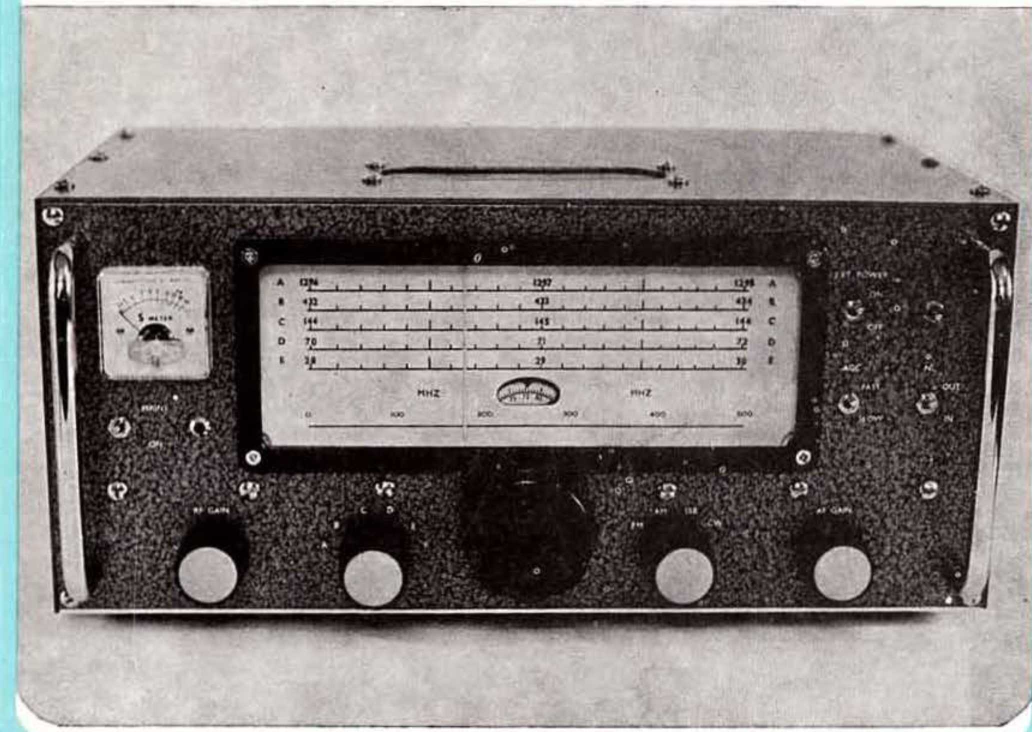
radio communication

October 1974

A MULTI-MODE 427 RECEIVER

by C. E. Saveker, G8AMU

An award-winning design fully described in this issue



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radio communication

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ABC
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Closing date for contributions unless otherwise notified: 4th of month preceding month of publication.

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- ★ **ADJUST CARRIER SUPPRESSION**
- ★ **PROVIDE 2-TONE TEST SIGNAL**
(Delivery is Ex-stock. SAE for details).

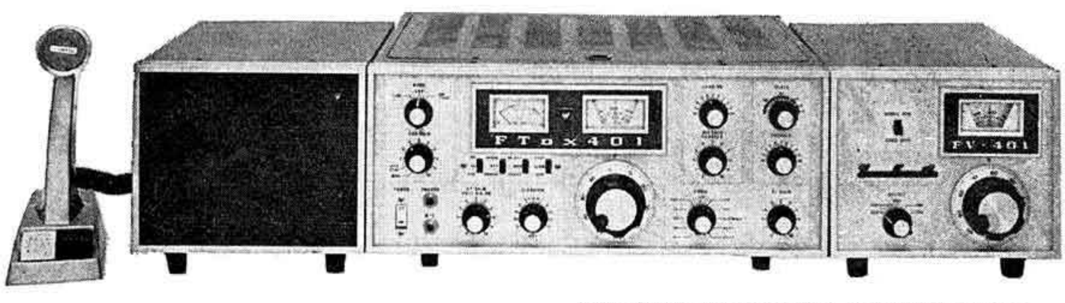
★ ★ ★ ★ ★

"ALL RECEIVERS 'FALL OFF' AT 30MHz!"

THIS HAS BEEN THE GENERAL OPINION OF RECEIVER SENSITIVITY PERFORMANCE FOR YEARS AND STILL APPLIES TO SOME MODERN EQUIPMENT! HOWEVER,

IT DOES NOT APPLY TO YAESU EQUIPMENT! **"YOU DON'T BELIEVE US? THEN HERE ARE THE FACTS!"**
TAKE YOUR PICK! EITHER REFER TO THE R.S.G.B. REVIEW APRIL 1973 OR OUR TEST ON AN OFF-THE-SHELF

YD-844 **SP-400** **FT-401** **FV-401**



SENSITIVITY

Input Freq. MHz	S + N:N for 0·50μ emf dB	S + S:N for 1·0μV emf dB
3·6	16	22
7·1	19	25
14·2	19	25
21·2	19	25
28·7	20	26
29·7	20	26

RECEIVER MEASURED PERFORMANCE

In order to compare receiver performance figures one must determine the following:

1. 'Voltage': is it emf or pd across, say 50 ohm input? There is a 6dB difference!
2. The signal + noise to noise ratio (S + N:N) in dB's.
3. The frequency at which the measurements have been made.
4. The bandwidth used.

Just in the same way as one can't compare apples with oranges, nor can one compare sensitivity figures unless the same standards are used. To use a narrower bandwidth would seem to give a recieiver a better noise performance. Equipment used for tests: Marconi signal generator TF2002AS, Digital Synchroniser (Marconi) TF2170AF, Power Meter TF2500.

Electronics (UK) ltd

SPECIAL OFFER! YOUR LAST CHANCE TO BUY SP-101, £9.90, FP-75 or DC-75 FOR YOUR FT-75, £16.50 EACH (including VAT)

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HF TRANSCEIVERS'/PSU's

FT-75, Few only	£115
FP-75 AC PSU for FT-75	£15
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DC-200 DC PSU for FT-200	£51
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FL50 + VOX	£83
FL400	£193

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FR50B + CAL	£67
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FR-400DX	£155
FR-400SDX	£210

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FT-2FB 12 ch.	£115
FP-2AC AC PSU/SPKR for FB	£38
FP-2AC/B AC PSU/SPKR + Batts	£71
SIG 200 200 ch.	£180
FT-2 AUTO AC/DC	£157

TEST EQUIPMENT

YC-355 35MHz AC PSU	£99
YC-355 WE 35MHz. AC/DC/ PSU	£120
YC-355D 220MHz. AC/DC PSU	£127
YO-100 Monitor Scope	£93

REMOTE VFO

FV50B VFO for FL50	£28
FV50C VFO for FT75	£28
FV-101 VFO for FT-101	£42
FV-101B VFO for FT-101B	£48
FV-200 VFO for FT-200	£42
FV-401 VFO for FT-401	£42

SPEAKERS

SP-101	£9
SP-101B	£13
SP-400/401	£11
SP-101PB Phone Patch	£29

LINEAR AMPLIFIERS

FL-200B	£195
FL-2100B	£195
FL-2500	£150

ACCESSORIES

YD-844 Table MIC.	£14.75
YD-846 Hand MIC.	£5.75
CW Filter FT-101	£16.00
FF50DX L.P. Filter	£12.25
Yaesu Log Book	£00.55

★ ★ ★ ★ ★

NEW? FM DEVIATION METER, ECM.5A. (Ex-stock)

★ **OPERATES 30-500MHz**

★ **CRYSTAL CONTROLLED EASY OPERATION**

★ **READS PEAK DEVIATION IN kHz**

★ **CALIBRATED 0-15kHz**

★ **BATTERY POWERED FOR PORTABLE USE**

NEW? 2m FM-SSB-AM-CW LINEAR AMPLIFIER, LA2. (Ex-stock)

AT LAST! THE LINEAR YOU'VE BEEN WAITING FOR TO BOOST YOUR 10 watts!

SPECIFICATION:

Power input plate: 350W max.

Drive power: 5-10W

Valve: 4X150A

PRICE: £275 + VAT.

SPECIAL INTRODUCTORY OFFER OF £239 + VAT FOR ONE MONTH.

(Foolscap SAE for details please).)

NEW CDE ROTORS (EX-STOCK)

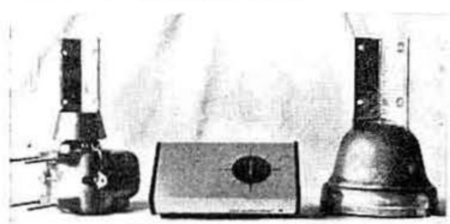
★ **NEW CD-44 £60**

★ **NEW HAM-2 £90**

(Illustrated right)

CDE ROTOR PRICES:
AR22R, £27.5
AR30, £25
AR40, £30

All prices exclude VAT



AR30, £25 AR40, £30

Western Electronics (UK) ltd

Agents: G3PRR Chesham (02405) 4143 G3ZUL Droitwich (090 57) 4510

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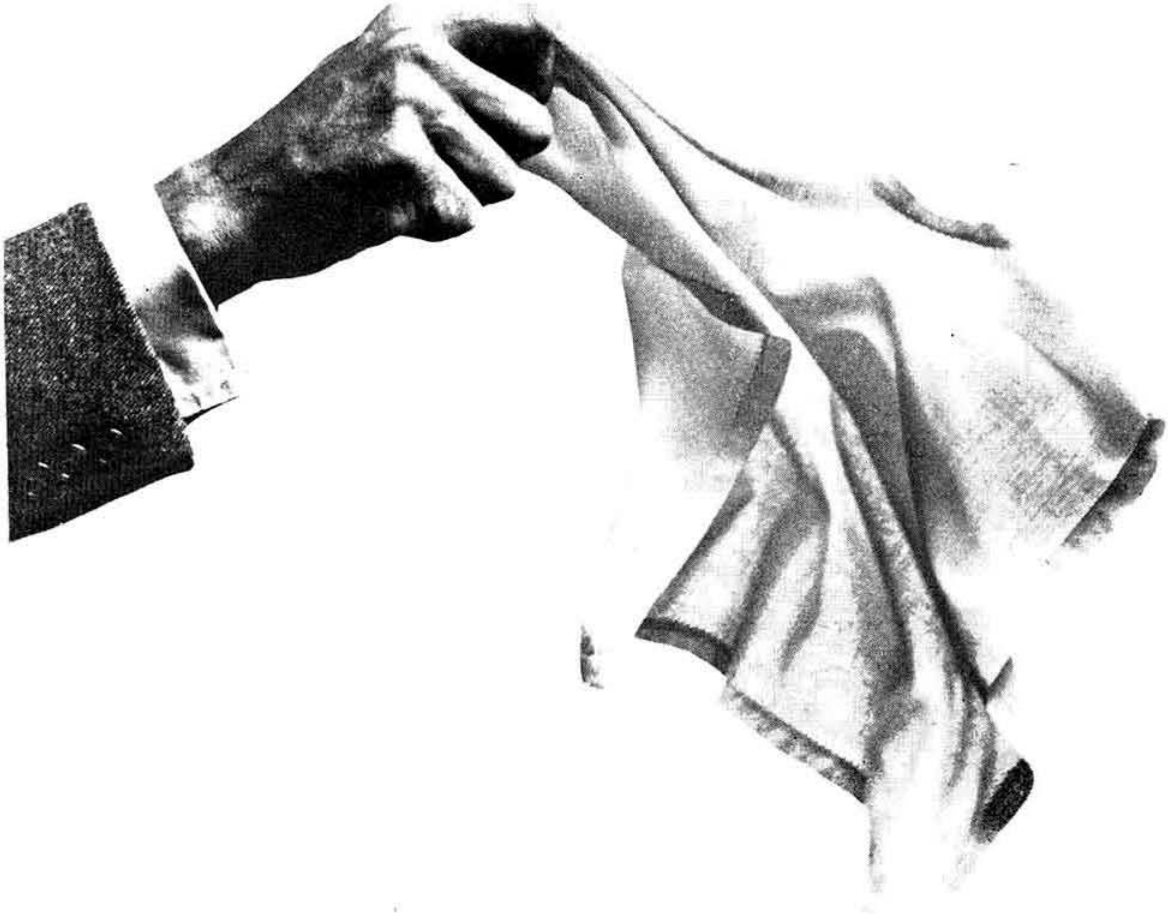
Goodbye to the long wait



for electronic components.

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It's just about impossible to buy a defective part from us. Because our checking is so pains-taking.

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All the goods supplied are branded goods. Produced by big-name manufacturers like RS, Mullard, SGS-ATES, Ferranti, Siemens etc.

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As an added incentive we're giving free purchase vouchers away. To the first 50 catalogue buyers whose applications are pulled out of the sack at 12 noon on the 31st October 1974.

At that time, at the Amateur Radio Traders Exhibition at Granby Hall, Leicester, comedian Brian Rix will open our correspondence sack and make the winning selections.

The first voucher out will be a £10 voucher. The next 49 will be £5 vouchers.

All catalogues will be despatched upon receipt of coupon and remittance; coupons will then go into the correspondence sack for the draw.

So don't delay. Use the coupon. Send today for your first Doram catalogue. It can make your life a whole lot easier. And you could win a voucher if your order is one of the first 50 out on October 31st.

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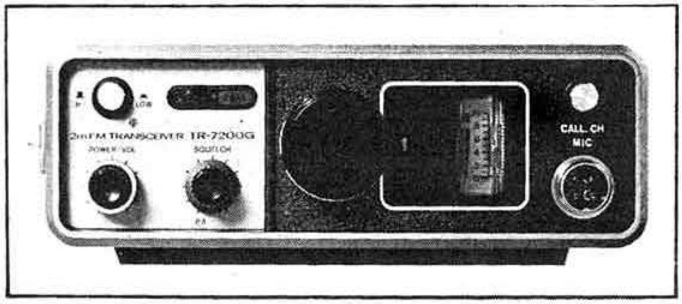
LOWE ELECTRONICS

SEE IT ALL AT GRANBY HALL,

TRIO

TR7200G



2m FM Mobile Transceiver TR7200G

22 Switch selected transmitting and receiving frequencies in the 2m FM band between 144MHz and 146MHz, five of which are factory-equipped with TX and RX crystals. Illuminated channel indication.

Extended operating possibilities after addition of optional VFO-30 which allows continuous fine tuning of RX and TX frequencies over the entire 2m FM range. Exceptional large signal response, high input sensitivity (1μV for 30dB S – N : N) with virtually no cross-modulation, effective spurious suppression and temperature compensation by use of newly developed semi-conductor devices.

Continuously adjustable Squelch eliminates background noise during reception.

Built-in 1750Hz tone burst generator with pushbutton control to activate relays of 2m FM repeater stations. Switch-selectable transmitter final stage delivers 1 watt or 10 watts output power with electronic over-load protection, input limiter and illuminated ON-AIR indicator.

Built-in speaker, illuminated S-meter which acts as relative output meter in transmitting mode, connector for external VFO-30 (optional), external speaker and earphones.

Works from 12V DC car battery during mobile or from Stabilized Power Supply PS-5 during fixed station operation.

STANDARD ACCESSORIES: 500 ohms PTT microphone with hanger, special mounting bracket for mobile operation, stand-off feet for fixed station use, power cable, spare fuse, etc.

Channels Fitted

145·50 Simplex	145·15/75 Duplex
145·525 Simplex	145·175/775 Duplex
145·55 Simplex	

PRICE £125 (VAT excl)

TRIO

TR2200G

The world's most popular 2 metre handy transceiver now comes complete with tuning fork controlled repeater access tone and facilities for 12 channels. With the advent of repeater operation in this country, it is now possible to work long distances with low power equipment and the sudden popularity of portable 2 metre equipment testifies to this fact. The TRIO TR2200G is a high performance transceiver with features not found in other rigs. Supplied with 3 channels fitted:—

145·50 Simplex
145·55 Simplex
145·175/775 Duplex

Most other I.A.R.U. channels available. **PRICE £80 (VAT excl)**

SPECIFICATION

TRANSMITTER

Frequency range	144–146MHz
Emission	*F3*
Output power	*1W*
Freq mult	*X12*
Antenna impedance	*50Ω*

RECEIVER

Sensitivity *Less than 1μV for 20dB S/N*

Intermediate frequencies 10·7MHz and 455kHz

AF output 0·5W

Power source 10·4–15·2Vdc negative earth (8 – UM3 batteries or optional NiCad pack)

Power consumption 450mA TX 55mA RX

Supplied complete with 3 channels as above, charger lead (built in charger for NiCad batteries), external dc lead, carrying case, shoulder strap, microphone, two battery carriers.

Stop Press! INOUE IC210 now only £200 (VAT EXCL)

This is your chance to obtain one of the finest 2 metre VFO controlled transceivers at an incredibly low price. The offer will be maintained whilst stocks last.

COMMUNIQUE

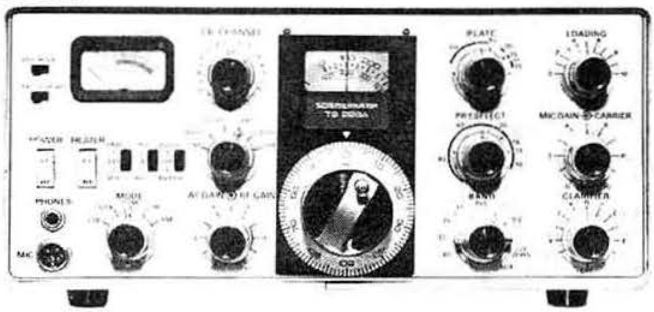
the new name in amateur band equipment at new, lowest prices!

Sole agents for Sommerkamp

TS 145 × 20

Dual gate mosfet front end
with I.C.'s throughout

£110



COMPARE OUR PRICES!

TS 288

12volt/240v **£310**

Our comprehensive stock includes the following:

TS145 × T-20	Transceiver	£110
FT250	Transceiver	£160
FT501	Transceiver	£365
FT201	VHF Trans.	£320
FT DX505	Transceiver	£300
FT220	Transceiver	£256
FT277b	Transceiver	n/a
FR101 DL	Receiver	£325
FR500sd	Receiver	£187
FR50b	Receiver	£65

FL500	Transmitter	£200
FL101 (1st time in UK)	Transmitter	£225
FL50b	Transmitter	£75
FL277	Linear Amp	n/a
FL2000b	Linear Amp	£192
FP250	Power Supply	£45

All prices plus 8% VAT

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Full range of **SOMMERKAMP** spares and accessories available.

Tuning and service facilities.

PLUS: New Sommerkamp 200MHz portable 12V/250V frequency counter now in stock.

Powerful 10m handsets available—ideal for NFDS etc.

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A limited number of distribution areas are available to the trade.

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This month's Heathkit selection. 2 metre FM equipment.

As with all Heathkit amateur radio equipment this month's selection of 2 metre gear comes to you in kit form. So besides the pleasure you'll get from using it, you'll also get a lot of enjoyment from building it.

And paying for it won't in any way be painful either. For example you can get up to £200 worth of equipment for just £10 a month on the Heath Monthly Budget Plan.

For a free catalogue or for a full specification sheet on any model, just write today.

HEATH Schlumberger

HW-202 2-M FM Transceiver

With all solid-state design, multi-channel capability, PTT mike and optional tone burst encoder. The HW-202 has 10 watt minimum output and is designed to operate into even an infinite VSWR without failure. Kit: £97.20.

HA-202 2-M FM Amplifier

Delivering 40 watts (nominal) out for just 10 watts in, the HA-202 needs only a 12 VDC supply. So you can easily use it in your car or boat. It features all solid-state design and is a perfect match for the HW-202 Transceiver. Kit: £41.05.

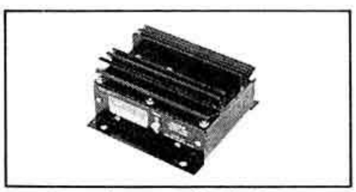
HA-201 2-M Amplifier

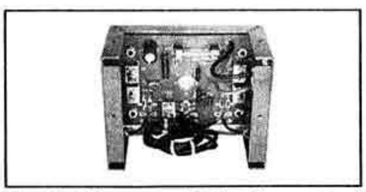
For both mobile and fixed station use from 12 to 16 VDC. The HA-201 operates from 1 to 3 watts FM input in the 144 – 146 MHz band, giving an 8 watt output for 1 watt input. Supplied in a robust metal case, it features all solid-state design on a single P.C. board. Kit: £15.15.

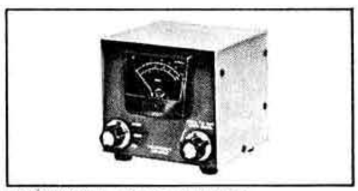
HM-2102 VHF Wattmeter

With a built-in SWR bridge and 50 to 160 MHz range, the HM-2102 is the perfect tune-up tool for 2-M gear, and covers 2-way commercial, aircraft and amateur communications. Kit: £20.55.

All prices inclusive of V.A.T. at 8%.







Amateur Radio Department, Heath (Gloucester) Ltd., Gloucester, GL2 6EE. Tel: (0452) 29451.

See us at the Midland National Amateur Radio Exhibition, Leicester. Oct. 24th, 25th and 26th.

RADIO SOCIETY OF GREAT BRITAIN

35 DOUGHTY STREET, LONDON WC1N 2AE

FOUNDED 1913
INCORPORATED 1926

MEMBER SOCIETY
INTERNATIONAL AMATEUR RADIO UNION

PATRON: HRH THE PRINCE PHILIP, DUKE OF EDINBURGH, KG

Membership rates: UK—£5.50, VAT included (Unlicensed members under 18 years of age—£2). Overseas—£5 (USA $12). Members are asked to notify changes of address without delay.

CURRENT COMMENT
Value Added Tax and subscriptions

HM Customs and Excise have now agreed that 60 per cent of the subscription paid by members relates to the cost of *Radio Communication* and consequently that part is not liable to VAT (ie it is zero-rated). This means that not only is the Society benefiting because there is now less VAT to pay, ie more of the subscription is being retained by the Society, but there is also a saving of approximately £4,000 due in respect of past VAT collected from members.

A substantial proportion of this saving belongs to the members (the subscription was £5 plus 50p VAT, but should have been £5 plus 20p VAT). Bearing in mind that the Society bore the cost of VAT until 30 June 1973, most UK members are entitled to a refund in respect of subscriptions paid between 1 July 1973 and 8 July 1974. Any member who would like to have his appropriate share of VAT returned should write to headquarters, marking his letter "VAT", and enclosing a self-addressed envelope.

However, if members can see their way to waiving any claim in this connection it would be much appreciated, as the additional sum, if it is retained in the Society, would be used for the benefit of the members.

As there has been an increase in revenue due to the VAT adjustments since 8 July 1974, it is hoped that the subscriptions can be pegged at their present rates until at least the end of the Society's present financial year, inflation permitting.

J. O. Brown, G3DVV
Honorary Treasurer

RSGB REGIONS MAP

Enclosed with this issue is a map showing the proposed new RSGB regions resulting from consideration of county boundary changes which came into effect earlier this year.

Also shown are the location of RSGB beacons, operational and proposed repeaters, and the location and details of RSGB news bulletin readers.

Since the map was printed the callsign of the Malvern Hills repeater has been changed to GB3MH. The sponsor of GB3LT was the Dunstable Downs Radio Club.

QTC *AMATEUR RADIO NEWS*

Repeaters

A meeting was held recently at the Home Office to discuss the future of repeaters in the amateur service. Representing the Home Office were members of their administrative and engineering staff while D. A. Findlay, G3BZG, and R. F. Stevens, G2BVN, attended on behalf of the RSGB. The opportunity was taken to clarify a number of matters arising from the installation and operation of repeaters, and subsequently the Home Office provided a statement covering the discussion. This includes the following points:

The total number of repeaters cannot be pre-determined. Each application will be assessed on the basis that only one station should serve any given area. This is likely to imply a distance of 100–150 miles between each repeater but if extreme propagation problems arise these figures may have to be varied.

Proposals to establish a repeater must be drafted on the lines of those already submitted by the Radio Society of Great Britain. They should conform to IARU Region 1 specifications, give the name, addresses and telephone numbers of the licensed amateurs responsible for the repeater (not usually more than four) and make provision for it to be switched off immediately in an emergency. It is considered that a realistic close-down time is 30min with 15min preferred.

On page 699 of this issue there is a short article by G3FZL and G3COJ outlining the present position of UK repeaters and drawing attention to ways in which the system can develop to the benefit of the amateur service. This should be read in conjunction with the map enclosed with this issue which shows the sites and channels of operational and proposed repeater stations.

Reciprocal licences

On page 578 of our September issue, under the above heading, it was stated two new licences are now being issued. The Home Office has pointed out that there are in fact four licences, consisting of fixed and mobile "G" licences which are renewable annually and fixed and mobile "H" licences which are valid for six months only.

In a note which explains the terms of the licences there is a paragraph dealing with the importation of equipment into the UK. It states that written authority from the Home Office is necessary before transmitting equipment covering any frequency between 26·1 and 29·7MHz is imported. In connection with an application for an amateur licence, permission to import this type of equipment will be given provided the equipment is only capable of being used in the amateur segment of this frequency allocation—ie 28·00 to 29·7MHz. Permission will not be given if the equipment could be used between 26·1 and 28·00MHz.

RSGB Tape Library

The tape and tape/slide lectures available from this library are becoming very dated and new material is urgently required, especially on uhf techniques, ssb techniques and practice, receiver parameters, modern receivers in general, slow scan television techniques, and Raynet.

Any member willing to prepare material and to record it for the library would be performing a considerable service to the Society. The lectures are in great demand and are most popular.

Offers of help should be addressed to the library curator, Mr G. Milne, G3UMI, 23 Linacre Road, Eccleshall, Stafford.

Change of contributor
Change of title

For very many years *Four Metres and Down* has been a regular feature in our pages, and for over eight of these years Jack Hum, G5UM, has been its contributor. Jack has now decided to pass on his pen to a younger scribe, and we place on record our appreciation of his unfailing regularity in reporting the vhf/uhf scene as a result of which *FMD* and G5UM became almost synonymous.

Next month we welcome a new contributor, Martin Dann, G3NHE, and a new title for his feature, *Four-two seventy*. It is felt that this title will more accurately define the 4m, 2m and 70cm bands on which G3NHE will be reporting.

CPR award discontinued

In 1954 the International Amateur Radio Club in Geneva introduced a special award having a scientific purpose, the Contribution to Propagation Research (CPR). During the past 10 years more than 1,000 diplomas have been issued and more than one million reports have been received. Since the processing of this data is progressing slowly and the number of reports collected is sufficient for the purpose of the study it has been decided to cease issuing the CPR Diploma as from 31 December 1974.

"VHF Communications"

The publishers of *VHF Communications* ask British subcribers to note the following new arrangements for payment.

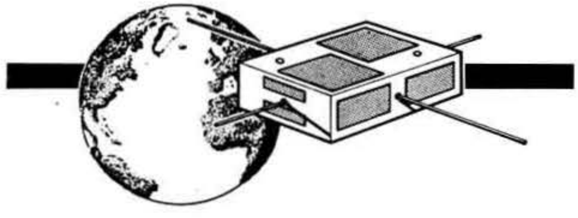
"When ordering magazines and material from us divide the DM price by six and send us a cheque to this value in sterling, making the cheque payable to Mr. T. Bittan of Hastings. Mr. Bittan will then pay these cheques into his private account in Hastings and these will be classed as payment. Please do not forget to add 50p for post and packing of all material orders up to £16, and 66p for orders in excess of this value. The required items will be sent direct from Germany. Address your orders and letters to Verlag UKW-BERICHTE, VHF Communications, Export Dept, D-855 Forcheim, Forstweg 19, West Germany."

Licence alteration

The Radio Regulatory section of the Home Office has stated that the restrictions appearing in footnote 4 to the schedule of the amateur (sound) licences have been modified and that the only spot frequencies which should be avoided are 144·00, 144·54 and 144·9MHz. In due course this change will be notified in the London Gazette but the effective date is immediate.

Looking Ahead

31 October-2 November—Midland National Amateur Radio Exhibition, Leicester.
25 November—RSGB lecture at the IEE.
6 December—RSGB AGM, Royal Society of Arts, John Adam Street, Adelphi, London WC2.
17 January 1975—RSGB Presidential Installation, Cardiff.



Due to a delay in the launch pad schedule a further postponement is necessary in the launch of Oscar 7, which is now due with the ITOS-G mission after 22 October 1974. This latest satellite, with its two translators and improved output, is currently undergoing thermal vacuum and solar simulation tests with satisfactory results.

Oscar 7 will be launched from California between 1711 and 1721gmt and will be ejected from the launch vehicle about one hour later over the Western Mediterranean. At first only morse code telemetry from the 435·1MHz beacon will be transmitted, but on the third orbit Oscar 7 will come within range of the Australian command station which will switch the telemetry to teletype. It will take time for the satellite to electrically and thermally stabilize and no translator operation should be expected for the first three days after launch. Thereafter the 2m to 10m and 70cm to 2m translators will be commanded to alternate day operation.

Stations in Western Europe will be the first to hear the telemetry following activation and are urged to pass their copy to the net which will be operating on 3,780kHz for checking and injection into the AMSAT net that will be active from pre-launch countdown until post-ejection on 14·280 and 21·280MHz. For last minute information on launch date check the weekly Oscar net on Sundays at 1015am on 3,780kHz, and the GB2RS news bulletins.

Quote from this journal, December 1972· "On Sunday 15 October at 1719gmt the sixth Orbital Satellite Carrying Amateur Radio was lifted off the ground at the USA Western Test Range . . ." *G5UM*; and "It is hoped by AMSAT that we will make maximum use of Oscar 6 during its expected one year life" *Bob Treacher, BRS32525*.

The one-year expected life has extended to two. It is appropriate on its second anniversary to extend congratulations to all who had a hand in designing and making it. May its successor do equally as well.

Countries heard and worked through Oscar 6 recently include FP8, KP4, PJ9, VP2 and VP9. Several UK operators are fast approaching semi-DXCC and activity continues at a high level now that regular orbits are assured by the control of CN8BO over the European area.

Sample equatorial crossing times and longitudes for October are:

12 October: orbit 9104, 16·59ut, 303°
13 October: orbit 9112, 08·19ut, 173°
14 October: orbit 9130, 18·49ut, 330°
17 October: orbit 9168, 19·39ut, 343°

The orbit period is 115min and the longitude increment 28·74°/orbit.

This receiver was adjudged the best exhibit in the Home Constructors Competition at the VHF Convention in April 1974

A multi-mode 427 receiver

by C. E. SAVEKER, G8AMU*

SPECIFICATION

Frequency coverage
Band A. 1,296MHz–1,298MHz
Band B. 432MHz–434MHz
Band C. 144MHz–146MHz
Band D. 70MHz–72MHz
Band E. 28MHz–30MHz

Power requirements
240V ac mains
11–20V ac/dc +ve or –ve earth
Two connection mute with changeover contacts

Modes: a.m., fm, ssb, cw.

Intermediate frequency: 10·7MHz. Xtal filter — 12·5kHz @ 80dB

Input impedance: 75Ω

Outputs: Audio 0·5W, loudspeaker, +9V dc, –12V dc' internal loudspeaker.

Panel controls

AF gain	Mode switch	Mains on/off
RF gain	AGC fast/slow	Internal ls on/off
Tuning	Noise limiter	S-meter
Band switch	Ext power on/off	

DESIGN CRITERIA

It is very difficult to find on the amateur market a low noise, good performance, general purpose receiver, covering all modes of transmission and suitable for vhf use. So after a lot of thought the following receiver was designed with these points in mind:

(1) Capable of receiving a.m., fm, ssb and cw.
(2) High sensitivity with low noise figure.
(3) Good cross-modulation and blocking performance.
(4) Good frequency stability and accurate dial setting.
(5) Free from spurious responses.
(6) Effective noise limiter.
(7) Good agc with fast or slow decay time.
(8) Self-contained requiring only power and aerial inputs.
(9) 240V mains or 12V dc operation for portable use.
(10) Using modern, readily available devices and components.

PRINCIPLE OF OPERATION

The complete receiver system is shown in the block diagram, Fig 1. The basic receiver is tunable over a range of 28-30MHz, this frequency being chosen for the basic i.f., rather than a low frequency, because of the ease with which a flat 2MHz-wide band could be achieved without the use of large tuning capacitors, and without the problem of tracking the rf and mixer circuits. Also the need for double conversion converters does not arise, due to the adequate separation of signal and oscillator frequency at least up to 1,296MHz. At frequencies higher than 1,296MHz the converter could be fed into the 144MHz converter, making this frequency the first i.f.

The selectivity is provided in the 10·7MHz crystal filter, which was the most costly part of the receiver. This filter is an fm type with a very flat top response; although suitable for a.m. and fm reception it is a little wide for serious ssb

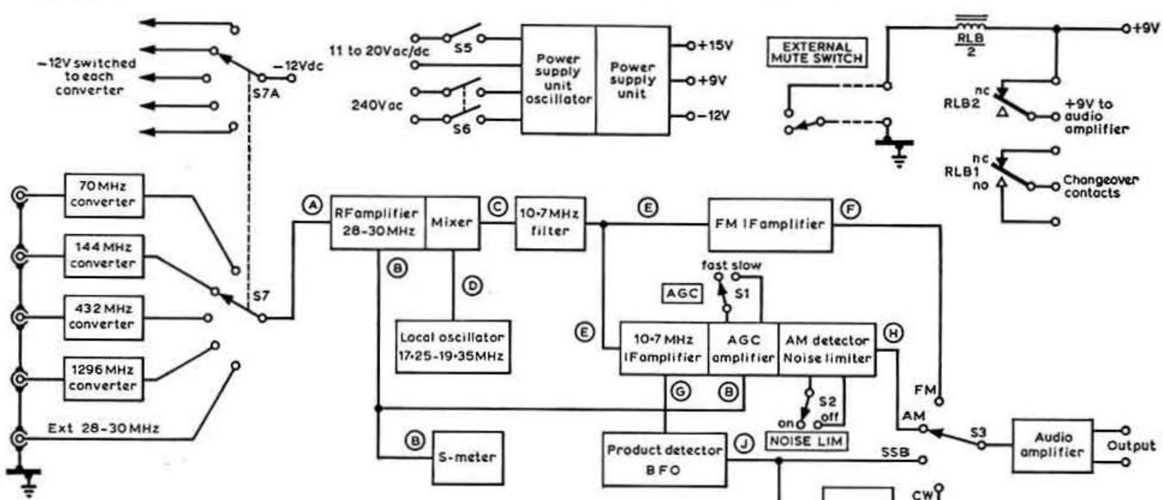
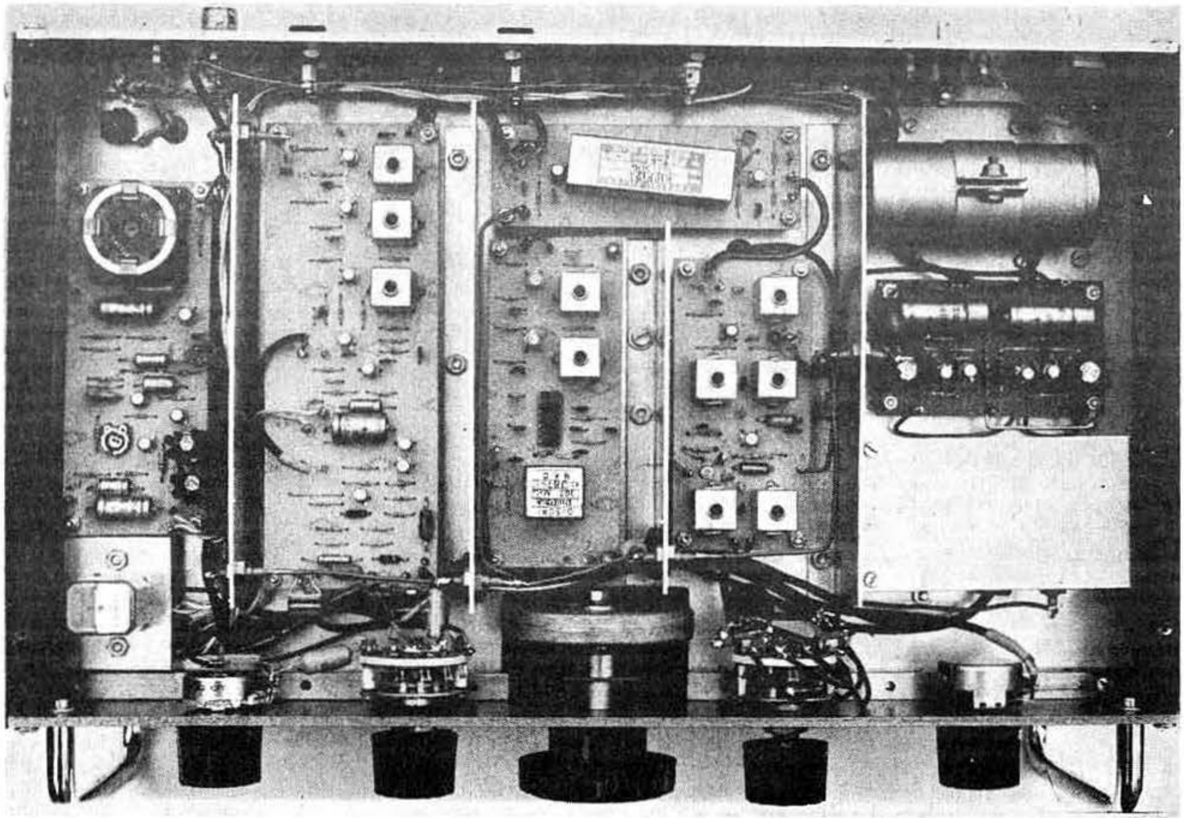


Fig 1. Block diagram

* Johnston House Lodge, Hatchlands Road, Redhill, Surrey, RH1 1BE.

