OPEN UP THE EXCITING WORLD OF SHORT WAVE LISTENING

TRIO
R 300
170 kHz—30 MHz. AM.SSB.CW.
3 Way AC Mains/Battery Power
Completely Self Contained
+TRIO Quality £184.50 carr. £3

FULL CATALOGUE AVAILABLE—SIMPLY SEND 45p IN STAMPS TO MATLOCK

LOWE SRX-30
New Receiver
500 kHz 30 MHz. AM.SSB.CW
Mains/12v Operation
Drift Cancelling System for Spot On Accuracy

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LOWE ELECTRONICS
119 Cavendish Rd., Matlock, Derbyshire. Tel. Matlock (0629) 2430 or 2817
The TS520 from Trio was, as we expected, an outstanding success and many thousands are now in use around the world. Following the Trio practice of listening to suggestions and comments from users of the equipment, the TS520 was uprated and appears as the TS520S. All accessories such as the TV502, VF0520 and SP520 are fully compatible with both models so there is no obsolescence. Major new features in the TS520S are:

- Full band coverage from 160-10 metres with WWV at 15 MHz and a most important uncommitted band which will be used following any expansion or modification of amateur HF bands at WARC in 1979.
- The TS520S gives you top performance for top band.
- New speech processor using the latest audio compression techniques to give you extra signal punch when in the pile up but without introducing any clipping or distortion. The compressor can be put into use instantly by front panel switching.
- Advanced noise blanker is built into the TS520S for virtual elimination of impulse interference such as ignition noise.
- The 3SK35 has a low noise figure (3.5 dB typ) and high gain (18 dB typ) which contributes to the excellent receiver performance—less than 0.2 µV required for 10 dB S/N ratio on all bands. When the signal levels are exceptionally high, a 20 dB attenuator can be inserted at the touch of a push button.
- A matching 8 pole 500 Hz CW filter is available and can fitted by the set owner in a few minutes. This filter gives the CW operator really excellent selectivity with stop band rejection of a very high order.
- Multi function metering of signal strength, ALC level, PA input current, RF output and HT voltage to the PA not only keeps the operator informed about the performance of the rig, but also allows instant calculation of power input. A built in low noise cooling fan keeps cabinet temperatures very low, even over extended operating periods.
- Tuning up the TS520S is simple and fuss free due to the provision of a low power tune up facility. No need to worry about the cracking noises which are often apparent in transmitters using line output tubes; rugged 6L46B tetrodes in the 520S give high power output with very low intermod products—in fact, the Trio TS520 series transceivers have always sounded outstandingly good on the air due to this fact.

The TS520S has all the features desirable in a high quality transceiver—RIT control, 25 kHz calibrator; separate mic gain and carrier level controls; built in speaker; power saving heater switch; provision for up to 4 fixed channels; all connector provision for linear and transverter control and many, many more.

Ask anyone about the TS520S, all reports are the same—it’s the best around.

TS520S
Setting new standards in 6 band transceivers

The luxury of digital readout is available on your TS520S by connecting the new DG-5 readout unit. More than just the average readout system, the DG-5 mixes the carrier, VFO and heterodyne oscillator outputs to show your exact frequency at all times in all modes. This handsome accessory can sit on the TS520S for in-shack use... or on the dashboard during mobile operation for safety and convenience. Six bold digits display your operating frequency, and the digital hold switch serves as a memory.

Unique feature—the DG-5 can be used as a general purpose counter reading signals from 100 Hz to over 50 MHz so it’s more than just a readout system.

N.B.—The DG-5 can be fitted to earlier TS520 models by using the adaptor kit DK-520.

TS520S £489 inc. VAT
DG-5 £132 inc. VAT

LOWE ELECTRONICS
119 Cavendish Road,
Matlock,
Derbyshire DE4 3HE
0629-2430 or 2817

FOR FULL CATALOGUE SIMPLY SEND 45p in stamps to Matlock.
NEW TS700S. 2 metre all mode transceiver

The TS700S is intended to be top of the line in 2 metre multi mode stations. Building on the solid foundation of the TS700G with its outstanding signal quality and unbeatable receiver dynamic range, TRIO have now incorporated all the facilities which customers have expressed a wish to see in the 700 series. Main new features are:

**Digital readout**

Built into the rig and using the same easy on the eye blue/green read out tube as the TS820. The counter is a complete frequency measuring system and incorporates the VFO and carrier oscillator frequencies to measure the CW transmit/receive shift as well as USB/LSB shift. The display reads to 100 Hz on SSB and CW but is automatically rounded off to the nearest kHz on FM. However, if you insist on reading to 100Hz, the touch of a switch restores this facility on FM also.

**Smooth accurate tuning**

Using the new dual ratio gearbox with flywheel action for fast band scanning. It is true to say that nothing compares with a real VFO backed up by first class mechanical engineering, when it comes to pin point accurate tuning of SSB and CW.

**Receiver pre amplifier**

The TS700S is fitted with a low noise receiver pre amplifier with carefully calculated gain figures to give that extra performance when digging into the noise for real DX. When signal levels are high, simply remove the pre amplifier at the touch of a front panel switch.

**Vox operation**

And break in CW using the built in VOX system. Front panel gain and delay controls allow instant adjustment to suit every situation.

**High/lowlow power**

A front panel button allows instant selection of high power or a nominal 1 watt low power transmitter output.

**Split frequency working**

Using the new external VFO unit VFO/700S. The frequency of the external VFO is checked by the digital readout on the TS700S. A press switch on the VFO allows instant frequency checking at any time and any frequency split or full transceive operation can be carried out using external VFO. A unique accessory for the VHF operator.

New standards of performance

On the samples which we have checked, the 10dB S/N ratio sensitivity is around 0.15 µV on SSB and the 20dB quieting level is less than 0.5µV on FM. This gives the TS700S a real lead over any other rig around. Plus of course all the features which make the 700 series so outstanding. Remember the signal quality resulting from the use of a high supply voltage on the PA and driver giving unbeaten linearity (TRIO patent). Remember the rugged, go anywhere construction which makes the 700 series so popular on expeditions and field days. Remember the all mode (AM, FM, USB, LSB, CW) operation—not all rigs have them. Remember the Simplex/Repeater/Reverse repeater operation available at the turn of a switch.

Finally, remember the combined reputations of TRIO and Low Electronics and you will agree with us that for the ultimate 2 metre all mode station it has to be the TS700S.

**TS700S £580 inc. VAT**

**TR2200G X**

**TR2200GX, £147 (3 ch.) £177 (12 ch.) inc. VAT**

This is the definitive 2 metre FM portable rig which has won praise from all over the world. Over 2W transmitter output with switched reduction to 400mW for local contacts. High gain receiver with double IF filtering at 10.7 MHz and 455 kHz for razor sharp selectivity.

The TR2200GX is supplied with all accessories including the battery charger for the optional Nicad battery pack, the removable telescopic antenna, the carrying case, the shoulder strap, external power lead, microphone and handbook. Fitted with 12 channels, the price is only £177 inc. VAT. If you wish to start out at a lower price, we can supply the rig fitted 3 channels for only £147. With all its performance, the TR2200GX is a must for the portable operator. At the price, it has to be the best around. Just look around at the next rally and see how many operators are carrying them.

**LOWE ELECTRONICS—FOR ALL THAT IS GOOD IN AMATEUR RADIO**

**HEAD OFFICE:**

119 Cavendish Road, Matlock, Derbyshire. Tuesday - Saturday 9 a.m.-5.30 p.m.

Telephone: 0629 2817 or 2430 9 a.m.-9 p.m. Telex 377482.

**BRANCHES:**

Communications House, Wallington Square, Wallington, Surrey. Tuesday - Saturday (morning) Telephone: 01-669 6700.

27 Cookridge Street, Leeds, Yorkshire. Monday - Saturday 9 a.m.-5.30 p.m. Telephone: 0532 452657.

Soho House, 362 Soho Road, Handsworth, Birmingham. Tuesday - Saturday 9 a.m.-5.30 p.m.

Telephone: 021-554 0708.

**AGENTS:**

John-G3JYG. 16 Harvard Road, Ringmer, Lewes, Sussex. Telephone: Ringmer 812071.

Sim GM3SAN. 19 Ellishmuir Road, Baillieston, N. Glasgow. Telephone: 041-771 0364.


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THE SHORT WAVE MAGAZINE
June, 1978

YAESU—the world's leading manufacturer
S.M.C.—the largest Yaesu UK distributor

Our two-year guarantee and a free "24 hour" Securicor service are but a phone call away.

NEW DE-LUXE GENERAL COVERAGE RECEIVER

The FRG7000 is a digital readout, to 1 kHz, general coverage receiver which inclusively covers 250 kHz to 30 MHz. The receiver is sensitive (0.7 µV for 10dB S/N) and very stable. Selectivity is switchable; ±1.5 kHz for CW/SSB and ±3 kHz (at -6dB) for AM. A digital clock is incorporated (settable to local and GMT time with a relay timer circuit for switching on tape recorder etc).

FRG7000 Digital Receiver, £306 + VAT.
YH55 Headphones, £8-75 + VAT

FRG7 Analogue or SMC Digital Readout

The FRG7000 Digital Readout.

The FRG7000 is a general coverage solid-state receiver with specifications unparallelled in its price range. It uses a Barlow Wadley Triple mix, drift cancelling loop for continuous, span-tuned coverage of 0.5 to 30 MHz. The receiver is sensitive (0.25 µV for 10dB S/N) and very stable. AM, SSB and CW modes catered for. A three position audio filter, RF attenuator, dial lamp conservation switch, recorder and phone sockets are fitted. It is mains powered, but should the supply fail, or portable operation be required, eight dry cells are automatically switched in. The U.K. Sales of many thousand FRG7's last year amply demonstrates the outstanding value and enormous versatility of the unit with applications in Amateur (First RX or standby), SWL (Amateur and BCL) or far less demanding professional applications.

FRG7 Analogue £164 + VAT
SMC Counter, £50-00 + VAT
FRG7 Digital, £217 + VAT
YH55 Headphones, £8-75 + VAT

The FR101 COMMUNICATIONS RECEIVER

The FR101D (de luxe) wide coverage 23 (from 1.5 MHz) 500 kHz bands + 4 and 2 metres (receiver). Analysis of the signal path shows a 0-20dB switchable attenuator, two section permeability tuned input filter, Mosfet R.F. stage and mixer (crystal controlled), three section top coupled bandpass filter, no gain at first IF, IC balance mixer, 20 kHz wide crystal filter, shunt diode noise blanker, single FET buffer stage, AM, CW or SSB (RTTY) filter, appropriate detector and audio stage. Add to this, two excellent VHF converters, squelch, FM detector, 1 kHz readout, excellent stability, TX monitor control, crystal control facility, switchable AGC transceive capability (FT or FL101) and that digital readout options are available of this (de-luxe) or the standard (less the plug-in optionals of converters, broadcast band crystals, filters, etc).

FR101 Standard Receiver, £372-00 + VAT
FR101STD Digital Standard, £453-50 + VAT
FR101D De-luxe Receiver, £665-00 + VAT
FR101DD De-luxe Digital, £541-00 + VAT

FOR THE VHF MOBILE THE FT227R FROM YAESU

The new FT227R uses a "single knob" tuned digital synthesizer employing a photoelectric sensor or an optical coupled system which eliminates both noisy, unreliable rotary switches, and crystal banks. Full coverage of 2 metres in 5kHz divisions with a ±600 kHz shift plus a memory feature which permits recall of any entered frequency or particular offset. Bright large, digital readout gives unequivocal readout of the frequency in use. The receiver offers 0.3 to 1.4V (for 20dB S+N/N) sensitivity into a ±6 kHz (at 6dB) bandwidth whilst maintaining a remarkable immunity to overload and image problems.
Communications Ltd

OF PROFESSIONAL EXPERIENCE

New Multi Mode 144MHz Transceiver and more!

Based upon the extremely popular FT221, Yaesu proudly present the top line multi mode 2 metre transceiver. Super accurate mode sensitive 10 kHz digital readout, 10W, of AM, 25W of FM (continuously variable) or 44 crystal channels, simplex or repeater (600 kHz and aux shift). 11 crystals control positions (per 1 MHz band) and full memory facility.

FT225R £720.00 FT225DRD £506.50
Counter £57.50 Memory £84.50
All prices are VAT exclusive

THE FT221R MULTIMODE FROM YAESU

The multimode USB, LSB, AM, FM, CW (with semi-break in and side tone), 2m transceiver offering the choice of phase locked VFO or 44 crystal channels, simplex or repeater (600 kHz up and down shifts), with unique "double push" auto tone burst, mains or 12v. (3A) operation, switchable "S" and centre zero tuning meter, noise blanker, switchable 25 kHz and 100 kHz calibration, ± 5kHz clarity, and an advanced noise blanker are some of the features packed into a cabinet only a few inches high, but through careful design the front panel remains remarkably uncluttered. Designed for a linear 10W, adjustable to 200W PIP, 2m. operation with the semi break in keying, with side tone, and the optional filter crystal control facility.

FT221R £357 + VAT YC221, £72.50 + VAT MANUAL, £9.50

THE FT7 MOBILE TRANSCEIVER

This is a 10-80m. transceiver, VFO controlled (per 1 kHz accuracy) plus crystal control facility. Selectable sidebands, CW, CW calibrator, clarifier and an advanced noise blanker are some of the features packed into a cabinet only a few inches high, but through careful design the front panel remains remarkably uncluttered. Designed for a linear 10W. operation, whose performance with the semi break in keying, with side tone, and the optional filter crystal control facility.

FT7 £300.00 F84 £29.50 FL110 £110.00

THE FT01IE THE MOST POPULAR RIG IN THE WORLD ! ! !

The FT-01IE is a complete mains or 12v. DC station contained in a compact 30 lb. package, 360W. P.I.P. of SSB (with in-built R.F. speech processor) 180W, CW and 80W, of AM 10 to 160m. (incl) 10 MHz RX. The sensitive and selective (permeability tuned RF stages and 8 pole crystal filter, receiver offers: threshold adjustable noise blanker, switchable 25 and 100 kHz calibrator, ± 5kHz clarity, and an advanced noise blanker are some of the features packed into a cabinet only a few inches high, but through careful design the front panel remains remarkably uncluttered. Designed for a linear 10W. operation, whose performance with the semi break in keying, with side tone, and the optional filter crystal control facility.

FTI £855.00 + VAT FT01IE £649.00 + VAT FT01IX £449.00 + VAT

THE FT901-SIMPLY UNBELIEVABLE PERFORMANCE

160-10m. (+ WWV Rx) 12 and 234v. (PSU built-in), SSB, AM, CW, FSK and FM (Tx & Rx). 1B0W.PIP, 80W.FL. Analogue 1 kHz and Digital to 100Hz. Sensitive, 25W of FM (Continuous variable selectivity 300Hz to 2-4 kHz and fixed 600Hz, 2-4 kHz, 8 kHz and 12 kHz (at 6dB) 80dB cross mod. rejection, 90dB desensitisation immunity (at 20kHz off at 14 MHz) Audio Peak and separate notch tuning. Positive RF feedback on 36460 toroidal tuned output stage (-31dB 3rd order) LF processor, VOX, Curtis electronic keyer, tune button (10sec, on full power), PLL VFO with memory for any TX, RX or T/RX frequency. Modular plug-in construction, all features of the FT901-The 1980's Transceiver available.

FT901DM £805.00 + VAT FT901EX £695.00 + VAT FT901ED £695.00 + VAT

STOP PRESS

The FT901 is simply unbelievable performance. 160-10m. (+ WWV Rx) 12 and 234v. (PSU built-in), SSB, AM, CW, FSK and FM (Tx & Rx), 180W.PIP, 80W.FL. Analogue 1 kHz and Digital to 100Hz. Sensitive, 25W of FM (Continuous variable selectivity 300Hz to 2-4 kHz and fixed 600Hz, 2-4 kHz, 8 kHz and 12 kHz (at 6dB) 80dB cross mod. rejection, 90dB desensitisation immunity (at 20kHz off at 14 MHz) Audio Peak and separate notch tuning. Positive RF feedback on 36460 toroidal tuned output stage (-31dB 3rd order) LF processor, VOX, Curtis electronic keyer, tune button (10sec, on full power), PLL VFO with memory for any TX, RX or T/RX frequency. Modular plug-in construction, all features of the FT901-The 1980's Transceiver available.

