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# The SHORT WAVE Magazine

VOL. XL OCTOBER 1982 NUMBER 8

# NRD-515

If I am absolutely honest, I am not certain whether I own an NRD515 because of its unbelievable performance as a general coverage receiver or just for the sheer pleasure of having and constantly admiring probably the finest piece of equipment available today.

Perhaps it comes down to the same thing, certainly the other NRD owners I have spoken to have all expressed the same feelings, that the NRD515 is a receiver in a class of its own.

As a person not owning the receiver, you may ask what sets this particular one above all others. This is difficult to define -- the feel of the equipment when wandering over the crowded band, its signal handling capability and selectivity can only really be appreciated by use. Technically, the equipment is above reproach. JRC's manufacture and production control methods as applied to other items in the range are equally applied to their amateur products. The other items I refer to, only a small part of the vast range, are marine radio equipment, Marisat mobile terminals, Omega navigators, doppler sonar, echo sounder/fish finders, communication satellite earth stations and a complete range of avionic beacons, radar and associated products. Indeed, a wide range application of electronic and radio technology for land, sea and air.

You may be forgiven for associating such advanced technology with complexity of operation, a piece of equipment that needs an operator with an electronics degree. However, the assumption is incorrect. The NRD is easy to use with the minimum of controls to ensure the operator really enjoys his listening time. Digital readout, MHz, mode and filter bandwidth switches together with a VFO knob that will tune the band continuously without using any other control, from 10 KHz to 30 MHz or vice versa. To assist with difficult band conditions the NRD515 has pass band tuning and the medium wave broadcast section from 600 kHz to 1.6 MHz has a preselector control to cope with the crowded conditions. Add the optional 600 Hz CW filter and the 96 channel memory unit and, as other NRD515 owners would say, "a joy to own".

Now available for the radio amateur who is also a short wave man is the NSD515 transmitter. Again, part of my station, the NSD515 is, without a doubt, the only companion for the NRD515. A connecting harness which links the two units together provides full transceive operation or on release of a push button the units assume their own identities and become separates. A "remote" position on the transmitter MHz switch enables the receiver MHz switch to control the transmitter, so, as you tune across the band and into an amateur section then the transmitter automatically "comes up" on the same band. With the remote VFO push button selected on the transmitter and the MHz switch at remote, the transmitter becomes the slave of the receiver and operating simplicity is yours. Of course, in only seconds the two pieces of equipment can be set to work cross band or duplex.

Add to the above an RF speech compressor, an overmodulation indicator and the ability to monitor your transmitted audio and you will see how easy it is to produce the perfect signal.

Add 100 watts of transmitted signal and an optional internal aerial tuning unit which is matched individually to each band and is switched from one band to the other remotely by either transmitter, receiver or memory unit and you will see how much care and attention to detail JRC apply to their range of amateur equipment.

| | |
|---|---|
| NRD515 | £948 inc VAT |
| NSD515 | £1,223 inc VAT |
| NDH518 | £198 inc VAT |
| NVA515 | £34.50 inc VAT |
| NBD515 | £148.35 inc VAT |

## perchance to dream

**LOWE ELECTRONICS**
Chesterfield Road, Matlock, Derbyshire. DE4 5LE.
Telephone 0629 2817, 2430, 4057, 4995. Telex 377482.

# ok, it was always a good receiver, but now with FM the **SRX 30D**, todays rig, yesterdays price.

- Extended coverage 200 kHz-30MHz.
- Digital readout in large green display units which give true unambiguous frequency information — even when you switch sidebands or use the clarifier.
- All new frequency synthesis using Plessey SL 1600 ICs for a new high standard of performance.
- All new audio system which produces outstandingly good quality on the built in speaker, and is capable of driving external hi fi speaker units for ever better sound.
- All new IF filters with optimum bandwidth for mode in use. Automatic filter selection from mode switch.

We predict that the SRX 30D will be a landmark in low cost, high performance SWL receivers. Just consider how much you should pay for a receiver covering 200 kHz-30MHz with accurate digital readout; high performance FM USB/LSB/AM with switched filters; drirt cancelling frequency synthesis; built in mains supply and built in speaker; high quality construction and advanced design — and so much more.

**SRX 30D NOW WITH FM STILL £215.00** Carr. £5.00

From Daiwa yet another aid to operating. In addition to the notch, SSB and CW filters, the AF606K is equipped with a PLL tone decoder; when the tone frequency of the CW signal and the free running frequency of the PLL tone decoder are the same a locked signal is generated. This locked signal keys an audio oscillator which then reproduces the received CW signal. However, there is a tremendous difference between the produced signal and the received one — no noise and, of course, no fading. **ANOTHER PIECE OF EQUIPMENT TO ENHANCE YOUR LISTENING.**


## AF606K £56.50 inc. VAT, carr. £5.00

With so many electronic keys and keyers on the market, it's hard to describe one that is better than the rest. Inevitably it is a matter of "feel", and the feel of the New Daiwa DK210 is superb. Being Daiwa, the quality of design and construction has to be of the best, but it's in use that the DK210 is so impressive. Designed to be used with an external paddle, to give greater personal choice, the DK210 is otherwise self contained, even to being battery powered (PP3). It offers a speed range of 10to 50w.p.m., built in sidetone, facilities for semi auto, or fully auto keying, and a tune position for adjusting your transmitter, but the outstanding feature is the adjustable "weight" control. This control gives an amazing improvement in the character of the sending, and completely removes that mechanical sounding "electronic morse" characteristic. Those experienced CW users who have tried out the DK210, have all said how good it sounds — and have usually purchased one. So will you if you try it out.

DK210 from DAIWA — A truly nice keyer.


## DK 210 £42.00 less paddle. CARR. £5.00.


Now from Daiwa, a new 2 metre monitor receiver. Using PLL synthesized circuitry, the SR1000E covers the entire amateur band in 5 KHz steps. It provides for today's amateur a small convenient means of monitoring activity on the busy 2 metre band. Compact and supplied with earphone, mounting bracket, the SR1000 provides for you mobile or fixed your contact with the 2 metre band.

## SR 1000 E £72.50 inc. VAT, carr. £2.25

**LOWE IN LONDON,** Open monday to saturday, six days a week
lower sales floor, Hepworths, Pentonville Rd, London. telephone 01.837.6702
**LOWE IN GLASGOW,** Open tuesday to saturday
4,5 Queen Margarets Rd, Glasgow. telephone 041.945.2626


# handability TR 2500

The TR-2500 is a compact 2 metre FM handheld transceiver featuring an LCD readout, 10 channel memory, lithium battery memory back-up, memory scan, programmable automatic band-scan and HI/LO power switch.

**TR-2500 FEATURES:**

- Extremely compact size and light weight 66 (2-5/8) W x 168 (6-5/8) H x 40 (1-5/8) D, mm (inches), 540g, (1-2lbs) with Nicad pack.
- LCD digital frequency readout, with memory channel and function indication.
- Ten channel memory, includes "M0" memory for non-standard split frequencies.
- Lithium battery memory back-up built-in, (estimated 5 year life) saves memory when Nicad pack discharged.
- Memory scan, stops on busy channels, skips channels in which no data is stored.
- UP/DOWN manual scan in 5kHz steps.
- 2.5W or 300mW RF output. (HI/LOW power switch.)
- Programmable automatic band scan allows upper and lower frequency limits and scan steps of 5kHz and larger (5, 10, 15, 20, 25, 30kHz . . . etc) to be programmed.
- Slide-lock battery pack.
- Repeater reverse operation.
- Keyboard frequency selection across full range.
- Frequency coverage, 144.000 to 145.995 MHz.
- Optional power source, MS-1 mobile or ST-2 AC charger/power supply allows operation while charging. (Automatic drop-in connections.)
- High impact plastic case.
- Battery status indicator.
- Two lock switches for keyboard and transmit.

**STANDARD ACCESSORIES**

- Flexible rubberised and antenna with BNC connector.
- 400mA heavy-duty Nicad battery pack.
- AC charger.

| | | |
|---|---|---|
| TR 2500 | HANDHELD TRANSCEIVER | £207.00 |
| ST 2 | BASE STAND/CHARGER | £46.23 |
| SC 4 | SOFT CASE | £12.19 |
| MS 1 | MOBILE STAND | £28.29 |
| SMC 25 | SPEAKER/MIKE | £14.49 |
| PB 25 | NICAD PACK | £22.31 |
| LH 2 | LEATHER CASE | £21.39 |

# portability TR 2300

So the TR2300 now costs less than its predecessor did in 1976. Not only that, the TR2200GX of 1976 only had 12 channels where the TR2300 of today covers the full amateur band.

So we rest our case — the TR2300 has to be, in today's market, outstanding value for money and, what is more, the TR2300 has an unprecendented reliability factor.

There is no need to talk of full 2 metre band coverage, the 1 watt of perfect transmitted signal, the fully comprehensive list of included accessories: carrying case, Nicad charger, 12 volt power cord, shoulder strap, hand microphone, collapsible whip antenna, reverse repeater facility, automatic tone burst, switchable illuminated frequency dial, consequent long life operation out in the field.

Don't ask us about the Trio TR2300 — ask our best form of advertisement: one of the 5,000 owners!

TR2300 PORTABLE TRANSCEIVER £166.75
Securicor Carriage £5.00

## SMC SERVICE

Free Finance on most substantial items. Importer guarantee on all Yaesu Musen. Free Securicor on major Yaesu items. Access and Barclaycard over the 'phone. Biggest branch/agent/dealer network. Ably staffed and equipped service dept. Securicor 'B Service' contract at £4.49. Biggest stockist of amateur equipment. 24 years of communications experience.

## FREE FINANCE

On *regular* priced items from: Yaesu, Ascot SMCHS, CDE, HyGain, Channel Master, Hansen, SMC, MFJ, KLM, Mirage and Hi-Mound, on invoices over £100 SMC offers Free Finance! How is it done? Simple, pay 20%, split the balance equally over 6 months or pay 50% down and split the balance over a year.

*you pay no more than the cash price!!*

## GUARANTEE

Yaesu's *own* warranty does not extend outside Japan. Repairs are the responsibility of the UK retailer. SMC's guarantee is backed, as UK distributors, by daily contact with the factory and many tens of thousands of pounds of spares and test equipment. Avoid hawkers offering sets without serial numbers, spares, service or advice back-up.

## NEW SHOWROOM:

Our superb new showrooms located within our new administrative headquarters in Rumbridge Street (abuts the Osborne Road Stores/Service/Manufacturing complex) is now *open six days a week 9 till 5-30.*

Six "Yaesu line up length" demonstration benches provide *you* with full "on the air" and "side by side" evaluation facilities. Check out a FT102, FT-ONE, FT230R, FT790R, KDK2030, plus all our standard goodies today.

## SUPER SELECTION

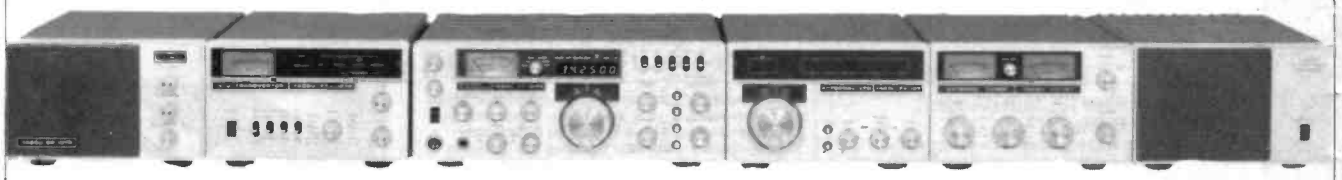
In our price list you will find the widest selection anywhere:— 200 stock lines of Yaesu, 600 different antennas, masts, rotators, coaxes, plus 300 items of communications equipment.

If that is not enough to tempt you into our showrooms as part of our inventory rationalisation scheme we are delighted to announce: substantial price reductions on the FT107 and accessories, added value on the FT902 plus a super sale!

## — SUPER SALE!

**Bearcat 220** Scanner..... £195
**MML144/25** Low Drive Linear..... £55
**260/145** ⅝ λ c/w gutter clip..... £10
**FT227RB** Synth 2m Mic tune..... £175
**FT227RXS** Synth 2m Scanner..... £195
**CPU2500RKS** Synth 2m Keyboard... £205
**KDK2025** Mk II Synth 2m 25W..... £179
**KDK2025** Mk I Synth 2m 25W..... £159
**ME521** Digital Multimeter..... £35
**MD35FS** Foot switch..... £5

*All prices include VAT and carriage.*



# FT107M

### SUPER RADIO — SUPER PRICES

If you have a yen for an all solid state HF transceiver with a "broad band" output that will deliver 75 per cent of maximum power into a 3:1 load, then look no further than this incredible value Yaesu. The FT107M covers 160-10M (all nine bands) and is fully equipped with: variable IF bandwidth, audio peak/notch filter, RF speech processor, variable threshold noise blanker, full metering — including SWR, and boasts a schottky diode ring mixer for excellent receiver dynamic range. The optional memory system provides 12 stored channels (with fine tuning), scanning from the optional microphone and the exclusive DMS-digital memory shift. This system using a photo interruptor (with fine tuning) to control the 100Hz synthesizer to provide any offset — up to 500KHz! — from the memory channel. A full list of accessories is available to compliment the FT107M. Illustrated above (from left to right): the SP1010P speaker/phone patch (normal speaker SP107 available); the FTV107R two band transvertor (two from 432, 145 or 70 or 50MHz); the FT107, itself, the FV107 remote VFO (with 5 crystal channels); the FC107 antenna coupler with twin VSWR/power meters, and the FP107E AC psu with speaker. Buy a FT107 and you can choose your accessories from the 'Line up' prices.

If sight of the full line up:
(FT + FP + DMS + FV + FTV + 144TV + SP — List £1,267.30) is too much to stand, its yours for **£999**!!!

| | FT107M | FP107 | FP107E | DMS | FV107 | FTV107 | SP107P | SP107 |
|---|---|---|---|---|---|---|---|---|
| LIST | £725.00 | £101.95 | £113.10 | £92.75 | £98.50 | £119.20 | £57.50 | £29.90 |
| SALE | £599 | £90.00 | £100.00 | £90.00 | £80.00 | £110.00 | £55.00 | £29.00 |
| LINE-UP | | £79.00 | £89.00 | £79.00 | £59.00 | £99.00 | £49.00 | £29.00 |

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Talke Pits, Stoke.
Kidsgrove (07816) 72644
9-5.30 Tuesday-Saturday

**LEEDS**
S.M.C. (Leeds)
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Leeds 16, Yorkshire.
Leeds (0532) 782326
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New Whittington, Chesterfield.
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S.M.C. (T.M.P.)
Unit 27 Pinfold Workshops,
Pinfold Lane, Buckley.
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9.30-5.30 (Lunch 1.30) Tues-Sat

**SMC AGENTS**

Edinburgh Jack GM8GEC (031657) 2430 day, (031665) 2420 eve.
Stourbridge Brian G3ZUL (03843) 5917
Bangor John GI3KDR (0247) 55162
Tandrages Mervyn GI3WWY (0762) 840656
Neath John GW4FOI (0639) 52374 day, (0639) 2492 eve.
Jersey Geoff GJ4ICD (0534) 26788

## FT ONE £1,295 inc. VAT @ 15% & SECURICOR

FREE FINANCE

*Option

- ★ Rx: 150kHz-30MHz. Continuous general coverage.
- ★ Tx: 160-10m (9 bands) or 1.5-30MHz commercial.
- ★ All Modes: AM, CW, FM*, FSK, LSB, USB.
- ★ 10 VFO's!!! Any Tx-Rx split within coverage.
- ★ Two frequency selection ways, *no* bandswitch.
- ★ Main dial, velvet smooth, 10Hz resolution.
- ★ Inbuilt keyboard with up/down scanning.
- ★ Dedicated digital display for RIT offset.
- ★ Receiver dynamic range up to 100dB!!!
- ★ SSB: Variable bandwidth *and* IF shift.
- ★ 300* or 600Hz*, 2,400 → 300Hz, 6kHz*, 12kHz*.
- ★ Audio peak and notch filter. FM squelch.
- ★ Advanced variable threshold noise blanker.
- ★ 100W RF, key down capability, solid state.
- ★ Mains and 12VDC. Switch mode PSU built in.
- ★ RF processor. Auto mic gain control. VOX.
- ★ Last but not least *full* break-in on CW.

## FT902DM £885 inc. VAT @ 15% & SECURICOR

- ★ 160-10 metres including new allocations.
- ★ Variable IF bandwidth 2.4kHz down to 300Hz.
- ★ Audio Peak and independent notch controls.
- ★ AM, FSK, USB, LSB, CW, FM, (Tx and Rx).
- ★ Semi-break in, inbuilt Curtis IC Keyer.
- ★ Digital plus analogue frequency displays.
- ★ VOX built-in and adjustable.
- ★ Instant write in memory channel.
- ★ Tune up button (10 sec, of full power).
- ★ Switchable AGC and RF attenuator.
- ★ 350 or 600 Hz CW, 6kHz, AM filters.
- ★ Clarifier (RIT) switchable on Tx, Rx or both.
- ★ Plug in modular, computer style constructor.
- ★ Fully adjustable RF Speech processor.
- ★ Ergonomically designed with necessary LEDS.
- ★ Incredible range of matching accessories.
- ★ Universal power supply 110-234V AC and 12V DC.

SPECIAL OFFER — NOW WITH CW FILTER, AM FILTER, CURTIS KEYER† AT NO EXTRA!

*Option

†D + DE MODELS

## FT102 £725 inc. VAT @ 15% & SECURICOR

"INSTANT" H.P.

- ★ 1.8-3.5-7-10-14-18-21-24.5-28MHz
- ★ All modes:— LSB, USB, CW, AM‡, FM‡, (‡Option board)
- ★ Front end: extra high level, operates on 24V DC.
- ★ RF stage bypassable, boosts dynamic range over 100 dB!
- ★ Variable bandwidth 2.7KHz→500Hz *and* IF Shift
- ★ Fixed bandwidth filters, parallel or cascade configurations
- ★ IF notch (455KHz) *and* independent audio peak
- ★ Noise blanker adjustable for pulse *width*
- ★ External Rx and separate Rx antenna provisions
- ★ *Three* 6146B in special configuration — 40 dB IMD!
- ★ Extra product detector for checking Tx IF signal
- ★ Dual meter, peak hold ALC system
- ★ Mic amp with tunable audio network
- ★ **SP102:**— Speaker, Hi and Lo AF filters, 12 responses!
- ★ **FV102:**— VFO, 10Hz steps and readout, scanning, QSY.
- ★ **FC102:**— ATU, 1.2KW, 20/200/1200 W FSD PEP, wire.
- ★ **FAS-1-4R:**— 4 way remote waterproof antenna selector.

- ★ 160-10 metres including new allocations.
- ★ Variable IF bandwidth 2.4kHz down to 300Hz.
- ★ Selectable CW fixed bandwidth CW-W and CW-N*.
- ★ Semi-break in with sidetone for excellent CW.
- ★ Digital plus analogue frequency displays.
- ★ 180W PIP and — 31dB 3rd order intermod.
- ★ RF speech processor fitted — adjustable level.
- ★ VOX built-in and is adjustable from the front panel.
- ★ Wide dynamic range for big signal handling.
- ★ High usable sensitivity, for those weak ones.
- ★ Superb noise blanker — adjustable threshold.
- ★ Attenuator; 0-10-20dB, AGC; slow-fast-off.
- ★ Clarifier (RIT) switchable on Tx, Rx or both.
- ★ Low level transvertor drive output facility.
- ★ Universal power supply 110-234V AC and 12V DC*.
- ★ Incredible range of matching accessories
- ★ 6 models: Digital/Analogue — AM/FM options.

## FT101ZD £635 inc. VAT @ 15% & SECURICOR

FREE SECURICOR

*Option

## FT707 £569 inc. VAT @ 15% & SECURICOR

PLASTIC BY 'PHONE

SMC FM MODIFIED VERSION AVAILABLE

- ★ 80-10 metres (including 10, 18 and 24MHz bands).
- ★ USB-LSB-CWN-AM (Tx and Rx operation).
- ★ 100W PEP. 50% power output at 3:1 VSWR.
- ★ Full "broad band" no tune output stage.
- ★ Excellent Rx dynamic range, power transistor buffers.
- ★ Rx Schottky diode ring mixer module.
- ★ Local oscillator with ultra-low noise floor.
- ★ Variable IF bandwidth — 16 crystal poles.
- ★ Bandwidths 6kHz*, 2.4kHz-300Hz. (600-350) Hz*
- ★ AGC; slow-fast switchable VOX built-in.
- ★ Semi-break in with side tone for excellent CW.
- ★ Digital (100Hz) plus analogue frequency display.
- ★ LED Level meter reads: S, PO and ALC.
- ★ Indicators for: calibrator, fix, int/ext VFO.
- ★ Receiver offset tuning (RIT-clarifier) control.
- ★ Advanced noise blanker with local loop AGC. *Option

## 2030 £199 inc. VAT @ 15% & SECURICOR

NEW

- 2M. 12 VDC compact 2 3/16" x 6 3/8" x 7 3/16" transceiver.
- 25W (+ fully adjustable low power), 12½ kHz steps.
- 10 "year long" memories for "crystal control" operation.
- Display reads to 100's of Hz *or* channel number.
- Bar led display for 'S' and relative power output.
- Sensitivity < 0.2μV for 12dB SINAD (0.14μV typical).
- Single knob frequency selection. 20 steps revolution.
- Rapid QSY button, end to end in a single turn.
- Digital RIT 1kHz steps, adjusted from main tuning knob.
- 2, 5 slot memories, simplex, Tx/Rx cross or 600 kHz offset.
- Memories entered by pushing main tuning knob.
- + and − 600 kHz split. Instant repeater input monitor.
- Band scan between, instant front panel selectable, limits.
- Scan stop requires squelch open *and* centre zero.
- Scanning and up/down tuning on the microphones.
- Reprogrammable; steps, tone, splits, and coverage.
- C/W mic. "Easy out" mobile mount and excellent handbook.

## WIDE COVERAGE ALL MODE Rx; FRG7700 £329 inc. VAT @ 15% & SECURICOR

- 30MHz down to 150kHz (and below).
- 12 Channel memory option with fine tune.
- SSB (LSB/USB), CW, AM, FM.
- 2.7kHz, 6kHz, 12kHz, 15kHz, @ − 6dB.
- 3 Selectivities on AM, squelch on FM.
- Up conversion, 48MHz first IF.
- 1kHz digital, plus analogue, display.
- Inbuilt quartz clock/timer.
- No preselector, auto selected LPF's.
- Advanced noise blanker fitted.
- Antenna 500Ω to 1.5MHz, 50Ω to 30MHz.
- 20dB pad plus continuous attenuator.
- Switchable A.G.C. Variable tone.

'7700 THE ONE WITH FM!

- 110 and 240V ac, 12Vdc option.
- Signal meter calibrated in "S" and SIMPO
- Acc; Tuners, Converters, LPF, Memory.
- **FRT7700**; 150kHz-30MHz, Switch, etc.
- **FRV7700A**; 118-130, 130-140, 140-150MHz.
- **FRV7700B**; 118-130, 140-150, 50-59MHz.
- **FRV7700C**; 140-150, 150-160, 160-170MHz.
- **FRV7700D**; 118-130, 140-150, 70-80MHz.
- **FRV7700E** 118-130, 140-150, 150-160MHz.
- **FRV7700F** 118-130, 150-160, 170-180MHz.
- **FF5**; 500kHz (for improved VLF reception).
- **MEMGR7700**; 12 Channels (internal fitting).
- **FRA7700**; Active Antenna.

## FT207R: SALE!

## £159 inc. VAT @ 15% & POSTAGE

LOW PRICE

- 144-146MHz (144-148 possible)
- 12.5kHz synthesizer steps
- Keyboard entry of frequencies
- Keyboard lockout safety feature
- Digital display to hundreds of Hz
- Display auto shutdown timer
- Four Channels of memory
- Memory back up disable switch
- Up/down manual tuning

- Bandscan for busy or clear channels
- Memory scanning features
- ±600kHz split built in
- Any split + or − programmable
- BNC antenna connector
- "On Air" and "Channel Busy" LEDs
- Built in condenser microphone
- 200mW AF to internal/external speaker
- 2.5/0.2W of RF output
- Rx; 35mA squelch, 150mA full vol.
- Tx; 250mA low, 800mA high
- 0.3μV for 20dB quieting
- Extenal speaker/mic available
- 1.7 (2.2)" D x 2.5 (2.7)" W x 6.7 (7.2)" H
- C/w Easychange NiCad pack, case, helical

- 144-146MHz (144-148 possible).
- 25 watts RF output (Low 2.5W).
- 150 (W) x 50 (H) x 176 (D) mm. 1.3Kg.
- Selectable 12½ or 25kHz steps.
- Up/down, memory/band scanning.
- Ten Memories with priority function.
- Easy "write-in" memory channels
- Large illuminated "any angle" LCD display.
- Display to 100's of Hz + special functions.
- Two independent VFO's.
- Operation between memory and "other" VFO.
- Memory backup "5 year" lithium cell.
- ± 600kHz and/or simplex.
- Manual and automatic tone burst.
- Large "full sound" speaker.
- Concentric volume/squelch controls.

## FT230R £239 inc. VAT @ 15% & SECURICOR

YAESU

## COMMUNICATIONS RX £995 inc.

**NRD515,** 100kHz — 30MHz, Digital, Electronic tune, 100Hz VFO, SSB/AM/CW/RTTY.

£50 OFF

## 2m, 250W (+) PEP. £449

**NAG 144XL LINEAR.** 4CX350F tube, 10W nom. drive, switchable pre-amp. RF and hard switching. Thermal delay.

# STEPHENS-JAMES LTD.

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LANCASHIRE & THE NORTH WEST'S LEADING RETAILER IN AMATEUR RADIO. 20 YEARS SERVING THE AMATEUR'S BY AMATEURS SPECIALIZING ONLY IN AMATEUR RADIO EQUIPMENT.

**THE ONLY APPROVED TRIO DEALER FOR NORTH WEST ENGLAND**

**TR7730** the new compact 2m Transceiver **£247.94**

## TR2300

TR2300 2m Synthesised Portable Transceiver. We have lost count of the number of this model we have sold over the last 12 months. Hikers, campers, climbers, you can hear them all over the country and reliability which is the essence of TRIO equipment. **£166.75**

**JAYBEAM**

| | |
|---|---|
| 5Y/2M 5 element yagi | £12.08 |
| 8Y/2M element yagi | £15.53 |
| 10Y/2M 10 element | £33.35 |
| PBM/14/2m. 14 element Parabeam | £48.30 |
| 5XY/2m. 5 element crossed yagi | £24.73 |
| 8XY/2m. 8 element crossed yagi | £31.05 |
| 10XY/2m. 10 element crossed yagi | £40.83 |
| Q4/2m. 4 element Quad | £25.88 |
| Q6/2m. 4 element Quad | £33.93 |
| D5/2m. 5 over 5 slot fed yagi | £21.85 |
| D8/2m. 8 over 8 slot fed yagi | £29.33 |
| UGP/2m. ground plane | £10.12 |
| MBM48/70cms. Multibeam | £31.05 |
| MBM88/70cms. Multibeam | £42.56 |
| TAS ¾" 2m. Whip mobile | £15.30 |
| C5/m. Colinear | £47.73 |
| C8/70cm. Colinear | £54.05 |
| D15/1296 23cm. Antenna | £36.80 |

Carriage on Antennas £4.50.