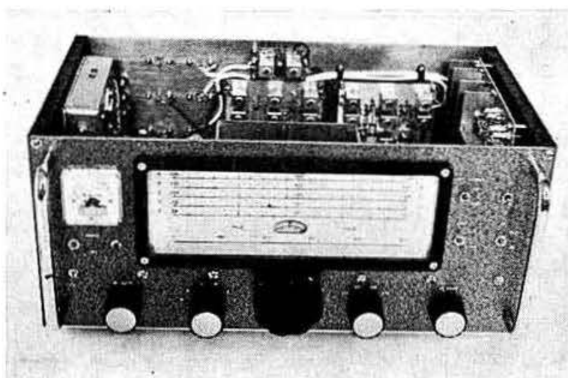


Underchassis showing, left to right: af board and cw filter; 10·7MHz a.m. i.f. agc detector and noise limiter; B10F12A 10·7MHz crystal filter buffer board, (top), 10·7MHz fm i.f. board, (left), rf/mixer board, (right); and power supply

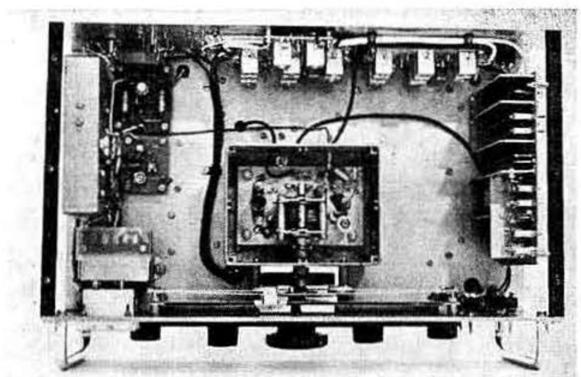
or cw work, but adequate room has been left for a ssb filter to be added and switchable from the front panel. By using an i.f. at 10·7MHz, the image of the wanted signals will be at twice the i.f. frequency, which is 21·4MHz away and out of the required tuning range.

The rest of the back end circuits are fairly conventional with the outputs of the a.m. i.f. amplifier, fm i.f. amplifier and product detector switched into the audio stages. All supply voltages are stabilized and are derived from a 15kHz oscillator, which is also stabilized against any voltage fluctuation of the input supply.

The converters for 70MHz, 144MHz and 432MHz are of conventional design, with their outputs at 28-30MHz switched into the receiver. High frequency crystals are used in the converters to reduce the number of multiplier stages and to ensure that the fundamental or harmonic frequencies



Front view with top removed



Top view showing local oscillator and converters

do not appear in the passband of the tunable i.f. No details are given in the circuit diagrams of the wiring to the converter and converter selector switch, but obviously one pole of the switch will be used to select the i.f. outputs from the converters, while another pole switches the −12V input to them.

The 1,296MHz converter has not been included with this design, as modifications and the use of transistor r.f stages are still being tried. The final design has not yet been decided upon, but this converter can be fitted into the receiver case at a future date.

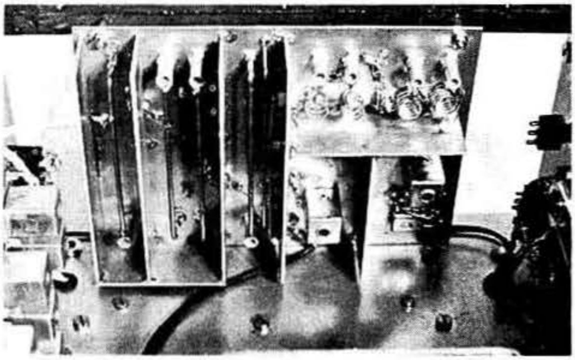
432MHz converter (Fig 2)

Two grounded base rf stages, TR43 and TR44, are used with emitters and collectors tapped into $\frac{1}{4}\lambda$ tuned lines. Inductive coupling is used between the rf and mixer stages.

The local oscillator chain consists of three stages, starting with an overtone oscillator, TR42, at 67·333MHz. The second stage, TR45, is tripling to 202MHz and the final stage doubling to 404MHz with TR46. All interstage tuned circuits are coupled by mutual inductance employing tapped input and outputs.

Oscillator injection at 404MHz is also inductively coupled to the fet mixer TR47 by L34, and the output at 28MHz is taken from a link wound over L36 in the drain of the mixer TR47.

The converter is built on double-sided copper laminate board with interstage screening, and the rf and mixer transistors are mounted in slots cut in the screens dividing input from output.



432MHz converter -

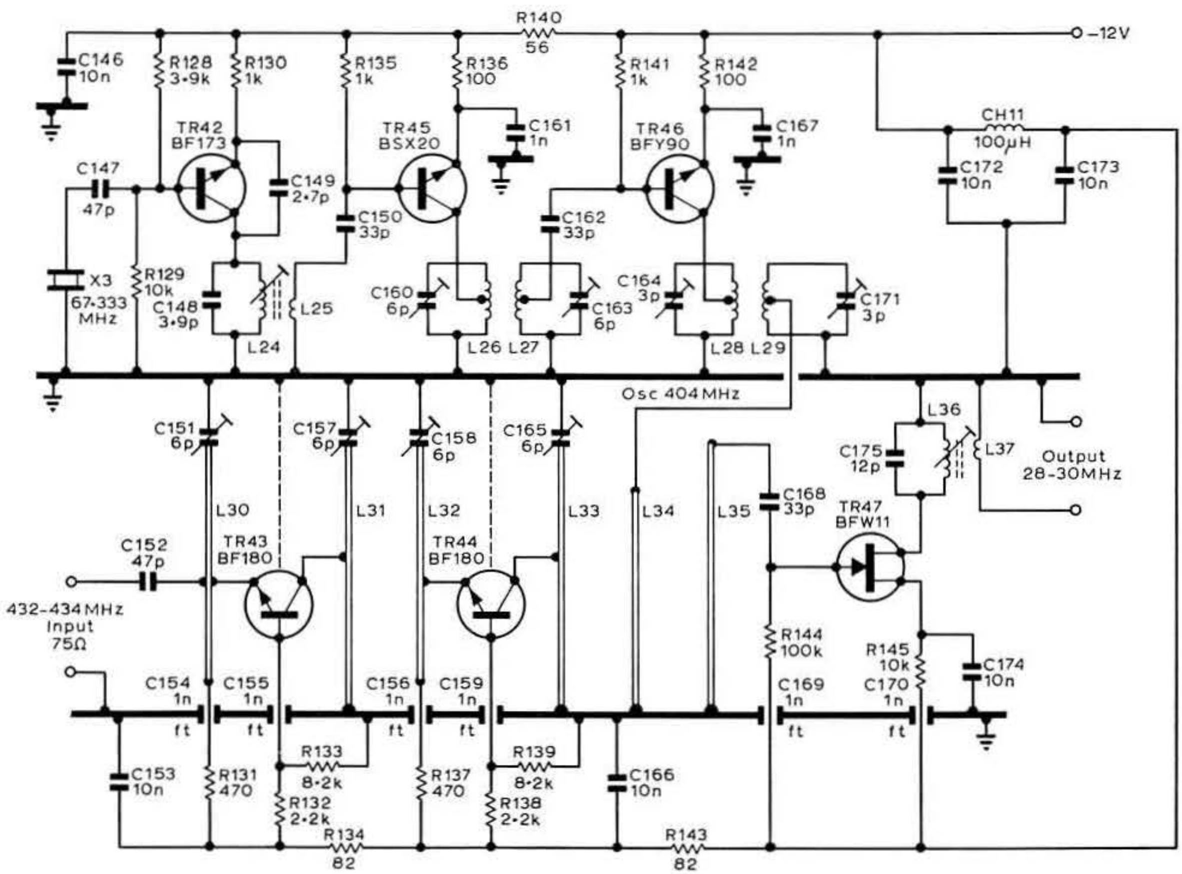


Fig 2. 432MHz converter

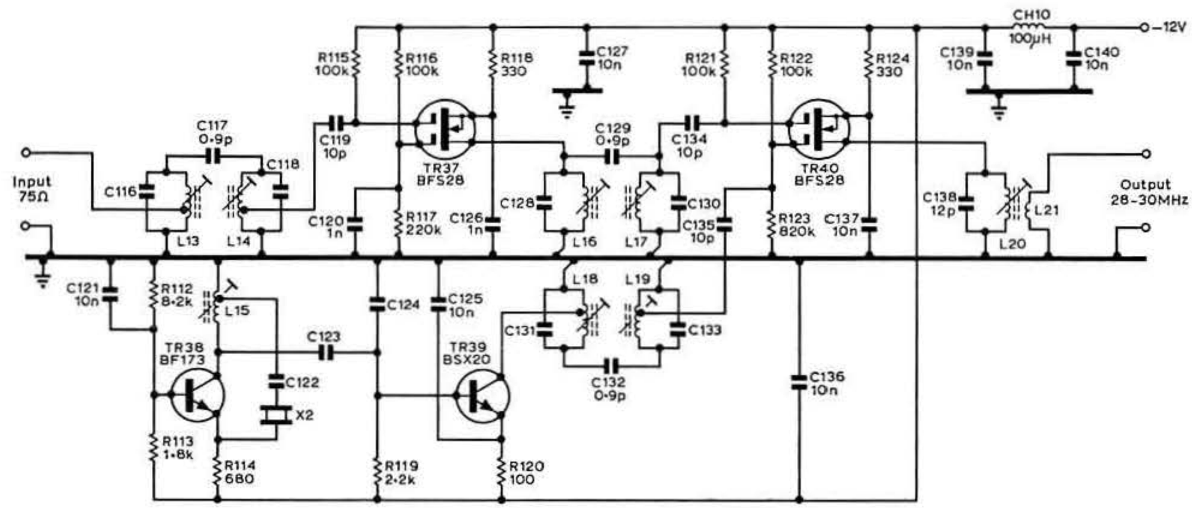


Fig 3. 70MHz and 144MHz converters

70MHz and 144MHz converters (Fig 3)

Both of these converter circuits and printed circuit boards are identical apart from the crystal frequency, and the tuned circuits.

The rf amplifier, TR37, is a dual-gate mosfet used in common source configuration. Bandpass capacity coupled input and output tuned circuits are used to give selectivity and good rejection of out of band signals. The output of the rf amplifier is fed into gate 1 of the mixer, another dual-gate mosfet, and the output is taken from a low impedance link winding coupled to the tuned circuit L20 in its drain.

TR38 is an overtone oscillator operating at 42MHz for the 70MHz converter and at 58MHz for the 144MHz converter. The oscillator is capacity coupled to TR39 which is an amplifier for the 70MHz converter and is used as a doubler to 116MHz for 144MHz. The output of the oscillator chain again uses capacity-coupled bandpass tuned circuits to reduce to a minimum any other multiple of the oscillator frequency reaching gate 2 of the mixer.

Coupling between the tuned circuit is very small and in the region of 0·9pF; this can be made up from two 1·8pF capacitors in series, or a short length of twisted pvc-covered wire.

The converters use a positive earth so that the tuned circuits can be taken direct to the chassis, which eliminates any possible instability caused by poor rf decoupling. A BF180 rf amplifier, TR41, was added to the 144MHz converter because the noise figure of the BFS28 was not acceptable, Fig. 4.

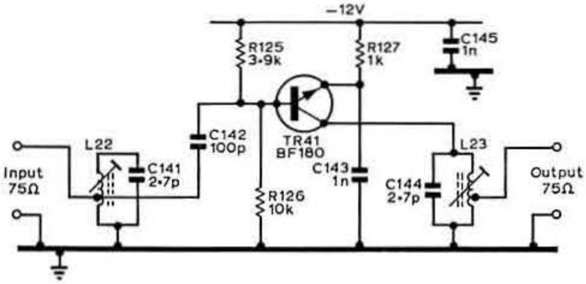
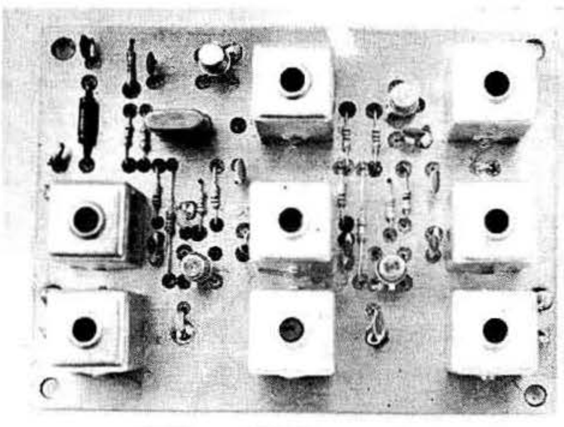


Fig 4. 144MHz rf amplifier

28-30MHz rf amplifier and mixer (Fig 5)

The purpose of the rf stage is to overcome mixer and i.f. noise, and to provide front end selectivity by enabling more tuned circuits to be added. The rf and mixer circuits are not tunable over the band, but a flat response with sharp cut-off at band edges is achieved, by using capacity coupled, bandpass stagger-tuned circuits.

The rf amplifier TR2 has forward gain control characteristics which can reduce the stage gain by as much as 50dB under maximum signal conditions. To achieve this, the agc voltage must be positive going to increase the collector current of the rf stage. As the agc is negative going, TR1 is used as an inverter and the zener diode D1 delays the agc



70MHz and 144MHz converters

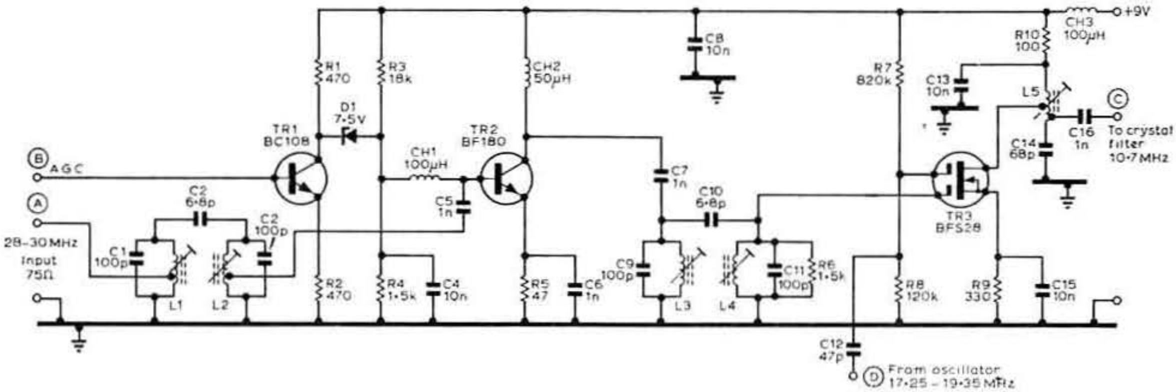


Fig 5. 28MHz-30MHz rf amplifier and mixer

voltage operating the rf stage until the gain of the i.f. amplifier has been reduced. The gain of the rf stage is not reduced until the agc voltage has fallen from its no signal level of +2V, to approximately 1·2V, causing the collector voltage of TR1 to rise to 7·5V above the base voltage of TR2, when D1 will conduct and increase the current through the rf stage, thus reducing its gain.

The mixer TR3 is a dual-gate mosfet, which is an excellent device for low cross-modulation, blocking and spurious response performance, due to its square-law characteristics, and its very high isolation between gates, which also reduces to a minimum the pulling of the local oscillator under large signals.

The local oscillator signal of 17·25–19·35MHz is fed into gate 2 of the mixer and the rf signal of 28-30MHz into gate 1, and the difference of 10·7MHz is extracted from the mixer's drain by L5.

Local oscillator (Fig 6)

The most stable oscillator tried with a high output in the region of 6V peak to peak, to drive gate 2 of the mosfet mixer, was the fet Colpitts. The oscillator covers a frequency range of 17·25-19·35MHz, which gives 5kHz above and below the 2MHz tuning range required. Good temperature stability was achieved by using one per cent silver mica capacitors and a 39pF ceramic C27, which has a negative temperature coefficient of −150 ppm/°C across the oscillator coil L6.

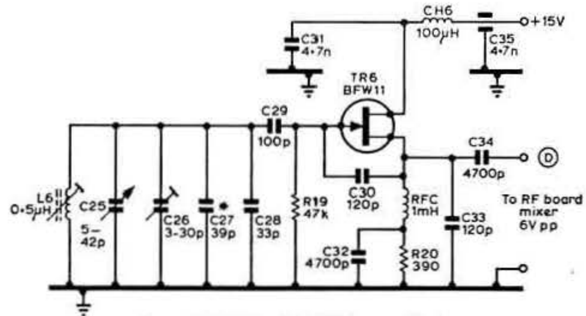


Fig 6. 17·25MHz-19·35MHz oscillator

It is supplied with +15V from its own stabilized supply to eliminate any frequency shift and fm due to other circuits loading the supply voltage.

The 4th, 8th and 24th harmonics of the oscillator can fall in the 70MHz, 144MHz and 432MHz bands respectively, but with adequate screening and decoupling of the supply leads this can be eliminated.

The oscillator was built on tinned copper laminate board mounted on aluminium for mechanical strength, and then bolted into the base of a diecast box, which is fitted to the back of the dial. The tuning capacitor is of high quality with ball-bearing races fitted at each end.

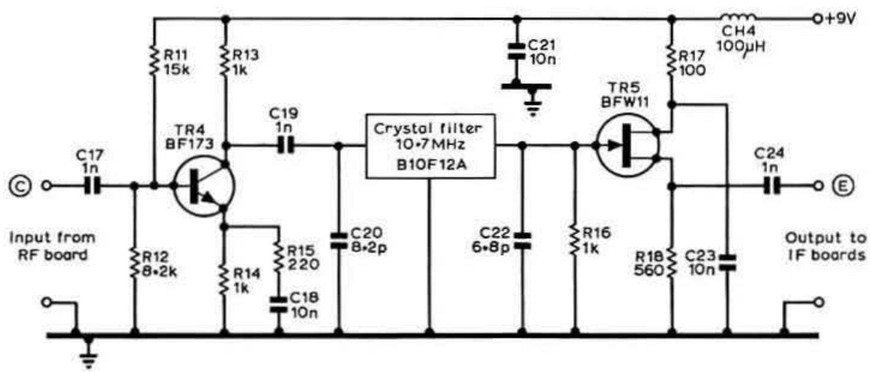


Fig 7. Crystal filter buffer board 10·7MHz

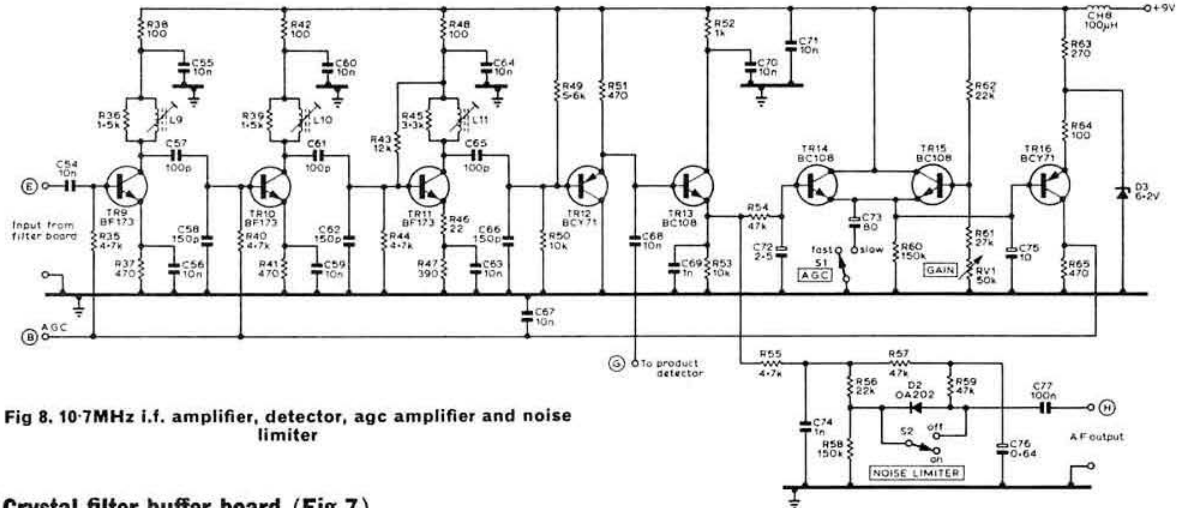


Fig 8. 10·7MHz i.f. amplifier, detector, agc amplifier and noise limiter

Crystal filter buffer board (Fig 7)

The i.f. filter must provide sufficient selectivity to discriminate against stations operating on adjacent frequencies, and still have a sufficiently broad response so that the outer sidebands of a desired fm signal are not distorted. The filter used is a 10·7MHz fm type which has a very good flat top response with about 1dB of ripple and is 80dB down at $\pm$12·5kHz.

Transistor buffers are used on each side of the crystal filter to avoid the mixer and i.f. circuits loading the filter and spoiling its response, and so that the correct terminating impedance for the filter can be used. These values are given in the manufacturers' specifications, and for the Nikko Denshi filter type B10F12A which was used they are 1kΩ and 10pF. The values for C20 and C22 are 8·2pF and 6·8pF added to the output capacitance of TR4 and the input capacitance of TR5 making an effective value of 10pF.

TR4 is an amplifier to make up for the insertion loss of the filter which is approximately 2dB, and TR5 is a fet source follower with its output taken to the a.m. and fm i.f. amplifier boards.

10·7MHz i.f. amplifier a.m. detector, agc and noise limiter (Fig 8)

The main i.f. amplifier uses three low-noise stages, tuned at 10·7MHz, and has a gain in the region of 100dB. The first two stages, TR9 and TR10, are agc controlled. TR12, an emitter follower stage, supplies the i.f. signal to the product detector and also to TR13, an emitter follower peak envelope detector for a.m. signals. The detector signal from the emitter of TR13 is taken via the usual r.f. filter to a conventional series-type noise limiter, D2, and then to the audio stages. The noise limiter can be switched off by bypassing the series diode D2 with the switch S2.

The agc voltage is obtained by comparing the dc component in the detected signal with a reference voltage. The comparator, TR16, is stabilized at 6·2V with a zener diode D3, and the agc voltage is taken from the collector of TR16 which is approximately +2V under no signal conditions. As the voltage at the base of TR14 rises with an increasing signal level, the emitter voltage will also rise, causing the collector current of TR16 to fall, thus reducing the agc voltage across R65. The agc normally has a fast attack and fast decay, but when C73 is connected across the emitter resistor R60 of TR14 and TR15 with S1, it will produce a slow decay of the agc voltage suitable for ssb and cw. RV1 is the rf and i.f. gain control which manually overrides the agc voltage by causing the base voltage of TR15 to rise, which in turn will increase the base voltage of TR16, thus reducing its collector current and the agc voltage to the level set by RV1.

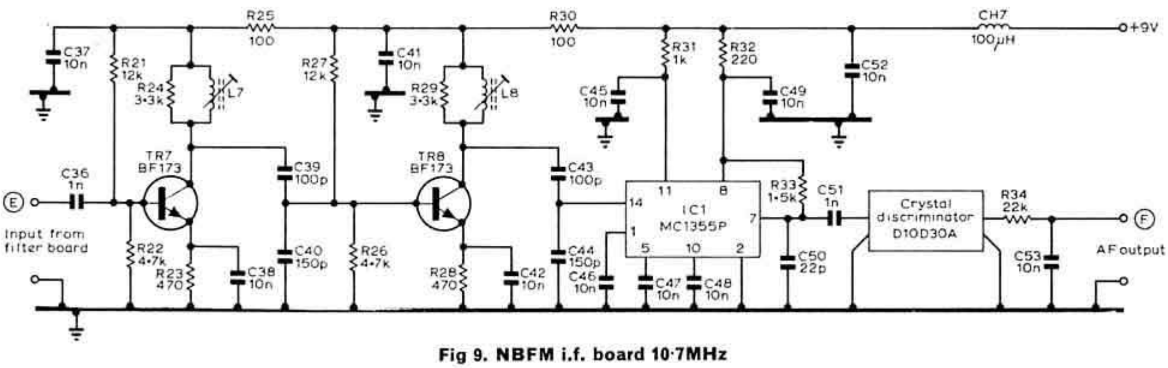


Fig 9. NBFM i.f. board 10·7MHz

C • •

FM i.f. amplifier board (Fig 9)

TR7 and TR8 are used as a two-stage high-gain, low-noise, tuned amplifier at 10·7MHz. As most fm detectors are sensitive to changes in the amplitude of the received signal, they must be preceded by a limiter that removes all amplitude fluctuations caused by fading and noise spikes, this is provided by an integrated circuit IC2 which is a four-stage high-gain fm/i.f. limiting amplifier using long-tailed pair stages which clip symmetrically. Thus when a certain signal level is reached further increases in input signal produce no change in the output. The limiting amplifier also has very low distortion and high a.m. rejection in the region of 60dB.

The agc is only applied to the r.f. stage to eliminate overloading of the mixer with very large signals. The output of the integrated circuit limiter is coupled into a crystal discriminator and then to the audio stage.

Several types of crystal discriminator have been tried and all gave equal results. The printed circuit board was designed for a discrete crystal discriminator, but as the 10·7MHz crystal required is approximately the same price as a commercial discriminator, and requires no setting up, the commercial one was used in this case.

S-meter (Fig 10)

The S-meter is controlled by the agc voltage, and under no-signal conditions the voltage at the emitter of TR20 is equal to that of the junction of RV3 and R79. As the agc voltage falls with a received signal the emitter of TR20 will rise above that of the RV3, R79 junction causing current to flow through the meter M1. Full scale deflection is set by RV2, while RV3 is adjusted for a zero reading with no signal input.

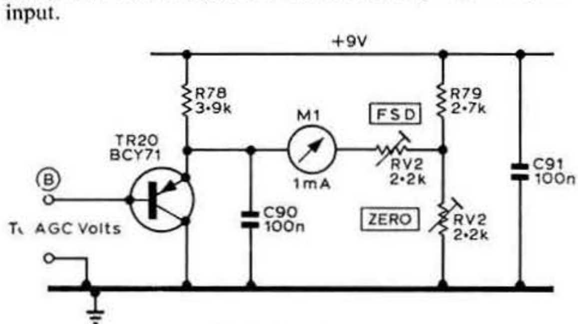


Fig 10. S-meter

BFO and product detector (Fig 11)

TR17 is used as a crystal Colpitts oscillator at 10·7MHz coupled to a fet buffer TR18. The 10·7MHz bfo signal is mixed with the 10·7MHz i.f. signal from TR12 by using a dual-gate mosfet TR19, and is then applied to gate 2. The i.f. signal is applied to gate 1 and the audio frequency product is extracted from the drain via an rf filter (C87, 89 and R77).

The bfo and product detector is fitted in a screened box, and mounted well away from the high gain i.f. amplifier to prevent the 10·7MHz bfo signal affecting the agc and S-meter circuits, so that the agc can be used on ssb and cw.

AF amplifier and cw filter (Fig 12)

The audio output stage provides about 500mW into a 3Ω loudspeaker from a conventional transformerless Class B amplifier, using a complementary pair of germanium transistors TR25 and TR26. The preset trimmer RV5 is adjusted to give a quiescent current of approximately 10mA with no input signal.

The cw filter has a bandwidth of about 100Hz at a frequency of 800Hz, but this frequency could be changed to suit the operator by adjusting the value of L12 or C93. The width of the filter can be decreased by reducing the value of the series resistor R80. TR21 is a single-stage fet amplifier to make up for the attenuation of the filter and to keep the audio output at the same level when used in the cw mode.

Power supply (Figs 13 and 14)

Three stabilized voltages are used for the receiver: +9V for all the main boards, +15V for the local oscillator and −12V for all converters. The +9 and −12V supplies are derived from conventional stabilized power-supply circuits, while the +15V supply uses a monolithic voltage regulator IC2.

The input to the power supply may be a little unusual, but it can be supplied with its own 12V ac from the receiver transformer or from an external supply of 11 to 20V ac or dc positive or negative earth. All supply voltages are fed through a bridge rectifier D8 to a simple series regulator supply of 8V. This supply is floating from earth enabling any polarity supply to be connected to its input.

The 8V regulator supplies a 15kHz oscillator TR35 and TR36, and the secondary winding of the oscillator transformer T2 is rectified with D12 and D15 giving +20V and D13 and D14 giving −20V which supply the +9V and

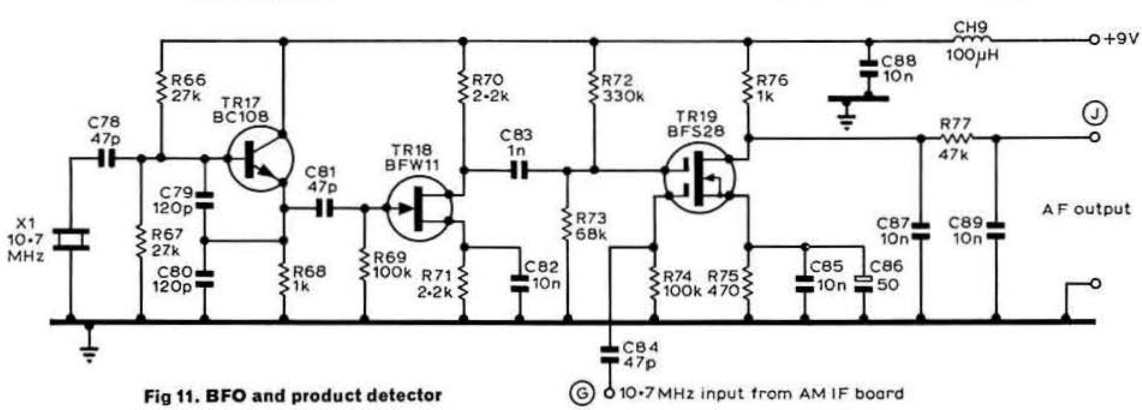


Fig 11. BFO and product detector

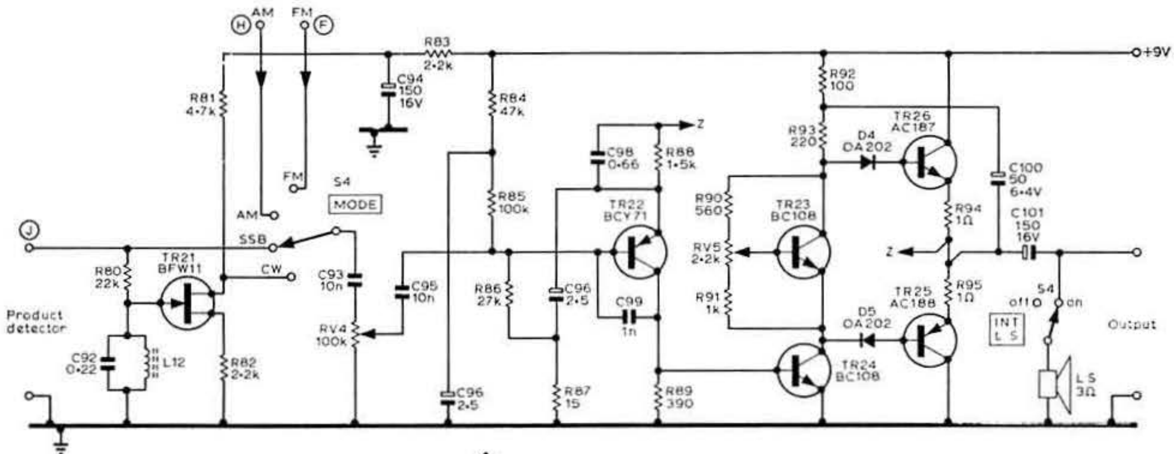


Fig 12. Audio amplifier and cw filter

COILS TABLE

All coils wound on 4mm coil formers with dust cores and screening cans unless otherwise stated. Type Neosid 722/1.

L1	8t 22swg tap 2t
L2	8t 22swg tap 3t
L3, 4	8t 22swg tap 3t
L5	30t 34swg tap 3t and 15t
L6	7t 20swg 0·4in former with dust core (0·5μH)
L7, 8, 9, 10, 11	30t 34swg
L12	500t 30swg LA1216 former (180mH)
L24	8t 34swg
L25	2t 34swg over L24
L26, 27	5t 18swg ¼in dia ⅜in long
L28, 29	3t 18swg ¼in dia ⅜in long
L30, 32	3in 14swg tap ¾in from cold end
L31, 33	3in 14swg tap 2in from cold end
L34	2·5in 20 swg pvc covered
L35	3in 16swg
L36	28t 32swg
L37	5t 32swg over L36
T2	5t bifilar primary 10t bifilar secondary 26swg FX2241 former

CHOKES

CH1, 3, 4, 6, 7, 8, 9, 10, 11	100μH
CH2	50μH
CH5	1mH

70MHz and 144MHz CONVERTER COMPONENTS

Coils	70MHz	Coils	144MHz
L13	9t 24swg tap 2t	L13	8t 22swg tap 1t
L14	9t 24swg tap 5t	L14	8t 22swg tap 3t
L15	15t 26swg tap 3t	L15	15t 26swg tap 3t
L16, 17	9t 24swg	L16, 17	5t 22swg
L18, 19	15t 26swg tap 5t	L18, 19	5t 22swg tap 2t
L20	26t 32swg	L20	26t 32swg
L21	3t 26swg	L21	3t 26swg
L22, 23	Not used	L22, 23	8t 22swg tap 1t

Capacitors	70MHz	144MHz
C116, 118	18pF	2·7pF
C122	22pF	6·8pF
C123	15pF	27pF
C124	47pF	100pF
C128, 130	18pF	6·8pF
C131, 133	15pF	12pF

All coils wound on Neosid 4mm 722/1 formers with dust cores and screening cans.

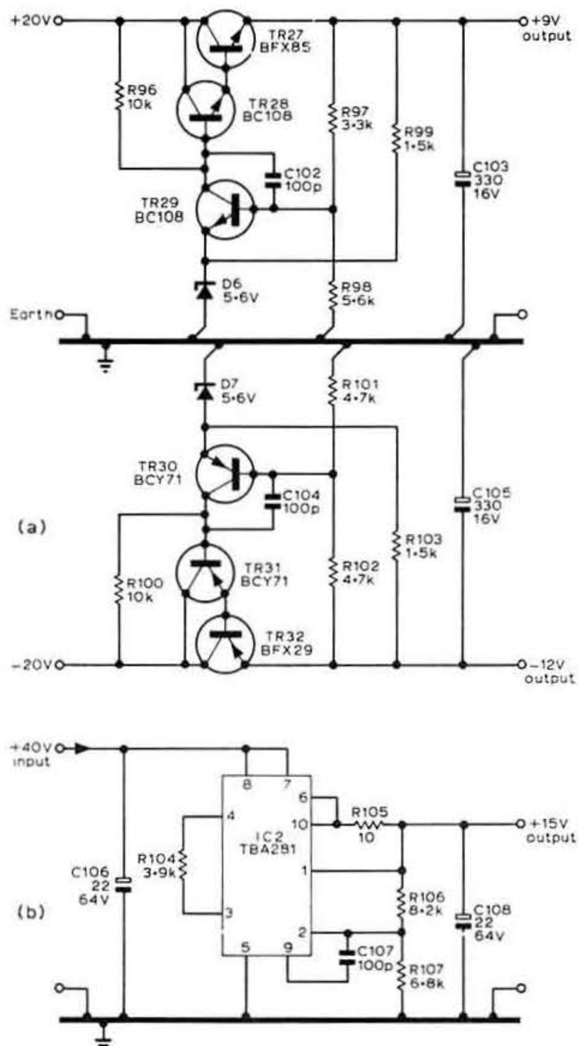


Fig 13. +9V −12V +15V psu

COMPONENTS LIST

CAPACITORS

All ceramic unless otherwise stated.