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THE SHORT WAVE MAGAZINE

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WATTMETER AND LOAD
Flat 50-150 MHz SWR ± 3% (100; 3) 120W in 50W FS (8%)
RF S20M P & P 85p + 8% VAT £23-50
30W peak 15W cont. 50 ohms PL259
VL529 VSWR 1:1 at 130 MHz
DL20 P & P 25p + 8% VAT £14-75

TRANSISTOR DIP OSCILLATOR
LDM815 1-5 GHz on fundamentals battery c/w
earphone and 6 plug-in coils, 2 kHz modulation.
LDM815 post free £38-50 + 8%
LIM870 Antenna impedance meter 1-150 MHz.
LIM870 post free £38-50 + 8%

COAX SLIDE SWITCHES
Up to: 15W, 1.5 GHz, 3 dB loss, 1-2: 1
VSWR, 450 dB isolation, 50 ohm "N" or "PL"
switch (ex P & P 80p, VAT + 8%).
TW5120 1 in 2 out nickel SO239 ... £4-50
TW5150 1 in 5 out nickel SO239 ... £9-95
TW5220 2 in 4 out nickel SO239 ... £10-40

LEADER WATTMETERS
LDM815 (through line illustrated) 1-5 MHz.
200-1000W P & P 75p £44-60 + 5% VAT
LPX1000 Absorption, 1-5 MHz 30-120W.
P & P P & P 350p £16-80 + 6% VAT

QUARTZ CRYSTALS LOW PRICE
FT255(B), FT255(B), FT200(B), FT300(B),
FT210(R), TW220, MS2, MR2. Converter
902-1020, ex-12. £6-95 + 12%
FT204, FT224, FT225, P, 11, TR2200(G),
C146, £6-00 pair (+ 12.5%) (P & P 20p)

BOOM MICROPHONE HEADSET
600 ohm magnetic lightweight boom mic.
Ideal for mobile or contests, etc. (Post free but VAT + 12.5%).
Microphone only ... £9-75
Footswitch only ... £14-75
MD35 complete ... £14-75

ULTRA BAL 2000
Permits Balun 250 MHz 50/75 ohm 90 ohm.
Body 9" long x 1½" dia. Rated to 200W PIP.
SO239 sockets (111) £9-00 + 12.5% (P & P 40p)

ANTEX (Kuraniishi) COAX
SWITCHES
1-25: 1 VSWR, 0-10 dB, 450 MHz isolation.
200W handling at 150 MHz.
KSW2 3 SO239 sockets £7-70 (+ 8%)
KSWIA 2 SO239, 1 PL259 plug £8-20 (+ 8%)

SML SWR METER
SWR25 Twin meter SWR25 Up to 160 MHz.
Calibrated to 3:1 SWR 600 P & P P 40p £10-00 (+ 8%)

AMPERE LINEAR AMPLIFIERS
RF sensing. All modes c/w bracket
10W drive. Free delivery, UK only.
APB2A 145 MHz 20W out £10-50
APB27A 432 MHz 45W out £11-50
APB28A 432 MHz 20W out £14-00
(+ VAT 12.5%)

CUSHCRAFT COLINEAR (illustrated right)
EX STOCK
RINGE RANGER 1-6dB gain over 3½ tubes. Uses 3x4 in
ARX450 437 MHz RINGE RANGER Post 65p £21-50 (+12.5%)
ARX4 144 MHz RINGE RANGER Post 85p £21-50 (+12.5%)

WATTMETER REMOTE RF HEAD
50-150 MHz ideal for mobile use.
Separate directional components 3½ x 3½ x 1½" and
illuminated indicator 3⅛ x ⅛ x ⅛ c/w brackets, etc. Power 20 and 200W FSD
(10%) SWR to 2:1 (+3%)
F5771/V P & P 85p + 8% VAT £21-50

12 VOLT POWER SUPPLY
ODR214
12V, DC from 340V, AC 3 amps. (10W)
31 lbs. 3½ x 4½ x 6½ + 8% VAT £12-55
Binding post terminals with 4mm. socket, installed.
ODR214 Post free + 8% £14-42

LEADER ANTENNA COUPLER
LAC25S
3½-33 MHz. 50/75 coax (SWR <5) and single
tube (100-2500 MHz) fed transformed to 50
Wattmeter 20 & 200W FSD, 55B 500W
P IP. Post free + 12.5% VAT £80-50

COAX RELAYS
12V DC, 50 ohm, Silver plated.
P & P 20p £10-50 (+ 8%)
Power cross over 1500 MHz
CX120 50W 35dB Cable entry £9-30
CX230 300W 40dB BN connectors £9-30
CX600N 600W 40dB N connectors £23-35

MFJ ANTENNA TUNERS
10-100m. 200W. 12 position Inductor,
12 steps + 0 12 steps + £4-00 £12-00
900 12 steps + C0239 £38-75 + 12.5%
900 £19-00 + Balun etc £49-25 + 12.5%

CRYSTAL FILTERS P & P free VAT £12.5%
Wide range: 1-18-10 MHz. C P 55B (2.5)
FT230 12 kHz 3CW (600 x 350 Hz.) 2W.
YF230F330 350Hz F101 8 pole £6-15
YF30F600 600Hz F101 8 pole £6-75
YF30F800 800Hz F101 8 pole £6-95
YF30F1000 1000Hz F101 8 pole £9-10

FM BOOSTER T203
50-100 MHz low noise pre amp. Fitted
leading leads (ear plugs) up to 20dB gain.
120Watts with LED indicator 14 x 3½ x 2½".
T203 £7-75 (+ 12.5%) (P & P Free)

MORSE KEYS FROM M'HOUND
HK707 (illustrated left) P & P 60p Hand
key 0-5 Kg override (12%) £6-80
BK100 P & P 60p (+ 12.5%) Mechanical
Sensor Auto Bug key £13-40
HK800 P & P 60p (+ 12.5%) Hand key
marble plinth (1 Kg) £28-90

MICROWAVE MODULES TRANSVERTORS
WORLD WIDE POST FREE
(full converter and counter range R & R etc)
MHT412/2B ... (+12.5%) £9-79
MHT432/2B ... (+12.5%) £11-00
MHT432/144 ... (+12.5%) £151-00

REACE UHF4 VHF/ULF meter
P & P 500 MHz, receive
head 5¾ x 1¾ x 2½ x 1½" x 6½" x 2½" x 2¼" x 2¼" x 2¼" x 2¼" x 2¼"
V.S.W.R. Measure SO239 sockets
UHF 4 P & P 50p (+ 8½% VAT) £12-75

VERSATOWERS (illustrated right)
20ft sections—telescopic—allow heavy galvanised. (+ 8% VAT.)
Large range of models — Small Example—
Standard 240 £238-90 Heavy Duty 240 £357-50
Standard 600 £389-50 Heavy Duty 600 £649-50

June, 1978
LEE ELECTRONICS LTD.

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SPECIALIST • STANDARD • ICOM • BANTEX
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FRG-7 — DIGITAL DISPLAY

Yes! The world famous FRG-7 is now available with digital read-out fitted by Lee Electronics in place of kHz dial.

Special Price £160 + VAT

For customers who already own FRG-7’s we can supply the digital read-out complete with installation instructions £170 + VAT

FRG-7 Digital £190

FRG-7 with analogue dial £154 + VAT

FRG-7 Perspex cover as illustrated £3.50

All plus 12.5% VAT

YAESU MUSEN PRICES (ALL AVAILABLE FOR IMMEDIATE DELIVERY)

FT301/T/RX 1-300, 100W, 12v... £490.00
FT301 D Digital Readout... £505.00
FV301 External VFO... £70.00
FP301 PSU/speaker... £255.00
FT300B 1/2 RX 1-30... £255.00
FP2008 AC PSU/Spk... £60.00
FRG RX 5-30 cont. AC/DC... £164.00

FRG7 Digital... £190.00
FT221R 2m. "All mode"... £357.00
FT222 10W, 400 ch. mobile, digital... £185.00
FT101E Transceiver... £435.00

FR101SD Digital Readout... £435.00
FR101ID Digital Readout... £505.00
FL101 T.X. 1-8-30 MHz... £250.00
FL101E T/RX 1-8-30 MHz... £250.00

C215 2m. 8ch. * 2 speed scan rate
* Scans 40 channels
C240 IOW. mobile

Special Offer A.S.P. A680 U.K.

STAR FEATURES:

- C146, 2m. converter £180.00
- MMC70, 4m. converter £100.00
- MMC70/LO, 4m. converter £120.00
- MMC144, 2m. converter £180.00
- MMC144/LO, 2m. converter £195.00
- MMC52, 70cm. converter £240.00

CONVERTERS

FRIOIE Transceiver... £435.00
FL101 T.X. 1-8-30 MHz... £250.00

VARACTORS

M1296, 23cm. varactor £3.00

ALL MICROWAVE MODELS SUBJECT TO VAT IN UK 8% ON FREQUENCY COUNTERS, ALL OTHER MODELS 12.5%

MICROWAVE MODULES DESPATCHED TO ANY PART OF THE WORLD POST FREE

M414/42 Transverter... £70.00
M414/28 Transverter... £50.00
M414/28 with 2 stage shifter... £110.00
M414/44 Transverter... £135.00
M414/44 R with 16 MHz shifter... £151.00
MHP1/3 or Power supply 12V... £50.00

M1296, 23cm. varactor £3.00

FM50/50 MHz counter £62.00
M5050/50 MHz counter £79.00
Divide by 10 prescaler, 500p £25.00

A.S.P. MOBILE AND BASE STATION ANTENNAS

Asp201 2m. mobile... £17.00
Asp2009 3dB 2m mobile... £3.25
Asp629 3/2 mobile... £6.00
Asp677 3dB 2m mobile... £12.00

ICOM RANGE

C215 2m. 10ch. (fixed 6 repeaters plus 4 simplex) £139.00
C215 2m. 10ch. (fixed 6 repeaters plus 4 simplex) £144.00
C215 2m. 55ch. £132.00
C22A 10W. mobile... £145.00
C240 10W. mobile... £159.10
C248 10W FM/SSB... £152.00
C211E 10W. FM/SSB... £140.00

All Transceivers +12.5% VAT

special offer. Constant current Ni-Cad chargers. Adjustable charge rate for AA or C type Ni-Cads * Price £24.40 + VAT p & p 50p

IOM ACCESSORIES

Extal 521 or 522... £4.50
er Case 202/215... £8.07
Mobile Bracket 202215... £10.25
Helical Antenna £3.25, p & p 25p

KYOCTO DIGITAL MODELLING

10W mobile 400-450kHz £25.00

F.D.K. RANGE

Quad 2m. (U1) 70cm. £212.00
Quad 2m. Mobile... £200.00
Quad 2m. Mobile... £200.00
Quad 2m. Mobile... £200.00
Quad 2m. Mobile... £200.00

HELICAL ANTENNAS

2m. approx. 161 ft. £15.15
2m. with ph 259... £3.05
2m. for I.C. £15.15
Triumph 1700 Gx, standard £285.00

J-Beam Antennas

All models in Stock

All + post 25p + 12.5% VAT

Alpha W43

2m 10W Mobile with scanning Channels fitted with 9 Channels £139.95 + VAT 12.5%

YES WE CAN NOW SUPPLY THE FT227R WITH AUTO-SCAN FACILITIES, DESIGNED AND MANUFACTURED EXCLUSIVELY FOR US—NOTE THESE STAR-FEATURES:

- Scans 40 channels
- 2 speed scan rate
- Locks out unwanted channels
- Automatic tone burst for repeater operation
- Reverse repeater facility
- Scans between 145-146 MHz in 25 kc/s. steps
- Scanning facility

Controlled by switch fitted to microphone (not illustrated)

PRICE: £229 + VAT
WATERS & STANTON
TELEPHONE HOCKLEY (03 704) 6835 (2 LINES)

TWO SUPER POWER® HOUSES . . . IMPORTED DIRECT BY US

**Den Tron**
MLA 2500
160-10m. 2kW
PEP
£695 inc. VAT
In Stock Now

- 1kW DC continuous
- ALC 615kΩ
- 3 speed cooling
- 234V/117V AC
- 2 of EIMAC 8875 tubes

**NAIGAI**
2200 Linear
160-10m. 2kW
PEP
£399
(carriage £4-50)

- 330V AC
- 4CX330F tube
- Receiver pre-amp
- 10-13 watts drive
- SWR meter built-in

IN STOCK

**Den Tron**
MLA 2500
160-10m. 2kW
PEP
£695 inc. VAT
In Stock Now

- 1kW DC continuous
- ALC 615kΩ
- 3 speed cooling
- 234V/117V AC
- 2 of EIMAC 8875 tubes

**JAYBEAM VHF/UHF ANTENNAS**

- **PMH2/4M 2 way harness** £9-39 (L0-75)
- **CS/2M 5dB collinear** £30-95 (L2-00)
- **BY2M 5 el. yagi** £7-70 (L0-00)
- **BY2M 8 el. yagi** £10-00 (L0-00)
- **BY2M 10 el. yagi** £11-32 (L1-50)
- **PBH10/2M paraband** £23-37 (L1-50)
- **PBH14/2M paraband** £31-16 (L2-00)
- **EXY2M 5 el. x'd yagi** £15-97 (L1-50)
- **EXY2M 6 el. x'd yagi** £19-91 (L2-00)
- **IDXY2M 8 el. x'd yagi** £26-33 (L2-00)
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- **PMH/2M 4-way harness** £66-80 (L1-75)
- **D8/70cm. el. slot** £11-34 (L0-00)
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- **HM/88/70cm. multibeam** £28-97 (L2-00)

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- **ASB 677 de luxe wave** £14-95 (L1-00)
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- **K220 magnetic mount** £68-50 (L0-75)

The TM56 is one of our most popular models, combining great performance with modest price. The TM56B has the basic receiver design of our mobiles and includes its own 230 volt AC supply, plus external 12V DC input. 12 fixed channel positions are included, plus 4 autoscans positions. Any one of the Autoscans channels can be cancelled. Price includes 10 channels, R3, R4, R5, R6, R7, S0, S20, S21, S22 and S23, necessary leads, etc., and 12 month guarantee. At £95 it is unbeatable 10 channel marine version £113-60 inc. VAT.
Multi-2700 Mk. II

The Ultimate 2M. All-Mode! STILL £489 inc. VAT!

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

IN STOCK NOW

FEATURES:
- 2 VFO's for instant QSY (one analogue the other synthesised) both usable on all-modes with VXO for fine tuning on SSB, FM, AM, CW.
- 16 watts output, 143-149 MHz reception (Tx 144-146 MHz), 220v. AC and 12v. DC, WBFM/NBFM, OSCAR downlink receive converter, speech processor, VOX, IRT, 100kHz calibrator, noise blanker, automatic tone-bursts, 4 or 600 kHz shift, 4-1.6 MHz shift (for 70 cms), RF gain, RF pre-amp, squelch, separate FM/SSB mic gain controls; variable AGC; Antivox; variable compression; CW semi breakin; accessory sockets at rear; supplied complete with mic. cables handbook and even log book. Don't buy any other model until you have compared it with the Multi-2700 Mark II. S.A.E. for full details.

QUARTZ-16

at £149.75 inc. VAT . . .

You Can't Beat It

2M. FM Model

IN STOCK NOW

FEATURES:
- 23 channels + 2 priority
- True "S" channel readout
- 12 watts output
- 7 channels fitted R3-R7, SO, S20

SPECIAL OFFER: S21, S23, £75.50 inc.

Quick release mobile mount

Mic and DC leads

Automatic tone-burst fitted.

S.A.E, for full details

M800D

25 Watts FM

The Multi-800D is a 25 watt FM transceiver with 800 synthesised channel 144-148 MHz. Tuning is manual or automatic with 3 speeds from 10 kHz second to 500 kHz second. Tone-burst is automatic and power is infinitely variable from 1 to 25 watts. A remote digital display is available and reverse repeater is obtainable at the flick of a switch (no need for re-tuning). There is a memory for two programmable frequencies, both are retained even after switch-off. The memory facility also enables other shifts to be programmed in (1.6 MHz for 70 cms) and the LED readout always reads true transmit and receive frequencies.

PRICE £249 inc. VAT

REMOTE DIGITAL DISPLAY £16 inc. VAT

EKI21 Keyer

- Built-in paddle
- 6-35 wpm
- External bkt. or ext. DC
- DCI50V/1A Max.
- Plug-in board
- Space-Dash ratio adj

PRICE £29.95 inc. VAT

MM202G Microphone

- High quality condenser mic.
- Boom weighs 5 grams
- Tx/Rx switch clips on gear lever
- Matches most transceivers (ex. IC240)
- Makes for safer driving
- Matches 600-50K ohms

PRICE £19.95 inc. VAT
OFFER A SUPERB RANGE OF TRANSCEIVERS FOR THE SUMMER

All are available ex-stock and delivery is free

IC-202
£162 inc. VAT

IC-202
The 2m. SSB/CW portable which is clean enough to use as a prime mover to drive a linear. The VXO gives continuous coverage over the ranges 144-6-144.2 and 144.4. The coverage can be extended with extra crystals switchable from the front panel. This is the ideal set to buy if you are thinking of sampling the delights and advantages of SSB on 2m. as it gives full coverage of the SSB and CW portions of the band with easy, continuous tuning.

Now available ex stock, delivered free for £162 inc. VAT.

IC-215
£159 inc. VAT and delivery

IC-215
By far the best 2m. FM portable on the market—with more power (3W) than most and batteries some 4 times as big as giving a reasonable period of operating use. Add to this the superb, clear modulation for which ICOM are so famous and a good receiver, plus a solid, reliable construction and you have really good value for money.

Total channel capacity = 15.
Channels fitted as 9520, 522, R3, R4, R5, R6, R7, R8, R9.

Now available at the special offer price of £159 inc. VAT and delivery.

AGENTS (Phone first—All evenings only except Norfolk and Burnley)

London—Terry G8BAM (01-556 9366) Scotland—Ian GM8DOX (0786-822 212) Norfolk—Tedd G3FEW (05088 632)

Wales—Tony GW3FKO (0222 702982) Burnley—(0282 34841) Midlands—Tony G8AVH (021 329 2305) North West—Gordon G3LEQ (Knutsford (0565) 4040) SHOP: Thanet Northern, Wombwell, Barnsley, S. Yorks,

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THANET FOR SERVICE

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

IC-211E

£549

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

IC-245E

£396

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

IC-701

Introducing "SLIM JIM" SJ2

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

An omni-directional 2 metre aerial developed by T & T from a design by F. C. Judd (G2BCX). Derived from the "J" the SJ2 is a free space aerial with better than 50% greater efficiency than conventional ground plane types due to the very low angle radiation field. The aerial is slim and compact (59 inches long) and as there are no radials it is unobtrusive and has low wind resistance. Supplied complete with mast clamp, £15-50 inc. VAT (carriage £1-00).

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

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

<table>
<thead>
<tr>
<th>MODEL</th>
<th>TYPE</th>
<th>BUILT-IN AMPLIFIER</th>
<th>IMPEDANCE</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TW-232</td>
<td>Ceramic Desk mic with PTT, Lock sw and gain cont.</td>
<td>Compression amp 0-30dB var.</td>
<td>&lt;4-5K</td>
<td>£25-00</td>
</tr>
<tr>
<td></td>
<td>Silver grey finish</td>
<td>NONE</td>
<td>500Ω</td>
<td>£4-99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-amp 0-15dB var.</td>
<td>&lt;3-5K</td>
<td>£9-00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compression amp 0-35dB var.</td>
<td>&lt;5K</td>
<td>£15-00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gain controls are external in all cases</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

During the evenings and at weekends when calls are cheap, why not use our Ansafone to record your requests for data, etc. (02273) 63850
NO PRICE INCREASE ON FT221R

All-mode operation—SSB (USB, LSB), CW, AM, FM.
All solid-state reliability with plug-in modules. Rugged 70-watt dissipation PA transistor for stability and reliability.
VHF local oscillator (133-137 MHz VCO) in PLL system minimises spurious responses.
12 volt DC or AC mains operation built-in.
Full 4 MHz (144-148) coverage with 600 kHz repeater shift and access tone generator.

