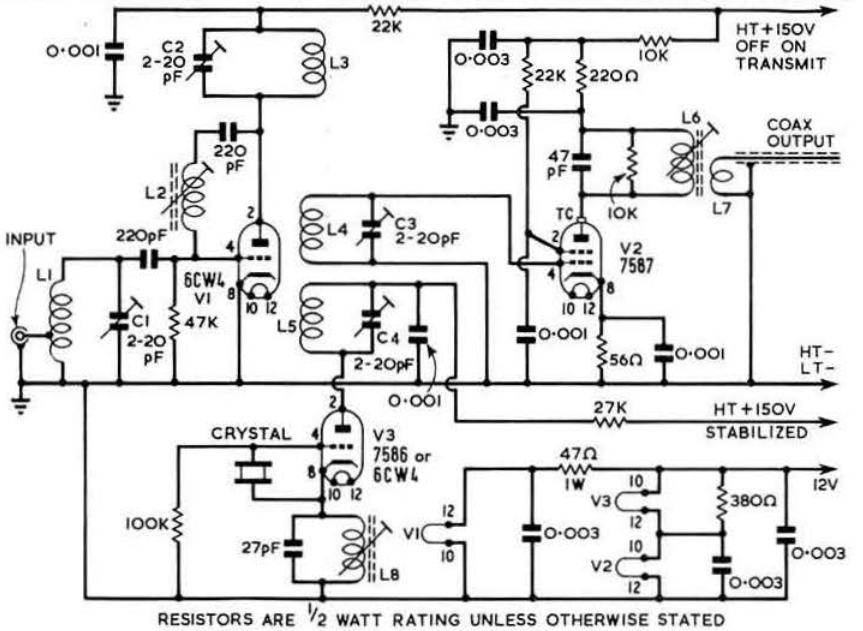


Fig. 1. Circuit of the Nuvistor converter. C1, 2, 3 and4 are 2-20pF variable capacitors, and all 0·001 and 0·003 μF capacitors are disc ceramics. Resistors are ½ watt rating except where indicated. L1, 8 turns, tapped at 2½ turns from earthy end, 22 s.w.g., spaced wire diam., ¼ in. diam. former, ¼ in. leads; L2, 27 turns, 28 s.w.g., close wound, 0·3 in. diam. slug-tuned former; L3, 9 turns, 22 s.w.g., spaced wire diam., ¼ in. diam. former, 1 in. leads; L4, 7 turns, 22 s.w.g., spaced wire diam., ¼ in. diam. former, 1 in. leads; L5, 6 turns, 22 s.w.g., spaced wire diam., ¼ in. diam. former, 1 in. leads. L6, 34 turns, 28 s.w.g., close wound, 0·3 in. diam. slug-tuned former; L7, 4 turns, small diam. p.v.c. covered wire, wound over earthy end of L6; L8, 12 turns, 28 s.w.g., close wound, 0·3 in. diam. slug-tuned former.

* 14 Howbeck Lane, Clarborough, Retford, Notts.

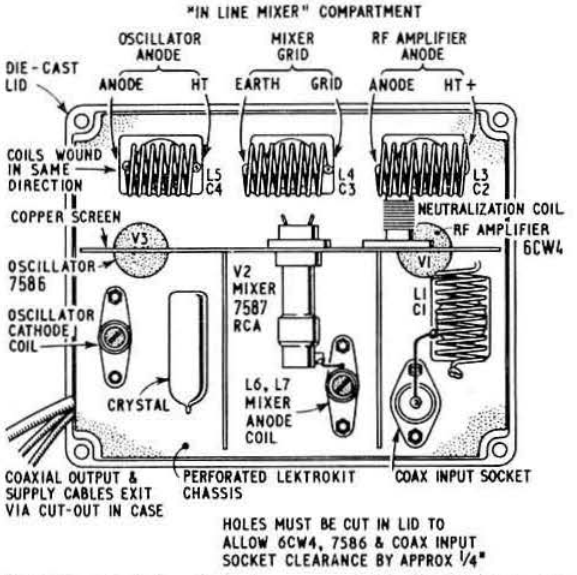


Fig. 2. Layout of the principal components fixed to the Lektrokit panel.

within screened compartments constructed from 25 thou' shim copper. The screens are bolted to the chassis plate and then soldered together.

As will be seen from Fig. 2, two of the valves protrude through the lid of the box, and holes are provided to allow these to pass through. Additionally, provision has to be made for the co-axial input socket to rise proud of the lid by about $\frac{1}{4}$ in.

As the setting up of the converter is carried out with it fully screened inside its box, holes have to be drilled to enable C1, C2, C3, C4, L2, L6 and L8 to be adjusted from outside.

With regard to the neutralizing of the r.f. stage, it should be noted that the neutralizing coil is situated in the mixer compartment, and that it is positioned at right angles to the other coils.

To a large extent, the performance of the converter depends on the mixer circuits. As will be seen from the illustration, the r.f. anode, mixer grid, and oscillator anode coils are all wound in the same sense. It is essential that they are connected as shown. The spacing between the coils is as follows: r.f. anode to mixer grid, $\frac{1}{4}$ in., mixer grid to oscillator anode, $\frac{1}{4}$-$\frac{3}{8}$ in. These spacings should not be treated as absolute, but are a starting figure prior to the adjustments described under the heading "Setting-up". The coils may be constructed as self-supporting, but the use of a $\frac{1}{2}$ in. diameter paxolin tube $3\frac{1}{2}$ in. long inserted into the coils during the setting up is a help in ensuring that they are all on the same axis.

Setting-up Procedure

The first comment to be passed is that all adjustments *must be made* with a non-metallic tool. This is quite essential if the adjusted positions are to remain as set when the trimming tool is removed.

The simplest method of adjustment is to approximately align the circuits to the correct frequency by the use of a g.d.o. Care should be taken to ensure that the g.d.o. is only coupled to the circuit being adjusted, and all valves in position so that their stray capacities are taken into account, with all tuning capacitors set for *maximum*, initially.

With the converter out of its case, tune the cathode of the oscillator circuit by adjustment of the core of L8 to either the crystal frequency, or if an overtone crystal is being employed, to the desired overtone, and then tune the oscillator anode circuit by means of C4 to the final injection frequency.

Tune the r.f. grid circuit, C1, the r.f. anode circuit, C2, and the mixer grid, C3, to 70 Mc/s. Unsolder one end of the 10K ohms damping resistor across the tuned circuit in the anode of the mixer, and resonate this circuit to the centre of the i.f. passband. Reconnect the 10K ohms resistor. Set the core of the neutralizing coil, L2, half way into the winding.

Place a short across L5. Connect a high resistance voltmeter—20,000 ohms/volt or better—across the 27K ohms resistor in the h.t. supply to the oscillator anode. Connect the power supplies. Tune the core of L8 while watching the voltmeter. It will be found that the voltage will fall slowly to a minimum, and then rise rapidly to a maximum. Set the core of L8 so that the voltage is some 20 per cent above the minimum voltage on the "slow" tuning side of the core. Disconnect the power, remove the short from L5, seal L8 and fit the converter into its box.

Connect the converter to a receiver tuned to the centre of the i.f. passband, and apply power to the converter once again. Connect a 4m aerial. At this stage it is quite probable that the r.f. stage will not be neutralized, and this will be indicated by excessive noise and/or spurious oscillation. Very carefully adjust the core of L2 to the point where this noise or oscillation ceases. After this, adjust C1, C2, and C3 for maximum aerial noise.

Remove the converter from its box and confirm that the spacing between L4 and L5 is about $\frac{1}{4}$ in. Replace converter. Tune C4 and observe the change in noise output. At this stage it should be found that tuning C4 will produce two distinct noise peaks. If only one noise peak is found, then *decrease* the spacing between L4 and L5 until this condition is achieved. Once the point has been reached where two noise peaks are obtained, the spacing between L4 and L5 must be carefully and gradually increased until the tuning of C4 indicates that they have merged into one. At this point, the degree of coupling for the mixer injection will be at optimum.

Final neutralization of the r.f. amplifier is best accomplished on a very strong signal. Care has to be taken to ensure that all the signal to the converter is indeed coming from the aerial, and that none of it is being picked up by the converter itself. For this reason, a g.d.o. is not suitable for this operation.

After having found, or arranged, such a strong signal, and tuned it in, the h.t. should be disconnected from the r.f. stage of the converter. Now adjust the core of L2 to the point where this signal is at its minimum. This adjustment is not very critical, but is essential for optimum performance.

Once the above adjustments have been completed, the r.f. and mixer stages can be peaked up on an identified weak 4m signal. In these adjustments, C1 is tuned for maximum output, and the spacing between L3 and L4 varied to give best signal-to-noise ratio. With the adjustments to L3 and L4, if the spacing is made too great, the circuits will become quite sharply tuned, and the gain will drop. Naturally when L3/L4 are adjusted, C3 and C4 will require peaking, but the object is to still retain the broad character of the resonant point.

It cannot be stressed too highly that the converter must be aligned in its screened box, and its performance assessed while it is encased. If it has been removed for adjustments to coil spacing, then it must be returned prior to evaluating what change in performance has resulted.

Modified Version

A modified version of this converter has been constructed

(Continued on page 403)

THE MONTH ON THE AIR

By JOHN ALLAWAY G3FKM

THIS month's article must commence with an apology and a correction. Firstly, apologies to all those who so kindly sent in scores for the All Band DX Table, which was inadvertently omitted by your scribe from last month's *MOTA*! Secondly, it now appears that the information concerning the pension awarded to Mrs Colleen Thorpe was incorrect. This was received from a number of different sources, and the writer is completely at a loss to understand the workings of the strange mind which originated the rumour.

Food for further thought has been provided by a letter from **VS9ABL**, who asks why it should be that our band planning restricts phone operators to rigidly defined sections of the bands, at the same time permitting c.w. operation anywhere. As he points out, if a c.w./phone contact is required it is necessary to move into the phone band, and woe betide any phone station who dares to operate in the exclusive c.w. sections! He suggests that adherence to band planning should be obligatory, and that on 20m, for example 14,000 to 14,075 kc/s should be exclusive to c.w., 14,075 to 14,125 kc/s mixed phone and c.w., and 14,125 to 14,350 kc/s exclusive to phone. Similar segments are suggested on the other bands. This would seem to your scribe to be a very fair way of sharing out our frequency allocation, and it is hoped that perhaps something may be done at international level to bring about such a scheme.

News from Overseas

In a letter to your scribe, Stephen Gibbs, formerly GM3MBS, 5A3CJ, MP4BEQ, and ZC4AK says that no amateur licences have been issued to new applicants since December 1963 when Kenya became independent. The only time he is able to talk to old friends is when he visits 5Z4ERR or 5Z4IR.

At the time this reaches readers Bob Snyder, **9V1LP**, will be on leave in England, visiting relations in Kent. He reports that so far only one station, KR6BQ, has been able to claim a " 9V1LP " certificate for contacting him on six bands during a single contest. W4BVV managed QSOs on all bands 80 to 10m during the ARRL contest this year, which is a particularly praiseworthy feat as the East Coast of the USA is the most difficult area of the world to raise on any band from Singapore. The only European station to qualify on five bands is G3FPQ. Incidentally this is a most attractively produced " sheepskin " and is well worth gaining.

Brian Barnes, **VP8IK**, has now moved from Halley Bay and is active from the Argentine Islands, Antarctica. He will be on the air every Friday at 20.00 GMT looking for G contacts on 14,180, 7,090, and 7,120 (?) kc/s s.s.b. He has parents who live at 55 Grove Way, Esher, Surrey. For QSL information see *QTH Corner*.

The RAF club station **VS9OC**, in the Sultanate of Muscat and Oman, is now back on the air after a long rest. Equipment is now available which covers 15, 20, 40 and 80m, s.s.b. included. Operating times will be mostly 10.00 to 18.00 GMT. A special lookout is kept for UK stations, and Saturday nights are reserved for contacts with the US. The club hopes that all who need a QSL from VS9OC for a contact in the past on a.m. or c.w. have received one, but those who are still without are promised one if they write to: Hon. Secretary, VS9OC, RAF, Masirah Island, BFPO 69, c/o GPO, London.

Top Band News

Full information has been received from **ZL3RB** concerning the highly successful ZL-G tests which took place in February and March, QSOs having been made with G3SED, G3UQD, G3SVD, G3CFV, G3RFS, G3PU, and G3RPB. At 07.20 on 26 February the first European was heard, and was believed to be GI3OQR, and the last G was heard on 20 March. W and VE stations were also heard at the same time as the Europeans, but no contacts were made as they did not appear to be hearing ZL3RB. A report was received from a listener of hearing a contact between ZL3RB and DL1FF at a time when the band was not open, so it is to be hoped that there has not been a bootlegger at work. In his letter ZL3RB also makes the comment that when he calls QRZ he does not want to hear his call repeated many times, but needs to hear the call of the calling station repeated so that he can identify it! Thanks are passed to all who took part in the tests, and an 18.00 to 19.00 GMT schedule is considered as a likely event next season.

This year's trip by the Cambridge University Wireless Society to the Isle of Man was quite successful, the highlight being the first GD—ZB2 QSO. This took place on 19 March at 01.55 with ZB2AM, and reports were RST 349 in, and 559 out. A total of 863 stations was worked during the ten day stay, and many were given their first GD contact by GD6UW.

According to 9V1LP signals from Europe have been audible in Singapore right up until mid-April. He reports G3SED at RST 469 on 10 April. Static is now at it's very worst and it is extremely difficult to even identify call-signs,

At the Hong Kong Amateur Radio Transmitting Society's Annual Dinner 1965, Past President George, VS6DS, presents the HARTS Trophy to Drake, VS6EK.

* 10 Knightlow Road, Birmingham 17.

Please send all items of news to arrive not later than **15 June** for the **July** issue, **13 July** for the **August** issue and **13 August** for the **September** issue.

so it seems that no more contacts will be had with 9V1 on 160m until Bob returns from leave and becomes active again in the latter part of the summer.

The Jamboree on the Air

As mentioned in last month's *MOTA* the ninth of these annual get-togethers will be taking place in October. Any amateur interested in the Scout movement is invited to take part. The first step would appear to be to establish the degree of local interest by contacting the local District Commissioner. If it is decided to take part the National Organizer (L. R. Mitchell, " Katoomba", Tyneham Close, Sandford, Wareham, Dorset) should be informed, preferably before the end of September. A most important point should be borne in mind by amateurs in the UK—no unlicensed person must be permitted to operate the radio equipment. This includes speaking into the microphone, but of course does not preclude the use of scout power to keep the log, etc!

QRP News

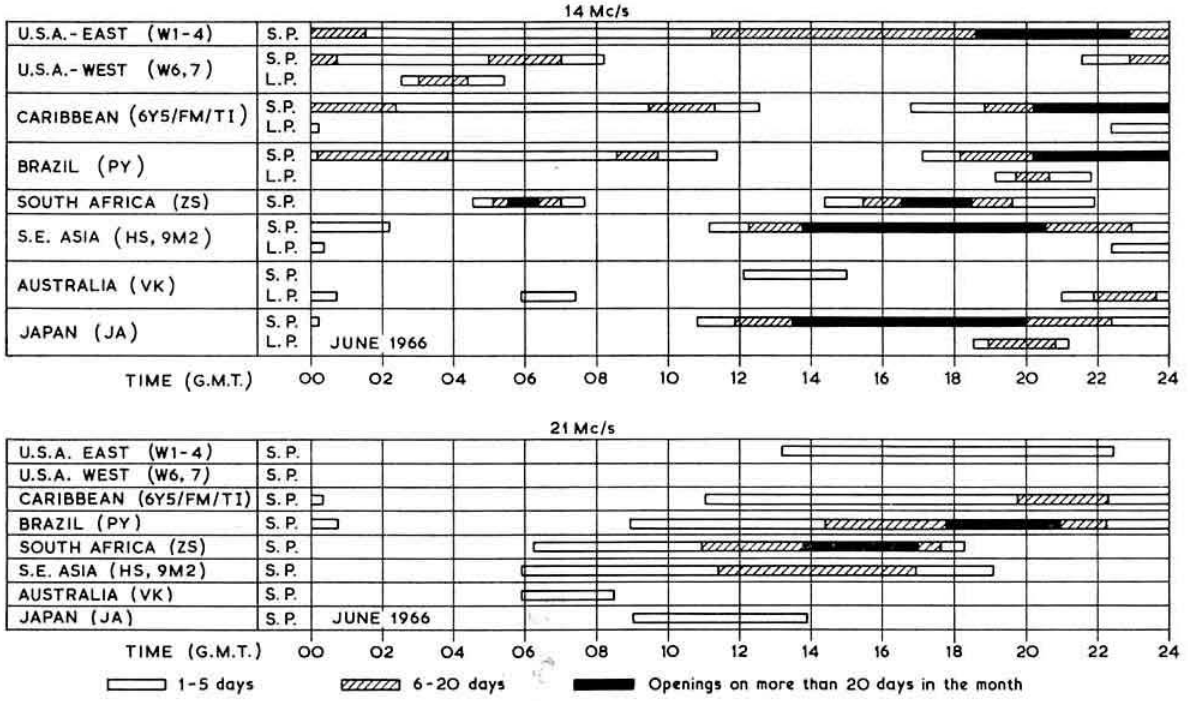
Once again support for this section has come from the same two correspondents. There must be many more stations running 25 watts or less—is there *no one* else who feels that to make the best use of aerials is a good idea? Certainly G3URX means to do better without increasing his power bill, he hopes to extend the earth system of his vertical to cover 1000 sq. ft. by using chicken wire! Aerials are also in G3TMB's mind, as he points out that fortunately the person at the other end of the QSO often has a much better aerial than his, and he wonders just how much depends on this fact. He has had a successful month with plenty of W and European contacts, and enjoys things as they are making friends and chatting to all comers.

DXpeditions

G3BHT will be operating from Luxembourg between 17 June and 1 July, using a KW2000 on 80 to 10m, both c.w. and s.s.b. His call will be either G3BHT/M/LX or G3ORK/M/LX, and he is also awaiting the arrival of an ON8 call for use in Belgium.

Iris and Lloyd Colvin are now in the UK and at the time of writing were hoping to appear on the bands with the appalling calls **GD5ACH/W6KG** and **GD5ACI/WB6QEP.** It is to be hoped that someone at the Post Office will do something

Propagation Predictions



The midsummer conditions in the ionosphere, which begin in May and continue until August, bring about a worsening in DX conditions on the h.f bands. On 28 Mc/s in the late afternoon on favourable days (i.e., with above average F2 m.u.f's), South Africa should come through, and in exceptional cases in the early evening. South America also. On 21 Mc/s only South America and Africa may be worked with certainty but the East coast of North America will possibly come through occasionally. The 21 and 28 Mc/s bands may frequently liven up for short skip contacts over distances from 300 to 1250 miles. 14 Mc/s is the main DX band, and the short summer nights make it possible under favourable conditions for the band to remain open for DX all night long. The summer conditions also frequently make contacts possible with various DX zones via the long path. This applies particularly to Western North America, Japan and Australia, and in exceptional cases with South East Asia and Central America. Hawaii may be worked on 14 Mc/s via the short path on favourable days between 06.30 and 10.30 GMT. 7 Mc/s will permit contacts up to 600 miles during daytime. The dead zone may interrupt local traffic during the day on this band because the F2 frequently falls below 6 Mc/s during the summer in the present phase of the sunspot cycle. 3·5 Mc/s can be used for local traffic day and night without interruption by the dead zone at night. DX contacts during the summer are usually only possible on 3·5 and 7 Mc/s when the greater part of the transmission path lies in darkness and the atmospheric noise level is below average.

The provisional sunspot number for April 1966 was 47.5 with activity evenly distributed throughout the whole of the month. The highest daily number was 74 on 3 and 4 April. The predicted smoothed sunspot numbers for August, September and October are 43, 46 and 49 respectively.

The Zurich Solar Observatory states that the predictions are now based on the expectation that the coming sunspot maximum will be reached in July 1968 and that the highest smoothed monthly sunspot number will be 100.

to enable overseas visitors to use something rather less cumbersome than the present series of call-signs . . . a special numerical prefix (as in Holland and Belgium for example) would surely be more appropriate.

It now seems that CR7GF has been able to proceed with his arrangements for his forthcoming trip to the Indian Ocean area. He now expects to start during the last week of May, or the first week in June, and will go first to **Glorioso Island** where he will stay three or four days, using the call CR7GF/FR7. From there he will proceed to **Comoro Is.**, and stay two or three days, his call being CR7GF/FH8. The third stop will be **Aldabra,** where a three or four day stay is planned. Frequencies used will be 7005, 14050, and 21050 kc/s for c.w. and 7100, 14100, and 21420 for s.s.b. QSLs should be sent to the addresses in *QTH Corner*.

The proposed visit by the VS9 gang to **Kuria Maria** has unfortunately had to be postponed due to a number of unforseen circumstances. VS9ARV was advised to apply for permission again later in the summer, so possibly this one will materialize in the autumn.

Another casualty appears to be the threatened trip to **Rio de Oro,** which now appears to be off. Rumour has it that a Spanish official is leaving soon for the area, and that he has an amateur licence. Only time will tell whether this is yet another false alarm!

During May W9WNV has been keeping the lower end of 20m warm with his appearances from **Minerva Reef** (IM4A), **Maria Theresa Reef** (W9WNV/FO8M) and **Suvorov Island** (in the Northern Cook Is.,) (W9WNV/ZKIS). He put through remarkably strong signals into Europe from all three places and was often audible from very early morning until evening. It is known that he managed 1700 contacts from 1M4A on s.s.b. during the *CQ Magazine S.S.B. Contest*, and a total of 4000 contacts during his 34 hours on the air from there. The FO8M operation produced 2000 contacts, 500 on s.s.b. during the 13 hours stay. He left Suvorov Island on 8 May, and was then heading back to the USA via Hawaii, where he hoped to be by 23 May. After this he should be travelling via South Africa to **Heard Island.**

The trip by VQ9HB to **Desroches Island** finally got under way on 22 April. Unfortunately Harvey had trouble with his s.s.b. after only a few hours operating as VQ9HB/D, and had to spend the rest of the weekend on c.w. He was an excellent signal on 21 Mc/s, and was audible from 12.00 to 22.00 on that band. The operation ceased at 05.00 on 25 April. Unfortunately Harvey's mother died during his absence on the trip. The writer is certain that all readers would wish to join with him in extending condolences to Harvey.

The Hong Kong Society organized a station (VS6AJ) for the eighth Jamboree on the Air. VS6BJ is seen with other Scouts at Morse House, Hong Kong.

QTH Corner

CR5SP	via DOTM, PO Box 7388, Newark, NJ. 07107.
CR7GF/FH8	
CR7GF/FR7	Ercall E. St. John, 6158 W. 74th St., Los Angeles 45, Calif.
CX9AAN	via W2CTN.
DU1OR	via W2CTN.
GD5ACH/W6KG	
GD5ACI/WB6QEP	via YASME Foundation, Box 2025, Castro Valley, Calif.
HC1GC	via W2CTN.
KB6CY	via W2CTN.
KC4USB	Kenneth W. Nokes, Island Park Road, Ipswich, Mass, USA.
WA0GFS/KM6	Clayton G. Conard, 418 Buena Vista Street, Alta, Iowa.
KS6BR	Box 986, Pago Pago, American Samoa.
PJ5MG	Wayne Warden Jr, RFD 3, Bloomington, Indiana.
TU2BA	PO Box 172 Abidjan, Ivory Coast.
VK0MI	Greg Johnston, 3 Inglis Street, Newtown, Hobart, Tasmania.
VP2AL	via VE3EUU, A. H. Iseman, 67 Tavistock Road, Downsview, Ontario.
VP6WR	via W2CTN.
VP8IK	via C3DHB, Signal Wing, School of Infantry, Hythe, Kent.
VQ9GF	via YV5 Bureau, RCV PO Box 2285, Caracas, Venezuela.
VQ9HB/D	via Les Hill, 31 St. Leonards Road, Eastbourne, Sussex.
VR2CC	T. Fred Carter, Beachcomber Hotel, Deuba, Fiji.
ZD8J	John R. Beck, RFD 3—Box 918, Merritt Island, Fla.
W9WNV/ZK1S	via W4ECI.
7Q7PS	via Kenn Smith, W1MRG, 85 Main Street, Groveland, Mass.
7X2AH	via August A. Nickel, 3326 Sargeant Drive, Charlotte 8, NC.
9M6NQ	PO Box 399 Jesselton, N. Borneo, Malaysia.

QSL Managers.

W2CTN	156 Ketcham Avenue, Amityville, NY 11701, USA.
W4ECI	3101 Fourth Avenue South, Birmingham, Alabama, USA 35233.

RSGB QSL Bureau: G2MI, Bromley, Kent

Certificates

The first **Worked Zambia Award** has yet to be claimed by an amateur outside Zambia. Requirements for it's award are for applicants to score ten " points " (in Zones 36, 37, and 38, 20 points) by contacting Zambian stations. 9J2 stations contacted on 7, 14, 21, or 28 Mc/s count 1 point, and those contacted on 1·8 or 3·5 Mc/s count 2 points. Zambian stations using 9J1, or 9J3 to 9J0 prefixes count double points. The same stations may be counted on each band worked. There are four classes—all c.w. all a.m. all s.s.b., and mixed, and the award is also available to SWLs. Applicants should send a certified list of QSLs held, together with 3s. 6d. 7 IRC's or $1 to RSZ Awards Manager, PO Box 332, Kitwe, Zambia.

The **Ria de Aveiro** Award will be given to any amateur who can produce evidence of contacting four stations in Aveiro (Portugal) since 1 January, 1966. American and African stations need only three, and the rest of the world two, to qualify. QSL cards should be sent to Comissao Municipal de Turismo, Aveiro, Portugal. Leaflets giving further details are available from G3FKM.

