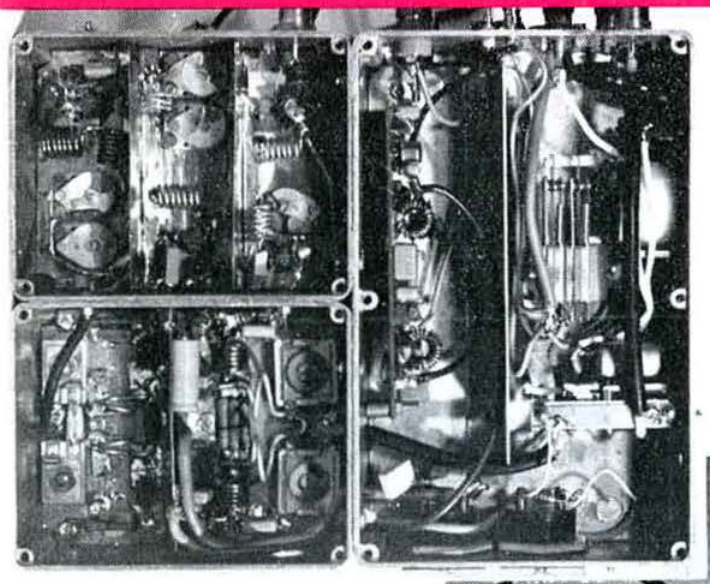
February 1977

radio communication

journal of the Radio Society of Great Britain



Underside view of transverter. Left: top, unit 2; bottom, unit 3. Right: unit 4

A 70MHz transistorized transmit/receive converter

by D. F. HARVEY, G3XBY, and C. S. GARE, G3WOS

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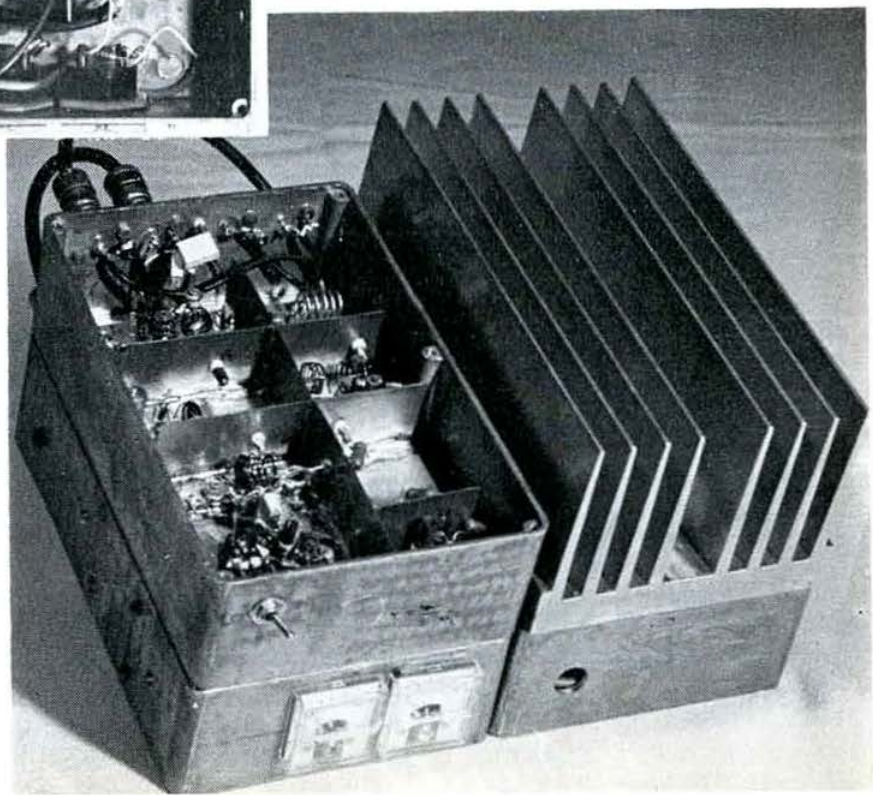

General view of the transverter. Left: unit 1 with unit 4 below. Right: heatsink with units 2 and 3 below

RSGB NEWS BULLETIN SERVICE

The RSGB news bulletin, callsign GB2RS, is broadcast every Sunday morning on hf and vhf, giving almost complete coverage of the British Isles. Its main purpose is to provide an outlet for amateur radio news items and announcements which, by virtue of their topicality or urgency, cannot wait for the next issue of *Radio Communication*.

The bulletin is prepared early on Thursday morning, and news items, marked "GB2RS news" should reach RSGB HQ by first post that day (telephoned items can also be accepted until 10am). No guarantee can be given of inclusion in part or whole of any item submitted and, once broadcast, items are not usually repeated.

SCHEDULE

Time	MHz	Location and coverage (hf) or beam heading (vhf) of station
0930	3·65	G2MI, Bromley, Kent (SE England)
1000	3·65	G8ML, Cheltenham (SW England)
	144·50	GM3UAG, Ellon, Aberdeenshire (NNW)
	144·50	G8GGK, Croydon, Surrey (NE)
1015	3·65	GI3GAL, Belfast (N Ireland)
	144·50	GI3TLT, Bangor, Co Down (N)
1030	3·65	G2CVV, Derby (N Midlands)
	144·50	G4DCH, Burnham-on-Sea (NW)
	144·50	GM3UAG, Ellon, Aberdeenshire (SW)
	144·50	G3PWJ, Brierley Hill (NW)
1045	144·50	G8CDP, Middlesbrough (NW)
	144·50	G8GGK, Croydon, Surrey (SW)
	144·50	G8BHQ, Stockport (NNW)
1100	3·65	G5VO, Bridlington (NE England)
1115	3·65	G3LEQ, Knutsford (NW England)
1130	3·65	GM3EHI, Bellshill, Lanarkshire (S Scotland)
1145	3·65	GM3HGA, Aberdeen (NE Scotland)

An rtty news bulletin, callsign GB2ATG, is also transmitted every Sunday at 1200 on 3·590MHz and at 1230 and 1245 on 144·6MHz. This bulletin carries items of interest to rtty enthusiasts.

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CONTENTS

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ABC
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

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Contributions and all correspondence concerning the **content** of *Radio Communication* should be addressed to: The Editor, *Radio Communication*, 35 Doughty Street, London WC1N 2AE. Tel 01-837 8688. (**Circulation** queries should be addressed to: The Subscriptions Department, RSGB).

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

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The 2m First Family

Where quality is a prime requirement

Regardless of where you are: in your QTH, on the road, on vacation, on a hike: you will always find a QSO on the 2m band with TRIO VHF equipment. And no matter on which transmit and receive frequencies other 2m stations are operating, with TRIO equipment you can always join in, because you'll be qrv on all international fixed-frequency channels—either in simplex or via repeaters.

2m FM Portable Transceiver TR-2200GX

The TRIO TR-2200GX is the latest model in the most successful line of 2m FM handy portable equipment ever produced. Logical development, aided by suggestions from happy owners has produced the best 2m portable available today.

Look at the features: over 2W output; receive sensitivity of 0·4 microvolts for 20dB quieting; I.F. shape factor of 2 : 1; exclusive tuning fork controlled 1,750Hz access generator; 12 channel capability with factory fitted crystals for S20, S22 and R7; designed for maximum flexibility of use, on internal batteries or external supply for mobile/fixed station operation; built in telescopic antenna and standard socket for external antenna connection. Built in metering allows checking of signal strength, transmit output and battery voltage. The TR-2200GX is housed in a rugged steel case for ultimate protection against accidental damage, with all operating controls placed for maximum operator convenience on the top face of the rig.

The most important asset of course is TRIO quality of design. No other manufacturer can match TRIO's vast experience in producing high quality electronic equipment and as a result, TRIO lead, not only in instruments and Hi-Fi, but also in the amateur field.

Unlike other portable equipment, the TR-2200GX is supplied *complete* with all accessories including a protective carrying case and shoulder strap, external power leads and the all important battery charger for the optional NiCad pack. A set of rechargeable batteries costs £9.72 including VAT. The same option on comparable gear can cost up to £30 so be sure to ask what you get for your money.

2m FM Mobile Transceiver TR-7200G

The TR-7200G is the best selling 2m FM mobile transceiver in Europe. Some of the reasons why this is so may not be obvious from the basic specification. It's not just the high sensitivity (0·3μV 15dB) quieting or the superb finish, it's the full range of accessories and the finest service backup in the country. It's the little details like the LED under the channel number indicator that is RF powered and only lights when you have a receiver crystal fitted. The "transmit" lamp gives the same function for the transmit crystals. This means that you no longer have to wonder which channels are operational when you are mobile. Did you know that by removing the rear panel accessory plug you can drop the receiver gain by 10dB to prevent the fellow next to you in the car park at the rally from blowing your head off!

Did you know that the swr protection system is not the "sudden death" variety but gradually reduces the Tx power with increasing SWR so that you are not put completely off the air when your mobile whip antenna gets wet. The same system protects the PA and driver from over voltage damage when the rig is used in a vehicle having a high charge voltage from the alternator.

Only Trio equipment has the unique tuning fork controlled repeater access tone generator to ensure access first time, every time.

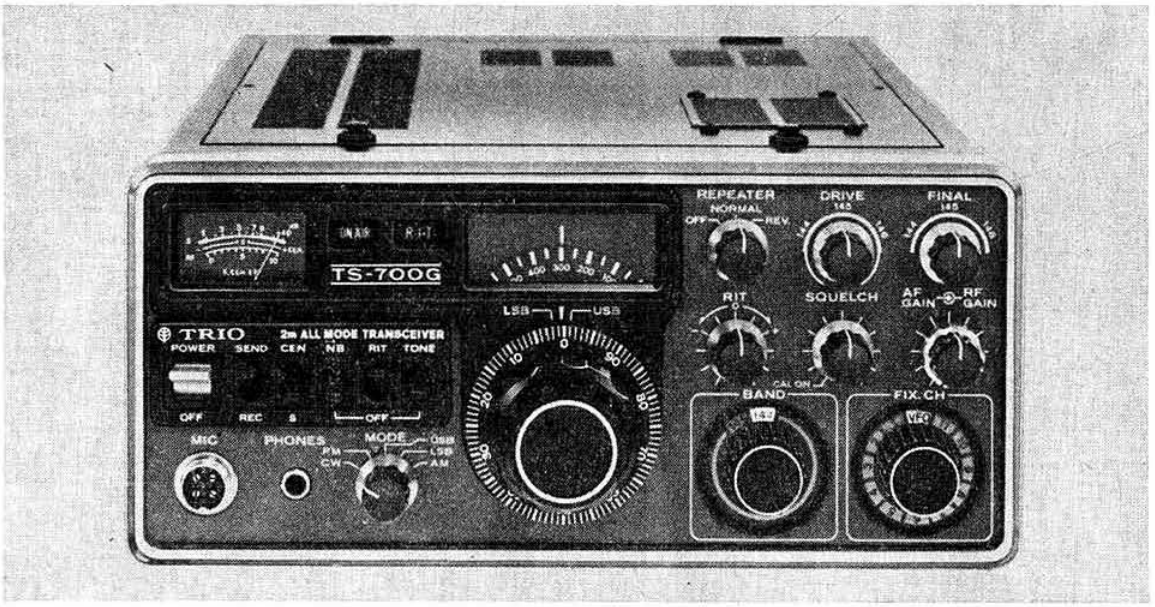
All these features and more, can only be provided in equipment made to professional standards by a professional company. The Trio Corporation is the largest electronics manufacturer in Japan offering a range of amateur equipment and you, the customer, benefit every time.

The TR-7200G comes to you complete with mobile mounting bracket, stand off feet for fixed station use, microphone, microphone bracket, cable manual and fitted S20, 21, 22, R6 and 7.

Extra channels available for TR-7200G at £10 inc VAT for 3 channels, £20 inc. VAT for 6 if ordered at the time of equipment purchase.

Sole Importers
LOWE ELECTRONICS
119 Cavendish Road
Matlock Derbyshire
Tel: Matlock 2817/2430

TRIO



TS-700G

In case you hadn't noticed, the TRIO TS-700 has a new look. Now updated and incorporating all the features which made it the most sought after transceiver on 2 metres, it now includes additional refinements which you, the keen radio amateurs, have requested.

The basic concept remains the same: a complete 2 metre station package operating from a.c. mains or 12V d.c. supplies, providing full VFO coverage of the 2 metre band with facilities for 22 crystal controlled channels for popular repeater and net frequency working. The same TRIO design standards such as the ultra linear PA operation resulting from the use of an inverter derived 20V supply, are still used. The same supply is also used to feed the driver and the audio stages of the receiver. TRIO's acknowledged leadership in the quality audio field has been put to good advantage in their amateur equipment. Everyone comments on the clean crisp audio quality of the TS-700G both on transmit and receive.

The main refinements can be summarised as follows:

★ New improved receiver front end system contributes to a new standard of sensitivity; 0·25μV for 10dB S + N/N ratio on SSB, 20dB quieting for 0·4μV on FM. This is the best receiver on the market today.
★ New FM IF strip with narrower filter for European market.
★ New centre zero tuning meter for FM.
★ Automatic tone burst.
★ New 100kHz calibrator with automatic disconnection of antenna to remove confusing outside signals. Automatic transmitter disable in CAL mode.
★ New logarithmic S meter.
★ New repeater and reverse repeater operation at the turn of a panel switch. Operates on either VFO or crystal controlled channels.
★ New improved audio system for FM and AM transmit.

The use of fully balanced mixing at all stages of frequency conversion guarantees a clean signal free from unwanted products. The power output of the transmitter is normally between 15 and 18 watts and this, in conjunction with the TRIO amplified ALC system, gives you an outstanding signal. Just listen to 2 metres and judge for yourself which rig always sounds the best.

If you are considering your once only rig for 2 metres, then the TS-700G has to be your logical choice. Backed by the largest company in Japan making amateur radio equipment, and the best service facilities in Europe at Lowe Electronics, the TS-700G SSB/FM/CW/AM transceiver has to be the all time best buy.

Sole Importers
LOWE ELECTRONICS
119 Cavendish Road
Matlock, Derbyshire
Tel: 0629 2817/2430

TS-700G £389.00 VAT excl.

TRIO

LOWE ELECTRONICS

Teleprinter signals are found over the whole radio spectrum. They convey news agency reports usually in English or French, weather information and personal or business messages in plain language or code. RTTY signals are also heard on all the amateur bands including 2 metre signals from Oscar satellites and may originate from any country in the world.

In the past, the main drawback in decoding these signals has been the necessity to use a mechanical teleprinter. The accompanying noise, oily smells and frequent maintenance problems, together with the difficulty in making speed changes to accommodate different standards have tended to put off all but the dedicated enthusiast.

The advent of solid state devices capable of decoding and displaying the RTTY information in complete silence has opened up a new horizon for the radio amateur and keen SWL. The all new TD224 video converter accepts RTTY information and processes it to produce a composite video signal which can be displayed on a 625 line monitor, or on a standard TV set using an optional UHF modulator. This now means that you can sit and enjoy contacts using RTTY and the SWL can use his general coverage receiver to read news and views from all parts of the world.

The display produced by the TD224 is in the form of seven lines of 32 characters, using large character size for easy reading and trouble free viewing. New information is displayed on the bottom line of the screen and when the line is full, the display steps up one line and continues reading. At the same time, the top line is removed from the display area. Operation of the TD224 is simplicity itself and all you need to copy RTTY signals is a suitable audio terminal unit (which we can supply), together with either a 625 line monitor or UHF TV set.

SPECIAL OFFER SECTION — GRAB NOW WHILST YOU CAN!

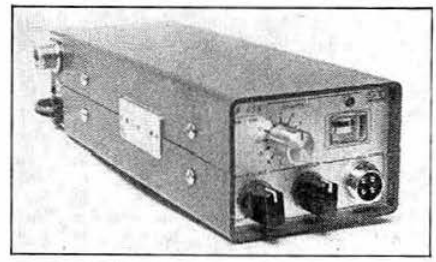
KF 430

* SMALL SIZE only 240 × 85 × 60mm.
* LIGHT WEIGHT only 1·2 Kg.
* FREQ. RANGE 433–346MHz.
* POWER O/P. 10W or 3W switched
* SENSITIVITY 0·4μV for 20dB q'tng.
* AF. B/Width. 500–3000Hz.

NOW ONLY £202 inc. VAT
FITTED 9 CHANNELS
***THE* BEST BUY AVAILABLE**

These brief details cannot convey the sheer quality of construction of the KF430. The entire receiver front end is housed in its own fully screened enclosure, as is the transmitter output section. Multiple tuned circuits ensure a clean output signal at all power levels. All crystals are fitted with individual trimmers for spot on accuracy. The receiver selectivity is to current UK and European standards and an automatic tone burst is fitted.

The KF430 comes with 9 channels fitted to cover all simplex and repeater channels in current use. A matching microphone and mobile mount are included.



Following the worldwide success of the TS 700, TRIO have taken the TS 700 basic design and packaged it for 2 metres SSB mobile use.

The TR 7010 sets new standards in receiver sensitivity and low spurious emission on transit. Operating CW and SSB from 144·1–144·335MHz, the TR 7010 covers CW SSB and beacon activity. 48 5kHz channels plus VXO and RIT provide continuous coverage.

Single conversion using an I.F. of 10·7MHz with a superb crystal filter provides outstanding selectivity. Wide range amplified AGC and newly developed FET devices in RF amplifier and mixer stages allow maximum sensitivity to be used with freedom from overload due to adjacent signals. Single conversion transmitter with fully balanced mixer system generates a beautifully clean signal with crisp audio quality.

TR 7010

HOORAY!
WE GOT SOME MORE—

ONLY £175
INC. VAT

T 599S

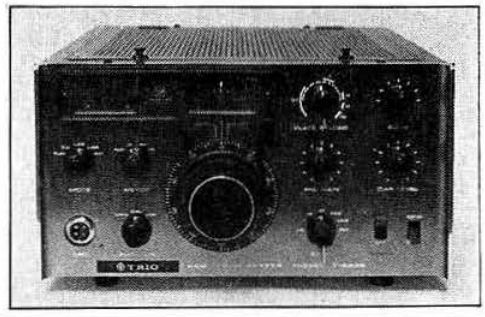
TOP TRANSMITTER AT ROCK BOTTOM PRICE

ONLY £255 INC. VAT

Completely solid state except for the driver and two 6146B fan cooled PA tubes (for that low intermod, signal that means real quality), the T599S has all that you could want. All mode operation SSB, CW, A.M. on all bands from 80m to 10m. Built in vox with adjustable delay and anti-vox. Multi position metering for complete operator information. Break-in CW with built-in sidetone generator. Dual impedance microphone input system—and of course, TRIO quality of construction with a die cast front panel and rugged casing. Signal quality.

Guaranteed by TRIO's acknowledged leadership in the audio field; by the use of an 8 pole crystal filter; by the use of linear PA tubes and by the use of an amplified ALC system which gives signal punch without sacrificing signal quality.

Measuring only 10¼" × 5¼" × 12" and weighing only 25 lb., the T599S is a real mighty mouse. Able to sit on the smallest operating desk, it's a perfect match for the R599S or the earlier JR599 receivers—or any receiver for that matter.



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THE QUALITY TRANSVERTER FROM THE PEOPLE WHO KNOW!

As you may already know, we are now manufacturing a 144MHz all mode solid-state linear transverter, MMT144/28 as pictured below.

This 144MHz unit is fully compatible with any 28MHz drive source and provides 10 watts continuous power output from power transistors capable of withstanding severe mismatch.

An internal aerial changeover relay of the PIN diode type is incorporated which has a through-loss of less than 0·2 dB. The combination of a low distortion balanced transmit mixer incorporating protected dual gate MOSFETS, to produce a spurious-free linear signal and a low noise receive converter, makes the unit ideal for all modes of transmission at 144MHz, particularly where a high degree of stability, linearity and sensitivity are of prime importance.

The use of high Q circuitry throughout ensures an extremely good spurious rejection and selectivity.

The unit is housed in a highly durable black diecast case, and all circuitry is constructed on high quality glass-fibre printed circuit board. The high power linear amplifier stages are housed in a separate internal compartment, thus ensuring excellent electrical and thermal stability.

SPECIFICATION

Frequency range: 144-146MHz
Input modes: SSB, FM, AM or CW
Input frequency range: 28-30MHz
DC power requirements: 12 Volts nominal
Current consumption: 2·2 Amps peak

Power output: 10 watts continuous rating
Drive requirements at 28MHz: 500 mW or 5 mW
Relative 116MHz output: —65 dB
Other spurious outputs: —65 dB
Receive converter gain: 30 dB

Receive converter noise figure: Better than 2·5 dB
Power connector: 5 pin DIN
RF input/output connectors: 50 ohm BNC
Size: 187 × 120 × 53 mm
Weight: 800 g

Price £88.88 inc VAT

Any further information on this product and others from our extensive range may be obtained by contacting our sales department, who will be only too pleased to help. Incidentally, we are now on telex. Should you require any information urgently, our number appears below.

MICROWAVE MODULES LIMITED

BROOKFIELD DRIVE, AINTREE, LIVERPOOL L9 7AN

TEL.: 051-523 4011

TELEX: 628608 MICRO 9

South Midlands

TOTTON (HEAD OFFICE), LEEDS (SMC NORTHERN)

DIGITAL II from KYOKUTO

SCANNER AND CRYSTAL T.B. OPTIONS

DIGITAL II, £235 + CRYSTAL TB, £10; SCANNER, TBA
SAVE £10 ON OLD PRICE!

The Digital 11 offers complete 5kHz step coverage across 2 meters and now with the Scanner 33, 25kHz channels from 145MHz upwards covered in around 10 seconds. It offers full lock and lockout on all channels. The scanner stops on a required channel for 10 seconds, then unless locked moves on. The bright digital readout comes from 6 seven segment LEDs.

Selectable 10 or 1 watt output for simplex or duplex (up and down shifts), across 144-146 (rx to 149MHz) from a tiny 6¼" × 2" × 7¼". Easily underdash mounted with the supplied mounting bracket, or slipped in place of the broadcast wireless.

For strong handling, and low noise the R.F. mixer, first I.F. (16·9MHz) second mixer (and LO) are all FET's. The front end is tuned by varicaps by the DC output of the P.L.L. with superb selectivity provided by a 15 pole (±8kHz at −6dB ±15kHz at −70dB). Ceramic filter. LED lamps indicate if the P.L.L. is unlocked or the squelch open. The V.C.O. is directly modulated (for exceedingly linear deviation). Unitary 6 circuit block construction (for seviceability and screening). Selective calling socket

SMC73 Ex-stock, only £114.50 + VAT

The SMC73 General Coverage Receiver

The SMC73 is an all Solid State, Mains and 12V, communications receiver covering 550kHz to 30MHz in four overlapping ranges. Frequency readout is by two illuminated dials tuned by coaxial spun aluminium knobs, the larger for general coverage, the inner for amateur band (10-80m) band spread (set by use of internal 3·5MHz crystal calibrator).

FET's are employed in the R.F. Amplifier, mixer, VFO and BFO (these latter two stages being fed from independent stabilised supplies) ensuring good sensitivity, stability (electrical and mechanical) dynamic range, (helped by adjustable RF attenuator), and marked freedom from 'pulling' of both the local and beat frequency oscillators.

An internal loudspeaker (but with jacks for 'phones and external speaker), illuminated signal meter, SO239 (UHF) coax. socket and binding posts for antenna, switchable envelope (A.M.) and product detectors (SSB/CW) (provision on switch for possible fitting of FM demodulator), are all features of this exciting new low price receiver.

CRYSTALS AND CRYSTAL FILTERS from SMC (£3.75 pair or £2.00 singles) P & P 20p. VAT 12½%

YAESU

FT2F, FT2FB, FTAUTO, FT224

(6, 18MHz Tx and 14, 52MHz Rx)

SIMPLEX S:-O, 12, 16, 19, 20–24

DUPLEX R0-R9 all IR (T & R)

FT200(B FT301(S) FT221(A)

FT101EX, FT75(B), **£2.20**

OTHERS

TR2200(G), C146A, C826, MB

(12MHz Tx and inc. 44MHz Rx)

SIMPLEX SO 20-24

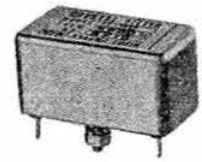
DUPLEX R3-R7

Selection of inverse receive

CONVERTER CRYSTALS, **£2.20**

38·666 (2m), 42 (4m), 50·5 (70cm)

YF30F350	350Hz F(*) 101 CW	£18.00
YF30F600	600Hz F(*) 101 CW	£18.00
YF30F12	12kHz F(*) 101 FM	£18.00
YF90H600	600Hz CW 9MHz	£16.00
YF90H2·4	2·4kHz SSB 9MHz	£16.00
YF90H12	12kHz FM 9MHz	£18.00
YF107M600	600Hz CW 10·7MHz	£16.00
YF107M2·4	2·4kHz SSB 10·7MHz	£16.00
YF107M12	12kHz FM 10·7MHz	£16.00
Carrier Crystals (9 or 10·7)		18/U each
		£2.00



KP202

WITH KCP2 CHARGER

The handheld KP202 with its 2W of RF and ¼W of audio, immunity to image and IF breakthrough, offers performance to rival all walkie-talkies and many mobile 10W sets. The KP202 is supplied with telescopic whip, leather handle/whip case and F type plug. Accessories include automatic (R channels only) crystal tone burst (£10.00), flexi stubby antenna (£5.75), leather case (£4.75), base charger KCP2 £11.25), set of 10 ni cads (£8.50), F to UHF adaptors (£1.45), F plugs, spare whips, spare hods, etc. EX-STOCK IN TOTTON

SIX CHANNELS FITTED S20 and S22 and any 4 of: S0, S21, S23, S24, R3, R4, R5, R6, R7, *only* **£104.75 (+ VAT)**

SOLID STATE MOBILE LINEARS (VHF & UHF) FROM KLM & AMPERE

2 meter, SSB/CW/FM, RF sensing with manual override, "Microstripline"
12V D.C. 10W drive
2" × 6·5" × 10" (11") (VAT + 12½%)
(Over 15 different models—S.a.e. details)
PA144/160/BL 145MHz 160W output **£155**

2 or 70 Superb R.F. sensing, excellent bias arrangements, c/w mounting bracket.
12V D.C. 10W drive
2·5" × 5·2" × 7·5" (8·5") (VAT + 12½%)
APB82A 145MHz 80W output .. .. **TBA**
APB57A 433MHz 45W output .. .. **TBA**

Microwave Modules Transverters

From Ten, Six or Two Metres (a '101 etc, a '620B or a '221R).

10W output, balanced Tx mixers, low spurious content, high sensitivity with dynamic range. (VAT + 12½%) (full converter range stocked S.A.E. details).

MMT144/28 or 50	2 metres	£79.00
MMT432/28 or 50	70 centimetres	£97.00
MMT432/144	Double conversion	£133.00

YAESU CLOCK

Analog clock with automatic advancing 24 hour time zone hour disc giving, at a glance, time in principal cities or time zone. Battery powered, self starting, shock resistant.

QTR24 only **£13.00** (VAT +8%) p & p 30p

COAX RELAYS
12V DC 50 ohm, Silver plated.
Ex stock P. & P. 30p (VAT 8%).

	Power	Crosstalk (at 500MHz)		
CX120	50W	35dB	Cable entry	£8.50
CX230	300W	40dB	BNC sockets	POA

COAX SLIDE SWITCHES
Up to: 1kW, 1·5GHz, 0·3dB loss, 1·2:1 VSWR, 50dB isolation, 50 ohm 'N' or 'PL' fittings.
Ex stock P. & P. 30p (VAT + 8%)

TWS120	1 in 2 out Nickel SO239	£5.40
TWS120G	1 in 2 out Gold SO239	£6.50

SEND LARGE (10" × 12") SAE OR 15p STAMPS FOR FREE YAESU CATALOGUE + 22 PAGE STOCK/PRICE, S.H. LISTS ETC

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YAESU

YAESU MUSEN

SECURICOR SERVICE

2 YEAR GUARANTEE

WE THINK IT THE BEST NOW IT COSTS LESS ! !

FT221R

FT221R—£339 (+ VAT)

Thanks to our bulk buying policy, we have beaten inflation and the falling pound saving you £22.50 on LAST YEAR'S price! As an added bonus all new SMC FT221Rs cover 4MHz and are equipped with 600kHz and 1·6MHz shifts.

Yaesu's state of the art technology brings you a fully modular plug in board construction, multimode, 2m transceiver that renders over the board "rats nest" wiring obsolete. The 134MHz phase locked voltage controlled oscillator, combined with automatic varicap tuning of the transmitter and receiver gives you, without resort to preselectors, an exceedingly clean transmit signal, and a sensitive receiver without degradation of strong signal handling capabilities.

FT221R FEATURES

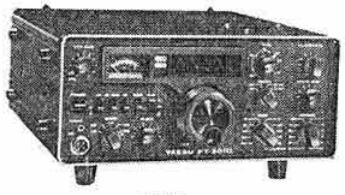
144–148MHz INCLUSIVE COVERAGE
MULTI-MODE A.M.-FM-USB-LSB-CW
234V AC OR 12V DC WORKING
11¾" (14") × 5" × 11¾" AND 22LB
DUAL SPEED SMOOTH VFO DRIVE READOUT TO BETTER THAN 1kHz
44 FIX CHANNELS (4 × 11) (2MHz)
SEMI BREAK-IN WITH SIDETONE
UNIQUE AUTOMATIC TONE BURST
P.T.T. MICROPHONE SUPPLIED
FRONT PANEL ADJUSTABLE VOX
FRONT PANEL MICROPHONE GAIN
ALC EXTERNAL PHONO SOCKET
70W DISSIPATION PA DEVICE
600kHz AND 1·6MHz RPT. SHIFTS
"S"/ CENTRE ZERO/OUTPUT METER
CLARIFIER (IRT WITH RT + TT)
2·4kHz SSB 12kHz FM BANDWIDTH
ADJUSTABLE SENSITIVE SQUELCH
100kHz CRYSTAL CALIBRATOR
SWITCHABLE NOISE BLANKER

THE FRG7, GENERAL COVERAGE RECEIVER Ex-Stock

The FRG7 is a general coverage solid state receiver with specifications unparalleled in its price range. It uses a Barlow Wadley Triple-mix, drift cancelling loop for continuous, spin-tuned inclusive coverage of 0·5 to 30MHz with calibration accuracy better than 5kHz. Frequency selection is accomplished by setting the RF (pre-selector and range switch), dialling up the required number of megahertz, then tuning the VFO knob as normal.

The receiver is sensitive (0·5μV for 10dB, S + N/N (SSB)) and stable (within 500Hz for any 30 minutes after warm up) with A.M., SSB and CW modes catered for. A 3 position audio filter, RF attenuator, dial lamp conservation switch, recorder and phone sockets are fitted. It is mains powered, but should the supply fail, or portable operation be required, 8 dry cells are automatically switched in. EX-STOCK IN TOTTON **£148.50** (+ VAT)

A TRIO OF YAESU WINNERS ALL EX-STOCK IN TOTTON



FT301
Top to ten, solid state, transceiver 4 models to choose from.
10 or 100W output, digital or analogue.

FT223
2m, FM 23 channels. 12V DC—10W output c/w tone burst, mic, mounting bracket, smart, sensitive and selective.

FT101E
WORLD FAMOUS transceiver, top to ten capability 3 models to choose; 234 and 12V DC speech processor, etc. Large range of matching accessories available.

For Further Information and FREE Yaesu Catalogue Send S.A.E.

SOUTH MIDLANDS COMMUNICATIONS LTD

Head Office, Main Showrooms and all Mail Order enquiries to Totton
OSBORNE ROAD, TOTTON
SOUTHAMPTON SO4 4DN
Hours of business: 9-5.30; 9-12.30 Saturday

Cables: Aerial Southampton
Telex: 477351 SMCOMM G
Tel: Totton (04216) 4930 & 2785

Northern Branch: **The Chambers No 3 The Parade, North Lane, Headingley, Leeds Tel. (0532) 78 2326 Hours of business: 9-5 Tues-Sat 9-8 p.m. Thursday.**

AGENTS (evenings) ALL QTHR
Brian Kennedy G3ZUL Droitwich (09057) 4510 **Peter Avill G3TPX,** Darton (022 678) 2517. **Ian McKechnie GM8DOX** Bridge of Allan (078683) 3223. **Howarth Jones GW3TMP,** Pontybodkin (035 287) 846. **Mervyn Anderson GI3WWY,** N.I. Tandragee (0762) 840656.

South Midlands Communications Ltd.

YOUR SINGLE STOP SOURCE FOR:—

VERSATOWERS

The telescopic, 20ft section, with full tilt over facility permits easy antenna adjustments. The low unit weight and superior design of solid ground post allows easy and cheap installation often without resort to concrete. Beware of false comparisons with other brands. Before buying a mast, we advise you to contact us giving full details. With 18 years experience in the design and manufacture of commercial masts and antennas, which are used from the frozen wastes of Antarctica to the deserts of the Middle East. We supply Nato, the UN, the Red Cross, the British Antarctic Survey, HM Government and to all continents, in fact, to over 100 countries.

We hold the largest stocks of masts and antennas in the UK, from the Versatower (copied but not equalled), to the products of Belgium, England and Australia detailed below.

ALIMASTS

TELESCOPIC LIGHTWEIGHT

3, 2 or 1·5m. Quick lock sections. Many versions 6 to 21 metres. Rigging extra. Carriage £2. VAT 8%.

7 × 2m	£38.75	6 × 3m	£42.50
4 × 3m	£28.50	7 × 3m	£55.75

HAMTOWERS

SELF-SUPPORTING

Galvanised lattice 10' sections. Freestanding with climbing steps. Carriage £3.50. Ex-stock 8% VAT.

30' c/w base grillage	£164.60
40' c/w base grillage	P.O.A.

TELOMASTS

TELESCOPIC GALVANISED

10' steel sections c/w guy rings, etc. Carriage £2. Ex-stock VAT 8%.

30' **£22.85** or **£41.75** c/w rigging
40' **£29.75** or **£53.75** c/w rigging
50' **£37.95** or **£69.95** c/w rigging

TELETOWERS

Telescopic Galvanised Lattice and Tube Section. Carriage + 8% extra.

42' **£121.00** (Rigging Kit £28)
57' **£174.00** (Rigging Kit £28)
79' **£224.00** (Rigging kit £48)
101' **£303.00** (Rigging kit £76)

CUSHCRAFT VHF OMNI (Carriage 95p) VAT 12½%

RINGO RANGERS ARX 6dB gain (over ¼λ), ultra low angle radiation, excellent 50 ohm match, uses 3 × ¼λ in phase and 1/8λ stub. 145MHz version approx 9' 6" (4½lb), 432MHz approx 3' 6" (illustrated centre right).

ARX2 Ringo Ranger 145MHz	£21.50	ARX450 Ringo Ranger 432MHz	£21.50
AR2 3dB Ringo Vert	£12.75	ABW144 2m Big Wheel ..	£14.50
AR25 QRO AR2	£15.00	ABW12S ABW harness ..	£7.30
CX1000 29MHz Ringo ..	£25.75	ASQ1 2m Squalo	£11.75

JAYBEAM 70 (4m), 144 (2m), 432 (70) (Car. £1) VAT 12½%

D5/2m 5 over 5 slot feed ..	£11.00	PBM14/2m 14 ele Para ..	£25.20
D8/2m 8 over 8 slot feed ..	£14.75	D8/70 8 over 8 slot feed ..	£12.50
5XY/2m 5 element crossed	£12.90	PBM18/70 18 ele Para ..	£15.00
8XY/2m 8 element crossed ..	£16.10	MBM48/70 48 ele Multi ..	£17.50
10XY/2m 10 element crossed	£21.30	MBM88/70 88 ele Multi ..	£23.40
5Y/2m 5 element yagi ..	£6.20	12XY/70 12 ele crossed ..	£24.00
8Y/2m 8 element yagi ..	£8.10	4Y/4m element yagi	£10.20
10Y/2m 10 ele long yagi ..	£17.20	PMH2/70 2 way harness ..	£4.75
14Y/2m 14 ele long yagi ..	£22.00	PHM2/4m 2 way harness ..	£13.20
Q4/2m 4 element quad ..	£13.20	PMH2/C Circ. phasing ..	£4.10
Q6/2m 6 element quad ..	£17.60	PMH2/2m 2 way harness ..	£5.50
PBM10/2m 10 ele Para ..	£20.50	JBL 15/59 2" Joint sleeve ..	£3.37

SMC TRAPPED DIPOLES (Post 45p.) VAT 12½%

S 500W P.I.P. 14SWG ..	£19.60	P 500W P.I.P. Cu/Terylene	
HP 1K P.I.P. 14 SWG ..	£21.75	braid c/w 75' feeder, etc. ..	£21.75

MOSELY TRI-BAND BEAMS (Carriage £2.50) VAT 12½%

TA33 3 ele 200W R.M.S. ..	£64.00	TA32 2 ele 300W A.M. ..	£44.00
Mustang 3 ele	£82.50	Mustang 2 ele 1kW A.M. ..	£66.00

GEM QUAD FIBREGLASS (Carriage £2.00) VAT 12½%

GQ2E 2 element ..	£119.00	GQ4E 4 element ..	£238.00
GQ3E 3 element ..	£178.00	CK1Q 1 ele Conv. kit ..	£60.00

G WHIP HF MOBILE (Carriage 90p) VAT 12½%

Tribander 10–20m (+ LF)	£14.61	LF40, 80 or 160	£4.87
Multimobile 10/20 (+ MM)	£18.06	MM40, 80 or 160	£4.87
Flexiwhip 10m (+ FF)	£12.42	FF15, 20, 40, 80 or 160 ..	£5.04
Basemount ¾" hole mount	£2.20	Telescopic whip for coils	£1.50

HY GAIN HF RANGE (Car. £1.00–£2.50) VAT 12½%

BN86 1:1 ferrite Balun ..	£12.00	TH2MKIII 10–20m 2 ele ..	£94.00
103BA 10m 3 element ..	£43.50	TH3JNR 10–20m 3 ele ..	£96.00
153BA 15m 3 element ..	£54.50	TH3MKIII 10–20m 3 ele ..	£137.00
203BA 20m 4 element ..	£103.40	TH6DXX 10–20m 6 ele total	£164.50
402BA 40m 2 element ..	£146.00	HY QUAD 10–20m 2 ele ..	£151.80
18V 10–80 Load Vert. ..	£24.50	DB1015A 10–15m 3 ele ..	£99.00
12AVQ 10–20m Trap Vert. ..	£33.50	LA1 Lightning arrestor gas	£20.30
14AVQ 10–40m Trap Vert. ..	£47.50	LA2 Lightning arrestor spark	£3.30
18AVT/WB 10–80m Vert. ..	£64.40	HY TOWER 10–80m Vert. ..	£162.80

BANTEX VHF WHIPS (Carriage 90p) VAT 12½%

70½ ½, 70MHz fibreglass ..	£4.00	B5U ⅝λ432MHz	£5.00
144½ ½, 145MHz FG or SS ..	£3.50	UCL Mid loaded	£8.00
B55/8145MHz	£6.35	TLM Trunk lip mount ..	£5.25
BGA FG ½ 2m fibreglass ..	£8.75	MB Magnetic Base	£8.50
BGA SS ½ 2m stainless steel	£8.50	Standard base unwanted deduct	£0.50

ROPES (Carriage extra) VAT 8%

3mm HT steel	yd. £0.13	X150 Rustproof 150m ..	£10.85
5mm HT steel	yd. £0.20	7 × 81g Galvanised 100' ..	£2.20

AERIAL INSULATORS (Post extra) VAT 12½%

2½" polyprop ribbed	14p	SMCP1 8" carbon polyprop	85p
NTI 4½" polyprop ribbed ..	45p	3" porcelain ribbed	33p

AERIAL WIRE (Carriage extra) VAT 8%

14SWG hard drawn cu ..	yd. 10p	7/·044 cad cu standard ..	yd. 17p
Cu terylene braid	yd. 13p	7/·036 cad cu standard ..	yd. 13p

COAX PLUGS (p & p extra) VAT 8%

PL259 Standard UHF plug	£0.48	258 Back to back (female)	£0.80
UHF fixed reducer	£0.56	"T" adaptor (2F + 1M)	£1.20
"Solderless" UHF RG8U	£0.51	Right angle (1M + 1F)	£0.90
"Solderless" UHF UR43	£0.51	Phono/car to SO239	£0.55
UG** Reducers state UR43 or 70	£0.14	SO239 2-hole socket ..	£0.37

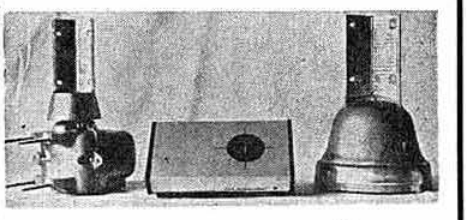
CABLES RF FEEDERS (Carriage extra) VAT 8%

RG8/U 50 ohm Heavy ..	yd. 35p	UR39 75 ohm Medium ..	yd. 24p
UR57 75 ohm Heavy ..	yd. 36p	T3278 75 ohm Distribution ..	yd. 20p
74 ohm Flat twin	yd. 8p	UR43 50 ohm Solid Cent. ..	yd. 15p
300 ohm Ribbon	yd. 9p	UR76 50 ohm Strand Cent. ..	yd. 15p

ROTATORS

Ex-Stock in Totton for fast delivery. VAT: Rotators 12½%. Cable and deliv. 8%. Carriage (BRS or post) FREE. Securicor delivery £1 extra (mainland).

