April 1978

radio communication

journal of the Radio Society of Great Britain

STROKE M ON THAMES

During an autumn holiday on the River Thames, G8ACN/M and G3DNQ/M cruised the area between Henley and Oxford and maintained contact with each other on 432MHz and with many amateurs in the Thames Valley on 144MHz. The photograph shows both boats moored at a rendezvous near Reading during the holiday; G8ACN/M on left and G3DNQ/M on right.

Photo: G3DNQ

NEW FROM Catronics

Introducing the most comprehensive R.T.T.Y. TERMINAL UNIT you can, or indeed need ever buy – the Catronics CT100

Inputs for:
Audio FSK signal in
Data in from V.D.U. (e.g. G3PLX)
TTY Keyboard or Tape Reader

Outputs for:
V.D.U. or other TTL compatible equipment
TTY Magnet – single or double current
AFSK to drive Transmitter

Featuring a unique digitally controlled **'Autoprint'** circuit which is a superior replacement for the 'Antispace' and 'Autostart' facilities found on some other terminal units. The terminal will ignore most CW and phone signals but will respond to a correct RTTY signal.

Tuning correctly into an RTTY signal is made simple with a single **'correctly tuned'** LED plus an additional **'Mark frequency'** indicator.

The FSK demodulator circuit utilises a special 'state-of-the-art' system to give excellent performance and stability at low cost. The demodulator is set to decode signals within 75Hz of nominal frequency i.e. 1200–1350Hz for space and 1370–1520Hz for mark, when in narrow shift position.

The teleprinter interface unit incorporates electronic 'de-bounce' circuitry to eliminate spurious switching from the Keyboard. The loop supply is protected by a separate fuse and is suitable for driving all single current and double current magnets known to be available.

Units are as follows:
CT100. Receive only RTTY Terminal Unit housed in attractively styled metal cabinet approx 9 by 7 by 2¾in with integral mains power supply. Input sockets for AFSK and TTL. Output sockets for TTL drive to VDU.
CT101. Hi-stability AFSK oscillator for transmission purposes. Output socket from oscillator suitable for driving high or low impedance microphone circuits.
CT102. Teleprinter interface unit. Input socket for Keyboard or Tape reader. Output socket for Printer Magnet.

Units may be combined, e.g. a complete terminal unit for reception and transmission with facilities for connection to Teleprinter is designed CT100/1/2.

Units CT101 and/or CT102 may be added to the basic unit CT100 by the customer at a later date if required.

VAT inclusive prices are as follows:

CT100/1/2 Complete Terminal Unit		**£88.00**
CT100 Receive only Unit		**£71.00**
	If ordered with CT100	If ordered separately
CT101 AFSK Oscillator	**£8.00**	**£12.30**
CT102 Teleprinter Interface	**£9.00**	**£13.70**

Plus delivery charge – **£3.00** (securicor)

AMATEUR RADIO BULK BUYING GROUP

G3PLX RTTY VIDEO DISPLAY UNIT

(April 1977 Rad Com)
Complete Kit (excluding modulator, keyboard and P.S.U.), **£77.15**
Set of printed circuit boards **£14.85.** Veroboards also available at **£4.30** each. Set of i.c.s including programmed 74188s, **£56.15**; 2513, **£8.50**; AY5-1013, **£6.25**; 2102–1, **£2.85**; SN74188, **£3.40** each or ready programmed **£8.20** per pair. 7MHz Xtal, **£2.85.**
Flashing cursor kit **£7.70.**
Diode Matrix kit **£11.50.**
NOTE regarding PROM program: The PCB's and programmed PROMs supplied by us make use of a slightly different program sequence resulting in different pin connections to those published in the 'Rad Com' article. Whilst constructors buying PROMs and PCBs from us will have no difficulty, those producing their own PCBs or having PROMs programmed elsewhere should note this important difference. A detailed modification sheet is available with the PCBs.

MULTIMODE 1600 TRANSCEIVER

Special price for complete kit, £215.00.
Receive only kit also available, £191.00.
PCB, **£10.50**; QC1246AX, **£31.50**; less carrier xtals, **£27.50**; XF9-E, **£33.75**; XF9-M, **£26.55**; 8545kHz Xtal, **£3.00**; 400ns delay line, **£1.50**; MD108, **£7.65**; RS12V Relay, **£2.25.**
MiniKit 1 (containing all the above) **£152.00.**
MiniKit 2 (semiconductors) **£54.50** or **£29.85** (receive only).
MiniKit 3 (R's and C's) **£19.55.**

VHF COMMUNICATIONS

JUST PUBLISHED

the WINTER 1977 edition
which includes articles on:

70cm FM Transceiver (Part 3)
Gain from Yagi Antennas
28/1296MHz Transverter
1296MHz Preamplifier
Modular ATV Transmitter
10GHz Transceiver (Part 3)

Send £1.25 for a copy of this edition or £4.50 for complete 1977 volume
Also 1978 subscription: £4.50

VHF COMMUNICATIONS is the English language edition of the German publication *UKW-BERICHTE*, a quarterly amateur radio magazine especially catering for vhf/uhf/shftechnology. It is published in spring, summer, autumn and winter.
All special components required for the construction of the described equipment, such as printed circuit boards, coil formers, semiconductors and crystals, as well as complete kits, are available for despatch direct from Germany. Many of the printed circuit boards, in addition to a few selected kits, are stocked in the UK. A price list of kits and materials is available – send SAE for your copy.
ORDERS TO: VHF COMMUNICATIONS AT ADDRESS BELOW

All prices include VAT but please add minimum of 30p for post and packing

DEPT. 804, COMMUNICATIONS HOUSE, 20 WALLINGTON SQUARE, WALLINGTON, SURREY SM6 8RG
Tel: 01-669 6700 Open 9am to 5.30pm Mon to Fri, 9am to 1pm Sat. Closed for lunch 12.45 to 1.45pm

Contributions **(including Members' Ads)** and all correspondence concerning the **content** of *Radio Communication* should be addressed to:

The Editor, RSGB,
88 Broomfield Road,
Chelmsford,
Essex CM1 1SS

Tel 0245 84938

Office hours: 0830-1630

Correspondence concerning the distribution of the journal and all other Society matters should be addressed to:

RSGB Headquarters,
35 Doughty St,
London WC1N 2AE

Tel 01-837 8688

Office hours: 0915-1715

radio communication

April 1978 Volume 54 No 4

CONTENTS

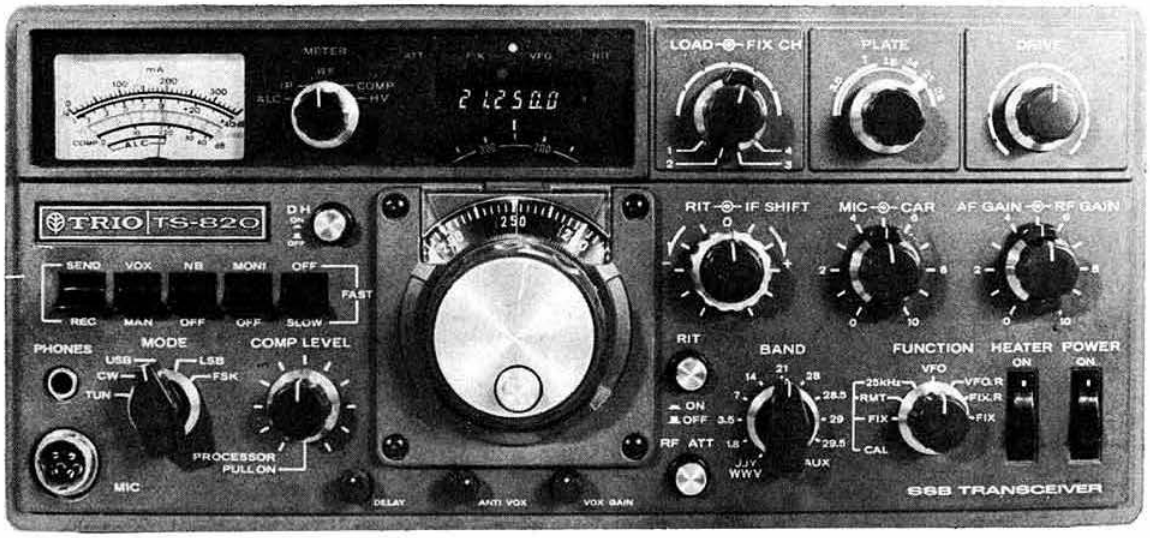
Radio Communication **is published by The Radio Society of Great Britain as its official journal on the first Thursday of each month and is sent free and post paid to all members of the Society**

ABC MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

20,286 copies per issue average circulation in 1977

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

TS 820



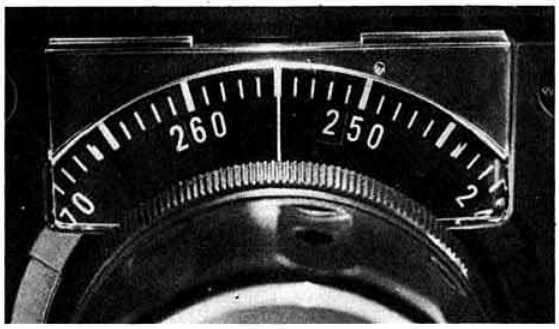
What makes the TS820 the finest HF transceiver available to the radio amateur? It's a unique combination of the unequalled design ability of Trio engineers together with their determination to make every function on the transceiver, both electrical and mechanical, perform at the highest level of perfection. That they have achieved their aim is amply demonstrated by the ever increasing demand for the TS820 all over the world.

The TS820 provides, in one package, a complete all band HF station with several design features which are exclusive to Trio and make this transceiver the leader in its field. Let's consider some of these more closely.

THE TUNING DIAL

Probably the most used control on any rig, but so often lacking in attention to detail. The common approach is to have two dials, one calibrated 0-100 KHz in 1KHz steps, the other 0-500 KHz in 100KHz steps. This means that the operator has to mentally add together two readings when trying to decide what frequency he is on.

Trio adopted a different system for the TS820 and the result is the twin disc monoscale dial.



This dial reads from 0-500 in 1KHz steps and as you can see from the photograph, is completely unambiguous—you know where you are all the time. This is Trio attention to detail.

PASSBAND TUNING SYSTEM

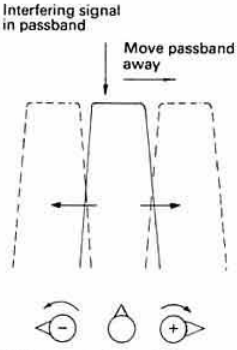
The insignificant little knob labelled "IF shift" on the front panel of the TS820, controls a system which is such a powerful operating aid in today's crowded bands that it has to be used to be appreciated.

In effect, the IF shift system gives the set operator the facility of moving the IF filter with its 8 pole selectivity, across the spectrum of signals appearing at the receiver mixer output, and it operates without changing the frequency to which the receiver is tuned. In practice, take the case of the VK3 who is S2 above the noise level and has just replied to your call. You have settled down to listen when I9XYZ comes up 2KHz away and splatters into your receiver passband—so just turn the IF shift knob to move the passband away from him, and there is your VK3 still readable whilst I9"!" vanishes.

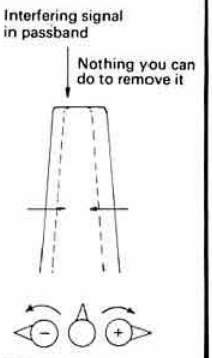
The facility also works with the CW filter fitted and it is then incredible, since you can tune the receiver to the middle of a bunch of stations and by turning the IF shift knob, pick them off one by one with no interference between stations.

This IF shift system is unique to Trio and must not be confused with "IF width" tuning using overlapping filters since this operates in a different fashion entirely. The "IF width" system gives the operator a basic filter bandwidth of, say, 2.5KHz for SSB and then allows him to mske this gradually narrower by double mixing an overlap filter in the IF. It has two snags, one in that you cannot move the IF passband away from an interfering signal and secondly, the overlap filter requires the use of two mixers in the IF chain which may degrade the IF performance—the TS820 of course is truly single conversion using only one fully balanced receive mixer.

Perhaps a couple of diagrams will help in understanding the two approaches.



I.F. SHIFT operates by retaining complete passband width but moving it so as to reject interfering signals



I.F. WIDTH operates by narrowing I.F. passband but remaining at same frequency. Little or no rejection of signals within passband.

DIGITAL READOUT SYSTEM

So often, the digital readout systems in transceivers do nothing more than count the VFO frequency and present this as the operating frequency—usually the counter reads 0-500 and the MHz digits are permanently wired to the bandswitch. It looks impressive but is usually inaccurate because it takes no account (a count?) oh never mind; of inaccuracies in heterodyne crystals or carrier oscillator frequencies. Let's face it, there's hardly any point in having readout to 100Hz if the only thing you have to set the readout against is the 100KHz calibrator in the receiver, but if you see a "CALIBRATE" knob associated with a digital readout unit, it's a sure sign of just such a system.

Trio, of course, did the job correctly, and in both the TS520S and TS820, the digital readout system measures all the oscillator frequencies used in the transceiver, does the calculations and presents you with your exact operating frequency regardless of band, mode, RIT shift or being on transmit or receive. It's again typical of the Trio attention to detail.

As a follow on to this point, consider what happens when you change modes in a transceiver. With the TS820, the carrier oscillator outputs are injected into the PLL system so that changing from USB to LSB does not change your operating frequency. In most other equipment, such a switch results in an operating frequency change of around 3KHz, and if in the same rig you have the simple so called digital readout system, that system will insist that you have remained on frequency when in fact you are yelling your head off 3KHz down the band.

From an ergonomic (lovely word that) standpoint, the TS820 panel layout further reflects the Trio care in design. You will notice that the controls are very sensibly arranged with AF and RF gain controls on concentric shafts as are the mic gain and carrier controls. Two more controls likely to be used together are the IF shift and RIT—so they're arranged to be together. It sounds simple in description but look at some rigs where the controls are arranged in seemingly haphazard fashion and you will see how difficult they could be to operate.

Whilst looking at the knobs, you might care to notice that Trio have provided, in addition to all band 160–10m coverage, an extra uncommitted band. This is to allow for the fact that at WARC, there may be additions or changes to the existing amateur bands. Looking ahead, the Trio design team made provision for this so there's no cause for concern if you own an 820 or 520S but it may be an idea to check on the bandswitch of the rig you just bought and figure out where that additional 18MHz band will go!!

Trio metering in the TS820 gives you a complete picture of station operation, including as it does, measurement of PA HT (how else can you calculate your power) and also compression level in dB so that you can set up the compression to suit your requirements, without relying on preset control settings and guesswork.

The fully variable, metered speech processor is a fast-acting low-distortion RF compressor as opposed to an IF clipping system which can introduce unacceptable loss of speech quality. Up to 40dB of compression is available without blowing the tops off the PA tubes.

As a further aid to setting up the rig, Trio include a monitor facility which samples the SSB signal from the transmit IF chain and demodulates it to allow you to check the quality of the transmitted signal.

When it comes to signal quality, Trio are the acknowledged leaders. The years of experience in the use of proper PA tubes (6146B in the 820) have given them this lead and the use of RF negative feedback around the PA and driver stages of the TS820 have made the already excellent intermodulation performance even better. If you want to check how a good signal should sound, just listen to a TS820, or a TS520 for that matter; don't simply take my word for it.

These notes give only a brief insight to the TS820 system. The entire transceiver is designed with extreme skill and only the TS820 can provide you with the best possible HF transceiver around today.

To complete the description of the TS820, we should also cover the ultra stable PLL system which gives single conversion on all bands, both in transmit or receive modes; the fully encapsulated VFO system; the automatic receiver audio bandwidth shaping to suit the mode in use; the true FSK system built into the rig with adjustable shift from 170-850Hz; the silent PA cooling fan; built in 25KHz calibrator; provision for extra bands and for fixed channel operation; the advanced noise blanker system; the switchable time constant AGC system; the "TUNE" facility that you can use all day without damage and no time limit; the front panel VOX controls; the digital hold facility; the provision of rear panel connectors for every possible use, including transverter, linear, phone patch etc etc.

ACCESSORIES

To complete the station, Trio offer a range of accessory units with design engineering to match the TS820 standards. The SP820 matching speaker unit is unique in having built-in high-pass and low-pass audio filter networks to assist you in digging out the last DXCC contact. The SP820 also has facilities for switching between two rigs so that you can make use of the speaker with your standby receiver or your VHF rig.

Finally, the specification which anyone can check at any time—these figures are correct and typical of any TS820. Let's face it, most of the leading DX operators and discerning amateurs are now using the TS820 Why not join the club and find out about Trio quality and engineering?

SPECIFICATIONS

Frequency Range	160 meter band 1.8 to 2.0 MHz
	80 meter band 3.5 to 4.0 MHz
	40 meter band 7.0 to 7.5 MHz
	20 meter band 14.0 to 14.5 MHz
	15 meter band 21.0 to 21.5 MHz
	10 meter band 28.0 to 28.5 MHz
	28.5 to 29.0 MHz
	29.0 to 29.5 MHz
	29.5 to 30.0 MHz
	WWV 15.0 MHz (receive only)
	A U X band uncommitted
Mode	CW, USB, LSB, FSK
RF Input Power	SSB: 200 watts PEP
	CW: 160 watts DC
	FSK: 100 watts DC
Antenna Impedance	50 to 75 ohms, unbalanced
Carrier Suppression	better than 40 dB (Mod. freq. at 1.5 kHz)
Sideband Suppression	better than 50 dB (Mod. freq. at 1.5 kHz)
Receiving Sensitivity	0.2 μV for 10 dB S + N:N or better
Image Ratio	160 to 15 meter band: better than 60 dB
	10 meter band: better than 50 dB
IF Rejection	better than 80 dB
Frequency Stability	Within ±1 kHz during one hour after one minute of warm-up, and within 100 Hz during 30 minute period thereafter
Receiving Selectivity	SSB: 2.4kHz (–6dB)/4.4 kHz (–60dB)
	CW: 0.5 kHz (–6 dB)/1.5kHz (–60 dB)*
	*) with optional CW filter
AF Output Power	More than 1.5 watts into 8 ohms
Audio Output Impedance	4 to 16 ohms (speaker or headphone)
Tube and Semiconductors	3 tubes, 5 ICs, 30 FETs, 74 transistors, 165 diodes
Power Requirements	120/220 VAC, 50/60 Hz or 12–13.8 VDC (with optional Power Converter DS-1)
Power Consumption	Transmit: 280 watts, Receive: 26 watts
Dimensions (W × H × D)	333 × 153 × 335 mm
Weight	16kg

The AT200 aerial tuner is, as you can see from the photograph, a comprehensive control centre incorporating not only wide range matching networks for 160-10 metres but also in line power metering, SWR measurement facilities and switching for up to three aerials, any or all of which can either pass through the matching section or be connected directly to the rig. The AT200 is of course suited to any rig but matches the TS820 and 520 series equipment in size and style.

SP820 £36 inc. VAT

AT200 £86 inc. VAT

SEE THE TS820 AT ANY OF THE BRANCHES LISTED BELOW

LOWE ELECTRONICS LIMITED

HEAD OFFICE:
119 Cavendish Road, Matlock, Derbyshire. Tue-Sat. 9am-5.30pm. Telephone: 0629 2430 or 2817 9am-9pm. Telex 377482.

BRANCHES:
Communications House, 20 Wallington Square, Wallington, Surrey, SM6 8RG. Telephone: 01 669 6700—closed Saturday afternoons.
27 Cookridge Street, Leeds, Yorkshire, LE2 3AG. Telephone: 0532 452657
Soho House, 362-364 Soho Road, Handsworth, Birmingham B21 9QL. Telephone: 021 554 0708—closed Mondays.

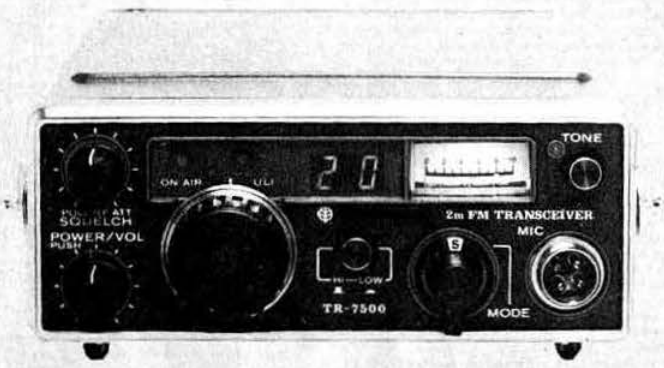
AGENTS:
John—G3JYG, 16 Harvard Road, Ringmer, Lewes, Sussex. Telephone: Ringmer 812071 (evenings and weekends)
Sim—GM3SAN, 19 Ellismuir Road, Baillieston, Nr Glasgow. Telephone: 041 771 0364 (evenings and weekends)
Alan—GW3YSA, 36 Pen Y Waun, Efail Isaf, Nr Pontypridd, Glamorgan. Telephone: Newton Llantwit 3809 (evenings and weekends).

FOR FULL CATALOGUE AND ANTENNA BOOK SEND 50p IN STAMPS

LOWE ELECTRONICS LTD

TR-7500

Why settle for anything less?



The TR7500 is the very latest 2 metre FM mobile to be introduced by TRIO and will delight the owner with its combination of performance, reliability and unique design. It represents another step forward in the TRIO product line and is designed to give you the very best FM transceiver available in its class.

Whatever you now own, or may have been thinking of buying, it would be foolish to settle for anything less than the TR7500.

PLL Synthesiser. no crystals to buy, ever, with the TR7500 since the operating frequencies are generated by a TRIO designed LSI phase locked synthesiser. This provides 80 FM channels at 25 KHz spacing from 144-146 MHz, all 10 repeater and reverse repeater channels. The channels are selected by a single knob and *no programming is required from the user*—just unpack the rig, connect 12 volts dc and you are on the air.

Unique display

TRIO attention to detail at its very best is shown in the method used to display the channel number. TRIO believe that ease of use is the priority consideration, and have arranged the large LED display to show the correct channel number at all times. If you want to operate on S24, turn the channel knob until the display shows 24—simple isn't it? Need R7? Turn the knob until the display shows 7. There's no need to wonder "did I programme S24 into channel 15 or channel 9?"

Repeater operation

Available at the touch of a front panel switch. Turn this to "N" (normal) and you operate normal repeater with 600 KHz receiver up-shift. If you wish to listen on the input, turn the switch to "S" (Simplex), and you are there — and can operate simplex on the input frequency. Need reverse repeater? Turn the switch to "R" (reverse) and you operate with transmit up-shift of 600 KHz. This facility is most useful when you hear several stations calling into a repeater with only one (of course) appearing at the output. Using reverse repeater operation you can call into the pack to invite anyone to a simplex channel for direct QSO.

Automatic tone burst is provided, with a front panel LED to remind you that you have the tone burst on. Needless to say, the 1750Hz is generated by TRIO's unique tuning fork oscillator which guarantees spot on frequency at all times and in all temperatures.

Performance plus

A combination of multi section helical filtering at signal frequency, monolithic crystal filters at 10.7 MHz, and sharp multi pole filters at 455 KHz allows the TR7500 to keep on working under strong adjacent signal conditions when other rigs give up.

The receiver performance for sensitivity is excellent. On the samples checked so far, we obtain 12dB SINAD for a startling 0·18 microvolts and under mobile conditions, we copy repeaters in terrain which previously presented real signal problems.

The transmitter generates a true FM signal at 10·7 MHz which is translated directly to two metres in a fully balanced mixer system. This guarantees a superbly clean signal with no unwanted multiplier products, and an all new PA system with specially developed transistors, gives rugged reliable power in excess of 10 watts.

As a final test for freedom from unwanted in band signals, we ran the TR7500 at full output with a TS700G coupled to it on the bench. Tuning from 144-146 MHz on the TS700G, we found just one signal—the wanted one. It was impossible to find a single unwanted signal coming out of the TR7500 under these extremely severe conditions. Wideband checks using the analyser revealed no spurious outputs detectable above noise level. At this point we retired happy!

Attention to detail

As is well known, TRIO introduced the since copied variable power SWR protection system, and it is of course fitted to the TR7500 with an improved high gain dc amplifier for tighter and faster control.

High/low band change is by push button, with S-meter illumination colour change to remind you of the band in use.

Another simple but typically TRIO thoughtful provision is the special channel knob with a deep moulded indent at S0. You can set this vertical by touch alone and can then count up the channels without even seeing the channel display. Great when mobile and you need you eyes on the road.

Finally the TR7500 with all its potent performance is packaged in a case not much bigger than a TR2200GX!

Accessories

The TR7500 is supplied complete and ready to use with TRIO quick release mobile mount, microphone, power leads, comprehensive manual etc. etc. Nothing more to buy to own the best mobile/fixed station FM rig on the market.

TR7500 £225 inc. VAT
DON'T SETTLE FOR ANYTHING LESS

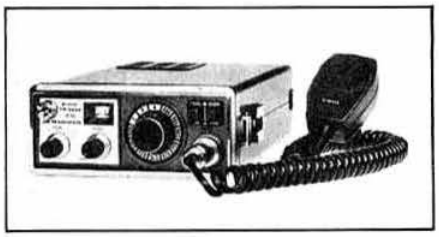
Noticed some smart remarks about "CB operators" and logbook entries last month; but when Joe says "lets try S17", can you remember what frequency that is? CQ one four five point four two five, craaazy man. As for log books, it's time to waken up fellas, you only need to show "band in use", not frequency. You know it makes sense (as someone once said).

LOWE ELECTRONICS LTD

TS700G £426 inc. VAT (also including the matching VOX-3)

Say what you will, the TS700G set the standard for all other 2 metre all mode transceivers. A very high standard which has yet to be surpassed. Full 2 metre coverage, VFO or 22 crystal channels, all mode operation AM, FM, USB, LSB and CW. Mains or battery supply. Normal and reverse repeater facilities at the turn of a switch. Trio exclusive tuning fork access tone generator with fully auto tone burst. Best quality signal on the band thanks to TRIO design excellence in low intermod amplifiers. It's simply the best rig that you can buy, and it's backed by the combined reputations of TRIO and Lowe Electronics.

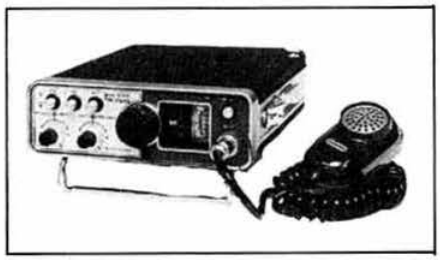
15 Watts output; 0·25 microvolt sensitivity; first class strong signal handling receiver; European standard selectivity. If you haven't yet handled the TS700G, rush to one of our branches and be prepared to be impressed. Send for full details now.



TR2200GX £139 (3 ch.) £169 (12 ch.) inc. VAT

This is the definitive 2 metre FM portable rig which has won praise from all over the world. Over 2W transmitter output with switched reduction to 400mW for local contacts. High gain receiver with double IF filtering at 10·7MHz and 455kHz for razor sharp selectivity.

The TR2200GX is supplied with all accessories including the battery charger for the optional Nicad battery pack, the removable telescopic antenna, the carrying case, the shoulder strap, external power lead, microphone and handbook. Fitted with 12 channels, the price is only **£160** inc. VAT. If you wish to start out at a lower price, we can supply the rig fitted 3 channels for only **£130**. With all its performance, the TR2200GX is a must for the portable operator. At the price, it has to be the best around. Just look around at the next rally and see how many operators are carrying them. Also available are a mobile mounting bracket at **£9.70**, a matching 10 Watt amplifier for **£45** and a flexible antenna. Send for full details now.

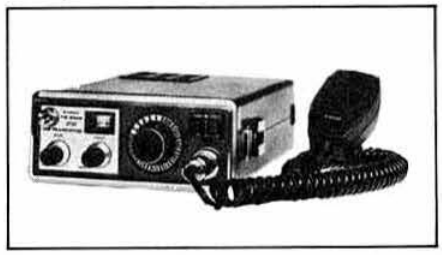


TR7010 £189 inc. VAT

Work real DX with ease on 2 metre SSB and CW. The TR7010 combines a high performance receiver with a 10 Watt transmitter and provides mobile or fixed station capability at low cost. Supplied ready to operate from 144·1–144·34MHz, the TR7010 covers all CW, SSB and beacon activity. 48 channels with 5kHz spacing plus VXO and RIT provide continuous coverage. Operation in any other part of the 2 metre band can be carried out by a simple crystal change and no re-alignment is required.

Single conversion using an IF of 10·7MHz with a first class crystal filter gives outstanding selectivity. Wide range amplified AGC and newly developed FET devices in the RF and mixer stages allow maximum sensitivity to be used with freedom from overload due to adjacent signals. The single conversion transmitter using fully balanced mixers generates a beautifully clean signal with crisp audio quality.

Join the SSB gang and work real DX for **£189**. Send for full details now.



TR3200 £182 inc. VAT

The newest FM handy transceiver from the ever expanding TRIO range. Superb performance for the 70cm operator with all the advantages of portability and TRIO reliability. 12 channel capability in the range 432–436MHz with three channels fitted (SU8, 18, 20). Transmitter output switched 2W/400mW and incorporating the exclusive TRIO 1750Hz tuning fork access tone generator (does that mean you can ring for credit?) High gain 5/8 wave antenna for enhanced performance on transmit and receive. Supplied complete with all accessories as for the TR2200GX and including the all important battery charger.

We have just received the first shipment of the VB3200 10W amplifier for the TR3200. Rather more complex than the VB2200, the VB3200 also includes a switchable receive preamplifier. Price . . . **£95** inc. VAT. Send for details now.

TRIO PRICES—ALL OUR PRICES INCLUDE VAT (12½%) WE DO NOT SEEK TO DECEIVE

TS820	£645.00		
VFO820	£112.00	TS700S	£542.00
DG1	£127.00	VFO700S	£83.00
SP820	£36.00	TR7010	£189.00
TS520S	£489.00	PS5	£58.00
DS1a	£40.00	TR7200G	£189.00
VFO520S	£94.00	VFO 30G★ON OFFER★	
SP520	£19.00	TR7400A	£329.00
DG5	£132.00	TR7500	£225.00
TS700G	£426.00	TR2200GX (3CH)	
SP70	£18.00		£139.00

TR2200GX (12CH)			
	£169.00	T599S	£383.00
RA1	£6.30	S599	£18.00
MB1a	£9.70	TL922	£697.50
VB2200GX	£45.00	HC2	£14.88
PS1200	£29.50	MC10	£9.00
TR8300	£227.00	MC50	£25.00
TR3200	£182.00	LF30A	£17.00
VB3200	£95.62	BPF2A	£27.75
R300	£184.50	PS6	£57.00
R599D	£403.00	AT200	£86.00

OTHER THINGS

Complete ranges of J-Beam . Microwave Modules . G Whip . Hy Gain . Rotators. Too much to mention. Why not simply send 50p in stamps and request our full catalogue and antenna book?

LOWE ELECTRONICS LTD 119 CAVENDISH ROAD MATLOCK DERBYSHIRE

Communications Ltd

OF PROFESSIONAL EXPERIENCE

YAESU

FT221R

VHF – SSB? – FM? – CW? – AM?
SMC – FOR CHOICE

THF FT221R MULTI MODE FROM YAESU

The FT221R. The multimode USB, LSB, AM, FM, CW (with semi-break in and side tone), 2m transceiver offering the choice of phase locked VFO or 44 crystal channels, simplex or repeater (600Hz up and down shifts), with unique "double push" auto tone burst, mains or 12v (3A) operation, excellent selectivity SSB 2·4kHz (1·7:SF) or FM 12kHz. Front panel adjustable VOX and mic gain, a calibrator (1MHz – 10), 1kHz readout and linearity, sensitive squelch, clarifier with IRT and IRT with ITT (makes FSK easy), switchable "S" and centre zero tuning meter, noise blanker, serviceable plug in boards all contained in 11½" (14") × 5" × 11½", 22lb rigid package. 600kHz and 1·6MHz shifts over 4MHz.

FT221R £357 + VAT YC221 £72.50 + VAT MANUAL £9.00

SCANNING DIGITAL II from KYOKUTO

DIGITAL II £235 SCANNER £49.50 (+ VAT 12½%)

The Digital II offers complete 5kHz step coverage across two metres 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 six seven-segment LEDs.

Selectable 10 or 1W output for simplex or duplex (up and down shifts), across 144–146 (RX to 149MHz) from a tiny 6½" × 2" × 7½". Easily underdash mounted with the supplied mounting bracket, or slipped in place of the broadcast wireless.

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

FOR VHF MOBILE THE FT227R FROM YAESU Ex STOCK £172 + VAT

The new FT227R uses a "single knob" tuned digital synthesizer employing a photoelectric sensor or an optical coupled system which eliminates both noisy, unreliable rotary switches, and crystal banks.

Full coverage of 2 metres in 5kHz divisions with a ±600kHz shift plus a memory feature which permits recall of any entered frequency or particular offset.

Bright large, digital readout gives unequivocable readout of the frequency in use. The receiver offers 0·3µV (for 20dB S + N/N) sensitivity into a ±6kHz (at 6dB) bandwidth whilst maintaining a remarkable immunity to overload and image problems. The 20W DC input transmitter features Hi/Low power outputs, AFP tone burst on repeaters and an out of band inhibition trip, etc.

FT227R

KYOKUTO DENSHI SCANNING FM2015R

The 2015 transceives across 144–146 (RX to 149) MHz in 5kHz steps tuned by coaxial switch stopped at 0 and 9.

A major feature is the four-channel RAM memory (with an internal Ni Cad back up) which may be programmed direct from the front panel by simply dialling in a frequency, no screw drivers, no soldering irons, no fuss. Frequencies can be recalled from the memory instantly or they may be scanned in either of two modes:—searching for a vacant or an occupied channel, five split (including + and −600kHz) for repeater or transvertor (even triplevertor) use. Multipurpose tone burst, RIT (centre off with "click"), modular constructions, centre zero meter, accessory socket, mounting bracket, microphone etc., are all provided. The sensitive receiver is varicap tuned by the DC level of the PLL. IFs of 16·9MHz and 455kHz provide high image rejection and good shape factor 2:1 at 70dB (12kHz BW). In the transmitter, modulation is applied directly to the VCO (for the ultimate in fidelity), auto power control and varicap tuning keeps power output constant at band edges and spurii way down. **Ex-STOCK. £245 + VAT (12½%).**

VHF HANDHELD

KEN KP202 TRANSCEIVER (+VAT Price)
144MHz, FM, 2W of RF and ½W of audio. Immunity to breakthrough.
Performance to rival all walkie-talkies and many a mobile set.
C/w F plug, leather handle/whip case and telescopic whip.
Fitted six channels S20 and S21 plus choice from S (21, 23, 24, 0)

R (3, 4, 5, 6, 7)	£114.50
R channel only crystal tone burst	£10.00
Flexible stubby antenna	£5.95
Case	£4.95
F to UHF adaptor	£1.65
Nicads	£9.00
Base charger KCP2	£12.75

MASTER CHARGE
BANK OF AMERICA
INTERBANK
VISA CARD

CARD NUMBERS ACCEPTED FOR NO-VAT EXPORT

VHF Monitor Receiver

SEIWA MR2 AND MS2 (+VAT prices)
Ideal for the SWL, the YL or even the XYL as the monitor receiver to keep you in touch. Tiny (2½" × 1½" × 4½") and light (8oz) slip into your pocket or onto your belt with the optional case. Sensitive double conversion superhet with 12kHz band width, auto squelch, and generous audio output c/w Nicads, Mains Charger, Earpiece, Antenna.

MR2(4) 70MHz 12 switched channels	£53.00
MRS 144MHz 12 switched channels	£53.00
MS2 144MHz 4 scanning channels	£62.00
Leather Case £1.90	Crystals each £2.00

NEW UHF FM AND VHF AM MODELS NOW AVAILABLE. SAE FOR DETAILS.

MS2

Please turn over for a small selection of aerials and accessories

Access

S.M.C. (Jack Tweedy) LTD
Roger Baines, G3YBO
79 Chatsworth Rd,
Chesterfield, Derbyshire
Chesterfield (0246) 34982
9-5 Tues-Sat

NORTHERN (LEEDS) BRANCH
The Chambers, No. 3 The Parade
North Lane, Headingley, Leeds
Tel: Leeds (0532) 782326
Open 9-5pm Tues-Saturday 9-8pm Thurs.

S.M.C. (Jack Tweedy) LTD
Jack Tweedy, G3ZY
Ham Shack, Roughton Lane,
Woodhall Spa. Lincolnshire
Woodhall Spa (0526) 52793
9-5 Tues-Sat (+ appt)

BARCLAYCARD VISA

NEW! ACTIVE RECEIVING ANTENNA

A COMPACT INDOOR ACTIVE DIPOLE FOR 60kHz to 70Mhz

MODEL AD170 Continuing our policy of constructive innovation we are proud to introduce what we think is the first broadband active dipole antenna at a price which puts it within easy reach of the Radio Amateur or short wave listener.
The Datong Active Antenna is designed for indoor mounting only but in all electrical respects it is in the same league as the active antennas the professionals use, and for which they pay prices comparable to a complete amateur bands transceiver.
The same performance advantages which make active antennas attractive to professionals make Model AD170 especially attractive to the amateur. They include:

- ★ Ultra broadband coverage from 60kHz to 70MHz.
- ★ Ideal for remote mounting (e.g. loft or attic) since no tuning adjustments are required.
- ★ Only 3 metres long yet signal-to-noise ratios in the LF and HF ranges are comparable to those from much larger conventional antennas.
- ★ Uniform sensitivity over the full frequency range minimise receiver intermodulation effects.
- ★ Balanced dipole configuration gives choice of polarisation plus useful directivity and eliminates dependence on ground plane or earth connection.
- ★ No need for expensive accessories such as antenna tuner units or matching units.

Although active antennas give lower signal strengths than conventional antennas, received noise levels are also lower and therefore signal-to-noise ratios are comparable when used with modern sensitive receivers.

Model AD170 is supplied fitted with PL259 coaxial output plug and complete with the accessories shown in the illustration, i.e. interface unit, head unit, 4 metre coaxial connecting cable (extendable if necessary), two 1·5 metre dipole elements, spare jack plug. A separate DC power supply is required (12v, at 80mA) and this plugs into the interface box and feeds the antenna via the coaxial cable. A suitable mains power unit is our new Model MPU. **(See special package price below.)**

FREQUENCY-AGILE AUDIO FILTER MODEL FL1

A versatile bandpass or band-reject filter with fully variable bandwidth and centre frequency plus unique search /lock/track capability for automatic removal of heterodyne whistles. Improves reception of CW, RTTY, and SSB. Connects between receiver and loudspeaker.

RF SPEECH CLIPPER MODEL RFC

Processes speech as a SSB signal at 60kHz to increase its ratio of average to peak levels without adding harmonic distortion. Improves talk power of SSB, FM, and AM transmitters without increasing the peak transmitted power. Connects between microphone and transmitter. (See articles by Dr D. A. Tong, Wireless World, Feb. 1975, 79–82 and Oct. 1976, 77–81).

UP-CONVERTER MODEL UC/1

Adds full receiving coverage from 90kHz to 30MHz to existing receivers or transceivers tuning 28–29MHz or 144–145MHz. The full range is covered in 30 1MHz wide synthesiser controlled segments. Also works as a two-metre converter. Connects between receiver and antenna.

MAINS POWER UNITS MODELS MPU & MPU/1

Good quality mains adaptors designed and made in the UK specifically for use with our products. The unstabilised output is suitable for Models FL1, AD170 and UC/1 when using 240v AC mains and for FL1 and AD170 when using 220v AC mains. MPU has a built-in 13 amp fused mains plug while MPU/1 has an 18 inch long mains lead.
When ordering please specify whether output plug is required to suit FL1, AD170, or UC/1.

PRICES: (NOT INCLUDING VAT): AD170 **£29.50**, MPU and MPU/1 **£5.50**, AD170 + MPU or MPU/1 special package price **£33.00**. FLI **£53.00**. UC/I **£105.00**. RFC **£40.00**, RFC/M **£21.50** (PCB version of RFC).
All prices are subject to VAT at 12½%. Prices include delivery within UK. More data on any product plus complete price list showing accessory leads, etc, available on request.

DATONG ELECTRONICS LIMITED

Spence Mills. Mill Lane, Bramley, Leeds LS13 3HL Tel: Pudsey (0532) 552461.

PAUL
G3VJF

ICOM **FOR QUALITY**

OFFER A SUPERB RANGE OF TRANSCEIVERS FOR THE SPRING

Apart from the IC-701 all are available ex-stock and delivery is free

IC-240 Think of the features you would instal in a mobile to provide a combination of optimum usefulness AND SAFETY. You will probably come up with the following requirements:

1 Easy channel selection with minimum knob twiddling—yet with all the normal FM channels available.
2 A fully automatic tone burst which operates only in repeat mode with NO buttons to press either on the front or on the back of the set.
3 Instant reverse repeat at the flick of a switch without any re-tuning or memory programming.
4 A very sensitive receiver with a spurious response performance far better than the average and a very clean transmitter with excellent clear, crisp modulation. (We measured a sensitivity of 0·1μv pd for 10dB sinad).
5 A reasonable price—but (more important) a quick, reliable after sales service.

COMPARE THIS LIST WITH PREVIOUS ADS FOR VARIOUS TRANSCEIVERS AND YOU WILL SEE THAT THE 240 WINS EVERY TIME:

IC-240

alone £179 inc. VAT

SUPERSCAN £77.63 inc. VAT (fitting £6.00 extra)

IC-202

£162 inc. VAT

◀**IC-202**

IC202 The 2m SSB/CW portable which is clean enough to use as a prime mover to drive a linear. The VXO gives continuous coverage over the ranges 144·0-144·2 and 144·2–144·4. The coverage can be extended with extra crystals switchable from the front panel. This is the ideal set to buy if you are thinking of sampling the delights and advantages of SSB on 2m as it gives full coverage of the SSB and CW portions of the band with easy, continuous tuning.
Now available ex stock, delivered free for **£162 inc VAT.**

IC-215 ▶

IC-215 By far the best 2m FM portable on the market—with more power (3W) than most and batteries some 4 times as big thus giving a reasonable period of operating use. Add to this the superb, clear modulation for which ICOM are so famous and a good receiver, plus a solid, reliable construction and you have really good value for money.
Total channel capacity = 15
Channels fitted = 9(S20, S22, R3, R4, R5, R6, R7, R8, R9)

Now available at the special offer price of **£149 inc VAT and delivery.**

IC-215

£149 inc. VAT and delivery

AGENTS (PHONE FIRST—All evenings only except Norfolk and Burnley)
London—Terry G8BAM (01-556 9366) **Scotland**—Ian GM8DOX (078683-3223) **Norfolk**—Ted G3FEW (05088 632) **Wales**—Tony GW3FKO (0222 702982) **Burnley**—(0282 34841) **Midlands**—Tony G8AVH (021 329 2305) **North West**—Gordon G3LEQ (Knutsford (0565) 4040) **SHOP: Thanet Northern**, Wombwell, Barnsley, S. Yorks, (0226) 756229

H.P. TERMS AVAILABLE

FOR ALL MAIL ORDERS AND SALES DURING BUSINESS HOURS

YOUR SOLE AUTHORISED UK IMPORTER FOR ICOM

Access

THANET ELECTRONICS

143 Reculver Road, Beltinge, Herne Bay, Kent (02273 63859)

Access

THANET FOR SERVICE

DAVE G4ELP

WITH THE TECHNICAL KNOWLEDGE AND EQUIPMENT TO SERVICE THEM PROPERLY BOTH BEFORE AND AFTER SALES

IC-211E ▼

£529

Giving you FM/CW/USB/LSB, all produced from the amazing ICOM synthesizer and patent LSI chip. Frequency read out is to the nearest 100Hz and it is amazingly stable and accurate. You can use the two frequency stores as separate VFOs or for any repeater shift required. The tone burst is automatic, of course, and reverse repeat is available at the flick of a switch. Add a keypad (we will give you the circuit to make your own or you will be able to buy one shortly) and find a new facility which is quite impossible with old-fashioned rigs. The original waiting list has now been dealt with and you can now have one from stock.

IC-245E £396▲

This truly amazing little box gets you mobile on FM, USB or (if you really think it a good idea) CW! The synthesizer is the same as the IC-211E and can be tuned to the nearest 100Hz, again with amazing accuracy. Of course such a versatile little box will often be used as a base station and facilities such as keypad operation can be added. They are now ex-stock—but only just!

IC-701

◄ Introducing "SLIM JIM" SJ2

144–146MHz—High efficiency 2 metre omni-directional vertical

An omni-directional 2 metre aerial developed by T & T from a design by F. C. Judd (G2BCX). Derived from the "J" the SJ2 is a free space aerial with *better than 50% greater efficiency than conventional ground plane types due to the very low angle radiation field.* The aerial is slim and compact (58 inches long) and as there are no radials it is unobtrusive and has low wind resistance. Supplied complete with mast clamp. **£15.50** inc. VAT (carriage £1.00).

The HF rig to beat them all, which will be available shortly to those who have their names on the list. ★All solid state including the finals. ★100W RF output Continuous Duty on All Bands, All Modes. ★All bands 1·8–30MHz. ★USB, LSB, CW, CW (narrow), RTTY. ★Double balanced Schottky Diode mixer used in both Tx and Rx. ★Fully synthesized with Digital readout to 100Hz and two stores to enable split frequency operation. ★ICOM's unique band-pass tune. ★VOX, Semi-break-in CW, RIT, AGC, Noise Blanker. ★Built-in RF speech processor. ★Extremely compact. ★All filters built in. ★12V or mains operation. ★Electret desk mic due in at the end of April.
After having used this rig for several weeks on the air we think that it is definitely the nicest HF rig we have ever used.

INTRODUCING A NEW RANGE OF MICROPHONES BY LESON. For the time being available only from Herne Bay.
All these are suitable for ICOM transceivers and have a PTT switch and a frequency response 300–2500Hz. They are NOT fitted with a plug.

MODEL	TYPE	BUILT-IN AMPLIFIER	IMPEDANCE	PRICE (inc VAT)
TW232	Ceramic Desk mic with PTT, Lock sw and gain cont. Silver grey finish	Compression amp 0–30dB var.	<4·5K	£25.00
DH-218	Moving coil dynamic. Hand held	NONE	500Ω	£4.99
DH-233	Moving coil dynamic. Hand held	Pre-amp 0–15dB var.	<3·5K	£9.00
CH-229	Ceramic noise cancelling. Hand held	Compression amp 0–35dB var.	<5K	£15.00

Post and packing **50p** in all cases. Gain controls are external in all cases

DURING THE EVENINGS AND AT WEEKENDS WHEN CALLS ARE CHEAP, WHY NOT USE OUR ANSAFONE TO RECORD YOUR REQUESTS FOR DATA, ETC. (02273) 63850

AMATEUR ELECTRONICS UK

HERE'S A VIEW OF OUR TOTAL FRONTAGE INCLUDING DELIVERY BAY AND STORES AND BELOW WE'D LIKE TO SPELL OUT A FEW FACTS ABOUT OUR ORGANISATION—

Ken Perfect G3FIK

FACT ● LARGEST SPECIALIST RETAIL STORE IN THE COUNTRY

FACT ● WIDEST RANGE OF TOP-NAME PRODUCTS AVAILABLE TODAY

FACT ● LARGEST STOCKS OF DIRECT AGENCY PRODUCTS

FACT ● BEST DEMONSTRATION FACILITIES

FACT ● FASTEST ATTENTION TO ORDERS/ENQUIRIES

FACT ● TOP AFTER-SALES SERVICE

FACT ● THE BEST DEAL IN THE BUSINESS—ONLY WE AS DIRECT IMPORTERS CAN OFFER YOU ALL THESE ADVANTAGES

Hours: 9.30-5.30 Continuous including Saturdays—Early closing Wednesday, 1 p.m.

HOW TO REACH US (EASY PRIVATE PARKING ON OUR 70ft. FORECOURT)

FROM SOUTH AND EAST. We are located approximately two miles from Junction 5 of the M6 from which follow signposts to Birmingham. Within ½ mile turn right at Clock Garage and proceed towards city. After one mile look for traffic lights at Fox & Goose and immediately over the lights take minor left fork into Alum Rock Road. We are located one mile from this point.
FROM NORTH. Leave M6 at Junction 6 (Spaghetti) and follow left fork down to traffic island beneath motorway complex. Take third turning off to Lichfield. One mile further on follow A4040 to the right and within 100 yds. vere again to the right, approximately one mile further on brings you to the Fox & Goose. Turn right and see preceding directions.
FROM THE WEST AND SOUTH/WEST. Follow M5 then M6 to Spaghetti Junction (see above). Alternatively, leave M5 at junction 4 or 3 and proceed to inner ring road. Turn South on ring road and leave on A47 (East). We are located three miles from this point.

AMATEUR ELECTRONICS UK

NUMBER ONE FOR YAESU MUSEN!

THE SUPERB
FT-221R
2 METRE TRANSCEIVER

STILL LEADS THE FIELD IN MULTI-MODE RIGS AS DOES THE FT-227R ON THE MOBILE SCENE.

ONCE AGAIN YAESU MUSEN WIN BOTH ON PERFORMANCE & VALUE-FOR-MONEY
SO WHATEVER YOUR AMATEUR RADIO INTEREST YAESU HAVE THE ANSWER—
NO ADVERTISEMENT CAN TELL THE FULL YAESU STORY SO WHY NOT TAKE ADVANTAGE OF OUR OFFER BELOW & GET THE LATEST YAESU CATALOGUE?

£2.50 FOR 25 PENCE!! 25 pence brings the latest Yaesu catalogue with our Credit Voucher for £2.50. A couple of stamps obtains the FT-227R, SWAN or ATLAS leaflets, used equipment list, or Digitex D110 Broadsheet.

MAIN AGENT

ATLAS RADIO INC.

FIXED STATION
OR MOBILE—
THE 210X & 215X
MAKE CROWDED HF
BANDS OPERATION EASY!

BRANCH: AMATEUR ELECTRONICS, UK—COASTAL, CLIFTONVILLE, KENT, KEN McINNES, G3FTE, THANET (0843) 291297. 9 a.m.-10.30 p.m.
BRANCH: AMATEUR ELECTRONICS UK-SCOTLAND, 287 MAIN STREET, WISHAW, LANARKSHIRE, GORDON McCALLUM, GM3UCI. TELEPHONE WISHAW 71382. (EVENINGS CARLUKE 70914)
AGENT: WALES & WEST—ROSS CLARE, GW3NWS, CAERLEON, NEWPORT. (CAERLEON 422232)—ONLY 20 MINUTES OVER THE SEVERN BRIDGE.

G3FIK

508-514 ALUM ROCK ROAD
BIRMINGHAM 8
021-327 1497
Telex 337045 6313

YAESU
proudly announces
1980's RADIO TODAY:
The FT-901DM HF Transceiver

The Ham's dream—to have the best—is now reality.

Advanced receiver features include rejection tuning, dual-filter variable-bandwidth IF passband tuning, and audio peak frequency tuning for sharp CW reception. Unparalleled receiver selectivity is yours.

Built-in Curtis 8043 IC Keyer! Provides reliable operation and superb immunity from RF interference.

Famous Yaesu quality workmanship throughout. Toroidal output circuitry and RF negative feedback for maximum reliability and purity of emissions. Rugged GE 6146B final tubes.

Memory circuitry allows you to store a frequency, then recall it with the push of a button for control of transmit, receive, or transceive frequency. Digital plus analog frequency readout. PLL frequency derivation.

VOX, calibrator, noise blanker, RF speech processor, and 20dB attenuator are all built in, not expensive accessories.

Modern computer-type plug-in circuit boards for quick servicing and clean layout.

The FT-901DM will be available soon. See your dealer for a colour brochure on the FT-901DM and other Yaesu products.

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

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

ELECTRONICS

TELEX 897406

FAST MAIL ORDER SERVICE

FDK

MULTI-2700 MkII

THE ULTIMATE 2m ALL-MODE!

The Multi-2700 is the ultimate in 2m all-mode transceivers. Established now for 2 years, the sales of this model increase every month! Proof indeed of its popularity and value for money. Unfortunately, within the limited space of this advertisement, it is just not possible to list all its many features. The manufacturers brochure runs to 4 pages! However, a S.A.E. will bring you a copy of this free of charge. What we can do is list for you some of its main features, then perhaps you will begin to see why more and more people are trading up to the Multi-2700.

IN STOCK NOW £489 inc. VAT

FEATURES:-
2 VFO's for instant QSY (one analogue the other synthesised) both useable on all-modes with VXO for fine tuning on SSB; FM, SSB, AM, CW; 16 watts output; 143-149mHz reception (Tx 144-146mHz), 230v AC and 12v DC; WBFM/NBFM; OSCAR downlink receive converter; speech processor; VOX; IRT; 100kHz calibrator; noise blanker; automatic tone-burst; + or − 600kHz shift; + 1·6mHz shift (for 70cms); RF gain; RF pre-amp; squelch; separate FM/SSB mic gain controls; variable AGC; Antivox; variable compression; CW semi-breakin; accessory sockets at rear; supplied complete with mic, cables, handbook and even log book! Don't buy any other model until you have compared it with the Multi-2700 Mark II. S.A.E. For Full Details

FDK

M800D
25 WATTS FM

IT'S THE FEATURES IT DOESN'T HAVE THAT SELL IT!

The Multi-800D is the latest 2m transceiver to leave the production line in Japan. It is a fully synthesised transceiver covering 144–148MHz with a full bodied 25 watts plus output to give you longer distance contacts. But its big attraction is the things it doesn't have. Ironical but true!

1) No restricted coverage—you can operate any channel you choose—no need to get the soldering iron out to change the diode matrix.
2) No power control on the rear panel; it's on the front—and the power is infinitely variable between 1 and 25 watts—ideal for transverting.
3) No tone-burst control on the rear panel—it's automatic but can be defeated by a front panel switch.
4) No confusing channel numbers or doubt whether you have selected the correct repeater shift—the bright LED read-out gives true frequency display on both TX and RX even when working normal or reverse 600kHz repeater shifts.
5) You won't have to retune the front-panel frequency selector for reverse repeater working or monitoring the input frequency—the flick of a front-panel control is all that is necessary.
6) The memory is not lost when you switch off the ignition or unplug the rig—it's there always and it can memorise two frequencies not just one!
7) It doesn't just have one repeater shift—you can programme any shift you wish in addition to the 600kHz—e.g. 1.6MHz for 70cms.
8) No wrist-aching tuning either—tuning is manual or electronic—you can take a leisurely stroll at 10kHz per second or race across the board at 500kHz per second.
9) And there are two safety features—every 100kHz of electronic tuning a bleep sounds—this means less looking at the dial and more eyes on the road—and there's also a remote "head-up" display available that enables you to place the frequency read-out in a position near the line of vision.

Having read about the things the 800D hasn't got, an SAE will bring you a four-page brochure about all the things it has got! But hurry—we already have a backlog of orders for the next shipment.

YAESU

SOUTH EASTERN STOCKISTS

(Note carriage charge in brackets—normally Securicor/first-class post.)

PLUS FULL TIME SERVICE DEPT.

FRG7 Gen coverage receiver 5–30Mhz AC/DC	**£163·00**	(£4.50)
FRG7D As above but digital readout	**£208.00**	(£4.50)
FR101D 160-2m+broadcast rx AC/DC	**£457.00**	(£4.50)
FT101E Transceiver 160-10m AC/DC	**£482.00**	(£4.50)
FT101EE As above less processor	**£466.00**	(£4.50)
FT101E Extra-narrow CW filter	**£21.83**	(25p)
FV101B External vfo for FT101	**£70.30**	(£4.00)
S.P.101B External speaker for FT, FR Series	**£17.40**	(£1.50)
FT200 Transceiver 80-10m 260 watts	**£309.35**	(£4.50)
FP200 Matching AC PSU for above	**£61.85**	(n/c)
YO100 Monitor scope	**£156.37**	(£4.50)
FT221R 2m all mode transceiver AC/DC	**£401.60**	(£4.50)
YC221 Matching digital readout	**£81.55**	(75p)
FT227R 400 channel FM transceiver 12V DC	**£193.50**	(£2.50)
YP150 150 watt dummy load	**£47.50**	(£2.50)
FT901DM Digital 160-10m transceiver	**£838.00**	(£4.50)
QTR24 Amateur Radio World clock	**£15.60**	(75p)
YH55 Communication headphones	**£9.00**	(75p)
YD844 Desk microphone	**£20.25**	(75p)
YD846 Hand microphone	**£8.40**	(75p)
OTHER ACCESSORIES		
EK121 Electronic keyer (see March issue)	**£29.95**	(75p)
MM202G Mobile safety mic (see March issue)	**£19.95**	(50p)
HP3A UHF TV filter	**£2.95**	(25p)
TV3300 Drake low pass filters	**£18.00**	(75p)
KR400 Aerial rotator (see March issue)	**£95.00**	(2.00)
9502 Aerial rotator (see March issue)	**£45.00**	(2.00)
AR40 Aerial rotator VHF/HF	**£53.40**	(2.00)
CD44 Aerial rotator HF	**£85.70**	(2.00)
Microwave Modules—all models ex-stock		
Aerial cable, brackets, masts etc ex-stock		

MAIL ORDER & HEAD OFFICE: HOCKLEY AUDIO, 31 SPA ROAD, HOCKLEY, ESSEX. TEL. 03 704 6835 (2 lines)

BARCLAYCARD VISA

ALL PRICES INCLUDE VAT — CARRIAGE CHARGES IN BRACKETS

AGENTS—G3XTX J.R. Electronics, 198 Collier Row Lane, Romford, Essex. Tel. Romford (0708) 68956.
GM3GRX Eric Simpson, 6 Drossle Road, Falkirk, Stirlingshire. Tel. 0324 24428

MONDAY TO SATURDAY 9 A.M. TO 5.30 P.M. EARLY CLOSING WEDNESDAY

Access

Western

The LATEST and GREATEST from YAESU FT901 DM

PRICE ONLY £842.62 Inc VAT

All-band, all-mode (inc. FM) HF transceiver. Variable IF passband; rejection tuning; built-in keyer; memory facility and many other first-class features. Write or phone for details.

