The NRD 515 is a PLL-synthesised communications receiver of the highest class featuring advanced radio technology combined with the latest digital techniques. The new NRD 515 is full of performance advantages including general coverage, all modes of operation, PLL digital VFO for digital tuning, 24-channel frequency memory (option), direct mixing, pass-band tuning, etc. JRC’s 65 years of radio communications experience will give you “the world at your fingertips”. The NRD 515 is but a single item from the JRC product range which extends all the way to full marine radio installations for supertankers.

NRD 515 HF RECEIVER £1090.20 inc VAT
LOWE ELECTRONICS Ltd.
CHESTERFIELD ROAD,
MATLOCK,
DEERBYSHIRE DE4 5LE.
TEL. 0629 2817/2430

<table>
<thead>
<tr>
<th>Frequency Band (Hz)</th>
<th>Area</th>
<th>Services</th>
</tr>
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<tr>
<td>10-14 W.W.</td>
<td>(a) Fa.</td>
<td>R. Nav.</td>
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<tr>
<td>90-110 W.W.</td>
<td>(c) R. Nav.</td>
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<td>2,000-2,045</td>
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<td>Aer. Mob.</td>
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<td>2,005-2,045</td>
<td>(b) M. Mob.</td>
<td>Aer. Mob.</td>
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<td>2,045-2,050</td>
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<tr>
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<td>(a) R.F.</td>
<td>(b) Aer. Mob.</td>
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<td>2,850-2,850</td>
<td>(c) M. R. Nav.</td>
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<tr>
<td>4,000-4,083</td>
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<tr>
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<td>(b) M. Mob.</td>
<td>Aer. Mob.</td>
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The NRD 515 is but a single item from the JRC product range which extends all the way to full marine radio installations for supertankers.
TRIO
pacesetter in amateur radio

**TS830S** £694.83 inc. VAT

The TS830S has every conceivable operating feature built in for full and lasting enjoyment of the HF bands. It combines VBT (variable band width tuning), IF shift and a IF notch filter as well as very sharp filters in the 455 kHz second IF.

**DFC230**
A digital frequency remote controller complete with up/down microphone and having four memories. Ideal for simpler mobile operation. Compatible with the TS830S, TS530S, TS130S and V and the TS120 series.

**R1000** £297.85 inc. VAT

Securicor Carriage £4.50

**TS530S** £534.98 inc. VAT. Securicor Carriage £4.50

The TS530S is an HF transceiver based on the reputation of the TS520 series. Included are of course the new bands, and of course the rig has both digital and analogue frequency readout.

**TS180S** £679.65 inc. VAT. PS30 £88.55

The TS180S is the super de luxe transistorized HF transceiver from Trio. Having so many features, memories, etc. Send for a leaflet, or ring for more details.

**TS130S** £525.09 inc. VAT

The TS130S is THE mobile 200 Watts PEP HF transceiver from Trio, again featuring the three new bands. Just the rig for mobile high power operation. Also available the TS130V, a 20 Watt PEP version.

HEAD OFFICE AND SERVICE CENTRE
Chesterfield Road, Matlock, Derbys. Tel. 0629 2817 or 2430.
Open Tuesday-Friday 9-5.30, Saturday 9-5.00. Closed for lunch 12.30-1.30.
For all that's best in ham radio, contact us at Matlock.
For full catalogues send 70p in stamps with your address. Mark enquiry SWM.
A familiar name, but a whole new receiver. Building on all the excellent features of the SRX-30, including the drift cancelling system covering 500 KHz to 30 MHz; the selectable sidebands and AM; the easy to use tuning system; we now introduce the all new SRX3OD which incorporates the suggestions made by our customers. Outstanding new features are:

- Extended coverage 200 KHz - 30 MHz.
- Digital readout in large green display units which give true unambiguous frequency information - even when you switch sidebands or use the clarifier.
- All new frequency synthesis using Plessey SL6 1641 double balanced modular ICs for a new high standard of performance.
- All new audio system which produces outstandingly good quality on the built in speaker, and is capable of driving external hi fi speaker units for even better sound.
- All new IF filters with optimum bandwidth for mode in use. Automatic filter selection from mode switch.

There is so much that is impressive about the SRX3OD that you have to see it and handle it to really appreciate the performance.

We predict that the SRX3OD will be a landmark in low cost, high performance SWL receivers. Just consider how much you should pay for a receiver covering 200 KHz - 30 MHz with accurate digital readout; high performance USB/LSB/AM with switched filters; drift cancelling frequency synthesis; built in mains supply and built in speaker; high quality construction and advanced design - and so much more.

Then look at our price for the SRX3OD and you will be even more impressed.

£195.00 inc VAT, Securicor carriage £4.50.

UL1000
£39.50 inc. VAT

The UL-1000 is a new concept receiving station accessories and will help any keen listener to improve the performance of his station, particularly in the difficult conditions existing in the medium wave band (500 KHz-1.6 MHz).

The UL-1000 is a self-contained variable gain, tuned pre-amplifier suitable for use with various aerial systems. A particular feature of the UL 1000 is the use of a high Q loop aerial for the 500 KHz-1.6 MHz band.

Carriage £2.00

There were shepherds abiding in the field, keeping watch over their flocks by night. And lo, the angel of the Lord came upon them, and the glory of the Lord shone about them, and they were sore afraid.

And the angel said unto them, “fear not, for behold I bring you good tidings of great joy, which shall be to all people. For unto you is born this day, in the city of David, a Saviour which is Christ the Lord”.

And suddenly there was with the angel a multitude of the heavenly host, praising God, and saying:

“Glory to God, glory to God in the highest, and peace on earth, goodwill towards men”.

LUKE 2 V 8 to 14

A PEACEFUL CHRISTMAS TO OUR FRIENDS.
### South Midlands Communications Limited

**SMC Service**

Free Finance on many items. Two year guarantee on Yaesu, Free Securicon on major Yaesu items. Access and Barclaycard over the telephone. Biggest Branch, Agent and Dealer network. Ably staffed, courteous, Service Department. "B Services" Securicon contract at £3.30! Biggest stocks of amateur equipment in UK. Twenty-two years of professional experience.

### SMC Guarantee

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

### SMC Free Finance

On regular priced items from: Yaesu, Ascot SMCHS, CDE, HyGain, Channel Master, Hansen, SMC, MFJ, KLM, Mirage and Hy Mound, on invoices over £100 SMC offers Free Finance! How is it done? Simple, pay 20%, split the balance equally over 6 months or pay 50% down and split the balance over a year. You pay no more than the cash price!

### Fox Tango One: The World Beater

#### Switching Regulated Supply

Extremely compact and light in weight, the switched mode power supply reduces substantially the space required to produce the operating voltages used in the FT-ONE. It is highly efficient, uniquely stable and offers superb reliability.

#### Elite Class Performance

In addition to the above and superb receiver filters, the FT-ONE is packed with subtle virtues. Rear panel jacks allow the use of both an external receiver and an independent receive antenna, when scanning, automatic halting on a received signal may be programmed, an optional Curtis 8044 keyer board is available and there is even a microphone squelch IAMGCI to reduce background noise pickup between words and sentences!

#### Gain/Intercept Optimized Receiver

Utilising up-conversion with a first IF of 73MHz, the FT-ONE RF amplifier stage uses push-pull power transistors configured to produce a typical output intercept of +40dBm. The first mixer is a diode ring module, then follows a low noise post amplifier, for optimum noise figure, with modern day intercept requirements. The result is a receiver with a typical two-tone dynamic range well in excess of 95dB (14MHz CW bandwidth). Additional gain tailoring is provided via a PIN diode attenuator controlled from the front panel.

#### Filter Ready for Competition

Three filter bandwidths are available for CW operation (two for FSK II), using optional 600Hz or 300Hz crystal filters. Filter insertion losses are equalized for constant IF gain. Both IF Shift and Variable Bandwidth are provided, and two CW filters may be cascaded, for competition-grade selectivity. For SSB work, the Variable Bandwidth feature eliminates the need for costly 1.5kHz filters, in addition, a high-performance audio peak and notch filter is standard equipment.

#### Expanded Operating Displays

Digital displays for the VFO frequency, memory channel, and RT offset are provided for quick frequency identification. The large front panel meter allows easy viewing of transceiver operating parameters, including final transistor collector current, input DC voltage, FM discriminator centre tuning, speech processor compression level, and forward/reflected relative power.

#### Non Options

Remember with your FT-ONE the noise blanker, speech processor and power supply are all built-in at no expensive options.

---

**SOUTH MIDLANDS COMMUNICATIONS LIMITED**

S.M. HOUSE, OSBORNE ROAD, TOTTON, SOUTHAMPTON, SO4 4DN, ENGLAND

Tel: Totton (0703) 867333, Telex: 477351 SMCOMM G, Telegram: "Aerial" Southampton

**SMC Agents OTHR**

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### Non Options

Remember with your FT-ONE the noise blanker, speech processor and power supply are all built-in at no expensive options.
**FT101ZD £635 inc. VAT @ 15%**

- 160-10 metres including new allocations.
- Variable IF bandwidth 2.4kHz down to 300Hz.
- 8 pole filters for razor edge selectivity.
- Selectable CW fixed bandwidth CW-W and CW-N.
- Semi-break in with sidetone for excellent CW.
- Digital plus analogue frequency displays.
- 61466 PA’s with 6dB of negative feedback.
- 180W PIP and -3dB 3rd order intermod.
- RF speech processor fitted — adjustable level.
- VOX built-in and adjustable from the front panel.
- Wide dynamic range for big signal handling.
- High usable sensitivity, for those weak ones.
- Selectable CW fixed bandwidth CW-W and CW-N.
- Semi-break in with sidetone for excellent CW.
- Digital plus analogue frequency displays.
- 61466 PA’s with 6dB of negative feedback.
- VOX built-in and adjustable from the front panel.
- Wide dynamic range for big signal handling.
- High usable sensitivity, for those weak ones.

**FT902DM £885 inc. VAT @ 15%**

- 160-10 metres including new allocations.
- Variable IF bandwidth 2.4kHz down to 300Hz.
- Audio Peak and independent notch controls.
- AM, FSK, USB, LSB, CW, FM, (TX and RX).
- Semi-break in, inbuilt Curtis IC Keyer.
- Digital plus analogue frequency displays.
- VOX built-in and adjustable from the front panel.
- Wide dynamic range for big signal handling.
- High usable sensitivity, for those weak ones.
- Selectable CW fixed bandwidth CW-W and CW-N.
- Semi-break in with sidetone for excellent CW.
- Digital plus analogue frequency displays.
- 61466 PA’s with 6dB of negative feedback.
- VOX built-in and adjustable from the front panel.
- Wide dynamic range for big signal handling.
- High usable sensitivity, for those weak ones.

**FT107M £725 inc. VAT @ 15%**

- 160-10 metres (including 10, 18, and 24MHz bands).
- Full broad band “no tune” power amplifier.
- 240W PIP, 75 per cent power output at 3:1 VSWR.
- 12 memory channels with clarifier on memory.
- Digital Memory Shift gives offset from memory.
- Up/down scanning control from microphone.
- Variable IF bandwidth — 16 poles of selectivity.
- Bandwidths: 6kHz*, 2.4kHz-300Hz, 600Hz-300Hz.
- Selectable CW “fixed” widths CW-W and CW-N.
- Tunable Audio Peak (AFP) and Notch filter.
- Diode ring mixer for very high Rx dynamic range.
- Noise blanker — front panel adjustable threshold.
- AGC; slow-fast-off switchable from the front panel.
- Attenuator 0-20dB, plus RF gain on front panel.
- RF speech processor fitted — front panel adjustable.
- Digital (100Hz) plus analogue frequency displays.
- Meter Reads: Vcc, Ic, ALC, Compression and SWR.
- Semi-break in with side tone. Vox built in.
- Choice of built-in or separate power supply units.

**FT707 £569 inc. VAT @ 15%**

- 80-10 metres (including 10, 18 and 24MHz bands).
- USB-LSB-CW-W-FSK-AM multi-mode.
- 100W PEP, 50% power output at 3:1 VSWR.
- Full “broad band” no tune output stage.
- Excellent Rx dynamic range, power transistor buffers.
- Rx Schottky diode ring mixer module.
- Local oscillator with ultra-low noise floor.
- Variable IF bandwidth — 16 crystal poles.
- Bandwidths: 6kHz*, 2.4kHz-300Hz, 600Hz-300Hz.
- AGC; slow-fast off switchable from the front panel.
- VOX built-in and adjustable from the front panel.
- Semi-break in with side tone for excellent CW.
- Digital (100Hz) plus analogue frequency display.
- LED Level meter reads: S, PO and ALC.
- Convenient concentric AF/FR gain controls.
- Indicators for: calibrator, fix/int/ext VFO.
- Receiver offset tuning (RIT-clarifier) control.
- Advanced noise blanker with local loop AGC.
- 29kHz crystal calibrator feature.
- Internal, xtal or external VFO control.

*Option.
**FT720RV** £245 inc. VAT @ 15% & SECURICOR

FT720 Control Head

* Four easy write-in memory channels
* Rx priority channel (auto check)
* Scanning band/memory empty/busy
* Up/down tuning/scanning from mic.
* Optically coupled tuning control
* Manual and automatic tone burst
* String LED's for 'S' and PO's status LEDs
* 1½ W of audio to internal/external speaker
* 3.3 (4.3") D x 6" W x 2 (2.2)" H

* FT720RV 10W, deck.
* FT720RVH 25W, deck

* 144-146MHz (144-145MHz possible)
* 12½ kHz synthesizer steps, 900kHz shift
* 0.5µV for 20:1B quieting
* Rx 0.5A, Tx 4.5A
* 5.8 (6.5") D x 6" W x 2 (2.2)" H

* 430-434MHz
* 25kHz synthesizer steps, 1.6MHz shift
* 0.5µV for 20dB quieting
* Rx 0.5A, Tx 4.5A
* 5.8 (6.5") D x 6" W x 2 (2.2)" H

* FT720RU 10W, 70cm.

--

**FT290R** £249 inc. VAT @ 15% & SECURICOR

* 144-146MHz (144-145 possible)
* Multimode USB, LSB, FM, CW
* 2.5W PEP. 2.5W RMS/300m W
* LED's, 'ON AIR', 'BUSY'
* Moving coil meter for S and PO
* Integral telescopic antenna
* Width 2.4kHz & 14kHz @ 6dB
* Optically coupled main tuning
* 100Hz backlight LCD display
* 10 memory channels
* 'Five year' memory backup
* FM: 25kHz and 12kHz steps
* SSB: 1kHz and 100kHz steps
* Any TX/RX split with dual VFO's
* ±600kHz split, 1,750kHz burst
* Mobile bracket available
* Matching 10W linear Amplifier
* Up/down tuning from mic.
* AF output 1W @ 10% THD
* 50Hz x 150(W) x 195(D) (1.3kg)
* Rx 0.70mA, TX 800mA (FM max)

* 8°C "Nicads or Drys Internal
* 5.8 15.2V DC External
* Pushbutton band change
* Scan on memory (±10kHz)
* Long battery life SMC 2.2A/Hr

--

**FT480R (2m) FT780R (70cm.)**

* USB-LSB-CW-FM (A3, A1, F3).
* Bandpass filter no tune design.
* Bandwidth 2.4kHz and 14kHz at - 6dB.
* Semi break in with side tone.
* Very bright blue 100Hz digital display.
* Display shows Tx & Rx freq (inc RIT).
* String LED display for 'S' and PO.
* Digital receiver offset tuning.
* Advanced effective noise blanker.
* Memory scanning with slot display.
* Up/down scanning from mic.
* Priority channel on any memory slot.
* Satellite mode allows tuning on Rx.
* Scanning for busy or clear channels.
* Size (Case): 8.3" D, 2.3" H, 6.9" W.
* LED's; 'On Air' Clar, Hi/Low, FM mod.
* Matching PP80 Mains PSU available.

**FT480R** £379 inc. VAT @ 15% & SECURICOR

* 144-146MHz (143.5-148.5 MHz possible).
* Excellent dynamic range sensitivity.
* FM: 25, 12½, 1kHz steps.
* SSB: 1,000, 100, 10Hz steps.
* Any TX/RX split with dual VFO's.
* ±600kHz standard repeater split.
* Four easy write-in memory channels.

**FT80R** £449 inc. VAT @ 15% & SECURICOR

* NMOS four bit micro control.
* 430-434MHz (440-445 possible).
* GaAs Fet RF for incredible sensitivity.
* FM: 100kHz, 25kHz, 1kHz, steps.
* SSB: 1,000, 100, 10Hz steps.
* Repeater access by use of dual VFO's.
* Four easy write-in memory channels.

---

1.6MHz shift now available
**FT208R(2m) FT708R(70cm).**

- 4 bit CPU chip frequency control
- Keyboard entry of frequencies/splits
- LCD digital display with backlight
- Ten channels of memory
- Memory back up five-year lifetime cell
- Up-down manual tuning
- Manual or auto scan for busy/clear
- Priority channel with search back
- Memory scanning feature
- Scan between any two frequencies
- Auto scan restart
- Quick change NiCad pack
- 1.75kHz tone burst
- Built in condenser microphone
- 500mW AF to int/ext speaker
- External speaker/mic available
- Keyboard offers 16 tone DTMF
- 16kHz x 81kHz x 39kHz
- C/w NiCad pack, helical

**FT708R £219 inc. VAT @ 15% & POSTAGE**

- 430 440MHz (440 450 option)
- 25kHz synthesizer steps
- Any split + or - programmable
- ±7.6MHz EU split standard
- Any split + or - programmable
- 12.5/25kHz synthesiser steps
- 144-148MHz (144-148 possible)
- 12.5/25kHz synthesiser steps
- Any split + or - programmable
- ±60kHz repeater split
- 2.5 or 0.25MHz RF output
- 20mA square 150mA max AF
- Tx: 20mA square 150mA max AF
- 0.25V for 12dB SINAD
- Dual conversion 16.9kHz and 45kHz

**FT708R £209 inc. VAT @ 15%**

- 430 440MHz (440 450 option)
- 25kHz synthesizer steps
- Any split + or - programmable
- ±7.6MHz EU split standard
- Any split + or - programmable
- 12.5/25kHz synthesiser steps
- 144-148MHz (144-148 possible)
- 12.5/25kHz synthesiser steps
- Any split + or - programmable
- ±60kHz repeater split
- 2.5 or 0.25MHz RF output
- 20mA square 150mA max AF
- Tx: 20mA square 150mA max AF
- 0.25V for 12dB SINAD
- Dual conversion 16.9kHz and 45kHz

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**SOUTH MIDLANDS COMMUNICATIONS LIMITED**

S.M. HOUSE, OSBORNE ROAD, TOTTON, SOUTHAMPTON, SO4 4DN, ENGLAND

Tel: Totton (0703) 867333, Telex: 477351 SMCOMM G, Telegram: “Aerial” Southampton
**FDK 750E TRANSCEIVER**

- 2M FM-SSB-CW
- 1/10 Watts
- All modes
- Digital readout
- 144-146MHz
- Tone burst
- RF gain control
- Dual FVO
- Up/down Mic
- Hardware kit

£289 (carriage free)

SAE FOR COLOUR LEAFLET

**AZDEN DESK MIC**

The new Azden DX-345 desk mic is purpose made for ham radio by one of Japan's foremost audio engineering companies. With its heavy die cast metal casing, built-in variable compressor and 500-50k ohm o/p, it matches any transceiver. Our ridiculously low price makes it a must. Available January

£29.00

**AZDEN 2M TRANSCEIVER UNBEATABLE PRICE**

£219 (carriage free)

SAE FOR COLOUR LEAFLET

**WE CAN SUPPLY ALMOST ANY AMATEUR RADIO PRODUCT**

**WE HAVE SOME VERY ATTRACTIVE PRICES**

**WE HAVE FULL SERVICE FACILITIES**

**WE ARE THE PEOPLE MOST PEOPLE COME TO!**
**C.B. ANNOUNCEMENT**

By the time you read this, C.B. should be legal. As one of the country’s largest communications outlets, we shall be selling only legal sets. And it won’t be rubbish! We’ve been pretty selective in our ordering so you’ll only find certain brands on our shelves. We are specialists and we have our name to protect! Get in touch with us and we will advise you on the best value for money.