**ALSO**

YC221 Digital readout adaptor for FT221 and FT221R.
Mod. kit needed for FT221 and "R" models without "D" suffix to serial number.

Details on request.

**Western PRICES:**
FT221R £392.63  YC221 £81.00  Mod. Kit £3.83

__Buy your Yaesu from Western__

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

Send 15p in stamps for latest Yaesu Musem equipment catalogue

JOIN IN on UHF with your FT101 (or other 28 MHz rig)

and the Western 70TV 432MHz TRANSVERTER

We have designed and built the 70TV up to a high standard. Not down to a price! Don’t buy a 70TV if you’re looking for a cheap unit.

BUT if you want to hear signals that some others can’t... the 70TV is the answer!

- Fully stabilised AC and DC PSU
- Full 10W, R.M.S. output
- Double conversion to minimise spurious outputs
- Noise figure 2-5dB typical
- Built-in 28 MHz attenuator 30:1
- Built-in relays
- Matches Yaesu styling
- Withstands infinity mismatch
- All units aligned on Hewlett-Packard Spectrum Analyser
- Can be driven by most 28 MHz Transceivers

Ex-Stock Now—ONLY £178.87 inc. VAT 20% off if ordered with FT101E or FL101!
REACH FOR THE SKY with WESTOWER
“THE STRONGER ONE”

* Standard types, rated at 75 m.p.h. with full load quoted
* Heavy duty types, rated at 100 m.p.h.
* Models from 25-119ft. All telescope down and tilt over
* Models for all soil conditions, with/without concrete
* Designed by chartered engineers to British standards
* Constructed of high quality special alloy steel
* Standard model 40% stronger than similar types

A HEAVY DUTY is well worth a little extra . . . COMPARE

<table>
<thead>
<tr>
<th>Size</th>
<th>Head Load at 75 m.p.h.</th>
<th>Price (inc. VAT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3S (58ft.)</td>
<td>125 lbs.</td>
<td>£387.72</td>
</tr>
<tr>
<td>3HD (58ft.)</td>
<td>250 lbs.</td>
<td>£483.32</td>
</tr>
<tr>
<td>4S (75ft.)</td>
<td>35 lbs.</td>
<td>£475.20</td>
</tr>
<tr>
<td>4HD (75ft.)</td>
<td>65 lbs.</td>
<td>£472.40</td>
</tr>
</tbody>
</table>

Head loads are for unguyed towers. Prices are for framed-base models (FBP) and are carriage paid except to Scotland, Devon and Cornwall. Over-water deliveries also extra.

Heavy Duty is up to 100% stronger than Standard

WESTERN’s PEP WATTMETERS
PM2000 and PM2001

FIRST IN THE FIELD OF DIRECT P.E.P. MEASUREMENT

* Frequency coverage: 3-5 to 30 MHz (PM2000)
* 50 to 150 MHz (PM2001)
* Direct measurement of SSB PEP output power
* RMS power measurement for AM, FM or CW
* Forward or reflected power readings at the flick of a switch
* Full-scale ranges: 200 to 2000 watts (PM2000)
* 5 to 200 watts (PM2001)
* Accurate to within 7%
* No calibration dials to set
* Large, clear, easy-to-read meter scales
* Can be left “in-line” at all times

PRICE FOR EITHER MODEL . . . £48.60 (inc. VAT)

PAYMENT: Cash or cheque, ACCESS (Mastercharge), VISA (Barclaycard), GIRO TRANSFER (A/c 288 6134) HP and Credit arranged

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N. Ireland: Les Lyske, GI3CDF, Newtownards (0247) 812449

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LOUTH: 9-12; 1-5pm Mon-Fri. By appointment Sat 9-12.
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WIDEST CHOICE, LARGEST STOCKS, PROMPTEST DEAL AND
FAST, SURE SERVICE RIGHT THROUGH.

Hours: 9.30-5.30 Continuous including Saturdays—Early closing Wednesday, 1 p.m.
Easy Parking on our 70ft forecourt—See last months issue for directions etc.
Two New Aces from Yaesu!

Once again the World's most progressive manufacturer of Amateur Radio equipment has come up trumps and this month you'll find two new aces in the YAESU winning hand—it's an established fact that more YAESU gear is in use than any other make and this has only been achieved by sheer technical excellence, innovation and style. Even the impressive range shown here is but a part of the full YAESU story and only the catalogue can convey the breadth and depth of the YAESU endeavour—why not take advantage of our offer below and get your own copy?

A FT-227R Provides new standards of convenience in 2 metre FM communications. A Phase Lock Loop Synthesiser generates 800 channels in 5 kHz steps between 144 and 148 MHz using an 'optical coupling' system for channel selection instead of a rotary switch that could wear out. A memory circuit allows you to memorise any of these 800 channels with return to the memorised frequency at the flip of a switch. The standard repeater shift or any other offset frequency can be utilised. Automatic tone burst and advanced circuitry to protect PA transistors from high SWR or reversed supply polarity. See Catalogue Page 19

B FT-7 The all-solid state FT-7 mobile transceiver provides high performance on the 80 through 10 metre bands. The operator may select upper or lower sideband or CW operation and the compact package provides many features engineered for convenience while mobile. A single knob provides all transceiver tuning and the state-of-the-art noise blanker minimises impulse-type noise such as that found in mobile applications. The FT-7 is designed for operation directly from your car's 12 volt battery. Can also be used as a base station with the matching FP-4 AC PSU. See Catalogue Page 18

C FT-901 DM Unparalleled receiver performance plus advanced transmitter features make the FT-901DM the ham's dream come true. The receiver features rejection tuning, dual-filter variable band width tuning and audio peak frequency tuning for maximum rejection of unwanted signals. Transmitter includes built-in Curtis keyer and RF Speech Processor and features a 10 second "TUNE" timer to safeguard your finals. Includes memory for both transmit and receive frequencies, an advanced noise blanker and offset tuning on both transmit and receive. All modes, USB, LSB, CW, FSK, AM and FM, 160 thru 10. See Catalogue Page 3

D FT-225RD This is the very latest of the growing 2 metre range and incorporates digital frequency read-out, optional repeater shift, variable power output, noise blanker, selectable AGC and gives all-mode operation on LSB, USB, CW, FM and AM. The 225RD is, of course, fully portable and can be operated off mains supply or 12v. DC and has a host of other fine features including provision for an optional memory unit. Model 225R analog version also available. See Catalogue Page 3

E FRG-7 The model FRG-7 is a precision built, high performance Communications receiver designed to cover the bands from 0.5 MHz-29.9 MHz without gap. The advanced technology employed in its circuitry includes the famous Wadley Loop System drift cancelling technique. This coupled with a triple conversion super heterodyne system guarantees extremely high sensitivity and exceptional stability. Careful design has minimised unwanted spurious signals so often encountered in cheaper imitations. Features include RF attenuator, selectable audio filter and automatic noise suppression circuit. See Catalogue Page 13

F FRG-7000 New all solid-state digital read-out general coverage receiver. Covers from 0-25-29.9 MHz AM, SSB, CW. Has unique digital clock feature which incorporates timer which controls rear apron connections to external equipment such as tape recorder, etc., etc. This de-luxe receiver has everything for the dedicated SWL and professional user and supplemenys the famous FG-7 which continues in production of course.

SPECIAL VOUCHER OFFER

Here's a 10-1 winning offer if you'd like the latest Yaesu catalogue. Just send us 4-9p stamps (36p) and we'll send you Yaesu's latest fully illustrated brochure together with our Credit Voucher for £3-60 against your eventual purchase. A couple of stamps will bring you the latest Atlas or Swan leaflets or our current used equipment list.
In 1963 Drake led the way by producing the first commercially available transceiver that employed the now widely copied 9 MHz i-f frequency. Even today, 15 years later, many major competitive transceivers are still being introduced using i-f’s in this range.

In 1978 Drake leads the way again by developing the first commercially available amateur transceiver that uses a 48 MHz i-f, through the technique of “Up-Conversion.” This system greatly improves image and general coverage performance, and will be copied in the years to come. With Drake you can join the new state of the art today!

Now RADIO SHACK LTD. presents a new addition to the famous C Line from the R. L. Drake Co., the “Creme de la Creme” of Radio Communications

DRAKE TR-7 solid state continuous coverage synthesized hf system

0–30 MHz continuous coverage reception capability.

160–10 metres Amateur Band transmission, including capability for Mars, Embassy, Government and future band expansions.

SEE OUR SPECIAL PRICE LIST ON OPPOSITE PAGE

15p stamps or 4 i.r.c’s for details

To answer your next question, the famous C line continues in production led by the big DXer’s ideal radio, the R-4C Receiver.

R-4C amateur band receiver, £427.50 inc. VAT

T-4XC matching transmitter with AC-4 psu package deal, £499.95

Join the Elite—use DRAKE, enjoy the best of service from Radio Shack!
RADIO SHACK LTD for

PRICE LIST

DRAKE RECEIVERS AND ACCESSORIES

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-4C</td>
<td>Receiver—SSB, AM, SW, RTTY</td>
<td>£380.00</td>
</tr>
<tr>
<td>FL250</td>
<td>Filter for R-4C (250 kHz)</td>
<td>£36.00</td>
</tr>
<tr>
<td>FL500</td>
<td>Filter for R-4C (500 kHz)</td>
<td>£36.00</td>
</tr>
<tr>
<td>FL1500</td>
<td>Filter for R-4C (5 kHz)</td>
<td>£36.00</td>
</tr>
<tr>
<td>FL6000</td>
<td>Filter for R-4C (6.0 kHz)</td>
<td>£36.00</td>
</tr>
<tr>
<td>4-NB</td>
<td>Noise Blanker for R-4C</td>
<td>£48.00</td>
</tr>
<tr>
<td>MS-4</td>
<td>Matching speaker for R-4C (20kHz)</td>
<td>£22.00</td>
</tr>
<tr>
<td>DSR-2</td>
<td>Digital Receiver</td>
<td>£2000.00</td>
</tr>
<tr>
<td>SSR-1</td>
<td>Receiver—general purpose</td>
<td>£133.20</td>
</tr>
</tbody>
</table>

DRAKE TRANSCEIVERS and ACCESSORIES

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR-7</td>
<td>Transceiver with DR-7 general coverage/Digital Readout Board fitted</td>
<td>£664.00</td>
</tr>
</tbody>
</table>

VERY SPECIAL PACKAGE DEAL FOR CASH SALES OR H.P. ONLY

We are offering the TR-7 Transceiver with DR-7 General Coverage/Digital Readout Board plus PS—7 Power supply for the exceptional price of £783.00 including VAT. (£696 ex. vat)

Obviously at this price we cannot accept trade-ins

Securicor Delivery £6.00

More Advertising on Pages 214 248 249

SECURICOR

DRAKE SALES SERVICE

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Just around the corner from West Hampstead Underground Station

Telephone: 01-624 7174


Open Monday—Friday 9-5, Saturday 9-12.30. Closed for lunch 1-2
JUST BEFORE YOU GO...

And buy a separate converter to cover 434–436 MHz to monitor the new OSCAR satellite, take a look at the latest addition to our product range.

DUAL RANGE 432–434 MHz & 434–436 MHz CONVERTER
TYPE: MMC432/28-S & MMC432/144-S

FEATURES

* Extra Range (434-436 MHz)
  For Satellite Reception

* Ultra Low-Noise First RF Amplifier Stage

* Highly Stable Zener Diode Controlled
  Crystal Oscillator and Multiplier Stages.

SPECIFICATION

<table>
<thead>
<tr>
<th>Input frequency ranges</th>
<th>432–434 MHz (low)</th>
<th>434–436 MHz (high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.F. output frequency</td>
<td>28–30 MHz or 144–146 MHz</td>
<td></td>
</tr>
<tr>
<td>Typical gain</td>
<td>30dB</td>
<td></td>
</tr>
<tr>
<td>Noise figure</td>
<td>3dB Maximum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>101MHz (low range)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>101.5 MHz (high range)</td>
<td></td>
</tr>
<tr>
<td>Oscillator frequencies</td>
<td>96 MHz (low range)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>96.666 MHz (high range)</td>
<td></td>
</tr>
<tr>
<td>Maximum frequency error at 432 MHz</td>
<td>± 5 kHz</td>
<td></td>
</tr>
<tr>
<td>R.F. connectors</td>
<td>50 Ohm BNC</td>
<td></td>
</tr>
<tr>
<td>DC power requirements</td>
<td>11–13.8 volts 12.5V nominal</td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>50 mA Maximum</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>110 x 60 x 31 mm.</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>260g.</td>
<td></td>
</tr>
</tbody>
</table>

DESCRIPTION

This 432 MHz converter is intended for use with either a 28–30 MHz or 144–146 MHz receiver to produce a high reliability receive capability for satellite or terrestrial communication.

The unit has two ranges, 432–434 MHz and 434–436 MHz, both for the same I.F. output frequency, which may be selected by means of a toggle switch mounted on one end of the diecast case. The second range (high) has been included to allow reception of satellite signals normally transmitted above 434 MHz.

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EDITORIAL

Untimely Inefficiency

We were surprised to read in the April issue of CQ that UK subscriptions to that magazine, paid to the RSGB acting as subscription agents, had been notified by the RSGB to the CQ circulation department, but that the money collected had not been forwarded; the subscriptions therefore failed to come into operation. Naturally, the result was letters direct to CQ from irate customers who knew nothing of the muddle at RSGB Hq.

The RSGB then decided to take no further subscriptions on behalf of CQ but the first intimation of this to the American journal was when they received the copy of Radio Communication which carried the announcement of the decision.

We are not in any way suggesting that there is dishonesty at RSGB Hq., merely that this is yet another example of their seemingly incurable inefficiency. Members have a right to know what went wrong this time.

That particular CQ editorial paragraph is being read all over the world, and can only do harm to the status of our national society at a time when we are coming up to the vitally important WARC 79 deliberations.

Over the years we have heard many protests from licensed amateurs and SWL’s who object to the term ‘ham’ in connection with Amateur Radio. Until now we have agreed with that view, but we must all move with the times: we are stuck with the word, which is in world-wide usage. Although it is a slang word of somewhat uncomplimentary implication, the Complete Oxford Dictionary gives a separate definition of it as ‘a radio amateur’—no more, no less. All we need do is remember that.
LAST time round we mentioned the possibility of some Iraq signals; in the event these materialised, and indeed by now those first 1500 QSL’s may have been used up. However, they are on exciter power only, and things are needed on the aerial front; the whole exercise, though, is one of training YI nationals in the arts of Amateur Radio, so it is a bit unfair to carp at the quality of the operating. After all, the YU’s running the training are going to insist at this stage that the YI students operate in accordance with the letter of the licence, not only for the benefit of the youngsters but, more important, so that no-one in Iraq can cavil at the way things are being done. At the time of writing it is understood that two actions are being pushed to help mop up the demand—firstly, the provision of some more power and improved aerials and, secondly, the application for a licence from the Finnish Embassy which would let Martti Laine, OH2BH, in for a session. OH2BH, readers will be aware, is a DX-er of enormous ability with much experience of the sharp-end of pile-ups.

Conditions
As we rise from the bottom of the sunspot cycle, with increasing speed, so do we find conditions in general improving. But of course not all that glistens is gold; trust Murphy for that! Solar storms occur with a frequency broadly related to the sunspot cycle, and these can put us down to 28 MHz. However conditions weren’t quite that bad all the time, and in the better periods Nick connected with G2CAS, out /P again; later, G2BOF (Leeds) who was running 1.5 watts and G3BFE (Stow-on-the-Wold) who had a sixty-foot wire strung up a tree, /P. After which there wasn’t a lot of joy until the very end of the period, when QSO’s were made with G4FAI in N. London, who had three watts, G3WWJ on two watts, and G4FJF of Dover who had five watts.

On a different tack, G2NJ/M and G5NX/M were both operating from the same car, G5NX at the wheel and the VHF phone rig, while G2NJ was pounding the brass on the back seat—two different stations in one car on the move and being operated simultaneously must be something of a “first.”

G3PKS (Wells) has one of the nearest comments on the band over the past month—“Frying tonight!”—which in fact, on occasion, extended right through our spectrum of interest. Europeans were worked, among them ON4GM who chipped in to a QSO between G3PKS and G4GTW, at about RS57/8 between all three stations; Serge then explained that he was using phased verticals of 70 feet, spaced quarter-wavelength apart, firing North-West from near Brussels. Upon changing the phasing to fire North-East, ON4GM virtually disappeared to both G station, and Jack reckons there was close on 50 dB ratio between front and null.

G3PPR (Sherborne) returns to the fold after some 15 years of QT; Rod has started an amateur radio society with some ten members, and they have a dipole on Eighty, a vertical for 21 MHz and, at the time of writing, a ten-metre beam built (out of old TV aerial bits) but not erected. A new interest is CW—a mode never used by G3PPR when he was in Birmingham; it isn’t the same as Phone, but it has a charm all its own once you try it in earnest. A move of home QTH is imminent, and once that is sorted-out G3PPR will be setting-up with his old Panda PR-120V and AR88 which has been rebuilt as suggested in Short Wave Magazine for July 1974; a memorable contact on Eighty was with G4GQH, who has rebuilt no less than eleven AR88’s using the article in question. There’s enthusiasm for you!

“CDXN’ deadlines for the next three months—
July issue—June 1st
August issue—July 6th
September issue—August 3rd
Please be sure to note these dates.

G2BY (I.o.W.) comes back to life again this month; Bert found himself a few QSO’s with other OT’s on the band but otherwise didn’t think much of conditions.

Before we leave Eighty, let G2NJ have a last comment, in which he notes that after about 1800z things started to perk up a bit with G’s up to the S8/S9 mark. One G operator worked around this time is an octogenarian who sends perfect w.p.m. Morse for as long as you care to ragchew and can speed it up if you care to try and copy.

Forty
Not much in the way of reports this month. G2BY found things generally not as good as they were a twelve-month ago, but still managed to hook VK3MR, VK3IM, VK3MJ, H13PC and sundry W and VE stations around 0800z.