OR IF YOU'RE VHF MINDED . . .
. . . THE MULTI-MODE 2M TRANSCEIVER

FT221R

All-mode operation—SSB (USB, LSB), CW, AM, FM. All solid-state reliability with plug-in modules. Rugged 7-watt dissipation, PA transistor for stability and reliability. VHF local oscillator (133–137MHz VCO) in PLL system minimises spurious responses.
12 volt dc or ac mains operation built in.
Full 4MHz (144–148) coverage with 600kHz repeater shift and access tone generator.

also YC221 Digital readout adaptor for FT221 and FT221R. Mod. kit needed for FT221 and 'R' models without 'D' suffix to serial number. Details on request.

Western PRICES INC. VAT — FT221R **£392.63** YC221 **£75.38** MOD. KIT **£3.83**

1978 YAESU PRICE LIST *from* Western

FREE SECURICOR DELIVERY
VAT NOT INCLUDED

FT101E	429
FT101EE	415
FT101EX	385
FL2100B	269
FV101B	67
SP101B	16
SP101PB	36
*YO100	139
FT200	277
FP200	57.50
FV200	67
FT7	275

FT301D	588
FT301SD	455
FT301	495
FT301S	340
FP301D	135
FP301	85
FV301	67
SP120	16
FL110	112
*YO301	139
LL301	26
301 Relay box	9
FC301	85

FRG-7	144
FR101D. Dig.	480
FR101D	410
FR101S. Dig.	400
FR101S	327
FL101	359
FL101RF	395
FT227R	172
FT221R	349
FT223 (11Ch)	175
FTV250	149

*These items – VAT 8%, others 12½%

FT901D	644
FT901DE	644
FT901SD	625
FT901DM	749
*YC500E	265
*YC500S	210
*YC500J	145
*YP150	43
YC601	107
YC221	67
QTR24	14
YD844	19.50
YD846	8
YH55	8

BUY YOUR **YAESU** FROM **Western** FOR

FREE Securicor Delivery
FREE Carriage on Warranty repairs
FREE Advice and Assistance

SEND 15p IN STAMPS FOR LATEST YAESU MUSEN EQUIPMENT CATALOGUE

COUNCIL

President
D. S. Evans, PhD, BSc, FIM, G3RPE

Executive Vice-President
J. Bazley, G3HCT

Immediate Past-President
Lord Wallace of Coslany

Honorary Treasurer
P. F. D. Cornish, FCA, G3COR

Telecommunications Liaison Officer
R. F. Stevens, G2BVN

Ordinary members
E. J. Allaway, MB, ChB, MRCS, LRCP, G3FKM
P. Balestrini, TEng(CIE), MITE, G3BPT
T. P. Douglas, MBE, AMIEE, G3BA
C. H. Parsons, GW8NP
R. F. Stevens, G2BVN
G. M. C. Stone, CEng, FIEE, FIERE, G3FZL
C. J. Thomas, G3PSM

Zonal members
Zone A. B. O'Brien, G2AMV
Zone B. J. Anthony, G3KQF
Zone C. D. J. Andrews, G3MXJ
Zone D. W. A. Scarr, G2WS, MA, FBIS
Zone E. D. H. Adams, GW3VBP
Zone F. W. F. McGonigle, GI3GXP
Zone G. A. M. Allan, GM3ZBE

REGIONAL REPRESENTATIVES

Region 1—W. M. Furness, G3SMM
Region 2—R. C. Andreang, G4CMT
Region 3—H. S. Pinchin, G3VPE
Region 4—T. Darn, G3FGY
Region 5—P. F. Chilcott, G4BBA
Region 6—F. S. G. Rose, G2DRT
Region 7—N. A. Smith, G3HFO
Region 8—D. N. T. Williams, G3MDO
Region 9—H. W. Leonard, G4UZ
Region 10—R. G. Barrett, GW8HEZ
Region 11—P. H. Hudson, GW3IEQ
Region 12—F. Hall, GM8BZX
Region 13—A. B. Givens, GM3YOR
Region 14—I. McKechnie, GM8DOX
Region 15—H. J. Campbell, GI8FOK
Region 16—*(Post vacant)*
Region 17—L. Hawkyard, G5HD
Region 18—*(Post vacant)*
Region 19—R. J. Broadbent, G3AAJ
Region 20—G. Mather, G3GKA

HONORARY OFFICERS

Awards managers
hf—C. R. Emary, G5GH
vhf—Jack Hum, G5UM

Emergency communications manager
P. Balestrini, G3BPT

Intruder Watch organizer
S. A. G. Cook, G5XB

Microwave manager
D. S. Evans, G3RPE

Slow morse organizer
M. A. C. MacBrayne, G3KGU

Taped lecture library curator
S. W. Coursey, G3JJC

Trophies manager
P. A. Miles, G3KDB

VHF manager: I. F. White, G3SEK

Correspondence to RRs and honorary officers should be addressed directly to them (QTHR).

RADIO SOCIETY OF GREAT BRITAIN

35 Doughty Street, London WC1N 2AE
Telephone 01-837 8688

Founded 1913 — Member society, International
Incorporated 1926 — Amateur Radio Union

PATRON: HRH The Prince Philip, Duke of Edinburgh, KG

The national society representing all UK radio amateurs

Membership is open to all those with an active interest in radio experimentation and communication as a hobby. Applications for membership should be made to the general manager, from whom full details of Society services may also be obtained.

GENERAL MANAGER AND SECRETARY
D. A. Evans, G3OUF

EDITOR
A. W. Hutchinson

ANNUAL SUBSCRIPTION RATES

UK corporate: £8, including VAT — **Overseas: £8.**

Associates under 18: £3. — **Students aged 18 to 21: £4.50.**
(Student applications should give the member's age at last renewal date and include evidence of student status)

OAPs with 15 years' membership: £4.50. Affiliated societies: £6.50 (including *Radio Communication)*; **£3.25** (excluding *Radio Communication).*

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)
1030	3·65	G2CVV, Derby (N Midlands)
	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	G3SMT, Stockport (NNW)
1100	3·65	G5VO, Bridlington (NE England)
1115	3·65	G3LEQ, Knutsford (NW England)
	144·50	GI3TLT, Bangor, Co Down (N)
1130	3·65	GM3TCW, Wishaw, Lanarkshire (S Scotland)
1145	3·65	GM3HGA, Aberdeen (NE Scotland)

An rtty news bulletin, callsign GB2ATG, is also transmitted every Sunday at 1200 and 1900 on 3·590MHz and at 1230 and 1245 on 144·6MHz. This bulletin carries items of interest to rtty enthusiasts.

RSGB AMATEUR RADIO EXHIBITION

ALEXANDRA PALACE, LONDON N22

5 and 6 MAY, 10am-6pm

Trade show

A wide variety of commercial receivers, transceivers, test equipment, antennas, masts and ancillary equipment will be exhibited. For the constructor there will be new and surplus components, solid-state devices, printed circuit boards, cables, rtty machines and sundries, vdus, kits, etc.

The following traders have confirmed bookings at the time of going to press:

Amateur Radio Exchange
Arrow Electronics
B. Bamber Electronics
J. Birkett
J. Branson
C & C Electronics
Castle Electronics
CP Developments
Crayford Electronics
Datong Electronics
F. R. Galka (Test Equipment)
Garex Electronics Ltd
Greenweld Electronics
J. Hackett Engineering
Johns Radio
JMG Electronics
Langrex Supplies Ltd
LB Electronics
Lowe in London (Catronics Ltd)
Microwave Modules
Modular Electronics
Packer Communications
PM Electronic Services
Polar Electronic Developments
Radio Shack Ltd
Radiotronic
SGS ELectronics
South Midlands Communications
Thanet Electronics
Western Electronics (UK) Ltd
ZNI Callsigns

Organizations which will also have stands are:

Radio Society of Great Britain
Members of RSGB committees and of HQ staff will be present to deal with queries and subscriptions.
RSGB publications will be on sale.
Live demonstrations of London's 10GHz beacon, GB3LBH, 10GHz television, latest amateur 2·3GHz gear and various test equipment

AMSAT UK
Amateur Radio Mobile Society
British Amateur Television Group
Radio Amateur Invalid and Bedfast Club
Raynet
Royal Corps of Signals

For newcomers

"What's it all about?" In the cinema
A continuous lecture — film show — question time

"Lucky numbered programme" draw

A Heathkit fm transceiver kit, type HW202, donated by Messrs Heath (Gloucester) Ltd, will be under construction at the exhibition, and the partially completed unit will be the main prize in the draw.

Dinner

The dinner will take place on Friday 5 May at 7.30pm in the Edinburgh Room. The guest speaker will be announced later. Tickets, £5.50 each, are obtainable only in advance, by application and remittance to RSGB HQ before Friday 29 April.

Admission

Admission, at the door, is 50p. Accompanied children under 12, free. Clubs may obtain tickets in advance, 10 for £4.
Advance bookings, dinner tickets and enquiries from the organizer, Les Hawkyard, G5HD, at RSGB HQ.

How to get there

Alexandra Palace is easly reached by road and has free car and coach parking. Bus services 29, 41, 102, 123, 134, 212, 221 and 244 are within easy walking distance, and service W3 connects with the underground at Wood Green (Picadilly Line) and Finsbury Park (Picadilly and Victoria lines).

Talk-in stations

Talk-in stations will operate during the exhibition, and GB2VHF, on 144MHz fm, 144MHz ssb (144·28MHz) and 432MHz fm (433·2MHz), will provide facilities, including approach and precision talk-in, and detailed parking and departure information. Visitors to London are asked to establish initial contact with GB3VHF as soon as possible on their journey. Also, a home-built amateur station will operate on 3·5MHz ssb.

Catering

Bars and buffet restaurants will be open throughout the exhibition opening hours, with "real ale" on sale.

QTC
amateur radio news

Region 19 representative
In the election for the Region 19 representative the voting was as follows:

Mr R. J. Broadbent, G3AAJ, 65 votes
Mr D. P. S. Wright, G4FBW, 50 votes
Mr J. N. Bolton, G4DGK, 29 votes

The number of invalid votes cast was 24.

Mr R. J. Broadbent is therefore elected as the regional representative for RSGB Region 19.

QSL Bureau—G3UAA-G3VZZ
Please note that the address of Mr M. J. Newton, G3UKW, sub-manager for the G3UAA-G3VZZ series, is now 53 Derwent Avenue, Garforth, Leeds LS25 1HN.

AMSAT-UK
Mr R. J. C. Broadbent, G3AAJ, has been appointed honorary secretary of AMSAT-UK, the radio amateur satellite organization of the UK. All correspondence concerning the organization should now be addressed to him for attention or distribution. His address is 94 Herongate Road, London E12 5BQ.

G3AAJ can also supply 1978 orbital calendars, price **£1.40** to members of AMSAT-UK, and **£2.80** to non-members. Remittances should be made payable to AMSAT-UK, and a 13½ by 8in self-addressed envelope carrying a **9p** stamp should be enclosed. Members should also advise their AMSAT-UK membership number.

AR self-discipline acknowledged
The effectiveness of the self-discipline of the amateur service was officially recognized in the Federal German parliamentary question hour on 10 November 1977. In answer to a question from the West Berlin deputy as to the reason for the difference in the monthly fees for amateur radio stations (DM3) and for cb fixed stations (DM15), the Parliamentary Secretary of State replied: "The effort required on the part of the FRG Post Office for the licensing and supervision of amateur radio stations is considerably less than that for low power cb fixed stations. In contrast to these cb stations, amateur stations may only be operated by persons who have passed an examination, the standard and level of which are determined by international regulations; this means that the effort and outlay of the Post Office for monitoring purposes are considerably reduced."

Threat to 144MHz
For a considerable time it has been reported from the Middle East area that 144-148MHz is being used for military traffic. The Israel and Cyprus national societies confirm this fact. Some months ago a West German radio magazine carried an advertisement stating that many thousands of unmodified hand portable and fixed stations had been sold to Middle East countries for use in this band. The matter was raised with Japanese manufacturers, but without any promises as to future sales being made. It is now obvious that the lucrative sale of large quantities of equipment outweigh other considerations. With the approach of WARC'79 the threat to amateur frequencies should be obvious.

One way of affecting the pockets of the manufacturers supplying such equipment operating on amateur bands would be to publish their names and ask all radio amateurs world-wide to avoid purchasing their products.

RAYNET SYMPOSIUM

Saturday 15 April 1978
0930am for 1000am

Post House Hotel, Leicester

Cost £4, including buffet lunch

Subjects will include: Raynet yesterday, today and tomorrow; Raynet and repeaters; Liaison with user services; Exercises; Live incident case histories; Equipment; and discussion periods.

Further details from G8CAC, QTHR, tel Desford 3026.

The Post House Hotel is situated within one mile of the M1, M69 and A46 junction 21.

New callsign series
The ITU has announced that the callsign series J2A-J2Z has been provisionally allocated to the Republic of Djibouti. Djibouti recently became the 154th member nation of the ITU.

Reciprocal licensing
The Home Office has announced that a reciprocal agreement has been concluded with Colombia. This gives reciprocity between the Colombian first category licence and the UK "A" licence.

Educational use of Oscar
Peter Greed, G3MQD, of The Headlands School, Swindon, has for some time used the Oscar satellites as part of an educational programme. He would be interested to hear from other schools engaged in this type of activity. His address is 18 Nursteed Park, Devizes, Wilts.

CCIR Study Groups
The amateur radio movement was well respresented at the final meeting of the present session of CCIR Study Groups in Geneva in January 1978. Among those "signing-in" were E. George, DL7IH; T. Welch, G3AYO; L. Barclay, G3HTN. K. Christian, G8BOF; R. Phillips, G8CXJ; H. Yoshimura, JH1DGF; S. Nakamura, JJ1CXI; M. Joachim, OK1WI; J. L. Nielsen, OZ8JJ; F. Wim de Vrijer, PA0XWA; O. Lundberg, SM0CKV; J. Belrose, VE2CV; R. Eldridge, VE7BS; P.

Barnes, VK3GH; I. Klepper, W3HGD; J. Deitz, W3JL; C. Dorian, W3JPT; J. Gatti, W4TRJ and E. Holliman, W5EUE.

The IARC, through the courtesy of its president, Ted Robinson, F8RU, made 4U1ITU available to the visitors, and many QSOs to "home" and to "dx" were made. Thanks are due to the station manager, for his endless patience in dealing with all the demands on 4U1ITU.

For most of the amateurs present it was a rare and happy chance to get together, which was much appreciated and enjoyed by all concerned. Unfortunately, there was no opportunity for all to assemble on any single occasion—although it may well be that the QRM at such a gathering would have been intolerable!

RSGB publications abroad

Members residing in North America are reminded that most RSGB publications are stocked at Ham Radio's Communications Bookstore, Greenville, NH 03048, USA. The toll-free telephone number for ordering books is 800-258-5353. New Hampshire customers should call 878-1441.

Scandinavian members may like to know that most RSGB publications are stocked at A/S Ahrent Flensborg, Skt Hansgade 9, 4100 Ringsted, Denmark. Tel (03) 6100 11.

In addition to these sole distributors, RSGB publications are held in stock by many of the IARU national societies and larger overseas bookshops, and a list of these is obtainable free of charge from RSGB HQ.

RAE pretests

From 1979 the Radio Amateurs' Examination will be in the form of objective tests containing multiple-choice questions, and anyone preparing alone for his or her amateur licence and living in the London area may be able to assist the City and Guilds of London Institute. In preparation for this change the institute is to pretest objective questions, trying them out on candidates who have reached examination standard. Pretests are intended to test the performance of individual questions and syllabus coverage. Information is obtained which assists the institute's reviewing panels in judging whether each individual question should be included in the question bank for use in future examinations.

In order to obtain reliable information, pretests must be administered to a sample of students which is as representative as possible of those who will take the examination. Many would-be licensed amateurs prepare for examinations without following a college course, and the institute invites such candidates who live around the London area to assist in the pretests. As well as helping the City and Guilds, the tests may help would-be examinees to revise their work and gain some examination experience. Volunteers who participated last year found the morning helpful and interesting.

The pretests are to be held at City and Guilds of London Institute, 76 Portland Place, W1, on Tuesday 2 May 1978 from 10am. Anyone willing to assist please contact Miss Jackie Clifford (01-278 2468, ext 485). Invitations will be issued to eligible candidates.

Congratulations to . . .

Brian Armstrong, G3EDD, former Council member of the RSGB, on his appointment as technical director of Pye Telecommunications Ltd;
and to
Ray Hills, G3HRH, also a former RSGB Council member, on his appointment as assistant director of engineering (operations) of the Independent Broadcasting Authority.

Edgware celebration dinner

The Edgware & District Radio Society, which started life as the Edgware Short Wave Society, is holding a 40-year celebration dinner on Saturday 20 May at the Railway Hotel, Station Road, Edgware. Past members who would like further details should contact the hon sec, G3MNO, QTHR; tel 01-907-1237.

West Mersea, Essex, event

With the assistance of the Colchester Amateur Radio Club, G2CVO/A will be operational from the Mersea Island Museum on the hf bands and 144MHz during the weekend 29 April–1 May. The museum is adjacent to West Mersea Church, the beach and free car parking. Visitors will be very welcome.

Please return!

Would the purchaser who collected the blind SWL's equipment advertised in the December issue of *Radio Communication*. Please return the receiver manuals then borrowed.

Improved strong signal performance using double-balanced mixers

by S. A. FOX, CEng, MIERE, G3VVS*

Introduction

This article will examine the critical signal handling stages in a popular transceiver and show how the strong signal handling performance can be significantly improved without any sacrifice in sensitivity.

Consider first the reasons for wanting good strong signal performance in the equipment used on the amateur bands today. There are various types of unwanted signals which can be detected by a receiver and which will degrade reception of the desired signal [1], these are:

(a) Image signals which can be identified by noting that they tune backwards across the passband. If the local oscillator in a receiver has a frequency f_{LO} and the i.f. frequency is denoted by f_{IF} then there will be an output produced by signals having frequencies f_{LO} plus f_{IF} and f_{LO} minus f_{IF}. Since only one of these signals will represent the wanted one, the other must be suppressed.

(b) Intermediate feedthrough signals which can be identified by noting that they cannot be tuned using the vfo.

(c) Spurious signals which are generated by the mixing action of both the mixers and any non-linear stages in the receiver. These signals are recognizable by the fact that, while they are tunable with the vfo, they are not being transmitted on the frequency indicated by the receiver. Ray Moore [2] has divided these spurious responses, normally generated by strong signals and known as harmonic modulation products, into two groups. First, strong signals can feed through the front-end and mix with harmonics of the local oscillator to produce the i.f. Second, a non-linear amplifier or mixer can generate harmonics of a strong signal which mix with the local oscillator.

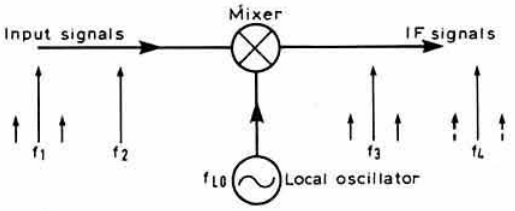


Fig 1. Introduction of cross-modulation in a mixer stage. f_4 is suffering from cross-modulation

(d) Finally there are the intermodulation products caused by multiple strong input signals and their harmonics mixing with each other and the lo to produce the i.f.

Other effects which can mar the reception of the wanted signal are cross-modulation, blocking and desensitization.

G3PDM[3] described cross-modulation as the most serious problem in designing a receiver for good large signal performance. This is because, once cross-modulation has taken place, it cannot be removed in later stages of the receiver. This type of spurious response is produced when the modulation on an adjacent signal is transferred to the desired signal. Fig 1 shows two signals present at the input of a mixer: f1 is modulated, f2 is a cw signal. At the output are two signals, both modulated, because the larger signal has driven the mixer into the third order curvature section of its input-output characteristic.

Blocking is a severe form of desensitization. This effect is caused when a strong signal outside the passband reduces the gain of the receiver, which will reduce the output level of the wanted signal. In blocking, the gain has been reduced to such an extent that the receiver goes silent. Both effects are caused by a large signal being rectified by an active device, such as a mixer, and causing a change in its operating point.

It should be remembered that the agc cannot be used to reduce the amplitude of unwanted signals, since the wanted signal would also be attenuated. Hence it is essential that the receiver is designed to cope with large unwanted signals while tuned to the weak station of interest.

Most of these spurious responses will be familiar to amateurs with solid-state receivers. They have been accepted as the price to pay for the many advantages of going solid state. However, significant improvements can be made to the average transceiver, thereby satisfying the homebrew enthusiasts who have yielded to the temptations of allowing a solid-state black box into the shack.

Critical measurements

Most receiver manufacturers quote figures for image ratio and i.f. rejection; typical values are around −50 or −60dB. Since the rejection normally varies from band to band, the figure quoted should be the worst case. The image rejection will normally be the poorest on the highest frequency band covered. The i.f. rejection will normally be the poorest on the bands with frequency coverage closest to the i.f.s used.

*1 Kitswell Way, Radlett, Herts WD7 7HN

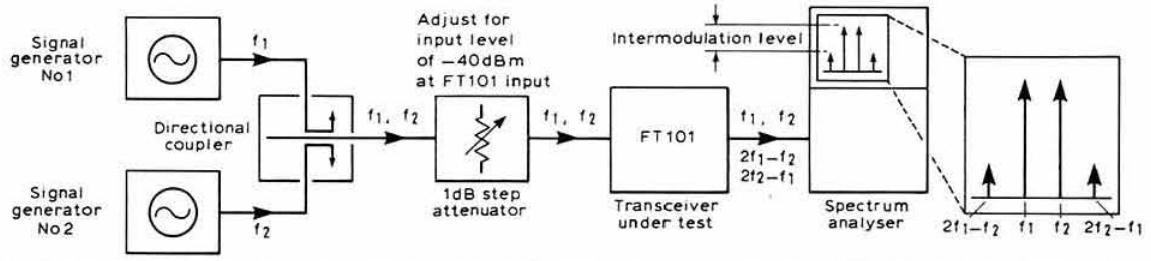


Fig 2. Equipment required to measure the intermodulation distortion produced at successive stages in a transceiver. The spectrum analyser must have an im specification of at least −70dB for two input signals equal to −30dBm. The directional coupler minimizes cross-talk between the signal generators

Perhaps it is assumed that users of the typical black boxes, widely advertised in journals such as *Radio Communication*, would not be interested in detailed specifications on parameters such as cross-modulation, blocking and intermodulation performance. Certainly it is very difficult to find more than a few such specifications which can be used as examples. However, this situation could change as it becomes more widely recognized that it is easy to build receivers with high sensitivity, while much more difficult to design for good strong signal performance. An excellent example of how cross-modulation and blocking could be specified was described by G4CDY and G2BVN in their review of the Yaesu FRG7 receiver [4].

In the case of intermodulation distortion, there is an infinite number of signal combinations which can produce the intermodulation products. Hence, normally, a measurement is made for a specified frequency spacing between the two strong signals, such as 10, 15 or 20kHz, and their level adjusted so that the third-order intermodulation products are equivalent to an input signal equal to 1μV. The level of the input signals is then used to determine the specification of the intermodulation distortion.

Alternatively, as described in [5], a spectrum analyser can be used for this measurement with the advantage of far greater flexibility. The effect of varying the signal frequency spacing and input levels can be seen immediately on the analyser's display. Also a spectrum analyser can be used to measure the intermodulation performance of each stage in the equipment being evaluated. The test set-up used for the modifications to be described is shown in Fig 2.

External modifications

The preselectors used in modern transceivers are a compromise between cost and performance. As noted by Moore [2] the low impedance (50Ω) tightly coupled primaries on modern antenna matching coils compound the strong signal problem because they degrade the *Q* of the tuned circuit. They also present higher signal levels to the active device. This compromise can be compensated for by the use of an antenna tuning unit. Both image signals and i.f. feedthrough signals will be attenuated. In addition, an atu will reduce the amplitude of large out-of-band signals and, hence, reduce the generation of spurious signals. Such a multiband coupler is described in [6].

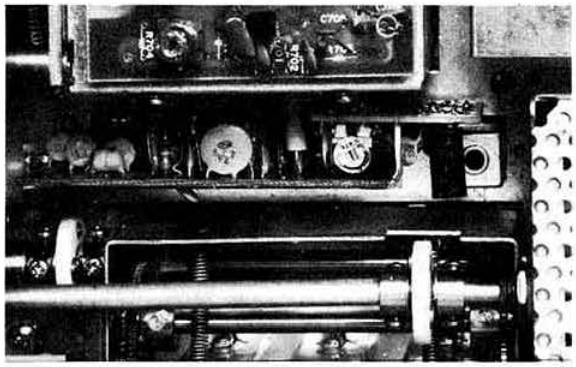


Photo 1. Method of mounting the modified first mixer to the rf unit

Internal modifications

The active stages up to the crystal filter for an early FT-101 are shown in Fig 3. The first mixer is a bipolar transistor which will have relatively poor strong signal handling capabilities. The second mixer is a dual-gate mosfet which, while having better strong signal performance, also has to handle much larger signals. Since the noise blanker is so effective for mobile operation it was decided that any modifications must not interfere with its

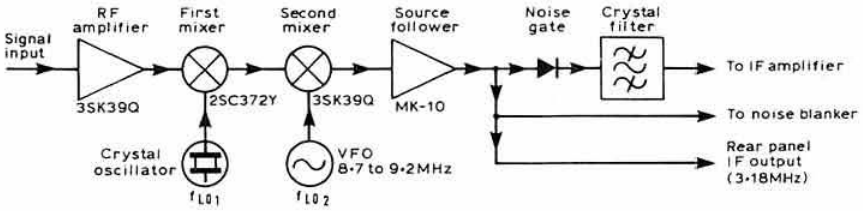
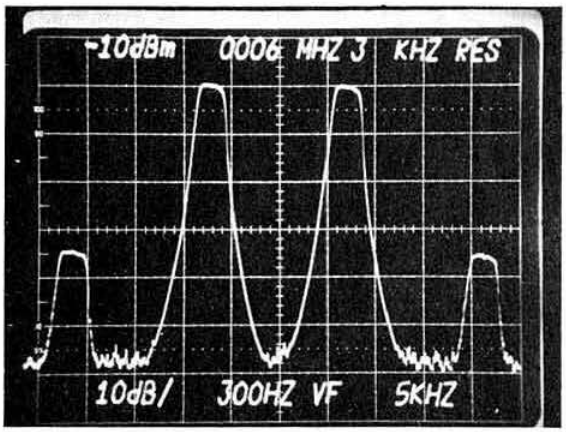
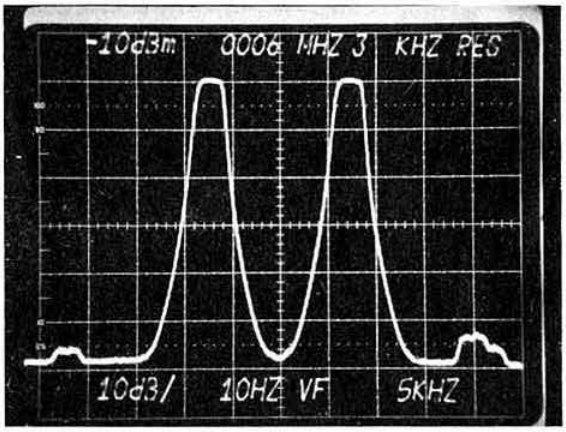


Fig 3. In the FT-101 a dual-conversion system is used ahead of the crystal filter. The rf amplifier and both mixers contribute gain to input signals





Photos 2 and 3. Spectrum analyser displays at the output of the first mixer indicating a 20dB improvement in the third order intermodulation distortion products by changing the first mixer from a bipolar transistor to a cross-coupled dbm

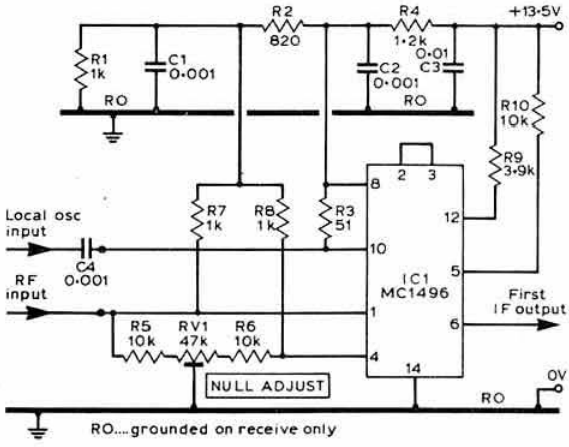


Fig 4. Cross-coupled, double-balanced mixer used as first mixer in FT-101

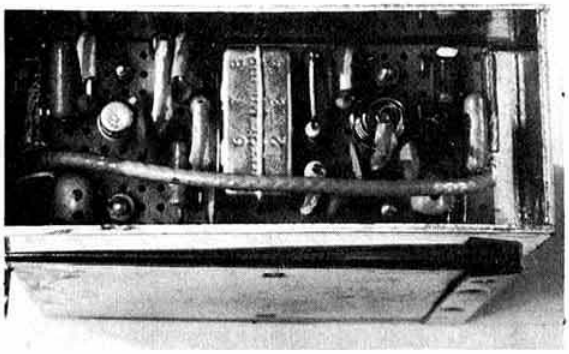


Photo 4. Method of mounting the modified second mixer assembly

operation. Several *FT Newsletters* [7] have reported that Yaesu has made extensive modifications to the noise blanker circuit, with the aim of reducing the degradation to reception of signals even though the blanker may not have been activated. For transceivers with the noise blanker on the low frequency i.f. unit, a considerable improvement in strong signal handling can be made by isolating the pulse rectifier diodes from the i.f. by means of a source follower. Finally, the source follower used to isolate the crystal filter from the second mixer must be very linear for signals which, at this stage, could be 200–300mV in amplitude.

Choice of mixers

For some time double-balanced mixers or ring modulators have been known to offer much better strong signal performance. They also have the property of attenuating the level of the signal and local oscillator frequencies by, typically, 40dB at the i.f. output point. Very comprehensive information on these building blocks is contained in [8]. Some important points are that these mixers are designed for use at low impedances (50Ω), have a conversion loss of approximately 7dB, and require significant local oscillator injection (typically 50mW). An example of the diode-quad double-balanced mixer is the MD108 which was used for the second mixer in the modified transceiver.

The cross-coupled double-balanced mixer overcomes two of the main disadvantages of the standard version; conversion gain can be achieved and the need for carefully

Table 1. Improvements in level of third-order intermodulation products by changing the first mixer

Input signal level (dBm)	Intermod level (dB) 2SC372Y	MC1496
−40	−35	−55

Note. Frequency spacing between F_1 and F_2 = 15kHz on 14MHz band.

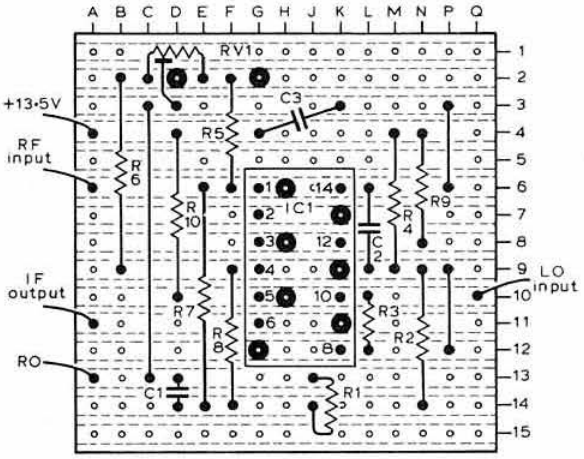


Fig 5. Veroboard layout for MC1496 mixer (component side)

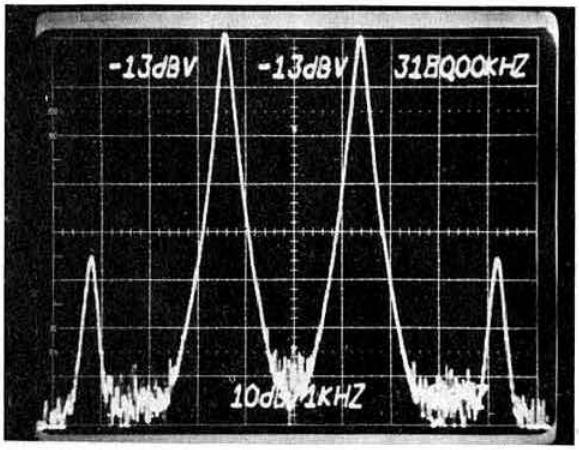


Photo 5 Spectrum analyser display of the FT-101 i.f. output with the MC1496, MD108 and source follower modifications. The third-order intermodulation products can be seen at −45dB

balanced transformers is eliminated. As noted by G3VA [9], with these devices the input and output circuits can be those of any conventional mixer. The MC1496 is an example of this type of mixer, which was used for the first mixer in the improved transceiver. Before any modifications were made, the sensitivity and intermodulation performance was determined to form the basis for comparative measurements.

Construction

A special version of the MC1496 was used as an intermediate measure during the modifications. It has become known as the "VK blob" after VK5PX and VK5ES who originated it. It is easy to fit and offers the advantages of a double-balanced mixer. Milt Lowens has described the blob extensively in [10, 11]. Fig 4 shows the circuit diagram for the modified first mixer, which was built on a piece of 0·1in Veroboard 1·5in². A suggested layout is shown in Fig 5. Before connecting the outboard unit to the hf printed circuit board, the following components must be removed: rx first mixer (2SC372Y), 470Ω emitter resistor and the 2·2kΩ base resistor to RO. The modified mixer is connected so that it is parallel to the main circuit board and does not short to the can of T105, see Photo 1. So that the 50Ω input impedance of the spectrum analyser could be matched into the transceiver, a source follower was made and connected to the output of the FT-101 bandpass filter. The improvement obtained in the intermodulation distortion produced by the first mixer is shown in Table 1 and in Photos 2 and 3.

Changing the second mixer necessitated several modifications. In order not to damp the bandpass filter response with the 50Ω input impedance of the diode-quad mixer, a source follower was used as a buffer stage. The 50Ω output impedance of the mixer was matched to the primary of T-112A in the FT-101, using a common base amplifier. This also compensated for the loss in gain introduced by changing the fet mixer for a dbm. Finally, it was necessary to increase the vfo injection level, and this was achieved by duplicating the buffer output stage used in the FT-101 vfo, with minor modifications to give a gain of approximately two. Fig 6 shows the complete circuit,

Table 2. Improvement in level of third-order intermodulation products measured at FT-101 i.f. output

Mod No	Mod status	Intermod level (dB)	Comments
1	1st mixer 2SC372Y 2nd mixer 3SK39Q	−15	Standard early FT-101
2	1st mixer MC1496 2nd mixer 3SK39Q	−18	Small improvement by changing first mixer
3	1st mixer 2SC372Y 2nd mixer VK blob preceded by source follower	−15	No improvement in intermods on original performance
4	1st mixer MC 1496 2nd mixer VK blob preceded by source follower	−15	No improvement in intermods by changing both mixers as indicated
5	As for (4) with modified source follower on If i.f. unit	−30	Improvements offered by new mixers now apparent
6	1st mixer MC1496 2nd mixer MD108 standard source follower	−30	Large signal handling of diode-quad mixer indicated
7	1st mixer MC1496 2nd mixer MD108 modified source follower on If i.f. unit, additional source follower buffering noise blanker diodes from 2nd mixer	−45	Optimum results obtained. See Photo 5

Note. Same input conditions as for Table 1.

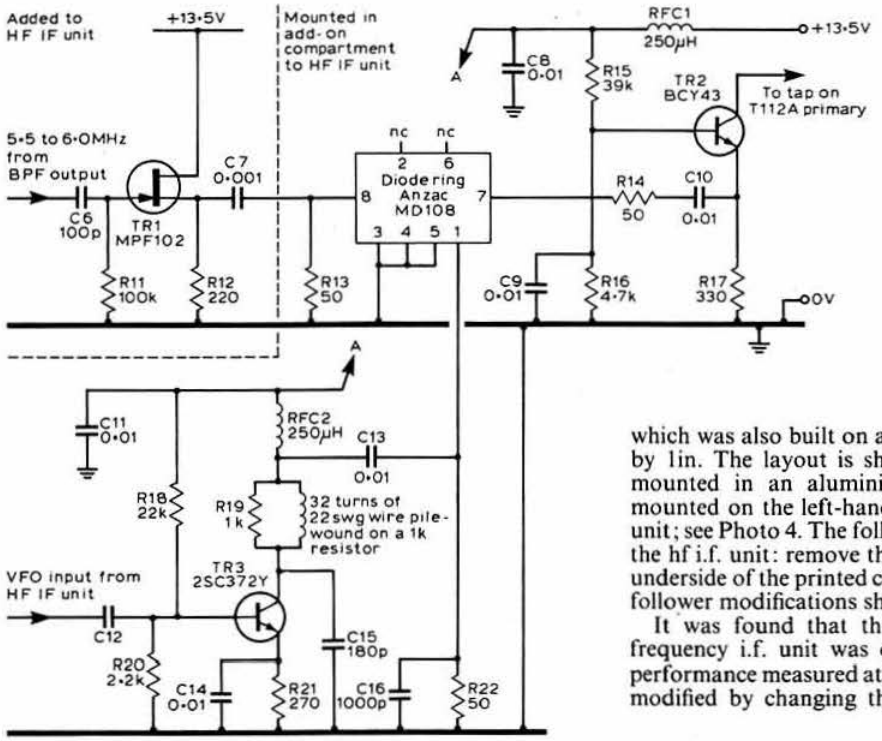


Fig 6. Source follower, double-balanced mixer, vfo amplifier and common base matching stage

which was also built on a piece of 0·1in Veroboard 2·5in by 1in. The layout is shown in Fig 7. The board was mounted in an aluminium box which, in turn, was mounted on the left-hand end of the high frequency i.f. unit; see Photo 4. The following changes must be made to the hf i.f. unit: remove the receiver second mixer, on the underside of the printed circuit board, and add the source follower modifications shown in Fig 6.

It was found that the source follower on the low frequency i.f. unit was degrading the intermodulation performance measured at the FT-101 i.f. output. This was modified by changing the junction fet for a dual-gate

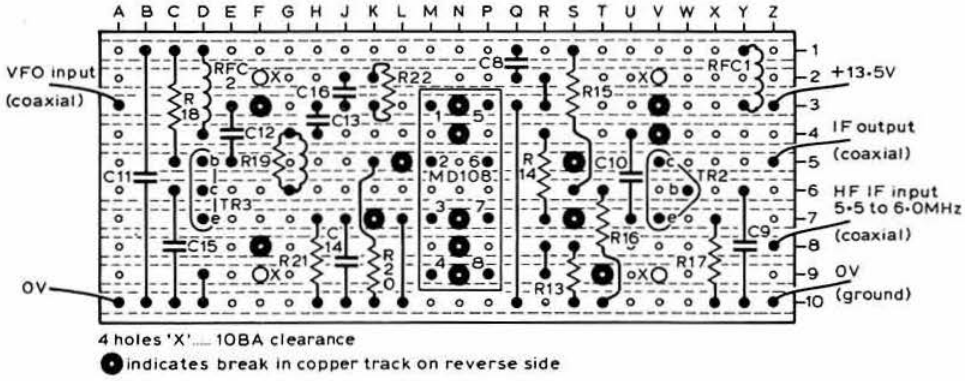


Fig 7. Veroboard layout for modified second mixer assembly (component side)

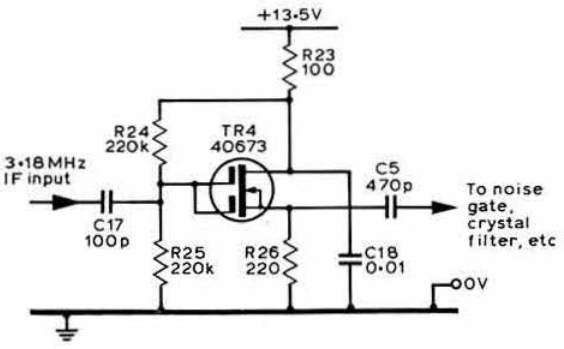


Fig 8. Modified source follower on If i.f. unit

mosfet and connecting it as shown in Fig 8. It may be found necessary to retune T-112A after completing the modifications.

Table 2 summarizes the improvements obtained in the intermodulation distortion at each stage of modification.

Conclusions

This project illustrated some of the considerations involved in modifying a solid-state transceiver to have good strong signal handling performance without sacrificing sensitivity. The use of double-balanced mixers yielded a receiver with a greater dynamic range and a better specification for the various unwanted signals previously discussed. To be able to tune in amateur signals on the 7MHz band with a quiet background during the evening, without interference from the strong

commercial signals, is a most satisfying experience. The modifications can be done for less than the cost of a crystal filter, and the results will satisfy the desire for a better rig.

References

[1] "Spurious responses in superheterodyne receivers". *Radio Communication Handbook*, 4th edn, p18.6.
[2] "Single-signal interference", Ray Moore. *Ham Radio Magazine*, February 1973, p7.
[3] "Plagiarize and hybridize", P. G. Martin, G3PDM/WI. *Radio Communication* March 1971.
[4] "Equipment review", T. Giles, G4CDY, and R. F. Stevens, G2BVN. *Radio Communication* March 1977.
[5] "Double-balanced mixer intermodulation distortion evaluation". *The Radio Amateur's Handbook*, ARRL 1976, p309.
[6] "Multiband couplers". *Radio Communication Handbook*, 4th edn, p13.37.
[7] "Noise blanker in the FT-101". *FT Newsletters*, March, July, August 1974; February 1977.
[8] "Double-balanced mixer". *The Radio Amateur's Handbook*, ARRL 1976, p304.
[9] "Technical Topics", Pat Hawker, G3VA. *Radio Communication* January 1971.
[10] "Cross-modulation problem". *FT Newsletter* September 1972.
[11] "The blob". *FT Newsletter* May 1973. □

Alternative repeater shift for the TS700

by A. J. Oakley, G8IWA*

THE modifications to be described were made to the author's early model TS700 to enable an alternative repeater shift to be obtained. This was needed so that he could continue to use the TS700 to drive his linear converter on 432MHz, and use the local repeater. The circuit is shown in Fig 1.

Warning. If this alternative repeater shift is used while the set is still connected direct to an antenna, out of band transmissions will be made.

The absolute minimum of parts is needed and, apart from the crystal, they are probably already in the junk box. However, the author prefers to use new components on work such as this. Most components fit into the heterodyne unit pcb, accessible from the top of the set, and the relay and two presets fit on to a new pcb which goes into a vacant space underneath the set. Reference to the operating manual is recommended before commencing the modification.

First, make the coil. The dimensions are given in Fig 2(a), and the author modified a coil former obtained from A. J. H. Electronics and costing 5p. Remove the coil wound on the former, cut off the four pins and file them flush both top and bottom. Drill four 1mm holes and insert four short lengths of 20swg tinned copper wire to make the new pins—slightly flatten the wire by pinching with pliers so that a *gentle* interference fit is obtained. Wind the coil, 11 turns of 34swg enamelled copper wire, and solder to a pair of adjacent pins Fig 2(b).

Next, after removing the top cover of the set (six screws), remove the plastic drive shaft for the FINAL tuning by loosening the two screws on the coupling at the rear of the set and then pulling the shaft out through the front panel. Remove the heterodyne unit pcb (nearest front panel) by undoing the four screws at each corner, and carefully lift it clear—there is no need to disconnect any of the cables from the board. Drill the solder from the (now)

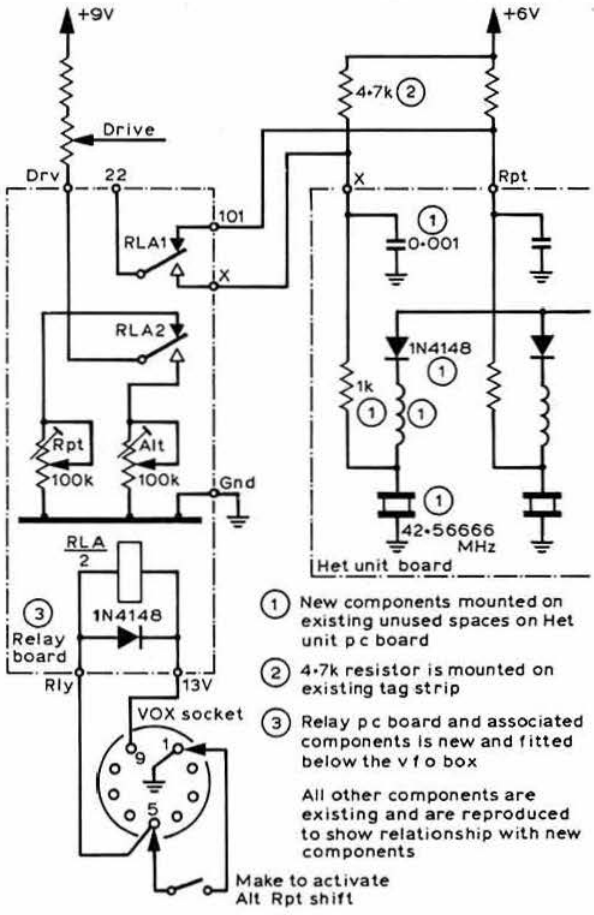


Fig 1. Circuit diagram

needed spare holes on the pcb with a 1mm bit; insert the coil, diode, 1kΩ resistor and 0·001pF capacitor into the board (Fig 3), solder up, and cut off excess wire. Replace the board and the drive shaft.

Having made the new pcb (Fig 4), mount the relay and Vero-pins. Remove the bottom cover (four screws) and mount the new board into the space below the vfo box, near the middle of the set just behind the marker unit.

*100 Normandy Avenue, Beverley, N. Humberside.

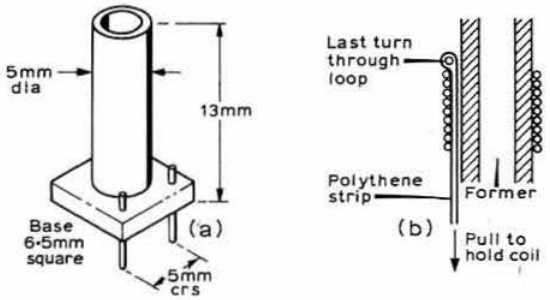


Fig 2. (a) Details of coil former. (b) Coil construction: (i) Prepare strip of polythene about 2mm wide and 50mm long; (ii) solder "start" end of wire to pin, then wind turns around former and over doubled polythene strip; (iii) pass last turn through eye and pull strip tight from bottom—this will hold coil firmly in place; (iv) solder "finish" end of wire to other pin

Secure it in place with four ¼in 4BA self-tapping screws, one in each corner.

Locate the multi-pin socket for RLA2, which is situated between the fm i.f. unit and the af unit, underneath the cable loom (see p22 of the operating manual). Pin 22 of this socket is nearest the front panel, on the right, and the wire from it is coloured orange on the author's set. Trace this wire from pin 22 on the relay socket to where it passes the new pcb midway between pins marked "22" and "101" (reference is made to pin numbers of new pcb). Connect the relay end to pin "22", and the other end to pin "101". Connect a new wire to pin "X", and thread it through the cable loom alongside the wire now connected to "101" until it comes to the top of the set. Connect it to the spare lug on the tag strip between the front panel and the heterodyne unit board, and then continue in the cable loom to pin "X" on the heterodyne unit. Wire a 4·7kΩ resistor from the same lug on this tag-strip across to the lug at the other end, where there should be a blue wire connected—if not, check that the resistor goes to the +6V line as the colouring could be different between sets. Now run a pair of wires from the "Rly" and "13V" pins to pins 5 and 9 respectively of the vox socket on the rear of the set, leading them through the existing cable looms.

Test by making a connection between pins 5 and 2 (ground), and checking that the relay makes when this is

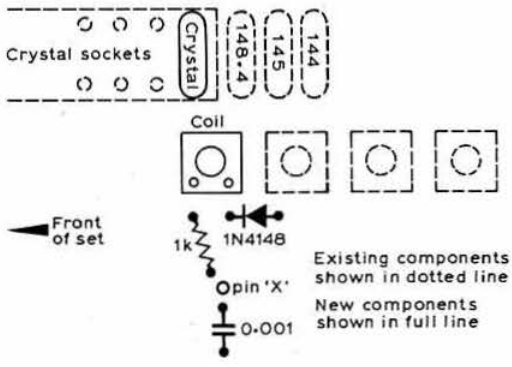
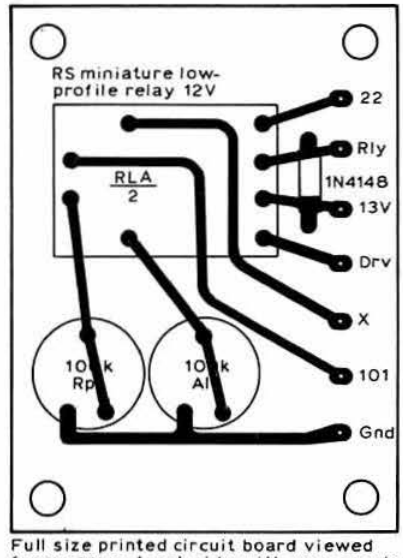


Fig 3. Part view of heterodyne unit pcb showing position of new components



Full size printed circuit board viewed from copper track side with components on reverse side

Fig 4. Printed circuit board and component layout

done. Finally, remove the 100kΩ preset from the tag-strip already used for the 4·7kΩ resistor, and lead a wire from the insulated lug just released, through the cable loom, to the relay pcb, and solder to the "Drive" pin.

Alignment and test should cause no problems. Plug the crystal into the socket furthest from the front panel (marked "X"), just next to the three crystals already soldered into the board. Adjust the coil to give the best reading with an absorption wavemeter, and then check with a frequency counter to bring the transmitted frequency exactly 1·6MHz higher than the dial calibration when the rpt band has been selected and the new relay energized. The author does this from the transverter (at the same time switching coaxial and antennas), so no inadvertent out-of-band transmissions are possible.

To adjust the two new presets, proceed as follows. Into a dummy load with the band switch on 145, tune the transmitter to 145·725, and adjust the DRIVE control on the front panel for best output. Now switch to RPT, and adjust preset rpt to give best output *without* moving the front-panel drive control. Reset the band switch to 145, retune the transmitter to 145·15, and re-adjust the front panel DRIVE control for best output. Now switch to RPT, energize the new relay, and adjust the alt rpt preset to give best output.

That is all. The set will now operate as before, but by energizing the new relay when on rpt band the transmit frequency will be 1·6MHz higher than receive, giving the right shift to transverting up to 432MHz and the uhf repeaters.

The measured power output of the transmitter will be less than normal when this alternative repeater shift is in use. This is due to the rf stages not being retuned to broadband them. This does not really matter, as most transverters do not need a lot of power to drive them, and the power output on 144, 145 and rpt bands will be unaffected by this modification. □

A transmitter monitor for 144MHz

by N. D. N. BELHAM G8FCH*

Introduction

It is always reassuring to have a visual indication that energy is actually leaving one's antenna, and even more reassuring to be able to monitor the modulation quality. In the case of an a.m. transmitter, both are done quite simply by using a small antenna coupled to a diode, meter and pair of headphones. However, things are not as easy with an fm transmitter. It might be thought that slope detection would be a quick answer, but consideration of the universal resonance curve, shown in Fig 1, gives no hope that the method would be successful at 144MHz.

Measurements show that, for a tuned circuit consisting of a coil and a capacitor, the Q at 10MHz is likely to be about 20, while at 100MHz this drops to about 10. The near linear part on either side of the resonance curve is centred about the 80 per cent mark. If the maximum deviation of the transmitter is limited to 5kHz, calculation shows that the change in response of the tuned circuit is only about 1 per cent of the peak response at resonance. At 100MHz the change in response would be only a twentieth of that. For discriminators depending on phase change for their action, the curve shown in Fig 2 gives no more hope of operation at or above 100MHz. A practical check, made by fitting a 144MHz tuned circuit to the Signetics N5111A ic discriminator, had negative results.

* 7 Binyon Close, Badsey, Evesham, Worcs WR11 5EY.

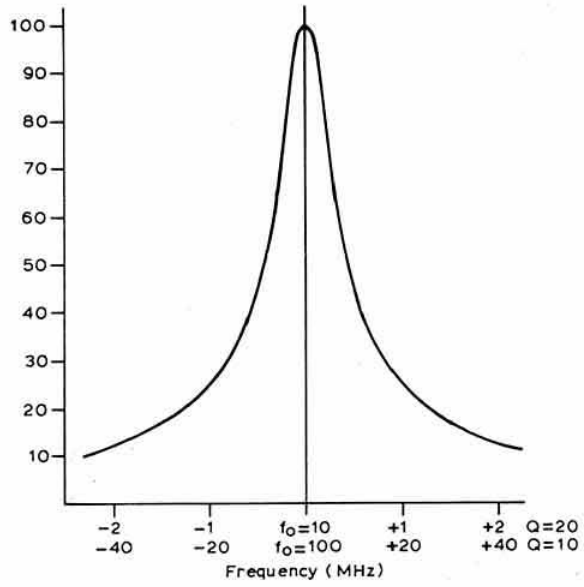


Fig 1. Resonance curve for parallel tuned circuits

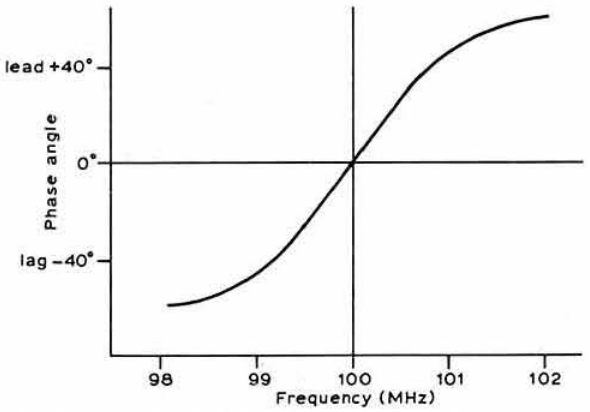


Fig 2. Phase angle of the impedance of a parallel tuned circuit

Construction

It has been the author's experience that it is better to construct experimental apparatus with each stage as a separate unit. This allows the design to be easily changed as experiments indicate and also facilitates the location of faults. The monitor to be described has been reduced to the bare essentials for the discriminator to operate in the 10MHz region, the units being mounted on Veroboard in a 5 by 7 by 2½in metal box. (Figs 3, 4 and 5.)

Components list

C1, 3, 4, 8, 9, 32	22pF
C2, 6, 10, 33	1nF
C5	27pF
C7	65pF trimmer
C11	25pF trimmer
C12	10pF
C13, 14	47pF
C15, 16, 17, 18, 20, 24, 27, 28, 29, 30, 34	0·1µF
C19	4·7pF
C21	0·01µF
C22	65pF variable
C23	100pF
C25	10µF electrolytic
C26	1µF electrolytic
C31	100µF electrolytic
D1, 2	silicon
IC1	Signetics N5111A
L1	6t ¼in dia
L2	3t ¼in dia
L3, 4	20t 7mm dia slug tuned
L5, 6	4t 7mm dia slug tuned
L7	19t 4mm dia slug tuned
M1	meter 100µA
Phones	low Z
R1	220Ω
R2, 5, 6, 11, 13, 14, 15, 16, 24, 27, 30, 31	100Ω
R3, 25, 32	10kΩ
R4, 7, 8, 29	3·3kΩ
R9	330Ω
R10	1kΩ
R12	220kΩ
R17	20kΩ
R18, 28	1MΩ
R19, 20, 22	4·7kΩ
R21	56kΩ
R23	2·2kΩ
R26	2·7kΩ
RV1	10kΩ preset
S1	dpdt
TR1, 2, 3, 6	BSX20
TR4, 7	2N3819E
TR5	BC109
X1	67·5MHz
ZD1	zener diode 6V 400mW

All the 0·1µF capacitors were 63V ceramic plates. Apart from the electrolytics, the remainder were low voltage ceramic plates.