AR30 (illus. right near and centre)	£39.50
AR40 (illus. right centre and far)	£46.00
AR33 (de-luxe control AR40)	£57.50
Big Torque sim CD44 Head	£79.50
CD44 (C.B. illus. left) med. duty	£95.00
Ham II (C.B. illus left) heavy duty.. ..	£129.00
2010/220 Stolle though Rotator type ..	£41.25
2030/220	£45.50
AK121	£3.60
5 core—AR30/40/33 2030 per yd	20p
8 core—CD44, Ham II per yd	32p



AEC METERS SWR, Power (Pr), Field Strength (F.S.) P & P 40p (VAT + 8%). Unless stated: SWR (± 10%), 1.5 to 160MHz, 50/75 ohm

SWR10	(TLH) single meter horizontal type	£8.15	SWR40	Single meter Vert. type with F.S.	£7.80
SWR20	(BLH) 50 ohm F.S., Pr. 10 and 100W FSD (±10%)	£9.90	SWR50A	(TRH) SWR (±5%) 3-5MHz uo, Pr to 1kW (±20%)	£9.60

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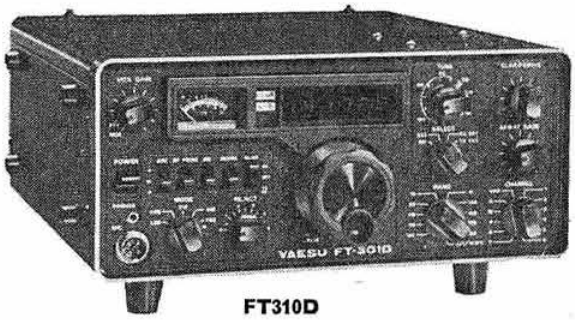
YAESU MUSEN

FT301 SOLID STATE GOLD LINE



FT310D

YAESU's state of the art fully modular plug in board, all solid state, top to ten transceiver, with RF processor and rejection control. Bandpass tuning, with wideband PA provides single knob transceiver resonance. 4 models, external VFO, monitor scope, 2 A.C. P.S.U.'s, etc.

FT301, 100W Analogue	FT301D, 100W Digital
TF301S, 10W Analogue	FT301DS, 10W Digital
FP301, PSU/Speaker	FP301D, FP301 with clock, etc.

FT301 FEATURES (WITH OPTIONS INSTALLED)

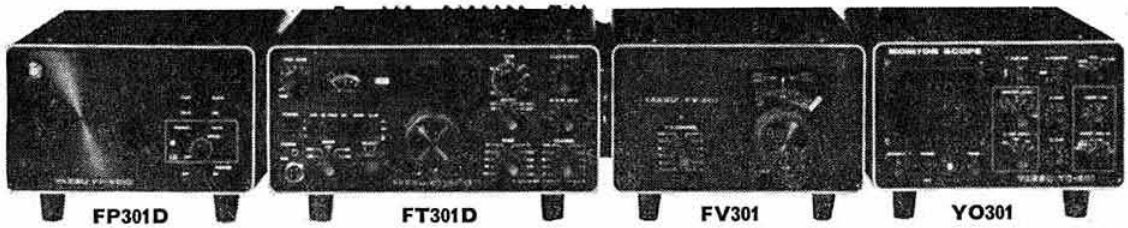
160-10 metre inclusive coverage
Multi mode USB-LSB-CW-AM-FSK
12VDC (234V with FP301 & FP301D)
11½" (14") × 5" × 11½", 22 lb weight
Silky smooth VFO drive
Readout to 100Hz (digital version)
11 fix channels per band Segment
Semi break in with sidetone
4 models—10/100 Dig/analogue
RX on M.S.F. (5MHz) and CB
Front panel microphone gain
R.F. derived feedback circuit
Rejection tuning (I.F. passband)
RF speech processor
Adjustable carrier level
Adjustable 3 position A.G.C.
Clarifier (IRT with RT and TT)
600Hz, 2·4kHz, 6kHz bandwidths
Triple PA protection circuit
100kHz crystal calibrator
Switchable noise blanker

FT301 SPECIFICATIONS

Frequency range
160-10 metres
M.S.F. and CB receive
Modes
USB, LSB, CW, AM, FSK
Frequency stability
>100Hz/½H (A.W.U.)
<100Hz for 10% line change
Backlash
50Hz
Antenna impedance
50 ohms, nominal
Power requirements
234V AC with FP301
13·5V DC 1·1A RX 21A TX

Sensitivity
0·25μV for 10dB N + S/N at 14MHz
Selectivity
SSB 2·4kHz at 6dB (1·67:1SF)
AM* 6kHz at 6dB (2:1SF)
CW* 600Hz at 6dB (2:1SF)
FSK as SSB
Spurious responses
Image > −50dB
Internal spurious <1μV
Audio output
3W (int. and ext. speaker)
Audio distortion
<10% at 3W output

Input power
>200W PIP A3j
>200W DC A1 (50% duty)
>50W A3 and F1
Audio response
0·3-2·7kHz ±3dB
Carrier suppression
> −40dB
Sideband suppression
> −50dB
Spurious radiation
> −40dB
Dimensions
11½" (14") × 5" × 11½", 22lb


FP301D FT301D FV301 YO301

OUR AGENTS

Amateur Electronics,
508-514 Alum Rock Road,
Alum Rock, Birmingham B8 3HX

South Midlands Communications Ltd,
S. M. House, Osborne Road, Totton,
Southampton, Hants SO4 4DN

Western Electronics (UK) Ltd,
Fairfield Estate,
Louth, Lincolnshire LN11 0JH

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The Leaders

WITH/FOR

YAESU

BUYING A FRG-7?

We despatch within 6 HOURS!
from our
NEW LARGE YAESU STOCK
OF ALL MODELS

FREE SECURICOR DELIVERY
and
SUPERB AFTER-SALES SERVICE

It pays to deal with "WESTERN"

If you want a general coverage receiver at a modest cost then there's only one answer . . . the FRG-7. Never mind the fancy specification (and it *is* very good!), what does it offer that some others don't? Why would you be better off with the FRG-7?

The answers are simple!

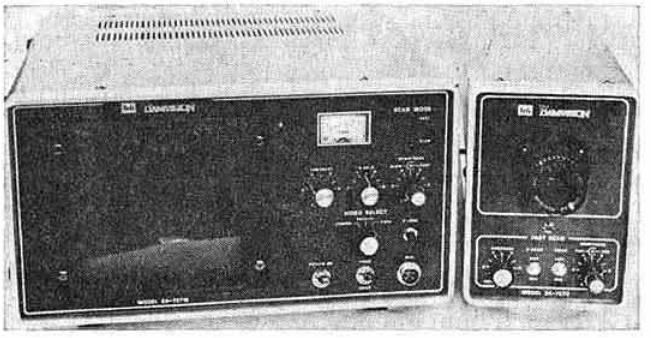
1. If you want to know what frequency you are on the FRG-7 tells you accurately. (If you buy a receiver with a band spread and a main tuning dial you only know the frequency accurately if you have the main dial set "spot on" which is a "chance in a million"!)
2. With high sensitivity and low price what more could you ask!
3. As a bonus it operates on mains, external 12V DC (car, etc.) or its internal batteries (8 × U2 cells extra).

DON'T DELAY ... ORDER TODAY ... FROM WESTERN

FANTASTIC FEBRUARY OFFER!! DON'T MISS IT!
2m ALL MODE TRANSCEIVERS. ONLY £299 + VAT

Save up to £85! All you have to do is *write* (no phone enquiries or part exchange) *with cheque* **(£336.37)** stating your requirements and we will either accept your order or return cheque. At worst you lose 5 minutes and a stamp (but you may save up to **£85**) all units carry a full 90-day warranty on parts and labour.

YOU'LL REGRET NOT SENDING US YOUR ORDER NOW!



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NEW DIMENSION
to your hobby with
SSTV

The HAMVISION

SS-727M MONITOR	**£405.00**
SS-727C CAMERA	**£303.75**
OR	
SS-303M MONITOR	**£236.25**

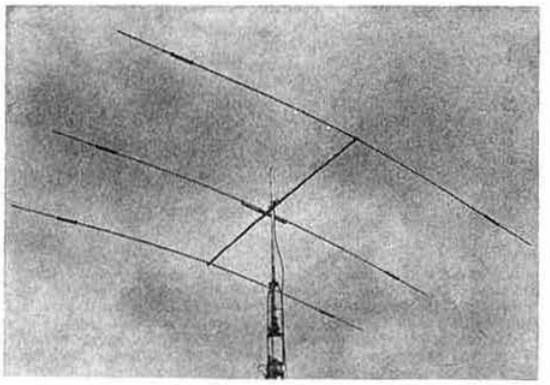
is all you require to send and receive SSTV pictures when connected to your SSB transmitter.

(Prices inc. VAT and Carr.)

Electronics (UK) Ltd

Radiate ... with the DX-33 "Penetrator" for 10-15-20m

THE FIRST OF A NEW PENETRATING RANGE OF ANTENNAS!



HERE'S THE SPECIFICATION ...

★ 3 elements on each band. ★ Broadband operation.
★ Heavy duty 2kW rated. ★ Stainless steel hardware.
★ Gain up to 8dB. ★ SWR less than 1·3 : 1.

HERE'S ITS PERFORMANCE ...

(Report received from a GM3) ... "I have erected and tried out the dx 'penetrator' supplied to me.

"I accepted this antenna because I had very good results from the quad supplied by you and as it was from your design I expected good results from a beam of your design.

"I may state that these expected results have been exceeded. I have had contacts with JA 5 and 9, W7, 5 and 8, K9 5 and 9, VE 5 and 9 and this is using a Sommerkamp FT250 running as they say barefoot."

AND NOW LOOK AT THE PRICE!

ONLY £73.12 (inc. VAT/Carriage)

(Price correct at time of going to press but will be increased shortly.)

Elevate ... with the Westower ..."the STRONGER ONE"...

★ STANDARD TYPES, RATED AT 75 MPH WITH FULL HEAD LOAD QUOTED.
★ HEAVY DUTY TYPES, RATED AT 100 MPH (APPROXIMATELY TWICE AS STRONG AS A STANDARD MODEL (AND EVEN OUR STANDARD MODEL IS ABOUT 40% STRONGER THAN SIMILAR TYPES!))
★ MODELS FROM 25-119'. ALL TELESCOPE DOWN AND TILT-OVER.
★ MODELS FOR ALL SOIL CONDITIONS, WITH/WITHOUT CONCRETE.
★ DESIGNED BY CHARTERED ENGINEERS TO BRITISH STANDARDS.
★ CONSTRUCTED OF HIGH QUALITY SPECIAL ALLOY STEEL.

Choose from over 50 different models: e.g. Standard 58' type 3S/FP **£270** inc. carr./VAT.
Heavy Duty 58' type 3HD/FP **£378** inc. carr./VAT.

Former customers please note we regret that we are no longer able to supply replacement sections and conversion kits for the 60 mph rated Versatower system.

HY-GAIN (Prices inc. Carr. and VAT)

BN86 1 : 1 ferrite Balun	£13.50	18AVT/WB 10-80m Vert.	£82.12		
103BA 10m 3 element	£56.25	TH2MK3 10-20m 2 ele.	£119.25		
153BA 15m 3 element	£67.50	TH3JNR 10-20m 3 ele.	£122.62		
203BA 20m 3 element	£123.75	TH3MK3 10-20m 3 ele.	£163.12		
204BA 20m 4 element	£151.87	TH6DXX 10-20m 6 ele. total	£168.75		
402BA 40m 2 element	£180.00	DB10-15 10-15m 3 ele	£118.12		
18V 10-80 Load Vert.	£28.12	LC80Q 80m coil for 18V	£14.62		
12AVQ 10-20m Trap Vert.	£40.50	LA1 Lightning arrestor gas	£18.90		
14AVQ 10-40m Trap Vert.	£56.25	LA2 Lightning arrestor spark	£3.24		

JAYBEAM (Prices inc. Carr. and VAT)

D5/2m 5 over 5 slot feed	£14.62	PBM14/12m 14 ele. Para	£30.60		
D8/2m 8 over 8 slot feed	£18.84	D8/70 8 over 8 slot feed	£16.31		
5XY/2m 5 ele. crossed	£16.76	PBM18/70 18 ele. Para	£19.12		
8XY/2m 8 ele. crossed	£20.36	MBM48/70 46 ele. Multi	£21.94		
10XY/2m 10 ele. cross	£26.21	MBM88/70 88 ele. Multi	£26.32		
5Y/2m 5 ele. yagi	£9.22	12XY/70 12 ele. crossed	£29.25		
8Y/2m 8 ele. yagi	£11.36	4Y/4m ele. yagi	£13.72		
10Y/2m 10 ele. long yagi	£21.60	PMH2/70 2 way harness	£5.91		
14Y/2m 14 ele. long yagi	p.o.a.	PHM2/4m 2 way harness	£9.11		
Q4/2m 4 ele. quad	£17.10	PMH2/ Circ. phasing	£5.17		
Q6/2m 6 ele. quad	£22.05	PMH2/2m 2 way harness	£6.86		
PBM10/2m 10 ele. Para	£25.31				

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ALAN CAMERON, GM3OGJ ALLOA (0259) 214653
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& STANTON

TELEX 897406

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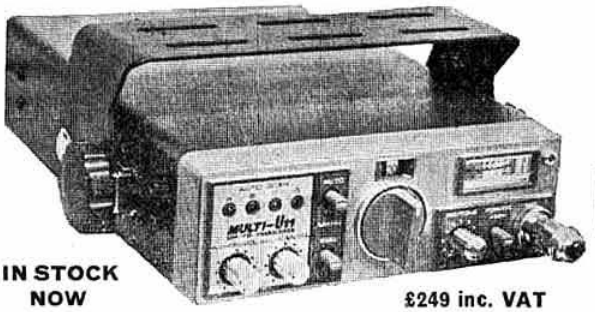
FDK

100% MORE CONTACTS . . . GUARANTEED !

WITH ALL FDK VHF & UHF MOBILES

FDK **for 70 cms Multi-UII**

NOW with 9 channels and 1750MHz tone-burst



IN STOCK NOW

£249 inc. VAT

WHAT ABOUT IT'S PERFORMANCE?
Well in case you thought that FDK mobiles had only operational advantages here's a few more facts and figures:

BOTH MODELS FEATURE 10 watts or 1 watt of fm—Narrow or wide deviation—narrow or wide rx filters (switchable)—RTI ± 5kHz—Automatic 4 channel scan (enables you to fit your local calling frequencies and repeater input channels so that any local activity is immediately heard)—Manual override on scan—test tone button—tx netting/monitor switch allows you to hear your transmitted audio and check your frequency—s-meter/centre zero/rf-meter—the channel-number dial is only illuminated when switched to channels fitted with xtals—on air light—p.a. heat-sink for cool operation—automatic p.a. protection—receiver, pre-amp fitted dual gate MOSFET—remote vfo socket—built-in speaker—supplied complete with mobile mounting brackets, DC power cord, microphone and comprehensive, English handbook, Matching AC psu and remote control vfo in stock.

STILL NOT CONVINCED! . . . OK here's the simple facts—no other rig available has better receiver sensitivity, transmitted audio or cleaner signal output . . . **ANOTHER FDK SOLD!!**

FDK ACCESSORIES

De-Luxe AC psu	£63.50
VFO (incl. 600kHz shift)	£89.00
Sound box	£10.50

100% MORE CONTACTS—?
There's not much point in having a rig full, of crystals and driving along listening to only one frequency. It's rather like having a vfo controlled rig and locking the dial in one position! It's common sense really but how many operators do just that? Think how often you may have driven around, particularly during the day when things are always a little quieter, listening on 145MHz whilst a local is calling CQ on S20. So near and yet so far? That's why all FDK transceivers are fitted with a priority "autoscan" facility. This automatically hunts out signals on up to 4 priority channels whilst still retaining the manual control on all channels. Programme it for 145, S20 and perhaps your local repeater input frequency, and immediately you have the capability of continually monitoring all local activity, quickly and safely with hands on the wheel. 100% more contacts and safer driving . . isn't that worth quite a bit?

FDK **for 2 metres Multi-II**

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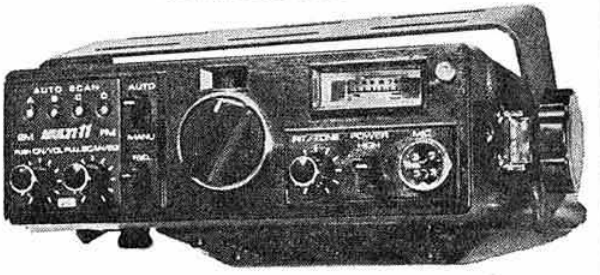

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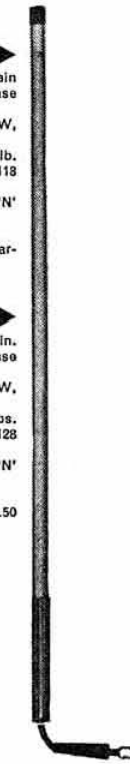

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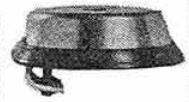

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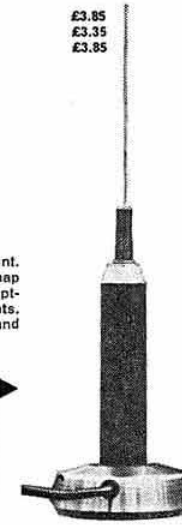

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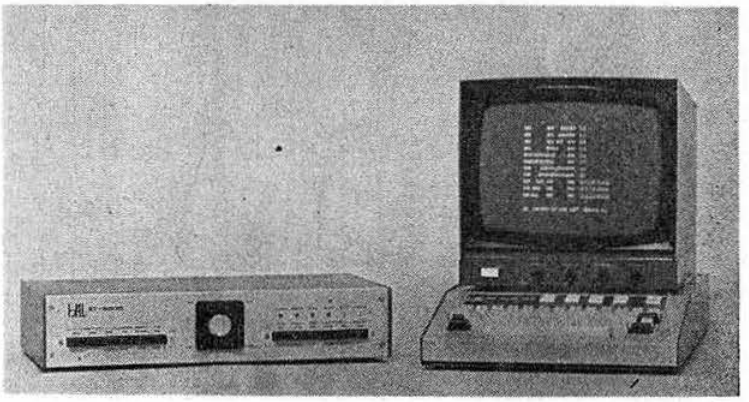

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Region 1	Cheshire, Cumbria, Greater Manchester, Isle of Man, Lancashire, Merseyside.
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Region 6	Berkshire, Buckinghamshire, Oxfordshire.
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Region 19	Greater London north of River Thames, Hertfordshire.
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QTC
amateur radio news

Visit of JARL president

The RSGB was honoured by a visit from Mr Shozo Hara, JA1AN, president of the Japan Amateur Radio League, in December. Accompanied by his daughter, he was on a flying visit to Europe during which he spent two days in London.

Mr Shozo Hara and his daughter at RSGB HQ with Dr E. J. Allaway, left, and Mr G. R. Jessop, general manager

He was met at London airport by Dr E. J. Allaway, RSGB President, who had been the guest of JARL during their 50th anniversary celebrations last year. A programme was arranged by RSGB for the only full day of Mr Hara's visit. After visiting RSGB headquarters he went to the BBC where he was interviewed in the Japanese service of the BBC Overseas Service. Afterwards he visited the House of Commons and Westminster Hall, and after lunch had tea at the House of Lords.

A member of RSGB HQ staff accompanied Mr Hara and his daughter to London airport on the following morning and saw them safely on their way home.

Post codes

It is the aim of the RSGB to collect the post codes of all UK members over the next two years, the Society having been informed by the Post Office that the use of these codes will become increasingly important as time goes on. In order to simplify the updating of UK members' records to include the post code, a space has been allocated on renewal notice forms, and in this members are asked to insert their post code if it is not included in their address on their next renewal form. Members changing their address are also asked to co-operate by including their new post code with their new address notification.

Club liability insurance

Many clubs and societies do not have adequate insurance to protect them against claims arising from injury to or damage to the property of members of the public. The RSGB reminds members that the consequences of a serious claim can be disastrous for an unincorporated club holding no capital, and these consequences may result in individual members being faced with liabilities quite beyond their means.

There is of course no need for any member to be exposed to such serious liabilities, as insurance is readily available at modest cost. The Society's insurers, the Sun Alliance & London Group, 40 Chancery Lane, London WC2A 1JB (attn: Accident Dept), will be pleased to give details of a simple insurance scheme which we hope many will consider to be of value.

It is recommended that careful attention be given to this important matter.

Regional Representative, Region 13

The Rev S. J. Smith, GM4DNM, has regretfully had to retire on health grounds from the office of regional representative for Region 13, and nominations are therefore invited to fill the vacancy.

Not later than 28 February 1977 any five corporate members resident within Region 13 (Borders, Fife, Lothian), may nominate any other qualified corporate member resident in the region for the office of regional representative by delivering their nomination in writing, together with the written consent of such person to accept office if elected, to the general manager at RSGB headquarters. Each such nominator shall be debarred from nominating any other person for this election.

In the event of no nomination being received from the corporate members in Region 13 by 28 February 1977, the Council reserve the right to make an appointment.

In the event of more than one person being nominated, a ballot will be conducted, details of which will be published in the April 1977 issue of *Radio Communication*.

More about membership cards

During December membership cards were issued to all paid up members of the Society resident in the British Isles (including Eire). Cards were also sent to members whose subscriptions were overdue in December, but who were within the normal grace period allowed by the Society.

Membership cards will be renewed annually after the member's subscription payment has been received, and will be sent out in batches once a month. Because of the possibility of delay resulting from this, a membership card will remain valid for discounts on books for three months after the renewal date. This will also allow for any late payments received from members who pay by standing order.

RSGB International Radio Communication Exhibition and Convention Alexandra Palace, London 6-8 May 1977

A considerable amount of work has, and is being, carried out to make this event worthy of the Royal Jubilee year. Stands are being booked by exhibitors and a wide range of equipment will be displayed. Lecturers have been booked for the vhf to microwave stream of the convention and for the alternative stream which will cover topics of interest to the hf operator, swl and novice.

Competitions will be held for the following trophies to be presented during the dinner/dance on the Saturday.

1. Horace Freeman Trophy for the best home-constructed (any category) equipment entered for exhibition.
2. John Rouse Trophy for the best piece of home-constructed equipment entered by a junior—16 years old on 1 May or younger.
3. The 1962 Committee Cup for the best piece of home-constructed equipment for vhf/uhf band entered for the exhibition.

The main social event will be the dinner/dance on the Saturday evening, and advance bookings can now be accepted. Tickets, price £5.50 each, can be obtained from RSGB HQ, and early purchase is advisable as seating will be limited.

Thought is being given to running a members' mart on Sunday, this idea being based on the lines of the "flea market" popular in the USA.

Data transmission

With the inclusion of a data facility in the new amateur licence, there is the opportunity to experiment with various forms of data transmission on the vhf bands. This would appear to offer the facility to work with other than Murray code (eg ASC II) and to experiment with error-correcting systems on the vhf bands. In view of the likely increase in the number of forms of data transmission modes, speeds etc on vhf, it would seem sensible to consider establishing data channels within the vhf bands which will allow data working to take place without causing confusion on established rtty traffic channels (eg 144·6 and 145·3MHz).

Members who have views on the use of data transmission systems (eg modes, frequencies, codes etc), are asked to pass them to the chairman of BARTG, G3OZF, QTHR, who has offered to collate the information and produce a fact sheet for all concerned.

IARU information

John Bazley, G3HCT, a member of the RSGB IARU Working Group, is the information officer and focal point for requests for information, lecturers etc. The working group is the liaison body between the Region 1 Division of the IARU and the Society. Later this year it will commence preparatory work leading to the 1978 Region 1 conference in Hungary. Correspondence should be sent to G3HCT, QTHR, and *not* to RSGB HQ.

Facts and figures

The Home Office advises that the following numbers of amateur licences were in force at 31 December 1976:

Class A	15,956	Class B/M	2,463
Class B	6,142	Class F/M	23
Class A/M	4,173	Television	318

With the introduction of the new comprehensive licence on 1 January 1977, the licences in force on that date were:

Class A	15,956	Class B	6,202

The callsign record received from the Home Office dated 17 December 1976 gives the latest callsigns issued in the G4 and G8 series as G4FOZ and G8MQU respectively.

Radio Amateur Old Timers' Association

Members of RAOTA should note that the next reunion will take place on Friday 22 April 1977 at The Horseshoe Hotel, Tottenham Court Road, London W1. The change in date from 6 May has been made to avoid clashing with the RSGB Radio Communication Exhibition and Convention taking place on that date.

Amateurs who have held a UK amateur transmitting licence for a continuous period of 25 years are eligible to join RAOTA. Further details and an application form can be obtained from the hon secretary, Miss May Gadsden, 79 New River Crescent, London N13 5RQ. Tel 01-882 1272.

"Ham Radio Report"

Subscription rates for this weekly newsletter containing up-to-the-minute news of amateur radio events were increased from 1 January 1977. The new overseas subscription rate is $26 to $30 per year. Existing subscribers can extend for up to two years at the old rates.

ARRL 1977 National Convention

The Scarborough ARC of Toronto, Canada, will be the host of this convention which will be held at the Sheraton Centre Hotel, Toronto, on 3-5 June 1977. Toronto has many strong British ties and it is hoped to include a G and ex-G cocktail party in the programme.

Further details can be obtained from G4CDE, QTHR.

Grampian repeater project

Mr M. C. Hately, GM3HAT, will give a talk on the proposed Grampian repeater project at the Aberdeen RC, rear of 91 Crown Street, Aberdeen, at 7pm on 18 February. All interested amateurs are invited to attend.

Exeter ARS re-activated

This society is once more an active group, meeting on the second Monday in each month at the Community Centre, St David's Hill, Exeter. Old and new members welcome. The hon secretary is Mr G. E. Wheatcroft, G3HMY, QTHR.

Stolen equipment

On 2 November 1976 from a Pye service van parked in Shorncliffe Road, London SE1: Pye vhf lo/hi band sig gen (65-180MHz), type SG3V, serial 471; Pye uhf sig gen (400-480MHz), type SG5U, serial 219; Pye modulation meter, type MM1, serial 306; AVO multimeter AVO8, serial 85251-C-159; Telequipment scope D61A, serial 595045; Marconi vhf/uhf test set, type 1065; Pye vhf reflectometer, type RFL1; Pye uhf reflectometer, type RFL2; Pye TM3 i.f. test generator (10·7MHz, 2MHz, 455kHz, 100kHz); Pye TM2 private line/tx/rx audio test set; Pye TM1 rf (diode) probe and fs meter. Information to Carter Street Police Station, tel 01-701 1113.

On 13 December 1976 in Reading: Trio 2200G, serial 230247; UB2200 amplifier, serial 060961; microphone. 2200G has three-position toggle switch in place of tone-burst push button on front-panel. Information to G4CWB.

On 6 January 1977 from Amateur Radio Exchange: FT200, serial 6H163108; FP200, serial 6H163108; IC201, serial 3705390; IC225, serial 2702192. Information to Ealing Police Station, London W5.

On 8 January 1977 in Weymouth, Dorset: Trio TR2200GX transceiver, serial 410073; home-built amplifier; 5/8 Bantex whip. Information to PC Castle, Weymouth 3011, or G3EGV.

A 70MHz transistorized transmit/receive converter

by D. F. HARVEY, G3XBY,* and C. S. GARE, G3WOS†

THE unit to be described represents a second-generation design with the two versions built replacing standard valve transverters. The use of transistors in the high-power (100W) section follows current commercial practice (although the design mode of ssb has not yet caught on at vhf outside amateur circles) and is now fully justified after initial doubts. Advantages include reliability, efficiency, simplicity of power supplies and ease of construction. The cost of the transistor amplifier compares very favourably with one constructed around a valve that would generate a similar power, eg a 4CX250B when the cost of all the power supplies, boxes, bases and relays is taken into account.

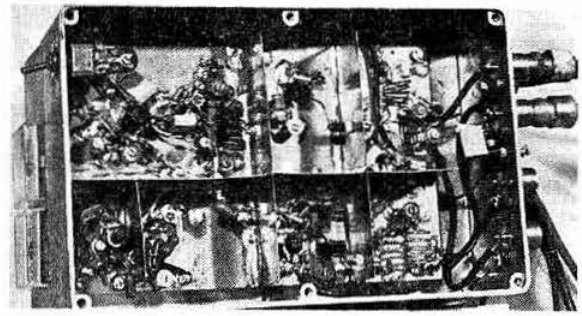
Transistors specifically designed for ssb use at 70MHz are available and a single transistor pa producing up to 150W p.e.p. (the Mullard BLX15) could have been designed. This would be marginally more expensive but the chief disadvantage is the high operating voltage of 50V; since the authors are interested in portable operation this approach was rejected as being too inconvenient. Suitable commercial transistors are designed for fm (Class C) operation in the 146-175MHz band and the change of mode can be accommodated by suitable modification to ensure linear operation. Due to the transistors being used at a lower frequency, useful extra power gain is also obtained.

A 40W 175MHz power transistor will produce 50–60W quite safely at 70MHz. This is partly due to increased efficiency but mainly to the much-improved second-breakdown characteristics obtained with the lowered operating frequency. The two types of transistor used, the Motorola 2N6084 and the Mullard BLY90, have proved to be snag-free in initial alignment and rugged in operation. The overall design is reasonably compact for the power output obtained and construction should pose few problems.

Circuit description

Local oscillator, receiver rf amplifier and mixer (Figs 1 and 2)

The crystal oscillator is of conventional design and uses a third overtone HC18/U 42MHz crystal, the circuit being obtained from the article on oscillators by VK2ZTB in the March 1976 issue of *Ham Radio*. In the authors' model the output frequency was within 1kHz of 42MHz so no frequency correction was needed, but if such adjustments prove necessary a trimmer is provided in series with the crystal. A capacitive divider feeds the buffer TR2, which provides signal isolation between the oscillator and the two mixers. No supply stabilization was necessary in the prototypes but should it be required a simple zener-regulated circuit should suffice.



Unit 1

The rf amplifier and mixer stages utilize 40673 dual-gate mosfets, the current through each being set to 2mA by the source resistors for optimum noise performance. The 50Ω antenna input is tapped down the tuned circuit to provide matching to the input of the amplifier stage; fine adjustment of this tap should produce an overall noise figure in the order of 2–3dB. L8 and L9 are critically coupled to provide maximum gain. The mixer follows standard design and provides about 10dB of gain; this, together with 20dB in the rf amplifier, gives the receiver an overall gain of 30dB. A link winding on the toroid L10 transfers the signals to the 28MHz receiver.

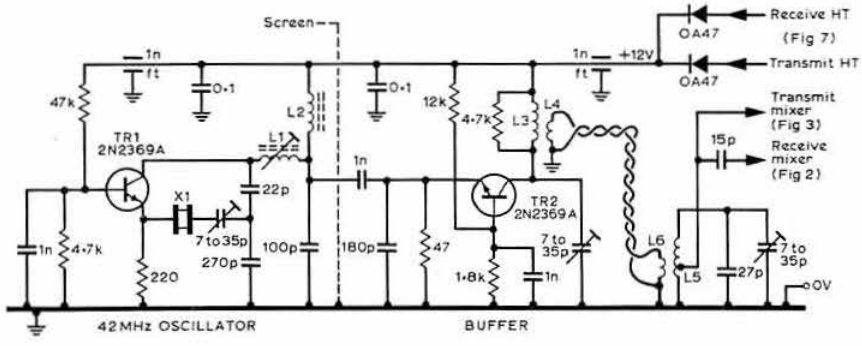


Fig 1. Local oscillator and buffers (unit 1)

* 102 Station Road, Hatton, Warks.
† 17 School Close, Braunston, Northants.

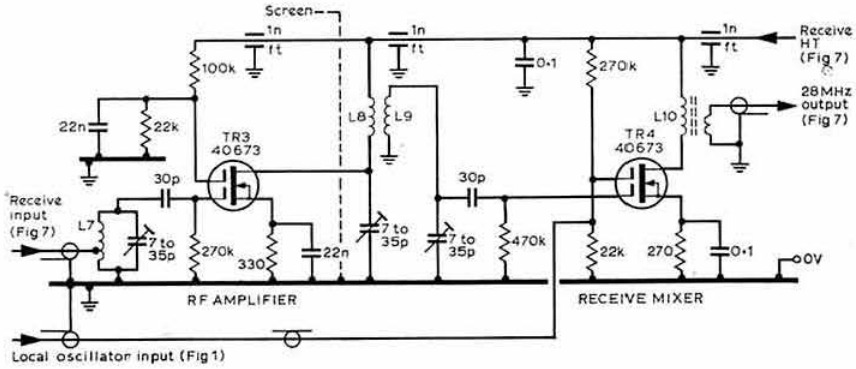


Fig 2. The receiver rf amplifier and mixer (unit 1)

Transmit mixer, buffers and low-power amplifier (Fig 3)

The 28MHz ssb input to the transverter is filtered by a double-section bandpass filter to remove the out-of-band spurii generated by the exciting transceiver. The drive level to the mixer is controlled by the resistive attenuator following the 50Ω input load. L14 is overwound on L13 to provide the two anti-phase signals needed to drive the balanced mixer. The 42MHz local oscillator injection is fed, in phase, to the emitters of the mixer transistors. No balancing potentiometer was necessary but small adjustments may be made by the relative positions of the independent trimmers in the mixer tank circuit. Any tendency to oscillation is suppressed by RFC1 and the 1kΩ resistor connected to earth.

To prevent unwanted loading of the mixer a buffer stage is provided in the form of TR8. A link winding is used to couple into the first power amplifier stage TR9. Ferrite beads were used on the input and output of this amplifier to ensure stability, but these may not be needed in some layouts. TR9 provides some 20-30mW output on 70MHz; this stage operates in Class A for maximum gain and best linearity. The output matching network provides good transfer of power to the following stage. Although no attempt has been made to match to 50Ω, coaxial cable may be used for interconnection with only minimal losses provided the cable run is kept short.

A high/low power switch is provided to ensure legal operation in the cw mode. This may also be used for low-power ssb operation to avoid excessive interference to other stations when working locally.

20mW-25W linear power amplifier (Fig 4)

TRs10, 11 and 12 are biased into Class AB and each stage should have its respective base pull-up resistor adjusted for 30mA standing current. The outputs to be expected from each stage are as follows:

TR10—600mW; TR11—4–5W; TR12—20–30W.

The outputs of TR10 and TR11 may be changed to a circuit similar to that used for TR12; during alignment this will enable each stage to be temporarily matched to 50Ω thus enabling the performance to be monitored. Any problems met may be resolved as they occur. Building and testing in one operation is definitely not recommended. The relatively large valve-type trimmers (air-spaced) used in the prototypes are not ideal. In several instances padding capacitors have been used. A more suitable type of trimming capacitor would be a compression mica type. This will be discussed in more detail in the section describing the pa.

The chokes isolating the bases of the transistors from the bias networks are not critical and although Mullard FX1898 six-hole beads wound with 22swg enamelled wire are specified, ¼in toroids or air-cored coils have been substituted and found to be satisfactory.