Component	Type/Rating	Value
C1, 3, 9, 11, 39, 43, 57, 61, 65, 102, 104, 107, 142		100pF
C2, 10, 22		6·8pF
C4, 8, 13, 15, 18, 21, 23, 37, 38, 41, 42, 45, 46, 47, 48, 49, 52, 53, 54, 55, 56, 59, 60, 63, 64, 67, 68, 70, 71, 82, 85, 87, 88, 89, 93, 95, 121, 125, 127, 136, 137, 139, 140, 146, 153, 166, 172, 173, 174		10nF
C5, 6, 7, 16, 17, 19, 24, 36, 51, 69, 74, 83, 99, 120, 126, 143, 145, 161, 167		1nF
C12, 78, 81, 84, 147, 152		47pF
C14		68pF
C20		8·2pF
C25		5–42pF
C26	Bee Hive trimmer	3–30pF
C27		39pF
C28	1% sm	33pF
C29	1% sm	100pF
C30, 33	1% sm	120pF
C31, 32, 34		4·7nF
C35	Bush mounting lead-through	4·7nF
C40, 44, 58, 62, 66		150pF
C50		22pF
C72, 96	6·4V	2·5µF
C73	10V	80µF
C75	25V	10µF
C76	6·4V	0·64µF
C77, 90, 91		100nF
C79, 80		120pF
C86, 97, 100	6·4V	50µF
C92	Polyester foil	0·22µF
C94, 101	16V	150µF
C98	Polyester foil	0·66µF
C103, 105	16V	330µF
C106, 108, 115	64V	22µF
C109, 110	25V	1,000µF
C111, 113, 114	25V	150µF
C112	Polyester foil	0·33µF
C117, 129, 132	2 × 1·8pF in series	0·9pF
C119, 134, 135		10pF
C138, 175		12pF
C141, 144, 149		2·7pF
C148		3·9pF
C150, 162, 168		33pF
C151, 157, 158, 160, 163, 165	Tubular ceramic trimmer	0·8 to 6·8 pF
C154, 155, 156, 159, 169, 170	solder-in lead-through	1nF
C164, 171	Tubular ceramic trimmer	0·8 to 3·8pF

1·8pF to 330pF Mullard 632 series ceramic
390pF to 4700pF Mullard 630 series ceramic
1nF to 22nF Mullard 629 series ceramic

RESISTORS

All resistors type Mullard CR16 0·2W carbon unless otherwise stated.

Component	Type	Value
R1, 2, 23, 28, 37, 41, 51, 65, 75, 131, 137		470Ω
R3		18kΩ
R4, 6, 33, 36, 39, 88, 99, 103		1·5kΩ
R5		47Ω
R7, 123		320kΩ
R8		120kΩ
R9, 118, 124		330Ω
R10, 17, 25, 30, 38, 42, 48, 64, 92, 120, 136, 142		100Ω
R11		15kΩ
R12, 106, 112, 133		8·2kΩ
R13, 14, 16, 31, 52, 68, 76, 91, 127, 130, 135, 141		1kΩ
R15, 32, 93		220Ω
R18, 90, 109, 110		560Ω
R19, 54, 57, 59, 77, 84		47kΩ
R20, 47, 89		390Ω
R21, 27, 43		12kΩ
R22, 26, 35, 40, 44, 55, 81, 101, 102		4·7kΩ
R24, 29, 45, 97		3·3kΩ
R34, 56, 62, 80		22kΩ
R46		22Ω
R49, 98		5·6kΩ
R50, 53, 96, 100, 126, 129, 145		10kΩ
R58, 60		150kΩ
R61, 66, 67, 86		27kΩ
R63		270Ω
R69, 74, 85, 111, 115, 116, 121, 122, 144		100kΩ
R70, 71, 82, 83, 119, 132, 138		2·2kΩ
R72		330kΩ
R73		68kΩ
R78, 104, 125, 128		3·9kΩ
R79		2·7kΩ
R87		15Ω
R105		10Ω
R107		6·8kΩ
R113		1·8kΩ
R114		680Ω
R117		220kΩ
R134, 143		82Ω
R139		8·2kΩ
R140		56Ω
R94, 95	CR25 0·33W	1Ω
R108	3W ww	220Ω
RV1	Linear	50kΩ
RV2, 3, 5,	0·05 trimmer pot	2·2kΩ
RV4	Log	100kΩ

SEMICONDUCTORS

Component	Type
TR1, 13, 14, 15, 17, 23, 24, 28, 29, 34	BC108
TR2, 41, 45, 46	BF180
TR3, 19, 37, 40	BFS28
TR4, 7, 8, 9, 10, 11, 38, 42	BF173
TR5, 6, 18, 21, 47	BFW11
TR12, 16, 20, 22, 30, 31	BCY71
TR25	AC188
TR26	AC187
TR27	BFX85
TR32	BFX29
TR33	BDY20
TR35, 36	BD204
TR39, 43	BSX20
TR44	BFY90
D1	BZY88 7·5V
D2, 4, 5, 10, 12, 13, 14, 15, 16, 17,	OA202
D3	BZY88 6·2V
D6, 7	BZY88 5·6V
D8	BY164
D9	BZY88 9·1V
D11	BYX10
IC1	Motorola MC1355P
IC2	TBA281

MISCELLANEOUS

Component	Description
S1, 2, 4, 5, 6	Miniature toggle switch
S3	4-way single-pole switch
S7	6-way 2-pole switch
T1	12V 1A heater transformer
Rly1, 2	Miniature relays with two c/o contacts
Dial	Eddystone Type 898
M1	0–1mA S-meter

CRYSTALS

X1 10·7MHz Type HC/18/C
X2 42MHz (70MHz converter) 58MHz (144MHz converter) Type HC/18/U
X3 67·333MHz Type HC/18/U
Xtal filter 10·7MHz Type Nikko Denshi B10F12A or Cathodeon BF4129
Xtal discriminator 10·7MHz Type Nikko Denshi D10D30A or Cathodeon BF4781

The author with the 1962 Committee Cup awarded for his success with this receiver in the Home Constructors Competition at the 1974 VHF Convention

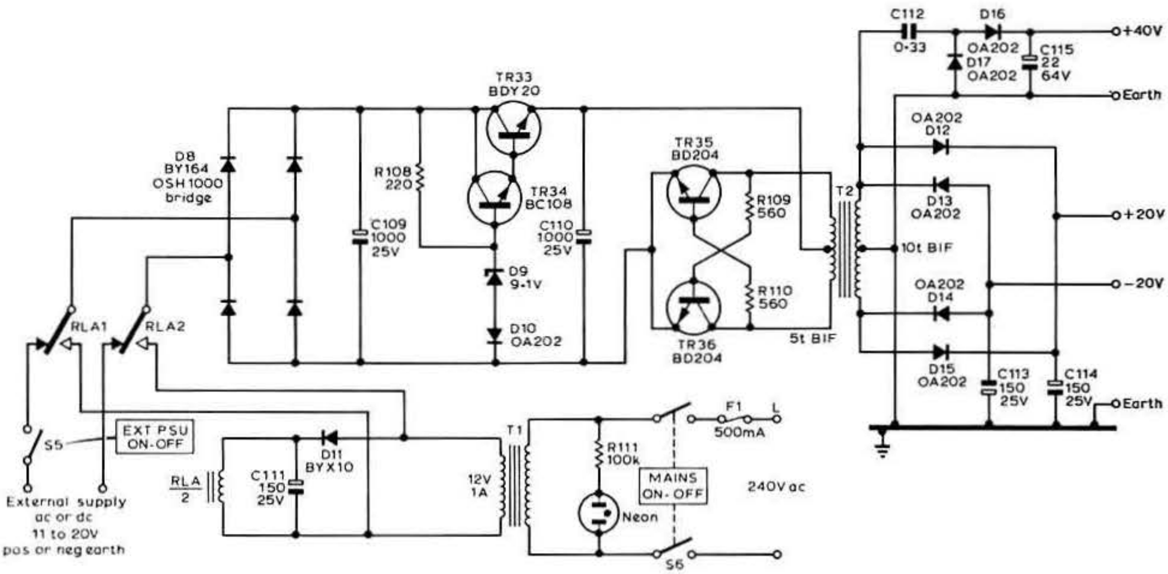


Fig 14. Power supply unit

−12V regulators. D16, 17 and C112 form a voltage doubler giving +40V, which is used to supply the +15V regulator using IC2.

Relay 1 is normally energized, but if the mains supply fails the relay automatically connects an external supply of either polarity to the bridge rectifier D8.

GENERAL CONSTRUCTION

The complete receiver measures 15in by 9in by 6½in. The front and back panels are constructed from 10 swg aluminium and are connected by four horizontal bars of ⅜in square-section anodized mild steel 8¾in long whose ends are drilled and tapped for 4BA bolts, for fixing to the panels. A platform of 14swg aluminium is fitted between the front and back panels by two 15in by ⅜in bars to make a very strong chassis. The top, bottom and side panels are fitted around the chassis with 4BA screws tapped into the anodized steel bars. A 4in elliptical loudspeaker is fitted into the top of the case.

The receiver was constructed as a number of sub-units so that each section could be set up and tested in turn before installing it into the receiver. This method also simplifies the drawing of the printed circuit boards and enables any board to be replaced in the future with a new or improved design without upsetting the rest of the receiver's calibration.

Each of the main receiver printed circuit boards is fitted to the underside of the chassis on 6BA pillars with aluminium screens between them. The product detector was fitted in a screened brass box and mounted as far away as possible from the i.f. board to eliminate any of the 10·7MHz bfo from reaching the i.f. and operating the agc voltage. The top side of the chassis is used to accommodate the local oscillator, converters and part of the power supply, leaving ample room for any other converter or unit to be added if required.

It is not suggested that anyone makes an identical copy of the receiver but they might find some of the ideas useful. Constructors undertaking a project of this nature are advised to use only good quality components; surplus or cheap components can lead to inferior performance and disappointment. When constructing any rf equipment keep all component leads as short as possible, especially decoupling points and all rf and signal leads of screened or small coaxial cable. Also, special care should be taken to ensure that the local oscillator is mechanically as well as electrically stable.

Although the receiver worked first time without any necessary modifications to the design, this is no guarantee that others built will work first time. It does mean, however, that if the design is closely followed, a minimum of trouble should be experienced.

RESULTS OBTAINED

The receiver has been in use by the author for almost two years and has worked extremely well. The improvement over the original valve receiver and outboard converters was considerable, especially on 432MHz; this was mainly due to the much lower noise figure and better selectivity and the facility of an fm discriminator, which is far superior to the original slope detection method.

With the increased 144MHz activity, a lot of large signals are now being experienced, but no spurious responses or cross-modulation have been noticed. Furthermore no strange effects have been caused by a public service link transmitter that operates a few kilohertz above 146MHz and is located only a few hundred yards from the author's QTH.

A useful modification or addition to the receiver would be some form of squelch circuit for use on fm and the output of the local oscillator could be used as a vfo or to mix with ssb to provide transceive operation.

In conclusion, the author wishes to acknowledge the invaluable help and assistance given by G3RIN in producing this receiver.

A practical phase-locked loop for 2m

by R. RAY. G8CUB*

THIS article describes a practical phase-locked loop for the vhf spectrum. The loop is based on an integrated circuit phase detector which produces reliable and consistent results. The circuit locks from switch on, and is suitable for transmitter and receiver applications.

Introduction

VFO control on the 2m band has become almost mandatory, and various approaches are open to the constructor aiming at a fully tunable transmitter. A phase-locked loop is one of the best, combining the purity of an oscillator at signal frequency, with the stability of a low frequency vfo.

The pll described tunes 135–137MHz for use with an ssb transmitter with a 9MHz ssb generator, although there is no reason why the circuitry cannot be applied to other frequencies.

Principles

The heart of the pll is the phase detector, which produces a voltage proportional to the phase difference between the two input signals. This voltage is filtered and used to control a vco. The output frequency of the vco is proportional to the control voltage, and any signal appearing on the control line will frequency modulate the oscillator. For stability, a second-order type 2 loop is chosen; ie the frequency and phase difference between the input signals to the phase detector is zero. A more complete explanation of phase-lock control can be found elsewhere [1].

The output of the vco is split into two in the buffer amplifier, one path providing the output, the other the signal to the mixer.

The third harmonic of a 43·3MHz crystal is selected, and mixed with the buffer output giving an i.f. of 5·1–7·1MHz. Both the signal from the i.f. amplifier and vfo are squared and fed into the phase detector as logic levels. Output from the phase detector is passed through a suitable filter and used to control the vco.

If the frequency from the i.f. amplifier and vfo are not the same the filtered voltage from the phase detector will change, thus altering the vco output frequency, and therefore the i.f. signal, until the frequencies and phases of the two signals are the same. As long as the loop is in the locked condition, tuning the vfo from 5·1 to 7·1MHz will cause the output frequency to change from 135 to 137MHz.

The phase detector and loop filter are contained in one package Motorola-type MC4044P. A few external components control the frequency range, loop bandwidth and the stability. The values of these components are determined from the loop equations. For more complete information refer to the application note on the MC4044P [2].

Loop equations:

$$K_v = \frac{\text{freq range out of i.f. amp}}{\text{vco control voltage required to produce that range}} 2\pi \text{ rad/s/V}$$

K_v = sensitivity in radians/second/volt of vco

eg:
$$K_v = \frac{7{\cdot}1 - 5{\cdot}1\text{MHz}}{4{\cdot}25 - 2{\cdot}32\text{V}} 2\pi \text{ rad/s/V}$$
$$= 6{\cdot}51 \times 10^6 \text{ rad/s/V}$$

Note that it is suggested that the vco is built first and measurement of voltage/frequency is made over the range 135–137MHz.

The gain constant K_p of the MC4044P phase detector is given as:

$$K_p = 0{\cdot}111 \text{ V/rad.}$$

For a required lock-up time of 1ms ωn is given as: $\omega n = 4{\cdot}5$ K rad/s and damping ratio ξ as $\xi = 0{\cdot}8$.

Gain correction factor of the active filter K_c is given as:

$$K_c = 0{\cdot}5$$

A suitable value for the capacitor in the loop filter is:

$$C = 0{\cdot}5\mu\text{F}.$$

R_a and R_b can now be determined.

$$R_a = \frac{K_c K_p K_v}{\omega n^2 C}$$

eg:
$$= \frac{0{\cdot}5 \times 0{\cdot}111 \times 6{\cdot}51 \times 10^6}{4{\cdot}5^2 \times 10^6 \times 0{\cdot}5 \times 10^{-6}}$$
$$= 35{\cdot}6 \times 10^3 \,\Omega$$

Therefore: $R_a = 33\text{K}\Omega$

$$R_b = \frac{2\xi}{C\,\omega\,n}$$

eg:
$$= \frac{1{\cdot}6}{4{\cdot}5 \times 10^3 \times 0{\cdot}5 \times 10^{-6}}$$
$$R_b = 711\Omega$$

Practically $R_b = 680\Omega$ and $C_b = 0{\cdot}47\mu$F

$$R_e = \frac{1{\cdot}4\text{V}}{I_{dss} \text{ of TR19}}$$

The above values are included in the circuit, though if, for instance, a different vco is used, the required loop components will have to be calculated.

Operation

TR1 acts as a 43·3MHz crystal oscillator, the crystal oscillating on its third overtone in series resonant mode. The output is capacitively coupled to TR2 which triples to 129·9MHz. Other multiplication products are greatly reduced by the reasonant circuit L3 and 18pF trimmer tuned to 129·9MHz. The oscillator chain output is applied to gate two of the mixer TR3.

The vco, TR7, is a Vackar oscillator with a frequency range of 135–137MHz, the frequency being controlled by the voltage applied to the varicap diode D1. TR8 provides a stabilized 5V supply for the vco. A source follower, TR9, acts as a buffer between the vco and subsequent stages. From the source of TR9 the signal is split into two branches. One branch is amplified by TR13, TR14 and TR15 acting as small signal Class A amplifiers, the signal coupled to L13

* Flat 2 Springfield, Highland Avenue, Brentwood CM15 9DD.

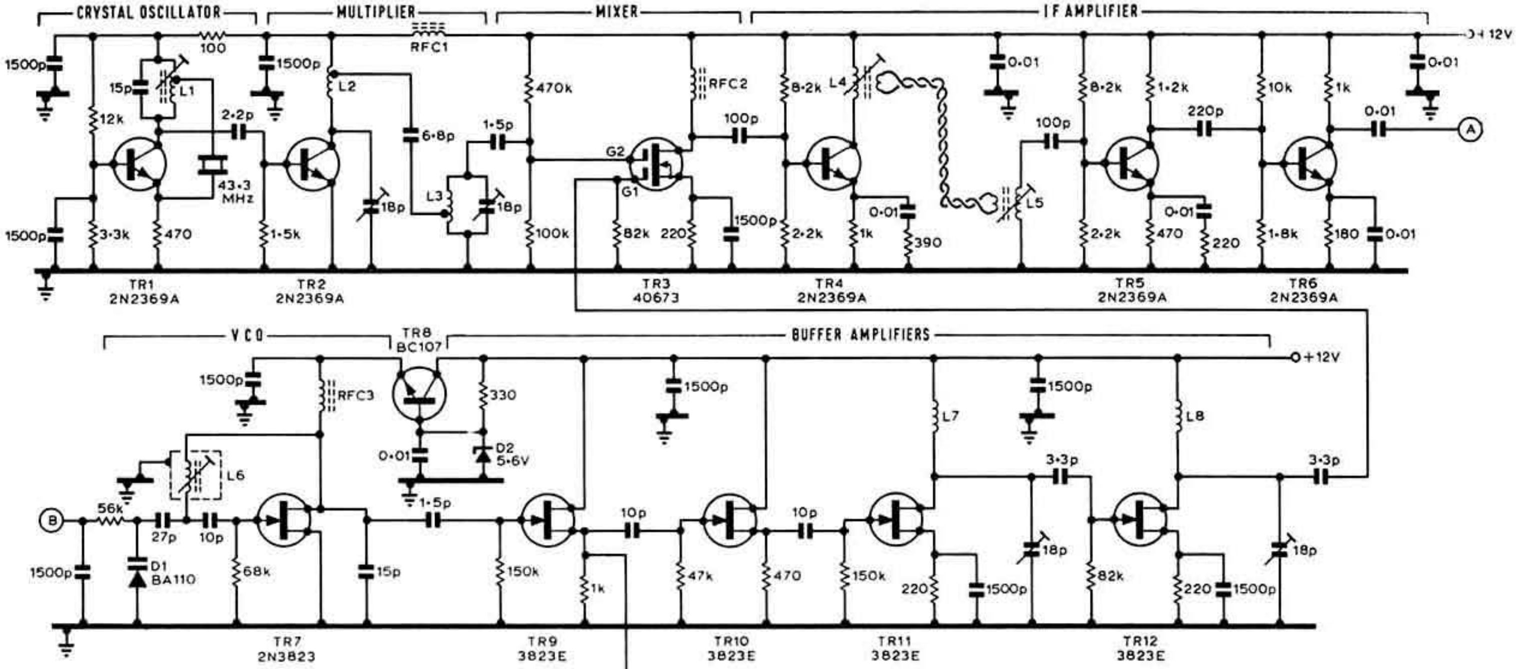


Fig 2. Circuit diagram of crystal oscillator/multiplier, mixer, i.f. amplier, vco, and buffer amplifiers

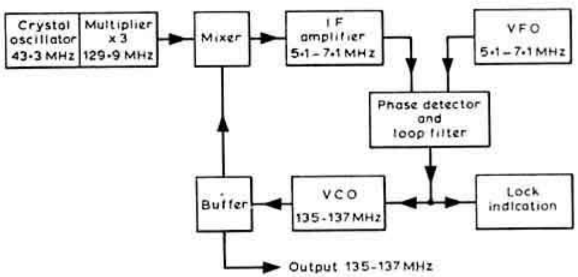


Fig 1. Block diagram

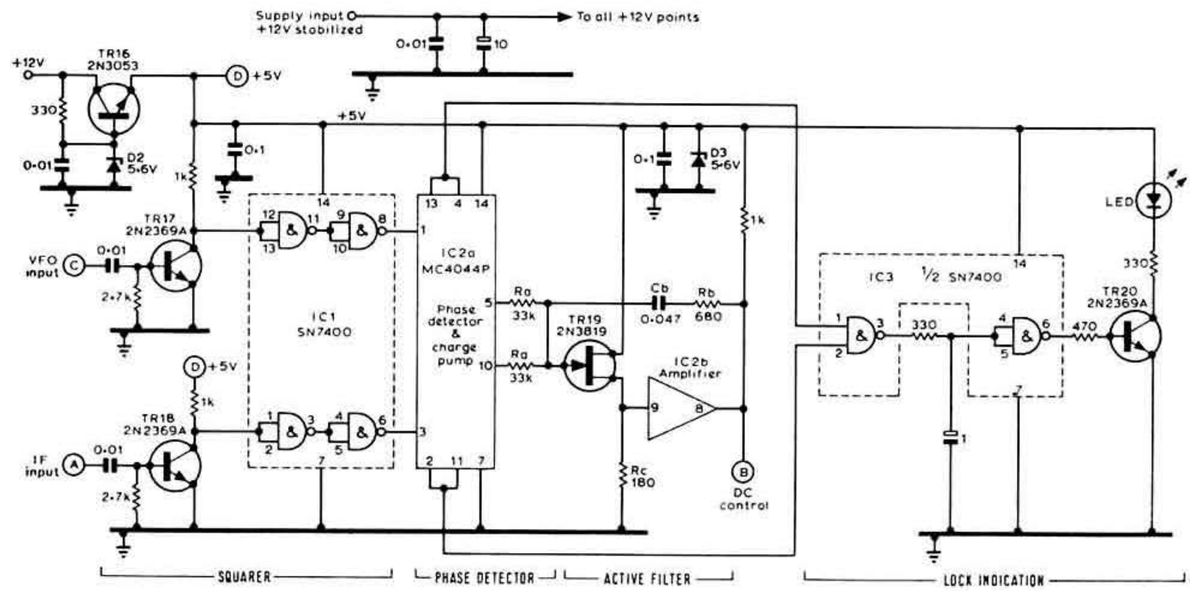


Fig 3. Circuit diagram of vfo, phase detector and loop filter, and lock indication

being the output. The other branch is buffered by source follower TR10, and amplified by TR11 and TR12 to provide an input signal to gate one of the mixer TR3.

The i.f. signal 5·1–7·1MHz is taken from the drain of the mosfet mixer and amplified by TR4, TR5 and TR6. Coils L4 and L5 resonate with stray capacitance to form a low-Q bandpass circuit at the i.f. frequency range. Individual stage negative feedback in TR4 and TR5 is achieved by resistors in series with the emitter decoupling capacitors.

The i.f. output from TR6 (2V p-p) is connected to the squarer TR18, which converts the sine wave input to a rough square wave, which is then shaped by two logic NAND gates. A vfo signal input of 2V p-p is required to drive the other squarer TR17, the square wave is shaped as with the i.f. signal by two more NAND gates.

The two square wave signals are applied to the inputs of the phase detector IC2. Outputs at pin 2 and 13 are logic pulses depending on whether the input signals are equal, high or low in frequency and phase. These outputs are applied to a charge pump circuit which converts them to fixed amplitude positive and negative pulses. These pulses are then applied to a lag-lead filter ($IC2_b$) (the response of which is controlled by C_b and R_b) which provides a dc voltage proportional to the phase error. Logic levels from the phase detector are applied to a NAND gate IC3 which through TR20 illuminates the led when the loop is locked. This dc voltage is used to control the vco, thus completing the loop. A circuit for the vfo is not given as many circuits are available to the constructor, and choice is a matter of personal preference.

Construction

The complete phase-locked loop was built into one box, the circuit being split up onto three printed circuit boards, except for the amplifiers TR14 and TR15, which are built as a separate unit. One board consists of the crystal oscillator, multiplier, mixer, and i.f. amplifier; a 20mm-high pcb screen surrounding the oscillator/multiplier.

The second board consists of the vco and buffers, a similar screen to the above surrounding the vco and separating the buffers.

The third board contains the squarers, phase detector and loop indication. All the boards are double sided, the top side being used as an earth plane in the usual manner. The 5V supply for the vco and logic circuitry must be obtained from separate stabilizers and not combined, as logic pulses on the supply line would modulate the vco. Signal paths were made with miniature 75Ω coaxial cable, the outer being soldered to the earth plane on the boards.

Alignment

The complete circuit can be aligned using a high impedance voltmeter, absorption wavemeter and a calibrated receiver, though access to an oscilloscope is preferable. Building of the vco first, and graphing frequency against voltage for 135–137MHz is required as mentioned previously. The vco should be checked to have reasonable stability and not be microphonic. The control voltage must be in the range 0·8–5·0V.

Tuning of the vco is best done at this stage by connecting the control line at the vco to a variable voltage source.

Measurement of the vco frequency can be done with a receiver and vhf converter with a 4–6MHz i.f. Reasonable output over 3–7MHz can usually be obtained from such a converter, giving an image range of 133–137MHz (assuming the oscillator is on the low side). Alternatively, the crystal oscillator chain can be aligned first (as below) and the buffers roughly tuned. Measurement of the i.f. frequency will mean the vco range can be calculated.

The crystal oscillator is checked to be oscillating at the required frequency, and the third harmonic selected at the collector circuit of TR2. The capacitor resonating with L3

Components list

TR1, TR2, TR4, TR5, TR6, TR14, TR15, TR17, TR18, TR20	2N2369A
TR3	40673, MEM616
TR7	2N3823
TR8	BC107, etc
TR9, TR10, TR11, TR12, TR13	3823E, 2N3823
TR16	2N3053 with heat sink
TR19	2N3819
D1	BA110
D2, D3	5·6V zener 400mW
IC1	SN7400
IC2	MC4044P
IC3	SN7400

L1	7t ¼in dia tap 1t from supply end
L2	5t ¼in dia tap 1t from supply end
L3	5t ¼in dia tap it from earth end
L4	80t 30g on 4mm former with slug
L5	90t 80g on 4mm former with slug. 3t link around L4 and L5
L6	6t 20g in 4mm former with slug in can
L7, L9	4t 18g on 4mm former
L8, L11, L12	4t ¼0 18g
L10	1t link on L9
L13	1t link near L12
RFC1	2t 36g on FX1115
RFC2	100μH choke
RFC3	6t 36g on FX1115

is adjusted to resonate at 129·9MHz, the adjustment being sharp as the circuit has a high Q. The mixer is assumed to be functioning correctly.

Output from TR6 should now be obtainable; adjustment of L4 and L5, together with the buffer tuned circuits, is made to give a fairly constant output at the i.f. range. This is not too important as long as the i.f. output exceeds 2V p-p unloaded over the whole range.

The phase-detector board should first be checked on its own. The supply line to the integrated circuits must be +5V ± 0·2V, the diode D3 is for protection only. Application of a signal, in the i.f. range, of 2V p-p (conveniently from the vfo), to the vfo input (c) will cause the control voltage to alter in one direction.

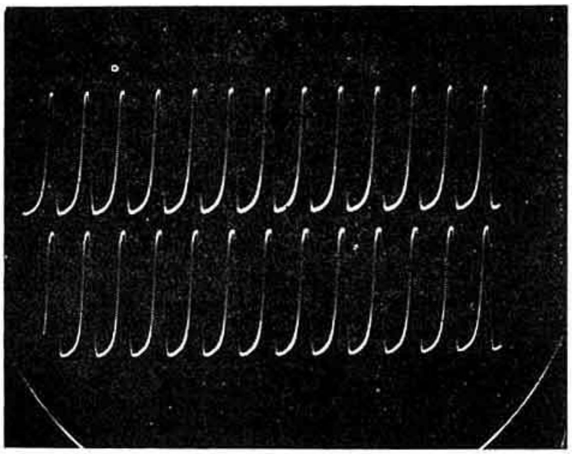


Fig 4. Waveforms at the collectors of the squarer transistors with the pll in locked condition. I.F. signal at the top, and vfo signal at the bottom of the picture. Scale: 2V/div, 0·2μs/dvi

Changing this signal to the i.f. input (A) will cause the control voltage to alter in the other direction. If this signal is applied to both inputs simultaneously, the dc voltage should stop at that instant, because the inputs are of the same frequency and phase.

Putting the boards together and connecting the vfo should give a working circuit. The loop should lock from switch on, and the control voltage track the vfo when it is tuned. The output branch buffers can now be tuned and link L13 adjusted to give an output of 1mW into 75Ω over the range 135–137MHz.

Displaying the output spectrum on a Hewlett Packard uhf spectrum analyser has shown the spurii level to be better than −60dB on the wanted signal; this level could be improved by better screening of the units, and using a vco with lower harmonic content.

Conclusion

The pll has been in use for three months and no problems have resulted except for having to realign the oscillator chain after dropping the unit! Being able to call other stations on their own channel anywhere in the band has proved a great advantage.

References

[1] "Phase Lock Techniques", Floyd M. Gardner, Wiley, 1967.

[2] Motorola application note AN-535.

RAE COURSES, 1974-5

The following list gives details of RAE courses which commenced in September but were received too late for inclusion in the lists published in the August and September issues.

Beckenham. Beckenham Adult Education Centre, 28 Beckenham Road, Beckenham. Wednesdays, 7.30pm, commenced 18 September. Tutor: J. M. Tripp, G3YWO. Details from the principal.

Birkenhead. Birkenhead Technical College, Borough Road, Birkenhead. Thursday evenings. Tutor: L. Roberts, G3EGX, 18 Croxteth Avenue, Wallasey.

Chertsey. Chertsey and Egham Institute of Further Education. Tuesdays 7–9pm at St Paul's Centre, Addlestone, and Mondays 7–9pm at Magna Carta Centre, Egham. Tutor: C. Duckling, G3SVL. Tel. Chertsey 64157 or Weybridge 51505 for further details. Commenced 23 September.

Chippenham. Chippenham Technical College, Cocklebury Road, Chippenham. Details from course tutor in the engineering department at the college.

Colchester. North-East Essex Technical College and School of Art, Sheepen Road, Colchester. Thursdays—commenced 19 September. Further details from D. Mason, Electrical Engineering Department.

Croydon. Western and Purley Further Education Centre, Technical College Annexe, Tamworth Road, West Croydon. Thursdays. Tutor: P. L. A. Burton, CEng, MIEE, MIERE, G3ZPB.

Doncaster. Doncaster College of Technology, Waterdale, Doncaster. Details from the Department of Electrical Engineering.

Farnborough. Haining Adult Education Centre, Robert Haining School, Mytchett, New Farnborough, Wednesdays 7.30–9.30pm, commenced 25 September. Tutor: G3OLB.

Ilkley. Ilkley Grammar School. Tuesdays 7.30–9.30pm, commenced 17 September. Tutor: D. B. Appleby, G8FUW.

Islington, London N1. De Beauvoir Evening Institute, Tottenham Road, Balls Pond Road, London N1. This is a booster course for those who have so far been unsuccessful in the RAE. Commenced 16 September but enrolment at any time during term. Tutor: F. Barns, G3AGP.

An fm channel scanner

by G. B. PACKER, G3UUS*

WHILE 2m fm activity in Britain has greatly expanded over the last few years, there are still areas of the country where contacts are sparse. This situation is not helped by the profusion of "accepted" channels, ranging from the older Japanese channels such as 0·480 and 0·80 to the new IARU recommended frequencies. To monitor even a few of these requires several receivers or a strong wrist to click through the switch positions. The object of this article is to describe a simple multi-channel scanner adaptable for use with the majority of currently used transceivers.

No attempt will be made to give step-by-step instructions; it is assumed that constructors will have their own ideas on circuit layout and front panel presentation and possibly obtain their power from alternative sources than the built-in mains psu.

Due to the low clock rate, most testing should be possible with a multimeter. For those with access to an oscilloscope, waveforms found in the various parts of the circuit are shown in Fig 1.

Logic circuits have two states, "1" and "0". In this article "1" refers to a voltage between 4 and 5V, and "0" refers to those lying between 0 and 1V.

Clock

There is nothing original in this design, it is just a simple multivibrator running at 8–10Hz. This speed is as fast as can be achieved, consistent with limiter or agc action which stops the scanning process. There is greater psychological satisfaction in watching a deliberate channel-to-channel scan rather than a dim blur.

The clock may be tested by using a voltmeter from the collector of TR3 or TR4 to earth. A rapid flutter of the meter movement should be visible.

Stop-scan

There are several ways of achieving this and it must act sufficiently fast to stop the clock from operating before the unit steps to the next channel.

TR2 serves to hold the collector of TR4 at a low level when a "1" occurs at point Q. This can be derived from the limiter of a valve receiver, as in Fig 3, or from the agc line of an fm modified a.m. radiotelephone.

An easy answer for modified pmr base stations is a spare contact on the squelch relay. S-meters, where fitted, are also a promising location for the stop-scan signal. The constructor's ingenuity is necessary to place the collector of TR4 at earth potential on receipt of a carrier.

The circuits in Fig 3 serve as suggestions for providing the required condition. RV1 is used to adjust the stop-scan point to that of the squelch threshold. Stop-scan and squelch thus occur at the same level of received carrier.

As can be seen from Fig 2, ILP10 will light when the scan is halted by a signal. The 25µF capacitor provides a short "tail" before scanning recommences.

* 8 Lock Close, Debenham, Suffolk IP14 6RS.

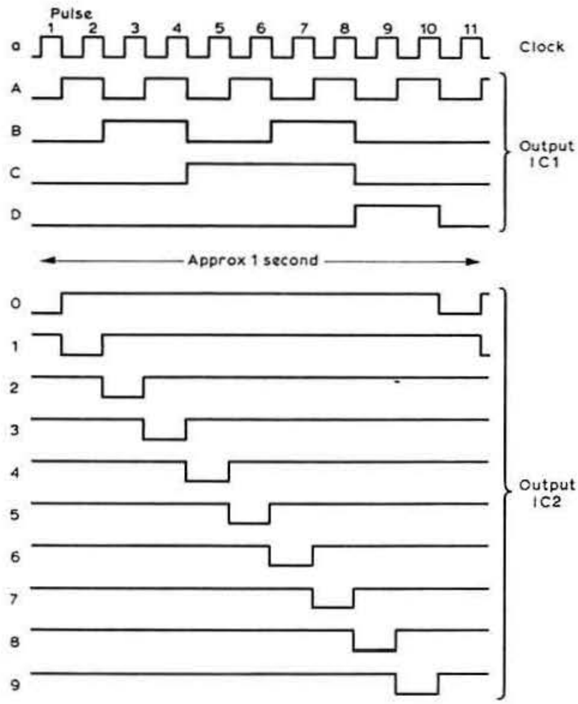


Fig 1. Waveforms to be found during operation of channel scanner

Channel counter

For each of the channels required to be scanned, a positive potential is needed to diode switch the correct crystal into the oscillator.

The SN7490 integrated circuit divides a stream of pulses by 10, but gives this as bcd (binary coded decimal) in a 1-2-4-8 format; hence the use of the SN7442 bcd-to-decimal decoder. Problems arise here because, as Truth table 2 shows, a "0" travels along the decimal outputs, not a "1".

To invert this condition 3 × SN7400 quad two-input NAND gates are used as inverters. (There are several other combinations of chips that would suffice, as it is merely a matter of availability.)

Hold and miss

Ten three-position miniature toggle switches were used for the hold, run and miss functions. Normally one contact is made, the other being open circuit. Moving the toggle to one side makes both, to the other breaks both.