Information on current certificates and awards will be found in the **Directory of Certificates and Awards** which is invaluable to the sheepskin hunter. It contains up to the minute details of some 600 awards, both for the transmitting amateur and the SWL. This volume is produced in loose leaf form, suitable for a three ring binder, by Clif Evans, K6BX, and publication is quarterly from 1 January each year. Each issue is self contained and amendments are not issued. Stocks of this book are not held to ensure that only current copies are distributed, but orders for direct delivery from

K6BX may be placed with G2BVN. The non-profit cost per issue is 18s. 6d. post paid with a suitable binder costing a further 7s. 6d. if required.

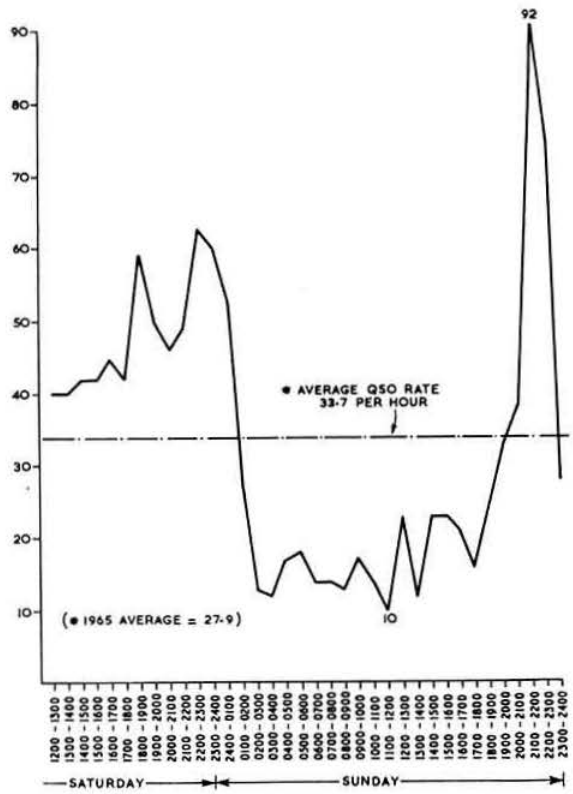
Contests

The Phone section of the **1965 CQ Magazine WW DX Contest** attracted rather more support than in 1964, there having been 899 entries received from 108 countries. Leading scorers include:

All band—single operator		Multi-operator single transmitter	
CX2CO	1,815,288 points	ET3USA	1,222,843 points
DJ6QT	934,677 points	I0FGM	1,129,323 points
DJ0NO	899,208 points	4X4HW	1,000,050 points
I1BAF	808,572 points	DL1JW	947,568 points
HB9ZY	769,384 points	HC1EY	710,874 points
YV5AXT	656,702 points	PA0HBO	705,024 points

The leader in the multi-operator, multi-transmitter section was YV9AA, who scored the enormous total of 4,795,200 points. In the single operator single band section GW3PMR was world leader on 160m with 360 points. Top Europeans on the other bands were: 3·5 Mc/s ON4UN (56,700 points), 7 Mc/s I1AIM (26,465 points), 14 Mc/s F7BL (703,056 points), 21 Mc/s DL6EN (219,090 points), and 28 Mc/s DL7BA (17,136 points).

This year's **Venezuelan Independence Contest** takes place between 00.00 on 2 July and 24.00 on 3 July, and as before will cover all bands 3·5 to 28 Mc/s, a.m. and s.s.b. The object is to contact as many stations in the American continent as possible. QSO points are two for contacts with Venezuelan stations on any band other than 7 Mc/s, and one for 7 Mc/s YV QSOs and for contacts with all other American stations. A multiplier is obtained by adding the number of DXCC countries, to the total of YV and W call areas worked. All band entrants multiply the total of multipliers on all bands by the total QSO points scored on all bands to obtain their score. Entries should be postmarked no later than 15 September, and sent to RCV Concurso Independencia de Venezuela, PO Box 2285, Caracas, together with $1 or equivalent in IRCs. Logs should show Date, Time, Station worked, Serial number sent (RS with number starting from 001), number received, multiplier, points claimed. A separate summary sheet should be enclosed. There is a most attractive certificate given to all stations in Europe who contact at least five YV's and five other stations in different American countries.



This graph shows the hourly QSO rate at G8FC (RAF ARS, Locking) during the CQ WW S.S.B. Contest. The peak late on the second day resulted from a good opening to the USA. The provisional score of 788,177 points was achieved from 1214 QSOs with 247 different prefixes.

The Amateur Radio Society of India announces that the dates of the **3rd VU2/4S7 Contest** have been changed to 06.00 15 October to 06.00 16 October for the c.w. section, and the same times on 29 and 30 October for the telephony section.

Results of the **1965 WAE DX Contest** show that the winners of certificates in the UK were:

C.W. Section		Phone section	
G2DC	49,719 points	G3OEV	162,194 points
G3OLN	12,492 points	GW3NWV	6,204 points
GM3SDZ	10,058 points		
GI3RTS	4,256 points		

World leaders were DJ3KR (c.w.) with 155,448 points, and DJ6QT (phone) with 178,412 points.

DX Briefs

Of particular interest to prefix collectors is **8P4AG,** who is reported as having been heard on 14,106 kc/s s.s.b. He is alleged to be in Gambia.

VS5JC has been active on 14 Mc/s c.w. between 13.00 and 16.00 from Brunei. He is said to have asked for QSLs via the Singapore bureau.

Another item for prefix hunters comes from Japan where it is expected that calls in the **JH1—JH0** series will be issued soon. The section between JH1XZZ and the end of the alphabet will be used for club stations.

Those still needing Kure Island will find **WA7EZW/KH6** at the high end of 14 Mc/s most mornings. He will be there until October.

G3LOJ, ex-ZC4AB, 5B4AB, 5B4AK, and 9G1FB, will shortly be appearing from **9M2** on all bands 80 to 10m, using a.m. and c.w. only. He expects to become airborne in July. Call-sign not yet known.

Band Reports

Conditions on the h.f. bands have continued to improve since last month, but as is to be expected there has been much less interest in the 1·8 and 3·5 Mc/s bands. No reports of any happenings on either of these have been received. Forty metres continues to reward the patient, and an apparently increasing amount of s.s.b. DX is being worked on this band. Unfortunately there are a few individuals who consider that 7045 is not a suitable frequency for telephony to use, since this is the one spot on the band known throughout the world as a s.s.b. DX net frequency this seems to be rather a paltry complaint.

Ten and fifteen metres have been producing signals from all over the world, and only Oceania is needed in the lists of

stations heard on 15 to make them look like 20m lists of a month ago. At long last there is quite considerable activity on s.s.b. on 10m, this should help to relieve some of the congestion on the other bands!

The following are thanked for their helpful reports, and for the considerable effort which they put in to assist this column: G2BOZ, G2LB, G3DO, G3FBA, G3HCT, G3HDA G3IGW, G3JFL, G3KSH, G3PUF, G3SML, G3URX, G4MJ, G8JM, G8VG, GW3AX, K6JAJ, BRS 20317, BRS 26928, A3942, A 4038, A 4182, A 4308, A 4552, A 4641, A 4871, A 4955, and John Daws.

3.75 Mc/s S.S.B.: VO1DN (22.42), 7X2AH (22.29).

7 Mc/s C.W.: CE8AA 8CS (23.00), CO2PY (07.40), CO3CS (07.07), CX2CO (21.40), EA8ET (22.40), HI8XAL (23.00, 02.49), HR5LB (06.40), W1FZJ/KP4 (06.25), OX3DL (06.59), OY3BB (14.11), UA0PY (19.10), UJ8AV (18.30), VK2EO (06.15), WA6UUS (05.50), YV3FB (05.35), ZD8J (23.00), ZL3JQ (05.45).

7 Mc/s S.S.B.: EA6AR (22.00), EP2AX (20.30), ET3AC (21.30), HK3AAG (06.25), JAs 4BJO, 6AK (21.00), OD5EJ (21.00), OX3's JV, LP (21.00), VE2AW, BK (21.30), VK2AGQ (06.29), VK3XM (07.20), VP2GLE (21.30), VP2SJ (21.30), VP6KL (21.30), ZB2AJ (21.00), ZF1XX (21.00), ZS1JA (21.00), 7X2AH (21.00), 9M2OV (22.00), 9Y4VT (21.30).

14 Mc/s C.W.: DU0DM (12.50), FB8YY (10.00), W9WNV/FO8M (13.00), HK0AI (21.25), HM1DK (16.30), JT1AG (11.15), KB6CY (07.20), KH6YL (07.31), KL7BZO (13.00), UA1KED (Fr. Josef Land, 09.20), UA1KAE (Antarctica, 09.49), UA0KYA (Zone 23, 03.25), VK9TB (Papua, 07.00), VK0MI (10.35), VP8HJ (22.30), VP8IY (19.38), VR2EK (08.40), VU2FN (05.36), XE1ZV (23.50), W9WNV/ZK1S (06.00—14.00), ZK2AF/MM (06.55), ZD7IP (22.00), ZD9BE (17.45), ZL4CH (Campbell Is, 07.00), 5W1AZ (07.13), 9E2LEL ?(14.38), 9L1TL (23.30), 9M8KS (14.35).

14 Mc/s S.S.B.: CP5AJ (11.30), CP6FR/5 (21.35), CR5SP (17.50), W6FHM/DU1 (08.40), DU1BSP (15.28), FB8YY (08.15), FK8AB (14.07), FO8s AA, AB, AG, AQ (06.30—08.18), W9WNV/FO8M (14.00), FW8RC (07.57), GD5ACH /W6KG (15.10), HC8SG (05.25), HL9US (18.30), KC4AAD (07.00), KC6CE, BO, CO (07.10—08.15), WA7EZW/KH6 (Kure Is. 07.00), KJ6BZ, CE, DA (06.49—07.15), KM6BL, CE (07.00), WA0GFS/KM6 (08.24), KS6's BH, BO, BR, BT (07.24—08.15), KX6DC (07.20), KX6DU (08.00), PJ4AC (22.15), TR8AG (21.11), UA1KED (08.30), UA0YP (14.22), VK2XT/M (Running 30 watts, 07.40), VK9DR (13.43), VK9XI (08.00), VP2VV (21.20), VQ9HB (18.30), VQ9HB/D (15.50), VQ9TC (18.08), VS9PCZ (Perim Is. 15.58), YK1AA (08.10, 13.47), ZF1GC (23.10), W9WNV/ZK1S (06.00—15.00), ZL5AA (08.40), 1M4A (Minerva Reef, 07.59), 5W1AZ (08.12), 5W1AX (08.25), 9M6AP (16.45), 9M6LR (16.12).

21 Mc/s A.M.: CO2FA (21.03), CR4AG (17.30), EA9AQ (16.26), HI3FAG (20.53), JA6FEY (14.42), MP4BBA (15.30) PY's (13.00—21.00), TN8AG (17.23), TT8AB (18.05), XE3EB (22.00), ZS8FK (16.57), ZS9G (17.07), 9K2AD (15.30).

21 Mc/s C.W.: CR3AD (11.10), CR6JA (09.32), CX1JM (17.55), FL8MC (19.40), HK3AV (12.49), HM1DE (09.08), JAs (08.30—10.50), KR6CO (10.15), KR8CS (08.56), MP4BEU (10.41), OA4INE (11.30), OA6W (21.52), TR8AG (19.00), VK9CJ (11.45), VQ8AW (13.00), VQ9HB/D (12.00—21.00), VQ9HB (12.47), VS6EN, FK (12.30), VS9ARV (11.30), VU2GC (08.40), VU2TZ (11.00), ZC4LK (20.00), ZD7IP (17.45), ZD8J (11.32), ZD8AM (11.00), 5R8CQ (16.12), 606BW (12.15), 9K2AN (14.04), 9L1JR (13.00), 9V1RS (15.20), 9Y4LZ (20.07).

21 Mc/s S.S.B.: CE6EW (19.30), CE7EB (18.25), CP1AG (19.00), CP1EO (21.00), CX8AAW (15.56), W6FHM/DU1 (09.15), FR7ZD (09.14), HC1VT (20.20), HK4KL (20.07), HL9TH (08.50), HP1PB (20.00), HZ1AB (16.00), JA1—O (11.00—13.00), KG6AAY (10.20), KR6DJ (09.10), KR6KJ (11.26), KV4EQ (15.08), LU7DGM (18.00), MP4TBO (14.10), OA1W (15.08), OD5BZ (12.50), PJ2MI (21.32), PJ5BE (20.22), PY7ACQ (Fernando do Noronha, 18.45), SU1DL (10.03), TG8FA (17.56), TI2CHV (18.20), TU2BD (14.20), UW9CC (09.56), UA0SK (09.58), VK2FN (10.55), VK9GN (T.N.G. 10.30), VP2AA (21.10), VP7DI (15.14), VP8CW (21.15), VQ9TC (14.00), VU2FN (12.15), XW8AL (13.25), YA1AW (14.20), YV7AV (20.39), ZD7RH (10.33), ZD8CR, RD (14.10), ZL3IS (07.35), ZP5KB (21.10), ZS3XG (17.30), 4U1SU (14.00), 606BW (14.00), 9L1JR (12.04), 9M2DQ (09.50), 9M6AP (10.35), 9V1CN (14.25).

28 Mc/s C.W.: CE3ZW (15.45), CR6PX (09.48), CR7IZ (14.15, 18.10), CX4AT (17.20), PY2AOP (16.25), PY7AKQ (16.30), ZC4GB (16.30), ZE3JJ (16.30), ZS1YE (15.50), 5R8CQ (16.30), 5Z4JX (13.45), 9Q5CJ (17.57).

28 Mc/s A.M.: CR6JP (17.42), CR7GR (16.16), CX2DV (16.30), HC3KE (21.10), LU4DW (14.55), OD5AD (15.31), UR2HF (12.09), W3s and W4s (21.00—22.00), ZC4LK (16.06), ZE2JA (16.42), ZS1BV (16.21), 5R8BY (18.07), 5X5JK (15.30), 9L1AJP (18.10).

28 Mc/s S.S.B.: CE6EZ (17.37), CE6EW (19.42), CR6AN (18.13), CX4AF (18.02), EA8AH (16.25), EL2AK (18.18), HK3AVK (18.35), HZ1AB (15.22), KP4BJM (18.10), OD5BZ (17.00), LU1DAB (17.17), PY2PA (17.48), SV1AE (17.46), SVOs WF, WU (Rhodes, 17.00), VP5AR (18.34), VS9AJC (15.45), VS9PCZ (14.06), YV4AGM (16.29), ZC4RM (15.13), ZD8WZ (19.30), ZE1AA (16.18), ZP4ZT (17.10), ZS's (14.30—16.30), 5A3TK (18.10), 5H3JR (13.28), 5N2AAZ (17.00), 7Q7RN (17.50), 9J2VX, WR (13.55), 9M2FX (09.33), 9Q5NT (17.03).

1966 Countries Table

	1·8 Mc/s	3·5 Mc/s	7 Mc/s	14 Mc/s	21 Mc/s	28 Mc/s	Total
G8VG	4	21	21	68	47	19	180
G3NMH	—	—	—	128	39	23	190
G3UML	3	22	12	116	43	19	215
G8JM	5	—	13	168	58	2	246
5N2AAF	9	14	16	87	46	11	183
G3IGW	19	41	39	47	44	1	191
G3KSH	7	15	26	40	29	8	125
9V1LP	6	12	20	27	23	14	102
G3LHJ	4	20	16	58	19	2	91
G3MWZ	7	10	1	20	6	—	52
G3JVJ	15	9	16	6	2	—	48
A4552	2	25	12	127	84	30	280
A4308	2	16	28	111	86	28	271
A4609	14	14	23	81	69	8	209
A4048	7	37	36	116	59	16	271
A4311	—	15	13	115	37	23	203
A4038	3	3	5	97	45	3	156
A4955	8	17	33	50	42	2	152
A4431	4	24	28	51	38	1	146
A4370	4	22	5	139	27	1	198
A4489	21	59	76	157	25	1	339
A3699	7	21	17	37	26	—	108
A3942	12	34	51	79	22	—	198
BRS25605	8	32	29	51	10	1	131

(This month's table is in order of 21 Mc/s plus 28 Mc/s totals)

All correspondents are thanked for their assistance, and particular thanks and acknowledgements are due to the *West Gulf DX Bulletin* (W5IEJ), the *LIDXA Bulletin* (W2FGD/W2MES), *DX'press* (PA0FX), *The DX'er* (Northern California DX Club), *Florida DX Report* (Florida DX Club), and the *DX News Sheet* (Geoff Watts). Please send all items for the July issue to arrive not later than **15 June,** for the August issue **13 July,** and the September issue **13 August.**

The G8ON All-band Aerial

By H. S. CHADWICK, G8ON*

IN September, 1957, an article appeared in the RSGB BULLETIN describing an aerial which had been developed by G8ON to put a consistent S9 Top Band signal into Guernsey, a distance of 300 miles, and proved to be a very popular design. The story did not end at this point, however, for, with modifications, the aerial was found to give a very satisfactory performance on other bands, and the next logical step was to try and reduce the dimensions for the benefit of amateurs with restricted garden areas. The results of nearly ten years' experimentation have been compiled, and form the basis of this article on the G8ON All-band Aerial. The smaller versions are described, but it should be appreciated that the performance of these is naturally not optimum on the lower bands. Furthermore, it has never been supposed that this is the best aerial for any particular purpose, but it is claimed that for the space, cost, wind-resistance and ease of operation and construction, it is very difficult to design so many bands into a more versatile aerial.

The basic design is shown in Fig 1: the effective portion of the aerial is a bent half-wave on the " design frequency,"

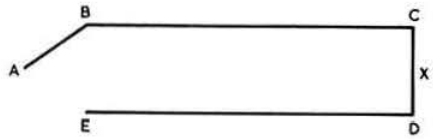


Fig. 1

Design Frequency	A-B	B-C D-E	C-D	Pole Height
1·8 Mc/s *	44 ft.	84 ft.	30 ft.	38 ft.
3·5 Mc/s	14 ft.	52 ft.	28 ft.	36 ft.
7 Mc/s	14 ft.	27 ft.	12 ft.	18 ft.
1·8 Mc/s	44 ft.	116 ft.	33 ft.	38 ft.

*Loaded with coil and 11 ft. length beyond point E (see text).

which in the case of the prototype was 1·8 Mc/s. Versions with design frequencies of 3·5 Mc/s and 7 Mc/s are used by G3PRD and G3OZN respectively, both in Worksop, and are operating regularly on all bands from 1·8 Mc/s to 14 Mc/s. It is clear that the aerial will function reasonably on one-half the design frequency as a quarter-wave, and is still in the field as an eighth-wave on a quarter of the design frequency.

Operation on the Design Frequency

This was originally all that the writer set out to achieve: higher frequency operation came as something of a bonus. Referring to Fig. 1, the lengths B-C, C-D and D-E add up to one half-wavelength at the design frequency. B-C and D-E are equal in length, and D-E is erected as nearly as possible exactly below B-C, so that C-X-D is vertical and E is directly below B. The point of current maximum will be at X, in the centre of the vertical portion. C-X-D should be as long as pole height will allow—though this may be a subject of compromise when higher frequency operation is also desired—and if a metal pole is used, it should be at least 6 ft. from that pole. It will be more satisfactory if the pole is not earthed, as a considerable current may be induced in it.

A single wire feeder from the a.t.u. is attached at point B. Lengths found to be suitable are around 45 ft. for 1·8 Mc/s and 3·5 Mc/s and 14 ft. for the 7 Mc/s design frequencies. These lengths are concerned only with ease of matching into the a.t.u., and with reducing the length to such fraction of a wavelength that radiation from the feeder does not greatly affect operation. It is supposed that, at the higher frequencies, some loss may be avoided by using tuned open-wire feeders as in a Zeppelin aerial. This has not so far been attempted, nor do h.f. results suggest that it is really necessary.

If C-X-D can be made a quarter wavelength long, the results at the design frequency will be excellent, but this is at the expense of the h.f. performance. The length is hardly practicable, however, and in the writer's, and the other cases mentioned above, C-X-D are 30, 28 and 12 ft. respectively. The height of C-X-D above ground should be from 5 to 10 ft. in all models, according to convenience.

In the half-wave mode, the maximum of current is at the centre (X) of the vertical portion C-X-D, and behaves like the " middle " cut out of a vertical half-wave, without requiring the unreasonable pole height. But in addition to the radiation from the vertical member, there is a further bonus. The points B and E are obviously at opposite potential, and B-C, D-E, are virtually the opposite plates of a charged capacitor, although it is shorted by the inductor C-X-D. A current—a displacement current—will therefore flow in the (air) dielectric between them. This view was first expressed by Dud Charman, G6CJ, and it was confirmed by placing an electrostatic screen, consisting of a system of parallel wires, horizontally between the upper and lower sections. When un-earthed, this had little effect on the signals, but when earthed (and the transmitter slightly retuned) the signal fell. Some stations reported as much as a 10db drop.

It will be noted that this aerial, except on the h.f. bands, would necessarily have a high feed impedance at the transmitter (A). This is considered advisable, as a high current in the shack means (i) greater possibilities of r.f. feedback, and (ii) greater loss by induction into nearby wiring. The smaller the output current, the smaller the losses in a high resistance earth connection. The weakest link in the average amateur station is a far too high resistance earth connection, which is good enough reason for passing through it as small a current as possible.

Those whose gardens will not permit the erection of an aerial of the design frequency in which they are most interested (e.g., 1·8 Mc/s in a 60 ft. garden) should try erecting a 3·5 Mc/s design, having, as for 1·8 Mc/s, an additional length of wire (E-F) between the end E and the kitchen window for instance. With high frequency operation in view this length of wire is most conveniently made about 11 ft. long. A clip or plug system can be devised to connect point E either directly to this wire, so extending the aerial by 11 ft., or via a coil which will load the length F-E-D-X up to a quarter wavelength on the desired low frequency. It can readily be seen that if F is to be a high impedance point—which the end of an aerial must always be—then the maximum of current must appear at point X, the centre of the vertical. While there will then be some loss of efficiency so far as the displacement current is concerned, this is still a good aerial. The coil and/or 11 ft. are removed for other, or at least some other bands. It is not possible to give general details as to the coil size—for it is electrically equal to whatever is missing from the length F-E-D-X to make up a quarter wavelength. It is best made by inserting a tapped or tappable coil of say 30 turns, with wire diameter spacing and 2 in. diameter at point E. A car headlamp bulb, or an r.f. ammeter if binoculars are available, is inserted at point X. With the transmitter tuned for maximum glow or reading, turns at either end of the coil are shorted out one by one, and the transmitter retuned each time for maximum reading or glow as appropriate. The coil size providing the greatest current at X is not hard to find. A

*25 Raines Avenue, Worksop, Notts.

more weatherproof coil of about the same inductance is inserted afterwards, the precise value of which is not critical.

Operation at twice the Design Frequency

This is the condition which holds up nearly every QSO by having to be explained twice, for it is so obvious to the other amateur that the aerial must " cancel itself out " in this mode—even after he has given you a good report!

Assume that the design frequency is 1·8 Mc/s. It follows that point X is a current point on 1·8 Mc/s, but on 3·6 Mc/s this current point has become a point of maximum voltage, from which it follows that the currents in the vertical above and below X are flowing in opposite directions. By drawing the arrows back up and down the vertical and into the horizontals it is apparent that, while in different directions in the *wire*, they are in the same direction in *space*. This is, of course because the aerial has turned back upon itself at the same point as the current did, and we have what almost amounts to two half-waves in phase. The aerial is not very fade-prone on the design frequency because it is emitting mostly vertical polarized waves (try it on the mobiles) and even in the $2 \times \lambda/2$ condition it retains some of that same property, because it offers the receiving aerial the choice of two half wave aerials; a double diversity effect. There will, however, be distances at which fading is intense—and of course these will not remain constant.

It may be encouraging to mention that the writer's first contact ever on 3·5 Mc/s was with the loaded 1·8 Mc/s prototype. The USA was reached on 8 watts—though admittedly this was using c.w.

Operation on Higher Harmonics

It will be apparent that if point X is a voltage point on the second harmonic of the design frequency, it will be a voltage point on every even harmonic. It also follows that it will be a current point on every odd harmonic. There is only one condition in which this aerial can be using an odd harmonic, apart from the design frequency, and that is the case of the 7 Mc/s design used on 21 Mc/s, but this will be treated later.

From the reasons set down above, the same conditions of both current and direction changes above and below X will again apply. Sketching in the current curves on each leg i.e., B-C-X, E-D-X, we see that the aerial is symmetrical about point X. Again each half-wavelength of wire in the top section carries a current in phase with that in the lower leg immediately below it. For the purists, this is not *exactly* true, but for the purpose of adding stickers to one's DXCC it is near enough!

From point X, going in either direction for a half-wavelength along the wire, we will have a section similar to a full wave vertical aerial, which will give very little radiation because its upper and lower halves are out of phase. We are therefore left with an equal number of halfwaves in the horizontals, and the polar diagram will resemble that for one of these horizontals alone, except that there is rather greater gain. The extent of the gain may be taken approximately from the tables C and D on page 378 of the RSGB *Amateur Radio Handbook*, but the aerial seems to be rather less efficient than the Lazy H.

When using the 7 Mc/s version on 21 Mc/s we appear to come up against a snag. Point X is now a current point, the vertical section plus the bits of horizontals adjacent to it no longer phases itself out, and yet the horizontals do. In this condition the horizontals behave like radiating feeders, the real " feeder " A-B radiates too, and the quarter-wave each side of X behaves rather like the aerial as a whole does on the design frequency, but less efficiently. The polar diagram becomes a nightmare, if indeed there is a polar diagram at all! One is tempted to sacrifice a white cockerel before switching on the rig.