**TUNE INTO THE WORLD... FROM YOUR ARMCHAIR!**

**FRG7700 £319**

Here’s a complete monitoring system that builds up into a comprehensive listening system for a wide variety of transmissions. Both locally and from the other side of the world. As communications engineers, we know there is good equipment and poor equipment. We rate the FRG7700 very highly. It forms the main unit of the system and provides one of the most cost effective ways of listening to the entire shortwave band. Listen to all the world news direct as it comes in from stations stretching round the globe. International family requests from Australia and New Zealand; sport from America; topical news comment from Russia and China. If you’re interested in Amateur Radio then the SSB facility lets you listen in on conversations with amateurs from places far and near. Hear a mobile operator motoring through the traffic in Manchester or going home from work in Perth, Australia. Listen to expeditions in Africa or the Antarctic. It’s all possible and the more skilled the operator, the more interesting it becomes. The possibilities are endless, skip to short radio, aircraft on the Atlantic, tactical reports on the ground from African. Military communication network. HAM radio frequency allocations, local airport. The unit is completely portable, running off self-contained batteries.

**YAESU’S SSB/FM PORTABLE**

**FT290R**

**£249 inc. VAT.**

Here’s the new all mode portable from Yaesu 2m FM/SSB/CW in a hand held unit! We’ve got large stocks in all models and we are specialists in our ordering so you’ll only find certain brands on our shelves. We have a large knowledge of electrical equipment and poor equipment. We rate the FRG7700 very highly. It forms the main unit of the system and provides one of the most cost effective ways of listening to the entire shortwave band. Listen to all the world news direct as it comes in from stations stretching round the globe. International family requests from Australia and New Zealand; sport from America; topical news comment from Russia and China. If you’re interested in Amateur Radio then the SSB facility lets you listen in on conversations with amateurs from places far and near. Hear a mobile operator motoring through the traffic in Manchester or going home from work in Perth, Australia. Listen to expeditions in Africa or the Antarctic. It’s all possible and the more skilled the operator, the more interesting it becomes. The possibilities are endless, skip to short radio, aircraft on the Atlantic, tactical reports on the ground from African. Military communication network. HAM radio frequency allocations, local airport. The unit is completely portable, running off self-contained batteries.

**MAIL ORDER SLIP**

**To:** Waters & Stanton Electronics, Warren House, Main Road, Hockley, Essex.

**Name**  

**Address**  

**Goods required**  

**Prices start around £70**

**Please rush me the above. Cheque enclosed for £**

**Please charge to credit card No**

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**PROFESSIONAL AIRCRAFT MONITOR**

**R517 £49.50 (as supplied to pilots, ground crew etc.)**

The R517 is a professional aircraft monitor, receiver, having superb sensitivity and capable of tuning across the entire aircraft band 118-134MHz. For easy tuning there is both a coarse and fine tuning control. In addition there is a 3 position switch for selecting xtal controlled channels (extras £3.00 extra) for your local airport. The unit is completely portable, running off self-contained batteries.

**TUNE INTO THE WORLD... FROM YOUR ARMCHAIR!**

**FRG7700 £319**

Here’s a complete monitoring system that builds up into a comprehensive listening system for a wide variety of transmissions. Both locally and from the other side of the world. As communications engineers, we know there is good equipment and poor equipment. We rate the FRG7700 very highly. It forms the main unit of the system and provides one of the most cost effective ways of listening to the entire shortwave band. Listen to all the world news direct as it comes in from stations stretching round the globe. International family requests from Australia and New Zealand; sport from America; topical news comment from Russia and China. If you’re interested in Amateur Radio then the SSB facility lets you listen in on conversations with amateurs from places far and near. Hear a mobile operator motoring through the traffic in Manchester or going home from work in Perth, Australia. Listen to expeditions in Africa or the Antarctic. It’s all possible and the more skilled the operator, the more interesting it becomes. The possibilities are endless, skip to short radio, aircraft on the Atlantic, tactical reports on the ground from African. Military communication network. HAM radio frequency allocations, local airport. The unit is completely portable, running off self-contained batteries.

**YAESU’S SSB/FM PORTABLE**

**FT290R**

**£249 inc. VAT.**

Here’s the new all mode portable from Yaesu 2m FM/SSB/CW in a hand held unit! We’ve got large stocks in all models and we are specialists in our ordering so you’ll only find certain brands on our shelves. We have a large knowledge of electrical equipment and poor equipment. We rate the FRG7700 very highly. It forms the main unit of the system and provides one of the most cost effective ways of listening to the entire shortwave band. Listen to all the world news direct as it comes in from stations stretching round the globe. International family requests from Australia and New Zealand; sport from America; topical news comment from Russia and China. If you’re interested in Amateur Radio then the SSB facility lets you listen in on conversations with amateurs from places far and near. Hear a mobile operator motoring through the traffic in Manchester or going home from work in Perth, Australia. Listen to expeditions in Africa or the Antarctic. It’s all possible and the more skilled the operator, the more interesting it becomes. The possibilities are endless, skip to short radio, aircraft on the Atlantic, tactical reports on the ground from African. Military communication network. HAM radio frequency allocations, local airport. The unit is completely portable, running off self-contained batteries.
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YAESU MUSEN

FT-101ZD Mk III

YAESU's FT-101ZD with FM is the most popular HF rig on the market thanks to its very comprehensive specification and competitive price. Incorporates notch filter, audio peak filter, variable IF bandwidth plus many other features.

FT-480R High technology all-mode 2 metre mobile

The most advanced 2 metre mobile available today - USB, LSB, FM, CW full scanning with priority channel, 4 memory channel, dual synthesized VFO system

FT-707 All solid-state HF mobile transceiver

The definitive HF mobile rig, digital, variable IF bandwidth, 100 watts PEP SSB, AM, CW (pictured here with 12 channel memory VFO). Latest bands

FRG-7 General coverage receiver

The set with the world-wide reputation YAESU's famous FRG-7 out-performs many a more expensive set. Rugged and reliable, it features high sensitivity and Wadley loop stability - a delight to use for the established amateur and new SWL alike

FRG-7700 High performance communications receiver

YAESU's top of the range receiver. All mode capability. USB, LSB, CW, AM and FM. 12 memory channels with back-up. Digital quartz clock feature with timer. Pictured here with matching FRT-7700 Antenna tuner and FRV-7700 VHF converter.

Sincere CHRISTMAS GREETINGS from all at Amateur Electronics

For full details of these new and exciting models, send today for the latest YAESU PRICE LIST and LEAFLETS. All you need to do to obtain the latest information about these exciting developments from the world's No. 1 manufacturer of amateur radio equipment is to send 36p in stamps and as an added bonus you will get our credit voucher value £3.60 - a 10 to 1 winning offer.
**FT-ONE SUPER HF TRANSCEIVER**

This is the latest and most exotic product from YAESU's superb design team. The new FT-ONE provides continuous RX coverage of 150 KHz - 30 MHz plus all nine amateur bands (160 thru 10m).

- All mode operation: LSB, USB, CW, FSK, AM, FM
- 10 VFO system
- FULL break-in on CW
- Audio peak filter
- Notch filter
- Variable bandwidth and IF shift
- Keyboard scanning and entry
- RX dynamic range over 95 dB!
- and NO band switch!!!

---

**FT-708R and FT-208R**

The new FT-708R and FT-208R provide new dimensions in operating flexibility for the discerning 70 cm and 2m operator. LCD display, 10 memories, memory and bandscan, priority function, internal lithium battery back-up. RF output FT-708R, 200 mW low, 1 watt high. FT-208R, 300 mW low, 2.5 watts high.

---

**WHERE TO FIND US**

Amateur Electronics UK
508-516 Alum Rock Road - Birmingham 8
Telephone: 021-327 1497 or 021-327 6313
Telex: 337045
Opening hours: 9.30 to 5.30 Tues. to Sat. continuous - CLOSED all day Monday.
The TS8100 is a compact lightweight 2 mtr FM transceiver, with an outstanding array of functions, FM1 for 25 KHz steps (for mobile use) FM2 for precise 100 KHz steps (for base station use). Microcomputer control giving many advanced features. Built in S-meter/memory, New type microprocessor with UP/DOWN switching, Built in high performance. N. Blanker. Side tone for CW.

TRIO TS8300 HF Transceiver £894.83
TRIO AT 210 All band Antenna Tuner/SWR £119.83
TRIO TS5000 HF Transceiver £534.98
SP200 Speaker £34.98
FD230 Digital remote control £179.98
RID0 Receiver £599.00
T3130 Solid State HF Transceiver £526.09
T5130 Solid State HF Transceiver £446.05
PS10 Power supply £78.95
PS10 Power supply £78.95
AT100 Antenna Tuner £78.95
T3122 2KW Linear Amplifier £324.91
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TR2300 Hand Held portable 2m £198.95
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TR7800 25 watt 2m FM Transceiver £284.91
TR7800 40 watt 2m Transceiver £314.87
TR1000 2m Multimode Transceiver £284.91
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TR9000 40cmFM Mobile Transceiver £334.88
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R7V Ref. VFO £138.00
M57 Speaker £29.40
RT Digital Receiver £394.88
Filters for TR7 £38.10
FM Antenna £22.75
MN7ATU/R Meter 250 Watts £124.20
MN80 ATU £230.00
DL 300 Dummy Load 30 Watts £21.00
DL 100 Dummy Load 1 KW £37.50
TV 3000 Low Patts Filter £18.40
AK75, Doublie Antenna 200 AWG £23.00

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TRIO R1000 £297.96
The latest general coverage from Trio. Frequency coverage 200 Hz to 2 MHz in 20 bands. Using an advanced PLL system. Full digital readout. Three filters 12 KHz for AM — 6 KHz narrow AM and 2.7 KHz SSB. Also incorporates a noise blanker. Operation from 100-240 V AC or 12 V DC.

TRIO R1000 Receiver £297.96
The latest general coverage from Trio. Frequency coverage 200 Hz to 2 MHz in 20 bands. Using an advanced PLL system. Full digital readout. Three filters 12 KHz for AM — 6 KHz narrow AM and 2.7 KHz SSB. Also incorporates a noise blanker. Operation from 100-240 V AC or 12 V DC.

TR9000 £694.83
The TR9000 is a compact lightweight 2 mtr FM USBL 5AC/4-BW Transceiver with an outstanding array of functions. FM1 for 25 KHz steps (for mobile use) FM2 for precise 100 KHz steps (for base station use). Microcomputer control giving many advanced features. Built in S-meter/memory, New type microprocessor with UP/DOWN switching, Built in high performance. N. Blanker. Side tone for CW.

TRIO TS8300 HF Transceiver £894.83
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TRIO TS5000 HF Transceiver £534.98
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FD230 Digital remote control £179.98
RID0 Receiver £599.00
T3130 Solid State HF Transceiver £526.09
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TR7800 40 watt 2m Transceiver £314.87
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RF Speech Clipper £75.95
D10 Morse Tutor £49.46
A02A0 Active Antenna £51.75
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Received antennas are the answer. They need no tuning yet have constant sensitivity from 200 kHz to well over 30 MHz.

Did you know that Model PC1 will extend the coverage of your SX 200 type antenna and you have a superb general coverage receiver. What better way to get high performance general coverage reception than with it fully reduced, you find you are reading code at the chosen speed. The all-CMOS equipment with a Schottky diode biased mixer with solid load frequency on circle of LED's. Connects to a国资 peak power were to increase by the overload and spurious signal sinks Experiments on conventional converters. It uses a 5040A quad transistors, combined with a linear amplifier, gives an excellent combination of low noise figure and strong signal handling capability. Its input and output gain controls also help you get the best out of all receivers. The all-CMOS design is highly reliable and versatile. The built-in preamplifier in the test receiver is a comprehensive general coverage communications receiver.

NEW PRODUCTS PREVIEW

Products not shown in this advertisement.

Model FL2: Direction finder attachment for FM VHF receivers/transceivers, gives directional readout on range of LED's. Connects to loudspeaker and antenna packs.

Model RFA: R.F. switched broadband preamplifier. Boosts gain and noise figure of receivers from 30 to 200 MHz.

VARIABLE SELECTIVITY FOR ANY RECEIVER

For sheer value for money, there is no better way to get high performance general coverage reception than with this compact and versatile unit. The all-CMOS equipment with a Schottky diode biased mixer with solid load frequency on circle of LED's. Connects to a国资 peak power were to increase by the overload and spurious signal sinks Experiments on conventional converters. It uses a 5040A quad transistors, combined with a linear amplifier, gives an excellent combination of low noise figure and strong signal handling capability. Its input and output gain controls also help you get the best out of all receivers. The all-CMOS design is highly reliable and versatile. The built-in preamplifier in the test receiver is a comprehensive general coverage communications receiver.

PRICE: All prices include delivery in U.K. Basic prices in £ are shown with VAT. Exclusive prices in brackets.

FL1 19.00 (21.40) VLF 25.00 (28.50) AD270 33.00 (37.95) MPU 6.00 (6.90)

FL2 18.00 (20.70) D70 24.00 (27.50) AD270 32.00 (36.95) MPU 5.00 (5.85)

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IC290E TWO METRE MULTIMODE MOBILE. 10W RF output on SSB, CW and FM. Standard and Non-Standard Repeater Shifts. 5 Memories and Priority Channel. Memory Scan and Band Scan, controlled at Front Panel or Microphone. Two VFO’s, Led S-Meter, 25KHz and 1KHz on FM — 1KHz and 100Hz Tuning Steps. Instant Rev-Repeat

IC25E 25W 2M FM MOBILE. Amazingly Small. Two VFO’s, Five Memories, Priority Channel, Full Duplex and Reverse, Led S-Meter, 25KHz or 5KHz Step Tuning, Same Multi-Scanning Functions as the 290 from Mic or Front Panel.

IC24G 10W 2M FM MOBILE. This is the Low-Cost, easy to use Economy Model. Full Band — 80 Channels at 25KHz Spacing by easy to use Press Button Switches. 12½KHz Spacing if required and the same Reliable Performance as the famous IC240. Price £169

IC202S/402 3W 2M or 70CM SSB PORTABLES. These Two have been around for a long time and are well proven. SSB, CW and Side-Tone. They come fitted with 144-144.4 (IC202S) and 432-432.4 (IC402). Battery or 12v operation. Built in Antenna or socket for External Antenna.

THE POPULAR IC2E HANDY TALKY — EVERYBODY HAS ONE!

CHECK THE FEATURES:
FULLY SYNTHESIZED — Covering 144-145.995 in 400 5kHz steps
POWER OUTPUT — 1.5W with the 9V rechargeable battery pack as supplied — but lower or higher output available with the optional 6v or 12v packs.
BNC ANTENNA OUTPUT SOCKET — 50 ohms for connecting to another antenna or use the Rubber Duck supplied.
SEND/BATTERY INDICATOR — Lights during transmit, but when battery power falls below 6V it doesn’t light indicating the need for a recharge.
FREQUENCY SELECTION — by thumbwheel switched, indicating the frequency.
+ 5kHz SWITCH — adds 5kHz to the indicated frequency.
DUPLEX SIMPLEX SWITCH — gives simplex or plus 600kHz or minus 600kHz Transmit.
HI-LOW SWITCH — reduces power output from 1.5W to 150mW reducing battery drain.
EXTERNAL MICROPHONE JACK — If you do not wish to use the built-in electret condenser mic an optional microphone/speaker with PTT control can be used. Useful for pocket operation.
EXTERNAL SPEAKER JACK — for speaker or earphone. This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

A full range of accessories in stock

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BP4 Empty Battery Case For, 6 x AA Cells £5.80
BP3 Standard Battery Pack £17.70
BP2 6 Volt Pack £22.00
BC30 Base Charger For Above £39.00
BC25 Mains Charger As Supplied £4.25
DC1 12 Volt Adapter Pack £8.40
HM9 Speaker/Microphone £12.00
CP1 Mobile Charging Lead £3.20
IC1/2/3Cases £3.60 each

All Prices include V.A.T.

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BUY DIRECT FROM US OR OUR AGENTS AND GET TWO FULL YEARS WARRANTY ON ALL EQUIPMENT

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IC720A 100W HF + GEN COVERAGE TRANSCiever. This is the Best Money can buy. AM, SSB, RTTY and CW. Built in Fan, Speech Processor, Two VFO’S and APC. Tuning Rates Down to 10Hz and memories. General coverage Receiver from 100KHz to 30MHz (Transmit too if you have a licence!). Run from 13V DC or use PS15 mains PSU. And to match the IC720A:—IC2KL 500W Output all Mode Linear Amplifier. Similar size and completely Automatic—No Tuning. ICAT500 Completely Automatic Antenna Tuner.

IC251E & IC451 2M and 70CM ALL MODE BASE STATIONS. Both well proven designs with twin VFO’S, Variable Tuning Rates and Power Output. Scanners and Memory Channels, Automatic Repeater with full Reverse, 144-146 or 430-440. 10W Output on FM, SSB and CW, Built in 12 and 240V supplies. None other like them.

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ALL TONO PRODUCTS NOW IN STOCK.