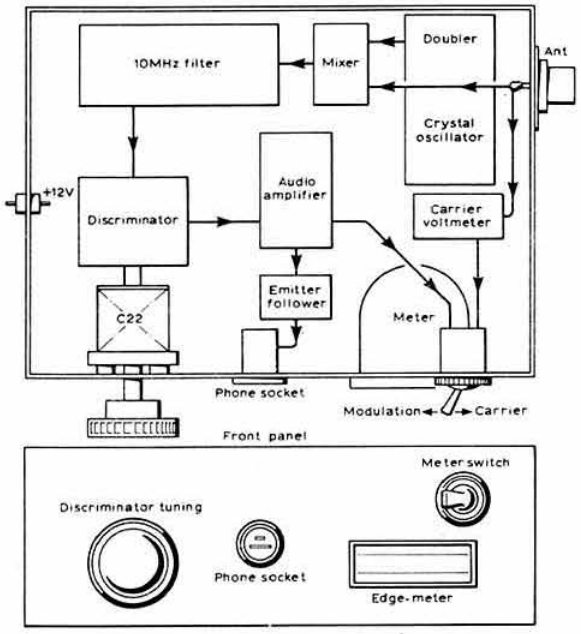
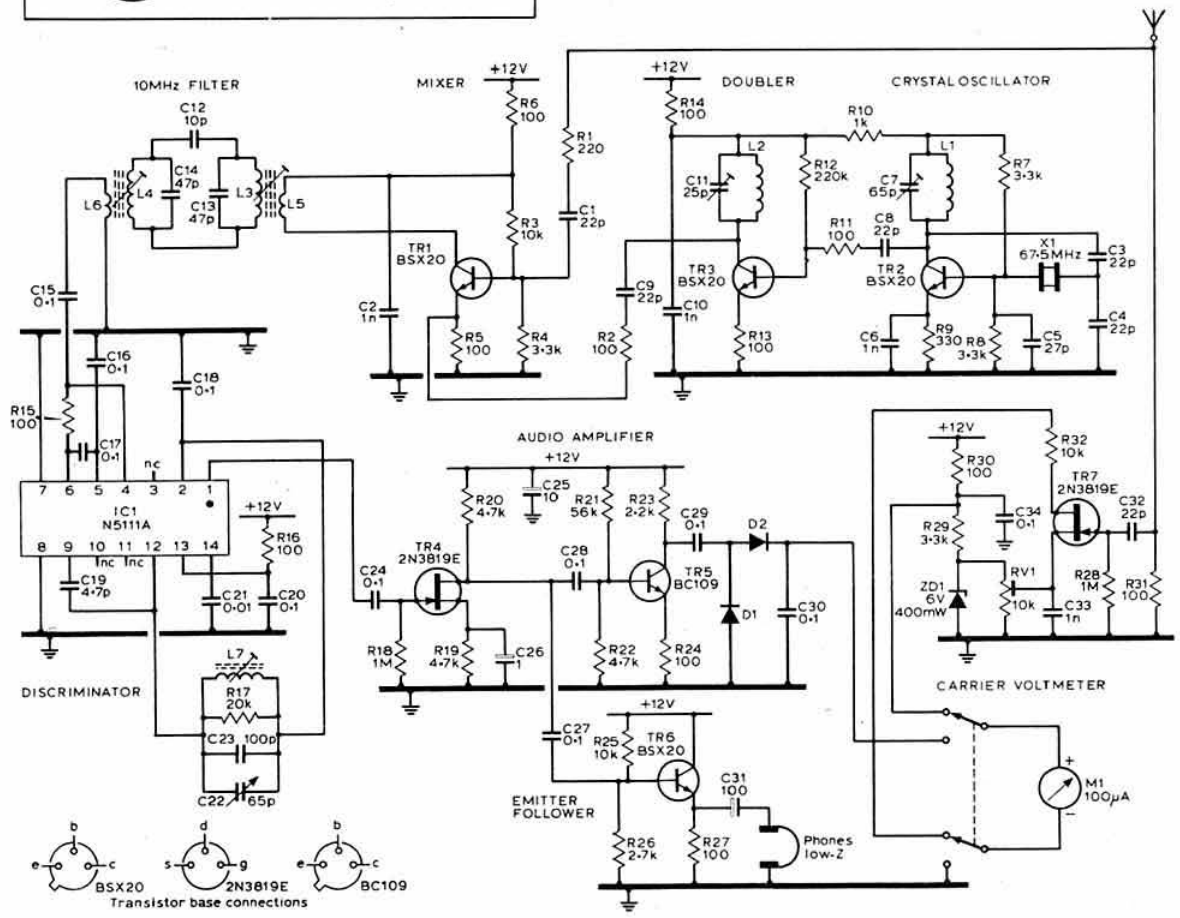


Fig 3. Layout and front panel

A small antenna, or coupling coil, the actual size of which will depend on the power of the transmitter, feeds the 144MHz signal to a simple mixer and also to a fet voltmeter for peak carrier level measurements. The single transistor mixer also receives the doubled output from a 67·5MHz crystal oscillator. The 9–11MHz filter considerably attenuates the 280MHz sum, and the two inputs, compared with the 10MHz difference. The filter is also worthwhile for stability reasons.

Integrated circuit discriminators of the type chosen start with a high gain limiting amplifier which feeds both inputs of a product detector, but with the phase of one of the inputs altered through 90° by means of an external tuned circuit. As the signal frequency changes with the modulation so does the phase of the feed supplied

Fig 4. Circuit diagram



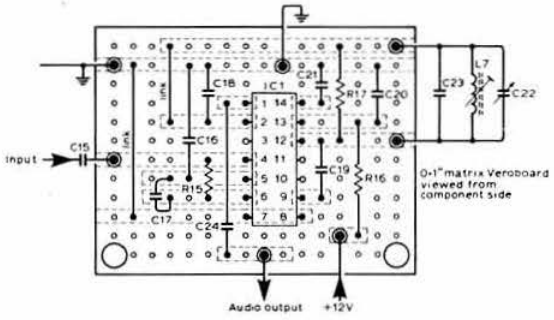


Fig 5. Veroboard discriminator layout (top view)

through the tuned circuit, and the product detector then provides an audio output. The ic is designed for broadcast use with a wide deviation, so it is necessary to use a low-Q circuit to recover sufficient audio from narrow-band frequency modulation.

The ic discriminator needs a tuned circuit that covers 9–11MHz if the 144MHz band is to be completely available. Since frequency at resonance is inversely proportional to the square root of the tuning capacity it must be possible to increase the minimum capacity by at least 50 per cent. This is done by shunting a ceramic 100pF capacitor with a 65pF variable. The tuned circuit must not have a dc path to earth, so care must be exercised in the choice of capacitor and the method of mounting.

The tuning is quite sharp and the control needs to be brought out to the front panel. No external tuning is needed for the 10MHz filter as this is followed by limiters in the ic; however, the filter needs to be set up, with the discriminator disconnected, by means of a dip meter. The output from the discriminator is fed to a single audio amplifying stage which, in turn, feeds an emitter follower to supply a pair of low impedance phones, and another amplifying stage which then feeds to diodes and modulation meter. In fact one meter is used and switched for either peak carrier or modulation measurement.

Setting up

The fet voltmeter will operate at lower levels than the conventional diode and microammeter. The 10kΩ preset bias control in the source circuit is adjusted until the drain current reads zero, and a carrier is then injected and the pick-up loop, or antenna, adjusted to give a suitable reading on the meter. The mixer requires a somewhat lower level and this is provided by inserting a 220Ω resistor, R1, in series with the mixer's signal supply; R2 enables the output of the doubler to be set at a similar level. The audio gain has been designed so that the modulation meter gives a suitable deflection when the carrier meter operates satisfactorily. The discriminator tuned circuit is best set while listening with headphones because the tuning is very sharp.

The monitor is sensitive enough to operate with transmitters having an output of 1W or more; for example, a pick-up coil of three turns, placed near the retracted antenna of a Trio 2200G, will enable the monitor to operate. □

NEW COMPONENT

I.F. filters

TOKO have announced a new series of i.f. filters for 455 to 470kHz. There are two types, the LFY, a four-section minature ladder filter, and the CFM2, which is a two-element mechanical filter. Data sheets showing the characteristics of these new devices are available from the UK TOKO distributor, Ambit International. From the same source a new catalogue is available listing the range of TOKO coils, tuneheads, and ceramic and mechanical filters. The cost of this is 40p from Ambit International, 2 Gresham Road, Brentwood, Essex CM14 4HN; tel 0277 216029.

Leader electronic kits

Arrow Electronics Ltd announce a new range of kits at present comprising a digital clock, bench power supply, laboratory power supply and a test bench oscillator. Each kit is of proven design, and the distributors claim that the make-up of the kits ensures easy assembly, soldering and wiring. Each kit comes complete with every component and a comprehensive manual of instructions, suitable for even the most inexperienced constructor. Leader kits are wholly produced in the UK and are available by mail or callers from the distributors, Arrow Electronics Ltd, Leader House, Coptfold Road, Brentwood, Essex; tel 0277 219435.

The Leader psu

Looking ahead

5-6 May—RSGB Amateur Radio Exhibition, Alexandra Palace, London N22.
15 July—BARTG Convention, Harpenden Public Hall, Harpenden, Herts.
17 September—IOW "get-together", Alverstone Manor. Details from G3KPO.
2-4 November—ARRA Exhibition, Granby Halls, Leicester.

A cmos frequency counter for receivers

by J. C. MOORE, G3OGM*

SEVERAL articles have already been published which describe frequency counters based on the use of digital ICs and seven-segment displays [1] [2] [4]. These counters form a useful item of workshop test equipment, and, in particular, they can be used to measure accurately the frequency of oscillators and transmitters. However, to measure the frequency of a superhet receiver it is necessary to perform a little mental arithmetic to add or subtract some combination of the i.f., local oscillator, and first or second oscillator frequencies.

This article describes a counter that can perform these operations automatically on up to three different input frequencies and give a continuous read-out of the answer. It may thus be used to measure the frequencies of

*34 Beamish Drive, Bushey Heath, Herts WD2 1HH.

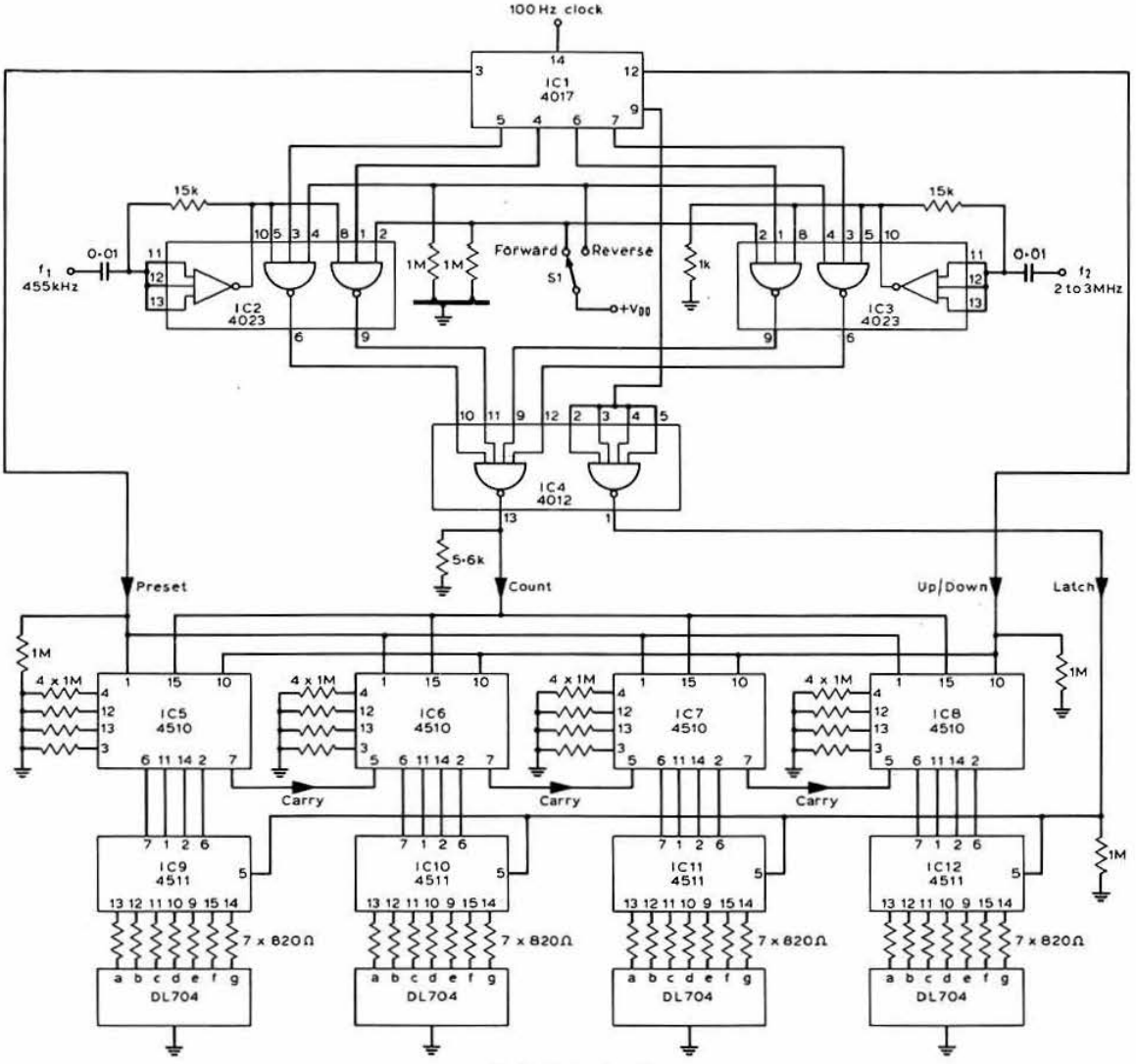


Fig 1. Main circuit

transmitters or receivers. With the addition of suitable input [2] and prescaling [3] [4] circuits it could act as a piece of general-purpose test equipment as well.

Most readers will be familiar with the well-known ttl ICs such as the 7490 divide-by-10 device, used in earlier designs, but it is equally possible to build the following circuit using ttl or cmos. After some thought, cmos was chosen because its greater degree of integration allows a given function to be achieved with less ICs, and the demands on power supplies are much simpler. The overall cost of the system would be about the same in either technology. In the author's application the slower speed of cmos (an RCA CD4017 will count to 5MHz typically with 10V supply) was no disadvantage. In any event the frequency capability could be extended upwards using prescalers. The cmos has few special requirements: uninstalled ICs should be treated with normal handling precautions although the author has heard of few cases of ICs being damaged by static. Unconnected inputs to gates should be earthed through 1MΩ resistors to prevent spurious operation. Unused outputs should be left open-circuit.

In this circuit the frequency counting is achieved in the normal manner by the 4510 ICs. (Fig 1. Throughout this article only the basic ic type numbers are quoted. Varying manufacturers' prefixes and suffixes are discarded to avoid confusion.) These are presettable bcd up/down counters. They are cascaded to give parallel synchronous counting, ie the clock input is connected to all ICs in parallel. As each ic reaches its full count of nine it generates a carry signal to the next more significant digit counter which enables it for one period of the clock pulse. This method is to be preferred to the more familiar ripple counting as it reduces propagation delays through the system.

The output of each 4510 feeds a 4511 medium-scale integration latch decoder and driver ic which can deliver

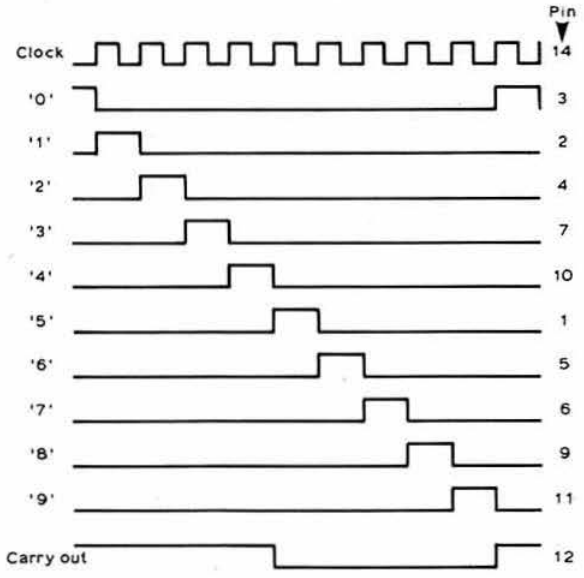


Fig 2. 4017 timing diagram

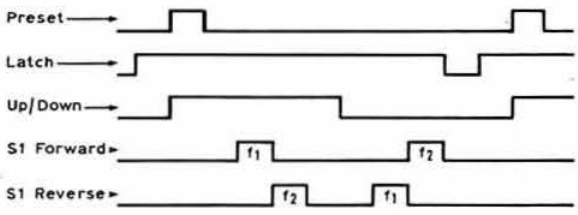


Fig 3. Count sequence

up to 25mA to each segment of a seven-segment led display direct. Similar functions in ttl would be performed by the 74190 or 74192 synchronous up/down counter, 7475 latch and the 7447 decoder driver.

LED displays were chosen for their cheapness and convenience but they consume more power than the rest of the circuit combined, and most of this is wasted in the 820Ω resistors. If the aim is minimum power consumption, eg for battery operation, then the extra expense of liquid crystal displays would be justified. These should be driven by the 4056 decoder driver instead of the 4511. The remainder of the circuit would be unchanged.

Because the 4510 can be preset and can count up or down (ie forwards or backwards) it can be used to measure the sum or difference of three different input frequencies, provided it is controlled to do this in the right order. The heart of the particular circuit to be described is the control system, which produces the correct sequence of pulses to the counters. There are three operations involved.

The first is to enable the latches which accept, store and display the contents of the counters after the end of the previous count cycle. When the latch pulse is removed the display will remain constant while the next cycle is taking place. Thus the display does not flicker but is refreshed once every count cycle, which is 100ms in this design.

The second operation is to use a pulse to preset the counters. If used in a single-conversion receiver it will be sufficient to preset to zero. In a double-conversion receiver it is necessary to preset to the frequency of the first local oscillator, which is assumed to be a known fixed frequency derived from a crystal. For example, the author's receiver has a tunable i.f. of 1·5–2·5MHz and oscillator crystals of 4·5, 5·5, 6·5, 7·5MHz and so on upwards. It thus gives general coverage in 1MHz strips from 2MHz upwards. As there is no real need to display the whole numbers of megahertz, it has a display of four digits showing hundreds, tens, ones, and tenths of a kilohertz. This has been found to be sufficiently accurate even for tuning to a known ssb channel, eg in the trawler band. It is thus only necessary in this receiver to preset 500kHz in all cases. A switch is provided to allow alternative presetting to zero when the tunable i.f. is used alone, eg to cover top band. This switch is not shown in the circuit here as the requirement depends on the design of the particular receiver. It is a simple matter to switch in any number of required presets by applying $+V_{DD}$ through a diode network if necessary, to the appropriate bcd inputs on pins 3, 4, 12 and 13 of the 4510s. Negative frequency presets are achieved by using the complementary number. Each of the presets is earthed through a 1MΩ resistor which holds the input at zero unless V_{DD} is applied.

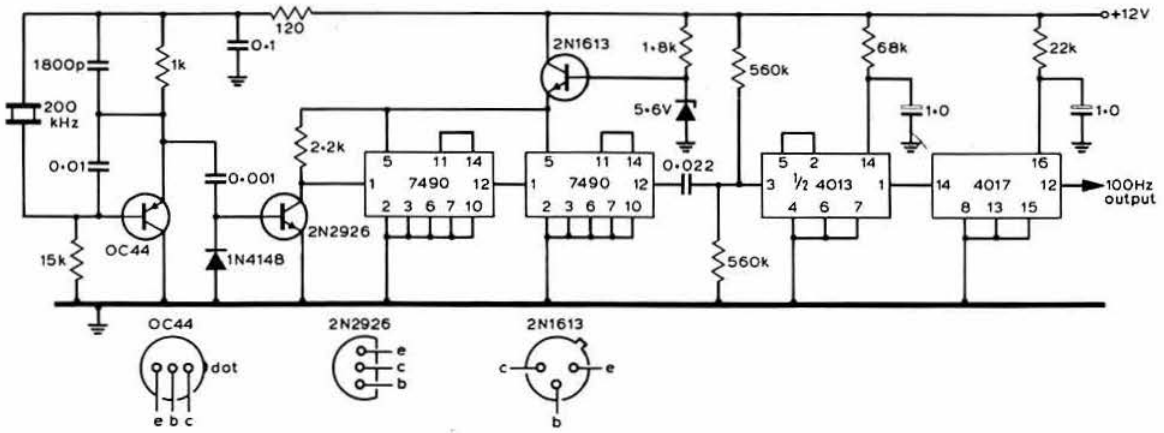


Fig 4. Crystal clock

The third and major operation is to count the input frequencies. The clock in this design generates 10ms pulses which gate the counters to measure to the required resolution of 100Hz. Because the received signal can be above or below the first oscillator, it is necessary either to count the second oscillator up followed by the carrier insertion oscillator (on 453·5 or 456·5kHz) down to leave the difference remaining in the counters, or in the reverse order.

This is where the 4017 ic comes into play. This is a divide-by-10 counter, but unlike the 7490 type its outputs are not bcd coded. The 4017 is a Johnson counter which has 10 individual output lines, each of which goes high in turn for only one clock period as the counter is clocked (Fig 2). Each of these output lines thus provides a pulse in a predetermined order, so the device can be used to control a sequence of up to 10 events in a set order. The ic also has a conventional carry pulse output which is at a tenth of the input clocking rate.

Figures 1 and 3 show how the sequence of pulses is used. S1 enables the appropriate pair of NAND gates to let through 10ms bursts of input frequencies in the right order. The carry pulse from pin 12 of IC1 sets all the 4510s to the condition for counting up for 50ms and then down for 50ms alternately. With S1 in the forward position Fig 3 shows that the sequence of operations is as follows: latch, preset, count f1 up, count f2 down, latch new result, and so on. In the reverse position it goes: latch, preset, count f2 up, count f1 down, latch new result.

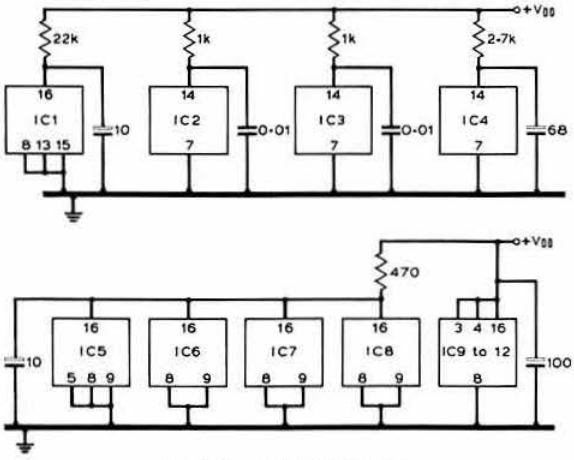


Fig 5. Supply connections

It will be noted that not all the outputs of the 4017 are used in this application. NAND gates in IC2 and IC3 are connected as inverters with feedback resistors to make a more or less linear amplifier with a voltage gain of about 10 in each case. This was found adequate for input signals of 1V peak to peak up to about 5MHz. The connections can be taken from any convenient point in the receiver oscillators as the input impedance is quite high. In the author's case this is direct from the collector of the variable oscillator buffer transistor and from the drain of the crystal-controlled carrier insertion oscillator through only a blocking capacitor in each case. If more gain or isolation is required it would be necessary to provide more amplification. In this unlikely event a simple solution would be to cascade one or two more cmos gates in the fashion already shown. The 4012 NAND gate IC4 accepts the two 10ms bursts of square waves and passes them in turn to the count inputs of the 4510s.

Any conventional clock circuit may be used to generate the 100Hz input to the control system. That used by the author is shown in Fig 4, complete with circuitry for interfacing the ttl counters (which happened to be available) to cmos.

The circuit was constructed in two units: one diecast box, 11½ by 6½ by 3cm, contains the 4510 and 4511 ics on a piece of Veroboard and the led displays connected via their 820Ω resistors; the other box, 12 by 9½ by 3cm, contains the crystal clock and all the control system on a piece of double-sided pcb measuring 11 by 8cm. This way only four connections are needed between the two boxes. The boxes are bolted together back to back allowing full access to all the contents. The combined assembly was mounted on top of the receiver, allowing the use of short interconnections at rf.

The 704 led displays are difficult to read when bare, because light leaks from illuminated segments to adjacent

dark ones. Some sort of filtering is necessary, and the author obtained a very clear display by Aralditing-on a section cut from the plastic lens of a pair of Polaroid sunglasses. The rectangular strip was held flat against the display surface while the glue set round the edges.

With the large variety of pulses floating round circuits of this nature, it is necessary adequately to decouple the power supplies to each ic. This design plays safe by isolating every ic in the control system independently, Fig 5. Under these conditions digital ics perform exactly as advertised, with no snags. The value of V_{DD} is not very critical, anything from about 8 to 15V being satisfactory. With the 820Ω resistors shown feeding the displays, each segment takes 12·5mA at a supply of 12V.

The counter has been in use for a year now and it is an invaluable aid with both a receiver and transmitter. The last digit of the display hunts more or less continuously between adjacent digits. This is only to be expected with two counting processes in each cycle, both of which are asynchronous with their input frequencies. It presents no problem to read, but could be eliminated by adding another 4510 counter in the chain preset to −5, reducing the clock frequency by a tenth, and not displaying the last digit. This reduces the resolution of the counter to 10Hz but leaves the display at 100Hz resolution, which is an expensive luxury.

References

[1] "The G3XGP frequency meter" W. H. Bond, G3XGP, *Radio Communication* June 1973, with corrections in December 1973.

[2] "Front end for G3XGP frequency meter" Technical Topics, *Radio Communication* October 1974.

[3] "A simple pre-scaler for 145MHz" C. H. Edlin, G3QC, *Radio Communication* July 1975.

[4] "A digital frequency counter and timer" G. F. Firth, G3MFJ, and D. M. Pratt, G3KEP, *Radio Communication* March 1976. □

A time-shared servo swr meter

by C. MacKEAND, WA3ZKZ/G4ARR*

THE usual swr meter is not a direct indicating device, but in the often prolonged business of setting up a new antenna, direct indication of the swr in the feed line would be a considerable advantage. A simple mechanism for achieving this is described here, and while it is not presented as a construction project it could be duplicated without too much difficulty.

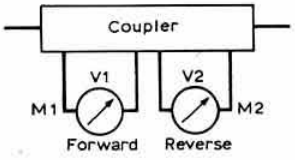


Fig 1. Basic swr indicator

The problem to be addressed is described by Fig 1, in which it can be seen that two independent voltmeters, V1 and V2, register the forward and reverse powers in the line, as determined by the coupler. So far so good, but in order to obtain the swr a ratio of these voltages is required, and division is difficult. It has been done elegantly [1] but the author was looking for a simpler approach. Whether or not he found it may be left to the reader to determine for himself.

Adopting a different attack, consider how the user of the conventional swr meter handles the matter. He adjusts the sensitivity of one common meter as in Fig 2(a) until the forward power is at a fixed or fiduciary level and then reads swr directly from a shaped scale in the reflected power position of the switch. Alternatively, as in Fig 2(b), if a dual potentiometer of good matching of sections is available, the two meters of Fig 1 are retained and the forward power is adjusted to the fiduciary level while simultaneously the reflected power meter settles to the swr reading. Here then is the germ of an idea. Substitute the forward meter with a current level detector, motorize the potentiometer, and automatically adjust the potentiometers to the required point; this might be a workable, albeit wonderfully clumsy, system.

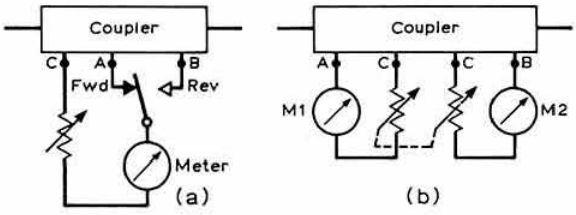


Fig 2. (a) Practical single indicator swr meter. (b) Modified presentation with forward and reverse meters

At this point the time-sharing concept enters the arena. In Fig 3 a meter is shown connected to a voltage source, and in series with it is a commutating contact which so vibrates as to spend 50 per cent of its time in the *nc* position and the other 50 per cent in the *no* position. If the frequency of vibration or commutation is high enough, the meter acts as a mechanical integrator or low-pass filter and the meter reading is apparently quite steady. If the resistor R is selected so as to deflect the meter to its fsd when the contact is maintained closed, then when it is commutating (at about 100 to 200Hz for most meters) the meter will read exactly half-scale. This assumes, as the author will continue to do, that the meter's internal resistance is very low compared with R. Note especially though, that when the contact is in the *no* position there is no current flow anywhere in the circuit at all.

* 115 South Spring Valley Road, Wilmington, Del 19807, USA.

To complicate the issue a little, add a second meter, as shown in Fig 4, and observe the behaviour of both meters. They will show the same current and, if both have the same fsd, the same reading. In fact both will also behave quite independently as regular voltmeters, although at 50 per cent of normal sensitivity. The scale resistor R is common to both meters but the currents never mix. When one is on, the other is off, and vice-versa. Complete electrical independence can be retained.

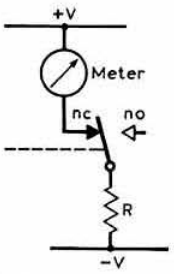


Fig 3. Commutating contact reduces meter sensitivity by 50 per cent

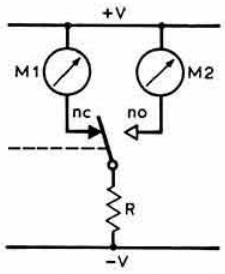


Fig 4. Meters are independent, with common range resistor

This new circuit can be applied to the swr meter of Fig 2(b), and Fig 5 shows this as it might be set up. Now the performance of Fig 2(b) can be duplicated by varying the single resistor R. This resistor will have an equal effect on the sensitivity of both meters. At this point one can see that if the only requirement is for the display of swr then the meter M1 is not needed as long as there is some way of setting the forward branch current to the fiduciary level and keeping it there by suitable variation of R. What is needed is a device to vary R automatically in such a way as always to keeep M1 at the same fixed reading.

Obviously this could be done electronically, but the hardware available suggested an electro-mechanical route. Fig 6 shows a meter movement equipped with a black paper flapper which will interpose between a light L1 and a photo-resistive cell PR1. As the applied voltage increases from zero, the light is initially shining directly on the cell, giving a cell resistance of the order of 100Ω. At a threshold value equal to the applied voltage needed to bring the meter to its fsd, the light begins to be obscured. As the applied voltage is further increased the cell is steadily further obscured to maintain its resistance

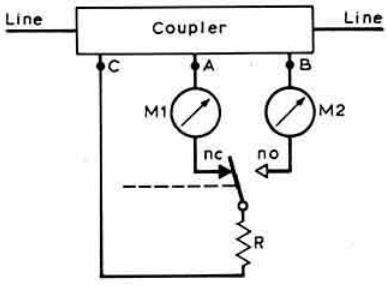


Fig 5. Single range resistor substitutes for ganged resistors in Fig 2(b)

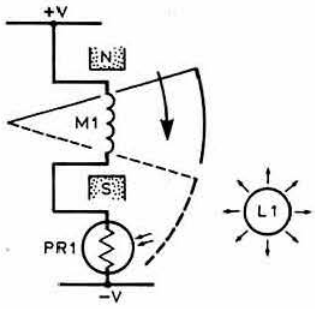


Fig 6. Photo-mechanical servo regulator

sufficiently high to permit only the fs current of the meter to pass. Since the dark resistance of such a cell is around 1MΩ, this simple device will provide a regulated current, in the author's case about 150μA, with an applied voltage of between a fraction of a volt and a hundred or so volts.

Here then is a simple regulator circuit, and its main possible problem is its stability. Will it oscillate? Fortunately, no. There are only two significant time lags in the system—the meter and the cell, and since what has been designed is known in process control terminology as a proportional-only controller, stability is assured. Also, the cell lag is large compared with the other time lags in the loop and so provides another favourable factor—the single dominant lag [2 and 3].

Having that hurdle safely out of the way, now combine the circuits of Figs 5 and 6. The meter movement M1 receives the forward signal from terminal A of the directional coupler and moves until the light impinging on the photo-resistive cell PR1 is so reduced that M1 is held at its preset value (that is, the value where the cell is partially obscured by M1's flapper). Whatever the value of resistance of PR1 necessary to do this, the same value is presented as the series resistance for M2. Therefore, provided M2 is of such a sensitivity that it will read full scale when the forward and reverse voltages are equal (ie when the swr is infinite) it will now read out in swr just as M2 did in Figs 2(b) and 5.

In the completed working device some means is necessary to drive the commutating contact. This is

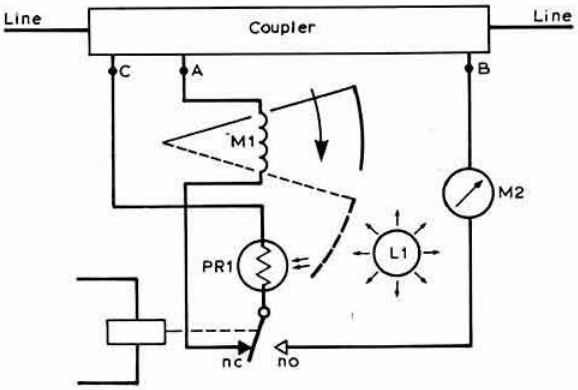


Fig 7. Range resistor automatically servo-adjusted

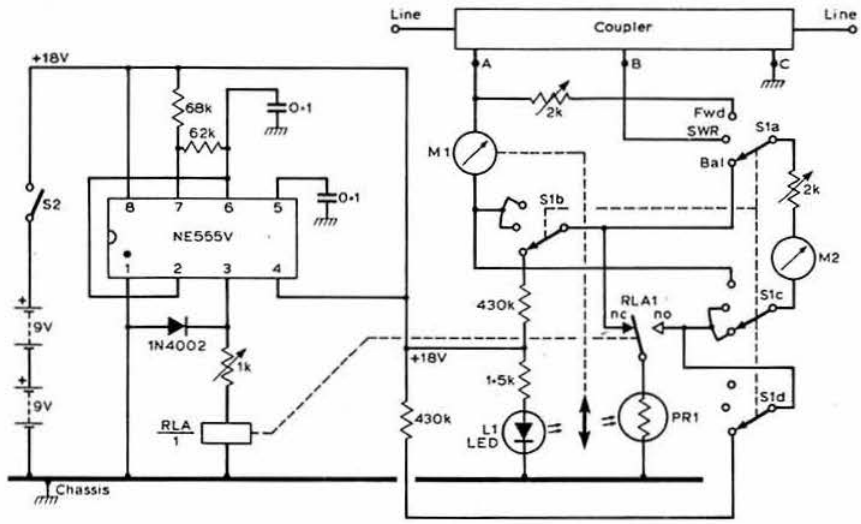


Fig 9. Circuit for the servo swr meter

accomplished by using a 555 integrated circuit running at about 150Hz, and the contact is a small mercury-wetted relay. In a less-than-perfect world, 50/50 division is not possible—some time has to be allowed for the contact to travel from the *nc* to the *no* position and vice versa. However, whatever the actual value, the main requirement, in this as in certain other fields, is equal time! The most expeditious way of providing adjustment of this proved to be a simple drive adjustment with a series resistor in the coil circuit of the relay, taking advantage of the natural drive/bias characteristics of the relay. Some means of detecting drive balance must also be provided. This is accomplished by switching to rearrange the meter as shown in Fig 8. Balance is detected by a zero reading on the meter, and is set by the series drive adjustment resistor R2.

The final circuit is shown in Fig 9 and this includes the balance circuit and a switch position for observing the forward power reading. This is also of use to determine whether the power level is sufficient to bring the regulator meter movement M1 over its operating threshold into the regulating mode. The relay driver 555 is mounted on a printed circuit board in a screening can to avoid the possibility of rf pickup changing the mark/space ratio of the relay contacts. The lamp is a led operating from the 18V dc battery supply for the 555 oscillator.

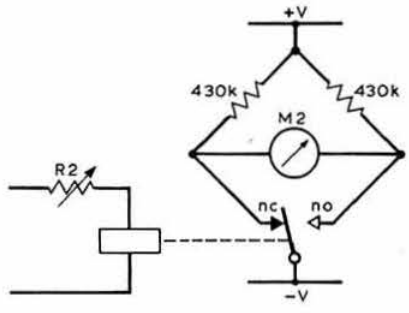


Fig 8. Balance circuit for adjusting relay bias

Final notes

After the flapper is put on the meter it will need rebalancing. Also a stop is necessary to prevent the flapper passing right over the photo-resistive cell on a transient and then being driven right out of other side by the now positive feedback! It is also necessary to have the cover on for it to work well; light from the room has to be excluded from the cell or it will lose its dynamic range. In order to get meaningful readings of swr it is necessary, as with any other swr meter, to be in the linear range of the diodes in whatever coupler is being used. For this reason a toroid transformer type of coupler is probably advisable.

The results obtained have been encouraging. There is a characteristically slow deliberate approach (3s) to a new reading, due to the need for the servo regulator to rebalance, and this gives a good indication of normal operation. A fully electronic analogue of this device would be interesting, and surely easier to duplicate. One possible approach would be to use a fet driven from an ic comparator current detector instead of the cell. As the detector and the cell are at different potentials there is obviously a grounding problem, which is solved in the author's version by the isolation provided by the meter movement and the opto-coupling. Also, if an electronic version is tried it is worth remembering that the regulating element, whether fet or photo-resistive cell must be ohmic. A bipolar silicon device for instance just will not fly due to its voltage sensitivity or non-ohmic nature. Finally, it would not seem too difficult to substitute the relay with a fet chopper.

References

[1] "A simple computing swr meter", David L. Fayman, W0GI. *QST* July 1973, pp23–29.

[2] *Process Control*, Peter Harriott. McGraw-Hill.

[3] *Fundamentals of Automatic Control*, G. H. Farrington, Chapman & Hall. □

An assured speech processor

by R. C. V. MACARIO, BRS33543*, and

T. DAVIES, BSc, GW4ADL

THE principle of speech processors will be well understood by most readers of this journal, and indeed useful discussion of the various methods of achieving satisfactory speech processing is available in earlier issues [1, 2, 3]. It is well known, and indeed was shown sometime ago [4], that the single sideband or rf method of speech clipping is the superior method and also gives an assured result. This is borne out by a more recent description [5] of an rf speech clipper based on the phasing technique of sideband separation [6].

There would, therefore, be little novelty in describing an rf speech clipper as such, and for this reason the philosophy of operation of the circuits is omitted. However, the unit to be described has two novel features which one might characterize as giving operational assurance. The first feature is the use of a polyphase sideband discrimination circuit based on a simple design formula so that an assured response is achieved and testing is not required (provided of course the wiring is correct). The second is speech level visibility. On portable equipment, or indeed on one's operational rig, oscilloscope monitoring is not always wanted. On the other hand, an indication of the actual "talk power" entering one's transmitter is very assuring.

As is usual today, with the wealth of low-power complex circuits readily available, the design uses a minimum of parts. A block diagram of the unit (in three tiers for clarification) is shown in Fig 1.

The first section consists of microphone signal audio bandpass shaping and level monitoring. The level monitor used (in place of a meter) is a line of leds driven by the novel Siemens UAA180 line-of-leds driver. Apart from processing the speech, one could just use this first part of the circuit (detail in Fig 2) as a microphone level monitor. Further description of this aspect is found below.

The second section is the well-reported polyphase network as first described by Gingell [7]; in this instance, buffered between operational amplifiers. The four output leads contain the audio signal, but differing by 90° from each other. Provided one gets the order right for mixing these up to a higher frequency with a similar set of phase quadrature carriers, and adds the output of a balanced mixer, only one sideband appears—plus various higher order carrier frequency harmonics.

The third tier has a simple LC filter to select the sideband at the fundamental frequency $f_0/4$, prior to the clipping or limiting process. Translating this new signal back to baseband requires a final stage of mixing and a simple low-pass RC filter.

Actual circuit

Many of the signal functions can be achieved by devices within a single ic package. Also, because clipping is a non-linear process, excessive regard for amplifier linearity is not essential, and the same applies to the mixers (switching modulators). Since the rf frequency employed does not come out of the unit, its value is arbitrary, and a "convenient" value may be used. The detailed circuit is shown in Fig 2. It has been drawn to focus attention on the device count rather than the circuit topology.

The first op-amp acts as a straightforward buffer amplifier, with the two capacitors C1 and C2 designed to give roll-off at 300 and 3,000Hz respectively. If a better response is required, this first stage should be replaced by the circuit of Fig 3, which consists of an active low-pass and high-pass second-order filter in series. Operational amplifiers come in packages of one, two, three or four per device, so the authors do not show a particular device number or make. The only requisite is to observe the +/− and o/p pins.

The polyphase network needs voltage driving from two out-of-phase signal terminals and it is good practice to use two further op-amps, as shown in Fig 2, for this purpose.

*2 Valley View, Derwen Fawr, Swansea SA2 8BG

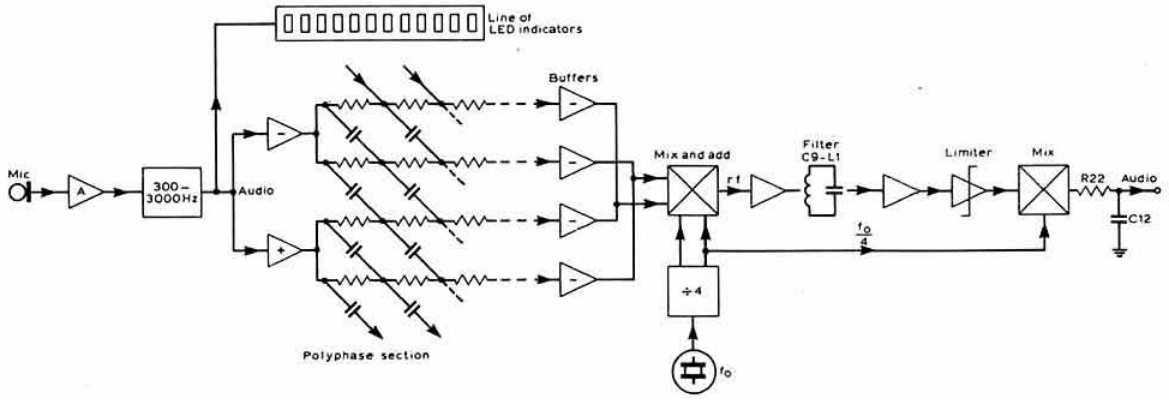


Fig 1. Block diagram of the unit

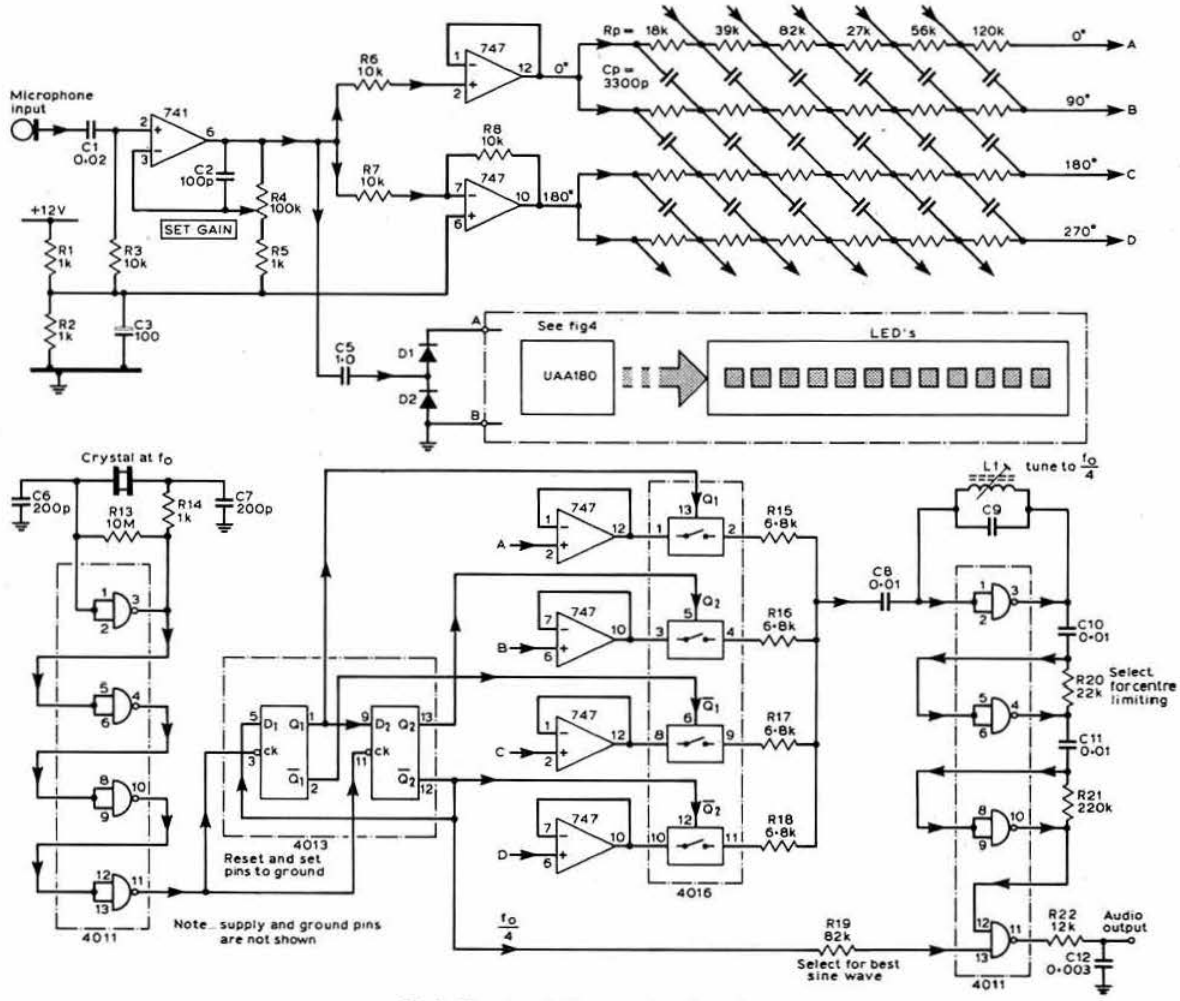


Fig 2. The circuit diagram for the unit

It is this input signal which is to be eventually clipped and therefore is a good point at which to monitor the level.

Envelope detection of the speech waveform provides a measure of the average level. Capacitor C4 (0·047μF) was chosen to give a suitable hang time.

The Siemens UAA 180 device is an 18-pin dil which provides the capability of driving up to 12 leds as the voltage applied to pin 17 is increased by 1V relative to pin 3. The detailed wiring schedule is shown in Fig 4. RS Components have available a line of 10 leds. The last two or the first two can be left off, or a different overload colour considered, for example. In Fig 2 the scheme is indicated more as the indicator appears in practice.

Polyphase circuit

Fig 5 plots the response of an actual polyphase circuit consisting of six sections; that is, 24 RC pairs. Each RC pair value (there are four of these to make one section) gives rise to a null in the response. Therefore, to achieve a useful discrimination of a given audio bandwidth, eg 300–3,000Hz, the RC pair values should be staggered. The actual number of pairs required to give a specified attenuation over a given bandwidth ratio (the ratio of the highest audio frequency to the lowest) was worked out by Weaver [8], and a useful curve is given in his paper. For example, six sections can theoretically achieve 64dB discrimination for a bandwidth ratio of 10:1. This is very nearly the case for Fig 5, which was achieved without any special component balancing and indicates the superiority of the polyphase method [7] over the conventional phasing method [9].

Because the performance depends entirely on where the RC pole frequencies are placed, then clearly these should also be chosen from the preferred values of R and C.

It turns out that the lowest frequency of cut-off should be chosen to correspond to the product of preferred values of R and C, eg 330Hz, rather than some arbitrary or otherwise specified value. The poles should then be chosen to fall on equally spaced logarithmic intervals between this lower frequency and an upper frequency,

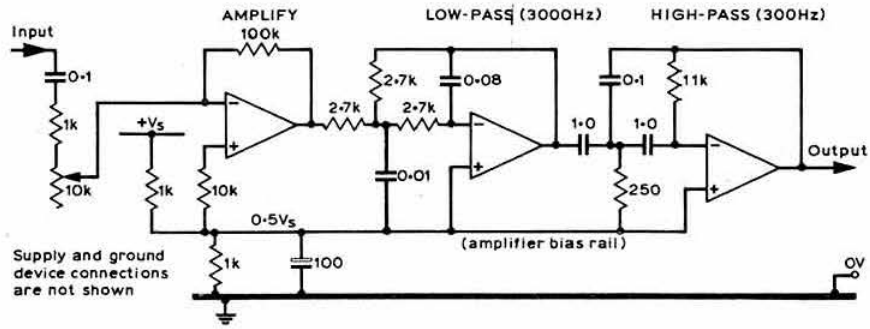


Fig 3. Improved microphone shaping amplifier

usually 10 times greater. Choosing a convenient value for the capacitance value, eg 3,300pF (so that R is not too small or large, etc), resistors on a preferred value scale over a 10:1 range can be selected at intervals depending on the order N of the network.

For example:

for 6th-order, R = 18kΩ, 27kΩ, 39kΩ, 56kΩ, 82kΩ, 120kΩ;

for 4th-order, R = 22kΩ, 39kΩ, 64kΩ, 120kΩ;

or R = 18kΩ, 33kΩ, 56kΩ, 100kΩ.

The discrimination bandwidth will differ slightly for the two orders. Also note that there is some advantage to be gained by staggering the order in which the R appears from the above table (see Fig 2).

Setting-up procedure

The actual circuit can be constructed on 0·1in spacing plug-in boards so that a working circuit can be achieved in a few hours. In any case it is probably best to divide the construction into three stages, in the sequence of Fig 1.

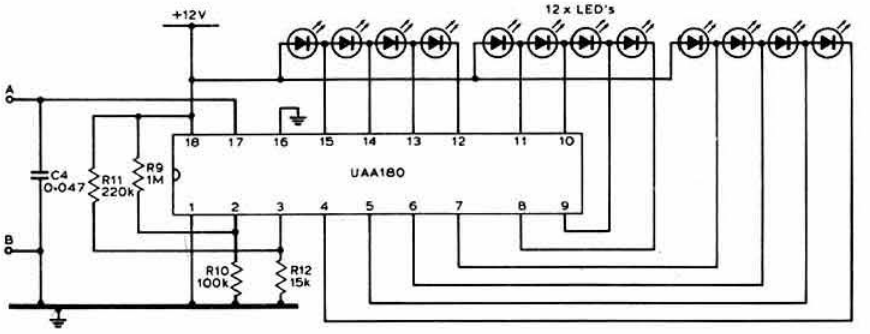


Fig 4. Wiring schedule for UAA 180

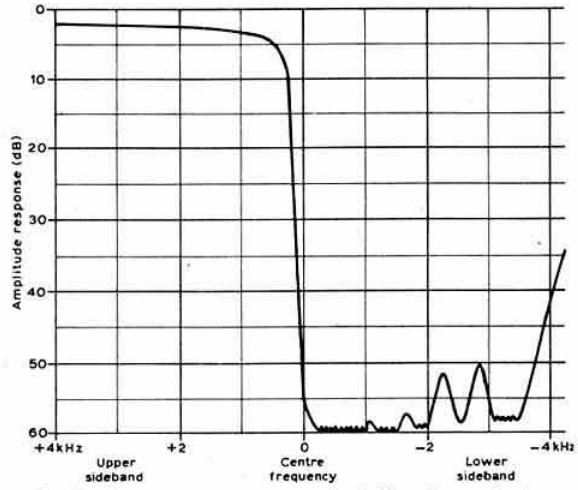


Fig 5. Frequency response of sixth-order polyphase network

To test the audio stage, use an audio generator. With the gain control R4 set to maximum, all the leds should light with an input of approximately 4mV. The peak-to-peak voltage swing at the out-of-phase inputs to the polyphase network will be approximately 1V.

The same ac waveform (in phase quadrature) should appear at points A, B, C and D, and should be exactly equal in amplitude. Meanwhile the local rf oscillator output should appear as a square wave at pin 11 of the first 4011 quad 2 input NAND gate. A divided-by-4 clock should appear at each Q output of the 4013 device. For this to be 450kHz (to match the coil L1) use a crystal at 1·82MHz, etc.

The first gate of the second 4011 acts as a tuned amplifier and also adds the signals coming from the four multiplier or quad bilateral switches (4016). The second and third gates of the remaining 4011 device act as limiting amplifiers—the clipping action—and produce a squared-up waveform. It is desirable to have symmetrical limiting, eg as the audio input is reduced, so the clipper output (of the stage under discussion) reduces to the resemblance of a sine wave. There appears to be a

variation from one device source to another affecting the symmetry of clipping, but this can be overcome by adjusting the value of R20 as indicated.

The fourth gate is used as a switching modulator to restore the signal to an audible signal. The simple RC section R22 C12 removes the rf harmonics. The output signal fully clipped level has a peak-to-peak value almost equal to the circuit supply voltage, eg 10–12V.

References

[1] "New techniques for amateurs", G. M. Ward, *Radio Communication* September 1969, p594.

[2] "Technical Topics", *Radio Communication* September 1971, p616.

[3] "Technical Topics", *Radio Communication* March 1972, p152.

[4] "Ordinary and processed speech in ssb application", H. G. Collins, *ARRL Single Sideband Handbook*, p217.

[5] "AF and rf clipping for speech processing", D. A. Tong, *Wireless World* February 1975, p79.

[6] "The phase shift method of ssb generation", D. E. Norgaard, *Proc IRE*, 44, December 1956, p1718.

[7] "SSB modulation using sequence asymmetric polyphase networks", M. J. Gingell, *ITT Elec Comms*, 48, February 1973, p21.

[8] "Design of RC wideband 90° phase difference network", D. K. Weaver, Proc IRE, 42, April 1954, p671.

[9] "Meeting ssb mobile radio specifications with operational amplifier phasing networks", R. C. V. Macario, IERE conference on "Civil land mobile radio", November 1975. □

Calculation of distances between QTHs using scientific calculators

by E. H. SQUANCE GI8OJG*

Having read the article on this subject by G8DET and G4BBR in the September 1977 issue of *Radio Communication*, it was noted that the examples given were for degrees only. Many calculators operate only in radians, and the equation worked very well using a Sinclair programmable machine in the simple scientific mode. The facility of many calculators to be programmed adds a new dimension to the problem, and the equation in the article adapts well to programming—a real help to successful contest operators!

The cheapest programmable machine available is the Sinclair Cambridge, and the author has tested the following program on many entries in the station log from his swl days and found it accurate to 0.125 per cent within the 400-1,000km range. The program is written out in the standard Sinclair format, with the execution sequence noted at the end.

Although other programmable machines have not been tested it should be possible to adapt this approach to suit any of them.

* 4 Henderson Road, Bangor, Co Down.

PROGRAM

Step number indicated by machine	Check digit	Key sign to press next	Step number indicated by machine	Check digit	Key sign to press next	Step number indicated by machine	Check digit	Key sign to press next
00	A	▼	12	0	Stop	24	A	▼
01	3	D-R	13	A	▼	25	3	D-R
02	8	Cos	14	2	Goto	26	7	Sin
03	2	Sto	15	0	0	27	6	)
04	0	Stop	16	5	5	28	E	+
05	A	▼	17	0	Stop	29	5	Rcl
06	3	D-R	18	A	▼	30	-	=
07	8	Cos	19	3	D-R	31	A	▼
08	.	X	20	7	Sin	32	8	Arccos
09	5	Rcl	21	.	X	33	A	▼
10	-	=	22	6	(	34	6	R-D
11	2	Sto	23	0	Stop	35	0	Stop
						36	-	-

EXECUTION

LO_1 − LO_2 = RUN LA_1 RUN LA_2 RUN Step to 17 LA_1 RUN LA_2 RUN X 111.12 =

LO_1 = Longitude of home QTH
LO_2 = Longitude of other QTH

LA_1 = Latitude of home QTH
LA_2 = Latitude of other QTH

All expressed as degrees.

A cmos rtty modulator for new tones

by J. T. Evans, BSc, G3VDB*

SINCE rtty transmission was first introduced into amateur radio, many techniques have been devised for generating the fsk signal. In the last few years, with the decreasing price of digital integrated circuits, several articles describing variable digital division of a high frequency oscillator have appeared. This article traces the evolution of a crystal-controlled cmos modulator, which produces the "new standard" European tones with high accuracy and purity.

The great advantage of digital tone production, as with all digital processes, is repeatability and long-term stability of the resulting circuit. These features will only be fully realized if the controlling high frequency is crystal controlled, but a stable LC oscillator could be employed if equipment were available for accurate initial setting. In the amateur station, such equipment may be obtained more easily than that required to set up three audio tones accurately, as would be required with most other modulation techniques.

The characteristics of audio fsk are now standardized in Europe as: 1,275Hz common space; 1,445Hz narrow shift (170Hz) mark; and 2,125Hz wide shift (850Hz) mark. Although wide shift has almost completely disappeared from amateur use, the author decided to retain it as a possible aid to checking equipment operating on the old tones of 2,125Hz, 2,295 and 2,975Hz. With data transmission now permitted on 144MHz and above, 850Hz shift may make a reappearance at the much higher data rates of 600 or 1,200Bds.

Block diagram (Fig 1)

The oscillator which is to be divided must run at an even multiple of all the output tones, the lowest usable frequency being 216·75kHz, which requires division by 102, 150 and 170. Since crystals below 1MHz are difficult to obtain, a higher frequency is normally employed, bringing the oscillator into the 1–15MHz range, where even surplus crystals are plentiful. The extra division stages then required may precede or follow the variable

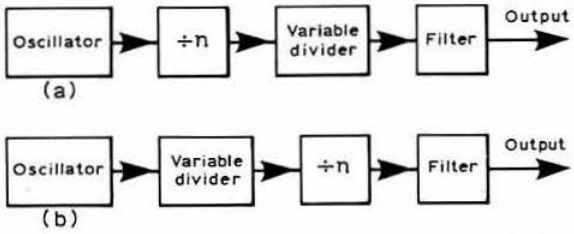


Fig 1. Two positions for the fixed division stages (÷n). The arrangement (b) produces lower telegraph distortion than (a)

* 144 Parkville Road, Withington, Manchester M20 9TY.

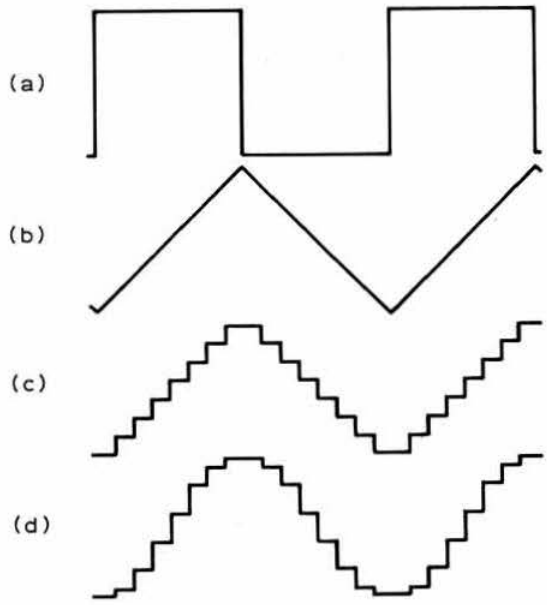


Fig 2. Derivation of digitally-produced waveform with low harmonic content. (a) Symmetrical square wave, no even harmonics, high level odd harmonics. (b) Symmetrical triangular wave, no even harmonics, lower level odd harmonics. (c) Digitally-produced approximation to (b). (d) Digitally-produced approximation to a sine wave

division process (Figs 1(a) and 1(b)). Extra division stages after the variable stages result in output distortion (due to limitations in the digital technique) being divided by the same figure, although at 45Bds and the carrier frequency normally employed for rtty this distortion is not significant. This reduction is because each character element requires more input pulses to the variable division stages, and the time of change from mark to space (or space to mark) can be better indicated in the audio output. Such considerations become very important, when the modulation rates become comparable with the tone frequencies and the shift. It is, therefore, advisable to put the extra stages after the variable division as shown in Fig 1(b).