G3PKS confined himself to saying that there was some DX around, and mentions G3EIW who fired up his /M rig during the middle of the evening and was promptly called by a VK; pretty fair considering G3EIW...
was only using 50 watts input and a short whip.

Comments

One wishes one had the facility to include colour pictures in the Magazine, the more so when one gets pictures like the one sent by G4GOF (Hastings); this is a view over the sea from his QTH up on Battery Hill, obviously taken early in a summer afternoon, and by summer we mean just that—the warm, dry, sunny sort of day that we all dream about. From here, G4GOF launches we mean just that—the warm, dry, sunny sort of day that we all dream about. From here, G4GOF launches an output on Eighty, dodging the French and Belgian trawlers with their 15 kHz spread, when what Jesse describes as QRN is not about (we suspect that this "QRN" is controlled by a thermostat, and that it needs suppression!). All these snags however, have not stopped G4GOF getting in some 170 QSO's (we suspect that this "QRN" is controlled by a thermostat, and that it needs suppression!).

Recent QSOs

Incidentally, just in time that these were the proposed plans for the GM3YOR/GM3OLK summer expedition. We now have it that the activity will be in OY between July 18 and 21 and TF from July 23 to August 5. The callsigns will be GM3YOR/OY and GM3YOR/TF, G4DXC similarly suffixed and GM8NCM ditto—but that doesn't mean those are the OY between July 18 and 21 and TF from July 23 to August 5. The callsigns will be GM3YOR/OY and GM3YOR/TF, G4DXC similarly suffixed and GM8NCM ditto—but that doesn't mean those are the OY between July 18 and 21 and TF from July 23 to August 5. The callsigns will be GM3YOR/OY and GM3YOR/TF, G4DXC similarly suffixed and GM8NCM ditto—but that doesn't mean those are the OY between July 18 and 21 and TF from July 23 to August 5. The callsigns will be GM3YOR/OY and GM3YOR/TF, G4DXC similarly suffixed and GM8NCM ditto—but that doesn't mean those are the OY between July 18 and 21 and TF from July 23 to August 5. The callsigns will be GM3YOR/OY and GM3YOR/TF, G4DXC similarly suffixed and GM8NCM ditto—but that doesn't mean those are the...
far has yielded some 140 countries worked in all continents; it is a bit ironic that the YI contact among that lot is probably a phoney that came on before the real Y11BGD could set up shop. The CO WW Phone contest accounted for UL7JAW, 4B1HR for an XE special prefix, KL7HR, KP4RF, D4CBE, V9PIB, TF3IRA, VU2ACD, 4Z41X, KZ5FR, 8P6FX, VE5UA, UA9CII, UA0ZBW (Zone 19), UA9PP, J28AG, JX3P, ZS1PH, EL2AE, JA7AMK, JA2FUA, JA6VZB, JA6AKW, OE5CWF/YK, the earlier ones on Phone, and from 8P6 onwards the favourite CW mode.

G2BY looked at the bands, and notes contacts with UA0 in Sakhalin, ZP5, PP7 (Alagoas, Brazil), VE7, and an assortment of W and W7, Wyoming being represented by K7LFY/7, and Utah by WB7EWW.

The Seer of Sheppey, G2HKU, managed to continue his ZL skeds, with ZL1VN, ZL1AAE and ZL3SE at 0700, which this year had held up five weeks longer than the previous year at the time of his letter. SSB of course, but CW was also used to work KV4AA and VK3MJ.

GM4DZX would appear to have stuck to 21 and 28 MHz, as under the 14 MHz heading of his letter it simply says “What's that?” A good question, indeed.

G3PKS only mentions one contact on the band, namely EP2IA; it looks as if Jack devoted his activities to other parts of the bands for which, it must be admitted, there has been excuse.

G3NOF (Yeovil) found things varying between poor and good; opening time has been as early as 0630 for W4-W5 stations, followed in due course by VK, ZL and the Pacific stations. It added up to SSB QSO’s with BV2B, CE0AE, DU6FG, FO8DO, HK2YO, KM6FC, KV4AA, KZ5ED, P29JS, many VK signals including VK8OB, W5AS, W5PZA, Y11BGD, YS1RVE, ZL4AU, ZL4X, 8P6BN and 9V1NR.

Some good openings to South America were noted by G4GMW (Bristol), using a sloping dipole, 6ft. at one end and 25ft. at the other, running NW-SE, and fed with the FT-101B and occasionally the FL-2100B linear. The list includes AP2SMT (Martyn’s first AP), LU4DLP, LU8DB, PY2CSV, PY7EC, SV11JG, UK9WAA, VE2AFU, VP9GE, W4APS and ZP5LOB.

Here and There

G2ADZ notes the death of G5YV—an old friend of his, and an operator well-known on the VHF Bands for many years, along with G5BY, G5MA and G2UJ; he will be missed in many ways.

Another Silent Key is that of W6TS, Ed Willis, the son of AC3PT, the Crown Prince of Sikkim.

On a completely different theme now, G3PKS mentions a QSO which at the time seemed quite reasonable but smelt a bit after it was mulled over. This was a QSO with CG1TX, giving name as Roger and QTH as either Sydney or Sidney (Jack didn’t write it down as it was sent) —either way he most certainly doesn’t seem to be in the area in which the CG prefix could apply.

At fairly regular intervals, W6AM (Palos Verdes) has an Open Day, at his shack at Rhombic Farm, some ten miles from Don’s Long Beach home. There, he has nine rhombics, each one reversible to give eighteen directions of fire, the rhombics mostly being on 140-foot poles. The shack (some 100ft. long!) is well filled with all the needs for communication on SSB or CW, although Don’s favourite mode is CW. All this leads up to the fact that the next Open Day is going to be on June 18; the date has been so chosen as to meet W1BB, but never seems to be the wonders of W6, and another to the 7 MHz list.

This writer notes that he has now used the band daily in due course by VK, ZL and the Pacific stations. It added up to SSB QSO’s with BV2B, CE0AE, DU6FG, FO8DO, HK2YO, KM6FC, KV4AA, KZ5ED, P29JS, many VK signals including VK8OB, W5AS, W5PZA, Y11BGD, YS1RVE, ZL4AU, ZL4X, 8P6BN and 9V1NR.

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Fifteen Metres

G2ADZ (Chessington) remarks that he has now used the band daily for a year; the conclusion is that the band conditions have improved enormously to the point where, for example, one could find propagation to JA and W/VE simultaneously, and indeed the rapidly changing skip is one of the features of the band. For the current month we note EP2LA, HP8ARK, YB1KW, 9M8HG, 3B8DU, YB1GF, EP2FN, J3LAP, V01NZ, VU2BK, K7H2O, VP1KS, W5FGOM/MM, JR6SBA, JR6FCZ, FM7BA, VU2CP and KA6RR, all of course on CW.

After some four years of neglect, G3YRR (Grimsby) is returning to the fold; Charles blames partly work, partly the need for a couple of new ones. While we may have to settle for the beams on the vertical. No ‘reflection’ on the beam he says!

GM4DZX (Glasgow) finds that while conditions on Ten have fallen off somewhat as compared with the previous month, he still managed quite a few contacts, among which we find most of the stations noted in our QSL List.

Martyn, G3GMW, informed us of a small error last month by which we put some of his 3-5 MHz QSO’s into the 7 MHz list. Back to this month, and we have all SSB contacts on 21 MHz with A4XGY, EP2YK, KL7JAI, N4UF, W1HN, W3NAS/MM in the Red Sea, W4ES and YU5XPV, the aerial in use being a one-element Quad loop at twelve feet.

Now we come to G2HKU and his CW, which enabled him to work VE3JKZ, W6VD and W9IV.

Looking down to the relevant bit of the G3PKS epistle, we find that Jack, like so many others found the band very mixed; sometimes just a few Russians, and at others DX from all over the world, including JA’s by the bucketful.

The analysis of things presented by G3NOF indicates that during this month, the morning VK/ZL stations have been long-path contacts as it seems rather as though the path just didn’t open, but the North Americans have been around from around 1200Z right on to as late as 2300. Thus it came to pass that G3NOF talked to CN8AK, K6AXC, OE6DK/YK, VK2BBD, VK2HNY, VK2NOT, VK5NCF, W6KTE, VK7NOW, W5NGE, W6KTE, W7KW (Arizona), W17UWE, W5DBX, ZS6AD and 9J2WR.

Yet another who reports variable conditions on 21 MHz is G2BY—on some days he could only find
short-skip to Europe, and on other days far better. Late evenings have been available on the good days, and late afternoon has seen quite a few W6 and W7 contacts made.

The G4DJY log indicates SSB contacts with ZB2BL, UL7JAW, FPOLK, VE6MP, K7RI, XK6WQ (a VE6 special), VE7IG, VC7WJ, CG4SW, HI8MOG, CG5RA, VE4RP, VE4GV, OA4PQ/YV5, VC7CCC, VE6ASI, CT3/OH2BC, JA6LLO, HClBU, N5AU, KH6CJ/4X, YV5CVE and PY5EG. As for the keyer, that was also used KH6CJJ/4X, YV5CVE and PY5EG. VC7CCC, VE6ASI, CT3/OH2BC, VE4RP, CG4SW, (a VE6 special), VE7IG, VC7WJ, FPOLK, VE6MP, K7RI, JA2FUA, and As for W7 contacts made.

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**QSL Addresses**

Perhaps the best way of keeping tabs on these is by way of a subscription to Geoff Watts' DXNS, at 62 Belmore Road, Norwich NR7 0PU, which each week sports some 35 or so QSL addresses, not to mention more up-to-date DX information than a monthly magazine could ever do, if only because often we get the information about a forthcoming expedition, because often we get the information from the DX community. Geoff is a DX specialist who manages to keep up with the latest DX news and predictions. His DXNS provides a valuable resource for DXers looking to get in contact with stations around the world.

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**Ten Metres**

G2BY remarks on the fact that sometimes Ten can be 'giving' at times when 21 MHz seems dead—Bert mentions his contacts with all W call areas but W7, plus PY, LU, and ZP, all of course worked on CW.

That ten-metre DSB rig of his, says G2BJY, was not up to the mark; but having, as they say, 'laid an egg' Geoff immediately set to and built a better machine. In spite of all his comments on how little activity was to be found, Geoff managed to find time to knock fifty countries by the time of his letter, the last one being GW4GSS near Wrexham, a steady S7 right through a long CW QSO at about sixty miles, doubtless some sort of odd VHF propagation effect. On a different tack, Geoff has decided to tackle the construction of a direct-conversion receiver, which should give him lots of entertainment; they look simple, they are simple, but they have to be right if they are to be of any use!

Our next stop is with G3NOF; Don made no contacts during the month, there being only Russians and, occasionally, openings to W/VE at the times when Don was listening.

A rather different situation appears in the letter from G2ADZ, who found it admittedly not quite like March but good nevertheless, good enough to cause some of the DX operators to get in one QSO and then change frequency so as to avoid the hordes of callers. Only one flat day was noted, that one being April 6, and the only Gotaways were HS3BP, SU1IR, VP2VJ, KG6JHH, OE5CD/YK and HK1RCB. That left CW exchanges to be entered in the log, from C6ABA, VO1EM, KZ5EK, VK2, VK3, KL3GQ, G4CBC/MM on the way to Australia, HZ1HZ, LU, JA's, ZD8TD who will soon be going to ZD7-land, YV's, CE1FA, OE8WLK/MM (who was anchored off Takoradi with hatches all battened-down and loading with cocoa stopped completely because of torrential rain), KV4AA, NS4CL and assorted UA9 and UA6 types.

G3PKS adds a comment to the effect that it is surprising how often one hears one or two good DX signals on an otherwise empty band; stations worked included UK6HAQ, N4HV, UA9XSE, KP4EQF, UA6DG, UA6HGR, the CGITX aforementioned, WB4LGI, RA6HMQ, OD5LX, PY7CC and PY4IMI.

G2HKU also looked at the band, and his CW was on tap for W9FSR.

As for GM4DZX, Bob found conditions rather a disappointment after the March lift, but he still managed quite a few interesting QSO's with the Caribbean and in to YV, PY, ZP and HK, plus some African stations.

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**Finale**

Deadline dates are shown in the 'box,' and your letters sent, as always, to “CDXN,” SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ. Meantime, excuse us please—we have a matter of a mast and a tribander to see to...
AMATEUR RADIO—COMMUNICATION OR TECHNOLOGY, OR BOTH?

PART IV

N. H. SEDGWICK, G8WV

We have reached the stage when the subject of HF transmitters must be treated in some detail; but since the modulation system used to convey the message intelligence by means of the RF power generated by the transmitter will greatly affect the parameters determining its design, it seems we should first look at such modulation systems as are likely to arise in HF amateur radio communication requirements. Our licences allow us to do things that have little merit in the pursuit of the hobby (such as use of A2 and F2) and which may well cause annoyance to others trying to communicate in the restricted and over-crowded frequency bands allocated for amateur HF use: we shall not include them in our list of systems likely to arise, for they are rightly shunned by the majority.

A1 Telegraphy

This consists of simply turning the transmitter on for a ‘mark’ and off for a ‘space,’ which is a two-state system with no intermediate states requiring the subtlety of comparison with a reference standard in detection. Coarsely, and without apology to those modernists who would already be throwing in the word ‘binary’, its excellent simplicity can be expressed: “If you hear it, it’s a mark, but if you don’t it’s a space.” This simplicity is reflected in the transmitter requirement, which needs to be just a clean RF generator of suitable frequency stability followed by as much amplification as is necessary to produce the required power; since one is not concerned with intermediate power levels there is no linearity requirement, so that design may concentrate on power efficiency. Because our licences still rate our power in DC input terms, the greater our power efficiency the more we can use, up to the point when power out equals power in!

Furthermore, since all or none of the power generated is used to signal the marks or spaces, the intelligence efficiency of the A1 system is 100 per cent. However, although determination of a mark or space at the receiving end theoretically conveys intelligence, there must clearly be a lot of such bits of intelligence to convey a message of greater significance than plain ‘yes’ or ‘no’, and a third dimension must be introduced by sending the bits of information sequentially in time. Note that even if the entire content of the message were the two-state ‘yes’ or ‘no,’ and it was agreed that ‘yes’ should be signalled by a single mark, it would be useless to indicate ‘no’ by a single space because this could mean anything from a transmitter breakdown to a receiver failure. Thus, such a modulation system requires transitions from space to mark and from mark to space to be taking place for even the simplest passage of intelligence.

If we use a number of bits of the basic two-state intelligence to convey the smallest element of a message (i.e., a letter of the alphabet) and a number of these letters are strung together in time sequence to spell a word, how should the start and finish of each letter be distinguished? In Morse code the indication is a gap in time between the last mark of a letter and the first mark of the next, of a duration too long to be confused with a space bit during a letter transmission; in teleprinter code there are no gaps in time between letters, and the system relies on time synchronism between transmitting and receiving mechanisms. Character recognition at the receiving end is done by a machine, and to make the synchronism requirement easy, all letters have the same number of bits and so occupy the same time, and the speed at which messages are sent is fixed and cannot readily be varied to meet variations in radio conditions.

In fact, A1 telegraphy will not reasonably support teleprinter signalling in the ‘start-stop’ mode on HF, because the synchronism requirement is too tough to cope with noise, fading, and multipath effects (bearing in mind that the receiving machine is an awful dunce which sulks for several characters if it happens to miss one start signal, and has great difficulty in recognising honest marks and spaces as distinct from noise and fades).

It is extremely difficult to make a machine which will receive Morse code and transcribe its marks and spaces into alphabetic characters, and so write the message on paper for us. The Morse operator is limited in the maximum speed at which he can read and write down messages received in Morse to around 25 words per minute; the really professional Morse operator can probably read a short message in his head quicker than he can write it down.

To handle Morse at higher speeds in order to make more economical use of radio channels when they are propagating well, the professional method has been to print out the marks and spaces as received on a tape which is then transcribed into alphabetic characters by a Morse operator at the slower speed determined by his capability. Several operators may be necessary to read the output from one HF Morse channel running at 60 w.p.m., or more. The amateur will never be in that situation because his messages are already limited and he is never under pressure as is the commercial operator passing traffic for third parties.

It looks as if Morse code is even less suitable than teleprinter code for use with A1 telegraphy, but in fact it is the other way about. An operator cannot read teleprinter code by ear because he lacks the capability of timing and synchronising to the traffic stream, but his brain has the complexity necessary for the recognition of Morse signal groups as alphabetic characters, and to record on paper those characters in message form simultaneously with the recognition process. Additionally, his recognition of marks and spaces is quite uncritical and he can read through noise, fading, and QRM with an accuracy that no machine could hope to achieve.

Given such a sophisticated receiving device as a trained human brain, Morse code can be varied to still further extend its readability in adverse conditions: the operator weighs in his judgment all the information he receives. The only redundancy in the code is when
conditions are good, and the sending operator is using a slower speed than the receiving operator is capable of taking down.

In adverse conditions slowing transmission speed will improve readability; we can also improve readability still further by using the sharpest possible receiver selectivity that will adequately pass the modulation waveform, so giving protection against noise and ORM. At the slow speeds used by amateurs this can mean very tight selectivity requiring a high order of frequency stability of both transmitter and receiver, but since the operator is constantly monitoring the received signal he will manually keep it tuned if it drifts. Exactly the same thing occurs in the case of SSB, and that is why amateurs pioneered the use of that system on HF while professionals avoided fully suppressed carrier working until such time as their equipment could cope with the order of frequency stability required.

Determination of the bandwidth required to pass a telegraphy signal is a direct function of the 'reversals' frequency of the signal, regarded as a square wave. By 'reversals' in Morse, we mean a continuous stream of dots at the speed at which dots are being sent in, say, letter 'H' or figure '5' in the messages, as this represents the highest keying frequency that occurs in use. As a general rule-of-thumb in telegraphy practice, the bandwidth required is five times the reversals frequency—so that up to and including the fifth harmonic of the frequency is passed, thus maintaining the square wave-form adequately for the purpose of telegraphy; if none of the harmonics were passed the square-wave reversals would turn into a sine waveform of the same frequency.