For maximum output power it would be desirable to earth the emitter of TR12. Unfortunately, with the simple bias circuit used, thermal runaway occurs at high temperatures. This could be overcome by using temperature compensation as in the pa, but only at the expense of increased circuit complexity. The value of the emitter resistor is a compromise. Initially 0·5Ω was tried but this significantly

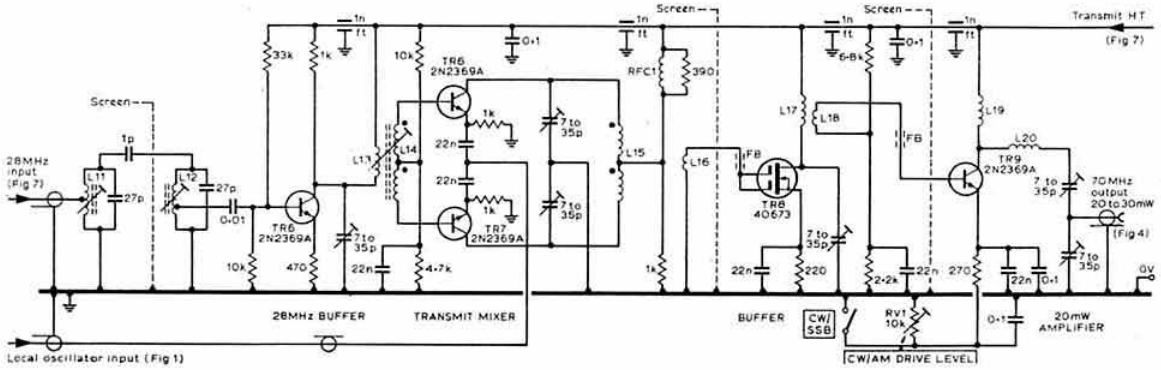


Fig 3. 28MHz buffer, transmitter mixer, buffer and first transmit amplifier (unit 1)

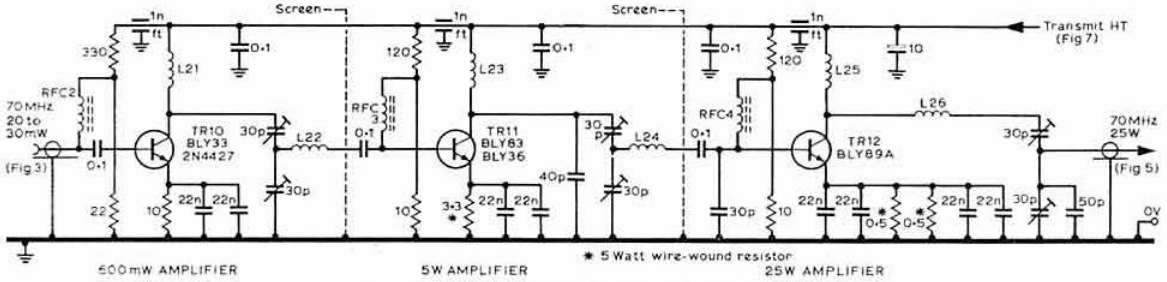
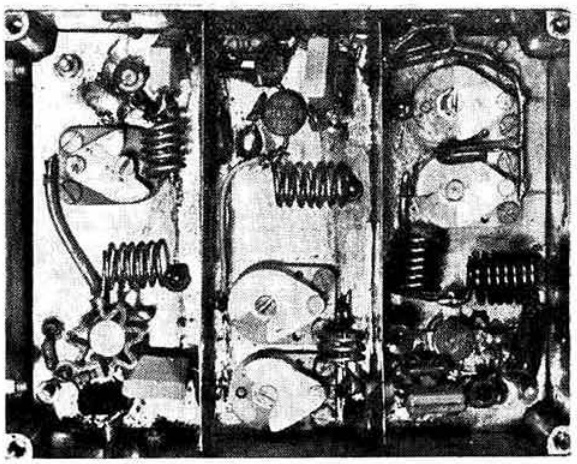


Fig 4. 20/30mW to 25W transmit amplifier (unit 2)



Unit 2

reduced the output power. When 0·1Ω was tried, thermal runaway occurred. A value of 0·25Ω prevented runaway and only reduced the output by about 15 per cent.

The output of TR12 is matched to 50Ω. This simplifies testing and alignment, but is wasteful of components. With the layout finally adopted the connecting coaxial cable is only a few inches long and normal interstage coupling could have been used. With longer cable runs the design shown is mandatory if losses are to be minimized.

The 100W power amplifier (Fig 5)

The final amplifier of the transverter converts the 20–30W output of the BLY89A up to a power level of 100W rms. This is achieved by the use of two Motorola transistors type 2N6084 or the much more expensive Mullard BLY90. These are fm transistors and as such cannot be used in amplitude-modulated amplifiers at their full-rated power due to an insufficient V_{ceer} rating. However, they do exhibit a reasonably linear power transfer characteristic, making them suitable for linear operation when forward biased.

The transistors used have proved extremely robust and do not appear to have been damaged by misuse during experimentation. Both prototypes have been operated with an open and short-circuit load for a number of minutes without damage.

Specification

$V_{cc} = 11{\cdot}5V$

	2N6084	BLY90
Drive power for 100W rms output	17W	14W
Power gain at 100W rms output	8dB	8·5dB
Maximum power output	125W	130W
DC input power for 100W rms output	140W	140W
Typical dc efficiency	67%	69%
Power supply current for 100W output	12·1A	12·1A

Detailed circuit description

The amplifier

The amplifier utilizes two Motorola soe (stripline-opposed-emitter) transistors operating in parallel mode to produce 100W rms into a 50Ω load. To simplify the alignment

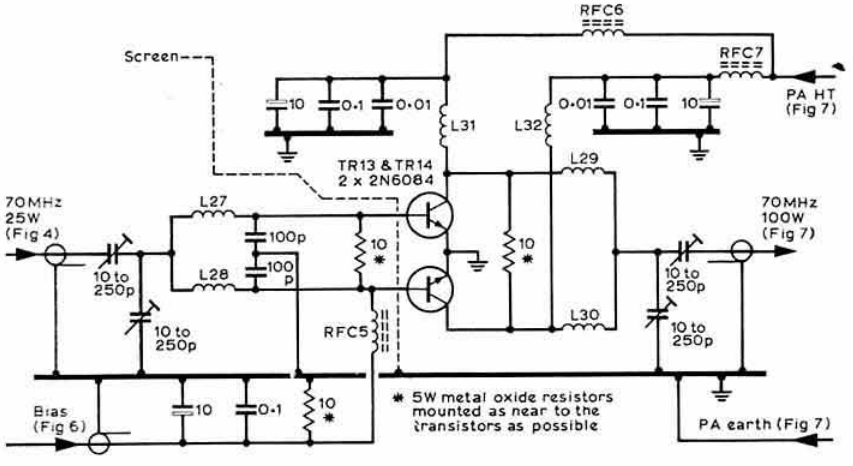
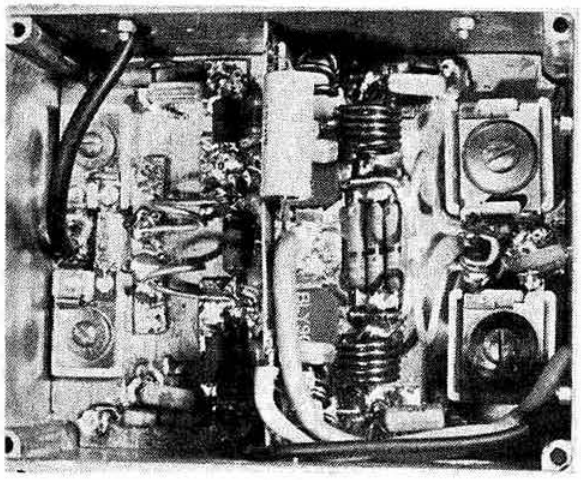


Fig 5. 100W transmit amplifier (unit 3)



Unit 3

procedure only one tuning network is used on the input and output. Drive balance is maintained by strapping both collectors and both bases together with low-value resistors.

The 50Ω coaxial input is matched to the very low base input impedance by the use of a combined L-network; drive power is shared equally between both bases by splitting the inductor in two. Two 100pF silver mica capacitors are placed across each base to earth to attempt partial neutralization of the parametric input capacitance of the transistors. Bias is applied to both bases through a ferrite-cored choke to isolate the bias generator from the signal. A discussion of the bias circuitry is in the next section.

To achieve maximum output power and gain from the devices the emitter connections to earth must be very low impedance and to this end all four emitter tags are soldered directly on to the earth plane. To increase efficiency when operating in a parallel array it is best not to tie the transistor collectors together directly but to connect them through individual collector inductors, these forming part of the output matching circuitry. The supply voltage is fed to the collectors via two air-cored chokes and two ferrite-ring cored chokes to prevent rf finding its way into the supply lines which could reduce efficiency and, more importantly, introduce instability problems.

Stability is ensured by the following design features:

(1) Screen between base and collector circuitry.
(2) Efficient supply decoupling and filtering.
(3) Strapping bases and collectors together with resistors.
(4) Capacitors placed between each base and earth.
(5) Low impedance bias supply.

The choice of components for the amplifier is critical in respect of losses; due to the high circulating currents (> 14A) very heavy gauge wire must be used for interconnections. The choice of mica-compression coupling capacitors might seem a little odd at first glance but in fact they are the only type of capacitor construction that can effectively be used, for two reasons: high-capacitance swing in a small volume, and, more importantly, in a mica-compression capacitor there are no sliding metal contacts in the rf path to produce excessive power losses. Also, the large, low-impedance metal vanes tend to reduce the series inductance and heating losses. If other capacitors with a different physical construction are used, they can easily become overheated and burn up. The authors initially used capacitors with a polythene dielectric which promptly melted on the first application of rf drive.

Only best-quality silver mica capacitors should be used in the circuit as the cheaper varieties, together with ceramic types, are excessively lossy and tend to destroy themselves through internally-generated heat. A separate earth cable should be used for the amplifier with one end connected to the 0V input of the transverter, and the other connected as near as possible to the transistor emitters. This is to prevent an excessive voltage drop occurring in the earth side of the supply and to preserve stability by preventing stray voltages being fed back to the driver stages generated by the high earth currents.

The biasing network (Fig 6)

For good amplifier linearity the bases of the pa transistors must be forward biased to generate a standing current greater than 20mA. This could be achieved by biasing the

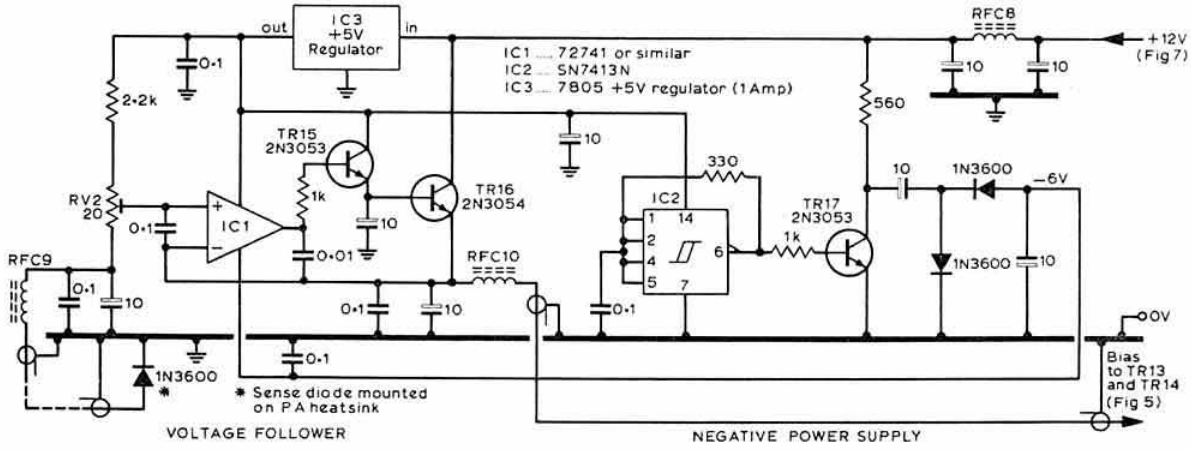


Fig 6. PA bias generator

bases positive with resistors but with this method an emitter resistor would have to be used to prevent thermal runaway when the transistors heat up. For the level of currents involved in this amplifier this is not feasible as efficiency would be adversely affected. If the emitters are strapped to earth, about 0·6V needs to be applied to the bases to drive the transistors into Class AB. If the bias is a fixed voltage, when the transistor heats up and the V_{be} drops the device is turned on harder and thermal runaway is initiated. To prevent this happening compensation needs to be applied by reducing the bias voltage by the reduction in V_{be}.

A silicon diode exhibits a drop in its forward voltage by about −2mV/°C so that by locking the transistor bias to the forward voltage of a diode mounted on the heat-sink it is possible to provide suitable temperature compensation. The sense diode is mounted on the heat-sink directly between the transistor mounting lugs and is connected to a voltage follower via a length of miniature coaxial cable. The output of the follower drives a Darlington pair to provide sufficient current amplification. The emitter of TR16 drives the bases of the two power transistors. The standing currents of the pa transistors are set to 20mA each by suitable adjustment of RV2. The level of compensation is set by the current through the compensation diode; overcompensation occurs when the diode current is greater than the transistor base current, undercompensation occurs when the diode current is less than the base current. The bias current (with no drive) for the 2N6084 is in the order of 2–5mA. In the prototype units, with the standing currents set to 15mA at ambient (25°C), the collector current increases to 17·5mA at a heat-sink temperature of 70°C.

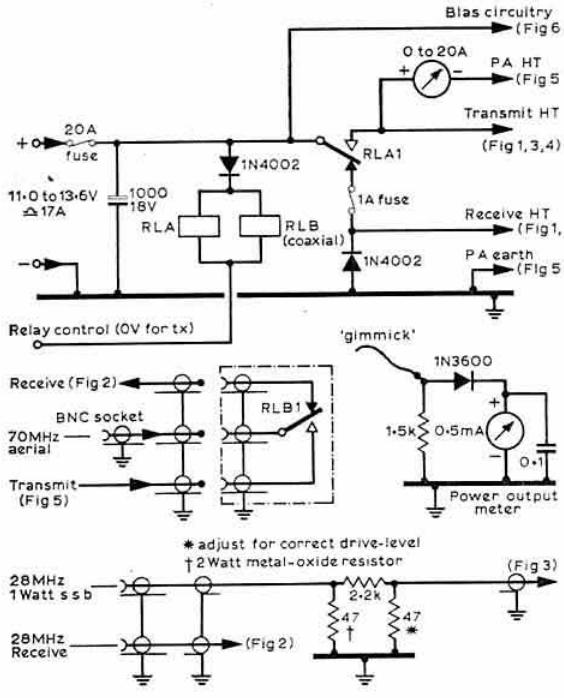
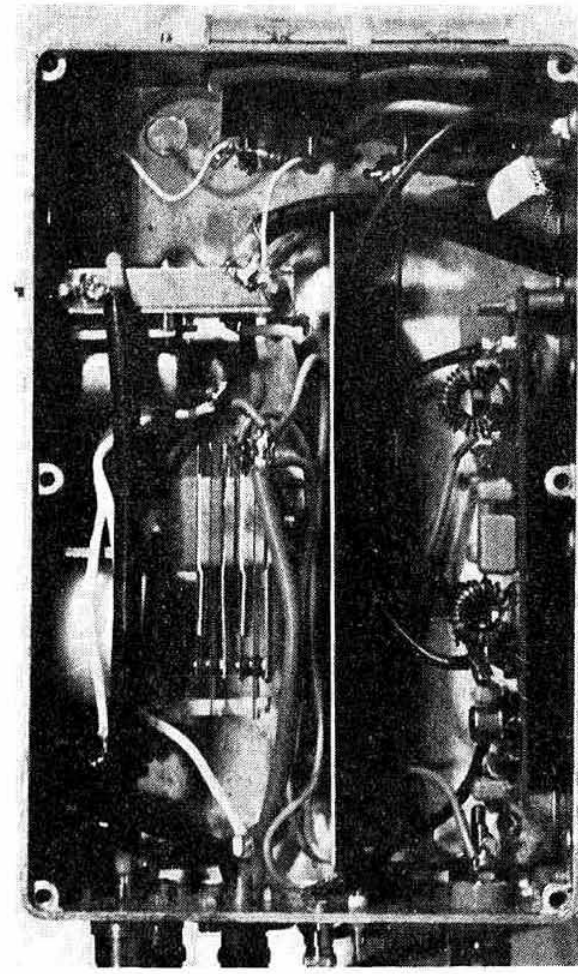


Fig 7. Control unit (unit 4)



Unit 4

(Other photographs appear on the front cover)

The voltage follower requires a negative voltage of about 6V so this is generated by a small logic inverter. The SN7413N Schmitt trigger is wired as a 100kHz oscillator which drives a transistor that creates a 12V peak-to-peak square wave. After passing through an isolating capacitor it is rectified by a diode and smoothed by a tantalum capacitor to produce about −8V under load.

Control circuitry

Reverse-polarity protection to the receiver +12V line is afforded by a 1A fuse and parallel diode. This method is not satisfactory for protection of the transmit line, where unacceptable losses occur in standard fuseholders at currents of 15A or so, and power diodes capable of providing protection are bulky and expensive. Instead a diode is wired in series with the power relay, completely preventing operation in the event of accidental supply reversal.

A 20A fuse in an automobile-type holder is placed in the main positive feed. Although 0·2V is lost at full power its inclusion is desirable for supply protection.

Construction

Modular construction has been adopted, based on two sizes of Eddystone diecast boxes, one twice the size of the other. They provide complete interstage screening, with compact unit dimensions. Each unit can be used as part of other projects. For instance unit 1 could be used to drive the G3WOS 70–432MHz transmit converter described in *Radio Communication* November 1975, while units 2 or 3 could be used as add-on amplifiers, powered by existing equipment.

Inter-unit connections are by coaxial plugs and sockets for all leads carrying rf, and by ptfe feedthroughs and wire for power distribution. Input/output, power and bias leads for the pa unit are passed through holes drilled in adjoining boxes, for interconnection using the shortest possible leads.

Three methods of electrical construction have been used in the prototype, each with particular advantages.

Unit 1 uses a single-sided copper-clad board as a ground plane. This is mounted on ½in brass pillars tapped 6BA. Countersunk screws attach the pillars to the base of a 6827P dcb. Thin brass screens 1¼in high are soldered to the ground plane and solder-in feedthroughs are mounted in each of the compartments thus formed. Power wiring is on the reverse side of the board. PTFE feedthroughs carry rf between compartments and, where appropriate, support components. Components soldered to the ground plane are used as stand-offs for circuit connections, and although the result is messy in appearance the ease of voltage/power measurement and circuit modification makes this method particularly attractive.

Unit 2 uses a ⅛in-thick brass plate cut to fit the internal dimensions of a 6908P dcb. This is mounted in the same manner as unit 1. Feedthrough capacitors again carry power to each compartment in the same way as unit 1. Because of the thermal inertia of the chassis, soldering is difficult and more formal wiring techniques have been used—solder tags forming earth connections and other components screwed down where possible. TRs11, 12 are bolted to the chassis which acts as a heat-sink. This means that tests may be made with the circuitry outside the dcb, which makes modification and measurement simpler.

Unit 3 uses a single-sided copper-clad board mounted flush with the base of a 6908P dcb. Clearance holes in board and box ensure that the metallic under-surfaces of TRs13, 14 are in direct contact with the heat-sink. Small pads of copper-clad board are fixed to the base-board with Araldite to form solid anchor points for the bases and collectors of TRs13, 14 and other components.

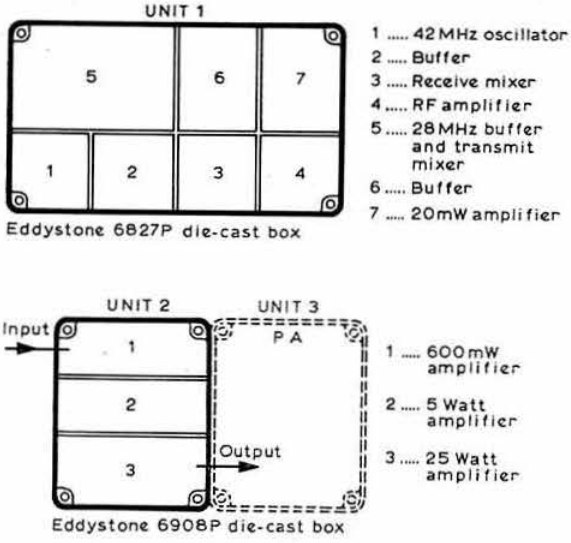


Fig 8. Units 1 and 2

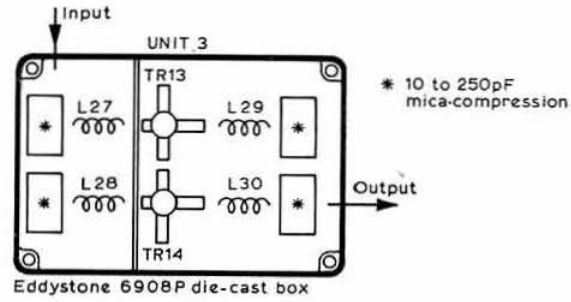


Fig 9. Unit 3

It is not possible to use feedthrough capacitors with this form of construction, but standard polyester and ceramic capacitors provide adequate bypassing. A screen soldered across the board provides complete isolation of input from output. The four 250pF mica trimmers used have mounting studs isolated from both connections. These are mounted on the board only; the dcb and heat-sink are drilled ⅜in to provide clearance. The complete board is attached only by the two transistors' studs and nuts, thus ensuring easy access. This form of construction has been particularly successful and would probably be used for the other circuitry as well in different circumstances.

The heat-sink used is a 200mm length of Marston type 63DN (unblackened); this will dissipate >60W continuously for a 40°C rise in temperature above ambient. This would be the worst case of continuous transmission, 120W output,

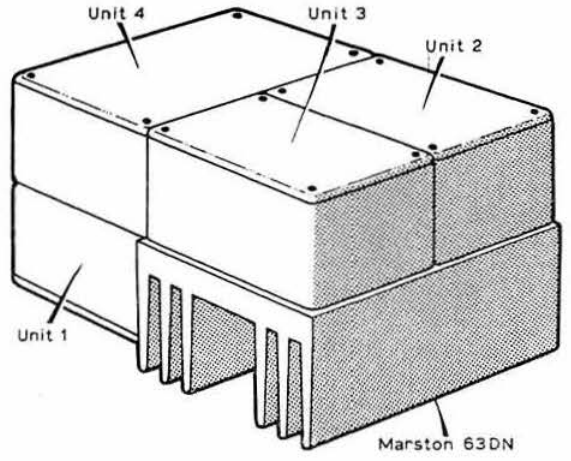


Fig 10. Box assembly

65 per cent efficiency, which cannot be met legally on 70MHz. In ssb service a 30 per cent duty cycle is normal, thus the design provides a 3 : 1 safety factor. However, it must be realized that during summer contests, for instance, duty cycle and ambient temperature will be much higher than normal. This, together with longer continuous hours of service, make "over-design" mandatory. The absolute maximum transistor junction temperature specified is 200°C. The heat-sink base thickness of 0·594in exceeds the length of stud available on the 2N6084 and BLY90. The finned side of the heat-sink must therefore be end-milled to a suitable depth to provide sufficient clearance for the mounting nuts. The surfaces must be truly square to ensure that the stud is not strained. To permit maximum heat transfer to the heat-sink, no edges should be chamfered.

Suggested alignment procedure

Unit 1

Fig 1

L1 should be set approximately to the correct frequency with no supply voltage by shorting the crystal and dipping L1 with a gdo. After this has been done the short should be removed and the oscillator checked for correct operation on 42MHz. If necessary L1 should be trimmed for reliable and consistent start-up on the application of power. L4 and L5 should be resonated for maximum output and the coupling link adjusted for approximately 700mV output to the tx mixer.

Fig 2

All the trimmers in the receiver section should be adjusted for maximum output into the 28MHz receiver. The relative positions of L8 and L9 should be adjusted to achieve the critical coupling needed for optimum performance. Minor adjustments of the antenna tap position on L7, made in conjunction with a noise generator, can optimize the noise factor but this will probably not be of significance due to the high ambient noise always encountered on 70MHz.

Fig 3

28MHz bandpass filter

Disconnect the top coupling capacitor and tune each of the two parallel-tuned circuits separately to 28·3MHz with a gdo. When this has been done reconnect the capacitor and re-resonate one of the tuned circuits to maximize the output.

Amplifier stages

Each of the amplifier stages should be tuned individually for maximum output using a suitable indicator such as a wavemeter, remembering that the settings of the two capacitors in each network are interdependent. Each stage should be checked for full stable operation before tuning the next. The final amplifier stage should be connected to a 50Ω dummy load and all trimmers finally adjusted for maximum 70MHz output, which should be in the order of 20–30mW.

Unit 2 (Fig 4)

The base bias resistors should be adjusted on all stages for standing currents of about 30mA with no rf drive applied. Temporarily connect L22 between the collector of TR10 and the series trimming capacitor, and connect a suitable power meter and dummy load between the two trimmers and earth.

Circuit data

L1	9 turns, ¼in former, slug tuned 28swg
L2	50nH choke
L3	8 turns, 18swg, ⅜in id, close wound, ⅜in long
L4	1 turn link in L3
L5	8 turns, 18swg, ⅜in id, close wound, ⅜in long, tap 1t from cold end
L6	1 turn link in L5, joined to L4
L7	5 turns 18swg, ⅜in id, length ⅜in, tap 1t from cold end
L8	5½ turns 22swg, ⅜in id, close wound
L9	5 turns 22swg, ⅜in id, close wound, coupled to L8
L10	9 turns 36swg wound on ferrite bead. 2 turns secondary
L11	10 turns 28swg on ¼in slug tuned former. Tap ¼ turn from cold end
L12	10 turns 28swg on ¼in slug tuned former. Tap ¼ turn from cold end
L13	16 turns 28swg on ¼in former, slug tuned
L14	3 + 3 turns, 22swg, bifilar wound, on L13
L15	5 + 5 turns, 22swg, ⅜in id, close wound
L16	1½ turns, interwound in the centre of L15
L17	5 turns, 22swg ⅜in id, length ¼in
L18	3 turns, 22swg, ⅜in id interwound in L17
L19	6 turns 22swg ⅜in id, length ¼in
L20	4 turns 22swg ⅜in id, length ¼in
L21	6 turns 18swg ⅜in id, length ⅜in
L22	5½ turns 18swg ⅜in id, length ¼in
L23	7 turns 18swg ⅜in id, length ⅜in
L24	3 turns 18swg ⅜in id, length ⅜in
L25	7 turns 16swg ⅜in id, close wound
L26	6 turns 16swg ⅜in id, close wound
L27, 28	2 turns 16swg ¼in id, ¼in leads
L29, 30	1 turn 16swg ¼in id, ¼in leads
L31, 32	5 turns 16swg ¼in id, close wound
RFC1	14 turns 22swg on 390Ω resistor
RFC2, 3, 4, 5, 10	6 turns on Mullard FX1898 6-hole ferrite bead
RFC6, 7, 8	10 turns 18swg on ⅜in diameter toroid
RFC9	1·5mH choke

Trimmers in unit 1 are 7/35pF ceramic items intended for pcb mounting. Bend rotor legs at right angles and solder to earth plane. Unit 2 trimmers are 30pF maximum air spaced.
Unit 3 uses 10/250pF mica-compression trimmers, nut-fixing (available from AJH Electronics, Rugby).

RV1	10kΩ 270° variable resistor
RV2	20Ω 10 turn potentiometer

200mm length of Marston 63DN unblackened extrusion (available from G3WOS)

Diecast boxes: 2 off Eddystone 6908P, 2 off Eddystone 6827P (available from Hawnt Electronics Ltd, Firswood Road, Birmingham B33 0TQ)

Apply low-level rf drive from unit 1 and adjust the trimmers for maximum power output, which should be in the order of 600mW. Reposition L22 to conform to the circuit diagram and temporarily relocate L24 as previously described. Both circuits should now be re-peaked. The power output from TR11 should be about 4–5W. With L18 correctly positioned TR12 should produce 25–30W output after tuning. Experimentation with the coil sizes might produce extra power and is probably worthwhile.

At this point a check should be made on stability over the total power range by looking for untoward effects that show up as "inflections" in the power output transfer characteristic. It cannot be over-emphasized that each stage should be unconditionally stable before an attempt is made to tune the next. Another good check is to vary the supply voltage between 9 and 13·5V while monitoring the output. If the circuit is prone to instability this technique tends to precipitate it. With all stages optimized the drive level should now be set correctly by adjustment of the 28MHz attenuator to ensure correct linear operation of the mixer. The post-mixer

drive level may be set by alteration of the coupling between L15 and L16. This last procedure is most important if adequate spurii and carrier suppression is to be maintained.

Unit 3 (Figs 5 and 6)
Build and test the bias circuitry first by connecting its output to a silicon diode instead of the bases of TR13 and TR14. Ensure that the multi-turn potentiometer is turned for minimum bias voltage (≏ 0·5V) and connect to the pa transistors. Connect a 10Ω resistor in series with the pa supply lead and adjust the bias for 60mA collector current (30mA per transistor). Remove the resistor and readjust as necessary. Connect the pa output to a dummy load capable of dissipating 100W at 100 per cent duty cycle via a suitable power meter. Apply drive from unit 2 and resonate the output circuitry, noting that a peak in collector current very nearly corresponds to maximum power output. At this stage always limit the total collector current to 4A. Now resonate the input circuitry, reducing the drive as necessary. After both circuits have been tuned the drive should be increased in steps, retuning the input and output at each stage. Any imbalance due to errors in construction or mismatched devices will be indicated by excessive heating of the strapping resistors. When 12A has been reached, 100W of power should be obtained.

The alignment is now completed by the possible readjustment of the post-mixer drive level as before. The a.m./cw drive level can be set to 50W input by suitable adjustment of the front panel drive potentiometer RV1. Because of mistuning at low power levels the efficiency is reduced and will be typically about 40 per cent. To improve this situation a compromise may be made by tuning the pa at an intermediate power level at the expense of maximum output power. □

Improving the selectivity of a rebuilt HRO

by T. HALL, BSc, GM3HBT*

Introduction

During a recent project of completely stripping down and rebuilding a vintage National HRO receiver, the author experimented to find an effective and simple way to improve the general selectivity of the receiver. The rebuild design drew heavily on useful information contained in the chapter on hf receivers in the *Radio Communication Handbook*, and the resulting receiver performed very well but with the usual rather inadequate HRO selectivity.

This article does not set out to provide a stage-by-stage description of the modified receiver, information which already exists several times over; in any case the basic receiver provides ample scope for wide individual design variations. However, experimentation in the selectivity field has resulted in a very compact, effective, and easily-constructed add-on module comprizing active filters, using the ubiquitous 741-type operational amplifiers, and it was felt that this would be of interest to the many HRO users who may not as yet have attempted improving their receivers. In fact, any communication receiver lacking in selectivity could benefit from the incorporation of such a module.

* 50 Hamilton Street, Larkhall, Lanarkshire ML9 2AU.

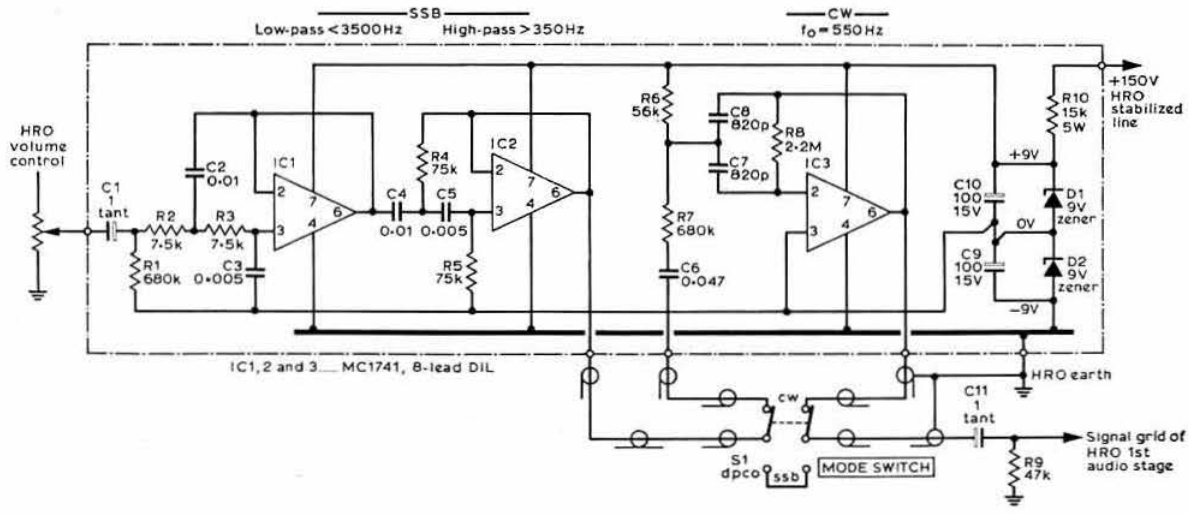


Fig 1. SSB and cw active filter networks for HRO

Components list

C1, C11	1μF tantalum
C2, C4	0·01μF ±10% polystyrene
C3, C5	0·005μF ±10% polystyrene
C6	0·047μF ±10% polyester
C7, C8	820pF ±2½% polystyrene
C9, C10	100μF, 15V electrolytic
R1, R7	680kΩ, ¼W, 5%
R2, R3	7·5kΩ, ¼W, 5%
R4, R5	75kΩ, ¼W, 5%
R6	56kΩ, ¼W, 5%
R8	2·2mΩ, ¼W, 5%
R9	47kΩ, ¼W, 5%
R10	15kΩ, 5W
D1, D2	9V zener diode
IC1, IC2, IC3	MC1741, 8 lead DIL
S1	DPCO switch

Circuit information

The HRO has a crystal filter which is excellent on cw, but which can have its effectiveness further improved by suitably "tailoring" the response of the receiver audio section. Also, with the crystal filter switched out, the bandwidth provided by the original HRO hardware is wider than is necessary or desirable to cope with the passband required for ssb signals. As this particular HRO has been designed for use on cw with occasional ssb (and no a.m.), the filter module, shown in Fig 1, comprises a permanently-connected ssb audio filter and a switchable cw filter.

The ssb filter consists of two stages, IC1 and IC2: IC1 is a low-pass filter with a cutoff frequency of 3,500Hz, and IC2 is a high-pass filter, with a cutoff frequency of 350Hz. The measured passband of the prototype is shown in Fig 2. Component tolerance variations within the specified limits will slightly vary the results from the designed data, but in practical terms have little effect on operation. Insertion loss at the mid-band frequency (around 1,500Hz) is less than 1dB.

The cw filter, IC3, provides a resonant peak at 550Hz (the author prefers this region rather than the 800Hz or thereabouts favoured by some commercial designers). This stage has a gain at resonance of around 3dB, which balances the 3dB fall in response of the ssb filter at this frequency, the effect being an apparent signal gain of this order on switching in the cw filter, and an overall effect of zero insertion loss on cw. The parameters associated with these response curves can be adjusted if required by manipulating a few simple formulas, and modifying component values to suit, but it is felt that the values shown should be generally acceptable.

For those who may like to experiment, a passband for ssb of 225–2,250Hz is obtained with R2/R3 10kΩ, and R4/R5 100kΩ; while a resonant peak of 800Hz for cw will result with C7/C8 560pF. These responses are of course approximate, depending on component tolerances.

If more selectivity is desired on cw, a further stage identical to IC3 could be added, taking care that components are accurately matched to those in IC3 to ensure the same resonant frequency in both stages. Such an arrangement would also obviously produce higher overall gain at resonance. In the HRO this extra stage was not considered necessary as the combination of the crystal filter and one audio filter stage was found to be adequate.

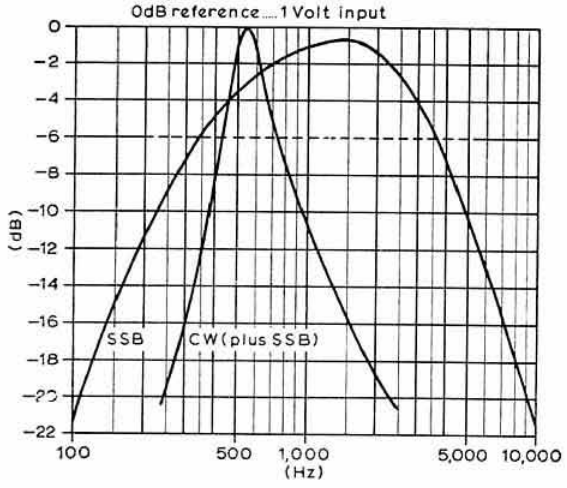


Fig 2. Response curves of ssb and cw active filters

Power supply

The psu arrangement adopted is one which can be used in any receiver with a stabilized voltage line, or in solid-state receivers with a supply voltage of 12V or above, ie ±6V supply to the operational amplifiers. Inserting the filters at the point indicated, after the volume control, normally involves audio levels in the order of only a few hundred millivolts, so the supply voltage to the filters is not too critical.

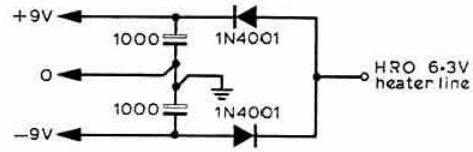


Fig 3. Power supply (unsuccessful). In this case the "0" line would have been connected to receiver earth, instead of the "-9V" line as in Fig 1

Readers should be warned that earlier attempts to use the circuit shown in Fig 3, which has been suggested elsewhere as being suitable for operational amplifier supply, were frustrated because of unresolved hum pickup problems.

Conclusion

The complete module, including the psu components, can be built on a small piece of Veroboard, the prototype measuring 4 by 1¾in. This can be conveniently mounted above or below the receiver chassis as dictated by layout. The positioning is not critical providing the leads to the mode switch are screened.

This cheap and simple little module has made a considerable improvement to the HRO, which now provides an excellent performance on 1·8 and 3·5MHz, the bands for which it was refurbished. The time taken to design and construct it has been well worthwhile.

Acknowledgement

Thanks are due to Mr A. Campbell, GM3NKG, for his assistance with this project. □

RTTY—what is it?

by J. B. HODGSON, G3YKB,* on behalf of the British Amateur Radio Teleprinter Group

IT must be stated at the outset that rtty is not high speed morse. Although a form of telegraphy, rtty (the abbreviation comes from the word *radioteletype*) has no connection whatsoever with the morse code. It is a mode of communication between machines using a code designed specifically for ease of reception by machines—the most significant feature being that all characters take equal periods of time for transmission, the amateur standard being 165ms per character.

The code

Internationally designated "CCITT No 2", the code is better known as Baudot or Murray. Each character comprises seven "bits" or "elements". These elements can be either "marks" or "spaces" (Fig 1). Marks and spaces are similar in concept to the key-up and key-down conditions of a morse signal. The first element is always a space and is known as the "start" pulse. The next five can be any permutation of marks and spaces, depending on which character is being transmitted. Finally, the seventh element, always a mark, is known as the "stop" pulse. With the exception of this stop pulse, each element is 22ms in duration, the stop pulse being 33ms. Sent at maximum speed, ie each character following immediately behind the previous one, rtty results in a signal rate of approximately 60wpm.