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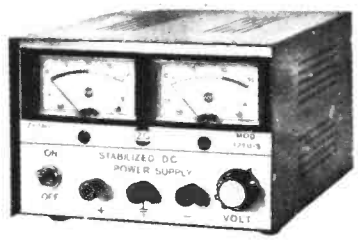

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## HF SSB TRANSCEIVER
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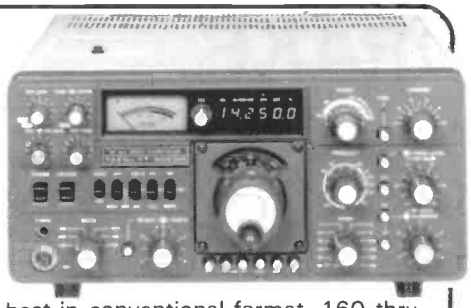

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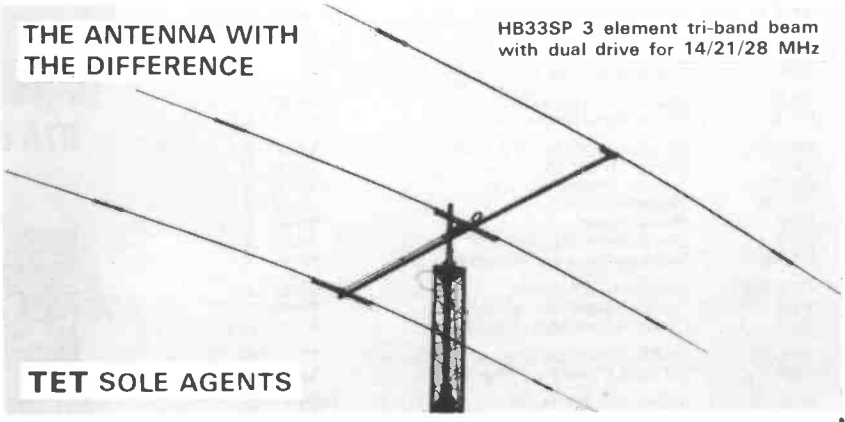

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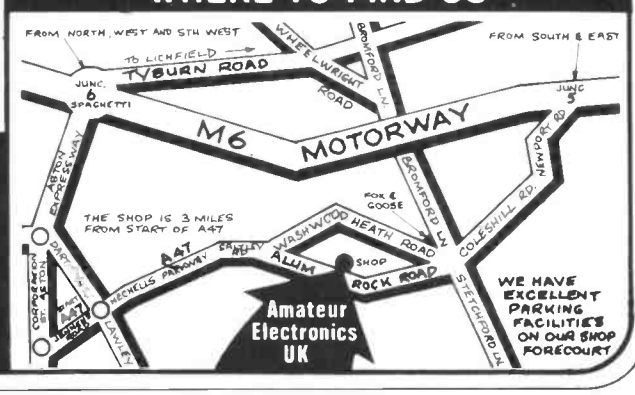

## ADVERTISERS' INDEX



# SHORT WAVE MAGAZINE


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## CONTENTS




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AUTHOR'S MSS

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FOR THE RADIO AMATEUR AND AMATEUR RADIO

The SHORT WAVE Magazine

EDITORIAL

# Changes in the Amateur Service

Discussions between the RSGB and the Home Office during the year have resulted in some important changes in the Amateur Servive, which each come into effect on October 1st.

On the 'debit' side first, the sub-band 431-432 MHz is to be allocated to private mobile radio services in the London area; this section of the band is not to be withdrawn at present, but amateurs are requested by the H.O. not to use it within 100 km. of Central London. Also, as secondary users of the sub-band 10.25-10.4 GHz we may have to share with any spillover from the Mercury allocation as additional primary users; however, the H.O. does not intend to withdraw this band for the time being.

Next the 'credit' side, starting with 18 and 24 MHz. These are now to be available to U.K. radio amateurs as secondary users — until amateur primary status is achieved — strictly on a non-interference basis and subject to the following conditions: CW (class A1A) only, maximum antenna gain in any direction shall not exceed 0dB with respect to a half-wave dipole, carrier power supplied to the aerial shall be 10dBW (or 10 watts), and the antenna itself shall be horizontally polarised to reduce ground-wave radiation. Exact frequency allocations are 18.068 to 18.168 and 24.89 to 24.99 MHz.

There is good news concerning 50 MHz, too. For research purposes only, a limited number of Class 'A' licencees will be able to operate on 50-52 MHz, outside U.K. broadcast hours and on a non-interference basis. Those who are interested in taking part in these night time activities should get in touch with G3WSN, the RSGB's VHF Manager.

The Home Office has also agreed to relax the controls on greetings messages sent by non-licensed persons, although for the moment they may only be sent from special event stations to stations within the U.K. Simple guidelines apply, which are that each message should not last longer than two minutes, the message shall not be sent more than once to each station in contact with the originating station, and the licensed operator must operate the transmitter although the non-licensed person may speak into the microphone. All very handy for this year's J-O-T-A on 16th and 17th October!

Finally, from 1st October also, and following agreement at WARC '79, amateurs may use 47-47.2, 75.5-76, 142-144, and 248-250 GHz. Power, classes of emission and safety precautions should be as for the other bands above 1 GHz.

Quite a package and, given the ever-growing demand on air-space by powerful lobbies and that losses are always much to be regretted, one which has plenty that we can be pleased about. A point worth making, with an eye to the interests of Amateur Radio in future similar negotiations, is that we must all look to our operating standards particularly where we are secondary users; a 'non-interference basis' means just that.

# VHF BANDS

NORMAN FITCH, G3FPK

## A Starter for Six

ALTHOUGH the 6m. band of 50-54 MHz was only officially allocated for amateur use to Regions 2 and 3 of the *IARU* at the *World Administrative Radio Conference* held in Geneva in 1979, nevertheless, individual countries in Region 1 may allocate part of it to amateurs. Examples are South Africa and Gibraltar. As far as the U.K. is concerned, the 50-54 MHz part to the spectrum is still used for Band 1 TV transmissions, although these are being steadily phased out until all Band 1 TV stations are closed down by the end of 1986. This year, the BBC is due to close down 38 stations.

In spite of the demands for more frequencies by the non-amateur, mobile services, the Home Office has been sympathetic to the idea that radio amateurs should have a 50 MHz band. Therefore, it is very gratifying that, from October 1, a limited number of Class "A" licensees will be permitted to operate between 50 and 52 MHz for research purposes only, on a non-interference basis, outside of TV hours. This is very much a foot-in-the-door matter and those fortunate enough to be granted operating permission will be honour bound to act within the terms of the concession. There is every reason to expect that, if this limited experiment does not give rise to any complaints, more stations will be able to operate on 6m. in due course. Any Class "A" licensees who would like to participate in these night-time tests should contact RSGB VHF Manager, Keith Fisher, G3WSN, at 7 Burlington Road, Swanage, Dorset, BH19 1LR.

## More Changes

A lot of mischief was caused recently by a report in a national daily newspaper concerning Ministry of Defence stations in the 70cm. band. This led the gullible to believe we were in the process of losing the band in the near future. This matter was concisely dealt with in the *GB2RS* News Bulletin on Aug. 22, putting it into proper perspective. It must always be remembered that we are *secondary* users of the band and, whether we like it or not, will only be allowed use of the band provided we do not cause interference to the primary users. So, as far as 432-440 MHz is concerned, it remains *status quo*.

An entirely unrelated matter is that the Home Office has allocated 431-432 MHz to the private mobile radio services in the London area. Because of the 10 watts *e.r.p.* restriction, there is little, if any, use of this section in the U.K., so this move is not a catastrophy. Although this sub-band is not being withdrawn, the Home Office is requesting amateurs within a 100 km. radius of central London to ". . . desist voluntarily from using it".

The 3cm. band is also allocated to us on a secondary basis. Now that the Government has given the go-ahead to the *Mercury* data system, using frequencies above 10.45 GHz, users who will have to move will be allocated 10.25-10.40 GHz, as primary users. This sub-band will not be withdrawn, but much depends upon any interference from amateur stations.

On to more esoteric stuff, from Oct. 1, the four new *WARC* microwave bands will become available. These are:— 47-47.2; 75.5-76; 142-144 and 248-250 GHz. All are exclusive amateur, including amateur satellite, service allocations. Power, classes of emissions and safety precautions as for the lower microwave bands.

## Awards News

Two more readers have joined the 2m. VHF Century Club this month. Certificate no. 349 goes to Stephen Ayling, G4ASL, from Coulsdon in Surrey. He was first licensed in 1971, when still at school, starting off on 160m. and 80m. using home-built gear, soon to tackle the HF bands with a *KW-2000A*. After a five year lay-off, Stephen came back in 1979 on 2m. FM from an apartment block in south London. He moved to the present QTH last year, his station now comprising an *Icom* IC-260E multimode transceiver, *muTek* preamp., 100 watts amplifier and 9-ele. *Tonna Yagi*, 10m. *a.g.l.*, the QTH being 110m. *a.s.l.* The next goal is the QTH Squares CC certificate.

John King, G6ADH, is the second G6 to join the club, his certificate being no. 350. John lives in Horley, Surrey and his interest in amateur radio goes back to 1930. His *s.w.l.* career began with an 0-V-0, home-built Rx and in 1934, he operated the late G2JM's Tx on 80m. Avid listening continued with home-brewed, battery-operated gear until WW2 in which he served some time as a wireless operator on assorted "WS" gear. *S.w.l.* activity resumed after the war using an *AR-88* Rx, but the hobby took a dive due to family and job commitments. John was supposed to retire in 1980, so passed the *R.A.E.* in Dec. 1980. However, he is still at work so time for G6ADH operation, which began on Feb. 14, 1981, is rather limited.

The station is equipped for 2m. and 70cm. On the former, there is a *Yaesu* FT-101ZD and *Microwave Modules* transverter, or *Icom* IC-251E, or *Trio* TR-9000, plus *MM* 100w. amplifier or home-built 4CX250B job, the aerial being a 16-ele. *Tonna Yagi*. On 70cm. John has a *Trio* TR-9500 and 100w. *MM* amplifier, the aerial being an 88 ele. *Multibeam*. The aerials are on a *Westower* telescopic, tilt-over tower, the 2m. one at 16m. *a.g.l.* and the 70cm. one two metres above it. He is working on his morse and towards our QTHCC award on 2m.

## Beacon Notes

The Wrotham 2m. beacon, GB3VHF, was still silent on the weekend Sept. 4/5. On 70cm., LA8AK mentions LA3UHF on 432.880 MHz running 7w. to a 15-ele. *Yagi* beaming at 180° from ES71a.

## Repeaters

Ron Glaisher, G6LX, was in the Irish Republic recently and operated mobile with his EI2VPY reciprocal call. He found the repeater network very good with none of the abuse heard on some U.K. relays. Ron mentions seven repeaters giving wide coverage from the GI border, down the east coast and round up the west side. They are sited in the Dundalk, Dublin, Waterford, Cork, Limerick, Galway and Sligo areas and G stations often work through some of them, across the Irish Sea. Reciprocal calls always have a "V" after the number. The series VAA-VKZ are for Class "B" folk, and VLA-VZZ for Class "A" amateurs. Class "A" Irish nationals have one or two letter calls, like EI9Q and EI6AS, while Class "B" people have three letter suffixes.

## Contest Corner

The weekend Oct. 2/3 is the UHF/SHF section of the *IARU* Region 1 Contest as mentioned last month. On Oct. 10, from 0700-1100 GMT, there is a Belgian 144 MHz event, all modes, where you only work Belgian stations. ON folk will give their club code. Each QSO is worth 3 pts. with a multiplier being the total of different clubs worked. Entries by Oct. 31 to ON5WL, who lives at Borgstraat 80, B-2880 Putte Beerzel, Belgium.

October sees the start of the seven *Cumulatives* sessions in the 432 and 1,296 MHz bands. On the 8th and 16th, the period 1900-2100 is for 432 MHz, the following two hours for 1,296 MHz. On Oct. 24, and for the remaining sessions on Nov. 1, 9, 17 and 25, the times start at 2000, all GMT.

## Satellite News

To date, *U-O-9 (UOSAT)* is still uncommandable but further attempts to regain control are imminent, now that the Stanford University's 150 ft. dish is fully operational again. There is confirmation from several sources that *O-7* telemetry has been heard, but it appears to be gibberish. Your scribe has listened for a few overhead passes but has heard

nothing. A German group known as the *Satellite Information Service*, has quoted a reference orbit for Aug. 29 as no. 35623, equatorial crossing time 0026 GMT at 97.1°W longitude. It is not clear where they got this information, though.

Adrian Chamberlain, G6ADC, (Coventry) has had further QSOs *via O-8*, mode "J" with N4AR in Kentucky, one a three-way with W4AUZ who is 12 miles north of N4AR. They are trying to get other satellite operators in Kentucky and Tennessee to come up on *O-8J*.

Ron Broadbent, G3AAJ, hopes that *AMSAT-UK's Satellite Users' Computer Handbook* will be on sale at the Leicester exhibition. This will contain programs for, and worked examples of, Az-el. aerial control, *Doppler* tracking, etc. For details of *AMSAT-UK* membership and services send an *s.a.e.* to *AMSAT-UK*, London, E12 5EQ.

## DX-Peditions

Walt Davidson, GW3NYY, (Swansea) has sent a detailed account of the operation from XM square when he, with G8TFI, GWs 6EWA, '8TVX and '8VHI used the special call GB2XM. The total number of QSOs was 1,059, comprising 913 on 2m., 134 on 70cm. and 12 on 23cm. The activity from Aug. 7 to 15 took in the *Perseids* meteor shower and they did another stint over the weekend of the 21st/22nd. When they set up the station on the 7th, an *Aurora* was in full spate and the best DX were UT5DL (LI) at 1,950 km. and HG8CE (KG) at 1,890 km. YU3ES (GF) heard GB2XM, but QRM prevented a QSO. F6FHP (AE) was a very southerly contact, and GM5EHK (ZR) the most northerly one. As well as "locals", many PA and D, F and ONs were worked. In another *Ar* on the 11th, GMs in WQ, WR, YQ and ZR were contacted.

Also on the 7th, there was a nice tropo. opening, particularly to Spain, where stations in VC, VD, WD, XC and YC squares were worked. Over the period Aug. 9 to 13, 24 MS QSOs were completed with various stations in D, EA, HG, I, LA, OK, OE, OZ, SM, UQ2, UR2 and Y, all except two on CW. UK2RDX (MT) was best DX at 1,986 km. 13 MS QSOs were incomplete but nothing was heard in another six skeds. All the foregoing on 2m, of course, using an *Icom* IC-211E and *Yaesu* FT-225RD with *muTek* front end, a *Tempo* 2002 amplifier and two, 14-ele. *Cushcraft Yagis*.

Walt did not think the *Perseids* were as good as last year though some good QSOs were made, with some 45 secs. reflections. The shower seemed to peak in the first half of the 12th. He complains about "... the numerous G6 stations who called us incessantly during our few SSB MS skeds!"

On 70cm, best DX were PAs and ONs in CM and BL squares and Fs in YI and ZH. The station consisted of a *Trio* TS-770E, *K2RIW* amplifier and four 19-ele. *Tonna Yagis*. On 23cm. the IC-211E and *MM* transverter giving 1.3w. was used, with four 23-ele. *Tonna* beams. The 12 QSOs were with G3TDG (AL); G3AUS, G3PBV and G4MAW in YK; G3FYX, G6GN and GW3CBY in YL; G3OSS and G8GP in ZL, and G4s KGC, 'KIY and 'LRT in ZM. QSLs *via* the bureau or direct, with *s.a.e.*, to P.O. Box 21, Swansea, SA1 1ED.

Another very successful and well-planned trip was that of Dave Crisp, G4OAE, to the Aaland Island of Kokar (KT05e). Dave managed the VHF side and Steve Lowe, G4JVG, the HF operation. In the period Aug. 11 to 16, 37 MS QSOs were completed, nine were incomplete, while nothing was heard from a further 16 stations. The station comprised an *FT-225RD* with *muTek* front end, a 2 x 4CX250B amplifier and two *Cue Dee* 15-ele. *Yagis*, complete with *Kungsimport* combiner and all mounting hardware, kindly loaned by *Cue Dee Produkter HB* of Robertsfors in Sweden. These aerials are very sturdily made and were quite heavy with the hefty boom between the two, plus stub masts. 800 *l.p.m.* was used on CW, using a tone keyer fed into the microphone socket of the transceiver. A home made, four memory CMOS keyer was used. A *Philips* N2234 cassette recorder with variable speed control and audio mixer to up-convert incoming signals completed the equipment, apart from loads of spares! Complete QSOs were made with the following G stations:— 3NSM, 3WZT, 4IJE, 8VR, 4IGO, 3IMV, 3VYF, 4FUF, 4MDZ, 3SEK, 3POI, 8NGO, and 3WOH. The G3PBV sked was incomplete and nothing heard from G4BRK, G4IYA, G8VES, G8VJS and G8WRB.

Some corrections to the brief report on the *HADRABS* Andorran results — p. 305, August issue. G8APZ confirms that 32 MS QSOs were completed. Best DX was SM7DLZ (IQ) and U.K. squares worked were AL, YL, ZL, ZM and ZN. No GMs were worked, nor was EI2CA heard. The Trans-Alpine propagation effect lasted for an hour from 1800 GMT. Signals were S1 and very "watery" in sound. By beaming towards HB9 stations in IK, JE, JF, KD, KE and KH squares were worked and heard. Robin stated that

**ANNUAL VHF/UHF TABLE**

**January to December 1982**

| Station | FOUR METRES Counties | FOUR METRES Countries | TWO METRES Counties | TWO METRES Countries | 70 CENTIMETRES Counties | 70 CENTIMETRES Countries | 23 CENTIMETRES Counties | 23 CENTIMETRES Countries | TOTAL Points |
|---|---|---|---|---|---|---|---|---|---|
| G2AXI | 51 | 7 | 66 | 19 | 45 | 12 | *10* | *2* | 200 |
| GD2HDZ | 52 | 7 | 62 | 14 | 39 | 9 | *3* | *2* | 183 |
| G4JZF | — | — | 82 | 22 | 58 | 17 | — | — | 179 |
| G3BW | 41 | 6 | 68 | 20 | 37 | 6 | *5* | *4* | 178 |
| G8TFI | — | — | 75 | 19 | 56 | 17 | — | — | 167 |
| G3PBV | 29 | 5 | 63 | 21 | 32 | 9 | *8* | *4* | 159 |
| G8RZP | — | — | 72 | 24 | 40 | 14 | — | — | 150 |
| G8RZO | — | — | 71 | 24 | 40 | 14 | — | — | 149 |
| G3FIJ | 42 | 4 | 52 | 17 | 25 | 3 | — | — | 143 |
| G6ADE | — | — | 60 | 14 | 50 | 14 | — | — | 138 |
| GW3NYY | — | — | 81 | 27 | 19 | 7 | — | — | 134 |
| G8VRJ | — | — | 46 | 15 | 33 | 11 | 20 | 5 | 130 |
| G6ADC | — | — | 64 | 13 | 39 | 8 | — | — | 124 |
| G4ARI | 35 | 2 | 67 | 19 | — | — | — | — | 123 |
| G8DEZ | — | — | 77 | 40 | — | — | — | — | 117 |
| G4MUT | 12 | 2 | 48 | 15 | 28 | 7 | — | — | 112 |
| G8ULU | — | — | 50 | 20 | 29 | 12 | — | — | 111 |
| G8HHI | — | — | 52 | 15 | 18 | 7 | 9 | 2 | 103 |
| G8VR | 10 | 1 | 56 | 32 | — | — | — | — | 99 |
| G6DER | — | — | 68 | 20 | 9 | 2 | — | — | 99 |
| GM8OEG | — | — | 74 | 25 | — | — | — | — | 99 |
| G6ECM | — | — | 74 | 24 | — | — | — | — | 98 |
| G3FPK | — | — | 75 | 22 | — | — | — | — | 97 |
| GW3CCF | — | — | 42 | 8 | 23 | 4 | 10 | 2 | 89 |
| G8LFB | — | — | 67 | 20 | — | — | — | — | 87 |
| GM4CXP | 8 | 3 | 46 | 17 | 6 | 3 | — | — | 83 |
| G8WUU | — | — | 41 | 15 | 18 | 6 | — | — | 80 |
| G8VFV | — | — | 60 | 16 | — | — | — | — | 76 |
| G4KLX | — | — | 53 | 18 | 3 | 1 | — | — | 75 |
| GW3CBY | 10 | 3 | 42 | 12 | *3* | *2* | 3 | 3 | 73 |
| G8KAX | — | — | 40 | 9 | 13 | 2 | 8 | 1 | 73 |
| G4MEJ | — | — | 47 | 23 | — | — | — | — | 70 |
| G4NBS | — | — | 24 | 5 | 24 | 4 | 11 | 1 | 69 |
| G4FKI | 21 | 2 | 23 | 10 | 9 | 1 | — | — | 66 |
| G8RWG | — | — | 54 | 12 | — | — | — | — | 66 |
| G4NRG | — | — | 34 | 14 | 12 | 4 | — | — | 64 |
| G6AJA | — | — | 49 | 13 | — | — | — | — | 62 |
| G6FSH | — | — | 51 | 11 | — | — | — | — | 62 |
| GW4HBK | 35 | 7 | 14 | 5 | — | — | — | — | 61 |
| GM4COK | — | — | 28 | 20 | 5 | 6 | — | — | 59 |
| GW8TVX | — | — | 39 | 11 | — | — | 6 | 3 | 59 |
| G8XTJ | — | — | 48 | 9 | — | — | — | — | 57 |
| G6CGY | — | — | 42 | 12 | — | — | — | — | 54 |
| G4BVY | 9 | 2 | — | — | 29 | 11 | — | — | 51 |
| G6HDD | — | — | 40 | 7 | — | — | — | — | 47 |
| G8XHL | — | — | 25 | 8 | 9 | 3 | — | — | 45 |
| G8ZYL | — | — | 35 | 8 | — | — | — | — | 43 |
| G8LXY | — | — | 18 | 1 | 12 | 2 | — | — | 33 |

**Three bands only count for points. Non-scoring figures in italics.**

they were QRV on 70cm. all the time but that there were few takers.

## Four Metres

George Haylock, G2DHV, (Sidcup, Kent) is using the new *Mizuho* MX4, 200mW. transceiver. With a dipole and 3-ele. beam, he has worked G3IOI in Essex and G4DZO/P in Sussex, finding the Rx very sensitive. Bill Hodgson, G3BW, (Cumbria) is striving to catch up on his rival GD2HDZ but reckons, with no room on his tower for the aerial, he is at a disadvantage. Frank Howe, G3FIJ, (Essex) added G4ADV/P (Cornwall) and G3ZQM/P (Durham) in the Aug. 15 contest. Dave Thorpe, G4FKI, (Essex) using just 8W. *p.e.p.* worked F0FDB, alias G4JCC, in DD63j on Aug. 15, in a crossband 4/10m. QSO. GD4IOM was a new 1982 country for Dave.

Paul Turner, G4IJE, (Essex) worked the rare WR square on Aug. 11, thanks to GM4CJG. The next day brought GM3WOJ/P in YT, and a crossband 4/2m. QSO with F6FHP (AE) and who received a one minute burst from Paul and a 47 report. On the 28th, YU3ES (GF) was worked crossband and received 19 bursts and 13 pings from G4IJE.

Terry Hackwill, G4MUT, (Berks.) is now on the band with a *Yaesu* FT-480R and *MM* transverter. He has a 4-ele. *Yagi* on an *Altron* SM-30 mast, but without a rotator at present. Best DX so far is GD4IOM in the Aug. 15 contest. Arthur Breese, GD2HDZ, worked 44 stations in the contest worth 468 pts., but reports that GD4IOM made over 70 QSOs for 900-plus pts. Dave Lewis, GW4HBK, (Gwent) thought contest conditions poor but managed G4EKT (ZN) and G3RQZ (AL). He caught some *Ar's* but missed the DX-peditions. Simon Rodda, G4PEM, (ex-G6DFE) plans 4m. operation from XK73a, now that he has his Class "A" ticket.

## Two Metres

G3BW made no *Perseids* MS skeds. this year but did work IW3QEF (GF) on the random frequency. Bill was bitterly disappointed at the poor results from his random "CQ" calls. He found the QRM outstanding, indicating the growing popularity of this mode. Best tropo. DX of the month was GU3OUR/P in Alderney, also worked by G3FIJ. Dave Sellars, G3PBV, (Devon) found the Aug. 7 *Ar* at 1252 with weak GM, PA and northern D stations. At 1551, EI5AOB (VN) was contacted on SSB, after which the beam was turned south to Spain for the tropo. Successes here were ED1RCF/EA1RCA (WD); EA1KV/EA1YV (VC) and EA1APY, with EB1MS (XC) heard. C31HY was worked on the 10th and the next day, another *Ar* happened between 1710 and 1900. However, Dave missed out on GM5ENZ (WQ) and GM4KUX/P (WR). He thought the *Perseids* shower poor and skeds. frustrating. A 42s. burst, after 44 mins., from HG5OV was insufficient to complete for JH square.

Clive Penna, G3POI, (Kent) worked 7 UB5s in the Aug. 7 *Ar* and best DX in the *Ar* on the 11th was UP2BJB. That day also brought a tropo. QSO with EA2JG/P (YC06h). Clive's *Perseids* successes were EA1KV (VC); SL2CU/2 (JZ); EA6FB (AZ); OK2VIL/P (KJ); G4OAE/OH0 (KT) and UA1MC (PU). On the *E-M-E* scene, he worked W5LUU and KR5F (ex-G5CSZ), both in Texas, on Aug. 14, the following day bringing OH7PI, I1RSQ, W5UN, (Texas) and WB5LBT (Louisiana). A short *E's* event on the 15th brought 17VRK (IA) and the weekend 21/22 *E-M-E* QSOs with HB9SV, W5UN, N4GJV and WD5CRK (Oklahoma). ZS6ALE was almost worked on the 21st.

Mike Lee, G3VYF, (Essex) says the Aug. 7 *Ar* came just at the start of a Russian contest enabling him to work UB5PAA (ML); UB5OBC (LI); UP2s BEA and BDO (NP); UC2ABN (MN) and UC2ACA (ON). The Aug. 11 *Ar* brought GM5ENZ and GM4IGS/P (YT), while MS gave IW5AVM (FC) on SSB and G4OAE/OH0 in the *Perseids*. August tropo. for Ken Osborne, G4IGO, (Bristol) included the "WD double act" on the 7th and EA1APY; EA2AA (YD) on the 11th and GM5EHK/P (ZR) on the 14th. *Perseids* QSOs were YU7MAU (JF) on the 10th, 16WJB (HC); G4OAE/OH0; YU2SFU; F1JG (CD) and IW5AVM (FC) on the 12th, and F6FTN (DC) and SM0LRN/P (JS) on the 13th.

G4IJE had made up to 106 MS QSOs by Aug. 31. His best-ever DX was UA3LBO (QO) at 2,120 km. on the 12th. New squares for Paul were I2CVG/7 (HB); OK2VPB/P (KJ); OH7RJ (NW); OH4UC (NV) and YU1OO (KC). He missed out on OH7UE (OW) at 2,118 km., in spite of a 40s. burst in the first period on Aug. 12. UT4DL (LI) was another new one *via Ar* on the 7th.