The SN7442 bcd-decimal decoder is intended to drive nixie tubes direct, each output having an open collector (no built-in load resistor). When a channel is selected for hold, Sn_a is closed, connecting the corresponding open-circuit collector in parallel with TR4. The scan proceeds normally until

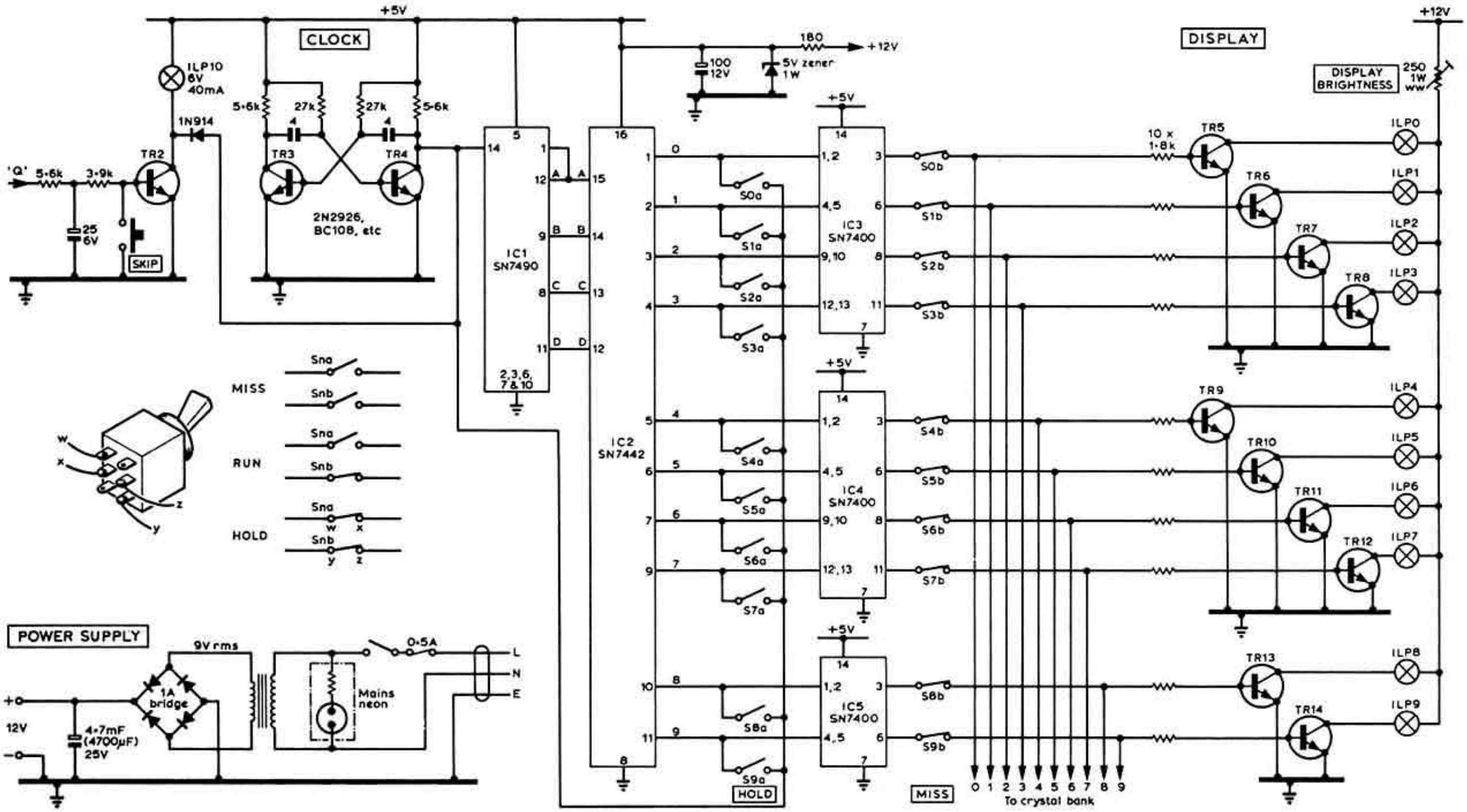


Fig 2. FM channel scanner circuit

Truth table 1

SN7490 decade counter

Input Pulse No	Output D	C	B	A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Truth table 2

SN7442 BCD-decimal decoder

Inputs D	C	B	A	Outputs 0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	1	1	1	1	1	1	1	1	1
0	0	0	1	1	0	1	1	1	1	1	1	1	1
0	0	1	0	1	1	0	1	1	1	1	1	1	1
0	0	1	1	1	1	1	0	1	1	1	1	1	1
0	1	0	0	1	1	1	1	0	1	1	1	1	1
0	1	0	1	1	1	1	1	1	0	1	1	1	1
0	1	1	0	1	1	1	1	1	1	0	1	1	1
0	1	1	1	1	1	1	1	1	1	1	0	1	1
1	0	0	0	1	1	1	1	1	1	1	1	0	1
1	0	0	1	1	1	1	1	1	1	1	1	1	0

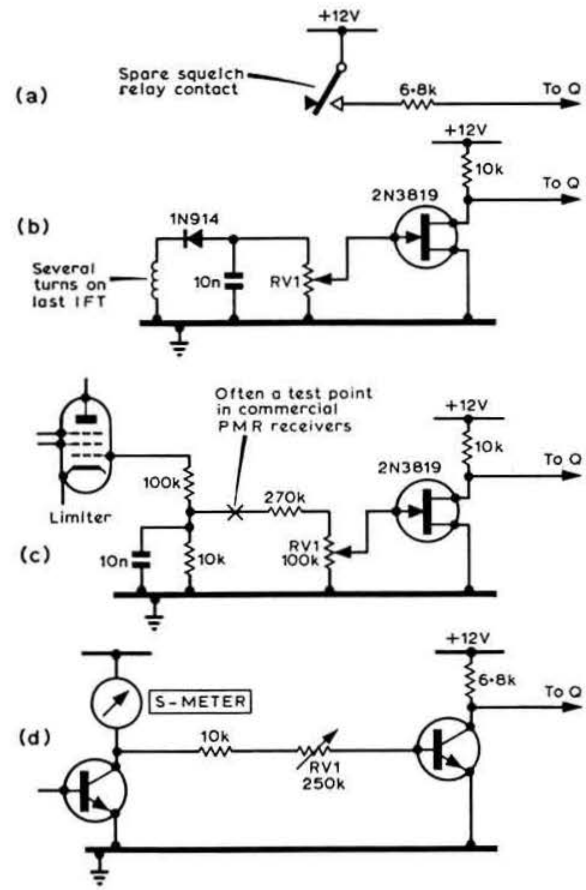


Fig 3. Four possible ways of stopping the scan

channel n is reached. The selected output transistor in the ic now conducts and holds the collector of TR4 permanently to ground, thus stopping the clock.

To miss a channel, Sn_b is opened so that "1"s appearing at the outputs of ICs 3, 4 and 5 may no longer reach their respective crystals. A two-fold action occurs: (1) no local oscillator drive is applied to the receiver on that channel; and (2) lamp n does not light as the unit scans through that position.

Skip

If the unit locks onto a channel, but the operator wishes to move on, a press of the skip switch allows the clock to recommence operation by momentarily shorting the stop-scan signal.

Display

Ten miniature lamps plus driver transistors are used. LEDs may be preferable but were not used due to non-availability at the time of construction. Channels 5, 6 and 7 in the prototype had lamps of a different colour to signify repeater output frequencies. TRs 5–14 are not in any way critical as long as they have an Ic_{max} of greater than the lamp's current.

Local oscillator

Fig 4 shows the simple RC circuit used to drive a Redifon valve base station with receive crystals at 8·5MHz. This circuit has been tried to 25MHz, but it is suggested that constructors who use higher frequency crystals duplicate the lo in their present receivers. It may be found that high-frequency crystals in this particular circuit require the

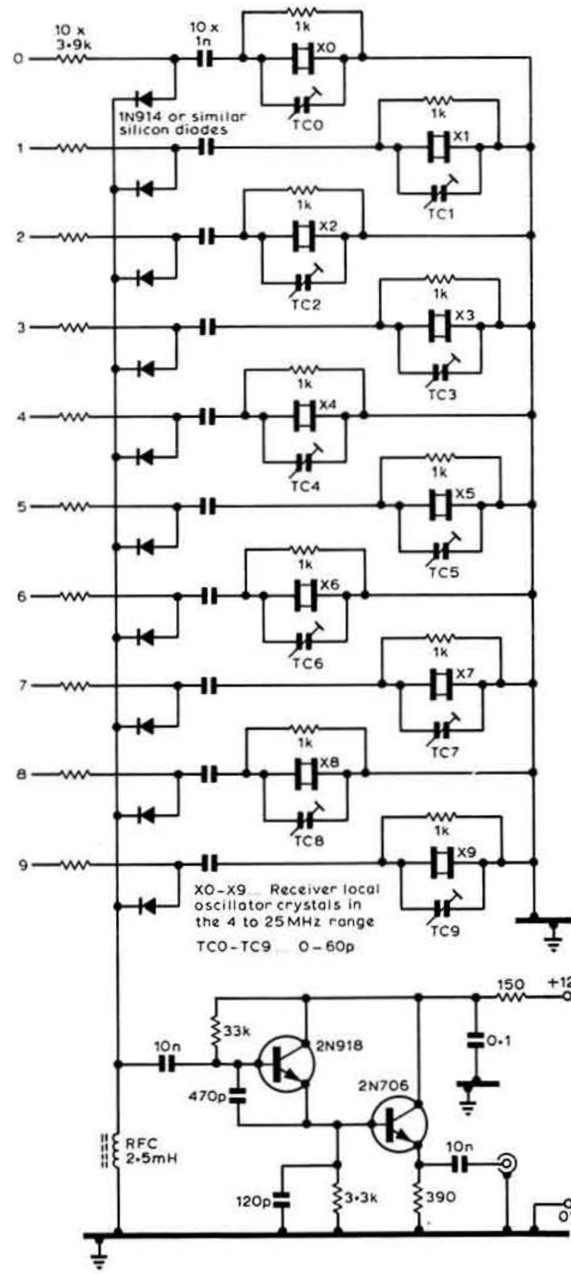


Fig 4. Local oscillator circuit suitable for crystals in the 4–25MHz range

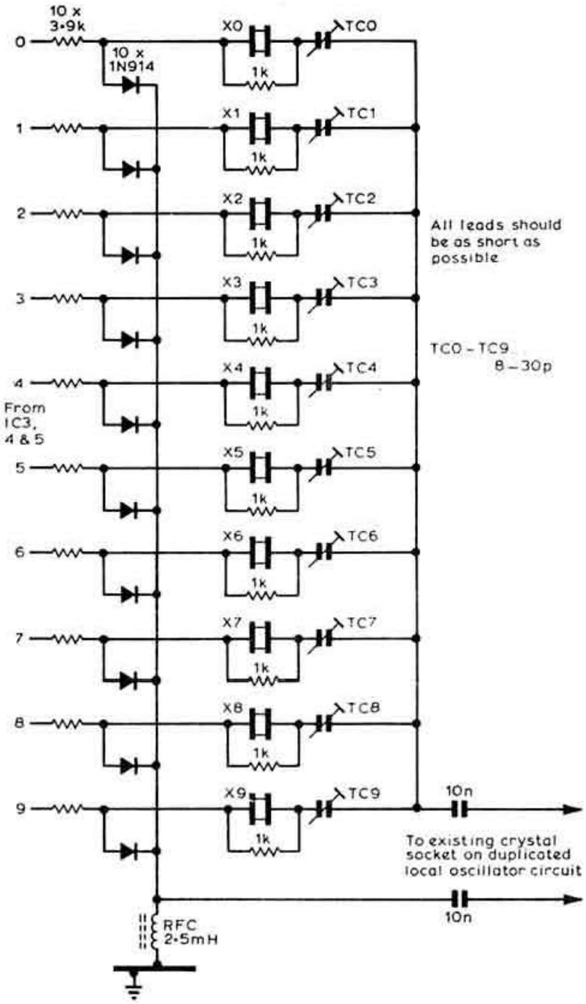


Fig 5. Using channel scanner with other transceivers

trimmers TC 0–9 connected in series rather than in parallel for operation on the correct frequency. In general, parallel resonance units designed for working into 30pF should be used.

Users of "black boxes" are especially recommended to duplicate their present lo circuits, as otherwise the resultant frequency shift could be intolerable. Fig 5 shows how this can be achieved with oscillators that do not have one side of the crystal earthed.

Further possibilities

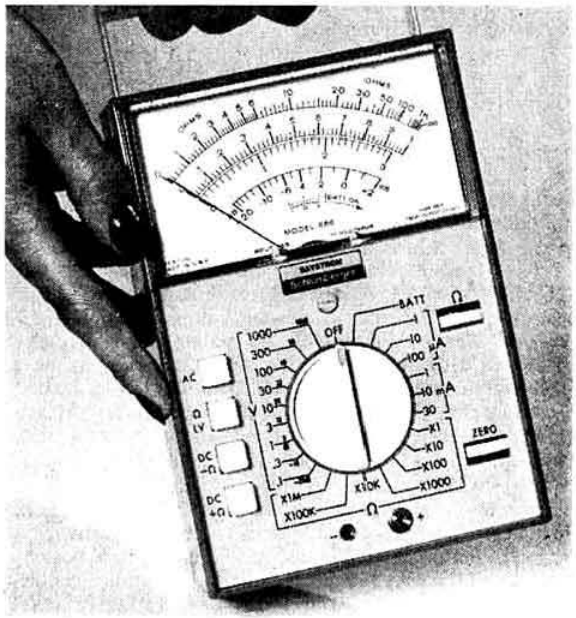
The dc levels to the crystal bank could be sent to the transmit crystals by another 10 3·9kΩ resistors from ICs 3, 4 and 5. To reduce spurious responses and emissions, it would be as well to arrange for the oscillator supplies to be switched between receive and transmit. In practice, however, it has been found that having to match the transmit channel switch to the receive frequency presents no serious inconvenience.

NEW PRODUCTS

Daystrom-Schlumberger multimeter

The latest addition to the range of drop-proofed multimeters is the type 666 designed particularly for semiconductor circuit troubleshooting. It has a 10MΩ input impedance and special ohms ranges. Like other models in the series the 666 is guaranteed to withstand a drop of 5ft, a feature which could be invaluable in field use. The instruments use plug-in circuit boards and can be calibrated without removing the instrument from its case. Other features include a single range switch, self-storing handle, externally replaceable fuse, temperature compensation and diode protected mechanism. Dimensions are 7in by 5in by 2¼in with a weight (including batteries) of less than 2lb.

Prices range from £33 upwards with immediate delivery, and further details can be obtained from Roger Pocock, Daystrom-Schlumberger, Bristol Road, Gloucester GL2 6EE.



Holdings rf clipper

Holdings Ltd announce the latest version of their rf clipper with improved layout and incorporating a glass fibre circuit board. This model has been available on the export market and can now be purchased in the UK. Like its predecessor the unit operates on receive and transmit and does not require any circuit changes, only additional leads to the vfo socket. The price of the unit is £48.40, inc VAT, and special prices are available for clippers purchased with the FT101 or FL2100. Further details are available from Holdings Ltd, 39/41 Mincing Lane, Blackburn BB2 2AF.

A clipper of this type has been supplied to the RSGB for review and it is hoped that a full report will be published in an early issue.

TECHNICAL TOPICS

by PAT HAWKER, G3VA

RECENTLY the 25-year-old-plus receiver I have been using for hf cw operation (not having yet joined those who believe that cw and hf are "outmoded") gave a few crackles and the signal output dropped by umpteen decibels.

Some relatively simple checks showed that no ht was reaching the anode of one of the i.f. stages and that there must be a break in the ift primary. It was not difficult to take out the ift, remove the screening can and uncover an interesting example of "green spot" corrosion of the type that can occur in windings at positive potential due to electrolytic action if any "pin holes" exist in enamelled-copper wire. By good chance the break was not in the winding proper but in the lead-in wire and could readily be repaired, the ift replaced and the 14MHz band once again revealed in all its glory (incidentally, from where on earth does the idea spring that *all* operation on hf is nothing but a dog-fight?).

Well, you are probably saying, see what happens if you insist on using old equipment built before the days of effective tropicalization and 10,000-hour mean-time-between-failures.

Umph, yes, perhaps. But are *you* so sure that when finally some fault does occur in your all-solid-state 1975 model with digital read-out and full frequency synthesis, with all those multitude of components on printed-circuit boards, you will be able to get it back in trim in an hour or two?

I have been reading a very interesting article on this subject by A. M. M. Aabad of Radio Bangladesh ("Use of electronic equipment in developing countries" *ABU Technical Review*, July 1974). He points out that many difficulties are experienced in such countries because, despite all the accumulated knowledge about tropicalization of components, the subject is still not given the importance it deserves, particularly in consumer goods: tropical heat, humidity, dust and insects soon show up these deficiencies.

But there is another factor: the more modern the design, the more headaches for users in countries such as Bangladesh. He writes: "In the latest state-of-the-art, miniaturization and the use of multiple-function component blocks have become the order of the day. The poorly tropicalized printed circuits give constant trouble. The modules and plug-in units cannot be replaced quickly . . . The high voltage components have abnormally short life—punctures in transformers and capacitors are not uncommon. The variable-type carbon components are affected by moisture. The push-button switches are affected by dust. The springs are affected by rust, heat and humidity . . . rubber components have a very short life. Oxidation is another enemy. Carbon resistors are generally unsuitable. Gadgetry in circuits invites maintenance problems. Delicate mechanical systems cannot stand rough handling. With the obsolescence of receiving tube circuits, the attendant failure rates have decreased; but the local faults in the semiconductor circuits have not been entirely overcome.

"While purchasing electronic equipment it is necessary to bear in mind considerations that may not be applicable to users in advanced countries. One aspect is the interchangeability of parts . . . replacement of valves and transistors with substitutes is a problem . . . manufacturers should issue more detailed instruction books and servicing manuals.

"Newly-ordered equipment fails to operate on initial testing . . . equipment may not be suitable for use on power supplies having frequency fluctuations, low voltages and frequent interruptions . . . semi-skilled personnel may unintentionally tinker with knobs, controls and circuitry . . . The designer should be aware of all such practical aspects and incorporate safeguards to the extent that is economically and technically possible."

Now admittedly most readers will be using equipment under much less exacting conditions than those found in Bangladesh. But the conditions under which amateur equipment is operated do at least have some points in common with those which give rise to the type of problems that A. Aabad had in mind. They are often very different from the air-conditioned, temperature-controlled environments, supported by skilled maintenance personnel and stores, that professional users expect and for which advanced equipment is often designed. The home repairer usually has to make do with a lot less test equipment than, for example, the £20,000-worth carried by the IBA mobile maintenance teams!

All this is not to condemn modern techniques or modern equipment. But looking at some of the advertisements for what might be termed "semi-professional" equipment (ie often highly complex equipment but built to consumer-type standards), one must sometimes wonder if anyone has really thought out how it is going to be kept going as long as my creaking, but easily repairable, HQ129X! But then perhaps I am being old-fashioned in expecting that equipment should have long life.

Path deviations, one-way propagation, hf tropo and LDEs

Thoughtful and interesting comments continue to arrive on the question of signals arriving off the great circle path, one-way propagation and tropo on 28MHz. There is just not space to do full justice to them this month although I take the opportunity of acknowledging information from Dr Jürgen Röttger, DJ3KR; Martin Harrison, G3USF; George Benbow, G3HB; J. K. Todd, G2KV; Ted Cook, ZS6BT, and George Sassoon, G3JZK.

So just a few brief snippets.

DJ3KR sends along a reprint of a formidable paper he presented at a 1972 conference of "AGARD" (NATO advisory group for aerospace research and development) on "Some effects of atmospheric gravity waves observed on a transequatorial radio path" and mentions that he hopes to publish an amateur-orientated paper on this material soon in *CQ-DL*. His paper includes the results of many observations made at the Max-Planck Institute of signals on about 14 and 17MHz arriving from Tsumeb in South-west Africa. These show deviations of up to $\pm 50°$ from the almost true north-south great circle 7,915km path due to irregularities of equatorial spread-F, with side reflections and side scattering due to ionospheric disturbances in the equatorial ionosphere travelling from west to east in the equatorial zone.

So here again, it seems to me, as in the New Zealand case one encounters the influence of equatorial spread-F and possibly chordal hop forms of transequatorial propagation, resulting in some very pronounced directional fluctuations.

DJ3KR commenting on the notes in the July *TT* writes: "Concerning one-way propagation, I certainly agree with G6CJ's interpretation on the different signal-to-noise ratio at both terminals of the radio path as being the cause of quasi one-way 'reception' (not propagation). However, short periodic fluctuations (some seconds up to minutes) of signal strength may be out of phase (provided proper conditions are existent) at the terminals due to polarization fading which, incidentally, is the Faraday effect. Here the earth's magnetic field indeed plays a role. However, it should be mentioned that not the ions, as suggested by G3UML, but the electrons in the ionosphere influence hf propagation, in spite of the fact that the ionosphere consists of ions and electrons which couple in a complicated manner."

Professor Martin Harrison, G3USF, was surprised to find in *TT* reference to his tropo reception at Keele of 28MHz signals from the GB3SX beacon. He provides background information on how he distinguishes this from scatter propagation (which he considers is insufficiently exploited on 28MHz by amateurs), mentioning that from his good location (650ft asl) when tropo conditions exist he can also hear G4JZ, Birdlip, Glos, and other stations up to around the Preston/Blackburn area.

Generally he believes that we have all become a little bemused by the neat diagrams of hf propagation when in fact there will normally be many different propagation modes involved. Because of this it might almost be an exception rather than a rule that signals from A to B should take exactly the same path as from B to A, without looking for new, sophisticated explanations.

On the subject of hf tropo, I recently came across a prewar reference by Dennis Heightman, G6DH, suggesting that the effects of tropo could be observed even on 3·5MHz and possibly on medium-wave signals!

On the entirely different subject of LDEs (long delay echoes) George Sassoon, G3JZK, has recently published a paper in *Spaceflight* (Vol 16, pp 258–264, July 1974) called "A correlation of long-delay radio echoes and the moon's orbit". In this paper he traces a statistically-significant tendency for such echoes to be heard when the trailing moon-equilateral position is above the observer's horizon. The significance of the equilateral position is that this is where a spacecraft could be parked without using up fuel. Personally I am not drawn to the theory that LDEs represent an attempt by extraterrestrial beings to make known to us their presence. But for those who are (and indeed for others concerned with long delay echoes) the information presented by G3JZK should be of interest.

Mini tone-burst oscillator

Alf Green, G4ABB, mentions that a number of people have shown interest in the tone-burst oscillator he uses with a Trio TR2200. As shown in Fig 1, this uses a National Semiconductor NE555 timer ic wired for astable operation; an unusual feature being the use of a timing network on the reset pin (pin 4) to provide the half-second tone period.

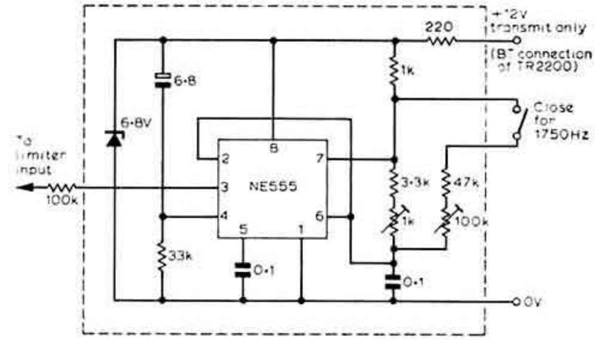


Fig 1. G4ABB's mini tone-burst oscillator

His complete unit was built on a small piece of circuit board using an eight-pin dual-in-line version of the 555 with miniature components; the overall size is only 1 by 0·6 by 0·5in. The zener regulator was found necessary to allow for battery fluctuations and he achieves a drift of 3Hz over a supply range of 9 to 15V. The circuit, he suggests, is far more stable than the usual system based on 7400 or 7413 devices, particularly with regard to temperature.

The constant drain of 30mA (at 12V) is unimportant with the TR2200 which takes 450mA on transmit, but with smaller hand-held equipment it might prove advisable to use a series transistor in the supply line to give the 0·5s gating.

Blue Tack and printer's rules

From Walter G. Borland, G3NXM, comes an idea for simplifying the mounting of printed circuit boards or copper-sided Veroboard in metal boxes. He writes:

"The usual way of mounting these is to drill the board and case and bolt it on, using spacers so that the copper does not come into contact with the box. A much simpler way is to stick the board onto the metal box using Blue Tack, a plasticine type of material made by Bostick and sold by most large stationers. It holds the board firmly in place, has excellent insulating properties so there is no contact between the board and box, and is easily removable. One can use the Blue Tack over and over again. The essential point, as the directions state, is to work the material in the hand for a few minutes before use or it will not stick.

"I have also used it for sticking a potentiometer on to the back of a meter and afterwards removing it. My family also use it for sticking pictures etc on walls, and when they are removed normally no marks are left, although it is not advisable to use it on wallpaper as it may lift the surface on removal depending on the softness of the paper. It works fine with paper of a similar quality to writing paper. I believe it can also be used for cleaning wallpaper in the same way as with 'Sooty City'."

I was interested to receive this suggestion as it happened that I had already purloined from the family a piece of what is obviously the same material and had been finding it useful for some repair jobs. The material must be quite old yet it still seems to retain good adhesion.

Harold Chorley, G5YH, mentions that he is one of the few (?) amateurs left who likes to make his own gear and in view of the difficulty of buying components specifically for amateur purposes finds the situation almost like that of the 'twenties when it was a matter of do it yourself or do without.

Recently he wanted to wind a coil at six turns per inch. No former, but this can be made. But how to cut grooves on the ribs at six to the inch?

His answer: a printer's rule. These can be fairly easily got (he uses a Chesterman No 476D). This gives dimensions in "ems" (the traditional printing measure based on the width of a letter M) in 12, 10, 8, 6 and 5-point sizes. Remembering that 72 points make an inch, the rule provides a useful series of those fractions of an inch that cannot readily be taken from a conventional rule:

12pt $\frac{1}{6}$in
10pt $\frac{1}{7}$in (as near as may be)
8pt $\frac{1}{9}$in
6pt $\frac{1}{12}$in
5pt $\frac{1}{14}$in (again as near as may be).

Incidentally if you are wondering how all these sizes are accommodated on the same printer's rule, G5YH says there are two double and one single (8pt) scales on the rule occupying three edges, the fourth edge is in inches.

A third hint comes, via *QST's Hints and Kinks* (July 1974), from W. H. Moody, WA2RKU, who suggests that excellent results in drilling copper-plated printed-circuit boards may be achieved using dentists' burr-drills. He says that for general integrated-circuit, transistor and component work a "No 2 burr" is ideal although I do not know if this is an international or USA-only classification. The burrs outlast many regular drills and are said to be practically indestructable.

Integrated noise suppression

The notes in the August *TT* on noise limiters and noise blankers has prompted John Haydon, G3BLP, to draw attention to a technique which is used in the Philips car radio type RN712 to improve vhf/fm reception, while the same system can also be realized with the help of a Philips/Mullard special-purpose integrated circuit type TDA1001.

Basically the RN712 has a filter after the fm discriminator which separates the audio signal into two parts: that above 53kHz and that below 53kHz. The spectrum below 53kHz represents the full stereo signal and goes normally into the af stages but subject to a delay of a few milliseconds. The high frequency components above 53kHz are fed via a shaping circuit and provide a trigger for a monostable which produces initially 40ns pulses to operate a gate in the audio amplifier chain. A further noise pulse can increase the length of the monostable blanking pulse although a limit is set so that in conditions of very severe interference the suppression will in effect be taken out of circuit. A feature of the circuit is the way in which the time constants are arranged to maintain the audio levels in the circuits after gating so that no discontinuities appear in the waveform. G3BLP reports that the circuit used in the RN712 is certainly effective when used in a vehicle which itself is adequately suppressed but has to cope with other vehicles on the road which are not!

Fig 2 shows the various functions of the TDA1001 which is connected between the ratio detector and audio amplifier for mono operation, or between the ratio detector and stereo decoder for stereo operation. The circuit consists of a high-pass filter for separating the interference from the audio signal, a controlled amplifier and a one-shot circuit for generating gating pulses. During bursts of interference the af signal, delayed by a low-pass filter, is interrupted by the gating pulses, thus keeping a constant output level. A 19kHz filter sustains the stereo pilot tone during suppression and a built-in integrating network controls the amplification so that the receiver remains operative even during continuous interference. The performance data suggest that the maximum residual gate pulse in the output signal is 1mV (peak-to-peak); maximum af input signal 1·5V.

It would seem to me that such a system would be of considerable interest for mobile operation or where no very sharp i.f. filters are used in the receiver which would distort the noise pulses.

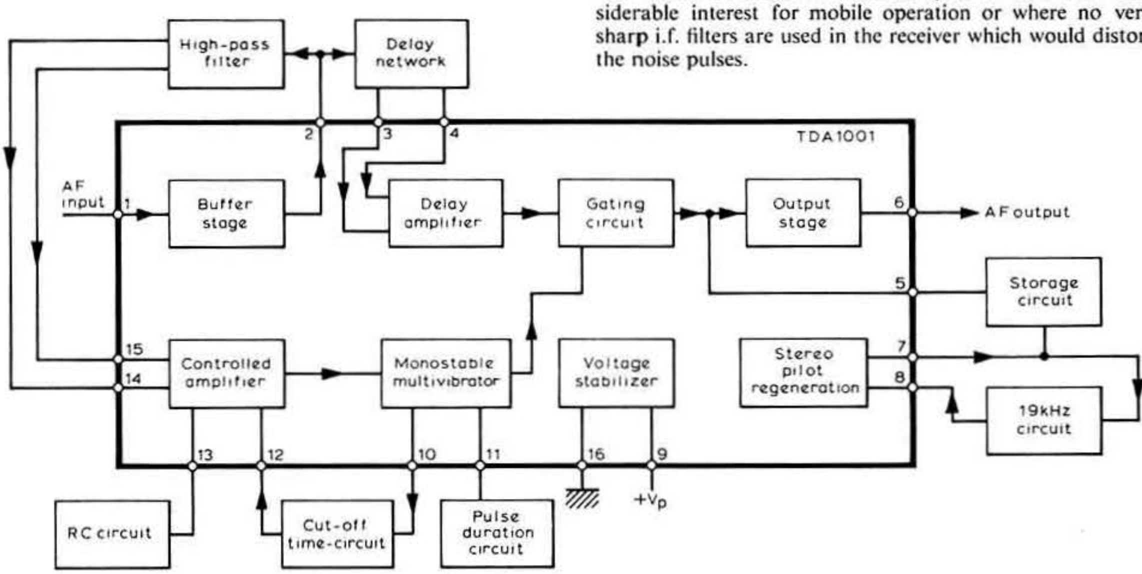


Fig 2. How the TDA1001 noise suppression integrated circuit is used to provide effective noise reduction on vhf/fm car radio reception

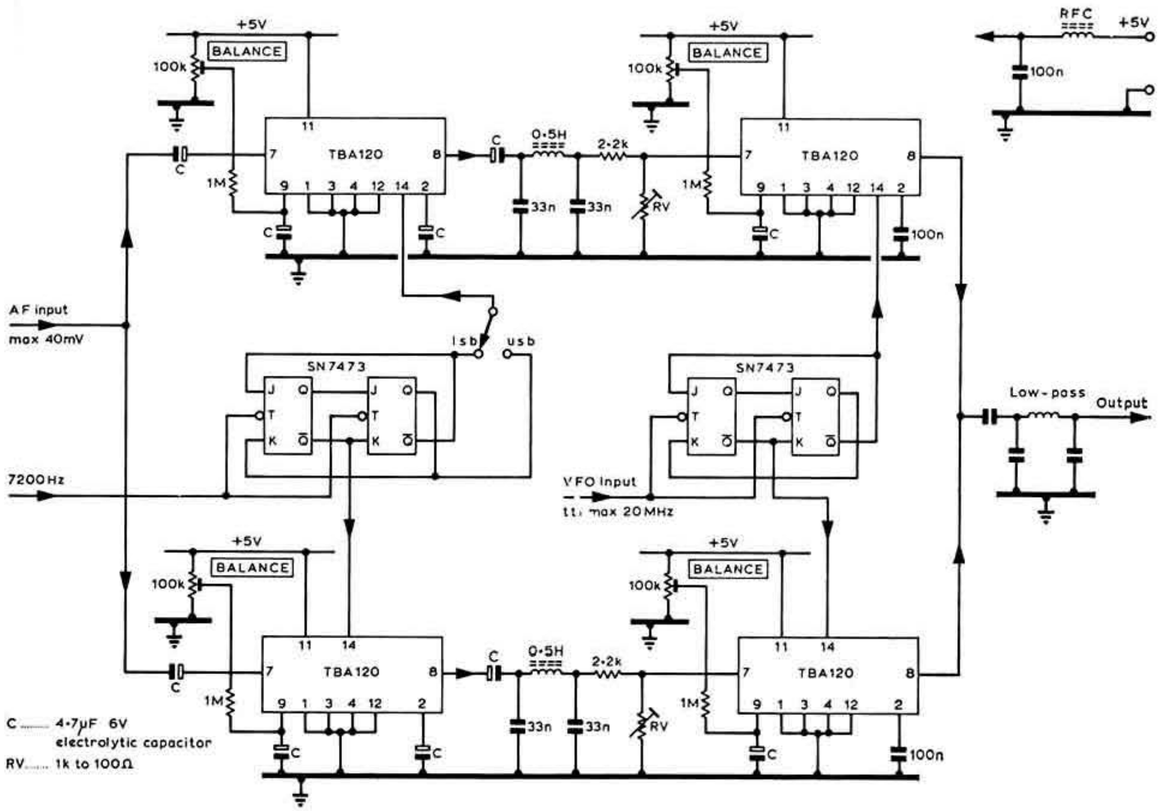


Fig 3. Third-method ssb generator using digital phase shifting and integrated-circuit balanced modulators (A de Muijnkc)

Third-method ssb generator

The concept of digital techniques in conjunction with third-method ssb generation has been mentioned several times in *TT*, including a recent reference to the generator developed by A. J. Turner, G3UFP (*Wireless World* September 1973). The advantages are that one can generate ssb without either an ssb filter or critical phasing-type component values. An ssb generator of this type, again using SN7473 devices as digital 90° phase-shifters by using a clock frequency of $4f$ appears in PA0SE's *Reflecties* (July 1974) from A. de Muijnkc of Utrecht. He uses four TBA120 ICs as the four balanced modulators, and Fig 3 shows his generator which is complete except for the clock inputs of 7,200Hz to provide the 1,800 af tone, and the vfo up to 20MHz (ie 14MHz vfo input to give 3·5MHz output). G3UFP in his article suggested that 10MHz represented about maximum for the SN7473, but presumably the Dutch experimenter finds them usable up to twice this figure.

Those cleaning solvents

In the August *TT* some cautionary notes were included on the need to take care when handling and using cleaning solvents, based on an article in *Electronics Design*. At the time I felt the original article presented a pretty horrific account of the dangers that can lurk in some of these chemicals. So it is worth noting that recent correspondence in *Electronics Design* indicates that some of the tabulated information in the original article (not reproduced in *TT*) *under* rather than over-estimated the dangers.

Alan Whitmore, BRS32669, noted the comments on the dangers of phosgene when etc, trichlorethylene etc is heated. He writes: "May I add to this warning? The smoking of a pipe or cigarette over some of these solvents is an excellent method of producing phosgene right under one's nose; not to mention the fact that most smokers inhale, taking this lethal gas straight into the lungs. Too many amateurs seem always to have a 'weed' hanging from the corner of the mouth while working on the rig!"

Front end for G3XGP frequency meter

Last year in *Radio Communication* (June 1973 with additional notes in the December issue), W. H. Bond, G3XGP, described a compact digital frequency meter for use between dc and 30MHz. Phil Lund, G4ADC, has constructed the meter on Veroboard and finds that it operates satisfactorily. However, he has developed an alternative front end comprising the input amplifier and Schmitt trigger which he has used for several months: Fig 4.