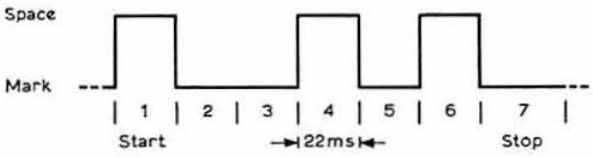


Fig 1. Letter "J"

The signal

It would be possible to transmit rtty using on/off keying (A1) but in practice one of two frequency shift modes (fsk) is normally employed. The most common of these modes, designated F1, is generated by shifting the rf carrier 170Hz lf for the spacing elements—this is the only mode used on the hf bands and frequently heard on 14,090kHz. The other mode, F2, is only used at vhf or higher frequencies and consists of modulating an a.m. or fm transmitter with audio tones, 1,445Hz to represent mark and 1,275Hz for space—this mode is usually referred to as audio frequency shift keying (afsk). It is worth pointing out that an fsk (F1) transmission can be generated by feeding afsk tones into the microphone socket of a sideband transmitter. Note that G8+3s are permitted to use rtty, either fsk or afsk.

Reception

Current practice is to resolve the signal into audio tones and reconstitute the telegraph signal in a "terminal unit"

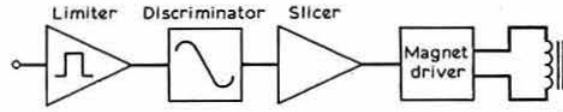


Fig 2. Typical tu block diagram

(usually abbreviated to tu and also known as a frequency shift converter). Fig 2 shows a block diagram of a common type of tu. The audio tones are first limited to take care of fading and then fed to a discriminator which determines whether the tone is a mark or a space. The slicer cleans up the signal which is converted into levels suitable for operating the teleprinter by the magnet driver. Ideally the audio signals should be taken from an isolated 600Ω receiver output, but in practice a simple connection in parallel with the loudspeaker functions quite well.

Transmission

With sideband equipment all that is required is to feed a 1,445Hz tone into the microphone socket; the tone is then switched to 1,275Hz for the spacing elements. However, some care must be taken over the design of the oscillator to prevent spurious emissions as the tones are keyed. For other transmitters some means must be found to remotely alter the frequency generating circuits; this usually means a varicap diode in the vfo or across a crystal.

Machines

Although they look complicated, most teleprinter machines are very straightforward and for basic two-way communication require no more than five electrical connections (excluding the motor supply). On the receive side, two wires go to the selector which is a particular type of electromagnet for converting the electrical signals of the tu into mechanical transitions—typically, a selector magnet requires a current of 20mA in one direction or the other. For transmit, the three connections come from a single-pole changeover switch arrangement—it normally stays at mark and switches over for the spacing elements.

Cost

RTTY is not an expensive mode—machines such as the Creed 7B can be picked up for as little as £5, but a more typical figure is £15. The tu, even if built entirely from brand-new components, need not cost much over £20. Paper and ink ribbons seem to last a long time with amateur usage so that £2–£3 will often cover a year's supply.

The reader is strongly warned against purchasing ex-computer machinery which, although often very cheap, does not use Murray code—such machines are certainly of no use to a newcomer.

BARTG

Formed in 1959, BARTG is the national society for rtty enthusiasts, and is, of course, affiliated to the RSGB. For the £2 annual subscription members receive newsletters containing technical articles, contest rules and results, gossip columns etc. The group's main objective is to promote rtty in the UK, which it does by publishing information and by transmitting a weekly news bulletin (GB2ATG). Membership details and application forms can be obtained from Mr A. Butcher, G3FSN, QTHR. □

*234 Gillingham Road, Gillingham, Kent ME7 4QT.

A low power 70MHz transmitter

by N. G. HYDE, CEng, MRAeS, MIERE, G2AIH*

THIS transmitter is intended primarily for portable operation and is powered from a 12V vehicle battery. Four transistors are employed in the rf section, with two ICs in the modulator. The dc power input to the pa transistor is approximately 6W, and the total current consumption on peaks of speech is about 1A.

Circuit description

The circuit diagram of the rf section is shown in Fig 1. TR1, the crystal oscillator, is a BFX89 vhf amplifier transistor, feedback from collector to emitter being obtained via a tap on L1. An HC25U third overtone crystal in the 35MHz range is used, and the value of the series capacitance C2 permits variation of the crystal frequency to a certain extent. Power supply to TR1 is regulated at 10V by the zener diode ZD1.

L1 is tuned by C4 and C5 in series; these two capacitors form a divider to match the oscillator to the following stage, TR2, which functions as a frequency doubler, employing a BSX20 high-speed switching transistor. A small amount of forward bias is applied to TR2 via R5 and R6.

TR2 is coupled to a 70MHz amplifier stage TR3 via a capacitive tap on the doubler tuned circuit, which consists of L2, C8 and C9 in parallel, and C10. TR3 is also an inexpensive switching transistor, type BSX61, which has been found effective at this frequency.

Output from the driver transistor is coupled to the power amplifier TR4 through a matching network consisting of the parallel-tuned circuit L3, C13, C14 and C15 in parallel, and the series inductor L4. The collector tuned circuit of the pa is an inverted-L circuit formed by L5, L6, and C19, with C20 and C21 in parallel; this arrangement matches the collector impedance to the 75Ω impedance of the aerial feeder.

TR4 is a TRW PT4176B capstan-type rf transistor. This transistor may not now be in common supply and suggested alternatives (which have not been tried) are the Mullard BLY85, or the BLY83 if it is desired to operate at a higher power. If either of these types is used it will be necessary to increase slightly the hole spacing on the rf pcb to accommodate the collector, base and emitter terminations. It may also be necessary to adjust the values of inductance and capacitance associated with the pa stage tuning, and to this effect provision has been made in the design of the pcb to permit additional fixed capacitors to be included in the transistor base and collector circuits.

To eliminate any parametric oscillation in TR3 and TR4 circuits, parametric traps (C16R8 and C18R9) are associated with both transistors. Inductors L3 and L5 are used instead of rf chokes in the collector circuits and, while presenting negligible damping at the operating frequency, they act as short-circuits at the much lower parametric frequency.

A small proportion of the rf output is applied via a 1pF capacitance C23 to an rf monitor consisting of a diode rectifier circuit (D1, R11, C24) and an external 0–1 milliammeter M1. Test points (TP1 to TP4) are included in the collector circuits of all four transistors to permit current measurement during initial alignment, and any subsequent checking. In operation TP1, TP2 and TP3 are short-circuited by links and an external 0·1Ω resistor is connected across

* 114 Tattenham Grove, Epsom Downs, Surrey.

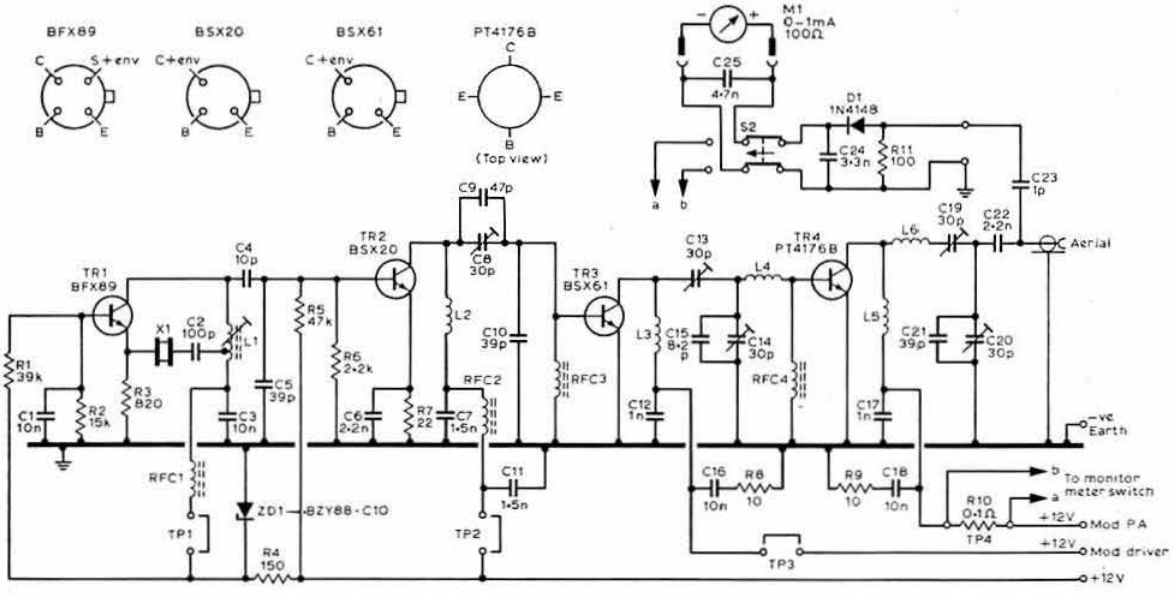


Fig 1. 70MHz transmitter circuit diagram

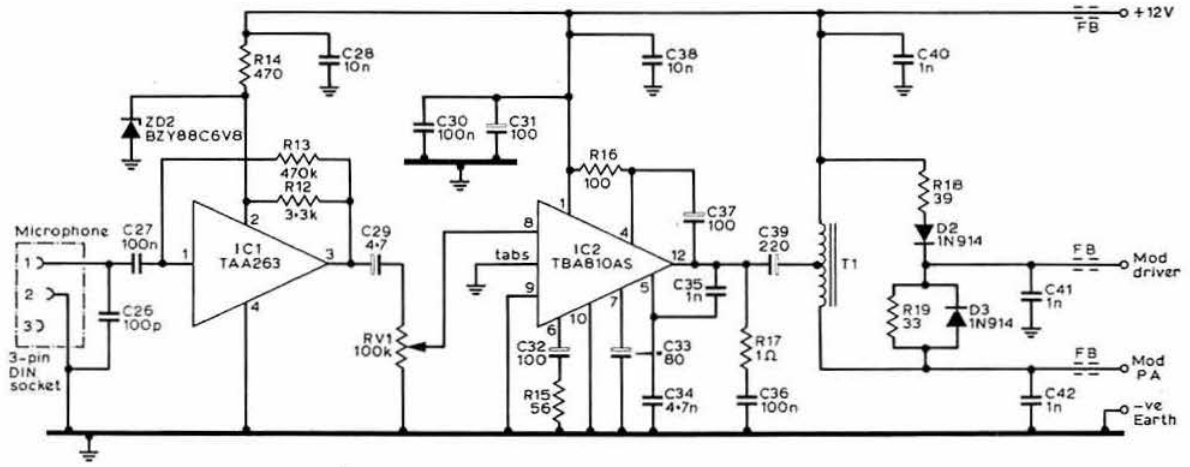


Fig 2. Modulator circuit diagram

TP4, the value of this resistor being such that a 100Ω milliammeter at M1 will have a full-scale deflection of 1A.

The modulator (Fig 2) consists of two ICs, a TAA263 preamplifier (IC1) and a TBA810AS power amplifier (IC2). The TAA263, which is a three-stage amplifier, was chosen simply because a circuit board incorporating this device was on hand and was suitable for the dynamic microphone to be employed. A single transistor amplifier could no doubt be substituted for the ic as the modulator described has considerable reserve of gain. If a single-stage amplifier is used and gain is insufficient it can be increased by reducing the value of the feedback resistor R15.

As the recommended operating voltage for the TAA263 is 7–8V the 12V supply is reduced to an acceptable level of 6·8V by R14 and the zener diode ZD2. R12 is the collector load resistor of the final transistor in the ic, with R13 applying negative feedback between output and input of the device. C26 is an rf bypass capacitor.

Output from the preamplifier is coupled to the main amplifier through a modulation depth control RV1. The circuitry associated with the TBA810AS is in accordance with that recommended by the manufacturer and will not be described here. Audio output from the modulator is applied to the pa through an autotransformer T1, which has a step-up ratio of 1:2. Again, this component was used because it was available, but a transformer having a slightly higher ratio of 1:2·5 would give a better match between the 4Ω output impedance of the modulator and the pa collector impedance.

Modulation is also applied to the driver transistor through a wave-shaping circuit R18, D2 and R19, D3 connected across the modulation transformer; the function of this circuit is to clip the negative-going half-cycle of the modulation waveform applied to the driver, thus increasing the drive level to the pa on positive-going half-cycles, which results in an improved modulation waveform from the pa stage. Ferrite beads with associated bypass capacitors are included in the positive supply lead, and in the output leads to prevent rf feedback into the modulator.

It should be noted that, if the modulator is tested as an audio-frequency amplifier driving a loudspeaker with one terminal earthed, then the polarity of C39 must be reversed for this test.

Components list

R1	39kΩ	**R7**	22Ω	**R14**	470Ω
R2	15kΩ	**R8, 9**	10Ω	**R15**	56Ω
R3	820Ω	**R10**	0·1Ω	**R17**	1Ω
R4	150Ω	**R11, 16**	100Ω	**R18**	39Ω
R5	47kΩ	**R12**	3·3kΩ	**R19**	33Ω
R6	2·2kΩ	**R13**	470kΩ		

All resistors except R6, R10—¼W carbon film. R6—¼W carbon film; R10 wire-wound.

RV1 100kΩ potentiometer

C1, 3, 16, 18	10nF	**C26**	100pF
C2	100pF	**C27, 30, 36**	100nF 100V mini mylar
C4	10pF		
C5, 10, 21	39pF	**C28, 38**	10nF
C6, 22	2·2nF	**C29**	4·7µF 15V electrolytic
C7, 11	1·5nF	**C31, 37**	100µF 25V electrolytic
C8, 13, 14 } **C19, 20** }	30pF miniature air-spaced trimmers	**C32**	100µF 10V electrolytic
		C33	80µF 16V electrolytic
C9	47pF	**C34**	4·7nF
C12, 17	1nF feedthrough type	**C35**	1nF polystyrene (or miniature ceramic)
C15	8·2pF	**C39**	220µF 16V electrolytic
C23	1pF	**C40, 41, 42**	1nF
C24	3·3nF		
C25	4·7nF		

All fixed capacitors are miniature 50V ceramics except those described

TR1	BFX89	**IC1**	TAA263	**ZD1**	BZY88C10
TR2	BSX20	**IC2**	TBA810AS	**ZD2**	BZY88C6V8
TR3	BSX61			**D1**	1N4148
TR4	PT4176B (TRW)			**D2, 3**	1N914

T1 Farnell T213 centre-tapped autotransformer

FB Ferrite beads FX1115

X1 35·13MHz HC25U 3rd overtone (for 70·26MHz)

RFC1, 2 2½t 28swg enam on FX1898 ferrite bead
RFC3, 4 2½t 26swg enam on FX1115 ferrite bead

L1 14t 28swg enam, tapped 2t, on Aladdin 7mm former, with dust-iron core
L2 4t 18swg enam, 7mm diameter 7mm long
L3 5t 18swg enam, 7mm diameter closewound
L4 4t 18swg enam, 7mm diameter 7mm long
L5 3t 18swg enam, 7mm diameter 8mm long
L6 5t 18swg enam, 10mm diameter 13mm long

7·875" x 2·25" ACTUAL SIZE

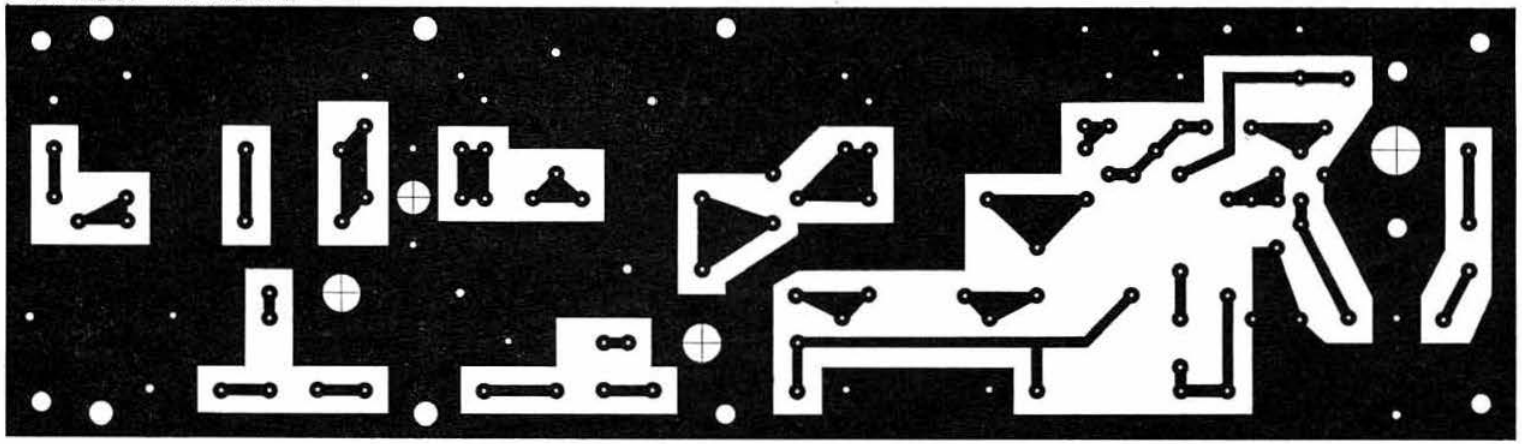


Fig 3. Transmitter pcb track layout

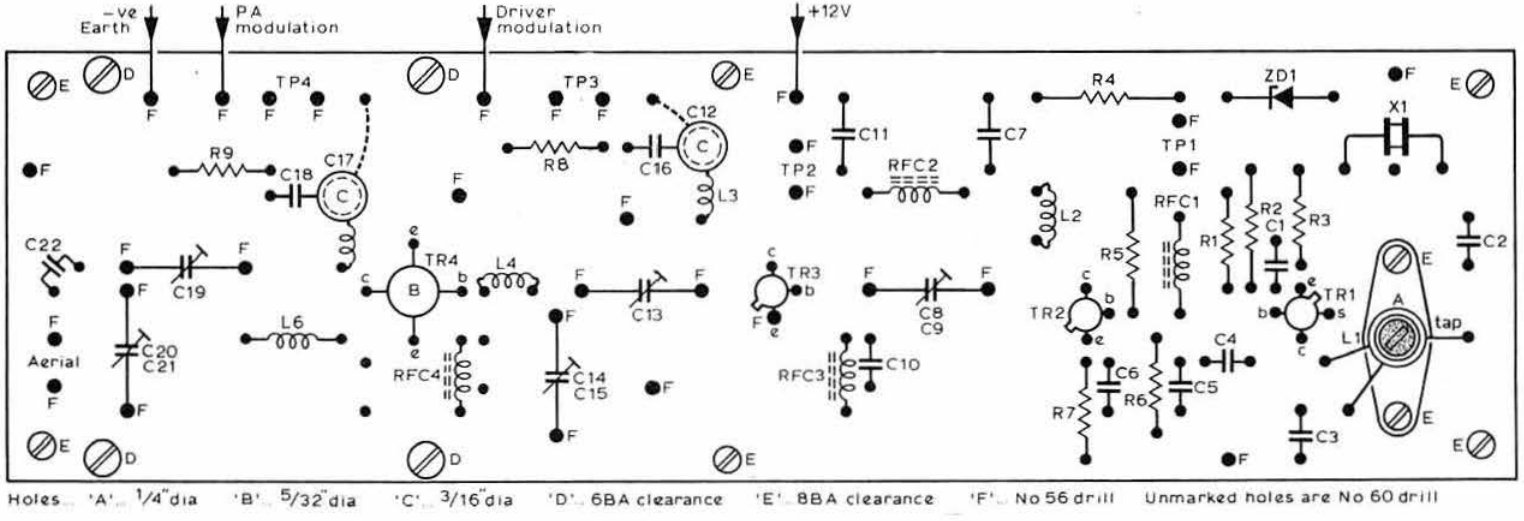


Fig 4. Top view of transmitter pcb showing location of components

Constructional details

With one small exception, construction is on glass-fibre-based PCBs. Double-sided board is used for the transmitter rf section, and single-sided board for the rf monitor (which in this instance is separated from, although it could be included in, the transmitter board), the preamplifier and the modulator proper. The exception is the modulation wave-shaping circuit which is constructed on a miniature four-way group board. No attempt has been made to miniaturize the equipment.

The rf board measures 7·765 by 2·25in and the circuit is constructed on a 0·125in grid. The track layout on the underside of the board, and the position of clearance holes in the copper on the topside of the board, are shown in Figs 3 and 4 respectively. Connections to the power supply, modulator output and test points are to pins made of short lengths of 18swg copper wire, soldered to the relevant land on the pcb and subsequently tinned; connections to the 30pF tuning capacitors are made to similar pins. At various points on the board 18swg wire is also used to connect the upper and lower surfaces; after soldering, these are cut off close to the copper foil. All pins at earth potential are soldered to both sides of the board. Holes for the pins are made with a No 56 drill, and adequate clearance around these must be allowed before etching the topside of the board. Holes for component leads are made with a No 60 drill.

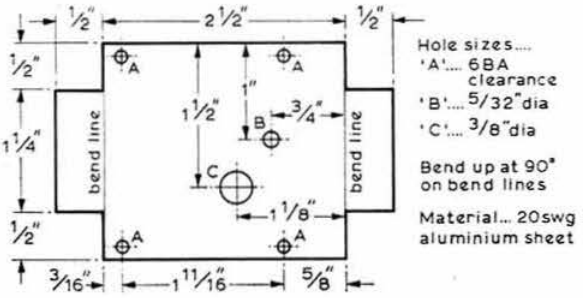


Fig 5. PA transistor heat-sink

The two feedthrough capacitors C12 and C17 are wired on the underside of the pcb to the lands adjacent to TP3 and TP4 respectively. The two emitter connections on TR4 are soldered to both upper and lower surfaces of the board. This transistor is fitted with a heat-sink located on the underside. The heat-sink (Fig 5) is fabricated from 20swg aluminium (the length of the threaded stud on the transistor determines the maximum gauge of metal that can be used) and is fitted with a spacing washer to clear the underside of the board, to which it is secured with four 6BA bolts and nuts. With the heat sink described the pa transistor runs barely warm, but if powers in excess of about 6W are contemplated it might be advisable to attach heavier gauge plates to the two wings on the heat-sink and to paint it matt black. Clip-on heat-sinks are fitted to TR2 and TR3.

Details of the rf monitor pcb are shown in Fig 6. This circuit is also constructed on a 0·125in grid and the board measures 1·125 by 1·0in. Coupling capacitor C23 is connected externally between the rf board and the adjacent monitor board.

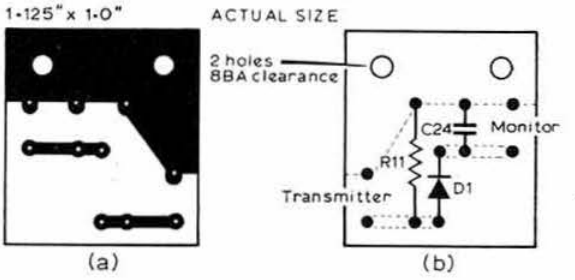


Fig 6. (a) RF monitor pcb track layout and (b) location of components

The microphone preamplifier and modulator boards measure 1·7 by 1·5in, and 3·2 by 2·3in respectively; both boards are constructed on a 0·1in grid. The preamplifier track layout and location of components are shown in Fig 7. Underside and topside views of the modulator pcb are shown in Figs 8 and 9 respectively. As with the rf board, connections to both of these are made through 18swg wire pins.

Details of the fabricated heat-sink for the TBA810AS are given in Fig 10. The two brackets which attach it to the ic are made from 1in 16swg aluminium angle, and the heat-sink plate is made from 14swg aluminium sheet. The heat-sink as described is probably over-generous for the low power level at which the ic is operated and a simpler type could no doubt be substituted. However, the only critical dimension is the spacing of 0·65in between the two 6BA holes in the brackets; this corresponds to the hole spacing in the tabs of the TBA810AS. A heat-sink for this ic can also be obtained from Ambit International. Interconnections between the various circuit boards are shown in Fig 11.

Alignment

It is recommended that for initial alignment the modulator is not connected, and that a lower voltage, eg 9–10V, is applied to the rf board. Correct frequency of operation should be checked as each stage is adjusted. Alignment procedure is as follows:

(1) With TP2, TP3 and TP4 open-circuited, connect a milliammeter (5mA maximum) across TP1. Adjust the dust-iron core of L1 for minimum current and then detune slightly to one side of resonance. (Tuning about the resonance point will not be symmetrical and the core should be set to the side at which the current rise is more gradual.)

(2) Connect a milliammeter (25mA maximum) across TP2 and check that the resonance position of L1 corresponds to maximum collector current to TR2. Connect a milliammeter (100mA maximum) across TP3 and adjust C8 for maximum drive to TR3.

Typical current readings with 12V power supply

Stage		Current (mA)
TR1	(oscillator)	1·8
TR2	(doubler)	13·5
TR3	(driver)	20 to 40
TR4	(PA)	approx 500
IC1	(pre-amplifier)	11
IC2	(modulator)	
	quiescent	12
	speech peaks	approx 400

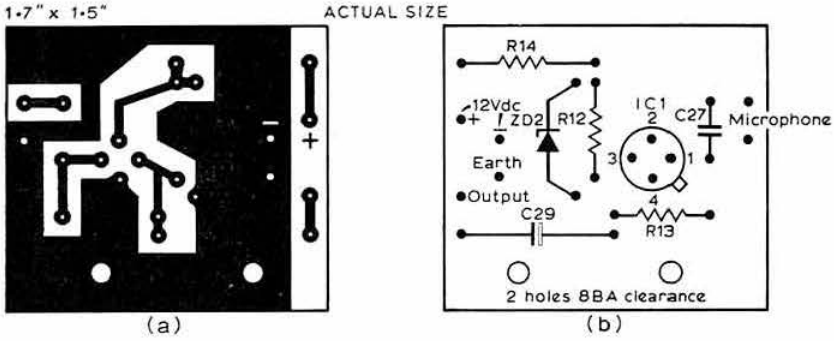


Fig 7. (a) Microphone pre-amplifier pcb track layout and (b) location of components

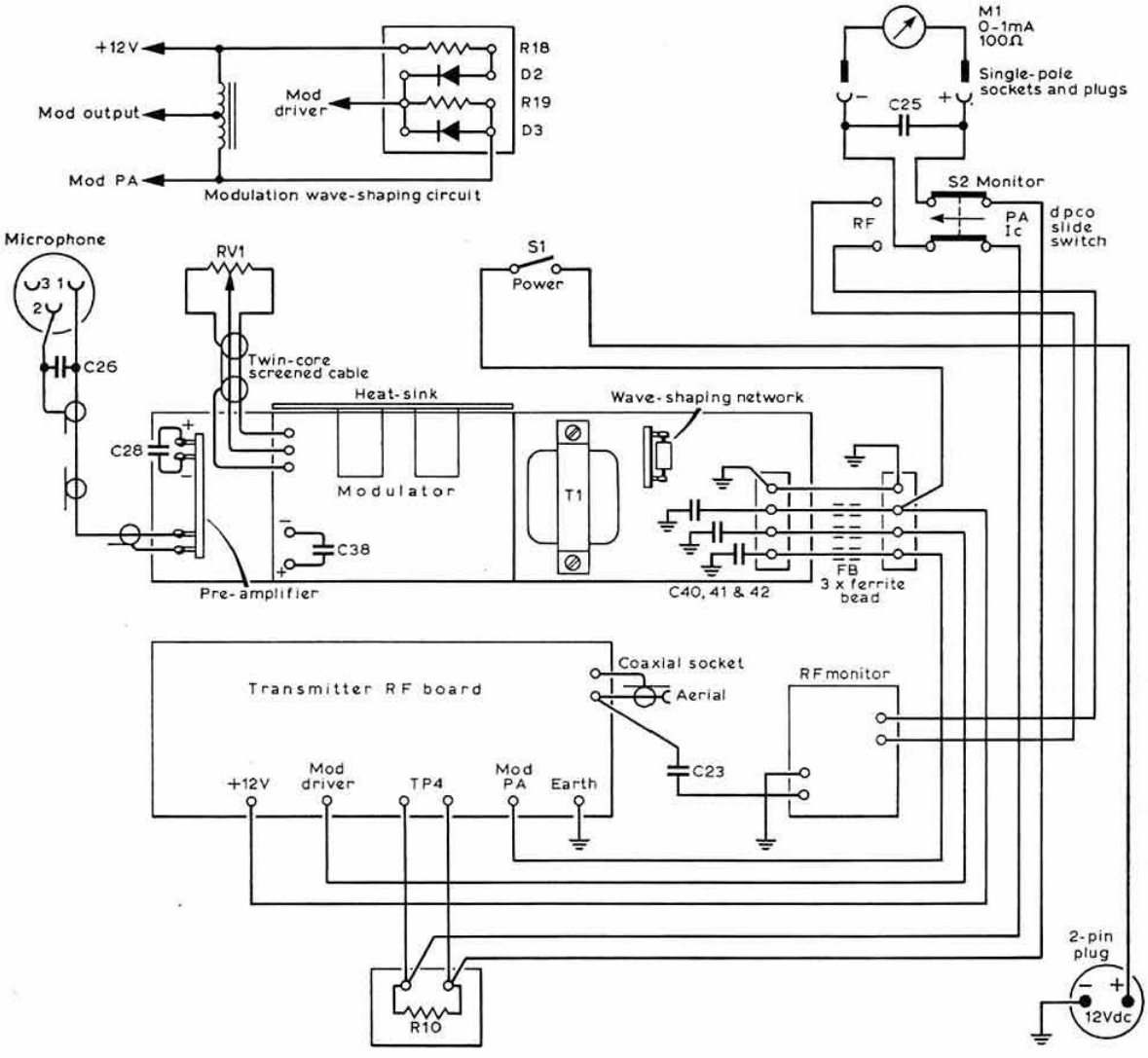


Fig 11. Interconnection diagram

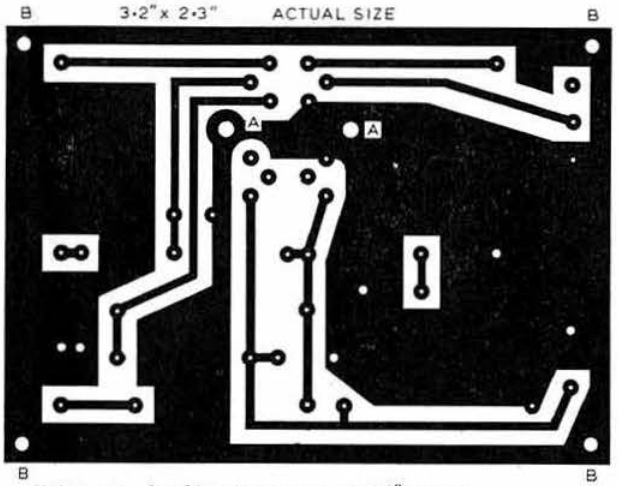


Fig 8. Modulator pcb track layout

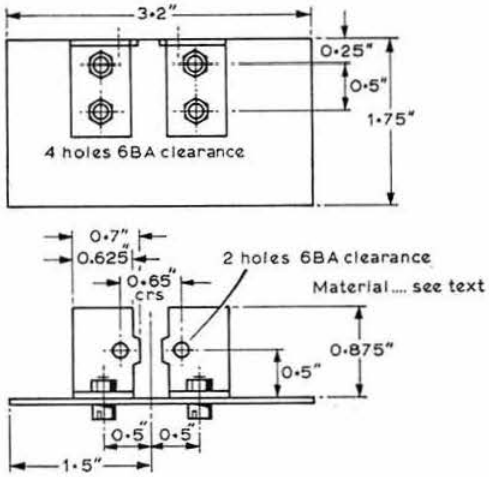


Fig 10. TBA810AS heat-sink

(3) Connect a suitable load to the transmitter output pins. Connect a milliammeter (500mA maximum for initial alignment) across TP4 and quickly adjust C13 and C14 for maximum collector current to TR4. Should this be excessive (eg more than 250mA at this stage) reduce the value of C14 until an acceptable level is obtained.

(4) Adjust C19 and C20 for maximum rf output.

(5) Apply 12V to all stages and repeat the alignment procedure several times until maximum rf into the load is obtained. This is necessary as due to varactor effect the transistors are voltage-conscious. After alignment, TP1, TP2 and TP3 should be short-circuited, and R10 connected externally across TP4. Modulation may now be applied.

If required, C14 can be used as a drive level control to the pa stage; a decrease in the value of this capacitance results in reduced drive to TR4. □

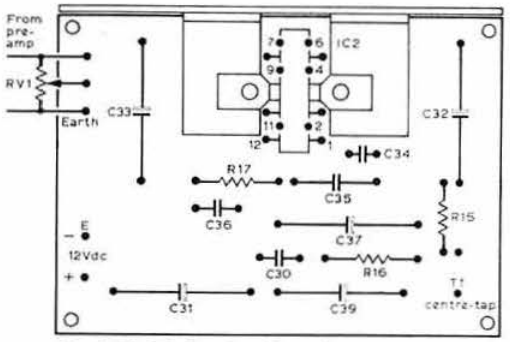
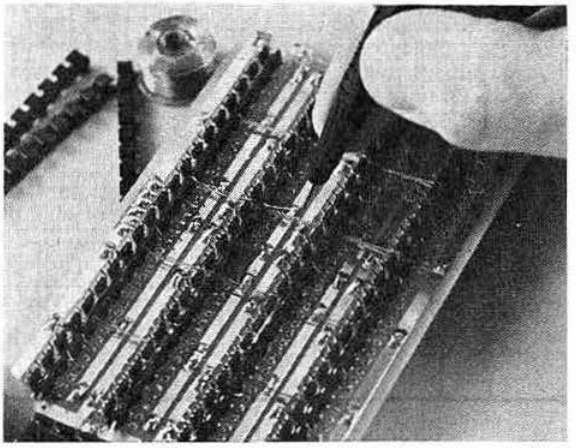


Fig 9. Modulator—location of components

NEW PRODUCT

Wiring system from Zartronix

The "Wire Distribution System" is designed to enable a prototype circuit board to be produced avoiding printed circuit techniques. Wiring is carried out with the use of a special "Wire Distribution Pencil" which uses solderable synthetic enamel wire (36swg BS3188). The point-to-point wiring is retained by moulded "Wire Distribution Strips" which are used for any desired integrated circuit packing density. Two types of strip are available: one, a general purpose moulding which can be used on all types of circuit board (when used with a quick-set adhesive); the other, designed specifically to press-fit into any board with 1mm diameter holes on a 2·54mm pitch matrix. The versatility of the strips ensures that there is no restriction on size or type of prototype breadboard used.



An introductory kit is available and this consists of WDS strips and pencil, spare spool, ic leg deformer, circuit board and instruction leaflet. Prices are: Intro-kit £5.60; WD pencil £1.71, and WD strips (glue or press fix) £1.30. All prices include VAT, with p&p 35p extra. These products are obtainable from Zartronix, 115 Lion Lane, Haslemere, Surrey. □

Some experiments with high-frequency ladder crystal filters

by J. A. HARDCASTLE, G3JIR*

Part 3. Filters for transmitters and receivers

Introduction

In this part, ssb transmitter filters are described and a set of capacitor coefficients for a six-crystal filter is given, and from this a seven-crystal, symmetrical receiver filter is derived. Before describing these new developments some test results on F6BQP filters [1] are reported.

F6BQP design

Three- and four-crystal filters (Fig 14) were constructed using the same crystals as before, so the effect of changing capacitor values and circuit impedances could be compared. The components used were the nearest standard values to those calculated from F6BQP's formulas. Fig 15 compares the performance of F6BQP and G3JIR three-crystal filters, showing how F6BQP has given a filter design having a smooth passband (Butterworth filter), while the G3JIR filter has a slightly better rate of cut-off at the expense of some passband ripple (Chebyshev filter). Exchange of skirt selectivity for passband ripple is a familiar feature of filter design commonly encountered in LC filters. The degree of ripple tolerable is a subjective decision and has not been investigated during these experiments.

A graph of the four-crystal filter response is not included because it is very similar in shape to the three-crystal filter. It is 3dB down at 9,677·8kHz and 9,680·4kHz, and 50dB down at 9,670·2kHz and 9,683·5kHz.

Lower sideband filter

A filter having few crystals has a distinctly asymmetric frequency response (Fig 15) which can be accentuated by

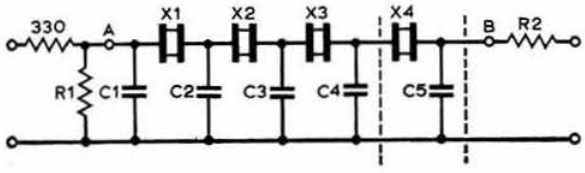


Fig 14. Three- and four-crystal filters.

	No of crystals	Filter type	R1 Ω	R2 Ω	C1	C2	C3 pF	C4	C5
(a)	3	F6BQP	230	230	50	150	150	50	—
(b)	3	G3JIR	350	350	75	150	150	75	—
(c)	4	F6BQP	310	310	25	100	150	100	25

*82 Acacia Avenue, Huyton, Liverpool L36 5TP.

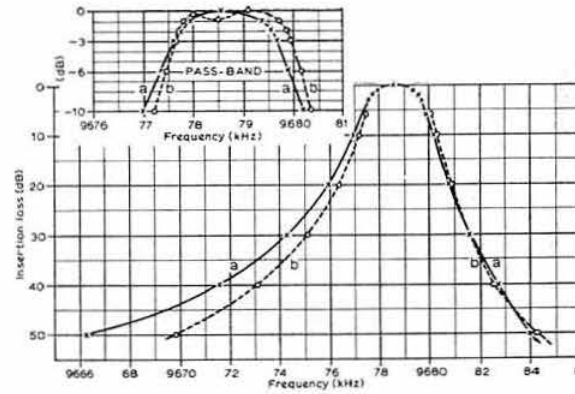


Fig 15. Three-crystal filters. (a) F6BQP; (b) G3JIR

shunting some, or all, of the crystals with additional capacitance. This reduces their parallel resonant frequency, bringing it closer to the passband and increasing the slope of the hf skirt. In Fig 16(a) three of the crystals are shunted with small trimmer capacitors adjusted to make the hf skirt as steep as possible, while maintaining almost 60dB stopband rejection.

Fig 17(b) illustrates the need for spacing out rejection notches to achieve a uniform stopband. If rejection notches are brought closer to the band edge, by further increasing shunt capacitance, greater rejection is obtained over a limited band, after which it steadily deteriorates. This added capacitance causes some deterioration of lf skirt selectivity, but like remote regions of the hf stopband this is not so important in an ssb transmitter, as in a receiver; particularly if audio bandwidth is limited before the modulator to reduce the width of generated sidebands.