Co. Fermanagh is a rare catch so Graham Taylor, G4JZF, (Staffs.) was pleased to work GB2NIS on the 3rd. An oddity was F1DPU/M over UO square in a New York bound DC8 on the 6th. He was using a *Yaesu* FT-290 by a window! Quite a lot of local and near-European stations were worked in the Aug. 7 *Ar* followed by Spanish tropo. in the evening. EAs were again in evidence on the 11th. Graham's only *Perseids* success was YU2FFU, but tropo. conditions were good, but activity low, on the morning of the 12th when DF9RJ (GI) was worked twice, first time *via* MS/tropo., the second by pure tropo. This was at 0200 when the HB9HB beacon was S5.

Quite an eventful time for Jon Stow, G4MCU, (Essex) who, on Aug. 11, used MS, tropo. and the *Ar* to rewarding effect, with LA8OW (EU) on CW; EA2JG (YC) and EA2AA (YD) on SSB and GM4KUX/P (WR) and GM5ENZ/P (WQ) respectively. Andrew Stone, G4OJR, (Suffolk) is a new correspondent and mentions that the *Lowestoft VHF Group* were in XM square for the *Ar* back on July 13/14, making 55 CW QSOs with 11 countries. Best DX were to IG, KQ, JJ, GF and HG squares in the period 2320 to 0425. Calls were GW4OJR/P and GW4GUF/P. From home on July 30, Andrew got YO7DL (LE60g) *via E's* at 1215 using 25W. to a colinear aerial.

Congratulations to George Gullis, (Wilts.) who is now G4PCI (ex-G8MFJ). The *E's* on July 30 brought him YO2BUG (KG) for a new country, HG8CE (KG) and YU7AR (KF) between 1205 and 1218. He was QRV for the Aug. 7 *Ar* and lists nice EA stations worked on tropo. on the 7th, 8th and 11th. G4PEM enters the Squares Table. Simon's station is an *Icom* IC-260E with *SOTA* 100W. amplifier, the aerial being an 8-ele. *Yagi*. RTTY and data transmission is envisaged for later on and readers are requested to beam towards Cornwall as there *is* activity in the county.

Welcome to another new correspondent Keith Hewitt, G6DER, (S. Yorks.) who enters the Annual Table. He runs an *Icom* IC-290E, *MM* 100W. amplifier and 14-ele. *Cushcraft* aerial at 50ft. The QTH is in a basin with no clear path in any direction. Mick Cuckoo, G6ECM, (Kent) lists many LA and SM stations worked in the end-of-July tropo. and later on the 31st, YO2BUG (KF) was another new one *via E's*. More LAs were worked on tropo. on Aug. 1, then on the 7th, the *Ar* brought DL5LAH (EO) and GM8BZX (YQ). On the 8th, Mick was into the southern France/Northern Spain tropo. which gave four more new squares.

G6FTB, Stuart Jackson, (Lancs.) had a number of queries about the counties recognised in the Annual Table, but all should be clear from the Sept. piece on page 358. Derek Newton-Goverd, G6HKT, is another new contributor from Wells in Somerset. He has worked 62 squares and 15 countries since he got his licence on Apr. 22, and enters the Squares Table. He uses a *Trio* TS-780 with 10W. to a 14-ele. *Cushcraft Yagi*, the QTH being an enviable 800ft. *a.s.l.* on top of the Mendips. Derek lists some nice tropo. and *E's* DX lately worked.

Jim Rabbits, G8LFB, (London) caught the EA opening on Aug. 11 which gave him EA2JG (YC) and EA2AA (YD) for a couple of new squares. The opening swung to central Europe the next day, with OE and OK heard and DF9RJ (GI) worked. Kevin Piper, G8TGM, (W. Sussex) had no luck with the five *Perseids* skeds, but did get YU3ES (GF) and F1JG (CD) on random SSB. He reckons he could get addicted to MS. Pete Godfrey, G8ULU, (Kent) missed most of the Aug. 7 *Ar* but did make his first contact on the mode with GM3WML (XQ). The event on the 11th, from 1700-1810, brought GM and GI

**QTH LOCATOR SQUARES TABLE**

| Station | 23cm. | 70cm. | 2m. | Total |
|---|---|---|---|---|
| G3VYF | — | 107 | 303 | 410 |
| G3POI | — | — | 379 | 379 |
| GJ4ICD | 1 | 99 | 215 | 315 |
| G3IMV | — | — | 305 | 305 |
| DK3UZ | — | — | 304 | 304 |
| G4IJE | — | — | 281 | 281 |
| SP2DX | — | — | 280 | 280 |
| GJ8KNV | 12 | 76 | 191 | 279 |
| G3JXN | 46 | 91 | 137 | 274 |
| LA8AK | 23 | 49 | 195 | 267 |
| EA3LL | — | 23 | 243 | 266 |
| G4IGO | — | 20 | 239 | 259 |
| G4ERG | — | 16 | 235 | 251 |
| G3COJ | 25 | 78 | 135 | 238 |
| G3XDY | 30 | 84 | 123 | 237 |
| G3PBV | 16 | 72 | 145 | 233 |
| G3BW | 5 | 31 | 193 | 229 |
| G4DEZ | — | — | 226 | 226 |
| 9H1BT | — | 11 | 210 | 221 |
| G3CHN | — | — | 221 | 221 |
| GM4COK | — | 26 | 194 | 220 |
| G8VR | — | 3 | 214 | 217 |
| GW3NYY | — | 42 | 169 | 211 |
| G4JZF | — | 68 | 140 | 208 |
| G8ATK | 13 | 68 | 124 | 205 |
| G8KBQ | 4 | 63 | 138 | 205 |
| G8HHI | 11 | 59 | 126 | 196 |
| G8RZO | — | 61 | 133 | 194 |
| G8RZP | — | 62 | 132 | 194 |
| G4MCU | — | 43 | 149 | 192 |
| G3NAQ | — | 58 | 128 | 186 |
| G3FPK | — | — | 184 | 184 |
| G4PCI | — | 28 | 155 | 183 |
| G3KEQ | — | — | 179 | 179 |
| GM4CXP | — | 26 | 149 | 175 |
| G2AXI | 8 | 60 | 106 | 174 |
| G4NFD | — | 36 | 138 | 174 |
| G4OAE | — | 18 | 148 | 166 |
| G8PNN | 23 | 50 | 91 | 164 |
| G8CXQ | — | 32 | 132 | 164 |
| G4NBS | 13 | 57 | 89 | 159 |
| GW4EAI | — | — | 158 | 158 |
| G4NQX | — | 46 | 111 | 157 |
| G4ERX | 6 | 46 | 104 | 156 |
| G8VRJ | 16 | 38 | 101 | 155 |
| GJ8SBT | 3 | — | 150 | 153 |
| G4AWU | — | 22 | 130 | 152 |
| G4GFX | 7 | 40 | 103 | 150 |
| GD2HDZ | 13 | 46 | 91 | 150 |
| G4HFO | — | 57 | 92 | 149 |
| G8FMK | 16 | 57 | 71 | 144 |
| G8KAX | 12 | 48 | 80 | 140 |
| G8ULU | — | 48 | 86 | 134 |
| G4HMF | — | 13 | 116 | 129 |
| G6ADH | — | 22 | 107 | 129 |
| G8LFB | — | — | 126 | 126 |
| G8TGM | — | — | 122 | 122 |
| G3FIJ | — | 29 | 90 | 119 |
| G6ADE | — | 54 | 64 | 118 |
| G6ECM | — | — | 118 | 118 |
| GM4IPK | — | — | 111 | 111 |
| GM8OEG | — | — | 109 | 109 |
| G8SRL | — | 21 | 83 | 104 |
| G6DDK | — | 10 | 93 | 103 |
| G4MEJ | — | — | 102 | 102 |
| G4GHA | — | — | 99 | 99 |
| G4MUT | — | 38 | 60 | 98 |
| G8KPL | — | 7 | 91 | 98 |
| G4MJC | — | 12 | 85 | 97 |
| GW3CBY | 4 | 15 | 77 | 96 |
| G8WUU | — | 22 | 70 | 92 |
| G6HKT | — | 28 | 62 | 90 |
| G8JAG | — | 7 | 81 | 88 |
| G4IRX | — | — | 85 | 85 |
| G8ZSU | 12 | 17 | 54 | 83 |
| G8RWG | — | — | 83 | 83 |
| G4BVY | 9 | 72 | — | 81 |
| G4KLX | — | 5 | 74 | 79 |
| G6ADC | — | 25 | 53 | 78 |
| G4NWT | — | 22 | 55 | 77 |
| GM8BDX | — | 24 | 53 | 77 |
| G8VFV | — | — | 76 | 76 |
| G8XIR | — | — | 66 | 66 |
| G6CNX | — | — | 63 | 63 |
| G8XMP | — | — | 62 | 62 |
| G4NRG | — | 9 | 51 | 60 |
| G4GXL | — | 4 | 52 | 56 |
| G8LXY | — | 20 | 34 | 54 |
| G4PEM | — | — | 50 | 50 |
| G6ABB | — | — | 49 | 49 |
| G8XQS | — | — | 47 | 47 |
| G8ZYL | — | — | 46 | 46 |
| G4LDY | — | 3 | 41 | 44 |
| G8MBI | — | — | 40 | 40 |

**Starting date January 1, 1975. No satellite or repeater QSOs.**

QSOs. A wait for a second phase instead found nice tropo. eastwards with OE5KI (HI) and DF9RJ (GI).

John Fitzgerald, G8XTJ, (Bucks.) echoes G3CHN's remarks last month about declining operating standards and refers to a G8H.. station who was setting a very bad example of operating during an EA opening. GD2HDZ highlights July 30 when he worked his second ever LA, '8EW (DS). The first was in 1976!

Geoff Brown, GJ4ICD, is busy gathering information on *E's* events world-wide, the ultimate goal being to see if it is possible to predict these events as can now be done with some success in the case of *Auroras*. He worked some EAs on VC, for a new square, on Aug. 7, EA1AZN being S9-plus-40dB! Andy Swiffin, GM8OEG, (Dundee) is now at a new QTH 450ft. *a.s.l.* His letter covers the excellent tropo. openings in July in which he worked LA8UU (DT) on the 13th, and EI3VIO/P (VP) on the 28th. He reports a very early morning phase in the Aug. 7 *Ar* and worked lots of DX in the afternoon one. However, it was somewhat marred by PA and D stations who persistently called even when he clearly indicated he was only listening for certain areas other than DL, DM squares, etc. This is a perennial complaint. Andy reckons the *Perseids* MS shower was "rubbish" this year! He found the random mode ". . . too much of a rat race" so will concentrate on skeds. in future. GW4HBK operated in the *Ar* on Aug. 7 but seemed to be on the edge of the Aug. 11 one.

As this was being compiled, a very widespread event was in progress throughout the afternoon and early evening of Sept. 6. At least 20 countries were heard/worked from G3FPK at QTFs 40°-80° for the eastern stations. The tragedy was the absence of Polish stations, of course. More next month.

## Seventy Centimetres

G3BW got GU3YGF/P in Alderney, who was S7 in Whitehaven with 400W. and 8 x 21-ele. *Tonna Yagis*. The Spanish lifts on Aug. 7 and 11 gave G3VYF WD and YD squares, while EI6AS (WN) and GM4DIJ (YP) were new in the Aug. 7 *Ar*. G3PBV worked GW8ROU/P on Aug. 11, and GB2XM on the 22nd, both in XM and Dave worked GU3YGF/P and GU3EJL in Alderney. G4JZF is very pleased after a year on the band with 18W. output. Aug. 7 brought EA1RCA (WD) but on the 11th, EA2AA was copying Graham at 1057, but it was a one-way affair. In that evening F1BUU (ZE) was another new one and GJ4JWA was country no. 17 for 1982. He also worked GU3YGF/P.

Not much activity from G4MCU apart from GB2XM and GU3YGF/P. John King, G6ADH, (Surrey) remarks on the difficulty of getting QSLs for 70cm. contacts; with 21 countries worked, he has but *two* confirmed! It seems that a couple of our keen readers owe him cards and he did send stamps. G6DER's station comprises the *IC-290E* and *MM* transverter with a 48-ele. *Multibeam* but the QTH is poor for UHF so no great scores are anticipated.

G6HKT uses a TS-780 with an *MM* 50W. amplifier. The aerials are now two 19-ele. *Tonnas* fed with *Andrews* LDF4-50 cable. G8ULU mentions the improved propagation after the doldrums of the Aug. 1 contest. Pete worked OZ7IS and OZ9FW, both in GP, on the 3rd. On the 8th came GW8ROU/P, and on the 17th, GU3YGF/P to bring the squares tally to 48. John Cooper, G8WUU, (Essex) has worked OZ for a new country, but is only QRP at present due to problems with the gear. He is a bit disappointed so far, as he is not too well sited. GD2HDZ's list shows OZ1CF, DB1BP and SM6ESG added at the end of July to make it nine countries this year. GJ4ICD is up to 99 squares, the latest addition being EA1RCA (WD).

George Szymanski, GM4COK, is back on dry land for a while and confesses to a *BBC Micro Computer* in the shack now. He has been using it to generate colour bars and text for fast-scan TV. GM4DTH and GM4HFM, also in Edinburgh, and GM3RVK in Fifeshire, all also transmitting TV, the latter putting out nice colour from tape, or a "rotating Snoopy in black-and-white from a camera!"

LA8AK (DS80b) uses an *MM* transverter into several HF rigs, a 50W. PA and 21-ele. *Yagi*. A 3SK97 preamp. is used. On July 13, Jan-Martin worked G8ATK (ZL66b) at 950 km. On July 30, GW8YUJ (XN59c) and on the 31st, GM3JFG (XR30b) were worked *via* tropo. He enters the Squares Table with 49 on the band.

## Twenty-three Centimetres

LA8AK worked G3JXN (ZL39e) on July 12 — 900 km. He suggests some good DX QSOs were lost due to bad operational skill. He prefers to call "CQ" on CW but anyone can call "QRZ?" if they cannot copy or send CW and he will reply on SSB. Jan-Martin's gear comprises a 1,296/28 MHz transverter into either a *Yaesu* FT-101B or *Drake* R4-C, with a 25W. PA and 23-ele. *Yagi*. Between May and August, stations in AM, AL, ZL, ZM, ZN and YO have been worked. G3PBV is still only running 3W. but is progressing with a 3CX100A5 PA. Dave did work GU4KNZ/P on SSB and made a weak CW QSO with GB2XM, so is quite pleased.

## Deadlines

Not quite such a hectic month. All your contributions for November by Oct. 6 to:— "VHF Bands", SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts. AL6 9EQ. The following deadline is Nov. 3. *73 de G3FPK*.

# IMPROVING THE ICOM IC-251E/211E RECEIVE PERFORMANCE WITH A muTek FRONT-END BOARD

PETER CONNORS, G8LEF

As the numbers of stations on two metres increases, the demands made on receiving systems to couple sensitivity with good large-signal handling grow ever more stringent. Although many modifications to multi-mode transceivers aimed at reducing the system noise figure have been published, less work has been done on increasing dynamic range. Many stations are happy to fall back on the ill-considered idea "it must be because we're so close" when confronted with a 'wide' signal — thus missing out on DX QSOs when conditions are good and the 2m. band is heavily occupied, and unjustly lumping together clean QRO signals with those from badly set up solid-state "linears". *See* Addendum (i).

This article will describe how to incorporate a readily-available commercial front-end, by *muTek Ltd.*, derived from work done by G3SEK and designed for incorporation in Yaesu transceivers, into the Icom 251E/211E transceivers. A 251E modified in this fashion has been in use for a year now at the author's QTH, 1150 feet *a.s.l.* in the congested (radio-wise) West Yorkshire conurbation, with excellent results, and a similarly modified IC-211E is in use by G3ZPU. The modifications are not for the faint-hearted, but those who would wish to carry them out "as part of the self-training of the Licensee in communication by wireless telegraphy" — read on.

## The Transceivers

The Icom 251E and 211E have identical front-end circuitry and component numbering in those the author has seen, and it would appear that the same would apply to the IC-251A which is the version for the American market.

A dual-gate MOSFET RF stage and mixer combine to provide average multi-mode performance, although Icom have incorporated more RF selectivity and less gain than other rigs which gives a little better receive performance on strong signals. The 144 MHz input, 10.7 MHz output, local oscillator and AGC lines, all interface readily with the muTek board which was designed for just such a front-end configuration. Provision of a switched 13.8 volt receive line to the muTek board requires the addition of a small piece of circuitry, but the major effort required is mechanical. Even this is straightforward enough, given a little common sense, because there is lots of empty space in the Icom rigs.

## The muTek Board

Gain distribution in this unit has been carefully engineered and proper terminations applied to the double-balanced mixer in order to achieve a sensitivity limited only by external noise, and a dynamic range which could only be improved by using larger local oscillator powers. *See* Addendum (ii).

The circuit was originally designed for the Yaesu FT-221/225 transceivers and parts of the muTek circuitry are redundant in the Icom rigs: a separate FM IF amplifier is not required and the Icom noise gate is retained, so some of the components in these areas are either unused or removed in the modifications. Although intended to be plugged into an edge connector, this board is easily mounted by means of soldered or bolted standoff supports to the threaded lugs in the diecast sides of the Icom transceivers. Connections between the board and the transceiver are made by means of flying leads soldered to the edge connection pads.

## Getting The muTek Board Ready

The author's board had already been used in a Yaesu FT-225 and was therefore to hand when the Icom's dual VFO and ability to be interfaced to a microprocessor prompted the rig change. The board comes with a circuit diagram and part numbering, so the changes to the board are easily described: it's worth familiarising yourself with the layout and components before starting, however.

The string of diodes D1 to D4 in the AGC line should be shorted out because the delay provided by these diodes isn't needed by the Icom AGC circuitry. All the components in the noise gate, R21, R22, L7, C18, C19, D5 and L8 should be removed, leaving only C17 still used. This will be on the 'earth' side of the IF input to the Icom; the other side of the IF transformer output link should go straight to the output edge connector pad (*i.e.* D5 shorted out) and this is the 'hot' side of the IF input to the Icom; *see* Fig. 1. Resistor R31 should be changed to 100K in order not to load the Icom AGC line too heavily — and that completes the electrical mods to the board!

In order to mount the board a number of methods are possible: if you look at the available space in the underside of the Icom you should find a way which suits the hardware to hand. The author used a couple of brass strips about ½-inch long and ¼-inch wide, drilled at one end. The other ends were soldered onto the board earth plane (upper side) opposite the edge connection side, and the appropriate (metric!) screws used to hold the strips down onto the diecast lugs on the inside of the Icom case; *see* Fig. 2. One of the strips was sandwiched under the power supply corner mounting in the IC-251E; the 211E has a differently-shaped power supply and a different mounting was found necessary in this case — the main thing is to make sure it is solid, accessible and doesn't foul any existing components.

The board isn't ready to go in just yet, however; a set of flying leads must be soldered to: the 13.8 volt supply line, and the AGC line (single wires); the IF output and the local oscillator input (single screened wires); and the 144 MHz input (the best quality 50-ohm thin co-ax you can lay your hands on — miniature PTFE is very good). Leave these about 18 inches long. although this will be reduced on final soldering up.

A final addition to the board is optional: if you are going to use the Icom Rx/Tx aerial switching, you should isolate the muTek board from the DC used to switch the changeover diodes by incorporating a small 1 nF ceramic capacitor with short leads in place of the 'bridge' on the muTek board input line. If you use a relay for the final bit of low noise figure, as the author did, then this isn't necessary.

## Getting the Icom Ready

Only three components need to be removed from the transceiver; this isolates the existing front end from the 144 MHz input and 10.7 MHz output paths. Again it is best to familiarise

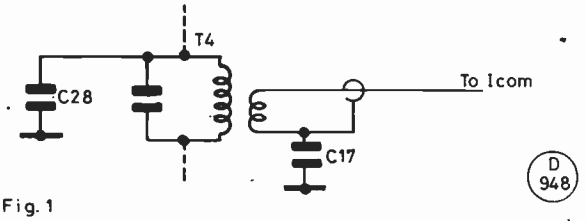


Fig. 1

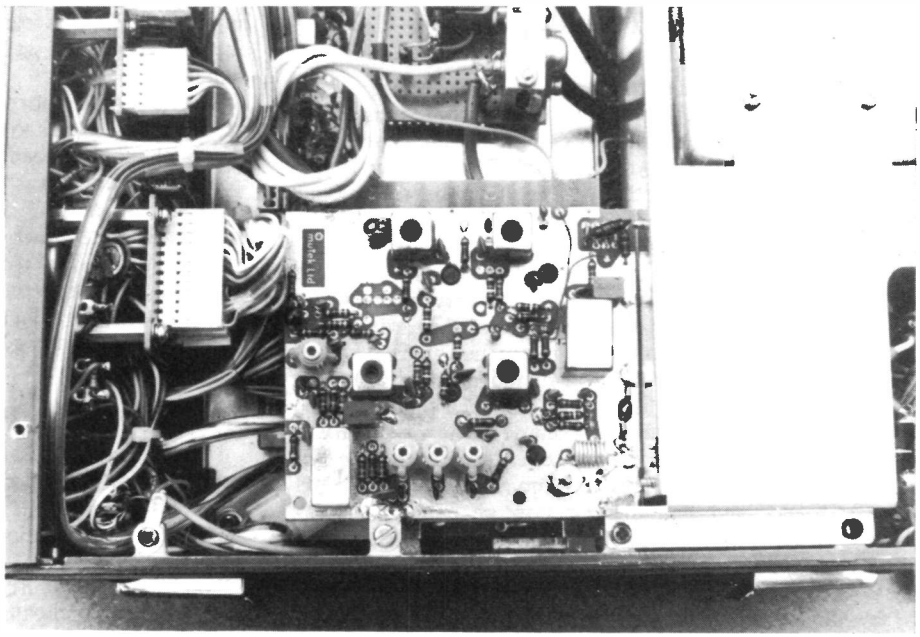

**Fig. 2. The underside of the IC-251E, showing the mounting method. The power supply is at the right and the *Veroboard*-mounted switching circuit and aerial relay can be seen above the muTek board; the *Veroboard* is mounted on the PLL circuit lid.**

yourself with the Icom main board layout and component numbering beforehand, but this can be done by examining the circuit and layouts supplied with the rig.

In order to gain access to the underside of the main board in the Icom, it is necessary to remove the power supply. This is readily done by disconnecting the multi-way connector and then removing the six screws holding it in: four inside and two on the back panel. This allows the removal of the following components from the main board: FL2 and L55 to isolate the IF side of the existing front end; C202 to isolate the 144 MHz input.

## The Extra Bit

There is no 13.8 volt line switched on receive in the Icom rigs; they use 9 volts for the front-end power rail and this obviously isn't enough to allow proper operation of the muTek board, so the 13.8 volts on receive rail must be added by means of the circuit in Fig. 3. This provides the appropriate supply to the board on receive — you *could* leave it permanently powered on both Rx and Tx by connecting to the 13.8 volt rail in the Icom, but the muTek board wasn't unconditionally stable when powered on transmit in the author's installation: this may give rise to spurious outputs on transmission and isn't likely to do the board much good, either!

## Getting It Together

The extra switching circuit may be built on *Veroboard* and mounted anywhere convenient by double-sided adhesive pads, *see* Fig. 3, or by using contact adhesive to glue it to grommets which are again stuck any where convenient. The circuit handles nothing but DC, so the layout isn't critical. The author is a sceptical soul, so ferrite beads were strung on all lines carrying DC just to make sure!

With the power supply still removed, mount your board at the location you've decided and check that it will be clear of the power supply when this is replaced. This is why the flying leads were left at 18 inches: to make sure they can be routed round the power supply in the final installation.

You can now start making the connections between the Icom and the muTek: join the IF output screened lead to the points on the underside of the main Icom board where L55 was situated. The inner goes to the end where FL2 was connected, the 'earth' goes to the other end of the L55 connection. Remember that the outer of this lead is 'hot' with DC because of the diode switching network in the Icom, so don't let it short out to the metalwork anywhere.

Connect the inner of the local oscillator feed to the gate 2 end of R188 and the outer to earth at the other end. Connect the AGC wire to a suitable point such as gate 2 of the Icom RF amplifier (Q47) and take the 13.8 volt feed from the switching board you've produced to the muTek supply rail. That switching circuit will need connecting to the 13.8 volt and 9 volt on transmit rail in the Icom at suitable points. The last connection is the 144 MHz input: if you've taking it to an external relay, this can be done by mounting a BNC socket in place of one of the spare phono type sockets on the rear panel, and connecting this to the front-end board input. If you're going to use the existing diode-switched input (remember that isolating capacitor on the muTek board!) then the connection should be made to the main board at the aerial side of the previously removed C202. The diode switching and the low-pass filtering on the IC25E input line do degrade the obtainable noise figure, however: the author added an inboard relay to the Icom and used the switched 13.8 volt line to perform the changeover function. This lets the transceiver to remain as such, whilst allowing the front-end board to perform at its best. A small coaxial relay such as the *Magnetic Devices* or *Ambit* 12-volt unit, widely advertised, is suitable.

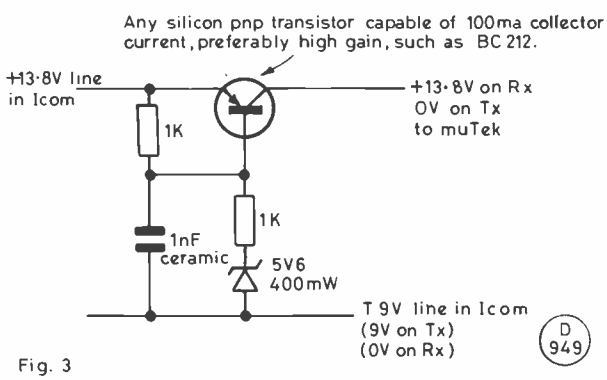


Fig. 3

## The Tweaking

After you've thoroughly checked out all those connections (remember to leave enough free lead to clear the power supply assembly) the power can be remounted and the board fastenings tightened up. Reconnect the multiway plug and socket to the Icom power supply module and you're ready to switch on: if you haven't made any mistakes, the receiver should be working but the AGC action and S-meter won't be making any sense. The Icom PSU is short-circuit protected, but if you don't hear any noise on receive (have you reconnected the speaker on the bottom panel?) then switch off and check round with a multimeter to see that the appropriate voltage is reaching the muTek board and that there aren't any inadvertent short-circuits in the signal path. If all is OK, you will find that the S-meter isn't moving as far as before on strong signals and that it isn't settling back to zero in the absence of a signal. This is all right because it's now necessary to adjust the AGC and S-meter circuitry to compensate for the fact that the muTek board is supplying more gain than the original Icom front-end, and that there is now an additional gain-controlled stage in the front-end (two gain-controlled IF stages in the muTek opposed to one gain-controlled RF stage in the Icom). This is very easily done in the Icom transceiver because it is one of the few designs in which AGC loop gain, AGC line DC level, S-meter zero and S-meter gain are all independently adjustable. The preset pots concerned are R106 for AGC gain, R92 for AGC DC level, R132 for S-meter zero and R26 for S-meter gain.

Terminate the receiver input with 50 ohms: a small non-reactive dummy load or a resistor mounted inside a PL259 plug will do. Monitor the AGC line voltage (at a suitable point such as the junction of C199 and C200) with a high resistance voltmeter (at least 20K ohms/volt) and increase the setting of R106 until the voltage has risen to about 3.8 volts. You may find you have to set R106 at maximum; in that case the final setting of the AGC level should be done by adjusting R92 to obtain the required voltage. Don't worry if the AGC voltage appears to be flickering — this means that the receiver is 'seeing' the thermal noise in the 50-ohm resistor as its noise floor! Remove the meter from the AGC line and adjust R132 until the S-meter is *just* sitting at zero; any increase in 144 MHz input level over the 50-ohm thermal noise level will now make the AGC circuit and the S-meter start operating. This is equivalent to a 273 degree Kelvin, or 3dB, noise floor which is the (infrequent) minimum you will ever see in 2-metre terrestrial work.