In fact, from the point of view of a Morse operator, he would not quibble at the shaping of the keyed tone Morse signals if the bandwidth were limited to the reversals frequency, so that each dot appeared as a sine-wave half-hertz instead of a square-wave half-hertz: the dots would just reach their peak amplitude in this circumstance and the operator would have no difficulty in recognising them as dots. The same degree of shaping would affect the onset and offset of the dashes, but since each dash is three times the length of a dot, the dashes would reach and hold their peak amplitudes. A figure '5' in Morse at a speed of ten words per minute takes around one second to send, so that this speed is equivalent to a 'reversals' frequency of 5 Hz.

The legendary CR-100 receiver (which saw regular professional service in the days when the Post Office used Morse code for its regular main line radio telegraphy service) has an audio filter with a bandwidth of 85 Hz at the half power points, but the operating instructions do rather emphasise its limitations due to receiver tuning drift. It was intended to be used on commercial circuits and was often remote from the place where the operators read the Morse—from undulator tape on which it had been recorded: this is quite a different requirement from reading Morse as it comes out of a receiver in the form of keyed tone. The connection between the receiver and undulator would certainly involve the use of polarised electro-mechanical relays and/or side stable electronic flip-flops which have a threshold voltage at which they just operate; if the leading edge of the applied signal slopes, and so offers a voltage gradient, there will be a delay in time before the operating threshold voltage of the receiving device is reached. If the signal amplitude changes due to fading (as of course it will), the point in time along the signal at which the threshold amplitude is reached will slide, so that fortuitous telegraph distortion of the bit lengths is introduced. In a bad case, the dot may fade below the threshold of the following device and so be missed, although an operator would have heard and recorded it.

A teleprinter receiving Murray code requires its receiving mechanism to be in synchronism with the transmitting mechanism, so that each of the five signal bits which make up a letter finds the character store ready to receive it as it comes along; at standard 50 bauds signalling speed, each signal bit is 20 milliseconds long and the necessary minimum time taken to record it in the receiving store is 7 milliseconds on a Creed 7B teleprinter. The unavoidable difference in motor speed between the sending and receiving teleprinters will introduce some time displacement in the signals and so will multipath propagation effects. In 'start-stop' Murray code signalling the timing of the bits of each character stems from receipt of the start signal; if this is displaced for any or all of the reasons mentioned, all the following bits of the character will be displaced by the same amount as far as the receiving mechanism is concerned because it is measuring the times from an incorrect starting point, and to this is added their own individual inaccuracy in time. One cannot afford to run any risk of introducing signal distortion by over-filtering against noise, and so one really has to include some odd keying frequency harmonics in the filter bandwidth to keep the square waveform of the keying more or less inviolate.

**F1 Telegraphy**

This is a narrow-band modulation system in which a small change of the signal frequency denotes a change from mark to space. The general convention is for a mark to be represented by the higher frequency. It is again a two-state system with the advantage that transmitter intelligence is 100 per cent efficient with all the power going into the intelligence, but since the transmitter radiates full power under both mark and space conditions, there is no ambiguity about space, and noise is less significant to the receiver because there is always a signal voltage present to combat it; however, Automatic Gain
Control is seriously limited due to selective fading. The mark and space frequencies fade at different times so that a strong mark signal may be immediately followed by a weak space signal, which finds the receiver sensitivity backed right off by the big AGC voltage arising from the big mark signal and still held on by the circuit time constant. AGC time constant must therefore be very short, and the change in frequency (shift) kept small to reduce as far as possible the selective fading effects. Professionally, a shift of 850 Hz was used pretty generally for many years, but latterly shifts were reduced as frequency stabilities improved.

The frequency shift system provides some protection against noise by cancellation in the discriminator, and against interference by capture effect. The improvement F1 gives over A1 as a telegraphy bearer system was found to permit use of 'start-stop' teleprinter working on HF, and this is what is known to amateurs as RTTY. Let there be no doubt about it, the system is poor, and this has always been known! The telegraphy code and synchronising system were developed for line working and are particularly unsuitable for an HF bearer circuit. Each alphabetic character is made up of five signal bits (marks or spaces) plus a start (space) and a stop (mark) signal for synchronising. Mutilation of any one of those bits will result in a wrong letter and hence the loss of all of them. In effect, the system multiplies the chances of incorrect read-out by 7:1. In addition, if a start signal is mutilated, not only does the remainder of the character get lost but the receiving machine is driven right out of synchronism by interpreting the next space it does receive as a start signal—with a consequential loss of about three characters whilst it gets back into synchronism, or loss of 21 bits as a result of mutilation of 1 bit!

RTTY takes advantage of an effective HF bearer modulation system to offset the disadvantage of a rotten synchronising and signalling system (when applied to HF) and there is nothing clever about it. The RTTY enthusiasts cannot claim to have pioneered the system, as the amateur fraternity can claim to have pioneered the HF band for DX communication, and SSB for high efficiency telephony. In fact, they are perpetuating an out-dated system which was used professionally as a stop-gap whilst its predictable weakness awaited the development of fully synchronous error-correcting systems such as Autoplex, or the completely different approach of Piccolo with its very modest synchronising requirement.

Although the actual signal keying speed frequency does not exceed 25 Hz and can be filtered following the discriminator to get rid of noise, the HF bandwidth of the circuitry preceding the discriminator must allow for the shift plus the keying frequency: this will typically be greater than 1000 Hz, so that the system occupies very much more of the narrow amateur frequency allocation than does an A1 Morse signal at hand speed. The teleprinter is, of course, a high traffic volume device originally developed to reduce the number of processes, and hence staff, through which telegraphic traffic had to pass at line terminals. Just where it fits in and serves a useful purpose in an amateur station which has no function or authority to pass on telegraphic traffic, little need to retain the short messages it is entitled to receive for more than a few minutes, is a matter for conjecture.

F1 transmission can, of course, be used with advantage as bearer circuit for other systems than 'start-stop' RTTY, such as synchronous teleprinter systems, and although facsimile is called F4 in the licence, the radio equipment is the same as for F1. However, F1 is no help in operator-read Morse code telegraphy, for he would need to distinguish between two tones instead of 'tone' and 'no tone', and his brain is better equipped for the latter.

A3 Telephony

Until ousted by SSB this was the normal modulation system used for amateur telephony. It implies carrier plus double side-band transmission, half the transmitter power being devoted to the carrier (which is used at the receiver as a reference frequency enabling the audio frequency of the original modulating signal to be reproduced by beating the modulation side-bands with the carrier in the demodulator circuit). The reference frequency could equally well be generated in the receiver, so retention of the carrier in the transmitting output amplifier is a waste of the power-handling capacity of the stage, as is also the use of both side-bands (which doubles the bandwidth of the transmission when only one side-band is necessary to convey the complete message intelligence).

Since only part of the transmitter power capacity is available to handle the intelligence, it is usual for the output to be provided by a high-efficiency Class-C amplifier which is non-linear in operation and would distort the modulation waveform if the modulation were applied to the input of the amplifier. Modulation has therefore to be applied at high level to the output of the power amplifier, which reduces the overall power efficiency considerably but does not count against the licensed input power to the PA. It is an expensive and inefficient method of modulation which has now been replaced in amateur practice by the A3J single side-band suppressed carrier system, well-known in line and long-wave radio service back in the 1920's, but awaiting the development of practical side-band filters for use in the HF spectrum.

We should not expect any return to use of A3 modulation, which is wasteful of power and bandwidth. Nor should we expect any interest in A3H, because A3J so clearly gives better results than either A3 or A3H.

A3J Telephony

As described above, this system occupies only the bandwidth necessary to the audio modulation, which in amateur practice is about 2500 Hz; there seems to be no easy way of reducing this bandwidth without reducing intelligibility, so there is scope for development in this respect. Because of the careful placement of the side-band filter relative to the carrier generator frequency, it is not practicable to carry out the SSB generation in a part of the circuit which is frequency-agile; therefore side-band generation and carrier suppression is invariably carried out in a fixed-frequency low-level circuit, the output of which is mixed with the frequency-agile devices and fed into tunable amplifiers. Consequently,
all the amplification employed must be linear to avoid distortion of the modulation waveform—which is a strict but not particularly arduous requirement. It does mean a reduction in amplifier power efficiency compared with Class-C, but taking into account the removal of the redundant components, i.e. the carrier and one sideband, the capability of the linear amplifier completely dedicated to amplifying just the intelligence in the signal results in a much better useful output. The output amplifier will operate in Class AB1, AB2, or B, according to the type of valve used.

Although it is true to say that all the power developed at the output of an A3IJ transmitter is intelligence bearing, this means its contents are all initiated by the modulation input; in fact if the modulation is speech, we know that it will contain much that is redundant to intelligibility, even if important to recognition of the speaker by his voice. Also there will be wide variations in the power of the speaker’s voice, between phrases, words, vowels, and consonants, so that the Peak Envelope Power must be adjusted for the loudest sounds, and the others are radiated at reduced power (unlike Al telegraphy in which every bit of intelligence goes at maximum power and there is no redundancy). The power variations of the voice can be electronically compressed to reduce, but not completely eradicate, this trouble but this gives the side effect of reducing the modulation signal-to-noise ratio.

A31J is another example of the message intelligence generator (the voice) requiring a high quality bearer circuit to make good the short-comings of the generator and its poor adaptability to the HF propagation medium. Unlike the man-made ‘start-stop’ teleprinter code, the voice is a natural means of communication which biases us tremendously in our desire to use it, and there is quite a lot of research going on into the technology of processing speech with the object of making it more suitable for telecommunications transmission. One hears of ‘digital speech,’ and if speech can be turned into a two-state telegraphic signal stream it can clearly be treated as telegraphy, which looks like quite a breakthrough, albeit well out of the reach of our fraternity for the present!

to be continued

BOOK REVIEW

"LEARNING TO WORK WITH INTEGRATED CIRCUITS"

The writer’s first awareness of computers came after reading an article on the ENIAC machine developed in the U.S.A. with its 15,000 valves. Then began the age of the semiconductor, quite easy to comprehend at first with simple bipolar devices, but later to become very much more complicated when Integrated Circuits arrived. Now we have such mysteries as "64-bit bipolar scratch pad memories", "look ahead carry generators", "14-stage binary ripple counters", not forgetting microprocessors.

Articles on IC’s generally seem to fall into two categories. Either they deal solely with the theory of the devices, such as gates and decoders, or they describe a piece of equipment, such as a counter, on the assumption that the reader knows how everything works. A more satisfactory approach is adopted by the ARRL in its new publication, Learning to Work with Integrated Circuits.

The book consists of reprints of QST articles by Jerry Hall, K1TD, and Charles Watts, K6HFB, describing a digital voltmeter and frequency counter. It aims to teach the reader how IC’s work while covering the design and construction of the projects. There are nine short parts the first of which describes how IC’s are made and work, the design philosophy of the DVM and DFM, and the power supply. Part 2 deals with binary arithmetic and BCD and includes the circuit and parts layout of the readout display.

The third part covers TTL IC’s and introduces the reader to the truth table, “The Ouija board of digital circuit designers”, to quote from the chapter heading.

In this section inverters, NAND gates and the 7447 decoder-driver IC are described. “How a Frequency Counter Does It’s Thing” is the title of Part 4, in which waveforms, monostable multivibrators, Schmitt triggers and flip-flops are covered, along with the etching patterns for the display and clock boards. Part 5 is devoted to the counter section and includes the counter p.c.b. layout to complete the digital part of the book.

Linear IC’s are given the treatment in Part 6, in particular the 741 operational amplifier used in the voltage-to-frequency converter board, and Part 7 shows how to put all the bits together, construct the probes and calibrate the DVM. The DVM clock is derived from the American 60 Hz mains but a simple modification is thoughtfully incorporated for those of us on 50 Hz supplies.

Part 8 is devoted to optional extras enabling the 4-digit readout DVM to be used as an equivalent 8-digit DFM with crystal controlled time base, again all the p.c.b. layouts being shown full size. As with all “perfect” designs, improvements are discovered later and the final part mentions these.

Learning to Work with Integrated Circuits comprises 48 pages size 10½ by 8½ inches and contains an index and shopping list for the resistors, capacitors, semiconductors and mounting hardware. The book is written in a highly informative and humourous style being well illustrated with excellent diagrams and photographs. This reviewer thoroughly recommends it to anyone keen to learn about IC’s and/or who wishes to build some very useful pieces of test gear. It is available at £1-65 including postage/packing from the Publications Dept., Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

N.A.S.F.
“AND IT HAD AN IVORY KNOB”  
D. J. BRADFORD, G3LCK

THIS story is near enough true and some old and middle timers may recognise its basis.

The Welworthy Radio Club was a well organised affair; the Second World War had not all that long passed and so there were plenty of very good CW operators available. The standard of technical expertise was high owing to the number of electronics firm that had moved into the area and prospered during the war, and as a result the annual turn out for the contest was a most satisfactory blend of operating skill and technical equipment. The fact that old G3— was also the local Boy Scout leader and G5— was in the catering business simply added a gloss to an already well finished set up.

The friendly neighbourhood farmer had made the usual big field, plus tractor and trailer available; the latter pair were used to haul the mounds of heavy tents, poles and gear to the chosen site. Soon the young members were beginning to arrive on their bicycles to do battle with the piles of canvas, and then in groups they would be available to help Mrs. G5— to keep the ‘brew up’ coming to the operators and log keepers. To keep the log, once they had cottoned on to what was necessary, was a rare privilege afforded to those whose Morse was ‘coming on’. Since the gear was run off vibrator packs and rotary converters, another chore was to hump the heavy duty lead-acid batteries to and from the clearing where the war-surplus Onan generator cracked a brisk charge into them.

Unlike most NFD’s the weather was warm and sunny. The surplus gas capes and wellies, that were just that, lay in an untidy heap in the brown 160lb. tent —the one set aside for rest and recreation. The whole place was abuzz with useful activity, with Bob keeping his eagle eye on things. “Hump that pole, tote that box—and when in doubt ‘come on’.”

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Then there came the moment for the final checks. “By God I’ll have him on a charge!” was the only comment he said it was. Anyway Mrs. G5— was well out of earshot. “What’s up Bert?” called G6—, after a decent pause. “Nothing I can’t fix,” came the reply in a tone that must have had the carburettor cowering in the grass. As if to underline the force of that remark a cheerful, well tuned crackle revealed that an early QRT was not on the cards—well not due to flat batteries, at least.

Another small cheer, this time from the operating tent, revealed another triumph over adversity, or that special branch of Murphy’s Law which is reserved for NFD aerial matching units: this one actually caused to flow up the ceramic spaced ladder. The previous year’s effort, the last-moment product of Stan the Slapdash, despite ten months advanced warning, had started off by failing to match anything; the bit of 12 s.w.g. copper wire that shorted across the input socket had eluded everyone until most other groups were handing out serial numbers approaching three figures, and this had created a certain muted hostility towards poor old Stan (the extent of this muted quality of feeling was a reflection of the sense of incompetence of all the ‘experts’ in locating the error). Its detection in the end had been the work of one of the two ‘tea boys’; he had meekly asked what was the purpose of “that piece of wire?” It was not a happy moment in the Club’s history. So it was that someone at the Transmitter Design Department of International Electronics Ltd., had been asked nicely to help: he had done a grand job—or someone at the lab. had, hence all those lovely mills. of RF.

Next the HRO-5; The HRO-5 of G6— was reverently placed on the table and attached to its vib. pack, its 6-volt battery seeming almost to sag under the strain! From the head phones a splendid cacophony of CW revealed that things were indeed looking promising. Then there came the moment for the final checks.

“Charlie’s on for the first two hours.” This was G6— speaking with that tone of certainty of one accustomed to command. “Anyone seen him?” Silence, a scurry of looking in tents and behind bushes, but no Charles. “You can’t blame me this time,” thought Stan.

G6— was dumfounded. He had made the schedules and circulated everyone twice! Once more he suppressed thoughts of ‘Court Martial,’ ‘Cashiered and shot’. The clock ticked on at an apparently accelerating pace towards ‘kick-off.’

No one actually saw the slightly stooping, grey haired, dark suited old chap appear on the site. However, there he was, complete with a brown paper parcel under his arm. It was only when he said to a by-now somewhat distraught G6—, “Good afternoon, I am G2—, I live locally and heard you were having NFD here. I rather enjoy a spot of W/T, perhaps I could help to operate while the last—I think you said Charlie—is found.” “Oh struth,” said young Nick, G3—, of whom it was said that he filed bits off the weight on his J36 bug key to make it go faster. “I should think he drove the works at Poldhu!” “Ssh!” said Mrs. G5—, he looks a very charming old gentleman.” G3F— said nothing but his face...
was a picture.

"Yes, er—, well," said G6—, "I suppose—um, thank you." The ancient Op sat down and surveyed the equipment. "Aha," he said, "the HRO, a fine receiver, yes indeed." His hands flickered across the controls, deftly flitting from BFO; to Phasing; to Selectivity and back to BFO. G3F—, who had grudgingly agreed to log, was seen to stop gloowering. The frowns faded into a look of amazement. Afterwards he was wont to report that signals appeared and QRM vanished in a quite uncanny fashion.

"Superb filter," muttered the ancient Op, "now for the key." With that he unwrapped the parcel. A quite distinct gasp went up as the block of mahogany was set on the table. (It's actual size varied at subsequent recounts but it never went under eighteen inches long). This was topped by a most intricate mass of lacquered brass, on the end of which was a 'damned great ivory knob'. "Oh my lord! Here we go, eight words a minute," was G3F—, of speedy-dot fame, inner groan.

"Five, four, three, two, one, zero!" chimed the spectators. A silence fell as the ancient Op's hand slipped to the key: it is a great shame that no one bothered to photograph the ensuing set of stunned faces. From the monitor tone in the headphones rang forth a faultless 38 w.p.m. "CQ, CQ, CQ, G6-/P calling CQ." G3F— was so surprised that he dropped his pencil. The AO smoothly slid across a piece of paper with callsign, time, reports and serials in an exquisite copper-plate hand QSO and raising the next one seemed to take seconds—and another—and another—and so it went on. No one spoke, they just looked. "Let us hope young Charles does not turn up," quipped the intending B.Sc., "with yonder ancient 'machine' who needs operators?"

After 50 minutes, during which time the serial had gone to 048, a somewhat flustered Charles arrived in his Austin 7, muttering something quite disgusting about "bloody mothers-in-law," and burst into the tent. The AO looked up. "Ah, so you are Charles, allow me to vacate the Operators' chair. You have a wonderful set up here so I must not get in the way of the number one Op." The scoring rate dropped sharply.