Upper sideband filter

An upper sideband filter may be made as shown in Fig 16(b). The passband is now controlled by the crystal's parallel resonant frequency and the stopband by its series resonant frequency. Because all of these crystals are of the same frequency a single deep rejection notch is produced at 9,678kHz, after which the stopband deteriorates. The passband in Fig 18(a) is 7kHz wide but in (b) it has been reduced to 4kHz by adding shunt capacitors to three of the crystals.

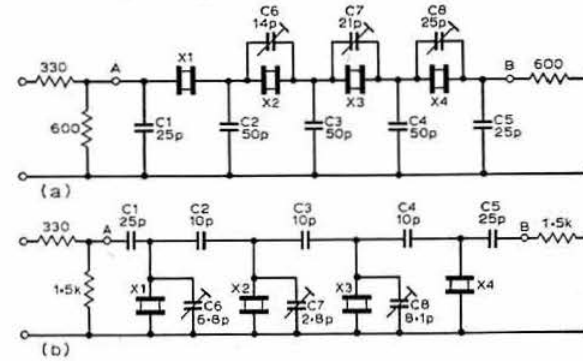


Fig 16. SSB filters. (a) Lower sideband; (b) Upper sideband; X1-X4 9,681·2kHz

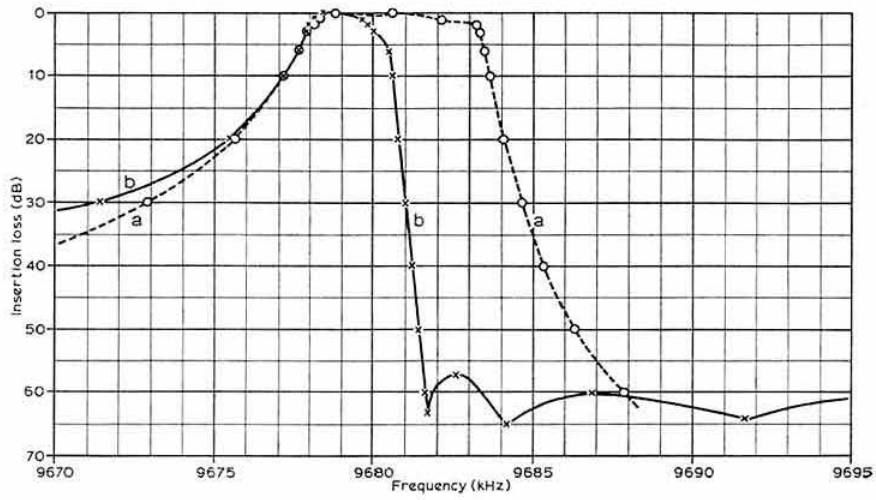


Fig 17. Lower sideband filter. (a) Without C6, 7, 8; (b) With C6, 7, 8

Upper sideband filters need to operate in a high impedance circuit and great care has to be taken over screening to ensure a good performance. While testing these filters it was noticed that the buffet amplifier output circuit was slightly influencing the passband shape, so a 330Ω resistor was connected in series with the input, to provide some isolation.

Dishal filters

Since writing the two earlier parts of this article an important paper [2] has been brought to the author's attention, by courtesy of G4CUE and G3VA. It describes designs for upper- and lower-sideband filters, and gives tables of design coefficients for Butterworth and Chebyshev filters.

Capacitor coefficients (Fig 19) for the six-crystal Chebyshev design have been derived from this information. These allow a filter to be designed without knowledge of the crystal's parameters, the only penalty being an inability to calculate the filter bandwidth, and this must be found by experiment; however, Figs 19 and 20 will provide a starting point for future designs. Butterworth filters designed from the data given in [2] were also constructed and tested successfully.

In both designs components calculated from these coefficients gave the required response shape without further adjustment. Dishal gives more design coefficients in [3] from which a wide range of filters may be designed.

Seven-crystal filter

A symmetrical filter for a receiver may be made by adding a shunt crystal (X7) to the Dishal filter (Fig 19). This is of the same nominal frequency as X1 to X6 but its series resonant frequency has been reduced by adding inductance L1. This combination produces a rejection notch which can be tuned by L1 to obtain the optimum If skirt response (Fig 20(b)). Reducing the inductance increases the notch frequency, steepening the If skirt, but if carried to excess this will degrade the If stopband. Adding X7 increases the passband ripple to 2dB but has no effect on the hf stopband.

Carrier oscillator

The series mode carrier oscillator circuit (Fig 21) was found to have useful vxo properties. Crystals can be pulled over the range 9,676kHz to 9,684kHz by tuning C1 and C2, which is more than sufficient for it to be used for generating either sideband. L1 was wound with 36swg enamelled wire, on a ¼in diameter former with an iron-dust core. To ensure

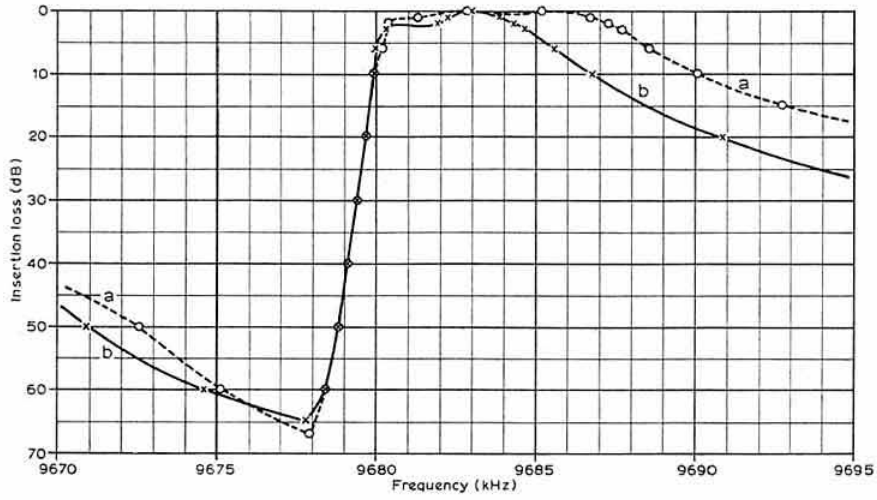


Fig 18. Upper sideband filter. (a) Without C6, 7, 8; (b) With C6, 7, 8

oscillation the dots indicating the start of each winding must be observed.

Conclusion

If a single outstanding factor were to be chosen from all the measurements which have been made it would be that it is almost impossible not to produce a filter of some sort, if the guidelines which have been given are followed. This should be sufficient to encourage even the most hesitant to try to construct their own crystal filters.

Another remarkable feature is the apparent lack of attention this type of filter has received, both in amateur and professional journals, and the author would be pleased to be advised of any relevant publications known to readers.

Results of readers own experiments would also be received with great interest.

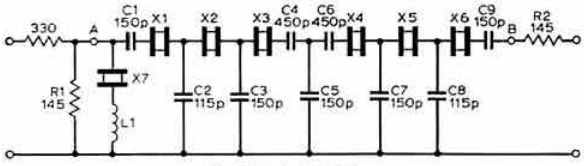


Fig 19. Dishal filter.
X7 and L1 are an optional addition to produce a symmetrical filter. L1 is 10 turns 28swg enam on ¼in diam iron-dust cored former. X1-X7 9,681·2kHz.
C1, C3, C5, C7, C9: see text, capacitance depends on bandwidth required. C2, C8 = 0·75C1

$$C4, 6 = \frac{1}{\frac{1}{C2} - \frac{1}{C5}} \qquad R1, 2 = \frac{1}{2\pi f C2}$$

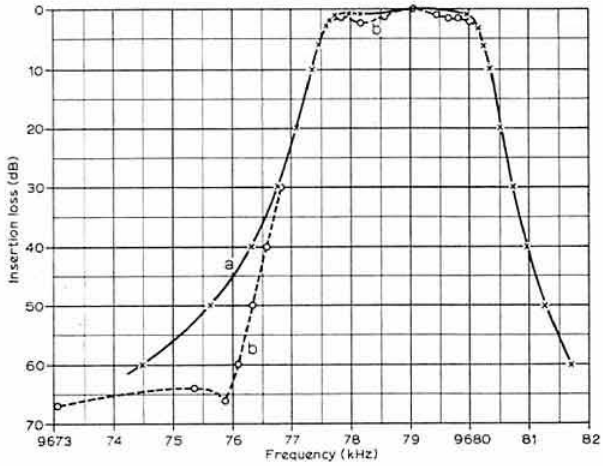


Fig 20. Dishal filter. (a) Six-crystal filter; (b) Seven-crystal filter

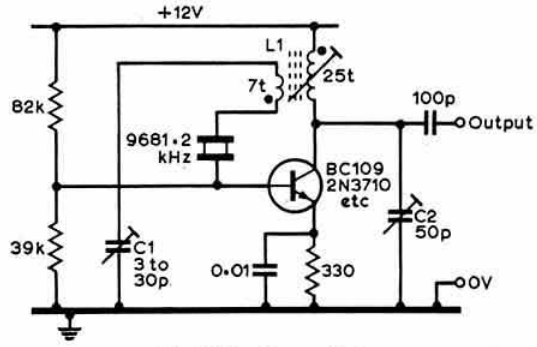


Fig 21. Carrier oscillator

References

[1] "Technical Topics", Pat Hawker, G3VA, *Radio Communication* September 1976.

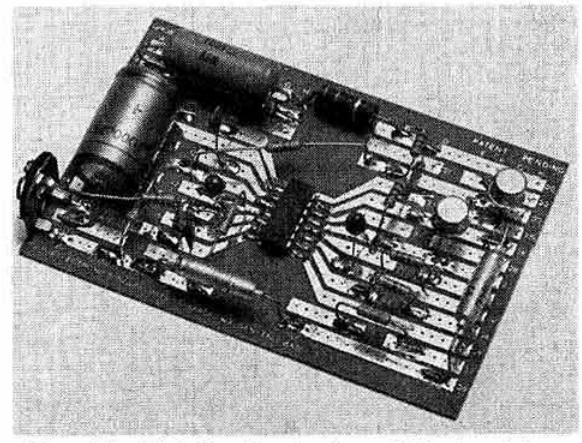
[2] "Modern network theory of single sideband crystal ladder filters", Milton Dishal, *Proceedings IEEE* Vol 53, No 9, September 1965, pp1205-1216.

[3] *Electronics Engineers Handbook*, Fink(Ed), McGraw Hill, Tables 12-1 to 12-7. Section 12, Filters, coupling networks and attenuators, by Milton Dishal. □

NEW PRODUCT

"Blob Board" prototype pcb

The manufacturer of the S-DeC board has introduced a new type of pcb, the Blob Board, which, it is claimed, will permit the user to go from circuit diagram to completed board in a short time and without the use of chemicals. The component layout can be drawn directly on the Blob Board with an ordinary felt pen, and the components are then laid out with leads on copper strip. A few blobs of solder and the circuit is complete. Components can be re-used and re-soldered, thus facilitating amendments. All Blob Boards are roller tinned. They are designed for the home constructor and prototype engineer and are said to be normally half the price of competitive boards. There are 12 different Blob Boards which, between them, will accommodate all components from discretes to ICs.



One of the Blob Boards, showing a finished prototype

They are obtainable from P.B. Electronics (Scotland) Ltd, 57 High St, Saffron Walden, Essex CB10 1AA, from whom leaflets and further information can be obtained by sending an sae.

swl news

Bob Treacher, BRS32525 *

WITH a very large mailbag to welcome in the first *SWL News* of 1977, your scribe hopes that all readers have a happy and successful year. With so much to squeeze into the page this time let us not waste any further space.

1976 and 1977 Countries Tables

The 1976 table is complete and the new table from 1 January 1977 has started. Last year's winner was Noel Phelps, BRS35608, with runners-up Neville Spry, BRS17567, and Keith Kerr, BRS35943. The leading A listener was Keith Morrison, A8883.

The 1977 table will appear for the first time in the April issue, and to enter a score in it is very simple. Keep a record of all the countries heard on each band from 1 January until 31 December and submit *scores only*, not the list of countries, before the deadline quoted in each *SWL News*. Participants should use the RSGB Countries List, obtainable from RSGB HQ (price 24p), as the basis for the entry.

Band conditions

From reports received, it would seem that we are emerging from the relatively poor conditions experienced during 1976. Many correspondents report good openings on each of the main bands. The 28MHz band has shown signs of life, according to Robert Small, A8841, and Robert Montgomery, BRS35397, who report VE2ZN/SU, 9G1JX, VP8HA, ZC4AU and 6W8AAD, while 21MHz has offered FR7BF, YN1RWG, VS6GG, ST2SA and A4XGQ to numerous reporters over recent weeks. The 14MHz band has seemingly been favourable to the Pacific area, with FK8CK a new country for Robert, A8841. Keith, BRS35943, reports KG6RL (Mariana Is), KH6JD and KG6ADX. Conditions on 7MHz around the Christmas period were affected as usual by heavy broadcast QRM, but signals have been reported from KC4AAC, FP8, JA, TG9, TI, KZ, 3D2AQ and the usual VKs and ZLs.

On the 3·5MHz band, conditions have again been very spectacular with much good dx to be heard. Between them, Robert, A8841, Keith, BRS35943, Steve Collis, A8961, and Neville, BRS17567, report KG6JIH, CR9AJ, JAs, HC8RG, VS6DO, YK1AA, W6, W7 and 5T5ZR, as well as more common dx countries such as HI, KZ5, ZF1, D4, HK, 6Y5 and KP4. Several SV stations have been heard on this band, which has given many people an all-time new one. With their almost total darkness the Scandinavians continue to hold the upper hand, and several SMs and OHs have been heard working FO8, VR1, 3 and 4, and KL7s. Good dx conditions should prevail on 3·5MHz until early March.

The 1·8MHz dx scene is again monopolized by Dave, A8312, and Noel, BRS35608. Dave's all-time score is now 49. The additions are VP9DX, W4EV/VP9, ZC4IO, JA3ONB and FG0CXV/FS7. Noel reports ZD8AA, 9Y4A, PJ8CM, CO2JA, C5AZ and IS0LYN. Dave was hoping to add 8P6 and CE to his all-time list as a result of dxpeditions supposedly active around Christmas.

1976 Countries Table—final positions

Station	10	15	20	40	80	160	Total	Mode
BRS35608	77	158	209	176	116	48	784	cw
BRS17567	76	171	236	112	146	11	752	ssb
BRS35943	76	172	216	113	153	17	747	ssb
A8883	50	142	216	82	118	0	608	ssb
A8890	66	124	187	87	94	24	582	ssb/cw
A8312	31	127	169	83	118	36	564	ssb/cw
A8849	63	122	180	75	93	12	545	ssb
BRS32286	58	121	155	47	92	0	473	ssb
BRS33823	29	82	147	59	92	17	426	ssb/cw
BRS35454	14	99	164	61	79	7	424	ssb
A8841	37	88	194	33	59	0	411	ssb/cw
A9123	30	99	149	31	64	15	388	ssb/a.m.
A8808	36	99	107	43	63	17	365	ssb
A8961	12	76	148	27	55	9	357	ssb
A9172	10	54	134	48	38	3	287	ssb
A9191	37	59	128	33	30	0	287	ssb
BRS36208	21	68	115	35	41	1	281	ssb/cw
BRS36842	2	10	147	6	20	1	186	ssb
A9199	10	24	41	14	6	1	104	ssb
A8960	3	16	41	5	12	0	77	ssb

All-time Countries Table

Station	10	15	20	40	80	160	Total	Mode
BRS17567	228	257	300	122	209	16	1,132	ssb
BRS35943	139	227	260	171	201	17	1,015	ssb
A8312	70	184	228	138	165	49	834	ssb/cw

QSL reminders

Belated New Year greetings are sent from our QSL sub-manager Dave Borne, G4CYW. Dave comments that too many of the envelopes he receives are too large to fit his filing drawers without folding, and some are too small to accommodate cards without folding the latter. The optimum size is 18 by 12cm. Some envelopes are excessively stamped and consequently take a long time to fill; Dave's advice is to put only 6½p on the envelope, which will guarantee 15 cards each time. Anyone not wishing to wait this long should mark their envelopes "Wait 5", for example. Dave would also appreciate notification of a change from A to BRS or to being licensed. This enables the swl callsign to be closed but at the same time enables any "straggler" cards to be forwarded. Newer members should note that it takes at least six months for a return card to arrive, so patience is required.

Other news

Crosbie Rodgers, BRS32286, writes in his capacity as secretary of the Dumfries & Galloway R&EC. The club has 34 members and separate RAE and electronics classes have been organized. Your scribe is delighted at the progress made on this venture, and is pleased to take a little of the credit! It is hoped that the club will continue to thrive.

Ray Williams, BRS6072, is an swl of long standing who is extremely interested in vintage radio equipment. Ray owns over 25 vintage sets dating back as far as 1922 and has appeared on BBC TV's *Nationwide* programme with his collection. Ray is interested in obtaining a "Bandscanner" receiver which was made by a firm from Poole who are now out of business. Much searching has not brought one to light. Anyone with information about this model should write to Ray at 204 Dysart Road, Grantham, Lincs.

Neville, BRS17567, has recently been visited by ZL1BD and treated to a splendid slide show of the latter's Hamilton

* 392 Rochester Way, Eltham, London SE9 6LH.

(Continued on p131)

technical topics

Pat Hawker, G3VA

PERHAPS it is true that most amateur transmitters and receivers are now factory built, but that does not mean there are no technical projects left for home construction and experimentation: antennas, antenna matching units, keyers, test equipment, ancillary units etc. The surprising feature is how often a fresh look at some aspect of radio communications suggests that we all tend to become too bound by ingrained attitudes and conventional beliefs that turn out to be nothing more than long-established fallacies: for instance that by definition any mini-beam is only a compromise that can never hope to compete successfully with a full-sized array.

Mini-beam ideas

In *TT* (December 1976) several ideas were presented on adapting the VK2ABQ X-beam principle to form mini-beams; and indeed even the full-sized VK2ABQ tri-band X-beam can be thought of as a form of compact beam with its turning radius of only 12ft. By coincidence, just before the December issue reached your letter boxes, a note was received from Les Moxon, G6XN, describing some recent investigations into mini-beams using the basic VK2ABQ approach, but in a rather different way. Subsequent correspondence has also highlighted his firm belief that it should be possible to develop "no-compromise" mini-beams that need be at no real disadvantage to full-sized units; and indeed, since they may often be raised to a greater height without becoming a major engineering operation, should often be capable in practice of out-performing their bigger but less tall brothers.

G6XN writes: "I am now confirmed in my belief that a mini-beam does not have to be a 'compromise', and this is very important if I am also right in thinking that many amateurs have lost interest in dx operation (or never acquired it) because they believe that without a big beam they cannot be competitive."

G6XN admits that hitherto two-element mini-beams have not given too good an account of themselves; yet he points out that it should not be necessary to lose *more than 2dB compared with a quad or 3-element full-sized Yagi at the same height*. This basic 2dB is made up of 1dB loss due to the use of two rather than three elements (and if this seems very little to lose refer to G6XN's excellent analysis of "Gains and losses in hf aerials", *Radio Communication* December 1973 and January 1974), and 1dB from tuning the beam for maximum (nominal) front-to-back ratio rather than (as should be done for a full-sized beam) for maximum gain (this is necessary to avoid paying too heavy a price in terms of bandwidth).

The gains from consideration of environment and height (ie getting the antenna well up in the clear) can more than compensate for this modest loss of 2dB. G6XN suggests that we must all be extremely careful in accepting any trade-off of fundamental gain for practical advantages, since otherwise one could end up with no real performance at all; and he urges that −2dB (compared with a properly designed and adjusted full-sized array) should be considered as about the right place to draw the line if top dx performance is to be achieved. But note that this implies that *it should be possible to obtain approximately 4dB forward gain from a light-weight mini-beam*, compared with the 6dB "gain barrier" for most rotary hf beams.

Then again most people using big beams insist on feeding them with coaxial cable. G6XN writes: "There is an average of 1dB (and a lot of money) to be saved by *not* using coaxial cable feeders. Again, with a mini or any other two-element beam, there is also a lot to be gained by driving both elements in a way which allows fine tuning to be carried out in the shack. This overcomes the problem of reduced bandwidth, although it requires two feeders and some skill on the part of the user."

Two open-wire feeders, brought into the shack, can offer the following advantages:

(1) Instantaneous beam reversal (a very useful operational feature that also more than halves the average time spent in beam turning).

(2) Beam becomes tunable from the shack and the beam reversal feature makes tuning very easy: one tunes for null on the receiver and then operates the reversing switch.

(3) Instantaneous reversal also provides a simple check on beam performance.

(4) Less than 180° rotation is needed and this allows simpler and cheaper methods of beam rotation.

(5) Interference can be nulled out.

A further very important practical advantage is that it no longer becomes necessary to "tune up" the beam with the elements close to the ground, with the problem of having to allow correctly for the effect of raising the antenna. Some ideas for remote tuning of quad antennas, based on an article by W6AJZ, were given in *TT* (July 1973, reprinted in *ART5*), although in this case only one element was so tuned.

Although G6XN has not yet applied the full two-feeder tuning system to a mini-beam he feels it could represent perhaps the single most important step towards the production of a real competitor to the big beams.

A "neutralized" VK2ABQ mini-beam

In his own approach to the VK2ABQ mini-beam, G6XN has adopted a novel "neutralizing" technique to overcome the "double-humped" response brought about by what in effect is a pair of high-Q circuits tightly coupled by end capacitances, making it very difficult to obtain anything like equal element currents at the same time as correct phasing. It is not intended, this month, to explain this system in detail as it is still in process of being tested; however, the basic arrangement is shown in Fig 1. Preliminary trials on 14MHz are most promising and appear to open up other applications for antenna-element neutralizing.

In adopting the VK2ABQ approach, G6XN is convinced that to make an element as small as possible without adding lossy components (eg the loss resistance of loading coils) one *must* "end load" and the end-loading *must* be confined within the space enclosed by the radiating elements (as for example in the capacity hat loaded mini-quad described by G3YDX in *Radio Communication*, October 1976) and that this can usefully be done with "bent-over ends".

G6XN considers the VK2ABQ tri-band mini-beam (Fig 5 of December 1976 *TT*) could be a serious contender in the

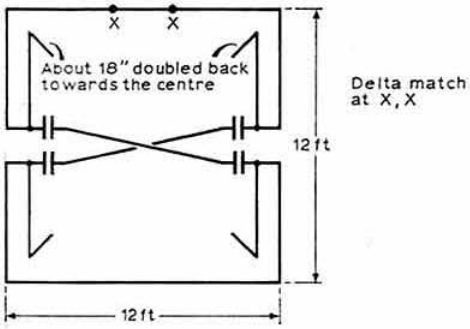


Fig 1. G6XN's neutralized form of the VK2ABQ mini-beam for 14MHz which has been tested at a height of 55ft with highly promising results as a "no compromise" mini-beam fully competitive with full-sized arrays at rather lower heights

search for high-performance mini-beams. While this might seem deliberately to *increase* (rather than neutralize) the capacitive coupling between the elements, nevertheless both techniques appear to be making deliberate use of capacitive coupling to create the "equal current" situation required to achieve good back : front ratio. On the other hand, the VK2ABQ approach will have a lower radiation resistance than the G6XN neutralizing technique and this means either less bandwidth *or* some sacrifice of gain (consistent with VK2ABQ's claimed 3dB forward gain), and greater wire diameter to achieve similar efficiency. Conversely, for similar results it should be possible to reduce the dimensions of the G6XN beam still further.

Clearly there is still a good deal of room for further investigations involving the use of two separate feeders to provide remote tuning, and in these notes I am briefly outlining only some of the many interesting points made by G6XN, although I hope to return to this subject before long.

One point made by G6XN is that he cannot believe that VK5HP's 7MHz version of the VK2ABQ beam (Fig 7 of December 1976 *TT*) can possibly resonate at 7MHz since the two 300Ω wires will tend to resonate as a single conductor and not as (2 × 17ft 5in) + (4 × 8ft 8in), ie 69ft 6in of wire. This might be worth checking since, rather curiously, in a subsequent issue of *Amateur Radio* VK5HP has described in detail a quad antenna based on the same form of folded element, so somehow he seems to have found the technique workable. I wonder if any reader has tried the idea and would care to comment.

Before leaving this fascinating subject of getting quarts out of pint bottles, one further general point made by G6XN: the importance of *not* securing wires directly to bamboo spreaders. Since such elements have low radiation resistances, they will have very strong electrostatic fields, and bamboo is a very bad insulator when wet. He uses polythene line (as thin as possible) exclusively for antenna insulation, and the corners of his elements are secured to radial ties, the spider being bowed to provide tension and clearance.

TVI statistics

It has been our practice over a number of years to include in *TT* a digest of the official annual report on radio interference complaints compiled by the Home Office Directorate of Radio Technology, although it is recognized that many cases of interference are not reported to the Post Office for investigation. The 1975 figures unfortunately did not become available until quite recently and must already be considered history rather than news.

Generally the whole trend of interference to radio and television broadcast reception continues downwards, with the number during 1975 down by 7·1 per cent to 39,050 cases, representing 44,499 complaints; roughly half the totals of 10 years ago. However, it is worth noting that interference to Band 2 vhf/fm radio was 23 per cent up, and this problem has doubled in the past five years (reflecting more use of vhf and vhf stereo by listeners?). On *television*, the changeover to uhf reception by most viewers and the larger number of uhf television stations giving improved coverage in many areas appear to be the main factors accounting for the downward trend. It is interesting to note that even now Band I television continues to be the service most affected by interference, although used by only a small minority of viewers. Indeed, the figures suggest that *interference levels* from lf to vhf are not really getting any lower, as they did in the years immediately following the introduction of regulations affecting domestic electrical appliances in the mid-'fifties. Perhaps more stress needs to be put on suppressing electrical interference at source.

The interference source officially listed as "radio transmitters, amateur stations only" is analysed over a number of years in the accompanying table.

	1968	1969	1970	1971	1972	1973	1974	1975
LW/MW	55	48	28	38	56	61	75	73
Band 1	725	821	630	467	462	329	140	82
Band 2	34	44	40	44	55	58	71	84
Band 3	319	492	394	300	306	221	108	42
Band 4/5	12	26	65	173	348	488	480	487
Mobile	6	11	4	5	15	12	12	17
Totals	1,151	1,442	1,161	1,027	1,242	1,169	886	785

Bands 1 and 3 are used for 405-line television (vhf); Band 2 is used for vhf/fm sound broadcasting; Band 4/5 is for 625-line television (uhf). Mobile refers to the public authority and commercial mobile services.

It is interesting to compare the UK experience with that in the USA where the vast majority of tv reception continues to be on vhf and where the enormous growth of citizens band operation has had a big effect. Richard J. Harris, G3OTK, has drawn my attention to an article "FCC swamped with complaints as sources of rfi/emi increase" (*Electronic Design* 20, 27 September 1976). This reports that of some 100,000 complaints (and the figure is rising) made annually to the FCC of interference to domestic entertainment equipment, some 87 per cent involve 27MHz cb transmitters. This is one reason why the FCC is making strong efforts to force cb manufacturers to reduce the spurii and harmonic outputs, including those from receiver oscillators and some of the various heterodyne-type frequency synthesizers.

But the article makes it clear that FCC is also adopting a new philosophy: not to consider that the transmitter is the sole villain. They are pressing for regulations that will force all equipment manufacturers to make consumer equipment less susceptible to rfi/emi: and to do this as an integral part of the design rather than just as an afterthought when the problem arises.

There is little doubt that much of the present problem on both sides of the Atlantic arises from the susceptibility of the af stages of receivers and hi-fi audio equipment to strong rf

fields; here the "blame" should not be placed on the transmitter but on the domestic equipment.

High-power transmission-line transformers

Those who believe that the days of the lone investigator and home research projects are almost over should consider the implications of the six-page article "Broadband matching transformers can handle many kilowatts" by Jerry Sevick of Bell Laboratories in *Electronics* (25 November 1976). This reports the discovery that broadband transmission-line transformers can have efficiencies much higher than anyone suspected, so that—for example—a broadband antenna matching transformer of this type and wound on only 1·5in diameter cores "can handle 800W without flushing".

Now Jerry Sevick is a professional engineer: but he is also W2FMI and author of many *QST* articles on using vertical antennas with really effective, multiple-radial ground planes. And it is clear that his work on transmission-line transformers stems directly from his amateur rather than his professional activities; indeed his use of such transformers for matching short vertical antennas was originally reported in *QST* (January 1976); an article also memorable for showing that a garden sunshade can make an effective top-loaded "umbrella" antenna.

As noted in *TT* (August 1976) the distinguishing feature of any transmission-line transformer (tlt) is that the windings are composed of two conductors carrying equal and opposite currents, similar to the "go" and "return" currents in a balanced transmission line, so that the net magnetizing ampere-turns in the core is theoretically zero. TLTs are already widely used in double-balanced mixers and modulators and increasingly for matching networks in transmitters, but W2FMI's work appears to open up new applications such as matching high-power transmitters to low or high-impedance antennas. While most TLTs are wound on toroid or variations of the toroid-type cores (see *TT*, August 1976, for references to shape factors), W2FMI points out that

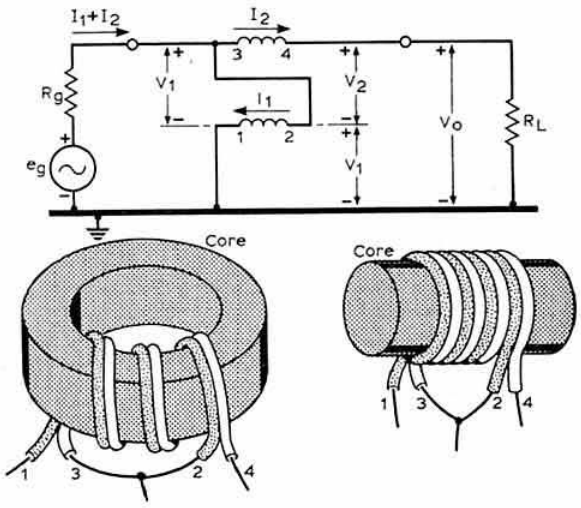


Fig 2. Basic transmission-line transformer and capable of broadband operation in both toroidal and rod form. This is the popular 4:1 unbalanced-to-unbalanced form using two wires of equal diameter closely wound around a magnetic core material

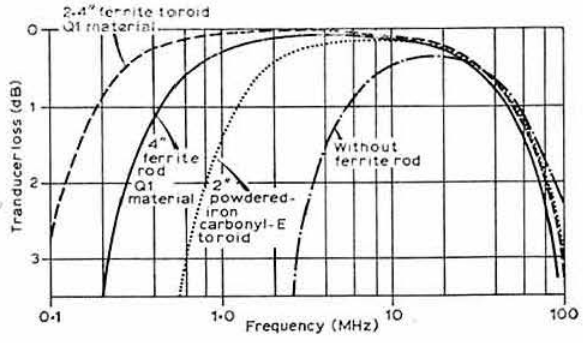


Fig 3. The configuration of Fig 2 extended to provide other ratios. A 4:1 impedance ratio is provided when the output is connected between earth and terminal 4; 9:1 when between ground and terminal 6. Tapping off the top winding (terminal 7) provides non-integer ratios

good results can be achieved with rod-type cores, or (over a more restricted frequency range) even using air-core formers: see Fig 2. It is mainly at the low-frequency end of the range that the performance of the toroid becomes clearly superior, Fig 3. In such transformers relatively few turns are needed. The original experiments used Q1 ferrite material but W2FMI suggests that there is still room for further investigation of core materials for applications involving powers of over 1kW.

Perhaps the biggest problem in using this technique is that of achieving large step-down or step-up ratios (a problem discussed in the August 1976 notes). W2FMI has, however, shown that taps can be used to provide a variety of impedance transformation ratios: Fig 4.

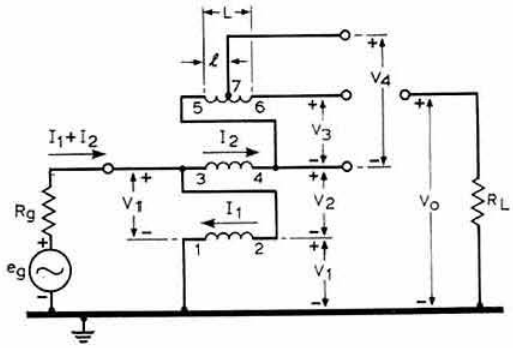


Fig 4. Response curves of transmission-line transformers. All units arranged to provide 4:1 impedance ratio to match 50Ω transmitter to 12·5Ω antenna. The tightly-wound transmission-line windings use 14 gauge enamelled wire on cores of the materials indicated as solenoids or toroids

As an example of the application of these techniques W2FMI includes a photograph of a 1·8/4(3·5)/7MHz matching unit suitable for use at powers up to 1kW with a 29ft vertical antenna with 13ft capacity hat and comprising two transmission-line ferrite-rod transformers; this appears to be a modified version of the matching unit described in *QST* (January 1976). The antenna is resonated using powered-iron toroids at low frequencies and by a variable air-dielectric capacitor at high frequencies.

In the tlt, W2FMI has shown that the core's role is to prevent shunting currents at all frequencies and never to couple energy, except at the very lowest end of the range. Other broadband matching devices—whether networks of capacitors and inductors or conventional transformers—have smaller bandwidths and lower efficiencies; high ohmic loss characterizes inductors of the size needed at low frequencies, and high core loss is a usual feature of conventional transformers, reducing their efficiency and limiting power handling capabilities.

So the high-power tlt matching technique appears to be a very promising technique both for amateur and professional applications. One of the *TT* readers who drew this to my attention was Gian Moda, I2SWX.

Frame receiving antenna

On several occasions we have mentioned briefly the use of simple frame antennas, with single-turn coupling coils, for dx reception of medium-wave broadcast or 1·8MHz stations. Each time enquiries have been received seeking further constructional details, although these are not particularly critical. As such a design has recently appeared in *Electronics Australia* (October 1976) the opportunity is taken of reproducing it: Fig 5.

About 100ft of plastic-covered wire (about 22swg) should be used for the main winding and this should be wound to a whole number of turns; if it will not tune to 2MHz with seven turns, take one off and try again. Seventy-ohm coaxial cable can be used instead of 300Ω balanced feeder to the receiver, but aim at making the windings and general construction as symmetrical as possible since the depth of the rejection null depends on the electrical balance. Tune in signals on the receiver, peaking the antenna tuning control and adjusting direction of loop for maximum pick-up or for maximum rejection of interference.

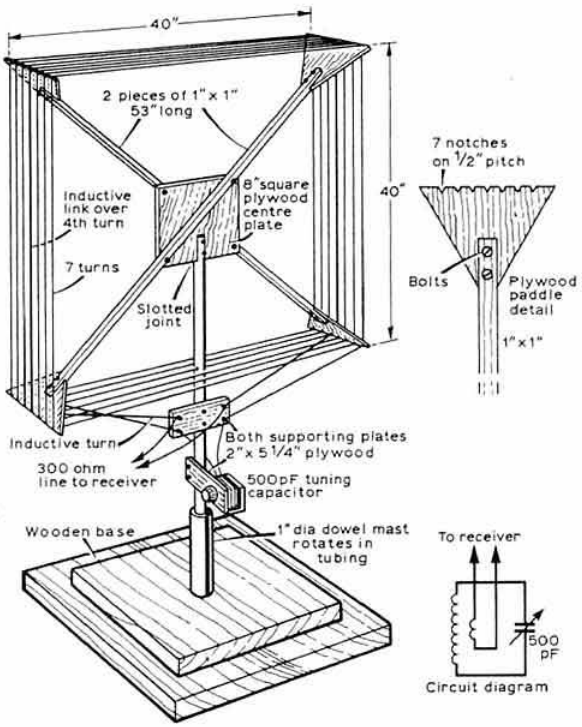


Fig 5. Constructional details of loop antenna for operation on medium waves and/or 1·8MHz and capable of providing deep null on interfering signals (*Electronics Australia*)

Coaxial connectors for gigahertz

Ed Oxner of Siliconix (who has been very busy recently preparing articles on the attractive new V-mos power MOSFETS such as the VMP1 and VMP4 devices) was interested to see the brief reference (*TT*, October 1976) to the need for accurate impedance matching in coaxial rf connectors when these are used right up to the gigahertz region. Many years ago he designed a new coaxial rf connector for the US Signal Corps, which proved to be the predecessor of the many miniature connectors, although his own design is no longer in current use.

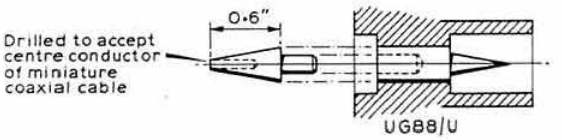


Fig 6. Ed Oxner's system of adapting coaxial connectors for operation as precision units into the microwave region

But it employed a basic design concept which may well still be pertinent; a scheme that allowed the connector to provide good performance in the microwave region. This concept can still be applied effectively to present-day BNC connectors. A small lathe could, he believes, "crank out" the small adaptors by the truckload. Using the type of adaptor shown in Fig 6 he has found that a modified UG88/U with mating connector will provide a vswr of under 1·3:1 up to beyond 6GHz.

Building penetration with hf

In *TT* (July 1976) very brief mention was made of a 3MHz ssb hand-portable communications system ("Figaro") developed by Plessey for the fire service and intended for communicating with firemen inside buildings and basements, and successfully used underground in the Moorgate tube disaster in 1975. The base station is set up at the scene of the fire or other emergency so that the range is often very short but can nevertheless involve large path losses because of the screening of reinforced concrete and/or the problem of getting the signals down into basements. An article outlining the design approach and the propagation problems ("Figaro —fireground communications in a highly-screened environment" by S. V. Judd, *Systems Technology*, June 1976) has been brought to my notice by Brian Castle, G4DYF.

A series of trials carried out in the lower basement of the Home Office Communications Headquarters building at Harrow showed that a 90MHz, 5W transmitter with a $\lambda/4$ whip antenna in the doorway of the main building produced no detectable signal in the basement of the reinforced concrete building some 17m below ground level. This led to a study of the factors involved in choosing an optimum frequency for such applications.

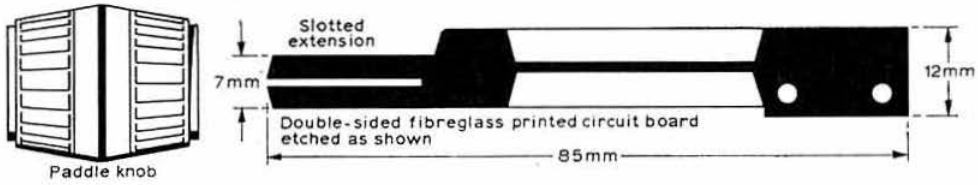


Fig 7. Fibreglass paddle for G3GJX keyer. The paddle knob consists of two slider pot knobs cemented back to back with bright end-trim removed from one

There are four major "trade-off" considerations: path attenuation at different frequencies; antenna size and efficiency versus frequency; noise distribution versus frequency; practical size and weight versus transmitter power.