If you actually like signals being S5 before the meter moves, just set the S-meter zero level so that this happens: and if you don't want the AGC to come on until signals have reached 20dB over noise, then you will have to reduce the AGC gain even further. Since R106 is probably already wound down to one end, you'll have to do this by reducing the muTek board gain. This can be done by either increasing the value of R37 on the muTek board or loading T4 with a resistor until you've got the AGC delay you want.

The author found it preferable to have the AGC action starting at the noise floor because his eardrums can't stand the hammer when he tunes across the band listening for weak signals from a big aerial array on top of a hill!

The remaining adjustment is to R26, the S-meter gain preset: this is *entirely* subjective. With S-meter calibrations depending upon an oriental subcontractor and the number and type of gain-controlled stages varying from rig to rig, the old "6dB per S-point" has long since gone out of the window! If you want to impress people you can set it for 40-over-9 for all signals; alternatively you can set it to give S9 only on local signals to upset people!

Originally the author set it so that full scale was reached on the strongest local signals so that a comparative strength reading was always obtainable when the question of "it's because we're so close" came up. It was found that comparable power levels at either end of a QSO didn't give rise to compatible reports, however, so the S-meter gain was set so that the reports each way closely matched (*i.e.*, if you work ten stations each running ten watts that give you a 9 report, your average report to them should be S9). There's no valid scientific basis for this, of course, but it lends itself to more consistent comparisons than the other methods.

## Performance

Receive sensitivity is now limited only by external noise for terrestrial (aerial pointed at the horizon) work: at the author's QTH this is dependent upon beam heading, time of day and season. In urban locations, some stations may find the S-meter never returning to zero because of man-made noise; only a move of house or E.M.E. will cure this! Available local oscillator power from the Icom is more than sufficient to drive the muTek, so with large signals there is now the luxury of finding end-stopping signals that vanish in ±10 kHz and weaker ones that are still there 0.5 MHz up the band! Indeed, since it is possible on many strong signals to be sure that you are listening to the transmit, and not the receive, performance you can often predict the manufacture of the equipment at the other end of a QSO after a little comparative listening.

The noise blanker in the Icom works as well as it did before: in fact it works better than the same board incorporated in the previously-owned FT-225. This is probably because the increased gain in the front end compensates for the reduced bandwith seen by the noise blanker.

The new setup has been in use for a year and no lack of reliability has been found; the author leaves his transceiver switched on all the time and has also used it for hours at a stretch in 2-metre contests with gratifying results.

If you're really a dab hand with the soldering iron, it's possible to make up a 'Chinese' copy of the muTek board without the unused FM amp. and noise gate and incorporate that into your rig. Otherwise, the above is the way to do it until we can prevail upon Chris Bartram of *muTek Ltd.* to produce a board with that switching circuit already on it, ready to interface with the Icom!

As you can see from the above, the modification isn't as straightforward as with the Yaesu rigs, but 2-metres *does* get hairier every day and the combination is both economical and completely reversible should you chicken out!

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*Addendum (i):* At the author's QTH, the demands on the receive system are particularly stringent because adjacent property on three sides have masts radiating out-of-band signals; in addition, the band I, II, III and IV transmitters at Moorside Edge, Holme Moss and Emley Moor are line-of-sight!

*Addendum (ii):* In addition, the muTek circuit uses a six-pole 15kHz filter instead of the two-pole roofing filter supplied in the Icom transceivers. This vastly improves the ultimate attenuation when 'off the side' of very strong signals; although the reduced bandwidth does reduce the noise-blanker action a little, this was less of a problem in the Icom installation than a similar Yaesu modification.

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**November issue due to appear on Friday, October 29th**

# BASICS FOR THE S.W.L. AND R.A.E. CANDIDATE, PART VII

## SUGAR-COATED THEORY

CONTINUING from the consideration of the various diode types, it perhaps doesn't take a lot of inspiration to realise that the difference between, say, a microwave signal diode and a big fat power diode is largely a matter of mechanics — getting the heat away in one case, and in t'other keeping the stray capacitance around and in the diode to a minimum so as to avoid capacitive leakage of the microwave RF signal.

Not quite so obvious intuitively is the situation in which we make, for instance, a couple of P-type areas on a chip of N-type material: Fig. 1 shows this, and is an archetypal germanium junction transistor. One of the P-type areas is called the emitter, the N-type part is the base, and the other bit of P-type is called the collector, which are all extended by leads to the outside world.

### Whoa!

From theory let us turn, for just a moment, to dear old practice. Pick up your testmeter and set it on the 'ohms' range, short the prods together and 'set zero' by twiddling the knob until the meter reads zero ohms, at or near full-scale deflection. Now, if you have another testmeter available, set that to a lowish DC voltage range and you can then measure the *polarity* of the volts coming out of the terminals of the meter on 'ohms'. You may be surprised to find that 'positive' comes out of the negative terminal and 'negative' comes out of the positive terminal. This is normal on a multi-range meter set to ohms. Now, pick up a diode — any old diode will serve for the moment, and measure its resistance. With the meter prods connected one way, you will see a lowish resistance, but if you reverse them, then you will see a much higher resistance — indeed, you may have to go to a high-ohms range to see this *reverse leakage* current at all. If your high-ohms range is around 20 megohm maximum, observe that your fingers holding the leads on to the prods may show a far greater leakage than the diode!

The result just mentioned indicates that you have a diode which is at least trying to do its thing; if you get low resistance both ways or a very high resistance both ways, or nothing at all, twist the leads together and chuck the diode in the bin. (Twisting the leads is insurance; if you miss the wastebasket or it falls out, and you find it under the bench in a year's time, the twisted leads will remind you that it was a dud. Do this twisting lark with all dud components, and save yourself much head-scratching when the new project won't play).

Now, can we apply a similar argument to a transistor? Yes, and no. If we can identify the base of the transistor, then we can say there is a diode between base and emitter lead, and another diode between base and collector; so if we put, say, the negative lead of the testmeter on 'ohms' to the base and we see conduction between base and emitter first, then base and collector also, we can now put the positive lead of the testmeter to the base and we should see high resistance between base and emitter, and base and collector — provided the third lead is not connected to anything at all. This last proviso simply says that we are taking care to test only the base-emitter diode by itself, and then the base-collector diode by itself. If this test works, you have made a fair rough check that the two junctions — base-emitter and base-collector — are present and hence you have a fair chance that it might still be a transistor. If it fails this test, in general it is a dud, so you can twist the leads together and sling it in the bin. (However, some economy-minded lads *have* been known to clip off the pin to the diode which is gone, leaving the base pin and the pin to the 'good' diode, and chuck it in the "come-in-handy-sometime" box, along with diodes that ought to be LEDs but don't light up and other such oddities).

Now back to our theory again. Look at Fig. 2. Here we have a primitive PNP transistor. In fact the N-type layer between the two

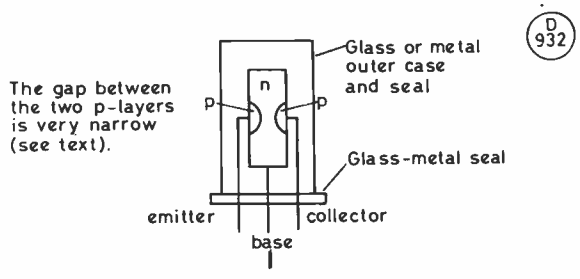



Fig. 1 BASIC CONCEPT OF GERMANIUM JUNCTION TRANSISTOR

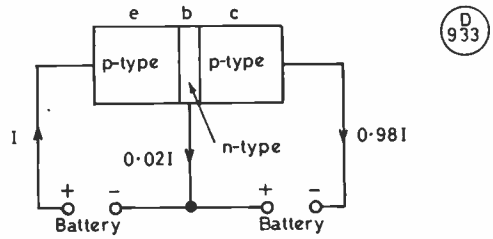



Fig. 2 Basic connections to demonstrate transistor action

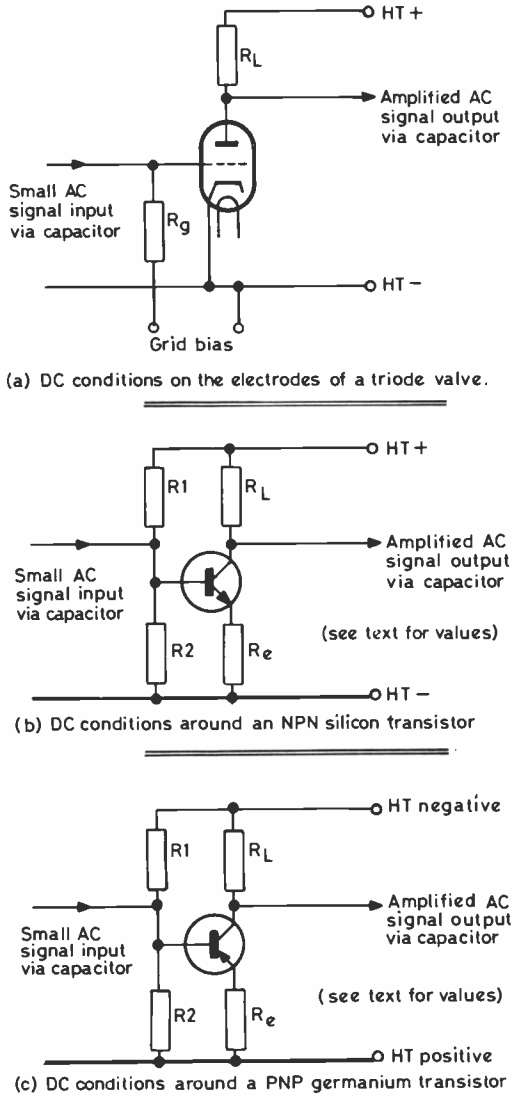
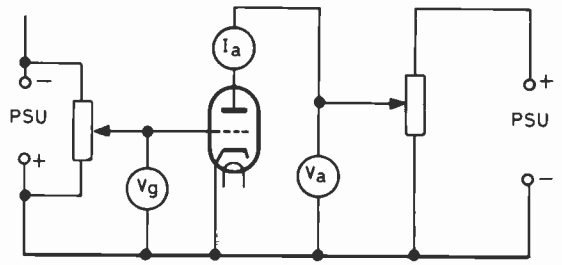
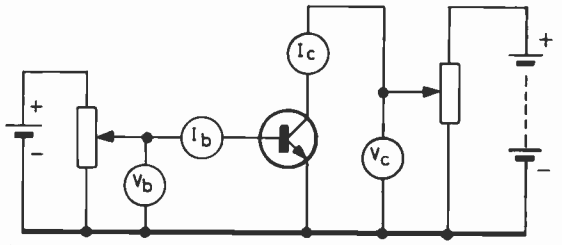



Fig. 3




(a) VALVE - See Fig.5 and text for discussion




(b) SILICON NPN TRANSISTOR - See Fig.6 for text and discussion. For PNP transistor, reverse polarity of both batteries.

Fig. 4 CIRCUITS FOR OBTAINING CHARACTERISTIC CURVES

D 935

P-type layers is very thin — of the order of 1/1000 inch thick. Thinking of this archaic transistor type means germanium; and if we connect voltages as shown in Fig. 2 such that the emitter-base junction is forward biased, and the base-collector junction back-biased (*i.e.* negative rail to collector, positive rail to emitter, and the base joined between the two rails as shown by the battery symbols) then we would expect that current will flow in the emitter-base junction and nothing much in the base-collector circuit. Wrong!

Because of the thinness of the N-layer, what happens is that current carriers from the emitter cross into the N-layer as we would expect, and a small proportion do indeed flow out of the base. However, the vast majority — something like 0.98 of the total — are 'captured' by the collector P-layer and come out of the collector wire, to return home to the emitter through the battery. Now, since we have in the emitter a current flowing in a low-resistance circuit, and we have as near as dammit the same current flowing out of the collector which is measurably higher-impedance, then a little reflection (*hint:* $E/I = R$, $I^2R = W$) will tell us that we have in fact got ourself some *current gain*. Lucky us!

## Whoa Again!

Imagine we have a doubtful germanium PNP transistor and we would like to know if it is really trying its best . . .

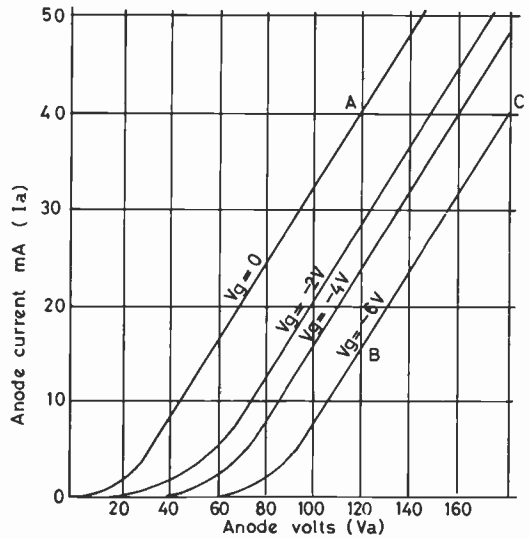
Take our testmeter up again, and hang the negative lead (out of which, recall, comes the positive polarity on the 'ohms' range) on the emitter lead of the transistor; put the other lead of the testmeter on the collector. Not much current will be noticeable at reasonable temperatures. Now, take a finger and suck it for a moment. Now put the damp finger between base and collector junctions, and you should see a rise in the current in the testmeter. Your wet finger has biased the transistor into some collector current. *Ergo,* you have a transistor, and at least at DC it is trying to work!

Of course, most modern transistors are based on silicon; but usually, the reversal of the testmeter leads will cause the same result if the transistor is an NPN one; and of course a silicon PNP transistor will respond to the test as already discussed for the germanium PNP type.

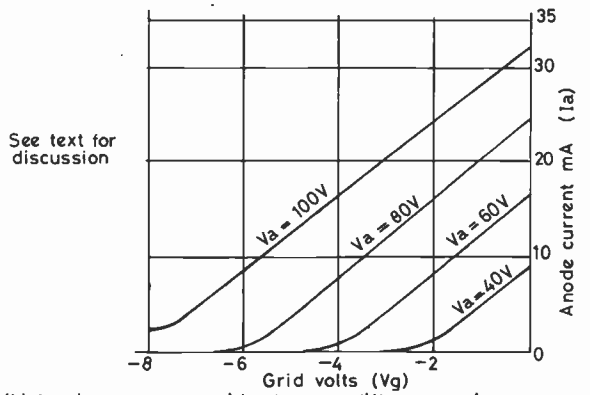
The rough test discussed above won't tell you how the transistor is, only that it is doing its best. For a better test, knock up a little tester such as the one given by G3RJV in the June issue on pp. 196-197.

## Differences

The early transistors were all made of germanium, and germanium has drawbacks. Firstly, the current out of the base is, relatively, higher than for a similar silicon device, so in effect we are saying that the germanium transistor has a low input impedance, relatively. In addition is the limited range of temperature over which they are usable. It is not unreasonable to say that a temperature of 80°C is as hot as a germanium junction transistor should get, *measured at the germanium,* and if it goes much higher we will see the dreaded 'thermal runaway'. If we have a current meter in the supply rail, the effect is seen as a sharp and progressive rise in rail current. Usually, by the time you've reached it and turned off the supply switch, your germanium transistor is no more! Hence a 'crow-bar protected' bench power supply, which is smart enough to detect such a rise in current and shut down instantly, is a worth-while project, and as it usually has both voltage and current meters as well it has the further advantage of releasing the station testmeter for general use. Of course, circuit design can go a long way to prevent such mishaps, as we shall show, but while experimenting, always beware of thermal runaway. The same effects are present in silicon devices but as silicon's leakage current is so low, and the maximum usable temperature of a silicon device so much higher (up to 200°C), one can say that thermal runaway is not a significant problem with a silicon device. It can still be 'popped' but usually it has been assaulted by an over-voltage 'spike' or some other carelessness.



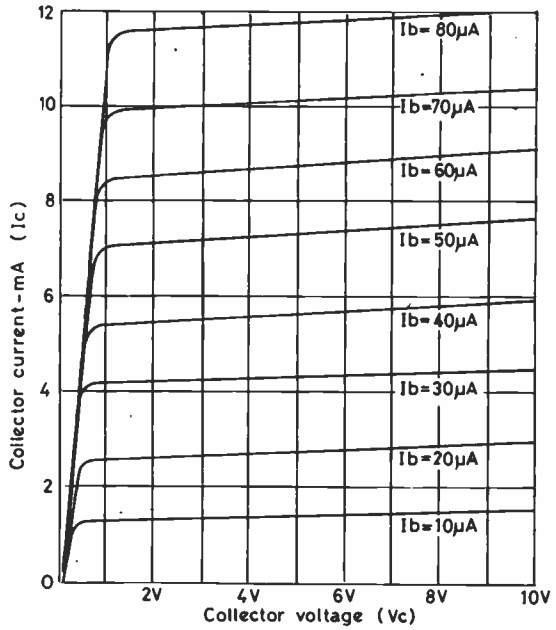

(a) Characteristic curves of a triode at different settings of Vg



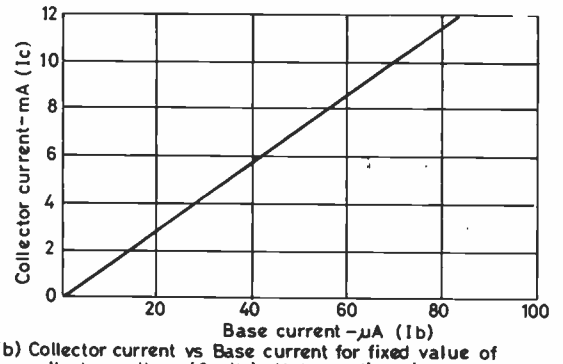

(b) Anode current vs grid voltage at different settings of anode volts

Figure 5

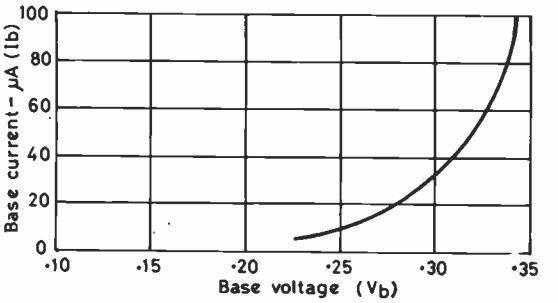
D 936




(a) Ic/Vc curves for typical small signal germanium transistor




(b) Collector current vs Base current for fixed value of collector voltage (3volts). Note the linearity




(c) Base voltage vs Base current at fixed value of Vc (3V) Note the non-linearity.

Fig. 6 SEE TEXT FOR DISCUSSION (D 937)

## Try One!

Take a silicon transistor of the NPN persuasion — say, a BC108 or one of its numerous equivalents, and wire it up as in Fig. 3b. You have a 'working' transistor stage even if you haven't yet thought of a job for it! In Fig. 3c we have the equivalent for a germanium PNP transistor. Compare it, old-timer, with the valve stage you know so well — say, a Class A small-signal stage with no signal, as Fig. 3a. What are the differences? — or rather what is *the* difference? All three are capable of taking a small low-frequency signal in, and putting out a bigger one. Disregard the piddling difference of size and polarity of the DC rails, and the presence or absence of a heater. What have we left? Just this — in the case of the valve the grid is biased to a voltage outside the range of the supply rail — a bit negative of cathode in fact — but the transistor stage has its base sitting at a value which lies somewhere *between* the two rails of the supply. Therein, masters, we have the Law and the Prophets of transistory, in practice. If you have a 'scope and an AF generator, or a microphone and an earpiece, feed AF in through a capacitor, and take AF out through a capacitor and prove for yourself that it's true.

*Characteristic curves* come next. Let's stay with a valve and a silicon transistor — forget the valve if you have done the characteristic curves of a valve before and concentrate on the transistor. The results will show you what the transistor is trying to do. However, you must recall that whereas the valve draws no grid current unless you drive the grid into the region between the cathode and anode voltages, in the case of the transistor it is obvious that we are in fact operating with one diode 'turned on' and so drawing current at all times (again unless you drive the base outside its normal range). So that a valve is a voltage amplifier and a transistor is more truthfully a current amplifier.

The circuit for the characteristic curve tracing is shown at Fig. 4; the idea is to be able to make one or other of the parameters constant while the other two are varied, and to plot the results in graphical form. From these graphs our imagination can then begin to see what is happening dynamically in the circuit. The curves appear in Fig. 5 and Fig. 6.

## Interpretation

Look first at the valve curves in Fig. 5a, and in particular at the one labelled $V_g = O$. It looks rather like what we have previously deduced a diode curve might look like — more volts, more current (until something breaks!). The other curves in the Figure look very much the same. However, note that if we can reduce the anode current by an increase in $-V_g$, so also can we bring the anode current back up again by leaving the grid alone and raising the anode volts. Look at the curve: at $V_g = O$, anode current of 40 mA results from 120 volts on the anode. Change $V_g$ now to $-6$ volts, anode current falls to 16 mA, but by bringing the anode volts up to 180 volts, we can recover our 40 mA. Hence we can say that for constant $I_a$, a change of 60 volts on the anode is produced by 6 volts on the grid. This is the *amplification factor,* denoted by the Greek letter $\mu$.

Another measure of what the grid can do is to note the change of anode current for a given small change in grid voltage, provided that we keep the *anode volts* constant. Such a curve is Fig. 5b, and the parameter we are talking about is the *mutual conductance,* or $g_m$, measured in milliamps per volt (or, to please the pundits, millisiemens!) and on the linear portions of the curves our specimen looks like about 4 mA/V.

Now, the anode current and anode voltage can change even though we keep the grid volts constant (ever seen a home-brew power supply going up in smoke?) Strictly we should be talking about $I_a/V_a$ and hence about conductance, but being plebs we talk about $r_a$ — the *anode* resistance.

All this from a set of characteristics — no wonder characteristic testers are laboratory tools! But, we're not done yet. All three, $g_m$, $r_a$ and $\mu$ are related, and we've explained how indirectly in defining them above. Let's just say that $g_m = \mu/r_a$ and that you can shift 'em about like Ohm's Law; so if you know you have two from the 'book of words', you can work out the third.

## Transistors

Here we are looking at the characteristic curves in Fig. 6, which are for a small-signal germanium transistor. Go back to Fig. 5 and see what mod. you would have to do to that circuit to cope with the germanium device — go on, have a bash!

Look first at Fig. 6a. If we drew in a bottom curve for $I_b = O$ $\mu$A, it would merely serve to make the bottom line of the graph a bit blacker — because we would have no bias to either of the two diodes of the transistor, and so nothing could happen. However, we have drawn the rest as a series of curves for collector current

*Continued on p. 441*

*EQUIPMENT REVIEW*

# THE KDK FM-2030 TWO-METRE TRANSCEIVER

THE vast majority of amateur radio mobile operation now takes place on VHF, an inevitable trend once repeater stations began to be established in ever-increasing numbers. Over the same period, traffic has grown considerably so the mobileer must be able to operate his equipment with the minimum of effort and concentration. Manufacturers have concentrated on this lucrative VHF mobile market and there are many single and multimode transceivers available to suit most pockets and requirements, many of which offer virtual one-knob control for safer operation whilst driving. The **KDK FM-2030 Two-Metre Transceiver** is a typical example of this trend.

## Description

The general appearance of the **KDK FM-2030** can be seen in Fig. 1. It is about the same size as the average car radio, the case being 162mm. wide, 55mm. high and 182mm. deep, and it fitted quite comfortably into the hole in the console between the front seats of the reviewer's car. A mounting bracket is supplied as standard if you want to fix the set under the dash or on a parcel shelf.

The main feature on the front panel is the red LED, five digit frequency read-out, to the right of which are more LEDs. There is a green one for receiving and an orange one for transmitting indications. Below these is a line of five labelled SIG/PWR, numbers 2, 4 and 6 being lemon colour and nos. 8 and 10 pink. The outer of the two concentric knobs at the extreme left is the FUNCTION switch, the inner one being the step tuning control and which can be pushed in to write into the memories. The three position switch to its right is the SCAN switch. From left to right, the three buttons at the bottom left are TUNING SPEED, RIT and REVERSE. Under the frequency display are two concentric controls. The outer one on the left hand knob is the MEMORY MODE switch, the inner one the AF volume control which is also a push-on, push-off switch for the whole transceiver. The outer ring of the right hand knob is the OFFSET switch, the inner one being the SQUELCH control. To the right of these knobs are two more buttons, the first providing a short, 1,750 Hz repeater access TONE, the second selecting HIGH or LOW POWER. At the bottom right corner is the six pin microphone socket. The rear panel accommodates an SO-239 antenna socket, a non-reversible, two-pin power socket and miniature jack socket for an external loudspeaker. A jack plug is provided.

Access to the electronics is by undoing two crosshead screws each side and lifting off the U-shaped covers, top and bottom. The respective views are shown in Figs. 2 and 3. The printed circuit boards are single-sided SRBP material, all components, test points and wire jumper connections clearly identified. The quality of the components and workmanship is up to the usual standard for this class of product. The 75mm. diameter loudspeaker is fitted to the top lid above the hole in the p.c.b. The microphone supplied for the U.K. market is a 500 ohms dynamic type, model **DM-100.** It incorporates a PTT switch and UP/DOWN buttons for remote tuning, the lead being a coiled one terminating in a plug with a screw retaining ring. A DC power lead with in-line fuse is supplied with a plug and screw retaining ring on the transceiver end. A spare 7 amp fuse is included.

## The Instruction Manual

The 16-page manual is clearly typed and well illustrated with diagrams, photographs and tables. Its seven sections comprise:— General features, Operating controls and functions, Block


**Fig. 1. Front view of the KDK FM-2030, two metres FM tranceiver. The detachable mobile mounting bracket is supplied with the set, is adjustable for tilt angle and can be fitted either to the top or bottom. The microphone clip can be fitted either side and the 500 ohms dynamic microphone supplied has "Up" and "Down" buttons for remote channel switching.** *Photo by T. Traill*

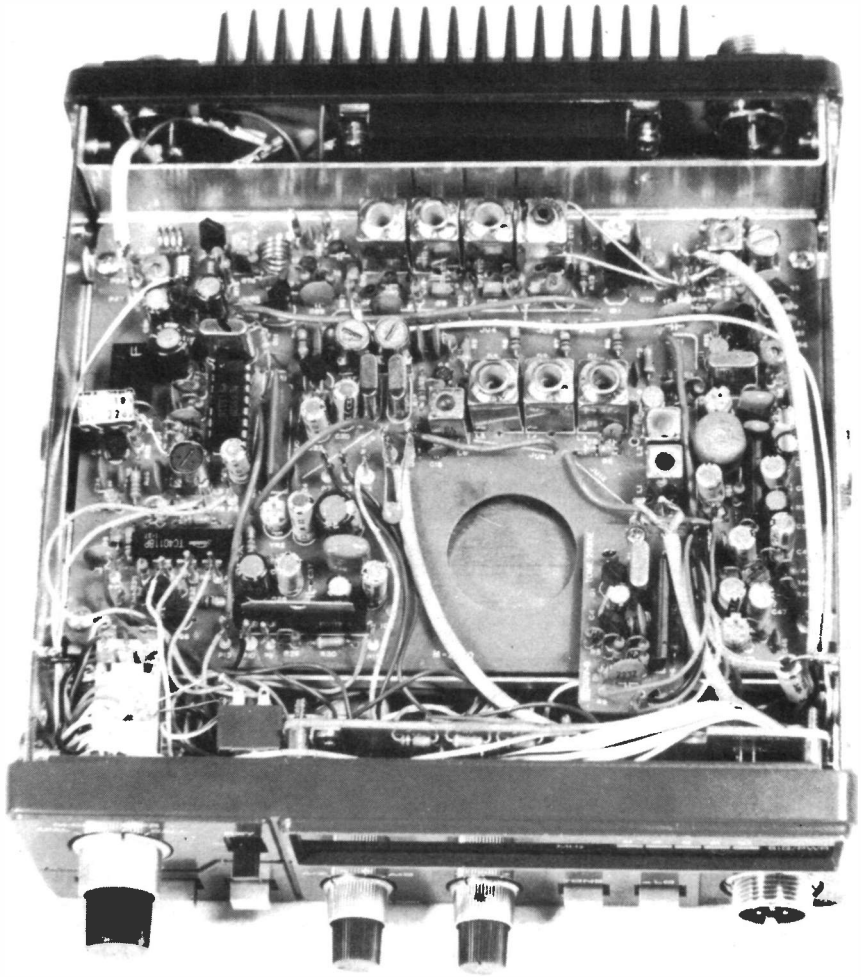


**Fig. 2. Top view showing the Main Unit p.c.b. which accommodates the bulk of the receiver and transmitting RF circuitry. The small board to the right of the hole is the crystal controlled tone burst unit. The rear panel, with finned heat sink, contains the Tx low pass filter, the PA module and automatic power control stages.** *Photo by T. Traill*

diagram, Photographs of transceiver interior, Circuit description, Alignment instructions and Technical specification. There is a separate sheet for the circuit diagram. Apart from some minor spelling mistakes, the text is in good English although the print size is rather small. The manual is A4 size and offset litho printed.