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<tr>
<td>7000 CW/RTTY/ASCII Terminal Tx/Rx</td>
<td>£699.00</td>
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<tr>
<td>350 CW/RTTY/ASCII Terminal Rx only</td>
<td>£259.00</td>
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<td>CRT120G VDU 12 inch Green Screen. Mains Power</td>
<td>£125.00</td>
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<tr>
<td>HC900 Intelligent Line Printer 4 Cases + 1</td>
<td>£590.00</td>
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<td>HC800 Line Printer Centronics</td>
<td>£449.00</td>
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<tr>
<td>SK7 Plus Adaptor for Printers</td>
<td>£8.50</td>
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<td>Preamps</td>
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<tr>
<td>RX-144 Mast Head Preamp for 2 Metres</td>
<td>£65.00</td>
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<tr>
<td>RX-430 Mast Head Preamp for 2 Metres</td>
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<td>SWR/Power</td>
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<td>ASW-180 1.8-160 MHz</td>
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<td>ASW-430 430MHz</td>
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<tr>
<td>2M-50W 40Watt Linear for 2 Metres</td>
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<td>2M-100W 90Watt Linear for 2 Metres</td>
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<td>MR-150W 10Watt Linear for 2 Metres</td>
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<td>MR250 10Watt Linear for 10Metres</td>
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<tr>
<td>UC70 50 Watt Linear for 7cms</td>
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TASCO TELEREADER

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<th>Product Description</th>
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<tbody>
<tr>
<td>CWR-688 CW/RTTY Terminal + VDU + Keyboard</td>
<td>£699.00</td>
</tr>
<tr>
<td>CWR-680 CW/RTTY Terminal. RX Only. No VDU.</td>
<td>£189.00</td>
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<tr>
<td>CWR-670. As above but Deluxe Model.</td>
<td>£259.00</td>
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SHORT WAVE MAGAZINE

(GB3SWM)

ISSN: 0037-4261

Vol. XXXIX DECEMBER, 1981 No. 458

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Published at 34 High Street, Welwyn, Herts. AL6 9EQ, on the last Friday of the month, dated the
month following.

Telephone: 04-3871 5206 & 5207

Annual Subscription:

Home: £8.40, 12 issues, post paid
Overseas: £8.40 ($17.00 U.S.), post paid surface mail

Editorial Address: Short Wave Magazine,
34 High Street, Welwyn, Herts. AL6 9EQ, England.

Prices shown in advertising in this issue do not necessarily constitute a contract and may be subject
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Articles submitted for Editorial consideration must be typed double-spaced with wide margins on
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Editorial

Re-Think Required?

The October amateur radio exhibitions have come and gone. Although both successful and well worth visiting, it does seem that perhaps some rationalisation should be considered for next year: two exhibitions so close together must have drawbacks from everyone's point of view, including the public's.

The impression we gained from our visit (our production schedules prevented us from mounting a stand at both shows) to the Granby Halls event, by far the smaller of the two, was of a well-organised affair. There was plenty of space between the stands — a pleasure for visitors — and it was even possible to get something to eat without joining an endless queue. Also, a considerable effort had been made to improve the notorious interior appearance of the building.

The new A.R.R.A. exhibition venue at Donington, though not perfect, was a great improvement in most respects. However, the idea of allowing the exhibition to spill-over into an unheated hall the best part of a mile away from the main centre, and then charging visitors to "bus" them to and fro, was not a happy one, and caused considerable annoyance to both stand-holders and visitors alike. Also, the arrangements for the disabled were non-existent — which was particularly sad in this International Year of the Disabled; indeed the lack of planning in this respect resulted in the RAIBC stand being tucked away in the remote hall which meant, to all intents and purposes, complete inaccessibility for the disabled.

But having said that, for our part it was enjoyable and, as always, a great pleasure to meet friends old and new at our stand; there really is nothing quite like the personal exchange.

Perhaps the strongest impression gained from the two exhibitions is the immense and increasing interest in amateur radio — and this can't be bad!

Increase

As a result of increases in many of our costs, regretfully we have to announce that the price of Short Wave Magazine will be 55p with effect from the January 1982 issue; direct subscription rate will be £8.40 (2nd class post). The new sub. rate takes into account increased postal charges due to come into force early in the New Year, but subscribers should note that, as always, we shall still be carrying part of the cost of posting the Magazine ourselves; current subscribers will not, of course, pay the new rate until their subscription falls due for renewal. Single copies, despatched from Welwyn by first-class post, will cost 80p.

Christmas

The Christmas holiday period means that the January issue will not be published until December 28th.

The staff of the Magazine would like to take this opportunity to wish all our readers and advertisers a very Happy Christmas and a Peaceful and Successful New Year.
COMMUNICATION and DX NEWS

E. P. Essery, G3KFE

Vale G2BVN

ROY Stevens, G2BVN, died on September 30, after a long illness. "Steve" devoted most of his life to Amateur Radio, and at that to the wider aspects of the hobby, as well as finding time to be a top DX operator. His views on many things were different to, say, the writer's, but having said that, we never doubted for one moment that his opinions were formed out of a one hundred-per-cent dedication to Amateur Radio, and that what he did at national and international level was entirely the result of his thought-out ideas.

Steve was, as his call indicates, one of the pre-war AA licensees and in September 1939 his training was to be put to use; he was one of the 'Early Birds' and so was in France by September 5; his return from that country was achieved one month after the Dunkirk beach had been cleared of the remnants of the British forces. Later in the war, he broke both legs in forced landing into the Western desert. In the post-war period he was well known in the councils of RSGB, of which he was President in 1966, and gradually in the wider, international sphere. It is sad to have to record that as he became an international figure, so the illness which finally incapacitated him took its hold, causing his retirement in 1978 from his job as a chief fire surveyor, and then forcing him into a wheel chair — but he was still working with his old vigour from that wheelchair right till the end. He will be missed in many places and many countries.

Top Band

We have mentioned once or twice that G4AKY is in the hunt for an Oceania QSO to complete his WAC from Harlow, after completing his first one from the previous QTH. Dave showed us some very interesting "graphs" he made, in which he plotted the sunrise and sunset paths in terms of date and time, for G (based on Greenwich) North ZL, and South ZL, the essential data being fairly easily obtainable. Plotting these three lots of data as three different-coloured "sine-waves" produces some interesting conclusions; for instance, one of the ZL points is in theory unworkable insofar as a path does not occur at any time during the year (albeit we think in good conditions it might be possible — not probable — for two or three minutes). Another interesting thing is that the curve for G can be adjusted for time quite easily by going westwards four minutes for one degree of longitude, or east by a similar amount, and this exercise brings out vividly the fact that the further west one goes the harder it becomes as the time-window decreases. All so theoretical, you may murmur. But, in fact, known G-ZL QSOs on Top Band can be shown to fit into the plot perfectly, although there aren't that many to play with. We are twisting the G4AKY arm for an article on all this 'ere long. Turning to Dave's October news, he seems to have been a bit down; on CW there are 14 countries, scattered around Europe, Asia and N. America, and 14 also on SSB, the best being EA9EU in Ceuta for an Africa contact and OH0BH for Aland. Among the gotaways, we were intrigued to see K1PBW on CW, and 4X4 on both CW and SSB.

That K1PBW signal is all the more surprising when we picked up the latest W1BB Bulletin, which makes no indication that Ernie had changed his mind about going QRT, so, one supposes, he may have a pirate on the band. Scanning the rest of the W1BB offering, we notice that January 1 next, the JAs have got an additional chunk of the band, between 1810 to 1825 kHz, but it is also noted that the licensing procedure is slow, so one should put a feeler out on their old allocation of 1907.5 to 1912.5 kHz. Another change is that between 1.8 and 1.9 MHz, the Ws are now permitted full power day and night. Stew reminds us that we should have noted earlier that G3CWI is on from VP8ANT from the beginning of November, for some 33 months, the spot being Rotmers Point, Adelaide Island, and the QSL route being by way of G3ZAY. Still with W1BB, he notes that GD4BEG has gone to a two element Yagi atop his vertical, which seems to be doing the trick after much trouble setting the beast up; and another trying Yagi beam is G3WXZ, who has a three-element one at 220 feet up, and plans to make it a six element job! On the other hand there is little doubt that a good "starter" aerial is an inverted-L arrangement of length around 165-175 feet total, going straight up from the ATU to about 25-40 feet and then horizontal-ish out to the end. The writer had one years ago like this and with a very poor earth it still performed well; we tuned it with a normal ATU, but W1BB makes the very fair point that all the thing needs is a variable capacitor in series with the aerial to co-ax inner, and a couple of radials or a ground mat to make the very best possible earthing conditions, to make quite a good first Top Band aerial system. It is a variation on the vertical monopole of course, but the extra length and horizontal top combine to make it a quieter receive aerial which is easier to match on transmit. Less than ideal, yes, but well worth giving a try.

G2HKU (Minster, Isle of Sheppey) has changed from an FT-101 to a new FT-101ZD Mk.III, and spent some time looking at the drift characteristics of the new and the old boxes, plus other measurements which seemed called for; but he did manage to find time for a SSB QSO with PA0PN, and another with G3ROO who was QRP — he of the "Tunbridge" transmitter-receiver currently being described in S.W.M.

Turning now to G3PKS (Wells), Jack seems to be having trouble with a recalcitrant rig — he puts it down to jealousy because he bought a shiny new Bencher paddle to replace the old two-nailfiles arrangement. However, there were some days on which the rig was working, and contacts made — but, not on Top Band!

Still with Top Band, we next come to remind you all of the ARRL Top Band CW contest, running from 2200 on December 4 to 1500z December 6. Notice this one doesn't have a class for DX-DX contacts, so for us it is largely a question of working W/VE stations to give them another country multiplier. One would have thought that ARRL would have brought the rules up to date and made the contest a world-wide one, to help boost activity. 5 points a QSO, and a multiplier of one for each ARRL section worked, DX countries and VE8; logs to be postmarked no later than January 5, and addressed to ARRL Communications Dept, 160 Contest, 225 Main Street, Newington, Conn. 06111.

80 & 40

Lumped together this month, since we have devoted so much to Top Band and other things. These are two bands where dedication most definitely has its reward; and in particular where careful thinking about the vital aerial can enable DX to be worked by people who are in sites normally considered impossible.

Down at the LF end of Eighty, where the dits and dahs live, one can often come across QRP stations; a look around 3.560 kHz is a good starter. If you are after the Big Fishes, then a look into the bottom five kHz of the band is sometimes fruitful if the
time is right. As to Forty, our 100 kHz segment is voluntarily planned to permit the bottom 40 kHz for CW, and Phone above; but it is noticeable how the SSB creeps ever further down into the CW territory.

G2HLU (Reading) found himself a new country on Forty, by way of SN0WRA, one morning when he felt driven to an early rising; it also did him a bit of good on 20, and yielded some Gs on 40 — that must have been early! On 3.5 MHz, there have been a few contacts written into the log, all down to the ON contest.

"CDXN" deadlines for the next three months —

January issue — December 3rd
February issue — December 31st
March issue — February 4th

Please be sure to note these dates

G2JN passes on the news that he worked G2OT/A, with G2UV driving the latter station; among the other points that arose was the RAOTA proposal that there should be a members CW net around 3520 kHz, at 1500z once a week. RAOTA member with views on such to pass 'em on to G2UV please. Another QSO was with G5NX/M on CW at Skipton, en route for Windermere, which became a three-way when G2BY in Ventnor I.o.W. chipped in to give a report to G5NX/M.

From G3IRM we have a note that the Tops CW contest is on December 5-6, from 1800 to 1800 GMT in the 3.5-3.6 MHz segment. Call CQ QMF, and gain points as follows: contacts with own country 1 point each, other countries in same continent 2 points, and with countries in a different continent 5 points, and contacts with the Hq stations GW8WJ or GW6AQ 25 points. W/A/K/N call areas each count as countries, as do those in VE/VO, VK, and Russia. Total the QSO points, and multiply by the number of prefixes worked. Each QSO counts as a serial number, to start at 001 as part of the serial number from 001 plus letters RS. Score points as

G4GMZ (Congleton) is a 7 MHz buff, and didn't stay far from it, as painting and decorating were stopped by early darkness and rain. A call to a weak PY1AJK proved to be, John says, the kiss of death, as the PY slipped slowly into the murk. An excellent CW QSO was with DK6CS who at 74 years old still puts out some beautiful Morse. For the rest there were several interesting QRP chaps around to be called and booked-in; something that is usually a pleasure both ends.

Talking of QRP, that was the G2HKU approach; on Eighty he mentions YU3DMU, G6AB, DJ3DE and G3ZWH/A on from Plymouth as all being worked with low-power, the last mentioned indeed being QRP both ways. D. Whitaker of Harrogate (he of those ten-metre tests when the sun was spotless) has been looking into 40 and 80 SSB mainly in the mornings. On Eighty we see KN6M, XE1AE, XE1OX, K6HN2/CT3, JX5VAA, and VP2EC all between 0500 and 0600; then in the next hour there was H18PPG, G1XV/S, G1XV/BB, JK16XX, HC1MD/3, HP3FL, LW8HL, FPOGAQ, VP2VGR, 9Y4VT, VP2KAA, 7X4MD, TF3YH, C6ADV, N6YK/VP2A, and J6LIR, plus another one which we couldn't construe. As for Forty, David is rather attached to the band, and so he winked out at 0500 on to 0600 HP1VXY, VE7EPA, HP3ML/1; from 0600-0700 T12CC, T12JIC, T2VEL, J73FW, J3BRG, FO8FG, CO2HT, KG4K4, VP2VGR, EL8H, COSY, CXSTU, ZD7HH, HP1XRR, 6W5WS, KG4DI, KL7U, KL7Y, VK9NS, T30BF, and between 0800 P41C4 and 43U6JN.

Later in the day, and back from work, ZS6AYM, SV I IT, 5N9ACO/8, FPOFLG, KL7U, KL7Y, VK9NS, T3OBF: and ZD7HH, HP1XRK, 6Y5WS, KG4DI, VP2VGR, 9Y4VT, VP2KAA, 7X4MD, TF3YH, C6ADV, N6YK/VP2A, and J6LIR just after. Then we guess the Whitaker shack was closed for an hour while the inner man was refreshed enough to locate 9K2DR at about 2000z.

Here & There

We've already mentioned the Tops CW contest and the ARRl 160 'test; and on a more local scene the Verulam affair was notified too late for inclusion.

That leaves us room to mention the WAB and HAB activities. This activity is based on some contesting and much award hunting, with the proceeds of the whole thing being given to RAIBC for the benefit of our blind and disabled comrades. To give a report to G5NX/M.

Back to contests-and-things. The R.A.F. club have their Christmas shindig on December 13, 1300z to 1700z; AM, FM, SSB, RTTY, CW, on 80 and 40 metres, and also VHF. Call QF QARARS Contest, and hand out RS(T) plus serial number from 001 plus letters RS; so the slow progress in BY towards Amateur Radio is still continuing. We wonder whether this has any bearing on the continued rumours of a ZA2HAM operation from Albania — if true, they will be on from December 4-14.

That San Felix DX-pedition seems to have been rather in the nature of a non-event; it seems that the easy part is getting the licence, the harder part by far being getting a permission to land and stay — the Chileans have political prisoners there, which may have some bearing.

Ten

We are rapidly coming to the end of our space and we've not even started on the HF bands yet! So, let's see what's what, through the eyes of G3NOF (Yeovil).

A change now from contests and awards, to the welcome news that VE7BC is noted both by Geoff Watts' DXNS, and TDBX, as having returned to China with some two-dozen crates of QSL cards; so the slow progress in BY towards Amateur Radio is still continuing. We wonder whether this has any bearing on the continued rumours of a ZA2HAM operation from Albania — if true, they will be on from December 4-14.

Now we have a letter from P. R. Short in Port Stanley Falklands, noting that South Sandwich Is are Crown property and that, therefore L1523 is not a legal prefix for that area; thus L1523 is a pirate. The point is taken, and we are passing a copy of this letter to ARRL and to RSGB for G3FKM.

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From his long experience on the band — he was an SWL for many years — Don notes the indications of a slide towards the sunspot minimum in the erratic conditions, some days good, some rather poor. Little has been heard in the mornings, save a few VK and JA signals peaking around 1100z on the short path some days. Caribbean signals have been noted around 1100-1200z, and North Americans from 1100 to 2200z. There were a few KH6s around 1800-1900, shortly after the few Africans had reached a peak at 1600. It added up to SSB contacts with A6XWT, CN8CO, D68AM, CX7BY, K6HNB/CT3, 8P6T, 8P6MH, VP2EC, VP2EM, HP1XRR, CX7BY, PJ3BQ, H10PGC, HK0EIHM, SZ4RT and P41C. G4LDs (Chelmsford) has been somewhat inactive due to problems with the rig; first a dry joint was removed and the USB oscillator now works, but the G3LLL clipper was being fitted a mishap with the soldering-iron saw off the IGFE and so killed the receive half of the rig. However, since January some 122 countries have been worked; the latest crop, before the rig died, showed 3B8CF, VE4BF, a morning session which gave some Europeans followed by a call from VK4APM all by 0900, some more W/VE, 9KD2R for a new country, ZL, UI7, JR6, P29NAB, then the RSGB ten-metre contest which was spoilt by an aurora, although it was still possible to work PP2ZDD, KY4AD, UA9CJA, 4X40Q, VE, KP4BZ, J73PP, and EUs; TI2CC was another new one, some VKs, UA9, and finally FP0GAQ. The rig was then repaired and tried out, with a few more in the CQ WW SSB contest for various Ws, JAs, VP9, VE3, 4Z4, VP2MFW, a call from V3ME in Belize, P41C (a PJ2 in disguise), HK3A, D4BCB, and VP2EM to take the countries total up to 128. G3OUC (Newbury) found conditions on Ten pretty good, with such as UA9CCS, JA8VDY, WA6NEV/P4, WB2, WA2, and FP8HL all raised from the mobile, plus the usual crop of Russians. Pat has a QRM problem as G4MLG lives next door and puts literally volts down the G3OUC ATU; but they seem to manage to work things out between themselves. The local nets are on 1.920 MHz and 28.3 MHz, so helping to sell the band occupancy.

Now we have a couple of letters from G3RHK (Ordsall) who comments on how little he has heard from the RSGB ten-metre contest; some 1700. QSOs tell the rest on this band: A4XIA, C31LX, CP1EQ, DJ3QC/3A, EA4KF, FB8WG, FK8DH, FP0GAQ, G3AAE/V9P, G4COA/W0 in N. Dakota, G4LGF/3B8, H44WF, HK0FBF, 18UBD/IC8, I980NU, J6JU, JA9, JX5VAA, KH6WU, a daffy of KL7s, N6TU/KHO, K7DD, ODSV, OE5JTL/YK, OH2LP/OHO, P29NBF, P29RNL, P41C, SV0BV/SV5, TE1C, TF3YH, VKs, Russians including UK1PGO in Franz Joseph Land, VP2s, VU2CJ, VS6JW, W7s, YJ8s, ZKs, and ZLs.

Turning to G3RKH also on 21 MHz; John mentions K7BA in Wyoming, FP0FSZ, C5AAP, SB4HY, FP0GAQ, and DJ3QC/3A.

Now, what about Twenty? As always, its own inescutible self, noisy, QRM aplenty, and all the rest — but the prime DX band nonetheless in the long-term. G3RKH says he doesn't have any set pattern of operating; sometimes early morning and then at tea time, sometimes a day without switching-on. All the same, he worked, as pick of the crop, XT2AT, VP8AEN, VK, ZL, 9Y4FS, C5AAP, XE1CB, 6Y5MG, and HRI1EAH.

G3NOF seems to have not done too much, although he says the long path to VK/ZL has been good around 0700, with some W6/7 as well, and KL7, KH6 showing around 1000. Contacts were actually booked in with G4LGF/3B8, H10PGC, OE1ETA/KH6, OY9R, P29BS, PJ3BQ, UW0MF, VE7CWG, VE7VX, VKs, ZK1CV, ZK1KM, ZL1WE, ZL3QN, QT7LW, and VP6OR.