This is where the 11 ft. length E-F comes in. If we short out the coil so as to insert the extra length, we have added a quarter-wave section at 21 Mc/s. Point F now becomes a high impedance point instead of point E, and therefore point X becomes a voltage instead of a current maximum. The top and bottom sections are in phase. Admittedly, part of the feeder A-B becomes a part of the top section, in phase with F-E, and the polar diagram is thus not quite what the textbook ordered.

In general, we may deduce the polar diagram on the higher frequency bands by taking the length X-D-E or X-C-B, reducing it by half a wavelength for the frequency in use, and referring to the textbook for the diagram of the number of half-waves which remain. We must allow some divergence from this, due at least in part to the fact that the lower element D-E is not nearly so far above earth as it would be in a Lazy H or similar aerial. This may reduce the gain, but seems to spread the lobes around.

An unusual effect has been obtained with the prototype, which cannot be explained. The addition of an 11 ft. length while operating on 14 Mc/s appears to move one lobe out of Brazil into VP8 and another from UA9 into JA and KR6. While little has been done on this, the matter does not seem to be one for complaint. The prototype works well on 28 Mc/s and loads reassuringly on 70 Mc/s, but little or nothing has been done with these bands.

While nothing is known about aerials of this type constructed for design frequencies above 7 Mc/s, it is clear that they would function. A 28 Mc/s design having its vertical C-X-D 8 ft. 6 in. long would have two horizontals each 4 ft. 3 in. long, and would be one half of a quad. Two

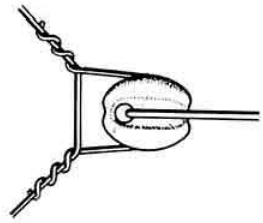


Fig. 2. Reducing the sharpness of bends at corners.

such aerials, back to back, fed at X(1) and X(2) with 600 ohm feeder, would be a half-wavelength broadside with a gain of 4·7db, as in diagram (C), *Amateur Radio Handbook*, page 378. These give some idea of the considerations which first led to the design of this aerial.

Constructional Practice

The design presents little difficulty, and the element lengths do not seem to be critical to within a foot or two at 3·5 Mc/s, or to an inch or two at 14 Mc/s. It is in general, a bad practice to make any aerial with sharp bends in it, for these may cause sharp changes in impedance at these points. To avoid this, the wire is not twisted through the insulators at B, C, D, but is secured by a " hairpin " of wire passing through them. The same technique should be applied if bends are needed in the feeder A-B. Apart from impedance changes, should the wire be removed for further use, this method will permit it to come away without undesirable kinks which are potential breaking points.

The 1·8 Mc/s design, when used on that band, may sometimes show a *reduction* in signal strength at a range of 10 to 30 miles. This is because, for a Top Band aerial, the angle of radiation seems to be rather low; this may well show up in the receiver by the reception of quasi-DX fishphone. One method, still unexplained, of increasing the semi-local signal is to add more verticals parallel with C-X-D and spaced about six inches apart, although this will adversely affect the performance of the aerial at the higher harmonics.

The lower limb of the aerial should not terminate on nor

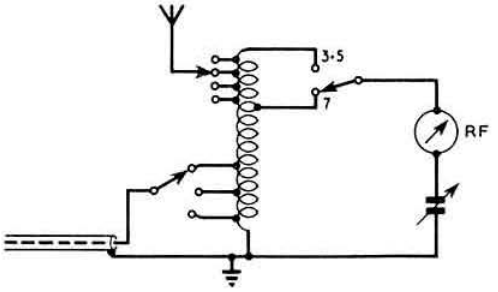


Fig. 3. The a.t.u. for high impedance at the feed point.

pass close to a metal pole. This can often be avoided by running D-E not precisely beneath B-C, but a little to one side. Experiments have shown that a divergence up to at least ten degrees has no noticeable effect, but the effect of a swinging wire within a few feet of a large metal object will cause some detuning.

Aerial Tuning Unit

This is a stupid name for such a device, because this unit does not, in the majority of cases, tune the aerial, but may instead be tuned by it. The aerial is tuned by its own distributed inductance and capacitance along the wire and all we can do is to couple the end to a device having the correct matching impedance. It is therefore more correctly a matching transformer.

The transformer shown in Fig. 14 on page 361 of the *Amateur Radio Handbook* is probably the most efficient way of coupling a single wire feeder. To use the unit on a number of bands, however, it needs modification. It is convenient to bring the co-axial inner conductor to a three-way one pole ceramic switch, with the three " ways " arranged to place the input across the coil at the earthy end. At the lower frequencies the feeder A-B will be less than a quarter wavelength which means that it will be presenting a capacitive impedance which can be higher than two thousand ohms or more. On the higher frequencies it may well be much lower, and with the feeder lengths quoted above it will be so. This is a strong reason for using at least two separate units, and one for each band is the ideal. Switching—a source of loss—can then be entirely avoided. If this is not practicable, separate units should be used for 3·5 and 7 Mc/s, and 14, 21 and 28 Mc/s.

A suitable unit for the lower bands may be made from an old TU5B coil and capacitor, as shown in Fig. 3. Because of the high impedance of the aerial feeder at this point, very little current will flow into the feeder, at least on 3·6 Mc/s. A useful indication is obtained by inserting the r.f. ammeter not in the feeder line, but in the closed tuned circuit. With the aerial disconnected, and using *low power* (or laying in a good stock of ammeters) the capacitor is tuned for maximum reading. If the coil size and co-ax taps are correct, maximum current will be obtained when the capacitor is using about 1 pF for every metre of wavelength. This is approximate, but a fair guide. The aerial is now connected to the hot end of the circuit, the capacitor being retuned for maximum current. Less capacity will be needed if the feeder A-B is less than a quarter-wave and more if it is greater. But in either case, the second maximum will not be as high as the unloaded maximum. Tap the aerial a few turns further down towards earth, and retune, when the maximum will again be lower than before. Keep repeating until the circulating current maximum ceases to fall when a lower tap is used. The tuning will also broaden after the correct point is reached. The transmitter should not be substantially altered during the process.

It may not be out of place to mention that the practice of retuning a transmitter to suit an a.t.u. is incorrect. The transmitter should first be tuned into a resistive load via an r.f. ammeter for maximum reading. The a.t.u. must now be tailored to suck the same power without retuning the transmitter. The dummy load should be tested for d.c. resistance both before and immediately after applying power. If there is a more than trivial difference, a heavier wattage dummy load should be used.

On the higher frequencies (14 Mc/s and above) the feeder as suggested will have a lower impedance, and the a.t.u. for these bands may conveniently have the ammeter in the feeder lead. Both the co-axial tapping points and that for the aerial must be variable over a wider range than for the lower frequency bands, but will probably cover only the lower end of the tuning coil. Fig. 4 shows the lay-out, but tapping points may vary from one installation to another. For each band, the taps should be made temporarily and varied for low s.w.r. before final fixing. Having chosen the correct value for the amount of coil to be tuned by the capacitor, the temporary tapping points can be estimated by a simple approximation. Counting back from point E on the aerial, subtract as many *complete* half-waves as possible from its length. The remainder is a length which is a function of the

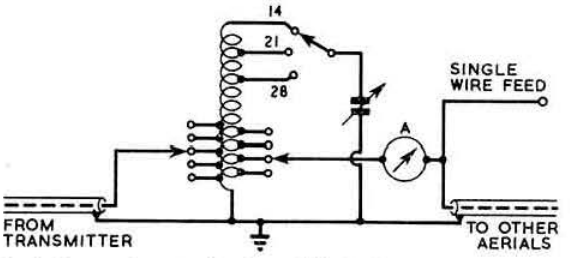


Fig. 4. An a.t.u. for those bands at which the feeder A-B will present a low impedance. This is normally 14, 21, and 28 Mc/s.

feeder impedance. Subtract this length from a quarter-wavelength, or if need be, a quarter wavelength from it. Work out the remainder as a fraction of a quarter-wavelength. Tap the aerial this same fraction up the coil from the earthy end. If in your subtraction you took the feeder length *from* a quarter-wavelength, the tap will probably have to be re-adjusted down the coil while if you took a quarter-wavelength from the feeder length, the adjustment may be in the upward direction. The co-ax taps should, of course, be chosen for lowest indicated s.w.r. on the line between transmitter and a.t.u.

It must in all fairness be admitted that a few very well-versed amateurs have tried this aerial and found no advantage in it, but this may be due to the fact that, being so well versed, they already were well-equipped; and the more all-band their habits, the less the failure, since the most efficient aerial on one band rarely functions well on another. It has advantage over the long-wire in that its polar diagram does not become confined almost to the wire direction at the highest frequencies. Further, it will operate quite well with a very indifferent earth connection, and finally, with a heavy duty l.t. transformer and a few yards of cable, it can be very readily de-iced.

In Good Company

Technical contributions to RSGB BULLETIN are regularly noticed in the review pages of *Telecommunication Journal*, monthly magazine of the International Telecommunication Union. Bill Browning's recent two-part article " Keeping track of *OSCAR* " and Jim Foster's " Propagation at 145 Mc/s with special reference to Tropospheric Scatter " received mention in the April issue.

Equipment Report

TRANSMITTER DUMMY LOADS

By B. D. A. ARMSTRONG, G3EDD,* and R. F. STEVENS, G2BVN†

Fig. 1. A 75 ohm Electrosil H39 resistor mounted with 1 in. capacitor clips as a coaxial dummy load.

AT almost any time, listening on the amateur bands will show that a large number of stations use an aerial as a transmitter load when carrying out tests. In the majority of cases these tests could be carried out on a dummy load and so avoid adding unnecessary QRM.

The problem of making a dummy load is not necessarily simple. It must present a constant non-reactive impedance over the range of frequencies which are likely to be used. Lamps are low cost but their impedance varies with dissipation and they are invariably reactive. A good dummy load is essential in measuring true output power of any transmitter.

Electrosil Resistors

One company that manufactures non-reactive high power resistors is Electrosil Ltd.,‡ who have offered resistors for test by the RSGB. These resistors consist of a metal oxide film deposited on the external surface of a glass tube. Silver metallized bands are applied to each end so that connections may be made.

The following table§ gives the main electrical and mechanical details:

Type	A.C. Watts at 40° C	Ohmic Range Min	Ohmic Range Max	Length	Diameter
H33	15	20	100	3 in.	0·5 in.
H35	30	20	200	4 in.	0·79 in.
H37	70	25	250	6 in.	1·1 in.
H39	140	45	300	12 in.	1·1 in.
HL250	250	50	300	12 in.	1·97 in.

The wattage rating quoted in the above table is continuous and may be increased three times by using suitable forced air cooling. Recommended coolants are silicone oils and distilled water for uncoated resistors, or transformer oils for coated resistors.

A very simple dummy load can be constructed as shown in Fig. 1. A 75 ohms H39 resistor was used. The contact clips at both ends are standard 1 in. capacitor clips, the coaxial connector is a bolt-in equivalent to the u.h.f. series SO239 (Greenpar GE 40010) and the centre conductor (the diameter of which becomes critical at v.h.f.) is copper tube 0·3 in. external diameter: it was slotted, squeezed and soldered to the inner coaxial socket. The other end of the inner conductor is soldered to the brass end plate.

Up to 70 Mc/s the load was an excellent match with a v.s.w.r. less than 1·2:1. On 144 Mc/s the length of the resistor becomes an appreciable part of a wavelength and although a v.s.w.r. of 2:1 was measured there were indications that special techniques may be necessary‖ to reduce this.

Increasing the Rated Dissipation

The Product Application Report by Electrosil Ltd. suggests that where space considerations prevail and it is desired to dissipate large amounts of power in a small physical size then the load may be liquid cooled. In order to

Fig. 2. A 50 ohm Electrosil H37 resistor mounted for oil cooling. Up to 350 watts can be safely dissipated for about 3 minutes.

* Member of the Technical Committee.
† President, and Chairman of the Technical Committee.
‡ Electrosil Ltd., Pallion, Sunderland, Co. Durham.
§ Electrosil leaflet "H" Type Continuous Film Metal Oxide Resistors Ref. E.2.10.
‖ Electrosil Ltd. Product Application "Using Film Resistors as High Power Dummy Loads."

maintain a low s.w.r. and to preserve the desirable coaxial geometry a type H37 resistor of 50 ohms value was mounted in a metal container in the manner shown in the second photograph. The connection to the load is made by a SO239 coaxial socket which is soldered to the cap of the container and the 14 s.w.g. copper wire connection to the bottom of the resistor passes symmetrically through the centre. Connections to the silver metallized bands at the ends of the resistor are made by copper strip which is solder jointed under pressure to ensure a large contact area. The container used is of one quart capacity and both distilled water and transformer oil were employed as coolants.

The unit was tested at frequencies up to 30 Mc/s and the v.s.w.r. was found to be extremely low, being in the order of 1·2:1. R.f. power of 350 watts was applied to the load and both coolants exhibited a temperature rise of 20°C after power had been applied for a period of three minutes. Continued application of power in the absence of any forced circulation of the coolant produced definite hot spots but the period before these became a significant factor would allow ample time for the adjustment of an amateur transmitter.

A dummy load constructed in the manner shown exhibits excellent characteristics and power handling capabilities (for UK stations) and is strongly recommended as a piece of equipment which should be found in every amateur station.

Another Minibook

Principles of X-Rays is the title of the second in the new series of Minibooks offered by Mullard Educational Service. Price is 2s. 6d. (post free), obtainable from Mullard House, Torrington Place, London, WC1.

Northern Radio Societies' Association

1966 CONVENTION MANCHESTER

3-4 September

Further Details Shortly

ARRL honoured by American Red Cross

On the occasion of the 10th Annual Banquet of the Quarter Century Wireless Association, held in Washington, DC, the then President of the ARRL (Herbert Hoover, W6ZH) accepted from Robert C. Edson of the American Red Cross a plaque awarded to the League " for generous and continuing assistance with emergency communications in time of disaster."

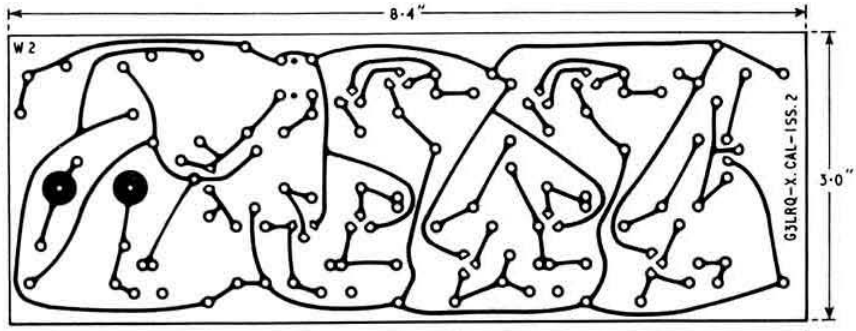
On the Air

On the Air is a new monthly 16-page news letter published by the Traffic Bureau of UBA under the editorship of Jane Hiernaux, ON4AD, 111 Avenue J. F. Debecker, Brussels 15 The newsletter contains a mixture of DX and contest news. last minute items, a ham bourse, and a v.h.f. column.

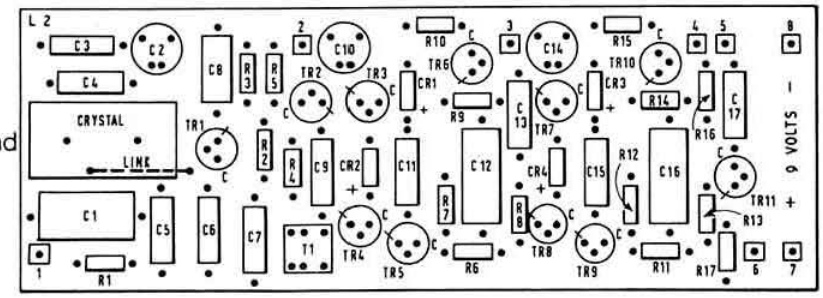
Printed Circuit Board for the G3LRQ Calibrator

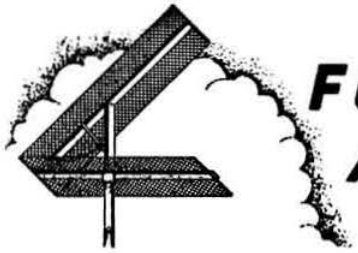
The description of the G3LRQ transistor calibrator published in the December 1965 issue of the RSGB BULLETIN has proved very popular and the author has received many requests for detailed plans of the printed circuit board used in the prototype. For the benefit of other members who may wish to etch their own circuit boards details are shown in the adjoining diagram.

(a) Wiring

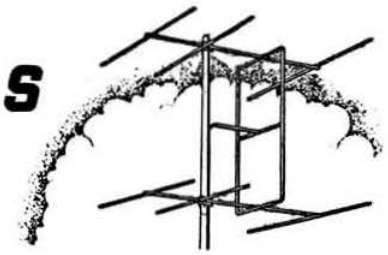


(b) Legend





FOUR METRES AND DOWN



By JACK HUM, G5UM*

VALEDICTION

TO be asked to take over *Four Metres and Down* from G2AIW is at once intimidating and stimulating. Fred Lambeth has conducted this feature for rather more than the last decade. How he managed to do so while at the same time very effectively performing the job of v.h.f. secretary to IARU Region I, greatly impressed many of us.

Fred's continuing activity on the international v.h.f. front will be to the benefit of all, and will be welcomed both here and on the continent of Europe, where he has long been held in high esteem as a Good European.

His past commitments have prevented him from appearing on the air as much as he would like. Here's hoping that the call-sign G2AIW, part of the v.h.f. scene from the Resumption 20 years ago, will be in evidence more frequently from now on, and that Fred will be heard getting around on the air.

Two Metre Band Plan Modified

The objective: Maximum effectiveness at minimum disturbance

After months of debate in which indeed " every avenue has been explored " and a mass of opinion sifted, the British Isles Two Metre Band Plan is to be modified with effect from 1 August, 1966. Here are details and comments:

DECISION: A c.w.-only section is to be created extending from 144·0 to 144·1 Mc/s. *Comment:* this alteration meets a widely expressed requirement to establish a telegraphy-only section at the l.f. end in accordance with practice prevailing on the lower frequency bands. C.w. gives promise of extending the DX potentialities of 2m to a considerable extent under conditions which might make a.m. telephony unreadable.

DECISION: The South Western zone formerly occupying 144·0 to 144·1 Mc/s will be merged with the next zone up, extending from 144·1 to 144·25 Mc/s. *Comment:* the amateur population of the two zones totals some 1300 stations, similar to that in most other single zones.

DECISION: The s.s.b. spot frequency will move from 145·1 to 145·41 Mc/s. *Comment:* This is to bring the British Isles practice into line with that on the continent

DECISION: Out-of-zone working operators are to be encouraged to use a frequency outside their own zone frequencies in order to *answer* CQ calls by netting on the calling station's channel. *Comment:* This important provision is intended to encourage the development of stable v.f.o.'s for 2m and to improve operating techniques. Operators are expected to call CQ within their own zones and to move into other zones to net on to the frequency of a wanted station, moving back again to their own frequency zone afterwards unless they are themselves called on the same channel.

* * *

There it is, then: a plan that meets the wish of the majority to retain some form of geographical band planning, causes minimum disturbance to the tranquillity of the existing scene, yet is forward-looking enough to be viable for a considerable time ahead.

Throughout the meetings at which the new plan was developed, *The Short Wave Magazine* has been fully engaged, and the advice and points of view put forward by Austin Forsyth, G6FO, to the Society's V.H.F. Committee have been valuable indeed. Which is as it should be, for the original British Isles Band Plan for Two was helped on its way by the enthusiasm and sponsorship it received from *SWM*.

Immediately, operators in the South Western zone who wish to acquire crystals for their new combined zone are invited to state their wants free of charge in " XTAL XCHANGE". We guess not many of them will wish to part with their existing crystals: these will be very useful for the new c.w. segment. But if they do, "XTAL XCHANGE" will help.

Longer term, there is a requirement for a good v.h.f. master oscillator design to help develop the netting, single-channel technique envisaged for the future. It should be keyable so that it may be used in the c.w. segment as well as for co-channel A3.

Just a few final thoughts on the revised Band Plan.

Although there is now an *exclusive* c.w. segment, don't forget that A1 can be used anywhere in the band, not just on 144·0 to 144·1 Mc/s.

If you *do* move about the band in search of QSOs always avoid working on or near the v.h.f. beacon frequencies. Especially avoid those aeronautical guard channels, too! You don't know what they are? Look at your licence!

Frequently check that international s.s.b. channel at 145·41 Mc/s.

THE NEW 2M BAND PLAN

Zone 1 *C.W. only* (Nation Wide)	144·0	to 144·1	Mc/s
Zone 2 *Phone* */*C.W.*	144·1	to 144·25	Mc/s
Zone 3 *Phone* */*C.W.*	144·25	to 144·5	Mc/s
Zone 4 *Phone* */*C.W.*	144·5	to 144·7	Mc/s
Zone 5 *Phone* */*C.W.*	144·7	to 145·1	Mc/s
Zone 6 *Phone* */*C.W.*	145·1	to 145·3	Mc/s
Single Sideband Spot Frequency (Nation Wide)	145·41 Mc/s		
Zone 7 *Phone* */*C.W.*	145·3	to 145·5	Mc/s
Zone 8 *Phone* */*C.W.*	145·5	to 145·8	Mc/s
Zone 9 *Phone* */*C.W.*	145·8	to 146·0	Mc/s

Members are invited to add the above amendments to their copies of The British Isles Two Metre Band Plan at the back of the current edition of the *Call Book*.

* Including s.s.b.

* Bulls Green, Knebworth, Herts. Please send reports to arrive not later than **10 June** for the **July** issue, and **8 July** for the **August** issue.

Rather more than "Points for the Boys"

During the course of the several weeks either side of the publication date of this issue of the BULLETIN there will be (or have been) contests on all four of the active v.h.f./u.h.f. bands.

The 70cm and 23cm conjunct event over the last weekend of May is just behind us. The first weekend of July sees the year's Second 144 Mc/s Portable Contest, with the first of the 4m portable events following three weeks after that.

What can be predicted with some certainty is that each of these contests will promote a much higher level of activity than is usual on any of the four bands concerned, which is a very good thing, even though it generally causes a *much lower* level of activity in the succeeding days, when a condition of *post-contest ennui* seems to be prevalent. What may also be predicted is that of the hundreds of stations active in any of the above mentioned contests only a modest proportion will send in entry logs.

To look at the picture presented by the two c.w. contests tabulated in the April issue of the BULLETIN is to get a fair idea of the way things work out in most contests today.

In the 2m c.w. table, 47 stations appeared: yet the top scorer, GW3RUF/P worked 91. What happened to the remaining 44?

In the 4m c.w. table 21 stations appeared: the top scorer, G3OXD/A, notched 43 that day.

Assumption: that 44 operators in the 2m contest and 22 in the 4m one came on in order to enjoy the prevailing enhanced occupancy, and at the same time to exercise a skill which can all too easily become rusty on v.h.f.—pounding the brass.

Subsequent contests, the 2m " Open " in March, and the 4m " Open " in April, generated a high degree of activity. In both events several contestants were heard exchanging serial numbers approaching the 200 mark, yet one would be prepared to bet a couple of E88CCs that only about 25 per cent of the people known to be on at the time appeared in the final tables in the BULLETIN. Of the remainder some were on the air, as we have said, to enjoy the occupancy. Others will say they came on " to give some points to the boys "—as if participating in contests were a bit below their dignity!

While wholly agreeing that no man need enter for a transmitting contest if he doesn't want to, it is worth remembering that the final tables which appear in the BULLETIN are in effect " photographs " of contemporary v.h.f. activity in this country. They will have an historic value in the future: they have an even greater value *now* as showing how intensely we are using our metre-wave allocations today.

If everybody (or nearly everybody) who exchanged serial numbers in a v.h.f. contest took the small trouble to put in an entry, the V.H.F. Contests Committee would probably wonder what had hit them—but wouldn't mind a bit!

Never fear about coming at the bottom of the tables: if there are 200 entrants there will be 197 losers!

Verb Sap in respect of the rest of the 1966 contests!

The closing stages of operations at G3AHB/P during the 2m Portable Contest on 8 May. The site of the station was the Chiltern Hills, from where 70 stations were worked. Right to left: G8AIJ, G3NLF, SWL, G8AOV, with G2XA operating.
(Photo by G3AHB)

" It gives me more gain than a halo . . . "

Contests and Computers!

Still on the subject of contests, one member we know loses patience after he has been operating for three or four hours single-handed.

" All this mechanical exchanging of serial numbers! You might as well sit back and let a computer do it for you! " he says, though he doesn't go on to say how otherwise are you to organize them?

He is not the only one who feels that contests tend to depersonalize amateur communication up to a point. Here is another slant to the question provided by Bill Scarr, G2WS, who has a few pertinent comments to make not so much about scoring methods but to the closely allied question of QRA Locators. Bill says: " I am still opposed to the QRA locator system for inter-G contest scoring.

" Surely most of us take part in contests for pure enjoyment—and with little thought of coming out at the top. For my part, the chief interest in a contact is in the other man's location and when he says ' Four miles S. Bristol,' I like to visualize him up on Dundry Hill.

" But if I'm merely to be given ' YL34G ' or some such series much of the interest is lost and there's certainly no time to be working out QRAs during a contest. Apart from this there is little doubt that exchange of QTHs gives more accurate information up to, say, 150 miles than does exchange of QRA Locators.