## Circuit Description

Firstly the receiver section in which the "E", or European version covers 144.000 to 149.000 MHz. The Rx is a double conversion design with IFs of 10.7 MHz and 455 kHz. Immediately after the antenna socket is a low pass filter, common to both Rx and Tx, then a solid-state switch and band-pass filter preceding the dual gate MOSFET RF amplifier, a 3SK78. Output from this goes through a three-stage, varicap tuned BPF to gate 1 of the 3SK74. The 133 MHz signal from the PLL VCO is fed to gate 2, the 10.7 MHz first IF being taken from the drain, through two monolithic crystal filters to the 2SC1815 first IF amplifier. Output from this is fed to a *Motorola* MC3357 LSI IC which includes the second local oscillator circuit, second mixer, noise amplifier, second IF amp., limiter and detector. The few external components include the 10.245 MHz 2nd LO crystal and a *Murata* CFW455F ceramic filter, which has a bandwidth of 12 kHz at the —6dB. points.

The audio amplifier driving the loudspeaker is a TA7222P IC. The S-meter signal is taken from the output of the 455 kHz filter, amplified, rectified in a voltage doubler circuit, then A/D converted to the TLM8051 LED display unit.

Secondly, the transmitter stages, commencing with the 2SC1815 microphone amplifier. The AF is further amplified and limited in a TA7061 IC, a LPF removing unwanted higher frequencies prior to the deviation control. Modulation is by means of a variable reactance of the LO VXO at 10.7 MHz by a 1SV50 varicap diode. This 10.7 MHz modulated signal is buffered and filtered and fed to a balanced mixer where it is mixed with the 133 MHz signal from the PLL department. The resulting 144 MHz signal is routed through a four stage, automatically varicap tuned BPF, then amplified in two stages to 300mW. The PA is an S-AV7, 25W. IC module, fixed to the rear, finned heatsink. As fairly usual with solid state PAs, an automatic power control — APC — system is incorporated. The maximum power level is set by rectifying and amplifying a sample of the output signal voltage and feeding it back to reduce the supply voltage to the 300mW. stage when maximum power is exceeded.

Thirdly, the phase locked loop section, the main part of which consists of another LSI chip, the TC9125 IC, containing the standard frequency oscillator and divider, phase comparator, programmable divider and data latch. An external 9 MHz crystal is used and the signal divided by 900 to give the 10 kHz standard reference frequency. The VCO operates around 133 MHz frequency control being achieved by obtaining a DC control voltage from the phase comparator, applying it to the VCO varicap diode, locking it into the PLL. The PLL LO is a VXO on 14.2922 MHz. Although not clear from either the block diagram of the description in the manual, this appears to be tripled twice to 128.63 MHz. To cover from 144.000 to 149.000 MHz, the VCO has to cover from 133.3 to 138.3 MHz with a 10.7 MHz IF. This VCO range, mixed with the 128.63 MHz signal, gives a converted output from 4.67 to 9.67 MHz and this is filtered to remove any harmonics, then buffered, before feeding back into the TC9125 IC. This LO frequency is divided by the ratio derived from data from the CPU and the phase difference between it and the 10 kHz reference signal is compared in the phase comparator. The resulting pulse from the comparator is smoothed to a DC voltage

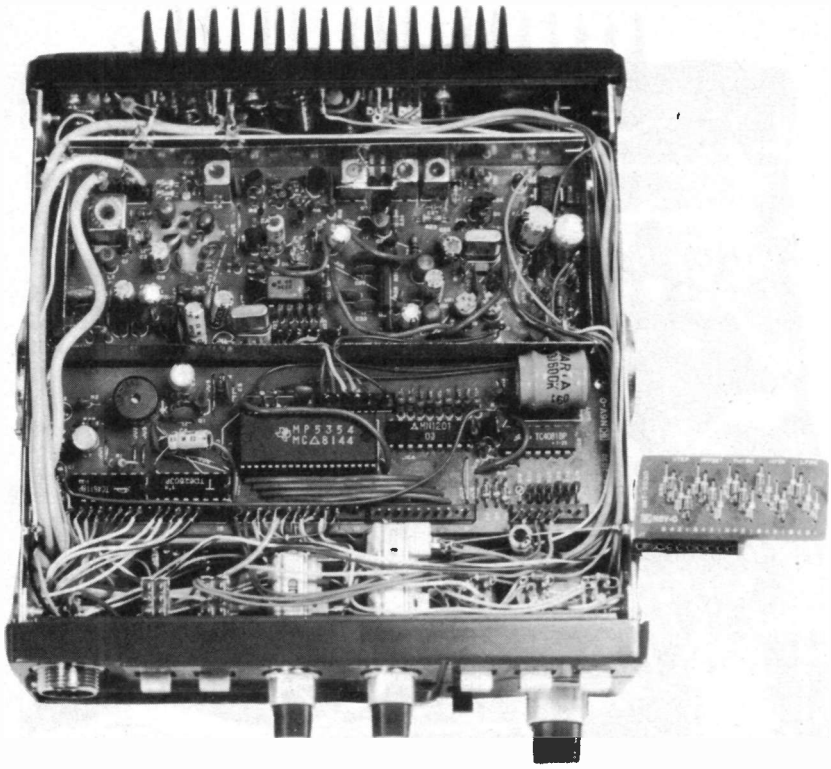


**Fig. 3. Bottom view. The board behind the front panel is the Control Unit with the CPU chip in the middle. The "loose" board at the right plugs into the 9-pin socket at the bottom right of the CPU and is the Initialize Unit containing the diode matrices for programming the CPU. The memory back-up battery is in the top right corner of this board. The rear p.c.b. accommodates the phase locked loop circuitry.** *Photo by T. Traill*

and used to control the VCO and auto-tuned circuits in the Rx and Tx.

Finally, the Central Processing Unit, an MP5354 IC for which **KDK** have developed their own programming. Initialize programming of the CPU is achieved *via* the BCD coded diode matrices in the initialization module visible in Fig. 3. The five parameters controlled are the Tx/Rx low frequency band edge, the Rx high frequency band edge, the Tx HF band edge, the Tx offset shift, and the dial and band scan steps. The BCD codes for the American, European and Japanese versions of the **FM-2030** are given in a table in the manual. A second table lists the CPU in/out combinations and a third the CPU data output. The CPU controls all the functions of the transceiver.

Normally when a CPU controlled piece of gear is switched off, all memories are lost. In this transceiver, there is a rechargeable NiCad battery to operate a memory back-up system. This 3.6 volts battery takes over automatically when the 5v. regulated supply starts to fall. The current drain is so little that it could retain memories for a year, according to the manual. During normal operation, this tiny battery is charged *via* the 5v. line.

## Operation

Operation of the **FM-2030** is best illustrated by some examples of FM operation. For normal simplex operation on any channel, the function switch is set to "Dial" and the offset switch to "S" for the U.K. and European market, tuning is programmed in the Initialization Module at 12.5 kHz per step, or 100 kHz if the SPEED button is depressed. For maximum sensitivity, the SQUELCH control should be backed off until band noise abruptly starts when the RCV LED will come on. Select high or low power then press the PTT button on the microphone to activate the Tx as confirmed by the red XMT LED and a string of PWR LEDs.

Next repeater operation. Here you select the desired repeater output frequency and switch the OFFSET switch to "Minus". When the PTT switch is pressed, the Tx will transmit 600 kHz lower as verified on the display. Many repeaters are now carrier accessed but some still require an initial tone to open them up. This tone is available when the TONE button is depressed. If you want to listen on the input frequency, press the REV button.

There are provisions for storing ten frequencies plus a priority CALL frequency, such as 145.500 MHz. The MEMORY mode switch has four positions:— A + B, A, B, and AxB, where A and B each have five memories. To set up the desired memory frequencies, turn the main FUNCTION switch to "M-CH". To insert, say, 145.375 MHz into Channel 1, you push the tuning knob into the "Write" position whereupon a frequency will be displayed. Turn the knob till 145.375 appears and release the knob when the display will return to "1". If you switch to "M-FR", 145.375 should appear. The A + B mode enables any of the Ten memories to be selected, "A" mode channels 1 to 5 and "B' mode channels 6 to 10. In "AxB" mode, you can work split frequencies, listening on Ch. 1, transmitting on Ch. 6, etc.

The SCAN switch has Busy, Off and Open functions and the upper and lower scanning limits are fully programmable by entering the desired frequencies in memories 5 and 10. In "BSY" mode, scanning stops when a channel in use is reached and in "OPEN" mode, when a free channel is happened upon. The SQUELCH control needs to be set to kill band noise when using any scan facility. If the FUNCTION switch is set to "M-CH" or "M-FR" the memories will be scanned in the same manner.

If a station is off frequency, the RTT button should be depressed. Then, each click of the tuning knob will alter the received frequency by 1 kHz. There is an audible "bleep" facility to indicate when the upper or lower band edges have been reached, accompanied by a sympathetic flashing of the display.

## Results

The reviewer has never possessed any FM gear for VHF and this was the first such item ever used in the station, so no comparisons can be made from personal experience. The **FM-2030** requires a nominal 13.8v. DC at 7 amps. maximum, this being derived from a regulated 20 amps. HF transceiver PSU. Once the Manual had been read thoroughly, operation in both simplex and repeater modes proved simple. At first, some weird moaning noises came from the loudspeaker when in transmit mode but these

disappeared when the SO-239 antenna socket was tightened properly: it is fixed by a ring which was a bit loose, so the earthy side was not making proper contact with the chassis. Occasionally the dial would miss a channel, *e.g.* it would go from, say, 145.600 to 145.625, missing out 145.6125 MHz. This effect was also observed in fast tuning mode when one 100 kHz channel would be missed out. This phenomenon was not confined to a particular frequency and, if overshoot did occur, it was simple enough to click back one step to set up the missing channel. Another odd effect was that in the review model, 145.525 MHz refused to go into memory no. 3. Although loaded in correctly, it always ended up as 145.505 MHz. Other frequencies could be written into no. 3 correctly and 145.525 could be written into all the other nine memories.

A slight hum was noticed on a monitoring receiver during transmission which was unaffected by turning down the microphone gain and deviation preset controls. However, it was at a very low level and only mentioned by one very local station who was receiving a very strong signal, so it was considered insignificant. Speech quality was reported as natural and well balanced. Monitoring of the carrier revealed a welcome lack of "phase noise" from the PLL system. The high and low power levels are specified as 25w. and 5w. respectively. No reliable power measuring device for VHF was available but the 7dB difference expected was checked on a carefully calibrated S-meter in a monitoring receiver.

At the commencement of transmission, the carrier frequency varied slightly for a fraction of a second, an effect only detectable when listening on a monitoring receiver in CW mode. Obviously, it is impossible to detect this on an FM receiver. The specification states the sensitivity as better than 0.2$\mu$V. for 12dB SINAD and the receiver proved to be quite sensitive. The Rx was tuned to 144.975 MHz, the GB3ANG beacon frequency, and a heterodyning signal introduced externally. The beacon came through a few dBs above the noise from 614 kms. under flat conditions. Considering the inevitable loss in filters ahead of the RF stage, this is a very satisfactory performance, no doubt of interest to those who like to work the so called horizontal FM DX.

The IF filtering is specified as *plus/minus* 6 kHz at −6dB and *plus/minus* 16 kHz at −60dB. Consequently it was expected that a very strong signal might be detectable on an adjacent, 12½ kHz channel since the selectivity curve of the filters would only be about 40dB down. This was apparent when very strong, local, stations were found, although never sufficient to render the desired channel unworkable. The scanning facilities proved quite positive once it was appreciated that the SQUELCH control needed to be used to silence the Rx before searching for busy or open channels. a point not mentioned in the Manual. Audio volume was more than sufficient for normal, home station use and probably adequate for all but the noisiest of cars. However, the bleeps emitted when the band edges are reached were very feeble and virtually useless.

## Afterthoughts

The transmitter coverage of the European model is 144.0125 to 145.9875 MHz, providing 159 channels. (N.B. It is hoped that FM operators would respect the international band plan and refrain from operating in the 144.0 to 144.50, 144.85 to 145.0 and 145.80 to 146.00 MHz sections assigned to CW/SSB, beacons and the satellite service respectively). For anyone taking this transceiver to the U.S.A., where the 2m band is 144.0 to 148.0 MHz and the repeater channels are not at 25 kHz intervals, it is a very simple matter to adapt the **FM-2030** to the "A" version by plugging in the appropriate Initialization Module. This automatically extends the Tx and Rx coverage, and alters the dialling from 12.5 to 5 kHz *per* click. The **TM-2** Tone Encoder Microphone would be the ideal microphone for U.S.A. use as it has touch-tone buttons, enabling one to dial into the nationwide telephone network, something not permitted to radio amateurs in the U.K.

In some scanning receivers, the scan stops before reaching the true centre of strong signals. This undesirable effect is overcome in the **FM-2030** by using a discriminator centre detector when scanning in BUSY mode, the signal for this being derived from the multi-purpose MC3357 IC. The operation of this circuit is described in the Manual which refers to "AND" gates. However, the IC concerned is a TC4011 which is a quad, two-input "NAND" gate device. The circuit diagram shows the conventional "NAND" symbols. Anyway, it works fine!

Finally, the transceiver submitted for review exhibited a sensitivity of 0.14$\mu$V for 12 dB SINAD, rather better than the 0.2$\mu$V specified.

## Conclusions

For the FM mobile operator in particular, the **KDK FM-2030 Transceiver** is well worth consideration bearing in mind its small size, power output and versatility. Using the Up/Down buttons on the microphone, it is hardly necessary to touch the tranceiver on a journey if a few appropriate repeater and simplex channels are programmed in beforehand. This transceiver is the successor to the FM-2025 Mark 2 and is a different design and layout entirely. The manufacturer is the *Kyokuto Denshi Company Limited* of Tokyo and the equipment was kindly loaned by **Messrs. South Midlands Communications Limited** of Totton, Hants.

*N.A.S.F.*

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*Davtrend Limited* **announce the latest product in their range of equipment for radio amateurs, the DRAE Morse Tutor. Designed as a learning aid for the Morse code, it can be set to give single letters, a group of five letters or continuous characters, and a feature of the unit is the Repeat Key giving a repeat of the last character. The Tutor has variable character speed and space, and a built-in code practice oscillator with key. For listening in the home, a phones jack socket is provided which disconnects the internal speaker. The DRAE Morse Tutor costs £46.90 inc. VAT and is available from the manufacturers, Davtrend Ltd., 89 Kimbolton Road, Portsmouth, Hants PO3 6DA (tel. 0705-816237), or from DRAE stockists throughout the country.**

# COMMUNICATION and DX NEWS

E. P. Essery, G3KFE

## The Bands

THE past month has seen the start of the transition from summer to autumnal conditions; the static has gone down and the MUF up, and of course the effect of that enormous outburst on the sun in mid-July will be wearing off by the time you get to read these lines. On the other hand, the LF bands have been opening earlier in the evening. Things are looking up at last!

## Top Band

No report this time from G4AKY, as Dave has been on a visit to the local hospital and is not yet back at work. As far as your scribe is concerned, the band has picked up no end; for instance, one evening at 2025 local time SM0EBP in Stockholm was heard and raised. The only pity of it was that the keyer chose this moment to die and the /A arrangements are not ideal for a straight key to be used, so Lord knows what the Morse sounded like!

G2HKU (Minster) used his SSB on the band to work G4IWA/P/OH0, OJ0MA, EA3VY, PA0AGA, PA0PN, and PA0RTR. On the key, contacts included EI9J, UK2RDX, OZ1BYB, OY1JH, OH2BNP/OH0, SM5BHW, UP2BKP, OJ0MA, and C30LM.

## Ten

The other end of the spectrum, but also the place where the change of season and sunspot are most evident.

G3FPK (Purley) comments that the band is often open in the N-S direction, but he was quite chuffed to work W1YT in New Hampshire on CW, at a time of midnight local on August 27. During the All-Asian contest there was, not surprisingly, quite a lot in the way of Asiatic call-signs, including CR9BK on CW. Another CW QSO was with G6ZY/EA6 in Ibiza for a new country on the band, while on SSB OE1HMB/YK was a good signal from the Golan Heights with his KWM-2 and rhombic aerial.

During the period in review, G4HZW (Knutsford) took his Quad down for a wash-and-brush-up; as Tony says, when you come to put it back up you find out who your friends are! However, it did go back up, and the helpers were rewarded; Tony got his reward by way of an Auroral session on August 7 for GM4OFI and PA0DUO, plus VS6CT, VK4BFO, DF7DC/0Y for the 200th country on 28 MHz, PY5AAX, I3VOM running 500mV and a dipole, SU1BA, JY9RC, OJ0MA, UK0AMM, UL7EAJ (both these on CW), VP5WJR, K2ARO, PJ8UQ, 8R1J, J28DM, ZS1JJ, VU9UGI, 4Z4XA, and lots of Sporadic-E contacts around Europe.

As far as G3PKS (Wells) was concerned, he seems to have been a bit demoralised by the nice /A site mentioned last time, as he refers to 28 MHz simply by saying he heard PY/LU and VS6 after tea on occasion, but nothing more.

The two letters from G4LDS (Chelmsford) tell a tale of plumbing-in the new place — sink unit, washing-machine — not to mention painting and decorating and, at the end of a week of 'holiday', developing a sore throat — the latter wouldn't be a problem on CW! The 28 MHz clip includes DJ0FL, OL3MBH/HB0, C31WG, and TYA11.

Now we come to G3NOF (Yeovil) who, like the others, notes a big improvement in conditions this time, albeit still with some bad days. In the couple of weeks prior to his letter Don noted South Americans during the evenings, plus the odd North American opening, with East Coast W and VE at S9 around 2300z. However, there were no contacts made on this band.

We nearly missed the 28 MHz offering from G2HKU, which was lurking coyly behind the staple; his CW found LU8DQ, PY1BOA, FC6ETS, PY5FI on the Big Rig, while his QRP CW at the four watt level dealt him another contact with FC6ETS.

## 21 MHz

Here we must note that, like many another, G4ITL (Harlow) has found the declining sunspot count has made 21 MHz into a very good substitute for the ten-metre contacts he has been missing — JA contacts are a good appetiser for one's lunch, for instance!

Nice to hear again from D. A. Whitaker (Harrogate) back on the band again after a period of inactivity. David mentions, heard on 21 MHz SSB, with times in GMT: 1000, VK9ND, W6IAE/KH0; 1100, 5T5ZR, AP2KS, W6IAE/KH0; 1600, TU2JL, D68AM, TN8AJ; 1700, HH5CB, FR7CG/T; 1800, S79ARB, A4XJN, ZS3JS, 8Q7AZ, ZD9YL; 1900, FR0FLO, VP8QP, LU9BBJ, HS1AMH, KH6WU and VP2EL/MM. In the morning period, around 0700, 9M8NL was logged.

G4PEM (Penzance) received his FT-DX401 on the day your scribe was in that fair town, and we watched Simon opening up all the packages and working out how he was going to set it up for HF — with a site looking out over the railway station to the sea he should be able to do pretty well in the favoured directions with the initial G5RV aerial; so far YV5AMH/OH2/P for a good mouthful, A71AD and FC9UC have fallen to Simon's assault.

We turn now to G2BON (Aldridge) who has an IC-701 and G5RV. Although Tom says conditions were terrible generally, it didn't stop him finding four new countries during the month in Togo, Diego Garcia, Iraq and Tahiti. A new station on Pitcairn Is. is the form of the YL operator VR6KY, Kari was heard and, by and large, the month was a triumphal success 'against the grain', as it were. Stations worked included A4XJN, 5V7HL, VQ9CI,CP6IM, JA0ODC, JA5RRG, JH6ZHF, JA1NDG/YI, ZS6UN, DU1AU, A71AD, FR0FLO, EA9KS, 4K1A in Zone 39, and UPOL.

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**"CDXN" deadlines for the next three months—**

November issue — September 30th
December issue — November 4th
January issue — December 2nd

*Please be sure to note these dates.*

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Like the other bands, 21 MHz has picked up, says G3NOF; there were some SP openings around 1000-1100 to VK-ZL and the Pacific, with VKs also around 1300. East Coast Ws have been heard between 1300 and 2300 with W6-7 appearing around 1600, but the band has been very unstable. SSB contacts were made with A4XJL, A4XJQ, A92F, AP2P, DF7DC/OY, HI8GB/6, JA1NDG/YI, JA7FEX, K5KG/OH0/OJ0, KB0BL (S. Dakota), M1C, OH0XX, PA3AXU/LX, VU9AVG, VU9GI, W6PU, VP8APB (Falklands), YC2QK, ZD7AL, ZL2BFU, ZL2BJX, ZS6AEN, 3B8FK, 5W5DQ, 6Y5MJ, and 9L1DR.

G4LDS threatens mayhem to his rig, having been told he has a 'sproggie' in the band at —55dB by one of the locals, so doubtless we shall hear next month that the whole shooting-match has been realigned and licked into shape for another 200 countries. Meanwhile, stations worked included the following: VE7DGI, PY4BB, ZP5JAL, 5N0ATW,

DJ5GI/EA6, UA6NQ, EA9KS, A4XGY, F6BTY/ST2, KD4UH, AP2SQ, JAs, TU2JD, 9K2BE, VS6CT, A4XJO, A4XIU, VS5GA, A4XYB, OH6UM/OH0, W2, W8, 5N8HEM, C53CC, 9L1YL, 8P6OR, 8P6NF, TU2JD, TU2JL, 5V7HL, J5HTL, VK8NNN, (at 1825), C53BI, TYA11, SV0AU, YB8AEG, 4K1A, F0CH/FC, CP8AL, A4XJL, JA1DNG/YI, CH3ROW, IS0OXK, TU2JD, K3POW, WD0EWD, ZD9BV, JA4EIS, JH3JUZ, ZL1CD, C53DF, UJ8JCQ/U8K, KX60B (Marshall Is.), YB0ACL, K6IAE/KH0, ZC4CW, ZP5MJO, and T30BY for Kiribati and country number 197.

G3FPK (Purley) raised an all-time new one in OH3JR/OJ0 on Market Reef and heard, on CW, KC6SX in E. Carolines who advised QSL *via* JA8OW. CW QSOs were completed with CR9BK, 6W8CC, and EK0K, this last being a Polar expedition in Zone 19 and Oblast 139 who was giving his QSL route as UA9OBA.

G4MVA (Snainton) writes with his latest doings; Glynn refers to 21 MHz as the band of the Gotaways(!) although he did make an SSB contact with 5B4CZ; the escapers included 3D6AK, (QSL *via* G3WPF) and TU2IE (QSL *via* DL4BAM).

**For many years a group of English radio amateurs has been transmitting daily weather reports on 14.302 kHz, at 0800 and 1800 GMT, to the 500-plus yachts, worldwide, equipped with amateur radio stations. Following a global fund-raising collection, and with the generous assistance of *Sommerkamp/Yaesu*, an FT-ONE 200-watt SSB transceiver has been donated to one of the group's number, Rudi Weber G4FTO — pictured here — to update the equipment and improve the service. In addition to weather reports, the group now also passes on messages free of charge to yachts, offers assistance to those needing urgent spare parts, and transmits search and/or emergency messages.**

## Odds & Ends

G3NOF has some hard things to say about the CB situation, as indeed does G3FPK. Don mentions that at least one of the local legal CB-ers has written to the local paper complaining about the obscene language, and he surmises that the authorities are in difficulties over shutting them down by reason of the lack of call-signs and lists of addresses. On the other hand, although G3NOF is unhappy about the illegal CB aerials around, your scribe feels this is possibly a positive thing to come out of CB from our point of view, as it does seem that if a CB aerial is immune from the planners and their plans, then by logical extension so are amateur radio aerials. Norman, G3FPK, finds the CB-ers a nuisance, especially at night and notes that locally there is a taxi service on 'Channel 41' as the latest local phenomenon in that area. Certainly we think the 6 MHz activities should be stopped by the authorities — a firmly-applied screw in that area while it is still not too difficult might well be worth it "pour encourager les autres" in legal behaviour!

Some time back, GM3OXX of the G-QRP Club sent in details on the third EU CW Fraternising QSO Party; he now sends us the results, as follows: in Class-A QRO, ON5GK had 347 points, DK5GD 229, and DK2VN 225; while in Class-B QRP, OK2BMA led with 143 points, SM6AOQ 125 and OK1DKW 103; Class-C NM any power, GW3OKA raised 403 points, I1CTG 266, and PA3BTH 228. All these have won a certificate.

From Rio de Janeiro, PY1CC writes to inform us of the Rio CW QSO Party, the last weekend of October, from 1500z Saturday to 1500z Sunday. The call is CQ RIO PTY, and the exchange is RST, QTH and name. Frequencies are 3510-3520, 7020-7030, 14030-14050, 21030-21050, and 28030-28050 KHz. No logs to be sent, just quick QSLs, *via* the sponsor, PPC, PICAPAU CARIOCA (Rio Woodpeckers Group) Box 2673, 20001, Rio de Janeiro, RJ, Brazil, as the co-ordinating group. The awards include the PPC-5B and EP-AA. Details from PY1CC as above.

On the Heard Is. front, the VK operation's problem is definitely shaping up as money. On the other hand, we hear that Jim Smith's VK0JS plans are coming into shape, with Jim travelling to Tasmania to conclude the charter of a 450-ton ship; there are said to be 6 operators in the party, including Jim and Kirsti. These two were also reported in E. Malaysia as 9M6NL and 9M6NS.

The BY1PK station has been monitored from various Far East parts by N1RM, and he says he has noted them calling for as long as an hour without a reply. Stations calling successfully do so by way of a standard 2 x 2 call, tail-enders or those giving less than a full callsign being apparently ignored. The style and skills of the operators varies quite markedly too.