Output filtering

The symmetrical square wave produced by this purely digital circuit cannot be used to modulate a transmitter directly, as it has an unacceptable harmonic content. In fact, this is exactly the technique used to produce 100kHz and 10kHz marker "pips" easily detectable up to tens of megahertz. However, there are a number of advantages to first producing square waves:

(i) the amplitude is constant as the output frequency is changed, and, if properly filtered, the resulting sine waves will also be closely matched in amplitude.

(ii) a 1:1 square wave has, ideally, no even harmonic content, and the odd harmonics decrease in amplitude at a known rate. The filtering problem can thus be accurately defined.

The problem of adequately filtering square wave signals has already been touched on elsewhere [1]. With the changeover to new tone standards it has become

impossible to design a suitable filter with the sort of tolerance components that amateurs prefer to use. The situation is aggravated by the author's decision to retain wide shift.

A close relative of the square wave (Fig 2(a)) is the symmetrical triangular wave (Fig 2(b)). Again it has no even harmonics, but now the odd harmonics fall off even faster, the third being at about −19dB and the fifth at −27dB. Higher harmonics are below −30dB and can therefore be ignored. Fortunately it is possible to produce an approximation to this triangular waveform, the staircase, up-down count of Fig 2(c), using the extra division stages already discussed and one other ic. This will have eight equal steps from peak to peak and will have a similar spectrum to the triangular wave plus a square wave component at 16 times the fundamental frequency, but of low amplitude. This component is easily reduced by a single RC stage, since there are four octaves between the desired output and the unwanted frequencies.

Sine wave synthesis

The staircase wave guarantees that unwanted components are below −19dB. This may be sufficient for many applications and, since it is a definite figure, is better than many circuits in common use. To further reduce these components, the eight steps of the staircase are given different heights corresponding to the value of a sine wave at that point in the cycle (Fig 2(d)). This will reintroduce a small amount of even harmonic content, and accurate values must be used for the step resistors. Ideally the waveform of Fig 2(d) contains only the required tone and a low-level sampling component at 16 times the fundamental. This can be eliminated by a single RC filter.

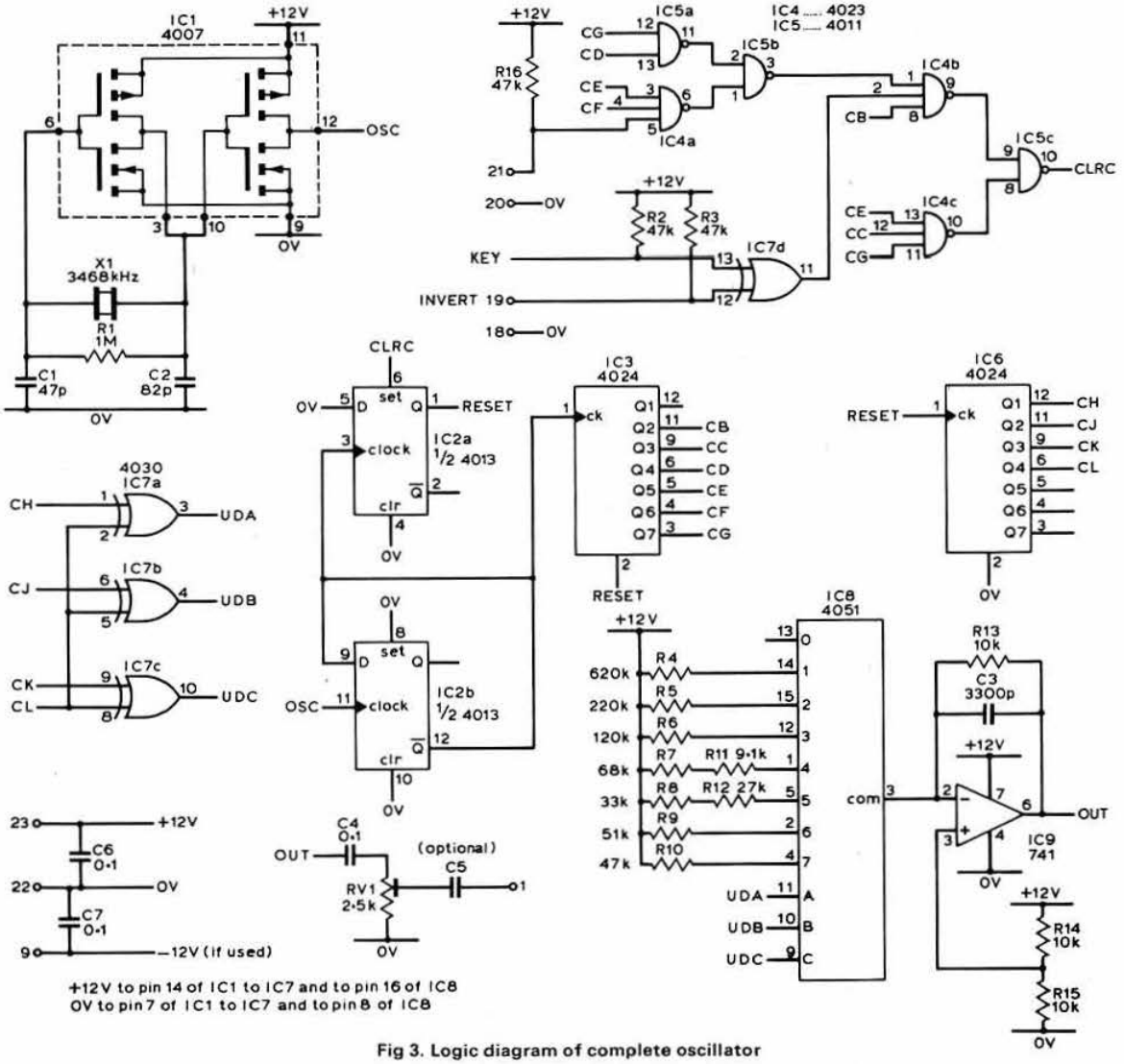


Fig 3. Logic diagram of complete oscillator

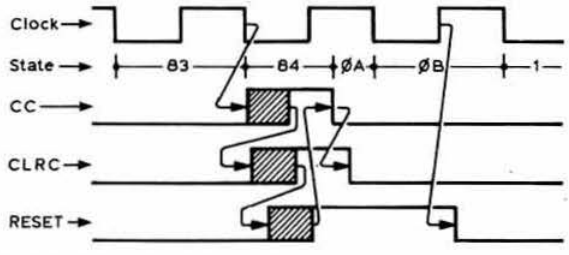


Fig 4. Illustration of the variable divider reset mechanism for a division ratio of 85

The circuit

A prototype was designed and built using surplus ttl ics. Programmable dividers were not available in the junk box, so a variable divider was designed with four-bit counters and gates to detect the count at which the divider had to be reset. When it was decided to attempt a cmos design to reduce the current consumption and allow a wider range of supply voltages, the conversion was relatively easy as the corresponding logical functions were directly available in cmos.

The first usable multiple, which is a power-of-two times 216·75kHz and above 1MHz, is 1,734kHz. A crystal at 3,468kHz was, very fortunately, obtained on the surplus market and after division feeds the variable divider. With one clock cycle of 576ns in which to detect the reset state, cmos is operating at its limits. To achieve satisfactory operation down to a low voltage, an unusual reset mechanism was used. This gave correct operation on the first cmos circuit built down to 6V and up to the maximum recommended voltage of 15V.

The final circuit is shown in Fig 3. A portion of a 4007 ic is used as a crystal oscillator, biased into its linear region by R1. C1 and C2 provide the necessary phase shift to keep the crystal oscillating. The inverter section of the 4007 acts as a buffer-amplifier to ensure full swing on the 3·468MHz input (osc) to the 4013 bistable which is connected in a divide-by-two configuration. The output at IC2/12 (CLOCK) is at 1·734MHz and feeds a 4024 seven-stage divider, IC3. This counter has a maximum count of 128 and feedback is applied from IC4, IC5 and the other half of IC2 to generate RESET, clearing the counter to zero after 51, 75 or 85 pulses of CLOCK for output tones of 2,125, 1,445 and 1,275Hz as required.

Normal variable division techniques require that the reset state is recognized, applied and removed in less than one clock pulse so that the divider is free to continue from zero again. An analysis of cmos delays shows that such operation cannot be guaranteed in the 576ns available, even at the maximum supply voltage. It was decided to detect states 50, 74 and 84 and to allow the reset to remain on for more than one clock cycle, over-riding the counter and causing it to remain at zero for nearly two clock pulses, thus dividing by the required amount. This not only allowed the reset to work satisfactorily but, because the states to be detected were even numbers rather than odd, it allowed an ic to be saved.

The reset action is illustrated in Fig 4. Assume that IP on IC4/2 is low, because the keyboard is indicating space. IC4/9 is then high, independent of other inputs, and the division ratio is determined by IC4/10. As the count changes from state 83 to 84, CE and CG will already be high, and CC will change to a high. IC4/10 therefore goes low, forcing CLRC high. This in turn forces RESET to go high and clears the counter IC3 to zero. The delays in the gating and in the appearance of CC are such that this state cannot be reached before CLOCK again goes high after 288ns. RESET thus remains high at the bistable output, holding the counter at zero during the following negative edge of CLOCK which would normally advance it. By the time CLOCK again goes high, 864ns after the edge which began the reset action, CLRC will have again gone low allowing the positive edge of CLOCK to make RESET low. The counter is then free to advance normally on negative edges of CLOCK.

It is important to notice that this method of reset depends directly on the slow speed of cmos for correct operation and, therefore, if great changes were made in the operating frequency, or if the circuit were copied back into ttl, the output frequencies would not be as expected. (The solution to this is simple; merely involving the interchange of CLRC and 0V on pins 6 and 5 of IC2.)

When generating wide shift mark, the signal WIDE is allowed to float. When state 50 is reached, CE and CF on IC4/3/4 will already be high and CB on IC4/8 will change from low to high. Again CLRC causes the counter to reset and to divide by 51, causing an output tone of 2,125Hz. The 84 detect is inoperative since the counter has already been reset. If WIDE is connected to 0V, then state 50 cannot be detected. State 74 is detected, again when CB goes high, since CG and CD on IC5/12/13 will be already high. An output of 1,445Hz will then be generated.

Reset occurs at 16 times the required output frequency. A second 4024 divider, IC6, is used to provide the extra division, only four of its outputs, CH, CJ, CK and CL, being useful. These are fed to a 4030 exclusive-or pack to produce UDA, UDB and UDC. These three together define the eight steps of the up-down count shown in Fig 2(c). UDA, UDB and UDC feed a 4051 eight-way multiplex, IC8, which in sequence connects its input resistors to the input of the 741 op-amp. Each step of the staircase thus has a different level determined by the resistor values, which are chosen to make the output of the op-amp very close to a pure sine wave. With the value of R13 shown, the output amplitude will be about one-tenth of the supply voltage. C3 removes the sampling square wave, which is at 16 times the wanted frequency. C4 and C5 serve to isolate the output from the transmitter input, and the preset RV1 allows the output amplitude to be set up to a suitable value for the transmitter microphone input.

Input from a teleprinter keyboard

Interfacing to the teleprinter depends upon the requirements of the individual station. The arrangement shown in Fig 5 is therefore purely a personal choice. Numbers beside input/output pins refer to corresponding numbers on the printed circuit board. S1, M1 and S2, M2 are current limited ±12V signals fed to the space and mark contacts of keyboard and auto-transmitter. The tongues of the two sending devices are connected to terminals T1 and T2 and feed TR1 and TR2 bases. The collectors of these transistors are commoned. So, if either sending device is on SPACE, pins 12 and 13 will be low. If both are on MARK, then this point will be high. TR1 and TR2 bases

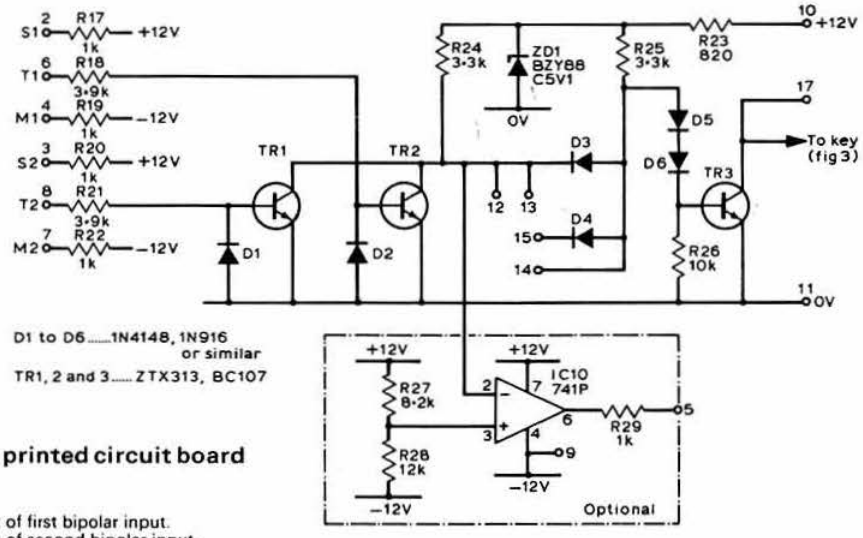


Fig 5. Input circuits for connecting several rtty devices to the modulator (see Table 1 for details)

Table 1. Pin connections to printed circuit board

1. Audio out to transmitter.
2. S1 isolated +12V to space contact of first bipolar input.
3. S2 isolated +12V to space contact of second bipolar input.
4. M1 isolated −12V to mark contact of first bipolar input.
5. Bipolar output from IC10 to drive fsk circuit of second transmitter (optional).
6. T1 tongue input from first bipolar device.
7. M2 isolated −12V to mark contact of second bipolar input.
8. T2 tongue input from second bipolar device.
9. −12V power supply input.
10. +12V power supply input.
11. 0V.
12. TTL input/output (see text).
13. TTL input/output (see text).
14. Non-isolated input/output of all devices keying oscillator at ttl levels.
15. Isolated input to key oscillator without generating local copy (see text).
16. 0V.
17. CMOS level output of all devices keying oscillator.
18. 0V.
19. INVERT. Earth for 1,475Hz or 2,125Hz MARK.
20. 0V.
21. WIDE. Earth for narrow shift, leave unconnected for wide shift.
22. 0V.
23. +12V.

are protected from reverse voltage by D1 and D2 when the keyboards are in the marking condition. The voltage swing at pins 12 and 13 is limited to 5V to allow this signal to be taken to a magnet driver using ttl levels. Alternatively, an open-collector ttl drive may be connected to pins 12/13. This commoned input would then produce local copy from the magnet driver. An isolated input is available at pin 15 which would not produce local copy in these circumstances, and the common of all the signals is made available at pin 14. TR3 converts from the ttl levels to the cmos level (12V) and feeds the signal KEY to the variable divider (Fig 3).

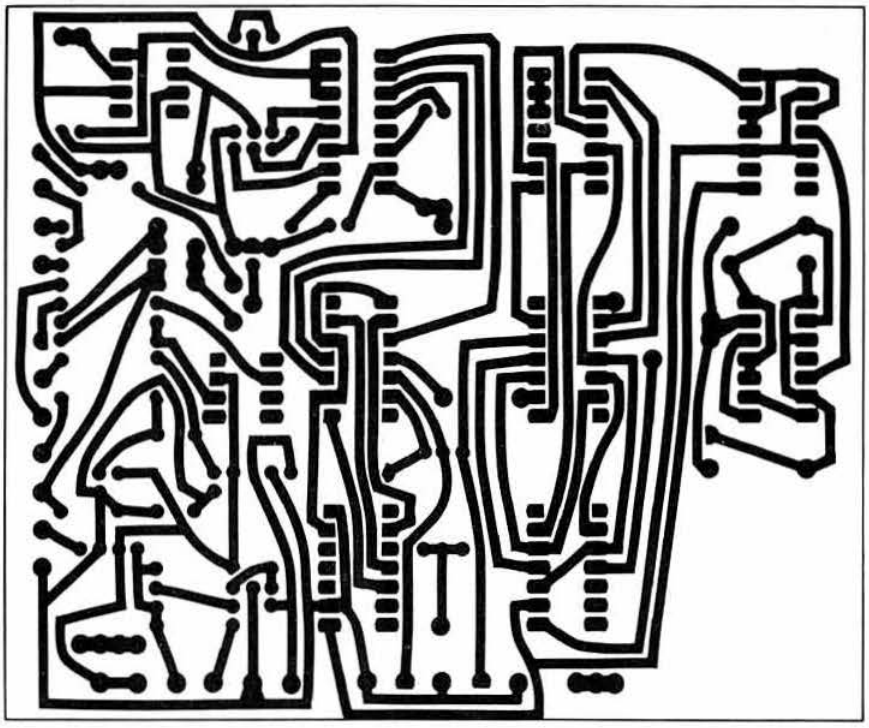
The operation of the variable divider was described in terms of the IP signal at the output of IC7/11. If INVERT (IC7/12) is low (connected to 0V) then, when the keyboard is on space (12V), IP will also be high and the tone generated for space will be the higher audio frequency. When INVERT is allowed to float, a space condition at the keyboard will cause IP to go low and the low audio frequency (1,257Hz) will be generated. The latter is the more usual condition, 1,275Hz, space. This facility is included, partly because the gate is otherwise spare, but it permits those with ssb transmitters which automatically transmit lsb on 3·5 and 7MHz to use a spare bandswitch section to also invert the keying sense of the tone oscillator, and thus to transmit rtty the right way up on all bands without remembering to change sidebands. Local copy is, of course, not affected if generated as described.

Construction

Once a digital circuit has been proved, the most convenient method of mounting and interconnection of the ics is on a pcb. A double-sided board has been devised for the modulator, with all signal connections on the non-component side and power tracks on the component side. It is illustrated in Fig 6. All holes are on a 0·1in matrix, and since the board is double-sided these must be drilled first so that the tracks can easily be aligned on the two sides. The tracks can then be drawn in and etched with the normal methods.

The assembly of the components on the pcb is shown in Fig 7, which should be self explanatory. Power supply pins (mainly on the corners of the ics) are shown with a round symbol, and these must be soldered on the top side of the board. A number of through links are required, and care should be taken to ensure that these are all correctly made. Numbered circles around the edge of the board have copper pads on both sides and are fitted with Veropins. Some of these act as through links for power supplies; again, care should be taken to ensure these are correctly made. The numbers on the pins correspond to the pin numbers on the logic diagram and input circuit diagram. In order to fit the board, resistors must be miniature types, $\frac{1}{4}$ or $\frac{1}{8}$W. R4 to R12 must be better than ± 5 per cent tolerance, but other resistors are not critical.

CMOS ics should be kept in conductive foam or foil until they are to be inserted into the pcb. Otherwise static charge build-up on the input pins may destroy the delicate oxide layer of the transistor gates. When fitting the ics to the pcb, a properly earthed soldering iron must



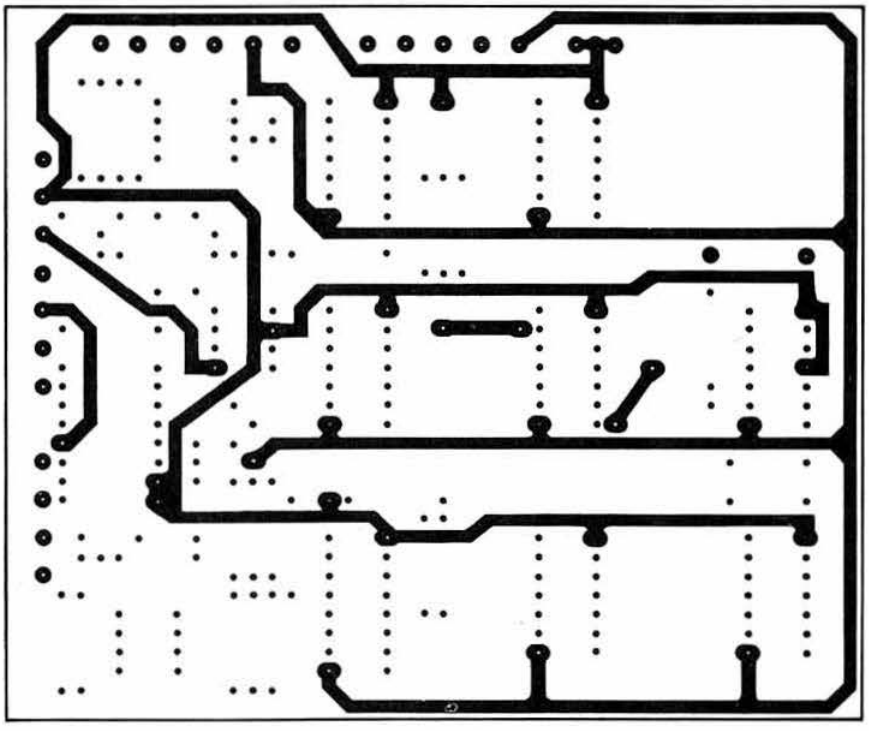


Fig 6. Printed circuit board layout. (top) Non-component side showing signal interconnections. (bottom) Component side showing power supply tracks and drilling template

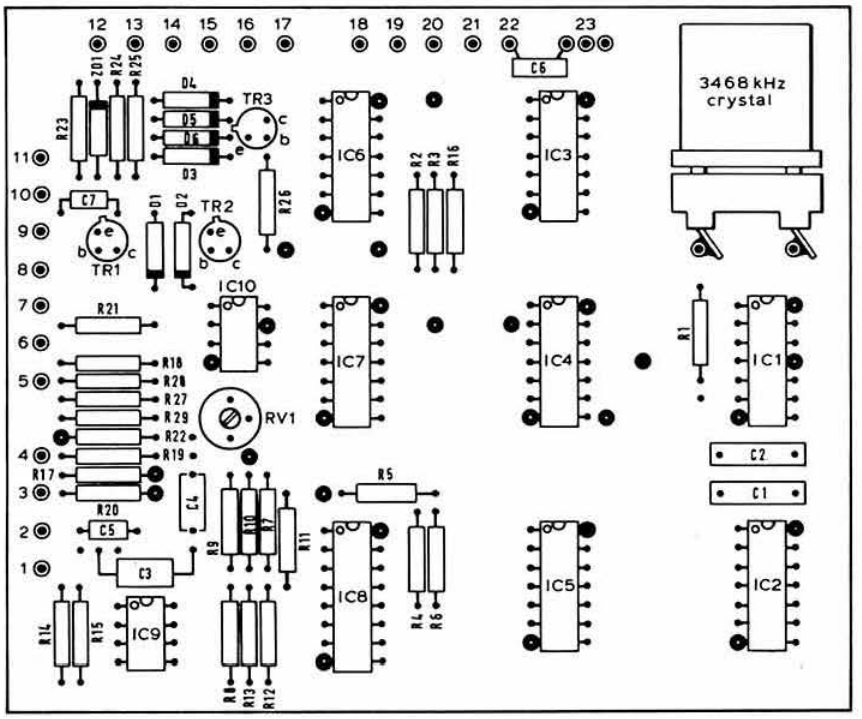


Fig 7. Component assembly

◉Vero pin ● DIL leg or through-link soldered on top side

be used to prevent mains leakage destroying the ics. If a pcb is not used, note that the unused gate in IC5 must have its input pins (9, 10) earthed.

When all the components have been assembled, and the circuit checked for solder splashes and errors, power may be applied +12V to pin 23 and 0V at pin 22. The output should drive a pair of headphones at pin 1. Earthing any of pins 12–15 should produce a change in tone from 2,125Hz to 1,275Hz. Earthing pin 21 should change the tone from 2,125Hz to 1,445Hz. If these preliminary tests are successful then the oscillator can be assembled in a box and included in the station permanently.

Fault-finding

If the above tests do not produce any results, start by listening for the crystal oscillator on a general coverage receiver at 3,468kHz. Check that 12V is getting to all the ic power supply pins (14 and 7, or 16 and 8 in the case of IC8). Check that all the through links have been made correctly. If the oscillator is heard at 3,468kHz check that the divide-by-two is working by listening at 1,734kHz. The variable divider is difficult to check without an oscilloscope, but if it is functioning then it should be possible to detect considerable hash on the medium and long wavebands of a transistor radio placed close by. An ear-piece connected through a 10–22kΩ resistor to pin 6 of IC6 should give the final output tone as a square wave, with pins 9, 11 and 12 in each case being at twice the previous frequency. If these tests do not reveal the cause of the trouble, enlist the help of someone with an oscilloscope and experience of digital techniques.

Simpler circuits

The purpose of IC9 is to act as a low impedance current sink for the level determining resistors of IC8. If the maximum output required is less than 200mV, then IC9 can be omitted. The output is then taken directly from IC8, pin 3, as shown in Fig 8.

As mentioned in the initial discussion, a staircase has a defined harmonic content which may be satisfactory for some applications. This waveform can be produced from UDA, UDB and UDC as shown in Fig 8(b), omitting IC8 and IC9.

Telegraph distortion of the output

FSK generation by digital circuits is a sampling process, and there is a delay between a change of telegraph signal at the input and the instant of the next sample. This delay introduces telegraph distortion to the system.

One can consider the fsk process as two loops intersecting at a single point, the smaller loop representing the higher frequency. Change between the two tones can only take place at the crossing point, and it is therefore easier for a high tone to low tone transition than for a low to high transition to occur; bias distortion is thus introduced. Further distortion is introduced because once the intersection has been passed, a full circuit of the loop must be completed before the transition at the input can appear as a change in the modulated output. If the arrangement of Fig 1(a) had been employed, the distortion at 45Bds with a tone of 1,275Hz would have been about two per cent, at 300Bds 14 per cent, at 600Bds 28 per cent, and at 1,200Bds the circuit would be unusable.

In the circuit just described, these distortions are reduced by a factor of eight, making the distortion satisfactory up to 600Bds and just usable at 1,200.

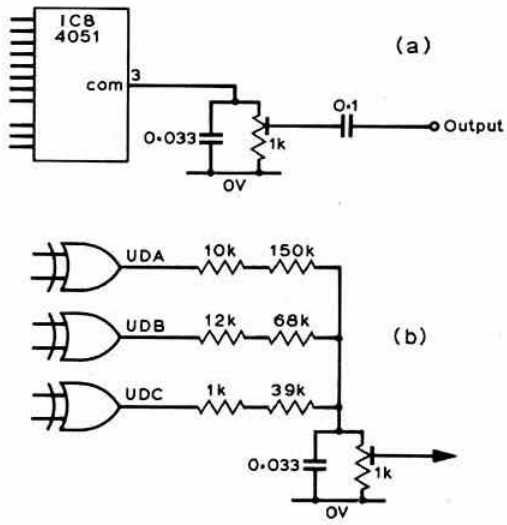


Fig 8. Simplified output circuits to give (a) low level sinusoidal output as Fig 2c; and (b) low level triangular wave output as Fig 2d

Spurii at higher data rates

It comes as a surprise to many just how much data can be crammed into the audio bandwidth of an amateur transmission or of a telephone line. In general, the maximum data rate is somewhat less than twice the shift (in hertz). Thus at 170Hz shift, 300 bits/s is feasible, and on 850Hz shift, 1,500 bits/s. In commercial applications the data rate is normally limited to 1·5 times the shift, but this is partly because of phase response problems in the telephone network.

As mentioned above, the distortion from this cmos modulator at these data rates is satisfactory. However, in a digital modulator, it is difficult to prevent the change from one tone to the other being instantaneous. As any rapid change in frequency or amplitude introduces strong sidebands, which are more commonly called key-clicks, this presents problems when using digital modulators at high data rates. The extra filtering required to overcome these problems is beyond the scope of this article.

Reference

[1] "Bandlimited RTTY Signals", J. T. Evans, G3VDB, *BARTG Newsletter* Sept 1974. □

As she is spoke

by M. OCKENDEN, MIL, G3MHF*

Anyone with an O-level in French who has tried eavesdropping on a QSO between two Parisians, will appreciate that there is more to it than simply: "Votre contrôle est 59, mon cher om." French, like every other language, has its own specialized forms of jargon and, hopefully, the following vocabulary will help one read the mail down in "Frenchman's Creek" (14,100-14,130kHz).

le QRA	the house, family
le QRA familial	family
le QRM boulot (*boulot* is slang for job) / *le QRM pro(professionnel)*	the salt mine
mon pro	my job
le QRM dodo (*dodo* is "bye-byes")	sleep
le QRM gastro (gastronomique)	lunch, dinner, etc
le QRM khaki	military service
le QRM santé	bad health
le QRM Tante Victorine	TVI
le QRM télé	watching tv
il a QRM video	he is a white stick operator
les QRO	the parents
l'om QRO	father
73 QRO	best 73 (big 73). This can be used at the beginning of a QSO as well as at the end.
les QRP	the harmonics
le QRPP	junior op (boy)
la QR-Pepette	junior op (girl)
passer en QRT total	to go silent key
le QSJ	QRK (the charge per word of a telegram)
un QSO visu	an eyeball QSO
un QSY	an excursion, visit
le QSY national	national service
le 600 ohms	a twisted pair
un om 4 pattes	dog, cat (four-footed om)
le 1000 pattes	train (centipede)
30 (etc) *spires au pa*	30 (etc) years of age (30 turns on the pa coil)
Hi trois fois	Hi Hi (Hi times three)
un 807 à col doré	a bottle of champagne (807 with a golden collar)
un battement nul	an eyeball QSO (a zero beat)
une boite à images	a goggle box
une bonbonne	a big valve (a carboy)
un caillou	a rock (a pebble)
la modulation personelle	the voice
les moustaches	splatter
un push pull à hélice	an aeroplane (a push-pull with a propeller)
un push pull à roulettes	a car (a push-pull on wheels)
arriver canon	to come in like a bomb (like a cannon)
arriver petit petit	to come in very weakly
couper les filaments	to go QRT (to cut the filaments)
mettre des vitamines	to switch on an afterburner (to put in vitamins)
passer en ppp (polarisation parallèle au plancher)	to get horizontally polarized (polarized parallel with the floor)
passer en position horizontale	to get horizontal
serrer l'extrémité des feeders	to shake hands (grasp the end of the feeders)
avec pantoufles	with an afterburner (with slippers)
sans pantoufles	barefoot (without slippers)

*39 Rattle Road, Westham, Pevensey, Sussex.

IARU
region 1 calling

R.F. Stevens, G2BVN*

WARC 79 preparations

There has been a valid criticism from some quarters that *Radio Communication* has not contained news of WARC 79 preparations in the same way as some overseas magazines. While information concerning WARC 79 activities has appeared on several occasions, the persons engaged in this work have been too busy to prepare long statements for the Society's journal, assuming that they were desirable and that there was space available.

A very great deal of time and money has been expended in an effort to ensure that the preparation of the case for the amateur service at WARC 79 is the best possible. The IARU cannot intervene with national administrations unless specifically requested, but can and does offer detailed advice to national societies as part of the task of ensuring worldwide co-ordination in frequency proposals.

VE3CJ, as president of IARU, convened a meeting of representatives from all three IARU regions in May 1976. This *ad hoc* international working group has met subsequently on several occasions, the last time being at Geneva between 13 and 18 February 1978. A brief report of the latter meeting appears below. The points raised will be further discussed at the forthcoming Region 1 Conference in Hungary, a subject covered in the February issue of *Radio Communication*.

IARU Geneva meeting

Those present included: president N. B. Eaton, VE3CJ; IARU secretary R. L. Baldwin, W1RU; IARU assistant secretary D. G. Sumner, K1ZZ; IARU Region 1 secretary R. F. Stevens, G2BVN; IARU Region 2 president V. C. Clark, W4KFC; IARU Region 3 director M. Owen, VK3KI; president of the WIA, D. Wardlaw, VK3ADW; vice-chairman IARU Region 1, Wojciech Nietyksza, SP5FM; and E. M. Glunt, W3OKN.

The purposes of the meeting were:

(1) to review plans and preparations for WARC 79;
(2) to observe the workings of the ITU, and to meet delegates to the Aeronautical WARC then in session in Geneva;
(3) to consider generally international amateur radio.

In the course of the meeting it was agreed that the following actions should be taken by IARU:

(1) a letter re-stating the IARU position on Article 41 should be sent to each society;
(2) the importance of the role of an amateur as a member of a delegation, where possible, would be highlighted in a circular to be sent to member societies;
(3) people with specialized knowledge who could assist the IARU WARC 79 team would be contacted;
(4) IARU headquarters was asked to prepare a descriptive and informative booklet on the amateur radio service for distribution to telecommunications authorities in developing countries;
(5) the IARU president was asked to write to each country to restate the role of the committee;
(6) the submission of papers furthering the interests of the amateur radio service to the Special Preparatory Meeting of the CCIR in October 1978;
(7) the submission of an article to the *Telecommunications Journal* of the ITU concerning the technical contributions of amateur radio to the work of the CCIR;
(8) the formulation of the IARU team to WARC 79;
(9) provision of the facilities and special items necessary for the IARU WARC 79 team.

In addition the following matters were discussed:

(a) the composition of the IARU WARC 79 team;
(b) international travel by the headquarters officers between now and WARC 79;
(c) other material relating to the advancement of the interests of the amateur service.

E. M. Glunt, W3OKN, recently retired assistant chief engineer of the Federal Communications Commission, and an expert on conference preparation and participation, presented a seminar on the working of ITU conferences. In addition, all present had the opportunity of observing an actual ITU conference in session.

On 16 February, the IARU headquarters and Region 1 were hosts at a reception at the ITU building for delegates to the Aeronautical WARC.

*51 Pettits Lane, Romford, Essex RM1 4HJ

oscar news

Oscar 8 in orbit

AMSAT Oscar D was lifted off from the Western Test Range in California at 1754 on Sunday 5 March. The launch went perfectly and the main payload, the Landsat C satellite, separated at 1907. Twelve minutes later at 1919, A-O-D became Oscar 8, and within seconds of ejection the telemetry of the Mode J beacon on 435·095MHz was heard by stations in the UK. The 29MHz antennas were deployed on 6 March and the beacon on 29·402MHz provided strong signals. For up to 14 days after launch, tests were being carried out by AMSAT to determine the orbital characteristics of the satellite, and the transponders were not available for general use. Despite continual requests that had been made for stations not to attempt to use the satellite, a number of European stations were heard through the Mode J transponder during the early orbits.

The latest orbital figures are: period, 103·23 min; longitude increment, 25·8°/revolution; inclination, 98·989°.

For latest information check the AMSAT-UK nets on 3,780kHz at 1015, on 144·280MHz at 1930, and the international AMSAT net on 14,280kHz at 1800, all on Sundays.

An article describing the spacecraft and its functions appeared in the March 1978 issue of *Radio Communication*. □

technical topics

Pat Hawker, G3VA

THIS month, if I can be forgiven a retrospective moment, *Technical Topics* enters its 21st year of publication, having started in what often seems the totally different world of April 1958. Since then it has run to 850-plus pages, around 1,500 illustrations diligently drawn by Derek Cole, and I suppose over three-quarters of a million words wrung out of several much-battered typewriters. And if today one comes near to that classic definition of journalism as scribbling on the back of (Japanese) advertisements, it was not always so.

In April 1958 the first hf ssb transceiver (Collins KWM-1) had recently been launched, but there was still plenty of a.m. to be heard on hf and virtually nothing else on vhf. A few germanium transistors were beginning to be used for auxiliary equipment but the silicon revolution had hardly begun (it was not until the early 'sixties that we started to use silicon power diodes in large numbers and began to appreciate the importance of peak inverse ratings and mains transients!). Digital logic was strictly for those massive early computers, and it was January 1967 before it seemed worth explaining integrated circuits, a couple of years after the fet had come along to make sense to the valve buffs (who had never really accepted the idea of current-controlled devices). Throughout the period the thermionic valve has steadfastly refused to move out of our stations, although a modern Rip Van Winkle who had gone to sleep in 1958 would be appalled at the way their prices have shot up since so many of the factories closed down. £4 or so for a dubious 6L6 (KT66): the first one I bought in 1938 cost me all of 3s 6d.

The equipment advertised in the *RSGB Bulletin* of April 1958 (it did not become *Radio Communication* until January 1968) included the KW Vanguard, completely wired and tested at 58 guineas (remember guineas, those up-market pounds?), Geloso G209 receiver (83 guineas), Eddystone 888 receiver (£110), the *ARRL Radio Amateurs' Handbook* at 34 shillings, and there was still plenty of solid war-time surplus such as a No 36 set offered as a bargain price table-top transmitter at £12.10s. Not a single item of Japanese or new American equipment in any of those sparse columns of advertisements.

But please do not ask me if I really think amateur radio is in a much better state today than it was in 1958—a technical columnist *has* to be a professional optimist and believe that every new development works out to our common advantage! Whatever he may think privately.

5A regulated power supply

A simple 0–15V, 0–5A, regulated power supply with variable current limiting is the sort of unit which it is very useful to have around. A supply to this specification, based on National Semiconductor publications, is described by Bruce Riley, VK3ZSR, in *Amateur Radio* November 1977. As shown in Fig 1 the supply is built around an LM723 dc regulator, but its 150mA capability is increased by means of an emitter-follower (TR1) capable of providing output up to 0·5A and then by a pair of power transistors (TR2, TR3). For these to be capable of handling the full output of better than 5A, they need to be mounted in suitable large and efficient heat sinks isolated from chassis. The pin numbers shown on the LM723 are for the dual-in-line package and not the metal can type which has different pin numbers.

The LM723 provides a reference voltage of approximately 7·15V at pin 6 with an output on pin 10 of about 2·2 times this reference voltage. The two 0·1Ω resistors balance the currents drawn by TR2, TR3 and must be capable of handling the full current; if space is available they can consist of air-spaced coils each wound with 5ft of 24swg copper wire, remembering they will have to dissipate a little heat. RV1 sets the voltage output of the unit; RV2 sets the current limiting by applying a suitable voltage to pin 2 of the LM723 to cut-off the output. The two built-in meters are optional, although useful.

Proportional control for crystal "oven"

In a "Reflecties door PA0SE" (*Electron* No 1, 1978) Dick Rollema reproduces a temperature regulating system for crystal oscillators in which a pair of 2N1711 transistors forms the "heating" elements and a BC108 transistor is used to "sense" continuously the crystal temperature: Fig 2. The idea apparently came from Massimo Corinaldesi, I6MCF, and was originally published in *Radio Revista* October 1977. The metal cans of the transistors are (carefully!) soldered to the metal casing of the crystal unit (HC16/U). It might be useful to smear a little silicone

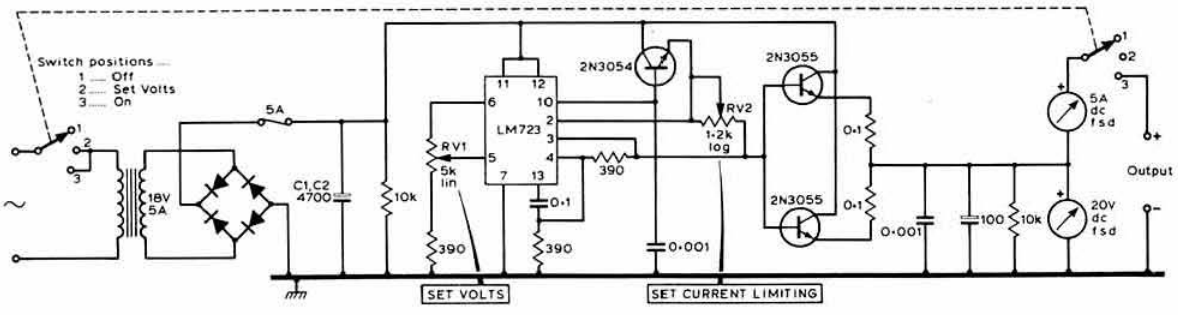


Fig 1. General-purpose 0-15V, 0-5A regulated power supply with variable current limiting as built by Bruce Riley, VK3ZSR

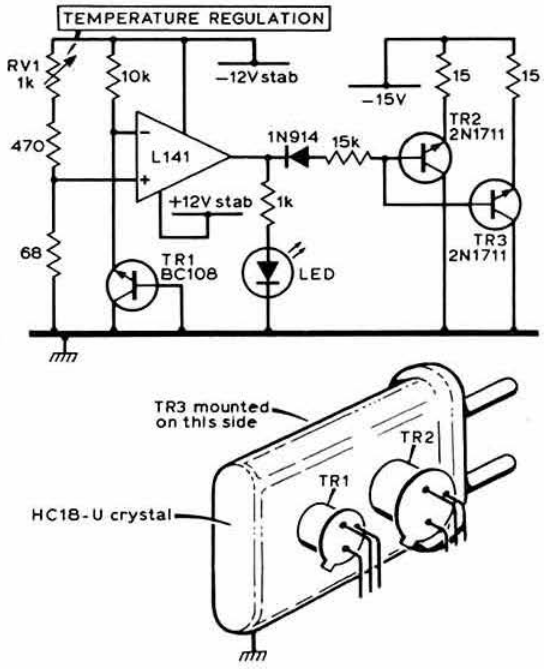


Fig 2. Proportional temperature control system for HC16/U crystals as proposed by I6MCF and using a pair of transistors as the heating elements and a BC108 transistor as the temperature sensor

grease around the transistor/crystal to improve the thermal contact, as is often done with heat sinks. I am not sure whether it might not also be useful to contain the crystal within some sort of thermally isolated enclosure to reduce heat loss and thus reduce the amount of "heating" required, although it would appear that the holder can, in effect, provide its own "oven". It would be interesting to hear the results of any experiments along these lines and the effects on frequency stability, as well as some indication as to the drain from the power supply, since these factors are not mentioned in PA0SE's write-up.

The use of a transistor as the heating element for a temperature stabilization system for a voltage-controlled oscillator was briefly mentioned by A. K. Langford, G4ARY, in *TT* February 1977, page 191. In his case a thermostat and vfo were mounted on one side of a double-copper laminated board and the power transistor "bolted" to the other side; this board was then sandwiched between layers of polystyrene foam for testing, although he indicated that the overall system was still in an experimental stage.

Keep that beam up!

The winter gales took another toll of antennas, but it is not only high winds that can bring an apparently well-built array tumbling downwards. Metal fatigue brought about by vibration over a long period (for example, due to vortex shedding at quite modest wind speeds) can be quite a problem at some sites. Some years ago (reprinted in several editions of *ART*) it was indicated that the addition of flat rubber strips (which may be formed by splitting down sections of garden hose), mounted towards the end of the elements, can absorb and dissipate mechanical energy and can be particularly effective in reducing breakages at sites where moderate winds tend to blow for long periods.

Another, even more insidious, reason why tubular aluminium-alloy elements do not always stay up as long as expected is electrolytic action, particularly in salt-laden or industrial (sulphur dioxide) atmospheres. Too often aluminium-alloy elements are bolted together or fixed into place with steel or brass nuts and bolts: brass is often used in an attempt to prevent rust. In *Amateur Radio* October 1977, the problems that result from the use of dissimilar metals in beams or vertical tubular systems are described in some detail. Where aluminium is in contact with another metal it is often attacked and weakened over a long period. This is due to the fact that dissimilar metals immersed in a conducting solution or electrolyte are likely to form an electrical "cell". The negative electrode (the aluminium) will then gradually lose weight and strength due to dissolution in just the same way as the zinc electrode does in a Leclanché cell.

Aluminium and zinc (which form negative electrodes) have positive "corrosion potentials" of 1·67V and 0·76V respectively, whereas copper (and brass is an alloy of copper) is well towards the opposite end of the corrosion potential table (0·34V) as indicated below:

Aluminium	+1·67V	Cadmium	+0·40V	Copper	−0·34V
Zinc	+0·76V	Nickel	+0·25V	Silver	−0·80V
Chromium	+0·71V	Tin	+0·14V	Gold	−1·68V
Iron	+0·44V	Lead	−0·13V		

To minimize electrolytic corrosion, screws, bolts and nuts can be made of steel with protective galvanized zinc plate coating. Cadmium or nickel plate can also be used, as can stainless steel hardware. These materials are all much better than brass, although corrosive action will not be completely inhibited. A final precaution is to paint joints of dissimilar metals in order to keep out all moisture and thus prevent the formation of an electrolyte. For highest protection, a first coat of zinc chromate primer should be followed by one or more coats of good exterior paint. Zinc chromate provides passivating action.

It should be noted that "stainless" steel is not corrosion resistant unless it has a good polished surface; if dirt or scale is present electrolytes can go to work and result in corrosion.

Huff and puff in cmos

During 1973–74 considerable interest was shown in the technique of vfo stabilization developed by the inventive Klaas Spaargaren, PA0KSB, and which I took the liberty of dubbing "huff and puff" when G3BY pointed out that the action reminded him of the old "hit and miss" gas engine governors which used to go "thump, thump, gasp, thump, gasp, gasp". A number of British amateurs tested the idea and found that it performed just as claimed: ie, improving a reasonably good vfo and putting it into the very top class without significantly degrading its rf noise spectrum.

The system allows an operator to tune a vfo freely to any frequency, and then the stabilizer automatically takes

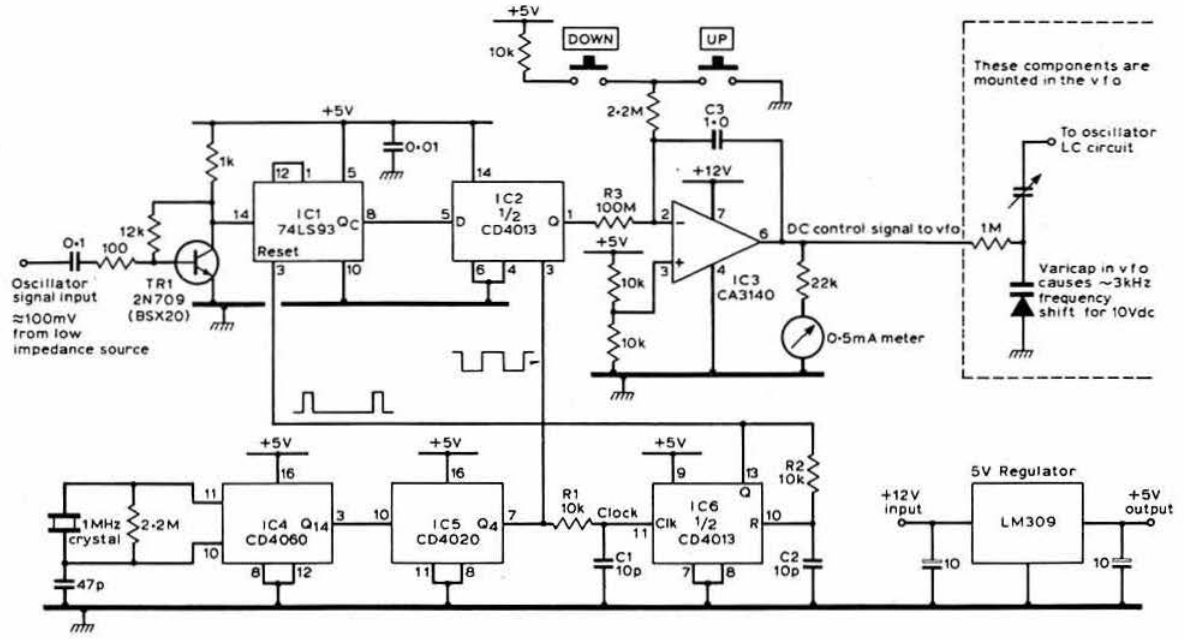


Fig 3. Circuit details of the cmos form of "huff and puff" vfo stabilizing system—the latest version of PA0KSB's system as described in *Ham Radio*

over and keeps the oscillator precisely tuned to the nearest "reference point", which can be at increments of only, say, 10Hz, although they may be 25 to 50Hz. Using digital techniques the stabilizer provides a correction signal so that the vfo output can only vary quite slowly around the reference point. It is important to note that the system is effective only when very little correction has to be applied between each of the time intervals since, if the vfo overshoots by drifting too rapidly, the huff and puff stabilizer will degrade rather than improve stability. The time-base reference frequency has to be very stable (usually derived from a crystal oscillator and chain of dividers) but need not be precisely 1Hz.

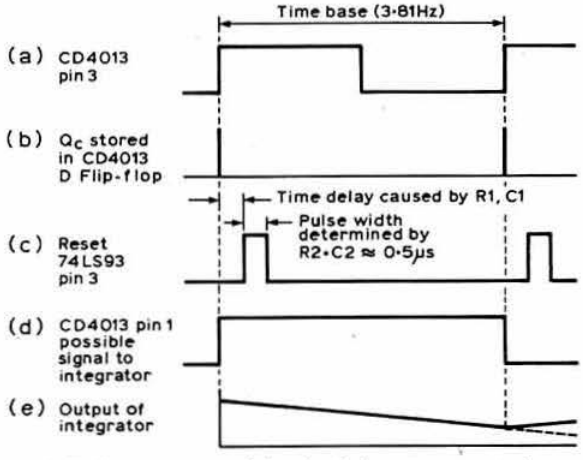


Fig 4. Timing sequence of signals of the arrangement shown in Fig 3 when a 1MHz crystal is used to provide a time base of 3·81Hz

In *Ham Radio* December 1977, PA0KSB describes the latest version of this useful and well-proven system. It differs from the original arrangement principally in using cmos logic, but it also incorporates a number of other changes of detail.

With a 1MHz crystal the output from IC5 (CD4020) represents a division of 2^{18} and is about 3·81Hz; the stabilization points are then spaced at eight times this frequency, ie 30·5Hz. FT241 crystals in the range 400–500kHz can be used with a dividing factor of 2^{17} which can readily be obtained by using output pin 2 of IC4 rather than pin 3 as shown in Fig 3. The CA3140 is the fet-input op-amp mentioned in the February *TT* and has a very high input impedance.

Stabilization points about 30Hz apart are capable of giving highly satisfactory results on both cw and ssb, although possibly not really spaced close enough together for some forms of fsk. The system has the significant advantage that it results in better oscillator purity (ie less sideband noise and jitter) than most forms of frequency synthesis. It is, of course, important that the rf harmonics that are created by the digital devices should not interfere with hf or vhf reception when the system is used on a receiver, and the stabilizer should preferably be screened and filtered.

Feedback

In the list of manufacturers' prefixes for integrated circuits and display devices (*TT* February 1977) the prefix MK was incorrectly shown as Motorola; it should have been Mostek, whose devices are supplied to the amateur market.

Gain of Yagi antennas—another view

Les Moxon, G6XN, has been reading the NBS publication *Yagi Antenna Design* from which some data were reproduced in *TT* January 1978, page 43. He notes that all the detailed information on optimizing the gain of multi-element Yagi arrays obviously represents a lot of hard work and that NBS publications tend to be regarded as impeccable sources. For these reasons he is reluctant to criticise the findings, but he cannot help feeling that the author, Peter Viezbicke, has failed to ask himself the two basic questions that should always be considered when presenting such findings: (1) do the results make sense?; and (2) are they consistent with previous work, and if not, why not?

G6XN is concerned about two of the basic findings of this investigation based on 400MHz model antennas: for a dipole with simple single-rod-type reflector, Viezbicke puts the optimum gain as only 2·6dB (increased by an extra 0·75dB to 3·35dB with a considerably more elaborate trigonal reflector). Then with the addition of just one director (using the trigonal reflector) *wham* the gain shoots up to 7·1dB. The third element thus appears to be capable of providing an extra 3·75dB of forward gain!

If this could be substantiated in normal practice it would, of course, be extremely important, particularly for hf operators, since it would make an overwhelmingly strong argument in favour of using three-element rather than two-element Yagi beams.

But, as G6XN points out, "Real life just isn't like this. Curves in the *ARRL Antenna Book* and elsewhere, based on the classic 1937 paper by G. H. Brown, show gains in excess of 5dB for a dipole plus reflector, and I have repeated the calculations myself many times, obtaining figures in the region of 5·2 to 5·4dB depending on the particular source from which one obtains one's data on mutual impedance."

G6XN continues: "It is true, as stated in the *ARRL Antenna Book*, that in practical antennas the gain is less than the calculated figure but, since the radiation resistance is relatively large compared with typical loss resistances, the theoretical gain is *nearly* all realizable in practice."

This, of course—as G6XN has previously pointed out for example in *TT* February 1977—makes a powerful case for using the lighter two-element arrays (which can be more readily raised to a good height) and encouraging further development of no-compromise *miniature* arrays with gains of up to 4dB or so. G6XN has shown on various occasions, as mentioned in my January notes, that a gain of 6dB is, in practice, the limit for a *three*-element array, only about 1dB more than what can be achieved with two full-sized elements.

In further support of his figure, G6XN quotes H. P. Williams who in *Antenna Theory and Design*, Vol 2, page 145, states that he had found it "never possible to obtain gain of more than 5·8dB over a half-wave dipole, but little difficulty in getting 5dB". If, in fact, one can get around 5dB from two-elements but less than 6dB from three, the natural choice for amateurs would be to settle for two and put the array up as high as possible.

Now it would seem that Peter Viezbicke has added to the confusion. Certainly there are a number of professional engineers who appear to be convinced that in doubling the number of elements from one to two it is impossible to achieve more than 3dB gain (double the effective radiated power), and this misleading idea can be found in a number of textbooks!

Again, a number of respectable sources suggest that it is possible to obtain more gain (about 0·5dB more) by using the second element as a director rather than as a reflector, but G6XN is unable to find any basis for this widespread belief and feels it may be just another of the many myths that still surround the Yagi. It is also worth stressing that while all this may seem to be just a mathematical debate about fractions of a decibel, it really is important to the amateur operator when translated into terms of cost-effectiveness, throwing into doubt the wisdom of both the large three-element Yagi and the large two-element quad, and opening the way to the high-performance mini-beam.

Low-noise 1·8/3·5MHz receiving antennas

It is generally recognized that for good dx reception on the lower amateur frequencies, a vertically-polarized antenna (usually, of course, loaded into quarter-wave form) should provide the strongest long-haul signals; but in practice such antennas when used in the normal urban or suburban environment are also likely, unfortunately, to provide the most intense electrical noise. For dx *reception* it may be much better to use an antenna (eg frame or even ferrite-rod antenna) that provides much less signal, but may sometimes provide a better signal-to-noise ratio because of its directional properties.

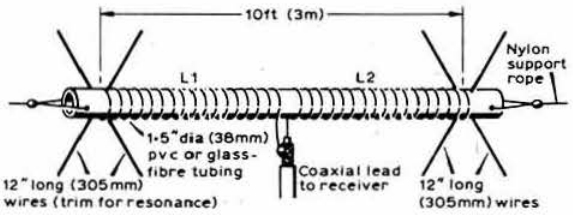


Fig 5. A 10ft helically wound 3·5MHz receiving dipole described by W1FB. The antenna is wound on pvc tubing and the capacitance hats at the ends of the element permit frequency adjustment and help to lower the Q of the antenna

In *QST* December 1977, Doug De Maw, W1FB, of ARRL, looks into this subject, although he recognizes that even after quite a lot of practical experiments he has "only agitated the surface". The classic Beverage wave antenna can give excellent results, but not everyone can run out some 560ft or more of straight wire, even if it only needs to be supported some 7 to 10ft above ground. W1FB describes a number of alternatives, including a shorter 200ft low wire used with the far end either open or grounded, and a 10ft helically-wound dipole for 3·5MHz (see Fig 5) with capacitance hats at the outer ends. This short dipole, he reports, appears to have low susceptibility to tv time-base radiation, but tends to be very narrow band.

A system which W1FB finds particularly effective is a half-wave open-loop antenna for 1·8MHz, again only 7ft high, but not requiring such extensive real-estate as the long wires: Fig 6. This is used in conjunction with a pre-amplifier, since the signal output is fairly low and some care needs to be given to avoiding pick-up from one's

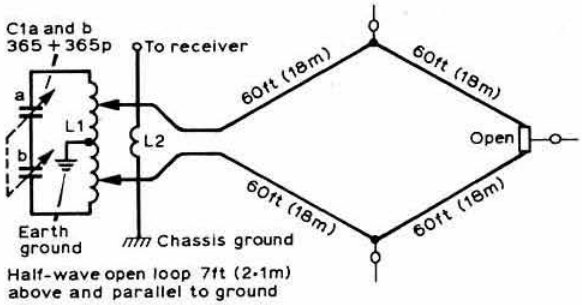


Fig 6. W1FB's half-wave open-loop low-noise receiving antenna for 1·8MHz. The antenna is parallel to the earth and at a height of 7ft. C1 is a two-gang broadcast-receiver tuning capacitor. L1 should have an inductance of 50μH and the feeders are tapped on L1 so as to obtain an swr close to unity

transmitting antenna, which can easily destroy pre-amplifier transistors and may even overwhelm protective diodes in the main equipment. The large, low loop can be set up in woodland, using trees for supports, without loss of effectiveness.

The multiband "rhombiquad"

Several years ago, ZS6AKA reported on various ways of using large horizontal loops to form multiband antennas; a recent reflection of this approach can be found in the "rhombiquad" which is attracting considerable attention in West Germany (*CQ-DL* No 9/77 by DF3FU and *CQ-DL* No 1/78 by Karl Hille, DL1VU). This square rhombic (Fig 7) can form an effective multiband system that can include switching techniques to allow it to be used in several different configurations; including an open type of loop, a terminated loop, a ring antenna, and as a loaded vertical for 1·8MHz dx operation. With 20·8m sides and a height of about 20m it will not go into many small gardens but is by no means impossible for those with rather more space, and it can provide an effective dx transmitting antenna on all bands from 1·8 to 30MHz.