" Looking up places on maps is also more interesting than plotting QRA points—and quicker.

" I do hope the V.H.F. Contests Committee will not sacrifice enjoyment to mechanisation—otherwise we shall soon be needing computers to work out our scores! "

Sundry Modes on " Seventy "

There is very little " sideband " on 70cm as yet (" There's precious little on 2 or 4 for that matter " the s.s.b. enthusiast will add!).

Where s.s.b. will really pay off is from the remoter parts of the country. Stations inaudible on A3 will probably be

workable on s.s.b. From Cornwall, **G3OCB** reports steady progress with the big rig, finding that the QQV03-20A amplifier at 432 Mc/s is not quite man enough for the job of driving the pair of 4X150A used in the final. By substituting a '6-40A as the penultimate stage, giving 10 to 30 watts of sideband, Clive hopes to do the trick.

At Dudley, in Worcestershire, David Taylor, **G6SBD/T**, is progressing with a 40 watt n.b.f.m. rig for 432·56 Mc/s, using a '6-40A as the final. Incidentally, by intelligent use of local topography he has achieved QSOs which might otherwise have been difficult. Clee Hill, 7 miles away, is his electronic stumbling block. He has worked G8ADD and G8DV by reflection from it.

" Twenty-Three," and—

Once it was 70cm that was the " difficult " band. This is no longer the case and three hundred G8-plus-threes know the reason why. They are the moving spirits that have galvanized this band.

Many of them are applying their know-how to the next band up, 23cm, aided, abetted and encouraged by a significantly large number of two-letter-call men. Of these one deserves a special plaudit and he is Clem Tucker, G5DT, that G.O.M. of the ultra-highs, 77 years young.

For years Clem was a beacon on 70cm (and still is). Now on 23cm he is the focus of activity which is so regular as to have become almost routine, yet which half a decade ago would be called staggering. What it amounts to is that any night he is able to make contact with a whole string of 23cm stations along a path extending from his QTH at Wallington in Surrey out through North-West London to as far away as Bletchley, where two more " beacon " stations, G3GWL and G8ABB, are regularly available. This is the better part of 50 miles and is done from typically average amateur locations.

Similar results are reported from other areas, and counties worked totals are rising. For example, G5FK, the GEC club station, now has seven counties notched.

The manner in which " Twenty Three " has developed and occupancy increased prompts thoughts about the " next band up again," i.e., 13cm.

—" Thirteen "

The 13cm band, extending from 2300 to 2450 Mc/s, has lately been the subject of renewed interest generated by the appearance at the V.H.F. Convention of a 13cm converter designed and built by Dr. Dain S. Evans, G3RPE, and the deserved winner of the 1962 V.H.F. Committee Cup in the Constructors' Contest.

If systematic work on 13cm is in train please send details for publication here.

On which subject herewith a comment from Heath Rees, G3HWR, writing about activity at G5FK:

" On 2300 Mc/s we have had our first contact using F3 on 2301·75 Mc/s, distance 500 yards, signal strength overwhelming! The receiver covers 2300 to 2310 Mc/s. The first set of equipment is modified commercial gear; the second generation is now in progress. G3RPE has built a simple converter for the band and two more are to be built, one by G3HWR and a spare for G5FK. A paper design for a transmitter using four doublers from 2m has been drawn, but it is unlikely that this will be built for a month or two (In passing note that 144 × 16 = 2304)."

Heath goes on to say that at his home station " the feed for the 1296 Mc/s paraboloid is to be made demountable to facilitate operation on 2300 Mc/s with the same dish. Can any of our aerial experts drum up a two-band feed for a paraboloid or corner reflector covering 1296 and 2300? "

Flashback to Moonbounce

From **WA6LET** via G3LTF comes a note about the attempt earlier in the year to work VK3ATN on 144·1 Mc/s on an earth-moon-earth path. Although the one-kilowatt US signal, radiated from a 60 ft. dish, was taped by VK3ATN, the latter was evidently not copyable at the American end, although he used 150 watts and huge rhombics.

No immediate plans are in hand for further tests, but the following comment from WA6LET is worth noting by any enthusiasts who still believe there is an easy way to Moonbounce: " We are pretty well convinced that Moonbounce is not worth scheduling unless each station can at least hear his own echoes part of the time."

Not entirely irrelevant to the above is the following, culled from *Electronics Weekly* for 27 April:

" *Amateurs Show the Way*: Australia's first earth satellite, *Australis*, is being designed and assembled in Melbourne—by Amateur Radio operators.

" It will weigh 35 pounds and is expected to be launched by the US at the end of this year. Co-operating in the project are the Wireless Institute of Australia, Melbourne University Astronautical Society, and Melbourne University Radio Club.

" The Australian Supply Department has offered test facilities in Melbourne and Salisbury. It is powered by chemical batteries with an operational life of three months."

Skeds Operative and—

Operators who either keep regular schedules or participate in fixed-time nets confirm that these are good methods for bringing apparently quiet bands to life. Nets and skeds guarantee something to listen to, with the promise of a QSO when they have finished.

It will probably be of value to the v.h.f. membership in general if details of regular schedules and nets are printed here, so please send them in—*but only if they are firm* and not as-and-when affairs.

To start off with, here are details of the net-sked times of a group which the writer happens to know, the Mid Herts:

Mondays, Fridays and Saturdays, 145·1 Mc/s, at 8 p.m. clock time.

Mondays and Saturdays, 433·1 Mc/s, at 9 p.m. clock time.

* * *

GW3LQE, Penarth, to G3GVM, Fareham, Hants.
Mondays to Fridays, 18.00 GMT, on 70·27 Mc/s.

* * *

EI2W, Sandyford, Co. Dublin. Most evenings, 19.00 GMT onwards, 432·597 Mc/s, using a 96-element array.

Three-Band Activity in North-Western Contest

Keep a special watch for north-western stations on Sunday, 17 July, between 09.00 and 17.00 GMT. This is the date of the RSGB North West Region V.H.F. Contest—and 70, 144 and 432 Mc/s will all be in use.

Organisers: the Ainsdale Radio Club (on behalf of Basil O'Brien, G2AMV, the NW Regional Representative).

Eligibility: the contest is open to all members and groups in RSGB Region 1, the NW of England.

Rules: copies may be had from Regional Rep Basil O'Brien, 1 Waterpark Road, Prenton, Birkenhead, or from Norman Horrocks, G2CUZ, 34 Sandbrook Road, Ainsdale, Southport.

Award: the winner will hold " The G2CIP Trophy," presented by the Ainsdale Club in memory of the late Ted Moor, G2CIP.

—Skeds Wanted

Members wishing to set up schedules or nets on any of the metre-wave bands are invited to state their requirements in this space; proposed dates, times and frequency should be given.

For a start, **G8ANQ** of Whitby, on 433·35 Mc/s asks for skeds at any time.

G8ADH, Ringwood, any time on 70cm. A 4X150 p.a. is on the way.

And from France comes a request from **F8DO** for m.s. skeds with ZB1, ZB2, GI, GM, GC and GD. Write to him direct: M. Cousin Marius, Ecole des Garcons 69, DRACE (Rhone).

From the Exeter Group comes support for the Thanet Radio Society's suggestion that a " Four Metre Activity Night " should be organized. Over a dozen Exeter area stations use " Four " regularly. They would like firm news of other clubs' wishes for a set night to be devoted to activity on this band.

Views, please, to help fix it!

Tech-Corner

" What sort of inductive coupling do you use between driver and p.a.? Must it always be symmetrical into a push-pull final? "

" How DO you manage to get a pentode mixer to have such a low noise level? "

Obvious questions maybe: yet what may seem to be the obvious and taken-for-granted once it is assimilated into your station may well be novel to the next man.

Which leads up to the thought that it would be a very good idea if readers of " Four Metres and Down " would pass on to their fellows through this page those small and practical tech-hints that do not warrant more extended treatment but represent the kind of thing that might be imparted during ragchews at the local club.

Dissected diagrams would be especially useful in this context where they help to clarify a point.

If enough v.h.f. hints and kinks are received we would consider making " Tech Corner " a regular thing.

Beacon News

Via Bill Burton, G8ANQ, of Whitby, comes some most valuable information received from LA4ND, hon. secretary of NRRL, about v.h.f. beacons in Norway.

LA1VHF near Rjukan 59·51N, 08·39E, 1845 m.a.s.l.—145·150 Mc/s.

LA2VHF near Trondheim, 63.2N, 10.15E, 552 m.a.s.l.—145·200 Mc/s.

LA3VHF near Harsted, 68.48N, 16.31E, 183 m.a.s.l.—145·250 Mc/s.

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	A1	
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	A1	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
6 April	08.52 GMT	130 c/s low
12 April	15.10 GMT	200 c/s low
19 April	15.10 GMT	160 c/s low
26 April	13.54 GMT	320 c/s low

LA4VHF near Bergen, 60.25N, 05.22E, 561 m.a.s.l.—145·300 Mc/s.

No information is given as to aerial directivity, but what *will* be evident is that all four beacons are well sited. Note that heights are given in metres.

A check on the frequencies given when conditions promise to be " up " will be well worthwhile. If any of the beacons are audible keep the beam north-east and put out some CQ calls on the key as well as on A3.

News has just come through that the South Wales beacon project has been approved by the GPO. Its call-sign will be **GB3GW** and its location University College, Swansea. The frequency of 144·25 Mc/s will be conveniently at the junction of two zones.

And Northern Ireland's beacon GB3GI should be fully operative as of 1 June. Listen for it now!

Personals

Welcome back to 2m to G4PS of Hampshire, after a long illness. He reports that getting back on the band and enjoying the friendly chats it produces has a considerable therapeutic value!

And to G5NU, Reading, who, QRT for 19 years, decided " Two " was the band to choose for his restart.

Congratulations to Harry Wilson, EI2W, on being re-elected as V.H.F. Manager for Eire at the IRTS Annual General Meeting in April.

Welcome to " Two " to G5ABY/DJ5DT/A who appeared on the band from Ealing in West London on 29 April with some impeccable c.w. His very first QSO on 2m was with G3DXI, followed swiftly by several more—all on the key.

" Very Highs " at Opatija

As this number of the BULLETIN was on the presses delegates were assembling at remote Opatija for the IARU Region I conference. On the v.h.f. front Geoff Stone, G3FZL, went along as the Society's V.H.F. Manager, and Fred Lambeth, G2AIW, in his capacity as secretary of the V.H.F. Committee of the IARU (There are two other working committees).

A fat dossier of recommendations from many European member-societies of IARU was due to be dealt with, and no doubt G3FZL will be reporting on these in detail next month. They range over such topical (and at times controversial) matters as Euroscar, band-planning, the status of active satellite contacts and m.s. contacts, to name only four.

Scottish V.H.F. Convention

G3FZL writes:

The 1966 Scottish V.H.F. Convention, organized by Bill Miller, GM3PMB, was held in Rutherglen, Glasgow, and was attended by some 50 people.

Support came mainly from the Glasgow area, although Dunfermline was well represented also. The Edinburgh contingent was somewhat weaker this year, and surprisingly, Dundee and Aberdeen were not represented at all. The lecture programme consisted of Peter Blair, G3LTF, who discussed some of the problems of 70cm moonbounce communications covering in particular the problems of constructing the parabolic aerial system. His remarks were very well received, especially by the Dunfermline Group and GM3FYB, who are currently engaged on constructing a 70cm moonbounce station with a 16 ft. dish. The second lecture was given by John Tuke, GM3BST, and covered the reception of facsimile cloud cover maps from the *Tiros I* satellite. The results obtained were extremely good and it was quite remarkable to see how the actual cloud cover problem closely resembled the weather map applicable at the same time. Clearly the use of this satellite and later ones in the same family will be of great value to the meteorologist and also to the v.h.f. worker who studies tropospheric propagation.

In addition to the lecture, there was a display of both

commercial and home built equipment. Of particular interest was the 3cm transceiver displayed by GM3NZI (Bathgate) operating on 10,140 Mc/s (transmit) and 10,080 Mc/s (receive). The aerial system consisted of a modified radar scanner, having a gain of 39db and a beam width of 2°.

In the evening, an informal dinner was held at which the Chairman was Fraser Shepherd, GM3EGW. The toast to the DX visitors was proposed by Alistair Fraser, GM3AXX, (Glasgow) and the Society's V.H.F. Manager, Geoff Stone, G3FZL, replied on behalf of the foreigners, who included GI5AJ, G3CCH, G3LBA and G3LTF.

It was in all a most enjoyable event, and next year will be held in Edinburgh.

No Wanderers in Wolverhampton

Bonhomie and good organization characterized the Midlands V.H.F. Convention and Dinner on 14 May at Wolverhampton's Park Hall Hotel. Everybody agreed that it was thanks to G6FK that this should be. " Freddie King " started the Convention ball rolling eight months before the event and the efforts he and his helpers put in were rewarded by an attendance of well over a hundred, with 80-plus sitting down to the dinner in the evening.

There was almost too much to see and do—far better that way than to have a shortage! If you couldn't get in to the lectures (" Colour Television " by Mr A. E. Newton of the Matthew Boulton Tech, " Varactors " by G8AKM and " R.F. Cables " by G2JT), you could see them on closed circuit TV organized by members of the Slade Radio Society.

There were two equipment displays, one professional, the other amateur with not a pin to choose between them for elegance of construction (the spur to the home-constructor to make his equipment look and sound commercial is a good and sharp one).

The judging committee for the amateur-built items had a hard job to decide who should be given top ratings, but at length their accolade for the best entry went to G2HIF for what could be simply described as a transistor v.h.f. converter but in fact was a remarkable piece of precision engineering: four miniature gang capacitors driven by a Muirhead dial through a gear train provided a degree of built-in selectivity unusual for a semi-conductor front end.

Second in the Constructors' Contest was G8AKM with his varactor multipliers, and third G3LLJ with his transverter.

It is worth recording that in planning this Convention, G6FK looked first for a site where there was plenty of car space, and certainly the Park Hall Hotel had that. It also laid on a superb five-course dinner, as everyone agreed.

Just as important, " Freddie King " wanted a good chairman for this, the first-ever Midlands V.H.F. Convention. In Tom Douglas, G3BA, he couldn't have chosen a better. Tom's words of wisdom in his after dinner address (there were no formal speeches), and particularly his emphasis on the need for all of us to *communicate* more, not just make contact, deserve to be widely heeded.

The idea of having a Midlands V.H.F. Convention should go from strength to strength. There is no lack of talent or organizing capability, and the venue is marvellous! We have a strong feeling there will be a repeat next year.

Italian Memorial Relay on 2 Metres

On 3 July, the A.R.I. is putting on to 144 Mc/s a special station I1VMD to honour the memory of Professor Francesco Vecchiacchi, a pioneer of radio relay operation. The station will operate from his birthplace, Garfagnana, between 07.00 and 18.00 hours GMT.

If fortune should provide an opening to Italy on the day any British Isles station who manages to work I1VMD should send a log extract to Gruppo A.R.I. Di Lucca, via Fabio Filzi, 3 Lucca, Italy.

Expeditions

All who worked the Cambridge University Wireless Society expedition to the Isle of Man in March will be interested in the following performance statistics sent in by J. A. Lush, G3TGY:

" In all 66 stations in 21 counties were worked on 4m and 77 stations in 24 counties on 2m. The best DX on ' Four ' was G3OUF and G3SKR at 260 miles, and on 'Two' was G5MR at 310 miles. The Wrotham beacon did not seem to be a very good guide to the number of contacts we could expect from the Home Counties. At its strongest GB3VHF was 589, and on Sunday night, when a string of London stations was worked, the beacon was only just audible above the local noise level.

" Since about one-in-three of the 2m stations worked asked for a 70cm QSO, an effort will be made to take some gear along for this band next year."

On " 2m " GD3SKT/A had 30 watts and a 6-over-6; on " 4m " 40 watts and a 3 element J-Beam.

Look out for G3BHT and G3ORK from Luxembourg between 18 June and 1 July. Call-sign: G3BHT/M/LX. Frequency: just inside the l.f. end of the 2m band. Aerial: portable 10-element Skybeam. It will not be possible to fix skeds in advance.

* * *

There is news of a possible h.f., 4m and 2m expedition to Sark during the first two weeks in August. The only details which are definite at present are the call-sign and modes: GC3OUF/P, with operation on s.s.b., RTTY and c.w. No skeds can be fixed yet.

Just to remind you that the writer hopes to work you between the appearance of these notes and 9 June. Call-sign GM5UM/P. Times 18.30-21.00 GMT nightly. QTH: Argyllshire. Frequency: 145·8 Mc/s.

Faraday Medallist

The 44th award of the IEE Faraday Medal has been made to Mr J. A. Ratcliffe, C.B., C.B.E., F.R.S., " in recognition of his extensive researches on the physics of the ionosphere and of his studies on the propagation of low-frequency radio waves." Mr Ratcliffe retired last month as director of the Radio and Space Research Station at Slough. Society members who attended the Cambridge Convention in 1960 will remember that Mr Ratcliffe delivered the main lecture on that occasion.

W4EII in Command

Lt. General Theodore J. Conway, W4EII, has recently assumed command of the 7th United States Army, Europe.

Nuvistor Converter for 70 Mc/s (Continued from page 388)

by G3BJD employing a 6AK5 mixer. Apart from changes to L6 and L8 it is otherwise identical. Although this converter has all the characteristics of its Nuvistor counterpart, it does show considerably reduced gain, and in its way, indicates the desirability of employing Nuvistors throughout if peak performance is required.

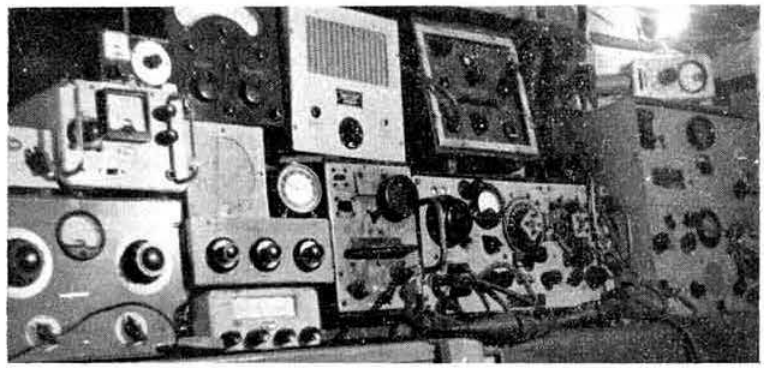
Results

This converter has given many hours of satisfactory portable operation, and, when fed from a 4-over-4 gamma matched array, its performance has been such that far more could be heard than could be worked. All British countries, with the exception of GC, have been worked on 4m.

It has produced contacts with over 40 counties, and for the Cumberland and Westmorland V.H.F. Group, overall winner's place in the 70 Mc/s section of the 1964 V.H.F. NFD.

Station behind the Call

G3UDW*



ALTHOUGH licensed for over 12 months Peter Williams, G3UDW, has not yet operated from his permanent address, but this does not mean that Peter has been inactive. Far from it, in fact, for during the summer season activity is mobile from a mini car, transferring during Autumn to a Luton (for the uninitiated a Luton is the portion of a large commercial vehicle directly above the driver's cab). This unusual shack is used because Peter's profession is travelling showman; he believes he is the only one in the country, and perhaps the world holding an amateur transmitting licence.

As with most radio amateurs, Peter was introduced to the hobby by an old timer who presented him with a t.r.f. receiver. But it was not until his nephew came to help at the fairground during his school holidays that he caught the bug. At the time Peter possessed a W.S. 22 set which did not work, but it was through his nephew's persistent requests to repair it for him that the ball once more began to roll. By then he was married, and more time was available for study, and when this was completed he finally entered and passed the RAE. He has since been heard to say "I don't know whether to thank my nephew or to kill him"!

The history of electricity in the Williams family goes back to the last century when Peter's Great Great Grandfather, Randell Williams, known as the King of the Showmen owned one of the very few electric generating plants in the country, for at that time most fairground people used paraffin flare lamps. To demonstrate the potential of electricity to the City of York, while on a visit he "accidentally" demolished one of the gas street lights. To pacify the local officials he organized temporary electric street lighting and so was the first man to bring electric light to the people of York.

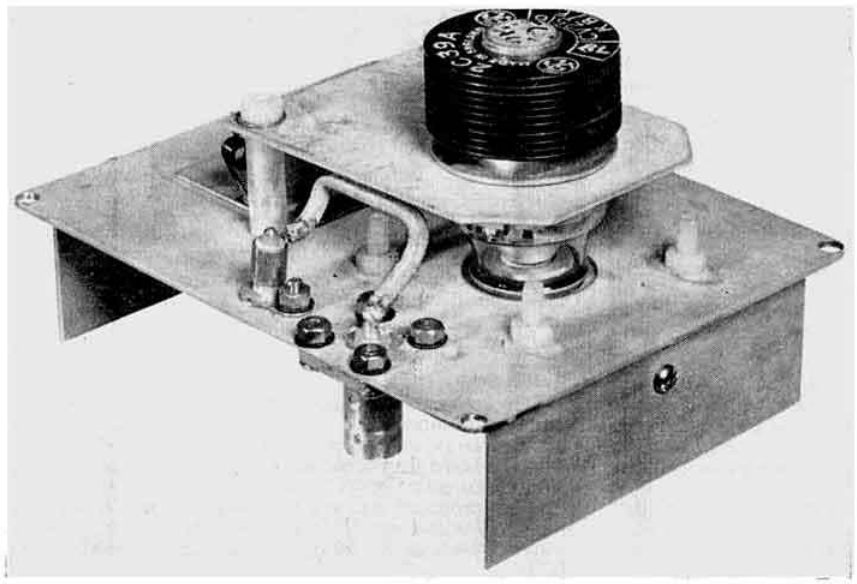
For those who have trouble supplying power for their mobile Top Band rigs they may like to bear in mind Peter's generating plant which gives him 110 volts at 200 amps!

His interest at the moment is experimenting with aerials on Top Band. After trying just about every type he is considering asking an acquaintance to construct his Big Wheel on insulating blocks and tuning that for the band. Other interests include the design of an electronic slot machine which has yet to be completed.

Those who think that Top Band is noisy should take note that the QRM on fair grounds makes Loran sound like a two watt transmitter working into a length of wet string.

G3UDW continues to experiment with aerials, and we hope shortly will succeed in bringing the strength of Loran far above the noise of the fair ground!

* 108 Leeds Road, Barwick in Elmet, Leeds.



The new Green E.C.E. 23CM1000 tripler amplifier aroused much interest at the recent London and Scottish U.H.F. Conventions. The unit matches the 70CM1000 and is the first commercially available 23cm equipment manufactured. The 23CM1000 can be driven by any 70cm transmitter and will run 100 watts d.c. input to the final amplifier. The price is provisionally £65.

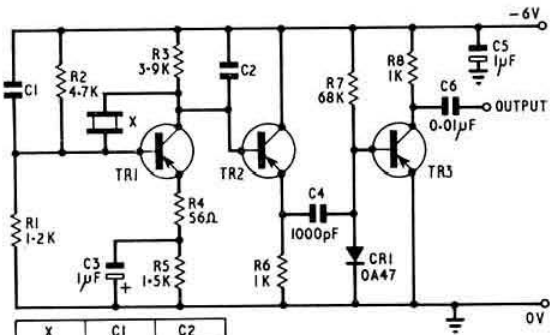
A Transistorized Crystal Calibrator

By B. PRIESTLEY, B.Sc., G3JGO *

THIS simple three transistor unit may be used with frequency standard crystals in the range 100 kc/s to 10 Mc/s to produce strong harmonics throughout a wide spectrum. The range over which harmonics of the fundamental crystal may be detected will be determined by the frequency of the crystal employed, the sensitivity of the detecting device with which it is used, and the order of the harmonic concerned. For example, with a 100 kc/s crystal, a receiver with normal sensitivity will detect harmonics up to about 15 Mc/s, and if a 500 kc/s crystal is substituted, to beyond 30 Mc/s.

Circuit Arrangement

The circuit of the calibrator is shown in Fig. 1. In this, TR1 functions as a conventional Colpitts oscillator, but with



X	C1	C2
100 kc/s	7000 pF	1500 pF
250 kc/s	1000 pF	500 pF
500 kc/s	750 pF	110 pF
10 Mc/s	100 pF	39 pF

Fig. 1. The transistorized crystal calibrator. The valves of C1 and C2 for different crystal frequencies are shown alongside.

the capacitors returned to the negative supply, and the addition of an unbypassed resistor in the emitter lead. Certain crystals were found to have a spurious mode at about half the correct frequency, and without this resistor, oscillation tended to jump between the correct frequency and the spurious frequency. Adding R4 not only corrected this effect but, in addition, improved the waveform at the collector of TR1, increased the transistor input impedance, and aided frequency stability generally.

The oscillator is directly coupled to transistor TR2 functioning as an emitter follower buffer stage to reduce the loading on the crystal by the following squaring stage.

The output from the emitter of the buffer is capacity coupled to the base of TR3 which functions as a squarer and so produces an output which is rich in harmonics. In order to prevent the peak drive voltage from exceeding the reverse voltage rating of the base-emitter junction of TR3, a clipping diode is connected from the base of TR3 to the emitter.

So that the harmonic level decreases gradually, tuned circuits have been omitted from the device, and the loads made entirely resistive. If it is required to increase the level of the harmonics within a particular frequency range, then R8 may be replaced by a tuned circuit which resonates at the desired frequency. For all normal purposes, however, the circuit will prove satisfactory as it stands.

Transistor Types

The design is tolerant of transistor types, and those used will depend on the frequencies to be handled by the various circuits. For frequencies up to about 2 Mc/s, TR1 may be an OC44 or similar. Where the crystal has a higher frequency than this, an OC170, or any of its equivalents, should be employed.