That Albanian talk seems to be still going on, but there doesn't seem to be anything solid coming out of it, either for DL7FT or EA8AK. Another one which might come up is a Laccadives operation in November, although again we have doubts. If the PY0 St. Peter & St. Paul operation, which has to be the worst-guarded secret of 1982, comes off, then it will probably be over by the time you get to read this.

Various sources mention the case of a South American amateur who is returning direct QSLs acompanied by IRCs, and instead is demanding a dollar bill. If this one hits you, send details to ARRL's DXCC Desk at Newington, as this is a flagrant violation of DXCC Rule 12.

Readers of Geoff Watts' *DXNS* will be aware already that Geoff has had to give up the editorial work due to illness in his family, so input for *DXNS* should go to "DXNS", Box 146, Cambridge, to arrive by first post Tuesday, when the work will be done by G3ZAY and G3XTT. This, it is hoped, is a temporary arrangement until the pressures on Geoff ease somewhat, and we must be thankful that G3ZAY and G3XTT have stepped into the breach meanwhile.

If you are a 7 MHz buff, you will be interested to know that A71AD recently had a party helping him put up a 7 MHz beam, and that he has plans to make Forty hum a bit this coming season.

By way of the invaluable W1WY we have data on various contests forthcoming. The biggest of course is the CQ WW DX Contest, Phone leg October

30-31, and CW November 27-28. The Rules have been essentially unaltered for many years, so we don't need to go into too much detail. However, the disqualification clause has been rewritten, clarified and further tightened, and we note that an extension of time is possible on log entries if requested. Logs are to be mailed by December 1 for the Phone leg and January 15 for the CW, addressed to CQ Magazine, 76 N, Broadway, Hicksville, NY 11801, USA, with the envelopes clearly marked CW or Phone. We have a copy of the official cover sheet which is Xerox-able if needed, but we don't have a copy of the standard log sheet — perhaps W1WY will fix this for next year?

The VK/ZL/Oceania Contest comes up over the weekend October 2-3 (Phone) and October 9-10 (CW). The rules seem to be largely similar to previous years. Logs go this time to ZL2GX, 152 Lytton Road, Gisborne, New Zealand, to arrive by January 31. The Phone leg of the RSGB 21/28 MHz SSB contest is on October 10 (and thus clashes with the CW leg of the VK/ZL/Oceania affair); logs for this one to G3FKM, Dr. E. J. Allaway, 10 Knightlow Road, Birmingham B17 8QB by December 1.

The RSGB 21 MHz CW contest follows on October 17, and for this one logs go to J. Bazley, G3HCT, Brooklands, Ullenhall, Solihull, Warwickshire B95 5NW, to arrive by December 31. Both these RSGB contests run from 0700 to 1900z. We notice one important rule, which is that unmarked dupes will lose ten times the points claimed, and over five dupes unmarked will result in disqualification. All we can add is that two such august personages doing the work should ensure that the results are 100% on the level, something we have had cause to doubt with some other contests.

However, it is time for us to return to the bands, and where better than. . . .

## Twenty Metres

On the day of his letter, G3PKS says he came to the conclusion that a CQ call would be worth it, conditions had improved so much; so around 0900 a few CQ calls turned up a couple of VKs and a ZL, all weak and fluttery as one would expect this late in the morning. However, even though Jack didn't reckon the band would hold up long enough to complete QSOs, the chance to try would have been appreciated — the Heavy Gang promptly moved in and blotted them out! On a different tack G3PKS has a little wonder about FP0, as one of these seemed to reply to his CQ but disappeared before Jack could find out!

Twenty for G2HKU meant SSB contacts with OH3JR/OH0, ZL3FV and ZL3RS, while the CW made it to LA7JO/OH0, KH6IJ, VK3DND, HL2HN, VK3ANJ, K0DHI, FM7WD, 4S7WP/MM, and K0KES.

G4LDS offers his crop, which after taking a few out to save space, adds up to 4X6GE, XE1FFA, 9Y4FS, VK5QV, VU2MKS, 7X5KCG, OA4AEW, VK3DN, JL1LTO, JA9YBA, VK5OS, VK2BZA, HV2VO, W5DDO, KC4OV, K9FD, VE1WV, HC2OA, VK3DCR, 9H1GD, VR6TC, 9M8PW for country number 200, HB9CJX/OY, ZL2AXZ, a ragchew with VQ9GD, ZS6ADB, 9L1MS, VK4ATC, VK3OM, KL7Y, KL7HCF, FP0GXV, VU9AU, (VU2AU with a special for the Games in New Delhi), ZS6QA, 5N8BRC, and a second one with 9L1MS.

G2BON managed things so as to get a SSB contact on the band with VK7OC, EA8VV, TU2EZ, VE1ATV, K5WGO, FO8FO, AX5FR, VK5AJD, KL7WF, VK3DN, and 5W1DQ.

The log of SWL Whitaker includes, again with times: 0600, C53DF, VK9ZA (Willis), 3D2ER; 0700, JW7FD, 5W1DQ, KH6LW/KH7, T32AF, VK2AGT/LH, OX9ZM, FW0AG; 0800, T32AF, A6AQ, D68AH/MM, AH6AI/MM; 1800, S83H; 1900 ZD7AL, SM0MLL/C9, 4K1HK; 2000, VP8HZ, 5H3BH; 2200, 5V7HL; and 2300, HH2CL.

G4MVA and his ten watts output used CW to work 4J10, VK3BHK, VK2DKL, (a QSO which didn't get to a finish), then YV5GAB, PR7ABJ, UF6FFF, KA4IFF, and WD8MEV.

The G3NOF analysis for this month indicates the LP openings to VK lasted up to around 0800 but not as good as in previous years, while a few Pacific stations were also around at this time, notably KH6LW/KH7 and 5W5DQ, but again not as many as in previous seasons. The band has not produced anything to excite the fibres, albeit N and S America have been strong around 2200z. The only SSB QSOs made were with JW7FD, OJ0MA, VK5CF, and VK5HL.

Turning to G3FPK, he has been gunning for FW8AG (SM0AGD, QSL *via* SM3CXS) for an all-time new one as Norman isn't interested in 'list' operations from the resident FW8s. It all added up to CW QSOs with HB9BPU/OY, OH3JR/OJ0, and 9M8JS, while G6ZY/EA6 was nailed on SSB. At night, Norman says, the band seems to be covered in a sheet of noise for some reason.

## 80 and 40

G4LDS makes an offering on 7 MHz, on which band his SSB worked LA8KQ, 4U1ITU, and EA5CTV/HB0.

G2BON shows up a blank on Eighty, but on Forty his SSB got out to LU1FJH, PY1HE, 6Y5FS, ZP5CCG, and KA3BUJ/8R1.

Th listening station of David Whitaker was used on 7 MHz, times also given: 0000, HP3FL, TG9HH; 0600, XE1CRM, CP6EL, V2AN; 2000, CN8CY; 2100, OH3JR/OH0; 2200, ZD7BW, UL7MAR, UL7QF, TZ0AQ (which David questions), VQ9GD, TN8AJ, VK6LK; 2300. HS0HS, UD6DJH, TF3CC, ZD7BW, TN8AJ, and HI8XJO.

For G4MVA, Forty is favourite at least while things are thus and thus on the higher bands; Glynn used CW of course, and raised HB9CJX/OY, UA1POL/U5Z, PY3TE, UI8BI, UD6DKW, UF6CR, YV2BE, KV4CI, EA9KN, TF3CU, and FP8HL.

All Forty, too, for G2HKU, who found 4Z4AB on SSB and TU2IE on CW with the big 'un, while to QRP four watts CW made it to UF6CR,EI9J, UM8MBA, DL1PMM, and UK9AAN.

For G3PKS an interesting one was from his /A site at Kenilworth when the low loops mentioned last time did well to sustain an eighty-metre CW QSO lasting over a half-hour one morning. Back home, Jack noted a marked improvement in Eighty during the month in the way of the daytime signals, albeit with some hiccups. As for 7 MHz, this also improved, but the BC stations were in attendance in strength as early as 1300 on occasion.

During August, says G2NJ (Peterborough), the CW end seemed dead during the early afternoons, but a CQ often turned up trumps; this was how Nick found GW3KOR/P near Barmouth who gave out a 599 report. G5JP was 569 from an HW-8 QRP rig, G2CNN was 599 from the top of a 700 foot hill near Thame while out /A, but the prize goes to G3YCC, Hull who was worked at 1830z on August 7 while he was running some 250 milliwatts. On the /MM front, G2NJ mentioned PA3ARE/MM when the ship was 20 miles from the Hull pilot station and bound for Immingham.

## Tailpiece

Under the note-head of *Amcomm*, South Harrow, one of our regular advertisers, we have a note of a DX-pedition to Alderney, signing GU5VS/A, on all bands 160-10, the operators being G5VS, G5APC, G3SXW, and G3TXF. The operation will be from noon GMT November 25 till midnight on November 28th, and all QSLs should be routed to G4HNP. This might stir up some activity on Top Band for once!

## Finale

That's it for another month. Lots of reports for next time, please, deadline September 30 to arrive; the address as ever is "CDXN", SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts. AL6 9EQ. CU at Leicester!

# PLUG IN YOUR SOLDERING IRON AND BEGIN HERE, PART V

## A GUIDE FOR THE INEXPERIENCED IN THE METHODS, TECHNIQUES, PITFALLS AND FOLKLORE OF BUILDING EQUIPMENT, WITH PRACTICAL PROJECTS TO BUILD ALONG THE WAY

**REV. G. C. DOBBS, G3RJV**

### A Credit Card Dipole Insulator

NOW you are reading this series of articles it is possible to put your credit card to a more realistic use in Amateur Radio. Take your credit card, long side up and draw a line down the centre. About an inch from the top of the card, drill two 4BA clearance holes; insert two half-inch 4BA nuts and bolts with two solder tags on each. Cut a dipole for the band required, attaching the ends to one each of the solder tags and solder the coax lead to the other two tags. Bind PVC tape around the coax and bottom of the card. There you have it — a good little dipole centre piece which has the two extra advantages of making the card so difficult to get at that you have to build equipment rather than buy it, and denying the XYL access to it at all.

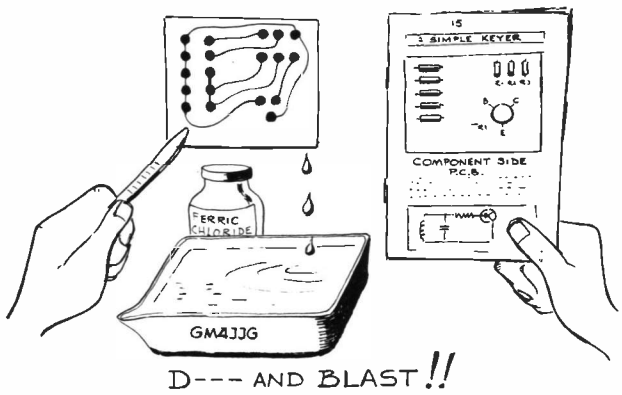
In *Part IV* of this series we considered etched circuit boards which did not require holes for component mounting. This is a very useful technique for building items of equipment, but is not as useful as a properly etched and drill printed circuit board. Quite a number of magazine articles give layouts for printed circuit boards alongside a particular circuit and sometimes enterprising companies produce ready made PCBs for amateur equipment, but both of these aids can lead to problems. The obvious problem I have encountered almost every time I have tried to use an existing PCB layout is that my components do not fit the space provided. Unless the type and manufacture of the components match the ones used by the author for his layout, making the components to hand fit the board can be difficult.

The amateur who is considering using a printed circuit board for his construction needs to be able to design his own individual board to match his available components to the circuit. An author's prototype PCB layout can be a real asset to provide a reference 'map' for the layout, but ideally the board should be etched to suit the actual components to hand. This article describes how to set about the task of making a printed circuit board to match a required circuit. "Bespoke tailoring" of PCBs is not the daunting task it may appear. Once the method has been mastered and the required equipment assembled it becomes so easy that the customer is unlikely to consider any other method of building equipment.

To demonstrate the making of PCBs and a few other little techniques on the way, we are to build a simple receiver for the 80 metre amateur band. The receiver is simple, but surprisingly effective on the band, and makes a good first receiver to build. The receiver uses the direct conversion technique. This mixes the incoming signal with a local oscillator in a similar manner to the superhet. However in this type of receiver, the difference between the two signals is the required audio frequency, so direct conversion from the RF signal to the audio signal occurs. The resulting beat note between the two signals makes the technique only suitable for CW or SSB signals, but these are the two most common amateur band modes. The audio signal also occurs either side of the receiver signal so the signals can be heard twice, on both upper and lower sideband. Although this is a minor inconvenience, it is useful at times to be able to swop sidebands to avoid QRM . . . and it makes the receiver seem more lively! It is a simple technique, too simple to be useful some would say, but it is usually those who have not tried direct conversion receivers who criticise them.

### The "PCB80" Receiver

Fig. 1 shows the complete circuit of the receiver. Not all of it will be built in this part but the full circuit is given so that would-be builders can amass all the required bits. The circuit is very simple. The signal from the aerial goes to RV1 which acts as an input attenuator, very useful for preventing cross-modulation in simple receivers, from where it goes to TR1 which is a basic grounded gate FET RF amplifier. The first, and only, tuned circuit for the signal is provided by L1 with C2 and VC1. One tuned circuit in a direct conversion receiver, especially after an RF stage is a bit of a liberty but this is a very simple receiver and we can get away with it. L2 couples the input signal to the mixer, two diodes, D1 and D2, with a preset balance control RV2.




The variable frequency oscillator is a single FET, TR1, in the basic Hartley circuit. Again sceptics may doubt the wisdom of such a scan circuit but in practice this circuit was amazingly stable for what it contains. L1 with C1 and VC1 tune the 80 metre band, the tapping on L1 providing the feedback to maintain oscillation. The output is taken from the gate of TR1 to the mixer. The last device on the Front End Board is the audio preamplifier transistor, TR2, whose output goes to a volume control potentiometer. The final amplification is provided by the cheap and ever-useful LM380N integrated circuit. This will drive a small loudspeaker or a pair of 8-ohm impedance headphones.

So far — so simple, except the discerning reader will have noticed that the designations for the components are repeated in the circuit, for example there are two TR1 transistors and so on. This leads directly to the first useful point about building equipment with one's own PCBs. It is easier and advisable to build the circuit up on small 'sub-boards' rather than attempt to put everything onto one larger board. Not only does each smaller

board provide less of a logistic problem — as they incorrectly say these days — but the constructor is able to build and test each sub-board in turn. In electronic construction, like most other spheres of life, problems increase in proportion to complexity; it is at least an arithmetical progression. So the PCB80 Receiver is divided into three boards; a Front End Board, an Oscillator Board and an Audio Board. These are clearly marked in Fig.1, and since each board is built in turn there is a separate component list for each.

## The Oscillator Board

The circuit for the oscillator is shown again in Fig. 2, alongside the layout used in the prototype. This illusrates the progression from circuit diagram to board but, as mentioned above, the layout can be varied to suit the individual components available to each constructor. To begin the process of laying out a printed circuit board, the equipment required to follow my method (there are many others) is a sheet of 0.1" spacing graph paper, some good quality tracing paper, a pencil and a pencil eraser. The graph paper with 0.1" spacing is probably best bought from an office stationers. Shops which supply graph paper for school use usually say "we don't stock it, sir, no one uses Imperial Measurements any more". They are quite right, except for NASA and the whole American nation, plus all the makers of integrated circuits in the world! Office equipment stockists often have it in large sheets, enough to make PCB layout for years to come. The best is tracing paper with a 0.1" grid printed on it, ideal for our application, but it is difficult to get hold of; try contacts in engineering companies.

The first step is to gather all the components to be placed on the board. This is a useful exercise in itself as I strongly advise constructors not to begin building a project until they have *all* the bits. This prevents frustration later when that vital component cannot be found to complete the board. Notice that not all of the components for the oscillator fit onto the board. VC1, in common with most control devices in circuits, is not board-mounted and the output coupling capacitor C4 is used as the output lead — but it could be mounted on the board. VC1 is a 50pF airspaced variable capacitor . . . eat your heart out constructors, where can you get one of those? Well, variable capacitors are very expensive; it is possible to get a Jackson Bros. component to perform this task and good though it is, it costs the earth. Such capacitors are things to be hunted and hoarded. Buy any reasonable looking airspaced variable capacitor that comes up at a rally or dealers at a fair price. How do you know their value in pF?. That's fairly difficult but experience helps and some AC bridges seem to measure the value quite well. For applications like the one here it is reasonable to use any airspaced capacitor that comes to hand and seems to have enough vanes to give the required value. It is then quite simple, in most types of capacitor, to just pull off vanes until the required frequency coverage is achieved. It might be simple and crude but it does work.

Very few problems should be encountered with the other components in the oscillator. The capacitor C1 ought to be of decent quality as it performs a frequency determining function. The NPO types are best but I can never find them; a polystyrene type would work well, but I actually use a silver mica type which did the job without frequency instability problems. The coil L1 is wound on a 3/16" diameter coil former with a powered iron slug. (An interesting, but pointless, sideline is that in recent correspondence with the YU QRP Club, their translation into English of a coil slug is a coil 'kernal' — perhaps a better term?)

### Table of Values, Fig. 1

#### Oscillator Board

R1 = 100K
R2 = 100R
C1 = 220 pF
C2 = 100 pF
C3 = 0.1 μF
C4 = 1000 pF
VC1 = 50 pF air-spaced variable
TR1 = 2N3819
L1 = 40 turns, 32 swg enamelled wire on 3/16" dia. former with core, tapped at 10 turns. *See* text.

#### Front-End Board

R1 = 3K3
R2, R4 = 4K7
R3 = 1M2
R5 = 100R
C1, C4 = 0.01 μF
C2 = 100 pF
C3 = 0.1 μF
C5, C6 = 0.22 μF
RV1 = 1K linear potentiometer, carbon
RV2 = 1K linear preset, carbon
VC1 = 180 pF Polycon semi-air-spaced variable
D1, D2 = 1N914
TR1 = 2N3819
TR2 = BC108
L1 = 40t, 28 swg enam. wire, T-50-2 core
L2 = 6 + 6T, 28 swg, bifilar wound on L1

#### Audio Board

R1 = 15K
C1 = 1μF 50V elec.
C2 = 100 pF
C3 = 0.1 μF
C4 = 100 μF 16V elec.
C5 = 100 μF 35V elec.
RV1 = 10K log. potentiometer
RFC1 = 5t, 32 swg enamelled wire through small ferrite bead
IC1 = LM380N

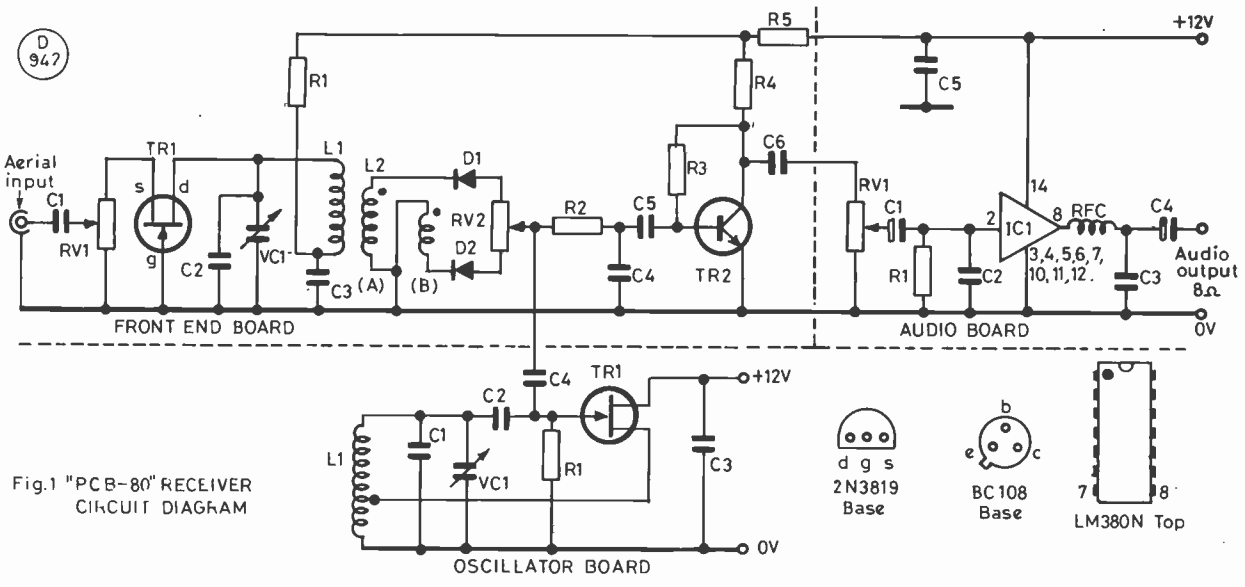



Fig.1 "PCB-80" RECEIVER CIRCUIT DIAGRAM

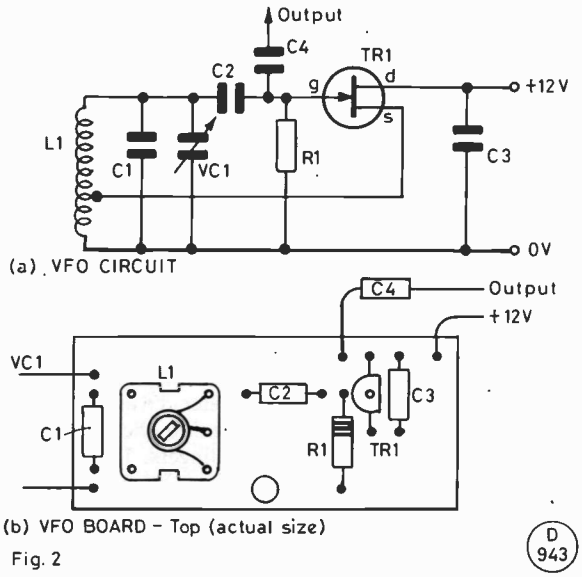



Fig. 2

The formers used for the prototype were small 3/16" diameter formers mounted onto a paxolin base, with 5 pins and a screening can. Any coil former of the same diameter would serve, but my layout is for this type of mounting.

Armed with the squared paper and a pencil, the layout is sketched onto the paper using the 0.1" grid as reference points. If the components are to hand they can be laid onto the paper to obtain correct spacing. This particular layout is small and simple and comparing Fig. 2 (A) and (B) shows that the layout closely matches the actual circuit diagram. This is not always possible as tracks may sometimes need to cross each other without connection. This can be done by making a wire jumper to take the circuit path over the top of the board to cross a copper track on the underside. It is best to avoid as many of these jumps as possible and good board designers pride themselves in having as few wire jumpers as possible. The only connection where this might have been the case is that between the tapping point on L1 and the gate (G) of TR1. However C1 is mounted to the left of the coil and VC1 is not present on the board and the track can go underneath the place in the board occupied by R1, so no jumper is required. It will be noticed that the layout is worked out looking down on the top of the board. Some constructors devise their layouts directly for the tracks on the underside of the board. This involves having to see the circuit upside down and back to front, a technique for better men than I (usually ending up with the problem in the cartoon). The layout is sketched onto the paper lightly with a pencil, including the interconnections which will form the tracks under the board. This sketch now has to be translated into a plan for the copper tracks under the board.

## Making the Board

A complete layout drawing including the interconnections which will form the copper tracks on the printed board has now been made. This drawing is covered with a small piece of tracing paper. Again using a pencil begin the tracing of the drawing by marking in with reasonably sized dots or blobs the points at which the components enter the board. This represents where the solder connections will be made. The lines which form the interconnections of the components can now be added between the dots. Attempt to use the shortest convenient route for these lines. It is also a good idea to add a mounting hole, or several, to take the screw or screws which will hold the finished board in place. These holes should be arranged to appear in places in the board which have copper connected to ground. In the case of this board I used only one mounting hole, seen just below C2 in Fig.2 (B).

This is still a layout viewed from the top (component side) of the board. The next stage is to turn the tracing paper over and mark in the lines again to show where the actual tracks of copper will go on the underside of the board. I usually do this with a thin felt tipped pen, again with fair sizes blobs for the soldered connection points. The finished result is shown in Fig. 3(A). Notice that there are some lines which go from the connection points to the bottom edge of the board: these are all the connections which join to ground. I find this is the easiest way to indicate such connections at this stage. This is now a fair indication of what the finished board will look like, except the lines of tracks will be thicker and the ground connections will be joined. I usually leave such details until working on the final board, as the type of drawing in Fig. 3(A) gives a very clear 'map' of how to draw the board.

The next stage is to transfer this layout to the actual copper clad board. Part IV of this series dealt with the choice and purchase of printed circuit board blanks. Saw a piece of unetched blank board, single-sided type, to just slightly larger than the size required for the final board. This board must now be prepared for use by cleaning it with household scouring powder, rinsing and carefully drying it with a cloth. The board will not be cleaned again before it is etched so this cleaning should be done with care and the board must be handled so as not to allow dirt or grease from the fingers to get onto the surface. Such dirt will itself act as an etch resistant and spoil the final etching process. The prepared drawing of Fig. 3(A) is placed over the copper side of the board and held in place. Small pieces of masking tape or even PVC tape will do this and they can be overlapped onto the plain side. The dots which form the soldering points, which are also the places which will take the component mounting holes, can now be marked onto the copper. I use a very useful little pointed tool which goes into a small 12 volt drill, but a centre punch or a sharp point can be used. All that is required is to mark with a small indentation the points indicated by the dots; this gives points of reference for drawing the rest of the board design and provides marker points for drilling.

The actual marking of the tracks prior to etching can now begin. The idea is to use an etch resistant that will cover the portions of the copper that are to remain after etching to form the printed circuit layout. The commonest way to do this is to use a special etch resist pen. Most constructors use the *Dalo* PCB marker pen. These are pens produced in America specially for this purpose. They work very well, although the fibre nib has to be worked for some time on a new pen to get adequate fluid flow, but are quite expensive. I have more frequently used spirit felt tipped pens sold by normal stationery shops; many of these pens, which are much cheaper than the Dalo pen, will resist the etchant very will. I have had excellent results from the Pentel spirit marker pens; these have a thicker point than the Dalo pens but for most applications in amateur boards thick tracks probably work better than thin tracks. Several types of pen can be used but it is best to

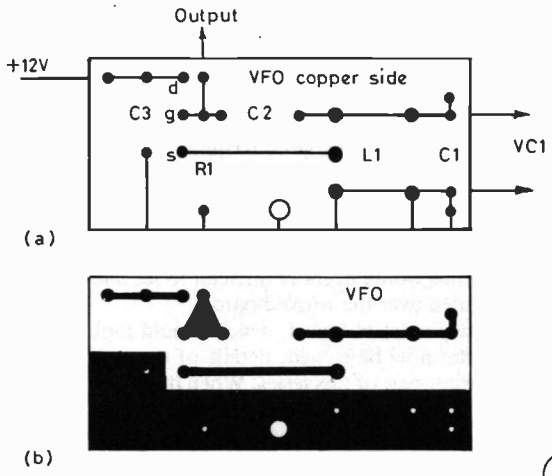



Fig. 3 PCB COPPER SIDE (actual size)

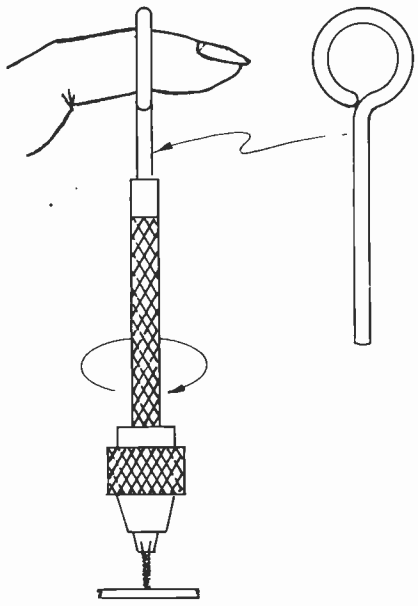


Fig. 4 PIN VICE DRILL

D 945

try out their etch resistant properties on scrap pieces of copper clad board before making up any final boards for etching. At the risk of starting a new addiction amongst radio amateurs, the easiest way to sort out pens which might do the job is to sniff them! The ones you want to sniff again are probably the best for the job. Some amateurs swear by using nail vanish as an etch resistant, applied with the little brushes in the bottles; this certainly works but can lead to family relationship problems.