A good deal of information on the various radiation patterns in different configurations is given by DL1VU, but here we have only space to bring out the main details and the way in which he matches his transmitter to the 450Ω open-wire feeder. The terminating resistor should be non-inductive and should be capable of dissipating at least five per cent of the dc p.e.p. input to the transmitter for cw or ssb operation, and provided that the key is not

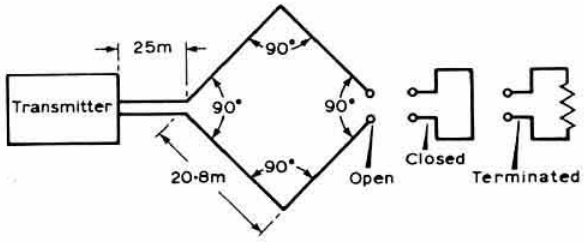


Fig 7. Basic details of the multi-band rhombiquad which can be used as an open loop, closed loop or as a terminated square rhombic. On 1·8MHz the feeders can be used as a vertical antenna, with top loading

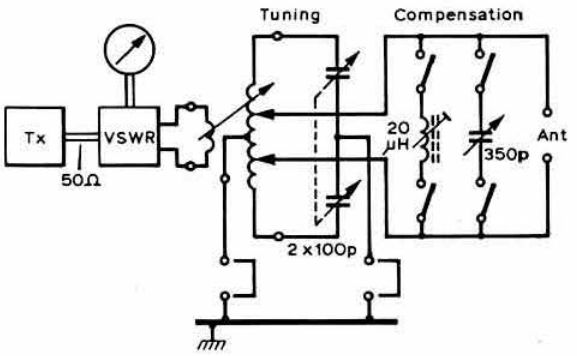


Fig 8. Matching arrangement used by DL1VU with the rhombiquad

held down for long. Although capable of providing considerable gain in a number of directions, the rhombiquad is relatively easy to construct or modify, if one has sufficient space and some suitable supports.

In praise of the Franklin

The timely reminder by Ray Brock, BRS36760 (*TT* November 1977), of the continuing virtues of the Franklin oscillator has not, as yet, brought forth any claims for a "definitive" solid-state oscillator, but there has been further evidence that this is a sound approach for receivers and transmitters.

For example, N. H. Sedgwick, G8WV, in a thought-provoking article "A thermostatically controlled oven for the vfo" (*Shortwave Magazine* December 1977), notes that amateurs often forget that the ambient room temperature of many typical "shacks" is very far from always being steady; equipment is often turned on at the same time as the heating and is used while the room is still heating up. His answer is to enclose the tuned circuit of his 5·0—5·5MHz vfo in a 20°C crystal oven, and his choice for oscillator was a Franklin. Care has to be taken to avoid heat-loss and heat gradients along the spindle of the tuning capacitor, but there were apparently few other problems. He advises that the two coupling capacitors should be as low in value as possible, consistent with maintaining oscillation over the tuning range; unfortunately he did not provide any circuit or component details.

One of the long-faithful adherents to the Franklin in valve form is Jim MacIntosh GM3IAA (ex VS1AA etc), who first began to study this oscillator while interned as a pow in Singapore, and used one based on two 6AG7s at VS2AA in 1949-50; His present transmitter continues to use the Franklin, this time with two 6CL6 valves which are miniature 6AG7s. He writes:

"I tried many different valves but the 6AG7 and 6CL6 remain unbeaten; good quality components were used and the power supply located outside the cabinet to avoid unnecessary heat. The small coupling capacitors were Cyldon variables (max 5pF) set to the smallest capacitance consistent with good oscillation. It was possible to key this oscillator with no detectable chirps or clicks. I experimented over a period of months and discovered it was preferable to key valve No 2 because the anode

current of this valve was considerably less than for valve No 1. This was not due to the particular valves, but to the Franklin itself. Grid leaks were a little critical and the cathode resistor of V2 was *not* bypassed; keying was in the screen grid circuit and the power supply was stabilized. The arrangement was described many years ago in *Mercury* (journal of RSARS). The only thing that has gone awry since 1960 was the replacement of a single capacitor. The rf output was taken from the anode of V1 into a cathode follower."

One of the significant advantages of the Franklin which was mentioned briefly last November is that the same basic circuit also forms an excellent crystal-controlled oscillator, by simply replacing the tuned LC circuit with an appropriate crystal. Here again, it is seldom appreciated that this arrangement can have excellent keying characteristics, without the slow "rise" and "decay" chirrup usually associated with a keyed crystal oscillator. The reason for this is the unusually high gain of the two-stage "maintaining amplifier".

Transversal filter plus stereocode

Harold Chorley, G5YH, is concerned that my reference to complexity may have put people off the G6CJ transversal filter using 741 op-amps as allpass filters (*TT* November 1977). He writes: "I made this time-domain transversal filter three years ago. It was all quite easy and the result of the 7dB improvement in signal-to-noise ratio is staggering. I copy with ease signals that I can, without the filter, barely hear through the noise.

"Following the filter, I use Dud's stereocode unit which has an advantage not mentioned in his and G3OTK's article (*Radio Communication* September 1975). It has given me, for the first time, binaural hearing on cw. I have a serious 'cut' in my left ear which, below Middle C, is as bad as −40dB. Therefore I use the 'top' channel of the stereocode for my left ear and equalize the channels at the peak (725Hz) so that I now have perfect binaural hearing."

Zig-zag sloper

Bob Eldridge, VE7BS (8386 McGregor Avenue, Burnaby BC, V5J 4H9, Canada), mentions that he would be interested to hear from anyone using a zig-zag sloper antenna. For some time he used an end-fed inverted-V on 1·8MHz, and then improved the operation on long paths (1,000 to 6,000 miles) by dropping the far end vertically. He has now changed this to a sloping dipole centre fed and with both ends vertical, based on the theory that the current flowing in the same direction in each vertical section should make the antenna work like a pair of phased verticals. These arrangements are indicated in Fig 9. The basic idea is to try to avoid having to install masses of radials. Certainly the zig-zag sloper of Fig 9 (c) does not require radials as part of the antenna system, since it is a dipole rather than a Marconi form of antenna, but I suspect that earth conductivity may be an important element in achieving good results.

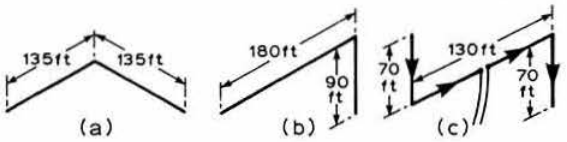


Fig 9. Arrangements used by VE7BS for dx operation on 1·8MHz showing the progressive modifications into the "zig-zag sloper" shown in (c)

The Gillette sideswiper

Recently (*TT* September 1977) it was shown that there is still a role for the sideswiper key, and details were given of a model built by G4OO in 1938 and still in regular use. This item attracts interest, and an increasing number of operators now seem to be using this type of key. One of these is Arthur Milne, G2MI, and his key makes use of a dodge that proved highly effective when it was built many years ago: a number of razor blades form the "springy" section, instead of the more usual length of hacksaw blade. The advantages include the fact that razor blades come complete with holes, eliminating drilling, and it is also easy to achieve the desired degree of stiffness by choice of the number of blades "in parallel".

To try out this inherently simple idea, I put together a key from some odd bits and pieces, using six old Gillette "Platinum" blades and with the plastic blade container used to form a slip-on paddle. All very crude and the main tool was a screwdriver, but the key worked quite well. It is perhaps only right to add a word of warning: a sideswiper operator makes his symbols on alternate sides of the key; a different action to a bug key or an el-bug, so one usually has to choose one or other form of keying and stick to it.

swl news

Bob Treacher, BRS32525 *

The 1978 table

The new table appears for the first time but unfortunately entries are a little sparse. Perhaps the late arrival of the journal has disrupted things somewhat. The basic rules for entering were outlined in the January issue of *Radio Communication*. Follow these and there will be no problems. Why not try to do battle with some of the listeners who have been in the top half of the table for the last couple of years?

For everyone's information it may be worthwhile to give your scribe's final copy dates until the end of the year: June issue—22 April, July issue—20 May, August issue—17 June, September issue—29 July, October issue—30 August, November issue—23 September, December issue—21 October. These dates may change slightly but they will act as a rough guide. A regular check should be made of the closing dates given at the end of each *SWL news*. For interest, the All-time table will appear again in July and October.

Erratum

It seems that the information given in the January *SWL news* regarding the RAE class at Loughborough was incorrect. Your scribe has received several letters stating that a successful course is being run in Loughborough, and all we can do is apologize if any problems have arisen as a result of the earlier comments.

28MHz beacons

Also in the January issue, the subject of 28MHz beacons was raised. At the time of writing, the band was in superb shape and it may be of assistance for readers to refer to the list of beacon stations published in *Radio Communication* February 1978, p128.

News from the regulars

Neville Spry, BRS17567, reports on the terrific conditions on 28MHz during late February and early March. Colossal signals appeared from all over the globe, some of the strongest being from the USA. On some afternoons, stations from W6 and W7 were stronger than stations on the east coast. During the second leg of the ARRL DX Contest on 4–5 March, one listener reports logging over 85 W6 and W7 stations in just under two hours. To many, the current 28MHz conditions are something completely new. Conditions simply have not been so good for many, many years.

Really strong signals from W6, JA and VK are a trademark of 14MHz, but such signals were consistently in evidence on 28MHz during the period under review. Some of the more exotic dx heard on 28MHz were as follows: KH6 and KL7 around 2000, KG4OO, A6XB, FY7BC, C5AL, S79DF, TG8DX, FP8DX, YS1GMV, PJ8CO, WB8ZJW/C6, YB0ACH, HZ1HZ and ST0RK. With the solar flux numbers above 200, 28MHz is certainly the band to monitor.

By the time this piece is read, it is hoped that the majority of keen dx swls will have crossed Clipperton Island off their wanted list. The expedition seemed fairly firm and, as one correspondent summed it up, "the pile-up will make Everest look like a pimple"!

Neville reports QSLs from H5IND (Bophuthatswana) plus FB8ZL.

Ken Sketheway, BRS20185, comments on improved conditions and the dx he is hearing on the JR310 receiver with a Datong AD170 active antenna in the loft. He also has hf dipoles outside.

Keith Kerr, BRS35943, had not been too active on the bands when he wrote, although he managed to add HH2MC and 9N1NFO on 3·5MHz. He also mentions JA activity after midnight on 14MHz.

Robert Small, A8841, now reports from Needham Market, a small town eight miles outside Ipswich. To prove he is always by the rig, Robert reports that on the day he moved he logged TG9AL on 7MHz at 0830 at Harwich, and was back at the rig at 2202 the following day to log 5T5CJ on 3·5MHz. His father, G3ALI, cannot be so keen, he was off the air for two weeks. Robert reports his usual crop of "goodies", including two new ones in the shape of FB8ZL and ZD9GG. QSL returns include 9U5CA, CR3BS, FB8WE, VE3HRS/TZ6 and VR6TC.

John Holmes, BRS38934, reports increased activity from his North London QTH with plenty of midnight oil being burned; his best dx being FM0AMF, VP2LDB and 9G1PF, all on 14MHz.

Finale

Letters are also acknowledged from BRSs 32286 and 31665, and ARSs 37906 and 39162. Please remember that the next deadline for copy and table scores to reach your scribe's home QTH is **22 April.** □

1978 HF Countries Table

Station	28	21	14	7	3·5	1·8	Total	Mode
BRS17567	103	123	149	24	68	5	472	ssb
BRS35943	53	67	96	61	104	1	382	ssb
A8841	44	73	142	47	69	0	375	ssb/cw
BRS32286	65	54	68	19	43	0	249	ssb
BRS20185	18	30	47	14	39	2	150	ssb

All-time Countries Table

Station	28	21	14	7	3·5	1·8	Total	Mode
BRS32525	203	260	283	189	229	25	1,189	ssb
BRS17567	236	265	319	136	220	17	1,188	ssb
BRS25901	197	269	308	179	182	16	1,151	ssb
BRS35943	135	227	266	172	203	18	1,021	ssb
BRS38876	74	189	233	150	181	61	888	ssb/cw
BRS35454	114	185	247	103	147	22	817	ssb/cw
BRS32286	96	195	225	75	172	4	767	ssb
A8841	93	177	264	69	117	0	720	ssb/cw

This table will next appear in the July issue.

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

microwaves

Charles Suckling, G3WDG *

RSGB National VHF Convention 1978

The two lectures organized by the Microwave Committee at this event were very well attended. In the first lecture, on the subject of locking Gunn oscillators, G8DEK began by reviewing the current practice at 10GHz of using unstabilized Gunn oscillators as transmitters and local oscillators, in conjunction with receivers with bandwidths of around 300kHz. He pointed out that the stability of most oscillators was already better than 15kHz, making this high bandwidth unnecessary. He proposed that 30kHz would be quite sufficient for unstabilized oscillators, with a consequent improvement of 10dB in received signal-to-noise ratios. However, there was a considerable advantage to be gained by improving oscillator stabilities still further, and G8DEK described three ways of achieving this: cavity locking, injection locking and afc. The first method, outlined in January 1978 *Microwaves*,was found to be particularly useful in locking higher power oscillators (50 to 200mW), which tend to have poorer frequency stability than lower power oscillators. The use of wavemeter cavities for locking was also mentioned, and G8DEK reported that it was desirable to place a phase-shifter between the oscillator and the cavity to obtain a good compromise between locking efficiency and power output. The success of this method was demonstrated by some spectrum analyser photographs which showed that the frequency of the locked oscillator remained within a 2kHz band for a period of at least 10s.

G8DEK continued by describing the injection locking technique in which a relatively low-level crystal controlled signal is coupled into the oscillator via a circulator. This causes the oscillator to assume the frequency stability of the crystal controlled source. On the subject of circulators, G8DEK mentioned that he had had considerable success in modifying radar band devices to 10GHz and that he would be pleased to provide information to anyone contemplating the use of such circulators. In the discussion which followed, an interesting injection locking arrangement which did not require the use of a circulator was described; in this, two identical oscillators were locked to a crystal source using a magic-T. One of the attractive features of this arrangement is that the outputs of the oscillators are combined to produce twice the output power. This would seem to be potentially most interesting, particularly if the technique could be applied to the locking of, say, two 100mW Gunn oscillators, or even two 1W klystrons!

While these methods work satisfactorily in the laboratory, there were likely to be some practical problems about their use in the field. G8DEK described a slightly more complex, but potentially more reliable, technique, in which the frequency of the Gunn oscillator was controlled by an afc loop. His arrangement used a 1N23 diode driven by a low frequency source to produce harmonics in the 10GHz region. The selected harmonic was mixed down to 10·7MHz in a second 1N23, using the Gunn as the local oscillator. The 10·7MHz signal was amplified by a conventional 10·7MHz fm strip, and the discriminator output used to adjust, via a dc amplifier, the supply voltage to the Gunn device, and hence the frequency of the oscillator. Very good stability can be achieved using this technique, which the writer can confirm, having used such a system to stabilize the receiver local oscillator during tropo-scatter tests with G8DEK and G3JVL.

In the second lecture, entitled "Getting started on 2·3GHz", G3WDG discussed the potential of 2·3GHz both as a local and as a dx band. It was shown that 2·3GHz should prove to be a useful frequency for tropo-scatter work, using practical equipment. For example, ranges greater than 300km should be possible using 10W of rf, receivers with noise figures better than 5dB, and 4ft dishes. G3WDG then described the design and construction of receiving converters, and recommended the interdigital mixer design described in *QST* January 1974. Some constructors had encountered difficulties with the local oscillator chain and i.f. preamplifier used in this design, and G3WDG outlined more reliable designs which are currently being developed for publication. RF preamplifiers were discussed next, and two designs capable of noise figures below 5dB were recommended. These were a two-stage amplifier using BFR34A transistors, and a single-stage NEC 57835 amplifier.

On the subject of transmitters, G3WDG discussed the design of 1,152MHz drivers and concluded that, in terms of reliability and ease of setting up, a tripler from 384MHz using a 2C39A was the best approach: a suitable design was described in *Radio Communication* January 1976. Varactor doublers were recommended to reach 2,304MHz, although their output power was generally limited to a few watts. For higher power operation, the use of a 2C39A as a pa, using the design which appeared in *Ham Radio Magazine* February 1975, was mentioned.

With regard to antennas, dishes greater than 3ft in diameter and either single or stacked loop-Yagi arrays were capable of good performance. The advantage of a dish was that it could be used on more than one band, a point worth bearing in mind considering the relative ease of becoming operational on the higher bands, once the basic 1,152MHz driver had been built.

Finally, G3WDG outlined methods which he had used to measure and optimize the performance of his equipment. A noise source was strongly recommended for aiding the tuning-up of converters, and a simple design which used a reversed biased transistor base-emitter junction as the noise generator was described. The use of ground and sun noise as a means of measuring noise figures and antenna gains was also discussed.

Microwave activity periods

A reminder that the first 3·4/5·7GHz activity period will be held this month; dates and times were given in *Microwaves* last month. A suggestion has been made by

Continued on page 333

*Physical Chemistry Laboratory, South Parks Road, Oxford OX1 3QZ.

4-2-70

Graham Knight, GM8FFX*

VHF Convention

More than 750 people attended the RSGB VHF Convention which was held on 25 February at the Winning Post, Twickenham. The specialist component suppliers were doing a steady trade throughout the day. Buyers at the Alexandra Palace exhibition always seem to be carrying off large boxes containing transceivers, but at Twickenham the vogue seemed to be for polythene bags containing proms, ics, and components for microprocessors. Even the items on the bring-and-buy stand seemed suited to the more technical amateur, with keyboards much in demand and even second-hand Hewlett Packard test gear at remarkable prices.

In the afternoon the RSGB President, Dain Evans, G3RPE, welcomed those who went to the nearby Whitton School to hear the lectures. These were divided into three streams, with standing room only at four of the lectures. Bob Burns, G3OOU, explained the techniques involved in building solid-state high-power amplifiers, and Mike Walters, G3JVL, demonstrated the construction and design of his highly-successful loop-quad Yagi antennas.

Mike Foster, G8AMG, and Chris Morcom, G3VEH, spoke to a packed audience on "Advanced repeaters". G3VEH demonstrated a touch-tone pad owned by G3OUF, and spoke of its use to control the various functions available on some American repeaters. Cross-band repeaters, sideband repeaters, television repeaters, and even one which could be called up to switch on a transmitter relaying a standard television test pattern, were among the many futuristic items spoken and dreamed about at this lecture. The problems involved in running two vhf repeaters from the same site also provoked considerable discussion. G4GRS spoke of his experiences with American repeaters, particularly one located at Washington which uses split-diversity reception techniques. A large section of the audience participated in discussing the GB3PT rtty repeater proposal—judging from the reaction, this particular project seems to have a great deal of support.

The largest audience of the day was reserved for the double-length meteor scatter lecture. More than 150 amateurs listened to the experts, Chris Bartram, G4DGU, Ian White, G3SEK, and Clive Penna, G3POI, describing the special techniques required for successful ms contacts. Some overseas amateurs had travelled to Britain especially for these lectures—these included ON5FF, C31OX, ON5UN and 11PE. Those attending received an additional bonus of a 10-page meteor scatter guide. This booklet gives written details of the special reporting systems, audio and memory keyers and, most important of all, the actual QSO format. This meteor scatter operating aid package also included tables by Geoff Grayer, G3NAQ, giving computer-prepared details of all the 1978 meteor showers showing the effectivity for particular path and time combinations.

It was noticeable that none of the talks or demonstrations was concerned with everyday operation—all the lectures were about advanced techniques. It was most encouraging that the specialized afternoon vhf programme was such an outstanding success.

Informality was the keynote for the evening, which was just as well as a conga line of nine Martlesham members went forward to collect their single but well deserved trophy. The raffle prize winners included G3BA with a tv game, a bottle of whisky for G3JYP, an fm discriminator for GM8FFX, and a bubble bath for G3OSS.The band proved popular with the 150 people who stayed for the evening entertainment and buffet supper. Pat, G3TEY, and Angelika, GM5CCI, were among the young ladies who boogied the night away to the first RSGB disco. "See you at Ally Pally" was the message frequently passed between mobile stations on the way home from Twickenham well after midnight.

Repeater Working Group open meeting

Council members Tom Douglas, G3BA, and Basil O'Brien, G2AMV, were among the 105 people who attended the recent open Repeater Working Group meeting which was held at the Wirral Mercury Inn. David Evans, G3OUF, the RSGB general manager, spoke of the events of the past year, including the freeze on repeater applications which had been imposed by the Home Office. This happened in the spring of 1977 when complaints to the authorities about deliberate repeater jamming reached large proportions. G3OUF emphasized that although the complaints were made by well-meaning licensed amateurs, they had resulted in a political decision to suspend further repeater licensing. The VHF Committee and its Repeater Working Group had advised the Society to try to proceed with the Phase 2 applications and, as a result of negotiations conducted by G2BVN and G6JP, the Home Office agreed to license these units last September. G3OUF explained that the Home Office ban on further repeaters continues but is the subject of further negotiation and review.

The general manager told the meeting that the RSGB expected the repeater jamming problem to continue until changes were made to the terms of the Wireless Telegraphy Act. A general discussion on repeater jamming took place, with many members and repeater group representatives expressing their views on the problem and relating their experiences. G8ATI of Macclesfield thought that transmitting equipment should only be sold to licensed amateurs. G8AUU suggested amateur radio equipment retailers should have a code of conduct requiring them to sell only to licensed operators. G3LEQ said many of the jammers used "blue box" (ex-private mobile radio) equipment which was easily obtained from surplus sources without going near the usual retailers—he knew of one jammer with 30 transceivers.

G3PAQ spoke of the problems in obtaining tape recordings or statements which could be used in court, he also gave details of a legal fund administered by the Southern and London UK FM groups. Much discussion took place on what to do if the local repeater is jammed.

*PO Box 49, Aberdeen AB9 8JA

In some circumstances, G3BA thought it advantageous to continue to have QSOs between strong stations who could ignore the jamming. G3XDV said his group's repeater in Kent had very little jamming simply because of its lower level of activity. Many attending expressed the view that more vhf repeaters in the London area would reduce the high level of activity on GB3LO and would therefore reduce the effectiveness of the present jamming of this repeater. G3LEQ showed the meeting a copy of the *Denbigh Free Press* which carried a front page story giving details of the conviction of a person who jammed GB3MP.

G3LEQ also spoke of a "pirates amnesty" in the Manchester area, where some of those recently convicted are attending morse and RAE classes and intend getting licences.

The election of the groups to the 1978 Repeater Working Group took place with only 56 votes being cast out of a possible total of 120. The results were: Section A—GB3CS, B(North-east England)—no votes, C—GB3MP, D—GB3HU, E—GB3BM, F—GB3PY, G—GB3NS, H—GB3KR, I—GB3SN, J—GB3BC.

Auroral reports

There has been considerable sunspot activity recently, with the solar flux reaching high levels despite the fact that we are still in the early stages of cycle 21. There was a steep rise from 31 January, when the solar flux measured 140; it reached a peak of 169 on 3 February but had declined to 163 by 10 February. Large flares were reported on 11 and 13 February, and a sudden commencement of a magnetic storm was reported on 15 February; all these signs heralded the auroral event which occurred on 16 February.

There have in fact been 19 auroral events in the first 57 days of 1978, thus keeping up the average of an aurora every three days already commented upon in previous *4–2–70* pages. A study of the dates reported in the previous seven months of *Radio Communication* reveals that some events have repeated as many as six times.

This year's auroral openings took place on 3,4,6,9,13,16,17,18,20,23,24,29 and 31 January and on 1,2,6,16,21,26 and 27 February. None of the February openings were large-scale events; most were fairly weak with only GM stations working to the Continent. As usual LA3WU and LA2PT were well in the forefront of the cw signals being worked by GM3DZB, GM3UKG, GM3JFG, GM4CXP and other Scottish stations.

The dates reported in these pages continue to be of interest to various scientific bodies, and the latest speculation is that some of the auroras reported are connected with the firing of rockets.

Moonbounce

Peter Blair, G3LTF, at Chelmsford, has already worked several USA stations via 432MHz moonbounce this year. Peter's best dx so far in 1978 has been a contact with Schichiro Mori, JA6CZD, who holds a First Class licence which allows the high power necessary for moonbounce operation. JA6CZD is located at Kurume, Fukuoka, 13,600km away—real dx by any standard.

Charles Suckling, G3WDG, and Chris Lancaster, G8HDR, have set up special antennas at Oxford University and have been able to listen in on some moonbounce contacts. Chris is working on a GaAs fet pre-amplifier to further improve the eme signals, and has obtained some special low-loss coaxial feeder cables from UHF Developments at Bedford.

Repeater control systems

To assist repeater groups, Thanet Northern have recently introduced a do-it-yourself control logic kit which consists of four glass-fibre boards, etched, drilled and tinned. Three of the boards are double sided and one is single sided. A 40-page manual gives full circuit description, parts layout and setting up instructions. This basic kit costs £24 and will then need 29 integrated circuits, 100 diodes and a few discrete components. It needs 800 solder joints and is recommended for an experienced constructor.

For those who would rather purchase a ready-made unit they have also made available a basic unit which consists of all the control electronics to convert a transmitter and receiver into a repeater, with the addition of antennas and filters. The unit includes toneburst decoder, time-out generator and transmitter control relay. It needs an audio link from the receiver and provides a separate audio link to the transmitter. The unit is supplied completely ready to use and will be pre-programmed before despatch to any GB3-plus-two-letter callsign. The time-out indicator can be adjusted for any period up to 3min maximum. The unit requires a 5V 500mA dc power source. This unit is contained in a small die-cast box and meets all the requirements for repeater control logic systems. The cost of this fully assembled item is £99·75.

Repeater news snippets

GB3PI has changed configurations on the receiver antenna . . . G4DOB now the contact man for GB3TW. . . Logic changes for GB3WW. . . GB3MR has reverted to the original antennas. . . GB3NM has made antenna changes to improve reception in difficult areas. . . Information about GB3PY now from G4BEL. . . The proposed repeater for Cumbria has requested a change of callsign to GB3AS to signify Anglo Scottish. . . GB3NA logic has been changed to the IARU-recommended tone access with carrier-only re-access system. . . G4EPD (QTHR 1978 *Callbook*—got yours yet?) is the new secretary for UK FM Group Northern. . . The Grampian Repeater Group has now submitted an application for a 432MHz repeater. . . Auchtermuchty repeater proposed by well-known Auchtermuchty resident and band leader Jimmy Shand—he is intrigued by the fact that the tone decoder responds to the third A above middle C on his accordion—further details from G3LEQ.

Sensation on 70MHz

Marc De Munck, ON5FF, caused a mild sensation at the VHF Convention by announcing that the ON6UG contest group had obtained special permission to operate on 70MHz during the July contest. Arrangements were hastily made for Polar Electronic Developments to lend the group one of their 70MHz transverters, and for SMC to supply a suitable beam antenna. The group will operate on 70MHz with the special callsign ON4ERX, and further details of this extremely interesting expedition will be included in future pages of *4–2–70*. The prospect of the

first Belgium to the UK contacts certainly fired the enthusiasm of 70MHz diehards G3JYP, G3FDW and GM3WOJ.

Mike North, G4EZV, in North Yorkshire, is QRV on 70·2MHz every Monday night from 2000 to 2200gmt with ssb. Mike would welcome skeds and these can be arranged by writing to 3 Shirley Villas, Rawfolds, Cleckheaton, West Yorkshire BD19 5LX.

Expedition bonanza

A group from Belgium will be in the Faeroe Islands for more than a month around June and will be active on 144MHz; full details in late news.

Between 5 August and 13 August ON6UG, ON5UN and ON1DV will be operational from QTH locator AC38h in Andorra using the C31OX callsign. This of course coincides with the Perseids meteor shower.

Richard Staples, G8MME and PE1AVU, will be operational from the Shetland Islands during the period 4 to 19 June and will be running full power on 144MHz and 432MHz. Skeds can also be made on these two bands for possible 1,296MHz contacts.

The Glenrothes expedition to the Faeroes and Iceland is already well organized, and almost fully booked for meteor scatter skeds. Further details from GM8NCM, QTHR.

Contests

RSGB member Edmund Ramm, DK3UZ, sends details of two cw-only contests which are to take place between 1900 and 2400gmt on 24 June and on 23 September. There are to be three categories: A—less than 3·5W output; B—less than 25W, and C—more than 25W output. The contest exchange consists of report, serial number, category and QTH locator. Multipliers can be claimed for each new QTH locator square, and five multiplier points can be claimed for each country. A copy of the full rules for these cw contests will be mailed to anyone sending an sae to GM8FFX.

The WAB VHF Contest takes place on all bands above 30MHz from 0900 to 2100gmt on 23 July. Full contest details are available from G3TWX, 13 Gannet Close, Haverhill, Suffolk, on receipt of an sae or a single irc.

Beacons

Jan Martin, LA8AK/G5BFV, reports that LA4UHF is now operational on 432·890MHz from QTH locator CT57d. Keying is ask/fsk and the transmitter runs 8W output to a horizontal antenna. LA8AK also reports that new beacon LA3VHF, on 144·880MHz from QTH locator DS78f, is under test running 5W output to a four-element horizontal Yagi beaming towards the southern UK and Holland. Full operation of LA3VHF is expected to start soon, and a further beacon, LA3UHF, is planned for 432·890MHz from the same site.

The West Kent ARS has constructed a 432MHz beacon as a memorial to the late Bert Allen, G2UJ. The beacon's callsign is that of Bert's initials, GB3WHA. The beacon will operate on 432·810MHz using a solid-state transmitter with 10W output. The antenna is an eight-over-eight slot-fed array beaming NNW, giving an erp in excess of 50W. Operation may already have started by the time this report appears in print, as the beacon is ready and will be switched on as soon as the licence arrives from the Home Office. GB3WHA will be sited at Crowborough, East Sussex, and will provide a long-awaited 432MHz beacon for the south-east of England. Reception reports should be sent to G4BOO, 7 Goddards Close, Cranbrook, Kent.

The growing number of UK stations equipped for reception on the 50MHz band will be pleased to hear of yet another new beacon for this most interesting band. The 50·025MHz beacon is operated by the Jamaican ARC under the callsign 6Y5RC, and runs 40W erp from a three-element horizontal beam. The beacon, which identifies on F1 and sends the callsign every 15s, has had extensive heat tests in Britain to simulate the high ambient temperatures in Jamaica. Reception reports will be forwarded to the Jamaican club by Peter Blakeborough, G3PYB/6Y5PB, 166 Bury Hill Close, Anna Valley, Andover, Hampshire.

New 144MHz and 432MHz records

Edgar Muller, YV5ZZ, set a new 144MHz record on 8 February by working Amilcar Sapare, LU5DJZ, in Mar del Plata, Argentina via transequatorial propagation. The QSO took place at 0030gmt using cw on 145·100MHz; 559/549 reports were exchanged. Edgar had 15 transequatorial QSOs in the period between 29 October and 8 February. Full details of all these contacts will be given in next month's *4–2–70* when a most intriguing comparison will be made with the dates of solar events. The YV5ZZ/LU5DJZ contact was over a distance of 5,486km, but this record stood for only four days when LU5DJZ worked KP4EOR in Puerto Rico—a new record distance for 144MHz of 6,120km.

A new 432MHz world record was claimed by Dr Walter Howse, VK6KZ, operating portable west of Albany, who worked Les Jenkins, VK3ZBJ, in Frankston near Melbourne, Victoria. This contact took place at 1015 local time on 11 January 1978 and is over a 2,460km distance. The equipment at the VK6KZ end was a British-made Microwave Modules 432/28MHz transverter feeding an eight-element Yagi at a height of 4m portable on a site 140m above sea level.

VK6KZ/P used a Microwave Modules 144MHz transverter and a five-element Yagi to work strings of stations in Adelaide, South Australia—a distance of 1,910km, during their summer openings in January and February.

It is most gratifying to receive letters direct from stations thousands of miles away who are creating new records and who take the time to mail or telephone details to *4–2–70* immediately after these tremendously successful contacts are completed. Our congratulations go to the operators detailed above, and one wonders by just how much the distance records can be further extended.

Unlicensed operation

The purge on illegal 144MHz operators in the Manchester area continues with one being sentenced to a three-months custodial sentence suspended for two years. Courts have heard evidence of pirates using Parabeams and rotators—in one recent case the magistrates ordered

REAL DX 1978

70MHz aurora	G3TYE-G3ZSS	320km
70MHz tropo	GM3WOJ-GU3HFN	590km
144MHz tropo	GM8MBP-DF5GX/P	1,300km
144MHz aurora	G3ZIG-UR2RQT	1,800km
144MHz ms	GM8NCM-SM3BIU	1,340km
144MHz te	LU5DJZ-KP4EOR	6,120km
432MHz tropo	VK6KZ-VK3ZBJ	2,460km

the confiscation of a nearly new Trio TS700 transceiver. In another case of pirate vhf operation the magistrates confiscated a vhf transmitter but did not order confiscation of a Labgear LG300.

New mobile amplifier

Peter Dalton, W6NLZ, writes from California mentioning the fact that he recently purchased a new solid-state amplifier for the 144MHz band. The unit is designed for boot mounting and has a dashboard remote control unit allowing the amplifier to be switched in or out from the driver's seat. The remote control can also select Class AB1 for ssb and a.m., or Class C for fm. Three high-power transistors in a combined circuit give 300W p.e.p. output on ssb for 15W input. The amplifier takes a peak current of 40A and is designed for 12V operation. A seven-section low-pass filter is incorporated after the pa transistors to ensure all harmonics are at least 60dB down and thus complying with the new American FCC regulations.

Peter says many field day groups in America are using this type of amplifier instead of carrying generators and valve linears. He does say that they still have problems in keeping this hungry beast fed with 12V batteries. At the time of going to press no British dealer is handling this high-power amplifier but doubtless it is only a matter of time before they start appearing over here. The price in the USA is $479

Late news

A large number of letters and telephone calls has been received following the publication in "Council Proceedings" in the February issue of *Radio Communication* of the following:

"Mr C. Thomas noted that several people had been convicted of setting fire to the Southampton repeater, although only one person had lost his licence, nothing had appeared about this in *Radio Communication*". Nothing has appeared about this in *4-2-70* simply because **no one** has been convicted of setting fire to GB3SN. Details of many court cases **have** been printed in *4-2-70* and this policy continues, but it must be stressed that information based on hear-say, rumour and speculation will not be published.

OZ3TZ and OZ7IF will be active from the Faeroes from 28 June to 26 July; they also hope to establish OY beacons on 144·885 and 432·885MHz.

Further auroras on 28 February, 1 and 2 March.

Finally, send your news and views to PO Box 49, Aberdeen or ring the *4-2-70* telephone answering machine by dialling 0224 780347. □

MICROWAVES

(Continued from page 329)

G3MCS that it would be worth reinstating the Monday evening activity periods on 1·3GHz which did much to aid the activity and technical development on this band a few years ago. This idea would seem to be most useful, and perhaps could provide a regular focus for home station activity on some of the higher bands as well, eg 2·3 and 3·4GHz. The writer would suggest calling on 432MHz from 8pm onwards to arrange tests.

Forthcoming events

Two round tables will be held this month. The first is on 16 April at IBA Engineering HQ, Crawley Court, near Winchester. The discussion session will be on the topic of flyswatter antennas for home station microwave operation, and will be started off by G3JVL. As usual, it is hoped to have a wide range of test equipment available. For further details please contact the writer or G3JHM.

The second meeting will be held at Sheffield University on 29 April. This is being organized by G8AGN, and the subjects to be discussed include 2·3GHz equipment and the locking of Gunn oscillators.

Moon noise on 10GHz

What is probably the first observation of thermal noise from the moon on 10GHz by an amateur, was made recently by G3JVL. The antenna in use was a 4ft dish, and the receiver included a preamplifier, loaned by Plessey Caswell, using three GAT5 GaAs fets, with a noise figure of 2·7dB. Although the presence of the moon in the beam of G3JVL's antenna only increased the noise output of the receiver by a few per cent, this was easily detected by rectifying the audio output and displaying the resulting dc voltage on a meter. In fact, the sensitivity of G3JVL's system is such that he has detected the variation in the noise power emitted by the moon during the lunar cycle due to its changing temperature.

1978 10GHz Cumulative Contest

The dates for the 1978 10GHz Cumulative Contest have been arranged as follows: 21 May, 25 June, 23 July, 27 August and 24 September. The rules will be essentially the same as last year's, and will appear in "Contest news" next month. □

the month on the air

John Allaway, G3FKM *

FOR as long as your scribe can remember, the name of the author of "How's DX" in *QST* has remained unchanged. It was always that of Rod Newkirk, W9BRD. However, Rod's long run (of over 30 years) has at last ended and the task has now been taken over by Bill Lowry, W1VV. This surely must set a new record of service to the amateur dx fraternity, and G3FKM is certain that all readers would like to join him in thanking W9BRD and wishing him a happy "retirement".

It seems that GJ2CNC is being troubled by a double who is using the callsign GC2CNC. The pirate calls himself Monty (the name of the genuine 2CNC) but is unaware of the change in Jersey's prefix which took place over a year ago. Likewise, GM4DSS is receiving QSLs for contacts which he has not made, originally this particular pirate was using the call G4DSS. Any further information on either of these would be welcome.

The callsign of the Gwent Contest Group, GW4ENT, is being pirated as G4ENT. One common denominator in all three instances is that the pirate is apparently someone who is poorly informed!

News from overseas

G2MI has passed along a letter received from Qatar. This points out that there are only two fully-licensed amateurs in the country, and that one of them is A7XA who is the oil minister. His station is usually operated by members of his staff and seldom by the sheik himself. The second call is held by the Emir himself and has not yet been used on the air. It is suggested that all other A7 calls being heard are not properly licensed.

John Stratfull, 3B8CV, will finally be leaving Mauritius this June after a nine-year stay. In future he may be reached at the address in "QTH Corner".

Top band news

Mick Bazley, VK6HD (also G3HDA), has supplied details of stations heard and worked during the months of December and January when he operated for a total of 39 days—on 20 of which he heard or worked Europe. This was his best average yet and, with 23 European contacts, his best season. The loudest European signal recorded came from DJ8FR, and strongest UK stations were G3MYI and G3SZA. Stations worked were as follows: DJ8FR, DL0KG; G3s CWI, IGW, JMJ, LWI, MYI (three times), RTY, SJE, XSE, ZFC, ZSU and ZYY; G4CP, G4EDG, HB9RM, OH2BD, OH3XZ, OF5NG, OH6DX and OK1HAS. Heard but not contacted were: EI8H, DJ8GW; G3s IQM, LIQ, PU and SZA; GM3IAA, OH1IX, OH2BM; OK1s FCW, KPU, MCW; OK2s BQU, PGU; and OK3LL. Mick reports a good opening on the morning of the CQ WW 160m Contest, but S7 noise from local power supplies prevented him making any contacts. It seems that there is a pirate VK6HD around, as QSLs are arriving for non-existent contacts. The equipment in use is a TS820S with external vfo, and the antennas are two inverted-Vs with apices at 85ft—one runs NE–SW and the other NW–SE.

G3UUZ (whose *Callbook* address is the Bishop Rock lighthouse, off the Isles of Scilly) has kindly supplied a list of frequencies on the band used by coastal stations throughout Europe and the Mediterranean area. It is important to avoid these as far as possible, *especially when interference could be caused to the priority users*. They are (in kilohertz):

1,800	1,827	1,866	1,904	1,927
1,806	1,834	1,876	1,905	1,929
1,811	1,841	1,879	1,906	1,939
1,813	1,848	1,883	1,908	1,988
1,817	1,855	1,888	1,911	1,995
1,820	1,856	1,890	1,921	
1,824	1,862	1,901	1,925	

G3CWI reports that what is thought might have been the first UK—ZS contact, or even the first Europe—ZS contact, took place between G3MYI and ZS4PB on 26 February. It appears that the earlier contact made by GD4BEG was with a pirate using ZS4PB's callsign. ZL3GQ (on cw) and ZL2BT (on ssb) have been active (the latter on 1,810kHz) at UK sunrise time since 1 March, and ZL2BT has already been heard.

W1BB's latest *160 Metre DX Bulletin* contains a wealth of information on band activities, as usual. Stew feels that conditions have in fact been very much down this winter, but he did enjoy listening to K1PBW holding a round-table contact with ZL2BT and a number of Europeans on the nights of 28/29/30/31 December. Snippets on individual achievements contain the news that G3JMJ contacted CE0AE on 3 January, and that GU3HFN made a two-way ssb contact with K1PBW on 6 November 1977 for what is believed to be the first GU-W QSO on phone on the band. G3CWI worked 50 countries during 1977, including JA, HC, ZF and XE. CE0AE looks for Europe on Tuesdays and Fridays at 0730—he transmits on 1,810kHz and listens around 1,827–1,829kHz. It seems that those fortunate enough to hear K6SE are listening to a rather special station—Earl has buried 20,000ft of radials and has four Beverage antennas each 600ft long!

Norwegian amateurs were allowed to use the segment 1,810–1,840kHz for the weekend of 11–12 February. This coincided with the Society's 1·8MHz contest, and thanks are due to the Norwegian telecommunication authority for their co-operation. It seems that now Loran is gradually moving out of the band there may be activity from those maritime nations which have hitherto been reluctant to give permission.

Dxpeditions

Marty, 5W1AT, together with ZM7MM and ZL3FM, hopes to be in the Tokelau Is for a 10-to-14-day stay during April. They hope to be active on six bands.

*10 Knightlow Road, Birmingham B17 8QB.

Long Skip says that there may not be any amateur signals from Sable Is for quite some time. Those who contacted VE1ASE back in 1967 will be interested to know that he is now VO2CW and still has the logs from his Sable Is days. Although there have been rumours of a forthcoming expedition to St Paul Is it seems that the Canadian DX Association has no knowledge of it.

VK2BJL has said that he will be visiting Mellish Reef in July and is looking for others who might like to go with him. He is prepared to go alone if he finds no volunteers.

Rumours of impending amateur activity from Iraq continue to circulate. However, I2FGP appears to have been refused permission to take his equipment across the border. A group of Yugoslav amateurs hoped to be more successful during the latter part of March.

DX news

It seems that QSL cards from K5CO/5A are not being accepted for DXCC credit pending proof of authorization of the operation. Similarly, 9U5CA cards are also being rejected as no documentation has been supplied. QSLs from XE4JJ—a callsign belonging to an expedition which was scheduled to take place a few months ago but was believed to have been cancelled—are being accepted.

Anyone who has contacted A6XB on cw has worked a pirate, as this station has never operated on this mode. A7XAH is sometimes to be found on Sunday at 1230 on 14,205kHz, and on Friday at 0600 on 14,250kHz. He is a diplomat, and not always able to keep these schedules. JT0DJT is quite often on 14MHz between 1100 and 1200 and has been heard on 14,128 and 14,220kHz. He is also active on cw and has been recorded on 14,001kHz at 0130.

ZD9GG, on Gough Is, has a schedule on 14,244kHz at 2030 on Monday, Tuesday, Thursday and Friday, and also on 14,320kHz at 1800. ZS2MI, on Marion Is, likewise tries to be on the air at 0500 on 14,202kHz, and at 1700 and 1930 on 21,302kHz. The present operator has a new QSL manager, WA4SSU, who has logs extending back to December 1977. ZS3WBC was due to be active from Walvis Bay during March. The station celebrated the 100th anniversary of the formation of Walvis Bay, and the operators were expected to be ZS3AA, ZS3C, ZS3KC and ZS3MV. 5V7AS, in Togo, is now quite active and asking for QSLs via IT9AZS. OK2BFP/D2A has been worked on 14MHz ssb—he often makes contacts in German but does speak English.

West Coast DX Bulletin has listed a number of decisions taken by the ARRL DX Advisory Committee. Their second 1977 Semiannual Activities Report recommends addition of Transkei and Southern Sudan to the DXCC list. It rejected Water Is (in KV4 area) and the Pribilof Is (in Alaska). It appears that their recommendations on the new "countries" have been shelved for the present but may possibly be resuscitated in 1980.

Kazuo, JA3KHJ, is currently in Zambia and has so far not been able to obtain a 9J2 call. He has previously been VR1AK, VR3AM, VR8E, VR8JA and S21JA, and hopes to visit Kenya during the coming summer and operate with a 5Z4 call.

The Canadian DX Association meets on 14,173kHz at 1900 on Sundays, and useful information on dx activities is often discussed. QSL cards sent to VE3FXT for contacts made with his recent African tour have been returned by the Canadian Post Office marked "unclaimed". It is believed that this is the result of a misunderstanding and those who have not already posted off their cards are advised to wait for a few weeks.

Bulgarian stations used the LZ100 prefix from 3 February to 3 March. This was to celebrate the 100th anniversary of the liberation of their country from the Ottoman empire.

According to the *West Coast DX Bulletin* the FCC has proposed that all new licensees in the Pacific area shall be given KH prefixes, together with a digit denoting the actual island or island group on which the station is located. Likewise in the Caribbean area the prefix will be KP and a digit. New "military recreation" stations will use the WN prefix.

Morse code practice

From 1 April W1AW has been beaming towards Europe on its 14, 21 and 28MHz frequencies (14,080, 21,080 and 28,080kHz) for morse code practice, and cw and rtty bulletins at 1400, 1500, 1600 and 2100 on Mondays, Wednesdays and Fridays. This is an experimental move which is designed to continue for three months and its future depends on listener response. Readers who find it useful are asked to write to ARRL.

Contests

The Bermuda Contest

0001 22 April to 2400 23 April.

All bands 3·5 to 28MHz. A maximum of 36 hours only may be operated, and off periods must be clearly logged. Each must be of not less than three consecutive hours. All stations shall be single operator only and must be operated from their own private residence or property. Top winners of the 1976 and 1977 contests shall be eligible for the area awards only. This year the rules make it clear that in order to comply with the Radio Regulations of the ITU no phone contacts may be made between the UK and the USA or Canada on 7MHz. British stations work those in the USA, Canada and Bermuda, and may work each station once on each band—either on phone or cw (cross-mode or cross-band contacts are not allowed).

British stations send RS/T and indicate their county (use abbreviations as listed on page 63 of January *Radio Communication*). Stations in Bermuda indicate their parish, in the USA their state, and in Canada their province. Each contact counts five points, and the multiplier is the total number of VP9 stations worked on each band added together. The same VP9 can be contacted on all bands. The top scorer in each state, province, and county will receive a printed award. The top scorer in the USA, Canada and UK will each receive a trophy which is presented at the Radio Society of Bermuda's annual dinner in October, and round-trip air transportation plus accommodation will be provided for the winners. This year's winners will stay at the Elbow Beach Surf Club.

Logs must indicate dates and times (in gmt). Duplicate contacts must be checked for, and score computed. All entrants must sign a statement that they have complied with the rules and the terms of their licences. Each page must be clearly marked with the call and name and address, and must arrive at: Contest Committee, Radio

QTH CORNER

A35ED	via WA7JOV, D. E. Greer, 2205 Sunset Drive, Medford, Ore, 97501, USA.
A35WL	PO Box 27, Nuku'alofa, Tonga.
AP2AD	via K1KNQ, Rosiello, Box 95—Turnpike Stn, Shrewsbury, Mass, 01545, USA.
FC0CUW	via I1ANP, M. Alberti, Via Priv Maralunga 12, I-19100 La Spezia, Italy.
FC0CYA	via HB9BFS, Dr E. Hoefling, Finkernstr 6, CH-8280 Kreuzlingen, Switzerland.
GB2BDS, GB2BRS, G3VGG, GE3VGG	J. K. Harvey, 38 Bodenham Rd, Birmingham B31 5DS.
GW4ENT, GW6GW	via GW4BLE, S. Cole, 10 Llanthewy Rd, Newport, Gwent NP1 4JR
JD1ADG	via JA2NJE, S. Kato, 1348 Kagamishima, Gifu, 501-01, Japan.
OY5J	(new) via WA3HUP, Mary Crider, RFD 2, Box 5-A, York Haven, Pa, 17370, USA.
P29BL	PO Box 7412, Boroko, Papua New Guinea.
SV0WZ	now H. Dankerl, 12104 Blaketon, Upper Marlboro, Md, 20870, USA.
VE3HRS/XT only	K. A. Stone, 2200 Roche Ct, Apt 1208, Mississauga, Ont, L5K 3Z6, Canada.
VR4YL	F6CYL, Ann Koloboff, 3 Rue de l'Etang, F-78430 Louveciennes, France.
WB6IWB/FK8	Box 1392, Vallejo, Calif, 94590, USA.
ZF1MT	PO Box 1554, Grand Cayman, Cayman Is.
ZS3WBC	PO Box 1234, Walvis Bay, 9190, South West Africa.
3B8CV	J. F. Stratfull, G3IJS, 37 Boxgrove Gardens, Aldwick, Bognor Regis, Sussex PO21 4BB.
5V7AR	via F6ABV, A. Belan, Le Pomingheat, F-63 Tallende, France.
9K2DX	(Op N6NI) via W6LV, W. Baker, 6 Hillview Ct, Burtlingame, Cal, 94010, USA.
9V1RS	(Now GD3OOK) J. Plenderleith, 24 Baldrine Park, Baldrine, Douglas, IOM.
9V1SO	(Now G3XGY) B. A. Harris, 4 Flamingo Cresc, Worle, Weston-super-Mare, Avon.
9X5BW	(Now CT1ZH) W. P. Berger, R 9 de Abril, Lt 5-R/C-E, S. Pedro Do Estoril, Portugal.
9X5SP	via DL8OA, A. Stabusch, Holbeinstr. 5, D-2000 Hamburg 52, W Germany.

RSGB QSL Bureau, G3DRN, 30 Bodnant Gardens, London SW20 0UD.

Society of Bermuda, PO Box 275, Hamilton 5, Bermuda, no later than 30 June 1978.

WAB Contests

0900–2100 7 May (Phone).
0900–2100 18 June (CW).
This year's contests will be if bands only (the hf band events will be resumed next year). Contacts may be made on 1·8, 3·5 and 7MHz, and logs must reach contest manager G3TWX not later than 50 days after the contest. Full rules may be obtained by sending a request plus sase or one irc to G3TWX, 13 Gannet Close, Haverhill, Suffolk CB9 0JL.

The CQ-M Contest

2100 13 May to 2100 14 May.
3·5 to 28MHz, cw and ssb—but not cross mode. The object is to contact Russian stations, and exchanges consist of RS/RST plus serial QSO number (from 001) for non-Russians while the Russians send RS/RST plus a number denoting which region (=oblast) they are in. There are single-operator single- or multi-band, multi-operator all bands (single transmitter), and listener categories. Contacts between stations in the same continent count one point, in different continents three points, and the multiplier is the number of "R-150-S" countries worked on each band added together. Own country counts only for multiplier credit. Listeners score one point for logging one report and two for logging a whole contact. Logs (use separate sheet for each band) should reach: CQ-M Contest Committee, PO Box 88, Moscow, USSR, by 1 July 1978. Memorial badges will be awarded to all overseas participants who make more than 10 QSOs with the USSR, and contacts during the contest may be used when claiming the various USSR awards: "R-150-S", "R-100-O", "W-100-U", "R-15-R", "R-10-R" and "R-6-K", by applying at the same time.

GM4ELV has supplied results of the **1977 Bornholm Contest**. GM4ELV himself was the leading UK station (with 1,504 points), and other UK entrants were GW3SLA and G4CLD with 1,166 and 112 points respectively.

Awards

The RSGB hf awards manager, Chas Emary, G5GH, has asked for members' attention to be drawn to the fact that **proof of Society membership** is required when applying for **any RSGB award**, and for **WAC**.

Band reports

The promise of rising solar activity evidenced in January has been sustained up to the time of writing. The WWV report for 3 February gave the solar flux as 169 and the geo-magnetic index (Ap index) as 11—a combination pointing to exceptionally high band conditions which were in fact evident during the weekend of 4–5 February. The provisional daily sunspot numbers from the Swiss Federal Observatory for those two days were 138 and 137, and the lowest recorded for that month was 52 on 20 February. The monthly Zurich number jumped from 49·3 in January to 89·8 in February—a value last reached in early 1972, and early in March WWV was again giving high flux and low Ap indices. Once again 28MHz was open into the USA for more than eight hours each day during the first weekend in the month. This summary has been provided by G8KG, and one can only endorse his findings by saying that conditions on 28MHz have been excellent at times. BRS31301 reports hearing discussion of a 50MHz opening between VK8 and Japan on 5 March.

Your scribe would like to thank the following for information used to compile this section: G2CDT, G2HKU, G3HB, G5JL, G6GH, G8KG, G3CWI, G3KSH, GM3LYY, G3RCA, G3UOL, GD4BEG, GM4CHX, G4EAN, G4EHQ, SP3AEE, BRSs 17567, 25429, 31301 and 33915, and A9191.

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

1·8MHz. 0100 *C5ABC* (QSL TO WB4ZNH). **0400** LA7Y/EA8, *ZC4IO*. **0500** *W4BRB*. **0600** K1PBW, VP2MBB, *VP2MUZ, ZB2G* (QSL to K2FJ). **0700** ZL2BT. **0800** *VP2MUZ*. **2200** EL0AN/MM (27N 42W, QSL to OH2BDP), *VP2MBB*.

3·5MHz. 0000 5H3KG. **0100** HH9OF. **0400** JY4MB. **0600** FG7BA. **2100** EL1I, HI8MFA, OX3HH. **2200** 9L1CA, 9N1NFO.

14MHz 0000 JA, W6. **0100** KC4AAD. **0700** A35AA, *FO8AK*, ST2SA. **0800** WB6IWB/FK8, KG6SS, VK2AGT/LH, VK9NI, VR4DN, YJ8GH, YK1AA, ZL. **0900** FK8BB, JA, W7ZGA/KG6, KG6RL (Box 189, Saipan), KL7, VK, ZL. **1200** J3AJ, P29JS. **1300** C21AA (Box 173, Nauru), KC6GF, *KG6SS*. **1400** J28AR. **1500** A7XAH (QSL to DJ9ZB), FB8XS, VU, W6/W7, 9N1MM. **1700** FB8ZM, KH6BB, *VK6WT*. **1800** KL7RW, VS6CW, ZS2MI. **1900** ZD7SD, ZL. **2000** FY7, KX6RA, TR8BJ (QSL to DJ5DA), ZB2AV/VP9, VE3HRS/XT, ZD9GG, ZS3WBC. **2100** HH2SD, KL7, VP2VEG (QSL to W0DVZ), VP8. **2200** WA3WAQ/TJ **2300** CE0AE, JA, VS5DX.

21MHz. 0700 P29BL. **0800–0900** JA, ZL. **1000** TJ1AA, *UA0YT, UK0YAA*. **1200** AP, P29JS, VK, VU, YM1ZB. **1400** FR7BE, HH2MC, J28AH, VU2LQA (QSL to DK6TU), YC1WE. **1600** XE1XF. **1700** *EL*,

FO8, XE, 5H3BP. **1900** A35DE, KH6, W6/W7, ZS3WBC, 5H3JR. **2000** W6/W7. **2100** CE3ZM, W6/W7/W0.

28MHz. 0700 JA, UI8, VK5FH, OE6DK/YK. **0800** K0AX/DU2, JA, P29PN, VK3, 4, 5 and 6. **0900** *EP*, HZ1HZ, JA, UA0, VK, VS6, VU, YM1ZB, 9L1NP. **1000** AP2KS, JA, VK, 5N2NAS. **1100** A4XGY, C5AL, KV4CI, P29JS, *VK8HA, 9K2DR*. **1200** A6XB (QSL to K1DRN), FG7AN, J28AO, S79DF, VP2AZB, VP8QC, YB0ACK. **1300** EP2RL, VE5RA, 5H3BP. **1400** C6ABA, EA9FD (Box 326 Melilla), OE6DK/YK, 5T5ZR. **1500** FM7AC, HZ1HZ, OX3GW, W6/W7, *3B8MS*, 5H3BP. **1600** CE, OK2BFP/D2A, HK0, OA, TG, *ZD8TH*, 7X2DG. **1700** W5/W6/W7, ZS3WBC. **1800** HH2MC, LU2A, S79DF, W6/W7, ZF1SB. **1900** KH6IAA, W7, VE7. **2000** FP8DX, KL7HDS, W5/W6/W7. **2100** W1–W4.

Many thanks to all correspondents—and especially to the authors of the following for items of news extracted: *RSZ Newsletter* **(9J2KL),** *Long Skip* **(VE1AL/3),** the *West Coast DX Bulletin* **(WA6AUD),** *DX'press* **(PA0TO),** *CQ Magazine* **(W1WY),** the *Ex-G Radio Club Magazine* **(W3HQO),** and *DX News Sheet* **(Geoff Watts).**

Please send all items for **June** issue **to reach G3FKM** no later than 5 May.