So, that's it on the bands.

**Finale**

We've cut very fine this time, but don't stop sending in your letters on that account — we can handle as much as you can send in! Deadlines are in the 'box' — address, as always, to 'CDXN', SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ. Meantime, a Very Happy Christmas and successful New Year to you all.
THE "TUNBRIDGE", PART II

CONCLUDING THE DESCRIPTION OF THIS EFFICIENT QRP TRANSCEIVER

IAN KEYSER, G3ROO

Crystal Mixer VFO

The problem in using high frequency IF is in designing the VFO. At first it was thought that one might get away with a 1.1 MHz VFO for the 10 MHz band, but on reflection obvious problems would arise. In the mixer circuit the VFO is used to switch transistors, and in the case of the 1.1 MHz VFO there would be a large amount of second harmonic at 2.2 MHz. This would beat with signals at 11.2 MHz and produce interference on the 9 MHz IF. This could be removed by traps at 11.2 MHz, but it was decided that a more elegant system of crystal mixing could be devised that would allow any band to be covered without changing the design. To remove all problems and harmonics it is advisable to place the local oscillator above the signal frequency, e.g. for eighty metres the VFO would need to cover 12.5 to 13 MHz, and for ten metres, 37 to 39 MHz. This is why crystal mixing is used: it is difficult to make a VFO stable enough at 12 MHz, and virtually impossible at 37 MHz.

At first it seems difficult to keep the spurii at a low enough level, but with modern ICs it amounts to little more than building the circuit and tuning up. The knack is in choosing the correct frequencies for the crystal and variable oscillators. The output frequency of the crystal mixer is the sum of the IF and the aerial frequencies for the crystal and variable oscillators. The output of the mixer by a tuned circuit, and a link winding on this circuit transfers the energy to a SL610 for amplification. As described in the transmitter section, this device cannot drive a tuned circuit directly, so a BC109 is used as an interface.

Setting up the Crystal Mixer VFO

Ideally a 'scope or valve voltmeter with an RF probe is required to set this circuit up, but a good general coverage receiver can be used and still obtain good results. Firstly use the receiver to check that the two oscillators are operating on the correct frequency. Having established this, couple the output of the PCB to the input of the receiver using co-ax cable and ensure that there is a minimum of coupling between PCB and receiver other than by the cable (this can be checked by shorting the co-ax with screwdriver, and the signal in the receiver should disappear; if not, there is too much stray coupling). Tune to the difference frequency, and a signal. There is one small birdy audible without the aerial connected, but with the aerial connected the received noise covers it completely. It is, of course, very important to pay attention to decoupling and screening to achieve this.

The VFO section of the circuit, Fig. 10, uses a Clapp circuit; this has been found to be stable enough at these low frequencies, and very easy to set up. An FET is used as the oscillator, and this is fed to an emitter follower with an adjustable output level. It is very important to set the levels of the injected signals into the mixer at the critical level. The crystal oscillator uses a two-transistor circuit which is extremely versatile; as it is required for this circuit to operate in either fundamental or overtone modes, and over a large frequency range depending on the chosen band, this circuit fills the bill admirably. It is only necessary to resonate the circuit at the frequency required, and the crystal will oscillate in the required mode. The difference signal is selected at the open collector output of the mixer by a tuned circuit, and a link winding on this circuit transfers the energy to a SL610 for amplification. As described in the transmitter section, this device cannot drive a tuned circuit directly, so a BC109 is used as an interface.

Tables of Values

Table 1

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
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<tbody>
<tr>
<td>C56, C57, C58, C60</td>
<td>0.047 µF</td>
</tr>
<tr>
<td>C59a, C59b</td>
<td>0.22 µF</td>
</tr>
<tr>
<td>C61, C62, C63</td>
<td>see below</td>
</tr>
<tr>
<td>C64, C65</td>
<td>0.01 µF</td>
</tr>
<tr>
<td>R10</td>
<td>3R, 1/4W</td>
</tr>
<tr>
<td>R11</td>
<td>6K8, 1/4W</td>
</tr>
<tr>
<td>R12, R13</td>
<td>22R, 1/4W</td>
</tr>
<tr>
<td>R14, R15</td>
<td>82K, 1/4W</td>
</tr>
<tr>
<td>R16, R17</td>
<td>40K, 1/4W</td>
</tr>
</tbody>
</table>

Note: In calculating the low pass filter capacitors the cut-off frequency should be 50% higher than the operating frequency and the cut-off frequency (see text). The reactance of C61 and C63 should be 30R, the reactance of L3 and L4 should be 40R. Resonating capacitors should be either polystyrene or silver mica types (all tuned circuits).
signal should be heard. This signal should be peaked to a maximum, reducing the RF gain of the receiver to stop any overloading. Now reduce the VFO drive preset until the output level starts to reduce rapidly; just prior to this point is the correct level. Now adjust the crystal drive preset until the same effect is noticed; this is now set. Now retune the receiver to the VFO frequency and adjust the VFO balance preset from minimum reading. Next tune to the crystal frequency and adjust the xtal balance preset for a minimum on the S-meter. The crystal mixer VFO is now set up.

### Setting up the Main PCB

There is little to do here, except set up the input tuned circuits. Firstly tune to mid-band and tune the input tuned circuit for a peak; tune the second for a peak 50 kHz inside the lower edge of the band, and the third tuned circuit should be peaked 50 kHz inside the top end of the band-edge. This should be repeated as there is some interaction between the tuned circuits. Where traps are used, a signal at 9 MHz should be injected at a suitable level, into the aerial socket, and the traps tuned for a null heard in the phones.
Setting up the Transmitter

Here it is only necessary to tune the tuned circuits for maximum output. In the case of the LF bands it might be necessary to damp the tuned circuits to get full coverage of the band; if this is the case and the drive is reduced too far, the emitter resistor of the driver transistor should be reduced to compensate.

Setting up the PA

There are two presets to be set up on this board. RV2, which must be set at maximum resistance first, is set up by inserting a milliammeter into the supply lead and adjusting the standing current, under no-drive conditions, to 25 mA. With a 50 ohm dummy load connected to the aerial apply a steady drive (key
down on CW, or whistle into the microphone on SSB) while looking at the reverse power on the meter. Adjust RV3 for minimum. The transmitter is now set up.

**Conclusion**

Although I have tried to be as descriptive as possible in this text, it must be understood that this little rig is quite an undertaking for a novice, and that every effort should be made to understand completely the principle of the design before commencing construction.

The set has been air-tested comprehensively on my station Rhombic, where all continents were worked in the first week on SSB, and also for several weeks by G2ACG on a 130-ft. long wire where the best DX was with W4. Under all conditions it was possible to have QSO's and always with very favourable reports; on CW it is easily possible to hear stations breaking in while transmitting at speeds in excess of 20 w.p.m. and although there is a slight click on the sidetone this is not radiated, as it is a function of the rather simple muting system.

PCB layouts have not been given for the muting board/PSU and the C10 and keyed oscillator boards as these are rather simple, and could easily be built on Veroboard to save the etching.

This article has been reproduced here by kind permission of the G-QRP Club in whose journal, "Sprat" (Spring 1981 issue), it first appeared.
VHF CONTEST SCORING WITH THE SINCLAIR ZX81

J. V. MOSS, B.Sc., AMBCS, G4ILO

The Sinclair ZX81 needs no introduction. With over 50,000 units already sold it is likely that many have found their way into amateur radio 'shacks' alongside the more usual equipment.

One amateur radio task ideally suited to a computer is that of scoring VHF contests. Many programs have been published or marketed commercially to perform this task, but none of these will run in an unexpanded ZX81, which has only 1K bytes of memory.

The QRA Locator system should already be familiar to most VHF enthusiasts, and is illustrated in Fig. 1. As can be seen, the first character, which is alphabetic, increases in units of 2° longitude, with A being 0°. The second character increases in units of 1° latitude, with A being 40°N. Since computers store alphabetic characters as numbers from n to n + 25 (the value of n depending upon the particular computer), the second character may be converted to latitude by taking its code and subtracting (n-40). For the first character, it is necessary to multiply the code by two, but since for distance calculation, it is only the difference in longitudes between two stations which is required, it is not necessary to subtract a factor to produce the actual longitude.

The third character, a number, decreases in units of 1/5° while the fourth, also a number, increases in units of 1/8°. However, in the last column of Fig. 1b, the fourth character goes from 9 to 0 and the third character increases by 1, and this must be allowed for in the conversion. It might seem to be simpler to treat the third and fourth characters as a two-digit number, and to subtract 1 so that for example, the numbers in the top row then run from 00 to 09. From the programming point of view however, it is simpler to convert the code to latitude and longitude character by character.

Finally, the fifth character is a letter from A to J, omitting I, and there is no direct relationship between their computer codes and their values in latitude and longitude. The only way to convert this character is by means of two tables, one for latitude and one for longitude. It is the need for these tables which makes it difficult to write a conversion program to fit within the limited memory of the ZX81.

In order to calculate contest scores, it is first necessary to find the distance between the two stations. Thus the program must first take in the QRA locator of the competing station, and convert that to latitude and longitude, and then repeat the process for each station worked, calculating the distance D as:

\[ D = \cos^{-1} \left( \sin(lat_a) \cdot \sin(lat_b) + \cos(lat_a) \cdot \cos(lat_b) \cdot \cos(long_b - long_a) \right) \times 111.18 \text{km} \]

The score S is then calculated as:

\[ S = \text{integer part of} \left(2 \times \left(\frac{D}{50}\right) + 1\right) \]

The program presented here calculates and displays both distance and score, each new score being added to a total which

---

**Table 1. ZX81 Contest Scoring Program**

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>REM PPNLNLNPKN5777533325</td>
</tr>
<tr>
<td>50</td>
<td>LET C = VAL&quot;0&quot;</td>
</tr>
<tr>
<td>60</td>
<td>LET R = VAL&quot;180/PI&quot;</td>
</tr>
<tr>
<td>100</td>
<td>INPUT Q$</td>
</tr>
<tr>
<td>120</td>
<td>LET A = VAL&quot;CODE Q$(2) + 1 + (35 -CODE Q$(3))*1/4&quot;</td>
</tr>
<tr>
<td>160</td>
<td>LET B = VAL&quot;CODE Q$(1) + (CODE Q$(4) - 29)/10&quot;</td>
</tr>
<tr>
<td>180</td>
<td>LET A = A + (Q$(4) = &quot;0&quot;)/VAL&quot;8&quot;</td>
</tr>
<tr>
<td>185</td>
<td>LET B = B + (Q$(4) = &quot;0&quot;)</td>
</tr>
<tr>
<td>200</td>
<td>IF C THEN GOTO 300</td>
</tr>
<tr>
<td>210</td>
<td>LET C = A</td>
</tr>
<tr>
<td>220</td>
<td>LET D = B</td>
</tr>
<tr>
<td>230</td>
<td>GOTO 100</td>
</tr>
<tr>
<td>300</td>
<td>LET A = ACS(SIN A<em>SIN C + COS A</em>COS C*2)</td>
</tr>
<tr>
<td>310</td>
<td>LET B = VAL&quot;INT(A/50)*2 + 1&quot;</td>
</tr>
<tr>
<td>320</td>
<td>PRINT Q$;B,A</td>
</tr>
<tr>
<td>350</td>
<td>GOTO 100</td>
</tr>
</tbody>
</table>

---

**Fig. 1 HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1b HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1c HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1d HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1e HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1f HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1g HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1h HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1i HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1j HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1k HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1l HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character

---

**Fig. 1m HOW THE QRA LOCATOR IS CONSTRUCTED**

(a) First Character

(b) Third & Fourth Characters

(c) Fifth Character
may be printed at the end of the run. It is not intended to be a
model example program, since it is necessary to employ a number
of space-saving techniques in order to fit the program into the
ZX81. The program will also attempt to convert practically anything
given to it into a distance and score, whether a valid QRA locator or not, since there is no room to include any
validation checks. Hence the operator should be careful to check
each code as it is typed in.
Variable Q$ holds the QRA code as typed in. Lines 120 and 160
convert the first four characters to latitude and longitude. Line
170 adjusts the result so that codes beginning V-Z are taken to be
west of Greenwich. Lines 180 and 185 perform the adjustment for
when the fourth character is 0.
Lines 190 and 192 add in the contribution of the last character.
The locations accessed by the PEEK commands are the letters and
numbers of the REM line at the beginning of the program; the
computer codes of these letters form the conversion table. Using
this technique, each element of the table takes only one byte of
storage, instead of five which a BASIC array would require. The
REM line must be typed in exactly as given, and it must be the first
line of the program.
The technique of enclosing arithmetic expressions containing
numeric constants within quotes, and using the VAL function, is
another memory-saving device which prevents additional
memory being used by the ZX81 to work out these constants and
store them in binary before the program is run.
Lines 200 to 230 see if the QRA given is the first one of the run;
if so, it is the home station's locator, and the values of latitude and
longitude are stored away. If not, then line 300 works out the
distance, line 310 the score and line 320 prints them out. Line 330
adds the score to the total.
To start the program, input R U N. First, the home station QRA
is typed in. The program will immediately ask for another input.
This is for the QRA of the first station worked. When this has
been input, there will be a pause of a few seconds before the QRA,
score and distance in kilometres are printed out. The program is
then ready for the next QRA.
After about six lines have been displayed, a 1K ZX81 will halt
with a report 4 because the memory is full. Type CONT and the
machine will clear the screen and continue. When the last QRA
has been entered, input STOP. The total score can then be
displayed by typing PRINT T.

---

**FINDING UK-OSCAR-9**

**NORMAN FITCH, G3FPK**

OCTOBER 6, 1981 saw the successful launch of another
NASA Delta 2310 rocket from the Western Test Range at
Vandenberg in California, the main payload of which was the
NASA Solar Mesosphere Explorer, or SME, spacecraft. The
secondary payload was the first amateur radio educational
satellite, UOSAT, the decision to build which was formally made
on January 18, 1979. The satellite was constructed in the
University of Surrey's Department of Electronics and Electrical
Engineering at Guildford by a team headed by Dr. Martin
Sweeting, G3YJO. The primary sponsors were AMSAT-UK,
AMSAT-DL, AMSAT-USA, The Radio Society of Great
Britain, plus several other organisations who, between them,
donated money and equipment.
The spacecraft is now known as UK-OSCAR-9 and, unlike its
predecessors Oscars 6, 7 and 8, it is not a flying repeater but a
sophisticated transmitter in orbit around the earth sending out a
constant stream of information. A detailed description of the
sophisticated transmitter in orbit around the earth sending out a
predecessors Oscars 6, 7 and 8, it is not a flying repeater but a
donated money and equipment.

**Orbit Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>95.37 minutes</td>
</tr>
<tr>
<td>Inclination</td>
<td>97.45°</td>
</tr>
</tbody>
</table>

In view of the great interest shown in U-O-9, the most
important matter is to know when and where to listen for the
spacecraft. As this is being written, it has been aloft for several
weeks enabling a reasonably accurate assessment of its orbital
parameters to be made. These prediction charts in this article are
based upon the following information obtained from the
Secretary of AMSAT-UK:—

<table>
<thead>
<tr>
<th>Station</th>
<th>Score</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YO77E</td>
<td>15</td>
<td>362.71299</td>
</tr>
<tr>
<td>ZL60F</td>
<td>3</td>
<td>70.456596</td>
</tr>
<tr>
<td>BL79E</td>
<td>9</td>
<td>211.45445</td>
</tr>
</tbody>
</table>

Table 2. Test Data

**Home Station QRA: AL34D**

The locations accessed by the PEEK commands are the letters and
numbers of the REM line at the beginning of the program; the
computer codes of these letters form the conversion table. Using
this technique, each element of the table takes only one byte of
storage, instead of five which a BASIC array would require. The
REM line must be typed in exactly as given, and it must be the first
line of the program.

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distance, line 310 the score and line 320 prints them out. Line 330
adds the score to the total.

To start the program, input R U N. First, the home station QRA
is typed in. The program will immediately ask for another input.
This is for the QRA of the first station worked. When this has
been input, there will be a pause of a few seconds before the QRA,
score and distance in kilometres are printed out. The program is
then ready for the next QRA.

After about six lines have been displayed, a 1K ZX81 will halt
with a report 4 because the memory is full. Type CONT and the
machine will clear the screen and continue. When the last QRA
has been entered, input STOP. The total score can then be
displayed by typing PRINT T.
TNA, curve we read off 32.6 mins. and an aerial azimuth bearing of 302°. Thus the spacecraft will be nearest about 0352½ GMT. Finally, the LOS curve gives 38.1 mins., so loss of signal would occur at 0358 at azimuth 237°. During the pass, the satellite will travel from due north, through northwest and west, disappearing in a southwesterly direction.

These charts can be used for any British Isles location but the AOS/LOS time will differ from the London ones. For each one degree of latitude north the observer is from London, the signals would be heard 15.9 seconds later. For example an Edinburgh listener would receive his first signals 73 seconds after the Londoner. Conversely in the early morning, descending node orbits, the AOS and LOS times would be a similar amount earlier.

For longitudes other than the Greenwich meridian of 0° the degrees longitude west scale figures should be increased by one's westerly longitude, e.g., someone in the extreme southwest of Ireland would need to add 10°. The curve shapes remain the same for all practical purposes and, from the information given, readers may trace off the basic "minutes and degrees" graticule and displace the tracing to suit their own lat./long. figures.

**Where to Listen**

In the introduction, mention was made of the various HF bands beacons, which are phase related, and to the SHF beacons. The General Data Beacon transmits on 145.825 MHz in NBFM mode with plus/minus 5 kHz deviation. The maximum Doppler shift of the signal due to the spacecraft's velocity is plus/minus 3.1 kHz. The Engineering Data Beacon is on 435.025 MHz using the same modulation system, but the Doppler shift is three times greater.

**Further Information**

Readers who are AMSAT members will know all about this interesting spacecraft from *Oscar News* and other publications. Those who are not yet members and who would like to know all about U-O-9, are invited to join AMSAT-UK. Full details can be obtained from: Mr. R. Broadbent, G3AAJ, Secretary AMSAT-UK, 94 Herongate Road, London E12 5EQ. Please send an s.a.e. for a prompt reply.

*Why not give (or ask for!) a subscription to "Short Wave Magazine" for Christmas. It costs just £8.40 for twelve issues.*
A HIGH PERFORMANCE
POWER SUPPLY AND
CONTROL SYSTEM FOR
4CX350/4CX250
AMPLIFIERS, PART VI
CONTINUING THE DESCRIPTION OF THE
EHT SUPPLY
JOHN H. NELSON, B.A., G4FRX and
M. C. A. MORONEY, B.Sc.