He suggests that this circuit is simple and easily constructed on Veroboard and is based on a readily available ttl integrated circuit Schmitt trigger (type SN7413) although since these devices are nominally rated for a maximum frequency

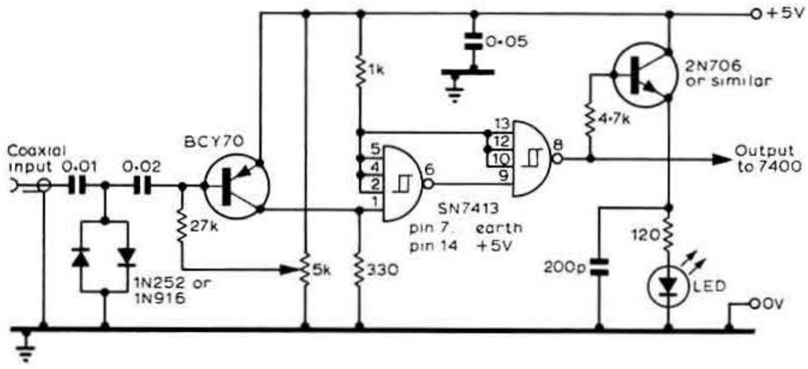


Fig 4. The alternative front-end used by G4ADC in conjunction with the G3XGP digital frequency meter described in "Radio Communication" in June 1973

of 10MHz it will be necessary to select a device having suitable high frequency performance: in his case the second device tried was found to perform to over 30MHz. Again the input transistor is not critical but should clearly be a type that will operate to over 30MHz. By choosing a pnp device in the circuit configuration shown, the correct quiescent voltage is provided for the input of the SN7413. The second half of the 7413 device is used as an inverter in order to avoid a reading of "1" with no signal. Output from the SN7413 is a square wave just right for feeding into the SN7400 signal gate of the meter proper. The potentiometer is adjusted for maximum sensitivity consistent with a reading of "0" with no signal.

Phase lock indicator

Mike Adams, G3ZLQ, in developing a heterodyne phase locked loop system for 70MHz found that a frequent problem was to determine if the loop really was in lock or not; not a simple matter unless it has a specific indicator system. Since his pll used an exclusive-OR phase comparator using ttl logic devices, he found it was a simple matter to use a D-type bistable device as a lock detector as shown in Fig 5.

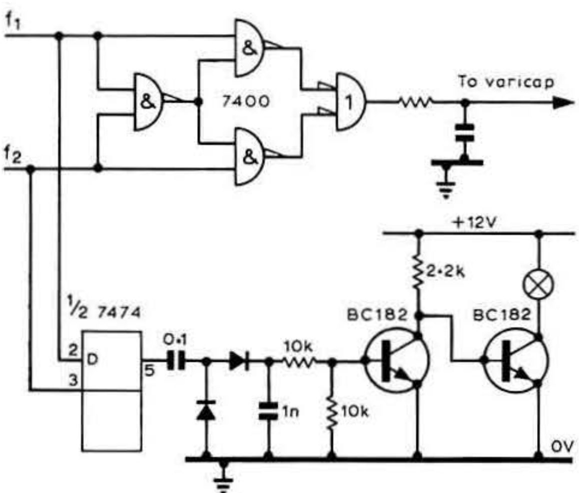


Fig 5. G3ZLQ phase-lock indicator system which detects a beat frequency output

In this f1 and f2 are the two frequencies for which it is needed to know the phase relationship. When they are in phase, that is to say the loop is in lock, the output of the D-type bistable will be a steady 1 or 0. On the other hand when the loop is unlocked the output will be the beat frequency of the two signals; this beat frequency can be rectified and used to drive the indicator as shown. When the loop is in lock the lamp will be "on".

G3ZLQ warns that the circuit is not entirely foolproof, since loss of f1 or f2 will cause the beat to disappear and so cause a false indication, but this, if it was felt to be a real problem, could be overcome with extra rectifiers and gating.

EDITOR'S NOTE

We regret that because of our draughtsman's temporary absence due to sickness, certain *Technical Topics* items have had to be held over until diagrams have been drawn

The RSGB News Bulletin Service

The RSGB News Bulletin, callsign GB2RS, is broadcast every Sunday morning. This bulletin can be received on either vhf or hf, which gives almost complete coverage of the British Isles. It keeps radio amateurs up-to-date about happenings in the world of amateur radio and gives information on coming events, supplementing and bridging the gap between successive issues of *Radio Communication*.

SCHEDULE

Time	Frequency (MHz)	Location and coverage (hf) or beam heading (vhf) of station
0930	3·6	Bromley, Kent (SE England)
1000	3·6	Cheltenham (SW England)
	145·8	Aberdeen (NNW)
	145·095	Croydon, Surrey (NE)
1015	3·6	Belfast (N. Ireland)
	145·8	Bangor, Co Down (N)
1030	3·6	Derby (N. Midlands)
	144·337	Weston-super-Mare (NW)
	145·8	Aberdeen (SW)
	145·3	Brierley Hill (NW)
1045	145·89	Middlesbrough (NW)
	145·095	Croydon, Surrey (SW)
1100	3·6	Bridlington (NE England)
	144·3	Brierley Hill (SW)
1130	3·6	Motherwell (S Central Scotland)
1200	3·6	Aberdeen (NE Scotland)

MICROWAVES—1,000MHz and up

by DAIN EVANS, G3RPE*

A 24GHz record

On 18 August, at the first opportunity after receiving their licences to operate in the 24GHz band, G3BNL and G3EEZ worked the 72km path from Cleeve Hill to Clee Hill on their first attempt. Both stations used crystal-controlled equipment employing a septupler from 3·5GHz, the 4mW output from which fed dishes 16in in diameter. Signal strengths were S9. A significant observation made was that the signals were still S5 with 11dB of attenuation in. This means that the equipment had adequate reserve to work the 150km necessary to gain a Microwave Award for the band, with the very important proviso characteristic of 24GHz operation—that it is not raining.

Dustbin lids as dishes

Several of the smoothly-rounded type of ordinary domestic galvanized iron dustbin lids have been checked and all have been found sufficiently accurate paraboloids to make efficient dishes at frequencies up to 10GHz at least. Their diameters ranged from 18 to 24in. A rule of thumb is that a dish should have a diameter exceeding 5λ, and preferably 10λ, at the frequency of operation, so this size of dish is best used above 3 or 6GHz. There will be some loss in efficiency if used at lower frequencies.

All the lids measured have a relatively long focal length: the ratio of focal length to diameter, f/D, was in the range 0·7 to 0·9. This restricts the feed that can be used to relatively high gain types, and the design data for one suitable type, the pyramidal horn, will be given.

The characteristics of a particular lid can be determined in a number of ways depending on the trouble one is prepared to take. The simplest method is to measure the diameter of the lid D and the depth at the centre compared with the rim, c. The focal length $f = D^2/16c$, and this value defines the approximate position of the feed. The f/D ratio can then be calculated, the value of which determines the characteristics of the feed required. For the writer's dustbin lid, a standard *Commission for the New Towns* model, $D = 19{\cdot}0$in and $c = 1{\cdot}59$in. The calculated focal length is 14·2in and the f/D ratio is 0·75. The gain of a dish is given by the value of $5(D/\lambda)^2$, assuming an overall efficiency of 50 per cent: for this lid, the gain to be expected ranges from about 26dB at 5760MHz to 38dB at 24GHz, the corresponding beamwidths being 8° and 2°.

A pyramidal horn feed consists of a length of waveguide which is flared at one end in one or both directions. The dimensions of the aperture as a function of the f/D ratio of the dish to be illuminated are given in Table 1. Dimension A dictates by how much the broad face of the waveguide is flared, and dimension B the narrow face. The length L is measured from the aperture to the apex of the pyramid formed by extrapolating back the flared part of the horn. The dimensions are given in terms of wavelengths, the actual dimensions being obtained by multiplying the values by the wavelength in air at the design frequency. For an f/D ratio of 0·75, the values are $A/\lambda = 1{\cdot}58$, $B/\lambda = 1{\cdot}17$ and $L/\lambda = 2{\cdot}5$. A horn feed for 10GHz, for example, for which $\lambda = 1{\cdot}181$in, would therefore have an aperture of 1·86 × 1·38in which tapers over a length exceeding 2·9in respectively to 0·9 × 0·4in if waveguide 16 were used.

TABLE 1

Dimensions of a pyramidal horn feed

Focal length/diameter of dish	A/λ	B/λ	L/λ
0·70	1·43	1·07	2·0
0·75	1·58	1·17	2·5
0·80	1·67	1·24	2·8
0·85	1·79	1·32	3·2
0·90	1·90	1·40	3·6
0·95	2·02	1·48	4·1

The values correspond to an edge illumination 10dB down on that at the centre of the dish.

More precise measurements of the shapes of the lids suggest that they were intended to be spherical rather than paraboloidal—clearly the manufacturers did not have this application of their wares at the forefront of their minds. A more rigorous approach is to determine by how much a lid deviates from a paraboloid, as this will set the maximum frequency at which it is efficient. The simplest way of determining its profile is to roughly shape (to fit within about ¼in) a piece of cardboard or hardboard which is placed across a diameter. The shape of the lid is transferred using a pencil mounted on a suitable spacer, from which the x and y co-ordinates can be taken at intervals for checking. From measurements of the diameter and depth, the focal length f can be calculated using the equations given above. From the relationship $x = y^2/4f$, the shape of the corresponding perfect parabola can be obtained. Table 2 gives actual values for a lid, and these are compared with a parabola of focal length 14·2in with all values for x shifted by 0·03in to produce a more symmetrical fit. By selecting a slightly different value for f, an even better fit could probably be obtained.

It can be shown that if the loss in gain due to large scale deviations is not to exceed 1dB, then the surface of a reflector must not deviate from a true paraboloid by more than about λ/15. In the present example, the deviation is 0·03in which, if made equal to this fraction of a wavelength, corresponds to a maximum operating frequency of about 26GHz. If used at a higher frequency, the loss would increase significantly; at a lower frequency, the loss would be proportionally smaller.

TABLE 2

Profile of a typical dustbin lid in inches compared with a parabola

Radius	Depth of lid	Depth of parabola	Difference
0	0	−0·03	0·03
1	0·02	−0·01	0·03
2	0·06	0·04	0·02
3	0·12	0·13	0·01
4	0·22	0·25	−0·03
5	0·28	0·41	−0·03
6	0·57	0·60	−0·03
7	0·82	0·82	0
8	1·10	1·10	0
9	1·41	1·38	0·03
9·5	1·59	1·56	0·03

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

Building blocks for the novice

by SVEN WEBER, G8ACC*

Diodes, diodes and diodes — and some experiments with them

(Part 7)

Constant current devices

In this part the intention of only talking about diodes has been modified with descriptions of circuits using transistors and other semiconductors, although in Part 6, almost incidentally, a transistor crept into one of the circuit diagrams.

Current sources, as was explained in Part 5, are devices that pass a fixed current independent of the voltage or, rather, potential difference across them. As with voltage sources, they are a concept that can only be realized in a perfect form theoretically, but nevertheless they can be made in a practical form if one does not insist on their being too good. To start with, one can define a figure of "goodness" for current sources, as in Part 6 with voltage sources, but this time it would be more convenient to have that expression upside down, that is $\frac{Z_{out}}{R_{out}}$, so a perfect constant current source would have a goodness factor (gf) of ∞.

It *is* possible to make a diode that is rated at a certain current and which holds that current quite accurately independent of the pd across it, within limits. Rather like a zener diode rated at a certain voltage irrespective of current through it. However, as far as the author is aware, diodes specifically made for this kind of use have only recently been put on the market. Surprisingly, it so happens that ordinary semiconductor diodes, biased in the reverse direction, have approximately this property over a limited range of pd. This applies particularly to the older germanium power types that had reverse currents in the milliampere range, rather than nanoamperes for modern silicon diodes. The reverse leakage current of *some* of these germanium diodes, although heavily dependent on temperature, stays more or less constant from under half-a-volt pd up to several volts. That is, if the local heating effect of the power being dissipated in them does not increase the leakage current—and above a certain pd across them (which can be found experimentally and which is markedly different if one compares any ~~two~~ diodes, even of the same sort), this effect becomes very marked if this pd is held across them for any length of time. Although these diodes obviously were not designed for constant current use and will differ widely in their characteristics, the effect can be used and is worthwhile investigating.

The series of AEI germanium power diodes type GJ-M would be suitable for this. Normally the reverse currents

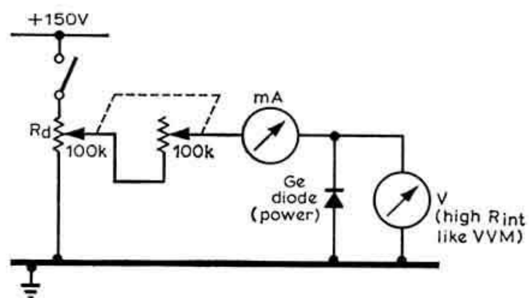


Fig 39. Circuit for investigating constant current curves

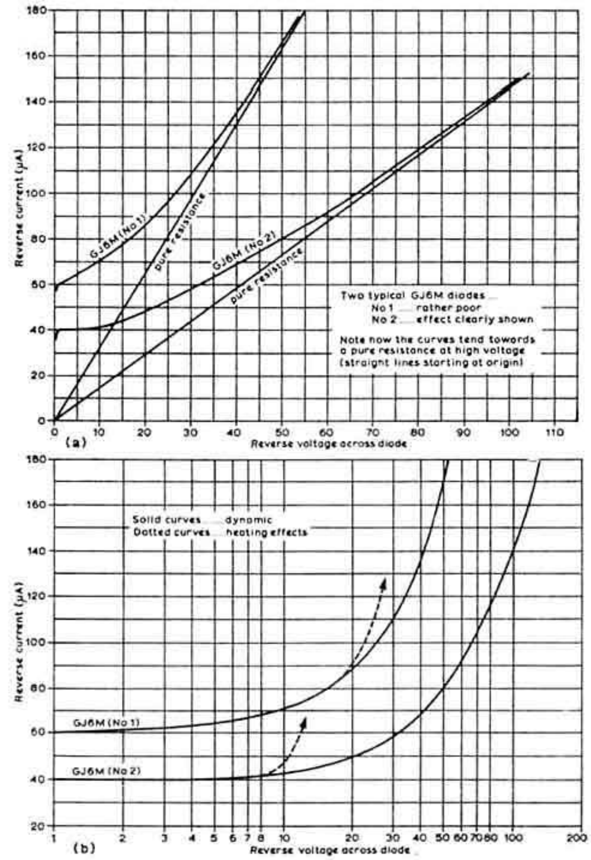


Fig 40. (a) Constant current curves for two randomly chosen GJ6Ms on linear paper. (b) Constant current curves for the same diodes on semi-log paper

* 132 Murray Road, Rugby, Warwickshire.

would increase in the following order: GJ5M, GJ3M, GJ6M and GJ4M from about 10μA to 2mA at 25°C, although one cannot assume that a given diode will pass the average reference current or even behave this way at all. However, take a diode of this series and put it into a circuit like Fig 39 and make a graph of diode current at various voltages (eg 0·5, 1, 2, 3, 5, 8, 10, 15, 20, 30, 40 and 50 and, if a high voltage diode is used, 80, 100, and 150V, applying the voltage only for a second or so) on linear or semi-log paper. If the diode is a good specimen, and some are not, one can expect it to look like Fig 40. Incidentally, a couple of points about this circuit: the ganged potentiometer is to protect the meter should anything go wrong, and if a GJ4M diode is used, the source must not be more than 75V (150V can be lethal). The voltmeter should also be a high resistance model, preferably a vvm.

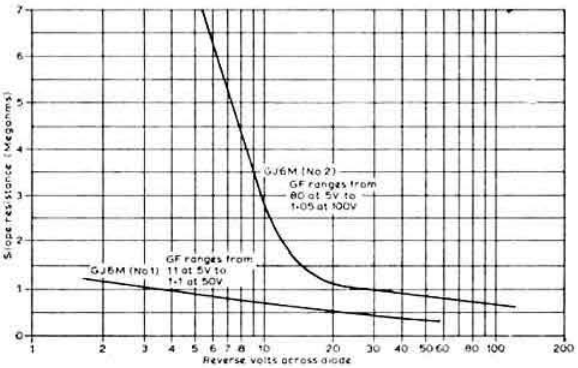
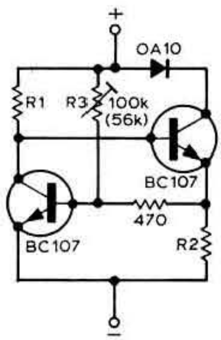


Fig 41. Slope resistance against voltage for the two diodes

Other germanium diodes will have differing currents, but the shape of the graph should be the same. Do what was done in Parts 1 and 5: obtain various tangents to the curve, measure their slope and draw a graph of the slope values compared with voltage to give the ac resistance or impedance; which should be constant, more or less, and of a pretty high value (Fig 41). The gf will have a maximum near the minimum voltage. As was mentioned earlier, the reverse current is extremely dependent on temperature and this can be seen by applying a pd of several volts across the diode and watching the current creep up—or even zoom up like a rocket—due to local heating effects if the voltage is applied for long enough. In spite of this, the diode has a limited range of the right sort of characteristic and can be called a constant current device (ccd), but unfortunately because of temperature effects it is not one that can be relied upon.

So far only reverse-biased germanium diodes have been mentioned. It is possible to get a higher impedance, gf and reliability by using large silicon alloyed diodes, or transistors and FETS operating under special restraint. A germanium transistor with a resistance between base and emitter (working on leakage current) is the simplest, but it is again sensitive to temperature changes (Fig 42). A circuit with the base taken to the junction between a diode and a resistor is better, but only works over a narrow range of voltage (Fig 43), but the current can be set to a convenient figure by R. A very good circuit is due to G. Weston (Fig 44) which has a gf of at least 50. Probably the easiest circuit is a simple fet (Fig 45) where the impedance ranges from 4MΩ down to 100kΩ with currents of from 100μA to 5mA respectively, but because of the fixed resistance in the source lead the gf is not all that good, going down to 15 or thereabouts at high voltages. Commercially available CCDS are of this type, incidentally.



Current	R1	R2	R3
1mA	47kΩ	470Ω	Set approx to 56kΩ then adjusted to give best linearity
2mA	39kΩ	220Ω	
5mA	33kΩ	91Ω	

Fig. 44. Weston's ring-of-two ccd circuit

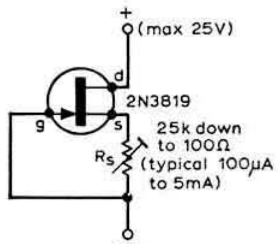


Fig. 45. CCD using fet

But all these models give substantially improved characteristics compared with reverse-biased germanium diodes except in two respects, that a minimum of some 3 to 5V is necessary across the circuit to give anything like linearity and that the maximum pd is severely limited unless expensive transistors are used. But they are all two-terminal devices that can be considered as the equivalent of a diode as far as constant current is involved. A true ccd needs no more than 0·1 to 0·2V pd to get up to a full value of impedance, but diodes of this sort are not commercially available yet.

Returning to the fet circuit in Fig 45, do the same with it as was done with the germanium diode, plotting a graph of current against pd (limit the pd to 25V and the current to 5mA). The result is shown in Fig 46 for various values of R_s

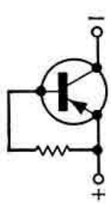


Fig 42. CCD using reverse biased germanium alloy transistor

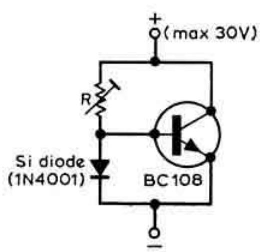


Fig 43. CCD using diode-transistor combination

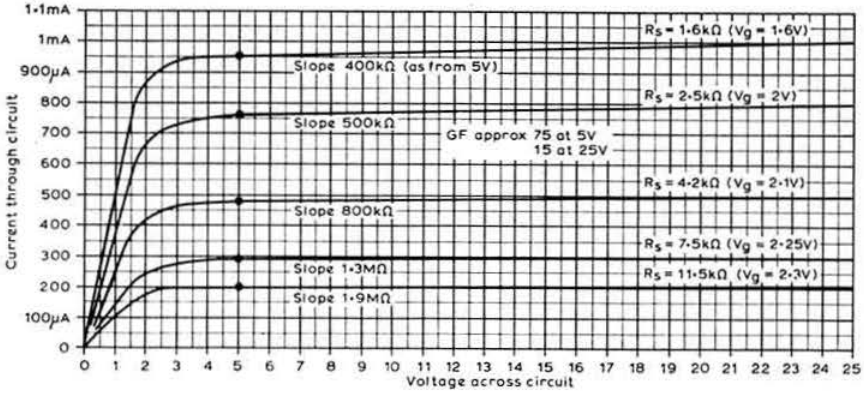


Fig 46. Constant current curves for 2N3819 (unselected) fet

which determines the current. This shows that over a limited range the characteristics are far better than the simple diode, although they are by no means perfect. But even with this somewhat imperfect substitute for a ccd, many circuits can be made that would be difficult or impossible without them. For instance, one of the uses for it was mentioned last month, feeding a zener diode to keep its voltage more constant if the source voltage varied. And the zener would have a lower dissipation at the higher range of source voltage as well. In fact, it is the best way of getting a constant voltage, feeding a zener with a ccd (and the reverse is true as well for constant current). This is because the input voltage is now determined by the maximum ccd voltage (and maybe dissipation) rather than the zener diode and normal R_s dissipations. And also because variations in V_{in} are minimized by the ccd so that V_{in} need not be much higher than V_{diode}, making cascading zener diodes a much more practical proposition. Further, the impedance of zener diodes is roughly constant over a wide frequency band (or is with the small ones), but that of CCDs (due to their capacitance and dynamic resistance) falls at high frequencies, so a capacitor in parallel with the zener diodes will bring the decoupling of a cascaded circuit, as in Fig 47, up to 100dB at 200kHz. The decoupling of Fig 36 (last month) would be only about 40dB at lf, and would get progressively worse as the frequency was raised unless large diodes were used or large decoupling capacitors were strapped across the zener diodes. And, of course, using CCDs for this kind of decoupling can also be useful in combating amplifier feedback due to phase shift produced by RC networks. This is because they not only shield devices from changes in supply voltages but also work the other way round by shielding the supply lines from the devices.

Another use for CCDs would be in RC networks, for instance in oscillators producing an output determined by C and R, like ramp waveforms. Normally the charge curve for a capacitance in series with a resistance looks like Fig 48

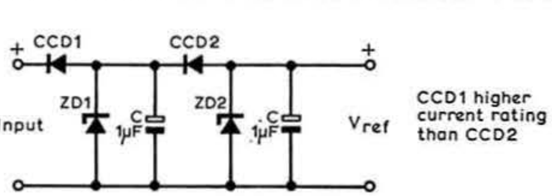


Fig 47. Cascaded voltage stabilizer using CCDs

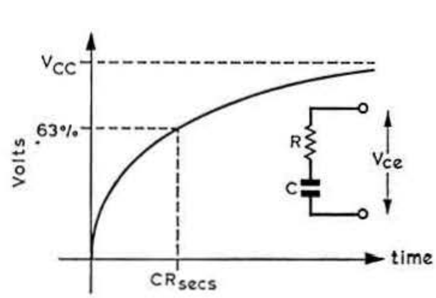


Fig 48. CR charge curve

and even taking small parts of this waveform, it is still pretty non-linear. However, feed the capacitor through a ccd and the change is dramatic. With a high impedance ccd, the waveform becomes as linear as one likes. Of course, one has to be careful not to degrade it by having an ordinary or non-linear resistance in parallel, or at least if one does it must be several tens of megohms (Fig 49). The frequency of oscillation would depend on the current being passed by the ccd (Iamps), the capacitor (Cfarads) and the voltage difference between the top and bottom of the waveform. In a case like Fig 49, where the triggering voltage is dependent on V_{cc}, this quantity comes into the calculation as well. If R_L is small compared with the static uni-junction resistance R_u and assuming that triggering takes place at $\frac{2}{3} \times$ pd across the UJct and that the minimum voltage the emitter falls to is

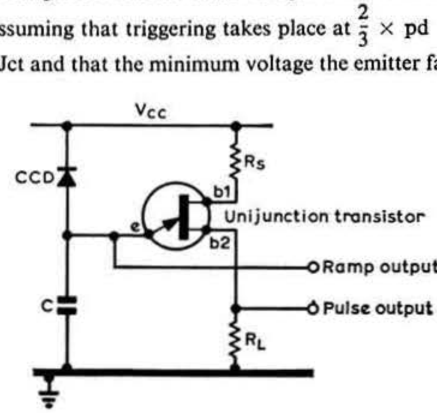


Fig 49. Linear ramp oscillator using uni-junction and ccd

3V, f would be approximately $\dfrac{1}{\left\{\dfrac{2R_uV_{cc}}{3(R_s + R_u)} - 3\right\}C}$

Last month, almost in passing, waveform clipping was mentioned as a use for zener diodes. Unfortunately, if square waves are wanted, zener diodes by themselves leave something to be desired as their clipping is quite rounded. But put a ccd in circuit and supply it with a few more volts (peak) than the zener diode rating and beautiful square waves will result at least at low frequencies (Fig 50: the two CCDs back to back are to cope with ac).

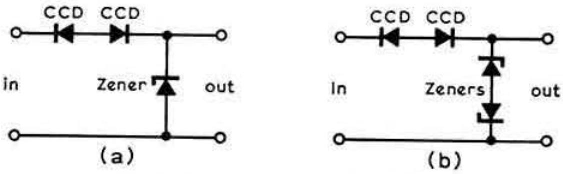


Fig 50. Wave squarers using CCDs

Probably the most useful application is as an amplifier load resistance—perhaps as an anode, collector or drain load in valve, transistor or fet respectively. With any amplifier, if the load resistance is R_L, the anode (collector/drain) impedance is R_a and the output change in current as against input change in voltage is g_m, the realizable gain for an output voltage across R_L will be $g_m\left\{\dfrac{R_LR_a}{R_L + R_a}\right\}$ by proportion, and if the impedance of the ccd that is used as a load is reasonable, the gain will be much higher than with a normal load resistance. There is only one drawback: how does one stabilize the mean dc voltage at the output terminal so that the amplifier does not bottom or switch off? The answer is by controlling the working point with some negative feedback and an example is given in Fig 51. If the 10kΩ resistor (R2) that is used as a load for TR1 is replaced by a ½mA ccd (say, a fet), the gain typically goes up from about 75 to 500 (voltage gain).

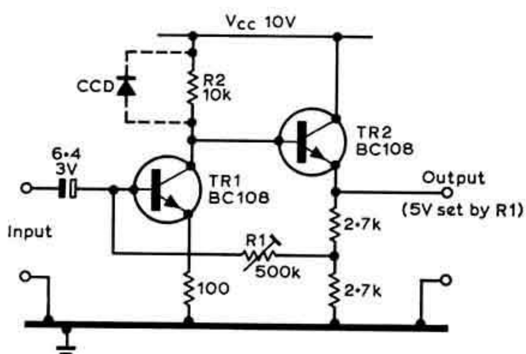


Fig 51. Amplifier using a ccd as a load resistance

Similarly in the common collector mode(and the equivalents), or emitter follower amplifiers, the load can be replaced by a ccd. If this is done, the voltage gain can be far closer to unity than with a plain resistor and the transistor dissipation will go down. This has applications in long-tailed pair or differential amplifiers (see Fig 52), and is almost invariably

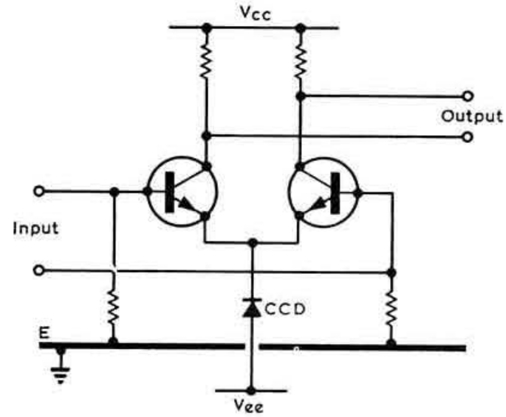


Fig 52. Long-tailed pair amplifier using a ccd

used in a somewhat different form in linear integrated circuits that have amplifiers of this type.

In Part 8: RF characteristics of signal diodes.

BOOK REVIEW

THE ARRL ANTENNA BOOK (13th edition). *QST* format (6½in by 9½ in). 336 pages, copiously illustrated. Obtainable from RSGB, 35 Doughty Street, London WC1N 2AE. Price £1.70 inclusive of postage and packing.

The general manager of ARRL, John Huntoon, states in the preface that the purpose of this volume is "to assemble such of the available information on antennas as may be useful to amateurs"; the multitude of aerial types and the immense range of frequencies involved make the task no light one. Readers of the previous editions will know what a help to understanding and good design this book has been, and the present edition represents the most extensive revision the publication has received in 25 years.

The earlier chapters still cover the fundamentals of wave propagation and aerial theory, but many supplements have been made in the light of new knowledge. The first five chapters deal with the principles of aerials and transmission lines, wave propagation and its relationship to aerial design, and the performance characteristics of directional aerial systems. A large section describes the use of the Smith chart in solving transmission line problems, with examples shown in detail.

Further chapters give complete data on specific designs for multiband aerials, 1·8MHz aerials; 3·5 and 7MHz aerials; 14, 21 and 28MHz aerials—a chapter to each group. A new chapter deals with the problem of aerials in a restricted space. VHF and uhf aerials get generous and detailed coverage. A notable expansion is in the information on cubical-quad aerials; and there is an addition in the design and construction information on log-periodic aerials.

Other new chapters deal with measurements, and a most interesting coverage of specialized aerials which are not so familiar to the amateur: such as the Beverage, the Sterba array, discone, conical monopole, fishbone, bobtail curtain, and the multee aerial.

The remaining chapters deal with the construction of wire aerials, rotatable aerials, mobile aerials, and a short one on finding directions; though the azimuthal maps are centred on points in the USA there are explanations and calculations which have a general interest.

No one needs to emphasize the supreme importance of an aerial system being well designed to make the best of the individual circumstances of the amateur station. A study of this excellent and interesting manual should make this possible and be a sound investment of time and effort. *T. P. A.*

FOUR METRES AND DOWN

by JACK HUM, G5UM*

Far north with A3J

As a demonstration of sideband's potency for long-haul, the GM3NAS/8FQE/P expedition to Scotland won plaudits from all who lay in wait for it on 144·17 during August early mornings and evenings. Only G4BPY of Walsall worked it in every county visited, from Clackmannan to the Island of Skye (which is Inverness), but numerous operators as far south as Sussex and in London caught it as far north as Banff. To allay rumours it is confirmed that the expedition did not visit Ross & Cromarty (no sites).

In all, six GM counties were activated to produce 489 contacts, all on ssb apart from one fm station, and a handful of cw, most of which found the expedition's signal level high enough to warrant a change from A1 to A3J.

Equipment used: 10-el fed by 400W p.e.p. and SB101 as prime mover. This was estimated to give about 15dB gain above that radiated by conventional 10W output stations: if the expedition station was less than S3 people wasted their time calling it. Higher power paid off at extreme range (but is of course wasted if you are talking to the man on the next hill, if we may state the obvious).

Something which impressed the three operators (G3NAS, 'NLY and 8FQE) was the high level of ssb activity in Scotland. "Why don't the G and GW men turn their beams north more often?" was a persistently heard request. The 'NAS/FQE sortie will no doubt persuade many that it is well worth doing so.

Repeating in VE7

While visiting Canada in August GM3DXJ was able to operate as GM3DXJ/VE7 and to learn what it is like to operate through the three 2m repeaters sited high on the mountains around Vancouver. Ranges achieved are customarily 100 miles, right down to Seattle in W7.

Tom Holbert says that operating discipline is impressive. There is no ragchewing: once a contact has been established it is customary to move to a simplex channel if the other station is within range. If he is not, QSO is maintained by short contacts at intervals of a few minutes. Always, the keynote is "Consideration for others who wish to use the repeater".

Access to VE7 repeaters is by carrier-on: no tone-burst is used, but there are safeguards such as "time out". All this is on 146–148: the remainder of the band is dominated by fm telephony.

Progress at GB3VHF

How best to resolve GB3VHF on its new frequency of 144·15MHz? Many ssb users have asked. The transmitter at Wrotham is nominally on 144·15 during "space" and about 1kHz higher on "mark", when the callsign is being sent. When listening to it on an ssb receiver zero-beat the carrier: the fsk is then into the passband.

* Houghton-on-the-Hill, Leicester LE7 9JJ

The GB3VHF crystal starts at 4MHz. During the resuscitation operations G3COJ built a tripler to 12MHz along with a bandpass filter at 12MHz to kill any output ±4MHz (the crystal frequency) away. Power output is 7W and there is a 40W pa coming along for installation when G3COJ has completed a thorough soak test of both it and its psu.

Further to the beacon scene, G2FNW high up on the Leicestershire wolds reports regular reception of the Dunstable Downs GB3DD on 23cm, and notes a marked increase in QRK (often to S9) when a rainbelt is approaching, followed by a sharp drop as it passes through. Farther north GB3DD is good copy with G3EHM on his 700ft ridge near Stoke on Trent.

Mode and code—again

Of last month's contributors to "Your Opinion", one at least supported the viewpoint consistently sustained here: that the vhf man should equip himself to use as many modes as possible, and that to exclude any (though some are more difficult than others, eg rtty, slow-scan, video) is to deny oneself converse with a circle of interesting people.

Ultimately, it is very much a matter of choice—and the pursuit of the art of radio communication provides this in profusion. Choice persuades one man to stick to one mode—maybe to one frequency in the 2m band—but choice impels another to spread himself more than this by trying several modes on various bands. It all turns on what the individual wishes to do; no one can deny him the exercise of his choice so long as it is accompanied by a decent signal and decent manners.

The same goes for the new licensee's exercise of choice when deciding to go all bands (Class A) or vhf only (Class B), also aired last month. The following statistics which one has deployed when speaking at radio club meetings tell their own story:

Rate of increase of Class A and Class B licences

Year	New Class A licences	New Class B licences
1969	702	519
1970	660	780
1971	560	750
1972	688	870
1973	466	614
1974 (first five months)	377	595

Another statistic: last month's NFD table listed 93 contestants. On the next page a routine 2m contest table listed 102, plus another 12 listeners. The exercise of preference on the British amateur radio scene today should be plain to all.

The dx clip

From ZB2BL comes a list of UK stations worked on 4m from ZB2VHF on 21, 23 and 24 June as far north as GM and GI, totalling 44 contacts and five "gotaways". Jim Bruzon checks 4m every weeknight from 1800gmt.

On the m-s front on 2m G3WSN was busy during the

August Perseids, and although some of the schedules aborted, that with SM3BIU gave a complete QSO. Even more rewarding was a contact with OK1VHK on ssb on 12 August believed first G-to-OK on meteor scatter using A3J, with a slightly alarming undertone: other G stations began to call the OK at random, evidently believing that he was audible by tropo!

For GW3ZTH the Perseids produced a good contact with DL7QY in Berlin, followed by another on 16 August. On 23 August 'ZTH and neighbour GW3NJW tried a diversity experiment on the DL. There were occasions when one could hear the German but not the other. Their regular m-s schedule with DL7QY is: GW3ZTH Fridays 2330gmt, 5min send and receive periods, with 'ZTH sending first. GW3NJW Saturdays 2330gmt using 2min send and receive periods, 'NJW transmitting first, all on 144·025MHz, and a challenge indeed to any skilled telegraphist listener and weak signal winkler.

How it is in VK3

During a brief visit to his native England, VK3ZBB was able to give us an insight into the metre-wave scene in Victoria, where he has been domiciled these past 14 years and enjoying every moment, to help supplement what we read in the Melbourners' lively journal, *The Victorian VHF-er*.

Bob Arnold told us that the ultimate in vhf dx from most parts of Australia was to work Japan on 50MHz, a band which, though as dead as 10m at the present point in the cycle, has a habit of bursting wide open to produce JA contacts in great numbers. It has been noted consistently that 6m will open to Japan earlier from Rockhampton up in Queensland than its does from Melbourne 1,100 miles to the south, maybe because there is a good sea path. Even so, the Rockhampton to Tokyo QRB is still over 3,000 miles, equivalent to the UK-USA path—which goes to show what could be done on 50MHz if it were available to British amateurs (as indeed it was by limited licence 25 years ago, right at the tail of the 11-year cycle when nothing could be done with it . . . and anyway television, then imminent, clobbered *that* one).

The Pacific ITU regulations that give the Australians the 50MHz band also present them with *four megs* on 2m, a situation which allows room for all modes to spread themselves and repeaters to flourish. The popularity of repeaters may be attributed to the wide use of fm on 2m, not from any particular choice but simply because nearly all the surplus vehicle radio boxes coming on to the surplus market happen to use that mode.

Single sideband is a growth mode on 2m, but the easy way in via the Liner 2 has not yet hit Australia: the device costs twice the UK price because the import duty on Japanese metre-wave gear is so high.

Another growth area is "the ultra highs" both on 70cm and 23cm. Bob Arnold, favoured with a clear site at 260ft asl, can push 23cm rf right over the top of the city and out across the sea path to Tasmania, more or less at any time irrespective of conditions, with an output of 3W. But it must be said that he makes the most of his site's capabilities: there is a tilt-over, locally-made tower which carries all the beams. Grouting it into solid volcanic rock, added 'ZBB, was a job he hopes never to have to face again!