"Where is he?" asked G6—, who was on the point of offering the visitor a cup of tea. "Over there." "Where?" "Good Lord!—I—Oh well, never mind." In subsequent discussions G6— could never be quite sure whether the slightly stooping figure had gone out of sight behind, or just before the hedge on the far side of the field.

The NFD session had been over the better part of a week, and the trodden patches of grass where the tents had stood matched the rest of the greensward with grasses upright once more. That celebrated HRO had been returned with due reverence to its detached residence; G3F—'s bug key had cooled down; G3G— had stopped looking into the window of the posh house agents who sold 'det. res. with approx 1/2 acre mature gdn.' A brief glance at his last salary cheque had finally made him accept the inevitable, 520, 260, even 130ft. of wire would not be his; life was indeed harsh.

No one had said very much about the AO and his amazing Morse key. The log checkers set about writing up the copy of the log that went off to RSGB HQ. (the one that was always sighted as the way to do it in the final report).

"Oi!" said the cheerful SWL who was sorting log sheets by bands, "why have we got a gap at the start?" He placed the sheets in front of G6—. "Look, nothing until G3— came on just under an hour after the start. Oh hell, I thought he was our sharpest Op., he must have changed bands and the first sheets have got lost." G6— and the others searched and researched for the papers, but there was no sign of the missing sheets.

As this activity was reaching its climax G3F— entered the club room. "Hey, what gives?" said he. "Why do these serials start at 049?" demanded the scribe in inquisitorial tones. "Cos' that grey haired old chap finished at 048," came the reply, "you know, G2—." "Don't be daft," came the voice of G8—, who had not been at NFD, "he couldn't have been operating." "Why not?" demanded several voices in unison. "Why not? He was killed early on in the war, that's why not. By gum but he was a fantastic telegraphist—used to use a ruddy great brass key. Do you know, it had a damned great ivory knob!"

With that G8— stopped speaking and no one else said anything at all—for a very long time.

The End

July issue will appear on Friday, June 30th.
A DIGITAL FREQUENCY METER, PART II
C. J. DAVIS, G3VMU

Clock Unit (cont'd)
The clock itself is a 100 kHz effort using two of the four gates in a 7400 quad two-input NAND gate. The frequency was chosen for the usual reason—but if you want to use a 1 MHz crystal then another 7490 stage will do the extra division.

The divider chain 7490's are connected as divide-by-five followed by divide-by-two so as to give a true square-wave output. Thus outputs are available at 1 kHz to give the 99 MHz to 1 kHz resolution, and the 1 Hz to give resolution to 1 Hz. Outputs are available at 100 Hz and 10 Hz which can be used for intermediate degrees of resolution if so desired.

The 7490 outputs are fed to the inputs of a 7401 two-input NAND gate with open-circuit outputs; these are wired in parallel to a 470 ohm resistor and to the supply rail, output to the control board being taken from this point. The other input to each gate of the 7401 is fed from a 7400 IC wired as an inverter and the inputs to the 7400 are wired in parallel and to the function switch; when a specific output is required, the input of the appropriate bit of the 7400 is earthed. When this is done the clock output appears across the 470 ohm resistor; thus the control wires all carry DC, and only one wire has to carry the time signal of the enclosure. This reduces the possibility of pick-up problems.

The clock, and all its control IC's and dividers are built on a piece of 0.1 inch matrix Veroboard; the enclosure in the original was an old square mustard tin, with some polystyrene or polyurethane foam padding. The control lines and PSU leads go in to the box at one end, while two wires are taken out of the other, and to the rear of the case where sockets enable use of the 100 kHz and 10 kHz for receiver calibration. A hole in the tin and a mating one on the back panel of the instrument itself are lined-up so that the trimmer can be tweaked into line with, say, Radio 2 on 200 kHz.

Control Board
The logic diagram is shown at Fig. 6, and the Veroboard layout at Fig. 7. This is the most complex part of the instrument.

Consider the situation when the gate has just closed after a counting-period. The counter is displaying the last count which is held in the latches; the closing of the gate triggers the time-delay monostable IC2 via the two-input NAND gate IC4d; after a period determined by VR1 and the 200 µF capacitor the Q output goes low. This in its turn triggers the first half of IC3 which is a dual monostable 74123, and its Q output goes high, transferring the counter total to the latch, so the display changes to the current one. The Q of this goes from low to high after a delay set by the 12K resistor and 150 pF capacitor. This transition is used to trigger the second half of IC3, whose Q output resets the counter to zero and enables the counter ready for it to begin counting.
as soon as the gate opens. The reset pulse is also applied to the "clock" input of IC1a, which in reality controls the whole shooting-match. When the J input is high and the K held low, on receiving the reset pulse just mentioned Q output goes high and Q low. In this situation, when the clock pulse arrives IC1a, having J high and K low, will change state so that the Q output goes low and Q goes high. Thus we have a suitable output to control the gate; the gate is one half of a 7400 quad dual-input NAND gate. The gate-control signal is also applied to another of the gates in this IC which is wired as an inverter driving an LED lamp; the LED glows when counting is taking place, and is just visible on the fastest gate time of 1 millisecond.

The Q output of IC1b is fed back to the reset terminal of IC1b which sets IC1a with Q low and Q high, biasing IC1b such that the next down-going edge causes IC1b

Table of Values
Fig. 7

| IC1 | 7473 |
| IC2 | 74121 |
| IC3 | 74123 |
| IC4 | 7400 |
| R1, R2 | 15K |
| R3 | 22K |
| R4 | 180 ohm |
| R5 | 220 ohm |

C1, C2 = 150 pF poly-styrene
C3 = 47 μF, electrolytic
C4 = 220 μF, electrolytic
VR1 = 22K linear
LED = any small one will suffice

On the Veroboard the following links should also be made:
BI4 to N13
J17 to O20
J22 to V22

The latch output is taken from S20; the reset output is taken from R15. The delay potentiometer and its associated fixed resistor go to T1; the signal input goes to FI1; the output to the counter going from G1. The LED is fed from F10.
to change state again; its Q goes low and Q high. The Q output causes the gate to close and the “gate-open” LED just mentioned to turn off. (The Q is not wasted, as it removes the reset-hold on IC1a). With both Q outputs high the output of IC4c will go low, triggering the delay monostable IC2 (a 74121), starting the whole cycle off again. The gate is held closed until the next reset pulse to IC1a, for the reason that with the J input low and K high on IC1b, it cannot change state until a reset pulse appears on IC1a—inverting the inputs and so enabling the clock pulses to cause a change of state in IC1b.

In summary then, the routine is: open gate for one period and count; close the gate and set the delay monostable; end delay; transfer to latches; reset counter and control bistable; and the next clock pulse then opens the gate and starts it all over again.

**Input Amplifier**

The circuit is shown in Fig. 8. It must provide a square-wave output up to the maximum frequency that the counter will take. The amplifier is DC coupled, using a 2N3819 FET as input, into a BSX20 in common emitter and a 2N3702 pnp transistor also in common-emitter; the collector load resistor connects to one side of a 74S13 dual Schottky Schmitt-trigger, which gives the fast square wave which the counter likes. The operating conditions are set by VR1 which can be either panel-mounted or preset—if the latter, then set it so that you get best sensitivity at the fastest frequency the counter will accept.

**Power Supply**

The whole counter runs off a five-volt supply, which is obtained from a 9 volt 1·5 ampere transformer, the output from which is bridge rectified then fed to a high value reservoir capacitor. This smoother voltage is then fed to a stabiliser comprising a 741 op-amp driving a BC108 which in turn drives a 2N3055 series-pass transistor. Output voltage is set by VR1, which must be done before the PSU is connected to any loads. See Fig. 9.

**Construction**

With a fairly complex instrument such as this it is best to get all the components and then build the instrument in some logical order. As far as the writer was concerned the power supply came first, haywired on the
bench with the 2N3055 pass transistor on an old bit of heatsink; once it was proven out, it was rewired into some semblance of decency and fitted into the case. The next part to be built could be the clock unit; if you have confidence, cut the tracks first and fit the components afterwards—but if you don't, fit the components first and cut the track after. Either way look very carefully to see no whiskers of copper and still left, preferably using a magnifying glass.

Now test the clock, either with a 'scope (ideally) or with a meter connected to the output of the one-second divider; the meter can then be moved to the clock output line and a check made that the output appears when the relevant line is earthed. Once it is working, carefully fit it inside its mustard-tin and set it roughly to the correct frequency.

Attention may now be turned to the five counter boards; flying leads connect them to the seven-segment displays, the reset, latch, count and power inputs. Be extra careful of the wiring to the DL707 displays, as they are particularly intolerant of short-circuits.

Each board may now be tested. Connect power but leave the other connections floating; with the power on the display should show zero. Now connect the reset line to earth and the count input line to the clock with the 1 Hz position selected. If all is well the counter will be counting up in seconds. With the transfer line o/c or at five volts the latch is not active; to test this line take it to earth when the display will "freeze"—lifting the line will cause the display to leap forward to whatever the counter now holds.

After each board is tested all five can be wired together and the clock times changed (just to see the numbers whirl away—a most satisfying sight!)

Next build the control board. No satisfactory method of testing it could be found except to connect it, with the controls on flying leads, to the counters. Make a simple astable oscillator and connect it to the gate input while the gate output goes to the first counter input. Switching on with the oscillator off should cause the counter to show zero; with the delay pot set to minimum and the clock set to give 1 Hz pulses, the gate display should now flash on-and-off at something like two-

Table of Values

<table>
<thead>
<tr>
<th>Fig. 10</th>
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<tbody>
<tr>
<td>R1</td>
<td>680K</td>
</tr>
<tr>
<td>C1, C2</td>
<td></td>
</tr>
<tr>
<td>R2, R11</td>
<td>270 ohm</td>
</tr>
<tr>
<td>C3, C5</td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>130 ohm</td>
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<tr>
<td>C6</td>
<td>all as in Fig. 8</td>
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<tr>
<td>R4</td>
<td>100 ohm</td>
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<tr>
<td>C4</td>
<td>25 pF ceramic</td>
</tr>
<tr>
<td>R5</td>
<td>22 ohm</td>
</tr>
<tr>
<td>D1</td>
<td>1N914 or similar</td>
</tr>
<tr>
<td>R6</td>
<td>1000 ohm</td>
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<tr>
<td>Silicon diode</td>
<td></td>
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<tr>
<td>R7</td>
<td>150 ohm</td>
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<tr>
<td>TR1</td>
<td>2N3819</td>
</tr>
<tr>
<td>R8, R10</td>
<td>470 ohm</td>
</tr>
<tr>
<td>TR2, TR4</td>
<td></td>
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<tr>
<td>R9</td>
<td>10 ohm</td>
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<tr>
<td>TR5</td>
<td>BSX20</td>
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<tr>
<td>VR1</td>
<td>50K linear carbon</td>
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<td>2N3905</td>
</tr>
<tr>
<td>TR6</td>
<td>BC108</td>
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second intervals. Now turn on the oscillator and see that the display changes to the frequency of it—wave a hot iron near or on to one of the oscillator transistors, when the frequency will change, showing that the control unit is operating correctly.

On to the input amplifier: this has no chassis but is wired direct into a tobacco-tin, using the tin itself to make the ground connections—just make it as tidy as you can with the shortest possible leads and feed through the capacitor on each supply line.

The units discussed so far will all mount nicely into the case size suggested earlier. All that remains is to mount the displays; they are each soldered to a piece of 0-1in. pitch Veroboard with one hole spacing between them, and the wires from the counter boards soldered direct to the pins of the display. A piece of dark ruby perspex can be put over a hole in the front panel just large enough to accommodate the displays (this cuts down the glare from the displays).

The counters are mounted vertically, held apart by 15mm. spacers, and the interconnections between each counter board made by 30mm. loops of wire. A bit of angle is fitted to the bottom spacers and the whole lot mounted to the floor of the case with about 5mm. clearance between the bottom of the counter boards and the case-bottom. The control board is mounted flat
and to the right of the counter "stack"; to the right again is the input amplifier; and yet further right is the space for the prescaler; the PSU fits at the right rear of the box. The box is made of two "U" sections, and fitted with rubber buffer feet.

**Setting-Up**

Most of the sections have already been set up in the previous text. All that remains is to beat the clock oscillator against Radio 2 on 200 kHz; on the prototype it was found possible to get the beat as low as one cycle in seven seconds with a steady hand, and once set it would "stay put" for several hours. This is more than accurate enough since it must be remembered that the frequency display is only accurate to ±1 digit.

The input amplifier pot has already been noted; if it is made to be a front-panel control, a tweak on it may help when one is at the uppermost range of the box.

Choosing the input 7490: when the input amplifier is completed, one can select the 7490—connect a volt-meter to pin 11 of the 7490 and ground. As long as the 7490 is counting the meter will sit at some intermediate value; thus one can inject a signal-generator in to the input amplifier winding the frequency up until the 7490 output latches up to rail or down to ground, and note the frequency. Repeat for the other counter 7490's, and select the fastest for the first stage, fed directly from the gate.

**Results and After-thoughts**

Does the counter meet the design requirements? Yes, and surprisingly enough the maximum frequency the prototype will count directly is 54 MHz; thus a prescaler to VHF/UHF will need only one divide-by-ten.

An alternative input amplifier was also tried, using discrete components rather than the 74S13; the Schmitt trigger in this case is made of a couple of BSX20 transistors and a diode, as in Fig. 10. Setting-up is just as before, although it was noted that as the maximum frequency is approached the count suddenly jumps to half frequency, at which point a tweak of the variable will bring back the correct count.

It seems, with hindsight, to be a miracle how the writer ever measured frequency accurately before! Every oscillator around has been measured, with some surprising results—some "stable" oscillators weren't, and others which were thought to be less stable turned out better than expected. Other uses are many; the output frequency of the generator can be accurately noted by using a tee-piece in its feeder; the grid-dipper can be measured by way of a coupling loop (very handy indeed if you are 'playing aerials'). The other possibilities are legion, limited only by your own ingenuity!
THE MONTH WITH THE CLUBS
BY 'Club Secretary'

LAST time around, at the very last moment, we had to find a bit of extra space and so there were a couple of scribes who didn't see their offerings in print. Please don't shoot us!

Up North

Apart from the third Friday which is missed each month, the York chaps turn up on Fridays at the United Services Club, 61 Micklegate, York. Their particular forte is in demonstrating our hobby to others, by way of a station at this or that event; one is coming up at the Great Yorkshire Show over the 11-13 July period at Harrogate.

Just now and again we hear from Otley. They showed their faith in the Hon. Sec. by re-electing him and adding a comment about a rising membership—good. They get together at an Hq. address near the centre of Otley on each Tuesday evening—it is suggested that you contact the Hon. Sec. for guidance as to how to get there. Incidentally, July 6 will see that same Hon. Sec. talking about his '48 years of radio.'

Westwards

We have the IRTS Newsletter and report on the AGM; it shows some 362 paid-up members of whom 233 are licensed. The total number of EI's licensed is some 554, with centres of activity well scattered around the Republic. If you want to know full details we strongly recommend having words with the Hon. Sec.—see Panel.

Back into England again, to Torbay, where the Hq. address is Bath Lane (rear of 94 Belgrave Road), Torquay. For the current information as to what is on the programme, we suggest you make contact with the Hon. Sec., at the new address in the Panel.

We have to refer you to the Hon. Sec. again; the issue of the Cornish Newsletter is almost wholly devoted to the AGM. However we can say that the general routine is to foregather at the SWEB Clubroom, Pool, Camborne, on the first Thursday in each month, the starting time being 7.30. If you've never been before, we recommend giving yourself plenty of time to find the Hq. and to get a seat—this is one club where the room is always full!

Our next stop is with the City of Bristol RSGB group, at their Hq. in Queens Building, University Walk, Clifton, Bristol 8; it should be noted that they start earlier than most clubs, namely at 1900. During June, on 26th, they will be entertaining G3RPE, the current RSGB President, and of course they will have plenty of work to do in connection with the Longleat Rally.

Over the border now and into (almost) Wales. The Blackwood crowd have a place at Oakdale Community Centre every Friday, where, apart from the club meeting they also have an RAE class and a Morse session. The main programme covers RAEN, discussed on June 2 by GW3MMU, followed by a talk and demonstration of Amateur TV by Gwent TV Group. June 16 is a talk and demonstration of TVI causes and cures by GW3NWS, and on 23rd some twelve members, selected by a draw a couple of weeks earlier, will be visiting the BBC TV studios at Cardiff. The last date in June is 30th, and on this occasion GW4COJ will be talking and demonstrating his MSF Time Code clock.

Midlands

Our first stop this time is with Peterborough, where the Hq. address is at the Scout Hut, Occupation Road, and the start set at 7.30. June 16 is the date, and the activity will be by way of preparation for VHF NFD.

The Cheltenham venue is The Old Bakery, Chester Walk, on the first Thursday, and the third Friday in each month. Unfortunately the May issue of the Newsletter we have to hand was blessed with a surplus of material, and this probably accounts for the absence of forward programme details. It is interesting to notice how, even though the group is a fusion of two already strong and active clubs, the general impression one gets is of even more strength and activity. There must be a moral here!

Another group which seems to maintain a high and consistent level of activity is the one at Derby. They are normally booked-in at 119 Green Lane, Derby every Wednesday; June 14 will be an exception in that this is set apart for a Barbecue at Drum Hill, Little Eaton. Of the others, June 7 is a Junk Sale, and on 21st there is an RSGB Tape-and-Slide lecture. The month will be rounded off on June 28 by a talk on simple receivers.

Stourbridge have a base at Longlands School for the formals and the activity nights, but the informals are held at the Shrubbery Cottage, Heath Lane, Oldswinford. June 5 is this month's activity evening, with the informal on the following evening June 6; they lead up to June 19, when they have a talk on Digital IC's.

If you are within the catchment area of Kidderminster you will no doubt be aware of the Youth Centre, Bromsgrove Street, as being the Hq. of the local club. On June 7 they have a Films evening, which will include one called 'The Tale of a Tower' detailing the work resulting from the falling of the Emley Moor TV mast, and another about the 'flying labs of the Civil Aviation Authority.'