Since the buffer transistor, TR2, handles the same frequencies as the oscillator, the type selected for TR2 should be the same as that employed for TR1.

In respect of TR3, it is important that this transistor is capable of amplification at the highest frequency at which harmonics are desired. While lower frequency types could be employed, it is suggested that an OC171 is used for TR3 since at 30 Mc/s, this type is still reasonably efficient.

Selection of Values for C1 and C2

It can be shown that, in a Colpitts oscillator, the negative resistance introduced in series with the crystal is approximately:

$$\frac{g_m}{\omega^2 C1 C2}$$

When this negative resistance exceeds the positive resistance of the crystal—considered as a series resonant circuit—then the circuit will oscillate. From this it follows that the product of C1, C2 tends to decrease as the frequency increases. One point to note, however, is that an inactive l.f. crystal may need an abnormally low value for C1 and C2.

While the ratio of C1 and C2 is not particularly important, variations do provide a convenient method of pulling the frequency slightly. An alternative method of bringing about a change of frequency is to connect a capacitor in series with the crystal.

As a guide, a table of values for C1 and C2 which have been found suitable for modern plated crystals is given.

Stability

Although no great claims are made for the long term stability of this unit, provided that it is soundly constructed, the ambient temperature remains reasonably constant, and it is fed from a Zener stabilized source, then it should prove adequate for all amateur purposes. With silicon transistors type 2N706, which, incidentally, require a reversal of the polarity of the supply, it is claimed that a stability of 1·8 c/s at 10 Mc/s can be achieved. Further information on this high stability unit can be obtained from Reference [1].

Reference

[1] *Electronics*. 3 April, 1962.

* 43 Raymond Road, Langley, Slough, Bucks.

CHANGES OF ADDRESS

Four weeks' notice is required to effect changes of address. When notifying Headquarters, please give the old as well as the new address. Advise changes promptly so that you receive every issue of the BULLETIN without interruption.

Mobile Column

By E. ARNOLD MATTHEWS, G3FZW*

A SHORT time ago the engine of the writer's car was removed for a major servicing, and on being replaced it was observed that the electrical noise generated was increased by at least 3 S points! A quick look round made sure that all suppression components had been replaced in an undamaged condition, and the cause was finally tracked down as being faulty bonding.

Pondering on this, one became aware that noise had been slowly increasing over the years anyway. Old cars get noisy in more ways than one! Rust, dirt and gradually loosening joints cause increased frictional static which prompts the thought that perhaps some of the /M DX operators work their DX partly because they have newer (and better) cars!

Rally Reports

In spite of the usual Trentham weather the attendance at the **North Midlands Mobile Rally** on 24 April was well over 2000. The rally was opened by the Lord Mayor of Stoke-on-Trent, Ald J. A. Boon, JP, and the exhibition section soon became the main centre of interest, many leading manufacturers and retailers of amateur equipment being among the 36 exhibitors. The new all-transistor transmitter/receiver by CSE aroused considerable interest. As usual, the raffle

G3VBA operating the 4m talk-in station at the first 1966 RSGB National Mobile Rally held on 1 May at Texas Instruments Ltd., Bedford.

(Photo by A4663)

was well supported, and the star prize (an Eddystone EC10 receiver) was won by Mr J. Neal, of 1 Windsor Street, Wombourne, Staffs, whilst the competition for the best mobile equipment was won by G3HVX (Hereford). It says much for the popularity of this rally that mobiles come from as far as Devon and Cornwall, Flint and Yorkshire year after year in the most inclement weather! This must give much satisfaction to G5PP and his Organizing Committee, who have had a particularly difficult time " behind the scenes " this year.

The first of this season's series of **RSGB National Mobile Rallies** was held at the Factory of Texas Instruments Ltd., Bedford on 1 May and was blessed with blazing sunshine, which brought out so many amateurs that the factory canteen had to close down quite early because no more food was available!

Road safety exhibits are a prominent feature of the rallies held there, and this one was no exception with interesting displays by Bedfordshire County Police and Bedford Road

* 1 Shortbutts Lane, Lichfield, Staffs.

The Slade Radio Society is rapidly becoming famous for its television activities as well as D/F, and there was good evidence of the effort being put into this mode at the North Midland Mobile Rally. Under the leadership of G6JZF/T a Land-rover was fully equipped to transmit A3 and A5 while mobile, pictures being transmitted to the station on the society's stand. The operator is John Spencer, G6ABH/T/M.

(Photo by G3TJA)

Safety Committee. A radar speed measuring instrument had been set up for all to see, and the positive action of the meter needle was impressive, as was the display of equipment normally carried in police patrol cars (including a camera for " caught-in-the-act " evidence).

KW Electronics, Daystrom, and Brian J. Ayres had taken advantage of the fine weather and set up their displays in the sun as did the operators of the talk-in stations (members of Bedford and Shefford Radio Clubs).

There were several picture quizzes including a series of radio puzzles (won by G3IVV), a " What-Where-Who-is-it? one for junior ops. (won by M. Lake), and " Spot-the-Pops " (won by Steven Wilders of Peterborough).

A new competition which attracted quite a lot of attention was the DX competition, in which contestants worked (or tried to work) 20m DX for five minutes, using a KW2000A and simple dipole. This was won by G3USB of Cambridge, who worked W4UMA.

An interesting 2m station was demonstrated by members of Texas Instruments Ltd. Radio Club. The transmitter p.a. used an L62 transistor, which is rated at 20 watts output at 100 Mc/s. It was rumoured that the price of these is around £15 each, which indicates that prices should soon be within the amateur range.

The Society's thanks are tendered to Texas Instruments Ltd. for their kindness in accommodating the rally.

" Why Mobile on Grandad's Band? "

The last sentence of G3AHB's letter (p. 265 of the April issue of the BULLETIN) is rather intriguing. Army equipment was not generally noted for its efficiency, and even now they do not seem to have heard of centre loading of aerials. Perhaps 160m /M is " doing things the hard way." This is something the professional cannot afford to do, except for research. The amateur can, and does so because of the challenge, and thereby learns to develop better equipment and technique. Perhaps G3AHB would like to investigate the possibilities of the 2-4 Mc/s band using amateur equipment. He will find that this part of the spectrum will give contacts measurable not in 100's of miles, but 1000's. That very experienced Top Band and v.h.f. operator G5PP asserts that it is possible to obtain equal ranges on 160m and 2m.

News from Headquarters

Election of Council Member for Zone D

The result of the ballot for a Council Member to represent Zone D until 31 December, 1966, was as follows:

Mr H. E. Perkins, G3NMH .. 61 votes
Mr G. Twist, G3LWH .. .. 80 votes

Mr Twist is therefore elected.

Regional Representation

The address of Mr S. J. Granfield, G5BQ, the Representative for Region 5, is 47 Warren Road, Cambridge, and not as shown on page 327 of the May issue.

Special Events Stations

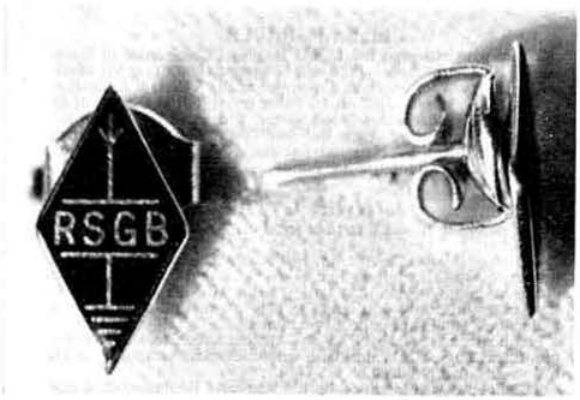
GB3GP will be operating on all bands over the weekend 11-12 June for the second Father and Son Scout Camp. Over 600 are expected to attend the Gilwell Park Scout Camp near Chingford, Essex, during this period. GB3GP will also be on the air during the weekend 25-26 June for the Annual International Weekend when Scouts from many lands will be in camp. Both stations will be manned by members of the Baden-Powell House Scout Amateur Radio Group.

The Royal Signals Amateur Radio Society will be operating its headquarters station **GB3RCS** during the Annual Royal Signals Reunion on 25 and 26 June. Permission for simultaneous operation has been granted and it is hoped to use the h.f. bands plus 144 Mc/s during the reunion. Contacts with past and present members of Royal Signals will be especially welcome.

The Peterborough and District Amateur Radio Society will be operating under the call-sign **GB3PAS** during the Peterborough Agricultural Show on 19, 20 and 21 July. All bands from 160m to 2m will be used.

VP1TA Sought

Mr H. E. Perkins, G3NMH, is anxious to locate an English amateur who held the call-sign VP1TA several years ago while foreman of a sugar refinery in British Honduras. He is believed to have since returned to the UK. Anyone who knows the present whereabouts of this amateur is asked to contact G3NMH at 24 Hook Street, Hook, Nr. Swindon, Wiltshire.



By applying some ingenuity, Joan Wightman, G3TPZ, wife of G3SOV, produced a neat pair of earrings from RSGB pin lapel badges. We wonder whether she will be a trend-setter!
(Photo by G3TLC)

The KW Vespa Transmitter

It appears that some members may have misconstrued our review of the KW Vespa s.s.b. transmitter in the May 1966 issue of the RSGB BULLETIN. Although a number of small points for criticism were discovered during the testing of the Vespa (as in almost all reviews of complex equipment), the considered opinion of Mr Brian Armstrong, G3EDD, who carried out the tests, is that the Vespa is a good "buy." In particular, the model tested showed up very well in the TVI tests.

With regard to the power unit, we understand a matching metal cabinet is available, price £4.10.0. This cabinet is, in fact, the same as that used for the KW2000 power supply.

The knobs fitted to the KW Vespa have brass inserts and should give no trouble in service.

G8DF appointed Director of Imhofs

A newly appointed Director of Alfred Imhof Ltd., manufacturers of instrument housings and accessories, is Mr A. E. Mitchell, who holds the call-sign G8DF. Mr Mitchell oined the company 20 years ago as an outside technical representative, was promoted to Sales Manager (Home) in 1958, and to General Sales Manager in 1960. He is well known among amateurs in the South of London as Chairman of the Sutton and Cheam Radio Society.

G3MSS appointed Managing Director of Collins Radio Company

Congratulations to John Savage, G3MSS, who has been appointed Managing Director of Collins Radio Company of England Ltd., in succession to Air Vice Marshall G.P. Chamberlain, C.B., O.B.E.

Affiliation

The following societies are now affiliated to RSGB:

AIR ELECTRONICS AMATEUR RADIO CLUB:
c/o D. G. Gamston, Royal Air Force, Topcliffe, Thirsk, Yorkshire.

CHELMSFORD AMATEUR RADIO SOCIETY:
c/o P. K. Blair, G3LTF, 26 Chaplin Close, Galleywood, Chelmsford, Essex.

SOUTHGATE RADIO CLUB:
c/o R. E. Wilkinson, G3TXA, 23 Ashridge Gardens, Palmers Green, London, N13.

Affiliated Society Representatives

The following have been appointed Affiliated Society Representatives:

PORT TALBOT RADIO CLUB:
H. G. Hughes, GW4CG, 20 Austin Avenue, Porthcawl, Glamorgan.

SOUTH SHIELDS AND DISTRICT RADIO CLUB:
T. Williamson, G3RKR, 38 Watson Avenue, South Shields.

TORBAY AMATEUR RADIO SOCIETY:
B. E. Symons, G3LKJ, 52 Reddenhill Road, Torquay.

Silent Keys

We record with sorrow the passing of the following amateurs:

H. N. Walls, G2DH, Manchester, Lancs.
K. R. Wilkinson, G3YP, Roundhay, Leeds.
P. J. Crosbie, G3NMQ, Croydon, Surrey.
L. Beevers, G3JLF, Clifton, near Manchester.
G. A. Gaskell, BRS27379, Prestbury, Cheshire.
C. T. Stevenson, Dundee, Scotland.

Obituaries

Dr. W. H. Eccles

Dr. W. H. Eccles, F.R.S., a well-known authority on wireless telegraphy, died on 29 April, 1966 at the age of 90.

Born near Ulverston on 23 August, 1875, William Henry Eccles was educated privately and at a secondary school in Barrow-in-Furness. In 1894 he entered the Royal College of Science, South Kensington, where in 1897 he was appointed demonstrator in the physical laboratory. After graduating at London as B.Sc. in 1897 and D.Sc. in 1898 with honours in physics, he became associated with Mr Marconi, and in the laboratory of the Wireless Telegraphy and Signal Company at Chelmsford carried out investigations on the waves in aerials and on coherers. In 1901 he was appointed head of the Department of Mathematics and Physics at the South Western Polytechnic, Chelsea, and 10 years later reader in graphics at University College. His research work at this period included an inquiry into crystal rectification, of which he formulated a theory based on electro-thermal considerations.

On the death of Professor Silvanus Thompson, he succeeded, in 1916, to the chair of applied physics and electrical engineering at Finsbury Technical College, where he remained until it was closed. He was chosen president of the Institution of Electrical Engineers in 1926, and of the Physical Society in 1928, and he had been President of the Radio Society of Great Britain and of the Institute of Physics and the Association of Scientific Workers. He was elected a Fellow of the Royal Society in 1921.

During the First World War Dr. Eccles acted as adviser on wireless to the Army Council (1915), served on the Electrical and Submarines Committee of the Admiralty Board of Inventions and Research (1916) and on the Air Force Wireless Technical Committee (1917), and was Director of the Admiralty Electrical Engineering Laboratory (1918). He was a member of Lord Milner's Imperial Wireless Telegraphy Committee, and the design of the wireless station at Rugby owed much to him. He also served on the Board of Agriculture's Committee on Electroculture (1920), the Postmaster General's Committee on Broadcasting and the Committee on Transatlantic Wireless Telephony (1922), and the Imperial Wireless Telegraphy Committee of 1924. Besides various scientific papers he was the author of a *Handbook of Wireless Telegraphy and Telephony* and of a *Treatise on Continuous Wave Wireless Telegraphy*.

(Reproduced by permission of *The Times*)

Horace Freeman

His many friends in the Society will be sorry to learn of the death on 14 May of Horace Freeman at the advanced age of 85 years. He had been in failing health for some time.

Horace Freeman was elected an Honorary Vice-President in October 1960 in recognition of his distinguished services to the Society as Advertisement Manager of RSGB publications since 1925. He was the only Honorary Vice-President.

Mr Freeman's association with radio dated back to 1922, when he put forward the idea for the first all-British Wireless Exhibition and Convention. The Exhibition, of which Mr Freeman was manager, was held at the Royal Horticultural Society's Hall, Westminster, London, from 30 September to 7 October, 1922, under the auspices of the Wireless Society of London (now the RSGB) and all its affiliated societies. This exhibition was followed in March 1923 by a similar show in Manchester, of which Mr Freeman was also manager. In 1924 Mr Freeman became Advertisement Manager for The Radio Press Ltd., and later that year he established his own agency (Parrs Advertising Ltd.,) which specialized in radio, electrical and mechanical engineering publicity. Parrs Advertising was merged with National Publicity Co. Ltd. in 1951.

Mr Freeman was manager of the first seven RSGB Amateur Radio Exhibitions held at the Royal Hotel, forerunners of the now well established International Radio Communications Exhibition held annually at Seymour Hall, London.

Mr Freeman was not always an advertising man. At the age of 14 he went to sea as an apprentice on a sailing ship, visiting South America, South Africa, Mauritius and USA. When life at sea began to pall, the young Horace left the ship at Sabine Pass, Texas, where he held a variety of jobs including control of an open air swimming pool. After a visit home to England, Mr Freeman went to Dallas, Texas, where he was employed at the head office of the Texas and Pacific Railway Co. Eventually, he worked his passage back to England.

Horace Freeman retired from business in 1960 and lived, up to the time of his death, at Effingham, Surrey. He was an Honorary Member of the Radio Amateur Old Timer's Association, having been elected at the time of its formation in 1958.

He donated a trophy to the Society in 1960—now known as the Horace Freeman Trophy—which is awarded annually to the member of the Society who has produced, for display at the Society's Annual Radio Exhibition, the most original piece of home-constructed equipment.

The Society was represented at the funeral by the General Manager.

To his daughter and his family we express our sympathies in their great loss.

Mrs W. Braint, BRS26914

The news of Beatrice Braint's death on the 14 April came as a great shock to her friends in the Crawley Amateur Radio Club.

Beatrice had been instrumental in helping a handicapped member of the Club to obtain his licence; and only a few weeks before her death had been presented with a special prize in the Crawley ARC Constructional Contest.

Our deepest sympathy goes to her husband, W. Braint, BRS 26911 in his great loss.

The RSGB and the Crawley Amateur Radio Club were represented at the funeral by G3TR, G3FRV, G3OUX and G3PHG.

E. O. Byrne, GI8LF

We were sorry to learn that one of the early experimenters in wireless, Edgar Owen Byrne, GI8LF, passed away on 22 April, 1966.

Edgar Byrne was quite well acquainted with Marconi, for in 1898 he used to accompany his father while transporting Marconi and his assistant Kemp to the miner's hut between Ballycastle and Rathlin, Ireland, which was their mainland base. Edgar clearly remembered the sparks jumping the gap. This early experience planted his seeds of interest in radio which flourished over the years. He built his own radio well before 2LO began broadcasting.

We offer our sincere condolences to his widow, daughter and two sons in their sad loss.

J. R. Clayton, BRS18352

It is with deep regret that we record the death of John R. Clayton on 22 March, 1966.

John, or Roy as he liked to be known, was Secretary of the Newark and District Amateur Radio Society for many years. In fact he was a founder member, and was a most consistent secretary with a flair for organization. Last year the Newark Society ran the Symposium at Ollerton with the aid of the RSGB, and this was an example of his genius at detailed organization. As a result of his work, he became a valued member of the RSGB Education Committee. One of his proudest moments was when the Newark Society became registered in the Service of Youth.

E. Greebe, G3LFU

It is with deep regret that we record the sudden death of Eric Greebe, G3LFU, of Norwich, at the early age of 48 years.

Eric had not been active under his own call-sign for many years, but this had no affect on his activities with the Norwich club, of which he was Chairman. His enthusiasm regularly took him to the Field Day station to lend a helping hand. He was anticipating a return to the bands this year using s.s.b., and such was his popularity that his many friends were quite as enthusiastically looking forward to this event as himself.

To Mary, his widow, and to his family, we offer our deep sympathy in their sad and unexpected loss.

P.G.

M. Smit, PA0LR

Those who attended the IARU Region I Conference in Lausanne—1953 and Stresa—1956 will be sorry to learn that Mr Marinus Smit, PA0LR, who was a member of the VERON delegation at both Conferences died on 16 February, 1966, at the age of 61 years. He had been closely associated with Amateur Radio for many years and prior to the war was Traffic Manager for North Holland in the then National Society, NVIR. Sympathies are extended to Mrs Smit and her family.

J.C.

J. Wylie, GW3LEF

The death at an early age occurred on 20 April of Jim Wylie, GW3LEF.

Although by profession an Inspector of Taxes, Jim was a brilliant electronic engineer in his own right, and could easily have obtained employment in the design field. He was an amateur in the best tradition, always ready to help others and a stalwart on Field Days and other collective activities.

His death at the age of 45 was a great shock to the amateur movement in South Wales, who extend deepest sympathy to his widow and two children.

The funeral was attended by the Regional Representative and twelve other amateurs.

C.H.P.

Society Affairs

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

The meeting was held on 1 April, 1966, and was attended by Messrs R. F. Stevens (President), J. Etherington, J. C. Foster, J. C. Graham, E. G. Ingram, L. E. Newnham, A. D. Patterson, J. F. Shepherd, G. M. C. Stone, J. W. Swinnerton and Louis Varney (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 N. Caws, L. N. Goldsbrough, F. K. Parker and E. W. Yeomanson.

Region 14 Representative

In view of the failure of members in Region 14 to appoint a Regional Representative, the Council acted on the advice of the members present at the meeting held in Paisley on 13 February, 1966 and appointed Mr A. F. Hunter, GM3LTW, Region 14 Representative. (Mr Hunter's appointment was reported on page 327 of the May issue of the RSGB BULLETIN.)

Recommendations of Committees

The Council accepted recommendations put forward by the V.H.F. Contests Committee relating to the results of the 70 Mc/s Contest 1965 (C.W.), the 144 Mc/s Contests 1966 (C.W.) and the V.H.F./U.H.F. Listeners' Championship 1965. The Council also accepted in principle a recommendation from the GPO Liaison and TVI Committee that a suitable field strength meter should be obtained for the use of the Committee.

Membership and Affiliation

The Council elected 106 new members (83 Corporate, 23 Associate) and approved 12 applications for transfer from Associate to Corporate grade.

The Council granted affiliation to the following Societies:

Chelmsford Amateur Radio Society
Pembroke and District Amateur Radio Society

Regional Representatives

The Council re-appointed Mr S. J. Granfield, G5BQ, to the office of Region 5 Representative, and Mr L. W. Lewis, G8ML, to the office of Region 6 Representative. (A notice was published on page 327 of the May issue of the RSGB BULLETIN.)

Region 9 Meeting

The Council formally approved the holding of an O.R.M. in Weymouth on 2 October, 1966.

Recorded Lecture Library

It was agreed to purchase a new tape recorder for the use of the Honorary Curator of the Society's Recorded Lectures.

Special Prefix for the Shetland Islands

It was reported that the Post Office had declined a request made by the Society on behalf of members in the Shetland Islands for the allocation of a special prefix.

The Post Office had stated, "Use of the 'territorial prefixes' G, GD, GI, GM, GW and GC, which have been published by the International Telecommunication Union in the Alphabetical List of Call Signs, was decided upon in consultation with the Radio Society of Great Britain in 1946/7. It was agreed that it would be desirable in the interests of both the Post Office and the Society, that requests for particular call sign prefix letters for counties, other islands which do not have their own administrations or other territorial divisions should be refused in view of the limited number of letters available and the possibility of protests against unfair discrimination if, at a later date, it were found to be impossible to satisfy all requests. We have accordingly refused requests made since 1947 for special call sign prefixes for a number of places including Anglesey, Orkney Islands, Lundy Island, The Scilly Isles and the Western Islands of Scotland. We are sorry to have to disappoint amateurs in the Shetland Islands too. . . ."

ARRL National Convention

It was agreed to accept an offer from Mr R. C. Hills, G3HRH, to represent the Society at the ARRL National Convention in Boston later in the month. Mr Hills would be in the USA at the time of the Convention.

Investments

It was reported that the Society's investment of £2000 in 5 per cent Defence Bonds would become repayable on 15 August, 1966. It was agreed to accept repayment rather than an offer of conversion into 5 per cent National Development Bonds and to refer to the Finance and Staff Committee the reinvestment of the proceeds.

Dundalk Convention

The Council agreed to support the Dundalk Convention to be held on 25 September, 1966. The Convention is being organized by the Belfast and District RSGB Group and the Mid-Ulster RSGB Group in conjunction with the Irish Radio Transmitters' Society.

Minutes of Committees

The Council accepted as reports the minutes of the following Committees: GPO Liaison and TVI (16.2.66), Mobile (23.2.66), Education (26.2.66), V.H.F. (28.2.66), V.H.F. Contests (2.3.66), ad hoc Headquarters (14.3.66) and Mobile (15.3.66).

* * *

The meeting ended at 8.18 p.m.

Tower View

An excellent view of the roof of RSGB Headquarters with its, now unused, aerial masts (shades of GB1RS circa 1948) can be obtained from the observation platforms of the newly-opened Post Office Tower. The roof and upper part of New Ruskin House can be located between the green dome of the library of the British Museum and the figure atop St. George's, Bloomsbury, the church immediately in front of Headquarters.

OFFICIAL REGIONAL MEETING

REGION 12

20-21 August, 1966

Further information next month

Book Reviews

THE RADIO AMATEURS' HANDBOOK (43rd Edition, 1966). By the HQ Staff of the ARRL. 648 pages, profusely illustrated. Price 42s. or 50s. (Buckram bound), post paid, from RSGB Publications, Dept. B, 28 Little Russell Street, London, WC1.

The new *Handbook* has many changes in the constructional designs but, naturally enough, only minor expansions and adjustments in the theoretical treatment.

There is a new four-transistor regenerative receiver covering the amateur bands from 3·5 Mc/s to 50 Mc/s, with two wavetraps to reduce interference from nearby broadcast stations. The Junior " Miser's Dream " five-valve receiver incorporates a *Q* multiplier and uses an i.f. of 3300 kc/s; it is designed for code and single sideband reception, has no envelope detector, but has a two-crystal filter.

Those who suffer greatly from Loran will be interested in a two-valve silencer for use ahead of any fixed-tune i.f. amplifier, and—on the radio frequency side—a short section on transistor output circuits replaces the treatment of multi-band tank circuits. The novice oscillator-transmitter has gone, and a much superior four-band 50 watt c.o.-p.a., with good screening, takes its place. There is a new 200 watt general purpose amplifier which can be used as a class AB1 linear amplifier for s.s.b., a class C amplifier for c.w., and a screen-modulated amplifier for a.m.

The single sideband, h.f. crystal filter exciter has been replaced by a new mechanical filter sideband exciter, generating a signal at 455 kc/s, and the need in this form for double conversion to avoid higher frequency image signals should not be considered a disadvantage. The output is 40 watts p.e.p. l.s.b. on 3·5 and 7 Mc/s with u.s.b. on 14 and 21 Mc/s and an output of 20 watts p.e.p. on 21 Mc/s. Manual or vox operation is provided, with anti-vox control, and a 7360 beam-deflection balanced modulator is used.