L303 also has some RFI suppression duties, but its presence is
part of another slight problem and its solution, which is
worthy of explanation. Rather naturally, all the preliminary
testing and modification work on the various prototypes was
done using sundry low-voltage transformers, and it will be
remembered from earlier in the article that one of the primary
design objectives was the "soft start". This part of the system was
made to work well quite early on, and it was not until slightly later
in the development proceedings and the graduation, so to speak,
to rather larger transformers, that a slightly baffling effect was
observed. This was that, at switch-on, there would be a slight
surge of voltage which would cease; the voltage would then begin
to rise as the soft start system came into operation. When the
authors finally bit the bullet and connected the EHT transformer,
the first application of power resulted in all the fuses to the system
blowing and the demise of the main thyristors (we learned more
about the fusing of semiconductor devices from that, but this is
discussed later). This was, to say the least, discouraging.

However, to cut a long story short, what we had forgotten was the
inclusion of "dV/dT protection".

Basically, a thyristor displays a capacitance between its anode
and cathode when in the blocking state, in much the same manner
as any other pn junction and particularly the varicap diode. It
follows that if a thyristor is subjected to a voltage with a large rate
of rise (dV/dT) a current will flow through the device, despite the
fact that it is in the blocking state. The larger the dV/dT, the
greater the current; and should this be equal to or greater than the
thyristor's holding current, it will switch on as though it had
received a gate pulse. This condition of large dV/dT can be
caused, for example, by the closure of the main switch (the
contactor in the case of the present design) or by switching
transients from other equipment on the same mains circuit. If the
current through the thyristor is limited in some way by the load —
for instance, if the load is purely resistive — a dV/dT switch-on
will cause no more than a single-cycle current pulse of limited
magnitude, so no damage will occur. If, however, the load is a
larger transformer feeding into discharged capacitors, which is
the case with the EHT transformer at initial switch-on, the
thyristor load impedance is virtually zero. The result
is an extremely large current pulse through the thyristors, which cause
their destruction.

Whilst it is possible to increase the dV/dT withstand capability
of a thyristor, it is nevertheless necessary to limit the maximum
dV/dT that can be applied to it. In this design, the combination of
L303, R312 and C304 acts as a snubber network to limit the
dV/dT to about 400V/microsecond, which is well within the
withstand capability of the thyristors. The presence of R312 in this
network provides damping to prevent ringing.

It is worth noting that, in general terms, the better the
RFI protection on a thyristor system, the less sensitive is it to dV/dT,
as can be seen from the duplicate function of R312 and C304 in
dV/dT and RFI protection. The particular variant in use at
G4FRX has neither any switch-on surge nor RFI on any HF or
VHF band, so it would seem that the problems have been solved;
indeed, the latter result puts a commercial motor-speed controller
(used by one of the authors for an electric drill and handling about
one-tenth of the power of this system) to shame! Thyristor controllers of one kind or another have a rather poor reputation as generators of mains-borne hash and assorted noises, but it would seem that suitable design tactics can easily eliminate this problem; to put it another way, the only means of detecting that a thyristor control system handling, potentially, a couple of kilowatts is in use at G4FRX is to look inside the box!

Returning now to the description, the thyristor stack controls the mains feed to the EHT transformer, which is shown in Fig. 6. The output of the transformer is rectified in a bi-phase half-wave system and smoothed to produce a DC output in the conventional manner. The current in the secondary winding of the EHT transformer is monitored by R421, which provides a negative voltage for the current feedback to the gain multiplier and the trip circuitry. The positive output from the smoothing network passes through R422, across which a voltage develops as the output current increases. This voltage is monitored by the network consisting of RV401, C423 and the LED in IC401. The current through this LED increases with the steady-state output current, and will also increase with a fast-rising output transient (flashover) through the action of C423. The time constant for the transient response is set by RV401. The current through the LED is reflected in the phototransistor on the other side of IC401, and this is used to operate the flashover trip circuitry.

The final stage on the EHT output side is the voltage feedback chains. These also double as the bleed resistors for the reservoir capacitors. The relatively high current through them is a deliberate ploy to improve the no-load stability of the unit. The use of separate chains for the control and trip feedback serves to protect the unit from a loss of feedback, which is not a particularly pleasant failure case prospect because the control system would then wind up to full output—depending on the use to which it is being put, this could be expensive! Conservative rating of R423 and R425 is extremely desirable here, and 25W units are recommended.

The purpose of R424 and R426 is to limit the feedback voltages if the control and trip circuits should be accidentally disconnected.

The trip sense amplifiers are shown in Fig. 7. These are based on the MC3423P1 crowbar protector IC, which for some strange reason seems rather difficult to come by from the usual sources; it is, however, available from RS Components under the stock number 307-890. It is worth a small digression here to mention that this is a most useful IC; G4FRX first used one in his transverter system, described in S.W.M. a couple of years ago, and has used them in many projects since then. The device will give an output current to fire a thyristor if the input voltage at pins 2 and 3 exceeds approximately 2.6V. It has an internal voltage reference and an internal latch which maintains the output current until the supply to the device is cut off. A number of other features, such as a time delay and remote actuation, are not used in this application. It does, however, have a disadvantage insofar as it is extremely sensitive to supply transients and hence requires copious decoupling!

The overload trip uses an averaging amplifier of an identical form to that used in the gain multiplier (Fig. 3) and in fact takes its input from the same point in the EHT section. The output of this amplifier is loaded by R503 and sensed by IC502. The trip point is set by the gain of the averaging amplifier, which is adjusted via RV501.

The flashover trip utilizes the phototransistor in IC401 as a simple emitter follower. As the current through the LED in IC401 rises, so does the current through RV502 and hence the voltage on its wiper. RV502 is used to set the trip point.

The overvoltage trip simply uses RV503 as a potential divider in the feedback chain, with IC504 sensing the voltage on its wiper. A low value resistor, such as R504, is provided on each trip sense amplifier so as to limit the output current to a safe level.

That completes the basic description of what has become known to his friends as "Nelson's atom smasher!" By way of a
little light relief before looking at how the unit may be constructed and persuaded to operate, it is worth taking a look at a few topics which cropped up during its development and which have relevance not only to this system but to power supply design generally; they tend to be the items that the textbooks leave you to discover the hard way!

**Design and Development Topics**

Even if one's approach to designing a power supply unit is the basic one mentioned in the first part of the article — that is to say, to take a suitable transformer, add rectifiers and smoothing and a sprinkling of fuses according to taste and hey presto! the EHT supply — one must consider the ratings of all of these components, just as one must if one wishes to build a more complex design such as the present one. To take the rectifiers first, there are two possible configurations — the bridge and the bi-phase half-wave — and the choice between them will have been dictated by the available transformer. Now any of the standard textbooks will give details of how to calculate the forward current rating, \( I_{FRRM} \) of the diodes, and also what the rectifier will have to cope with in the area of what used to be known as PIV but which data sheets nowadays tend to refer to as \( V_{RRM} \). All is quite straightforward and obvious; for instance, with the bi-phase half-wave arrangement as used in the "atom smasher", the peak reverse voltage across each "leg" of the rectifier will be 2.8 times the value of the transformer secondary. If we take as an example a 2000-0-2000V transformer, this will imply 5.6kV as the total \( V_{RRM} \). This in turn will suggest that each "leg" of the rectifier will have to be made up of several diodes in series to achieve this value, since common semiconductor diodes do not seem to have values of \( V_{RRM} \) much in excess of 1200V. Our old friend the BY127, for instance, has a value of 1250V.

Now assuming that we wish to use this particular device with our 2000-0-2000V transformer, conservative design would suggest using at least six per "leg" so that there was something in hand to cope with mains transients, etc. (this is one reason why mains filters and VDR suppressors are a Good Idea in power supplies of any kind; transient voltages on the mains can reach very high values, and rectifiers which are run right up to their preferred value of 470K or 560K is in order, with about a 2W corresponding to 500 ohms per volt of \( V_{RRM} \); so in the present case, our 2000-0-2000V transformer, this will imply 5.6kV as the total \( V_{RRM} \). This in turn will suggest that each "leg" of the rectifier will have to be made up of several diodes in series to achieve this value, since common semiconductor diodes do not seem to have values of \( V_{RRM} \) much in excess of 1200V. Our old friend the BY127, for instance, has a value of 1250V.

Also, of course, equalising capacitors of about 0.01 \( \mu \)F, at a suitable working voltage, are usually suggested. This is one good sound stuff, but, with the honourable exception of Volume 2 of the RSGB's *Radio Communication Handbook*, Chapter 16, the textbooks don't seem to mention what is probably the most important characteristic of rectifier diodes (not that the data sheet itself is sometimes any better in this respect. i.e. the available transformer. Now any of the standard textbooks will give details of how to calculate the forward current rating, \( I_{FRRM} \) of the diodes, and also what the rectifier will have to cope with in the area of what used to be known as PIV but which textbooks usually go on to suggest that equalising resistors are placed across each diode, usually of a value corresponding to 500 ohms per volt of \( V_{RRM} \); so in the present design, for example, which uses 1000V devices, the nearest preferred value of 470K or 560K is in order, with about a 2W rating.\(^1\)

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\(^1\)In fact, the calculated value for the IN5408 at 100°C — i.e. a worst case — gives a value of fractionally over 1.6M, so the rule-of-thumb figure is very conservative.

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### Table of Values

The EHT Supply

| R1, R2, R3 | 4K7 |
| R4 | 15K |
| R5 | 750K |
| R6, R8, R9, R10, R12, R13 | 10K |
| R7 | 390R |
| R11 | 330K |
| R101 | 1K0 |
| R102 | 500K |
| R103, R104 | 20K |
| R105, R106, R114 | 82K |
| R107, R108, R109, R118 | 100K |
| R110, R111, R113, R116, R117 | 47K |
| R112 | 24K |
| R115 | 150K |
| R201 | 5K0 |
| R202, R204, R210, R215, R220, R222, R224 | 1K0 |
| R203 | 800R |
| R205, R209, R214, R219 | 4K7 |
| R206 | 27K |
| R207, R212, R217, R223 | 10K |
| R208, R213, R218 | 100R |
| R211, R216, R221, R220 | 82R |
| R301, R302 | 1K3, 10W |
| R303 | 4K7 |
| R304 | 470K |
| R305 | 1K0 |
| R306, R309, R314, R315, R316, R317 | 100R |
| R307, R310 | 47R, 2W |
| R308, R311 | 82R, 2W |
| R312, R313 | 10R, 10W |
| R401 to R420 | 560K, 2W |
| R421 | 1R, 25W |
| R422 | 5R, 25W |
| R423, R425 | 390K, 25W |
| R424, R426 | 1K5 |
| R501 | 1K0 |
| R502 | 20K |
| R503 | 10K |
| R504, R505, R506 | 20R |
| R507 | 100R |
| C1, C3 | 2.2 \( \mu \)F, 25V |
| C2, C4 | 470 \( \mu \)F, 25V |
| C5, C6 | 1 \( \mu \)F, 25V |
| C7 | 10 \( \mu \)F, 35V |
| C8 | 100 \( \mu \)F, 16V |
| C9 | 2.2 \( \mu \)F, 35V |
| C10 | 10 \( \mu \)F, 16V |
| C11 | 1 \( \mu \)F, 35V |
| C201, C202 | 100 \( \mu \)F, 10V |
| C203 | 0.01 \( \mu \)F, 20V |
| C301, C302 | 0.1 \( \mu \)F, 50V |
| C304, C305 | 0.47 \( \mu \)F, 20V |
| C306, C307 | 0.047 \( \mu \)F, 20V |
| C308 | 0.1 \( \mu \)F, 20V |
| C401 to C420 | 0.01 \( \mu \)F, 1kV |

**Note:** All resistors 1/2W except where specified. Transistors may be any switching types, and diodes usual clamper/clocking/steering variety, i.e. 1N4148, 1N4001.

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\(^1\)In fact, the calculated value for the IN5408 at 100°C — i.e. a worst case — gives a value of fractionally over 1.6M, so the rule-of-thumb figure is very conservative.
Screened box

Mains input
(Fig. 6)

Controlled voltage to EHT transformer
(Fig. 6)

Fig. 5 SCR STACK AND PHASE CONTROL
the rectifiers are concerned, and thus the only factor limiting the prospective current in the poor old rectifier diodes is the secondary resistance of the transformer.

The formula to bear in mind here is that due to Mr. Ohm; the current which will inexorably flow is that found by dividing the transformer's secondary peak voltage by the series resistance of its secondary. For instance, if we consider the previous example of a 2000-0-2000V transformer, a reasonable value for the resistance of its secondary might be 55 ohms assuming that it has about 1 amp rated secondary current. Thus the peak voltage will be given by 2000 times root 2, which is 2828; 2828 divided by 55 gives a current of just over 51A which, for a bi-phase rectifier, will flow in each leg.

Now the current surge which is represented by this figure is basically exponential in character, and for any reasonable value of smoothing capacitor it will be tending to pass its worst within about a half-cycle of the AC waveform from the secondary. But it must nevertheless be handled by the rectifiers, which is where the parameter of IFsm comes in. If we examine the data sheet for the ceramic equalising capacitors. The theory is that these are, being ceramic, slightly piezo-electric: when they are subjected to the steeply rising waveform characteristic of thyristor drive, a slight degree of mechanical deformation takes place and thus they will go into a glass case forthwith) the effect is somewhat important!

Some published supplies add resistors in series with the secondary, or between the rectifiers and the smoothing capacitor, but this will adversely affect regulation as well as meaning more components dissipating unwanted heat: in fact, one often has the uncharitable suspicion on looking at the rectifier diodes and resistors chosen that the designers have not really thought through their designs well enough. Many diodes are available with much higher values of IFSM than the BY127, and the present design, for example, uses the 1N5408. This is a 3A diode with a VRM of 1000V and an IFSM of 185A. It costs the same as a BY127 and, although one needs to use more of them per leg because of the lower VRM, one tends to sleep better at night as a result of knowing that they are that much less likely to blow up. The author's EHT transformer is, as previously mentioned, a 2300-0-2300V component, and its secondary resistance is 62 ohms; this gives a worst-case surge current of about 52A, which is well within the capabilities of the rectifiers to handle.

The BY127 is quite an old design, and in fact certain component suppliers seem to regard it as obsolete — perhaps this explains its relatively low ratio of IRM to IFSM. Certainly, it seems that one needs to think carefully about the rectifier limitations before simply using a component because So-and-so's design did!

Still on the subject of rectifiers, it is worth noting that most manufacturers require that semiconductor diodes are derated in terms of IRM if used into a capacitive load — the usual figure here seems to be a factor of 0.8. This means that if, for instance, one were using the BY127 in a bi-phase half-wave system, the total capacity of the rectifiers would theoretically be 1.6A instead of the 2A (i.e. 1A per leg) which is specified. In other words, the IRM is specified in terms of a resistive load, and the data sheet value must be multiplied by 0.8 if used in a capacitor-input filter configuration such as the majority of EHT systems.

Moving slightly away from the subject of rectifiers themselves and considering the complete rectifier stack, with associated equalising resistors and capacitors (which in fact could be omitted if avalanche diodes, such as the BYW56, were used, but these are still relatively expensive devices) there is one interesting effect which may be observed, especially when using a thyristor drive system; it caused a little dismay at G4FRX until the cause was, at least provisionally, identified. When the EHT transformer and its associated rectifier stack was first connected to the thyristor drive, it was noticed that as the voltage began to wind up the rectifier stack itself started to make a noise rather reminiscent of a very high-voltage power line on a damp day; it was a slightly sizzling, crackling sound which suggested an imminent disaster, and we waited with some trepidation for the smoke and flames. It was then noted that the quality of the sound changed with the load; and, although we had by this stage become relatively inured to pyrotechnics of one sort or another, we were relieved to note that none of the components seemed to be about to depart with the usual explosion!

Having considered the matter, we came to the conclusion that the components responsible for the sound effects were, in fact, the ceramic equalising capacitors. The theory is that these are, being ceramic, slightly piezo-electric: when they are subjected to the steeply rising waveform characteristic of thyristor drive, a slight degree of mechanical deformation takes place and thus they "rattle" at 100Hz. In the prototype rectifier stack (which has managed to last for the duration of the tests and development without exploding, bursting into flames or blowing fuses: it should go into a glass case forthwith) the effect is probably accentuated because the capacitors used were physically large 3kV working components that were available at the time. No doubt the theory could be tested by substituting other types of capacitor; however, the authors must confess that they rather like the sound!
At least you know that the grey box contains something other than a low-power transformer and rectifier unit!

Still on the subject of "noises off", it is noticeable that some transformers seem to take objection to thyristor drive and "buzz" quite badly at certain points in the input waveform. Again, this does not seem to be the precursor of any loud explosions or fuse-blowing, and is probably a function of the constriction of the core and the tightness of the laminations. The author's 2300-0-2300V transformer, for example, is completely quiet, but a 2000-0-2000V component which was tested on one of the prototypes had the authors wondering whether there was a DC offset getting into the primary and standing by to remove power in the event of a problem; it even drowned the noise from the rectifier stack!

The moral of the story would seem to be that if either seem somewhat vocal, there is probably nothing amiss: a setting which corresponds to about half-power is the worst case, and unless smoke is seen to rise from somewhere there is no cause for alarm.

The next item for consideration is probably the transformer itself, and here again the standard textbooks, such as the RSGB Radio Communication Handbook, Volume 2, chapter 16, go into the necessary details. The only point to be made here is that, due to the relatively light duty cycle in most applications, it is not necessary to obtain a transformer which is capable of the full output current which is required from the unit. For example, if we wish to use a pair of 4CX250Bs, the maximum anode current would be 500mA peak on SSB (not, of course, that the anode current meter should be showing peak currents of 500mA!) and about the same on CW. However, since one generally spends about 50% of the time in "receive", and also since the basic duty cycle of SSB and, to a lesser extent, CW is quite low, it is only the extreme case such as MS working or long RTTY transmissions which would require the full 500mA rating from the transformer secondary: a 300mA rating would probably be quite in order for the average amplifier which was not used for these latter two modes.

The smoothing capacitors, however, do need some thought and some derating, and it is in this area above all that skimping will not do — the manner in which some manufacturers get away with it is somewhat mystifying! It is obvious at the outset that the choice is between electrolytic capacitors or paper types of one sort or another, and since we are attempting to smooth voltages of the order of 2 or 2.5kV and no electrolytic has this order of voltage rating, they will have to be used in series along with appropriate equalising resistors of about 100 ohms per volt of the capacitor's rated voltage. Since any failure here is likely to lead to a disaster, these components should again be generously rated.

For reasonable regulation, some 20 or 30µF is really a bare minimum for the order of load represented by a pair of valves, and certainly it would appear that nothing could be simpler than connecting the appropriate number of capacitors in series to suit the required value of voltage rating and capacitance. For
example, if we required a 2000V rail and had four 100µF 500V components to hand, these would seem to be quite usable. . . .