The studies covered frequencies from 16kHz to 100MHz, and it was determined that on the basis of path attenuation, noise and portable antenna performance, the only real hope for a system capable of working under such conditions was in the frequency range 2 to 8MHz.

It was considered particularly important to achieve maximum possible performance from the portable antenna which had to be such that it would not impede the fireman in his work (whip antennas were ruled out by the Home Office on grounds of weight and compatibility with the other equipment carried or worn by firemen). The system finally adopted was a small loop antenna stitched into an overall and enclosing an area of 0·75m². The efficiency of such an antenna (disregarding body losses) is proportional to the third power of the frequency and it can be shown that for a fixed frequency the efficiency is proportional to the third power of the diameter, or to loop area to the power of 3/2. It is thus important that such a loop should enclose as great an area as is feasible.

S. V. Judd believes that a loop is in fact the most efficient 3MHz transmitting antenna that can be worn unobtrusively. A 1m vertical whip would need so much inductive loading that very little power would ever reach the antenna element, let alone be radiated. The small loop is resonated with relatively lossless mica capacitors, and the bandwidth is sufficient to radiate any of three channels within a spread of 60kHz, with a loss of only 1dB on the two outer channels. For the "base" station a loop 1m in diameter and made of 4·8mm aluminium tube enclosing an area of 0·6m² was used in the first trials; and for the final "duplex" system two loops at right angles, enclosed in fibreglass tubes with spring hinges to allow it to be folded for transport, measures 0·76m by 0·15m diameter.

The use of hf transmitting loops attracted a good deal of interest among amateurs a few years ago, following their adoption by the US Army (see *ART*) and were shown to be quite effective provided that the resistive loss is kept as low as possible by using copper or aluminium tubing (or the outer braid of coaxial cables as suggested by G6NA). S. V. Judd reports that the adoption of this approach plays a major role in the success of the Figaro system.

The very compact portable transceiver unit is based on the SL600 series of integrated circuits (with agc, vogad and vox) built into a sandcast alloy casing 228 by 190 by 38mm; this casing also contains the 12V, 1·2Ah nicad battery and the antenna tuning circuit and is capable of some 10W p.e.p. ssb output. The base station has about double the output.

It is interesting to find hand-portable transceivers reverting to low hf operation after so many years in which the trend has been to ever higher frequencies. I recall the old US Army SCR536 hand-portable units of the 1944-5 era; these operated between 3 to 6MHz with an urban range of around a half-mile, using the old 1R5, 3S4 range of miniature battery valves.

G3GJX keyer ideas

In the September 1976 issue of *Radio Communication* (pp 600–3) Brian Grist, G3GJX, described "A fourth generation cw keyer using cmos ICs" representing a modern yet low-cost approach to the construction of a very practical keyer. He has recently sent along two useful follow-up ideas which can be applied to this and possibly other keyers: a fibreglass paddle; and a "touch" paddle. He writes:

"The fibreglass paddle shown in Fig 7 is etched in regular double-sided pcb material; it is easy to make and a vast improvement on the usual hacksaw-blade key paddles. The fibreglass is resilient without excessive springiness and the inherent damping prevents bouncing. The paddle itself is made from a pair of slider potentiometer knobs cemented back-to-back (most component catalogues present a choice, including brushed aluminium knobs that can look quite smart!).

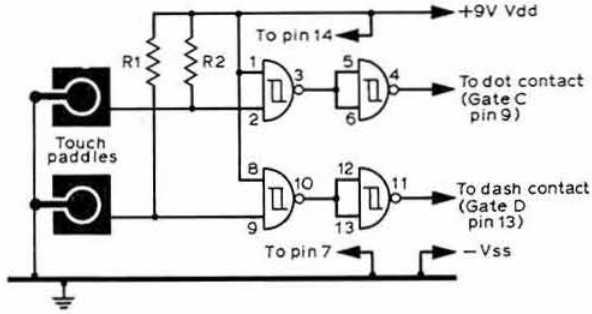


Fig 8. Add-on touch paddle for the G3GJX cmos (September 1976) keyer using CD4093 (quad two-input NAND schmitts). R1 and R2 should exceed 20MΩ (see text)

The touch-paddle alternative of Fig 8 is also practical. R1 and R2 can be 20MΩ or more to provide adequate sensitivity. For those lacking the softness of youthful fingers (like me) the paddle works best if the touch contacts are raised rather than flat. A matrix of Veropin heads in 0·1in pitch board is good, but interleaved pcb tracks are likely to prove disappointing."

Constructional details for both these ideas are given in the illustrations.

Temperature stabilization of vfo

A. K. Langford, G4ARY, comments on the suggestion by P. J. Horwood, G3FRB (*Radio Communication*, November 1976, p827) that temperature stabilization offers a useful approach to increasing the stability of vfos. He writes:

"I have been working on these lines (when time permits). I began testing a voltage-controlled vfo using a transistor-array integrated circuit and found it had a poor temperature coefficient but was linear over a wide range. So I decided to stabilize the temperature using one of the transistors as an 'on-chip' sensor: Fig 9. The thermostat and vfo were all mounted on one side of double-copper laminated board and the power transistor 'heater' bolted to the other side. This board was then sandwiched between layers of polystyrene foam for testing, with only the light emitting diode (led) and 10-turn potentiometer mounted externally.

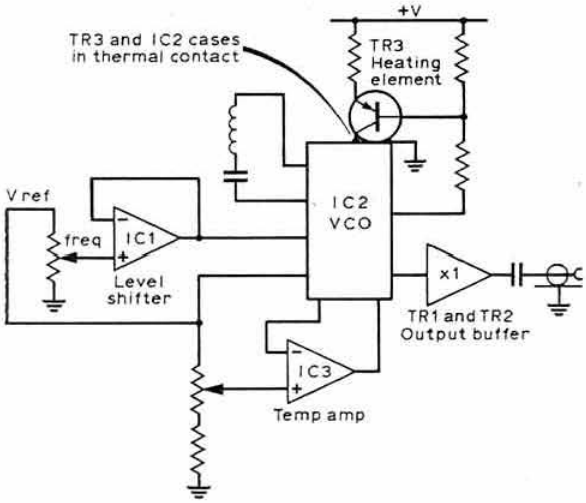


Fig 9. Voltage-controlled variable frequency oscillator with on-chip thermal stabilization. IC1 level shifter; IC2 vco; IC3 temperature amplifier; TR1, TR2 output buffer; TR3 heating element (*G4ARY*)

"I do not have a counter to measure exactly the frequency drift, but frequency stability was found to be good after an initial 'burn-in' period; but there was a problem of short-term cycling due to the low thermal capacity of the copper foil and power transistor, and I intend to rebuild the board to improve this.

"Although the idea is sound in principle, a low temperature coefficient vfo should be used. If good thermal insulation is not used and/or a poor thermostat circuit with large hysteresis then the vfo may prove to be worse for the addition of the 'oven'."

Reducing power drain of relays

Two ideas for using 24–26V surplus relays on 12V supplies were reported some time ago in *TT* (February 1973) and *ART5*. A modified version of one of these techniques turned up recently in *Electronics* (9 December 1976) but this time primarily as a means of substantially reducing the power drain of the relays. John R. Nelson points out that useful power saving can be achieved in this way with battery-operated equipment, taking advantage of the fact that a relay needs

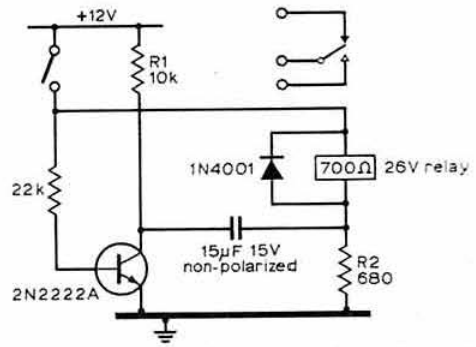


Fig 10. Operation of a 26V relay from 12V supply

only about half of its nominal voltage during hold-in, provided that it can be given a boost during pull in. By using a transistor to switch in voltage from a charged capacitor the necessary extra voltage can be provided just when it is needed.

The system, Fig 10, is based on the non-polarized electrolytic capacitor which is initially charged to 12V through R1 and R2. Closing the switch applies 12V to the relay coil and, at the same time, turns on the transistor, thus dropping the positive side of the capacitor to earth. This effectively forces −12V on the other side of the capacitor, putting some 24V across the relay coil which then pulls in. Once the capacitor has discharged through R2 and the relay coil, approximately 7V remains across the relay coil and this is sufficient to keep it energized.

The circuit as shown is intended for 26V relays having coil resistances in the region of 1,000Ω; to suit the requirements of different relays the value of R2 may have to be adjusted.

The capacitor should be a non-polarized type since there will be a reverse voltage across it whenever the relay is energized. Should power to the circuit be interrupted the switch must be opened and closed to reactuate the relay. A diode across the coil protects the transistor from transients.

SWL news

(Continued from p125)

QTH. Neville's new year resolution was to leave 3·5MHz to the "nut cases, whistlers and blowers" who spoil people's enjoyment of the band. Strong words indeed, but one hopes the powers that be will catch up with the people concerned.

There are three new correspondents this time: Dr H. Squance, BRS37884, uses a JR500S with a delta loop at 130ft; Bob Taylor, BRS36842, uses an NCX5 with four crossed dipoles situated in the loft—he started listening on 1·8MHz but in recent years has tended to concentrate on 14 and 3·5MHz; and Stephen Casey, A9107, who lives near Manchester and uses an FR50B with several long wire antennas and an inverted-V.

Readers will note the appearance of the all-time table which has received some support. This will be republished in the June issue.

Correspondence is also acknowledged from As 9123, 9199 and 8808, and BRS36625.

The deadline for the April issue is 3 March. □

microwaves

Dain Evans, G3RPE*

Operating news

In a letter to G8DEK, SM4ETO has given details of his 2·3GHz equipment which will be of wider interest. He uses a crystal-controlled driver on 384MHz with the Mullard BGY22/BGY23 combination to produce 10W at this frequency. The output feeds a varactor tripler which generates 3W at 1,152MHz. 2,304MHz is generated by a WA9HUV doubler (*Ham Radio* December 1975) using a 2C39BA triode with 630V on the anode. The 8·5W of output obtained corresponds to a gain of 4·5dB, which confirms the performance reported by WA9HUV and which some UK amateurs have found difficulty in reproducing. On the receive side, he uses a BFR91 preamplifier to a Schottky barrier mixer with the local oscillator on 2,160MHz. SM5DJH and SM5CCY are given as the only other stations on this band.

SM4ETO is also active on 1,296MHz using a 300–400mW cw/ssb exciter followed by a multistage linear with two 2C39s or 7289s in the final stage. During the summer when operating his club station SK6AB from Gothenburg he worked G4BYV, G4BEL, G3LQR and G3DAH, and also GM8BJF for the first GM/SM on this band. He has a small transceiver for 10GHz, a band he shares with SM6AYS and SM5CCY/SM5DJH. For the record, Swedish microwave allocations are at 1·3, 2·3, 5·6, 10 and 21GHz.

VK2AHC (ex G3BAK) continues to pioneer the microwave bands in his part of the world and (most important) continues to write up his experiences for the benefit of others. His articles in *Electronics Australia* for May-August 1972 and for July 1976 contain a mass of information on what goes wrong and how to put it right and are well worth reading. He now has crystal-controlled equipment for 3·4GHz which employs a X6 or X8 multiplier from the RCA RM47 modules which are used to generate about 10W of drive at 400 to 600MHz. He is anxious to test this new equipment over the 240km path he covered some time ago on 2·3GHz and which will probably set a new VK record.

A letter from Rolf Backstrom, OH2BEW, notes that "we have now started our 10GHz campaign here in Finland with good results." We await details with great interest. Rolf has now been made the microwave manager of SRAL.

Interest in 10GHz in this country still remains at a very high level, of course. G3MWV and G3NMY are now active on 10·1GHz from Cromer (AM07J), North Norfolk, using Gunn oscillator transceivers based on the GM3OXX approach. Both stations naturally are well sited for working paths over the North Sea. Schedules can be arranged any evening at 1900 or 2100 on 144·17MHz ssb. G3PFR's appeal in the November *Microwaves* to others in the Liverpool/Manchester area who were also interested in 10GHz produced the following callsigns: G4DRX near Stockport (also active on 3·4 and 5·6GHz), G4DDK, G8HGF and G8KNX at Stone in North Staffordshire, and G4FDL and others in the Warrington area. G3PFR and G4DDK have a schedule each Thursday at 2200 on 144·19MHz ssb which others are welcome to join. As has been mentioned before, the frequency of 144·33MHz has been suggested as a preferred frequency for microwave talk-back and nets and is already being used for these purposes.

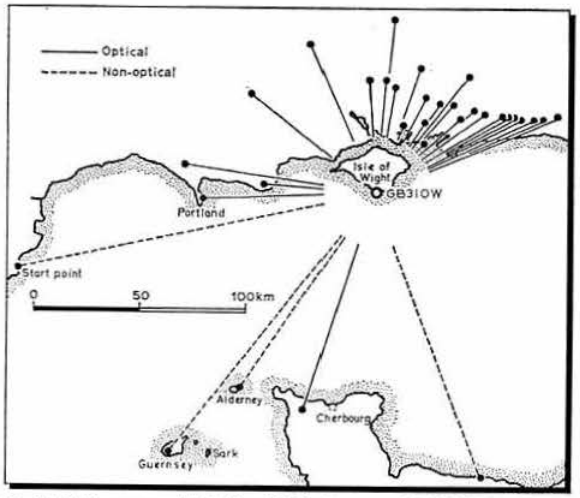


Fig 1. Paths over which the 10GHz beacon GB3IOW has been heard

Beacon news

The new 1,296MHz beacon GB3AND is now operational. It is sited 93m asl, 17m agl, at Andover, 50km north of Southampton, at ZL63B NGR SU379466. The beacon is entirely solid-state and generates 5W erp when used with its omnidirectional 4-stack slot array which has a gain of 6dB. Its frequency is 1,296·87MHz and it is keyed at 15s intervals. Reception reports would be welcome and should be sent to G3PYB or G8ADM, QTHR. A proposal for a 1,296MHz beacon on Emley Moor has been received and is being processed. G3TQA is the contact.

Fig 1 indicates the coverage of GB3IOW as compiled by G3JHM. Much of the north coast of France may be within its range under enhanced propagation conditions.

GB3LBH, the 10GHz beacon sited at Romford, has been operating at a higher power since 19 December: it now uses a 200mW Gunn oscillator on 10,100MHz. The 10dB extra power has already had one significant effect: G4ALN can now hear it at all times over the 3km path to his home—a path obstructed by trees, a railway bridge and a row of houses—with his receiver sitting on the table in his shack with its 25dB horn antenna pointed at the window. The beacon has already been heard at many sites at up to 25km distance from Romford and most recently has been heard on the North Downs by G3JHM as a very strong signal at Tatsfield and as a weak signal at Chelsfield (3km SE Orpington) at distances of 32 and 23km respectively.

There is a possibility that this beacon will be monitored continuously for three months by students at Imperial College as part of their final year project. This 25km path from Romford to the centre of London should be particularly interesting because it is only just optical and therefore rather sensitive to variations in propagation conditions.

Continued on p135

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

4-2-70

Graham Knight, GM8FFX*

Below 145MHz

Martin Dann really started something when he wrote in the December *4-2-70* about the need to get channelized below 145MHz. More than 20 letters have been received on the subject. Only one writer agreed, he said "It is very difficult to get a QSO on any of the four simplex channels, they are always busy". He would do well to follow the advice of an old timer on vhf, who prefers to remain anonymous, who writes "Channels are the worst thing that has ever happened to the 144MHz band. I have a simple five-valve transmitter, incorporating a vxo circuit, which allows me to use just four crystals to cover the whole band. I hear channelized operators with modern commercial equipment complaining that all their channels are in use. Someone should tell them they are only listening on half-a-dozen spot frequencies and there is the whole of the rest of the 2MHz available. To become channelized is a backward step."

The most important letter came from the VHF Committee which has recommended that the frequencies between 144·500 and 144·900MHz be used by fixed stations for fm and a.m. on a non-channelized basis. They stress that care must be taken to avoid fixed known frequencies already used for other purposes.

Rally talk-in frequencies

Nothing can be more infuriating to the vhf operator than to hear endless contacts being made by the talk-in stations at rallies *on the calling frequencies*. The VHF Committee is to be thanked and congratulated for making a recommendation which deals with this problem: the fm working frequency for all rallies should be 145·550MHz, and the ssb working frequency for all rallies should be 144·280MHz.

The calling frequencies should be treated by all vhf operators as "holy ground" and only used for calling CQ. Once a contact has been established the stations should QSY leaving the calling frequency clear for other operators.

Beacons

The Emley Moor beacon on 432·910MHz continues to be a reliable pointer to 432MHz band conditions. The reed relay which is responsible for the keying was recently replaced after more than one billion operations. The keying was also speeded up, so probably the new one may last less than a year. GB3EM has now been heard from the north of Scotland to Germany, Holland, Belgium and France.

DL0PR, the German beacon, is still the most consistent signal from the Continent. It was heard on several days over the Christmas period. The frequency is 144·910MHz and the transmitter runs 150W, the QRA is EO54C.

9H3ML is the callsign of a beacon proposed for Malta, and a frequency of 144·120MHz has been suggested. The beacon would run 50W of erp and would be a most useful guide to sporadic-E propagation.

GB3NEE, the Durham beacon, enjoyed a brief period of operation on 144·935MHz running just 3W output. Even with the low power it was heard in France and Sweden. Unfortunately since both the beacon and the Tyne and Wear repeater share the same IBA mast at Burnhope, problems of interaction have occurred necessitating the temporary closure of GB3NEE. The VHF Committee has recommended the new frequency of 144·130MHz for the beacon. The keying fault mentioned last month has been cured and higher power operation on the new frequency will recommence soon.

DX news

Further details are now available about the 432MHz opening reported in last month's *4-2-70*. New RSGB member SM6HYG was beaming east when he heard G8AGU/P calling CQ. When Carl was beaming in the correct direction signals were S9 plus both ways. A tape from G8IXN confirms SM6HYG had an outstanding signal in Cornwall over a path distance of 1,391km. Carl worked a further 10 English stations on 432MHz in QRA squares ZN, ZL, YN, YK and XK.

GM5MCJ works on the Brent oil platform which is located in QRA square AT midway between the Shetland Islands and Stavanger. As Lutz is to be there for two more years he has applied to the Home Office for permission to operate on 144MHz. He is not sure if he will be classified as an island off Scotland or whether he will be designated as "mobile marine".

Lutz reports seeing many spectacular auroral displays last winter and describes them as being nearly overhead. As he will have his antenna 100m above the sea, and bearing in mind the sea path all the way down the east coast of Britain, results should be interesting to say the least. He promises to QSL all the QRA square hunters.

The high pressure systems which were around over the Christmas holiday period enabled many operators to work over distances not normally possible in late December.

Meteor scatter

G4DSC, G3SEK, G3POI and G3CCH have all been active on meteor scatter frequencies, the best dx reported being northern Sweden. G3WZT, whose ms contact with Corsica is recorded above, held several skeds with EA4EO last year. The seven contacts which were successfully completed with Madrid are a considerable achievement. John finds it interesting that many of the complete contacts were made during small showers. During the Delta Aquarids some bursts lasted up to 26s. He recommends other ms operators to try the smaller showers as they often give surprisingly good results.

"Firsts" and "longests"

G3WZT worked FC6ABP in QRA locator EC25E on 8 June 1975. This is believed to be the first QSO between England and Corsica. John is located in Horsham, Sussex, and he recently received the QSL card confirming this meteor scatter cw contact.

Wideband interference

Many stations report hearing wideband interference on the 144MHz band. It usually lasts about 10min S8 in strength and extending from 144 to above 145MHz. It is a pulsed-type transmission and has changed in beam heading from SW to NE during one period of interference.

* PO Box 49, Aberdeen AB9 8JA.

This suggests it may be radiated from a satellite but the times do not relate in any way to Oscar passes.

G8HUY has volunteered to gather information about this problem so that the matter can be studied further. If you hear this interference send details of the time, beam headings and bandwidth to John Hill, G8HUY, 172 Clotherholme Park, Ripon, North Yorkshire.

DX expeditions

G3SCP/LX will be on the air again this year, operating from the highest point in Luxembourg 3,500ft above sea level. From a lower site last year Greg worked everywhere except G. Stations in Switzerland, Denmark, Germany and even as far as the coast of Holland all gave good reports but no G stations or beacons were heard. Greg is taking a bigger beam and 50W of power this year, certainly many British operators will be looking for their first contact with LX.

Another much-travelled amateur is Keith, G8FUF, whose home base is at Southend. His plans for this year are still on the secret list but he promises it will be far away. More details soon.

After the success of their trip to Northern Ireland the enthusiastic lads from the Glenrothes group are seriously thinking about OY—the Faroe Islands.

CW calling frequency

A gremlin crept into the December column and wrongly assigned the 144MHz cw calling frequency to 144·500MHz. This most important frequency is of course 144·050MHz. This is one of the most active sections of the band with many cw contacts taking place around this frequency. G6OX, G3JEQ and G3DAO are prominent among those who have been monitored working dx unavailable to those of us on telephony.

Dreams do come true

Many of us have looked at antenna catalogues and wished we could have four 14-element Parabeams instead of our more modest 144MHz antennas. For G4DZU in Leeds this dream has come true. Douglas now has four of these extremely large beams at the top of a 60ft Versatower in a box formation with the antennas spaced 16ft from each other. The gain of this antenna is in excess of 20dB.

Another antenna specialist is Vicky, G8HCL, who has four 14-element long Yagis on top of a 60ft tower. This station is often an outstanding signal in contests and is located at the top of a small hill near Weybridge.

Before you rush out to buy four beams bear in mind the fact that G4DZU's antenna has a wind loading of over 400lb in a 100mph gale. Putting up a large array is not a simple matter, it requires a great deal of forethought and planning and is a considerable feat of both mechanical and electrical engineering.

As both G4DZU and G8HCL are well sited and running high power one wonders how loud they are with each other despite the distance separating these huge beams.

Repeaters

The recently-formed Tyne and Wear Repeater Group certainly kept the promise made in their informative newsletter to put GB3TW on the air. Operation started at the stroke of the appointed hour. Although using temporary antennas, coverage is very good and stations well to the south are able to access the repeater without difficulty. As GB3TW is a steady S5 signal at the GM8FFX location 300km away, some time has been spent listening to the various operators using the repeater. So far it is being used in a proper and sensible manner, many of the users are mobile and several fixed stations have been heard establishing a QSO and then moving to a simplex frequency. Let us hope it continues to be free from the problems which beset some of the other repeaters further south.

The Birmingham uhf repeater is now fully operational on an input frequency of 434·950MHz. It is proving to have very good coverage and is compatible with its vhf counterpart GB3BM.

Judging by the number of tone-bursts heard on 145·150 MHz, many exiled Scots coming home for Christmas and the New Year expected to be able to access GB3CS as soon as they crossed the border into Scotland. At the time of writing, this repeater, despite various promises, is not yet on the air. A special meeting of the Central Scotland FM Group is soon to be held in an attempt to breathe new life into this three-year-old project.

REAL DX 1977

70MHz	G3TSA-GM3ZBE	380km
144MHz	G3POI-I1BEP	913km
432MHz	G8CQS-G8GXP	330km

Above is the first table recording dx worked this year. As this was compiled on 10 January, it will be realized that the contacts were made in the first few days of the year. Anyone having worked further on any of the four bands should send details for inclusion in future tables.

American repeater viewpoint

There are now quite a large number of American operators at RAF Edzell, in the Tayside Region. One, GM5BQA, misses the phone patch facilities he had in the USA and the ability to use touch tone pads to operate several repeaters. He must be one of the few people in Britain who has built his own 144MHz repeater. It was a very sophisticated device using two 432MHz links from a 4,000ft mountain top, back to Jim's home in a Californian valley.

Contests

Jan, LA8AK, sends details of the 1977 Scandinavian Contests. Many British stations took part in last year's events, and as there are to be 12 activity periods for the 144 and 432MHz bands, conditions must be favourable on some of the dates.

The 144MHz section is held on the first Tuesday of each month from 1800 till 2300gmt. Most of the activity is on ssb with some cw around 144·050MHz. The 432MHz section is held at the same times but on the first Thursday of each month.

There are already hundreds of Scandinavian operators on 144MHz, and the number on 432MHz is growing rapidly thanks to the export of a large number of British transverters.

Remember our own RSGB contest, the 144MHz open, is to be held on the weekend of 5-6 March.

Auroral research

No reports of auroral contacts have been received since the end of November but two visual displays were seen in the month of December. Many amateurs are expressing a great interest in the recent launching of two Skylark 12 rockets which may soon reveal some of the mysteries of the aurora borealis. The two research rockets were carrying experiments for four groups—the Southampton and Sussex Universities, The Appleton Laboratory at Slough, and the Mullard Space Science Laboratory.

Until the development of the Skylark 12, studies of the aurora had been confined to smaller rockets reaching a maximum altitude of 150 miles. The second of these new three-stage rockets was launched in December from a site in Arctic Norway. It reached a height of 450 miles, actually passing through an auroral arc for the first time. Dr Bryant, the scientist in charge of the study, said: "The arcs can be as much as 1,000km long and are 100km high. The new rocket is giving us information we never had before and more data has still to be processed."

As amateurs, we too can participate in research by reporting our auroral contacts to the Propagation Studies Committee. Report forms are available from G2FKZ who, along with Ron Ham, prepares the warnings of solar disturbances which are often given on GB2RS news bulletins.

The grape vine

G3ZNZ, the first winner of the UKW Award, is often heard working DL stations in fluent German . . . . . G5YV is back on the ms trail . . . . . Brian Russell, RS33915, from Runcorn in Cheshire, says he is going to be a regular contributor to this column—a northern threat to Harold Meezra in Kent . . . . . Funny to hear Oscar putting out its own "happy birthday" message saying it would have many happy returns if everyone used low power . . . . . PA0VV recently worked crossband from 1,296MHz to a station replying to him on top band. Can anyone claim a bigger frequency difference? . . . . . SM6HYG now active on 144MHz rtty . . . . . Whose repeater equipment described as inferior?—clue—not yet on the air . . . . . Pat, G3TEY, says she can hear all the British repeaters from her site at the top of Mow Cop but has never used one yet . . . . . Another yl operator, Glenys, G8KWD, has been working much dx from Swindon . . . . . G6JP caught in the middle of a QSO between F1CCP and GM8FFX but could not get a word in edgeways . . . . . An excellent article on the RSGB Awards by G3LXP in the Verulam Club newsletter.

Your callsign's reputation

An operator's reputation is established by what is emitted under his callsign. Others listening to him (or her) rapidly assess whether the person is worth communicating with or is better left alone. G5UM, secretary to the VHF Committee, writes:

"Recognizing that there has been some deterioration in the vhf/uhf operating standards, the VHF Committee at its last meeting of 1976 thought it would be useful to republish here the "VHF/UHF operators' code". General observance of it would check any further such deterioration. Emphasizing that the fall-off in standards is only slight, it is simply that the idiot fringe are all too obvious in a predominantly common-sensical vhf/uhf scene. It had been observed in the past that when the operator's code was published an immediate improvement in operating standards resulted, and it is hoped it will once more have the same effect."

The vhf/uhf operator's code

When operating his (or her) station the vhf/uhf operator

1. Before transmitting, senses the band for conditions, level of activity and occupancy of the intended channel;

2. When sending CQ announces location (newcomers may not be in the *Callbook*, older hands will not be egotistical enough to assume everyone knows their locations), and goes on to state beam heading when a directional aerial is in use;

3. When engaging in a QSO will give the other person's callsign first, then one's own: in net operation will call stations in "Callbook order", ie, alpha-numerically;

4. Uses the transmission mode appropriate to the frequency in use; never uses repeaters if simplex is possible;

5. Never uses phone in cw areas but resorts to cw if communication is difficult, and the licence permits;

6. Maintains a good-mannered microphone technique by avoiding irrelevant back-chat, by refusing to allow "funny men" near the transmitter (especially during contests), and by abjuring all facetious callsign phonetics, having noted the recommendations written into the licence;

7. Avoids the pitfalls of duplex operating by announcing both the "home" and "away" callsigns frequently and the bands in use, not allowing the intimacy of the mode to tempt transgression of **6** above;

8. Is at all times considerate of others, especially of the operator in the next street or town, by avoiding modulation overspill or keyclicks;

9. At the end of a QSO pronounces the callsign distinctly, and the location, for the benefit of any distant listeners; and . . .

10. Makes a final check in case others may be calling; if they are, and time is short, suggests times for future meetings.

Late news

The aurora which took place between 1600 and 1900gmt on Sunday 9 January enabled G3DAH to work several stations in Sweden on 144MHz. Roger, G3CHN, wasted no time in working the new GU and GJ Channel Islands prefixes. In fact he had worked his first five countries in 1977 by 0006gmt on 1 January. Thirty-eight repeater proposals submitted under phase 2. Clive, G3POI, used single sideband to work via meteor scatter the Italian station recorded in the dx column above.

Finally, thanks to all correspondents this month. Please send news and views as soon as possible for next month. □

Microwaves

(Continued from p132)

A number of other 10GHz beacons are in the pipeline. GB3CMS, to be located near Aberdeen, has now reached the stage of a firm proposal. A beacon to be sited in Alderney is progressing slowly but steadily. A function of both these beacons is to help with exploring propagation by superrefraction over sea paths. A beacon to be sited in the Guildford area to complement GB3LBH by covering west London, and one in the Dunstable area are still in the speculative stage. Abroad, the possibility of establishing beacons at Den Helder and also at Noordwijk on the coast of Holland is being explored, as is one at Lannion on the north coast of Brittany. □

the month on the air

John Allaway, G3FKM*

The severe interference emanating from the Soviet Union continues to cause problems to many services from time to time. It is reported that some European administrations have received the following message from Moscow: "Radio installations operated in hf bands are being experimented in Soviet Union and these experiments could possibly cause interference of short duration to your radio facilities. We are now taking actions in order to decrease eventual interference. Your reports will be attentively studied by Ministry of Posts and Telecommunications of the USSR. Regards. Minsviaz."

On a number of occasions items of news from *Radio Communication* have appeared in the Soviet publication *Radio*. They have included extracts of information on RSGB affairs which have been distorted to place an unfavourable light on western society and it is hoped that criticism by that same society of the present illegal activity by the Soviet Union on international frequency allocations will also receive due publicity in the same place.

News from overseas

G3FET (ex 5B4LR) is now on Masirah Is, Oman, but has no A4 licence at the time of writing. Although he left Cyprus in August 1974 he has received numerous QSL requests for QSOs after this date, and such contacts were obviously made with a pirate.

At the ninth annual convention of the Radio Society of Ontario Inc in Toronto last October, the directors elected Tom Atkins, VE3CDM, as president. Tom joined the RSGB in 1943 and currently holds the call G4ABN although he passed the RAE back in 1950. He is active on all bands 3·5 to 430MHz and is currently specially interested in fast-scan tv.

Hedley Russell, 7Q7HR, returned to the UK at the end of January after three years in Malawi. He says that all activity in that country ceased in February 1976. Hedley's UK callsign is G4EDZ.

DX news

VK0AC has been reported on the air from Macquarrie Is. He is VK2ZQK who is on the island for two years, and it is believed that no QSLing will be undertaken until he returns to Australia. VK9CCT was active from Cocos Keeling Is early in December and may return. This was VK5CCT and he was heard around 14,165, 14,195, and 14,210kHz between 0800 and 1300.

3Y3CC was due to appear on the bands around 15 January and to be active for six weeks or so. He will be located in Queen Maud Land, Antarctica. FR7AI/E has been on Europa Is (which counts as Juan de Nova for DXCC purposes) and may still be there. His equipment consists of a TS-510 and dipole aerials.

Peter Reed, G4BVH, is at present active from Masirah Is, Oman, using the callsign A4XVK

PY0ZAE should leave Trindade Is at the end of this month. At the time of writing his operating hours were restricted to the periods 0930-1120, 1500-1700 and 1900-0050 because of limited power supplies, but he hoped to receive batteries which would enable him to be much more active and also to work on 7 and 3·5MHz.

Portuguese Timor, CR8, has now been deleted from the ARRL DXCC listing. All contacts since 15 September 1976 with this area will count as with Indonesia following the invasion of the territory by the latter.

CE0AE hopes to have a new beam soon and to make Easter Island contacts a little easier, and he also hopes to be active on 1·8MHz. To date he has contacted 186 countries. His direct QTH is Father David Reddy OFM, Parroquia, Isla de Pascua, Chile, but QSLs should be sent via WA3HUP.

The 9D prefix which has been heard recently emanating from Iran has been issued to celebrate the 50th year of the Pahlevi Dynasty. 9D5A (and also EP2SV) QSLs should be sent to WA6AHF and those for 9D5B to K4OD.

Some HZ1AB activity has been noted recently. The operator's name was Terry and he seemed to be on the air on Thursdays and Fridays around 1300 on 14,210kHz.

The Seychelles Is are now independent and have the new prefix S7. The territory includes Aldabra, Farquhar and Desroches Is and it is expected that the last two mentioned will be deleted from DXCC listings in the near future. According to the *West Coast DX Bulletin* there is a good chance that DXCC credit will be given for D6A contacts and that the old country of the Comoro Is will be deleted and replaced by D6—Comoro Is, and FH8—Mayotte. The same source reports that ST0 is still under consideration but that no early decision is expected.

The writer is interested to note that the block prefix allocation S8A-S8Z has now been given to Transkei. This in spite of the hypocritical attitude of many UN members to

* 10 Knightlow Road, Birmingham B17 8QB.

QTH Corner

CT4AT	via W1YRC, R. Beaudet, 30 Rocky Crest Rd, Cumberland, RI, 02864, USA.
FR7AI/E	Y. Hoarau, 4e Km, St Francois, Reunion.
KC4AAC	via K7ODK, 4286 W Maplewood Av, Bellingham, Wash, 98225, USA.
VP2EEQ	YASME, PO Box 2025, Castro Valley, Calif, 94546, USA.
VP2LDU	via JA1KSO, PO Box 7, Aobadi, Yokohama 227, Japan.
VP2VDJ	YASME (see VP2EEQ).
YB3AB	(CQ Contest QSOs) PA0LOU, Laarpark 34, Zundert, Netherlands.
ZD8AA	via WA4TLB, 107 Leonard St, Dumfries, Va, 22026, USA.
ZD8AB	via ZD8AR, PO Box 4308, Patrick AFB, Fla, 32925, USA.
3A0FY	via F9UW, C. Bazillou, Les Orangers, 208 Av L-Pasteur, 06190 Roquebrune, Cap-Martin, France.
5W1AB	via W4KA, L. Haljsman, 1044 SE 43rd St, Cape Coral, Fla, 33904, USA.
7P8BC	via WA9SMM, R. E. Davis, 942 E Clark St, Warsaw, Ind. 46580, USA.
9D5B	via K4OD, Box 135, Front Royal, Va, 22630, USA.
9G1JJ	PO Box 5247, Accra, Ghana.
9L2NL	via IT9AF, O. Arena, V Garibaldi 516, 95045 Misterbianco, Sicily, Italy.
9Y4A	via W2AYJ, 33 Pearsall St, Babylon, NY, 11702, USA.

RSGB QSL Bureau, G2MI, Bromley, Kent BR2 7NH

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the formation of the republic and the fact that the ITU is an agency of that organization.

G3UTO left for the Cayman Is on 24 January taking an FT101E with him. He should be on the air by now using the callsign ZF1PS on 14,150kHz or nearby, and his stay will last 18 months.

ZK1BA expects to spend some time on Manihiki Is during April. QSLs for his previous visit have now been sent out. It seems that logs for the period 4 to 22 September 1976 belonging to VR3AH may have been lost en route to K2BT. ZL1AFH may visit Norfolk Is soon for an extended stay. FO8DM is located on Toubouai Is—this is part of French Polynesia for DXCC purposes but separate for the DUF award.

Welcome

The following overseas amateurs became members of RSGB during December: DA2BB, EI7CX, K2JV, LA3PU, ON5NR, ON5YB, ON6JG, OZ1DDJ, SM0GYQ, VE2IB, VE3AS, VE3DGS and ZS6ALS.

QSL via . . .

The following list of QSL managers, which may be helpful to readers, has been supplied by A8312:

AI4ARU-W4WYR	ST2SA-DJ9ZB	VQ9HCS-WA1HHA
CX3BR-W3HNK	TR8BJ-DJ5DA	VP8HZ-GM3ITN
FG0BKZ-F6BBJ	VP1MPW-W5QSX	VR3AK-KH6AHZ
FG0CXV/FS7-W4PRO	VP2G-W5MYA	VS5DB-JA2KLT
FP8DX-K9OTB	VP2KF-VE2DCY	VU2LQA-DK6TU
FP8HL-K9OTB	VP2MB-WA8TDY	WA6EGL/VQ9-W4FLA
HB0BHA-DL0KL	VP2EEG-W3HNK	WB6EWH/VQ9-K4OSE
HB0XAA-DA2BA	VP2KAA-W3HNK	YB7AAQ-W1YRL
JW5NM-LA5NM	VP2GMB-W5MYA	YS1MAE-W2KF
KC4AAC-K7ODK	VP2LCG-K0KJS	ZB2CJ-G3ATN
KP4EAJ-WA4KJR	VP2MOC-K2JOC	ZF1AL-WA4SVH
PY0PO-PY7PO	VP5A-K4UTE	8R1CB-W2MIG
SV0WZ-OE3NH	VP5IZ-WA4SGF	9V1SQ-VE1FFA
		9X5PT-VE3BOZ

Awards

Information has recently been received from the Radio Amateur Association of Greece concerning the awards it issues. They include the following:

The World Award. Requires contacts with 100 different countries (including Greece).

The Europe Award. For contacts with 20 different European countries (including Greece).

Paul, formerly WB2OZW, is now K2OZ. He is an RSGB member and enjoys contacts with British amateurs

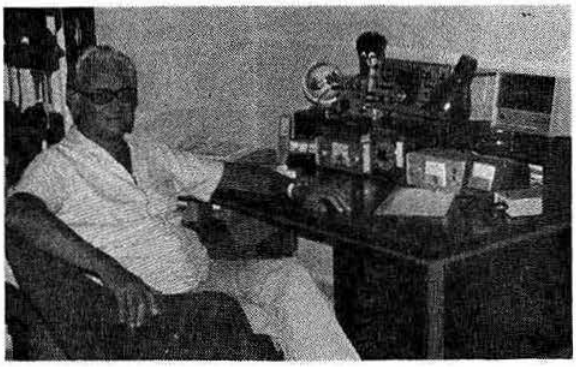
Athens Parthenon Award. The SV APA award requires contacts made with 10 SV stations.