On the subject of masts and towers, a perennially sensitive one in Britain, Bob Arnold tells us that increasing resistance to them is occurring in Victoria, but with the authorities holding the radio amateur in proper respect, and given a well-argued case, this resistance can generally be reduced to a nil value.

. . . and in Europe

Helpful advice for intending radio holidaymakers abroad comes from "Four Johnny Johnny", Jack Ward of Barnsley, one of the best-known vhf mobileers in the UK, and known on the Continent as F0AAV, ON8KJ *et al.* Recognizing that numerous UK men will take Liner 2s across the channel, he recommends using the top channel on this box, 144·330MHz. Here replies to CQ calls will be noticed. Lower down they will be clobbered by fm repeaters which still have not been moved under the new European band plan. "What a surprise to me to find our Continental friends were dragging their feet," says Jack Ward. He doubts if the repeater moves will be complete before another 12-15 months.

In France, stations use both the QRA locator system and their *département* numbers. A visitor may check which *département* he is in by observing the last two figures of local car number plates. In Belgium the province is given over the air (never confuse Luxembourg province in ON with Luxembourg, LX, advises "Johnny Johnny").

His many trips abroad allow Jack Ward to hear UK procedures as *others* hear them: "Pretty good with only the odd fellow making himself a nuisance by breaking in during a contact, or, when I gave a directional call to ZN locator, getting practically every other zone calling me instead . . . just misplaced enthusiasm but at the other end it sounds like bad manners and bad operating procedure."

Contest topics

The RSGB Region 1 VHF Contest in June brought a bigger-than-ever entry, reports G2CUZ. Best scores, adds Norman Horrocks, were 36 on 70MHz with Gibraltar QSOs enjoyed by G3XIM/P and G3XSN/P (others missed out on ZB2VHF because they failed to listen out for cw); 37 on 432MHz and over 150 on 2m. The new G3SMM Shield goes to popular GD2HDZ, who won the single-operator section. The Ainsdale Club won the G2CIP Shield as top notchers in the multi-operator table, and G4BWG was top of the outside-the-region participants.

Winners of the WAB VHF Contest, 1974, were G4ANS (multi-operator, with G4CNG) and G8IQQ/A single operator. All information from G4BFY, WAB Contest Manager.

A spate of "Seniors"

To look back to August and a record number of seven Four Metres and Down Senior Awards issued in one month is to gain the impression that the ssb revolution has simplified certificate collecting. The dx is today much easier to work than it was a year ago. But getting the cards in remains no easier, and many a would-be claimant finds himself stuck on a maddening 12 + 55 as the flow of incoming cards follows an asymptotic law.

Getting any kind of "Senior", then, is difficult, some are more difficult than others, and probably the hardest of the lot is the 4m one by reason of the scattered nature of the 70MHz population (no Class B men on 4m to fill it out). So special plaudits go to G3JYP for earning himself 70MHz Senior Award No 17, only the second one to be claimed this year (John Reed of Luton got the other last April from

G3ZMD). Bill Capstick makes light of this success: "I suppose I am pretty well placed for county working, being about half way between Lands End and John o' Groats", which would be true enough if there were plenty of 4m activity in the counties surrounding his small town of Appleby in Westmorland (Cumbria to county chasing buffs from 1 January next). To most of us he is very much out on a limb, which adds lustre to his award. At his valley location a 12-el stack is at present in use. It gives a lower angle of radiation than the 4-el Yagi and reduces meteor pings that carve up distant low-level cw signals—and there have been plenty of these: 'JYP submitted 46 cards for cw contacts, 12 for a.m. and four for ssb.

Sideband's proliferation on 4m will ease the dx-working problem, more especially as every operator being a Class A licensee is prepared to employ cw for cross-mode contacts when the need arises. Even on 2m, where plenty of ssb activity is available to help along the pursuit of 15 plus 60, cross-mode capability is still valuable, and was indeed much in evidence during the recent GM3NAS/P operations in N Scotland. For most of the time, though, single-mode capability (ie sideband only) will do the trick because there is now so much A3J around on 2m.

What if single-mode capability should be cw only? It has been the wish of G3DAO ever since he first came on to 2m in September 1970 to earn the 144MHz Senior Transmitting Award wholly on telegraphy, not altogether a self-denying ordinance, for Peter Cutler, like many operators who take A1 seriously, prefers the mode to any other. In the ensuing four years 2,098 contacts via the fingertips were made on 2m in 21 countries and 68 counties from a sea-level site on Selsey Bill. Now Senior Certificate No 59 is on his wall.

Another unusual claim was that of Martin Briscoe, who in the course of his work travels the length of the kingdom and is able to put G(GM, GW)8AOB/P on the 2m air from exotica such as Cornwall and Shetland, taking in the summit of Ben Nevis on the way, all of which should have been incentive enough for the other fellow to "QSL for sure." Many failed to do so. Others omitted the vital /P from the G(GM, GW)8AOB callsign. All came right in the end—and Senior Certificate No 60.

Near neighbours GW3NNF and GW8FOL look like rare dx and rare prefixes to distant Continentals, but to get to them they are compelled to fire through Welsh mountains and much of England en route. Now they hold Seniors Nos 57 and 63 respectively thanks to penetrative A3J, which even earned them auroral contacts in season. To Ray Evans G4AGE, in N Derbyshire goes Senior No 58 (he now has ssb active on 432·2 as well as 2m), No 61 to G8ATS way out in East Anglia and No 62 to Bill Raybould of Dudley, most of whose cards were for G8FUI plus a few addressed to G4DFE (yes, it is quite in order to submit verifications for a former and a current callsigns, so long as the station remains in the same place).

Apropos single-mode attempts to win an FMD Award, Ron Winson of Reading set himself the target of securing the Standard Certificate within 12 months of being licensed as G8HWO and using fm (phase mod) only. He did it in eight and gets parchment No 399. He hoped to be the first G8H—to achieve it, but was pipped in a matter of only two weeks by G8HPD in Herts, who got himself No 398, and by G8HSX last February.

Microwave operating awards

A member will be entitled to claim a Four Metres and Down Operating Certificate for the first contact he makes on any of the five microwave bands as follows:

13cm 500km or farther	**3cm** 150km or farther
9cm 400km or farther	**15mm** 150km or farther
6cm 300km or farther	

Claims, supported by a verification card, to G5UM, VHF Awards Manager.

Other standard awards for 2m go to G4ALB (No 395), G2CDX (396), G8GMU/P (396A), G8DML/P (397).

On 4m, certificate No 113 goes to G3CDG/P, won largely by consistent operating on the Cotswolds near his home at Cheltenham.

And on microwaves a certificate to G3VPF/P for his first contact beyond 150km on the 3cm band. Esoteric? Not a bit: this was Award No 17 in the 10GHz category, and goes to confirm once again the significant developments proceeding in this area of amateur activity.

From the IoW came the first 70cm claim to be received by the VHF Awards Manager for five months. Fred Parkman dug out some cards dating back as far as 1966 and found he had more than the needful three plus 20 to earn G8AHF the 432MHz Standard Transmitting. He gets No 109. He put in a double claim and gets No 400 in the 144MHz Transmitting clip.

Here and there

A repeater fund to help finance the proposed central Scotland repeater (callsign will probably be GB3CS) has been opened by the Central Scotland FM Group. Donations large or small will be welcome, and should be sent to the treasurer, GM8DIJ, at 39 Marionville Rd, Edinburgh.

Positioning beams on to ssb stations is difficult because signals do not stay on long. When using A3J announce your location to help the other man get a fix on you.

The 1975 *RSGB Amateur Radio Callbook*, due out at the end of this month, closed for press at the end of August. Since then many new callsigns will have been issued; if yours is one of them, say where you are every time you send CQ.

Reiteration in this column about the charms of 70cm as a local net band is having effect. Portsmouth/Southampton members meet nightly on the band at 8pm, we are told by G8AHF. Four are equipped for 23cm. Ditto in the Kettering/Corby complex: here a talk-link operates regularly on 433·2MHz.

New name, same product: J-Beam are now Jaybeam Limited, with a new address, Moulton Park Industrial Estate, Northampton NN3 1QQ (the Q is appropriate).

What they say

"Now we are near sunspot minima some of the hf dx boys might care to take down their quads and tribanders and put up a similar size of array for 4m (or 2m) for a change and a new experience. After all, they can buy a Europa for either band to plug into the back of their transceivers!"—G3JYP.

"Far too many operators spend about 10-15min listening on the cw end of 2m and, hearing nothing, either go QRT or belt off up to the phone end. To do any good at cw you have got to stick at it . . . bags of patience"—G3DAO.

"I support G8CXV's criticism of repeaters (September) . . . a

VHF/microwave records

The following list of believed-current metre-wave records is compiled from the records of G3RPE and G5UM. Neither of them claims that it is either wholly up to date or exhaustive: the next "lift" may render some of the information redundant overnight. Members who may have been responsible for setting up new records are therefore invited to furnish the details, so that appropriate amendments may be made to the list below.

Band (MHz)	UK	Europe
50	G5BY-ZS1P, 6,000m, Nov '47	EI2W-XE1PFE, 4,200m, 16 Nov '58
70	GM3EGW-ZB2VHF, 1,430m, 11 June '67	GM3EGW-ZB2VHF, 1,430m, 11 June '67
144	G3DAO-LZ2FA, 1,350m, 23 June '74	EI2W-YU1EXY, 1,387m, 4 July '57
432	GD2HDZ-OE2OML, 856m, 13 Oct '72	GD2HDZ-OE2OML, 856m, 13 Oct '72
1,296	G4BEL-OE2OML, 640m, 20 Jan '74	G4BEL-OE2OML, 640m, 20 Jan '74
(GHz)		
2·3	G3LQR-DJ2HF/P, 272m, 20 Jan '74	G3LQR-DJ2HF/P, 272m, 20 Jan '74
3·4	G3BNL-G3EEZ/P 98m, 23 April '73	—
5·6	G3BNL-G3EEZ/P, 98m, 23 April '73	—
10	GW4BRS-GM3OXX/P, 152m, 11 May '74	GW4BRS-GM3OXX/P, 152m, 11 May '74
21	G3BNL-G3EEZ/P, 45m, 12 Nov '72	G3BNL-G3EEZ/P, 45m, 12 Nov '72

Band (MHz)	World	E-M-E
50	LU3EX-JA6FR, 9,200m, 24 Marh '56	—
70	GM3EGW-ZB2VHF, 1,430m, 1c1 June '67	—
144	W6NLZ-KH6UK, 2,540m, 8 Jul '67	SM7BAE-ZL1AZR, 11,055m, 4 Mar '69
432	WODRL-K1PXE, 1,205m, 17 Aug '71	K2UYH-VK2AMW, 10,000m, 10 Mar '73
1,296	WA2LTM-W9WCD, 770m, 26 Oct '72	WB6IOM-G3LTF, 5,492m, 27 April '69
(GHz)		
2·3	W4HHK-WA4HGN/4, 249m, 11 Jul '70	K4RJ-W6YFK, 2,000m, 22 Nov '72
3·4	W6IFE/6-K6HIJ/6, 214m, 18 Jun '70	
5·6	W6OYJ/6-K6HIJ/6, 214m, 18 Jun '70	
10	W7JIP/7-W7LHL/7, 265m, 31 July '60	
21	G3BNL-G3EEZ/P 45m, 12 Nov '72	

cheap telephone system, nothing else. As for fm operation on fixed frequencies (frequencies, not channels, is what we are allocated in the licence), how some users passed the RAE I don't know!"—G3RND.

"For over 150 miles of the 200-mile journey London to mid-Wales I am inside the service area of one or other of the repeaters. Activity is concentrated, coverage is more complete, and there is always someone to talk to, even at 3am!"—G8CKT (writing in *London FM Group Newsletter*).

"It is most encouraging to hear and work an increasing number of G4 + three stations in the cw end of 2m; all credit to them for learning the code *and using it* . . . I am relieved to know that there are a few of us left who realize there *is* a mode of communication other than ssb"—G3DAO.

"Apropos 'Now where was I?' discussion in *FMD*, many fixed stations who have a go in 2m and 70cm contests would refrain from putting in a log if they were forced to use a QRA Locator map for scoring their contacts. A road map is much easier and quicker to use, from past experience"—G4DBW (ex G8HBA).

"Surrey Radio Contact Club has moved the club net frequency to 145·35MHz to conform with the new band plan"—G4DDY (ex G8GGX), chairman.

Valediction

Now, after 8·5 years behind the *FMD* typewriter one feels it is time to pass on this job to a younger practitioner of the metre-wave art. Few would deny that G3NHE is one of the most active, well-informed and well-equipped operators on the "427" scene, and one is glad Martin Dann has accepted an invitation to take over the reporting of that scene with effect from the November issue. Your future contributions to him, then, at 49 Windermere Court, North Anston, Sheffield.

Repeater frequency planning

by A. H. B. BOWER, G3COJ, and G. M. C. STONE, G3FZL

THE advent of repeaters in the UK began with the licensing of GB3PI on an experimental basis in August 1972. Further proposals followed for repeaters in the Bristol Channel area (GB3BC), London (GB3LO), Malvern Hills and Four Marks (not yet operational) and the RSGB VHF Committee was asked to suggest frequencies.

IARU Region 1 had designated 10 channels, R0 to R9, with the output frequency 600kHz above the input—see Table 1. GB3PI was already on R6 and the same channel was chosen for GB3BC. This was (and is) in the nature of an experiment—if two repeaters could co-exist on the same frequency (though perhaps with different access tones) the number of crystals required by users would be reduced. If the interference were excessive one of the frequencies could be changed. Similar arguments applied to the London and Malvern Hills schemes for which R7 was suggested.

More repeater proposals were submitted and it became evident that a comprehensive plan was needed. It was desirable for the plan to be ahead of events, not behind as the band plan had become. A group from the VHF Committee consisting of G3COJ, G3JHM, G3NUE and G8AXA had worked on the new 2m band plan and helped to bring about the plan which came into effect in February 1974, and the same group, with G3FZL replacing G3NUE, was asked to look at repeater frequencies.

This was a much more difficult task. With a band plan, the requirements in terms of modes and frequencies available are clearly known. With repeaters, a good crystal ball is needed to tell where interest in them is going to arise. To obtain an idea of the density of amateur activity and hence, it was hoped, the likelihood of repeater proposals, the location of all RSGB Affiliated Societies (except for overseas and non-localized ones such as BATC) was plotted on a map of the UK. This showed an area of maximum density running from London through the Midlands to the North-West. It was therefore decided that a plan should have maximum allocation density in this area, falling away gradually on either side.

Moreover, it was necessary to consider how the channels should be distributed in order to minimize intermodulation. For example, a receiver in a strong signal area from Channels 5 and 6 might have difficulty if it were actually trying to receive a signal on Channel 4 or 7, where the third-order intermodulation products from Channels 5 and 6 would be generated in the receiver. Both G3HWR and G3ZGO have written interesting, though unpublished, papers on this subject and grateful acknowledgement is made to them for their work. However, the problem is only likely to arise with

Table 1. Frequencies of IARU channels

Channel	Input	Output	Channel	Input	Output
R0	145·0MHz	145·6MHz	R5	145·125MHz	145·725MHz
R1	145·025	145·625	R6	145·150	145·750
R2	145·050	145·650	R7	145·175	145·775
R3	145·075	145·675	R8	145·200	145·800
R4	145·100	145·700	R9	145·225	145·825

Table 2. 144MHz repeaters

Proposed or actual allocations

Channel R2	Bacton (GB3NB)*
Channel R3	Barnsley (GB3NA)*
	Martlesham (GB3PO)*
Channel R4	Newquay
	Buxton (Sheffield University)
Channel R5	Belfast
	Birmingham
	Four Marks, Hants (GB3SN)
Channel R6	Mynydd Machen (GB3BC)
	Barkway (GB3PI)
	Central Scotland (GB3CS)*
Channel R7	Crystal Palace (GB3LO)
	Aberdeen
	Malvern Hills (GB3MH)*
	Scottish Highlands (Rannoch)
	Torbay

*Callsign provisional and subject to Home Office approval

several repeaters in the same or nearby sites, and before this stage is reached it is hoped that they will have spread to 432MHz or 1,296MHz to take the strain off 144MHz.

Considering actual frequencies, R0 input is 145·0MHz, a popular mobile and more general calling channel which is unlikely to be used in the UK as a repeater input. R8 output (145·8MHz) is a widely used net frequency, especially for Raynet, and its use as a repeater output might lead to problems. This leaves eight channels, R1-7 and R9. Several possible plans were produced using R1-7 with R9 as spare. This was subsequently reduced to five to reduce the number of crystals users would have to buy, leaving the other channels as reserves. Table 2 shows the channels suggested for repeaters in action or proposed at the time of writing.

Repeaters are as yet experimental and it is impossible to say how they will develop. Perhaps there will be a national network on 144MHz with regional coverage on 432MHz, eg in the are of the town. There is also the possibility of using 12·5kH spacing at a later date. Also some groups are developing ideas for linear repeaters—should these be in band or crossband? If the latter, what bands? eg 70cm in, 23cm out, or vice versa.

In addition to the 2m band repeaters already mentioned, three proposals for 70cm in-band fm repeaters have been submitted to the RSGB. The first of these to be submitted to the Home Office was that of the Pye group for a repeater to be located in Cambridge using the frequencies of 431·25 MHz in and 433·25MHz out. The input conforms to standards accepted in Germany and Switzerland but the output is kept below 433·5MHz to avoid possible interference to amateur television.

The RSGB VHF Committee will do its best to see that development occurs in a planned and orderly manner. Your comments are invited, especially in respect of new developments such as uhf or shf repeaters.

Paper received

"Back-scatter results from Lindau—1. Observations of radio aurora." P. Czechowsky, W. Dieminger and H. Kochan, *Journal of Atmospheric and Terrestrial Physics*, 1974, *36*, 955–966.

Radio amateurs, and particularly those participating in the RSGB Scientific Studies programme, will be interested in this paper which was published recently. It summarizes an analysis of auroral signal observations, using amateur beacons as signal sources, which has been carried out at the Max-Planck Institute at Lindau/Harz. The measurements were made at various receiving sites from pen recordings of DL0AR, Bielstein (29·0MHz); DL0PR, Garding (145·971MHz); and SK4MPI, Borlänge (145·96MHz), each of which radiates 150W in a northerly direction.

The results confirm the known relationship between the strength of signals, returned with the characteristic flutter from auroral scattering centres located to the north of both transmitter and receiver, and the level of geomagnetic activity. A striking example of this is given in one of the diagrams used to illustrate the way that auroral effects decrease in intensity as the signal paths progress further south. (A point not mentioned in the text, but perhaps worth noting here, is that variations on the northernmost path [SK4MPI—Oslo] bear a remarkable resemblance to the horizontal component of the earth's magnetic field on the accompanying magnetogram from Lovö, Sweden, whereas the paths further south tend to resemble the peaks and troughs defining the vertical component.)

At high latitudes the frequency of occurrence of radio aurora has been shown elsewhere to reach a peak at quite moderate levels of magnetic disturbance, subsequently suffering a decline as the activity increases, an effect due to the auroral belt having moved further south under those circumstances. In this study, however, this effect was not noted, even on the SK4MPI—Oslo path, where a steady increase in the number of observations with increasing magnetic activity was noted. On the southernmost path considered, DL0AR to Lindau, activity became relatively infrequent and only 13 radio auroral events were recorded in the 10-year period 1963-72, all of them at times when the local K index of geomagnetic activity was 6 or greater (on a quasi-logarithmic scale running from 0 to 9).

As the strong correlation with magnetic disturbances implied a close connection with the current in the polar E region which caused them, an attempt was made to determine the latitude of the current maximum at intervals of 30min using a technique involving magnetic data from a chain of observatories situated approximately along a north-south line. A plot of these, taken in conjunction with a map showing where the aerial polar diagrams of the various transmitter/receiver pairs intersect the E-region at 110km (the average height of auroral-E ionization), is shown to offer an explanation for apparent discrepancies in the records where the signal level on one path has reached a maximum while on another it has suffered a decline.

Statistics for all the paths show peaks between 1800 and 2000 and at 0100 local time (all times quoted refer to 15°E). A chart, drawn with polar co-ordinates on latitude and local time, is given in the paper. It outlines the times of occurrence on the various paths in greater detail and reveals a spiral construction which has been noted by other workers whose works are cited among the references. The gap between the two peaks is shown to vary from between 2000 and 2200 on northern paths to between 2200 and 0100 on southern paths. The authors point out that the period was too short to be able to establish any connection with sunspot numbers.

Although the title refers only to auroral observations two other forms of back-scatter are dealt with, using data relating to the DL0AR—Lindau path exclusively. Between 1963 and 1968 the dominating mechanism was Es (Sporadic-E), which showed two peaks daily, at 1200 and 1800 local. There was a shallow minimum in the number of occurrences at about 1400 and a more-pronounced minimum at 0400. The "season" for Es back-scatter is shown to begin in March, increasing to a maximum in June, which is well-maintained into August before declining sharply. A secondary peak occurs in December, leaving minima in February and October/November.

The other form of back-scatter identified was via the F-layer. Instances of single-hop propagation were infrequent, confined to the autumn and winter months between 1600–2200 and 0500–0600. However, a two-hop mode was also present during the winter months, starting when the critical frequency exceeded 9MHz. It involved a reflecting layer situated approximately over Uppsala in Sweden, and seasonal plots of critical frequency of F2 measured at the observatory there have a similar form to plots of the frequency of occurrence of these two-hop F2 ground-backscattered signals recorded at Lindau.

The title of the paper suggests that further analysis of this work involving amateur beacons will be forthcoming at a later date, and this will be awaited with interest by all those who have contributed observations to the international radio-auroral propagation projects.

G3LTP

THE MONTH ON THE AIR

by JOHN ALLAWAY, G3FKM*

IARU Region 1 News dated August 1974 lists the names of countries in Africa who are members of ITU. In all 41 are noted and it is depressing to see that in only 12 is amateur radio sufficiently developed for them to have societies who are members of IARU. In view of the important world conference which is to take place in 1979 it is a matter of the greatest urgency for amateurs to do all they can to encourage the amateur service in the remaining 29. On the day when the votes are counted that cast by the smallest of these territories will rate equally with that of the USA, USSR or UK. Much good work has been done by our representatives who have been present at previous conferences but it is the duty of all of us to demonstrate that we can be of use to the communities in the developing nations.

Roland Whiting, 5B4WR, secretary of the Cyprus Amateur Radio Society, wishes readers to know that the CARS QSL bureau has been transferred to PO Box 1267, Limassol, and that the Famagusta address is no longer applicable.

A letter from ZL1HV has been received in which it is pointed out that permission for Scouts to use the microphone during JOTA has been granted yearly since 1970 and only applies for the duration of that event, and only to those stations who have applied to use their stations for the Jamboree.

Dxpeditions

Jim Henderson, WB6ZCB, Tom Hawkins, 5W1AR/KH6HDA/WA7LFD, and possibly others will be on the air from the Tokelau Is for two months commencing about 15 October. Jim has already been given the callsign ZM7AH, and Tom ZM7AI. During the CQ WW DX contest they may use the call ZM7AJ. All bands 3·5 to 28MHz will be used and ZM7AH will use mostly cw, ZM7AI mostly ssb.

VS5MC made a reconnaissance trip to Spratley Is during August but found that the island was already inhabited and wisely did not attempt a landing. However, Maurice is still interested in putting Spratly on the air and is enquiring from ARRL whether Amboyne Cay or Barque Canada Reef (both located some 100 miles SE of Spratly) would come under the same country heading.

WA6AHF, WA6OEY and KZ5JF are planning a visit to Baja Nuevo (HK0) to take place late in November. Others, including HK0BKX, may accompany them. Both cw and ssb will be used on all bands 3·5 to 28MHz, and the equipment will include Collins 30L1 linears, a triband beam, and dipoles for the lf bands. The group will probably be on the air during the week following the CQ WW DX contest.

News from overseas

G8AKA, of Racal, has provided information on Ambrogio Fogar, I2NSF/MM, who is sailing around the world in his 35ft sloop *Surprise*. At the end of August he had already rounded South Africa on his return journey. The voyage started in Italy on 5 November 1973 and has not all been smooth—the sloop was capsized by a storm in February, holed by a whale in March, and capsized again in May. I2NSF/MM operates mainly around 14,125kHz but can also work around 21,200kHz. He has a Swan SS200 and Hastler mobile aerial and he operates on ssb only. QSOs are restricted to important matters only, as available fuel for the generator is limited. ZL1BAK, who was New Zealand co-ordinator for I2NSF/MM, lists some 28 ZL and VK amateurs who helped while the ship was in their area.

A reminder that the Ex-G Radio Club holds nets on Sundays at 1900 on 14,347kHz for world wide participants, a Pacific net at 0500 on Saturdays on the same frequency, and an Australian net at 0900 on Wednesdays on 3,650kHz. There is also a cw net each Saturday at 1900 on 14,065kHz. UK stations are especially invited to participate. Officers of the club for 1974–75 are Don Rayner, W3CTR, President, L. A. Kelsall, VK2AKV Vice-President, Reg Cherrill W3HQO, hon secretary/treasurer. The UK general secretary is F. W. Fletcher, G2FUX, 53 St Ives Park, Ringwood, Hants, and the UK awards secretary Lt Cdr H. G. Cunningham, G8FG, 235 Station Rd, West Moors, Wimborne, Dorset. Membership is open to those who were born (or whose parents were born) or naturalized in the UK and are domiciled abroad.

G3YKR/MM is aboard the 33ft yacht *Orlando* which departed from the UK late in August for the West Indies and will return in May 1975. Some operation may take place from various islands in the area in the meanwhile. Julian favours 14,295 and 14,320kHz and has an HW32A. He has a schedule with his QSL manager (G3ZSS) and G3TDM at 1730 each Sunday on the former frequency.

G4RZ reports receiving a letter from ZS1JJ—formerly G4BIC—who is an active member of RNARS, in which he sends his best wishes to all.

DX news

There is a new station on the air from Sudan. This is ST2AY (ex-GW3UPK) who will be in Khartoum for 18 months, and has been heard on 14MHz ssb. 9G1AR has returned to Ghana, and John Lunsford (who will be remembered as XV5AC) is also in 9G1. XT2AK has closed down and may move to Mauretania or Niger. George Smith, who is from California, is 5T5GS and will be using that call for about three years. He has been heard around 14,215kHz at 0500. HB9TZ returned to Bamako in early August and has been active again as TZ2A around 14,150 and 21,150kHz. QSLs for his previous Mali operation between 23 February 1974 and 27 March 1974 have all been despatched by his QSL manager HB9AIJ.

7SL2AO is on the air from Umea (Laen AC), and 7SL2AN from Boden (Laen BD) in Sweden during the period August to December 1974. The special callsigns commemorate the

* 10 Knightlow Road, Birmingham B17 8QB

350th anniversaries of the Kungl Vasterbottens and Kungl Norrbottens regiments of the Swedish Army.

A number of callsigns have been used by a pirate station who gives his QSL manager as W2AIM; these include 5X5SL, TY6ATE and 5A1LT. W2AIM points out that he does not act as QSL manager for anyone.

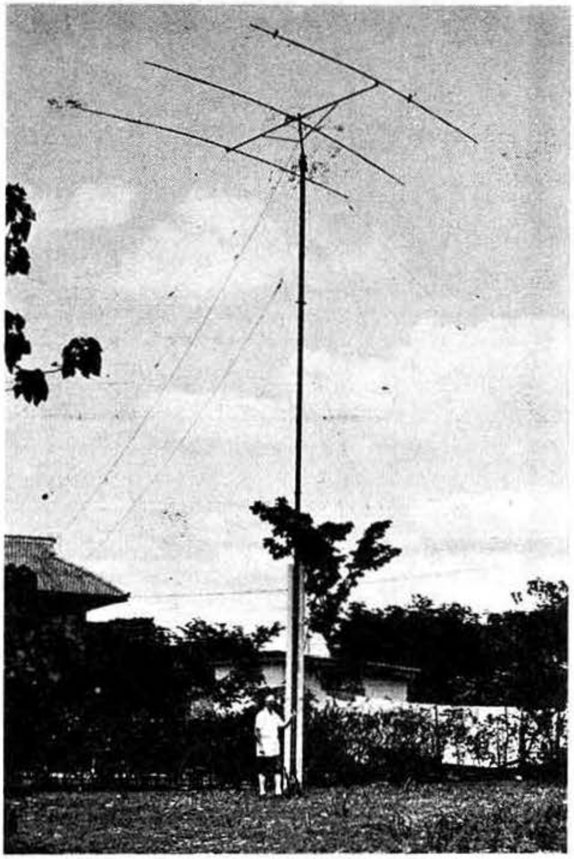
Chuck Allen, 9K2DX, has a Kenwood TS-520 and tri-band beam and will be in Kuwait for two years. WN3VEX/VQ9 is located at Diego Garcia in the Chagos Is and will be there until February 1975. He has been worked on 21MHz ssb.

Latest news of activity on Nauru Is is that five callsigns are active—C21DC, C21NP, C21CT, VK2ZO/C21 and C21NI (the club station). C21JL, C21KM and C21NW are being used as /MM calls, and C21DX and C21CW have been allocated to visiting Japanese dxpeditioners. C21AA and C21DR are no longer on the island and have returned to Australia.

On the 50th anniversary of the first radio transmission by the Italian state broadcasting company an amateur radio station will operate from Rome with the special prefix and call I50RAI. The station will operate on all hf bands from 1 to 31 October. In the same period 46 amateurs who are associated with RAI will use the special prefix IZ and a special diploma will be awarded free of charge to European stations who contact I50RAI plus IZ stations in at least five call areas (non-Europeans need only three). Send QSLs for I50RAI and lists of contacts for the diploma before 15 January 1975 to: RAI, PO Box 6250, Rome, Italy.

K6EC reports that he has all the HC8PS logs for 1971 and 1972 and can deal with QSL requests.

W9ZNY hopes to be in Taiwan during October and to operate from BV2A. It is understood that the latter now has a 14MHz beam.



17 October 1973: the last day 5N2ABG Kaduna, Nigeria was on the air. Eric is holding the guy wire to let down the trapped dipole prior to dismantling the Hornet beam for the final QRT after approximately 10,000 QSOs in seven years. Now G4DGR in Accrington, Lancs, using the same KW2000A but only a long wire as yet.

Awards

The WGSA

Issued by the Gothenburg ARS for contacts with stations in Gothenburg since 31 December 1952. Each contact counts one point and European applicants need 10 points; others need two. Send QSLs and list of contacts, with five IRCs, to: "WGSA Manager", GSA, Box 6009, 400 60 Gothenburg 6, Sweden.

The ZL-74 Award

For contacting 50 ZL stations during 1974, with at least one from each district ZL1–ZL4. No QSLs are required, but certified log data and three IRCs should be sent to ZL2GX, 152 Lytton Road, Gisborne, New Zealand.

The New Zealand Counties Award

For confirmed contacts with at least 20 ZL counties. Endorsements are available for each subsequent 20 up to 100 and a special certificate for all 112. A check sheet may be obtained from ZL2GX for two IRCs, and the award itself costs three IRCs.

The DXCC Award

G4BAL has received a note from ARRL pointing out the fact that the $3·50 application fee for this award (see July *MOTA*) may be remitted in the form of 20 IRCs by UK applicants. The information that the phone DXCC award is not to be discontinued was issued in Bulletin No 493 from ARRL HQ. This contradicts strong rumours that it was to be dropped.

Contests

The CQ WW DX Contests

0000 26 October—2400 27 October (phone).
0000 23 November—2400 24 November (cw).

All bands 1·8 to 28MHz. Exchanges consist of RS/T plus "*CQ*" zone number (UK is 14). Three points are gained for contacts with other continents, and one for contacts with one's own. Contacts are permitted with one's own country for multiplier purposes only—no QSO points may be claimed for these. The multiplier is the total number of zones and DXCC countries contacted on each band added together (DXCC and DARC countries lists are both used). Final multi-band scores are arrived at by multiplying total QSO points by the total of countries and zones worked on each band added together. There are three categories of entrant—(a) Single-operator single- or all-band, (b) multi-operator single-transmitter (all band), and (c) multi-transmitter multi-operator. In (c) several transmitters may operate simultaneously but only one signal may be put out on each band. Entrants should use separate log sheets for each band and follow the layout of the official log form with 40 QSOs per sheet. Log and summary sheets may be obtained from *CQ* by sending IRCs and a large addressed envelope. A *few* summary and log sheets *may* be available from G3FKM. Logs should be sent to: CQ WW DX Contest Committee, 14 Vanderventer Av, Port Washington, LI, NY, 11050, USA. Phone logs must be postmarked no later than 1 December and cw logs before 15 January.

Results of the **1973 CQ WW DX Contests** have been received and are as follows:

CW SECTION

Single-operator, single-transmitter

Callsign	Points	Band	Callsign	Points	Band
G3MXJ	**696,102**	**All**	G3RZI/A	179,144	14MHz
G3LNS	688,584	All	G3JKY	22,700	14MHz
GM3CFS	**134,429**	**All**	G8DI	8,991	14MHz
GW3SYL	108,330	All	G3UJG	6,090	14MHz
GW4COP	104,920	All	**GI3OQR**	**182,400**	**7MHz**
G2AJB	59,286	All	**G3KDB**	**46,371**	**7MHz**
G3CWL	880	All	G4ALG	11,395	7MHz
G5BAU	**19,092**	**28MHz**	**G3KWK**	**49,312**	**3·5MHz**
G3RUX	16,571	28MHz	**GM4ASY**	**2,224**	**1.8MHz**
G3HCT	**191,664**	**21MHz**	**G4BEG**	**1,848**	**1·8MHz**
G3FXB	**238,128**	**14MHz**			

Multi-operator, single-transmitter

Callsign	Points	Callsign	Points
G3RRS	**313,940**	G3RCV	63,630
GW3UCB/P (1·8MHz only)	5,224		

PHONE SECTION

Single-operator, single-transmitter

Callsign	Points	Band	Callsign	Points	Band
G3LNS	**2,145,297**	**All**	**G2BOZ**	**80,025**	**28MHz**
GD3MBC	**378,834**	All	G5BAU	73,514	28MHz
G3SEM	357,435	All	**G3HCT**	**669,987**	**21MHz**
GM5BCV	**248,448**	**All**	**GW3ZQH**	**196,842**	**21MHz**
GM3BCL	215,280	All	GW4BUC	12,328	21MHz
G3JVJ	70,300	All	**G3XYP**	**153,960**	**14MHz**
G4BMA	68,160	All	G3KWK	17,340	14MHz
G3JKY	36,822	All	**GM5AXY**	**5,390**	**14MHz**
G2AJB	36,736	All	**GM3YCB**	**1,464**	**1·8MHz**
G3MWZ	23,940	All	**GW3UCB** (G3WXS)	**1,122**	**1·8MHz**

Multi-operator, single-transmitter

Callsign	Points	Callsign	Points
G4ANT	**2,782,483**	G3RRS	749,024
G3FXB/P	2,350,788	G3KMI	496,620
G3WYX	2,231,455	G8JC	451,564
G3UBR	1,534,326	G4BUE	381,036
G3RCV	1,083,576	G3FVA	189,376

Congratulations to certificate winners (listed in bold type). In the cw section G5BAU was world fourth on 28MHz, G3HCT world second on 21MHz, G3FXB world fourth on 14MHz, GI3OQR world third on 7MHz, and G3KWK world fifth on 3·5MHz. Readers may be interested to know that this is the 10th consecutive year that G3HCT has been top European on 21MHz and that his 1970 score was a European record. He was world top in the 1967 event, and has now been world top for two years in the phone section. Other outstanding performances in the phone section were those of G3LNS (world seventh all band) and GM3YCB (world third on 1·8MHz).