The first point is that a 2000-0-2000V transformer does not imply a 2000V rail; depending on the rectifier configuration, the voltage which appears across the smoothing capacitors will be a good deal higher than 2000V, and indeed for the bi-phase half-wave rectifier as used in the present design, the voltage off-load can be calculated as 2000 times root 2, that is 2828. So if four 500V capacitors were hooked up to a 2000-0-2000V transformer and rectifier system, there would be a loud explosion! It follows that the capacitors must be chosen with the peak voltage which will appear across them in mind, and, for a capacitor-input filter, this will be 1.414 times the transformer secondary voltage with no load. Bearing in mind that some derating will improve reliability, it would seem that capacitors of about 3kV working voltage would be required; that is to say, two more of our 100µF 500V components as mentioned above. The problem then, of course, is that the effective capacitance of six 100µF components in series is 100/6µF, that is to say just over 16µF, which is distinctly on the low side for this type of application.

The other important factor is the ripple current rating of the capacitors used in the smoothing. As a rule of thumb, one can assume that for a bridge or bi-phase half-wave rectifier, the ripple current in the smoothing capacitors will be 1.3 times the load current; in other words, if we again take our pair of 4CX250BS up to 500mA anode current, the ripple current in the smoothing capacitors in the power supply will be roughly 650mA. Now it is true to say that one should never run electrolytic capacitors at their full ripple current rating, and thus it would be prudent to think in terms of capacitors possessing a 1A ripple current at 100Hz for use with our pair of valves and their EHT supply.

To summarise, the capacitors need to be chosen on the basis of:

1. The required working voltage, bearing in mind that for a capacitor-input filter the voltage across the capacitors will be 1.414 times the voltage of the secondary winding under no-load conditions and also that a little derating is a sound idea.
2. The capacitance, bearing in mind the requirements of (1) above and that a minimum of 20 to 30µF is required.
3. The ripple current rating, bearing in mind that it will need to be about 1.3 times the load current plus a fairly substantial derating factor as discussed above.

Manufacturers tend to state the ripple current ratings of electrolytic capacitors in their catalogues or data sheets but seldom, if ever, on the capacitors themselves, so that a quick telephone call or letter to the maker will save a rather messy and explosive problem later on. Remember if all else fails that a physically large capacitor will have a higher ripple current rating than a smaller one. One final point in this area is that some makers rate the ripple current of their products at 50Hz instead of 100Hz, presumably with a half-wave rectifier in mind instead of a bridge or bi-phase half-wave; some research has led to the rather surprising fact that there does not seem to be a linear relationship either way between the 50Hz and 100Hz ratings, so a little care is required to be certain that the capacitor will be usable.

(to be continued)

Correction

In Fig. 3 (Part V, November issue, p.492), R102 should be connected to the −15V rail, not the +15V rail.
On to Cheltenham, and the Old Bakery in Chester Walk, Clarence Street, where the gang foregather; on December 3 for an AGM, and on 18th for a natter.

The Chesham lads have just had an AGM, and therefore as we write the new committee are huddled in a corner getting their programme together; they have, in December, high hopes for an outdoor event — so G8PUC would like you to contact him at the address in the Panel.

Cheltenham have changed their Hq to the Spitfire Club at Tangmere, on the first and third Mondays of the month. For December 7 they have some slides of the year’s activities, and on the 21st they are going to have a Christmas Social evening.

Back in 1947, the Hon. Treasurer of Clifton was elected to his post, and in 1981’s AGM he stood down — not a bad term of “temporary” office. The group are now to be found on Fridays at New Cross Inn, which lies at the junction of New Cross Road and Clifton Rise, New Cross, London. December 11 is down for a constructional contest, and on the 18th they have the Christmas Party — so we guess the other evenings are informal.

If you are near Colchester we commend the local club to you; they are at Colchester Institute in Sheepen Road, and from the programme it looks like alternate Thursdays as a rule. December 10’s down for a film show which we understand will include “The Secret Listeners”.

Another ‘Thursday’ club is at Conwy Valley, where they are now to be found on the second Thursday of each month, from 7.45 in Green Lawns Hotel, Bay View Road, Colwyn Bay.

One of the biggest clubs around is Cornish, which meets on the first Thursday in the month at the SWEB Clubroom, Pool, Camborne; we are just a little ahead of their programme, but we can guarantee they will have something fixed up. If in doubt, you can always contact the Hon. Sec. — see Panel.

Crawley have a video-cassette evening, with “The Secret Listeners” and the G6CJ Aerial Circus. This is set for December 9, at Trinity United Reformed Church Hall, Ifield, Crawley.

Nice to see the Cray Valley newsletter heading again, although it does seem to consume editors at a rate of knots! But, it tells us that they are going to be at Christchurch Centre, High Street, Eltham, on the first Thursday in December, with the doors open at 7.30 p.m. No doubt they have something set up for that date, and the Hon. Sec. — Panel — will be able to give you the gen.

Now we move on to Crystal Palace, where Saturday, December 19 is down for a film show and Christmas Party. This will be as usual at Emmanuel Church Hall, Barry Road, SE2 at 8 p.m.

Up we go now to Derby; December 21 is the junk sale, and on the 9th there is a night on the air, this being followed on December 23 by the Christmas Party, which leaves December 30 for “The Year in Retrospect”. All these are at the Hq which is on the top floor at 119 Green Lane, Derby. Incidentally they now have a record paid membership of no less than 208!

The Central Library is the Dudley Hq, on the 2nd and 4th Tuesday in each month — December is an Open Meeting.

Although we don’t have a programme, we are advised that East Antrim are booked in at Carnittall Hall, Mossley, on the second Tuesday in the month. Details from the Hon. Sec., at the address given in the Panel.

New One

This is at Edenbridge, and they are to be found at the Conference Room, the Women’s Institute Hall, Station Road, Edenbridge, Kent, on the second Tuesday of the month. For the rest, try the Hon. Sec. at the Panel address.

The second and fourth Thursdays are the ones at Edgware; December 10 is a junk sale, but for this month they appear to be scrubbing the other meeting which would have fallen on Christmas Eve.

The Ex-G Club name is self-explanatory; for those born in, or naturalised to the UK but domiciled abroad. Details from the UK Secretary at the address in the Panel.

December in Fareham shows us December 2 for a talk on microprocessors and how they work, by G4IJP, followed on 9th by a night on the air. Then they have a slide show by G8VOI on 16th, and a blank for the following week — Christmas Eve again being responsible.

Farnborough seem to be a bit coy about their Hq address in the current newsletter, but we have it on record as the Railway Enthusiasts Club, Access Road, off Hawley Lane, which is near the M3 bridge. December 9 is the Chairman’s Evening, and on 23rd it is a social evening with YLs and XYLs.

We come now to the G-QRP Club, and their membership of 1209 at the last count. Anyone interested in the use of low power, or for that matter home-brew, could well think about a subscription — we think the newsletter alone is worth more than that. Details from the Hon. Sec. — see Panel.

Guildford foregather at the Model Engineers Hq in Stoke Park on the second and fourth Fridays; for more information contact the Hon. Sec. — see Panel.

On to Harrow, and the Roxeth Room, Harrow Arts Centre, High Road, Harrow Weald, on Fridays. For the rest of the story, we have to refer you to the Hon. Sec. at the address in the Panel.

The Harwell club meet at the Social Club of the AERE at Harwell on the third Tuesday of each month, with membership open to all with an interest in the hobby. Details from the Hon. Sec. — see Panel.

Turning to Hereford, we find their dates are December 4 and 18. The first of these is down for G4BVY to talk about receiver performance, and the other one is a “Fun Evening and Christmas Quiz”.

### Deadlines for “Clubs” for the next three months—

- **January issue** — November 27th
- **February issue** — December 31st
- **March issue** — January 29th
- **April issue** — February 26th

*Please be sure to note these dates!*

The Home Counties ATV group caters for amateur TV buffs within reach of the Swan Hotel, High Street, Iver. The date is normally the fourth Wednesday in each month. More details from the Hon. Sec. at the address in the Panel.

I.R.T.S. have turned their newsletter back into the earlier simple form, as a way of cutting costs, but it still has much of interest; and of course since IRTS is a national society, the Hon. Sec. can put you in touch with activity anywhere in EI. He is in the Panel.

Tuesdays are operating and Fridays nattering at the Hq in Unity Hall, near the Snoop Inn, Wootton Bridge, Isle of Wight; to judge by the latest letter, there has been an upsurge of get-up-and-go, and this can’t be bad!

The Liverpool group is based on the Conservative Rooms, Church Road, Waverley, and their chosen evening is Tuesday in the month. Details from the Hon. Sec., by letter only please, at the address in the Panel.

For the moment, the Louth group is at Pleasant Place, off Ramsgate, Louth, However, it seems there just might be a change of venue, so a call to the Hon. Sec. might be a good idea.

December 3 is also the date for Meirion, at the Ship Hotel in

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**Volume XXXIX THE SHORT WAVE MAGAZINE**

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Names and addresses of Club Secretaries reporting in this issue:

BARRY COLLEGE of F.E.: J. A. Share, GW3OKA, J Uplands Crescent, Llandough, Penarth, S. Glamorgan.

BOLSOVER: D. Brocklehurst, G8KIP, 33 Cheshunt Drive, Clowne, Nr. Chesterfield, Derby S43 4JG.

BRAINTREE: Norma Willicombe, 35 Crescent Road, Braintree. (Braintree 45058) 


CAMBRIDGE: D. Leary, G8KJY, 9 Priory Avenue, Swavesey, Cambs. CB4 5RY. (Swavesey 31126)


CHELTENHAM: G. Cratchley, G4L11, 47 Golden Miller Road, Prestbury, Cheltenham. (Cheltenham 48591)

CHESHAM: A. Scott, G8PUC, 8 Lyston Road, Chesham, Bucks. HP5 2BJ. (0494-75545)

DERBY: Mrs. J. Shardlow, G4EYM, 19 Portread Drive, Darley Abbey, Derby DE3 2BJ. (0332-556875)

DUDLEY: N. Rock, G8RLY, 28 Conway Avenue, Kingswinford, Staffs. (Kingswinford 277561)

E. ANTRIM: J. Welch, G4JXM, c/o 20 Brynarth Brae, Doagh, Ballyclare, Co. Antrim BT39 0RJ.

EDENBRIDGE: K. M. Hawkins, G3ZMC, 19 Forge Croft, Edenbridge, Kent TN8 SBW. (Edenbridge 86303)

EX-G: F. W. Fletcher G2FXU, 53 St. Ives Park, Ringwood, Hants. BH24 2DX. (Ringwood 35651)

EXMOOR: D. Jones, c/o Loughrigg, East Street, South Molton, Devon.

GLENROTHES: I. Robertson, G4M6HG, 123 Albury Avenue, Glenrothes, Fife.


HÖRNDEAN: D. Bernard, 33 Greenfield Crescent, Cowplain, Portsmouth, Hants. (Hornend 593429)

LEEDS: C. D. Giedhill, 21 Wardes Place, Bramley, Leeds LS13 3NS. (Pudsey 576702)

LOUGHBOROUGH: J. S. Smith, 91 Anson Road, Shepshed, Loughborough, Leics. (Letters only)

MALVERN HILLS: R. Dixon, G4BYY, 9 Wye Road, Malvern, Worcs. WR4 4EF. (Malvern 52000)

MELTON MOWBRAY: R. Winters, GINVK, 32 Redwood Avenue, Melton Mowbray, Leics. LE13 1TJ. (Melton Mowbray 35699)

MID-ULSTER: D. Campbell, G4KXQO, 119 Drumgor Park, Craigavon, Co. Armagh, Northern Ireland BT61 4AH.

OTLEY: Mrs. P. Horne, G8KRU, 14 Fieldhead Road, Guiseley, Leeds LS20 1DT.

UNIVERSITY OF KENT, CANTERBURY: P. Cockerell, G6CSZ, Keynes College, U.C.K. CT2 7NZ.

VALE OF THE WHITE HORSE: A. Lovegreen, 16 Church Lane, Wallingford, Berks. (Wallingford 37482)

VERULAM: G. Dale, G1PFZ, 16 Palfrey Close, St. Albans. (St. Albans 57665)

WACRAL: L. Colley, G1AGX, ‘Micasa’, 13 Ferry Road, Wayne, Nr. Hull, Yorks. HU5 5XU.

WIMBLEDON: E. G. Allen, G3DRN, 30 Boudnant Gardens, Wimbledon. (01-947 3914)

WIRRAL: G. O’Keeffe-Wilson, G4MIA, 20 South Drive, Upton, Wirral. (051-6771531)

WORCESTER: D. S. Pritt, G8TZE, 15 Patchill Lane, Twyning, Nr. Tewkesbury, Glo.

See November issue Panel for names and addresses not appearing here.

Dolgellau, and it is set aside for a session of RAE revision, and a matter to follow.

On to Melton Mowbray, where the evening of December 18 is given over to a Grand Christmas Junk Sale. This popular event is to be run off at the St. John’s Ambulance Hall, Asfordby Hill, Melton Mowbray.

The Midland AGM was back in October, and no doubt the new programme is all but complete; however, they had already fixed up for a Christmas Natter Night on December 15 at HQ, which is at 294A Broad Street, and that is almost opposite the Birmingham Repertory Theatre.

Like so many others the Mid-Sussex gang will be having some sort of social evening in December; this is on December 10. Their other meeting would have been on Boxing Day had they not cancelled it. The venue is Marle Place, Further Education Centre, Leylands Road, Burgess Hill.

One of the few Sunday meetings is at Mid-Ulster, where the locals gather at the home of G14BAC in Banbridge, Co. Down; the start is sharp at 1500, and there are various interesting items on the programme for these first Sundays each month.

Northern Heights notes that CB and amateur ariales are affected by high winds; for more on this phenomenon, try a visit to the Bradshaw Tavern, Bradshaw, Halifax, on any Wednesday evening. December 2 is a Family Evening, with pie-and-peas, for which they want some advance warning of your attendance.

Alternate Mondays at Tamar Secondary School, Paradise Road, Millbridge, Plymouth; and we have a feeling they have a sort of social evening in December; this is on December 10. Their next stop is at Reigate where they have the constructional contest on December 15. This is at the Conservative and Constitutional Centre, Warwick Road, Reigate.

It is a bit sad that the Royal Air Force note about their AGM arrived just too late for inclusion in the November issue, as it was down for November 6. However, any serving or ex-R.A.F. type can still join for the effort of writing to the Hon. Sec. for details.

At Saffron Walden they have the third Wednesday of each month booked at Debden Village Hall; they are in the process of putting together a programme to suit the interests of all the members. Details from the Hon. Sec. at the address in the Panel.

St. Helen’s has a place at the Conservative Club, Boundary Road, weekly on Thursdays. Someone must be working hard because almost all these dates had a settled programme during October and November; so no doubt there is something set up for December.

Skegness, the ads. used to say, is so bracing — be that as it may there is a good local club, based on the “White Swan”, Burgh-le-Marsh on the first and third Tuesday each month; various activities are on the go, to suit a wide range of interests.

Now we head for South Birmingham, and here they have the main meeting on the first Wednesday; to which they add every Thursday evening for operating the club rig, and every Friday for an open evening. All are at Hampstead House, Fairfax Road, West Heath, Birmingham.

On the first Monday in December, Southdown have their AGM, at Chaseley Home for Disabled Ex-Servicemen, Southcliff, Eastbourne, East Sussex.

South-East Kent YMCA is a group that covers the area around Dover, from HQ at Dover YMCA, “Godwynhurst”, Leytonstone Road, Dover. On December 2 there is a natter evening, with a film on lasers down for 9th. December 16 is a talk on meteor scatter, and 23rd is naturally enough set aside for a Christmas Social; a final date for 1981 is December 30, and on this evening the Chairman, G8KEN, will be suggesting things to do in 1982.

December is AGM-time at Southgate; the second Thursday in the month, at St. Thomas Church Hall, Prince George Avenue,
Oakwood N14.

Next we have Stevenage; December 3 was “to be announced” and on 10th there is a social evening at the Broadway Hotel in Letchworth; then on December 17 it is back to Hq for a natter evening. Hq is at the Staff Canteen, British Aerospace Plant B in Six Hills Way, Stevenage.

Nice to hear again from Stratford-on-Avon; but for the moment we have to refer you to the Hon. Sec. for the details of venue and dates — he is in the Panel.

For Sutton & Cheam are December 4 at Sutton College of Liberal Arts, Cheam Road, Sutton, and December 18 at Banstead Institute, High Road, Banstead.

Turning now to Sutton Coldfield we are told they have a booking on December 14 for a talk on MPs and ATUs; and that the venue is Sutton Coldfield Public Library, Sainsbury Centre.

For the Thames Valley members we can only say that they are in session on the first Tuesday of each month, at Dittons Library Meeting-room, Watts Road, Thames Ditton. We could also add that although we don’t have the latest, from past experience they will have something going “on the night.”

Amateurs around the Ramsgate district are served by the Radio Club of Thanet, at Birchington Village Centre, on alternate Fridays.

The Thornton Cleveleys group is really booming, with 140-plus members, all getting together on Monday evenings at the Leisure Centre, Cleveleys.

Looking to Torbay, we find they have an informal every Friday, plus the main meeting on the last Saturday of the month; all at Bath Lane, rear of 94 Belgrave Road, Torquay. In addition, they are running an RAE course at Torquay Technical College.

The Tyneside lot are still using the Community Centre, Vine Street, Wallsend, every Monday evening, and various activities are being run; and they say they are pleased to welcome visitors and new members.

The Vale of the White Horse club have their Hq in the club room upstairs at the “White Hart” in Harwell, every Tuesday, with the first one in each month down for a ‘main’ meeting.

We seem to be a bit out of phase with the Verulam newsletter, but it tells us that they have a place at the Charles Morris Memorial Hall, Tyttenhanger Green, Tyttenhanger, near St. Albans, on the fourth Tuesdays in the month; and there is also an informal on the second Tuesday in the month at the R.A.F.A. in St. Albans.

W.A.C.R.A.L. is the club which brings together all committed Amateurs around the Ramsgate district are served by the Radio Club of Thanet, at Birchington Village Centre, on alternate Fridays.

The Thorndon Cleveleys group is really booming, with 140-plus members, all getting together on Monday evenings at the Leisure Centre, Cleveleys.

At Wakefield they are in session on December 1 for a club project evening, on December 15 for a social evening at Hq, and 29th for an on-the-air and natter date; and all are at Room 2, Holmefield House, Denby Dale Road.

The West Kent area is covered nicely by, oddly enough, the West Kent club, which is based on The Adult Education Centre, Monson Road, Tunbridge Wells, and on December 11 there is to be a home-based Fox Hunt.

After a long silence we hear again from Wimbledon, and we see they are now at the St. John Ambulance Hall, Kingston Road, Wimbledon, on the second and last Fridays.

A new venue is mentioned for Wirral; they are now in a place at Minto House School, Birkenhead Road, Hoylake, where they are to be found on the first and third Wednesdays in each month. To get there, take a West Kirby bus from Moreton, and get off at

Over now to Worcester, where a new Hon. Sec. takes the seat; but he can still say that they are based on the “Old Pheasant”, New Street, Worcester, on the first Monday in each month. December’s meeting is to be addressed by G3RGD, on the subject of the joys of using Morse as an operating mode.

Every Tuesday evening you can join the Worthing club, now at their new Hq in Pond Lane Amenity Centre. They have to have something going with 100 members!