A useful addition to the section on transmission lines is a business-like wide-range coupler for balanced open-wire lines, which has a built-in Monimatch. The v.h.f. side shows a new strip-line converter for 432 Mc/s: the strip lines are used for superior selectivity in r.f. mixer, and local oscillator stages, and it is claimed that the converter can be duplicated easily without requiring elaborate test equipment. Most v.h.f. and u.h.f. operators, one imagines, should be attracted by an interesting " noise blanker " for use against ignition noise and other pulse types: it is a two-valve amplifier with a bandwidth of 1·5 Mc/s, and clipping diodes, to be used between a crystal-controlled converter and the main receiver. Its performance capabilities are highly praised, and it should be a boon to many sufferers.

Another new design which is noteworthy is an a.m./c.w. crystal controlled exciter for 144 Mc/s, with an r.f. output of about 2 watts for local QSOs, or to drive a linear p.a. Other designs include kW amplifiers for 50 and 144 Mc/s. There are some additional tips on linear v.h.f. amplifiers, and a new pulsed two-tone oscillator with which to measure what virtue a linear p.a. possesses. The tests which should be made on a sideband p.a. or transmitter can be made with an oscilloscope and this oscillator. It is completely self-contained, uses transistors, and is small enough to be housed in a 5 in. × 6 in. × 9 in. box. It would seem desirable that the degree of suppression of sideband and carrier, and the goodness of amplifier linearity should be checked at the transmitting end as the gear is so simple, comparatively inexpensive, and a good design is available. Single sideband is a rather sophisticated system, and it should have proper test equipment.

There are many other changes and improvements to the *Handbook*, and the reviewer is anxious not to give the impression that the constructional side is all-important: this is not so, for this side can mean very little to the reader who neglects the theoretical basis of the design and operation. This is given in full measure and in the well-known and valued *Handbook* style. It is, literally, a wonderful book.

T. P. A.

SHOP AND SHACK SHORTCUTS. Compiled by D. L. Stoner, W6TNS. Published by Cowan Publishing Corp. 224 pages, 6 in. × 9 in. Available from RSGB Publications. Price 29s. post paid.

The material in this volume is presented in the form of short articles, mostly varying in length between a quarter page and two pages, taken from the pages of *CQ Magazine* since 1947, and now grouped together under convenient headings. The thirteen chapters deal with hints, kinks and shortcuts applying to home-built, commercial and surplus equipment. Some idea of the balance of the text may be gained from the fact that the three chapters devoted to receiver, transmitter and aerial improvements occupy some 90 pages. A surprising omission is that of an index, but the general presentation of the text and diagrams is good and the binding will stand workbench usage.

R. F. S.

CQ ANTHOLOGY 1952-1959. Edited by Art Seidman, K2BUS. Published by Cowan Publishing Corp. 256 pages, 6 in. × 9 in. Available from RSGB Publications. Price 23s. post paid.

This second volume of reprints from *CQ Magazine* covering the years between 1952 and 1959 is half as big again as the volume covering the earlier years, and contains some 70 articles. An indication of the scope of the contents can be obtained by a glance at the chapter headings: Improving Equipment; V.H.F.; S.S.B.; Surplus; Mobile; Transmitters and Receivers; Theory; Operating; Test Equipment; RTTY and History. The text deals with current amateur equipment, i.e., the DX100 and NC300, and with surplus items such as BC348, BC603 and ARC-5. There is a good assortment of different types of articles, slanted at both the technical and the practical approach, and the text and diagrams are clear and easy to read.

R. F. S.

ELECTRICAL HOBBIES. By F. G. Rayer. Published by Collins at 5s. 160 pages.

Mr Rayer has written a number of articles in radio journals, and this small book is a summary of the author's coverage for beginners in the field of electrical pastimes. The range of work attempted is so very large that the book can only scratch the surface of many topics. Although very extensive in coverage, with model railways, photographic equipment, bicycle and moped lighting, electric clocks, a.f. amplifiers, radio control equipment, etc., all touched upon, very little is mentioned concerning Amateur Radio. This is perhaps a little disappointing from our point of view, bearing in mind Mr Rayer holds the call-sign G3OGR.

The section on radio control is fairly detailed, and should prove useful to modellers.

Mr Rayer suggests that the book might be suitable for the " young family member." It is felt, however, that the language is probably a little higher than the average 14-year-old's vocabulary, although it should be all right for intelligent boys and adult beginners. There are a few vague patches, for instance, the " output from a Morse oscillator is taken through a capacitor to the amplifier input." True, but the earth return is just as important. A diagram would be helpful for this kind of thing.

On the whole, *Electrical Hobbies* is to be recommended—one very favourable point is the low price, just 5s., which means it should find a place on most bookshelves.

K. L. S.

CONTEST NEWS

— RESULTS — REPORTS — RULES —

Low Power Contest 1966

The 1966 Low Power Contest was held on 3 April and produced 20 entries, which is an increase of five over 1965. The result was just about as close as it could be, with only two points separating first and second positions.

The winner, P. J. Ball, G3HQT, of Surrey achieved a score of 1582 and turned in a fault-free log. He used a home brew transmitter running 0·5 watts, except for two contacts where he used 5 watts to work a PA and a DJ. These two QSOs earned him the two points lead over the runner-up, P. H. McPherson, G3TEL, of Berkshire, who also put in a faultless log to score 1580 points. His transmitter was transistorized and ran with an input of 0·95 watts. In third place is Brian Keyte, G3SIA, of Warwickshire, with a score of 1510 points.

The standard of operating was very good indeed and all the competitors seemed to have enjoyed the friendly nature of the contest.

Conditions were quite good until late afternoon when the European signals began to cause heavy QRM.

Position	Call-sign	Points	Power	Aerial
1	G3HQT	1582	0·5–5	132 ft. end-fed
2	G3TEL	1580	0·95	300 ft. end-fed
3	G3SIA	1510	0·5	140 ft. inverted V, 68 ft. high
4	G3IGU	1490	0·5	135 ft. 35 ft. high
5	G3JVJ	1385	0·4–2	133 ft. inverted V, 35 ft. high
6	G3SWA	880	0·2–0·3	134 ft. end-fed 25 ft. high
7	GW3OAY	860	0·49	132 ft. inverted V, 50 ft. high
8	G3BIK	850	0·9	132 ft. end-fed
9	G3DOP	840	0·35	132 ft.
10	G3IAR	735	2·0	135 ft. end-fed
11	G3TXZ	730	1·0	123 end-fed 45 ft. high
12	G3CWL	620	0·45	132 ft. 15 ft. high
13	G2BHN	600	0·45	132 ft. centre-fed 40 ft. high
14	GM3PFQ	580	0·5	130 ft.
15	G3JKY/P	570	0·9	132 ft. centre-fed
16	G3NEO	545	0·5–5	ZL Special
17	G4AL	515	0·95	140 ft. end-fed
18	G3ORU	489	0·5–5	Trap Dipole
19	G3UJG	305	3	132 ft. inverted V
20	G3BY	225	2·4	120 ft. end-fed 28 ft. high

Comments from Competitors

Most entrants comment on the large number of European stations on during the late stages of the contest. G3JVJ would like to see more GW and GM stations taking part. G3SWA found CQ of little use and had to chase stations, but enjoyed the relaxed atmosphere of this contest. G3TXZ suggests that there be a bonus for countries as well as counties worked, which would encourage working the continental stations. The only /P entry (G3JKY) operated in the open with the gear carried on a bicycle.

There was very little criticism, most operators appearing to thoroughly enjoy the contest.

Transmitters used were mainly equipped with valve p.a. stages; only five stations used transistors. Of those using valves the types ranged from small battery valves to a 6V6, 807 and TT21. Seven stations used home made receivers.

V.H.F. Listeners' Championship

The following is a report on the first three months.

			144 Mc/s (1)	70 Mc/s (1)	144 Mc/s (2)	Total
1	R. A. Ham*	BRS15744	—	1180	2450	3630
2	D. A. R. Poulter*	A4048	—	1055	1915	2970
3	R. W. F. Thomas	BRS15822	—	—	1600	1600
4	G. Swan*	A3696	—	—	1535	1535
5	A. G. Baker	A4248	—	—	1530	1530
6	E. J. Harland	A4388	—	—	1485	1485
7	A. A. Goacher*	A3942	700	—	680	1380
8	D. J. Butler*	A4242	—	560	645	1205
9	S. Williamson	A4743	—	220	540	760
10	D. J. Barlow*	A3768	—	—	730	730
11	S. L. Berry	BRS27482	—	—	530	530
12	R. Eve	A4751	—	—	360	360

* Entrants in 1965

D/F Qualifying Events

Details of the **Oxford D/F Qualifying Event** are as follows:
Sunday, 19 June, 1966.
Organizers: E. L. Mollart and M. P. Hawkins.
Frequencies and Call-signs: To be announced at the start.
Map: Ordnance Survey, 1 in. to 1 mile, Sheet 145.
Assembly Point: NGR 468185, on B4027, 200 yards east of junction with A423.
Assembly Time: 13.00 BST for 13.20 BST start.
Entries and Tea: Intending competitors should notify the organizers as soon as possible, at 17 Spinfield Mount, Marlow, Bucks., stating the number in the party who will require tea.

Details of the **Derby Qualifying Event** are as follows:
Sunday, 17 July, 1966.
Organizers: A. Hitchcock and F. Allsopp, Cedar Lodge, Northfield, Kilburn, Derby.
Frequencies and Call-signs: To be announced at the start.
Map: Ordnance Survey, New Popular Edition, Sheet 121.
Assembly Point: NGR 509148, Beacon Hill entrance, from B591.
Assembly time: 13.00 for 13.20 start.
Entries and Tea: Tea, price 6s. 6d. per head, will be taken at Blakeshay Farm, NGR 513118. Intending competitors should notify the organizers at least a week in advance stating the number of people in their party who will require tea.

Details of the **High Wycombe Qualifying Event** are as follows:
Sunday, 31 July, 1966.
Organizer: W. J. North, G3TRY, 3 High Street, Lane End, High Wycombe.
Frequencies and Call-signs: To be announced at the start.
Map: Ordnance Survey, New Popular Edition, Sheet 159, Chilterns.
Assembly: 13.00 BST for 13.20 BST start.
Location: NGR 803931, Wheeler End Common.
Entries and Tea: Intending competitors should notify the organizer as soon as possible, stating the number of people in their party who will require tea.

BARTG Spring RTTY Contest 1966

The 1966 Spring BARTG RTTY Contest on 12-14 March was even more successful than the first event last year. Activity on all bands was tremendous and the QRM, particularly on 20m, was really amazing. The c.w. operators kept well out of the way! A particularly pleasing feature was the appearance of rare RTTY countries, which enabled contestants to increase their country multipliers.

W2RUI, with the fantastic score of 90,720 points, is the undisputed leader, but credit is due to all concerned for their hard work. There is no doubt that to keep in the top ten requires perseverance, sanity, and the ability to go without sleep for long periods. One other operator who deserves special comment is VE3AYL, Gwen, who appeared in the contest for the first time and scored a historic place in the top ten.

All continents were represented in the contest instead of Asia being absent as last year. Thanks are due to HL9KF for giving some people that extra continental multiplier that was very badly needed. KW6DS also showed up for the contest and submitted a very creditable first time score. In Europe, OK1KUL moved up into 14th place in the very first contest in which he has participated.

More countries were on the air than submitted logs, as is evident from the check of scores that was carried out. It is obvious that the list could have been much longer. It would be remiss of us not to comment on some of the outstanding presentations. Don, K8MYF, sent along his usual immaculate log and K5OLU was also deserving of special mention; contributions such as these make the task of checking all that much easier.

The BARTG Committee is particularly pleased that the system of scoring has once again shown that equal weight can be given to stations in different continents. It must be admitted, however, that the Asian and Australasian stations do suffer from a lack of " available " operating time, no doubt due to the relative lack of activity in that part of the world. However, it is certain that all who entered enjoyed the contest, and congratulations go to the leaders.

The secretary of BARTG, G2HIO; wishes to place on record

special thanks to his wife, G6CW and G3MP for their help in checking the final figures.

Comments Received

" Five new countries—wish the contest announcements could precede the rat race by at least a month " (W2RUI). " Thanks again for a good contest " (WB6RXM). " I enjoyed the contest this year even more than last year " (K8JTT). " It was an excellent contest with plenty of activity, good conditions and plenty of DX " (K3GIF). " Very fine business indeed, waiting for the next " (I1ROL). " Suggest that extra points be awarded for narrow shift. Contest very enjoyable " (W1OUG). " Had a lot of fun in the contest " (W0HAH). " P.A. transformer went up in smoke! " (G3LDI). " Civilized hours complete with NAAFI breaks were worked " (G3EJF). " Sure enjoyed the first contest on RTTY, only wish that I had built up a better TV in time—Hi—(VP9BY). " Very FB Contest—QSO'd HI8RR for a first, he was so excited I couldn't begin to explain the rules " (W3KDF). " Thanks for a nice contest, it is a very enjoyable and wonderful event " (K8MYF). " Copied many Europeans, HA5KBB, S9 on 20m. EL2F also 20 over nine, but a pile up " (W6AEE). " I will now start clearing paper out the shack " (PA0FB). " Thanks for my first RTTY Contest. I promise to take part in the future " (OK1KUL). " See you next time " (G3MWI). " Conditions on all bands generally poor—consistently strong stations, OK1KUL and HA5KBB " (VK3KF). " I am looking forward with great anticipation to next year's contest " (K5OLU). " Very fine contest; had a ball of a time doing more listening than anything else! " (K2YEQ). " This was one of the best Contests it's been my pleasure to operate—' Murphy's Law ' left me alone " (WA6WGL). " Il y avait beaucoup des stations et beaucoup de DX sur l'air " (F2LV). " Thanks for the fun—worked seven new countries " (W1GKJ). " It was a great pleasure for me to join your contest, hope this will not be the last " (DJ6ZBA). " I was very proud to work Europe on 80, even though the contacts counted the same as the ones 200 miles away with the USA " (VE2HL). " This was one occasion where ' ladies don't come first,' but it was my first RTTY Contest and had a lot of fun " (Gwen Burnett, VE3AYL). " Just want to give a point to my friends " (W2WL). " My first RTTY Contest and while I didn't do so well, certainly enjoyed it " (K4AWQ). " This was my first RTTY Contest and I sure enjoyed it " (W7QCN/0). " Hope to hear more of the G boys on RTTY, tell them to swing their beams my way! " (VK2EG). " Best results ever had in any RTTY Contest, got WAC during the contest " (LA6J). " The test was grand and certainly enjoyable " (WA6LDF). " Had a wonderful time and am looking forward to next year, if I am still on Wake Island " (KW6DS). " Time as usual was divided between contest and *OSCAR* " (ZL1WB).

Check logs received from: PY2SO, SM2CQC, ZL1WB, UQ2-22317/UD6.

The log from Alex. E. Wilks in Azerbaijan, USSR, listed 49 contacts of 29 stations in 14 countries. This was the first list from USSR SWL for an RTTY Contest.

It seems that we will now have to organize a separate listeners' contest for the same period!

Posn	Station	Countries 10m	15m	20m	40m	80m	Total	Continents	Contacts	Points
1	W2RUI	—	12	28	5	3	48	WAC 6	97	90,720
2	DJ6ZBA	—	6	20	5	11	42	WAC 6	73	81,060
3	I1ORS	1	5	22	4	7	39	5	120	78,702
4	K8MYF	1	13	24	5	2	45	5	130	78,660
5	W1GKJ	—	11	23	5	5	44	5	103	71,368
6	G3MWI	—	2	20	4	7	33	WAC 6	93	69,498
7	K5OLU	—	10	19	4	4	37	WAC 6	125	69,190
8	W3KDF	—	11	24	5	2	42	5	80	68,544
9	VE3AYL	—	8	19	3	3	33	5	78	57,176
10	I1KG	—	4	26	—	—	30	WAC 6	72	56,160
11	K3GIF	—	7	22	8	—	37	5	50	54,316
12	WA6WGL	—	9	16	5	1	31	WAC 6	99	51,956
13	DL1VR	—	7	18	—	6	31	4	73	46,682
14	OK1KUL	—	—	15	2	10	27	5	72	46,440
15	VE2HL	—	8	19	1	4	32	3	77	42,996
16	LA6J	—	1	19	2	4	26	WAC 6	46	42,952
17	W4CQI	—	—	21	3	3	27	5	64	38,016
18	W6LDF	1	7	15	1	—	24	WAC 6	61	37,104
19	XE1YJ	—	7	7	3	3	20	4	93	34,440
20	PY2CQ	—	—	21	—	—	21	5	57	32,802
21	K8YJQ	—	3	18	2	2	25	5	46	32,700
22	KW6DS	—	4	15	—	—	19	5	62	30,780
23	W8GPB	—	—	17	—	4	21	4	90	25,788
24	VE3IR	—	9	10	—	1	20	5	31	25,724
25	KH6EM	—	4	9	—	2	15	5	70	25,500
26	K2YEQ	—	—	19	—	—	19	5	40	24,776
27	W1OUG	—	7	12	—	—	19	5	27	22,762
28	W0HAH	—	4	14	—	2	20	4	41	20,360
29	G3CIO	—	—	10	—	5	15	5	35	20,130
30	SM5KV	—	—	16	—	—	16	4	38	18,880
31	W8CAT	—	8	8	—	2	18	4	28	17,784
32	VK3KF	—	—	14	—	—	14	5	19	16,660
33	W6AEE	1	6	5	3	4	19	3	56	16,264
34	HL9KF	—	—	14	—	—	14	4	31	15,400
35	G6CW	—	3	5	1	3	12	4	24	14,972
36	WB2GPP	—	3	14	2	—	19	2	25	12,046
37	I1ORL	—	—	13	—	—	13	3	30	11,388
38	WB6RXM	—	5	6	1	1	13	3	33	10,218
39	G5ZT	—	2	9	—	1	12	3	24	9,984
40	F3PI	—	—	10	—	—	10	4	13	9,060
41	F2LV	1	2	9	—	—	12	3	16	8,730
42	PA0FB	—	3	3	—	7	13	2	24	8,320
43	VK2EG	—	—	9	—	—	9	4	15	8,550
44	W1ACW	—	—	9	—	1	10	3	23	7,180
45	W2FAN	1	6	3	1	2	13	2	28	6,760
46	G3LDI	—	—	7	2	—	9	3	13	6,570
47	W1WL	—	1	10	1	—	12	2	16	6,336
48	F8KI	—	1	8	—	—	9	3	16	6,624
49	G2HIO	—	1	7	—	—	8	3	18	6,076
50	VO1BL	—	—	9	—	—	9	2	19	5,310
51	LA6OI	—	—	9	—	—	9	2	15	4,878
52	K4AWQ	—	—	6	—	—	6	3	10	3,960
53	W7QCN/0	—	2	3	1	—	6	2	18	2,760
54	G6JF	—	—	8	—	—	8	1	12	2,432
55	VP9BY	—	—	4	—	—	4	2	18	2,320
		Multiple Operator								
1	K8JTT	—	4	14	2	4	24	5	64	31,728

Grafton Top Band Contest

There was a high level of activity during the Grafton Radio Society's Annual Top Band Contest held on 26 March and 2 April, and although it was generally a very successful event, a rather disappointing number of entries was received. The leading entrants are placed as follows:

Open Section

1 G3IGW 144 pts. (C.W. Winner)
2 G3LYW 140 points. (Phone winner)
3 G3RRJ 127 points.
4 G3SZF 86 points.
5 G3LIV 85 points.

Members' Section

1 G3SIL 93 points. (Phone and C.W. winner)
2 G3RX 63 points.
3 G3THQ 52 points.

Second 144 Mc/s Contest 1966

The results of the Second 144 Mc/s Contest published on page 335 of the May issue of the RSGB BULLETIN described a 445 km contact between GW3RUF/P and F9NJ as the best achievement. The credit for the longest distance contact should, however, have gone to G3HRH who worked F9LE over a 478 km path.

CONTESTS DIARY

4-5 June	-CHC/FHC/HTH QSO Party
4-5 June	-National Field Day (For rules, see page 51, January 1966)
19 June	-Oxford D/F Qualifying Event (see page 411)
3 July	-Fourth 44 Mc/s (Portable) Contest* (see page 338 May 1966)
9-10 July	—1.8 Mc/s Summer Contest (see page 338, May 1966)
17 July	—Derby D/F Qualifying Event (see page 411)
24 July	—Third 70 Mc/s (Portable) Contest *
31 July	—High Wycombe D/F Qualifying Event (See page 411)
13-14 August	—WAE Contest (C.W.)
3-4 September	—V.H.F. NFD *
10-11 September	—WAE Contest (Phone)
11 September	—80 Metre Field Day
18 September	—D/F National Final
16 October	—Second 1296 Mc/s Contest *
15-16 October	—RSGB 21/28 Mc/s Telephony Contest
15-16 October	—Second 432 Mc/s Contest *
29-30 October	—RSGB 7 Mc/s DX (Phone) Contest
29-30 October	—RSGB 7 Mc/s DX (Phone) Contest
12-13 November	—RSGB 7 Mc/s DX (C.W.) Contest
19-20 November	—Second Top Band Contest
4 December	—Fourth 70 Mc/s (C.W.) Contest *

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

Rules for the RSGB 7 Mc/s DX Contest 1966

Radio Amateurs throughout the world are invited to take part in the fifth RSGB 7 Mc/s DX Contest to be held on 29-30 October and 12-13 November, 1966.

Attention is drawn to the rule permitting multi-operator entries. If there is not a considerable increase in support for the multi-operator section the Committee will be obliged to omit it in future.

Rules

1. **Duration:** Each section of the contest will take place between 18.00 GMT on the Saturday and 18.00 GMT on the Sunday as follows:
Phone: 29-30 October, 1966. **C.W.:** 12-13 November, 1966.

2. **Eligible Entrants:** The contest is open to licensed amateurs in all parts of the world who must operate in accordance with the terms of their licences.

3. **Contacts:** Contacts must be made in that portion of the **7 Mc/s band** for which the entrant is licensed. Contacts with unlicensed stations will not count for points. Proof of contact may be required. Only one contact may be made with a specific station, whether fixed, portable, mobile or alternative address in each section. Duplicate contacts must be logged and clearly marked as duplicate without claim for points.

4. **Contest Exchanges:** An exchange of RST (or RS) reports followed by a three figure serial number starting with 001 for the first contact and increasing by one for each successive contact and for each separate section (for example, 58002, etc.) must be made before points can be claimed.

5. Entries may be made as (i) Single Operator, (ii) Multiple Operator. Logs must clearly state whether (i) or (ii).

6. **Entries:** Entries (*a*) should be clearly typed or written on one side only of foolscap or International A4 size paper; (*b*) must be ruled in columns headed (in this order): (i) Date/Time (GMT); (ii) Call-sign of station worked; (iii) I sent him; (iv) He sent me; (v) Bonus points; (vi) Total points claimed; (*c*) must be addressed to the **Contests Committee, Radio Society of Great Britain, 28 Little Russell Street, London, WC1, England,** the name of the contest being clearly shown on the top left hand corner of the envelope which must **be postmarked not later than 28 November, 1966.** Log sheets are available from RSGB Headquarters.

SAMPLE COVER SHEET

RSGB 7 Mc/s DX Contest 1966 Claimed Score .....

Section ..... Call-sign .....

Name .....

Address .....

Transmitter ..... Aerial(s) .....

Receiver ..... Call-signs of operators .....

.....

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

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

Failure to provide and sign the declaration may involve disqualification of the entry.

7. **Scoring:** British Isles stations may not work each other for points. Overseas stations may only claim points for contacts with British Isles stations (G, GB, GC, GD, GI, GM and GW).

Each completed contact between a British Isles station and a station in any one of the six Continental areas will score as follows:

Contacts between British Isles and Continent of Europe	5 points
Contacts between British Isles and Continent of North America	15 points
Contacts between British Isles and Continents of South America, Africa and Asia	25 points
Contacts between British Isles and Continent of Oceania	50 points

Bonus Points:

British Isles Stations: A bonus of 20 points may be claimed for the first contact with each new country. For the purposes of scoring, the **RSGB Countries List** will apply with the exception that VE, VK, W/K, ZL and ZS call areas will each count as separate countries.

Overseas Stations: A bonus of 50 points may be claimed for the first contact with each British Isles country-numeral prefix, i.e. G2, G3, G4, G5, G6, G8, GB, GC2, GC3, GC4, GC5, GC6, GC8, GD2, GD3, GD4, GD5, GD6, GD8, GI2, GI3, GI4, GI5, GI6, GI8, GM2, GM3, GM4, GM5, GM6, GM8, GW2, GW3, GW4, GW5, GW6, GW8.

8. **Awards:** Provided that the adjudicated score is 600 or more points certificates of merit will be awarded to the overall leaders and runners-up in each section and to the leading station in each of the other five British Isles countries. Certificates will also be awarded to the leading station in each overseas country. VE, VK, W/K, ZL and ZS call areas counting separately as in Rule 7. Awards will only be made if there are 10 or more entries in any section.

Listeners' Section

1. **Duration:** Each section of the contest will take place between 18.00 GMT on the Saturday and 18.00 GMT on the Sunday as follows:
Phone: 29-30 October, 1966. **C.W.:** 12-13 November, 1966.

2. **Eligible Entrants:** The contest is open to short-wave listeners throughout the world. All entrants agree to be bound by these rules. Only the entrant may operate his receiving station for the duration of the event. Holders of amateur transmitting licences are not eligible to take part.