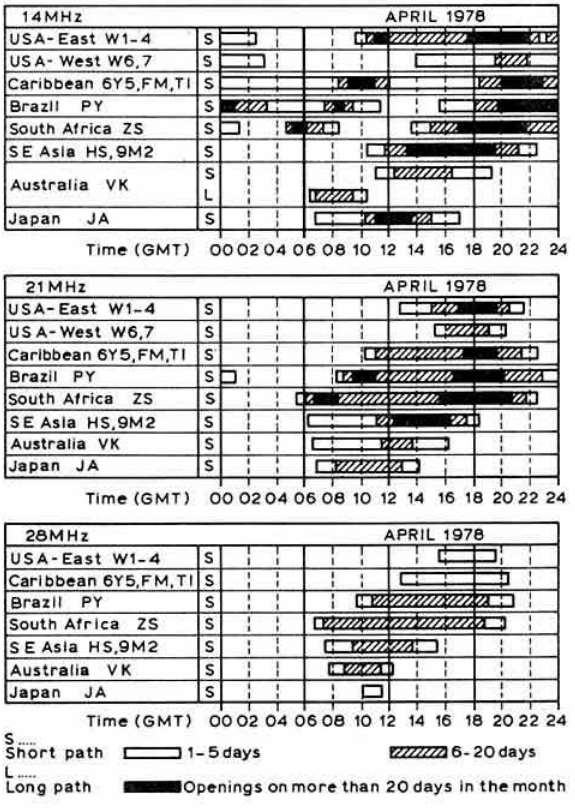
Propagation predictions

During April the changeover to summertime conditions takes place, which means that the F2 mufs will decrease during daytime as summer advances; the opposite will be true for night-time frequencies. For this reason propagation conditions are worse during daytime in summer and better at night, but, as we are now in the increasing period of solar activity the difference will not be so noticeable. On **28MHz** only South America, South Africa, South East Asia and Australia will be heard more often, while on **21MHz** only traffic with western North America, Australia and East Asia will not be certain.

Conditions will improve on **14MHz** because of summer conditions, and as the days lengthen the band will remain open longer at night. Traffic with Central and North America should be possible all through the night, but with South Africa it will be interrupted at night. Traffic with Hawaii should be possible between 0830 and 1000 and from 1830 to 2000, but as the path lies across the North Pole, traffic will be interrupted by static. Traffic via the indirect path will be very limited on this band, except with Australia, but this will improve as the season advances.

Chances of dx will still be possible on **7MHz** as long as the greater part of the path lies in darkness. As the season advances dx on this band will be interrupted more and more by static. The advancing summer and increased static will shorten the distances covered on **3·5MHz.** Local traffic will seldom be interrupted by the dead zone.

The provisional sunspot numbers from the Swiss Federal Observatory for October, November and December 1977 were 41·3, 26·6 and 41·3 respectively. The figure for January 1978 was 49·3 and the latest predicted smoothed numbers for May, June and July are 49, 51 and 53 respectively.



HF propagation study

Predicted hpfs (MHz × 10) for April 1978

GMT=	00	02	04	06	08	10	12	14	16	18	20	22	24
Aden	191	181	195	263	318	336	348	347	348	276	255	200	191
Ascension	206	210	186	144	293	331	346	359	366	376	315	241	206
Bahrain	178	171	199	252	303	319	327	322	322	262	227	187	178
Bangkok	147	136	197	230	262	288	288	281	263	252	195	154	147
Barbados	190	173	161	150	174	258	282	285	298	294	294	249	190
Bermuda	173	150	140	129	150	213	244	248	265	261	265	221	173
Bogota	182	159	152	140	182	219	268	276	286	282	282	235	182
Buenos Aires	200	194	183	173	186	291	321	327	337	333	317	246	200
Cape Town	197	183	135	244	319	342	356	366	368	379	282	223	197
Colombo	171	162	202	251	296	310	312	313	305	274	227	178	171
Cyprus	168	161	173	225	277	295	303	301	301	276	246	180	168
Dakar	196	204	181	196	274	321	336	345	348	345	310	255	196
Denver	148	133	128	126	126	131	174	196	202	211	216	182	148
Fairbanks	145	143	149	166	169	173	172	176	180	174	176	168	145
Falklands	201	200	185	185	167	277	329	336	347	342	317	242	201
Gibraltar	119	124	108	138	174	195	210	208	216	211	192	145	119
Hong Kong	130	128	192	218	247	267	271	257	216	206	177	147	130
Honolulu	148	141	144	159	180	185	169	154	190	202	195	169	148
Iceland	100	93	94	114	147	164	173	171	177	169	155	124	100
Jamaica	177	154	144	136	172	206	255	265	272	270	272	230	177
Lagos	206	213	186	229	309	343	356	366	373	387	290	234	206
Las Palmas	172	177	161	172	239	275	294	295	303	301	275	214	172
Lima	191	177	169	155	211	174	290	295	313	307	304	251	191
Los Angeles	148	133	129	133	125	121	147	194	210	218	211	178	148
Malta	138	138	131	176	215	241	248	248	252	243	213	158	138
Mauritius	202	169	182	262	322	338	354	355	352	329	267	206	202
Mexico	161	139	129	128	173	158	219	238	246	241	241	201	161
Moscow	117	101	140	178	206	230	233	232	230	218	182	131	117
Nairobi	201	197	185	261	322	346	361	362	370	308	270	210	201
New Delhi	157	148	199	235	279	295	295	293	272	209	194	163	157
New York	164	153	130	130	130	182	210	220	239	237	241	206	164
Osaka	130	131	177	199	223	237	241	205	177	167	167	148	130
Perth	169	162	202	249	294	309	299	242	214	191	186	168	169
Rio de Janeiro	201	200	185	182	173	314	328	335	347	341	318	258	201
Salisbury	204	206	176	260	327	347	364	366	376	368	286	219	204
Seychelles	195	188	194	248	293	340	355	352	361	304	263	208	195
Singapore	157	148	199	235	279	295	295	293	290	256	215	163	157
Suva (s)	147	145	154	178	195	211	220	210	210	199	181	159	147
Suva (l)	200	209	183	218	235	191	176	172	158	188	307	232	200
Sydney (s)	130	128	192	218	247	267	239	218	204	192	176	147	130
Sydney (l)	191	181	172	158	221	173	164	150	140	147	232	248	191
Teheran	171	162	202	251	296	310	312	313	308	261	224	178	171
Vancouver	148	136	134	147	145	135	163	172	185	176	194	173	148
Wellington (s)	143	143	159	190	206	230	211	199	192	169	176	155	143
Wellington (l)	199	205	182	199	195	164	152	144	139	158	229	238	199

Bands recommended are those between hpf and half hpf.

The maximum usable frequency (muf) for a given path at a given hour, varies from day to day. The highest probable frequency (hpf) is derived from statistical analysis of the daily muf values and is that value exceeded on three days of the month. Likewise, the optimum working frequency (owf or fot) is the value exceeded on 27 days.

HPF, muf and fot thus relate only to the probability (0·1, 0·5, 0·9 respectively) of a sky-wave path existing—there is no inference that signals will be workable. For amateur purposes it is found that bands between hpf and half hpf provide the best communications.

The prediction tables show the hpf in megahertz times 10, at two-hourly intervals of gmt, on a number of different routes to/from the UK.

Election of RSGB regional and area representatives for the period July 1978–June 1981

Regional representatives

Not later than first post on Friday 28 April 1978, any five corporate members resident in a particular RSGB region 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 Membership & Representation Committee at RSGB headquarters. Each such nominator shall be debarred from nominating any other person for this election of regional representatives.

The names of the present regional representatives are given on page 290 of this issue.

In the event of no nomination being received from the corporate members in any region by 28 April 1978, the Council reserves the right to make an appointment.

Any representative who on 30 June 1978 will have held office for only 12 months or less, may continue in office for a further three-year period. It would assist the Membership & Representation Committee if the representatives concerned would notify the committee of their wish to take advantage of this extension.

Nominations already received for the vacancies in Regions 16 and 18, advertised in the February 1978 issue of *Radio Communication*, will be accepted together with any others received for those regions up to 28 April 1978.

The composition of each region, subject to any minor border adjustments, is:

Region 1	Cheshire, Cumbria, Greater Manchester, Isle of Man, Lancashire, Merseyside.
Region 2	All that part of Humberside north of the River Humber, North Yorkshire, South Yorkshire, West Yorkshire.
Region 3	Hereford and Worcester, Salop, Staffordshire, Warwickshire, West Midlands.
Region 4	Derbyshire, all that part of Humberside south of the River Humber, Leicestershire, Lincolnshire, Nottinghamshire.
Region 5	Bedfordshire, Cambridgeshire, Northamptonshire.
Region 6	Berkshire, Buckinghamshire, Oxfordshire.
Region 7	Greater London south of the River Thames, Surrey.
Region 8	Kent, East Sussex, West Sussex.
Region 9	Cornwall, Devon.
Region 10	Dyfed, Gwent, Mid Glamorgan, Powys, South Glamorgan, West Glamorgan.
Region 11	Clwyd, Gwynedd.
Region 12	Grampian, Highlands, Orkneys, Shetlands, Tayside, Western Isles.
Region 13	Borders, Fife, Lothian.
Region 14	Central, Dumfries and Galloway, Strathclyde.
Region 15	Northern Ireland.
Region 16	Essex, Norfolk, Suffolk.
Region 17	Isle of Wight, Channel Islands, Dorset, Hampshire, Wiltshire.
Region 18	Cleveland, Durham, Northumberland, Tyne & Wear.
Region 19	Greater London north of the River Thames, Hertfordshire.
Region 20	Avon, Gloucestershire, Somerset.

Note: The regions in England and Wales are based on the counties as set out in the schedules to the Local Government Act 1972.

The Channel Islands and the Isle of Man are not dealt with by that Act.

The regions in Scotland are based on the county boundaries which became effective on 1 April 1975.

Area representatives

Not later than first post on Friday 28 April 1978, any five corporate members resident in an area may nominate any qualified corporate member resident in that area for the office of area representative, by delivering their nomination in writing together with the written consent of such person to accept office if elected, to the Membership & Representation Committee at RSGB headquarters.

Any representative who on 30 June 1978 will have held office for only 12 months or less, may continue in office for a further three-year period. It would assist the Membership & Representation Committee if the representatives concerned would notify the committee of their wish to take advantage of this extension.

An area is a conveniently sized geographical district, town or group of towns which has at least 10 members.

In the case of London, area representatives may be nominated for groups of postal districts. In the case of certain other large towns, area representatives may be nominated on a geographical basis, eg North Birmingham, South-East Manchester.

Ballots

In the event of more than one person being nominated for a particular office a ballot will be conducted, details of which will be published in the June 1978 issue of *Radio Communication*.

Resignations

If, at any time and for any reason, an elected representative wishes to resign his office, he should notify headquarters who will advertise the vacancy. Local members cannot automatically appoint another member to undertake the duties of a representative who has resigned.

The Council reserves the right to call upon any representative to resign his office if, in their opinion, he is considered to be unsuitable or unsatisfactory.

RSGB committees, 1978

(The President is an ex-officio member of all committees)

Education: D. H. Adams, GW3VBP; J. Anthony, G3KQF; G. L. Benbow, G3HB; T. Darn, G3FGY; L. E. Newnham, G6NZ; G. C. Oxley, G8MW; D. M. Pratt, G3KEP; W. A. Scarr, G2WS; F. C. Ward, G2CVV.

Finance & Staff: E. J. Allaway, G3FKM; D. J. Andrews, G3MXJ; J. Bazley, G3HCT; D. Cornish, G3COR; B. O'Brien, G2AMV; L. E. Newnham, G6NZ; C. H. Parsons, GW8NP; R. F. Stevens, G2BVN; C. J. Thomas, G3PSM.

HF Contests: E. J. Allaway, G3FKM; D. J. Andrews, G3MXJ; J. Bazley, G3HCT; D. S. Booty, G3KKQ; R. L. Glaisher, G6LX; M. Harrington, BRS20249; C. A. P. Henderson, G4FAM; P. A. Miles, G3KDB; E. L. Mollart, BRS10977*; A. M. Smith, G3IAS; D. Thom, G3NKS.

IARU Working Group: E. J. Allaway, G3FKM; D. J. Andrews, G3MXJ; J. Bazley, G3HCT; W. M. Dunell, G3BYW*; R. J. Hughes, G3GVV; A. M. Smith, G3IAS; R. F. Stevens, G2BVN; D. Thom, G3NKS; R. M. Warner, G3SAR; I. F. White, G3SEK.

Interference: S. R. Allen, G4CYR; D. J. Andrews, G3MXJ; J. Anthony, G3KQF; P. F. Jobson, G3HLF; A. S. Kessler, G4DXA*; Miss J. Maggs; J. E. Martin, GU3YIZ*; K. H. C. Parker, G8HTA; J. E. Swayne, G3BLE*; J. W. Swinnerton, G2YS; C. L. Turner, G3VTT.

Membership & Representation: D. H. Adams, GW3VBP; A. M. Allan, GM3ZBE; E. J. Allaway, G3FKM; D. J. Andrews, G3MXJ; J. Anthony, G3KQF; W. F. McGonigle, GI3GXP; B. O'Brien, G2AMV; C. H. Parsons, GW8NP; W. A. Scarr, G2WS.

Mobile & Exhibition: P. Balestrini, G3BPT; T. Darn, G3FGY; L. N. G. Hawkyard, G5HD; R. S. Hewes, G3TDR; W. J. McClintock, G3VPK; N. O. Miller, G3MVV; G. W. Norris, G3ICI; D. Smith, G4DAX*; P. A. Thorogood, G4KD; E. W. Yeomanson, G3IIR.

Propagation Studies: L. R. Barclay, G3HTF; B. Chambers, G8AGN; T. Damboldt, DJ5DT*; W. M. Dunell, G3BYW; R. G. Flavell, G3LTP; R. A. Ham, BRS154744*; M. Harrison, G3USF*; R. J. Hughes, G3GVV; C. E. Newton, G2FKZ; A. M. Pomfret, G3LZZ*; J. Spurling, G4AQI; A. Taylor, G3DME; R. C. Whelan, G3PJT*.

Raynet: P. Balestrini, G3BPT; Mrs J. Balestrini; M. Barker, G8CAC; E. R. L. Bassett, BRS16075; R. W. Bullard, G8NMW; L. A. Crane, G3PED; S. W. Law. G3PAZ; T. I. Lundegard, G3GJW; J. Scarborough, G3MBO; E. W. Yeomanson, G3IIR.

Technical & Publications: R. J. Eckersley, G4FTJ; T. Giles, G4CDY; P. J. Hart, G3SJX; J. P. Hawker, G3VA; R. S. Hewes, G3TDR; P. J. Horwood, G3FRB; A. W. Hutchinson, editor; M. H. McFadden, GI3VCL*; J. W. Mathews, G6LL*; R O. Philips, G8CXJ; H. W. Rees, G3HWR; R. F. Stevens, G2BVN.

Telecommunications Liaison: E. J. Allaway, G3FKM; P. Balestrini, G3BPT; J. Bazley, G3HCT; S. A. G. Cook, G5XB; T. P Douglas, G3BA; R. J. Hughes, G3GVV; D. M. Pratt, G3KEP; R. W. Price, G4BSO*; R. F. Stevens, G2BVN; C. J. Thomas, G3PSM; F. C. Ward, G2CVV.

VHF: A. M. Allan, GM3ZBE*; G. C. Badger, G30HC; A. H. B. Bower, G3COJ; A. H. Dormer, G3DAH; T. P. Douglas, G3BA; C. M. Goadby, G8HVV*; P. J. A. Gowen, G3IOR*; J. Hum, G5UM*; G. I. Knight, GM8FFX; C. J. Morcom, G3VEH*; M. J. Sparrow, G3KQJ*; G. M. C. Stone, G3FZL; R. J. Taylor, G4BEL; I. F. White, G3SEK.
VHF Contests: L. N. G. Hawkyard, G5HD; F. Mathews, G8ACJ; W. J. McClintock, G3VPK; C. Sharpe, G2HIF; G. M. C. Stone, G3FZL; C. W. Suckling, G3WDG; R. J. Taylor, G4BEL; L. V. G. Turner, G4CUT.

*Corresponding member.

obituaries

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

Mr H. Haynes, G2ALH
Harold Haynes died recently, aged 57. He had many contacts in the UK, although his major interest on the air was in overseas contacts. He was a senior executive with Mullard Ltd, and was well known to the RSGB.
Mr J. Hunter, GM6ZV
Jimmy Hunter, who died on 23 February, represented the RSGB in Scotland during the war when he was active on all bands. His main interest became the vhf bands, which he operated exclusively for many years, and he was instrumental in popularizing the 144MHz band in Scotland during the 'sixties.
Mr L. A. Jackson, G3HPR
Mr Jackson, who died on 25 January, had been a member of the Society since 1946.
Mr P. J. Nichols, G3XOR
Phil Nichols died on 12 February. He was a well-known personality in the Birmingham area.
Mr H. W. Portch, G8EQP
"Bob" Portch, who died on 19 February, was one of the well-known voices on 144MHz in the Bristol area.
Mr C. R. Waterer, G2HP
Cyril Waterer died on 18 December 1977. He was a life member of the RSGB and a member of RAOTA.

We have also been advised of the deaths of:
Mr A. C. Bennett, GW3SOP;
Dr A. H. Forman, BRS6907, on 24 January;
Mr W. Hamnett, G8EMQ, on 19 January;
Mr E. Morgan, G3COD, on 3 May 1977;
Mr Q. S. Stephenson, G3KS, on 28 December 1977.

your opinion

SPECIAL PREFIXES
The Editor
Radio Communication
Sir—How I agree with Mr Milne about that GE prefix! I must confess, though, that I used it to make some easy contacts, no doubt disappointing some eager beavers who thought they had hooked a new country.

Indeed, I would go further and pronounce a curse on all special prefixes. As Mr Milne says, a prefix is intended to make identification of a country simple. Some of those we hear today make it harder, if not impossible.

Incidentally, am I the only operator who dislikes the modern style of prefix beginning with a figure? No doubt the proliferation of independent countries and the unfortunate shortcomings of the alphabet make some such system inevitable, but though we may have to accept it, we do not have to love it.

J. J. Maling, G5JL

SCOTTISH RALLY
The Editor
Radio Communication
Sir—I would like to draw the attention of all Scottish and north of England radio amateurs to the Scottish Amateur Radio Rally which is being held in The Palace of Art, Bellahoustoun, Glasgow, on 10 June 1978.

Scotland usually only manages one major event each year and the various organizing committees go to great lengths to make each event a success. Every amateur can help in making such events successful by coming along and taking part in the various activities, for example the homebrew equipment competition. For us in the north to attract the trade stands we must be able to attract as many people as possible. In 1978 we are trying to encompass as many different aspects of amateur radio as possible without concentrating on any one subject.

For many it is the only time we can see all those new rigs in the flesh without the benefit of glossy pictures etc, so I appeal to all Scottish amateurs, come along to the Scottish Rally, you will not be disappointed.

T. G. Wylie, GM4FDM

SLOW MORSE TRANSMISSIONS
The Editor
Radio Communication
Sir—There must be many amateurs in the Norwich area who are interested in learning morse, either to obtain a full "A" licence or perhaps just out of interest. I have been trying since the summer to receive regular slow morse transmissions on my FRG7 (having passed my RAE, a G8--- is just not enough) but without success.

I have contacted G3KGU, who agrees that regular and consistent reception, so vital to proper study, is not easy in this area. Could I, therefore, appeal through your pages for some kind-hearted person on 3·5MHz to put this part of the world on the slow morse map?

M. Webb, G8OTN

SSB REPEATER PROPOSAL
The Editor
Radio Communication
Sir—May I register my complete opposition both to Mr Whitaker's (G3RKL) "plan" for channelizing the bottom half of the 144MHz band and his proposal for ssb repeaters.

To the majority of serious ssb operators, and probably all the cw addicts, the idea of channels is quite ridiculous, especially to those who use these modes on the hf bands.

At the recent VHF Convention, the meteor scatter group put forward a plan for the expanded use of the section 144·155 to 144·200MHz, in view of the steadily increasing interest in this mode by European amateurs. Thus the proposal to have ssb repeater outputs in this part of the band would neither fit in with this scheme nor comply with the IARU Region 1 band plan.

The proven superiority of ssb over all other telephony methods in current amateur use renders ssb repeaters unnecessary. I feel it is now time for Council to state categorically that G3RKL's proposals will be firmly rejected and that the Society will not consider *any* such ideas in the 144MHz or any other band, and will not be influenced by any suggestions that we are only seeking to show the professionals the way.

N. Fitch, G3FPK

QSL BUREAU
The Editor
Radio Communication
Sir—May I, through your pages, take the opportunity to thank all members who have sent me their good wishes on my appointment as the Society's QSL Bureau manager.

Most users of the bureau are following the few simple rules which were outlined in the December issue, and which help the bureau to run smoothly. There are, however, still a few thoughtless ones, like the GW who sent me over 300 unsorted non-standard cards bearing the recipient's callsigns on one side only.

The question of over-sized cards is becoming an acute embarrassment—very few of these reach overseas destinations without being folded, and the point has been made so many times in the past that the message really should be getting through by now. So postcards sized 5½in × 3½in only please, gentlemen!

Thanks are also due to G2MI for his invaluable guidance and help in making the changeover relatively painless; to our grand team of sub-managers, and also to the staff at HQ.

E. G. Allen, G3DRN

contest news

432/1,296/2,304MHz Open Contest rules

1600–1600gmt 6–7 May 1978

All entries and checklogs to: VHF Contests Committee, c/o L. Hawkyard, G5HD, 100 Shirley High St, Southampton, Hants SO1 4FB.

This contest is timed to coincide with an IARU multiband event. Each band will be tabulated individually and no multipliers will be used.

The following general rules, published in the January 1978 issue of *Radio Communication* will apply: 1, 2, 3, 4a, 5a, 6a, 7b, 8, 9a, 10a, 11–22.

RSGB 21/28MHz Telephony Contest 1977 results

With both bands open for world-wide contacts during the whole of the contest period, the 1977 event attracted a substantially higher participation compared to recent 21/28MHz contests. The excellent propagation conditions posed a question for UK entrants as to whether to go for a quick collection of prefix multipliers and then flat out for contacts, or whether the best tactics were to spend more time looking for a higher multiplier with a lower number of contacts.

The UK winner, yet again, was G3OZF, with another regular 21/28MHz leader, G3MXJ, as runner-up. G3OZF opted for the higher prefix decision and still managed to obtain sufficient contacts to give him the edge over G3MXJ, who achieved 175 more QSOs. The third-placed entrant, G3FXB, also went flat-out for contacts, making more than either of the other leaders, but with a lower multiplier on 28MHz he finished some 5,000 points lower than the winner.

The contest for the leading position in the overseas section was a close fight between VP8NO and 9J2BO. Both stations made nearly the same number of contacts, but VP8NO, with the benefit of a large rhombic aerial owned by Cable & Wireless and oriented towards the UK, managed to find a few extra multipliers on 28MHz, and this gave him nearly 2500 extra points. In third position was YO6AWR, who led a large contingent of East European entrants with single-band (21MHz) participation.

There was a substantially higher entry for both the UK and the overseas receiving sections of the contest. The regular leading participant in many of the current RSGB receiving events, BRS32525, was first in the UK section, with another regular, BRS35943, as runner-up. In third place was BRS39044. The overseas leader, DL-A33/131090, did very well by logging a greater number of UK prefix multipliers than many of the entrants in the overseas transmitting section. The runner-up, JA9-2156, in common with the majority of other overseas listeners, concentrated on the 21MHz band.

There was some confusion about the time that the contest ended. The rules as published contained an error, but this was corrected in a subsequent issue of *Radio Communication* and the majority of entrants worked the extra hour as was intended by the HF Contests Committee. In general, the logs were excellent, but there is still some misunderstanding about the prefixes used by USSR stations. A substantial number of UK entrants in both the transmitting and receiving sections under-claimed their multipliers, and a few did the opposite. All logs were adjusted so that the multiplier list was common for all UK entrants.

The committee thanks all entrants who submitted logs and the very large number of overseas stations who sent check logs. Unfortunately a number of logs arrived too late for checking, due to the dock strike in the USA and late mailing. In all, some 40 logs were received after checking had been completed and these have not been included in the results. It is worth reminding overseas entrants that sea-mail can take quite a long time to reach the UK from the USA and other countries where the traditional passenger ship service has been virtually eliminated in favour of air transit. While airmail costs more, it does avoid the disappointment of having a good log rejected because of late arrival.

G6LX

UK TRANSMITTING

Posn	Callsign	Points
1	G3OZF	197,118
2	G3MXJ	194,028
3	G3FXB	191,940
4	G4CNY	171,189
5	G5CAA	167,580
6	G3NAS	149,688
7	G3ZQW	147,672
8	G4APL	118,698
9	G4EHF	83,172
10	G4DUW	73,342
11	G6LX	65,770
12	G3UMV	63,366
13	G3KMI	62,682
14	G4BHE	51,550
15	G4BWP	51,172
16	G3ZOE	44,793
17	G3WHK	41,712
18	G4CYA	40,915
19	G3MGW	37,092
20	G4AFJ	37,028
21	G3LBS	35,739
22	G3NML	30,723
23	G4BYY	28,775
24	G2QT	28,512
25	GM3CFS	23,182
26	G3XBN	18,522
27	G4FAM	15,915
28	GU3YIZ	15,264
29	G4BXT	10,791
30	G3XFW	8,160
31	GI4GDV	7,920
32	G3YMC	7,350
33	G3SWK	6,996
34	GM4AWA	5,445
35	GM3SSB	4,800
36	G4DDL	2,967
37	G2AJP	2,520
38	GM3RFR	1,200
39	G3DME	1,012
40	G3TKR	405
41	GM5AXY	360
42	G3ILO	105

UK RECEIVING

Posn	Station	Points
1	BRS 32525	86,358
2	BRS 35943	54,462
3	BRS 39044	29,550
4	BRS 34740	24,549
5	BRS 38213	23,829
6	BRS 34032	23,030
7	BRS 33832	22,935
8	BRS 35191	22,775
9	A 8808	17,493
10	BRS 34310	17,415
11	A 9191	14,338
12	BRS 38827	12,600
13	BRS 26407	11,988
14	BRS 39015	8,640
15	BRS 38323	8,569
16	BRS 36910	2,592
17	BRS 38830	1,452

OVERSEAS RECEIVING

Posn	Station	Points
1	DL-A33/131090	12,420
2	JA9-2156	2,280
3	UA6-150-331	1,815
4	UP2-038-806	1,210
5	YO6-1414	1,110
6	SWL-W2 MAYS	1,095
7	SWL-W0 MARTINS	993
8	PA0-SWL 09982	900
9	JA5-4001	775
10	SWL LEVERS (W6)	553
11	JA4-30756	396
12	UP2-038-672	252
13	JA8-3891	180
14	JA6-30556	108
15	JA1-18277	102
16	SWL AMIES (W4)	90
17	DM-33-45671	27

OVERSEAS TRANSMITTING

Posn	Callsign	Points
1	VP8NO	26,892
2	9J2BO	24,408
3	YO6AWR	12,768
4	UK5MAF	10,980
5	UV3CE	10,530
6	4Z4IX	9,513
7	I8ZLW	8,568
8	N4MM	7,824
9	UA6LBC	6,570
10	VE3UK	6,426
11	UK6LEZ	6,390
12	EP2TW	5,904
	C5AAP	5,904
14	UK2GKW	5,700
15	CY3GCO	4,248
16	UA3DCY	3,978
17	UW1AE	3,852
18	UW3EQ	3,729
19	UA3TN	3,600
20	JA6GHS	3,234
21	UA9CAE	2,847
22	UA6ADC	2,820
23	JH1YDT	2,664
24	W0WP	2,250
25	UA3DN	1,950
26	UB5UAT	1,500
27	UB5LU	1,260
	YU1ELM	1,260
29	UC2WP	1,152
30	UW3RR	1,092
31	VE4SW	1,080
32	UA3DDF	1,077
33	UP2BBF	888
34	KA6RR	883
35	K8CFU	861
36	N4BU	840
37	W9SS	756
38	JA2CGH	612
39	UB5VAW	540
40	LU1BAR/W3	483
41	UA1AET	478
42	UA3TR	468
43	ZS1Sg	460
44	OH5BM	452
45	UL7GAA	432
46	W3MR	420
47	K6KUQ	405
48	ZL2BCO	400
49	VK2XT	378
50	JA2YKA	315
51	JR6HJD	300
52	SM4DHF	295
53	W6UZ	275
54	JA0FMB	252
55	K0PVI	207
56	UA9MS	192
57	ZL1AGO	185
58	UL7AAQ	180
59	WD8JTW	168
60	JA5VOB	144
	JA6VZB	144
62	JA4BKL	90
	JA8RUZ	90
64	VE7AV	72
65	WB5UKP	63
66	WA6DNM	62
67	JE3TYR	60
68	SP9KRT	45
69	UM8NNN	30
	JF3ONM	30
	PY1ZBG	30
72	JA1KAW	24
73	WB0MPH	18
74	SM5CXO	12
75	JH2WIC	3

HOW THE LEADERS MADE THEIR POINTS

	21MHz QSOs	21MHz Mult	28MHz QSOs	28MHz Mult	Transmitter	Antenna
G3OZF	644	58	55	36	520+linear	3-el at 75ft
G3MXJ	843	49	31	25	SB401+linear	TH-6 at 60ft
G3FXB	888	51	26	19	T4XC+linear	Quad at 60ft
VP8NO	142	13	190	14	FT101+linear	Rhombic at 60ft
9J2BO	237	16	103	8	TR-3+linear	TH-4
YO6AWR	225	19	—	—	100W	3-el

VHF NFD 1978 rules

There are no changes to the rules this year. The new system of scoring introduced last year appears to have been well received. It is also interesting to note that the Dutch are now using this system for their cup contests. Figures in square brackets refer to general rules for vhf/uhf contests published in the January 1978 issue of *Radio Communication*.

1 **Duration.** From 1600gmt 1 July to 1600gmt 2 July 1978.

2 **Bands.** Up to four separate stations can be used, operating on the 70, 144, 432 and 1,296MHz bands. Only one station can score or give points on each band. Single-band entries on 144MHz will not be accepted.

3 **Operators.** Any RSGB member or group of members operating from the British Isles may take part (nb this excludes Eire). Two groups operating from the same site can combine their scores subject to Rules 2 and 4. Each group should send its own summary sheet.

4 **Stations.** All the stations forming one entry must operate from within a circle of 1km radius centred on the operating position of any of the stations. Proof of permission to use a site may be required. All equipment, including antennas, must be installed on the site during the 24 hours preceding the contest or during the contest. The site may not be used for any transmitting activities by the group or member during the five days before this time.

Stations may not use public mains supply. Power for all equipment must be derived from an on-site generator or battery.

5 **Scoring**

(a) On the 70, 144 and 432MHz bands, contacts will be scored by radial rings [7a].

(b) Contacts on 1,296MHz will be scored at one point per kilometre.

6 **Contest exchanges**

(a) Contestants must exchange both callsigns, signal report, serial number (starting at 001 on each band), QTH locator and QTH [11]. Only one scoring contact on each band may be made with each station [10a].

(b) The QTH given on 1·3GHz must differ in form from that given on the other bands, eg a location given as "10km north of Marlborough" on 432MHz could be given as "8km south-west of Swindon" on 1·3GHz.

The 1·3GHz station may operate on any other band for the purposes of arranging a contact, but the exchange of contest information must take place on 1·3GHz only and may not be interrupted by recourse to another band. CQ calls on another band should clearly be "for 1·3GHz only".

7 **Entries**

(a) All entries must be postmarked not later than 16 July 1978.

(b) Separate sets of log sheets and 427 cover sheets are required for each band.

(c) A summary sheet must also be completed. Otherwise the scores on each band will be listed but the total will not appear in the overall results table.

(d) Entries must be addressed to: The Chairman, VHF Contests Committee, 12 The Rampart, Haddenham, Cambs CB6 3ST.

8 **Other rules**

The following general rules will also apply: [5a, 6a, 9a, 10a, 11–22].

9 **Awards**

The Surrey Trophy will be awarded to the overall winners, and certificates of merit will be awarded to the overall runner-up, the leading entry from each country and the highest scoring station on each band. The Tartan Trophy will be awarded to the leading Scottish entry.

Listeners Contest rules

A listeners contest will take place at the same time as VHF NFD. Each band will be treated as a separate event. Listeners' contest rules 1–3 (January 1978 *Radio Communication*) will apply.

144MHz Portable Contest rules

1600–1600gmt 27–28 May 1978

All entries and checklogs to: VHF Contests Committee, c/o W. J. McClintock, G3VPK, Maple Leaf, Gt Braxted, Witham, Essex.

The following general rules, published in the January 1978 issue of *Radio Communication* will apply: 1, 2, 3, 4d, 5a, 6a, 7a, 8, 9a, 10a, 11–22.

December 1977 144MHz Fixed Station Contest results

Conditions for this contest were rather good on a NE-SW path, and tended to favour stations in the south-east of England. Quite a number of Continental countries were worked, including Belgium, France, Germany and Holland. In reply to one contestant who asked why group names were not included in the results; the amount of useful information which can be tabulated in the column width of the table would be reduced if they were included.

The winner is the Norfolk VHF Contest Group operated by G3ZIG and G8CTZ, and the University of Kent ARS operated by G8IFT and G8IQL is the runner-up. Certificates go to both stations.

Although F1DBE sent in a clean and well-tabulated entry it could not be accepted because he operated portable, but his points have been included with his callsign.

G4CUT

Posn	Callsign	Points	QSOs	QRA	ASL	Ant	Best dx	Km
1	G3ZIG	1,849	207	AM35	180	10Q	DC5GDA	610
2	G8KUC	1,516	207	AL56	200	2×14E	DC5GDA	654
3	G3UNU	1,169	227	ZM04	250	8S	F1CRP	540
4	G4ASR	1,065	225	—	364	6Q	GM8DMZ	515
5	G4BEM	1,046	184	ZN71	966	10E	F1CRP	495
6	G8HCL	974	245	ZL58	240	4×14E	PE1BIE	550
7	G3BDQ	925	170	AL04	360	2×6Q	PE1AHH	440
8	G3PYE	854	166	AM61	50	8S	F1CRP	460
9	G8KMW	836	154	AM51	110	10×Y	F1KBF	665
10	G4BWG	831	195	ZL50	30	14E	GM8MJV	635
11	G8GMF	806	172	ZL76	675	14E	PA0RUB	440
12	G8BBC	782	216	ZL40	90	14E	GI8KIA	520
13	G4FDX	775	141	ZL08	500	14E	DL8SF	625
14	G3ERN	770	182	AL11	220	8S	GM8ODN	433
15	G4EUR	743	144	YL50	350	6Y	GM8MJV	630
16	GM8MJV	673	53	YR80	270	2×8E	G4DZW	627
17	G3ZRS	669	126	ZN28	135	14E	PE0FKM	440
18	G3YEG	664	195	ZL26	730	2×14E	PE1ARC	392
19	G3WCS	661	131	YN47	200	2×6Q	G8OCN	355
20	G4FBK	646	191	ZL39	170	6Q	PA0FHG	360
21	G8JNV	642	129	ZM10	8	6Q	GI8EWM	420
22	G8AHK	633	183	ZL68	170	10E	PA0XMA	513
23	G4CCH	628	122	ZN37	125	14E	G4DZW	300
24	G8KOM	618	171	ZL36	405	10E	GM8ODN	435
25	G8LYD	610	122	YN50	250	14E	ON6IZ	640
26	G4EEE	594	156	ZL55	350	14E	F1KBF	466
27	G3UGF	574	116	ZN11	1150	10E	ON6IZ	464
28	G4DYP	523	130	ZM21	500	14E	F1CRP	467
29	G3AHD	519	95	YN46	120	6Q	F1CRP	537
30	G8AZA	504	76	ZO69	235	14E	GI8EWM	354
	G8OCN	504	106	ZK17	6	14E	PE1ASN	340
32	G3WHK	492	165	ZL49	120	10E	GM3PXK	535
33	G3SWB	471	156	ZL46	250	8S	G4EEV	311
34	G3GWB	468	110	ZM67	—	14E	PE0MAR	331
35	G8KHI	451	118	ZL09	265	8E	GM8ODN	410
36	G3UVW	448	106	ZM43	190	14E	PE0MAR	325
37	G6UW	445	94	AM61	66	8E	GI8KIA	480
38	G4AVV	434	165	ZL50	370	6Q	DC9ZL	720
39	G4CMV	427	152	ZL60	430	8E	G8AZA	320
40	GW3UOO	387	63	YN65	180	5X	GM8MJV	420
41	G8GLQ	384	86	YL48	185	8E	G4CJG	354
42	G8OAC	370	90	ZL33	300	2×8E	F6BBQ	372
43	G3UER	364	96	ZN35	50	8S	G8EFS	270
44	G8LZA	343	117	ZL59	500	10X	G8LYD	274
45	G3LCH	333	131	ZL50	—	—	GW8EQH	—
46	G8KHN	324	72	ZK21	200	8S	G8JHL	295
47	G8MZV	322	70	YM77	230	5E	GM8MJV	563
48	G4GGV	321	125	ZL38	120	10E	PE0JAH	392
49	G8KPA	315	71	ZM41	540	6Q	G3BDQ	245
50	G4AEZ	303	109	ZL30	130	10E	DB5KG	460
51	G4BRT	299	85	ZK04	—	10E	PE1ARC	—
52	G8GPO	280	50	ZO34	190	6Q	G4DZW	400
	G8FMC	280	78	ZL17	450	8E	F1DBE	237
54	G8IWA	262	59	ZN18	126	14E	GM8MJV	382
55	G4EEV	257	47	ZO58	100	10E	G4DZW	375
56	G8LVM	255	71	ZM14	150	10E	GM8ODN	275
57	G8GXE	248	118	ZL38	200	8E	F1CRP	380
58	G3XWZ	232	71	ZN64	470	9E	GM3PXK	350
59	GW4EAI	231	55	YL25	720	6Q	ON5NY	425
60	G8HWG	198	58	ZM16	350	8E	G8GMF	190
61	G2FNK	195	88	ZL48	41	10E	G3AHD	316
62	G8OCT	194	40	ZN30	10	8E	F1DBE	445
63	G8NSL	185	47	YM59	200	5Q	G8KUC	260
64	G8KUQ	183	60	YL10	250	12E	G8JHL	176
65	G4FDF	181	51	ZM39	10	8E	GW8CFQ	195
66	GM3PXK	178	27	YP11	350	10E	G3WHK	540
67	G4EDI	168	110	ZL49	—	8E	G8LWU	—
68	G8KMG	166	66	ZL10	430	10E	PE0MAR	293
	G8ITS	166	111	ZL40	56	6Q	G3ZIG	130
70	G3XUS	165	45	AK11	75	8E	G3UNU	256
71	G4AGQ	158	78	ZL66	530	Halo	F1DBE	189
72	G8FDL	138	34	YN38	437	4E	GM8MJV	401
73	G3GGL	110	35	YM59	80	10E	F1CRP	440

Posn	Callsign	Points	QSOs	QRA	ASL	Ant	Best dx	Km
74	G8MFK	89	29	YL10	200	5E	G3AHD	176
75	G8DXD	86	34	YM69	125	8E	G3ZRS	200
76	G8IIW	85	37	ZN12	110	8E	GW3UCB	130
	G8NQP	85	29	ZL72	250	8E	G4ASP	162
78	G8EQX	82	33	ZM41	450	6S	G4CCH	148
79	G8LVX	71	51	ZL39	150	5E	G8KUC	53
80	G8CTT	44	26	AL41	240	8E	G8KMW	110
81	G4EGG	21	15	YN38	232	GP	GW3UCB	56

Check logs are acknowledged from: F1DBE/P76 (562 pts), GW3UCB, GW3VKL, G4DPT, G8DHD, G8KMW, G8LZP, G8MMF.

1978 RSGB Direction Finding Contests

The full programme of eight qualifying events is published in "Contests calendar", and competitors' attention is drawn to a minor change to the rules which are distributed before the start of each event. Details of the first three events are given below.

DF Qualifying Event Chelmsford

Date: 23 April 1978.
Map: OS Sheet 167 1:50,000 series, Chelmsford & Harlow.
Assembly: 1300bst for start at 1320bst.
Location: Unclassified road just west of Pleshey NGR661 143.

Intending competitors requiring tea are asked to notify Mr W. Petchey, Forge Cottage, Good Easter, Chelmsford CM1 4RS, (tel 024531 612) not later than 16 April.

DF Qualifying Event Burton-on-Trent

Date: 21 May 1978.
Map: OS Sheet 128, 1:50,000 series, Derby and Burton-on-Trent.
Assembly: 1300bst for start at 1320bst.
Location: Half-mile along unclassified road reached from Burton town bridge NGR 257 242.

Intending competitors requiring tea are asked to notify Mr R. Parsons, Communications Group, National Coal Board, Mining Research & Development Establishment, Burton-on-Trent, Staffs (tel 0283 216161, extn 649) not later than 7 May.

Contests calendar

22-23 April	144MHz CW (Rules in March issue)
23 April	DF Qualifying Event, Chelmsford (Details in April issue)
6-7 May	432/1,296/2,304MHz (Rules in April issue)
7 May	Region Round-up CW (Rules in March issue)
7 May	DF Qualifying Event, Salisbury (Details in April issue)
21 May	DF Qualifying Event, Burton-on-Trent
21 May	Region Round-up SSB (Rules in March issue)
27-28 May	144MHz Portable (Rules in April issue)
3-4 June	HF NFD
17-18 June	Microwave
18 June	DF Qualifying Event, Rugby
24-25 June	Summer 1·8MHz
1-2 July	VHF NFD and SWL (Rules in April issue)
9 July	DF Qualifying Event, Coventry
16 July	3·5MHz FD
23 July	DF Qualifying Event, Dartford Heath
30 July	144MHz QRP
6 August	DF Qualifying Event, South Manchester
13 August	70MHz Open and SWL
20 August	DF Qualifying Event, Slade
2-3 September	SSB FD
2-3 September	144MHz Open and SWL
17 September	DF Final, Basingstoke
October-November	432MHz Cumulative
7-8 October	432/1,296/2,304MHz
14-15 October	21/28MHz
21-22 October	7MHz SSB
22 October	70MHz Fixed
4-5 November	7MHz CW
4-5 November	144MHz CW
11-12 November	2nd 1·8MHz
3 December	144MHz Fixed

DF Qualifying Event Salisbury

Date: 7 May 1978.
Map: OS Sheet 184 1:50,000 series, Salisbury and the Plain.
Assembly: 1300bst for start at 1320bst.
Location: The Pepperbox NGR 213 248.

Intending competitors requiring tea are asked to notify Mr A. Newman, 74 Victoria Road, Wilton, Salisbury, Wilts SP2 0DY, as soon as possible.

Mobile rallies calendar

23 April—North Midlands Mobile Rally, Drayton Manor Park, near Tamworth. Rally chairman, B. Willetts, G8DEM; publicity, N. Gutteridge, G8BHE, 68 Max Road, Quinton, Birmingham 32. Details later.
30 April—Tulip Time Rally, Spalding Grammar School, Priory Road, Spalding (new venue). All the usual attractions.
14 May—East Suffolk Wireless Revival, near Ipswich. Details from G4EVN.
21 May—Northern Mobile Rally, Victoria Park Hall, Keighley. Details from G8DFZ.
21 May—Welsh Amateur Mobile Rally, Barry Rugby Football Club, Cemetery Lane, Barry, South Glam. Details from GW3WBU, tel Penarth 702877.
28 May—Hull & DARS Mobile Rally, University of Hull, Cottingham Road. All the usual attractions. Details from sec G3WYW.
10 June—Scottish Amateur Radio Mobile Rally, The Palace of Arts, Bellahoustoun Park, Glasgow. Details from GM4FDM.
11 June—Elvaston Castle Mobile rally, Elvaston Castle Country Park (five miles SE of Derby on the B5010), from 10am. Talk-in on 144MHz and 432MHz. All the usual attractions for the whole family including full catering facilities. Rally free, but local authority car parking fee of 25p. Further details from G4CTZ, QTHR.
18 June—Plymouth RC Mobile Rally, Club HQ, TAVR Building, Lambhay Hill, Plymouth, Devon. Details from G3SCW, tel Tavistock 2876.
18 June—RNARS Mobile Rally, HMS Mercury, Petersfield, Hants. Details from G4DIU, tel Havant 79464.
25 June—Longleat Mobile Rally. Details from G4FRG.
9 July—Upton Radio Rally. Details from M. Monro, G8DLL, 127 Monarch Drive, Worcester, tel Worcester 423276.
15 July—BARTG Convention, Harpenden Public Hall, Harpenden, Herts, 1100-1700. Attractions will include trade stalls, bring and buy, picture tape factory, demonstrations and lectures (including one on "Microprocessors" by G3PLX, which should attract particular attention) and refreshments. Easy access provided by rail and motorway network, with car parking facilities. BARTG members and non members welcome.
16 July—Hornsea ARS Mobile Rally, Hornsea School, Hornsea, North Humberside. Details from G8KFK.
23 July—Cornish Mobile Rally, Truro. Details from G3NKE, tel Camborne 712419.
23 July—Anglia Mobile Rally, Stanway School, Winstree Road, Colchester, 10am. Details from G4DKI, QTHR, tel Colchester (0206) 67512.
30 July—Scarborough RS Mobile Rally, Scarborough Technical College. Details from G3RTN.
6 August—RSGB National Mobile Rally, Woburn Abbey.
13 August—Derby Mobile Rally.
20 August—Preston Mobile Rally. Details later.
10 September—Stalybridge Festival Mobile Rally, Cheetham Park, Stalybridge, Cheshire. To be held in conjunction with the Stalybridge 1978 Festival. Details from G8KQP, QTHR.
10 September—Telford Mobile Rally, Town Centre Malls, Telford, Salop (approached via A5 exit off M6, A442 from N and S, or M54 from W). Free admission and free parking for 5,000 cars. Jointly organized by Telford & D ARS and Salop ARS, the rally attractions will include trade stands, exhibitions, "flea market" for private sales, licensed bar, refreshments and toilets, club stands; and a free coach ride to Ironbridge Open Air Museum, the largest of its kind in Europe. Further details from G8DIR, tel Shrewsbury 64273, or G3UKV, QTHR.
17 September—Peterborough R&ES Mobile Rally, Walton School, Mountsteven Avenue, Peterborough. Details from G3EEL, QTHR, tel 65423/62881.
24 September—Harlow & DARS Mobile Rally, Netteswell Comprehensive School, Harlow. Details from G8FRG, 232 Pennymead, Harlow, tel 0279 32486.
1 October—Great Lumley Mobile Rally, Community Centre, Great Lumley, Tyne & Wear. Trade stands, etc. Details from G8JLQ, QTHR.

members' ads

These subsidized flat-rate advertisements are accepted as a service to members of the 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 75p (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, RSGB, 88 BROOMFIELD ROAD, CHELMSFORD, ESSEX CM1 1SS.

Do not post to RSGB HQ or Advertising Representative

FOR SALE

Audio sig gen (Solartron), 25Hz to 500kHz 600/75Ω, 60dB atten in 1dB steps, £50. HF sig gen (Marconi), 30kHz to 30MHz a.m./cw, 1μV to 1V, £30. VHF sig gen (Marconi), two units, 95 to 155MHz 5μV a.m./cw (sine/square), 50Ω, internal calibration, £40. 100W 70cm pa, two units made by Electronic Developments, comp with psu, blower, etc, £75. Buyers must collect. Kevin Viney, G8KDC. Tel Orpington 22443.

HRO, 175kHz–30MHz, new valves, capacitors, realigned, manual, calibration charts, xtal, psu, spkr, £35. Marconi TF 867 Standard sig gen with xtal reference, circuit/manual, exc cond, £75. TDA-10-1 telegraph message coder, £4. Cantram coder, different code sequence otherwise as TMC above, £3. BNC plugs and chassis sockets, 40p ea or 75p per pair. Small mains axial cooling fan, £2.50. Magslip tx, mint, £4. OC28 pnp power, 25p ea. John Dawson, "Dog Lane Cottage", Fenny Compton, Warks. Tel 0295 77269.

Racal RA17L rx, as new, £230. MA168B diversity switch, £35. Murphy solid-state ssb converter, £45. Marconi TF801D/1 generator, £300. Wayne Kerr 0-22B 10kHz–10MHz generator, £75. Professional 19in instrument cases, £10. Miscellaneous items. Tel West Drayton 43694, after 6pm.

Trio TV502 transverter, mint cond, £130 ono. 6S2 rtty reperforators (two) with spare governor, offers. Two 807 a.m. modulators including mod transformer and psu, wkg order. Last two items buyer collects. G3WRT. Tel Colchester (0206) 45099, after 6pm.

Telequipment D52 dual beam 'scope, immac, exch for valve type tx/rx, anything considered. Unused Heathkit GD-1U gdo (not kit), £30. Class D wavemeter, mains operated, £10. All items carr extra. GW8CMA, QTHR. Tel Swansea (0792) 27496, after 7pm.

Heathkit 'scope OS2, £30. G3LLL clipper for FT101B, £30. 3BP1A crt c/w mumetal screen and base, £3. Pair National walkie-talkies, 27MHz suitable for conversion 28MHz, £10. KW lp 52Ω filter, £2. Offers welcomed. G3VLL, QTHR. Tel Doncaster 66766, daytime.

Tape deck, Wearite reel-to-reel, mono, 3 heads, £18. Four 8½in reels tape, £4. Sig gen 5 to 55MHz, sei, £12. Modulation trans, Woden UM2, £3. HRO dial, £2. *Wanted:* Information atu 7180 24-LRU-52B. G3JNM, QTHR. Tel Bolton 43999.

GPO dials, fb cond, 75p ea. GPO bells, 50V ac, two 500Ω coils, 50p ea. AM25B control box, 6ch, £1. Control cable, with conns, £1. All post incl. *Wanted:* AM25B tx coils for 144MHz. All letters answered. GW8OGI, 31 The Park, Ruthin, Clwyd LL15 1PW.

Trio 2200GX, fitted 3ch, mint cond, nicads, charger, £110. Mercury minimitter, 150W input with a.m. and fm, in good order, £25. Will deliver both items within 50mile radius. G4FVI, 85 Sidney Street, Folkestone, Kent.

TR2200GX, S0, S19-24, R3-R7, nicads, charger, auto toneburst, hi/lo power, rig in good cond, orig packing, £130. G4FHN, QTHR. Tel Bristol 571212.

Codar AT5/T28, mobile psu, control box, all leads, diagrams, £35. Two heavy-duty mobile whips, 80m/160m available if required, £10. Eddystone E898 dial, unused, £10. Woden modulation transformer UM1, £3. G3XBN, QTHR. Tel 0273 553824, daytime not weekends.

Atlas 210X, virtually new, fitted maker's optional expensive and efficient noise blanker, ideal mobile rig, £100 under list price. Also Heath SB614 monitorscope, half price, £85. Robinson, G2KF, QTHR. Tel 072 681 2337.

15m Swiss quad, dural/copper constr, f/b cond, offers. Class D wavemeter c/w headphones (250V ac), offers. Buyer collects or carr extra. GM3VXR, QTHR. Tel Motherwell 65443.

Inverter, 12V dc to 240V ac, 40W, brand-new, made by Astro Electronics Chesterfield, £10. G4CKA, 41 Park Mount Drive, Macclesfield. Tel 25154.

G2DAF ssb tx and psu, beautiful construction, £35; Eagle SR550 ham band rx, £30; B40 rx, all coils 40kHz–30MHz, psu, £15; Cossor 3343 ganging oscillator, £5; chart recorder, £15; all ono. Deliver near Manchester. G3ZCE. Tel 061-431 4136.

Trio 2200GX, fully xtalled, nicads, etc, £120. Tel Shrewsbury 65748, anytime.

Strumech W60 tower, Strumech electric winch; would sell separately; offers. G4BYW, 4 Gleneagles Way, Fixby, Huddersfield HD2 2NH. Tel 0484 40867, evenings.

A unique Sommerkamp FT250 tx/rx, ac psu, handbook, worked 120 VK novices in four months, going solid-state, £240. G3CGQ, QTHR. Tel 0582 25519.

FT101B, mint cond and performance, £330. G3VQL, QTHR. Tel Nesscliffe 230.

Racal RA17, ssb adapter, works very well, 0·5–30MHz, reluctant sale, space needed, £300. Prefer buyer collects, demonstration any time, could deliver London area. G4AKG, QTHR. Tel 01-686 1756.

Shack clearance, must sell: *SWM* 1975–6, *TV* March to August 1972, 20p ea plus large sae. Also *PW, PE, RC, EE, WW* and more. SAE for details. Robin Bayley, 8 Field Lane, Kemberton, Nr Shifnal, Salop TF11 9LR.

QRT sale: TS820 dig, 12V, ext vfo, spkr; FL2100B; KW109; RA17L; TH3Jr tower; and lots more. GI3ZSC, QTHR. Tel 08 494 72378, evenings.

Trio 7200G fm mobile tx/rx, exc cond, 7ch, S0, S20, S21, S22, S23, R6 and R7, tuning fork toneburst, comp with mobile mount, £135. *Wanted:* TS700, FT221 or similar. G4EXT, QTHR. Tel 01-856 4595.

Rotator, Stolle 2030/220, cable, little used, £36. Taylor. Tel 01-668 8617 (Purley).

Junker precision hand key, unused, £20. G4DND, QTHR.

KW77 rx, £70. *Wanted:* good quality keyer paddle. GW3TKG, QTHR.

ETM2B electronic keyer, side-tone oscillator, as new, £38. Heathkit DX100U cw tx, £30. G4AWT, QTHR.

FDK Multi 2700 Mk2, exc cond, must sell, going hf, £385. Tel Shrewsbury 65748, anytime.

FT101 Mk2, all options, incl G3LLL clipper, remote vfo, spkr, notch filter, £340. Uniden 2030, int preamp, 12ch, £130. Antenna, specialist magnetic base, and 2m mobile λ/2 antenna, £10. HRO rx, immac, all coils, new valves, £40. G3TSL. Tel 0532 503133, daytime, or Otley 56330, evenings.

KW Atlanta 10–80m tx/rx, 500W p.e.p., £225. Icom IC22A, 13 ch, £140. Telequipment 'scope type 4A, wkg, £20. Sanyo music centre, £100. New Philips colour 22in tv 550, nine months tube guarantee, £225. G4GHE, 10 Druids Close, Egerton, Bolton, Lancs. Tel Bolton 592929.

KW204 tx, 160–10, mint, £135. 12AVQ, 20–10m, used, £15. DPKB 103 vertical, 80 and 40m, £15. G3UEN, QTHR. Tel 0262 850258.

1976 DX/USA callbooks, plus supplements, effectively 1977, £4.50 ea. Unused C & C HC13U 100kHz xtals, £1.75 ea. B7G 100kHz xtal, £1.50. Two 4CX250Bs, unused, £4 ea. *Wanted:* good twin paddle for iambic keyer. G3IZJ, QTHR.

Trio 9R59DS rx, 550kHz–30MHz, stabilizer bandspreader, matching spkr set, new valves, £50. Sony fm/a.m. cassette recorder CF-320, leather case, rechargeable battery, perf cond, £49. Taylor. Tel 01-668 8617 (Purley).

Microwave Modules 50MHz counter, £55. 500MHz prescaler, £19. Jaybeam 432MHz colinear type U5, £13. TW 2m Nuvistor converter, 28MHz i.f., £7. Pair of 587BLYs, £6. G4BWW, 7 Grange Lane, Freshfield, Formby, Merseyside. Tel Formby (07048) 78732.

18AVT/WB, 10m trap and upwards, will separate; B44 Mk2 tx, two xtal controlled chs; rx, tunable; transistorized psu; AR22 rotator and control box; all good used cond, any reasonable offers considered. Letters only please. G3OBX, QTHR.

Cassette tape recorder, £5. *Radio Communication Handbook*, 4th edn, £1·50. Buyer inspects and collects. G3BIA, QTHR. Tel 01-977 6705.

Clearing shack: Hallicrafters SX111 tx, £65. Telford TC9 2m tx, £60. Heath Mohican, psu, £27. 2FM70 transverter, £15. 15A variac, £4. MM 2m a.m. tx, £15. R208 rx, 10–60m, £10. Plus many useful items. G8JAO, QTHR. Tel Malvern 63270.

Eddystone Triple-8 amateur bands hf rx, truly immac cond, £85. Tel Shrewsbury 65748, anytime.

Ham II antenna rotator, new and unused, in orig carton, £120. G3EHG, QTHR. Tel Sedgley 3827, after 6.30pm or weekends.

Drake T4XC, R4C, MN2000, L4B, new IC30A, £180. Colin 70cm, £18. FV101, £45. SP101, £10. 432/28MHz transverter, £65. 1·3GHz 28MHz, £18. 14-el, £18 and £10. 70cm 88-el, £19. SE600, £290. 18AVT, £45. Mepham. Tel Haywards Heath 57609.

HW32 20m ssb, ac psu, £60. Bantum, £5. 10·7MHz filter, £4. Cambridge handbook, £1. Hughes. Tel Pangbourne (07357) 2119.

FT200 and FP200, six months old, still under warranty, £260; Technical Associates audio compressor, £12; SWR 50, £8; G-whip, multiband, used once, £15; all mint, would sell complete, £280. Would prefer buyer collects. G4FKZ, QTHR. Tel 061-624 2808.

HW8 with HWA71 psu, constructed and aligned by electronics engineer, two months old, £100, no offers, free ATU. *Wanted:* Pye Cambridge or similar, going on 2m. G4GKB. Tel Warwick 43868.

Eddystone S640 amateur band rx, diecast spkr, requires overhaul/revalving having been stored since 1955, £24. G3IES, QTHR, on behalf of late BRS member. Tel Bristol 500742.

Marconi TF867 sig gen, 15kHz–30MHz, good wkg order, £18. DX100-U tx, mint, £45. Heathkit Mohican rx, £25. TF4288/1 valve voltmeter, £5. Buyers must collect; view evenings, weekends. G3SDK, QTHR.

KW1000 linear, good cond, £165. G6ZR, QTHR. Tel Bristol (0272) 46502.

Shure M75ED type 2 magnetic stereo cartridge, £15; Goldring G800 magnetic stereo cartridge, £8; both brand-new, duplicated presents. A. P. Thomas, G8GNI, Garrow House, 110 Heslington Road, Heslington, York. Tel York 58743.