The third one to be screened is entitled 'Aerial Synthesis.' On June 21, they are in the great outdoors, with a Fox Hunt starting from the Hq.

Now we head for South Birmingham, where the venue is still at Hampstead House, Fairfax Road, West Heath. On the first Wednesday of each month they have the main session—June 7 with G3MTI discussing the GB3MH and GB3MA repeaters—as well as weekly openings of the club shack on Thursdays for HF activity nights, and on Fridays for everyone.

It seems years since we heard last from Willenhall, but is does rather look as though they have been doing "quite nicely, thank you." They now have a new home, at the Little London Community Centre, Bloxwich.

Deadlines for "Clubs" for the next three months—
(For July issue—May 26th)
For August issue—June 30th
For September issue—July 28th
For October issue—August 25th

Please be sure to note these dates!
Road South, Willenhall. They will be there on June 14 for an ‘On the Air’ night using the club G4ETW call, and are booked in for alternate weeks. An outside event occurs on Saturday, June 10, by way of the Willenhall Carnival, and they have a station prepared; it will be located in Willenhall Memorial Park.

Every Friday evening the Coventry gang get together in Wheatley Room, Baden-Powell House, 121 St. Nicholas’ Street, Radford, Coventry. This give us June 2 for a Night-on-the-Air, and June 9 for a Treasure Hunt. June 16 is a Night-on-the-Air with a difference—VHF and out /P. June 23 is set aside for a club D/F event, and on 30th, they are getting ready for VHF NFD.

Wolverhampton have their place at Neachells Cottage, Stockwell End, Tettenhall, Wolverhampton. On June 5, the subject is Digital Logic, by G8HHK, followed on 12th by a Natter session in the clubroom. June 19 sees a visit to the Lancashire Police Hq. Control Room.

Hereford seems to have gradually built up over the years until now an attendance of 35 people is almost a normal thing, and very good for a relatively thinly populated area. The venue is the County Control, Civil Defence Hq., Gaol Street, Hereford; they are there on June 2 and June 16, on both of which dates the programme was ‘open’ at the time of their Newsletter printing. However, as we have said, they hold a relatively large membership, so doubtless something will have been set up by the time this comes to be read.

On to Wirral, and their Hq. at the Sportcentre, Grange Road West, Birkenhead (we need to get the venue in quickly so we don’t confuse anyone between the two clubs on the Peninsula!), where they get together on the first and third Wednesdays of each month. The copy of the Newsletter we have on hand doesn’t cover the programme beyond the end of May, but the new editor is otherwise doing a good job in the face of the usual shortage of material. One of the few offerings he did have was a rather good letter from G3CSG on the subject of home-brew and the absent of SSB designs these days—no need for him to worry much longer,

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IRTS (Region 1): J. Ryan, EI6DG, 23 Dollymount Avenue, Clontarf, Dublin 3.

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OTLEY: R. L. Davis, G8DFZ, 25 Ashfield Place, Otley, West Yorkshire.

PETERBOROUGH: J. E. Annakin, G8DZ, 109 Ashfield Road, Peterborough, Cambs.

RAI.B.C.: H. Boull, G2CLP, 14 Queens Drive, Bedford MK41 9BQ.

REIGATE: F. H. Mundy, G3XSZ, Westview, Ranmore, Bookham, Surrey.

SOLIHULL: L. G. Boswell, G4AEP, 170 Kestral Avenue, Solihull, West Midlands B22 8QX.

SOUTH BIRMINGHAM: Mrs. K. A. Apperley, G8KPA, 35 Denise Drive, Harborne, Birmingham 17.

SUTTON & CREAM: J. Korndorffer, G2DMR, 19 Park Road, Sutton, Greater London.

STOWMARKET: R. N. Preston, G8MYE, 13 Boulters Close, Stowmarket (5857), Suffolk.

STEVENAGE: T. J. Tugwell, G3KMV, 11 The Dell, Stevenage, Herts.


WILLENHALL: M. P. Batchelor, 19 Newlands Close, Willenhall (01-255 8729.)

WOLVERHAMPTON: J. Cook, G8EGD, 75 Windmill Lane, Crows Nest, Wolverhampton WV3 8HN.

WOLFEPHAMTON: J. Cook, G8EDG, 75 Windmill Lane, Crows Nest, Wolverhampton WV3 8HN.

YORK: E. Annakin, G8DZ, 109 Ashfield Road, Peterborough, Cambs.
we will soon have something to help him along!

G4AEJ is back in the Hon. Sec. seat for Solihull, and his last-minute note tells us that on June 20 they have G4ELO talking about Microwave Links, at the Manor House, High Street, Solihull. It is nice to know that things are all back on the lines after the sad and unexpected death of their previous Hon. Sec., G3PYR.

Although they have lost the use of the old club shack in Shady Lane, the South Manchester chaps have been able to get a room at their existing Hq. for use as a shack and for the Monday meetings—they hope to have it all set up by the time this comes to be read. On to their “main” meetings, on Friday evenings at the Community Centre, Norris Road, Sale, where the programme looks rather like: June 2, a talk by G3USF on Sporadic-E Anomalous Propagation; June 9 the winner of the home-brew competition to be selected; the official opening of the new Shack set down for June 23; and on June 30 the Hon. Sec. will himself take the stand, to discuss the design of a Cathode Ray Oscilloscope for use in the amateur station.

Nationwide

In fact, all the entries in this lot are international in their membership. For example, we have in front of us the AMSAT Newsletter; most people will be aware that this is the world-wide organisation which supports the building of the Oscar satellites. Reading the Newsletter carefully we notice that the cost of one of the Phase III satellites is around 250,000 dollars—this covers two units of course, and the “back-up” unit will be available for another launch later on. Of the sum mentioned the main items for each unit include, for example, 2400 solar cells at 10 dollars a time, two transponders, 2 Cosmic computers and a kick motor, making some 62,400 dollars as a start for each of the pair of units. No wonder the programme needs support! It is of great interest to notice how much the educational aspect of Oscar has interested folk outside Amateur Radio—there are donations from companies, and of course many schools are making use of the Oscar telemetry for educational purposes. Details of AMSAT-UK can be obtained from the Hon. Sec.—see Panel.

The G-QRP Club is as active as ever, and its Newsletter is one of the best around. Low-power operation is something of interest, the more so as so much of the gear is home-brew—which in its turn means that there is a lot of good constructional stuff in Sprat. Furthermore, they have an arrangement whereby most of the magazines from overseas are scanned for articles of interest to the QRP home-brewer, and interesting ones added to the “library.” A list is published in each issue, and anything on the list is made available for the price of a member’s s.a.e. and a few coppers. For all the details, contact the Hon. Sec.—see Panel for his new address.

On now to A.R.M.S., and on the front cover we notice that there is a reproduction of the standard A.R.M.S. QSL card; on the inside front cover we see a list of goodies available through the club. The amateur radio mobile station is the chap they cater for, whether fully licensed or SWL; and for those who go to foreign parts, the question of reciprocal licensing and how to go about the formalities is dealt with by their information service. Well worth a subscription—for details, contact the Hon. Sec., at the address in the Panel.

R.A.I.B.C. caters for the blind and invalid among us, whether SWL or licensed. In the current issue of Radial we see an appeal for a new Hon. Sec., for the simple and sad reason that G2CLP has been told to stop rushing around so much by the medics. One has to say that the size and extent of RAIIBC now is such that it is a bit more than a one-man task, and yet not enough to cover a full-time secretary’s salary. So G2CLP seeks to split the workload at present associated with the task so that, come an illness such as he recently had, the “system” has enough slack to keep all on the rails while the sick one recovers. (We could add that that sort of thing also applies to holidays; there is nothing worse than a return from holiday to find a large backlog of work which lays you right back where you were before the holiday started!). So, volunteers are required—write to G2CLP at the address in the Panel.

WAMRAC is the one for those in our hobby of Methodist faith—at least, that was how it started, but it seems to be adding members from all denominations of Christianity, worldwide. Details of their activities are best obtained from the Hon. Sec. at the address in the Panel.

Southern

Our first out of the hat is Verulam, who are to be found in the Market Hall, St. Albans on the fourth Thursday in each month, for their “main” meeting. During the summer months they are also found on the second Thursday in each month at Salisbury Hall, London Colney. This month they have an extra, in the form of a joint meeting with the Edgware group on June 22, when they will have a Trade Show put on by Amcomm Services of South Harrow.

Reigate seem to have June 20 as their “members evening”, which we understand to be what others call their formal date; G3VLH will be talking about simple circuits. There is also a Natter evening, at the Marquis of Granby in Redhill. The formals are held in the
At the March meeting of the Thames Valley Amateur Radio Transmitters Society, Richard Limebear G3RWL (right) who is Communications Officer of AMSAT-UK, presented a lecture and practical demonstration of Oscar satellites. During the meeting Oscar 8 passed overhead and a satisfactory down-link demonstration was mounted. On the left is Victor Brand, G3JNB, Chairman of T.V.A.R.T.S.

Constitutional Centre, Warwick Road, Redhill.

Now to Crawley, who have their place at Trinity United Reformed Church Hall, Ifield, on June 21. This group also have informals, but these are held at members homes in rotation. An extra date for at least some of the gang in June is on June 17 for a visit, along with some of the Crawley Astronomical Society, to the home of Cdr. Henry Hatfield.

At Cheshunt the Hon. Sec. says that he always seems to get his programme finalised just in time to miss the deadline! However, for June we see a visit by G3AAJ on 7th, followed a week later on 14th by a talk on getting started with QRP by G4FAI; and on 21st they will be hard at it preparing everything for the exhibition station at Rosedale Sports Club on 24th. The last line of the programme appears to refer to June 31(!) but as it is a normal Natter evening at Hq., it seems more likely that June 28 was meant.

If you are looking for a club in the Stowmarket area, all you have to do is to find the railway station, and then you should be able to see the Red Cross Hall, where it all happens. As for the date it is easy to recall—the first Monday in each month; the June date will be a talk on Mobile Interference, and the July one is set apart for their preparations for the station to be shown at Stowmarket Carnival.

One of the well-organised scribes is the one from Cray Valley, where the details are set out in a standard format so that sheets can be pre-printed. From it we see June 1 as a main meeting, at which G4FAM will talk about his month in the United States, while June 15 is a Natter evening. June 18 sees the group putting on a station at Greenwich Festival for which they have applied for the callsign GB3GF. The Hq. address for this club is Christchurch Centre, High Street, Eltham.

It is quite a while since last we heard from Maidstone YMCA, who used to write in so regularly and, to judge by the letters, must be one of the best equipped clubs around in terms of shack, gear, aerials, accommodation and so forth. The New Hon. Sec.—see Panel—makes it quite clear that things are still very much alive, and issues an invitation to visitors and potential new members to look in on any Friday evening at the 'Y' Sportscentre, Melrose Close, Maidstone, Kent, where they have quite a lot of things set up for member's entertainment in the coming weeks.

For the first time we note that a club is to spend an evening discussing the revised 1979 RAE syllabus; Acton, Brentford & Chiswick is the one, on June 20, at Chiswick Trades and Social Club, 66 High Road, Chiswick, London W4.

Although they normally have a booking for the first Monday of each month, the Southdown group are so organised that if this should fall on a Bank Holiday, their booking is put back a week. June 5, at Chaseley Home, South Cliff, Eastbourne is covered by a talk on 'Metalwork Principles and Practice,' by G8NPC.

Bournemouth (Wessex A.R.G.) group have a place at the Dolphin Hotel, Holdenhurst Road, into which they can just about cram all the regular attenders; and that doesn't mean a small group, because it's a big room! Find them on June 2, for a talk by G8AKA on UHF converters (432 MHz input and 70 MHz output—a bit unusual, but possibly a good idea). June 16 will also be of interest in that G2MI, for so many years the hub of the QSL Bureau system in this country, will be talking about some of the problems and the highlights of amateur radio between 1920 and 1939.

On the list of activities for Chiltern we note a special-event effort at Bellington Fete on Saturday, June 24, and on June 28 they are 'at home' to members of the Oxford club. The clubroom is at 42 Castle Street, High Wycombe—there is limited parking at the back of the building, or you can try Corporation Street, or the local multi-storey car-park from Level 6 of which a footpath runs to Credon Street, just opposite Castle Street.

Now to Addiscombe, which is mainly a contest club, although they obviously like other things too. They can be located on any Tuesday at the Spread Eagle, Portland Road, South Norwood from 9.15. Looking through...
their list of events, we notice something for everyone, right through from 3.5 MHz to the microwave regions.

At Surrey the Newsletter includes a letter from the chairman, who this year retires under the three-year rule. We also notice that G3FWR is standing down as Hon. Sec. after many years in the post; but for this time, at least, his name remains in the Panel for the simple reason that we don't as yet have the details of his successor. The lads are based at T.S. Terra Nova, 34 The Waldrons, South Croydon, where they have the first and third Wednesdays.

At the Crystal Palace AGM the Hon. Sec. was re-elected, and under A.O.B. they discussed the GB3LO situation. As a result, the committee were able to brief their ASR as to the views they should put forward at the subsequent RR's meeting, with the hope that their view would prevail and be noted and actioned at RSGB Council level. The group meet at Emmanuel Church Hall, Barry Road, S.E.22 on the third Saturday in each month, the meeting being arranged so that some Morse tuition can be given beforehand.

There are two places where one might find the Sutton & Cheam gang, namely Sutton College of Liberal Arts, and Ray's Social Club. In June, we notice that there is a session on WARC 79 on June 22 at the College, and a picnic on Sunday, June 4, not to mention the coach trip to the Longleat Mobile Rally on June 25, and an entry in NFD—no wonder there isn't a date at Ray's social club until July 19!

The Barking Newsletter doesn't make any mention of the programme, but we know they are to be found at Westbury Recreation Centre, Westbury School, Ripple Road, Barking, on most weekday evenings. The group will be on display at Dagenham Town Show, which one would guess requires most of the June period for preparation; but we do notice one break for them, in the form of a Field Weekend over June 17 and 18.

June 1 is the date for Stevenage to hear from G3AGP about Electronics in Medicine, while on 15th G4DDX will be talking about D/F Receivers. The venue is the Hawker Siddeley Dynamics Canteen in Gunnels Wood Road.

Finally, we go to West Kent who are at the Adult Education Centre, Monson Road, Tunbridge Wells, on June 9, when G8DET will be talking about the side of the Post Office which the customer does not see or hear. June 23 is down for a talk about Logic, how to design and use it; we'd like to mention the speaker's name but for once the Hon. Sec.'s, usually clear handwriting can't be deciphered with any certainty. However, the rest is clear, that these are the formal Friday dates, and that at the same venue they have informal Natter sessions on the Tuesday of the alternate weeks to the formals.

QRT

Down to the bottom of the pile again, and it remains just to ask you to send in your August material by the date shown in the 'box' in the piece (if you are thinking about July, you've missed the bus!), addressed as ever to "Club Secretary," SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ.

THE OTHER MAN'S STATION—G4AYG

Our subject this time is John Elsworthy, G4AYG, 27 Balton Way, Dovercourt, Essex. The first picture, taken some nineteen years or so ago, shows the young G4AYG-to-be at his seat of office as signals instructor to 2194 Sqdn., A.T.C., where he first learned to enjoy putting a station on the air each Sunday morning. Of course, if you expose yourself to a germ, you must expect to be infected—which is how John came to be seen in the second picture, with a little less thatch on top and more round the sides! The rig at the time of the later photograph was a KW-2000A used with an MFJ audio filter, to enable G4AYG to pursue his interest of CW QSO's on Eighty in the mornings. He may well be using something different by now, as we understand some fourteen different rigs have been tried! Outside there is the aerial, and this is where the work starts. Umpteen radials, all buried ½-inch below the lawn deal with the ground side of things, and there are 66 and 33-foot wires to feed Marconi-wise. Fourteen years have gone by working in electronics, and John is now hard at work for the sea-going R/O ticket, followed by the D.o.T.I. Radar Servicing Certificate and then, hopefully, by a few trips to see the sea. In the car G4AYG, like so many, uses VHF gear; between Lowestoft Technical College and Harwich the journey seems shorter with the rig running, and of course it is handy when one gets lost!

So there it is—another amateur enjoying his licence in his own distinctive manner.
**VHF BANDS**

**NORMAN FITCH, G3FPK**

**Solar Events**

WOW! Reportedly the biggest solar flare for ten years has been responsible for several complete blackouts on the HF bands and some mammoth auroral events.

Fomite No. 296 goes to Ray Devereux, as well as on 2m. and 70 cm. He also transceiver the KW-2000B and Jack 4-ele. Jaybeam yagi active on Sunday mornings and when G3CO has QTH following the purchase of a really got underway from the present 4m. operation started in the late 1950's from a previous location but was issued in early 1938. 2CKB in 1937, Jack's present call licensed in January, 1960.

Colne near Colchester, Essex, has been responsible for several com-

These being surplanted by an Icom Ranger Tx and Microwave Modules. 1973, AM operation with a Pye Yaesu FT-221R acquired last July and to which a 3N204 preamplifier has been added. Ray's present aerial is a 5-over-5 array at 35ft., the QTH being 200ft. a.s.l. Current activity is building the 4CX250B amplifier featured in the Magazine in the July and August 1973 issues.

**Contest News**

**Results:** From GB2RS comes the results of the March 144/432 MHz events. These are given in the order, call, points and QSO's for each of the four contests. 144 MHz Single-Op. G8KMW, 2463 (352); G8JAG/P, 1839 (244); GW4GTE, 1597 (240). Multi-Op. 144 MHz G3PIA/P, 4340 (560); G3PMH/A, 3855 (506); GW3OXP/D, 3537 (461). Single-Op. 144/432 MHz G4ASR/P, 4886 (346); G8GP, 2320 (98); G3SPJ, 2172 (203). Multi-Op. 144/432 MHz GW8BHH/P, 7733 (525); GW4ALE/P, 5068 (306); G8KUC, 5026 (432). Congratulations to all.

In the 1296 MHz Open Contest on April 1, the winner was G4BEL/A with 2638 points from 34 contacts. In second place was G3SBV/P 1124 (23) and third was G4DRC/P 1118 (21). In the 432 MHz Open the following day, the Fixed section was won by G3VPK 608 (94), with G3WOH 315 (48) second and G8GP 283 (73) third.