3. **Entries:** Entries (*a*) should be clearly typed or written on one side only of foolscap or International A4 size paper; (*d*) must be ruled in columns headed (in this order) (i) Date/Time GMT; (ii) Call-sign of station heard; (iii) Report and serial number sent by station heard; (iv) Call-sign of station being worked; (v) Bonus points; (vi) Total points claimed; (*c*) must be addressed to the **Contests Committee, Radio Society of Great Britain, 28 Little Russell Street, London, WC1, England.** The name of the Contest must be clearly shown on the top left hand corner of the envelope, which must be postmarked not later than 28 November, 1966. Log sheets are available from RSGB Headquarters. All entries must contain the following declaration:

I declare that this receiving station was operated strictly in accordance with the rules and spirit of the contest and I agree that the decision of the RSGB shall be final in all cases of dispute. I do not hold an amateur transmitting licence.

Date ..... *Signature* .....

4. **Scoring:** British Isles entrants may only log overseas stations working **UK stations in the contest.** Overseas entrants may only log **British Isles stations in contact with overseas stations in the contest.** A station whether fixed, portable, mobile or alternative address may be logged once only for the purpose of scoring. *CQ or test calls will not count for points.*

For British Isles entrants, each completed log entry of a contact between a British Isles station and a station in the following continents will score as indicated:

Continent of Europe	5 points
Continent of North America	15 points
Continents of South America, Africa and Asia	25 points
Continent of Oceania	50 points

For overseas entrants, each completed log entry of a contact between a British Isles station and any other station in the contest will score as indicated:

Where the listener is in continent of Europe	5 points
Continent of North America	15 points
Continents of South America, Africa and Asia	25 points
Continent of Oceania	50 points

5. The Committee reserves the right to disqualify any entrant whose log is consistently inaccurate.

Bonus Points:

British Isles Entrants: A bonus of 20 points may be claimed for the first station logged in each new country. For the purpose of scoring the **RSGB Countries List** will apply, with the exception that VE, VK, W/K, ZL and ZS call areas will each count as separate countries.

Overseas Entrants: A bonus of 50 points may be claimed for the first station logged in each British Isles country—numeral prefix, i.e. G2, G3, GM4, etc., as listed in Rule 7 for the Transmitting Contest.

6. **Awards:** At the discretion of the Council, certificates will be awarded to the British Isles leading entrant and runner-up and to the leading entrant in each overseas country.

Don Adaway, GM3UBK, operating GM3GUJ during the c.w. section of the 7 Mc/s DX Contest held last November. The station came second in the Multi-operator Section with 1243 points.

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.

AERE (Harwell) ARC is giving consideration to launching an organized constructional project with the first item possibly being a v.h.f. converter. It is hoped, that, as far as possible, whichever unit is finally decided upon, it will be knitted together from junk box stocks. *G2HIF.*

Ashton and District ARG has set the group up on a club basis, and now meets alternate Fridays at the Ashton College. A club station is to be established as soon as possible. Prospective members are assured of a cordial welcome. *G3VDS.*

Baden-Powell House Scout ARG now has its club station fully operational. Power has recently been boosted by a KW600 linear. Two exhibition stations are to be provided at Gilwell Park on the 11-12 and 25-26 June. *G3TGS.*

Basildon and District ARS is all set for NFD from a site on the Laindon Hills. Visitors to the site will be welcome. *G8AAO.*

Bedford ARC recently held its first social evening which was greatly enjoyed by those who attended, but which did not receive the support it deserved. Meetings in June will be on the 14th when there will be an inquest on NFD, and on the 23rd when further attention is to be given to the club transmitter project. *G3VBA.*

Bristol RSGB Group. Final preparations are well in hand for the group's mobile rally at Longleat to be held on 26 June. Talk-in stations will be operational on 1·8 Mc/s, 70 Mc/s and 144 Mc/s from 10.00 onwards. No mobileer within range should miss this one. *G5UH.*

Cambridge and District had a very interesting talk by G5AAE/K9ALP who described the activities of the North Wisconsin Club. In June the /T aspirants will be able to get some real gen from G6BBY/T and G6PGF/T when they describe the ins and outs of constructing a TV camera. *G5BQ.*

Chippenham and District ARC has plans in hand for the construction of an a.m./c.w. transmitter for 160/80 to be followed, it is hoped, by some s.s.b. gear for the h.f. bands. For those who feel that they have two left feet, or that mastering Samuel Morse's invention unaided is far from a piece of cake, are reminded that Morse classes are held on Tuesday evenings. *G6NV.*

Cornish ARC. "Listening around 80m recently, I have been amazed at the behaviour of some s.s.b. nets. To argue about technical points is fair enough, but to argue on such matters when it is obvious that nothing is known about the subject seems to be more than a little off-beat. What appalled me was the deliberate rudeness to stations breaking in. Surely it is better Ham Spirit to spend a couple of minutes to give the chap a report." Your conductor makes no comment to these watered down observations, except to observe that the Ham Spirit is sometimes given a downright beating by the empty kettles. *G3OCB.*

Crawley ARC has been busy with plans for NFD. Three new call-signs in the G3V series have been issued to members in the last few weeks. A new venture is the setting-up of a net on 70·155 Mc/s and on which five stations are active. *G3FRV.*

Cray Valley RS seemed to have more than its fair share of bad luck in the second 70 Mc/s contest. Aside from the question of the weather which seemed bent on putting paid to operations before they even started, it was found that a transistorized receiver and a valve converter just couldn't get along with each other. In the end the club was represented by G3AWD and G3OCC operating from their respective QTH's. *G3DNC.*

Crystal Palace and District RC reports that the new committee has arranged a tentative programme and, as was requested at the AGM, the accent is more heavily in the direction of items of direct interest to radio amateurs. *G3FZL.*

Derby and District ARS has recently visited the Derby telephone exchange, the Rolls-Royce High Altitude Test Plant and their Vibration Department. Visits during June and July will include the Derbyshire Royal Infirmary Radiotherapy Department. *G2CVV.*

Dorking and District RS reports that it held a very

The Baden Powell House Scout Amateur Radio Society was recently presented with a KW 600 linear amplifier, and this was air-tested at G3TGS by G3SEM who contacted scouts in Chicago and New Brunswick, K9MDM/P and K2BFW. The Chief Scout, Sir Charles MacLean, is seen with some of the group members listening to the American scouts.

G5PP introducing the Lord Mayor of Stoke-on-Trent at the opening of the North Midlands Mobile Rally on 24 April 1966, watched by G3NCX and G3UD.

(Photo by G3TJA)

The Leicester Hobbies Exhibition was recently held in the Granby Halls, and the Leicester Radio Society took the opportunity of operating three radio stations, supported by a demonstration of closed circuit television.

successful surplus sale recently and that an ex-GPO van has been purchased to enable members to have their own Mobile station. *G3UJU.*

Ealing and District ARS recently held one of its most successful junk sales since the club was formed late last year. Operation is now taking place on 2m with 15 watts into a halo at 50 ft. G3SSI won the club's constructional contest with his combined a.t.u. and s.w.r. bridge. *G3SGT.*

Echelford ARS will be holding an exhibition station at the BP Research Centre, Sunbury, on 18 June, operating under the call G3UES/A.

Edgware and District RS held an enjoyable D/F contest on 8 May. On Monday, 9 May, G3RNK/T gave an interesting lecture on Amateur TV. The club Net takes place on 1875 kc/s on Wednesdays at 21.00. *G3RAA.*

Irish Transmitters Society extends to EI2W well deserved congratulations for the fact that he holds 25 first v.h.f./u.h.f. contacts between EI and other countries. This is a very fine record and illustrates well that consistent operating on the v.h.f. bands has its rewards. See you there? *EI6AS.*

Leicester RS took part in a very successful Hobbies Exhibition during April and which was attended by some 18,500 people. Three stations were in operation backed up by a live demonstration of closed circuit TV. Such was the popularity of the exhibitions that it seems likely that it will become an annual event. *G3LRS.*

Loughborough ARC has a full and well balanced programme ahead. June meetings, apart from NFD, will take place on the 10, 17 and 24. *G3IPL.*

Lt. Col. Per Anders Kinman, SM5ZD, Vice-Chairman, IARU Region I, R. F. Stevens, G2BVN, President, RSGB, and J. Clarricoats, G6CL, Secretary, IARU Region I, were guests at the recent Sutton and Cheam Radio Society's Annual Dinner and Dance.
(Photo by G3HQX

Loughton and District RS has now cleared its AGM and is looking forward to another year of progress. While members are always pleased to welcome newcomers, they would like to see more of some of the old stagers. *G3LBS.*

Magnus Grammar School RS is pleased to report another success in the GPO Morse test. All plans seem to be set for NFD, during which it is hoped that there will be some reunions with old members. *G3JNK.*

Maidstone YMCA ARS was delighted with the fact that it had obtained first position in the Affiliated Societies' contest, and this has created renewed enthusiasm for even greater effort in NFD. Owing to the fact that new premises are being constructed, the society will shortly have to use a temporary venue but, when they are completed, they will have the benefit of first class facilities. *G3ERY.*

Mid-Warwickshire ARS is, on 13 June, having a lecture on receiver servicing. By the end of the month, in addition to the Top Band transmitter currently in operation, the society hopes to have its home brewed s.s.b. 80/40m transmitter functioning. *G3UDN.*

North Kent RS is meeting on 9 June for an inquest on NFD. By all accounts this is a club in which home constructed equipment figures highly, many members being engaged in current projects from 4m to s.s.b. *G3ENT.*

Members and Guests of the Thanet Radio Society seen at their seventeenth annual dinner held on 2 April this year.

Northern Heights ARS enjoyed good support for its AGM held in April. Meetings in June will be a visit to Manchester ARC on the 8th; operation of a demonstration station at the Halifax Charity Gala on the 11th; and a talk by G3IGW on the 22nd. *G3MDW.*

Paddington and District ARS is meeting on 8 June for a talk by G3MHQ " Top Band Transceiver on a Shoestring " to initiate the club project. All being well there will be a field day held during the summer, but in the meantime, a multi-band aerial has been erected for the l.f. and h.f. bands. *G3PAD.*

Peterborough and District ARS held its second D/F contest on the 6 May when G3EEL acted as the " fox " and SWL Peter Jefferey was the winner. Much work is being put into the demonstration station which will be operating during the Agricultural Show 19-21 July inclusive. Some idea of the undertaking can be gained from the fact that they intend to operate all bands 160/2m. Visitors are always welcome. *G3KPO.*

Port Talbot RC held a social early in April which was a thumping success with visitors from Cardiff, Swansea, Rhondda, Pembrokeshire and Carmarthen. There can be no doubt that this event has become one of the most notable in South Wales.

Purley and District RC has its AGM scheduled for 17 June,

a meeting that all members are asked to make a special effort to attend. Prior to this on the 3rd there will be a natter night. The club runs two Nets, and both enjoy a high degree of support. One is on Grandad's short wave band of 160 every Sunday at 10.30, and the other " theres more on Four for sure " on 70·32 Mc/s on Wednesdays at 20.30. *G3FTQ.*

Plymouth RC held its AGM on 3 May, and is now looking forward to a further year of progress. After a number of years of serving the club well, first as Assistant, and then as Hon. Secretary, Barry Curnow, G3UKI, is passing the job on to another. *G3PRC.*

Radio Invalid and Bedfast Club has a superb " shortie " which should be emblazened on the wall of every radio workshop throughout the country, and the credit for which goes to George Stokes:

MAN—PLIERS—ELECTRIC WIRES . . .
BLUE FLASHES—MAN—ASHES.

Don't let this be your epitaph. *G3LWY.*

Reigate ATS's interest in u.h.f. activity is growing rapidly with four members active on the band and another six building equipment. It is hoped that a 23cm project will be completed in time for V.H.F. NFD. *G3NKT.*

Royal Naval ARS will be welcoming visitors and mobilers to the Open Day at RN Air Station, Lee-on-Solent at 14.00 on 27 June. There will be a full Fleet Air Arm flying programme. Talk-in will be on 160 and 4m. If you are within travelling distance, don't miss this one. *G3ENI.*

Saltash and District ARC is meeting on the 3 June for an Open Night, and on the 17th for a mobile evening out. *G2DFH.*

Southampton Group. No meeting will be held at the University in June, but the clubroom at 20 Carlton Road is open on Wednesday and Friday evenings. *G3HKT.*

Surrey Radio Contact Club. Owing to the new regulation regarding car rallies, it seems unlikely that the annual mid-summer Treasure Hunt will take place. Apart from this blow below the belt, the club reports that the rest of the programme is shaping up quite well. There was nearly an outsized snag at the AGM when insufficient members turned up to make a quorum, but, with a number of panic 'phone calls, eventually the required number was made up. Just why is it that normally stalwart members avoid AGM's as though they were catching? *G3KGA.*

Sutton and Cheam RS elected its new committee late in April, and now has their sails set for the coming club year. *G3HQT.*

Swindon and District ARC has a red letter day on Wednesday, 29 June (AGM). The opening cannon will be fired at 8 p.m. No trusty warrior should be able to look back and regret a battle missed, and, don't forget, they also serve, those who only stand and stare. Prior to this, on the 15th, will be a talk on stereo broadcasting. *G3LLZ.*

South Birmingham RS members had a good time at the Trentham Gardens Mobile rally, and met many old friends. At the last club meeting G3KVH and G3NVA showed slides of their visit to the USA many of which were of personalities worked over the air. *G3OMG.*

Thames Valley ART will be holding a meeting on 1 June for the purpose of dotting the i's and crossing the t's in respect of NFD arrangements. All those with jobs to do are asked to make a special effort to attend. *G3JKA.*

Torbay ARS held its AGM late in April, and the new committee is now hard at it planning for the year ahead. *G3LHJ.*

Verulam (St. Albans) RC thoroughly enjoyed a talk by G3SBA on transistorized equipment recently. What was particularly intriguing was the range of equipment which could be constructed on a " kitchen table " workshop. The talk given earlier by Eric Mollart seems to have had good effect and many members are constructing or adapting equipment for the D/F Hunt planned for the 26 June.

OFFICIAL REGIONAL MEETING
REGION 9

2 OCTOBER **ROYAL HOTEL**
WEYMOUTH

FURTHER DETAILS NEXT MONTH

The club has just acquired a new meeting place, the Cavalier Hall, at the junction of the A405 and A5 in St. Albans. Mr Turner of the GPO will be lecturing at the next meeting on 15 June, which starts at 7.45 p.m. *G3GJX.*

West Kent ARS has decided on its club project which is to be a 2m transceiver designed by G4IB. It seems likely that about ten of these units will be constructed. The Annual Constructional contest was well supported. G3TLB took first prize, and G3SSE second place. Meetings will take place on 3, 17 June, and advance notice is given of that to be held on 1 July. *G3SSE.*

Wirral ARS is meeting on the 15 June for a discussion on the experiences encountered during NFD, and on the 6 July there will be a lecture and demonstration of the six band a.m. transmitter by G3CSG. *G3FOO.*

Wolverhampton ARS is off on a mystery trip on the 20 June which will be strictly non-radio and to which members YLs and XYLs are invited. *G3JJR.*

New Catalogue from Henry's Radio Ltd.

The latest catalogue issued by Henry's Radio Ltd. of 303 Edgware Road, London, W.2, runs to 152 pages and lists more than 5000 stock lines. The transistor and associated components section has been enlarged and there is now a separate hi-fi section. The catalogue costs 6s. post paid but includes discount vouchers to the value of 6s. which can be used when placing orders.

A 16 page section of the catalogue, giving the prices of transistors, valves, Zener diodes, rectifiers and crystals, is available to members free of charge.

Southern Amateur Radio Association

The South London Mobile Club, the Purley and District Radio Club and the Wimbledon and District Radio Society have formed an association which will be known as SARA, the Southern Amateur Radio Association. This took effect from 1 June, 1966.

Can You Help?

● J. G. Owen, A5078, Llwyn-Fryn, Penmynydd Road, Llangefni, Anglesey, who wishes to obtain circuitry for 70cm, 23cm amd 3cm transmitters and receivers?

Second International Convention
KNOKKE, BELGIUM
16-18 September, 1966

Full details may be obtained from V. Claeys, ON4UM, Hoogstraat 68, Beersel, Belgium, or from Bob Fevery, ONL1322, Meermlnlaan 22, Knokke, Belgium.

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).—8, 22 June, 6 July, 8 p.m., 77 Clifton Road, Southport.

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

Ashton.—3, 17 June, 1 July, 8 p.m., Ashton-under-Lyne Technical College.

Blackburn (ELARC).—2 June, (Half yearly meeting), 15 June (Mullards Annual Meeting at the Town Hall, Blackburn—by invitation), 7 July (Visit by Regional Representative), 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).—14 June (Tape Lecture W1BB), 12 July (Quiz Night—Bury *v* Eccles), 8 p.m., Old Boar's Head (private room), Crompton Street.

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

Crewe & District.—6 June, 4 July, 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 8.30 p.m.

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

(LULARS).—6, 20 June, 4 July, 7.30 p.m., Students' Union, 2 Bedford Street North, Liverpool 7.

Macclesfield (M&DRS).—7, 21 June, 5 July, The George Hotel, Jordongate.

Manchester (M&DARS).—Wednesdays, 7.30 p.m., 203 Droylsden Road, Newton Heath, Manchester 10.

(SMRC).—Fridays, 7.45 p.m., Rackhouse Community Centre, Daine Avenue, Northenden.

Morecambe.—1 June, 6 July, 125 Regent Road.

Preston.—14 June, 12 July, 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.—1, 15, 29 June, 13 July, The Blossoms Hotel, Buxton Road, Stockport.

Wirral.—1, 15 June, 6 July, Harding House, Park Road West, Claughton, Birkenhead.

REGION 2

Spen Valley (SVARS).—9 June ("RTTY," by G3KEP), 16 June (Model Boats at Bately Park Lake), 23 June (Discussion Night), 30 June (Open Meeting), The Grammar School, Heckmondwike.

REGION 3

Birmingham (SBRS).—15 June ("S.S.B.", by G3LNN), 8 p.m., The ScoutsHut, Pershore Road, Selly Park, Birmingham.

REGION 4

Derby (D&DARS).—1 June (Surplus Sale), 4-5 June (National Field Day, Glebe Farm, Blagreaves Lane, Littleover), 8 June (Radio and Component Quiz—with prizes), 15 June (Film Show—M. Shardlow, G3SZJ; J. Anthony, G3KQF), 22 June (D/F Practice Night—Social evening and rag-chew for non-participants), 29 June (Visit to Radiotherapy Unit at Derbyshire Royal Infirmary—limited to thirty), 7.30 p.m., Room 4, 119 Green Lane, Derby.

Heanor (H&DARS).—7 June (Components Quiz), 14 June (Sale of Surplus Equipment), 21 June ("Aerial Tuning," by R. Harrod, G3RWN), 28 June (Film Show), 7.30 p.m., Room 14, Heanor Technical College, Ilkestone Road, Heanor, Derbys.

Hunstanton (ARS).—26 June (Bucket & Spade Party—Brookes Refreshment Rooms) opposite the Railway Station on the promenade.

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.

Magnus GS (MGSARS).—Tuesdays, 3.50 p.m., The Junior Physics Lab., Magnus Grammar School, Newark.

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&PARS).—Fridays, 8 p.m., Old Windmill (behind Peacock Inn), London Road, Peterborough. 19, 20, 21 July (Exhibition Station GB3PAS), Peterborough Agricultural Show.

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

REGION 5

Bedford (B&DARC).—Second Tuesday and Fourth Tuesday of the month, 7.45 p.m., West field School, Queen's Road, Bedford. Slow Morse, 7.30 p.m.

Cambridge (C&DARC).—3 June ("Building a TV Camera," by G6BBY/T and G6PGF/T, 10 June (Film Show), 17 June (Informal), 24 June (Natter Evening). Fridays 7.30 p.m., Club Headquarters, Corporation Yard, Victoria Road, Cambridge.

Cambridge University (CUWS).—No formal Meetings during Summer Term. Transmitting from Grange Road site.

Luton (L&DARS).—4, 5 June (Participation in NFD), 7 June (NFD Inquest), 14 June (Club visit to ITA Transmitter, Sandy Heath, limited, numbers), 21 June (D/F Trial with members' home-built gear), 28 June (G3SVJ on the air), Tuesdays, 8 p.m., ATC HQ, Crescent Road, Luton, Bedfordshire.

March (M&DARS).—Tuesdays, 7.30 p.m., rear of Police Headquarters, High Street, March, Cambridgeshire.

Royston (R&DARC).—Wednesdays, 8 p.m., Manor House Social Club, Melbourn Street, Royston, Herts.

Shefford (S&DARC).—2 June (NFD Final Preparations and Dummy Run), 9 June (NFD Post Mortem), 16 June (Mobile Demonstration), 23 June ("Getting started on Amateur Radio," by C. Pettifer G2DPQ), 30 June (Lecture by C. Brown), 7.45 p.m., Church Hall, High Street, Shefford, Bedfordshire.

REGION 6

Cheltenham.—2 June ("V.H.F. the Modern Way," by G3BA), 8 p.m., The Great Western Hotel, Clarence Street.

REGION 7

Acton, Brentford & Chiswick (ABCRC).—21 June ("Facsimile Transmissions by G3SSM,") 7.30 p.m., AEU Club, 66 High Road, Chiswick.

Ashford (Middx.) Echelford (ARS).—8, 22 June, 7.30 p.m., Links Hotel, Ashford.

Bexley Heath (NKRS).—9 June (NFD Inquest), 7.30 p.m., Congregational Hall, Chapel Road, Bexley Heath.

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

Croydon (SRCC).—14 June, 7.30 p.m., Blacksmiths Arms, South End.

Dorking (D&DRS).—14 June (Informal Meeting), 8 p.m., Wheatsheaf, Dorking. 28 June (Informal Meeting), Old Windsor Castle, Bookham.

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

East Ham.—Tuesdays fortnightly, 7.30 p.m., 12 Leigh High Road, East Ham.

East Molesey (TVARTS).—First Wednesday each month, Prince of Wales, Bridge Road, East Molesey.

Edgware (E&DRS).—4-5 June (NFD), 13 June (Informal Meetings), 27 June (D/F Club Contest), 8 p.m., John Keble Hall, Church Close, Deans Lane, Edgware.

Gravesend (CRS).—15 June, 7.30 p.m. RAFTA Club, 17 Overcliffe Road.

Greenford (G&DARS).—Alternate Fridays (17 June), 8 p.m., Greenford Community Centre, Oldfield Lane, Greenford, Middlesex.

Guildford (G&DARS).—10, 24 June, fortnightly, 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).—Fridays, 8 p.m., Roxeth Manor School, Eastcote Lane.

Havering (H&DARC).—8, 22 June, Romford.

Holloway (GRS).—Mondays and Wednesdays (RAE & Morse), 7.30 p.m., Fridays (Club Room), 7.30 p.m., 35 Montem School, Holloway Road, N7.

Hounslow (HADRS).—13, 27 June, Canteen, Mogden Main Drainage Department, Mogden Works, Isleworth.

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

Kingston.—9, 23 June, fortnightly, 8 p.m., YMCA, Eden Street, Fridays (weekly Morse classes), 2 Sunray Avenue, Tolworth.

Leyton & Walthamstow.—14, 28 June, 7.30 p.m. Leyton Senior Institute, Essex Road, London, E10.

London UHF Group.—2 June (UHF News), 7.30 p.m., Bull and Mouth, Bloomsbury Way, Holborn, WC1.

LONDON MEMBERS' LUNCHEON CLUB

will meet at the White Hall Hotel, Bloomsbury Square, London, W.C.1.

at 12.30 p.m. on Fridays, 17 June, and 15 July 1966

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

London Members' Luncheon Club.—12.30 p.m. third Friday every month, White Hall Hotel, Bloomsbury Square, Holborn.

Loughton.—3, 17 June, 7.30 p.m., alternate Fridays, Loughton Hall (Nr. Debden Station).

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

Norwood & South London (CP&DRS).—18 June, CD Centre, Catford, London, SE6.

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

Purley (P&DARC).—17 June, 8 p.m., Railwaymen's Hall, (Side Entrance), 58 Whytecliffe Road, Purley.

Reigate (RATS).—16 June, 7.30 p.m., George & Dragon, Cromwell Road, Redhill.

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

Scout ARS.—16 June (Meeting), 7.15 p.m., Baden Powell House, Queens Gate, South Kensington. 11-12 June (Father & Son Camp), 25-26 June (International Weekend).

Science Museum.—21 June (GB2SM "On the Air Again") 6 p.m., Science Museum, South Kensington.

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

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

South London Mobile Club.—B. Negri, G3LXN, 25 Telforscot Road, SW12.

Southgate & District.—9 June, 7.30 p.m., Parkwood Girls School (behind Wood Green Town Hall).

St. Albans (Verulam ARC).—15 June, (Mr Turner, GPO, on Interference Problems), 8 p.m., Marconi Service Department, Hedley Road.

Sutton & Cheam (SCRS).—21 June, 8 p.m., The Harrow Inn, High Street, Cheam.

Welwyn Garden City.—9 June (Planning V.H.F./NFD), 8 p.m., Club, Cottage, Burnham Green, near Welwyn.
Wembley (CECARS).—10 June, Visitors ring ARNold 1262 first.
Wimbledon (W&DRS).—10 June, 8 p.m., Community Centre, St. George's Road, Wimbledon, SW19.

REGION 8

Crawley (CARC).—8 June, (Informal). For details contact G3FRV, 22 June (RSGB QSL Bureau, by G2MI), 8 p.m., Trinity Congregational Church Hall, Ifield.
West Kent (WKARS).—3 June (Constructional Project and NFD arrangements), 17 June (Aviation Radio by G3NPU), 1 July ("RTTY," by G3PAH), 7.30 p.m., Art School, Monson Road, Tunbridge Wells.