QTH, individual design, detached 2/3 bed bungalow, integral garage, large kitchen, dining/lounge, utility room, loft shack, many extras, superb garden backing south to park, pp for antenna proven fb dx location, £23,500. G3CPS, QTHR. Tel 01-578 6186.

Trio TR7010, 2m, ssb, preamp, seven months, £150. Stolle 2030 rotator, 5-el Yagi, 21yd 50Ω coaxial, nearly new rotator cable, £45, will split. Minimitter rx MR44/11, ham bands, double super, £20. HF bands tx, home-made, 15W, a.m., needs attn, good cabinet, £10. Buyers inspect and collect. G3ADK, QTHR. Tel Luton 27595.

3-el tubular beam ant, 10–15–20m, matching feeder, as new, £25, plus carr unless collected. G2NR, QTHR. Tel Linstead 294.

TR2200GX, fitted 9ch, charger, nicads, helical, all orig accessories incl packing, £125. G8MVS, QTHR. Tel 01-462 1860, evenings.

FRG7, exc cond, hardly used, orig packing, £135 ono. G8KBK, QTHR. Tel 0272 872671.

Complete station: AR88D rx, S-meter, spkr, £45; 150W Panda tx, tuning unit, spares, £30; speech compressor, £15; gen cov rx, 550kHz–30MHz, xtal, bfo, limiter, S-meter, £30; Marconi ind/cap bridge, £7.50; all with manuals; xtal calibrator, £9.50; 160/80m homebrew s'het, £3.50. Buyers test and collect. Save over £25, £115 the lot. G3AEP, QTHR. Tel 0253 720756.

NCX5 Mk 2 tx/rx, mint cond, manual, £150. IC22A, 12ch xtal, mobile mount, Diamond $\frac{5}{8}$in whip, £115. DFM and DMM, aligned and checked by Dorani, £105 new, £75 the pair. All collected or carr paid by buyer. G3TFN, QTHR. Tel 061-761 2952.

Creed 34 reperf, works, needs a little attn, £20 ono. Buyer collects. G8JAZ, QTHR.

Marconi TF995, £150. Heathkit 100MHz counter, £60. Eddystone EC10, £45. 400–500MHz pa 2x4x150, £50. Homebrew 2m a.m. tx/rx, 18W, £50. *Wanted:* Bird Thruline and probes, 500MHz modmeter, 500MHz counter, 20/30dB power attenuator; make, price, cond. G8APV, 23 Bousfield Road, New Cross, London SE14. Tel 01-732 6918.

"Rad Com", Jan '64–Dec '77, offers. Pye Tulip mic, £8 ono. VK2ABQ beam, hf, £10. G3NXD, QTHR. Tel 0562 850570.

HAC DX Mk2 rx, covers 9–170m, comp with headphones, cond as new, £10 ono. Marshall, 21 Oaklands Road, Groombridge, Tunbridge Wells, Kent. Tel Groombridge 526.

Antenna switch, 3-way, SO239 sockets, £6.34, post 50p. Broadcast trap, stop band 550 to 1,600kHz, reduce your crosstalk, £6.09, post 30p. G4DIB, QTHR. Tel 01-467 9033.

Teletext, built and running as per *Television* mag, best offer over £199. (Hayes, Middx). Tel 01-848 3599, Tuesdays and Thursdays after 6pm.

Heath GR54 gen cov rx, £20. Panda Cub 160–10m tx, £15. Cossor twin-beam 'scope, £20. Hudson mobile AM10B tx/rx, low band, £8. BC625A 2m a.m. tx, incl ac psu, £8. Various other tx/rxs. G4AWF, QTHR. Tel Blackpool 811108.

Universal bridge, Wayne Kerr B221, with low impedance adapter Q221, £100 ono. Pye Pocketphones, pair xtalled SU8, PP3 battery powered, £30 ono. Teague, Ponds Farm, Chalfont Road, Seer Green, Beaconsfield, Bucks.

Liner 2, mains psu, £105. G3RHP, QTHR. Tel Helmingham 403.

KP202 2m H/H, fitted S20, S21, S22, R5, R6, R7, as new, toneburst, case, helical, nicads, charger f to uhf, all for £110 ono. G8LQV, QTHR. Tel 0295 3529, daytime or early evening.

FT200, FP200, comp, mint cond, similar to FT101 capability, £270 ono. G8ISC, QTHR. Tel 02406 3460.

Test equipment: double beam 'scope, dc-15MHz Marconi TF1331, manual, £55; sig gens —TF144G, £25, TF801A 10–300MHz, £25; Heathkit RF1U, £10; BC221 and charts, £15; scrap CR100, manual £5. Going mpu-crazy so must sell. G3RQF. Tel Southampton 446418.

B44 tx/rx, circuit diag, 12V supply so would convert to 4m portable, exc cond, £15. 12V 8A mains trans, as new, £5. Carr extra both items. I. Loudon, 6 Clarendon Crescent, Edinburgh EH4 1PT. Tel 031-332 0884, most evenings.

Atlas 180, c/w 12V dc cable, mic, £250. Console and psu for Atlas, £90. MT1 mobile antenna matching transformer, £8. ETM3C Space-mark squeeze keyer, perf, £50. Tavasu mobile ant, comp, £10. *Wanted:* IC215, c/w nicads, charger. G4DXC, QTHR. Tel Bingley 3289.

Heathkit gen cov rx GR78, Microwave Modules 2m converter, comp with manual, £70 ono. G8BJV, QTHR. Tel Manningtree 2874.

Heathkit HW32 ssb tx/rx, full 20m band cov, homebrew psu, £75. G3MRJ, 62 Long Grove, Baughurst, Basingstoke. Tel Tadley 4606.

Comp 400W 80/10 ssb cw stn: rx 7360 first mixer; Collins ssb and cw filters; Eddystone dial; calibrator, etc; exciter 70W output vox and ptt; 400W amp 3-811As; 'scope envelope monitor; all above with spare tubes; high power transmatch with swr bridge; 35ft stainless steel mast; 12ft lengths Dural etc; all built professional standards; any reasonable offers for lot, or split. G2MA, QTHR. Tel Wickersley 2708.

VHF high-band fm handhelds, 3ch Stornos, GEC Couriers, comp nicad, cases, ideal 2m, £40. Starphone uhf talk-through base stn (repeater) with cavities, £60. GEC nicad charger, £15. Pye PF2 nicad charger, £15. G8LXI, QTHR. Tel West Kingsdown 2733.

South Africa country home, modern, compact, four bedrooms, furnished, spotless cond, near Cape Town, separate shack; swop for similar UK accommodation for approx two years. Owner visiting UK April-May to arrange. ZS1SX, Box 234, Durbanville 7550. Tel Crawley (0293) 24797.

Mains psu 13·8V output stabilized, suitable mobile tx/rx, for use as base stn, current foldback 3·5A, plus essential crowbar protection at 15V, output metered, input and output switched and fused, £15. G3GOG, QTHR. Tel 01-856 7442.

Pair PF1 Pocketphones, nicads, no xtals but should work ok, £23, plus £1 p&p. BC906D cavity wavemeter 144–235MHz, cct, charts, £5, plus p&p. *Wanted:* full-size violin bow, good cond. G8AKT, QTHR.

Hallicrafters SX-100 rx, 0·538–30MHz, usb/lsb notch filter, new mains trans, exc gen purpose rx, £90. C. Ward, 1 Cherry Close, South Wonston, Winchester. Tel 0962 882246.

KW Atlanta, £170. B40 rx, £35. Collins TCS12R, £14. 50ft telescopic tower, winch, £75. HQ1, £50. TF144F sig gen, £12. Valves, *SWMs, Rad Coms*, etc. G3UGE, 5 Ida Road, West Bromwich. Tel 021-553 0409, after 7pm.

FDK Multi 2000, hardly used, £235. Robot 80A camera 70B monitor, must sell, offers. Sentinel 2m converter, £10. 2m 6-el quad, £14. AR30 rotator, £20. Eddystone dial 898, new, £8. AR88 w/change switch, £2. P846, £4. G4BGE, QTHR. Tel Bracknell 21502.

Eddystone EC10 Mk2, instruction book, mains/battery psu, case slightly marked, performance checked, £110 ono. C. Ward, 1 Cherry Close, South Wonston, Winchester. Tel 0962 882246.

Xtals: HC6U 8MHz R0, R3, R6, S20, £2 ea. *Wanted:* HC25U 12·127MHz or 6·0635MHz (S21), HC6U 24·5MHz, 26·0MHz. G3PTU, QTHR. Tel 0484 88506.

Racal RA17L communications rx, good cond, in maker's cabinet, plus handbook, £199 ono. Will deliver 50 miles. G8BFW, QTHR. Tel 021-748 2352.

2m Redifon GR470 fm base stn tx/rx, 80ch synthesized drive, all solid-state, 25W output, repeater and reverse repeater, mic, handbook, £90. G3UFB, QTHR. Tel St Albans 60134.

Belcom FS1007P 16ch scanning tx/rx, fitted S0, S20–S24, R3–R7, digital clock, ideal living room rig, £150. Heath IB102 frequency scaler, £50. *Wanted:* circuit diagram and/or other servicing details Airmec mod meter 210A. G3MNV, QTHR. Tel 021-353 3012.

FT200, FP200, £170. Electroniques QP166 rf unit, £10. Eddystone 898 dial, £5. Kokusai mechanical filter type MF455–15CK, with xtal, £17. Codar AT5, £15. G4DAQ. Tel Luton 34053.

Liner 2 2m ssb tx/rx, good cond, comp with accessories, £100, or exch for KEN KP202 2m fm handheld. G4EDR, 39 Clarence Drive, Filey, N Yorks YO14 0AZ.

Eddystone 750, mint, exc gc rx, £50. CR100, good wkg order, manual, £20. KW Victor tx, good wkg order, 120W cw/a.m., exc speech quality, £25. Labgear LG50 tx, 50W a.m./cw, tatty but wkg, £10. G4ETS, QTHR. Tel Thornbury 416988.

KW204, £175. KW202, £170. Matching spkr, £6, exc cond, VAT paid. YO100 'scope, £60. Interested in exch for sstv/rtty solid-state gear. Trio world clock, £9. Transport by mutual arrangement. DJ0BU, c/o Globe Cinema, BFPO 38.

3in oscilloscope, £16. Four 4C250Bs, £8. Yaesu hand mic, audio compressor, £8. Twin meter swr bridge type FS1-5, £6. GDO, old but wkg, £8. Two Racal film dials, £6. Handbook and almost two comp sets of valves for Racal RA17, £10. Avo-minor multimeter, case, £7. All plus p&p. G4AWJ, QTHR. Tel Heathfield, Sussex, 4803.

Property late G5BG: Panadaptor, incl spare tubes and transformers, £35; Avo model 8, £40; BC221, no charts, £15; three range vvm, £10; Marconi uhf wavemeter TF-643A, £10; 100W variac, £3; test set BG-3, 160–220MHz, £5; pair Bendix selsyns 50V, £25; Heath gdo, £15; two Microwave Modules converters, 144/29–30MHz and 144/4–6MHz, £12 ea; c/r bridge, £10; sae list of assorted xtals 1·9–30MHz, 200 valves (1940–70) and 21 good meters. G8LT, QTHR. Tel 032 732 321.

TS700, mint, late model, professionally set up, much above average, built-in sidetone, xtals for all popular channels, VOX-3 unit, all accessories, £310 ovno. G4FRX, QTHR. Tel 01-602 5855.

Telford TC7 Mk2, tunable i.f. (28–30MHz), mint cond, plugs, manual, circuit diagram, £40 ono. G2HH, QTHR. Tel Bradford-on-Avon 2966.

KW2000E, plus 18AVT 10m to 80m vertical antenna, Datong speech compressor, £300, no splitting. G4AYP, QTHR. Tel 0423 61597 (north) or 07356 5793 (south). Delivery any reasonable distance from line joining Newbury (Berks) to Harrogate (Yorks).

Mic/tel headsets, Hosiden BH001 200/15Ω, modern design, new, boxed, £6, plus 45p post. Edgewise meters, 2in scale, 0·5 or 1·0mA fsd, new, £1.75, plus 20p post. Roband stabilized psu, 450–550V, 150mA, two 6·3V htrs, £12, plus carr. G3YLO, QTHR. Tel Berkhamsted 73717.

AR88LF plus spkr, £35. CR100, fitted with Microwave Modules 14–16MHz 2m converter, £25. Buyers collect. G4FSI, QTHR. Tel Farnham (Surrey) 5218.

Sommerkamp FRDX500, 160–10m, incl cw filter, exc cond, manual, carton, £150; Yaesu vfo FV4005, exc cond, £40; Hi-Mound BK100 semi-auto mech key, £8; 2m 808 Jaybeam, £8; all ovno. Also, Hatfield attenuator type QSC, 75Ω 0–11dB, 1dB steps; phasing tx 160–10m, psu; 4m Pye Vanguard, control box; Advance attenuators; and many other useful items and units. G4BRT, 7 University Road, Southampton. Tel Southampton 552661.

Pair 4CX250Bs, bases, chimneys, 144MHz high power coaxial filter, vernier tuning, all new, sae details. High quality marine morse key, ball race action, filters, cover, new, £22. Datong UC/1, brand-new, unused, with high grade s/state psu, £105. G3GUU, QTHR.

Trio TS-520 hf tx/rx, ac/dc psu, cw filter, recent checkover by Lowe, £320. Eddystone EA12 rx, ham bands only, realigned, immac. G4FOG. Tel 01-360 5436.

KW1000 linear amp, mint cond, plugs, manual, circuit diagram, £150. G2HH, QTHR. Tel Bradford-on-Avon 2966.

FR50B, exc cond, calib, orig packing, handbook, £75. Joystick System J, few months old, (£42 new); Ws, VE, etc worked on this antenna indoors; offers? G4FXA, QTHR. Tel Atherton (0942) 878567, evenings.

Creed 85R printing reperforator, keyboard, £10. 7·5A 13·8V highly stabilized psu, settable 6–30V, electronic cut-out, £12. Lister type D 1½ hp hopper cooled stationary petrol engine, £35 ono. Buyers collect please. Thwaites, 15 Spring Head Road, Kemsing, Sevenoaks, Kent. Tel Sevenoaks (0732) 62481.

KW Vespa Mk2 160–10m ssb tx, £75. Codar AT5, fixed and mobile psus, tx/rx switching, £25. Labgear top band converter to car radio, £5. G3UJF, QTHR. Tel 01-303 4220, evenings.

Heathkit HD1410 iambic electronic keyer, £25. Creed 7B, 110V dc psu in fitted box, £25. 18AVT/WB trap vertical, £35. Buyer collects or carr extra. G4EVK, QTHR. Tel Bath 858928.

VHF/UHF rf power transistors: 2N5637, £6; 2N5641, £1.50; 2N5642, £5; 2N5589, £1.50; 2N5591, £5; 2N5644, £3; 2N5645, £5; 2N5646, £6; 2N5848, £5; 2N5849, £6; MM1552, £6; MM1553, £6; MM1696, £3; MM1697, £3. G3GOT, QTHR. Tel Terling 229.

TR7010, preamp, £125. C146A, S20, 22, 24, R6, 7, Basemaster, nicads, £80. KF145, 12ch fitted, modded, £90. 28/432MHz transverter boards, 4W o/p, £40. Valve ham band rx, bfo, Q-mult rf/i.f. gain, £20. G8FAT, QTHR. Tel 01-908 1911 ext 42, office hours.

Europa-B, £60. AR44 rotator and control, £50. 8Y/2m beam, £6. Buyers collect. G3IMP, 7 Islington Close, Newport, Salop. Tel 0952 812134.

Yaesu FRG7, mint; Redifon linear amp, uses two QY4–400s, one required; offers. G4BNQ. Tel 0532 665831.

21in colour monitor, £25. 8in monitor, £10. Perdio Portarama (405/625), £10. Heathkit RF1V sig gen, £15. 931A photomultiplier tube, £4.50. Test card C monoscope tube, £5. SE5J tube, base, screen, £10. Test card C transparency, 8in by 6in, £1. Must clear. Mulford. Tel 01-764 6207.

Rare Canadian wartime w/s No 29, wkg, £25 ono. Creed teleprinter auto-tx 6S/6, spares, manuals, £9. *Wanted:* Avo valve characteristic meter Mk4; wkg Redifon GR410 tx/rx; Avo valve tester CT160. G3UCT. Tel Fleet (02514) 6998.

Oscilloscope, Solartron CD523S, 10MHz bandwidth, £30. Goodmans Twinaxiom 15W full range hi-fi spkr, £7.50. Pair Eagle FR 6·5 hi-fi spkrs, £3.50 ea. G3WDX. Tel 01-866 9494 day, or 92 33859 evening.

Racal RA17L, recent overhaul, vgc, £200. FT75, DC75, FP75, VF50C, vgc, £175. IC22, 5ch, xtal toneburst fitted, £100. Electronic organ parts: two Kimber Allen keyboards, footpedals, two spkrs, all electronics up to pa, offers. G3UUV, QTHR. Tel Chippenham 2703.

Yaesu FLDX 400/FRDX 400, matching spkr, orig cartons, manuals, £350 or swop same priced Trio/Yaesu TS520/FT101, etc. Hartley DB 13A 'scope, manual £20. Avo type CT38 vvm, £7. Collect. G4EKG, QTHR. Tel 0386 41105.

Ex deceased swl. Brand-new boxed FR101DD, SP101B spkr, perspex cover, cost £557, no offers, £425; will deliver 50 miles. Codar PR30, £5. Eddystone Edometer gdo, new, £15. Trio 9R59DS, £45. Burns FMD1 fm unit, 100kHz i.f., manual, £5. G2AK, QTHR.

Pye U450L uhf base stn tx and rx, as new, unmodified, in lockable cabinet, circuit ideal for 70cm, buyer collects, £37. High power Londex type coaxial relays with plugs, £6. VHF/UHF reflectometer modules with plugs, £3.50. Carr extra. G8ENI, QTHR. Tel Cheslyn Hay (0922) 415374.

FT2FB, S0, S20–24, R5, 1R5, £125. FTV250 2m transverter, as new, £120. *Basic Electronics*, six parts, £7; *Basic Electricity*, five parts, £6; together, £12. G4CTW, QTHR. Tel Southampton 846568.

2m converter (Emsac), mains psu, £15. Homebrew 2m tx, fm, a.m., cw, power pack, £18. G3AEP, QTHR. Tel 0253 720756.

Creed 7P/N3 perforator type 45, 230V ac, £12. *Wanted:* 7TR or 85 with covers. G3GOT, QTHR. Tel Terling 229.

FR101DD, digital, as new, boxed, £425 ono. Datong FL1, £35. 8 × 8 70cm antenna, £9. Prefer buyers collect or carr extra. Colin Sykes, 15 Hereford Street, Oldham OL9 7SA. Tel 061-633 2306.

Six Pye Bantam nicads, three charger units, separate or together; offers to Tony Richards, "Ferndale", Lake Road, Ambleside, Cumbria. Tel 09663 2558.

Pair 572B valves, new, unused, as specified for FL2000, KW1000, etc, £33. Ext vfo for KW2000B, £35. Lafayette HA230 rx, £20. DX40 and VF1U, £20. Bay 96 70cm tripler, swr bridge, £5. All prefer buyer collects. G3WIE. Tel Southampton 556894, evenings.

Prinz 60mm Astro telescope, ×234, tripod, finderscope, many accessories, new cond, £20. Hudson lo-band rx, £6. Codar Q-mult, £3; pre-sel, £4. Class D No 1 wavemeter, 250V wkg, manual, £7. 23cm and 70cm varactor triplers, £4. 70cm MBM46, £8. G4GED, QTHR. Tel 01-575 1454.

TR7200G, 10ch, boxed, mint cond, £140 ono. Europa B, mint, £60. CPS10 psu, £25. Would part exch for TS700G or FT221R, with cash adjustment. G3GHB, QTHR. Tel Inkberrow 792582, evenings.

Pye F9U/T 5W uhf base stn, comp, talk-thru' panel, as new, suitable for repeater, diagrams, £175 ono. 4m Cambridge, a.m., 3ch, £15 ono. HW32A, ac psu, good cond, £60 ono. GM4FDM, QTHR. Tel 050-581 5468.

Gardner's ht oil filled transformer, 240V input 50Hz, output 410V × 435V 460V twice at 230mA, 540V 570V 600V at 250mA, £10. Buyer must collect, evenings or weekends. G3SDK, QTHR.

FT101EE, cw filter, mint cond, demo any time, going FT901, £410, all extras. G4AKG, QTHR. Tel 01-686 1756.

"Wireless World", bound volumes 18–25 incl, Jan '26–Dec '29, good cond, collector's item, offers. G2DMR, QTHR.

Heathkit SW717G gen cov rx, 550kHz–30MHz, exc cond, comp with manual, £35. Tel Calne (0249) 814633, evenings or weekends.

Yaesu twins FR101D FL101RF, mint cond, not available separately, seen wkg, buyer inspects and collects, £520. G4FRN, QTHR. Tel Cobham 3197.

TV camera, 525/625, Marconi, comp with manuals, £25. Hudson AM112, mic, control box, £10. R1392D, psu, as rec'd ex-Min, £20. Telequipment 'scope, 6MHz, slight fault, with s/manual, £25. G8NGF, QTHR. Tel 01-527 6502.

Nicad 12V batteries, 1Ah (approx), ex-equip, £2.25 ea. EC10 Mk2, £95; Cossor C2/8 300mW 2m portable tx/rx, £25. *Wanted:* lb fm/a.m. Westminster; 770U rx; Pye, ITT, radiotelephone manuals; W15U Westminster boards; etc. G8EPR, QTHR. Tel Bewdley 403773, after 6pm.

Pye Cambridges, a.m. high band; one 12·5kHz, exc cond, unmodified, £25 ono; one modified for 2m, 25kHz, rf board u/s, £7. G4BRK, via G4BRT QTHR. Tel Southampton 552661.

Heath HW17/A 2m tx/rx, rx tunable, much modified incl new metal rx dial, exc dual-gate mosfet preamp; HG10B vfo, works with above making tunable tx; both good wkg cond, £50 ono. G8LBK, QTHR. Tel Formby 73322.

Trio 7010 ssb 2m tx/rx, as new, mobile mount, etc, £140; part exch deal with uhf/fm blue box considered. *Wanted:* lid/base for Cambridge AM10D. G8MMM, QTHR. Tel 051-677 2564, evenings.

Storno Viscount tx/rx, xtals S20, S22, R7, 10W out, exc cond, £40. Trio 9R59DS communications rx, spkr, stabilizer, £35. *Wanted:* Channel Master or similar rotator, vhf absorption meter. G8NFS, QTHR. Tel 01-455 0953.

Dual trace oscilloscope tube, unused, (Data) 5in, £16. 12/24V dc/dc converter, £6. Storno Viscount controls/spkr, £4. Radiovisor burglar alarm, (i-r ray), £15. Microwave burglar alarm, £25. Push-button telephone (726L), £2.50. W. H. Joyce, 41 Rochdale Road, London E17 8JF. Tel 01-539 5421.

Trio TS515 tx/rx, £220. TL911 linear, £130. Heath swr/pwr meter, £18. Datong processor, 2-tone osc, £25. Variac 15A 0–270V, £20. Variac 8A 0–270V, £12. TA33 Jr beam, AR44 rotor, £45. Emigrating. GM2AHD, QTHR. Tel Dumfries 4669.

IC240, good cond, £150. Brand-new ARX2 2m colinear, £20. G3YKB rtty terminal unit, £20. G4CVC, QTHR. Tel Swanley 65052.

KW201 rx, handbook, boxed, £100. G5JZ, QTHR. Tel Rushlake Green 211.

IC240, immac cond, very little used, orig packing, etc, going multi-mode, £140; post paid within reasonable distance. GI3ZCU, QTHR. Tel 0232 56221 ext 36, 9am to 4.30pm.

IC22A, all accessories, orig packing, toneburst, R3–R7, S0, S20–24, 145·32MHz, £135 ono. G8KYH, QTHR. Tel Coventry 610408.

Hammarlund HQ170 amateur band rx, 160m–10m, vgc, comp, manual, mains transformer, £115. G4GQN, Plum Tree Farm, Manley, Cheshire. Tel 09284 441.

ZVC ssb i.f. board with KUGXF9B, plus vfo, £50. 57-key ASCII keyboard, £30. Ultra Valiant hi-band base stn, tx, rx, control box, unmodified, £25. G3TKD, QTHR. Tel 0244 41246.

BC221M and BC221AF frequency meters, each with ac mains psu, both £16. *Wanted:* AR88D rx; price, cond, etc. P. M. Cleaver, 86 Main Road, Dovercourt, Essex. Tel Harwich 2195.

Telequipment D53 dual trace 'scope, vgc, manuals, £240. G4BLZ, QTHR. Tel Lee-on-Solent 550721.

WANTED

Tuning capacitor for high-voltage use, 100pF approx, plate separation at least 0·1in, clean and in good cond, good price paid if right. Davies, G3KYK, 37 Dawnay Road, Gt Bookham, Surrey. Tel Bookham 54991.

Ham band or gen cov rx for novice swl, reasonable price please. Will collect if necessary. Landor, 6 Queens Road, St Helier, Jersey.

AR88LF manual, urgent, your price paid. G3GIQ, QTHR. Tel 01-567 6389.

AR88D, orig or very good wkg cond. J. Penzer, "Sea Cot", Canal Foot, Ulverston, Cumbria.

B2 tx/rx, comp, first class cond, also manual. Coleman, G5BH, QTHR. Tel 01-672 7592.

Clean HW8 with mains psu. Will exch HW32A with matching psu, mint, no mods, 200W p.e.p. Letters please, all will be answered. G4GOT, 7 Gaisford Road, Worthing, West Sussex BN14 7HP.

SSB tx, KW Vespa or similar, with 160m; 2CQ Q-multiplier/loudspkr unit for Drake 2C rx. G4CHL, QTHR. Tel Gravesend 68233.

For the Wireless Museum: very old txs, rxs, spkrs, valves, components, pre-war books, magazines, catalogues etc. Collection arranged. Details please to curator, G3KPO, QTHR. Tel 098 386 2586.

Heathkit Twoer or similar basic a.m. tx/rx. All letters answered. G8GYG, 2 Park View, Queensbury, Bradford, Yorks. Tel Bradford 882354.

Someone with wkg Redifon GR410 ssb tx/rx prepared to offer advice/help to owner of set with stubborn fault; also R209 Mk2 and CT160 valve tester in good wkg cond. G3UCT, 27 Glen Road, Fleet, Hants. Tel Fleet (02514) 6998.

18ATV, preferably /WB, 14ATQ with 80m coil, or similar trap vertical antenna. GM4DQD, QTHR.

Codar mains psu type 250/S, suitable for AT5 tx. G4BRG, QTHR. Tel 01-529 3803.

Swan 350 pa mod info. Would much appreciate any info on successful replacing of 6HF5s in Swan 350. EI5AJ, 64 College Park, Corbally, Limerick.

CR tubes, GEC 924F and VCR 138A (CV1587). G2FKO, QTHR. Tel Bideford 2964.

Datong FL1 filter. G4FYS, QTHR. Tel Yeovil (0935) 4773.

"The services textbook of radio transmission and propagation" vol 5. G8GHP, 6a Portobello Parade, Fawkham Road, West Kingsdown, Sevenoaks, Kent TN15 6JP. Tel West Kingsdown 2978.

Old pattern GEC valves, type 2759 or CV5060. Parker, 133 Station Road, Cropston, Leicester LE7 7HH.

Mumetal shield for VCR139A, or could be any larger size; also EN31 valve. G3KGN, QTHR. Tel 0702 77779.

Indicator type 62 ex-RAF, any cond; also manual or circuit Telequipment 'scope D31, buy or borrow. Boyd, 25 Eric Road, Stubbington, Hants PO14 2RP. Tel Stubbington 3517.

Compact 10m beam suitable for windswept QTH, HQ1 minibeam. IC22A or similar for mobile. Eddystone 750, 888 or EA12. G3UFX, QTHR. Tel St Buryan 407 (Cornwall).

March and April 1961 issues of *RSGB Bulletin*. Handbook for G2DAF rx, or circuit diagrams. C. R. S. Smith, 19 Hyde Road, Kenilworth, Warks CV8 2PB.

Oscilloscope, portable with reasonable spec, double beam preferred, around £30–£40. Could inspect and collect within 50mile radius Nottingham. G4EBT, QTHR. Tel Budworth 3808.

898 dial; xtal filters, 9MHz, ssb, cw; parts for ZVC board Sept '74, particularly ics and MD108; electronic key paddle. Why? G3RIR, 129 Margards Lane, Verwood, Dorset. Tel 0201 234998 evenings, or 0703 34433 ext 3428 daytime.

Canadian 52 tx/rx, comp, in good wkg cond; individual connectors, etc, considered for spares. R209 Mk2 (12V), in good wkg cond. Redifon GR410 tx/rx, in wkg cond, set only reqd. Taylor, G3UCT, 27 Glen Road, Fleet, Hants. Tel Fleet (02514) 6998.

Yaesu FV401 remote vfo, any cond. G3RWH, QTHR. Tel Cowes 3323.

Pye Cambridge or similar mobile r/t for band C 112–136MHz, a.m., will collect from UK. EI2CR, QTHR. Tel Dublin 503281.

Mobile dc psu for KW2000 A or B, must be comp with connecting cables and plug. Also Codar TS28 rx for 160m and 80m. GI3GRD, QTHR.

STEPHENS-JAMES LTD G3MCN

47 WARRINGTON ROAD, LEIGH, LANCS WN7 3EA TEL 0942-676790

TRIO

TS820 HF Transceiver	£645.00
DG1 Digital read out option	£127.00
TS520S HF Transceiver	£489.00
TS700S VHF Transceiver	£542.00
TS700G VHF Transceiver	£426.00
TR7500 VHF FM Transceiver	£225.00
TR7200G VHF FM Transceiver	£189.00
TR7010 VHF SSB Transceiver	£189.00
TR2000GX FM Portable Transceiver	£139.00
TR3200 70cm FM Portable Transceiver	£182.00
TR8300 70cm UHF/FM Transceiver	£227.00
PS5 Power Supply Unit	£58.00
SP70 Speaker	£18.00
DM800 G.D.O. Absorption Wavemeter	£45.36
CO1303G Monitorscope	£129.00

All crystals and accessories available.

AT200 Antenna Tuner	£82.55

YAESU

FRG7 Solid state receiver	£162.00
FR101D Receiver	£457.00
FL2100B Linear amplifier	£302.06

DRAKE

SSR-1 Solid state receiver	£150.00

STE MILAN

AR10 28-30MHz AM-SSB Receiver module	£39.50
AA1 Audio amplifier for AR10	£4.75
AD4 FM Discriminator	£5.00
AR20 FM Crystal controlled receiver module	£50.00
AT23 FM Crystal controlled transmitter	£50.00
AG10 Tone burst unit	£4.50
AL8 10 watt Linear amplifier	£27.00
ARAC 102 2 band Receiver	£100.00
ARAC 170 70cm and 10m Receiver	£127.00
ASAP Stabilised 2½ amp power unit	£27.50
AB40 40 watt Mobile FM amplifier	£55.00
AK20 VHF/FM Transceiver	£160.00

HY-GAIN

14AVT 10-15-20-40m Vertical antenna	£56.19
18AVT/WB 10 to 80m Vertical antenna	£81.45

ROTATORS

AR40	£51.57	KPR400	£97.00
CD44	£106.87	AR22R	£48.38
HAM2	£145.12		

G-Whip Mobile antenna range

Tribander helical 10-15-20m	£19.75
LF Coils for tribander	£5.91
Telescopic for coils	£2.25
Basemount standard	£3.38
Basemount swivel type	£4.45
Flexiwhip basic 10m	£11.25
Coils for flexi	£5.91

New Selecta De Luxe Range

Selecta 1m mast section	£9.56
Selecta 18" mast section extension	£5.00
Selecta 10-15-20m head	£14.65
Selecta coils for LF	£6.25

SXR30

New model solid state receiver
550KHz to 30MHz £142.75

MICROWAVE MODULES

Transverters

MMT432/28-S	£133.88
MMT432/144-R	£169.88
MMT144/28	£88.88

Converters

MMC144 any IF	£20.25
MMC144/28 LO	£22.50
MMC70/any IF	£20.25
MMC70/28 LO	£22.50
MMA144 Preamp	£14.63
MMC432 any IF	£27.00
MMC1296 any IF	£28.00

Frequency Counters

MMD050/500	£85.32

JAYBEAM

4Y/4M 4 metre 4 element Beam	£12.65
C5 2M Glass-fibre coliner	£30.93
8Y/2M 8 element Yagi	£10.00
5Y/2M 5 Element Yagi	£7.71
PBM10/2m 10 element Parabeam	£25.35
PBM14/2m 14 element Parabeam	£31.43

Full range of antennas for 144MHz, 70cm available with full range of tubing, clamps, etc. SEND SAE for full details.

COMTEK

2m Linear Amplifier	£141.50

MARRC

NR56V 2m FM Receiver 12V dc	£54.00

F.D.K.

TM56B VHF Monitor Receiver	£85.00

STATION ACCESSORIES

Single Meter SWR Wall type	£9.50
Single Meter SWR Desk type	£9.80
Twin Meter SWR Desk type	£10.80
3 way Antenna Switch	£5.50
6 way Antenna Switch	£16.50
Bauer Single Paddle Unit	£10.95
Junkers Morse Key	£29.75
Samson ETM-3C C-Mos Keyer	£63.88
Katsumi Electronic Keyer	£60.75
STE Electronic Keyer	£106.00
NyeKing 001 Morse Key	£6.75
NyeKing 002 Morse Key	£7.81
NyeKing 003 Morse Key	£8.43
Hy-Mound Morse Key	£8.75
Drake TV3300 Low Pass Filter	£18.00
HP3A Low Pass Filter	£2.95
Plastic Antenna Insulators	£19

PL259, **50p**; SO239, **45p**
Cable Reducers, **16p**. Elbows, **85p**
UR43 CoAx, **18p**/m. UR67, **72p**/m
300 ohm Twin Feeder **10p**/m
Yaesu and Trio hand and desk microphones.
Postage extra on all items.
SAE with all general enquiries please.

SWL TUNING UNITS

MK1 Cover 2-30MHz	£17.50
MK2 Covers 550KHz to 30MHz	£23.00

Designed and manufactured by us. Fifty switchable tunable positions, will match any antenna to your receiver. Now in use in over 40 countries. Price includes VAT and postage on these items.

SECONDHAND EQUIPMENT

Atlas 210 with Mobile Mount	£375.00
Comtek 2m Linear Amplifier	£100.00
Drake R4C with 2 Filters	£450.00
Drake T4XC Transmitter with Ac psu	£425.00
Eddystone EC10MK2 Receiver with AC psu	£125.00
Eddystone EC10MK2 Receiver	£115.00
Eddystone 840C Receiver	£65.00
F.DK. "Quartz" VHF FM Transceiver	£120.00
Heathkit SB230 Linear Amplifier	£320.00
Icom IC22A VHF FM Transceiver	£120.00
KW200A Transceiver (AC psu has no cabinet)	£125.00
Magnum 2 Transverter	£85.00
STE AK20 VHF FM Transceiver	£100.00
STE ARAC102 Receiver	£80.00
Trio TS515 Transceiver	£210.00
Heathkit HW32A Transceiver HB psu	£85.00
UNIDEN 2020 Transceiver and speaker	£400.00
Eddystone 770R Receiver	£120.00
Yaesu FL101 Transmitter	£255.00
Yaesu YO100 Monitorscope	£110.00
Sommerkamp FT277 Transceiver and clipper	£315.00
Yaesu FT2F VHF FM Transceiver	£90.00

Shop Hours Mon to Fri 9.30am to 5.30pm
Saturday 9.30am to 5pm
ACCESS and Barclaycard facilities.
HP terms arranged. Part exchanges always welcome. Good clean equipment bought for cash. Items sold on a commission basis.
We are located on the A574. Turn at the Greyhound Motel on the A580 (East Lancs Road) and we are about ½-mile on right. No parking problems at any time.

NOW YOU CAN DIG

out the **RARE DX** from under tiring whistles and CW interference. Tunable Audio Notch Filter tunes 350–5000Hz and drives speaker. Get **DX OTHERS CAN'T HEAR, FOR ONLY £7.90.**

ANTENNA FAULTY? Measure resonance and radiation resistance FAST with an Antenna Noise Bridge, 1–150MHz, 20–200 ohms. **GET a STRONGER SIGNAL** for only **£8.20.**

GETTING CLOBBERED? PUNCH THROUGH with a Speech Compressor. **FOUR** times **TALK POWER** for only **£8.60.**

NO LONG WAVE? Cover 100–600KHz with an L.F. Converter, feeds your 3·5–4 MHz receiver, only **£8.80.**

Each easy-assembly kit includes all parts, case, printed circuit etc, postage, money back assurance. **SEND** off **NOW.**

CAMBRIDGE KITS 45 (RD) Old School Lane, Milton, Cambridge.

SPECIAL OFFER. CA3089E, **£1.50**; 2N3866, **80p**; 2N3553, **£1.00**; 40673, **60p**; 2N5180 **30p**; 3N201, **60p.** 2m. 12V FM TX board. Phase modulator 5kHz deviation max. Size: 140mm × 82mm × 23mm. HC25/U Crystal. Multiplication X12. Sent for evaluation, P&P **30p.** 12V 1W **£20,** 2N4427, **70p**; CA3001, **£1.50**; 2N5913, **£1.50**; 2N5945 (4W, 8dB), **£8.00**; 2N5946, **£11.00**; 2N5641, **£4.00**; ZTX327, **60p**; 40964, **£1.40**; 40965, **£1.50**; 2N3375, **£2.00**; OC202, **10p**; PT3500, **£1.20**; BLY33, **£1.80**; 2N5590, **£5.00**; 2N5591, **£8.00**; 2N3632, **£3.00**; 2N6080, **£4.50**; 2N6081, **£5.50**; 2N6082, **£8.00**; 2N6083, **£9.00**; 2N6084, **£12.00**; 2N5642, **£8.00**; 2N5643, **£11.00**; BYF50, **20p**; BC108, **10p**; BC183L, **10p**; BLW39, **£3.00**; 2N3478, **40p**; 3N202, **90p**; MPF102, **40p**; 40841, **50p**; BC167A, **10p**; BSY90, **30p**; 2N3904, **10p**; 2N3906, **10p**; **Integrated Circuits**: CA3007, **£1.00**; CA3014, **80p**; CA3018, **70p**; CA3023, **80p**; MC1550G, **50p**; MC1596G, **£2.00**; CA3000, **£1.00**; SL620/30C, **£2.00**; MC1741CG, **80p**; 2N3819, **20p**; 2N2270, **40p**; BLY55, **£2.00**; Transmitter tuning capacitor 79pF, **£1.00**; SO239 sockets, **50p**; N socket to BNC socket adaptor, **£2.50**; N socket to N plug, **£2.00**; N plug to N socket, **£2.00**; HC25/U crystal sockets pcb, **15p**; Minimum order **£1.00.** Mail order only, P&P 20p.

HELLER ELECTRONICS
49 Blossom Waye, Hounslow, Middx., TW5 9HB

DIODES/ZENERS

1N914	100v	10mA	.05
1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.05
1N753A	6.2v	z	.25
1N758A	10v	z	.25
1N759A	12v	z	.25
1N4733	5.1v	z	.25
1N5243	13v	z	.25
1N5244B	14v	z	.25
1N5245B	15v	z	.25

SOCKETS/BRIDGES

8-pin	pcb	.25	ww	.45
14-pin	pcb	.25	ww	.40
16-pin	pcb	.25	ww	.40
18-pin	pcb	.25	ww	.75
22-pin	pcb	.45	ww	1.25
24-pin	pcb	.35	ww	1.10
28-pin	pcb	.35	ww	1.45
40-pin	pcb	.50	ww	1.25
Molex pins .01		To-3 Sockets		.45
2 Amp Bridge		100-prv		1.20
25 Amp Bridge		200-prv		1.95

TRANSISTORS, LEDS, etc.

2N2222A	NPN (2N2222 Plastic .10)	.15
2N2907A	PNP	.15
2N3906	PNP (Plastic)	.10
2N3904	NPN (Plastic)	.10
2N3054	NPN	.35
2N3055	NPN 15A 60v	.50
T1P125	PNP Darlington	.35
LED Green, Red, Clear, Yellow		.15
D.L.747	7 seg 5/8" High com-anode	1.95
XAN72	7 seg com-anode (Red)	1.25
MAN71	7 seg com-anode (Red)	1.25
MAN3610	7 seg com-anode (Orange)	1.25
MAN82A	7 seg com-anode (Yellow)	1.25
MAN74A	7 seg com-cathode (Red)	1.50
FND359	7 seg com-cathode (Red)	1.25

C MOS

4000	.15
4001	.15
4002	.20
4004	3.95
4006	.95
4007	.35
4008	.95
4009	.45
4010	.45
4011	.20
4012	.20
4013	.40
4014	.95
4015	.90
4016	.35
4017	1.10
4018	1.10
4019	.50
4020	.85
4021	1.00
4022	.85
4023	.25
4024	.75
4025	.30
4026	1.95
4027	.50
4028	.95
4030	.35
4033	1.50
4034	2.45
4035	1.25
4040	1.35
4041	.69
4042	.95
4043	.95
4044	.95
4046	1.75
4049	.45
4050	.45
4066	.95
4069	.40
4071	.35
4081	.70
4082	.45
MC14409	14.50
MC14419	4.85

– T T L –

7400	.15	7473	.25	74176	1.25	74H72	.45
7401	.15	7474	.30	74180	.75	74H101	.75
7402	.20	7475	.35	74181	2.25	74H103	.75
7403	.20	7476	.40	74182	.95	74H106	.95
7404	.15	7480	.55	74190	1.75		
7405	.25	7481	.75	74191	1.05	74L00	.25
7406	.35	7483	.95	74192	.75	74L02	.25
7407	.55	7485	.75	74193	.85	74L03	.30
7408	.25	7486	.25	74194	1.25	74L04	.30
7409	.15	7489	1.35	74195	.95	74L10	.30
7410	.10	7490	.55	74196	1.25	74L20	.35
7411	.25	7491	.95	74197	1.25	74L30	.45
7412	.30	7492	.95	74198	2.35	74L47	1.95
7413	.35	7493	.35	74221	1.00	74L51	.45
7414	1.10	7494	.75	74367	.85	74L55	.65
7416	.25	7495	.60			74L72	.45
7417	.40	7496	.80	75108A	.35	74L73	.40
7420	.15	74100	1.15	75110	.35	74L74	.45
7426	.30	74107	.35	75491	.50	74L75	.55
7427	.45	74121	.35	75492	.50	74L93	.55
7430	.15	74122	.55			74L123	.85
7432	.30	74123	.55	74H00	.15		
7437	.30	74125	.45	74H01	.25	74S00	.35
7438	.35	74126	.35	74H04	.20	74S02	.35
7440	.25	74132	1.35	74H05	.20	74S03	.30
7441	1.15	74141	.90	74H08	.35	74S04	.30
7442	.45	74150	.85	74H10	.35	74S05	.35
7443	.65	74151	.65	74H11	.35	74S08	.35
7444	.45	74153	.75	74H15	.45	74S10	.35
7445	.65	74154	.95	74H20	.30	74S11	.35
7446	.95	74156	.95	74H21	.25	74S20	.35
7447	.95	74157	.65	74H22	.40	74S40	.20
7448	.65	74161	.85	74H30	.20	74S50	.20
7450	.25	74163	.85	74H40	.25	74S51	.25
7451	.25	74164	.60	74H50	.25	74S64	.20
7453	.20	74165	1.50	74H51	.25	74S74	.35
7454	.25	74166	1.35	74H52	.15	74S112	.60
7460	.40	74175	.80	74H53J	.25	74S114	.65
7470	.45			74H55	.20		
7472	.40						

74S133	.40
74S140	.55
74S151	.30
74S153	.35
74S157	.75
74S158	.30
74S194	1.05
74S257 (8123)	1.05
74LS00	.25
74LS01	.35
74LS02	.35
74LS04	.30
74LS05	.45
74LS08	.25
74LS09	.35
74LS10	.35
74LS11	.35
74LS20	.25
74LS21	.25
74LS22	.25
74LS32	.40
74LS37	.35
74LS40	.45
74LS42	1.10
74LS51	.50
74LS74	.65
74LS86	.65
74LS90	.95
74LS93	.95
74LS107	.85
74LS123	1.00
74LS151	.95
74LS153	1.20
74LS157	.85
74LS164	1.90
74LS367	.75
74LS368	.75
74C04	.25
74C151	2.25

9000 SERIES

9301	.85	95H03	1.10
9309	.35	9601	.45
9322	.75	9602	.45

MICRO'S, RAMS, CPU'S, ETC.

74S188	3.00
1702A	4.50
MM5314	3.00
MM5316	3.50
2102-1	1.45
2102L-1	1.75
TR1602B	4.50
TMS 4044-45NL	14.50
8080AD	12.00
8T13	1.50
8T23	1.50
8T24	2.00
8T97	1.00
2107B-4, A	4.00
2708	11.50

LINEARS, REGULATORS, etc.

MCT2	.95	LM320T5	1.65	LM340K15	1.25	LM723	.50
8038	3.95	LM320T12	1.65	LM340K18	1.25	LM725N	2.50
LM201	.75	LM320T15	1.65	LM340K24	.95	LM739	1.50
LM301	.45	LM324N	.95	78L05	.75	LM741 (8-14)	.25
LM308 (Mini)	.95	LM339	.95	78L12	.75	LM747	1.10
LM309H	.65	7805 (340T5)	.95	78L15	.75	LM1307	1.25
LM309K (340K-5)	.85	LM340T12	1.00	78M05	.75	LM1458	.95
LM310	1.15	LM340T15	1.00	LM373	2.95	LM3900	.50
LM311D (Mini)	.75	LM340T18	1.00	LM380 (8-14 PIN)	.95	LM75451	.65
LM318 (Mini)	.95	LM340T24	.95	LM709 (8, 14 PIN)	.25	NE555	.50
LM320K5 (7905)	1.65	LM340K12	1.65	LM711	.45	NE556	.95
LM320K12	1.65					NE565	.95
						NE566	1.75
						NE567	1.35

INTEGRATED CIRCUITS UNLIMITED

7889 Clairemont Mesa Blvd., San Diego, CA 92111 U.S.A.

No Minimum

All prices in U.S. dollars. Please add postage to cover method of shipping. Orders over $100 (U.S.) will be shipped air no charge. Payment should be submitted with order in U.S. dollars. All IC's Prime/Guaranteed. All orders shipped same day received.

SPECIAL DISCOUNTS

Total Order	Deduct
$35 - $99	5%
$100 - $300	10%
$301 - $1000	15%
$1000 - Up	20%

Phone (714) 278-4394 BarclayCard / Access / American Express / BankAmericard / Visa / MasterCharge

WHAT DOES QM70 STAND FOR?

QM70 MEANS VALUE PACKED EQUIPMENT DESIGNED AND MANUFACTURED FOR YOU, THE DISCERNING LISTENER OR OPERATOR. JUST LOOK AT THE RANGE OF EQUIPMENT LISTED BELOW, THE COMPETITIVE PRICES, PROVING THAT QM70 MUST PRODUCE THE BEST VALUE FOR MONEY EQUIPMENT AVAILABLE TODAY.

WHY PAY MORE? JUST COMPARE THESE PRICES!

ITEM	OUR PRICE	OTHERS
NEW ★ BUCCANEER 28/144 15 Watt (40 Watt PEP) Solid State Transverter	£79.00	£88.88
70/28 MHz Converter	£16.50	£20.25
144/28 MHz Converter	£16.50	£20.25
432/28 MHz Converter	£22.00	£24.75
432/144 MHz Converter	£22.00	£24.75
432 + 434/28 MHz Converter	£26.00	—
432 + 434/144 MHz Converter	£26.00	—
28/70 MHz 2 Watt Solid State Transverter	£52.00	—
28/144 MHz 2 Watt Solid State Transverter	£52.00	—
SCORPION High Power 28/144 MHz Transverter	£93.00	£112.50
40/50 Watt 144 MHz Linear Amplifier	£45.00	£49.50
COUGAR 144/432 MHz FM Transverter	£55.00	—
COBRA 144/432 MHz FM Transverter	£73.00	—

PRICES INCLUDE VAT AND UK CARRIAGE. ALL UNITS NORMALLY EX STOCK AND CARRY OUR 12 MONTH GUARANTEE. FOR FULLER DETAILS AND SPECIFICATIONS WRITE/PHONE FOR DESCRIPTIVE LITERATURE.

QM70 Electronics Limited,
Severnside South, Bewdley, Worcs DY12 2DX.
Tel Bewdley (0299) 400070.

QM70 ELECTRONICS LIMITED

Optimum Performance with KW

Decca-KW 103 Combined Swr/Rf Power Meter is an instrument for measuring a 50 ohm coaxial line feeding an Aerial System or Dummy Load (1) Standing Wave Ratio. (2) RF Power with two ranges 0-100 & 0-1000W when used with a 50 ohm Dummy Load.

Decca-KW 1000 Linear Amplifier for SSB and CW 10-80 metres, 1200 watts p.e.p. Input SSB, can be 'driven' by most 100 watt Transceivers and Transmitters. Employs a pair of T160L Tubes in grounded grid. Pi-section input and output circuits. Built-in 2·4Kv P.S.U.

NOTE: The well-known KW LOW PASS FILTER passing 3-30MHz is available from stock.

Decca-KW Dummy Load is air convection cooled and has been designed as a purely resistive 50 ohm load up to 30MHz. Power capability up to 1000W.

Decca-KW 107 Antenna Tuning System incorporates E-Z match, SWR/RF Power Meter, Dummy Load, Antenna switch. High power version KW 109 is available.

Decca-KW Balun Mk.II. The Decca-KW Balun is broadband —3 to 30MHz, rated up to 2KW p.e.p. 1:1 Ratio. 50 ohms 'unbalanced' feed to 'balanced' output. Waterproof moulded case. Suitable for dipole and Beam aerials.

Other KW Favourites KW E-Z match; KW Traps (the original and the best) KW Trap Dipoles; KW Antenna Switch; Stockists for Hy-Gain beams and Verticles; CDR Rotators; Shure Microphones etc. KW spares are normally stocked for a minimum of five years after manufacture of equipment. Write or 'phone for catalogue.

KW

Serving Radio Amateurs World-Wide

Amateur Radio Products
DECCA COMMUNICATIONS LTD

Cramptons Road, Otford, Sevenoaks, Kent TN14 5EA. Tel: Sevenoaks (0732) 50911

Write or phone for catalogue.
*Easy terms available on equipment over 12, 18 or 24 months.

FRG-7 DIGITAL £180

LEE ELECTRONICS LTD

ESTABLISHED FOR MORE THAN TWO DECADES

KEN G8JVL

01-723 5521 CLOSED THURSDAYS

400 EDGWARE ROAD, PADDINGTON, W2

LONDON'S LARGEST STOCKISTS OF YAESU ● ANTENNA SPECIALISTS ● STANDARD ● ICOM ● BANTEX ● JAYBEAM ● REVCO ● QM70 ● ATLAS ● ETC

FRG-7—DIGITAL DISPLAY

Yes. The world famous FRG-7 is now available with digital read-out fitted by Lee Electronics in place of kHz dial .. .. .. **Special Price £180** + VAT

For customers who already own FRG-7's we can supply the digital read-out complete with installation instructions .. .. **£37.00** + VAT

FRG-7 Digital **£180** .. .. FRG-7 with analogue dial **£145.00**

FRG-7 Perspex cover as illustrated **£3.50** All plus 12½% VAT

YAESU MUSEN PRICES (ALL AVAILABLE FOR IMMEDIATE DELIVERY)

FT301 T/RX 1·8-30. 100W 12V	£485	FRG7 Digital	£180	FR101SD Digital Readout "S"	£387	YC500J 500MHz Counter 10 PPM	£210
FT301D Digital Readout '301	£585	FT221R 2m, "All mode"	£339	FR101DD Digital readout "D"	£480	YC601 Dig. Display 101 & 401	£110
FV301 External VFO	£65	FT227 10W, 400ch mobile, digital	£169.50	FT101E Transceiver	£429	YO301 Monitor scope	£123.50
FP301 PSU/speaker	P.O.A.	FT223 T/RX 2m, FM23ch 12V	£139.50	FL101 T.X. 1·8-30MHz 230V	£325	YO100 Monitor 2 tone osc	£139
FT200B T/RX 3·5-30	P.O.A.	FR101D DeLuxe "S" BC, FM	£480	FL2100B Linear 1·2kW PIP	£269	SIG80R T/RX. 2m. FM 80 × 25kHz 12V	£195
FP200B AC PSU/Speaker	P.O.A.			FT101EE T/RX 1·8-30 AC/DC	£408		
FRG7 RX·5-30 cont. AC/DC	£145						

ALL + VAT 12½% EXCEPT MONITOR SCOPE, CLOCK, COUNTER, WATTMETER, + 8%

MICROWAVE MODULES DESPATCHED TO ANY PART OF THE WORLD POST FREE

MMT144/28 Transverter	£79	**FREQUENCY COUNTERS**		**CONVERTERS**		ATV435/51 converter	£24
MMT432/28 Transverter	£97	MMD 050/50MHz counter	£62	MCC70, 4m converter	£18	MCC1296 converter 28 or 144MHz IF	£2
MMT432/285 with Oscar shift	£119	MMD 050/500MHz counter	£79	MCC70/LO, 4m converter	£20	All 2m converters can be supplied with IF outputs of 2-4-12-14-18-28MHz 70cm models with IF 'puts of 28-14-18- or 144MHz.	
MMT432/144 Transverter	£133	Divide by 10 prescaler, 500p	£25	MCC144, 2m converter	£18		
MMT432/144R with 1·6MHz shift	£151	**VARACTORS**		MCC144/LO 2m converter	£20		
MMP12/3 Power supply 12V, 3A stabilized	£50	MMV 1296, 23cm varactor	£33	MCC432, 70cm converter	£24		

ALL MICROWAVE MODELS SUBJECT TO VAT IN UK 8% ON FREQUENCY COUNTERS, ALL OTHER MODELS 12½%

A.S.P. MOBILE AND BASE STATION ANTENNAS

Asp201 ¼w 2m mobile	£3.25	Asp393 ½w 3dB 2m mobile	£17	Asp E462 70cm 3dB mobile	£7.23
Asp2009 ⅝ 3dB 2m mobile	£5.95	Asp no hole boot mount	£3.70	Asp E667 70cm 3dB mobile	£16.90
Asp629 ½w 3dB 2m mobile	£7.60	Asp magnetic mount	£8.95	Asp A659 UK 70cm 5dB, base antenna	£19.00
Asp677 ⅝ 3dB 2m mobile	£13.50	Asp cutter clip less cable	£3.85		

Special offer A.S.P. A680 U.K. 6dB 144/148MHz Co-linear Power handling 350W. Length approx. 12ft. List **£51** special offer **£41.50**

ICOM RANGE		**STANDARD RANGE**		**F.D.K. RANGE**		**ICOM ACCESSORIES**	
IC215 2m 8ch	£139	C146 2m H/held	£113.50	Multi UI (UII) 70cm mobile	£221	Extals S21 or S22	£4.50 pr.
IC215 2m 10ch (fitted 6 repeaters plus 4 simplex)	£144	C860 10W mobile	£130	Multi 11·2m mobile	£184	ER Case 202/215	£6.67
IC202 2m SSB	£152.00	C828 10W mobile	£159	Multi 2700 Fm/ssb. Tx/rx	£435	Mobile Bracket 202/215	£10.23
IC22A 10W mobile	£145	**KYOCUTO DIGITAL MODEL 2015**		**HELICAL ANTENNAS**		Helical Antenna	£3.25, p & p 25p
IC240 10W mobile	£159.10	10W mobile 400ch Tx/rx	£245	2m with 13 BNC	£3.85 each		
IC245E 10W FM/SSB	£352			2m with ph 259	£3.85 each		
IC211E 10W FM/SSB	£470	**J-BEAM ANTENNAS**		2m for IC215, Trio 2200 Gx, standard C146A	£3.25	**J.V.L. 6dB CO-LINEAR**	
All transceivers + 12½% VAT		ALL MODELS IN STOCK		All + post 25p. + 12½% VAT.		DC grounded, low angle radiation pattern, fully adjustable for max gain and min SWR **£29.00** + £1.50 p & p	
						All above items + VAT 12½%	

SPECIAL OFFER. Constant current Ni-Cad chargers. Adjustable charge rate for AA or C type Ni-Cads. Ideal for C202/215, C146A, Trio, etc. Price **£8.35** + 8% VAT. p & p 50p.

SUPER-SCAN

Manufactured for us, and designed exclusively for use with the IC240. Note these star features ★ Scans 40 channels in 25Kc/s steps. ★ Locks out unwanted occupied channels ★ Adjustable scan rate ★ Adjustable phase period ★ Manual mode feature ★ Automatic ±600kHz shift of TX frequency when repeater mode is selected ★ Large six digit display shows frequency to 5Kc/s ★ Display always shows frequency in use including TX frequency when PTT is operated. ★ Call for demonstration.

Price **£69.00** + 12½% VAT post free

SPECIAL NOTICE! The above Super-scan unit is terminated with 14-pin plug to plug into rear of IC-240, but customers' IC-240's have to be wired with socket to accept the above unit. We can carry out the above modification if required—price **£6** inc VAT and return postage.

EXPORT ENQUIRIES WELCOMED

FREE PARKING AT REAR OF SHOP

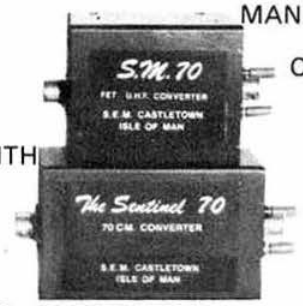
S.E.M.