Next stop Yeovil, and Building 101, Houndstone Camp; December 3 is a Quiz by G3KSK, and he follows this up on 10th with “Some Simple but Useful Formulas”; a change to G3MYM on 17th with “Electrical Bandspreading” as his theme. Next a Wednesday evening, when they have the natter night on 23rd. Finally, December 31 is another natter plus, possibly, christening the new band.

Latecomers

We managed to fit most of them into their slot, but there are still a few, starting with Braintree where the new publicity secretary is, again, a YL; she tells us that they have the first and third Mondays at the Braintree Community Centre, Victoria Street, which is next door to the bus station; December 18 is a social evening.

Cambridge has an update to let us know they are still using the Visual Aids Room, Coleridge Community College, Radegund Road, and the club scribes note that the latter is a turning off the well-known Coleridge Road in the south part of the city. Every Friday it is.

At December’s Chelmsford meeting, there is some doubt as to whether it will be a junk sale or a Chinese take-away — find out by going on the first Tuesday to the Marconi College, Arbour Lane.

On Exmoor we find the local club to be based in South Molton, at Loughrigg, East Street, every Thursday.

Another lost sheep returned to the fold is at Glenrothes, where they write to advise that on December 20 they have Mr. Alex McGrow, who will give a talk on metal detecting and bottle collecting. For the venue, we must refer you to the Hon. Sec. — see Panel.

Horndean meet at Merchiston Hall, every second Tuesday of the month — details from the Hon. Sec. at the address in the Panel.

Up there in Kilmarnock & Loudoun, they now have their place at the Broomhill Hotel, London Road, having abandoned the old Buchanan Centre venue. December 22 should be interesting in that they have social evening with other Ayrshire clubs.

We are asked to remind readers of the Christmas Rally on December 13, organised by Leeds & District A.R.S., which will be held at Pudsey Civic Centre, Dawsons Corner, Pudsey; this is a purpose-built exhibition centre on the Leeds Ring Road.

Olney club writes in to say that they are running the Northern Mobile Rally on May 23, 1982, at the Great Northern Showground in Harrogate. Details on this, and the club too, from the Hon. Sec. — see Panel.

The Barry College of Further Education get together every Thursday at Weycock Cross Annex, Barry; they have also got a Rally provisionally set for May 1982.

Bolsover is a new one to us, although they have been around for three years; they have a booking every Wednesday at “The Angel” in Bolsover. At the time of writing the programme was still to be pasted together, but now they will have things all set up, doubtless.

If you want to find the Malvern Hills lads, try the “Red Lion” in Great Malvern on the second Tuesday; December 8 is down for the AGM. Start at 8 p.m. (with morse between 7.30 and 8 p.m.).

Finally, University of Kent, Canterbury; they are in session at 1400 on Wednesdays in Eliot Seminar Room 4, University of Kent, Canterbury. More details from the Hon. Sec. — see Panel.

Finale

That, mes amis, is yer lot for this time. For the next three “Clubs” features, the deadline dates are indicated in the body of the piece; all your letters addressed to your “Club Secretary”, SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts, AL6 9EQ. Meantime, enjoy your Christmas, and take care. 73!

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LAST time round, we looked at capacitance, inductance and resistance in the world of DC, switching on and switching off. Now, we must look at AC conditions as applied to these three components. So — perhaps it wouldn’t be a bad idea to define AC, and to decide on what waveform we will regard as the “standard”.

Definitions

We may define an alternating current as a current which varies in a cyclical manner and crosses the “zero” line in each repetition. Those inverted commas around “zero” imply that we may arbitrarily define our zero, which, as we will see later, will cater for such a case as an AC ripple voltage superimposed on a DC HT voltage.

Turning to our standard waveform, let us consider firstly the desiderata. Firstly, it would be nice if a standard waveform of voltage applied across resistance, or inductance or capacitance, would result in a current waveform of the same shape. It would also be nice if such a waveform could be generated to a fair approximation easily enough to enable us to experiment; and it would be nice if we could resolve a complex periodic waveform into a series of our standard waveform and multiples thereof. Such a waveform exists, and this paragon of all the virtues is called a sine wave. One cycle of a sine wave is traced out if, on graph paper, we plot the sine of an angle as the angle goes from 0° to 360°, see Fig. 1a. If you know what a sine is, relax while we explain to the others.

At Fig. 1b we show a right-angled triangle inside a circle. Consider this triangle — any right-angled triangle for that matter. The longest side lives opposite the right-angle (and a right angle is 90°); this longest side is called the hypotenuse. In our figure, then, the hypotenuse happens to be a radius of the circle. The angle of 90°; this longest side is called the hypotenuse. In our figure, then, the hypotenuse happens to be a radius of the circle. The angle of the triangle which lives at the centre of the circle we have marked as θ — the Greek letter “theta”. We have already defined the hypotenuse; we may now call the side opposite to θ the “opposite” side of the triangle, and the third side can be called the “adjacent” side since one end of it forms part of the angle θ. If we want the sine of an angle, we draw a right angled triangle having one of its angles as theta — the angle whose sine we want — and then sine θ may be defined as the ratio of the length of the opposite side divided by the length of the hypotenuse, i.e., AB/OA.

Still with Fig. 1b, if we can now imagine radius OA being rotated anticlockwise and thus angle θ changing, line AB will change in length and therefore the ratio AB/OA will change: thus the value of sine θ can be related to the degrees round the circle. Let us call the right-hand end of the horizontal 0°, and sweep round in an anticlockwise direction through the full 360° of the circle and — lo! — 360° is the same as 0°. At 0°, the opposite side just disappears, and so sine 0° also is zero; at 45° opposite divided by hypotenuse side equals 0.707; at 90° the hypotenuse and the opposite side equal, and so sine 90° equals 1.

Now, what about 91°? The triangle we drew for 91° will have the same proportions as the one we drew for 89°, and so the sine is the same. Next to 8 = 180°, where the value of AB/OA again reaches 0. At 181° AB/OA is of the same proportions as at 1° but the sign of the sine has become negative. Carrying on, it reaches maximum negative at 270° and Oat 360°, completing the cycle. So 361° is the same as 0° in the next cycle.

So, with all this in mind, you can plot it out on a bit of graph paper for yourself, and come out with something like Fig. 1a; and if you do a repeat but using the sine tables or a calculator you should get an even better plot. However our point is simply that Fig. 1a is a picture of one cycle of a sine wave.
relationship will differ from moment to moment. But, notice, the angle notation doesn't make reference to frequency.

Now, let's look at a sine-wave of voltage applied to a capacitor. Recall first what happened to the electrons when we put a battery across our capacitor; see Fig. 4. If the sine-wave of voltage starts at the origin and goes positively, we may note that the maximum rate of change of voltage occurs around 0° and 180°, and the minimum rate of change of voltage occurs at those points (90° and 270°) where the waveform changes direction. Thus, we may say that at 90° and 270°, current is momentarily zero; an electron heading into the capacitor slows, stops for an instant, and starts to retreat whence it came. At the origin, the instant the volts start to rise there is a rush of electrons to the capacitor which falls away as the rate of change of volts declines. Applying this argument over several cycles of voltage and we see a relationship between current and voltage like Fig. 4, and clearly the two sine-waves are 90° out of phase, with the current leading the voltage. Notice two things; firstly that to get to this position we did not need to have a current flowing inside the capacitor — the current rushes to a plate and then away again, on either side. Notice also that, since we have been talking of rate of change at various moments, we have implied that the higher the frequency of the sine-wave, the greater the maximum value of the current for a given amplitude of voltage.

What about power? We agreed earlier that $E \times I = W$. Recall from school days that if we multiply two things of like sign the result is positive, and conversely that if we multiply two things of opposite sign the result is negative. Applying this argument to a resistor, clearly "W" is at a maximum when current and voltage are at maximum (whether positive or negative) and at zero when voltage and current are zero. Turning to our capacitor, the voltage and current are 90° out of phase, and so if we multiply E by I, there will be times when E and I are both positive and other times when E and I are negative; and for an equal proportion of each cycle E and I will have opposite signs. What does this mean? Simply that for half the time we are looking at negative power! If we have taken positive power to mean that work has been done (the resistor case saw the resistor get hot), then clearly negative work is the case where the component is returning power to the supply. Thus, in the case of a capacitor, we may say that over a period of time comprising any number of complete cycles of voltage, there is power going into the capacitor for half the time and for the other half of the time that power is negative, and so returned to the supply. Although volts and current can both be shown to flow, no power is dissipated within the capacitor.

Now, what about the other question relating to capacitors, namely Ohms Law? Clearly, if we make our capacitor infinitely large, our maximum currents will also be infinitely large; and if our capacitor is vanishingly small our current will be vanishingly small. We have also already indicated that our waveforms are connected by reference to "rate of change" and clearly the higher the frequency, the higher the rate of change. Thus, the E/I relationship can vary, as it did with a resistor, so we have some property akin to resistance but somewhat different. Let us call it Reactance, and give it the symbol X. For a capacitor, we can show that $Xc = \frac{1}{2 \pi fC}$. The reactance of a capacitor varies with frequency: at zero Hz it is infinity, and as frequency rises so $Xc$ will fall. A useful property, as we shall see.

However, enough of capacitors — away with them! Let us change our view a bit and look at Inductance. If we apply a pure inductor, clearly infinite current will flow as there is no resistance present. If we make a coil a perfect inductor, we can apply an alternating voltage and see an alternating current, but once again we shall see a phase displacement as with the capacitor,
Letters to the Editor

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

Dear Sir — So now we have the “rights” of Class-B licensees! In my simplicity I thought that anyone applying for a Class-B licence must be satisfied to operate within the limitations of that licence. If he/she wishes to operate on frequencies below 144 MHz, then he/she applies for a Class-A licence.

But now it appears that Class-B licensees have a “right” to more of the spectrum. Well, dear G8SUH (November Letters), there is a simple way to achieve your aims: just apply for a Class-A licence and then you will be able to use more of the spectrum, and it will not even cost you more in licence fees.

A Class-B licence is a VHF/UHF-only licence, intended for those whose interests lie in that part of the spectrum. It is not a Novice Licence; it is not an easy option for those who cannot be bothered with the Morse test. It is a pity that there are some Class-B licensees who think that that is just what it is.

Rev. J. L. Marshall, G3RKH

Dear Sir — I really must comment on the letter from G8SUH and his associates in the November issue.

Apart from the fact that they refer to one and the same thing first as a “privilege” and then as “their rights”, what really annoys me is their silly use of the term “old boys!” and the veiled suggestion that they are not sincere. The use of expressions like these do nothing to further their argument, and they would do well to remember that no one age group or social stratum has a monopoly of either knowledge or organising ability.

The reference to CB in their letter must be an unfortunate one — anyone who prefers the chaos on these frequencies really must be an innocent abroad. Having made their opinions known, they now want someone else to run their campaign. May I suggest that they employ the usual democratic methods of trying to alter things, i.e. by canvassing their MP’s and my means of the ballot box.

Of course there is one easy solution for those wishing to use more of the spectrum, but I hesitate to suggest it because a certain amount of hard work and application is required — go for a G4 licence!

E. G. Allen, G3DRN

P.S. I well remember, when Class-B licences were first issued, the remark in one of S.W.M. ’s features (I think it was G6QB’s piece) that “these new licences will separate the real amateurs from those who only want to play”. Was he right?

Dear Sir — I felt I must write to express how much I am enjoying the current series of articles by John Nelson, G4FRX. His precise approach is highly commendable and to me, very satisfying. If it fails to work when I first switch on, I know I shall have only myself to blame!

I very much hope that we shall be seeing more articles by G4FRX in Short Wave Magazine after the present one is concluded.

Simon Collins, Portsmouth

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

“A Word in Edgeways”

More Blush!

Go back to Part I, June issue; on p. 193 we referred to the penny and the battery, and energy doing the trick. This was correct, but on p. 194 when we turned to the penny and said “power” made it hot. Energy it must be, and energy defined as work done. Thanks G3CWX for spotting the error.
VHF BANDS

NORMAN FITCH, G3FPK

Satellite News

OSCAR 9 is successfully in its planned orbit as near as makes no difference. At the time of editing, there seem to be several sets of figures for the period and longitude increment, depending upon which “experts” one listens to. Orbital predictions based upon observations of actual passes are being broadcast on various nets, together with the latest information. The main one is on 3,780 kHz from 1015 on Sunday mornings, with others on the same frequency on weekday evenings from 1900.

At present, U-O-9 is not in the right attitude for deploying the 5 foot boom, the telemetry suggesting the spacecraft is on its side, rather than upright, very slowly spinning on the axis in the direction of its orbit and occasionally tumbling. Both on-board computers are now working and the speech synthesiser is sometimes on. (Your scribe heard it on October 8 on orbit no. 499. The deviation was somewhat low, but the audio was adequate as received in SSB mode with zero beat carrier). Only the 2m. General Data Beacon on 145.925 MHz is operational so far.

It seems that it is taking much longer to get U-O-9 into a stable attitude than was previously intimated. Quite rightly, the University of Surrey team is in no hurry to activate the remaining experiments until project manager Dr. Martin Sweeting, G3YJO, is absolutely certain that the spacecraft’s attitude is correct and under complete control and that the on-board computers are functioning 100%.

AMSAT-UK has transparent U-O-9 overlay “circles” for polar projection maps at 50p plus postage. For reasons beyond its control, the latest orbital calendar did not appear in time to carry on from the previous one. By the time this appears, the new prediction for 0-8, U-O-9 and NOAA 6 and 7 will be available at £1.29, incl. postage. It is hoped to have the second Best of Oscar News handbook ready by Christmas at £1.29, incl. postage. Full details of AMSAT-UK membership and services can be obtained by sending an s.a.e. to The Secretary AMSAT-UK, at 94 Herongate Road, London E12 5EQ.

AMSAT-UK received a message that a listener had heard some telemetry from the 435 MHz beacon on 0-7, generally thought to be long defunct. However, this report must be treated with some scepticism.

Rumours are rife that further Soviet amateur satellites are about to be launched in the RS series. From one of the AMSAT nets, it seems that Leonid Labutin, UA3CR, was the originator of this information but did not give any details. A low power transmitter is operating from the roof of UA3CR’s Moscow home with the callsign RS-0 on 29.331 MHz. It has been heard in the mornings around 1000 to 1200 sending continuous telemetry as the unsuccessful RS-1 and RS-2 transponders did a few years ago. In earlier RS-0 operations, one could send: RS-0 de G3FPK, and get one’s call back and a report.

Beacon Notes

Due to the forthcoming loss of the top 200 kHz of the 4m. band, as mentioned last month, the RSGB’s VHF Committee has tentatively decided to adopt the following plan for U.K. beacons; GB3CTC — 70.030 MHz; GB3SX — 70.040 MHz; GB3SU — 70.050 MHz and GB3ANG — 70.060 MHz. This information via Brian Bower, G3COJ.

On 2m., GB3VHF was restored to service on October 23. Brian advises that the keyer has been modified to give; “2 x letter shift, carriage return, live feed,” before the RTTY identification. The keyer was built by Richard Russell, G4BAU, who designed the electronic clock seen on BBC 2 television.

On the 20m. VHF net, OZ4VY mentioned a new Swedish 2m. beacon, SK2VHG on 144.890 MHz. It is very far north in KB1a and runs 100 watts to a 16-ele. grid superienced south. This one might be useful to monitor for meteor shower activity, although U.K. folk are far off its main beam.

Contests

The results of the RSGB/IARU 144 MHz contest over the Sept. 5/6 weekend were announced over G2BRS. In the portable section, G4BPO/P was first and G4BGW/P came second. The multi-operator section was won by John and Jackie Brakespear, using the latter’s call, G8RZO, with G8ZHP in second spot. Ken Ellis, G5KW, (Scilly Is.) reports the first 6m. reception of west coast U.S.A. signals this autumn on Nov. 13. He worked W6DRA, WA6PES, K77V (Wash.). Ken also heard K6MYC, KB7WW (Oregon), K7CAI (Wash.) and KB60.

George Szymanski, GM4COK, (Edinburgh) has a dipole for 6m., end on to the U.S.A. but that which brought in many strong Ws and VEs. On Nov. 1 he worked three of each and the next day, two more VEs, crossband on 10m. John Baker, GW3MHW, (Dyfed) has been busy moving into a new VHF shack and got back to 6m. receiving with an indoor dipole. Crossband QSOs with W1 and W2 were made on Nov. 1 and with W1-4, W8-0 and VE1 on the 2nd. He reports that the 2nd. was a very fine day with W8 stations making W.A.C. Many more Central and South American stations are QRV.

Nov. 2 seems to have been a rather historic day, according to GW3MHW. Stations in SB4, ZB2 and 5V1 were heard working into the U.S.A. as were the few PAs who have special spot frequencies above 53 MHz on a non-interference basis, CW only. An HA station has joined the 6/10m. crossband scene.

Mike Probert, GW4HXO, (Dyfed) has sent in a long and informative letter. He is completely new to crossband working and it must be one of the most interesting and cheapest facets of the hobby. “A simple dual-gate, MOSFET converter, 2-ele. Yagi and the station 28 PAs who have special spot frequencies must be treated with some scepticism. “A simple dual-gate, MOSFET converter, 2-ele. Yagi and the station 28 MHz transceiver and you’re away!” Mike heard his first 6m. signals on Oct. 5 — the ZS6 beacon. He called ZS6LN at 1657 on 28.885 MHz giving an RST 519 report. Further crossband contacts took place on
Oct. 6, 7, 16, 17, 18, 21, 22, 24, 30 and 31 and on Nov. 1. Stations worked were EL2AV, VP2YGR, KV4FZ, H1RDAF, that probably a "first," EL2FY and several east coast Ws and VEIs.

On Nov. 1, Mike reckons 6m. sounded like 40m. on a Sunday morning, but complains that many Ws do not mention where they are listening on 10m. He has found it best to call "CQ" about 10 kHz away from 28.885 MHz, saying where he is listening on 6m. This ruse resulted in some pile-ups and QSOs with about 40 stations in the period to 1445 on Nov. 1. While one station was running 2 kilowatts to four 8-ele. stacked Yagis at 140 ft., the most enjoyable QSO was with WA1YKM, where they are listening on 10m. He has several east coast Ws and VEIs. Mike between SV1DH, using his special call G4HJD, believes that "firsts" on 6m. were made as being very active. He has a beam.

A enjoyable QSO was with WA1YKM, where they are listening on 10m. He has several east coast Ws and VEIs. Mike between SV1DH, using his special call G4HJD, believes that "firsts" on 6m. were made as being very active. He has a beam. Mike Allmark (Leeds) reports F, propagation up to 60 MHz on Nov. 1 and 2, with U.S.S.R. TV and W1-5 and VE stations heard on 6m.

Four Metres

Dave Sellwood, G3PBV, (Devon) has managed to work his first fixed station in the county at last; it was G4CIZ in Exeter who is now QRV with 10w. to a 4-ele. Yagi. Paul Turner, G4JE, (Essex) has been doing some 4m. to 2m. crossband MS tests with YU3ES in GF39d. On Nov. 1, Stane, using a 2-ele. Yagi and the converter built by Paul, received 12 pings and 16 bursts, the longest being 8 secs. at S55. Paul was using 50w. input and a 5-ele. Yagi on 4m and the QSO, which started at 0500, was completed in under half an hour. The QRB is 1,212 kms.