QTH Corner

CO2FA	via VE6AKV, 7612 23rd St SE, Calgary, Al, T2C 0Y1, Canada.
CT2BN	via WA9PZU, 5711 W. Brooklyn Place, Milwaukee, Wis, 53216, USA.
DX1AAV	15545 SW 99th Av, Miami, Fla, 33157, USA.
FB8XF	via F2MO, M. Dort, Maison Heldut, 64 St-Pierre-D Irube, France.
FH8CJ	BP 438, Moroni, Comoro Is.
F0AVG/FC	via DK5OS, Callinstr 32, 3000 Hanover, Germany.
FY0BHI	via F2QQ, R. Gemehl, Domaine du Petit Beauregard 14, Bat 9, 78 La Celle-St-Cloud, France.
FY0BHK	via F5IQ, J. Cappez, Domaine Du Bois Des Roches, Bat 80–3–28, 91 St-Michel/Orge, France.
G3YKR/MM	via G3ZSS, Easter Hill, Christchurch Lane, Lichfield, Staffs.
HR6SWA	National Weather Service, PO Box 120, Grand Cayman Is.
KX8BCF	via WB8QV, 138 Hutchinson Drive, St Clairsville, Ohio, 43950, USA.
P29DV	via W8PD, 3891 Weigel Lane, Hamilton, Ohio, 45015, USA.
PQ0ARM / **PQ0NS**	via PY7ARM, PO Box 1998, 50000 Recife, PE, Brazil.
ST2AY	PO Box 4142 Khartoum, Sudan.
TZ2A	via HB9AIJ, Karl-Mathysstr 6, CH 2540 Grenchen, SO, Switzerland.
WN3VEX/VQ9	via W3KT, J. Bieberman, RFD–1 Valley Hill Rd, Malvern, Pa, 19355, USA.
XW8FN	USAID/FHWA, APO San Francisco, Cal, 96352, USA.
ZB2WZ	via WA0VPK, 2185 Randy Av, White Bear Lake, Minn, 55110, USA.
ZF1BR	via W4KA, 1044 SE 43rd St, Cape Coral, Fla, 33904, USA.
ZK1DJ	via WA6DNV, I.F.Keith, 857 Ashbury St, San Francisco, Cal, 94117, USA.
5B4 QSL Bureau	PO Box 1267, Limassol, Cyprus.
5T5GS	via W6KTE, 214 S. Emerald St, Anaheim, Cal, 92804, USA.
5V7PW	via DJ1AM, Loisachstr 13–A, 8900 Augsburg 21, Germany.
9K2DB	via HB9XJ, Ottostr 33, CH 8005 Zuerich, ZH, Switzerland.
9K2DC	via W3HNK, Box 14, Norwood, Pa, 19074, USA.
9K2DX	via W6LV, 6 Hillview Court, Burlingame, Cal, 94010, USA.
9L1AP	via I3SCO, M. Scotti, V Roma 31, 34071 Cormons, GO, Italy.

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

Odds and ends

G4DAA is the callsign of the Channel Contest Group in Sussex. Members include G3FXB, G3MXJ, G3XBN, G3ZQW, G4BUE, G4BVH, G8FMJ, and two enthusiastic listeners who have already taken the RAE. Participation is anticipated in several major contests. QSLs go to G3ZQW.

G4CKN would like readers to know that his call is being pirated on 14MHz cw by someone who uses the name Tim or Reg and location as Stafford. The Post Office has been informed.

Band reports

Conditions on the lf bands seem to have begun to improve with the approach of the darker evenings. In spite of the low level of sunspot activity a great deal of unusual dx has been worked on 14MHz and many Pacific stations have been logged. King Namygal of Sikkim has been using his AC3PT call on the same band and causing considerable excitement.

Many thanks to the following for the information listed below: G2HKU, G4RZ, G5JL, G6GH, G3GVV, G3NKQ, G4COR, BRSs 17567, 17991, 25429, 31301, 33539, 34775, ORSs 30694, 31026, As 7056, 8306, 8312, 8428, 8431, 8713 and Mr Bernard Miller.

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

1·8MHz. 0300 *PY1RO*, W2HCW.

3·5MHz. 0000 PQ0ARM, PY, VP9HP, 4X4TM. **0400** ZS6DW. **0500** OA4AHA. **0600** *ZB2WZ, ZLs 3FZ, 4IE.* **2200** *TJ1AX*, VP9HM, VS6DO, *9H1BB.* **2300** EL7F, KV4FZ.

7MHz. 0000 CO, EA9EY, HC, TG, TI, *VU2ZX*, ZB2CF, ZP. **0100** YN, VP2DM. **0200** CE3AAE, HR4RL, VP9AD, XE. **0400** *HI8RHM.* **0500** *CX2AQ, F0AVG/FC LU, XE1TW, YK5CDL, ZB2WZ.* **0600** *KP4, M1C, TI, VK, ZL, K9KGA/6W8.* **0700** VK, 3A2EE. **2000** JAs 2BET, 4GUF,

Propagation Predictions

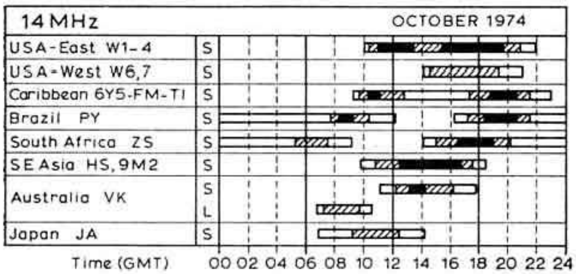
Conditions on the hf bands are at their best during October and November. As we are at present in the declining path of the sunspot cycle no real improvement will be noticed on **28MHz.** Only on favourable days, (days with above average F2 MUFs) will traffic be possible with South America between 1100 and 1700gmt, and with Africa between 0830 and 1630gmt.

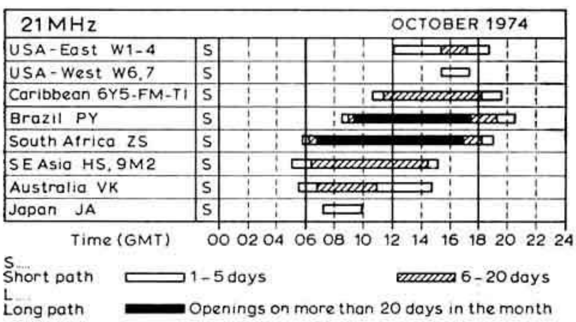
Conditions will be much improved on **21MHz.** Eastern North America should be heard during the afternoon but traffic with western North America will only be possible under exceptional circumstances. Traffic with Central America, South-East Asia and Australia will be much improved compared with the summer months. Occasionally traffic with Japan should again be possible. As a rule, dx will be more favourable from Southern Europe than from more northerly countries.

All continents should be heard with certainty on **14MHz,** but the shorter days mean that towards the end of the month the band will close from between 2000 and 2100gmt. Contact with KH6 should be possible on favourable days on 14MHz between 1630 and 1800gmt.

The **7MHz** band will be the main carrier of dx traffic from two to three hours before midnight and during the latter half of the night. Traffic on this band will always be possible while the larger part of path lies in darkness. Conditions for dx on **3·5MHz** will as a rule be worse than on 7MHz, it will be interrupted repeatedly by the dead zone during the second half of the night.

The provisional sunspot number for August 1974 from the Swiss Federal Observatory was 33·7 with the last week of the month displaying little solar activity. The predicted smoothed monthly sunspot numbers for December, January (1975) and February are 25, 24 and 23 respectively.





VP8NS, ZS1KJ. **2100** CR7JO, TJ1EZ, VP8NP, 5T5LO, 9G1DY. **2200** FP0YY, M1C, SV0WEE (Crete), TJs *1AX*, 1EZ, ZP5AR, F2JD/5U7, 8P6, 8R1. **2300** *A9XU*. EP2VJ, FP8DH, PQ0ARM, PQ0NS, VP2SAG, YV, 9Y4.

14MHz. 0400 FR0BCS (F9MS), PJ2MI, 4S7DT. **0500** *CT1/G5RV*, PQ0ARM. **0600** F0HI/Corsica (G3KFT), *FO8EG*, HR6SWA, KH6IJ, KX6IG, VQ9GP, 5W1AL, 5W1AR. **0700** KH6, KS6DH, ST2AY. **0800** W6DDM/KB6, KL7, KS6s, CC, EZ, *SP9PT/VE8*, W7GLU, YJ8DE. **0900** *A35FX*, C21DX, KX6LP, PQ0NS, YK1UN, 5W1AN. **1000** VP2SV, YJ8BL, ZD3U. **1100** K4KMA/KM6. **1200** VS6, XV5AA. **1300** AC3PT, C21DX, *WB9BXX/KG6*, *3D6AW*. **1400** FP0YY, KC6SX, VK9YV, VS5MC, YB7AAJ (Borneo), YK1KAS. **1500** FR7ZU, HZ1TA, UA0YT, XV5AB, YB3AP, 3B8DR. **1600** A6XB, *AC3PT*, VK9XI, 5V7PW, 9M2, 9M8s *HG*, NK. **1700** *FR7ZW*, *FR0BCS*, *PJ0CJ*, PA0IWH/S2, ST2AY, VQ9BP, VS5s LH, MC, 4S7CF, 8Q6AC. **1800** CR9AK, KH6HJF, *TA2AE*, 5H3JL. **1900** A7XA, ZD7SD, *5X5NK*. **2000** *HH1WF*. **2100** KC4AAC, VE6JL/SU, ZL. **2200** *HK0BKX*, *TR8PB*, VK, VP8HA, ZL, K9KGA/6W8, 9L1JT. **2300** PZ0CJ, TU, VK, VP2EEB, VP2SRC.

21MHz. 0900 FB8XF, JA. **1000** VU2IJ, 5N2ESH. **1200** *YK5CDL*. **1300** CE3CZ. **1500** ZD9BT. **1600** *C31GW*, VP2AC, VQ9GP, ZS. **1700** *CR7*, *FR0BCS*, PY, *SM7JZ/SU*, TR8VE, VP8FL, *ZD7PS*. **1800** CR3KD, PQ0s ARM, NS, ZEs, 9G1AR. **1900** *VP2LAW*, W2, ZS3JP. **2000** CE, CR4, HK0BKV, HR6SWA, PY. **2100** CE, CX, HC, HI, LU, VP2MM, 8R1AG. **2200** YS1MAE, ZF1WE.

28MHz. 1600 4Z4KB. **1700** UP2PAC. **1900** LU6DWZ, PY. **2000** CE3EZ, CR6QU, HKs, JA8PMF/MM (off ZS3), LU, PY. **2100** TI2AJF.

Very many thanks to all correspondents and to the authors of the following for items from their publications: the **West Coast DX Bulletin** (*WA6AUD*), **DX'press** (*PA0INA/PA0TO*), the **Ex-G Radio Club Bulletin** (*W3HQO*), **DX News Sheet** (*Geoff Watts*), the **29 DX Club Newsletter** (*George Allen*), **World Radio News**, the **DX'ers Magazine** (*W4BPD*), and **Long Skip** (*Nick Sawchuk*).

Please send all items for the **November** issue to reach G3FKM **no later than 9 October** and for **December** by **6 November.**

OBITUARIES

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

Mr A. Bell, G2XA
Arthur Bell, G2XA, died in retirement at Hull on 30 August. He previously lived at Slough where he was active in the local club.

Mr J. Cass, G4CIY
Jim Cass of Wellingore, Lincoln died in early August. He was a member of Lincoln Short Wave Club.

J. H. Cottier, G3DEW (ex 9M2HC)
John Cottier died on 27 July. A former education officer in Malaya, he was active for many years in the Merseyside area, and in Salop after his retirement.

Mr E. Elliott, G6PV
Ted Elliott died in his 78th year on 28 July at his home in Sheffield. Prior to retirement he lived in Coventry for 16 years. A real "old-timer" he still liked to build rigs with antique components.

Mr J. P. Male, GM6IS
Mr Male, of Greenock, died on 31 August. He had been a keen hf band man and was an active NFD operator, but after he lost his sight had confined his activities to 80m nets with his many GM friends.

Mr A. H. Parker, G3OV
Mr Parker died while on holiday on 14 August.

Mr H. R. Saunders, G3GTI/ZB1HS
Harry Saunders died in his early fifties on 14 May. Although not greatly active in recent years he was well known to older members of the RAF amateur radio fraternity.

YOUR OPINION

The Editor
Radio Communication

Electronic Ignition

Sir—Following the publication of my article in the August issue I received letters giving the experiences of Messrs Shortridge and Lester, and, in addition, as some months have elapsed since the article was written, I have had more experience. The vehicles concerned are a Volvo 164, Minor 1000, Ford Cortina and Commer Cob van.

Petrol consumption gain in all cases about five per cent overall and in two cases "appreciably more" or "about 10 per cent" for constant fairly high speeds on a motorway—presumably because conventional ignition falls off at high rpm.

Starting either improved or "was never a problem before".

Plug and contact breaker wear. This varies from "reduced wear" to "as new after 6,000 miles when without the electronic unit new plugs and points were needed at about the same mileage".

Problems. With the Volvo and a Sparkrite system serious misfiring was experienced until a modified system which raised the voltage across the points to 150V at 1mA was fitted. This then operated for 7,000 miles without the slightest trouble and much reduced point and plug wear. Possibly this is due to a combination of the Sparkrite and the Volvo, as several such units have operated without trouble in British cars.

One kit was a failure due to inadequate parts.

To sum up, it seems that an overall expectation of five per cent reduction in petrol consumption is reasonable, with improved starting and less performance degradation due to plugs and points wear thrown in. Many thanks are due to Messrs Lester and Shortridge for sending in details of their own and friends' experience.

B. Priestley, G3JGO

The Editor
Radio Communication

Sir—Further to the discussion in *FMD* about the use of QRA/QTH in metre-wave contests, the use of vague locations such as "8k SE of Lewes" or "Hastings" taken from the 10-miles/in map could be construed by the licensing authority as being misleading. A more precise location, well known to the local officials, such as "Firle Beacon" or "The Harrow" would be much more acceptable, but this is not allowed by contest rules, since these accurate locations may not appear on the 10-mile map.

Regulations insist that the portable/temporary location be transmitted, but do not insist that fixed locations be sent. They do not insist that locations be recorded at the receiving end. There is therefore no substance in the VHF Contest Committee's insistence that they have to ask for this information to satisfy licence regulations.

Contest Rule 15 demands that operation be within the terms of the licence. One signs to this effect on Form 427. Any further requirement to this end is superfluous.

IARU Region 1, of which RSGB is a member, merely requires the QTH locator as the geographical part of the contest exchange. Should we not fall into line?

The operators of G8BQX/P have been instructed that if a station requires a longer contact than is strictly necessary for contest exchanges it is to have one. There is always plenty of time for ragchews in contests; we worked 297 in the last, with gaps of up to half an hour in the log due to lack of traffic. This demolishes the argument that the whole thing becomes too impersonal and mechanical without a longer geographical exchange.

John Ridd, G8BQX

The Editor
Radio Communication

Sir—May I please make reference to the article in the September issue entitled "A self contained high-power linear amplifier for the hf bands".

I am not quite sure what is meant by electrolytic capacitors of seasoned vintage, but feel it implies, at best, examples which have been inactive for some time.

If electrolytic capacitors are unused for a period of time greater than 6 to 12 months, they may draw excessive current if the full rated voltage is applied from a low resistance source. Damage or failure may then result. The recommended reformation procedure is to apply the working voltage of the component via a current limiting resistor, typically 10kΩ, wire wound. The capacitor will then reform to its original rating without damage. This usually takes 1 to 2 hours, when the leakage should fall to a low stable value.

The proposal in the article to apply only 50 to 100V across each capacitor, or apply 300V across four in series, assuming them to be deformed, would: (*a*) cause excessive current to flow; (*b*) reform to the applied voltage level only. When connected into circuit, excessive current would again flow. Ideally they should be reformed to a voltage above that encountered in the circuit, in this instance 350V for 250V duty.

I trust these points will be of interest to you and the membership.

J. H. Lepper, GM3JHL
Customer Applications Department, Plessey Capacitors

The Editor
Radio Communication

Sir—I see in "Council Proceedings" in the August issue that consideration is being given to possible restriction on societies associated with commercial organizations or educational bodies. This, I feel, is fraught with danger. How can it be decided that a society is unfairly assisted by the organization to which it is affiliated?

I am sure that the majority of the societies in question only gain perhaps in the availability of more advanced test equipment and in the professional skills of their members. On the other hand if these advantages are to be neutralized we must consider that many clubs have professional engineers among their members who do not hesitate to put their expertise and in many cases (albeit unofficially) the facilities of their employers at the disposal of their club.

To eliminate all inequalities it must be ruled that all equipment must be constructed on the kitchen table using only a knife, fork and spoon as tools. Testing and alignment must be completed with the help of a moistened finger only, by a person who has never earned his living in the radio and electronics industry and whose sole qualification is RAE.

In the contest itself, operation must be limited to amateurs who have never operated professionally either in the Services, the Merchant Navy or operated a business radio in anger.

No, Sir, the advances in our hobby come mainly (but, I readily admit, not entirely) from persons who bring their professional expertise to amateur radio and take their amateur radio expertise to their professional fields. This is the way of progress, not the limitation of all to the lowest common denominator.

W. B. Kendal, G3GDU
Secretary, Civil Aviation Authority Radio Society

The Editor
Radio Communication

Sir—May I make a real plea to all radio amateurs with a callsign, to give this clearly during their transmissions.

I am a "new boy", anxious to obtain my "A" licence and use a good communications receiver to get the feel of the air by listening in to transmissions. I regularly tune in and listen to voices over the air and hope to log the sender and recipient, only to find that their callsigns are gabbled away making it quite impossible to hear what was said. It seems as though British amateurs are ashamed of giving their callsigns, and a lesson could be taken from the Italians who give theirs clearly and distinctly. I have even heard a British amateur, in a ragchew with three others on the 3·5 band, simply give the last three letters of his callsign, omitting the "G3" which later I heard repeated by one of this "party".

Another instance when four amateurs were talking together. Their conversations were interesting but *all* of them forgot to repeat their callsigns for over 20min until reminded by another amateur who chipped in and threatened to log them. Immediately *all* gave their callsigns together, making it quite impossible to distinguish any of them.

PLEASE: G2s, G3s and G6s, remember that *you* were once SWLs and anxious to pass the RAE; have pity on at least one "new boy" and try to remember to give your callsign clearly and concisely enough for all to hear it. Many thanks.

J. Devereux-Colebourne, BRS34929

The Editor
Radio Communication

Sir—May I express my thanks to the stations who radiate slow morse practice transmissions, in particular—G3RAF, G3FWW and PA0AA, who have aided me to obtain my Class A licence.

My thanks to you all, gentlemen.

D. R. Dabinett, G4DEP, formerly G8EVP

CONTEST NEWS

June 1974 70MHz Contest results

A very unsatisfactory contest for contestants and the VHF Contests Committee alike. The late change of date and the non-publication of the rules created a lot of confusion and a stream of angry letters and comments. Fortunately, nearly all stations started and stopped at the same time and the other rules concerning scoring and contest exchanges fell into their usual pattern. Because three fixed stations submitted entries it was considered just and fair to include them in the table and judge the contest as an open event rather than a portable. ("You can't have a more open contest than one with no rules"—G3LVP.)

On a more pleasing note, the winner, G3JYP/P, reported that half of his 62 contacts were made using ssb. Several other stations also commented upon this rapid move away from traditional a.m. The results table lists the transmitter final stage and the 1st rf stage of the receiver. The QQVO . . . is still very popular for a pa but the monopoly of the 6CW4 has now given way to a variety of transistors, although it is interesting to note that no one device has a universal popularity.

Finally, a note on conditions, which were about average, with some sporadic-E when short bursts of European broadcast stations were heard in the band.

Posn	Callsign	Points	QSOs	Best dx	Km	Transmitter	Receiver
1	G3JYP/P	652	62	G3XCS	495	QQVO6/40	3N140
2	GW3WRA/P	439	67	G3JYP/P	320	QQVO3/20A	40673
3	G3XUS/P	378	76	GD2HDZ/P	465	QQVO3/20A	6CW4
4	G3WMR/P	301	57	GI3FFF/P	420	2x PT4166	2N5245
5	G3TDM/P	292	36	G3VPF/P	416	QQVO3/20A	TIS34
6	G3VPF/P	241	43	G3JYP/P	460	QQVO3/20A	3N140
7	G3CDG/P	203	37	G3JYP/P	320	QQVO3/20A	ECC88
8	G3JEQ/P	202	60	G3JYP/P	410	QQOV/7	6CW4
9	GW4ABR/P	194	39	G3DAH	308	QQZ3/20A	Fet
10	G3RDQ/P	176	30	GD2HDZ/P	350	PT8726	2N5245
11	G4ALE/P	162	38	GD2HDZ	440	2x BLY93A	BF180
12	G3LCH/P	152	48	G3JYP/P	397	6146	Mosfet
13	G4AZS/P	121	23	G3XUS/P	270	QQVO3/20A	2N5245
14	G3LVP	106	23	G3JYP/P	390	QQVO6/40	AFZ11
15	G5HD/P	59	17	G3DAH	208	QQVO3/10	MPF122
16	G3YQW	46	10	G3JYP/P	430	QQVO3/20A	BFW 10
17	G3VPS/M	37	19	G3WMR/P	155	QQVO6/40A	EC91
18	G3OIT	37	9	G3JYP/P	390	QQVO6/40A	Mosfet
19	G3PCN/M	13	7	G3XUS/P	60	QQVO3/10	AFZ12

Check log received from G3DAH

BERU 1974 results

The winner this year is David Dudley, VE3BVD, operating from the Humber Technology Amateur Radio Club as VE3HUM. This station is the one used by last year's winner. Equipment was an SB101/SB200 transmitter with a Collins 51S-1 receiver and TH6DXX, 204BA and 80m inverted-V aerials. In second place is W. J. Harrison, VE1CD, using a Collins KWS1 and 75A4, a triband beam and dipoles. Top UK operator is A. J. Slater, G3FXB, who was in the No 1 UK spot last year just 80 points ahead of D. J. Andrews, G3MXJ.

On the receiving side the winner is that veteran of BERU, Eric Trebilcock, BCRS195, taking part in his 33rd BERU contest. In second place is BRS15822 who was in fourth place last year.

In the transmitting contest, entries were down from 76 in 1973 to 64, and in the receiving contest from 6 in 1973 to 4 in 1974.

Conditions on the whole were pretty poor, and there was also a clash with WSEM.

The HF Contests Committee is very grateful for the large number of suggestions regarding this contest and a special study group has been set up to consider its future. Among the suggestions are: "Change to autumn"—G2QT; "36 hours"—G3CWL; "48 hours"—VK2BPN, G6CJ and VE5RA; "48 hour with 30-hour operation"—VO1AW; "Bring back phone section"—G3JKY; and from UK winner G3FXB—"Complete reorganization". VE entrants ask for rules to be published in *QST*, the committee would like this done and the rules are sent to *QST* each year; maybe the VEs who are members of ARRL can get their society to reproduce them.

TRANSMITTING

Posn	Callsign	Points	3·5MHz	7MHz	14MHz	21MHz	28MHz
1	VE3HUM*	3,043	608	835	1,235	290	75
2	VE1CD*	2,887	536	655	1,696		
3	VE2NV	2,840	445	635	1,345	340	75
4	9H1CH*	2,733	320	333	1,015	820	245
5	9H1CG	2,520	324	318	1,168	585	125
6	VO1AW	2,498	493	395	1,310	275	25
7	VE2WA	2,342	601	470	1,071	200	
8	VR1AA*	2,325	335	775	800	415	
9	G3FXB*	2,285	275	380	1,015	465	150
10	VE3GFY	2,250	335	655	1,120	140	
11	G3MXJ	2,205	380	225	950	600	50
12	VE3BWY	2,104	248	520	926	410	
13	VX1KE	2,080	645	340	905	190	
14	G5WP	2,070	480	295	920	375	
15	5Z4LW*	1,959	75	75	963	701	145
16	VS5MC*	1,955		280	1,030	495	150
17	ZE8JJ	1,904		240	898	616	150
18	G6CJ	1,880	345	330	855	350	
19	VE7UZ	1,800	500	715	585		
20	VK2BPN	1,775	230	665	705	150	25
21	VE2AYY	1,703	203	235	915	325	25
22	VE3AU	1,633	320	505	733	75	
23	G5RI	1,595	250	290	850	205	
24	VP7DX	1,590	290	400	495	355	50
25	VE1EK	1,393	325	270	798		
26	9J2CL	1,344		125	488	581	150
27	G3SXW	1,190	175	165	675	175	
28	G3JVJ	1,185	125	100	590	370	
29	ZL1HV	1,120	150	480	440	50	
30	VE2AYU	1,020	210	160	625	25	
31	ZL1HY	990	265	290	310	125	
32	ZB2CJ*	945			945		
33	VP2MJ	918			918		
34	G3KMA	915		25	610	255	25
35	7Q7RM	903			125	628	150
36	G3QT	895	75	75	595	150	
37	G3GC	835	125	50	560	100	
38	G3VDL	815	75	75	465	200	
39	VK3ZC	815	175	240	400		
40	G3VW	805			580	225	
41	VS6EY	785		25	200	535	25
42	VE3BBH	776			776		
43	G2HLU	775	140	100	510	25	
44	G5VU	755	75	25	480	175	
45	G3PVA*	693			693		
46	VE3KZ	690	270	175	220	25	
47	G3RUG	656			656		
48	G3ZDD	653	170	75	333	75	
49	VK2BJL	580	210	295	75		
50	VK6RU	565		25	350	190	
51	G3JKY	530		25	275	230	
52	VE5RA	530	25	70	435	0	
53	G3NKS	520			370	150	
54	VK3KS	480			455	25	
55	G3UYM	430		50	380		
56	G5MY	415			415		
57	VU2UR	335			335		
58	VK3RJ*	275	275				
59	G3MWZ	255			255		
60	G2BLA	240	25	25	140	50	
61	G3CWL	225			200		25
62	VK3KX*	215				215	
63	G8KU*	200				200	
64	G3UJG	125			125		

RECEIVING

Posn	Station	Points	3·5MHz	7MHz	14MHz	21MHz	28MHz
1	BCRS195*	1,485	330	695	460		
2	BRS15822	1,235	140	125	715	255	
3	BRS18461	678		75	493	130	
4	VU0020	310			310		

* Certificate winners

TROPHY WINNERS

G3FXB	Col Thomas Rose Bowl
VE3HUM	Senior Rose Bowl
VE1CD	Junior Rose Bowl
BCRS195	Receiving Rose Bowl

1974 Summer 1·8MHz Contest results

Once again good summer conditions ensured a lively and interesting contest, with stations from seven countries submitting entries and a further three, including the USA, appearing in the logs. On the other hand fewer British stations were active during the contest period, which meant that the leaders were hard put to exceed 100 QSOs. Also disappointing was the apparent lack of interest in the multi-operator section.

Generally the usual high standard of logs was maintained. There were, however, very many errors in copying reports from weak stations, particularly those outside the UK, and it is evident that more care is needed when signals drop below S7.

Certificates of merit will be awarded to: GM3OLK, G3RBP, G3VMW, DK6QI, OL6ARH, OL8CDQ and OH2BO.

Comments: "Activity very low in last two hours—what about an earlier start and finish?"—G3VMW. "Apologies for poor cw but keyer kept getting stuck"—G4BUE; "Very poor support from the north-west"—G3KZR.

UK SECTION

Posn	Callsign	Points	4nty	Posn	Callsign	Points	Cnty
1	GM3OLK	512	FE	23	G3KZR	303	LR
2	G3RBP/A	506	EX	24	G3DCZ	299	SY
3	G3VMW/A	493	YS	25	G3TLF	292	YS
4	G3PDL	492	LN	26	G3FJE/A	290	BD
5	G3MXJ	487	SX	27	G3VDF	286	NM
6	G3RVM	477	WE	28	G3ZON*	285	SY
7	G3IGW	463	YS	29	G4ALG	277	BE
8	G3XEP*	443	YS	30	G4CWH	272	SY
9	G3XTJ	439	LD	31	G3UQW	268	KT
10	G6BQ	437	KT	32	G4BXT	267	KT
11	G4BJM	421	BS	33	G3ZNH	255	WE
12	GM3PFQ	390	FE	34	G3IUB/A	250	WK
13	G4BUE	367	SX		GI2FHN	250	DW
14	GCPWY	345	HD	36	GM3ZRT	243	AY
15	G3YRZ	344	CE	37	GW3GWX	236	CV
16	G3LCH	339	LD	38	G4BXN	227	SY
17	G3YMC	332	BE	39	G4CMY	209	GR
18	G4BMK/P	320	BS	40	G2FNK	146	MX
19	G3WXS	315	GR	41	G3NYA	121	WK
20	G3RCW/A*	311	NM	42	G2CIL	117	SX
21	G3XZK	309	GR	43	G4CZB	57	LD
22	GM3YOR	306	FE				

OVERSEAS SECTION

Posn	Callsign	Points	Posn	Callsign	Points
1	DK6QI	286	6	OH2BO	65
2	OL6ARH	174	7	OL8CCR	57
3	OL8CDQ	169	8	OL6AQP	48
4	OK2PAW	86	9	OH3NB/5	12
5	OL6AQV	75			

* Multi-operator entry.

The HF Contests Committee gratefully acknowledges check logs from GW4BCA/A and A8306.

144MHz CW Contest rules

Dates: 2–3 November

Times: 2000–0100gmt.

All entries and checklogs to: VHF Contests Committee, c/o G3FZL, 11 Liphook Crescent, London SE23 3BN.

The following general rules, published in the January 1974 issue of *Radio Communication*, will apply: 1, 2, 3, 4b, 5a, 6a, 7a, 8b, 9b, 10a, 11–26.

Marconi Memorial VHF/UHF CW Contest rules

To mark the centenary of the birth of Marconi, the Italian national society ARI is organizing a vhf/uhf cw contest open to all amateurs in IARU Region 1 (Europe and Africa). The usual IARU rules apply, and are summarized below.

Dates: 2–3 November.

Times: 1600–1600gmt.

Contacts on A1 only, on 144, 432 and 1,296MHz according to the band plan. There will be six sections: fixed and portable/mobile on each of the three bands; all six section winners will receive a "Marconi Plate" presented by ARI.

Contacts consist of exchanges of RST and serial number (starting at 001 on each band and increasing by one for each successive contact), and QTH Locator. Contacts by active repeaters or translators are invalid.

Scoring will be *one point per kilometre*. Please use RSGB vhf/uhf log sheets and sign the declaration on form 427. The total claimed score should also be shown at the top of the first log sheet.

Entries should be sent for checking to the adjudicator of the RSGB 144MHz CW Contest (rules in this issue) by 18 November. Entrants may submit their contacts on 144MHz between 2000 and 0100 for the RSGB event, but must send in two separate logs since the Marconi Memorial logs go to ARI. Serial numbers for the RSGB contest need not start at 001.

RAYNET

by S. W. LAW, G3PAZ*

It must be galling for those dedicated members who keep an ear to the activities of the user services to come across the occasional incident where our help could be used but we must hold back until called upon. One case which comes to mind was a recent discovery of an unexploded bomb resulting in an evacuation procedure and the tying up for many hours of every available official vehicle to the extent that calls were sent out for a fresh supply of batteries for the units on scene. There was positively no vehicle available immediately for this purpose and we are sure that one of our mobiles would have been only too pleased to have carried out that small chore to the great relief of the incident officer on site. Apart from the radio aspect, this was where our services could have released a few units for other essential routine tasks.

The foregoing serves to emphasize to groups (and controllers in particular) the urgent need to ensure liaison with local user services. No matter how well organized a group may be within the radio framework, its existence is virtually useless unless the user services are made fully aware of its availability and terms of reference. It can be a chastening experience to approach a member of a user service (even an official of rank) and meet a blank and puzzled response almost amounting to disbelief! This may appear incredible to our members after 21 years of Raynet activity but we can assure you that it is only too true. Make sure that this cannot occur in your area. Does your local MP know about you?

Leicester show

As we have mentioned before, Raynet will be represented at the forthcoming show at the end of this month and we trust that visiting members will make themselves known at the stand. Any offers of assistance will be appreciated, particularly the loan of photos of Raynet interest or paperwork covering individual group activities We hope to see you there.

Growth and rebirth

We are pleased to find that our west-country representation has been revitalized by the formation of a new group in the county of Somerset. Due to the energetic efforts of G8HNM a nucleus has been formed under his leadership in the Taunton area and we hope to see a rapid expansion as previous members rally to the flag.

Call-out procedure

How is your call-out procedure? It is interesting to note the methods adopted by various groups according to the distribution of members, sub-groups and the topographical aspects of the area. As we are aware, most emergencies are of a local nature and do not require the participation of a large group. It is therefore pointless to draw up your family tree for call-out purposes to include members over a very wide area, but rather to consider the most efficient method for a call-out covering possible hazards in particular locations. Naturally it goes without saying that these have been studied and discussed with your local user service who will have statistical information as to the probabilities of local hazards. Needless to say the controller or his deputy should be made aware of a standby or call-out immediately it arises if he is not the originator. (Incidentally, we do not recollect any yl controllers in the history of Raynet. We see no reason why the traditional feminine intuition should not prove of great value in this framework.) It is well worth the effort to thrash out a viable call-out procedure which suits your particular needs. You will find efficiency greatly improved when the need arises; and that may be sooner than you imagine!

Hon Registrations Secretary; Mrs L. A. Crane, "Greta Woods", Bromley Road, Ardleigh, Colchester, Essex.

* 130 Alexandra Road, Croydon, Surrey CR0 6EW

MEMBERS' ADS

These subsidized flat-rate advertisements are accepted as a service to members of RSGB. They must be submitted on the Members' Ads order form printed in each issue of *Radio Communication*, or on a postcard similarly laid out. Each **must** be accompanied by a **recent** *Radio Communication* wrapper addressed to the advertiser, as proof of membership, and a remittance by postal order or cheque for 40p (stamps not accepted). They will not be acknowledged. Those not clearly worded or punctuated will be returned. No correspondence concerning this service can be entered into.

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

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

The RSGB reserves the right to refuse advertisements, and accepts no responsibility for errors or omissions or for the quality of goods offered for sale. Advertisements may be edited or abbreviated as necessary.

Members are advised to enclose a stamped addressed envelope when replying to advertisements.

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

FOR SALE

Eddystone 940 communications rx vgc spare set valves + manual, £110. Also wanted ex RAF box kite. P. M. Cleaver, 86 Main Road, Dovercourt, Essex CO12 3LH. Tel Harwich 2195.

Eddystone EC10 Mk I with battery and mains psu, £35. G8AEV 2m converter i.f. 1·5–3·5MHz, £6. 2m tx 30W to 3/20A mod EL84s with psu and xtals, £10. GM8GJH, QTHR.

HRO perf order, all shortwave coils, £20. DX40U mint, £9.50. Tx/rx type 62 good cond, £9.50. 2m BCC base station, modified to tunable rx. 25W a.m., perfect, £30. Selection of vhf/hf xtals. SAE. White, 24 Staplehall Road, Bletchley, Bucks.

Exchange Pye 2m base tx Imhof case circuits and Solartron CD513 scope with handbooks faulty dc amp for HRO comp but not necessarily wkg. Offers for B2 rx with own psu. G3LYU, QTHR. Tel Leicester 876459.

Telford TC9 tx; Telford TC7 tunable i.f.; G4BBP 2m conv. Telford bandsearcher. Comp 2m station, nine months old, perf cond, will deliver 50 miles from Swindon, £115 ono. G8IMF. Tel Highworth 762995.

Microwave Modules 2m a.m. tx, 5W, mobile or fixed station, includes mic but less xtals, £25. Also Prinzsound R999 multiband rx, £35. GM8HYC. Tel 041-959 4455.

Heathkit HR10B rx vgc with xtal calibrator and manual, £40, post and packing extra. D. Smillie, 8 Lauder Crescent, Wishaw, Lanarkshire. Tel Wishaw 73012.

Cambridge AM10D, £15. Murphy 821H, £7. 4X150 2m lin, £12. Psu, £5. TF801A sig gen, £18. 12V 250V psu, £3. Electroniques valve front end 12V inv fitted, £6. Xtal tester/sig gen 2m, £3. Tel 051-632 1216 evngs. 47 Queens Ave, Meols, Merseyside, L47 OLS.

AM10D Cambridge, 2m, £26. Trio 9R59DS, perf, £40. 4MH 2m 16W a.m. tx and modulator, £20. Sentinel 2m converter 2–4MHz i.f., £12. 10-el Skybeam, £5. 4-over-4 slot-fed Yagi, £3. M. W. Booth, 7 Hall Royd Walk, Silkstone Common, Nr Barnsley. Tel Barnsley 743002 office hours.

Programmable digital keyer with erasable 1024 bit mos memory. Programmable manually or with built-in keyer. 2 speed ranges 10–60 wpm. Automatic stop or repeat capability. Ideal for cw contests or meteor scatter operation, £60. G3WZT, QTHR. Tel Partridge Green 710565.