MANUFACTURERS AND SUPPLIERS OF COMMUNICATIONS EQUIPMENT

PO BOX 6, CASTLETOWN, ISLE OF MAN
Tel: Port Erin (0624) 833714 or Marrown (0624 85) 277

WE WILL CONCENTRATE ON 70cms THIS MONTH

All our other converters, pre-amplifiers, power amplifiers and Z match are in stock. For more data, refer to previous ads, ring or write.



THREE NEW 70cm PRE-AMPLIFIERS

THE SENTINEL 71

A two-stage, highly selective, stripline circuit giving 3dB NF and 18dB gain. Size: 2½ by 1½ by 3in boxed unit. Price: **£12.00** + VAT = **£13.50** with Belling Lee sockets, or **£1.50** + VAT = **£1.69**, extra for SO239 sockets. Both Ex STOCK.

THE PA3/70

Same performance as the SENTINEL 71. Printed circuit board only 1¾ by 1¾ by ½in deep for installation inside your transceiver. Price: **£8.00** + VAT = **£9.00** Ex STOCK.

THE SENTINEL 70 AUTO PRE-AMPLIFIER

Same performance as the others but with an automatic RF changeover relay for putting in the aerial co-ax of your transceiver. Size: 2½ by 1½ by 4in. Price: **£18.00** + VAT = **£20.25** with Belling Lee sockets. For SO239 sockets add **£1.50** + VAT = **£1.69.**

70cm CONVERTERS

SEM 70 70cm TO 2 METRE FET CONVERTERS

Performance is 3dB NF 30dB gain. Size: 1½ by 2½ by 3in. Available in three different versions.

432–434MHz – IF output 144–146MHz. Price: **£18.00** + VAT = **£20.25**
434–436MHz – IF output 144–146MHz. Price: **£18.00** + VAT = **£20.25**
Switched 432–434MHz and 434–436MHz – IF output 144–146MHz. Price: **£25.00** + VAT = **£28.12.**

SENTINEL 70 70cm to 10 METRE FET CONVERTERS

Performance is 3dB NF 30dB gain. Size: 1½ by 2½ by 4in.
Also available in three versions.

432–436MHz IN – 28–30MHz OUT. Price: **£20.00** + VAT = **£22.50**
434–436MHz IN – 28–30MHz OUT. Price: **£20.00** + VAT = **£22.50**
Switched 432–434 and 434–436MHz to 28–30MHz. Price: **£27.00** + VAT = **£30.37. All Ex Stock.**

All our equipment is guaranteed for 12 months. For more details on any of our equipment, please ring or write.

To Order: CWO or credit card. Just 'phone your credit card number for same day service.

ALL OUR EQUIPMENT WILL BE AVAILABLE AT THE RALLIES FROM THE AMATEUR RADIO SHOP, HUDDERSFIELD.

REG. WARD & CO. LTD.

G2BSW G8CA

K.W.
103 VSWR Meter and combined Power Meter **£23.00**
107 Combined E-Z March, VSWR and RF Power Indicator, Dummy Load and Antenna Switch for 3 outlets **£108.00**
KW Dummy Load, 50Ω (encased with SO239) **£20.00**
Trap Dipole Co-axial Feeder **£26.00**
3-way Antenna Switches (for co-ax) **£7.50**

SHURE MICROPHONES
Model 444 **£25.26**
Model 201 .. .. **£9.50**

YAESU
FT101E Transceiver .. **£429.00**
FT200B Transceiver and FP200 PSU **£330.00**
Yaesu 301D all solid state tcvr **£599.00**
FR101 S Receiver .. **£299.00**
FR101 D Receiver .. **£390.00**
YD844 Desk Mic **£18.00**
YD846 Hand Mic **£7.50**
YH55 Headphones .. **£8.00**
SP101B Speaker **£15.00**
YO100 Monitorscope .. **£118.00**
FT221 .. .. .. **£339.00**
New G/C Receiver FRG.7 **£144.00**
S.E.M. Z-match **£28.00**

All above prices plus VAT at 12½%. NB– 'Test Equipment', VAT at 8%. includes SWR/PWR meters and dummy loads.

USED EQUIPMENT

KW201 Rx and handbook, with external Heathkit "Q" multiplier, **£130.00**

AGENTS FOR G2DYM ANTI-TV ANTENNAS, AND BALUNS

Valves for Yaesu, etc, 6BZ6, GU8, 6KD6, 12AX7A, 12BY7A, 12AU7, 6JS6C, 6146, 6HF5, 6LQ6, 6EA8, 6GK6, 6146B, 6KD6, RCA Valves for KW equipment, etc.
Sentinel 2m Preamps and 2m convertors/Europa transverters, J Beams and Stolle rotators. 140' 14g ant. wire, insulators, 52 & 75 ohm co-ax, and UHF plugs, sockets and reducers, G-Whip mobile antenna, Wightraps, Mast Couplers. Hy-Gain verticals, SWR 10 (Twinmeter), SWR/PWR Meters.

AMTRON KITS

TRADE INS WITH PLEASURE, OUR STOCK OF GOOD SECOND-HAND EQUIPMENT CHANGES DAILY—LET US KNOW YOUR REQUIREMENTS.
Due to currency fluctuations prices of imported equipment are liable to alteration.
ADD 12½% VAT to all prices except used equipment.
HP TERMS AVAILABLE *CARRIAGE EXTRA ON ALL ITEMS*

ACCESS/BARCLAYCARD

AXMINSTER, DEVON EX13 5DP Telephone 33163

G. W. M. RADIO LTD.

ALL PRICES include VAT and Post/packing

PLUG-INS for CD1212 OSCILLOSCOPES. Dual Trace Unit CX1252 or 40Mc/s Wide Band Unit CX1251, clean and as bought from Ministry, **£25** each.
C.R. TUBES for Hartley 13A 'scopes, **£15.**
CALLERS ONLY. Various MF and VHF non-spec. Marine installations. Condition 'as is' to overhauled, from about **£25.**
RECEIVERS PCR2. A few more of these wartime 'amenity' sets, good performance on short waves but no BFO. No PSU. Needs 250v DC and 12v. **£12.**
31 TRANSCEIVERS, no accessories, **£8.** R. F. FILTERS, clean up your supply leads, 2·5 amps at 250v AC or 600v DC. A quality item, **£1.25** or 5 for **£4.** A few PFI re-chargeable batteries, **£5.50** a pair.
UHF board etc all sold as previously mentioned but we still have the 9 channel conversion kits at **£3.50,** or the high pass aerial lead filters at **£2.**
AIR TRAFFIC CONTROL 10 watt AM Transmitter by GEC, 19" rack mounted, AC supply built in, only needs crystals and tune for 2 metre operation. **£16.00.**
RADIO TELEPHONES. all Low Band and all LESS accessories. All 12V.
ULTRA VALIANT MR4A61. AM Solid state receiver, 3 quick heat valves in TX **£11.50. COSSOR COMMANDO CC300** series. Similar spec. to Valiant. AM PA and driver valves missing (QQZ03-20 and QQZ03-10), **£7.50. STORNO VISCOUNT** FM QQV03-10 PA and valve front end, IF, AF and PSU solid state **£7.50.**
SIGNAL GENERATORS. Oscillator Test No. 1, CT212, covers 85kc/s to 32Mc/s in 7 bands. AM-CW-FM Attenuator 1 Microvolt to 1 volt. AC Mains or 12V DC. Complete with leads, checked over and operable. Compact and well made, **£27.50.**
EXECUTIVE leather open-flat tool case, like brief case when closed. As new with keys, **£12. PRECISION** DC Voltmeters. 0-3, 0-50V, approximately 7" mirror scale. Polished wood box, excellent condition, **£15.**
BC221 FREQUENCY METERS. Complete will charts, less power supply. These are recently recalibrated, **£20.**
VALVE VOLTMETERS CT208. Mains powered, 1-100v DC 1.5-150v AC. Complete probe and mains lead, **£18.**
NOISE GENERATOR CT410. 15kc/c-160MHz, 8 minute timer, 5-25-100 ma Diode Current, metered. Output impedance 10-2000 ohms, attenuator and power meter. AC mains powered, **£14.**
AKG Lightweight **HEAD & MIKE SETS,** model K58. Mike 2/300 ohms, headphones 75 ohms. Ideal for Mobile use and in excellent condition. **£5.50.**

Carriage charges are for England and Wales only.
Terms: Cash with order **Early closing Wednesday**

G. W. M. RADIO LTD. 40-42 PORTLAND ROAD, WORTHING, SUSSEX Telephone 34897

William Munro (Invergordon) Limited

distributors for

NEC Amateur Radio Equipment

NEC NEC

CQ110E DIGITAL READOUT TRANSCEIVER

Frequency Range	10M to 160M
Modes	LSB USB CW AM FSK FAX/SSTV
Power Requirements	100/234V AC or 13·5V DC
Input Power	280W PEP (240W on 28MHz)

CQ 201 EXTERNAL DIGITAL READOUT VFO

Three Outputs	5·0-5·5MHz 8·2-8·7MHz 8·9-9·4MHz
Frequency Counter	10Hz to 30MHz
Output Voltage 2V (p-p)	Impedance 50-100ohms
Counter unit input Level	0·1V (p-p) 100Hz > 1V (p-p) 100Hz >
Power Requirements	100/234V AC

CQ 301 LINEAR AMPLIFIER

Frequency Range	10M to 160M
Mode	LSB USB CW AM
Power Requirements	100/234V AC
Max Input	2KW SSB 1KW AM
Drive Power	100-200W
Circuit	2 × 3-500Z in Grounded Grid A1

M110 DESK MICROPHONE

Dynamic Unidirectional—Impedance 50K—Frequency Range 200-10,000Hz Flexible Shaft with diecast base for stability and two position Switch.

SP110 EXTERNAL SPEAKER UNIT/DIGITAL CLOCK

High Quality Speaker Unit 4W 8ohm range 180-8000Hz. Digital Clock with 7-segment display, with 59 minute sleep timer, and 24 hour alarm setting with two AC outlets one unswitched and one switched controlled by clock. Power Fail Indication. Power Requirements for Clock 100-234V AC and 50/60Hz switch Selection.

★ ★ ★

IN 1978 WE SHALL BE ANNOUNCING EVEN MORE INTERESTING EQUIPMENT FOR THE DISCERNING AMATEUR

★ ★ ★

NEC **IN ADDITION TO OUR OWN SHOWROOM YOU CAN TEST AND EXAMINE NEC EQUIPMENT AT:** NEC

AMCOMM SERVICES, 194A Northolt Road, South Harrow, Middlesex. Tel 01-864 1166

THANET NORTHERN, 64 High Street, Wombwell, Yorks. Tel 0226 756229

TONY BLACKMORE, 2 Joseph Parry Close, Llandough, Penarth, S. Glamorgan CF6 1PL. Tel 0222 702982

L. A. WILES & SON, Aisthorpe, Scampton, Lincoln. Tel 0522-71-351

★ ★ ★

WE ALSO STOCK

Antennas and accessories—Microwave Modules—Polar Electronic Developments—Modular Communications Systems—Antex Products—Components, Semiconductors etc.

USED EQUIPMENT available at time of preparation of copy as follows:—FT301D, FP301, FR101D, IC202, MEL25/202P and a Hallicrafters SX101A (for customer)

Telephone 0349 852351 **100 HIGH STREET, INVERGORDON, ROSS-SHIRE V18 0DN** **Telex 75265**

ACCESS **BARCLAYCARD** **HIRE PURCHASE**

Your Route to 70cm Repeater Operation

THE MMT 432/144-R

This double conversion linear transverter, MMT 432/144-R now includes a 1·6MHz shift, specifically included for UK repeater operation.

The 1·6Hz shift is achieved by the inclusion of two separate local oscillators (101MHz and 101·4MHz), which produce two ranges at 70cms (LOW RANGE: 432–434MHz, HIGH RANGE: 433·6–435·6MHz), both for an IF of 144–146MHz. The switching of these ranges, which is accomplished by appropriate linking of the 5-pin DIN power plug, may be wired to allow standard repeater operation, reverse repeater operation etc.
Please note that a suitable toneburst signal must be generated by the 144MHz transceiver to allow repeater access.

FEATURES

- ★ 1·6MHz repeater facility or simplex
- ★ Highly stable regulator-controlled crystal oscillator stages
- ★ Pin diode aerial changeover relay with less than 0·2dB through-loss
- ★ Extremely low noise receive converter
- ★ Built-in automatic RF vox with override facility
- ★ Separate internal PA compartment ensures excellent electrical and thermal stability
- ★ Use of latest state of the art power amplifier transistors provides reliable 10 watts continuous power output

SPECIFICATION

Frequency coverage:	432–434MHz (low range) 433·6–435·6MHz (high range)	Receive converter noise figure:	3dB maximum
		First oscillator:	101MHz or 101·4MHz
Selectable Offset:	1·6MHz	Second oscillator:	116MHz
Input frequency range:	144–146MHz	First if:	28MHz
Input modes:	SSB, FM, AM or CW	D.C. power requirements:	11–13·8 volts, 12·5v nom
Input drive for full output:	10 watts nominal	Current consumption:	2·1 amps peak
Power output:	10 watts continuous rating	RF connectors:	50 OHM BNC sockets
Output impedance:	50 OHM	Power connector:	5-pin DIN socket
Relative 404/405·6MHz output:	Better than–65dB	Size:	187 by 120 by 53mm
Other spurious outputs:	Better than–65dB	Weight:	975g
Receive converter gain:	10dB typical	Price:	£151+ VAT. (£169.88 inc. VAT)

MICROWAVE MODULES LIMITED

BROOKFIELD DRIVE, AINTREE, LIVERPOOL L9 7AN

TELEX: 628608 MICRO G TELEPHONE: 051-523 4011

L. HARDIE GM2FHH)

YAESU	YC-500J Freq. counter	£286.00
	FRG-7 Gen cov Rx. Anal.	£162.00
	FRG-7 Gen cov Rx. Digital	£223.00
	FT-227R FM 2m Transceiver	£189.00
	QTR-24 World clock	£25.66
DRAKE	SSR-1 Gen cov Rx	£150.00
GRUNDIG	Satellit 2100 (list £278)	£220.00
	SSB Adapter SSB2000	£20.00
JAYBEAM	Most antennas ex stock:	
	Kenrotor KR-400	£95.00
	Stolle 2010	£49.00
	RZ-100	£12.96
USED EQUIPMENT		
	Drake SSR-1 as new	£130.00
	Drake T4X gud cndx.	£200.00
	Heathkit HR-1680 as new	£160.00
	Heathkit DX-100/SB10	£75.00
	2DAF Linear in 5'6" Rack with Variaced PSU in VGC (Buyer collects)	£80.00

RSGB Publications. Towers Transistor Selector (13,000 Transistors listed). Radio Tools. R.S. Components. We stock thousands of bits & pieces. Try us for plugs, sockets, cables, components. All prices include VAT. Carriage extra. Shop hours 09.30–13.00 & 14.15–17.30. Early closing Wed.

542 George Street, Aberdeen AB2 3XL
Tel: 0224 20113

HARRY COLLINS

ST. TERESAS, ELY ROAD, WATERBEACH, CAMBRIDGE
TELEPHONE (0223) 860555

Prices quoted inclusive of VAT. Callers welcomed by appointment. Cash with order. Postage and Carriage extra.

Electrolytic capacitors, 2200 pF, 40V, **25p** each; 1000pF, 16V, **10p** each; 64pF, 100V, **35p** each; 16 & 32pF, 350V, **50p** each; 900pF, 100V, High grade screw terminals **35p** each.
Skeleton Presents. 47Ω, 470Ω, 2.2k, 4.7k, 10k, 22k, **5p** each.
P.C. Board Pots. 250r, 330R, 5k, 10k, 68k, **10p** each.
Monitor Cathode Ray Tubes, M38, 100WA/S, **£10** each.
Wirewound Multiturn Pots, 5000Ω, 10p each.
Base Station Receivers, Type 30, **£7** each.
Colour Television Monitor Scan Coils, Type M38 **£1** each.
Self-return Toggle Switches, 10p each.
Camera Pan and Tilt Controls (Inc. 4 micro-switches), **£1** each.
Phillips Fluorescent Tubes, 6" 4W Pi-Pin **50p** each, 21" 13W Pi-Pin, **£1** each.
Pye 50 Watt VHF Transmitter with local and remote 125–15G MHz, **£85** each.
PF1 Battery Chargers, 12-way, **£15.**
Controls, Miniature 100k ON/OFF Sw., **15p** each; 500k ON/OFF Sw., **10p** each.
Assorted Boards, With capacitors, resistors, transistors, etc. (Useful for spares).
Cathodeon Crystals Ovens, HC6/V, **25p** each, 10 at **£2.**
Vidicon Scan Coils (Pye LYNX). Brand New, **£3** each, 10 at **£25.**
Pocket 'Phones, £18 per pair: Covers, **30p** pair.
Colvern Wirewound Multiturn Pots, 5000 Linear, **30p** each.
5 Henry Chokes, 600M/A, **£4** each.
Relays Various 4 at **£1.**
Jack Field Plugs and Sockets, 20p Pair.
Venner Synchronise Motors, 240V 50c/s, **£1** each.
Pye W15 AM Westminster weather-proof Freq. 146–154 complete, **£75** each.
Pye F27, 99.7–99.7; AMV, 82.3–86.7; AM5, 138–105, **£80** each.

UHS Starphone	£80	**Dawe DC VVM** Type 611A	£40
Lowband AM Starphone	£100	**Marconi VVM** TF1100	£40
Marconi DEV Meter TF7910	£90	**Marconi VVM** TF1041	£40
Pye High Band FM Pages (Sentinel) with chargers	PG1 £20	**Single Sided P/C Board, Double Sided P/C Board, £1** sq.ft or price on quantity, or cut to order.	
1 only Fursehill Spec. Analyser (up to 30MHz)	£50		

GAREX (G3ZVI)

BRITISH MADE VHF EQUIPMENT
TWOMOBILE FOURMOBILE

Companion units for 2 or 4 metres. They feature Tx, Rx and PSU for 12V DC input in a single unit 12 × 8 × 4". **Full coverage tunable** AM/FM Rx with excellent VFO stability even under mobile conditions. Professional grade sensitivity AND selectivity. Crystal controlled AM/FM Tx, with superb audio quality. Based on popular R/T components for ease of servicing and ready availability of spares. Comprehensive handbook and low-cost after-sales service. Prices: **Twomobile £135; Fourmobile £121.50** (inc. VAT).

We stock the popular **NR56VF-1 2m Rx,** with switched 144–146MHz VFO and 11 xtal controlled channels, ideal for fixed, portable or mobile use. Built-in LS, 12V DC operation. **£54** inc. VAT. (xtals **£2.50** each).
NOW WITH IMPROVED VFO—EXCLUSIVE TO GAREX
SR-9 Marine Band Rx (156-162MHz) similar to NR56 **£59.40** (xtals **£2.79**).

An sae brings you full details of any of the above. Credit facilities available and part-exchanges welcome.

NEW COMPONENTS:
Relays 6v coil, 25A contacts, SP make **80p**, 2P make **90p**
GPO type 3000, 1Ω coil, pull-in current approx 200mA. 1M + 1B contacts, ideal for psu cutout. **80p** each, 5+: **70p.**
Integrated circuits: 723 (TO5), **75p**; SN76660, **75p**; CD4001AE, **25p**; NE555, **55p**; 709 (TO5), **30p**; 741 (DIL 8), **30p**; 7410, **25p.**
Rectilinear pots multiturn, preset, pc mtg.
10, 20, 25, 100, 250, 500, 2·5k, **35p** each, any 5+: **25p.**
BNC **50ohm free sockets, 20p** each; 12 for **£1.45**; 50 for **£4.90.**
Neons Panel mounting, type JH8, 8mm hole, 240V, red, amber or clear; **35p** each, any 5+: **30p**, 10+: **27p.**
Miniature, wire end **8p** each, 10+ **6½p**, 100+: **4p.**
LED's Panel Mounting, type JH5, 6·5mm hole, red: **48p**, green or amber; **72p** Any 5+, less **10%.**
Logic probe type JH320, **£11.95.**
Resistor Kits. E12 series, **22Ω to 1M, 57 values,** 5% carbon film, ⅛W or ¼W (please state). **Replenishments available**

Starter pack, 5 each value (285)	**£2.95**
Mixed pack, 5 each ⅛W + ¼W (570)	**£5.40**
Standard pack, 10 each (570)	**£5.40**
Giant pack, 25 each (1425)	**£13.25**

PL259 UHF Plugs + reducer **68p** each, 5+: **60p.**
SO239 UHF Socket panel mtg. **55p** each, 5+: **45p.**
NICAD RECHARGEABLES—physically equivalent to zinc-carbon types. AAA(U16) **£1.64**; AA(U7) **£1.15**; C(UII) **£3.15**; D(U2) **£4.94**; PP3 **£5.20. ANY 5**+: less 10%; **ANY 10**+: less 20%.
Slide switches, min. DPDT **18p** each; 5+: **14p.** 2 pole 3 position **22p** each; 5+: **18p.**
Toggle switches, min. full range SP thro' to 4P C/O/sae list.
GAREX FM detector conversion ready assembled with full fitting instructions. Tailor made, easy-fit design for AM Cambridge, replaces squelch board with minimum of other modifications, **£5.40.** Transistor Vanguard (AM25T) version with modified squelch circuit, **£5.94.** FM/AM facility requires SPCO switch or relay.
CRYSTALS FOR 10 METRES: (HC25U) 28.500MHz Tx plus 28.045MHz for Rx (455kHz I.F.) make that "C.B." w/t legitimate **£4.50** pair.

INTER SERIES ADAPTOR KIT. Super value, up to 40 different combinations of BNC, UHF, N, TNC & C series connectors, male and female. Complete in PVC wallet. **£19.95.**

We are stockists of **REVCO** aerials for VHF—Amateur, glider, and PMR band types available.
Authorised distributor for **J. H. Associates Ltd,** professional quality switches, indicators and special products.
Lists available covering Revco & J. H. products.

EX-EQUIP ITEMS (GUARANTEED)
Aerial relays (Pye), 12V coil, **£1.30.**
455kHz filters (50kHz ch. spacing) **Hi or Lo** impedance, **£1.**
455kHz AM IF strips ex AM25B, with cct. **£1.35.**
Mains transformers, multitap primaries

345-0-345V 150mA, 5V 2A	**£4.45**
275-0-275V 220mA, 5V 4A	**£4.45**
Auto 0-100-110-150-200-230-240-250, 200VA	**£3.65**

HT chokes, 5H 80mA, 4H 240mA, 1·25H 350mA, 1·8H 125mA **£1.55**
Butterfly trimmers large 2 × 17·5pf, 2 × 10pf **85p**
10·7 IFT (valve type) 2½" × ¾" square double tuned **35p**; 2 for **45p**; 6 for 95p
Mobile PSU 12V DC input (floating for + or − E) transitor inverter 170, 220 or 380V DC at 180mA, output, fully smoothed, chassis section, self-contained, fully wired and tested, with circuit. **£5.45**
As above, put partly assembled (as cut out) complete with all components, circuit, finish-it-yourself **£4.60**

PRICES ARE INCLUSIVE OF UK POST AND PACKING AND VAT

Mail order only. Sole address for orders and enquiries
GAREX ELECTRONICS
7. NORVIC ROAD, MARSWORTH, TRING, HERTS HP23 4LS
PHONE CHEDDINGTON (STD 0296) 668684
6.30pm-9pm AND WEEKENDS ONLY SAE with all enquiries please.

G8CZW Digital Frequency Meter

Complete 50MHz kit **£54.00** inc VAT, post free (UK)

	£		£
ZN1040E Count/Display IC	8.10	Hardware and Wire Pack	1.45
Integrated Circuit Pack	9.25	Case. Two-tone pvc-faced steel, punched and lettered (+95p P & P)	5.75
Displays and Filter Pack	7.78	Min BNC Sockets (50Ω)	0.65
Semiconductor and Diode Pack	2.47	Min BNC Plugs (50Ω)	0.70
Resistor and Capacitor Pack	3.10	500MHz Prescaler Kit	1.78
Logic and Display PCBs	4.84	SP8631B 500MHz IC	8.96
5MHz Crystal	3.45	NE592 Wideband Video Amp	1.43
Transformer 8-0-8VO·5A (−75p P & P)	2.48	DFM Reprint (post free)	0.50
Switches, Knob, BNC's etc.	4.15		

NEW! **Hi-Z Buffer Kit enables DFM to count below 100Hz £6·50 (inc P & P)**

G8CZW Digital Voltmeter

Complete kit **£44.30** inc VAT, post free (UK)

	£		£
ZNA116E 3½ Digit IC	6.48	Hardware and Wire Pack	1.20
Integrated Circuit Pack	5.24	Case, Two-tone pvc-faced steel, punched and lettered (+95p P & P)	5.75
Displays and Filter Pack	7.78	IC Sockets Pack	1.08
Semiconductor and Diode Pack	2.60	Transformer (+75p P & P)	2.48
Resistor Pack inc cermets	4.64	5V Reg, 2 Rect, 2,000μF Cap, Mains SW, Fuse and Holder	3.75
Capacitor Pack	1.58	DVM Reprint (post free)	0.35
Logic and Display PCBs	2.05		
Voltage Attenuator Pack	0.68		
Range Switch 6P 4-way	2.38		

All prices inc VAT at the standard rate. Please add 20p P & P for packs. SAE for full lists.
Overseas—Deduct 8% off these prices.

Designer approved

ELECTRONICS (OLDHAM) LTD
83 Lees Road, Oldham OL4 1JW
Tel: 061-624 8812

ATTENTION FT-101, FT-301, TS-520 & TS-820 OWNERS: for unbeatable CW performance we offer as direct replacements for existing filters, purpose designed 250Hz 8 pole filters—**£25.50.**
MONOLITHIC CRYSTAL FILTERS, 3 LEAD HC18/U can size 3dB BW 20KHz, 20dB BW 60KHz, 9.0 & 10.7MHz—**£3.70,** 21.4MHz **£5.20.**
CRYSTAL DISCRIMINATORS—avoid the need to convert to 455KHz. Extract quality audio from the 1st I.F. 9.0 & 10.7MHz **£13.50,** 21.4MHz **£14.30.**
TBG-2 Tone Burst Generator **£8.00.**
SAE please for further data on above. Add 12.5% VAT.

INTERFACE QUARTZ DEVICES LTD
29 Market St, Crewkerne, Somerset.
Tel: (0460) 74433. Telex: 46283

G2DYM ANTI-TVI TRAP DIPOLES

CUT OUT TVI TX-ing and SWL-ing MODELS:—
SWL, **£29.81**; 500 Watt or SWL, **£41.06**
2KW, **£46.68**; all complete inc. 75ft feeder.
VAT and CARRIAGE. Send 10 by 7in 12½p s.a.e. and 3 × 9p stamps for details, aerial article, test reports, testimonials.
LAMBDA, WHITEBALL, WELLINGTON, SOMERSET

HIRE! BUY! or HP!

Two metre and 70cms Receivers/Transceivers, etc, by MICROWAVE MODULES, ICOM, FDK.

ASP ANTENNAE FOR 2 METRES AND 70 CMS MOBILE, from £6.62

EXAMPLES:

IC-240 2 metre mobile Tx/Rx fully synthesised, NO XTALS to buy. Simplex, Duplex, Reverse Repeaters, Auto Toneburst.
TO BUY: **£179.00**
TO HIRE: **£14** per month for 12-month period.
HIRE PURCHASE: Deposit **£36**. Over 12 months **£13.64** per month.
TOTAL PAID = **£199.70**
Over 24 months **£7.69** per month.
TOTAL PAID = **£220**
ALL PRICES INCLUDE VAT. SEND SAE FOR HIRE CONDITIONS

SECOND-HAND BARGAIN CORNER

IC22A. 10 channels auto Toneburst. A fine mobile Tx/Rx, 2 metres, **£120.**

MICROWAVE MODULES TRANSVERTER 144 metres to 70cms = **£125**
MULTI-11 Auto Scan Mobile 2M Tx/Rx = **£165**
QUARTZ 16 2 metre Mobile Tx/Rx = **£135**

All from

BOOTH HOLDINGS BATH

6 Golf Club Lane, Saltford, Bristol BS18 3AA

Telephone
Saltford (022-17) 2402 After 7pm for G3NXU (B. Booth)
Windsor (075-35) 51767 After 7pm for G8DPH (T. A. Booth)
London (01-723 3167) Daytime for G8DPH (T. A. Booth)
Bristol (0272) 712730 After 7pm for G3XOD (R. Horsman)

INCORPORATES HAM HIRE AND RENT-A-RIG
MEMBER OF TAFA

T.D.S. 2-METRE PRE-AMP

Everyone knows how good the SD 306 is. By incorporating this device into our pre-amp we can offer you superb cross modulation performance together with a low noise figure.

TYPICAL SPECIFICATION

Noise figure:- 1.6dB — Gain 22 DB — cross mod 1% with 100mV interfering signal — Size 1.7" x 1.1" x 0.5" — Power 9-15V (negative earth) **Price £6.50.**

PIP TONE

For SSB Dx ops. Meets home office requirements (see QTC Rad. Com. Feb. 78).
Small PCB only **£4.95.**
C.W.O. Mail order only — 30p p.&p. on all orders.
T.D.Services, Ruislip, Middx.

FM CRYSTALS – prompt service
2 metre Channel S18 (145·450) now available from stock
Tx ranges 4, 8MHz in HC6/U; 6, 12, 18MHz in HC25/U
Rx ranges 10, 44MHz in HC6/U; 14, 44, 52MHz in HC25/U
Other channels available in same ranges:
S0 (145·0), S8 (145·2), S16, S20–25, S32 (145·8), R1–R8
70cm Channels SU8, SU20, RB0, RB2, RB6, RB10, RB14
12MHz Tx and 84MHz Rx in HC18/U (Pocketphone)
24MHz Tx and 34MHz Rx in HC25/U (Starphone)
Inclusive price **£2.90** each 10% discount on 10 or more

Made-to-order crystals 2–105MHz 30ppm **£3.60** each, del. within 6 weeks.

HARTLEY CRYSTALS Phone 04 868 7597 Giro 35 563 4007
Green Lane, Milford, Godalming, Surrey GU8 5BG

"Mosley"—the tested and proved Antennae

TOWERS ROTATORS COAX ROPES

Send for HANDBOOK containing full details of Antennas and other technical information. 33 pages **50p.** *Refundable upon purchase of Antennas.*

SOME ANTENNAS

Mustang	3 Elements, 10, 15 and 20 metres ..	**£118.00**
TA-33 Jr.	High power Model incl. Balun 3 Elements, 10 15 and 20 metres ..	**£108.00**
TA33 Jr.	3 Elements, 10 15 and 20 metres ..	**£95.00**
TA32 Jr.	2 Elements, 10, 15 and 20 metres ..	**£64.00**
TA31 Jr.	Rotary dipole, 10, 15 and 20 metres	**£40.00**
ELAN	3 Elements, 10 and 15 metres ..	**£76.00**
TD-2	Trap Dipole, 40 and 80 metres ..	**£33.00**
TCD-2	Trap Dipole, 40 and 80 metres compressed	**£40.00**
V-3 Jr.	Trap Vertical, 10, 15 and 20 metres ..	**£29.00**
Atlas	Trap Vertical, 10, 15, 20 and 40 metres	**£50.00**

SWL ANTENNAS

SWL-7	Dipole 11, 13, 16, 19, 25, 31 and 49 metres	**£27.00**
RD-5	Dipole 10, 15, 20, 40 and 80 metres	**£27.00**
Orbit	Vertical 11, 13, 16, 19, 25, 31 and 49 metres	**£45.00**

Prices correct at time of going to press

MOSLEY ELECTRONICS LIMITED
Administrative Address only

196 Norwich Road,
New Costessey,
Norwich NR5 0EX
ENGLAND

(All antennas available ex works carriage and VAT extra)

CB ELECTRONICS G3LRB

UNIT 3, 771 ORMSKIRK ROAD, PEMBERTON
WIGAN WN5 8AT Phone Wigan (0942) 216567

THE BEST IN THE NORTH-WEST

The people with a wealth of technical experience and know-how relating to amateur radio techniques, requirements and servicing, who will always be pleased to advise and assist in all respects whether it be sales, service or information.

HOW TO FIND US

From M6 Junction 26 follow signs for Wigan A577. At first traffic light (T junction) turn right towards Wigan. At next traffic lights you are there **BUT** turn left, then 10 yards turn right **BY CO-OP** (Telephone kiosk) and shop is slightly to your right. Plenty of parking space. Distance from motorway ½ mile.

From Wigan follow A577 for Skelmersdale to traffic lights at Pemberton (Ye Olde White Swan Hotel on your left). Turn right then 10 yards and right again by telephone kiosk. Distance from Wigan 2½ miles. *Closed Wednesday*

AT LIST PRICES
YAESU
UNIDEN
ELECTRONIC DEVELOPMENTS
J. BEAM LTD.
HY GAIN
C.D.E.
BELCOM
S.S.M.
WESTERN ELECTRONICS
F.D.K.

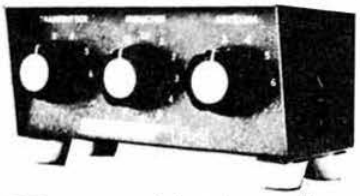
MICROWAVE MODULES
ANTENNA SPECIALISTS
S.C.S. LINEARS AND PREAMPS
EMOTATOR ROTATORS

Part exchanges welcome
H.P. and credit terms
S.A.E. all enquiries

AMCOMM SERVICES

194a NORTHOLT ROAD
SOUTH HARROW,
MIDDLESEX, ENGLAND

SST T-2 ULTRA TUNER



Tunes out SWR on any coax fed antenna as well as random wires. Works great on all bands (160-10 metres) with any transceiver running up to 200 watts power output.
Increases usable bandwidth of any antenna. Tunes out SWR on mobile whips from inside your car.
Uses toroid inductor and specially made capacitors for small size: 5¼" × 2¼" × 2½". Rugged, yet compact. Attractive bronze finished enclosure. SO-239 coax connectors are used for transmitter input and coax fed antennas. Convenient binding posts are provided for random wire and ground connections.

ONLY £32.50 inc. VAT and carriage

SST T-3 IMPEDANCE TRANSFORMER

Matches 52 ohm coax to the lower impedance of a mobile whip or vertical. 12-position switch with taps spread between 3 and 52 ohms. Broadband from 1-30 MHz. Will work with virtually any transceiver—300 watt output power capability. SO-239 connectors. Toroid inductor for small size: 2¾" × 2" × 2¼". Attractive bronze finish.

ONLY £13.40 inc. VAT and carriage

GUARANTEE All SST products are guaranteed for one year

RSGB PUBLICATIONS
MAPS, CHARTS, SUNDRIES, ETC.
LES HAWKYARD, G5HD
100 SHIRLEY HIGH STREET SOUTHAMPTON, SO1 4FB
TEL. 773378 9-5.30 WEEKDAYS

JAMES & MARTIN ELECTRONICS LTD
Staines Road, Feltham, Middx.
PROTOTYPE AND PRODUCTION METALWORK
Specialists to the Electronics Industry. Panels, chassis and sheet metal details. Milling, turning, drilling. Machining in all metals and plastics. G3VVB.
Tel. 01-570 3127 **OS Ref TQ 113748**
Plant list on application.

FROM G8MWW
UR43 COAX – 50 ohms @ 13p per M, pp 2½p per M
UR95 COAX – 50 ohms Miniature Nylon @ 5p per M, pp ½p per M
100m Eq Wire – 5m × 20 colours, stranded, £1 post 30p
300 Mixed RESISTORS – Carbon film for £1.20 post 50p
75 ohm – High quality low loss TV Coax @ 15p per M, post 2½p per M
300 ohm – Twin ribbon Feeder @ 8p per M, post 1½p per M
REVCO Professional Solder Suckers, £6.00, post 60p. **10 mixed new** Miniature Xtals, my choice, for £1, post 10p. SAE for full lists of Xtals & Cables.
W. H. WESTLAKE, CLAWTON, HOLSWORTHY, DEVON

ONLY GETTING HALF RESULTS FROM YOUR FT.200, FT.101/B/EE/E?

Ask for our FT.101 "Bits & Pieces" and mod. list or details of our G3LLL RF Clippers—FT.101 £48 inc. VAT. FT.200 £49.50 inc. VAT.

G3LLL's RF CLIPPER

★ More receive gain & selectivity ★ Terrific audio punch ★ Simple to fit ★ On approval service (send 6-week post dated cheque) Cash, Access or Barclaycard ★ Free Shure 201 Mics or half price 444 Mics with clippers to UK stations ★

YAESU EQUIPMENT ON DEMONSTRATION—OUR CLIPPERS SELL WORLD WIDE—HUNDREDS ON AIR IN USA

MORE PART-TIME OVERSEAS AGENTS WANTED—ALL COUNTRIES

HOLDINGS PHOTO AUDIO CENTRE
39/41 Mincing Lane, Blackburn BB2 2AF. Tel: 59595/6

SAMSON ETM-3C KEYERS

Professional-grade C-MOS keyers built for dependable Marine & Commercial use world-wide—Backed by Spacemark service.
Only 1μA battery idling current! **ETM-3C, £63.88**

ETM-4C MEMORY KEYER—Has ETM-3C features plus 4 separate memories (2 combinable). Erase/Rewrite memories as often as desired. Send CQs etc. just by pressing a button!

JUNKER PRECISION HAND KEY, £29.75

BAUER SINGLE-PADDLE KEY UNIT, £10.85

88mH TOROIDS for rtty, cw, sstv, filters, **90p** each

SSB 90° AUDIO PHASE SHIFT NETWORKS, octal based.

All prices postpaid and include 12½% VAT. Please send stamp with all enquiries.

SPACEMARK LTD.
THORNFIELD HOUSE, DELAMER ROAD, ALTRINCHAM, CHESHIRE
(Tel: 061-928 8458)

TMP ELECTRONIC SUPPLIES

SHOP NOW OPEN

9.30am to 5pm daily, early closing Tuesday at 1pm. Sat 2.30pm
Full stock of all SMC equipment, Yaesu etc, at

BRITANNIA STORES, LEESWOOD, MOLD, CLWYD, CH7 4SD

Tel: Pontybodkin 846 STD 035 287

CLASSIFIED ADVERTISEMENTS

Private advertisements **15p** per word, minimum **£3.00.**
Trade advertisements **25p** per word, minimum **£5.00.**
Box Number 75p extra to wordage or minimum.
Semi-display 1/12 page (1⅜" × 3") (35 × 76mm) **£21.00.**
1/16 page (⅞" × 3") (22 × 76mm) **£15.00.**
Please write clearly. No responsibility accepted for errors.
Latest date for acceptance—1st of preceding month.
All classified advertisements must be prepaid.
Copy and remittance to: C. C. LINDSAY,
2 Leyburn Gardens, Croydon CR0 5NL. Tel: 01-686 5839.
Members' Ads must be sent to the Editor at Chelmsford.

FOR SALE

G.I. AMATEUR SUPPLIES GI3ZIA for Trcvrs, Rx, Tx, Antennas, Mics, etc. Trade-in's welcome. Large stocks at 10 Church Street, Enniskillen, N. Ireland. Tel: (0365) 22955.

QSL CARDS, LOGBOOKS. Samples 9p. Beauprint (G3OYI) Meltham Road, Honley, Huddersfield.

QSL CARDS, printed to your own specification on white gloss cards. Send SAE to Caswell Press, 11 Barons Way, Woodhatch, Reigate, Surrey.

QSL AND LISTENERS' CARDS. We offer a range of styles and prices, all on quality card and at short delivery. SAE for samples. G3VZF, 5 The Close, Radlett, Herts.

YAESU FT dx 560, 560W pep Transceiver with 160m, unmarked, £225 ovno. YD844 mic, £10. 4 × 512 bit programmable iambic keyer, sae details, £60. Glaser, G3ZEN, 18 Buckingham Street, Brighton. 0273 23290.

MORSE CODE SELF-TUTOR, January Radcom, PCB available. SAE details. Rees (G4EIJ) 17 Finch Road, Chipping Sodbury, Bristol, BS17 6JF. Chipping Sodbury 314243.

35 WATT, 2m AMPLIFIERS. RF switched, filtered output. Rx amplifier included. Power units available, £52 inc. HIGH 'Q' FILTERS, 100 WATT (not 10W as Feb. ad.) 2m and 70cm, £19.50 inc. QTHR, G8AEU.

RCA VALVES, NEW BOXED, 6146A, £4.95 each; 6146B, £5.95 each. Matched pairs, 50p extra. Prices inclusive. By return post. A. E. White, G3HCU. Tel: (Dorking) 0306-730 215.

HB9CV 2m & 70cm BEAMS Mk II improved version only £5.50 inc. carriage. SAE details. Amtest, 55 Vauxhall Street, Worcester, WR3 8PA.

TIP31C POWER TRANSISTORS. 100V, 40W, new stock c/w hardware, 38p each, 6 for £2. Mammoth Electronics, Larkfield, Debden Road, Newport, Essex.

STORNO SPARES AND 2m FM SETS, junk prices. S20 crystals, £3 pair. Controls, connectors, PB's, filters, UHF Starphone, vavactor triplers. SAE G8AKA, Reading 332582.

WANTED

GOOD SECONDHAND EQUIPMENT ALWAYS WANTED. Come to Amateur Radio Exchange for the best deal. 2 Northfield Road, Ealing, London W13. Tel: 01-579 5311.

MINT, FACTORY CONDITION, COLLINS 'ROUND EMBLEM', Type 30L-1. Also 312B-4. Sell Datong FLI, £35. Drake R4C, boxed, used one hour. Box 166 RSGB, 2 Leyburn Gardens, Croydon, CR0 5NL.

ATTENTION ALL FRG7 OWNERS

Fit one of our DIGITAL DISPLAY UNITS FDU 7. Reading out to 1 kHz making one of the finest receivers even better.
(Full fitting instructions supplied.)
Also we make three models of R.T.T.Y. Demodulators (TU)
HB5 1. Amateur Receive only New Tones.
HB5 2. Amateur Receive plus AFSK.FSK.
HB5 3. Commercial. 170·425·850. Old Tones.
(All complete. Tested and Guaranteed)
(Nett Price: EX WORKS inc. postage)

FDU 7	£34.95
HB5/1	£45.50
HB5/2	£52.50
HB5/3	£48.00

(C.W.O. Cheque or ACCESS accepted)
Just telephone your card No. in to us

B. BROOKES ELECTRONICS
69 LEICESTER STREET, NORWICH, NR2 2DZ Tel. (0603) 24573

SERVICE ENGINEER & SALES ENGINEERS REQUIRED

In consequence of our continued and successful expansion in the retail and wholesale fields of amateur and commercial communications we are once more looking for new staff to fill the above posts.
In addition to a sound general knowledge of amateur radio communications equipment – Service Engineers should have either considerable practical experience of servicing electronic equipment or appropriate technical qualifications – Sales Engineers should have a sound knowledge of electronic components, preferably within the retail trade and some practical servicing experience. The ideal candidate will be a licensed amateur, be keen to work at his hobby, have a friendly manner, a spirit of willing co-operation and a desire to maintain our high standard of service and customer relations. We are looking for enthusiastic, cheerful, hard-working people who would enjoy being part of a busy "go-ahead" company.
Please apply in the first instance by telephone to HQ at Totton (04210) 7333

South Midlands Communications Ltd
Osborne Rd., Totton, Southampton, Hants SO4 4DN.

VACANCY

Active amateur or advanced SWL to operate our mobile radio division including installations/sales. Ability to supervise staff training schemes and participate in sales of all amateur radio equipment essential.
AMATEUR ELECTRONICS, 508-514 ALUM ROCK ROAD, BIRMINGHAM, 8. Tel: 021-327 1497 /6313.

ADVERTISERS INDEX

MEMBERS' AD ORDER FORM

FOR SALE ☐ WANTED ☐ (Tick as appropriate)

- **See Members' Ads page for conditions of acceptance.**
- **Not more than 40 words, including name, address, etc**
- **Do not forget 75p remittance plus wrapper.**
- **Please write in block capitals, or type.**
- **Use correct address**

Licensed members are asked to use their callsign and QTHR, meaning that their address in the current *RSGB Amateur Radio Call Book* is correct. BRS and A members will, of course, have to provide their name and address.

I enclose cheque/PO for **75p** to cover the cost of this advertisement.

Signed .....

Date .....

PUBLICATIONS OBTAINABLE FROM RSGB

RSGB members *can obtain a* **10 per cent discount** *on the prices listed below* **at the time of ordering** *(excluding* Ham Radio Magazine *and* Ham Radio Horizons*). To obtain the discount, deduct 10 per cent, calculated to the nearest penny, from the total value of the order (using the latest price list) and enclose a remittance for the balance. Also enclose an address label from a recent* Radio Communication *wrapper as proof of membership.*

RSGB PUBLICATIONS

Technical books

Amateur Radio Awards	£2.15
Amateur Radio Techniques (5th edn) *(Out of print)*	
Guide to Amateur Radio (16th edn) *(Out of print)*	
Morse Code for Radio Amateurs	54p
NBFM Manual	£1.38
OSCAR-Amateur Radio Satellites	£4.20
RSGB Amateur Radio Call Book 1978	£3.21
RAE Questions and Answers	£2.00
Radio Amateurs' Examination Manual (7th edn)	£1.60
Radio Amateurs' Examination Revision Notes	86p
Radio Communication Handbook 5th edn, Vol 1	£9.36
Radio Communication Handbook 5th edn, Vol 2	£8.12
Radio Data Reference Book (4th edn)	£3.65
Service Valve and Semiconductor Equivalents	48p
Teleprinter Handbook	£8.89
Test Equipment for the Radio Amateur (2nd edn)	£4.42
TVI Manual *(Out of print)*	
VHF/UHF Manual	£6.82
World at their Fingertips (Paperback)	£1.63
World at their Fingertips (De-luxe)	£2.76

Log books

Standard Log	£1.42
Receiving Station Log	£1.54
Mobile Mini-Log	£1.09
De-luxe Log	£3.16

Maps, charts and lists

Countries List/HF Awards List	25p
Great Circle DX map (in tube)	£1.29
Oscar map (in tube)	43p
QTH Locator map (Western Europe) (in tube)	£1.15
QTH Locator map (Western Europe) (on card)	57p
UK Beacon List	19p
UK Repeater List	19p
IARU Region 1 Beacon List	19p

Members' sundries

Callsign lapel badge (5 weeks' delivery)	£1.60
Lapel badge (RSGB or RAEN emblem, pin fitting)	51p
Tie (Maroon or Blue)	£1.96
Radio Communication Easibinder	£3.00
Car window sticker (RAEN or RSGB) (self-adhesive)	31p
Members' headed notepaper (50 sheets) quarto	85p
Members' headed notepaper (50 sheets) octavo	60p
Radio Communication back issues *(as available)*	84p
RSGB contest log sheets (100)	77p
RSGB teeshirt (large, medium or small)	£2.25

Prices include postage, packing and VAT where applicable. For air mail despatch, please ask for price before ordering. Goods are obtainable, less p & p, at RSGB headquarters between 9.30am and 5pm, Monday to Friday.

POSTAL TERMS: Cash with order. Stamps and book tokens cannot be accepted. Cheques and postal orders should be crossed and made payable to "Radio Society of Great Britain". Giro A/C No 533 5256.
All overseas orders: add £1 to cover insurance if required.
Please write your name and address clearly on the order.

ORDER FROM:

OTHER PUBLICATIONS

American Radio Relay League

Antenna Book (13th edn)	£3.86
Course in Radio Fundamentals	£2.96
FM and Repeaters for the Radio Amateur	£3.09
Solid state Design for the Radio Amateur	£5.80
Hints and Kinks	£2.37
Radio Amateurs' Handbook 1978 (Paperback)	£7.30
Radio Amateurs' Handbook 1978 (Hardback)	£10.21
Ham Radio Operating Guide	£3.19
Single Sideband for the Radio Amateur	£3.52
Getting to know Oscar from the ground up	£2.46
Specialized Communication Techniques	£3.19
Understanding Amateur Radio	£3.65
VHF Manual	£3.74
Electronic Data Book	£3.20

Radio Amateur Callbook Inc

American Callbook (USA listings) 1978	£9.75
American Callbook (DX listings) 1978	£9.98
World Atlas (Amateur radio prefixes)	£1.75

Radio Publications Inc

Beam Antenna Handbook	£3.90
Better Short Wave Reception (3rd edn)	£3.42
Cubical Quad Antennas	£2.77
Simple, Low-cost Wire Antennas *(out of stock)*	

Miscellaneous

Amateur Television	£2.20
Complete Handbook of Slow-scan TV	£5.83
International VHF FM Guide *(Out of stock)*	
RTTY the Easy Way	£1.02
Radio Amateur Operators Handbook	£1.11
Radio Valve & Semiconductor Data	£4.00

MORSE INSTRUCTION AIDS

G3HSC Rhythm Method of Morse Tuition—	
Complete Course (two 3-speed lp records and one ep record plus books)	£5.60†
Beginner's Course (one 3-speed lp record and one ep record plus book)	£4.12†
Beginner's lp (0-15 wpm) plus book	£3.44†
Advanced lp (9-42 wpm) plus book	£3.44†
Three-speed simulated PO test 7in ds ep record	£1.15†

† *Overseas orders: add* £1.12

MAGAZINE SUBSCRIPTIONS

QST (including ARRL membership) (per annum) £9.25
Subscriptions for *QST* should be sent to RSGB, 35 Doughty Street, London WC1N 2AE.

Ham Radio Magazine (per annum) (incl air delivery)	£14.00
Ham Radio Horizons	£6.00

Subscriptions and changes of address for *Ham Radio Magazine* and *Ham Radio Horizons* should be sent to: Ham Radio Magazine (UK), PO Box 63, Harrow, Middlesex HA3 6HS.

RSGB Publications (Sales), 35 Doughty Street, London WC1N 2AE

A. J. H. ELECTRONICS

Proprietor: A. J. HIBBERD (G8AQN) Tel RUGBY daytime 76473, evening 71066

Terms of Business: Cash with order, Mail order only, or Callers by appointment. S.A.E. with enquiries

Handling Charge 40p Minimum order **£1.00.** Official orders accepted on a strict monthly basis. **Prices now include VAT**

FULL MONEY-BACK GUARANTEE ON ALL ITEMS

"KENT" MODULES

PROFESSIONAL GRADE MODULES NOW AVAILABLE TO THE AMATEUR

10·7MHz NARROW BAND F.M. I.F. AMPLIFIER

PERFORMANCE

Sensitivity – 4μV (EMF from a 50ohm source) for 20db quieting

Selectivity – ±7½kHz @ 3db, ±25kHz @ 60db.

A.F. Output – 200mV p-p when input is above limiting threshold and modulated ±5kHz @ 1kHz.
– 75uS de-emphasis
– Output 3db down @ 4kHz, 20db down @ 8kHz (de-emphasis removed)
– Noise output to suit squelch circuit on A.F. board

Supply D.C. – 9 to 15V @ 30mA (negative earth)

FEATURES

High sensitivity and selectivity
On board crystal filter buffering for ease of interface
Single Conversion
Audio low pass filter to remove unwanted high frequency noise
"S" meter and delayed AGC outputs
Small size only—97 × 42mm

PRICE £26.50. inc. VAT

2WATT AUDIO AMPLIFIER WITH SQUELCH

PERFORMANCE

Power Output – 2W minimum into 4Ω < 10% distortion

Sensitivity – 75mV p-p @ 1kHz for full output

Bandwidth – 200Hz to 15kHz

Squelch – noise operated, threshold adjustable over the range 0 to 20db s/n

Supply – 9 to 15 volts D.C. @ 7mA quiescent (neg. earth).

FEATURES

True noise operated squelch with adjustable threshold, no hysteresis
Will drive a wide range of speaker impedances, 4 to 16Ω. Thermal overload and short circuit output protection.
Rectified and filtered squelch output available for channel scanner etc.
Small size only 52mm × 52mm

PRICE £9.50 inc. VAT

ALL MODELS FINISHED TO PROFESSIONAL STANDARDS AND FITTED WITH MOUNTING BUSHES

PYE EUROPA MF5FM (12½kHz channel spacing) receiver section boards, these are a complete FM receiver but less the RF amplifier (one FET)—volume control and channel switch, crystal holders fitted for only three channels but we will supply three separate to make to a six channel unit, ideal for 144MHz FM, although these are brand new boards they are sold as untested due to the fact we have no way of checking them, complete with circuit for only **£26.00** a cheap means of making a first class monitor receiver.

TRIMMER CAPACITORS 10mm dia. ceramic, 2-8pf, 3-10pf, 4-20pf, 10-40pf, all **10p** each.
7mm dia. ceramic, 3-9pf, 2·5-16pf, 7-35pf, all **10p** each. Tubular ceramic, 1-6pf solder in type, **8p** each; **60p** for 10.
Mullard tubular ceramic 0·8-6·8pf bolt in type, **15p** each. Ceramic miniature compression P.C. mount 10-40pf, **8p** each.
Plastic semi-airspaced 2-25pf 10mm dia. **6p** each; 10 for **50p.**
Oxley airspaced 9mm sq base 1-10pf and 1-15pf, **18p** each; 2-30pf **20p** each.
Erie teflon tubular trimmers "530 series" 0·25-1·5pf 4mm dia. × 11mm, **10p** each.

JACKSON TETFER TRIMMER Cat. No 5640 9mm sq base, **40p** each; also 8mm P.C. mount, **40p** each.

PLASTIC SEMI-AIRSPACED TRIMMER as used in PYE Westminsters P.A. stages 10-60pf, **15p** each.

JACKSON BUTTERFLY TRIMMERS 17+ 17PF 1·2mm air gap Cat. No C713, **50p** each; a few with ¼" spindle, **65p** each.

ELECTRONIQUES TUNING DIALS reduction 6-1 and 36-1, uses epicyclic drive, moulded clear plastic front, size 100mm × 160mm, supplied with two scales and two pointers, **£6.00.**

STEREO CAR CASSETTE player amplifier boards with two amp. ICs NEC-uPC 1001 H2, some models with uPC 1025H, requires 12V D.C. 3½W per channel, removed from new equipment by manufacturer, size 120mm × 45mm, supplied with circuit, **£2.25** each.

FM RADIO FRONT END TUNER Units 88-108MHz (remove three Cs and it tunes Air Band) and 2m very high quality and stable unit with exceptional sensitivity FET RF amp. NPN mixer and separate osc. AFC. and AGC inputs, works from 9-15V D.C., with circuit; new and unused BARGAIN @ **£3.30** each; two for **£6.00.**

AM25T/S six channel PYE VANGUARDS 12½KHz channel spacing with all control equipment in very good condition HIGH BAND 148-174MHz **£40.00** each postage £3.00.

COSSOR CC303 boot mout high band six channel mobiles 12½KHz channel spacing, 25W RF output with all control equipment ONLY **£25.00** postage £3.00.

COSSOR UHF LINK UNITS CCRTR4A size 19" × 3" × 9" deep approx. 2W RF output make nice repeater all solid state **£50.00** with circuit.

COSSOR VHF AM BASE STATION RECEIVERS 19" rack mounting all solid state type CC603R 24V DC input adjustable to 12V DC. HIGH-BAND 12½ KHz channel spacing **£25.00** postage £2.

COSSOR HIGH BAND TRANSMITTER matching unit for above receiver **£28.00** postage £3.00.

PYE SG1/U six channel crystal controlled UHF signal generator with internal rechargeable battery, or mains operation good condition **£40.00.**

VARLEY INVERTERS 24/28V DC input, 115/250V AC 50c/s output @ 500W, transistor type **£35.00** buyer to collect by arrangement.

HONDA PETROL GENERATOR type ED250 6V/12V/24V DC output used only 10 Hrs. mint condition **£108.00** buyer to collect by arrangement.

BC221-Q FREQUENCY METER with original calibration charts, mint condition **£28.00** buyer to collect by arrangement (one only).

470KHz AM IF AMPLIFIER BOARDS as used in Car Radio/Cassette players full of miniature Rs & Cs two double tuned IFTs, trimmers, coils, tantalum Cs, transistors, and LM382N low noise stereo pre-amp, size 1½" × 4½" new unused no info. **£1.25.**

CAR RADIO/CASSETTE STEREO AMPS contains two TA7205P Ics (5·8W @ 13·2V) per channel, plus Rs & Cs, Ex-equipment, manufacturers rejects **90p** each.

CAR CASSETTE PLAYER AUDIO AMPS contains two TA7205P 5·8W ICs plus LM382N stereo low noise pre-amp plus all Rs & Cs on PC board 4½" × 1¾" these are new and unused but reject due to solder faults (shorted tracks etc) **£3.00** each sorry no circuits.

FCS8100A 24 Hr CLOCK MODULE with ·8" 4 digit display with alarm output, only requires 12V ct transformer and a few switches to make a complete clock, last few at old price only **£11.50** each. With data.

BARGAIN BOX OF P.C. BOARDS this contains mostly damaged, broken, or incomplete car radio boards plus other types these are sold by weight a minimum of 2Kg (over 4lb) only **£2.00** plus £1.25 post (UK ONLY)

HP1FM HIGH BAND FM PYE BANTAMS 25KHz channel spacing single channel very good condition with leather cases **£65.00** (two only please telephone to reserve)

TAD110 AM/FM mixer—osc—IF amp IC up to 30MHz as used in SF1 starphone portables **£1.50** each.

TAA300 audio IC 1W output @ 9V as used in SF1 starphone portables **£1.25** each.
U2 size Ni-cad batteries 3·5 A/Hr ex-equipment charged before despatch money back guarantee **£1.30** each

Most items still available as last month's advert.

59 WAVERLEY ROAD, THE KENT, RUGBY, WARWICKSHIRE

Printed in Great Britain for the RADIO SOCIETY OF GREAT BRITAIN, 35 Doughty Street, London, WC1N 2AE
by E. T. Heron & Co Ltd, Essex and London