GW4HJO is now running about 30w. PEP of SSB from a home-built transverter as designed by G3XBY and G3WOS. Mike found conditions very poor in October, apart from the Auroras G4JZF, GW3RGL, and John Davies, GW4IOI, Welsh stations on 4m. are Ted Hays, GM3TAL and G6WR. Two more new stations on 4m. are G3COJ and G4JE. Mike Allmark (Leeds) caught the Oct. 20th and 21st, when he worked UU3ES in GF39d. On Nov. 8, Stane, using a 2-ele. Yagi and the converter built by Paul, received 13 pings and 16 bursts, the longest being 8 secs. at S55. Paul was using 50w. input and a 5-ele. Yagi on 4m and the QSO, which started at 0500, was completed in under half an hour. The QRB is 1,212 kms.

GW4HJO is now running about 30w. PEP of SSB from a home-built transverter as designed by G3XBY and G3WOS. Mike found conditions very poor in October, apart from the Auroras. With some two months of persistent low pressure systems dominating our weather, tropospheric conditions on VHF have been pretty dismal, until the beginning of November. However, some Auroral activity did break the monotony, while the MS addicts were unaffected.

Mike Allmark (Leeds) caught the Oct. 22 Ar at 1310 on Band 1 TV and at 1330 copied OZ1EKI on CW. The band was well populated with DL, PA and OZ stations on SSB, with lots of QRN on the CW end. UW2DRD (MS68F) was winkled out but a UP2 and an OH7 in NW got away. On the way home from the local ale house at 2100, a visual Aurora was seen. The first radio phase ended at 2210, the second one beginning at 2340 with only a few QSOs. Nothing was heard at 2230 when a sked had been arranged.

Three bands only count for points. Non-scoring figures in italics.
15m. CW, he realised much of it was very Auroral on Sept. 22 so went over to 2m. only to find local SSB in progress. However, the CW end revealed GMs but numerous CQ calls on SSB produced nothing. So Steve feels that a go at the morse test is even more desirable. His transceiver is the Multi FDK-750E, Lunar 100w. amplifier and Jaybeam 10xy aerial. John Moxham, G8KBO, (Somerset) runs 25w. on the band and enters our Squares Table. He caught the Ar on Oct. 20 and contacted GM4LPG (YR52f) and GM4BYF (YP04d) with OK1MB (HK) heard. In the Oct. 22 affair, he worked G6BCO (YN07a), G4KKG (WP77e) and GM6ALC (XQ77e). On Nov. 3, in a good spell of tropo. to the south, John had QSOs with EA1TA (VD), EA1CR (XD), F1BOF (AE), F1FVV (ZE), F1CCM (ZE), F6FRR (ZF) and other Fs further south.

John and Jackie Brakespear, G8RZP and ‘RZO respectively, have re-entered the squares table from the new QTH. They welcomed the tropo. lift on Nov. 3, their transceiver is the Multi FDK-750E, Lunar 100w. amplifier and Jaybeam 10xy aerial. He reports the death of GJ4JVP (ZE), F6FRR (ZF) and other Fs further south.

John, who made the first GJ/OE 2m. QSO in 1975. Three other GJs are in hospital and Geoff suggests the size of their tax bills might be a contributory cause!

Andy Renouf, G3SBT, had a number of QSOs in the Oct. 22 Ar and got four new squares as a result. These were G8YDZ (WP), GM4JYZ (XP), GM4LPG (YR) and GM6ALC (XQ). He got five reports of “59A” and many “49A”. At the end of the event, GM6GFF was S7 running just 2½ watts!

George Szymanski, GM4COK, returned home from sea on Sept. 12 thus missing all the summer E’s. He has been on MS but found the Orionid and Taurid showers very poor. Even so, he made complete QSOs with F8OP (CG), DL6NAA (FK), SP9AI (Jl), SK7JD (IR), OK1MDK (HJ), F1JG on SSB in CD square in 21 mins., OESXDL (HI) and I6WJB (HC) at a QRB of 1,995 kms.

George has caught several recent Ar’s and wishes people would respect directional CQ calls. Calling only for OH and U stations, he is invariably answered by many “local” Europeans. Nevertheless, on Oct. 20 he did contact UR2RQT.

Walt Davidson, GW3NYY, (Swansea) planned to move his aerials from the chimney on the house, to a mast at the bottom of the garden in an attempt to overcome many audio breakthrough problems in the neighbourhood. During October, the best QSOs were HOJ0N (KU) via MS on the 11th., EA1QI (VD) via Ar on the 20th., and UA2FAY (KO) via MS on the 26th. The latter was a new country and Walt wonders if any were “firsts”? Between Oct. 3 and 26, 16 MS QSOs were completed, providing 8 new squares and a couple of new countries. An Ar on Oct. 11, 1520-1630, produced three GMs in YP square on CW. Walt was QRV for the Oct. 20 event from 1600-1945 and had a ball on CW working 21 squares and 8 countries. Only 90 mins. of the Oct. 22 Ar was used with 7 squares and 4 countries contacted.

Richard Hope, GW8TVX, (Swansea) confirms “pretty grim” conditions till Nov. 2 when he worked F1FVP (ZF), F1CYB (BH), EA1ED (VD), with F1KCP in BI heard. Reg Woolley, GW8VHL, (W. Glam.) worked French stations in XI, ZJ and YL on Oct. 22, 24 and 31. In the tropo. lift of Nov. 2/3 he worked EA1CR and EA1s ED, QJ, RCA and TA, all in VD square. EA1RCA told Reg that EA8XS did not work into Iceland, recently, as having been rumoured; his best DX was to GD, as already reported.

Paul Turner, G4IJE, was on in the Oct. 20 Ar and worked SM6HHF (G5) for a new square. In the Oct. 22 affair he worked two more new ones; LA6VC (ES) and UP2BFR (LP), with UC2ABT heard. On the MS front, Paul completed with 1SMZD (FY) on the 20th., and OH2BB (LT) on the 23rd. Via tropo. on Nov. 2/3, he worked EA1CR and EA1TA, and into AE square. On the 3rd., HB9HB beacon was audible as was OESXDL (HI77b) at 1500. DLOSG (GJ77j) peaked S3 at 1700. At 1753, Paul was called by OESXDL (HI) and at 1851 worked DKSQG (Gl).

OZ4VW said the Ar on Oct. 11 rumbled on from about 1200 to 2000 but no really good DX was around. Finn’s best QSO was UA3MBJ at 1,600 kms. In the Oct. 20 event, Pete Bates, GM4BYF, (YP04d) did not come on till 1600 as he did a hasty rebuild of his amplifier. OK, SP and Y stations were worked from Scotland at QTFs 80 to 90°. Ray James, GM4CXM worked into 1K square and a UR2.

Mark Turner, G8OBS, was operating...
At present, but a 2 x 4CX250B amplifier on one of 21-ele. Tonna Yagis. on an az-el. mount soon on 70cm. so this rare county should be available says that GU3FRO on Sark now has a Belgian from Sheppey, ON7PO. GJ4ICD (ZH63g).

Best DX was F1CCM (ZE17c) and F6ETZ (ZG). Conditions on the south were excellent, F1BOF/P gave John his 46th. square on Multibeam. G8KBQ worked stations in Expander with his FDK-750E and a 48-ele. Orpington is QRV on the band using the conditions on Oct. 17 and 25. G8EIU in southern DX. Even so, Tony lists some conditions for the contests apart from Nov. 2, even though he could not work the FIBOF/P on Nov. 2. HB9AMH/P was Cumulatives Graham's best DX being and ZG heard. G4JZF participated in the Fl BOF/P (AE) worked and stations in ZF worked. Things were better on Nov. 2 with as "diabolical", with a mere five stations bad cold on Oct. 17 but the conditions were quite good contacts to the south were excellent, Tony Collett, says that the London Marconi Memorial event going on at the University of Nottingham station, G3UNU in the Occ. 20 Ar and the first QSO was at 1420 with an OZ at QTF 45° while the GMs were coming in at 10 to 15°. A surprise contact was YU7PX (KF01c) at 1901 who could be QSL-ed via YU7JDE. Ken Wood, GM3WCS (YQ73c) worked into DL, ON and PA and said that G3AAQ/A in Newcastle heard HB, SP and UR2 in this event.

Tulive Penna, G3PGO (Kent) took part in the CW contest on Nov. 8 and had 96 QSOs at an average of 14 1/2 pts. each. The tally comprised 30 DLs, 17 Fs, 6 ONs, 13 PAs, the rest being U.K. stations. Best DX was DK5AI (FL33b). John Hunter, G3JMV, (Bucks.) had 86 QSOs; 50 continents, the rest U.K. Neither thought the rules of the RSGB contest made it worthwhile looking to work British stations as much time was wasted swopping QTHs, not necessary in the Marconi Memorial event going on at the same time.

**Seventy Centimetres**

G3PBV has worked "the elusive county of Hertfordshire" at last in the guise of G8ASL. The *Cumulative* were generally poor; *Sylestis* QRM and gales on Oct. 9, a bad cold on Oct. 17 but the conditions were not too bad. Oct. 25 Dave describes as "diabolical", with a mere five stations worked. Things were better on Nov. 2 with F1BOF/P (AE) worked and stations in ZF and ZG heard. G4IZF participated in the *Cumulative* Graham's best DX being F1BOF/P on Nov. 2. HB9AMH/P was heard.

G8GX/E4NBS reports the poor conditions for the contests apart from Nov. 2, even though he could not work the southern DX. Even so, Tony lists some good contacts considering the conditions on Oct. 17 and 25. G8EIU in Orpington is QRV on the band using the *Expander* with his FDK-750E and a 48-ele. Multi-beam. G8KBQ worked stations in AL, YN, ZH and ZM on Nov. 2 and F1BOF/P gave John his 46th. square on the band. The next day, although conditions to the south were excellent, activity was low. Beacon FX6UHF (ZE18) on 432.87 MHz was Z3 most of the day. Best DX was F1CCM (ZE17c) and F6ETZ (ZH63g).

G8RZO and G8RZP have been taking it in turns in the *Cumulative* with Jackie getting the Nov. 2 leg and making 76 contacts, the best DX being in to EL square, plus G8PWX in Tyne and Wear. The following day brought their first Belgian from Sheppey, ON7PO. G4ICD says that GU3FR0 on Sark now has a *Yaesu* FT-480R and GASFET amplifier, so this rare county should be available soon on 70cm. G4M4COK is back on the band with 10w. at present, but a 2 x 4CX250B amplifier on the stocks. George's aerial array is a couple of 21-ele. *Tonna Yagis* on an az-el. mount as he plans to try some Auroral contacts and MS work on the band. G8V8VH1 mentions that F5JY in ZJ22e is on the band with 500w. Reg worked EI9Q at 1533 on Oct. 31 and was heard by E19BG (VM). EI9Q has loaned Tom a 60w. amplifier. On Nov. 2, Reg worked E1AEED (VD95h) who runs 10w. and a 21-ele. beam.

**Twenty-three Centimetres**

G3PBV only heard G81DZ/P on the Isle of Wight in the *Cumulative* on Oct. 17 and called in vain. G8KBQ has one watt on the band but missed the contests due to storm damage to the aerials. By Nov. 17, the system should be fully operational again and John will be looking for contacts on the band. He can be reached by telephone any time on Gatsby (OW584) 33145 for arranging skeds. G8GX/E4NBS made four QSOs on Nov. 2, locally, but heard G8GDZ (W. Midlands), G4MHC (Wors.) and G4KCT (York). G8SBTT hopes to have better equipment built for January should any good tropo. appear.

**Random Jottings**

Tony Collett, says that the London morse tests are held on Tuesdays only. The address is:— Post Office External Telecommunications Executive, Maritime Radio Service Division, Room 203 Lansec House, 23 New Fetter Lane, London EC4A 1AE. The 'phone number is 01-583 0000. (Yes, 0000). Ask for the Maritime Radio Service Division when you get through.

FQ square seems to be a little rare and OZ4VH has heard OZ3GW in a recent *Aurora* if you need it. UA2FAY (KO) in Kaliningradsk has a home built transceiver, 120w. and a 13-ele. *Yagi*, so should be quite workable on MS and Ar. G3PBV asks why many operators give calls in the forms, "G, figure six," or "G applications?", which he reckons could be confusing in weak signal conditions. Why not "Golf six?"

Some late news about the new Soviet amateur satellites has been received by AMSAT-UK in the form of an official announcement passed on by Mr. A. Gschwind, HAS/WI, in Budapest. Three satellites are planned, each with a 2-to-10m. downlink passband. As of Nov. 10, AMSAT-UK in the form of an official announcement passed on by Mr. A. Gschwind, HAS/WI, in Budapest. Three satellites are planned, each with a 2-to-10m. downlink passband. As of Nov. 10, AMSAT-UK in the form of an official announcement passed on by Mr. A. Gschwind, HAS/WI, in Budapest. Three satellites are planned, each with a 2-to-10m. downlink passband. As of Nov. 10, AMSAT-UK in the form of an official announcement passed on by Mr. A. Gschwind, HAS/WI, in Budapest. Three satellites are planned, each with a 2-to-10m. downlink passband. As of Nov. 10, AMSAT-UK in the form of an official announcement passed on by Mr. A. Gschwind, HAS/WI, in Budapest. Three satellites are planned, each with a 2-to-10m. downlink passband. As of Nov. 10, AMSAT-UK in the form of an official announcement passed on by Mr. A. Gschwind, HAS/WI, in Budapest. Three satellites are planned, each with a 2-to-10m. downlink passband.

**Sign Off**

Have a Happy Christmas. The January deadline is December 2, and the February one, January 6. Everthing to:— "VHF Bands," "SHORT WAVE MAGAZINE," 34 High Street, WELWYN, Herts., AL6 9EQ. 73 de G3FPK.
## DATONG D70MORSE TUTOR

**DATING PRODUCTS**

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<tr>
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<td>MPU1</td>
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### MORSE EQUIPMENT

- **RX/KEY:**
  - MX70: Squeeze Pad ($70.00)
  - RX54: Down Flow ($39.00)
  - RX55: Down Flow (I/P) ($79.90)
  - RX70: Deluxe Up/Down Key ($59.99)
  - RX71: Squeeze Key ($29.95)
  - RX72: Squeeze Side Tone Monitor ($74.00)

### DECK MICROPHONES

- **SHURE 4440:** Dual Impedance ($29.95)
- **SHURE 528T:** HF Power Microphone ($39.90)
- **ADAMS ADN 2025:** Repack ($48.00)
- **ADAMS ADN 2030:** Comp. Mic. w/ 1000Hz Preamp ($59.99)
- **ADAMS ADN 3025 ELL:** Clap-on ($69.90)

### HAND MICROPHONES

- **TAD 900 Flat Mic.**
  - $4.99 (HF)
  - $4.99 (VHF)

### MOBILE SAFETY MICROPHONES

- **TRIO MC 3036:** 600MHz ($498.00)
- **TRIO MC 3136:** 600MHz ($589.00)
- **ADAMS ADN 2025 SS:** Hands Free 1200kHz ($69.99)
- **SHURE 528T:** HF Power Microphone ($39.90)
- **SHURE 520:** High Imp. Quality Mic. ($69.90)

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- **PC1:** Gen. Cov. Conv. HF on 2m Rig ($120.76)
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### DATONG DATA COMPRESSION UNITS

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<tr>
<th>Band</th>
<th>Product</th>
<th>Price</th>
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<tbody>
<tr>
<td>2m</td>
<td>C5/2M SSB collinear</td>
<td>£47.70</td>
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<tr>
<td></td>
<td>BY/2M 3 ele yagi</td>
<td>£12.95</td>
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<tr>
<td></td>
<td>BY/3M 3 ele yagi</td>
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<tr>
<td></td>
<td>BY/3M 10 ele yagi</td>
<td>£33.40</td>
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<td></td>
<td>BY/10M 2M 10 ele Para</td>
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<td>BY/14M 14 ele Para</td>
<td>£46.25</td>
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<tr>
<td></td>
<td>SKY/2M Cross 4 ele quad</td>
<td>£34.70</td>
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<td>SKY/2M Cross 8 ele yagi</td>
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<td>C4/2M 4 ele quad</td>
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<td></td>
<td>D4/2M 4 ele quad</td>
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<td></td>
<td>D5/2M Double 5 yagi</td>
<td>£21.80</td>
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<td>G5/2M Double 8 yagi</td>
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<td>USP2M Unipole</td>
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<td>HO/2M Mobile 'halo'</td>
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<td>HM/2M 'halo' + mast</td>
<td>£5.75</td>
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<td></td>
<td>TAS 1/4 wave whip</td>
<td>£16.25</td>
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<td></td>
<td>X6/2M/1270m Dual Band</td>
<td>£25.85</td>
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<tr>
<td></td>
<td>LR/12M 4 3/4 dB vertical</td>
<td>£41.35</td>
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**FOR 70cm Band:**

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<th>Price</th>
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<tr>
<td>DB/70m Double 8 yagi</td>
<td>£22.40</td>
</tr>
<tr>
<td>P8M 18/70m 18 ele</td>
<td>£27.50</td>
</tr>
<tr>
<td>MBM40/70m 18 ele Multi.</td>
<td>£31.00</td>
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<tr>
<td>MBM48/70m 16 ele Multi.</td>
<td>£42.00</td>
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<tr>
<td>MBM120/70m 12 ele Multi.</td>
<td>£54.00</td>
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<td>X6/2M/1270m Dual Band</td>
<td>£41.35</td>
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- SKY/2M Cross 12 ele yagi: £36.75
- C4/2M 4 ele quad: £26.85
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— Wanted: Eddystone S.640 Rx; FT-243 7 MHz band crystals; HF GDO. Details and price please. (Berks.). — Box No. 5758, Short Wave Magazine, 34 High Street, Welwyn, Herts. AL6 9EQ.

— Selling: Icom IC-251 with matching speaker, £395. IC-25M VHF marine, £190. — Mansi, G8VVK, QTHR. (Tel: Great Yarmouth 67597 after 6 p.m.)

— Selling: Yaesu FT-707 transceiver with FP-707 power supply, 11m. fittted, three weeks old, £550. — Ring Newport, Orpington 26435.

January issue: due to appear December 28th. Single copies at 80p post paid will be sent by first-class mail for orders received by Wednesday, December 23rd, as available. — Circulation Dept., Short Wave Magazine, 34 High Street, Welwyn, Herts. AL6 9EQ.


— Selling: Yaesu FR-101S digital receiver, little used, immaculate, £325 or near offer. — Lawton, 36 Doctors Hill, Stourbridge, (Tel: Brierley Hill 70180, office hours).

— Selling: Marconi Kestrel Mk.III transmitter/receiver with 240V. AC/PSU, working, £75 or near offer. Buyer collects. — Elsworth, G4AYG, QTHR. (Tel: 02555-7175).

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