Having removed the tracing paper, begin the marking of the board by putting in quite large dots to mark the drilling/soldering points. Some of these may need to be larger than others, for example on this board if the coil former with pins is used quite large solder pads are required for connections to the pins. Do not be afraid to make reasonably sized blobs, remembering that a hole is to be drilled through the centre and enough copper should remain to make a good solder connection. These blobs provide the points from which the rest of the track lines can be added. It is important to avoid skin contact with the board to prevent grease marks being made on the board, so draw in the lines with care. The fastidious use a ruler, but ensure it is clean. For a simple circuit board, like this one, the track lines can be made thick which is a safeguard against over-etching. Very thin lines can disappear if the board is over etched, so the thicker spirit felt pens are ideal for such simple boards. Fig. 3(B) shows the finished board. Note that the ground connections are not only joined but are extended to cover a considerable amount of the board surface. This has electrical advantages in providing a larger 'earth mat', and leaving less copper to etch aids the chemical process. It is common to extend the ground connection copper to cover almost all of the board for many applications. The tracks then appear in small 'islands' in the copper. This extension of the ground connection has not been done on this board for two reasons. The first is that this is not a good idea for variable frequency oscillators, where close proximity of frequency determining components and the ground can cause stability problems — hence the use of double sided board is to be avoided for VFO boards. The second reason is simply to show in this demonstration board how the printed track is made up and this would be more difficult to see had the ground mat been extended over the whole board.

The completely marked board, which should look something like Fig. 3(B) can now be etched; details of the etching process appeared in the last part of this series. When the etching process is complete the board is carefully washed and the etch resistant is removed. This can be done with a solvent, but is quite simple to do with household scouring powder and thereby cleaning the copper at the same time. The holes which bear the component are now drilled, and this does require a little specialist equipment.

There are several small 12 volt drills available which are ideal for this task; I have used the same one for some seven years. It is a small handled drill powered by 12 volts with a range of collets, drills and burrs. Conventional power drills are not suitable because of their large size and few will take drills small enough for the holes required. I have used a hand twist drill with a collet held in the chuck, but this method is difficult. If a newcomer wishes to try making a few small boards before investing in a drill, Fig. 4 shows a cheaper alternative that is suitable for small printed circuit boards. This idea was offered to me by Ronnie Marshall, GM4JJG, a canny Scot with an eye for economy. Small pin vices are relatively inexpensive and most have a hollow stem at the opposite end to the collet. A piece of brazing rod is bent into shape, as shown, and inserted in the hollow end; the rod will probably have to be some 3/32" in diameter. To use the simple pin vice drill, insert the left hand index finger into the loop on the rod and twirl the stem with the right hand fingers. The finger in the loop can control the amount of pressure applied to the drill. I have tried this with a cheap pin vice (it only cost £1.95) and it is surprisingly effective and probably breaks less drills. GM4JJG used a standard pin vice made by *Eclipse*. Small twist drills suitable for PCB work can be quite expensive so look for bargains; some people use dentists drills which have been available on the surplus market, but I have not seen any for sale for some time. Twist drills suitable for PCB work are available from the *Tandy* chain of stores. The only real rule to observe when drilling printed circuit boards is *always drill from the copper side,* drilling from the plain side can lift the copper from the boards.

The complete board now requires cutting to size. The usual method is to hold it firmly and saw off the excess board with a hacksaw. This is best done from the copper side and with a full size hacksaw rather than a 'junior'' hacksaw. Again from GM4JJG we have a good little idea for printed circuit boards; this is a simple PCB cutting tool. This can be made by anyone who has access to a grinder, from old hacksaw blades. The blade is ground to the shape shown in Fig. 5, and the hook-like end provides a good cutting edge. The tool is simple to use: a steel ruler is placed along the line to be cut, with the copper side up, the hook shaped cutter being drawn along the edge of the ruler to cut into the board. The board is turned over after a few good score marks have been made and scored along the same line on the reverse side. With good score marks on both sides it is easy to bend the board and cleanly snap off the excess along the scored line. The edges are cleaned up with emery paper or a small file. This simple tool produces very straight cuts in printed circuit boards, costs nothing to make and can be reground when blunted.

The first component to mount on the board is the coil L1. If the coil formers with the base and pins are available the coil can be wound in the manner shown in the inset drawing on Fig. 2(B). Stiff wires are used to provide the anchor points for the leads from the coil. Three wires are used, 22 s.w.g. is about right, although I use wires clipped off the ends of old scrap resistors. Use one very short wire at one end, with a wire about the same height as the coil at the other end, and a wire a little higher than a quarter of the way up the coil for the centre pin. Scrape a little enamelling off the end of the coil wire and tin the end of the wire prior to soldering it to the shortest support wire. Wind on 10 turns and then pull out about six inches of wire and form it into a twist. The rest of the turns are added to the coil and the top is soldered to the long wire at the other end of the bared copper. Ensure that both sides of the twist are tinned and solder the twisted wire to the centre support, cutting off any excess. The method of twisting out the wire is the

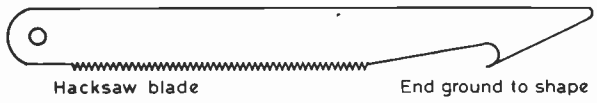



Fig. 5 PCB CUTTING TOOL

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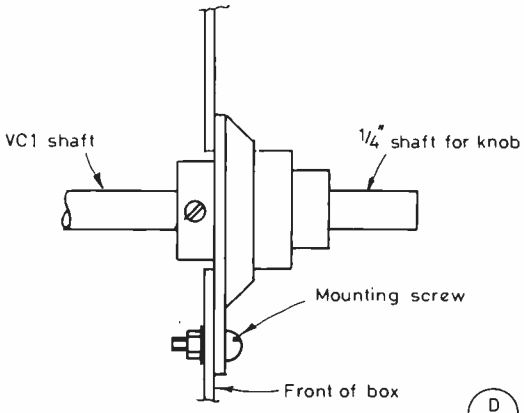


Fig 6 VERNIER DRIVE MOUNTING

commonest way to make a tapping in a coil. The coil can now be soldered into the board.

Note that the tapped end of the coil goes to the side of the circuit nearest the ground connection. If a coil former similar to the one illustrated is not available, any suitable 3/16" diameter former can be used. In this case the wires from the coil will have to be taken directly to the points in the board for the three connections to the coil. It is wise to secure the turns of the coil when it is mounted, and the clear glue used for plastic model making does this job very well. C1, C2, C3, R1 and TR1 can now be soldered into place. The technique for soldering components into a board is simple: only add one component at a time and solder by jamming the iron bit between the wire from the component and the copper on the board. Use the wire and the copper to melt the solder, not the iron bit, and allow a nice flow of solder to cover the connection.

## Mounting the VFO

In many previous articles in *Short Wave Magazine* I have pointed out that stability of frequency in a VFO depends upon good mechanical stability as much as any other factor. "Built like a Sherman tank" or "built to be dropped from 30,000 ft." are expressions I have used. This little VFO deserves a similar approach. The circuit board needs to be placed on a screened box which should be large enough to take the control VC1. A small aluminium box can be bought to suit the job, or the more skilled engineers may like to make their own box. It is commonly assumed that such boxes should be aluminium but I would like to plead the case for using tin plate to make small screen boxes. Aluminium tends to stretch when bent and can be difficult to work, whereas tin plate is very rigid in small box construction, lap joints can be soldered and as a material it is cheap, even free if old scrap pieces are used. There is nothing fundamentally wrong with having *Oxo* or *Heinz* written on the outside of one's VFO.

With the values given for the tuned circuit in this VFO the whole of the 80 metre band can be tuned. The range of tuning is too sharp for a direct knob drive on VC1 so some form of slow motion drive is required.

Slow motion drives can be a problem. The type used for commercial tuners with a drum and cord are not really suitable for amateur radio use. The reduction rate would require a very large drum and the backlash is usually too great for our application. (Perhaps readers who are skilled at the vice and lathe will rush off and build beautiful drives . . . if you can do that write to me — I'd like to meet you!). I use the small inline epicyclic drives which are very reasonably priced; they can often be obtained for well under a pound at radio rallies. Fig. 6 shows what these drives look like and how to mount them onto a VFO box. More will be said about dials for such drives and hardware in general in the next part of this series.

All that remains to complete the VFO is to add the power lead and the output lead. The 12 volts required for the oscillator (it will function well with 9 volts if a battery test is envisaged) can be taken into the box *via* a lead-through. Lead-throughs are little devices which push-fit into holes in the side of a box or case to take signals or supplies into and out of the container. Some have built-in capacitors to provide extra decoupling for the lead; in this application a 1,000pF lead through capacitor would be ideal. The lead through for the output does not want to be the capacitor type. To save money it is possible to simply take the 12 volts and output through the side of the case, using PVC covered wires passing through small holes. We amateurs can be an unsophisticated lot!

## Testing the VFO

Before applying power to the board check the wiring with great care. Opinions vary as to whether to test such a circuit when it is finally mounted in the box or bench test it first. A bench test can be useful, especially if alterations are to be made, but do not expect good stability until the board is firmly housed in its box. The board is mounted into the box with a single 6BA nut and bolt fixing. The board is held above the bottom of the box by a stand-off spacer. A metal spacer is really required here as the copper ground connection on the underside of the board must make good electrical contact with the box. The simplest method of testing an oscillator, for those with little test equipment, is to listen for the signal on a receiver. Any reasonable receiver which will resolve a CW or SSB signal can be used for the test. The more fortunate may have access to a frequency counter in which case they can directly read the frequency of the output. The output may be measured using the simple RF Probe described in the last part of this series. If the VFO fails to oscillate check the wiring with care. The feedback tapping should be enough to ensure reliable oscillation but if all else fails the tapping point could be tried a few more turns up the coil. This requires rewinding the coil but the prototype presented no such problems and oscillated well with several changes of FET and supplies as low as 6 volts.

Once oscillation has been established, the frequency range of the VFO will require adjustment to cover the band. The given values should cover the whole 80 metre amateur band with just a little to spare. The components which determine this range are L1, C1 and VC1. The slug on L1 should produce quite a lot of frequency shift. Ideally the minimum amount of slug should be screwed into the coil as heating within the core is a common cause of instability. The more the slug is screwed into the coil former the lower the frequency will go, but if the slug has to be inserted deep into the former consider altering the capacitance of C1. A higher value of C1 will lower the frequency and a lower value will raise it. If VC1 is above the value stated some vanes may have to be removed to give the coverage required. These can be pulled off with pliers (take care!) or saw a few vanes off the back of VC1. By juggling with the tuned circuit the desired frequency range should be achieved. If problems arise hitting the band or getting the ends of the band into the range of VC1, the coil turns could be changed a little. More turns give a lower frequency and less turns a higher frequency. This may all seem very daunting but the suggested values ought to give the useful range with very little adjustment.

The mixer in the completed receiver is passive, that is powered by the signal alone, and therefore plenty of injection is required from the VFO. The RF Probe for the last article can be used to check the output from the VFO. The only simple way to alter the amount of injected signal into the mixer is to adjust the value of C4, the output coupling capacitor. The RF Probe measures peak-to-peak RF voltage, and up to 10 volts can be fed to the mixer without problems. At this stage just ensure that there is a good output and any changes in C4 can be made when the mixer is built and in use.

So all we have built this time is a VFO: not very useful in itself. Although it *can* be swished about along the band and left running for a while to check for drift — not forgetting that the drift might just be the receiver, not the VFO! In the next part of this series we will complete the PCB80 receiver and put the VFO to useful work. So gather components in readiness.

# CALCULATION OF SUNRISE AND SUNSET TIMES USING THE APPLE-2 MICROCOMPUTER

D. J. REYNOLDS, G3ZPF

FOR operation on the low frequency bands it is useful to be able to calculate the times of sunrise and sunset, for both home and the DX QTH. The program to be described does just that, and in addition checks to see if a 'dark' path exists between two points on the globe for any given date. Indication of whether it is a long or short path is given, together with the relevant times.

The program was written to run on an APPLE 2+ computer with floating point BASIC, and occupies about 5.25k of memory, but should be capable of being modified to run on other machines without too much trouble. Extensive use is made of the APPLE's screen formatting facilities, but suggestions will be made about conversion for other machines, as well as a line by line description of the program operation for those who wish to modify it for their own purposes.

The program is based on the following formulae:—

$$\text{Sunrise Time} = \frac{W}{15} + \frac{\text{Cos}^{-1}(\text{Tan u . Tan N})}{15}$$

$$\text{Sunset Time} = \frac{W}{15} - \frac{\text{Cos}^{-1}(\text{Tan u . Tan N})}{15}$$

N = Latitude in decimal degrees north (southerly latitudes are − ve).

W = Longitude in decimal degrees west (easterly longitudes are − ve).

u = Inclination of earth's axis in relation to the sun.

The value for *u* can be obtained with reasonable accuracy from the formula

$$u = 22.5 \text{ Sin } (360f - 90)$$

where *f* is the number of days since 1st January divided by 365.25, and the value of *u* is in degrees.

The use of such relatively simple formulae will give sunrise and sunset times to within about 15 minutes, but for those who like to be exact I would recommend "What time does the sun rise and set" in the July 1981 issue of *BYTE*. This article goes into great depth, but is fairly mind boggling (to me at any rate) so keep a stiff drink handy.

## Program Operation

Once the program has been entered, the RUN command will cause the title page to be displayed. Pressing RETURN results in a request for the date, followed by the longitude and latitude of the other station. To save having to enter your own coordinates each time the program is run, enter them into lines 200 and 220 before saving the program. When entering the LAT/LONG of the "away" station, values of longitude are valid from +180 to −180, with latitude valid from +90 to −90. They are to be input in degrees (decimal values), and personally I get them from a great circle map and guesstimate them to the nearest degree.

Having entered the coordinates of the "away" station, the screen clears and the sunrise/set times for the "home" and "away" stations are given, together with the times of any 'dark' paths between them on that date. Indication of whether it is a long or short path is given, followed by the option to re-run or quit.

## Conversion to Other Machines

Since the program operates entirely in text mode, little trouble should occur when converting to other dialects of BASIC although a summary of the screen handling facilities of the APPLE seems advisable at this point.

| *LINE NUMBERS* | *FUNCTION* |
|---|---|
| 140 - 170 | Title page. |
| 190 - 220 | Enter your home QTH longitude and latitude (in degrees) into the program at this point. |
| 230 | Dimension character strings for sunrise/set times of the home and away coordinates. Times in decimal GMT are first converted to hours/min., and then into a character string so that leading zeroes may be displayed. |
| 250 - 370 | Date input routine. *See* text for alternative on other machines. |
| 380 - 540 | Date validity checks, together with loop back if an erroneous input is found. |
| 550 - 660 | Converts current month into number of days in year up to start of that month, for use later in program. |
| 670 - 750 | Entry of "away" stations coordinates and range checks. |
| 760 - 780 | Calculate value of *u* for current date. |
| 790 - 820 | Calculate sunrise time at home location (RH) in decimal GMT, then use subroutine from line 1250 to convert to a character string. |
| 830 | Enter returned values from subroutine at line 1250 into RH(1) to RH(4). |
| 840 - 850 | Calculate sunset time for home location (SH) in decimal GMT, then use subroutine at line 1250 to convert to a character string. |
| 860 | Enter returned values from subroutine at line 1250 into SH(1) to SH(4). |
| 870 - 910 | Calculate sunrise time at away location (RA) in decimal GMT, then use subroutine at line 1250 to convert to a character string. |
| 920 | Enter returned values from subroutine at line 1250 into RA(1) to RA(4). |
| 940 - 950 | Calculate sunset time at away location (SA) in decimal GMT, then use subroutine at 1250 to convert to a character string. |
| 960 | Enter returned values from subroutine at line 1250 into SA(1) to SA(4). |
| 970 - 1010 | Clear screen and display sunrise and sunset times for both the home and away locations. |
| 1010 - 1240 | Decision tree to determine if any 'dark' paths exist between specified locations on current date. Based on the fact that to have a short darkpath, then the sunset time at the eastern end must be earlier than the sunrise time at the western end. Similarly for a long darkpath, the sunrise time at the western end must be later than the sunset time at the eastern end. A grey line path occurs when the two times are the same (or very close). |
| 1250 - 1350 | Subroutine to convert decimal GMT into hours/mins., with leading zeroes. Returns values to main program in TA, TB, TC, and TD. |
| 1360 - 1520 | Output messages called to screen by decision tree in lines 1020 - 1240. |
| 1530 - 1600 | Check for re-run/quit. |

```
140  PRINT : PRINT : PRINT "A PROGRAM TO CALCULATE GREY LINE": PRINT "OPEN
     INGS ON THE LOW FREQUENCY BANDS."
150  PRINT : PRINT "THE SUNRISE & SUNSET TIMES FOR ANY TWO": PRINT "POINTS
      ON THE EARTH ARE CALCULATED AND": PRINT "COMPARED TO SEE IF A 'DARK'
      PATH EXISTS": PRINT "BETWEEN THEM ON A GIVEN DATE."
160  VTAB 24
170  INPUT "PRESS RETURN TO CONTINUE";A$
180  HOME
190  REM ****HOME LONGITUDE****
200 B = 2
210  REM ****HOME LATITUDE****
220 C = 52.5
230  DIM RH(4): DIM RA(4): DIM SH(4): DIM SA(4): DIM RE(4): DIM SE(4): DIM
     RW(4): DIM SW(4)
250  TEXT : HOME : VTAB 4
260  PRINT "ENTER THE DATE.......(DD/MM/YY)": VTAB 4: HTAB 23
270 DI = 1
280  GET A$(DI)
290  IF  ASC (A$(DI)) < 48 OR  ASC (A$(DI)) > 57 THEN  PRINT  CHR$ (7);: GOTO
     280
300  PRINT A$(DI);
310  IF DI = 2 THEN DI = 4: PRINT "/";: GOTO 280
320  IF DI = 5 THEN DI = 7: PRINT "/";: GOTO 280
330  IF DI < 8 THEN DI = DI + 1: GOTO 280
340 X = 10 *  VAL (A$(1)) +  VAL (A$(2))
350 Y = 10 *  VAL (A$(4)) +  VAL (A$(5))
360 Z = 10 *  VAL (A$(7)) +  VAL (A$(8))
370  HTAB 1
380  IF X = 0 THEN  VTAB 10: PRINT "         ** DATE CAN'T BE ZERO **": GOTO
     540
390  IF X > 31 THEN  VTAB 10: PRINT "         ** DATE CAN'T BE  >31 **": GOTO
     540
400  IF Y = 2 AND X > 29 THEN 520
410 LY = 1: REM  LEAPYEAR PRESET
420 Z = Z / 4: IF  INT (Z) <  > Z AND Y = 2 AND X > 28 THEN  GOTO 530
430  IF  INT (Z) <  > Z THEN LY = 0: REM NOT LEAPYEAR
440 Z = Z * 4: IF Z = 0 AND Y = 2 AND X > 28 THEN  GOTO 530
450  IF Z = 0 THEN LY = 0: REM NOT LEAPYEAR
460  IF Y = 4 AND X > 30 THEN 520
470  IF Y = 6 AND X > 30 THEN 520
480  IF Y = 9 AND X > 30 THEN 520
490  IF Y = 11 AND X > 30 THEN 520
500  IF Y > 12 OR Y < 1 THEN  VTAB 10: PRINT "         ** MONTH ENTRY INVALI
     D! **": GOTO 540
510  GOTO 550
520  VTAB 10: PRINT " ** DATE INVALID FOR MONTH SPECIFIED **": GOTO 540
530  VTAB 10: PRINT " ** DATE INVALID FOR YEAR SPECIFIED! **": GOTO 540
540  FOR ZZ = 1 TO 5: PRINT  CHR$ (7);: NEXT ZZ: VTAB 4: CALL  - 958: GOTO
     250
550  IF Y = 1 THEN Y = 0
560  IF Y = 2 THEN Y = 31
570  IF Y = 3 THEN Y = 60
580  IF Y = 4 THEN Y = 91
590  IF Y = 5 THEN Y = 121
600  IF Y = 6 THEN Y = 152
610  IF Y = 7 THEN Y = 182
620  IF Y = 8 THEN Y = 213
630  IF Y = 9 THEN Y = 244
640  IF Y = 10 THEN Y = 274
650  IF Y = 11 THEN Y = 305
660  IF Y = 12 THEN Y = 335
670  VTAB 10
680  PRINT "ENTER THE OTHER STATION'S LONGITUDE": PRINT
690  PRINT "IN DEGREES WEST  (DEGREES EAST ARE -VE)": PRINT : INPUT "....?
      ";D
700  IF D <  - 180 OR D > 180 THEN 670
710  VTAB 18
720  PRINT : PRINT "ENTER THE OTHER STATION'S LATITUDE, IN": PRINT : PRINT
     "DEGREES NORTH  (DEGREES SOUTH ARE -VE)": PRINT : INPUT "....? ";E
730  IF E <  - 90 OR E > 90 THEN 710
740  IF E > 67 THEN  GOTO 1490
750  IF E <  - 67 THEN  GOTO 1490
760  REM  CALCULATE SUNRISE TIME (RH),  AND SUNSET TIME(SH), FOR THE HOME
     CO-ORDINATES
770 W = X + Y
780 U = 22.5 *  SIN (( ATN (1) / 45) * ((360 * (W - 1) / 365.25) - 70))
790 T =  TAN (( ATN (1) / 45) * U) *  TAN (( ATN (1) / 45) * C)
800 S =  -  ATN (T /  SQR ( - T * T + 1)) + 1.5708
810 RH = (B / 15) + (S / (15 * ( ATN (1) / 45)))
820 T = RH: GOSUB 1250
830 RH(1) = TA:RH(2) = TB:RH(3) = TC:RH(4) = TD
840 SH = (B / 15) - (S / (15 * ( ATN (1) / 45)))
850 T = SH: GOSUB 1250
860 SH(1) = TA:SH(2) = TB:SH(3) = TC:SH(4) = TD
870  REM  CALCULATE SUNRISE TIME (RA), AND SUNSET TIME (SA), FOR THE 'AWAY
     ' CO-ORDINATES
880 P =  TAN (( ATN (1) / 45) * U) *  TAN (( ATN (1) / 45) * E)
890 M =  -  ATN (P /  SQR ( - P * P + 1)) + 1.5708
900 RA = (D / 15) + (M / (15 * ( ATN (1) / 45)))
910 T = RA: GOSUB 1250
920 RA(1) = TA:RA(2) = TB:RA(3) = TC:RA(4) = TD
940 SA = (D / 15) - (M / (15 * ( ATN (1) / 45)))
950 T = SA: GOSUB 1250
960 SA(1) = TA:SA(2) = TB:SA(3) = TC:SA(4) = TD
970  HOME
980  PRINT : PRINT "SUNRISE TIME (HOME)= ";RH(1);RH(2);RH(3);RH(4);" GMT."

990  PRINT "SUNSET TIME  (HOME)= ";SH(1);SH(2);SH(3);SH(4);" GMT."
1000  PRINT : PRINT "SUNRISE TIME (AWAY)= ";RA(1);RA(2);RA(3);RA(4);" GMT.
     "
1010  PRINT "SUNSET TIME  (AWAY)= ";SA(1);SA(2);SA(3);SA(4);" GMT."
1020  IF B <  = D AND B - D >  =  - 180 THEN 1060
1030  IF B <  = D AND B - D <  - 180 THEN 1080
1040  IF B > D AND B - D <  = 180 THEN 1080
1050  IF B > D AND B - D > 180 THEN 1060
1060  FOR J = 1 TO 4:RE(J) = RH(J):SE(J) = SH(J):RW(J) = RA(J):SW(J) = SA(
     J)
1070  NEXT J: GOTO 1100
1080  FOR J = 1 TO 4:RE(J) = RA(J):SE(J) = SA(J):RW(J) = RH(J):SW(J) = SH(
     J)
1090  NEXT J: GOTO 1100
1100 RE = (1000 * RE(1)) + (100 * RE(2)) + (10 * RE(3)) + RE(4):SE = (1000
      * SE(1)) + (100 * SE(2)) + (10 * SE(3)) + SE(4):RW = (1000 * RW(1)) +
     (100 * RW(2)) + (10 * RW(3)) + RW(4):SW = (1000 * SW(1)) + (100 * SW(
     2)) + (10 * SW(3)) + SW(4)
1110  IF SW >  = RW AND SE <  = RE THEN  GOTO 1150
1120  IF SW < RW AND SE > RE THEN  GOTO 1150
1130  IF SW >  = RW AND SE > RE THEN  GOTO 1200
1140  IF SW < RW AND SE <  = RE THEN  GOTO 1200
1150  IF SW <  = RE THEN  GOSUB 1370
1160  IF SW > RE THEN  GOSUB 1430
1170  IF SE <  = RW THEN  GOSUB 1450
1180  IF SE > RW THEN  GOSUB 1470
1190  GOTO 1530
1200  IF SE <  = SW AND RE <  = RW THEN  GOSUB 1370: GOSUB 1470
1210  IF SE <  = SW AND RE > RW THEN  GOSUB 1390: GOSUB 1470
1220  IF SE > SW AND RE <  = RW THEN  GOSUB 1410: GOSUB 1470
1230  IF SE > SW AND RE > RW THEN  GOSUB 1430: GOSUB 1450
1240  GOTO 1530
1250  IF T < 0 THEN T = T + 24
1260  IF T > 24 THEN T = T - 24
1270 H = T -  INT (T)
1280  IF H = 1 THEN  GOTO 1310
1290 HA = H * 0.6
1300 T =  INT (T) + HA
1310 TA =  INT (0.1 * T)
1320 TB =  INT (T) - (10 * TA)
1330 TC =  INT (10 * T) - (100 * TA) - (10 * TB)
1340 TD =  INT (100 * T) - (1000 * TA) - (100 * TB) - (10 * TC)
1350  RETURN
1360  REM  *****PATH SUBROUTINES*****
1370  PRINT : PRINT : PRINT "SHORT PATH OPENS AT  ";SW(1);SW(2);SW(3);SW(4
     );" GMT.": PRINT "AND CLOSES AT        ";RE(1);RE(2);RE(3);RE(4);" GM
     T."
1380  RETURN
1390  PRINT : PRINT : PRINT "SHORT PATH OPENS AT  ";SW(1);SW(2);SW(3);SW(4
     );" GMT.": PRINT "AND CLOSES AT        ";RW(1);RW(2);RW(3);RW(4);" GM
     T."
1400  RETURN
1410  PRINT : PRINT : PRINT "SHORT PATH OPENS AT  ";SE(1);SE(2);SE(3);SE(4
     );" GMT.": PRINT "AND CLOSES AT        ";RE(1);RE(2);RE(3);RE(4);" GM
     T."
1420  RETURN
1430  PRINT : PRINT : PRINT "NO SHORT PATH OPENING IS AVAILABLE"
1440  RETURN
1450  PRINT : PRINT : PRINT "LONG PATH OPENS AT   ";SE(1);SE(2);SE(3);SE(4
     );" GMT.": PRINT "AND CLOSES AT        ";RW(1);RW(2);RW(3);RW(4);" GM
     T."
1460  RETURN
1470  PRINT : PRINT : PRINT "NO LONG PATH OPENING IS AVAILABLE"
1480  RETURN
1490  HOME : PRINT "THE OTHER STATION IS BEYOND 67 DEGREES"
1500  PRINT : PRINT "OF LATITUDE. IT WILL BE IN CONTINUOUS"
1510  PRINT : PRINT "DAYLIGHT DURING THE SUMMER MONTHS, AND"
1520  PRINT : PRINT "CONTINUOUS DARKNESS DURING THE WINTER."
1530  VTAB 21: PRINT "RE-RUN....";
1540  INVERSE : PRINT "S";: NORMAL : PRINT "AME DATE  ";
1550  INVERSE : PRINT "N";: NORMAL : PRINT "EW DATE  ";
1560  PRINT "OR ";: INVERSE : PRINT "E";: NORMAL : PRINT "ND ";: GET B$
1570  IF B$ = "S" THEN  HOME : GOTO 570
1580  IF B$ = "N" THEN  HOME : GOTO 250
1590  IF B$ = "E" THEN  TEXT : HOME : END
1600  PRINT : GOTO 1530
```

The APPLE text screen has 40 characters per line, and 24 lines on the screen. Each character may be in NORMAL (white on black), INVERSE (black on white), or FLASHING mode.