In the Portable event, the winners were G3PMH/P 643 (126) with GW3UBX/P 563 (83) second and G3NNG/P 524 (103) third.

**Coming Events:** The Microwave Contest is scheduled for the weekend June 17/18. In the absence of any further information it is assumed the rules will be as last year.

VHF NFD is from 1600-1600 GMT on July 1/2 and is an IARU event on 144, 432 and 1296 MHz with 70 MHz for those who have this band, including ON4ERX. The rules are as for last year so single band 144 MHz entries will not be accepted.

On June 24 the German CW Activity Group, AGCW-DL, is running a CW affair from 1900-2400 GMT on 2m. There are three categories. “A” is below 3.5 watts output; “B” is below 25 watts o/p and “C” is over 25 watts o/p. Exchanges to be the usual RST plus serial number followed by your power category and QTH locator. E.g. 579001/B/EL25a. Complicated scoring system but, as entries can be post-marked up to October 31, there is plenty of time to write to DK3UX at P.O. Box 38, D-2358 Kaltenkirchen, German Federal Republic to ask.

**Super DX Region 1**

Following the stop press item last month, Ray Cracknell, ZE2JV, in Salisbury, Rhodesia, and George Vernadakis, SV1AB, 15 km. north of Athens, concluded a CW QSO on April 12 between 1756 and 1806 GMT on 2m. over a calculated distance of 6258 km.

On April 28, ZE2JV worked Costas Fimarerlis, SV1DH, in Athens at 1737 GMT, followed by Spyros Chimarios, SV1CS, at 1748. During the latter QSO, Paul Galea, 9H1BT, in Malta heard ZE2JV. Paul's signals have also been heard by ZE2JV but as of April 30, no two-way contact had occurred. Thanks to Professor Martin Harrison, G3USF, for passing on the above.

In line with Magazine policy to give maximum publicity to the scientific aspect of our hobby, a full report of this season's achievements and tests on transequatorial propagation will appear as a separate article in the July issue.

**Sporadic E**

Possibly by the time this issue appears, there may have been some E's QSO's on 2m. On April 26, Mike Dormer, G3DAH (Kent), mentions having heard what sounded like Spanish-speaking stations on 144-250 and 144-170 MHz at about 1400 for ten minutes, but he was unable to break in. On the DUBUS 20m. VHF net on May 6 the Norwegians and Swedes were talking about VHF E's propagation to eastern Europe, while at 0900 the previous day, SM3BNU heard DL0PR for about 1½ minutes possibly via E's.

It is proposed to develop an E's warning net in an attempt to enable more amateurs to participate in this interesting and rewarding type of propagation. However, it is stressed that those in the system will be expected to file reports giving full details of times, stations heard, as well as worked, QTH locators, etc. All reports received by G3FPK will be forwarded to the RSGB Scientific Studies Committee. Eventually, when enough data has been received on each E's event, Serge Canivenc, F8SH, the IARU Region 1 VHF E's
Coordinator, will produce a report for the CCIR in Geneva.

Would any readers interested please write to Ian White, G3SEK, at 83 Portway, Didcot, Oxon., OX11 0BA, giving full details of their monitoring facilities on VHF—e.g. bands covered, in addition to amateur, from 45 MHz up—aerial and receiver details and home and work telephone numbers. Ian will then try to evolve some kind of warning system. It is proposed to use it also for auroral warnings.

**Beacon Information**

The frequency of the 6m. band VHF beacon ZS6PW in Pretoria, mentioned last month, is 50-029 MHz. Permission has been given for a 50 MHz beacon in Cyprus, 5B4CY. As this is being edited, it is not certain if the QRG will be 50-08 or 50-5 MHz, however it is already to go and will beam toward the U.K. The licence for the 70 cm. Crowborough beacon, GB3WHA, on 432-81 MHz has been issued and it could be in operation by the time this appears. Reception reports to G4BOO (QTHR).

**DX-Pedition Calendar**

The G8MME/PE1AVU trip to the Shetlands is scheduled to commence on June 4 for 12 days. (See page 23 in the March issue and page 108 in the April edition). The GM3JFG and G8AGU trip to Barra from June 6 to 9 is imminent—see page 156, May. From June 11 for 10 days, Gordon Meddings, G4DGM, and Tony Fegen, VE3BUL/GW3TFF, will be operating mobile and portable in the northeast and southwest of Scotland. They will be QRV on 144-245 and 432-245 MHz with 80 watts output on each band, SSB.

From June 28 to July 26, OZ3TZ and OZ71F are reported to be going to the Faroe Islands, one object being to install 2m. and 70 cm. beacons. John Givens, GM3YOR, has sent details of the proposed Faroes and Iceland trip covering all bands from 160m. through 70 cm. if allowed. The party comprises GM3YOR, GM3OLK, GM8NCM, G4DSE, G4DXC and possibly G8HDR. The dates are:—July 18-21, OY and July 23—August 5, TF. On VHF the call GM8NCM/OY and -/TF will be used. When your scribe spoke to Alistair, no licences has been received but he did not foresee any problems. The CW frequencies would be 70-072, 144-012 and 432-012 MHz and the SSB ones, 70-236, 144-236 and 432-236 MHz. No skeds are being accepted except for MS on 144-175 MHz SSB, now pretty well fully booked.

From July 25 for two weeks, Jon Dougherty, G4FUT, will be on holiday in Luxembourg. He plans to be on 144-38 MHz SSB/CW from about 2000 onwards but it is basically a touring holiday. Dave Storrs, G8GXP, will be on holiday in Cornwall in the last week of July and first week of August with gear for 2m. and 70 cm. A one day trip to the Scillies is planned.

**Moonbounce**

In the first leg of the ARRL E-M-E Contest, Ian White, G3SEK, had a QSO with K1WH on April 15. His aerial system is on a polar mount which is a great advantage. Doug Parker, G4DZU, has his 56-ele. array fully az-el controlled now and remarks how the general urban noise diminishes when he points it skywards. Dave Price, GW4CQT, has concluded E-M-E contacts with W6PO, W7FN, K1WH and SM7BAE. All the above on 2m.

**Satellite News**

Many Oscar 8 users are complaining about the weak downlink signals, particularly on Mode "J" and it does seem that a good receiving set-up with low noise pre-amp. and a gainy, well-aimed aerial system is required. The main point to emphasise is that on no account should lots of power be used in an attempt to hear your own signal due to deficiencies in the Rx system.

AMSAT has decreed Mondays to be QRP days on O-8 and this would indicate 8-10 watts e.r.p. for Mode "A" and about one watt e.r.p. for Mode "J."

O-7 is reported to have been switched into Mode "A" by pulsed transmissions from a commercial station in Norfolk, operating in the 70 cm. band. Naturally this caused a lot of indignation but it must be remembered that this band is allocated to amateurs on a secondary basis on the understanding that we do not interfere with other services. Nevertheless, it does seem rather provocative that the Home Office allocated frequencies in the most used part of the band. These transmissions have now ceased but will reappear in the autumn from another part of the U.K. for a few days.

New stations on the satellites include A9XBC on 29-43 MHz and H18XRM on 29-44 MHz while UA1ABS, UC2ABB, UC2ABN and UG6AD have been heard on Mode "B."

**Meteor Scatter**

Chris Bartram, G4DGU, welcomes the idea that a list of MS operators’
QRG's be published and advises that he uses 144-117 MHz. Clive Morton, G4CMV (Leeds), complains that the Lyrids shower of April 21-23 was a non-event with reflexions little better than sporadic meteors, a point echoed by many on the DUBUS net the following weekend. However, he managed QSO's with SM2CKR (KX12g) and DJ5MS (G11se) on CW on the 22nd. The best reflexion from DJ5MS lasted 15 seconds but most were weak and less than two seconds duration.

Alistair Simpson, GM8NCM (Fife), uses 144-175 MHz for his SSB MS operation and worked DM2BYE (HM53a) on the 22nd April, via 11 bursts and 23 pings. He received 21 bursts and 50 pings from F6FHP (AE21g) but the Frenchman seemed to have QRM on his end so no QSO was made. Clive Penna, G3POI (Downe), has added four more squares by MS thanks to F1ANY (BD), YU2RGO (HF), YU1NOK (JF) and SM5BEI (JU).

Auroras Galore

In case anyone is in any doubt, although the peak of sunspot cycle no. 21 is not expected for a couple of years yet, the Sun is very active present, one result being an abundance of auroral events. George Szymanski, GM4COK, reports these on April 3, 4, 5, 11, 12, 13, 14, 22, 23, 24 and 27. His letter was dated the 28th and there were events on the 30th and on May 1, 2, 3 and 4.

Thanks to Charlie Newton, G2FKZ, here is a potted history of what happened at the end of April. On April 28 at 1330 GMT a major solar noise storm erupted lasting 25 minutes at 136 MHz and 82 mins. at 95 MHz. The solar flux reached 197, an all-time high for cycle no. 21. (N.B. The highest figures for the maxima of cycles 20, 19 and 18 were 165, 245 and 190 respectively).

The immense solar flare which caused this erupted from a sunspot group of area 1,200 millionths, the largest for ten years, at 22°E and 41°E, at 1308 GMT. It lasted for 106 minutes and the intensity was 2400 flux units. This was a category “10” flare and caused an immediate sudden ionospheric disturbance which blacked out all HF bands communications for a couple of hours. A secondary “10” flare of 150 f.u.’s lasting six minutes was recorded at 2144.

Unfortunately over the weekend of April 29/30 no data were transmitted from Meudon. On May 1, 2, 3 and 4, the solar flux indices were 179, 180, 179 and 175 respectively. When the event started on the 28th, the sunspot count was 119 and on May 1-4, the numbers were 215, 247, 142 and 106 but it is worth pointing out that it is the solar flux level which is the most important parameter. Another parameter is the Ap figure, which is.

<table>
<thead>
<tr>
<th>QTH LOCATOR SQUARES TABLE</th>
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<tr>
<td>Station</td>
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<td>G3OR</td>
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Starting Date January 1, 1975. No satellite or repeater QSO’s. "Band of the Month": 70 cm.

Daily Equivalent Planetary Amplitude of magnetic activity. The Ap figure for the 28th was low, at 13, but the May 1-4 values were 50, 55, 33 and 50. Other laboratories have reported a category “10” flare at 1940 GMT on May 1 of 2860 f.u.’s and another at 0638 on the 2nd lasting six minutes.

So much for the solar event, now to what it meant to VHF/UHF operators. The first of the auroras was on the afternoon of April 30. Jon Dougherty, G4FUT (Sunder-
The first phase of the May 1 event appears to have started around 1328 GMT when G4FUT heard GB3LER aurorally. He worked PA, DL, DM before fade-out at 1415. GM8NCM managed a couple of Dutchmen. At G3FPK, GI, GM and GW stations were logged with the last weak GM disappearing at 1416.

The rig was switched off at 0250 GMT and the second phase but stayed the course until fade-out at 0250 GMT the next morning. Pick of his 33 QSO's were:-SP1AD (HN29), UR2ARB (MS70), SP2LU (HN61), SM5BEI (JU72), UR2RQT (MS80), RR2TEJ (NT72g), SM3FGL (IW26) and SM3AKW (IW30). He was called by OF1MG at 0130 but could not make it due to the tremendous QRM, however, Jon did work 13 countries in the 24 hours.

G4CMV missed phase 1 and did not get in on the act of phase 2 till 2345 GMT and stayed on till fade-out at 0235. At first, he was hearing only EI, GI and GM "locals," but things hotted up from 0100. Clive's best DX were:-OH1FA (LU42h), UR2RQT (MS80e) and SM0FLV (JT62h). He noticed that, towards the end of the event, QTF's affected the "quality" of the signals and beaming about 15° further east produced a much rougher note. Also the Doppler shift was about 500 Hz LF whereas in most other auroras, Clive has noticed a 1-2 kHz HF shift.

At G3FPK, the second phase was in progress when the rig was switched on at 2130 GMT for a sked. GB3CTC (XK64a) was 41a at 2200 and GB3G1 (XO41j) was very strong all the time, EI, GI and GM were worked but no real DX was copiable in London up to 0030 when your scribe threw in the towel.

The best of the series was the widespread event of May 3/4. GM4COK is reported to have been on from 1400 to 0500 with a two hour break sometime, and George worked 19 countries. Coming just at deadline time, few written accounts have arrived. Using just 40 watts output to a 10-ele. yagi, Ray Elliott, G4ERX (Essex), worked into YP, YQ, YR and ZO squares between 1700 and 1830. He was on from 2215 till 0245 also and his best DX on CW included:-SM5EKQ (HS48d), LA3WU (CU47d), SM5FND (HT80g) and SM4FXR (HT57g). QTF's throughout were between 0° and 15° until the end when it swung around to 30°.

At G3FPK, the affair was in progress when the gear was switched on at 1600 but only GM, PA and G were heard. The event was still going on at switch-off at 1747. The second phase produced SM and LA contacts interesting one being SM4EBI (GT24g) only workable at 345° when all others were best at 15°. The rig was switched off at 0045 so all the Russian DX was missed. Keith Naylor (Essex), using the call G4FUF on CW, mentioned working UA3DCR (OQ),
UK2BAB (MO), UR2RQT (MS), UR2RDR (KS), UQ2QL (KQ) and OH0’s JN, AZV and AAZ in JU square between 0100 and 0300 GMT.

Another operator running only 40 watts output, "... from an ancient Europa..." is G4FUT whose best DX includes:—UR2RQT, OH1FA (LU42h), UR2RGM (MS47e) and OH2LX (NU04b). Jon’s aerial is a 6-ele. Quad.

The events were not confined to 2m. and on 4m., DK2ZF heard G3SPJ and G13RXE. Angus McKenzie, G30SS (London), worked G3LDR (Tynie & Wear), G13TLT (Co. Down) and GM3JDX in Edinburgh. Your reports on these mammoth auroras would be appreciated for next month.

The aurora of April 4 produced LA’s in CS, CT, CU and FT for G4CMV, plus SM3DCX (IV63b) and SM5BEI (JU72c) on 2m. CW. Richard Diamond, operating as GM4CVI from Aberdeen, worked 41 stations in 9 countries and 26 squares on CW in the April 11/12 affair between 2320 and 0215, the best DX being OH5LK in NU. This one went on till about 0600.

The event on April 11 was very good and GM3COK (YP04b) also worked the OH5 plus OH3TH and OH1FA. George also mentions a good aurora on the 24th from 2345-0315 GMT but with very few stations participating. All the U.K. beacons plus DL0PR and SK4MPI were Ar. He only worked four stations including UR2RIC (LS03g) and OH2CX (MU65c).

Twenty-three Centimetres

Steven Ruff, G18EWM (Co. Antrim), did not hear a single station during the April 1 contest. G8FUF has completed his 23 cm. transverter to the DF8QK design in VHF Communications for 4/1977, using the local oscillator output of 1 mW at 1268 MHz from a Microwave Modules converter. Present set-up is producing one watt output with a 10 watts amplifier to follow.

John Tindle, G3JXN (London), found conditions in the contest of May 6/7, "... very average..." with the Isle of Wight his best DX. P. B. Moss, G8OGD (Nottingham), disagrees with the idea of 2m. SSB repeaters but suggests that just one on 1296 MHz might create more activity.

Seventy Centimetres

GM4COK promises to be QRV soon on 70 cm. with 10 watts to a pair of 48-ele. Multibeams. In the May 6/7 contest, G3JXN’s transverter blew up! G18EWM is QRV Wednesday evenings on 432-2 MHz looking for contacts. He only worked four stations in the contest on April 2 and blames the Belle Vue show for the lack of activity in the northwest.

Two Metres

Dr. David Hutchinson, GI4FUM, moved to Lisburn (Co. Antrim) on Dec. 29 last and lists 106 different GI’s worked on 2m. since then—98 of them on FM! He uses an Icom IC-202 SSB transceiver and has a 10-ele. Yagi to put up sometime. A 35 watts amplifier is available. G4FUT mentions a very nice temperature inversion in the early afternoon of April 19 along the northeast coast which brought in GB3LER at S9-plus-40 dB. He writes:—"Unfortunately all the GM’s appeared to be playing with the new Aberdeen repeater and no contacts were made." Bob Mackean, G8LYH (Liverpool), mentions the lack of GI’s and wonders why they do not point their beams across the water.

Conditions for the CW contest on April 23 were rather dismal. The leading stations appear to be G3POI with 780 points from 66 QSO’s, G3IMV 615 (94), G3SPJ/P 521 (69) and G3BDQ 519 (72). Colin Wooff, G3SPJ (London), used a “barefoot” IC-202 from YO78d his aerial straddling the Lancs./N. Yorks. border.

Deadlines

Another exciting month over and several items had to be omitted. The absolute deadline for the July issue is June 8 and for the August edition, July 6. Everything to:—"VHF Bands,” SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts., AL6 9EQ. 73 de G3FPK.

PHOTOGRAPHS ALWAYS WANTED

Readers are reminded that we are always glad to have good photographs of Amateur Radio interest for general illustration in SHORT WAVE MAGAZINE. Though colour prints can sometimes be satisfactorily reproduced black-and-white, we much prefer the latter in the original. Except that we cannot conveniently make use of photographs that are either very small or very large, size is not of great importance as this is in any case determined to our requirements in the block-making process. What is important is that the picture should be clear and sharp with fully descriptive notes—and this description should not be written on the back of the print itself, but on a separate piece of paper lightly attached to the photograph. Payment is made for all pictures used, immediately on publication.

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<td>RFC/M</td>
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**USE (Tx or Rx) FREQUENCY**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Output Frequency</th>
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<tbody>
<tr>
<td>45450/514</td>
<td>45.200/R7T</td>
</tr>
<tr>
<td>45175/R7T</td>
<td>45.175/R7T</td>
</tr>
<tr>
<td>45450/R2T</td>
<td>45.450/R2T</td>
</tr>
<tr>
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<td>45.400/516</td>
</tr>
<tr>
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<td>45.475/523</td>
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<td>45.475/542</td>
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<tr>
<td>45400/542</td>
<td>45.400/542</td>
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</tbody>
</table>

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