Balkans Countries Award. Requires 20 contacts with stations in the Balkans (SV, YO, YU, LA, ZA and European TA).

In each case contacts must have been made after 1 January 1973, and may have been on cw or ssb. For the SV APA and BCA contact with SV1SB counts as two. QSLs need not be sent, but a copy of the log (certified by two other amateurs or a club official) and 12 IRCs or $2 must be sent to award manager SV1IG, Anastasios Panos, c/o RAAG, PO Box 564, Athens, Greece.

The White Rose Award

To obtain this award 50 points are needed (non-European applicants need 30). They may be scored as follows: 10 points for working the club station of the WRRS—G3XEP or G8LVQ. Five points for working a member of the society and three for any other Yorkshire contacts. Send verified log extracts or certified list signed by a recognized amateur radio association plus 10 IRCs, $2, or £1 to the White Rose RS, 83 Town St, Armley, Leeds 12. The certificate is attractively printed in three colours on a golden background. A society net will be held at 1700 each Monday near 3,710kHz to help stations working for the award.



Leonard Snowden, 9H1CH, first licensed 50 years ago as 6XP and later G6XP. In 1948 he was issued with the callsign G2BW (believed to have belonged to the Marconi Company before the war)

Contests

The Common Market DX Contest

0600 to 2400 2 April (cw).
0600 to 2400 3 April (phone).

Organized by UBA. The object is to increase the activity of EEC amateurs and to work as many stations outside it as possible on 3·5 to 28MHz. Categories consist of single-operator: (1) all bands; (2) low bands, 3·5 and 7MHz, and (3) high bands, 14, 21 and 28MHz. There is also a multi-operator single-transmitter class. Exchanges consist of RS/T plus serial number (from 001). Points for EEC stations are one for contacts with others in the EEC, two for other non-EEC European stations, five for non-EEC stations elsewhere. No points for working own country but this is permitted for a multiplier. Multipliers consist of one on each band for each DXCC country contacted. (Non-EEC participants score five points for EEC QSOs and two for other European contacts and their multipliers are the nine EEC countries). Separate logs should be completed for each band and give date, time, numbers exchanged, points and multipliers. A summary sheet with signed declaration that the station was operated in accordance with amateur spirit, radio regulations, and the contest rules must be enclosed. Entries must be mailed before 30 April to: Contest Committee, Michel Le Bon, ON4GO, Chee de Wavre 1349, B-1160 Brussels, Belgium. Note that listeners may enter and score five points for each complete QSO between EEC and non-EEC stations recorded.

The SP DX Contest

1500 2 April to 2400 3 April (cw).
1500 16 April to 2400 17 April (phone).

3·5 to 28MHz. Contact Polish stations and exchange RS/T plus serial number (from 001)—SP stations will give RS/T plus a two-letter code which indicates the "county" in which they are located. Each contact counts five points and the multiplier is the number of counties worked—note that they count once only irrespective of the number of bands on which they are worked. There are single-operator single- and multi-band, multi-operator multi-band (one transmitter), and listener classes. Listeners should log the callsign of the SP station, the callsign of the station being worked, and the code sent by the SP. Each SP may only be logged once per band and counts three points. Logs must indicate

Winners of the 1976 Bermuda contest: (l) G4GI and (r) G3FXB. This year's event takes place on the week-end of 16-17 April and will be a mixed phone/cw contest

Members of High Wycombe Scouts taking part in the 1976 Jamboree on the Air

date, time, exchanges, multipliers and points, and should be accompanied by a summary sheet giving scoring, operating class, name and address, and the usual signed declaration. A multiplier check list should be enclosed, and entries must be postmarked no later than 30 April and sent to: PZK, SP Contest Committee, PO Box 320, 00-950 Warszawa, Poland. Note that each of the PZK awards may be claimed on the basis of contest contacts if the requirements were met—special application should be sent with the logs.

Results of the **1976 World Wide WPX** contest have been received from W1WY. British scores are as follows:

Single-operator

		points			points
G3XHK	All band	131,906	**G3XYP**	14MHz	405,805
GM3MZV	,, ,,	77,112	**G3TOE**	,,	385,472
GM3CFS	,, ,,	76,347	G4DKT	,,	127,161
G4BBA	,, ,,	64,224	G4DMN	,,	114,072
G3YBH	,, ,,	55,421	G3TXF	,,	92,752
G2AJB	,, ,,	47,864	**GC3YIZ**	,,	71,142
G3ZLQ	,, ,,	35,456	G4CVZ	,,	74,983
G4DBW	,, ,,	12,160	**GW3SLA**	,,	28,441
G4ETK	,, ,,	11,466	**G3TJW**	3·5MHz	184,300

In the multi-operator single-transmitter section scores were: **G4DAA** (850,580), G3RUV (725,340), G3RCV (704,220), G8JC (648,507), G6CW (298,592), G2FNK (242,608), and **GD4CCL/P** (191,672). G4DAA was world fifth. Certificate winners are printed in bold type.

Band reports

The 3·5 and 7MHz bands have been quite good for dx working during the month but manners at the hf end of the former band have often left a great deal to be desired. On 14MHz, openings to VK and ZL have been good at times, and there have been spasmodic openings on 21MHz to VK, ZS and S America. G4CWE reports an opening on 28MHz on 29 December between 1130 and 1600 when 5B4CY, RD6DIF, SV1KB, 9H4H and other Europeans were heard. This was followed by an opening into LA and SM between 1900 and 2030. More Europeans were heard on 3 January.

Many thanks to the following for supplying information used in this section: G2HKU, G4RZ, G5JL, G6GH; G3s

AAE, KSH, NKQ, UOL, G4CWE, GI4DAV, G4EAN; BRSs 17567, 25429, 35608, and As 8312, 8713, 8961, and S. Sharred.

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

1·8MHz. 0000 *W1, W2, W3.* 0100 *W4s BRB, HBK.* 0200 *W9DC.* 0300 *KP4EAT.* 0400 K2ANR, *W1-W3, WB9UES, VE1BCZ,* VE3BBN. 0500 *K1YHK,* K8RHH, *VE3BWY.* 0600 *N0DX.* 0700 EA8CR, *PY1RO, K3NPV, W3PA, W9MAL, W0PVB, W0RW,* ZD8DO. 0800 K1PBW, K6SE. 2000 *UA1TXX.* 2300 *KV4FZ, VO1KE, WA8ZDF.*

3·5MHz. 0000 FM7AV, *JT0ICB, UK9s,* VP2DQ, W7KW, *ZD8DM,* ZS6DN, 9G1JX. 0200 K6MYC, W6EE, 9Y4SF. 0300 VP2LL, ZS6s DW, HI, *9K2DR.* 0400 JY3ZH. 0600 FO8EX, HC8GI, K7OXB, W7DV. 0700 *HC2SL,* K6UA, VP2VBG, VR1AA, VR3AR (QSL to WA7GQA). 0800 JA1KXY, K6QM, WA6TVC, OA4RB/W7, UA0LH, *VP1MWP, ZF1RD, ZL3GQ.* 1700 VE2ZN/SU, *UM8MAO.* 1800 JA6BSM, YK1AA. 1900 KA6YL, TA2AR. 2000 CR9AJ, KG6JIH (QSL to K6TBQ), *OD5LY, TZ2AB,* 9X5SP. 2100 *EP2EA,* JAs, ZD7SD. 2200 EA9EW, JA4KGR, JA6BSM, VS6DO, 9J2PS. 2300 A6XP, A9XBD, AP2KS, *CX9BT,* D4CBS, *FG7AM, UH8HBI, 9K2EP,* 9M2s DQ, MK, PV.

7MHz. 0000 *FM7AV, PY0ZAE,* VP2KF. 0200 *PY0FOC, VP2s EEQ, LDT, VU2s IOC, JN, RQ, 9J2WR.* 0700 *JA1MYO,* 6W8AAD. 0800 *JA7AMK, W7YTT, ZL3SQ.* 1400 AP2P. 2100 CX, KP4, OY6FRA, PY. 2200 JA2BAY, *ZS6QU/3.* 2300 AP2KS, LU, PY.

14MHz. 0000 VP8s NX, PB. 0800 JAs, KC6CF, KG6, UA0, VKs, VK0AC, ZL, 9G1JJ. 0900 CR9AJ, *JT1KAA,* XT2AE, 5N2ESH. 1000 CE8FB, HZ1TA, KL7, *UK0YAA* (Zone 23), VK4IV, VP8HZ. 1100 P29PN. 1200 *AP5HQ, VQ9FC,* ZL2ABZ. 1400 YB0ABO, S79P. 1500 FB8s XO, ZI, FO8DO, TD76GI, VK0TB (QSL to VK3ADD). 1600 FR7ZW, *FY7AN,* VE5/VE6, W6/W7. 1700 *FB8WW, FR7AI/E,* ZD8, 9M2. 1900 PY0ZAE, VP5IZ. 2200 KH6OR, *XE.* 2300 KC4AAC.

21MHz. 1000 *G3ZRS/MM* (off Mozambique), ST2RK, *VK8OB, ZC4IO,* 4S7KM. 1100 FR7BE, VQ9DF, XT2AE. 1200 FL8WR, *PY1RO/0,* ZE, ZP, ZS, 5Z4. 1300 HC2YL, *SM6DJI/MM* (Red Sea), *9L1CD.* 1400 9G1JX. 1500 *W4, ZS5OV.* 1600 VP2s EEE, EEQ, W2, 3, 8. 1700 *9Y4XX.*

Acknowledgements to the authors of the following for items obtained from their publications: the *West Coast DX Bulletin* (**WA6AUD**), *DX'press* (**PA0TO**), *CQ Magazine* (**W1WY**), the *Ex-G Radio Club Bulletin* (**W3HQO**), the *29 DX Club Bulletin* (**VK6RV**), and *Long Skip* (**VE1AL/3**).

Please send all items for the **March** issue **to reach G3FKM** no later than **5 February,** and for **April** by **12 March.**

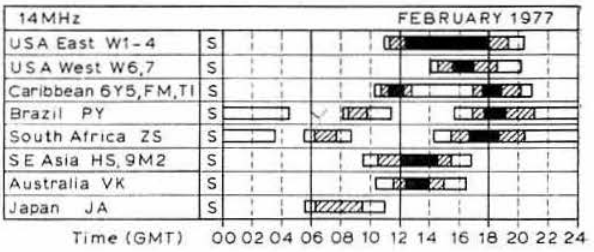
Propagation predictions

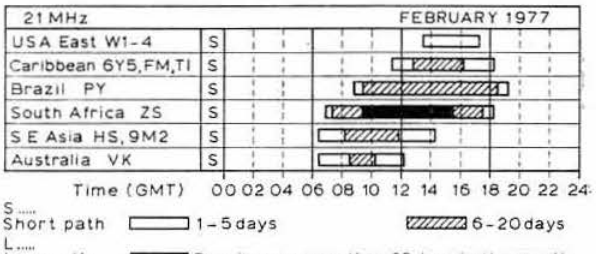
During February the winter conditions come slowly to an end, days lengthen and towards the end of the month **14** and **21MHz** will remain open longer than in previous months. There is still very little sunspot activity and **28MHz** will be of little use for dx; only in very exceptional circumstances will traffic with Africa be possible on this band between 1000 and 1530gmt, and traffic with South America between 1300 and 1600gmt will be even more remote. This low solar activity will also still be noticed on **21MHz;** only traffic with Africa will be certain on this band. Eastern North America will be heard now and again on days with above average MUFS. Probably no traffic will be possible with western North America, Hawaii, Alaska and Japan.

Conditions on **14MHz** will greatly improve towards the end of the month, as days will be longer and the band will remain open for a few hours after sunset. Only from about May will this band remain open all night for dx. Chances for dx via the indirect path will decrease from now on. Contact with Hawaii and Alaska will only be possible on favourable days on 14MHz between 1700 and 1830gmt via the direct path.

During the present conditions there will be little interference from static on **7** and **3·5MHz** so these bands will often be open for dx. QRM permitting, traffic with North America will be possible on 7MHz from about 2100gmt. During the latter half of the night traffic on this band will be interrupted, as will 3·5MHz from time to time. Local traffic will be affected by the dead zone and will be almost impossible during the latter half of the night.

The provisional sunspot number for December 1976 from the Swiss Federal Observatory was 15·0, with solar activity distributed through the last three weeks of the month. The predicted smoothed numbers for April, May and June are 8, 9 and 9 respectively.





It is reported from USA sources that cycle 20 reached its minimum in July 1976 contrary to other forecasts that predicted mid-1977. The peak period for cycle 21 is now predicted as 1981.

HF PROPAGATION STUDY

Predicted HPFs (MHz × 10) for February 1977

GMT =	00	02	04	06	08	10	12	14	16	18	20	22	24
Aden	141	122	117	173	275	300	285	268	260	185	150	141	141
Ascension	150	153	143	114	216	295	295	293	289	279	190	161	150
Bahrain	131	121	112	174	268	295	275	260	219	167	139	135	131
Bangkok	112	97	88	169	244	260	256	190	163	134	111	115	112
Barbados	135	128	122	115	115	158	258	263	268	257	190	144	135
Bermuda	110	107	106	93	87	122	232	246	244	230	178	135	110
Bogota	128	121	119	106	106	133	251	258	257	242	190	143	128
Buenos Aires	145	144	138	122	148	251	282	279	281	272	190	150	145
Cape Town	152	130	126	119	275	304	298	289	286	266	177	155	152
Colombo	108	115	106	180	260	286	270	251	209	159	133	133	108
Cyprus	124	115	106	130	242	275	262	244	230	167	135	125	124
Dakar	150	153	143	122	216	295	295	293	289	279	190	161	150
Denver	102	93	87	81	74	93	106	187	219	191	155	121	102
Fairbanks	112	106	93	83	107	120	121	134	139	153	138	131	112
Falklands	145	147	140	121	172	237	265	281	281	274	190	152	145
Gibraltar	92	89	84	75	136	181	188	181	182	154	112	89	92
Hongkong	103	78	79	162	221	247	168	148	139	131	105	103	103
Honolulu	110	105	93	82	102	121	126	111	91	153	138	131	110
Iceland	78	75	59	60	87	140	163	162	152	128	97	78	78
Jamaica	110	107	106	96	89	136	225	248	247	233	181	138	110
Lagos	152	153	140	120	258	301	296	293	290	275	186	161	152
Las Palmas	131	129	124	108	174	244	260	251	252	232	164	128	131
Lima	138	135	130	119	126	117	268	268	270	266	190	145	138
Los Angeles	102	93	87	81	74	117	111	140	206	183	154	120	102
Malta	105	100	93	94	186	218	220	210	206	153	122	105	105
Mauritius	136	111	119	164	277	301	293	276	275	190	155	145	136
Mexico	102	94	87	81	81	136	145	232	232	211	169	122	102
Moscow	89	82	67	98	182	211	213	196	167	125	92	89	89
Nairobi	147	126	125	152	277	304	291	281	279	209	162	144	147
New Delhi	116	105	94	174	251	267	261	194	153	139	119	122	116
New York	108	106	98	84	81	97	195	237	233	214	168	126	108
Osaka	106	82	82	114	192	153	135	111	124	122	106	105	106
Perth	126	114	106	180	258	284	255	215	178	150	131	129	126
Rio de Janeiro	145	147	140	122	138	267	286	281	281	274	190	152	145
Salisbury	150	126	129	136	279	307	294	289	285	237	171	150	150
Seychelles	143	84	116	174	274	298	290	271	268	190	150	143	143
Singapore	116	105	94	174	251	267	261	235	182	139	119	112	116
Suva (s)	111	106	83	81	134	178	197	178	126	144	125	122	111
Suva (l)	155	152	144	112	224	194	166	159	128	172	188	161	155
Sydney (s)	103	78	79	162	221	238	186	181	153	133	105	103	103
Sydney (l)	139	135	133	119	141	183	133	131	130	138	178	145	139
Teheran	128	115	106	180	260	286	268	249	195	152	133	133	128
Vancouver	107	100	87	82	83	94	84	119	161	168	144	125	107
Wellington (s)	101	84	70	108	178	210	185	173	140	130	110	106	101
Wellington (l)	148	147	141	117	183	157	107	111	130	158	190	157	148

For information on the use of this table, see page 284, *Radio Communication* April 1976. Please send reports to Mr J. Spurling, G4AQI, 15 Tibbs Hill Road, Abbots Langley, Watford, Herts WD5 0EE.

council proceedings

A brief report of the Council meeting held on 9 November 1976

Present: Dr E. J. Allaway (*President, in the Chair*), Lord Wallace (*President-elect*), Messrs D. J. Andrews, P. Balestrini, R. J. Baker, J. O. Brown, D. Byrne, R. W. Fisher, Dr D. S. Evans, Messrs W. F. McGonigle, C. H. Parsons, W. A. Scarr, D. M. Thomas, R. F. Stevens (*members of Council*), G. R. Jessop (*general manager*), A. W. Hutchinson (*editor*), D. A. Evans (*minutes secretary*).

Apologies for absence were received from Messrs D. M. Pratt, C. J. Thomas and G. M. C. Stone.

Financial report and accounts for the year ended 30 June 1976

Mr Brown circulated copies of his detailed revenue figures and budgets and explained in detail some of the items contained in them. A discussion on various aspects of Society finances and economies followed.

Data processor

Mr Jessop reported on the progress that had been made in programming the machine.

Mr Parsons read the following recommendation of the Finance & Staff Committee: "That the capacity of the data processor should be increased by ordering a 9·1 Megabyte store at a cost of £1,850".

Mr Jessop briefly amplified the statement by outlining the advantages of transferring additional work on to the data processor, such as the advertising and bought ledgers, in addition to the possibility of producing the *Call Book* with the aid of the data processor in future at reduced cost. It would be wise to give this recommendation serious consideration. He pointed out that the cost of alterations to Society headquarters for the data processor had been some £2,000 less than budgeted, and that the Society had been fortunate in ordering the data processor when it did at a cost of some £2,000–3,000 less than the present price.

Mr Fisher asked if the additional storage capacity had been envisaged when the original memory size had been specified.

Mr Jessop said that it had not really been appreciated just how effective the processor would be and, because transferring other ledgers to the processor would offer considerable ease of control, a probable benefit to the cash flow situation would have resulted had the increased memory size been considered at the time.

Mr Baker queried why these points had not been appreciated earlier and asked if it was possible to say how quickly the additional expenditure would be recovered.

Mr Jessop said it was impossible to say how quickly the additional cost would be recovered as there were too many unknown factors. However, the result would be most beneficial.

Mr Parsons added that the Society would be able to undertake work for external bodies if the memory size were increased and this could well be a source of additional income.

After some further discussion the proposal was carried unanimously.

Structure of committees

At the previous Council meeting it had been recommended that the chairmen of Society committees be asked to report their feelings on a possible new structure for Society committees. It was reported that there had been very little reaction.

Mr Stevens said he had looked at the committees that he had been on and he held the view that this was not a time for change.

Mr Jessop said he felt the time was right to appoint an hf committee and he considered that this would be a step in the right direction.

Mr Andrews said that he thought priority should be directed towards a strong headquarters and this in turn would give a better position from which to restructure at a later date.

Mr Balestrini thought that a Raynet person should be on the VHF Committee, and that committee minutes should be circulated to all committee chairmen so that differing views could be reconciled.

Mr D. Thomas questioned the effectiveness of the committees, the cost effectiveness of vhf sub-committees, and whether more managers improve the membership services.

Dr Evans gave his view that the Society's committees should be based on sub-division of the radio spectrum rather than specific functions.

Mr Baker said that he thought co-ordination between committees would probably be the key to a better Society.

Mr Parsons said he thought the Society was trying to do too much with the resources it had available. He thought the running of Society headquarters was of paramount importance and that this basic problem had to be solved before the Society tackled other issues.

Mr Scarr suggested that a working party be set up to examine all the problems which were at present under discussion. After some further discussion the following proposal was adopted:

"That a working party be set up in 1977 to study the whole Society in depth with a particular relation to the organisation of the Society's HQ, the organisation of Council and its committees and the inter-relation between HQ, Council and committees."

Mr Jessop said it was quite impractical to try to run the Society's HQ by committees—HQ had to look after the financial and business interests of the Society while the committees dealt with the structure of the hobby—these two aspects of the Society should not be confused.

Membership and representation

It was reported that the rate of applications for membership was continuing at a good level. In July there were 141, in August 143 and in September 215. It was resolved:

(i) to accept reduced subscriptions from 23 members;
(ii) to waive the subscriptions of four members;
(iii) to grant life membership to Mr D. W. Robinson, G3FMT;
(iv) to grant affiliation to the Comite International Radio Maritime, the ICL Radio & Electronics Society, the Hornsea Amateur Radio Society, the Norweb Electricity Amateur Radio Club, the Oxford University Radio Society, the Portsdown Hill Repeater Group (UHF), and the Tamworth Amateur Radio Society.

Council approved the appointment of Mr M. Dennison, G3XDV, as Area Representative for the Canterbury/Herne Bay/Whitstable area.

It was announced that following the election for a Regional Representative for Region 7, G3HFO had been appointed.

VHF Managers' meeting, Amsterdam

Dr Evans, who had attended the meeting, said that on the microwave front there had been some enthusiasm shown by the Italians, Germans and Dutch and one or two other countries but little interest was shown by the rest of the meeting. The main part of the meeting concerned vhf matters, and of particular note was the fact that the RSGB and other countries in Europe had not adopted the Warsaw Conference Plan for 432MHz repeaters. He thought the position with regard to WARC 79 was somewhat depressing as many societies did not seem to be in effective touch with their national administrations.

Mr Baker said he thought it was necessary to explain for the record why the RSGB Repeater Working Group had recommended a change from the IARU plan. When members of the UK delegation had returned from Warsaw they put forward the IARU plan for repeaters on 432MHz but it had been rejected almost unanimously by repeater groups and atv enthusiasts around the country. It was the basic problem with atv activities which had decided the matter in favour of reversing the input and output frequencies in order to reduce interference to atv operators. The whole matter had been thoroughly discussed by the RWG prior to its presentation to the VHF Committee.

Presidential Installation 1977

Lord Wallace gave details of the reception which would be held in the House of Commons dining room at 7 for 7.30pm on 22 January. The maximum number of people which could be catered for was 250. After some discussion it was agreed that there should be a charge of £2.50 per head or £4 for a member and guest.

Committee minutes

Council received the minutes of the following committee meetings: IARU Working Group (17.6.76), Raynet (26.6.76, 11.9.76), HF Contests (15.6.76, 2.9.76), VHF Contests (24.7.76, 23.9.76), Repeater Working Group (13.8.76, 18.9.76), VHF (16.8.76, 13.9.76), Mobile & Exhibition (18.8.76, 21.9.76), Finance & Staff (2.9.76), Membership & Representation (7.9.76), Education (11.9.76), Technical & Publications (27.9.76), Telecommunications Liaison (30.9.76).

Council discussed the proposal in the minutes of the Mobile & Exhibition Committee (18.8.76) to hold a mobile rally at Woburn Abbey in order to restore it to the calendar. It was agreed not to allow this venture to proceed and to advise the committee accordingly.

Retirement of Council members

This being the last Council meeting of 1976, Dr Allaway thanked all its members for their work during the year.

He particularly thanked Messrs R. J. Baker, G3USB, and D. Byrne, G3KPO, who were retiring from Council, and on behalf of their colleagues on Council wished them well in the future.

Mr Scarr remarked that 1976 had been a difficult yet interesting year for the Society and congratulated **Dr Allaway** on his term of office as President and thanked him for his great efforts on behalf of the Society.

your opinion

The Editor
Radio Communication

Sir—The accounts to 30.6.76 again show a sizeable deficit which includes expenditure of £1,868 under the heading QSL Bureau, Beacons and Intruder Watch. My guess is that quite a large proportion of this can be attributed to the cost of running the QSL Bureau. Arthur Milne continues to provide exemplary and first class service to all using the bureau, but reports that 40 per cent of cards are not collected.

I, for one, must admit that even a rare dx card does not now give me the sense of elation which used to be the case many years ago, and for this reason I only send cards against a specific request and never ask for one. If he is in my log—I know I have worked him!

I am not decrying the exchange of QSLs in any way, *but*, should it continue as a free service? Should the Society have to bear the work load and not inconsiderable cost of covering an exchange of cards between A and B who may only live a few miles apart, or of providing the service for operators who claim that they QSL 100 per cent, or for those who simply want some low-cost wallpaper?

To the best of my knowledge the RSGB is one of the very few providing a free service and to me it seems logical to ask, especially in these hard times, why the payment of a small fee should not be considered for those wishing to use the bureau.

Exchange of cards for specific awards could be exempted, as also could other special categories if necessary. Incoming cards would not, of course, be affected, but surely the avid QSLer would not object to paying 1p or 2p for each card he forwards to the bureau for processing? Small stickers could be sold by the Society for this purpose.

F. E. Stallworthy, G8WS

The Editor
Radio Communication

Sir—I am sorry to note that once again no G8+3 nor any swl has been appointed as a member of Council. Obviously if they do not put their names forward as candidates they cannot even be considered, and therefore once again a not inconsiderable proportion of the Society membership does not have its own spokesman. What is the reason? Are they shy?

J. O. Brown, G3DVV

The Editor
Radio Communication

Sir—The "Current Comment" statement of RSGB views (p813 November) is welcome as far as it goes. Nevertheless it reveals the ambivalent attitude to licensing in general, so painfully obvious at club meetings and expressed on the air.

I refer to the sting in the tail of item 4, where the phrase "... crystal-control and type-approved apparatus..." is used. Surely, this is what the argument is all about?

At present, and in the past, it has been the policy that radio amateurs, at least, have not had to use type-approved apparatus so long as it falls within the confines of a broad specification. It has been understood as axiomatic that it is primarily the operator at his particular address who is licensed, not the apparatus, and if his apparatus fails to conform to the broad specification, it is the operator who is penalized on the grounds of ignorance or wilful delinquency.

To change the emphasis to force use of type-approved apparatus but acknowledge that the average citizen will never need to know if such apparatus has been illegally modified or drifted well out of specification is to legalize irresponsibility. Surely, as a Society, we cannot underwrite such a change?

I cannot help feeling that when we consider the problem of licensing operators for a so-called citizens' band, we must continue to accept that the principle of law that the user is responsible for defects in the equipment, not the maker, must remain.

It is the abandonment of this principle in other countries which has given rise to the precise chaotic situation which exists there today.

B. Howlett, G3JAM

The Editor
Radio Communication

Sir—I thought you would like to read this bit of bureaucracy that I quote direct from the tv licence reminder current at this time.

The SCHEDULE.

Para 4). If any message, other than a message for the receipt of which the use of the apparatus is authorised, is unintentionally received, no person shall make known its contents, origin, destination or existence, or in fact of its receipt, to any person other than a duly authorised officer of Her Majesty's Government, a person acting under the authority of the Secretary of State or a competent legal tribunal, and shall not reproduce, in writing, or make use of such message or allow it to be reproduced in writing, copied or made use of.

To my simple mind this means that if anyone receives intelligible tvi they are utterly sworn to secrecy in the matter, not being allowed to acknowledge its existence and certainly not allowed to tell anyone but the Secretary of State!

K. R. Clarke, G3KRC

obituaries

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

Mr C. A. J. Meadows, MBE, G3RVV
Charles Meadows died on 18 December aged 71. He was active mainly on 2 and 160m.

Mr R. Palmer, G5PP
Bob Palmer, who died on 25 October, was an active and long-established member of the Midland ARS, of which he was a past-president and a vice-president. He was a keen constructor, lecturer and dxer, and the main-stay of the MARS-CARS-Bristol contests, especially on top band. He was a tireless worker at and visitor to mobile rallies.

The Society has also been informed of the deaths of:
Mr J. J. Loudon, G3SWR,
Mr H. J. L. Monk, BRS8295, and
Mr S. Gill, BRS35155.

East Midlands Amateur Radio Group Lecture

7.30pm, 23 March 1977

Radio Spectrum Utilization
(Co-ordination or chaos)

by

Dr J. A. Saxton, CBE, DSc, PhD, CEng, FIEE, FInstP
Director of the Appleton Laboratory

at

St Helen's House, King Street, Derby.

Admission by ticket. Seating limited

Details from Tom Darn, G3FGY, QTHR, or Ripley 2972, or from local club secretaries

contest news

November 1976 144MHz CW Contest results

There was an enthusiastic entry for this contest—39 entrants compared with 35 last year and 22 in 1974. Conditions were mostly poor although some good dx QSOs, both GM/G and G/DL were made. Activity, however, was high.

Some comment was made that the RSGB contest did not conform in timing to the IARU Region 1 event. This year the society responsible for international contests is ARI (Italy). They have changed the original Region 1 agreement, which was a 12-hour contest 2000–0800gmt, to what is now called the Marconi Memorial Contest originated two years ago. Timing of this is 1600 to 1600gmt. The RSGB event was kept within these limits but was shortened because it was felt that a 24-hour cw contest in November would be too long, hence the 2000 to 0100gmt choice. This did, however, cause a problem of incompatibility and the VHF Contests Committee will give careful thought to this when planning the 1977 event.

The winner will be awarded a certificate, as will the leading fixed station, G3WSN. Thanks are due to G2HH and G3DNQ for check logs. *G3FZL*

Posn	Callsign	Points	QSOs	Best dx	Km
1	GW3WOH/P	562	70	F8BG	535
2	G3YYF/P	461	61	GM4DSZ/A	690
3	G3LCH/P	447	73	ON5UN/P	445
4	GW3WRA/P	445	62	F8BG	430
5	G3WSN*	422	68	GM4CXP	483
6	G3NNG/P	420	70	GM4DSZ/A	600
7	GW3UCB/P	381	45	F9FT	652
8	G3CHN	365	35	F9FT	560
9	G4AEQ	324	48	ON5UN/P	490
10	G3UGF	276	41	ON5UN/P	478
11	G3DAO	260	36	DK0BN/P	540
12	G3OSJ/A	248	42	DF4KP/P	625
13	G3FPK	238	42	G3UGF	295
14	G3WUX/A	235	53	ON5UN/P	260
15	G4APL	226	48	G3UGF	305
16	GM4DSZ/A	220	16	G3YYF/P	706
17	G4DLB/P	211	54	F8BG	412
	G5UM	211	41	GM4DSZ/A	502
19	G4FDX	189	43	G3AZI	257
20	G3FIJ	177	29	GW3UCB/P	305
21	GM4CXP	169	17	G3WSN	460
22	G3XTT	163	40	ON5UN/P	330
23	G5HD	161	29	ON5UN/P	320
	G2BLA	161	37	G3CHN	306
25	G3SCZ	156	44	ON5UN/P	—
26	G3YOZ	151	29	ON5UN/P	275
27	G3JKB	147	40	G3GZJ	365
28	G4DHA	138	16	G3WSN	362
29	G4DHF/A	132	26	G3XDV	287
30	G4DEE	128	30	DF5KP/P	500
31	G3BTO	116	28	G3GZJ	310
32	G6UW	112	24	ON5UN/P	—
33	G4DDX	109	27	ON5UN/P	275
34	G2YS	98	28	G3CHN	270
35	G3RSD	84	10	GM4DSZ/A	—
36	G5KV	78	21	ON5UN/P	295
37	G3LRS	70	16	G3YYF/P	220
38	G3ILO	69	15	ON5UN/P	420
39	G4EGG	20	8	GW3WOH/P	140

* Leading fixed station.

Low Power Contest 1977 rules

1. The general rules for RSGB hf contests, published in the January 1977 issue of *Radio Communication*, will apply.

2. When. 0700–1700gmt 17 April 1977. A maximum of eight hours operating is permitted in not more than two periods. The start and finish of which to be clearly shown in the logs.

3. Eligible entrants. Single-operator stations only. British Isles entrants must be members of the RSGB.

4. Sections.

(a) British Isles stations.

(b) Overseas stations including EI.

5. Contacts. CW (A1) only in the 3·5MHz and 7MHz bands. Exchanges should consist of RST, serial number and power group, eg 569 001/2W.

6. Scoring.

Power group	1W	2W	5W
Points	100	50	25

Contacts between QRP stations. Each station scores points for his own power group **plus** the points for the other station's power group.

Contacts with other stations. Score points according to entrant's own power group.

Overseas stations may only claim points for QSOs with British Isles stations.

7. Multiplier. A multiplier of two operates on all contacts on 7MHz.

8. Logs. Separate log sheets must be used for each band. Column 5 should be headed "Power group recd", Column 6 "My power group".

9. Entries. To RSGB HF Contests Committee, c/o D. S. Booty, 139 Petersfield Avenue, Staines, Middlesex TW18 1DH, England. Closing date for **overseas** logs 28 May 1977.

10. The 1930 Committee Cup will be awarded to the winner, and certificates will be sent to the leading three stations in section (a) and to the leading three stations in section (b) and to the leading station in each overseas country.

National Field Day 1977 rules

1. The general rules for RSGB hf contests, published in the January 1977 issue of *Radio Communication*, will apply. The provisions of General Rule 8 are modified by Rule 13.

2. Applications. Each group intending to compete must submit an application on form HFC 10/77 (obtainable from RSGB headquarters) to Mr D. S. Booty, 139 Petersfield Avenue, Staines, Middlesex TW18 1DH. Only entries on properly completed forms will be accepted.

3. When. From 1700gmt Saturday 11 June to 1700gmt Sunday 12 June 1977.

4. Eligible entrants. Any group of RSGB members within the prefix zones G, GJ, GU, GD, GI, GM and GW. NFD is a multi-operator contest as provided for in General Rule 5(b).

5. Contacts. CW (A1) only in the 1·8, 3·5, 7, 14, 21 and 28MHz bands.

6. Sections. Entrants will compete in the Open or in the Restricted Section and will operate one portable station on one or more of the above six frequency bands.

7. Power. Entrants in each section may use licensed power.

8. Equipment.

(a) Open Section. Only one transmitter and up to two receivers may be connected at any one time. A transceiver may be used as a second receiver provided the transmitter section is disabled. The use of two operating positions is not permitted.

(b) Restricted Section. Only one transmitter and one receiver may be connected at any one time.

(c) Both sections. The presence on the site of additional amplifiers or modified commercial equipment capable of excess power, may result in the entry being disallowed.

9. Antennas.

(a) Open Section. No part of any antenna shall be higher than 60ft (18·5m) above ground.

(b) Restricted Section. Only one antenna is allowed and this is to be of wire as a single element, or a single element vertical of pipe, tubing or wire. Trapped antennas are permitted. No part of the antenna shall be higher than 35ft (11m) above ground and have no more than two support points. Examples of permissible antennas are long wires, centre-fed dipoles, and trapped verticals.

10. Installation. General Rule 4(b) applies.

11. Scoring. Points will be scored as follows:

(a) Fixed stations in the British Isles	1 point
(b) Fixed stations in the rest of Europe including Eire	2 points
(c) Fixed stations outside Europe	3 points
(d) Fixed stations in the British Commonwealth	6 points
(e) Portable and mobile stations in the British Isles	3 points
(f) Portable and mobile stations in the rest of Europe including Eire	4 points
(g) Portable and mobile stations outside Europe	6 points
(h) Portable and mobile stations in the British Commonwealth	12 points

A multiplier of two will be applied to the total claimed score for contacts on the 1·8 and 28MHz bands only.

12. Group contacts. Points must not be claimed for contacts made by a competing station with members of its own group, whether fixed, mobile or portable.

13. Entries. These are to be in accordance with General Rule 8 with the following exceptions:

(a) The normal cover sheet will not be used. Special cover and summary sheets will be sent to the person responsible for the entry.
(b) Points claimed must be totalled separately for each band.
(c) Entries must be sent to the RSGB HF Contests Committee, c/o Mr M. Harrington, 123 Clensham Lane, Sutton, Surrey SM1 2ND, postmarked not later than 27 June.
Entries sent direct to RSGB headquarters will not be accepted.

14. Trophies.

(a) The National Field Day Trophy to the group competing in the Open Section having the highest checked score.
(b) The Bristol Trophy to the group competing in the Restricted Section having the highest checked score.
(c) The Gravesend Trophy to the group having the second highest checked score in the section having the largest number of entries.
(d) The Scottish NFD Trophy to the Scottish group having the highest checked score.
(e) The Frank Hoosen Trophy to the group having the highest checked score on the 14MHz band.
(f) Certificates of Merit to the groups having the highest checked scores on the 1·8, 3·5, 7, 21 and 28MHz bands.

15. Check logs. While overseas stations are not eligible to enter NFD, check logs are very welcome. A certificate will be awarded to the overseas station in each continent whose check log shows the most points contributed to competitors.

16. Inspections. All stations are subject to inspection by nominated representatives of the HF Contests Committee.

The inspector's brief will be to ensure that the rules and spirit of the contest are being observed. Should the inspector be unable to locate the site due to inadequate or incorrect information given on the application form, the entry will be disallowed. In the event of a last-minute change of site, it is the responsibility of the members of the group to make adequate arrangements for the inspector to locate the new site.

Contests calendar

12-13 February	1st 1·8MHz (Rules in January issue)
19-20 February	ARRL DX CW
26-27 February	REF Phone
5-6 March	144MHz Open (Rules in January issue)
5-6 March	ARRL DX Phone
12-13 March	Commonwealth (Rules in December issue)
19-20 March	ARRL DX CW
20 March	432MHz Open
26-27 March	CQ WW WPX SSB
2-3 April	70MHz Open
16-17 April	Bermuda AR Contest (phone/cw)
17 April	Low Power (Rules in February issue)
24 April	144MHz CW
1 May	Queen's Jubilee CW
14 May	1·3GHz Open
15 May	432MHz Open
22 May	Queen's Jubilee Phone
28-29 May	144MHz Portable
11-12 June	HF NFD (Rules in February issue)
18-19 June	Microwave (3·4—24GHz)
25-26 June	Summer 1·8MHz
2-3 July	VHF NFD
17 July	3·5MHz FD
31 July	144MHz QRP
13-14 August	70MHz Open
3-4 September	SSB FD
3-4 September	144MHz Open
1-2 October	UHF Contest (432MHz—2·3GHz)
8-9 October	21/28MHz
15-16 October	7MHz Phone
23 October	70MHz Fixed
October-November	432MHz Cumulative
5-6 November	7MHz CW
12-13 November	144MHz CW
12-13 November	2nd 1·8MHz
4 December	144MHz Fixed

raynet

P. Balestrini, G3BPT *

The Raynet Committee chairman takes up his quill for the first column of 1977 and hopes that all members enjoyed a happy Christmas and will enjoy a peaceful and prosperous New Year.