The commands VTAB and HTAB enable the cursor to be positioned anywhere on the screen prior to printing. VTAB is valid from 1 to 24, corresponding to the number of lines on the screen (counting top to bottom) whilst HTAB is valid from 1 to 40, corresponding to the number of characters per line. This facility is provided on some machines by the PRINT@ statement.

TEXT sets the text mode on the APPLE, whilst HOME clears the screen and returns the cursor to the top left hand corner. PRINT CHR$(7) beeps the APPLY speaker. The INPUT statement requires the RETURN key to be pressed following the requested information, whilst the GET statement waits for a single keystroke before continuing, and does not require the RETURN key to be used. The APPLE generates an automatic carriage return/line feed after printing on the screen, but this facility can be overridden as required by following the PRINT statement with a semicolon.

As far as I am aware, all other functions used in the program are common to all versions of BASIC and the above information together with the program description should enable anyone to adapt it for their machine. The only areas which may cause confusion to the tyro not using an APPLE are probably the date input routine (lines 240-370) and the check for a re-run (lines 1530-1600). The date input routine can be simplified to:—

```
INPUT "DAY ? ";X
INPUT "MONTH ? ";Y
INPUT "YEAR ? ";Z
```

plus the necessary print statements to position it on the screen, and checks to ensure that only integer values are input. (There's always a wiseguy. . . .)

The check for a re-run gives the option of same date/new date/quit. Again the use of input statements will suffice, together with a GOTO 250 (re-run new date) or a GOTO 570 (re-run same date).

## Using the Program

The significance of dark paths, and grey line paths will already be known to the experienced operator, but for those unfamiliar with the terms, there are a number of established publications which explain the vagaries of LF propagation far more eloquently than your scribe could ever hope to. One publication well worth reading is "80 metre DXing" by ON4UN, which also gives a detailed account of designing aerials for the LF bands.

Readers may well wish to modify the program to present the output in a form more suited to their requirements, and it is hoped that the program description together with the listing is detailed enough to enable them to carry this out. The author would be happy to answer any queries about the operation of the program following an *s.a.e.* to QTHR.

# CLUBS ROUNDUP

## By "Club Secretary"

WHEN this comes to be read, the autumn programme will be in full swing, the HF band conditions on the uplift . . . things will be *happening*. Let's see just what it's all about.

### The Mail

First on to the field are **Abergavenny**, with their Hq address at Pen y Fal Hospital, Abergavenny at 7.30 p.m. each Thursday in the room above Male Ward 2. They also have an RAE class running, on Tuesdays, at Nevill Hall Hospital, and we understand they are now a registered RAE exam centre — details from the Hon. Sec., *see* the Secretaries' Panel for his address details.

One of the few to mention the MCC question was the **Acton, Brentford, & Chiswick** group. On October 19, they will foregather at the Chiswick Town Hall and talk about their holiday activities and show slides — an annual treat, this one.

For our next stop we go to **Atherstone**; their Hq is not mentioned but our records show Tudor Centre, Coleshill Road, Atherstone on second and third Thursdays. This means October 14 for the RSGB tape on Top Band DX, and on 21st John Arrowsmith and Nick Trotman will be talking about their trip to OH0-land.

Next **Aylesbury Vale**, and that means Stone Village Hall, which is two miles west of Aylesbury along the A418. October 5 is down for a talk by G6AGE entitled "British Telecom — The New Challenge". Four weeks later, in November, the group will be entertaining G3OUF, the General Manager of RSGB.

October 26 is the one for **Biggin Hill**, at the Memorial Library and they will, for the second time in their short history as a club, be entertaining the RSGB RR; this time by prior arrangement, and so no doubt with lots of questions for him to answer.

We now head for **Braintree**, where they are very reluctant to mention their own details, albeit they do carry them for several others! However, a look in our card-index tells us it is the Braintree Community Centre, adjacent the Bus Park, Victoria Road, on the first and third Monday each month.

The **Bury** club are to be found at the Mosses Youth and Community Centre, Cecil Street on Tuesdays; the main meeting will be the Construction Competition on October 12, the other Tuesdays being informals.

For **Cambridge University** all we can do at the moment is to ask any prospective members to note the Hon. Sec's. details in the Panel, and to note that they will be putting on a show at the Societies Fair to be held in Kelsee Kerridge Hall on October 6 and 7.

On October 7 the **Cheltenham** group will be at the Old Bakery, Chester Walk, Clarence Street, for a visit by *Microwave Modules Ltd.*, although it was still not finally confirmed at the time of writing their letter.

At **Chesham** the locals foregather on the second Wednesday in each month at their new place, namely The Stable Loft, Bury Farm, Pednor Road, Chesham. New members are always welcome, and should contact the Hon. Sec. — *see* Panel for his details.

We turn now to **Cheshunt** and that means the Church Room, Church Lane, Wormley, near Cheshunt; if you think of looking them up we strongly suggest you contact the Hon. Sec. first for directions, or be quite sure you are in Wormley as well as Church Lane! Every Wednesday evening.

**Chichester** are now in the Fernleigh Centre, North Street, Chichester; October 5 is an informal in the Blue Room, and on 21st there is a sale of surplus equipment and junk, in the Green Room.

It is always the *last* Wednesday of the month for **Chiltern**, at the Sir William Ramsay School in Hazlemere, High Wycombe; a 7.30 p.m. start for a busy evening.

That all-important AGM appears on the **Colchester** programme on October 7, in the Staff Common Room, Colchester Institute, Sheepen Road, Colchester. The October 21 meeting is now down for a talk on Moonbounce — a change from the previously announced arrangement.

On to Wales and **Conwy Valley**, and the second Thursday in each month at Green Lawns Hotel, Bay View Road, Colwyn Bay; the new committee is now hard at it drawing up the programme.

**Copeland** foregather at the Market Hall, Egremont, West Cumbria, on the first and third Wednesday in each month. Details from the Hon. Sec. — *see* Panel.

At **Cornish** the base is, as for so many years, the SWEB Club Room, Pool, Camborne; on October 7 they have a talk by G3WKP entitled "Beetling around Africa".

For the current details on the activities at **Crawley** we have to refer you to the Hon. Sec. — *see* Panel.

We turn now to **Cray Valley** where they continue in occupation at Christchurch Centre, High Street, Eltham, where they are to be found on first and third Thursdays. No doubt by next time we will have some more programme data, but we must allow time for the new committee to examine all the input they got at the AGM.

The new Hq for **Crystal Palace** has been adjudged a great success by the members — All Saints Parish Rooms, Upper Norwood; the third Saturday evening in each month would give you a chance to sample it. October 16, for example, is down for a junk sale.

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**Deadlines for "Clubs" for the next three months—**

*November issue—September 24th*

December issue—October 29th
January issue—November 26th
February issue—December 31st

*Please be sure to note these dates!*

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Nice to hear again from the **Dartford Heath D/F** group again; they seem to have moved Hq to the "Malt Shovel" in Eynsford, where they can be found on October 13; in addition they have a D/F Hunt set up for 17th. Details from the Hon. Sec. — *see* Panel.

Over the weekend of October 16/17, the **Denby Dale** gang will be taking part in the Jamboree-on-the-Air, but before that, they will be at the Pie Hall to listen to Peter Burnett, G4BLL; and on October 27 they have a film evening. In between these Wednesdays they have noggin-and-natter sessions. All the details from the Hon. Sec. — *see* Panel.

At **Douglas Valley** the locals foregather at Shevington Conservative Club on Thursdays *except* the second one in each month. On October 7, G4NAR will be giving a talk on digital control and synthesizers, and this club also have plans for J-O-T-A. Details from the Hon. Sec. — *see* Panel.

At **Dudley** the arrangement is to head for the Central Library on the second and fourth Tuesdays of each month. Details from the Hon. Sec. at the address in the Panel.

Up North now, to **Dumfries and Galloway**, which means the first and third Monday of each month, at the Cargenholm Hotel in New Abbey Road, Dumfries.

Nice to hear again after a longish gap from **Echelford**; they still have their meetings on the second Monday and the last Thursday in each month, at The Hall, St. Martins Court, Kingston Crescent, Ashford, Middx.

There are three dates in the **Edgware** calendar for October: October 14 is an informal, October 23 is down for a

**Names and Addresses of Club Secretaries**

**reporting in this issue:**

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WORCESTER: D. S. Pritt, G8TZE, 15 Paxhill Lane, Twyning, Nr. Tewkesbury, Glos.
WORTHING: Mrs. J. Lillywhite, 41 Brendon Road, Worthing, West Sussex BN13 2PS.

demonstration station at the SSAFA Fayre in Stanmore Park, and the details of the meeting on 28th remained at the time of writing to be finalised. The Hq address is 145 Orange Hill Road, Burnt Oak.

We turn now to **Farnborough** where October 13 is a film night by G4MBZ, and October 27 a natter night. The meeting place is the Railway Enthusiasts Club, Access Road, off Hawley Lane, hard by the M3 bridge.

People in the Holsworthy area should be involved in the **GB3CH Repeater Group** — and some of the transients using the repeater could help to keep it rolling with a donation — the Hon. Sec's. details are in the Panel.

For details on the **Greater Peterborough** activities in October we must refer you to the Hon. Sec. We note with some amusement that their VHF NFD activities were a point of focus for the U.S.A.F., R.A.F. and local police as a result of a totally unconnected demo going on in the district!

It is October 8 and 22 for **Guildford**, the first for a quiz night with G8PHG and G8JMP, and the latter for an equipment sale. The venue is the Guildford Model Engineers Hq in Stoke Park.

Next we come to **Harlow** and we have it that their Hq is at Mark Hall Barn, in First Avenue, Harlow, where they are to be found every Tuesday evening from 2000.

Turning to **Harrow**, they meet at the Arts Centre, High Road,

Harrow Weald; October 1 is a talk on *Microdot* terminals, and 8th is informal and practical. October 15 sees a "Basics Lecture", this one being on Power Supplies, while the October 22 date is filled by a film show. Finally, October 29 is down for a talk "Further Stories behind the Controls".

At **Hastings** they seem to have lost the use of the premises at 479 Bexhill Road, but a new venue in the Bexhill area is on offer. The main meeting each month, however, continues to be on the third Wednesday in the month at West Hill Community Centre. For the rest we refer you to the Hon. Sec. — *see* Panel.

Fairkytes Arts Centre is the home of the **Havering** group; October 6 is a business meeting, and on 13th G8KAX will be illustrating a talk entitled "You've Got to Have By-passes"! The Constructors' Cup comes for grabs on October 20, and on 27th there is an informal.

Turning to **Hereford** now, at the County Control, Civil Defence Headquarters, Gaol Street, Hereford, we find they are still finalising the details for October 1, and on October 15 there is an informal meeting of the gang.

If you go to Leeds there are, we are told, two clubs, so our reporters wish to be clear that they are **Leeds & District**, based on Old Hall Golf Club, Woodhall Lane, Pudsey every Monday night. They are preparing for a Christmas Rally at Pudsey Civic Centre on December 12, to follow the successful one last year.

Another club changes home — this time it is **Lothians** and they will be found in future on the second and fourth Thursday of each month at Drummond High School, off Broughton Street, Edinburgh. Details from the Hon. Sec. at the address in the Panel.

**Marconi (Portsmouth)** company club is running the Mary Rose Award, and they write to tell us that the applications are rolling in — some 56 have been issued to the date of their letter. Details on both the club and the Award from the Hon. Sec. — *see* Panel. This is of special interest this month as this is the time, if all goes well, when the *Mary Rose* will re-surface, and in so doing add enormously to our knowledge of the development of naval architecture by filling a gap of several hundred years.

We go next to **Meirion**, where the move to Nannau Country Club has already doubled the numbers attending meetings. Try the first Thursday, giving October 7, when there will be an evening of films from RSGB and elsewhere. The Hq is at Llanfachreth, near Dolgellau.

October 19 is important to **Midland** members as it is the AGM, at 294A Broad Street, Birmingham, opposite the Repertory Theatre, where the gang have their own custom-built Hq. We believe they also have regular meetings on Wednesdays at the same venue.

For the **Mid-Ulster** club the AGM is impending as we write, so no doubt we shall have more details on what's what next time; meanwhile we must refer you to the Hon. Sec. — *see* Panel for his vital statistics.

The **Northern Heights** gang have their base at the Bradshaw Tavern, Illingworth, near Halifax, and will be in residence on October 6 for G6CJS to give a talk on amateur television, October 13 for a visit by G4DAX, the RSGB's RR, and on 20th for a talk by G4BLL called "The Hitch-Hiker's Guide to SS/TV".

At **North Wakefield** the lads foregather at Carr Gate Working Men's Club, every Thursday evening — details from the Hon. Sec. at the address in the Panel.

October 4 is down for an Activity Night on HF at **Plymouth**, and on 18th there is a Junk Sale at Tamar Secondary High School.

October 14 and 28 are the dates for **Pontefract**, the former being down for a talk by G3ESP on "The Energetic Electron — a look into its life and habits"; on 28th G8NDF will give the second part of his talk on VHF Aerials. The Hq is at Carleton Community Centre, where the club room is on the top floor.

At **Southdown** they cover the Eastbourne and district area, from Hq at Chaseley Home for Disabled Ex-Servicemen, Southcliff, Eastbourne, where they attend on the first Monday of every month.

Now we head for **Spen Valley** which means Old Bank Working Men's Club, Mirfield, West Yorkshire. October 14 is a combined project and committee night, and 28th an Open Night for members of all the local clubs. In between these Thursdays the gang foregather for an informal noggin and natter session.

If you are interested in going to the **Stevenage** club, it is suggested you contact the Hon. Sec. as there is a change of venue in the wind.

A search for the **Sunderland** gang on a Monday or Thursday evening would lead you to "The Brewery", Westbourne Road, Sunderland, Tyne & Wear. A pity the brewery is retired! The talk is on the first Thursday of each month, and for October will be all about Amateur TV.

At **Surrey** the current problem appears to be in gripping their elusive Hon. Sec. who is often out of the country. However, the club can be found on first and third Mondays in the Mess Deck at *TS Terra Nova,* 34 The Waldrons, South Croydon. On October 4 they will be entertaining the *Wood & Douglas* team with their goodies, and on 18th there will be a CW and informal chat session plus the club station on the air.

Now to **Sutton Coldfield**, and this means the Central Library and the second and fourth Monday of each month. More details from the Hon. Sec.

The **Swale** group have their Hq at Sittingbourne Town Hall; on October 11 they have the AGM, and at the time of their letter October 25 details were still to be finalised.

October 5 at Thames Ditton Library Reading Room, Watts Road, Giggshill, Thames Ditton, will be a film night for **Thames Valley**.

The **Thanet** group foregather on October 8 for the AGM and October 22 for a junk sale, at Birchington Village Centre. They also have a club net on 28.4 MHz on Sunday mornings and on 145.575 MHz on Thursday evenings.

**Thornton Cleveleys** are mourning the death of their President, Mark Denny, G6DN, an active member right up to his death at the age of 90—indeed he had a contribution in the club's July newsletter. For details of the club, contact the Hon. Sec.—*see* Panel.

A new Hon. Sec. at **Torbay**, where the October 30 meeting will be listening to G3LHJ recalling the history of the club; in addition they have every Friday evening, the Hq being at Bath Lane, rear of 94 Belgrave Road, Torquay.

**Tynedale** have irregular meeting dates, and so we must refer you to the Hon. Sec, who says he can be reached by phone at any time. *See* Panel for the needful.

The **University of Kent at Canterbury** club have a shack atop the highest hill in East Kent, with all the gear and beams for bands 1.8 to 144 MHz. Although this is available to members throughout the year, meetings as such are on Tuesdays, talks and informals alternating. Details from the Hon. Sec.—*see* Panel.

The details for the October meeting of the **Vale of the White Horse** are not given, but we can say that the meetings will be on the first and third Tuesday of the month at the White Hart Inn, Harwell village. Contact the Hon. Sec. about their RAE course.

Turning to **Verulam**, their Hq is at the Charles Morris Memorial Hall, Tyttenhanger Green, Tyttenhanger, near St. Albans; the formal is there on the fourth Tuesday of the month, but the informal on the second Tuesday is taken at the new R.A.F.A. in Victoria Street, St. Albans.

For the venue for the **Wakefield** October meetings on 5th and 19th, we must refer you to the Hon. Sec. (*see* Panel) in case the completion of the alterations to the normal Hq are delayed. The 'normal' place we refer to, incidentally, is Holmfield House, Denby Dale Road.

Once a year the **WACRAL** crowd have a Conference; this year is their 25th Anniversary one and is fully booked. However they will have a station GB4CC on the air over the weekend October 22/23/24 from the Conference and they also keep in touch with regular nets, the main one for UK members being on 3775 kHz at 0830 on Sunday mornings.

The **West Kent** folk have their meetings on alternate Fridays at the Adult Education Centre, Monson Road, Tunbridge Wells; with informals on the following Tuesdays at the Drill Hall in

Victoria Road. October 1 is an Open Evening with beginners welcome, October 15 the Celebrity Lecture with Ted Allbeury's "Radio—My Inspiration"; and on 29th G4BOO will be receiver performance testing, an exercise for which you are requested to bring your own receiver.

For details of the **Wimbledon** meetings we must refer you to the temporary Hon. Sec.—his details are in the Secretaries' Panel.

What most clubs call a 'noggin and natter' or an informal is known to the **Wirral** chaps as 'D & W' dates—this stands for 'Drinking and Waffling!' Thus the formals are on October 13 for a talk on advanced driving techniques, October 27 for G8UZZ to talk about understanding receiver parameters, both at Irby Cricket Club; and the D & W sessions are on October 6 at the Hotel Victoria in Heswall, and October 20 at the "Red Cat" in Greasby.

The October 3 date for **Worcester** is at the Oddfellows when D. Yates will be talking about simple aerials and how to tune them; the informals include some project activity and are on the third Monday of each month at the "Old Pheasant" in New Street.

At **Worthing** you have to head for the Amenity Centre, Pond Lane, Worthing on a Tuesday evening each week; of these October 5th is the AGM and 12th is the Autumn Junk Sale.

Every Thursday evening the **Yeovil** members and their visitors and guests head for Building 101 at Houndstone Camp, Yeovil; October 7 is an RSGB tape talk on radio bands, modes, etc., and on 14th G3MYM will be talking about the D-layer. This, one guesses, is a prelude for his talk on the 21st when he explains how the ionosphere refracts a radio wave. Finally on 28th there is a relaxing natter-session.

The Annual Dinner at **York** is on October 15, so we guess this is one Friday when they won't be at the United Services Club, 61 Micklegate, York. On a different tack, their station at the Great Yorkshire Show was beset by the blackout resulting from a solar flare, which will have given them some pause for thought in answering bystander questions!

## Finalé

That's it for another month; check your position on updating please, and let us have the needful—the dates are all shown in the 'box' in the body of the piece. Send your date appropriate to the month for which deadline you are posting; and of course the club Hq address, Hon. Sec's name, and telephone number if this is possible, and please mark all alterations in these areas—it's very easy to miss one in a big pile! The address, of course, is "Club Secretary," SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ.

## RAE Course

**Bath:** course commences September 28; for details contact tutor Peter Bubb, 58 Greenacres, Bath, Avon. (Tel. Bath 27467).

*continued from p. 423*

against collector volts for a series of small base currents: nice and regular, aren't they? If we had chosen to use constant values of $V_b$, they wouldn't have looked so regular; the reason can be seen in Fig. 6c. However drawing on what we did at Fig. 6a, look now at Fig. 6b and note just how linear the relationship is until you get right to the bottom left-hand corner. Notice also how after an initial very steep rise, the collector current becomes all but constant.

But — enough is enough for one session. Have a think about it, and if you've got some meters and a couple of batteries or bench power-packs (and a transistor or two!), connect them up and see for yourself.

See you next time!

# "A Word in Edgeways"

**Letters to the Editor**

*The views expressed here are not necessarily those of the Editor, nor should they be taken to represent any particular SHORT WAVE MAGAZINE policy.*

*Dear Sir* — Regarding Philip Short's, G3CWX, letter in the August issue of *S. W.M.*, I feel I have to make a comment in reply.

The 'society situation' which he mentions will no doubt be answered elsewhere; sufficient to say that lack of interest means lack of knowledge.

However, concerning the Morse code: I would like to put forward that it is the *only* reliable method of communication - and that takes a lot of saying when one considers my position in the G-QRP Club! This has suddenly been brought home to the armed forces (which had phased-out CW almost entirely) as a result of the Falklands crisis, during which I understand unreliable speech communication caused many dangerous situations. I suggest Mr. Short spends a little time this winter monitoring 500 kHz where, almost on a daily basis, he will hear distress traffic; in such situations, Morse is used wherever possible because of its reliability and accuracy.

Having said that, I would also add "live and let live" — Mr. Short, please continue with your mode and linear (1kW?), but one day turn off the linear and take the output from the transverter socket and maybe you'll find you enjoy yourself. . . .

*Ian Keyser, G3ROO,*
*SSB Manager, G-QRP Club*

*Dear Sir* — I am the proud owner of a Heathkit GR-78 receiver. However, fine receiver as it is, I am experiencing difficulty with the main tuning control.

As I scan across the scale, the needle becomes stuck about halfway along the scale and refuses to budge; after constant twirling of the main tuning knob the needle eventually moves slightly. Could anyone give me advice on how to overcome this problem?

I am only 14 years old, and I am studying for the R.A.E. which I hope to take this December.

*Peter Fordham, RS47078,*
*2 Links Avenue, Gidea Park, Romford, Essex RM2 6ND.*

*Dear Sir* — With regard to the letter from Ian Moth, G4MBD, in September *S. W.M.*, perhaps if some of the radio magazines were to publish details of any court cases that resulted in fines and/or equipment confiscations, this would spur us on to pass information to the relevant authorities.

May I suggest a CAP (Caught All Pirates) certificate, requiring five confiscations, three fines, or one imprisonment, to win.

*Graeme Caselton, G6CSY*

*Address your letters for this column to "A Word in Edgeways", SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ.*

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**Exchange:** R-600 general coverage receiver for SX-600. — Dunkeld, 16 Jefferson Close, Lancaster.

**For Sale: Barlow Wadley XCR-30** communications receiver, covers 500 kHz to 31 MHz, £95. — Heaton, Flat 2, 95 Redington Road, London NW3 7RR. (Tel. 01-435 4105).

**Selling:** Yaesu FRG-7 with digital readout, little used, £170. KDK VHF FM 2m. transceiver with transformer, used as base, as new, £130. Both include Securicor delivery. — Steele, Mayberry, Chilbolton, Stockbridge, Hants.

**Sale:** Acorn Atom, 12K RAM, 8K ROM, with leads, manual, PSU and software, £160. — Ring Grimsby (0472) 824615 evenings.

**Sale:** Kenwood TR-2300 70cm. portable transceiver, 7 channels, with charger, telescopic aerial and carrying case with shoulder strap, £130. Icom IC-280E, 2m., with scanner, toneburst, remote lead and mobile bracket, £160. Both 'or near offer'. (Yorks). — Box No. 5773, Short Wave Magazine, 34 High Street, Welwyn, Herts. AL6 9EQ.

**New Ticket** wants FT-101ZD or FT-902, and maybe FC-902. Cash waiting. — Ring Reddaway, Hendre 761 (N. Wales).

**Sale:** Microwave Associates 10 GHz Gunnplexer transceiver, £90 or near offer. — Ring Spencer, G3ILO, 045383-3411 or 0453-45461.

**Wanted:** "Short Wave Magazine" for August '64, January '65 and February '77. — Cook, 36 Farm Road, Crombie, Fife.

**Selling:** R-1000, fitted for 12v. DC, with accessories and manual, original packing, as new, with new KX-2 ATU, £200. Genuine reason for sale. — Ring Robinson, Bury St. Edmunds 61951.

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**Sale:** Heath SW-717 Rx, factory aligned, £50 plus carriage. — Ring Nesbitt, North Shields 572379.

**For Sale:** Complete 2m. portable station: TR-2300 with all accessories, SP-40 mobile speaker, ¼-wave gutter, mount, two months old, boxed, etc., £165.—Ring le Fort, 0432-269770.

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**Wanted:** New licence requires 2m. transceiver. Details and price please. — Belfield, 2 Steeton Avenue, Hull HU6 7AZ. (Tel: 0482-859445).

**For Sale: TR-2400,** with nicads, slow charger, heavy duty leather case and **ST-1 base unit,** £145. **KF-430** 70 cm. 3/10W mobile, fitted SU8/18/20/22 and RB2/4/6/10/14, £95. **MML 70/100** 4-metre 100W linear, only used once, £75. All items in excellent condition with circuits/manuals. All 'or near offer'. Delivery 50 miles Bristol. — Ring **0454-415185, 9 a.m. to 9 p.m.**

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**Wanted:** 9R-59DE receiver, ETM-2 keyer, oscilloscope. Details and price please.—Elsworthy, G4AYG, 27 Balton Way, Dovercourt, Harwich, Essex.

**Sale: Icom IC-720A all-band transceiver with PSU, 4 months old, exactly as new and under guarantee, genuine reason for sale, £840 or near offer. (Clwyd). — Box No. 5774, Short Wave Magazine, 34 High Street, Welwyn, Herts. AL6 9EQ.**

**For Sale:** FRG-7 Rx, bought December '80 and not used since July '81, absolutely mint condition, with over 300-ft. 50-ohm coax antenna, £185 or near offer (no separate sale).—Ring Hill, Harrogate 58394.

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**Selling:** Icom IC-202S, two years old. — Ring Haslip, 07914-87154.

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**Sale:** Trio communications receivers: 9R-59DS, £45; JR-500S, £55; JR-310, £65. — Ring Mitchell, Draycott 3390 (Derbys.)

**Sale: TM-56B 2m. monitor, complete with 14 xtals, excellent condition, £60. — Ring Paul, Bradford (0274) 596907 after 6 p.m.**

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**Selling:** Heathkit HW-12 80-metre 200-watt SSB transceiver, with mic., speaker, mobile and bench power packs, spare valves and manuals, all in good condition, £95. — Ring Ball, Penketh 2381.

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