REGION 9

Bristol.—24 June (Films by Mullard and GPO), 7.15 p.m., New Lecture Theatre G44, Royal Fort, Bristol University, Woodland Road, Bristol 8.
Burnham-on-Sea (B-o-SARS).—Second Tuesday in each month 8 p.m., Crown Hotel, Oxford Street, Burnham-on-Sea.
Camborne (CRAC).—First Thursday in each month, Staff Recreation Hall, SWEB Headquarters, Poole, nr. Camborne.
(CRAC V.H.F. Group).—First Thursday in each month, 7.30 p.m., The Coach and Horses, Rydar Street, Truro.
Exeter.—First Tuesday in each month, 7.30 p.m., George & Dragon Inn, Blackboy Road, Exeter.
Plymouth (PRC).—Tuesdays, 7.30 p.m., Virginia House, Bretonside, Plymouth.
Saltash (S&DARC).—3 June (Open Night), 17 June (Mobile Evening contact, by G2DFH), 7.30 p.m., Burraton Toc H Hall, Warraton, Saltash.
South Dorset (SDRS).—First Friday in each month, 7.30 p.m., Labour Rooms, West Walks, Dorchester.
Torquay (TARS).—Last Saturday in each month, Club HQ, Belgrave Road, Torquay.
Weston-super-Mare.—4 June ("Transistors" by EMI representative), 7.15 p.m., New Engineering Block, Technical College, Weston-super-Mare.
Yeovil (YARC).—8 June, (Junk Sale), 7.30 p.m., Park Lodge, The Park, Yeovil.

REGION 10

Cardiff.—13 June, (Surplus Sale), 7.30 p.m., TA Centre, Park Street, Cardiff.

REGION 14

Auchenharvie (A&DARC).—Wednesdays and Thursdays, 7.30 p.m., Auchenharvie Community Centre, Stevenston, Ayrshire.
North Ayrshire (NAARC).—First Sunday in each month—7.30 p.m., Ardrossan ATC HQ, The Academy, Sorbie Road, Ardrossan.

REGION 16

Basildon (BDARS).—5 July (Social). Details from G3IJB.
Chelmsford (CARS).—5 July, 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).—Last Wednesday in each month. 7.30 p.m., Red Cross HQ, Gippeswyk Hall, Ipswich.
Norwich (NARC).—Mondays, 7.30 p.m., 20 June, ("The Old Days"), Old Lakenham Hall, Mansfield Lane, Norwich.

LOOKING AHEAD

19 June.—Northern Mobile Rally.
25 June.—RN Air Station Lee-on-Solent Open Day.
26 June.—Lion Safari Mobile Rally, Longleat Park.
26 June.—Hunstanton Bucket and Spade Party.
10 July.—Hurn Airport Mobile Rally.
10 July.—South Shields Mobile Rally.
24 July.—Cornish Mobile Rally.
14 August.—Derby Mobile Rally.
29 August.—Peterborough Mobile Rally.
3-4 September.—Northern Radio Societies' Convention, Manchester.
4 September.—Swindon Mobile Picnic.
11 September.—RSGB National Mobile Rally, Woburn Abbey, Bedford.
2 October.—Region 9 ORM.
26-29 October.—RSGB International Radio Communications Exhibition.
9 December.—RSGB Annual General Meeting.

MOBILE RALLIES

12 June The RSGB Rally arranged for this date has had to be cancelled.

19 June.....**Northern Mobile Rally**
Harewood Park, near Leeds
Organized by the Northern Amateur Radio Mobile Society

25 June.....**RN Air Station Lee-on-Solent Open Day**
Organized by the Royal Naval ARS

26 June.....**Lion Safari Mobile Rally**
Longleat Park, on the Frome-Warminster Road, A362
Organized by the Bristol RSGB Group

26 June.....**Hunstanton Bucket and Spade Party**
G3JEC's Brookes Refreshment Rooms, the car park, opposite the railway station
Organized by G. E. Wegg, G3ANM, Cobgate, Moulton, Spalding, Lincs

10 July.....**Hurn Airport Mobile Rally**
Hurn Airport, Bournemouth
Organized by the Wessex Amateur Radio Group and BAC Radio Club

10 July.....**South Shields Mobile Rally**
Organized by the South Shields and District ARC

24 July.....**Cornish Mobile Rally**
Rentire Headland, Newquay
(Details later)
Organized by the Cornish Radio Amateur Club

14 August.....**Derby Mobile Rally**
Organized by the Derby and District ARC

29 August.....**Peterborough Mobile Rally**
Riverside, near the swimming pool, Peterborough
(See page 334, May)
Organized by the Peterborough and District ARS

4 September.....**Swindon Mobile Picnic**
Lidiard Park, near Swindon
Organized by the Swindon and District ARC

11 September.....**RSGB National Mobile Rally**
Woburn Abbey, Bedfordshire
Organized by the Radio Society of Great Britain

Northern Mobile Rally — 19 June

Harewood Park, near Leeds. 12.00 reception

Competitions and raffles will be held, and there will be a sale of surplus equipment. Further information from G3MGI.

Talk-in stations: G3OGV/M, 160m; G3GJV/M, 2m.

Organized by the Northern Amateur Radio Mobile Society

RN Air Station Lee-on-Solent Open Day — 25 June

Full Fleet Air Arm flying programme, static exhibits and refreshments. 14.00 17.30.

Talk-in station: G3BZU, 160 & 4m.

Organized by the Royal Naval Amateur Radio Society

Lion Safari Mobile Rally — 26 June

Longleat House, Warminster, Wilts.

The recommended entrance is on the Warminster—Horningsham Road, past the village of Scotland. Alternatively, the main entrance (NGR ST842440) or Lion Park entrance (NGR ST805417) may be used, but there is a likelihood of queueing to enter the park.

Organized by the City and County of Bristol Group

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.

TVI

I think that the letter by G3ABZ calls for acclaim and emphasis. The average amateur does give up too readily, but this may be due to his not knowing that the cards are *not* in fact, stacked against him.

The impression appears to persist that if he is heard over his neighbour's equipment, he is in the wrong. The great difference between being heard on a certain frequency, and actually *emitting* on that frequency is not fully appreciated, except perhaps by the GPO officers! I have always found these gentlemen a distinct asset. Neighbourliness doesn't come into the picture until the other man is equally prepared to discard his square-commutatored vacuum cleaner. If one thinks otherwise, one's neighbour need only buy a crystal set to put one off *every* band. It is a big point to be able to receive TV while transmitting, especially if those picking up your sound can hear that you are doing so. A monitor receiver in the shack is a perfect check in this respect. But the highest card of all is an offer to the complainer—" if your telly won't work, you may come round and watch mine! "—the more forceful when you admit your telly cost a lot less than his (as in my case)!

I think a more effective way than that suggested by G3CDE would be to devote some BULLETIN space to the understanding between the GPO Liaison and TVI Committee—to whom all praise—and the Post Office. I am convinced that most of those who QRT for telly simply do not realize how unnecessarily defeatist they are. Place your own telly where it can be seen readily through an uncurtained window, and carry on regardless. This treatment has " cured " several cases of " TVI " in my own neighbourhood. Unfortunately it doesn't cure square commutators too!

H. S. CHADWICK, G8ON

Worksop, Notts.

TVI/BCI: A Neighbour Problem?

Who said that neighbours are unco-operative as far as TVI and BCI are concerned? The writer's faith in good neighbourly relationship was dramatically strengthened as the result of a recent incident.

Neighbour, who recently moved into the deadly sphere of radiation around the shack, was listening to some records played on his record player. Suddenly a strange voice broke through the music and appeared to be complaining to a third person that due to heavy electrical noise produced by some electric motor in the neighbourhood he was unable to copy the transmission and suggested terminating the contact. Neighbour, having learnt about a radio amateur in the vicinity by querying the strange looking mast in the garden adjoining his and believing himself to be the culprit of the complaint switched of his record player at once. He then proceeded to knock on writer's front door and apologized for the inconvenience which he unwittingly caused through playing his record player! Red faced, and still listening to the music of an electric drill somewhere, writer in turn apologized for breaking through neighbour's hi-fi set and the matter was amicably closed. By the way, writer's QTH is for sale together with neighbour at no extra charge.

F. J. LENGYEL, G3TUC

Chelmsford, Essex.

Effectiveness of TV Low Pass Filters

While it is extremely important to obtain a good match between an aerial and feedline at the transmitting frequency when endeavouring to eliminate TVI an important point to bear in mind is that a low pass filter can only effectively attenuate harmonics if correctly terminated *at the TV frequency*.

A 14 Mc/s dipole will give a reasonable match to 80 ohm line at both 14 Mc/s and 42 Mc/s, and will enable an 80 ohm filter in the feeder to effectively attenuate 42 Mc/s harmonics. A 21 Mc/s dipole, however, although giving a reasonable match to 80 ohm line at 21 Mc/s, presents a hopeless mismatch to the same line at 42 Mc/s and the same filter would thus be ineffective for harmonic suppression at 42 Mc/s.

It can be shown, however, that parallel 14 Mc/s, 21 Mc/s and 28 Mc/s dipoles fed with 80 ohm line through a filter, gives good suppression over a fair number of TV Band 1 channels. This aerial, plus a triband, single feeder quad operating on the same principle, has enabled G3CAZ to run 150 watts 100 per cent modulated a.m. through TV hours on all the DX bands in various locations and do reasonably well in ARRL, *CQ* and RSGB contests.

It follows that before introducing a matching section, a tuned trap, or even a balun, into the output of a transmitter which is not giving trouble, it is advisable to assess how it will affect the impedance of the aerial system at the TV frequency concerned.

JOHN J. SPRINGATE, G3CAZ

Burnham, Bucks.

Direct Measurement of S.W.R.

The Monimatch type of standing wave ratio indicator is deservedly popular, but the lack of a direct reading scale on home constructed models is a snag.

However, if the forward and reverse voltages are A and B respectively the s.w.r. is calculated as $\frac{A+B}{A-B}$. This is familiar in the calculation of modulation depth, which is presented as an abac in several handbooks. As s.w.r. is generally calculated as a ratio greater than one a conversion scale as follows may be pencilled on the Abac.

100% — 1 : 1	50% — 1 : 2
90% — 1 : 1·1	40% — 1 : 2·5
80% — 1 : 1·25	30% — 1 : 3·3
70% — 1 : 1·43	20% — 1 : 5
60% — 1 : 1·67	10% — 1 : 10

At low power levels the r.f. diode voltmeter will give a reading proportional to the power and not to the voltage, and so indicate a better than actual s.w.r. Thus readings can be checked by reducing power slightly and making a new measurement of s.w.r. If it improves substantially the first reading is suspect and should be repeated with more power, or the coupling of the loops to the main line should be increased.

The other snag, sensitivity proportional to frequency, is curable over a substantial bandwidth by shunting the diode voltmeter input with a suitable capacitor. This permits the device to be calibrated directly in forward and reflected watts if suitable equipment is available. This may well appeal to the s.s.b. operator who wishes to exploit the new regulations.

B. PRIESTLEY, G3JGO

Slough, Bucks.

Trees as Aerial Supports

G3KMH's letter in the March BULLETIN, prompts me to describe a method that I have successfully used for many years.

I tie the line to a tennis ball and lob it over the intervening obstacles with a briskly wielded tennis racquet. After a few attempts I have always succeeded in getting the line where I have wanted it. On one occasion, during my misguided youth, I had the temerity to use this method to place an aerial over a road complete with telephone lines. How many bells were rung when the wire was ultimately dragged over I shall never know! However, I am sure our benevolent Post Office will forgive me; it really was a very long time ago—and it was such a good aerial!

A. E. J. COOPER, G5VT

Bishop's Stortford

Morse is a Ham's Best Friend?

I must object most strongly to the headline " Morse is a Ham's Best Friend " on page 312 of your May issue. This would seem to be yet another attempt to indoctrinate readers, especially SWLs, with the all-too-prevalent and entirely erroneous belief that c.w. is the begin-all and end-all of Amateur Radio.

Brass-pounding is the most primitive form of radio communication, akin to the African tom-tom or the Red Indian smoke signal. It has shown no advancement (other than the wholesale butchery of the English language) since the Spark Tx gave way to the r.f. carrier. I admit that c.w. does have its uses, especially as an emergency means of communication, and for this reason I would strongly oppose any suggestion that the GPO Morse Test should be abolished, but to continue to regard c.w. as our primary mode in this day and age is positively ridiculous!

Let us catch up with 1966; amateurs should be looking to the

future, striving to improve and perfect the various modes of speech communication, instead of concentrating their energies on the mode used by their Great Grandfathers. Shift some of the emphasis off c.w.—there is no room for that superior " holier-than-thou " attitude of many " dotty-dash " types, many of whom boast that they don't even possess a microphone—let them see that this is not something to be proud of. This is 1966—let's get " with it," before it is too late.

In closing, may I say that I consider the article on page 312 to be excellent, and feel that many SWLs will find it extremely helpful—a pity it had to be spoiled by such a misleading headline!

E. A. RUDOLPH, G3SIL

Stanmore, Middlesex.

As I have taught the Morse Code at intervals over the past twenty-five years, have coached most of our recently-licensed local amateurs for the Morse Test and now hold a class for candidates at our local Technical College, I was interested to read the article " Morse is the Ham's Best Friend " by E. Chicken, G3BIK.

My interest prompts me to point out that the information at the bottom of page 313 (which states that the space between words or groups is equal to five dits) is now superseded and the space is equal to seven dits. The authority for this is: " R.R. & A.R.R. annex to I.T.C. 1959 as printed in GPO Handbook for Radio Operators, Rg 67, 1961 amended to September 1964."

It would appear that this amendment is not generally known as even newly-published works on the subject are in error. All publications to hand have been checked and so far I have found only one which quotes the new spacing. Another splits the difference and says that the spacing is six d.ts. which it has never been!

I trust this may clear up a popular misconception.

There is another point which interests me. In view of the wide variation between Morse Test examiners, the quality of oscillators and keys used for same and the actual method of conducting the tests, would it not be possible to have an automatic transmission for the candidates to copy? If the transport of transmitting heads for perforated tape is not feasible, the test could be transferred centrally from perforated to magnetic tape. No doubt this might penalize " shaky " candidates who might scrape through under a lenient examiner who is kind in his estimation of 12 w.p.m., but at least it would produce a standard test, and I must say that I have never yet heard a failed candidate complain that his failure was undeserved!

I am sure that examiners and candidates alike would welcome some such standardization as arrangements and equipment vary not only from one centre to another but from one test to the next at the same centre.

I realize, of course, that these arrangements are purely the province of the GPO but, as one examiner himself recently commented, some of the equipment provided is " out of the Ark." But with all the modern facilities at their disposal, it is a source of surprise to me that the GPO still maintains Morse Tests on the highly individual lines on which they are run.

Candidates and examiners may both prefer it that way and certainly, despite all the discrepancies between tests, there is a steady flow of new licence-holders and always a list of hopeful candidates, so the system cannot be unsuccessful, though I feel sure it could be modernized.

MARY I. SHAW (Mrs), G3OMM

Halifax, Yorkshire.

American Licensing

The most probable reason for the falling-off in the issue of new amateur licences in the USA, referred to in the last issue of the BULLETIN, appears to be the easy availability of Citizen's Radio licences. Though limited to the 27 Mc/s band, with restricted power and aerials so that DX is not possible, these licences offer many of the attractions of genuine Amateur Radio without the painful necessity for passing an examination and a Morse test. The enthusiasts, among other things, issue QSL cards, operate mobile, run emergency networks and use D/F equipment (see American publications such as *Popular Electronics*). It is obvious that many radio enthusiasts who might have become amateur operators in our sense of the word, have taken the easier course, and the Citizen's Radio band has become a form of second-fiddle amateur band.

ALAN G. DUNN, G3PL

Hull, Yorkshire.

Contests

The letter from GW3GHC in the April issue prompted me to take a look at " Contests Diary " for 1966, and the results of my " survey " of contests are shown in the table below. The first figure is the number of RSGB contests and the second the total.

Band	Number of Weekends Phone	C.W.
1·8	0/1	5/7
3·5	0/8	4/11
7	1/9	3/10
14	0/8	2/9
21	1/9	2/9
28	1/9	2/9
70	4/4	5/5
144	4/4	5/5
432	3/3	3/3
1296	3/3	3/3

The figures include a few not shown in the " Diary," e.g., *CQ* WW contests.

As the 1·8 Mc/s and v.h.f. contests are unlikely to offend anyone, we will examine the situation on the h.f. bands. The only " all-band " contests sponsored by RSGB are NFD and BERU. Two hundred stations running 10 watts on NFD should not seriously inconvenience high power non-contestants, while BERU makes little impact on 3·5 and 7 Mc/s and rarely extends far up the other bands (this year I made 39 contacts below 14020 kc/s and 2 above!). Eighty-metre Field Day and the Low Power Contest are unlikely to cause havoc owing to the low powers involved, and although the 7 Mc/s contests are the noisiest affairs run by the Society, they probably leave other bands quieter for non-contest operators. The 21/28 Mc/s Telephony Contest has plenty of kc/s to fit into, and non-contestants should be able to " find a hole." Thus I feel that the RSGB is already showing the way in the matter of contests but G5YN's suggestion of frequency limitations in the September 1965 issue is worth considering.

GW3GHC has some sound points in his " Code of Practice " but I cannot agree with his 24 hour limit as some countries might be restricted to operating at inconvenient times, e.g., all Saturday or part of Monday morning!

Although I realize some contests have been missed from the figures, it does seem that " Contests occupy the whole of the bands during the summer months " is an exaggeration.

Several correspondents comment on contest operators being a minority. If this were so, there would surely be no problem as the contest operators would then be looking for holes in the bands!

One point missed by all correspondents on this subject is this: If contests were eliminated the stations usually involved would spend more time on the air spreading their activities over more weekends. The h.f. bands would thus become more " cluttered " during good conditions and very quiet indeed during poor conditions.

My final words are GW3GHC's: I enjoy contests.

A. J. GOULD, G3JKY

Beckenham, Kent.

Reading the various letters that have been written on the subject of contests, it would appear that whereas the " anti's " are punitively inclined, those who enjoy contests are most eager to find a solution acceptable to those on both sides of the fence. This is not surprising, for the true spirit of sportsmanship is as common among our own contestants as it is in the athletics field.

Unfortunately there are those who have the " win-at-all-costs " mentality, but the average amateur finds no pleasure in taking an unfair advantage over his opponents. The action of G3BMY in a low power contest some years ago was a fine example of this. On this occasion the rules allowed 20 points per contact for stations using 0·1 watt instead of 0·5 watt as in previous contests, and Tom Cashmore declared that his transmitter would only reduce power to 0·2 watt, and therefore obtained only 10 points per QSO. Yet he still won!

In the correspondence referred to, no one has mentioned the idea of a restricted band for contests, and this would seem the ideal solution. A 15 kc/s segment for the c.w. events would still leave ample space for other users, and would provide an incentive for the raising of operating standards and receiver performance. (Contests and DX-chasing have, after all, been responsible for

a great many of the improvements in amateur equipment over the years.)

On a different tack, and with the " portable " season just around the corner, I would like to offer further suggestions to the would-be tree-halyard throwers. I do not agree with the gentleman who recommended fishing line, for if the weighted line whips round a high branch it cannot be broken—and this material is expensive. A fine hemp, as used by printers, is ideal, and with the addition of 3 ft. to 4 ft. of rope between the twine and weight, cut fingers are avoided and more control and impetus are gained. By standing on a box or other object, clear of long grass, a greater arc can be described, resulting in accurate throws in excess of 80 ft.

JOHN J. YEEND, G3CGD

Cheltenham, Glos.

I have read the letter from 9H1AD, G3SJQ (March BULLETIN) and I fully support his views.

Having carefully read Sir Evan Nepean's (G5YN) letter in September, I cannot see any real difficulty in implementing his suggestion that only part of each band (c.w. or phone) should be used in contests leaving the remainder available for those who do not wish to participate.

While not wishing to spoil the pleasure of those who enjoy contests it is equally true that the contestants have no right to spoil the pleasure of the many thousands who have no interest in contests. Nor is it true that contests cover only one or two weekends a year. They cover a very large number of weekends. The ARRL DX contest covers four weekends (two c.w., two phone); then there are *CQ* WW DX Contests, the PACC, Helvetia 22, BERU, RSGB 21/28 Mc/s, REF Contests, WAE Contests, and so on.

While contests may be valuable in creating activity on bands with low activity, especially the v.h.f. bands, no one can claim that 20 metres has low activity.

It is surely time we put our house in order, and who better than the RSGB to set an example and limit its own contests to, say, half the band (c.w. or phone) in each contest. I believe others would follow. Can it be that the RSGB is so modest that it underestimates its own influence in international affairs?

E. M. WAGNER, G3BID

London, NW3

Second 144 Mc/s Contest (Open) 1966

The publication of the results of the above contest in the May issue of the BULLETIN serves as an excellent example to illustrate a point which has caused me growing concern over a number of years of activity on v.h.f.

Bearing in mind that this is an Open Contest, it is significant to note that, of the first eight stations, five operated " portable " and two operated " oblique A " from other than their normal home locations, leaving only one to operate a normal permanently installed home station. While I would be the last to belittle the efforts of the seven referred to, I begin to wonder whether the time has not come to create a separate class in this contest for normal " home " stations, for it must be agreed that no amount of fine equipment and sophisticated aerials can make up the advantage to be gained from operating from a hand picked favourable location with equipment considerably less complex.

This is the only 144 Mc/s phone contest open to fixed stations and it is in real danger of being swallowed up by portable stations taking the top places. If there are others who share my views, perhaps the V.H.F. Contests Committee would care to consider such a division for future years.

R. C. HILLS, G3HRH

Welwyn, Herts.

GB2RS News Bulletin

There seems to be a hard core of amateurs in this country who are just oblivious of what goes on around them!

Apart from those who still do not know the address of the RSGB QSL Bureau, there is the much larger number who seem to be unaware of the existence of the RSGB News Bulletin Service.

3600 kc/s is the frequency and 09.30 on Sunday mornings is the time of the first transmission.

I am utterly amazed at the number of stations who call CQ or conduct QSOs on 3600 kc/s while the BULLETIN is being read.

Do these people know what frequency they are on? Do they have any means of ascertaining this information, or is it plain bloody mindedness?

Frankly, I am fed up with tying myself down each Sunday morning trying to give a service to my fellow amateurs, just to have it made unreadable by a bunch of inconsiderate, incompetent clots.

A. O. MILNE, G2MI

Bromley, Kent.

QSL Managers

If Mr Milne considers certain remarks re " Grandads Band," as derogatory, I suggest that he re-read his own letter (the latest) on QSL managers.

I am not such a lazy so-and-so as Mr Milne implies in his letter, and considering the tone of his remarks, do not like being referred to as an individual when in all but name, I have been identified.

Mr Milne, for years, has had an unenviable task as RSGB QSL Manager. That the RSGB Bureau is probably the best in the world, is to his credit entirely. In addition, he has performed many services on our behalf. Probably because of these many tasks, he appears to be sadly out of touch with certain aspects of operating from a country which has a prefix " to be desired." Judging from his remarks, it would seem that he has never taken the trouble to furnish himself with the facts regarding QSL managers, or why the DX man (as opposed to the G), should avail himself of their services.

I am not excusing myself for accepting the offer of W2CTN. However, I would state that if I had not taken over the running of the CARS Bureau, I would not have found it necessary to " QSL via W2CTN." I did, nevertheless, make out over 1000 of my own cards, a good percentage of which went via G2MI. Mr Milne is not the only person who had several commitments; at least, I did find the time to get on the bands!

I could give an example of the trouble that W2CTN goes to to ensure that a card is sent only to the person for whom it is intended, that those who " try it on " do so unsuccessfully, if anyone is interested.

Incidentally, Cyprus became an Independent Republic within the Commonwealth on 16 August, 1960, although the prefix did not change until 1962—it was not a British Crown Colony whilst I was QSL manager.

Finally, I trust that Mr Milne has many pleasant journeys, threading through the Coast stations on the one hand, whilst threading his way through London's traffic on the other. I never could understand how one can do both, at one and the same time, whilst giving one's full attention to both—but then that's another subject for discussion.

E. H. ROSS, GM3LWS
Formerly Manager CARS QSL Bureau/ZC4CZ/5B4CZ/ZC4FB/VP8CZ/G3LWS

Auchtermuchty, Fifeshire.

SWL QSLing

I would like to comment on the letter by S. Shaw (February, 1966 BULLETIN). What the OE suggests seems a good idea in theory, but in practice it doesn't work; not for me anyway.

While I was in Cyprus with the call 5B4JF I was inundated with SWL reports, mainly from OK, YO, YU, etc. As I could not afford to send them one of my personal QSL cards I bought a well-known rubber stamp outfit and made up the following:

5B4JF. THIS REPORT AGREES WITH MY LOG
Signed John Farrar

Having stamped this in a prominent position on the SWL cards I sent them to the bureau with the rest of my QSLs. They were *all* returned. I don't for one minute suspect G2MI, for the error obviously lies with the foreign bureaux. Perhaps others have had better luck than I.

J. FARRAR, G3UCQ

Trencrom, Hayle, Cornwall.

Can You Help?

● R. W. Limebear, G3RWL, 190 Winchmore Hill Road, London, N21 who requires 160m conversion details for the Geloso 209 receiver?

● C. B. Raithby, School House, Martin, Lincoln, who requires the formula for making special varnish to coat brass terminals?

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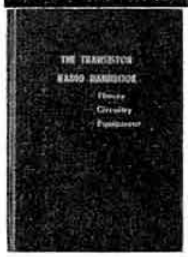

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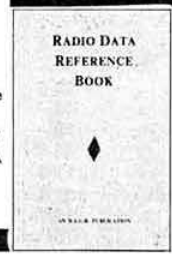

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