The year

Mention should be made of the importance to Raynet of the new licence and the inclusion of county emergency planning officers in our lists of user services. This has resulted in an increase in activity and a welcome increase in the standing and importance of Raynet members in community service.

Exercises apart, services rendered throughout the year have ranged from flood tides and gales, forest and heath fires, standby at county shows, lost children etc. During all those incidents and activities Raynet members freely gave of their time to the credit of the amateur service at large. On behalf of the membership I thank all radio amateurs for their help and assistance under both exercise and incident conditions. In particular, thanks are due to the repeater groups for their pledge of co-operation ..... Raynet, repeater groups and community service has been the spirit of 1976.

The first issue of the Mk2 version of the controllers newsletter appeared in November by courtesy of RSGB headquarters who undertook the task of duplication and despatch. This will be of a periodic nature rather than regular, when there is something to say and communicate to members via their controllers. It is hoped that all the controllers have returned the questionnaire to G3GJW, thus enabling the completion of our committee records.

Membership and group numbers have increased during 1976; in particular it was pleasing to confirm the formation of a group in Lincolnshire under the controllership of G8IJC, long-standing members will remember this as an area of great activity many years ago. Welcome back to the fold!

Covering new ground we were equally pleased to confirm the formation of groups in Devon and the Channel Islands under the controllership of G4EWZ and GU4ASO respectively.

Presentation

At the annual committee dinner in November, Arnold Matthews, one of the founder members of Raynet, presented to the chairman a silver medallion as a badge of office. This fine piece represented many hours of work, and was a personal pleasure to receive on behalf of the service. Thank you, Arnold!

Insurance

From time to time enquiries are received from the membership regarding insurance coverage during exercises and incidents, and all are reminded that Raynet members in possession of a current registration card are covered under an insurance policy executed by the RSGB on behalf of the network.

1977

We look forward to a continuing increase in membership. Non-members reading this column should consider the value of community service to the radio amateur and to the Society; if interested send an sae to the hon secretary, Mr E. R. L. Bassett, 57 Upper St Helen's Road, Hedge End, Southampton, who will send full details of how to join and what is involved.

In conclusion, thank you all for your continued interest and support, for your co-operation during incidents and forbearance during exercises.

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

* "Merrivale", Willow Walk, Culverstone, Gravesend, Kent DA13 0QS.

RSGB SLOW MORSE PRACTICE TRANSMISSIONS

These slow morse practice transmissions are sponsored by the RSGB. Alterations and additions to this list should be sent to the honorary organizer, Mr M. A. C. MacBrayne, G3KGU, 25 Purlieu Way, Theydon Bois, Essex.

Clock time	Callsign	MHz	Mode	Town
Sundays				
0900	G3WNR	145·600	F2/F3	South Shields, T & W
		omni-direct		
		1·815	A2/A3	
		144·250	A1/A3J	Knutsford, Cheshire
0930	G3LEQ	145·250	F2/F3	
		433·200	F2/F3	
1015	G3CGD	1·875	A1/A3	Cheltenham, Glos
1030	G3NPB	1·875	A1	St Ives, Cornwall
1030	G3LR	1·810	A1	Accrington, Lancs
1030	G4DKK	1·970	A2/A3	Caterham, Surrey
1100	G2FXA	1·900	A1/A3	Stockton-on-Tees
1130	G3BLS	1·920	A1/A3	Osney, Oxford
1200	G3HVI	144·750	A2/A3	Stoke-on-Trent, Staffs
		omni-direct		
1230	GU4CHY	144·500	A1/A3J	St Peter Port, CI
		to north		
1500	G4EHW	144·250	A1/A3J	Peterborough
		to southwest		
1815	G4DVZ	1·915	A1/A3J	Leeds, Yorks
1830	G3NCZ	1·920	A1/A3	Blackburn, Lancs
Mondays				
1800	G3SWR	1·980	A1/A3	Birmingham
1830	G3ZQS	144·310	A2/A3J	Darwen, Lancs
		to north		
1830	G3VBI	1·910	A1/A3	Goole, Yorks
1900	G3ZRZ	1·980	A1/A3	Blackpool, Lancs
1900	G4FKZ	3·575	A1/A3	Chadderton, Lancs
1900	G3LR	145·575	F2	Accrington, Lancs
		1·920	A2	
1930	G3RAF	3·550	A2	Locking, Avon
		145·475	A2 or F2	
1930	GI3SXG	144·110	A1/A3J	Newtownards, Co Down
2000	G3IBJ	1·910	A1/A3	Southampton, Hants
2000	G3XWZ	1·910	A1/A3J	Mansfield, Notts
2000	GM4ELV	3·570		Arrochar, S/Clyde
2030	G3ASR/A	1·875	A2/A3J	Harrow, Middlesex
2130	G3LQI	145·300	F2/F3	Lancing, Sussex
Tuesdays				
1800	G3SWR	1·940	A1/A3	Birmingham
1830	G4BNA	3·590	A1	Swindon, Wilts
1900	G3LR	145·575	F2	Accrington, Lancs
		1·920	A2	
1930	G3RAF	3·550	A2	Locking, Avon
		145·475	A2 or F2	
2000	G4AEU	1·910	A1/A3	Southampton, Hants
2000	G3EFS	1·914	A2/A3	Bromley, Kent
2000	G4EZA	145·200	F2/F3	Colchester, Essex
		omni-direct		
		vertical		
2045	GM3CRY	3·550	A1/A3J	St Andrews, Fife
2045	G4AEU	145·550	F2/F3	Southampton, Hants
		omni-direct		
		vertical		
2130	GM3UAG	145·400	A1/F3	Ellon, Aberdeenshire
		to south		

Clock time	Callsign	MHz	Mode	Town
Wednesdays				
1900	G3LR	145·575	F2	Accrington, Lancs
1900	G3ULY	1·826	A1/A3J	Culgaith, Cumbria
1900	G4FKZ	3·575	A1/A3	Chadderton, Lancs
		1·920	A2	
1930	G3RAF	3·550	A2	Locking, Avon
		145·475	A2 or F2	
2000	G8QU	1·970	A1	London N22
2000	G3BPE	1·975	A1/A3	Bexley, Kent
2000	G3SWP	144·200	A2/A3J	Doncaster, Yorks
		omni-direct		
2000	G4EHW	144·250	A1/A3J	Peterborough
		to southwest		
2015	G3WVJ	1·845	A1/A3	Staines, Middlesex
2030	G4FFC	145·575	F2/F3	Pertenhall, Beds
		to south		
2100	GM4DSZ	144·200	A1/A3J	Aberdeen
2100	G3HVI	144·750	A2/A3	Stoke-on-Trent, Staffs
		omni-direct		
Thursdays				
1800	G3SWR	1·980	A1/A3	Birmingham
1830	G4BNA	3·590	A1	Swindon, Wilts
1830	G3NC	1·968	A1	Swindon, Wilts
1900	G3YEI	1·850	A1	Fleetwood, Lancs
1900	G3BLS	1·920	A1/A3	Osney, Oxford
1900	G3LR	145·575	F2	Accrington, Lancs
		1·920	A2	
1930	G3RAF	3·550	A2	Locking, Avon
		145·475	A2 or F2	
1930	G3ASR/A	1·875	A2/A3J	Harrow, Middlesex
(1st and 3rd weeks of month only.)				
1930	G3ZRZ	1·980	A1/A3	Blackpool, Lancs
2030	G3KGU	1·915	A1/A3	Theydon Bois, Essex
2130	G3LQI	145·300	F2/F3	Lancing, Sussex
Fridays				
1800	G3SWR	1·940	A1/A3	Birmingham
1900	G3NPB	1·875	A1	St Ives, Cornwall
1900	GU4CHY	144·500	A1/A3J	St Peter Port, CI
		to north		
1900	G3LR	145·575	F2	Accrington, Lancs
1900	G4FKZ	3·575	A1/A3	Chadderton, Lancs
1930	G3PQF	144·360	F2/F3	Farnborough, Hants
		to north-east		
		1·920	A2	
1930	G3RAF	3·550	A2	Locking, Avon
		144·475	A2 or F2	
2000	G4EHW	144·250	A1/A3J	Peterborough
		to southwest		
Saturdays				
0930	G2FNK	1·930	A1/A3J	Staines, Middlesex
1145	G4DYF	3·590	A1/A3	Sevenoaks, Kent
1900	G3LR	145·575	F2	Accrington, Lancs

G3BZU morse proficiency transmissions at 15, 20, 25, 30, 35 and 40wpm are made at 2000 clock time on the first Tuesday of each month on a frequency of 3·520MHz.

Mobile rallies calendar

3 April	White Rose Rally, Lawnswood School, Leeds.
17 April	North Midlands Mobile Rally, Drayton Manor Park.
22 May	Northern Mobile Rally, Victoria Park Hall, Keighley.
29 May	Suffolk Wireless Revival, Ipswich. Details later.
5 June	Maidstone Mobile Rally, "Y" Sportscentre. Details from G3WXL, QTHR, or Maidstone (0622) 890031.
12 June	Longleat Mobile Rally. Details nearer the date.
12 June	Elvaston Castle Rally, near Derby. Further details from P. Neal, G3WFU.
19 June	Royal Naval ARS Mobile Rally, HMS *Mercury*. Organizer: M. Puttick, G3LIK, 21 Sandyfield Crescent, Cowplain, Portsmouth, Hants PO8 8SQ.
17 July	Cornish RAC Mobile Rally, Truro Rugby Club Ground. Details from G3NKE, QTHR.
14 August	Derby Mobile Rally, Lower Bemrose School (Rykneld School). Details from G3FGY, QTHR.
25 September	Harlow & D ARS Rally, Netteswell Comprehensive School, Harlow. Details from G3WUX, G8FRG, G3YDI, QTHR.

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 alternate issues 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 50p (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 1st 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. Traders who are members must enclose a signed declaration that the items for sale or wanted are part of, or intended for, their own personal amateur station.

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.

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

FOR SALE

Heathkit HW101, inc SB600, ac/dc psus, HM102 wattmeter, KW E-zee match and TTC swr bridge, £260. HQ1 minibeam, £40. G4ZU minibeam, £10. Scientific programmable calculator, £35. Marconi TF995A, £250. 500MHz (10^7 over) frequency counter, £400. 500MHz modulation meter, £130. S51B Scopex, almost new, £50. Burns wavemeter, £18. Level TM3 ac micro voltmeter, £50. Avo 8 Mk2 inc case, £40. Marconi TF1064/5M, requires piston gears, £70. HMV Stereomaster inc decoder, £25. ZVG board, comp, £45. Send sae for numerous components inc xtals, valves, transistors, ics etc. G3TYR, QTHR.

Solartron CD711S oscilloscope, £45. TS382U audio generator, £20. KW coaxial antenna switch, £3.50. KW107, £60. Mullard 5–10 amp, £7.50. TF144G, £8. G3OXS, QTHR.

"Short Wave Magazine", bound volumes 1949–66 inclusive, offers. Top band tx in prof case, comp with modulator 5763, final 10W, in current use but space needed, £25. G3KRT, QTHR. Tel Ruislip 38287 evenings.

Trio TR7010 2m ssb tx/rx, one year old, good cond, £160 ono. Gone hf mobile. R.T. Payne, GM4AWA, 65 Durley Dene Crescent, Bridge of Earn, Perth PH2 9RD. Tel 0738 21241 ext 238.

Mobile suppression components. VHF spark plug covers, £1.29. Many more types of suppressor available, send sae for list. Sentinel 2m converter, 4–6MHz i.f., £12. Marconi sig gen type TF390F, £5. Haseldine, G8EBM, 15 Wheeldon Way, Hulland Ward, Derbyshire. Tel Hulland Ward 530.

Eddystone 898 dial, unused, £14. Instrument case, 12 by 9 by 9in, drilled for 898, £10. Two high band Storno CQM13, need attention, with circuits, £10 each. Low band Cossor, £6. Kokusai MF455-10CK with xtals. £10. All ono. G3WGN, 22 Sandfields, Frodsham, Cheshire. Tel 31594.

Yaesu FRDX400, little used, property of late swl, offers over £130. Buyer collects. G8HSH, QTHR.

Trio 9R59D with spkr, wkg well, £35. *Wanted:* Airmec C864 rx. Handy, 105 Humber Avenue Coventry. Tel 0203 22201.

IC202, less than six months old, 144·00 to 144·80, boxed, as new, gone FT101E, £150. G8KOP, QTHR. Tel 01-200 0466 after 6pm.

70cm Starphone M5 mobile tx/rx, multi channel with all repeater and SU8 xtals, comp with handbook, spkr and mobile mount, £95. Vibratrol 10W in 100W out 2m solid state amp, £50. G3VZV, QTHR. Tel Whipsnade 872848.

Liner 2, 144·10 to 144·53, improved rx, exc cond, manual etc, £120. XF9B, £25. Eddystone 898 dial, unmarked, £10. Professional 70cm 3–20A tripler, built in psu and switching, £12. MD108. SL610. SL640. SL621. *Wanted:* FT200, FP200. G3XJS, QTHR. Tel 04947 2344.

Datong RFC clipper, mint, £27.50. Roller coaster, comp with counter dial, £5. Philips 3¾ips mono tape recorder plus lashings tape, £10. KW103 swr meter, £7.50. TE20D rf sig gen, £17.50. All plus carr. *Wanted:* FL2100B linear. G3DOG, QTHR. Tel Walton on Thames 26076.

9R59DS rx, good cond with extra i.f. gain control, £45. AM25B Vanguard tx/rx, fm, 6ch, fitted S0, S20, £38. 70 high stab resistors, 110–6·8mΩ, 1–2W, £1. G4EZE. Tel Newcastle 615652.

Ultra Cub hand-portable tx/rx, xtals and wkg GB3LO, S20, BNC antenna fitting, £30. G4EPI. Tel 0277 226146 after 6pm.

IC201 fitted preamp, reverse repeater, exc, mint cond, little use, only £295 ono. G4EMG, QTHR. Tel 01-534 3460.

American callbooks, 1974 US and dx listings (rest of the world), £5 each. 1976 Gs only, £1 inc p&p. G3TJY, QTHR. Tel 020 122 2142.

Bantex magnetic mobile mount, £4.50. SSM SM71 70cm preamp, £4.50. Transistor beam splitter for scope, £10. *Wanted:* 5UP7 crt, tube for Hewlett Packard 175A. G8EPQ, QTHR. Tel Kings Lynn 61554 after 6pm.

Linear tubes, 650W output, QY4-400, brand new, £15. *Wanted:* Manual or details Hallicrafters Super Skyrider, 1940s vintage rx. G3OWQ, QTHR. Tel Sandwich 3997.

455kHz mech filter, 2·4kHz bw with lsb xtal, £10. 3A rf ammeter, £2. Londex AE coaxial relay, £3. CT436 scope plus h/b, small fault, £40. All plus postage. G3YGM, QTHR. Tel St Just 222.

IC22A, exc cond, 10ch on 2m plus xtals for 433·2MHz and RB4 for trip conv 70cm, £140 ono. MM 70cm conv tripler, boxed, wired with rf vox coaxial relays etc, used with IC22A for 70cm mobile, £36 ono. G4FGJ, QTHR. Tel Oakley 3304.

KVG XF-9A filter, £15. CW filter XF-9M, £15. Both with carrier xtals. G8FPT, QTHR. Tel 01-504 4942.

FT101B, vgc, only two years old, bargain offer at £360. G4CEN, QTHR. Tel 0425 615895.

FT200, FP200, exc cond, all 10m, £260 ono. FR100B, good cond, all 10, 11 and 160m WWV plus fm discriminator, £70 ono. G4FGJ, QTHR. Tel Oakley 3304.

SSM 2m Europa, £60. Antec 2m ⅝λ whip and window clip, £8. G-whip, 10m Flexiwhip with 80m coil and base, £12. Yaesu YD844 desk mic, £12. Two pairs of Pye Pocketfones with batteries, wkg SU20, £26 per pair. BC221 freq meter, no psu, offers. Hunt, GW4CBR, QTHR.

Standard rack cabinet, modern design, 6ft high, 24in deep, £20. Valves, ex-equip, 2C39A, 85p each. 6080, 50p each. 50Ω Bird Termaline coaxial resistor, 500W, as new, £45. 36 sender modulator, clean, £12. Carr by arrangement. G8ACF, QTHR. Tel Orford 328.

KW500 linear amp, vgc, solid state power supply, built in antenna, changeover relay, £65. Tel 0473 310 442.

Creed 75 teleprinter, as seen but fair cond, £25. Creed 75 t/p cw reperforator, as seen but fair cond, £30. The pair £50. G3LCS, QTHR. Tel 0908 313379.

Marconi test equipment, TF934, deviation meter, £12. TF1104 vhf alignment oscilloscope, £18. TF894A audio tester, £6. TF1041 valve voltmeter, £20. All with handbooks. 1in vidicon tube, £5. *Wanted:* Creed 75 teleprinter, exchange or why. G3NGK, QTHR. Tel 01-462 2178 evenings.

VDU cw keyboard and 12in monitor, 21 lines, 80 characters, 110/300 baud, ASC11 code, 64 characters, V24 or ttl i/o, scroll mode, auto tx, superb professional VDU in A1 cond, cw manual, £350, no offers. Delivery at cost. Tel Dunstable 600358.

Liner 2, as new cond, all usual accessories, £110 ono. Pye 2m base station, a.m. with four xtals in vxo plus net facility, £17 ono. 6 over 6 2m, £4 ono. G8FMC. Tel Tring 4948.

Cossor Companion 2m walkie talkie, 200mW o/p, fitted R5 xtals, spare nicads, charger, manual, can be heard on GB3BM most lunchtimes, £20 or exchange Heathkit Mohican or similar. G3XVN, QTHR. Tel Market Drayton 3995 evenings.

20ft steel lattice tower, with 12ft dural, 1½in extension, comp with guys and head bearing, offers. G3MGW, QTHR. Tel 0206 2382.

Disposal of the effects of the late BRS Raven. One Drake R4C, purchased mid-1975, hardly used, with Teleton loudspkr system, two pairs headphones, small aluminium mast, £300. Cheques should be made payable to Mrs J. B. Raven. Apply c/o *Radio Communication*.

2m gear. Linear, built in psu, £25. Bandpass filter to suit, £2. 427 rx, October 74, near comp, £10. Miniature scanning rx, £25. Tx/rx tone-burst timeout, ideal for beginner, £25. All prof built. GW8JOJ, 12 Black Barn Lane, Usk, Gwent.

Bendix 100–150MHz sig gen, £3. Telequipment D31 scope, £20. Electronic double paddle key, £12. 30MHz gdo, £2. 160m tx, £5. 160m ¼ wave 14swg copper-coated steel, £3. 1MHz 100kHz 10kHz digital marker, £3. Cooper, GW8JOJ, 12 Black Barn Lane, Usk, Gwent.

FTDX401, FV401, ls, as new, £300 or exchange for TS700, FT221, IC201 in same cond. G4DBX, QTHR. Tel Crewe 581657.

Trio 9R59D, hardly used, as new, £30. Joystick antenna and Joymatch artificial earth, £20 both. 19 Dunella Road, Hillsborough, Sheffield S6 4EG.

T28, £8. Bantex ⅝ whip, £4. Jaybeam mast, £4.50. Bolex P2 zoom, cine Eumig phonomatic projector, 8mm. Renaissance chess set. Sae enquiries. GM3WIG, QTHR.

Multi 7 10W/2W fm tx/rx, fitted toneburst, S20, S21, S22, S0, R6, R5 and R7, good cond, offers around £100. GW3YKZ, QTHR. Tel Newport (Gwent) 58314.

Yaesu FTDX560, £215. Europa B, £80. 12AVQ vertical, £18. Sentinel preamp, £5. Rebuilt and in good wkg order, telephone answering machine, GPO-approved type, £60. G3NJQ, QTHR.

Eddystone EC10, with mains psu fitted, manual, immac cond, £60 plus carr. Henderson, 53 Dumyat Drive, Falkirk, Scotland. Tel Falkirk 25559.

30ft lattice tower, 3 by 10ft sections with ½ section as base, £35. Buyer collects or arranges carr. Xtals 72·5MHz, 72·7MHz, £1 each. G4AED, QTHR. Tel 0953 882187.

Two lattice towers, approx height 35/40ft, sides 15in, to be lowered and removed from site of deceased amateur. Contact via G4CJY. Tel 0494 30018.

2m 15–20 G&D 2m a.m. tx, plug-in ac and 12V power supplies, £20. KW Vanguard type, h/b, 160/10m, £20. 2m G&D converter, 4–6MHz with own power supply, £10. Reasonable delivery. G3JSB, QTHR. Tel 0423 872361.

Hansen swr meter, 50Ω, SWR3, £4. Katsumi electronic keyer EK9X, £5. AKG mic D11D-HL, £4. Pair brand new unused 6KD6 valves, £2.50. GM3WRN, 2 Maryfield West, Inverurie, Aberdeenshire.

Trio JR60 all valve communications rx, ·54–30MHz, 142–148MHz, needs a little attention, £30. G3ZZK. Tel 01-476 4050 evenings.

Yaesu FRDX400 deluxe, cov 160–2m amateur bands, manual, £160. G4CNB, QTHR. Tel 0621 782388.

Trio JR599, 160–2m a.m./fm/ssb, £100. LA106 2m linear amp, exc cond, £120. FT200 plus FP200, £200. TC9 tx, a.m./fm, vfo, exc cond, £50. Buyer collects. G4EUH, QTHR. Tel 0272 557555.

Xtal ladder filter experiments, see *TT* Sept and Nov 76. HC18U xtals, 8·950MHz, £1 each. Some 5·000MHz HC6U and 8·000MHz HC18U, £1 each. Send sae with remittance and order. Richard Bowell, 16 Margarite Way, Wickford, Essex.

Eddystone EC10 Mk2, £55. HQ1 Minibeam, £35. Sentinel 2m converter, 4–6MHz i.f., £10. Asahi echo trap vertical, 10–40m, £15. Halo £1. G3ZJF, QTHR. Tel Windsor 68364.

EC10 style h/b rx, fm discriminator, £35. Linear amp kit, 4×TT21, £30. Two 250V dc psus, £3. Four big heatsinks, £2. Two EMI 450 spkrs, £5. BCC69 and psu on 4m tuneable rx, £7. TV tennis kit, mains isolation trans, offers. G4DPP, QTHR. Tel 01-575 0189.

Belcom FS1007P 2m channel scanning tx/rx, fitted nine channels, narrow filter, automatic toneburst, as new, £150. Reason for sale, gone multimode. G8DYF, QTHR. Tel 01-462 2083.

Drake R4B, MS4 spkr, 160m, handbook, £200. Marconi H4000 ssb tx/rx, 1·6–15MHz, mains 12V dc, handbook, £60. Icom 2m fm tx/rx IC21XT, mains, 12V dc, mic, R5, R6, R7, S0, S20, S21, S22, handbook, £90. *Wanted:* 3TF7 for R390. G3RCE, QTHR.

Liner 2, fitted preamp, rf control, mounting bracket, antenna, £115. FV4005 vfo for PT560, £30. Both ono. Twin track tape recorder, three motor type, £12.50. Sae for details. G4DGH, QTHR. Tel North Chapel 556.

Eddystone EB35 all band rx, original packing, good cond, £50. Sony CR160 Global thirteen band mains portable rx, as new, £140. Amstrad stereo amp, £10. Prefer buyer collects QTH or London. G3ACB, QTHR.

Pye Pocketphones, one pair xtalled and wkg well on 433·5, two pairs not wkg, must sell, no sensible offers refused. G4DXA, QTHR. Tel 0532 684781.

Pye Vanguard, 145MHz fm, £30. Trio 9R59, £40. R1155, £10. HW100 and ac power supply, £160. *Wanted:* FR400 rx in good cond. GW4DJW, QTHR. Tel 035 287 877.

Heathkit HW202 fm tx/rx, with HWA-202-1 psu, suitable mobile or base station, plus HA202 40W amp, £155 ono. G8JBK, QTHR. Tel Colchester 230318.

Trio 9R59D rx, good cond with spkr, handbook, voltage stabilizer, xtal calibrator, £45 ono. SSM 2m converter, i.f. 2–4 to suit above rx, £12 ono. Carr arranged. *Wanted:* FRDX400, JR599, cost around £100. Wells, 58 Portland Street, Colne, Lancs BB8 0LX.

4CX250, bases, chimneys, unused, £5 pair. BC221, wkg cond unknown, comp charts, £4. Buyer collects. Four uhf braidbreaker high-pass tvi filters, per Feb 74 *RadCom*, £1 each. Two SL640C, £1.25 each. SL610C, 75p each. One SL622C, £2. 641C, 621C, £1 each plus postage, G3IZJ, QTHR.

Top band tx, with twin meter swr bridge, matching atu and psu, offers. G4CJQ, QTHR. Tel 01-524 3169.

KEN KP202, S0, S20, S22, R5, R6, R7 fitted, nicads, charger λ/4 whip, £90. Liner 2, unmoded, with mobile mount, mic, good cond, £110. Car fm stereo cassette player, 4W per channel, with spkrs, £30. G8JZK, QTHR. Tel Romford 47998.

AR8516L rx, £165. 888A, £60. RA1, £20. 2M20 2m tx, £25. 12V mobile tx/rx, tx on 145MHz, £10. Two high speed chart recorders with dc amp, no paper, £12. Dartronic 381 scope, £12. All ovno. Tel 0782 21164.

Exchange Yaesu FR101D rx, all amateur bands 2m down, fm/a.m./ssb/rtty/cw, wide and narrow filters, exc cond, for TS700 preferably, or FT221. G8JSK, 99 Huntbach Street, Hanley, Stoke-on-Trent. Tel 0782 262825.

Nikkormat FTN camera FI-4 auto-Nikkor, ERC accessories, mint cond, a snip at £90, or consider exchange for amateur rx, JR310, FR50B etc, in similar cond. Easton, 36 Holystone Avenue, Newsham Farm, Blyth, Northumberland NE24 4QD. Tel Blyth 5359 after 6pm.

Heath SB301/E 80–10m rx, mint, £125. Garex 2m tx/rx, mint, £100. 2m pa QQZ06–40, o/p 12V dc, i/p rf switched, £20. *Wanted:* Liner 2. 144/28 converter. Ringo ARX Coliner. G8HLJ, QTHR. Tel 051-653 0767.

FT101B, unmarked cond, very little used and not used mobile, mic, plugs, fuses, manual etc, as supplied, £310. Prefer buyer inspects and collects. G3DAA, QTHR. Tel Teignmouth 3303.

Heathkit HW7 QRP cw tx/rx, built and wkg, £40. Codar AT5 tx, T28 rx, mains and 12V psus and connecting leads, £40 ono. G4AYX, 20a North Fen Road, Glinton, Peterborough PE6 7JL.

Heathkit HW32A, 20m, 200W p.e.p., very little used, manual, no psu, £55. HRO-MX, unmod, nine coils, original psu, good cond, £27. Prefer buyer collects. Tel Chippenham 3740 evenings/weekends.

B40, good cond, with handbook, offers. Microwave Modules 2m converter, 2–4MHz i.f. with mains psu, £12. G8CQY, QTHR. Tel Southampton 767935.

KW1000C rf amp, £65. 572B, /T160L, new, boxed, £9 each or £15 pair. Kokusai mech filter MF455–15K, £5. G3TQF, QTHR. Tel 0533 394873.

Liner 2 with PA3 preamp, £105. Microwave Modules 432/144 varactor tripler, £13. Sentinel converter 432/144, £12.50 plus carr. G4DGM, 106 Goldthorn Hill, Wolverhampton.

Get going on rtty. 7Bs, £13. 7B/RPs, £18. All comp with base and cover, some spares available, can deliver reasonable distance. G8JLT, QTHR. Tel Doncaster 842788.

SB104 all solid state digital tx/rx, £395. SB644 rvfo, £49. HP1144 psu, £59. All constructed to professional standards, delivery arrangeable. G2KF, QTHR. Tel Par 2337.

Pye Lynx tv cameras, comp less lens, from £28. Solarscope CD513, new tube, exc wkg cond with manual, £38. RF sig gen, £6. Creed 75 with perforator, £28. G2DAF ssb tx, pair 6146s comp with psu, £45. G3KRC. Tel 01-449 9653.

Liner 2, £100. Pye Pocketphones tx/rx, 433·2MHz, with tx battery and manual, good cond, £33. Pye Vanguard, fm mod and discrim, varicap tuned rx 145–146MHz, inc control, cables etc, £25. Trio 9R59D, stabilizer and calibrator, £35. G8EUQ. Tel 01-953 3882 after 6pm.

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Heathkit SB10U ssb adaptor, £25. Emsac 2m converter, 28–30MHz i.f., £5. PA3 pre-amp, £4. Mains transformer 800–0–800V 500mA, £6. Choke 500mA 6H, £2. Choke 200mA 7H, £1. G2DJA, QTHR. Tel 0424 751164.

Withers 2m/28 transverter/psu, 200W, £50. JXK 2m/28 mosfet converter, £5. 2m 10-el Jaybeam, £2. 70cm trip amp, QQVO2–6s, £2. Heathkit HWA17 inverter, psu, £10. 300V twin stabilizer psu, £20. Other items, components etc, callers please. G3LAS, QTHR. Tel Hertford 56122.

GEC Kenilworth, hiband, 4ch, 12½kHz, comp and wkg, £40, or exchange for similar but fm. G8CPB, QTHR.

Eddystone 940/S, with plinth spkr, as new, very little use since new Oct 69, manual, £150 ono. Buyer collects, cash sale. *Wanted:* FL50B with FV50 plus manuals, mint cond. G3FK, QTHR. Tel Breamore 436.

PF2UB, xtalled for 433·20, spare battery, £75 ono. G8EZM, 1 The Orchard, 20 Orchard Road, Bromley BR1 2PS. Tel 01-460 1418.

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Drake R4A, exc cond, spare valves and handbook, £140 ono. G3KDB, QTHR. Tel Lichfield 53398.
LM14 frequency meter (naval version of BC221), in mint cond, with psu, charts, handbook and spare valves, £40. BC221 in good cond, £15. G3YDY, QTHR. Tel 0245 62493 evenings.
Liner 2 preamp, £110. Datong rf clipper, £30. Pye U450L uhf fm base, £25. Vanguard, £10. Westminster W15AM, £30. VHF fm Ranger, £8. 46-el 70cm Multibeam, £8. 70cm 8/8, £4. 2m 14-el Parabeam, £10. Telomast 40ft cw rigging, £10. 30m UR67 coaxial, £5. Stolle memomatic rotator, £15. 8-el 2m beam, £5. 160–10m ssb/a.m./fm exciter, £20. 2m 6–40 linear, £10. Jaybeam portable mast, £3. G8GOT, QTHR. Tel Wakefield 58654.
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AEI CT52 miniature oscilloscope, leads, handbook, case, £25. 9·000MHz, 8·000MHz, new HC6U, £1.25. 1MHz and 100kHz B7G, £1. Beckman sub-miniature 10/15 turn duodials, £1. 10 turn pots, 1, 20, 50k, 75p. New capacitors, 1973, 15,000μF 40V 17A, £1.25. Meters, xtals, coaxial plugs and sockets. Carr extra. G8ENI, QTHR. Tel 0922 415374.
FT75 mobile tx/rx, 80–10m, 40W p.e.p., 15ch vxo or ext vfo, ac/dc psu, £160. FV50C vfo, £25. Standard C826 MC 2m 12ch fm tx/rx, £145. Westminster W15AM midband, 130–156MHz, £38. G4AFY, QTHR. Tel Kidderminster 63358.
Venus SS2 monitor, and C1 camera sstv with lens, perf cond, still in original box, with manuals, accept £330 pair, will not split, or exchange for TS700, FT221. G4BFS, 19 Manor Close, Aveley, South Ockendon, Essex.
Transverter, 28–30MHz to 144–146MHz, nearly comp, all parts, Microwave Modules converter, built into professional cabinet, similar Magnum 2, £40 ono. Sinclair 3000 stereo amp, exc cond, £18 ono. G8FIH, QTHR. Tel 0249 812047.
Liner 2 fitted preamp, mobile mount, mic etc, £90 or offer. Eddystone EC10 Mk1, £40 ono. Microwave Modules 70/2MHz converter, £12. Eddystone S640, offers. Buyer collects. G3YPP, QTHR.
Trio 9R59DS gen cov rx, £35. Buyer collects or can deliver reasonable distance. G4FIE. Tel Glen Parva 8705.

WANTED

Information re large wavemeter marked CLS4891D, and oscillator 375 S/S, range 7kHz to 12MHz with Muirhead dial, all costs paid, circuits returned etc. G3KDQ, 40 Oakwood Drive, Ravenshead, Nottingham.
Linear amp, gdo, antenna matching unit, any cond as long as wkg ok. 21MHz coil and circuit for HRO. Fyffe, 23 Mid Street, Kettlebridge, Fife.
FT200 with FP200, HW101, HW100. *For sale:* Liner 2 etc, see separate ad. G3XJS, QTHR. Tel 04947 2344.
Three to four bedroom house within eight miles radius of Stone, Staffs, approx £14,000, must be good vhf site. G8LCQ, 43 Meadow Close, Houghton-le-Spring, Tyne and Wear. Tel 0783 842350.
Information as to how one can receive satellite weather pictures on 625 line tv with tv conversion plans or converter design. Prepared to reward cash or in kind with info on space, gravitation, time, energy, magnetism. Correspondence on this subject invited from serious-minded, especially readers of B. L. Cathie's *Harmonic 695 and 33.* Observed shift on oscilloscope of locked audio signal backwards in time in vicinity of rapidly discharged large industrial equalisation condenser, could be magnetic flux upsetting time base, could be real time shift, any deep thinkers? H. Graepel, EI1DA, Kinsale, Irish Republic.
RTTY equipment, 2m fm tx/rx, TA33Jr. Dr G. V. Bulger, G3WIP, 58 Newick Road, London E5 0RR. Tel 01-985 1314 home, 01-539 5522 work.
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455kHz, or other frequency below 9MHz, ssb and cw or cw only mech or xtal filters, please give price and data inc bandwidths and impedances. GM4DQD, Zoar, Wadbister, Girlsta, Shetland Isles.
Collector-enthusiast trying to locate old radios made before 1933, mains or battery, books, magazines, valves before 1937, spkrs, good price paid for equipment in above average cond. C. Sawyer, 210 Gordon Avenue, Camberley, Surrey. Tel 0276 29460.

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Trio TX599 or T599S wanted urgently, must be wkg, preferably with manual and cables, good price paid for a good rig. R. J. Napper, 22 Rydal Drive, Hale Barns, Altrincham, Cheshire. Tel 061-980 4252.
Yaesu FR50B, mint cond. *For sale:* Brand new AVO model 8 Mk3 with leather case and 50A shunt, will exchange for FR50B or similar amateur bands rx. Letters only please. Steven Pocock, 57 Golden Avenue, East Preston, Sussex BN16 1QX.
Eddystone 888A or KW707 or similar amateur band rx. G8LND, QTHR. Tel Reading 733257.
Telford TC10, full details. G8HBO, QTHR. Tel 01-399 8196.
ATU, or loading coil and variable cap in box for top band. G4FAJ, QTHR. Tel 054 33 2169.
HF QRO linear, Collins or similar. Mobile linear 2m. Electronic key. Drake lp filter. Lightweight oscilloscope. Heavy duty rotator. Antenna switch. VHF manual. G3NZT, QTHR. Tel 044 83550.
Handbook and circuit of Serviscope by Telequipment, buy or borrow and copy. Desperate. G3XHC, QTHR.
BC348, BC342, state price and cond. Openshaw, 516 Walmersley Road, Bury, Lancs.
Manual, circuit or connection diagram Storno CQM13C, control box, cables, mic. Manual for SX24. G3LYU, QTHR. Tel Leicester 876459.
Drake T4X or T4X-B, top price offered depending on cond, no guarantee required, will buy comp Drake rig if not splitting, will collect, spot cash. G3TYY, QTHR.
Anyone interested in swopping oscilloscope for my Zenith E 35mm camera, tripod, daylight loader, and Mullard 3-3 tape amp, all exc cond, cash adjustment if necessary. A. Schiffman, 41 Benton Road, Ilford, Essex IG1 4AU. Tel 01-518 1562.
Three Carlisle amateurs require Heathkit RA1 manual or loan of same for copying if possible. G3ULY, QTHR.

Looking ahead

24 April—NRSA Convention, Belle Vue, Manchester.
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OMEGA

TE-701 Antenna Noise Bridge 2-30MHz	£23.50
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AR40	£48.94
CD44	£100.13
Ham II	£133.38
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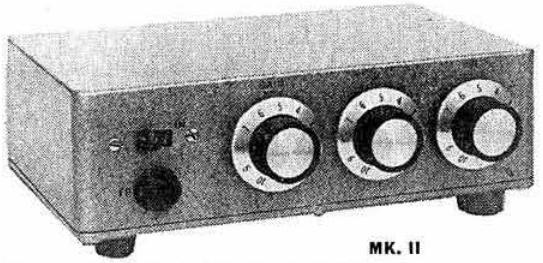

MK. II

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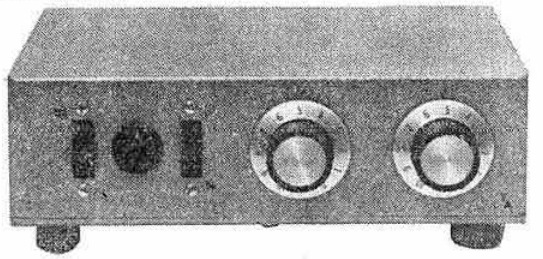

RX PEAK AND NOTCH FILTER ★ no gimmicks ★ all integrated circuits ★ will clear QRM in seconds ★ 1 watt o/p stage ★ headphone socket ★ goes between RX and loudspeaker ★ by-pass switch ★ notch-width control for optimum width of notch ★ tune control allows you to put the notch or peak where you want it ★ runs from internal PP9 battery or any supply from 9V to 15V ★ will also peak up CW signals. **£24.50** + VAT (12½%).

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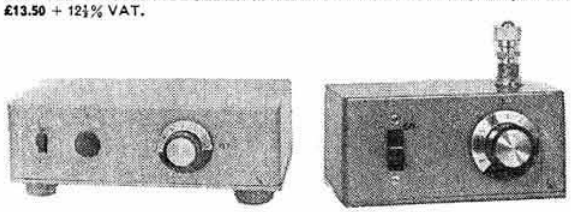

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