SEI ssb filter QC1246AX, new plus xtals, £16. QQVO6/40A new boxed (2), £3 each. 7360 (2) new boxed, £2 each. All items ono. G3JDN, QTHR. Tel Reigate 40646, after 6pm.

Rank Murphy a.m. mobile tx/rx TR1005, low band f (unmodified for 4m), TX9W, R+ 1μV, AF2-5W, all transistor except YL1000 driver and YL1080 output, 28 by 22 by 9·2cm, Spkr and ptt mic, service manual, £32 carriage paid. GM3XON, QTHR.

BC221 frequency meter, charts and manual, £20. 2m 14el Parabeam, £12.50. Atu No 7, £10. Valves pair QY3-125 with bases, £4. QQVO6-40A with base, 5763, 6CH6 new, offers. Homebrew swr meter, £2. Gumbrill, 32 Brooks Way, Lydd, Kent. Tel Lydd 20608.

KW Vespa and psu vgc, 6LQ6 pa, £75. Emsac 2m converter 28–30 i.f., £5. HSC morse record and test, £1. PCR rx works but needs attn, £2. Buyer collects. G4CMU. Tel 01-540 6910 after 6 pm.

Creed 7B teleprinter with silence cover, professionally built terminal unit incl all psu and cro monitor, 2 scrap 7Bs for spares, all for £40. Philips hf valve voltmeter GM6014, £20. Marconi vhf sig gen type 41, £15. B44, £5. 3–6MHz Command rx, £5. *Wanted:* Eddystone psu type 924 (for EC10). Dr G. K. Laycock, 54 Arundel Drive, Fareham, Hampshire PO16 7NS.

HQ1 10–20 minibeam new, £38. GR78 Heath rx, £55. Good TZ31 10–20 trap rotary dipole, £10. Meaden, G3BHT, QTHR. Tel 021-308 4764.

Swan 500C tx/rx 3·5–28MHz 400W p.e.p. built-in xtal cal comp with matching psu and manual, £170 ono. AVO mains electronic V/R/C tester with vhf probe, needs attention, £5. G5WG, QTHR. Tel 01–504 5499.

Inoue IC-2F, £55. Antec mobile aerial 2m, £3. Solid State Modules 2m converter 4–6MHz, £9. G3SHQ. Tel Southampton 444195.

DX4OU never used, £12. Large amount home-built test gear, coils of cable suitable rx aerials, lots of components. Would exchange lot for decent rx, AR88D, 216 etc. Harrison, 202 Whitecate Drive, Blackpool. Tel 64394. G3SNH.

Offers: sale or exchange. Hundreds of valves; deaf-aid, acorns, miniature, metal, octal, all types to 807. Ex-govt tester free. Edwards, 28 Rook Grove, Willingham, Cambs. Tel 0954 60686.

Ex/Acft txs pair 4X150s, final 250W cw easy mod linear ssb circt, new cond, £10 each, buyer collects. G3IUL, QTHR after 4 Oct.

KW2000A plus ac psu, £140 ono. SB200 linear, £105 ono. Pair for £220. BC221 with int psu and charts, £15. G3GIQ, 271 Popes Lane, Ealing, London W5 4NH. Tel 01-567 6389.

Radio Amateurs Examination comp home study course, 21 manuals maths tables, study notes and test papers, £15. Storey, 13 West Crescent, Matlock, Derbyshire. Tel Matlock 3813.

Mosley trap vertical 10/15/20/40 guys feeder, £12. Tiger mobile transistor converter medium to 160/80, £5. HRO mobile pack, £4. HRO ac pack (not wkg) £2. Handbooks/photostats SX24 38 R1155 HRO, £1. each, carriage extra. G2FKS. Tel Cambridge (0223) 47220.

Barlow Wadley rx new unwanted gift, £95. Heath GR78 rx immaculate cond, £50. HQ1 mini beam 10–15–20m as new, £36. Securicor delivery if requested. G3UFL, QTHR. Tel Chelmsford 440851.

LM373 National Semiconductors, a.m./fm/ssb/i.f. amp/det 4 off new in makers' packing with data, 80p each. Xtals HC6U 1,819kHz 1,821kHz unused Jap types, £4 pair. *Wanted:* Electroniques i.f. strip and gc front end. Tulk, 8 Cleves Close, Weymouth, Dorset.

Manuals: SCR211/BC221, echo box TS-270/UP, Pye AM10B, PTC116-117, PTC703-704, PTC 2207, Hallicrafters HT-32, National NC-127, Collins 75A-2, 30K, Hammarlund super pro BC-779A, £1 each or 25p loan. Xformer 230V to 13-15V 60A, £3.50. G6ZH, QTHR. Tel Banwell 2119.

KW2000E, ac psu and handbook 4 months old, perfect cond, genuine reason for selling. Offers. Can be seen evenings or weekends. G3XLL, QTHR. Tel Norwich 48685.

6-channel a.m./fm Pye Cambridge. Xtals for 144·48, 145·0, 145·8, plus mains stabilized psu, dipole aerial, vgc and perfect wkg order, £39.50 ono. P. I. Martin, GM4AZC, 41 Ottoline Drive, Troon, Ayrshire KA10 7AN.

Creed 7E in exc cond comp with base and silence cover, £25. Frequency counter with preset and multiplier facilities 32MHz 8 digit readout but less input preamp, £35 ono. Buyers collect or possibly can deliver. Bonner G3TGF, QTHR.

SSM Europa as new with valves plus pre-amp and aerial c/o relay, £50. Mk 2 version no bugs. Plus fitted fan. G3STJ, QTHR. Tel Billericay 54472.

AVO CT-38 vvm 97-range with leads, probe, etc. £20. AVO electronic testmeter 44-range with leads, probe, £10. Taylor 75-A vom 50μ/A 1,000V ac/dc 10MΩ 20kΩ pv, £5. Electrolytics 150μF/450V 10p each, ideal linear psu. All items plus carriage. G3MOE, QTHR. Tel Cheltenham 24217.

Lafayette HA600A gen cov rx, vgc comp with handbook, £40. IC fm discriminator with 455kHz ceramic filter, afc output, unused withdata, £3. S. J. Ruffle, G8ICY, 10 Mulberry Hill, Shenfield, Brentwood, Essex. Tel Brentwood (0277) 219017.
New 12V nickel cadmium encapsulated battery 2AHr, £8. Advance PM4 stabilized power module 4–15V at 3A, £5; transistor Ranger 2007 on 2m, with xtal, £6. All plus carriage. List for xtals, meters, tx valves, etc. *Wanted:* Osker power meter and Microwave Modules preamp. G8ENI, QTHR. Tel Cheslyn Hay 415374.
Liner 2 pre-amp 5 months, £110 ono. 12V rechargable battery 5in by 5in by 3in drives Liner 2 for hours, £5.50. CCTs, pocketphones SL600 series tx/rx, FT200 FT401 10p plus sae, ccts copied 10p. *Wanted:* 2m transverter, why?, Versatower TA31J 12AVQ. G4BXD, QTHR.
AR88 and DX100 in good cond and appearance, £55. G3DBZ, QTHR.
23ft/31ft lattice tower in good cond with base (self supporting) £32. J-Beam 2in tube jointing sleeve (15in), £1. Also 18in stand-off wall brackets, comp, £2. Buyers collect. Mr Phipps, 47 Dean Rd, West Hinckley, Leicestershire. Tel Hinckley 36811.
FT/FP200, £185. FV200, £35. DC200, £45. YD846, £5. Comdel CSP11, £50. Storno Viscount, rx poor on 145·5, £25. 18AVT no 80m, £20. Hustler, mast body bumper mounts, spring, res 80/40/10, £25. G3ZYN 38 Downlands, Waltham Abbey, Essex. Tel Waltham Cross 29327.
Heathkit HP23 ac psu, £20. Pye AM25B comp unmodified, £25. RX based on G2DAF Mk2 design, £20. G2DAF tx and psu, £20. Type 10 xtal calibrator with psu in new case, £5. G3MNV, QTHR. Tel 021-353 3012.
Pye Tulip mic, £5.80. KW trapped dipole, £8. Television cross-hatch generator, £4.50. Perdio eht tx sstv, 50p. Headphones, padded stereo/mono, £3.50. New Japanese ps six switched steps, 3–12V 500mA, £5. *Wanted:* 12AVQ etc. G3NXD, QTHR. Tel 0562 850570.
Inoue IC20, fm/a.m. detector mod, xtals six channels, halo included, £80 ono. KT340 rx similar to HE30 suit beginner, with 2m converter, £15. Q. G. Collier, 43 Belvedere Road, London SE19 2HJ.
2m tx Telford TC9 with mixer type vfo, £60. Asahi 10–40 trap vertical with radials and coax, £20. Poulter, G3WHK, 279 Aragon Road, Morden, Surrey. Tel 01-337 0117.
Superb 2m mobile Pye Cambridge AM10D but converted a.m./fm fm ic discriminator varicap modulation 6 channel 144·25, 144.40, 144·48, 144·60 145MHz, 145·15/145·75 repeater, transmit lock, end transmission bleep plus tone-burst, Westminster mic, £78. Robert G8IJP. Tel 02753 4776 evenings.
2MHz tx compact, £12. Transformer new 425V 200mA, 6·3V 4A, 6V 4A, 5V 3A, £2. Two Hunts capacitors 16pF 500V new, £1. 15W inverter needs attention, £1.50. Osmabet transformer 200/40V 6V 250mA new, £1. H. H. Seymour, 74 Harold Estate, Pages Walk, London SE1 4HW.
Heath HW-32, HP-23 psu, matching spkr cabinet, £65 ono. SP-600jx gen cov rx, £90 ono. GM5AWT, Box 175, RAF Edzell, Brechin, Angus DD9 7XH. Tel 035-64 414.
KW Vanguard Mk2 with atu, in good wkg cond, £20. G3YTD, QTHR. Tel 0607-44 3066.
Have equipment as last ad, plus more components, bits and pieces turned out of junk box. Would one person or club with car be interested in lot for £10 ono and collect? A. J. Bartlett, 4 Kelsall Close, Kidbrooke, London SE3.
Mod terraced 3-bed house, large kitchen, integral garage, central heating, close amenities and M3, £10,800. Bridgen, 87 Beaulieu Gardens, Blackwater, Camberley, Surrey. Tel Yateley (0232) 870399.
Going QRT HW100 SB200 KW103 E-Z match, £150 lot. QQVO6-40 (new), £3. QQVO3-20, £2. BC221 (with psu and charts), £12. 6146(3), 50p each. Stolle rotator memomatic, £12. Freq meter (digital), £10. Burns wavemeter TC-101 (with probe), £12. Burns SP-1, PM-1 kits, both for £7. Heath HM-2102, £12. Tradipier gdo, £7. Heath 1M-17 with probe, £12. Heath RF-1U, £9. RF ammeter 0–3A, £1. Greenpar uhf 12W load, £5. Bowhay, 20 Park Road, Bracknell. Tel 22169.
KW Vespa Mk2 with psu, £40. HRO with bandspread coils, £17. Creed 7B with silence cover, £10. 656/M auto-tx, £8. 7TR/3 reperf, £8. 2 × 80-0-80V loop psu, £5. Other junk. Sae for list. G3YKR, QTHR. Tel Emsworth 5612.
Hygain 18AVT/WB vertical aerial, 9 months old, vgc, £28 ono. March '73 to December '73 *Rad Comms*, 75p. AT5 tx, psu, SR550 rx, spkr, xtal mic, rf meter, £15. J-Beam omni-V 2m aerial + 10m UR57 coax, £7.50. Pair 18in stand-off brackets, £1.50. Pair 24in stand-off brackets, £2. *Wanted:* teleprinter (mains). A. V. Neilson, 78 Ackers Hall Ave, Liverpool L14 2EA.
Bound volumes *Practical Electronics* from first issue to date, 10 years, comp all advts, £20 ono. 6ft 19in rack with rear door, £10. Very powerful portable pa loudhailer, £12. Q5er, £4. D. Byrne, Watergate Quadring, Spalding, Lincs. Tel 077-584 485.
Ten-Tec 20/40m QRP tx/rx cw rx cw a.m. ssb two class D wave-meters, one faulty, £27 carriage paid. Will separate. Livermore, Village Farm Cottage, Market Weston, Diss, Norfolk 1P22 2NY.
Heathkit 0-12-U 5in scope, £25. AM10D, 5m varicap tuning, £25. *Wanted:* FT2FB or similar fm rig with tone-burst. Emsac TX2 with psu. G4CTU. 12 Parkland Avenue, Kidderminster, Worcs. Tel 3966.
Advance volstat 190/260V in, 240V 500W + 60/70V at 7A out, £10; buyer collects. Spectrum group "A" tv masthead pre-amp with downlead psu, £5. *Wanted:* 70cm/28MHz converter. 240V 1-5kW alternator. G3TCG, QTHR. Tel Fairseat 822043.
Heathkit GR78 rx inc Nicads, improved rf stage, new cond, £55. G3TFA, QTHR. Tel Harbury 612806.
FV50B vfo, new and unused, £25. G3LBT, QTHR. Tel 0268 412177.
OS2 scope, £18. Digital counter, £20. 160 mobile rig, £15. 2m rotator equipment, £6. 2m tx, £5. AR88, lf, £40. 160 tx, £5 sae. List of components, xtals. D. Lupton, 34 Westbourne Close, Milford, Salisbury, Wilts. Tel Salisbury 24841.
Complete 400W 2m station comprising HW32 tx/rx, h/b transverter single 4CX250B linear amp, all in neat cases, single psu, units fully metered, all connecting leads etc £120. G8CVO, QTHR. Tel Bolton 57775.
Omega-T ant noise br, TE7-01, £7. Pair Eddystone tx vbles 142pF, £2 ea. All new cond. Also pair Labgear dble sp vbls abt 50pF good cond, £1 ea. Sundry rcvg vbles, cheap. All post extra. G2GM, QTHR.
LA600 G & D, linear, Lafayette HA55 vhf rx, handbooks BC610E, BC312, NC100A, Wilcox vfo, circuits, R1475, TA12E *SWM* from 1954, *PW* from 1963, reversible motor ok 2m beams. Offers all items. Prefer buyer inspects and collects. GW3LCQ, QTHR.
Heathkit HW-202 mobile rig, comp with 4-freq tone generator and xtals for 3 channels, including GB3PI. HA-ZOZ 40W amplifier, well built and 100% working. Will demonstrate, £130 ono. Hudson mobile rig, £12. G8GGL, QTHR. Tel Leighton Buzzard 66134.
Francis & Lewis 32ft radio mast with ladder attached, cheap for dismantle and take away. G3FRY, QTHR.
TSL Tuner 86–108 cabinet. Avantic amplifier. Mahogany cabinet three legs. Stentorian 10in spkr tweeter cross-over network, £30. Browns super K moving coil headphones new, £5. Dansette record player Gerrard, £15. Buyer collects. G5TH, QTHR. Tel Kirkham 3390.
DX100U vgc in regular use, buyer collects, £29. Tel Maldon, Essex 55641.
Two new 42MHz overtone HC18U xtals £1.75 each. G3ARU, QTHR. Tel 01-989 3196 after 7pm.
Comp 2m rig (but less hf rx): 10W a.m. tx, mosfet converter, J-Beam 4-el Yagi, mic, leads, etc, £35. Ray Norris, St Catharine's College, Cambridge CB2 1RL.
Trio TS510, two years old, new 61465 fitted, £135. HRO plus coils, £15. Collins TCS15 with psu, £12. Class D wavemeter, £8. 32ft steel tower, dismantled, £20. Prinz 550 telescope good cond, £35. G4BQE, QTHR. Tel Goldthorpe 3575.
Heath HW17A 2m tx/rx spare valves dial and output transformer, unmarked case as new, £50. Prefer buyer collects. G8DPO, QTHR. Tel Northampton 810085.
Pair 28·5MHz hand-held transceivers, £20. 2m 5W transverter (solid state) + G3AEV converter, £24. (Will sell less converter or separate). 100MHz fm GEC base tx, £5. Buyer collects. G3YSG, QTHR. Tel 068-46 2564.
Trio JR310 good cond, £55. KW Victor 120W a.m. cw, £30. Buyers collect. G6NK, QTHR.
Trio 9R59DS new boxed with 1MHz xtal, hardly used, £42. Ideal swl. Sentinel 2m converter 28–30 i.f., hardly used, £10. G3TSO, QTHR. Tel Kington Langley 393.
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SB301 all filters fitted SB401 with xtal pack and MOD5 for Europa. Some spare valves. All cables and instruction books, £120 each ono. Deliver up to 100 miles. G2DVA, QTHR. Tel Frodsham 33407.
Tabletop tx/rx for 4m 3/20A output ready to go on 70·2MHz, £35. Honda E300 genny immaculate, only £60. Converter 70cm (G2DD) with preamp, £6. Many smaller items, sae for list. G5UM, QTHR.
Trio 9R59DE ok but modded, £25. CR70A rx perf, £17. 7·5-9·0V fully regulated 10A psu 40V transformer, new, £13. American mags mostly 1930s approx 50, offers. G8HTS, 7 Howard Close, Tewkesbury, Glos GL20 8QT.
19 sets. Three comp sets with some spares. Will split up. Offers. Arnfield, 29 Lapwing Lane, Brinnington, Stockport.
Heathkit 10-12U scope, mint, £30. Unicom memory calculator, £30 ono. 2m converter, DL6SW, 28–30MHz i.f., £5. 70cm converter, 28–30MHz i.f., £8. Xtals, 1,620·0kHz, 1,535·0kHz pr, £3. 11·710MHz, 11·720MHz, £1.50 each. 52·8333MHz for 1,296MHz conv, £2. Pawley, 52 Sumatra Road, West Hampstead, London NW6. Tel 01-794 9934.

HW100 with psu, spkr, £100. Matching 2m transverter with 4CX-250B pa, built-in psu, coax relay, converter, £80. Transverter 4m, built-in converter, QQVO3/10 pa, requires psu, ant-rly, 28MHz drive, £30. 4m xtals 75p ea sae. 70cm Multibeam, offers. G3OUF, QTHR. Tel Amersham 21573.

Dash Cambridge on 145, Emupressor, 2m converter, 70cm converter, CTX2 2m tx, TW topband tx with mains and 12V PSUs, 2m transverter, 80–160 transverter and integral Heath psu, command receivers, 2m and 4m xtals, other items 160–70cm. List from G3YNT, QTHR.

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Trio 9R-59D rx, £35. P. Kenyon, G8CAK, QTHR. Tel Much Wenlock 406.

AM10B 2m Cambridge 6-chan, 12·5kHz with control box, cables, cradle, etc, vgc, £25. G4BIK, QTHR.

Hammarlund HX50 tx, 230V, 160–10m, manual, mint, £75. Brenell STB2 stereo recorder built-in amplifiers and speakers, mint, virtually unused. Full service data, £150 or exchange FT200, NCX5/2 or similar. G3UQP, QTHR. Tel Huntington 56041.

Equipment of late G2ABV. Heathkit DX100, £25. Telequipment S51A 'scope, £25. RCA wavemeter, coax relay, 650-0-650 250mA transformer, plus many magazines and small items for callers. G4AEZ, QTHR. Tel 01-366 7166 evenings.

BC453 Q-fiver, £4. Eddystone S-meter in case, £4. Eddystone spkr, £3. IN23 xtal type tester, £2. Gecophone early 'twenties xtal set, also one home-brew same period. offers or why?, carriage extra. Sae enquiries. G3ZCO, QTHR.

Plessey PR155 gen cov rx, £500. Collins 75S-3B rx, £300. Collins 32S-3 tx, £350. Collins 75S-3C rx, £425. Solartron dvm LM1240, £40. Racal 9520 frequency/period counter, £55. Tel 01-229 1229 or write J. Yu, 8 Basing St, London W11.

Trio 9R59DS rx, 18 months old, clean cond, spkr 1MHz calib, voltage stab, outboard xtal controlled converter, 40–10m, needs few parts little work. Also comp Q-mult. No splits, £50 ono. Why? G8IXB, QTHR. Tel Maidenhead (Berks) 26010.

B24 tri-band minibeam, £24. G3IUS. Tel Wootton Bassett 2501.

Racal TRA109C mobile ssb 160–40 autotune whip handbook, £55. R1475 and psu, £15. AT5 and psu, £15. BC221 stab psu, £15. 4m equipment Pye base 70·26 tunable rx, £10. 6CH Ranger with controls £6. Reporter, £2. G3OQC, 57 Thorpe Place, Tattershall, Lincs.

FR50B rx vgc fitted xtal calibrator, £47. Burgis, 11 Morningside Avenue, Portchester, Fareham, Hants. Tel Portsmouth 812611 ext 429, (office).

Drake MN4 matching network with manual, mint, £45. Heathkit swr meter perf PL259 connections with manual, £6.50. G3FH, QTHR. Tel Highcliffe 5974, evenings.

Swop miniature tv tube Mullard A28-14W 9in, scan coils, base, cap, 100 B7G/B9A valves E88CC, 6CH6, 5763 etc, pair PL509 tx valves, for why? sae. G3AAJ, QTHR. Tel 01-989 6741.

Matched pair RCA 6LQ6 new, £5. Matched pair 6HF5, used but good, £1.50. New RCA valves 12BA6 (3), 12BE6 (2), 12BZ6, 6GK6, 6EW6, 75p each. Hallicrafters SX28 manual, £1.50. *QST* January 1946 to September 1969, *CQ* January 1958 to July 1969, *Short Wave Magazine* April 1955 to December 1970; *RSGB Bulletin* January 1949 to December 1969, *Ham Radio* 1973. All comp and good, offers. *Wanted:* 40ft telescopic tower, must be complete and perfect, base may not be essential. G6XY, QTHR. Tel Kenilworth 52679.

12·5kHz Pye 455kHz bandpass filter low Z, £6. Solid state 96kHz ssb tx/rx unit containing 2 xtal filters, ideal basis rf speech processor. New valves: 6/40A, £4; 3/20A, £3.50; 3/10, £1; matched pair 4CX250B, £7; 6146, 2C39A, 3C100A, 8298, 6BH6 etc. Sae for info please. G8CYN/G4BEW, QTHR.

10–160m cw/a.m. transmitter plus vfo (6146B pa). Creed 7B. Pair 4CX250Bs. TW4 communicator 12V wkg plus mains psu. Homebrew psu 300/150V Stab 6·3V ac. Pocketfone cases, other components. SAE please. Cordingley, 20 Lansdown Parade, Cheltenham, Glos.

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Icom IC21 with IC21 vfo both in good cond. Modifications: extra 10·7 filter, separate 455kHz i.f. strip with vfo for a.m. and ssb, £135. ono. Prefer buyer inspect and collect. G8DBO, QTHR. Tel Melbourne (Derbys) 3275.

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KW2000B with ac power supply. State price and cond. S. Fletcher, 35 Elm Grove, Bromsgrove, Worcestershire.

KW2000 or KW2000A/B with ac power supply required in good working order. All enquiries will be acknowledged. Please write or telephone after 6pm to R. Alban (GW3SPA) 15 Mountjoy Place, Penarth, Glamorganshire. Tel Penarth 707794.

For disabled pensioner, general coverage short wave receiver with bandspread and bfo. Codar CR70A, Heath Mohican etc would suit, about £15 maximum. Contact via G4AVV QTHR. Tel 01-653 1148.

Urgently required: Manuals or circuit info for PCR rx and GEC Electra tv. Please state price required. S. Blake, 37 Chaucer Drive, Aylesbury, Bucks.

KW2000 or FT101 tx/rx. G3SZY, QTHR. Tel Stetchworth 366.

Hy-Gain model TH2 Mk3 Thunderbird in good cond, what price, only room for 2 element, carr paid with or without balun. GI6VU QTHR.

Can you help please? Circuit diagram of rx and tx Comet type 320, for photocopy and fast return. G. Didelot, 16 Impasse Louise Michel 44600 St Nazaire, France.

Faulty CR100 or B28 rx. Any cond acceptable, even incomplete. Anywhere. Briscoe, 27 De Vere Gardens, Ilford, Essex. Tel 01-554 6631.

J-Beam three or four element beam xtals 42MHz 49MHz, Pye low band rf board, also xtal 120-66MHz or 40-22MHz or any to give 362-MHz. G4ADE, QTHR. Tel Cleckheaton 77838.

Manual and or handbook for Cossor oscilloscope model 1049. Will buy or borrow and return after photocopy. Also to complete restoration rx type R1475 mounting tray type 656 a.m. ref 10A 17535. G4CCW, QTHR. Tel 01-651 1410.

9MHz ssb filters XF9A XF9B, McCoy, SEI or similar, would consider 10·7MHz. Also HRO dial and drive units. *For sale*: AF speech clipper, £6. UHF tv masthead preamp, £5. G3PJT, QTHR. Tel Comberton 3137; or G3PLP, QTHR, tel 021-744 3187.

Grid dip oscillator. King, SMC, RAF Laarbruch, BFP043.

Good cond Taylor model 45D valve tester, Taylor model 68A signal generator (or similar) complete leads and manual. Also Class D wavemeter No 1 Mk2 and HRO model 5T wkg or u/s for spares. Details please. G3WHM, QTHR.

Racal Panoramic viewer. G3VPI, QTHR. Tel 0473 79186.

Viceroy Mk2 cu/pu, or 250V etc txfmr and lf choke from same. Circuit also needed. Also Hustler 10–80m trap vertical. Russell, 3 Goss Close, Nailsea, Bristol BS19 2XB. Tel Nailsea (027-55) 4351 evenings.

Compact 160m ssb tx/rx. Separate tx also considered. G3ZZD, QTHR. Tel Tunbridge Wells 34117.

Comp morse course records and books required by schoolboy just passed RAE. T. Peel, Bankwood, Ninelands Road, Hathersage, Sheffield. Tel Hath 394.

Eddystone 770R Mk2 or R216. J. M. Heath, 235 Thorne Road, Wheatley Hills, Doncaster, DN2 5AR. Tel 66311.

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A.M./fm 2m tx/rx in good wkg cond. RX must be tunable across whole 2m band. Pref tx to be multi-channel with xtals. Pawson, 112 High Street, Somersham, Huntingdon, Cambs PE17 3EN. Tel Somersham 684 evenings.

FR DX500 Sommerkamp rx, must be in good cond preferably with 50kHz dial and all extras 160m 2m. FM and cw filters etc. Cash. G3XNX, QTHR. Tel Brixham 0803 85 4504.
FT100 or FT150 tx/rx, cowl gill motors. Price and details to G3YAA, 10 Millers Lane, Stanstead Abbotts, Ware, Herts. Tel (office) 01-634 4337 or (home) Ware 870010.
Pye Cambridge dash or boot. Any band any cond. Also parts, cables, boxes etc Westminster tx oscillator board, rx oscillator board or dismantled Westminster, any cond. G8DDM, QTHR. Tel Penn (049 481) 4483.
UHF tunable rx—viz: S27, S770R, R216. Heathkit tower. Heathkit linear. RF26 unit. *RSGB Call Book* 1974. VHF coaxial relay. Apply Baker, Bontnewydd, Aberystwyth. Tel Ffon Bronant 608.
AR88D waveband switch in new cond, also dial mechanism, price immaterial. 7Q7RM, Box 472, Blantyre, Malawi.
You, help please, urgent, circuit/manual for Philips 'scope GM-5659. Buy, loan, why? Your price paid. G3ESB, QTHR. Tel Derby 671536.
7400 ICs on boards, marked or unmarked any quantity. Telescopic tower. HF beam. VHF beam. Honda generator. Buyer will collect. G3MGV, QTHR. Tel 01-550 0032 evenings/weekends. 01-554 3434 office hours.
Spkr Bezel for RA17. Bridgen, 87 Beaulieu Gardens, Blackwater, Camberley, Surrey. Tel Yateley (0232) 870399.
Pye Tulip mic, desk type used with Pye base station installations. GM3NVU. 16 Well Park Ter, Bonnybridge FK4 1DE
Barlow-Wadley XCR-30 rx with TR801 fm tuner and nickel cadmium rechargeables, £50. TT21 valve, boxed, £1. SEI xtal oscillator type QC1261, £3. Tel Bampton Castle 694 evenings.
Mohican rx model GC-IU. G8BDJ, QTHR.
FT100 manual required urgently to buy or borrow. N. Fudge, 10 Hall Close, Bramhope, nr Leeds, Yorkshire. Tel Arthington 2958.
Pye Westminster and F27 base, any cond band mode considered, also vhf rf power meter. Cook, 26 Thames Close, Chertsey, Surrey. Tel 61393.
For private collection. Early (say pre-1930) morse inker, w/t components, valves, interesting straight receiver, etc, at sensible prices. Willing to restore but items should be reasonably complete. All letters answered. G2BCI, QTHR. Tel 01-580 4468 ext 7811, office hours.

Contests calendar

5-6 October	—UHF NFD & SWL (Rules in April issue)
5-6 October	—VK/ZL/Oceania (phone)
12-13 October	—VK/ZL/Oceania (CW)
12-13 October	—21/28MHz Telephony (Rules in May and July issues)
October	—Start of 70MHz Cumulative (Rules in September issue)
October	—Start of 432MHz Cumulative (Rules in September issue)
19-20 October	—7MHz CW (Rules in June issue)
20 October	—432MHz SSB (Rules in September issue)
26 October	—High Wycombe Practice Triple DF (Rules in August issue)
26-27 October	—CQ WW DX (phone)
2-3 November	—7MHz Phone (Rules in June issue)
2-3 November	—144MHz CW (Rules in October issue)
9-10 November	—Second 1·8MHz (Rules in September issue)
23-24 November	—CQ WW DX (CW)
24 November	—Verulam ARC 144MHz
1 December	—Verulam ARC 1·8MHz
8 December	—144MHz Fixed

INTERFERENCE PROBLEMS

Members accused of causing interference or who suffer interference from external sources are invited to seek the assistance of the Interference Committee in solving their problems.

Enquiries should be addressed to: The Chairman, Interference Committee, RSGB, 35 Doughty Street, London WC1N 2AE.

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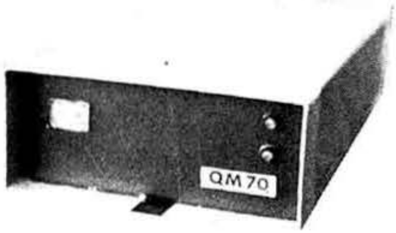

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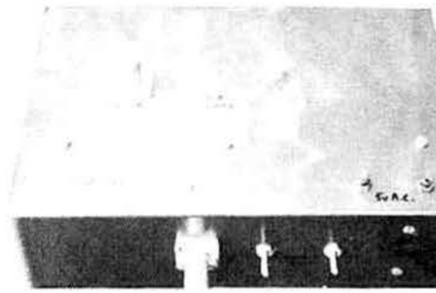

432 LINEAR AMPLIFIER

ANNOUNCING THE NEW 28/432MHz TRANSVERTER with 4W output all modes (A3J, A3H, A3, F3, A5). This all solid state transverter is the Mk II version of our highly successful 1W output version. The 4W output version together with the QM70 432 linear will produce up to 40W output on the 70cm band.

The Transverter Features

★ 12V negative earth operation, ideal for portable or mobile
★ Silicon transistors used throughout including the mixer for high output and excellent spurious signal rejection
★ P.A. transistor will withstand infinite VSWR conditions
★ Receive converter employs mosfet mixer for excellent strong signal handling characteristics
★ Receive converter noise figure = 3dB.
★ Solid state antenna change over relay (Hewlett-Packard P.I.N. diodes)
★ Led indications of transmit and receive conditions
★ Single harness supply to your existing ssb transceiver
★ Liner 2 version available
★ Second I.F. output (optional)
★ Fully compatible with our 432MHz linear amplifier
★ Attractively finished cabinet measuring 10" × 5" × 2"

Price = **£75.** Extra I.F. output = 75p. BNC or SO239 sockets 50p each extra.
4W Transverter and linear amplifier if ordered together = **£95.**
The 1W output version is still available (Specs as above) at **£57.50.**

MINIVERTERS

These units are compact transmit transverters operating from 12V negative earth. Versions for 4m, 2m, and 70cm are available. The units feature

★ Zener stabilised crystal oscillator
★ Balanced mixer utilises silicon transistors thus combining relatively high output with low spurious emission
★ **TWO** buffer amplifiers after the mixer
★ Output stage will match into load impedances between 50–75ohms
★ Output power levels: 4m = 500mW; 2m = 350mW; 70cm = 80mW
★ Reverse polarity protected
★ Separate supply inputs to oscillator chain and mixer/amplifier enabling the oscillator section to operate continuously for use with receive converters
★ Attractively styled and finished in die-cast box

Miniverter **£25** (all models).

144/432MHz VARACTOR TRIPLER

Your opportunity to get going on 70cms by one of the cheapest routes.

★ Micro-strip construction for high efficiency
★ 20W input produces 14W output
★ Accepts FM and AM (reduced modulation AM)
★ Units are aligned for maximum output on 70cm and minimum spurious output
★ Attractively styled and finished

144/432 Varactor tripler **£12**

432MHz LINEAR AMPLIFIER

Amplifier operating in the linear mode capable of amplifying ssb, fm, video or am in the 70cm band.
The amplifier features

★ 2C39A valve in stripline cavity
★ 5W input giving 50W output (1000V anode supply)
★ BNC connectors as standard
★ All voltage supplies decoupled
★ Supplied less power supply and blower. Details supplied with amplifier
★ Attractively finished in die-cast box measuring 7¼" × 4¼" × 2". **£26.**

144MHz SOLID STATE TRANSVERTER

A fully solid state transmit receive transverter operating from 12V negative earth for operation with your existing hf sideband transceiver. Featuring the following:

★ Receiver uses dual gate mosfet mixer preceded by **2 RF** stages
★ Transmitter uses all silicon transistor complement
★ Output power = 2W
★ Front panel contains, relative RF output meter, led's to indicate transmit and receive states
★ Sufficient power to drive QQV06–40A amplifier to full valve ratings
★ Supplied complete with aerial change over relay
★ Housed in cabinet measuring 10" × 5" × 2"
★ TWO I.F. outputs from the receive converter
★ This transverter offers an economical means of getti ng on 2m ssb with your hf ssb transceiver
★ 144MHz solid state transverter **£37**

Also available less antenna c/o relay with the receiver and transmitter fed to separate sockets on the rear panel **£35.**

432MHz CONVERTER Mk II

The up-dated version of our highly successful Mk I 70cm converter is now available both ready built and in kit form.
WITH CRYSTAL:

★ **TWO** RF stages. Gain = 30dB typical
★ Mosfet mixer for excellent strong signal characteristics and low noise NF = 3dB
★ Floating earth operation. 12V at 30mA
★ 28-30MHz I.F.
★ Choice of one or two I.F. outputs
★ Supplies decoupled to prevent I.F. breakthrough
★ Complete kit of parts available with full building and alignment instructions together with crystal for 28–30MHz I.F.
★ Attractively styled and finished

432MHz converter **£16.** Kit form **£10.50.** Extra I.F. output **50p.**

⁎ ALL PRICES INCLUDE CARRIAGE. ⁎ FULL 12 MONTH GUARANTEE ON ALL UNITS

Send large s.a.e. for full detailed literature and current stock levels.

AGENT:

Chris Goadby, 58 Savill Road, Lyndfield, Haywards Heath, Sussex.

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SOLATRON CD1014 (CT436) Double Beam DC—6 mc/s, good working order £54 by Securicor.

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AERIAL INSULATORS. 1½" white egg type, 6 for 55p.

TRANSMITTER P.A. units STC T4188, tunes 2·8 to 18 Mc/s manual or 28V motor drive. 13" × 8" × 8". Pair CV2518 (4 × 150) 28v blower cooled. Bases are NOT UHF type. Ideal basis for Linear Amplifier construction, £8.75.

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Telephone 34897

Terms: Cash with order. Early closing Wednesday

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The FT. 101

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Plus ease of servicing. It might look compact, but we find it very easy to get at to repair when occasionally necessary.

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TVI.

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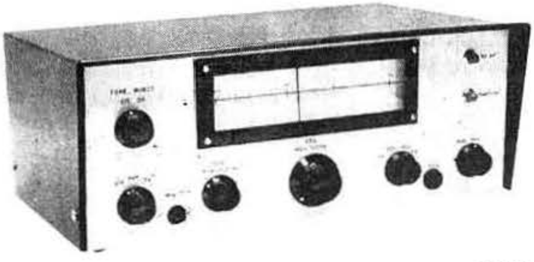

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Signed ....

Date ....

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