RADio COMmunication

February 1986

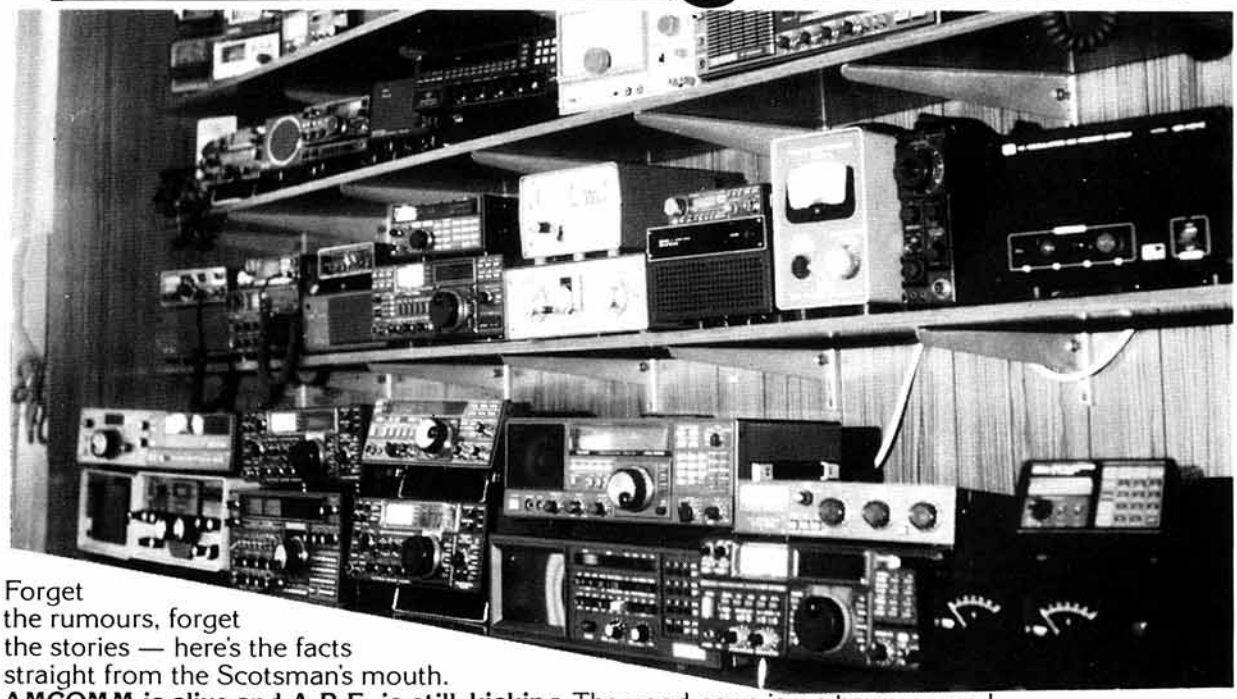
Willie McClintock, MSc, G3VPK, with Joan Heathershaw, G4CHH, after she had installed him as the 52nd President of the RSGB

(Installation report next month)

Journal of the Radio Society of Great Britain

AMCOMM A.R.E.

What on Earth's going on in Uxbridge Road...



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Technical articles on subjects of amateur interest are always welcome and should be sent to: The Editor, *Radio Communication*, 88 Broomfield Road, Chelmsford, Essex CM1 1SS.

All articles received are reviewed for technical merit by the RSGB Technical & Publications Committee, or an acknowledged expert on the subject, before acceptance. Payment at high competitive rates will be made for all articles published.

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The editor will be pleased to send intending authors a manuscript preparation guide, and to give any other advice and assistance requested.

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We give below a list of approved dealers in the UK. Any dealer not on this list has no connection with the UK distributor network and has no direct factory backing. Great care should be taken when purchasing your amateur radio equipment, to ensure that the dealer is factory approved. In any case, first contact our sole distributor for the UK: Lowe Electronics Ltd., who will be pleased to advise you of your nearest dealer.

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The **Trio TS940S,** a first class competition HF transceiver

£1695.00 inc VAT

. . . designed for SSB, CW, AM, FM and FSK operation on all amateur bands from 160 to 10 metres. The transceiver incorporates a 150kHz to 30MHz general coverage receiver having an excellent dynamic range (typically 102dB on 20 metres, 50kHz spacing, 500Hz CW bandwidth). Designed to cope with today's band conditions and with the serious DX'er/contest operator in mind, the TS940S has a comprehensive range of front panel receiver controls;

SSB IF slope tuning; operating in both LSB and USB modes, front panel controls allow the independent adjustment of either the high or low frequency slopes of the IF passband.

CW VBT (variable bandwidth tuning); allows the passband width to be varied without affecting the centre frequency.

IF notch filter; provides in the order of 40dB attenuation to the interfering signal.

AF tune; active filtering reduces interfering signals and white noise in the CW mode.

Narrow/wide filter selection; a selection of filters, both 8.83 and 455kHz are available for the operator who requires maximum selectivity control. The TS940S comes with both 2.7kHz SSB filters (8.83 and 455kHz) and the 6kHz AM filter (455kHz) built-in.

CW variable pitch; dual mode noise blanker and separate RIT/XIT controls complete the facilities.

To aid serious operating on both amateur and broadcast frequencies, the TS940S has;

A large, heavy diecast knob with a moulded rubber cover which when rotated at normal tuning speeds results in frequency steps of 10Hz. Rotation of the tuning knob in excess of 2 to 3 revolutions per second results in the step size and tuning rate being increased.

In addition to instant access to each amateur band using the band select keypad, the same keys can be used to directly enter any frequency within the operating range of the transceiver. Once entered, the VFO can be used to tune away from the selected frequency. Truly flexible operating in the TRIO tradition.

The TS940S has two VFOs, front panel switches enable split frequency operation, both VFOs to be quickly put on the same frequency and the reversal of the transmit and receive frequencies during split frequency operation.

40 memory channels, each of which remembers both frequency and mode are available. Frequencies can be easily transferred from memory to either VFO. Memory is backed up by a lithium battery. The transceiver operating system is held permanently in ROM and is not dependent upon the back-up supply.

The transceiver will scan all memory channels and between user programmed frequency limits as set in memories 9 and 0.

Accurate and quick frequency readout is ensured by the use of a large fluorescent tube digital display combined with an analogue sub-scale. The analogue display can be switched to read a 1MHz or 100kHz span, tuning in either 20kHz or 2kHz steps.

A feature new to HF transceivers is a green, back-lit dot matrix LCD which shows graphically VBT and IF slope tuning positions, can be used to review the frequencies stored in the 40 memory channels and other VFO, will provide information on the automatic sequence of operations when using the internal (optional) tuning unit, and when selected, displays both the time and owner programmed on/off switching times.

In addition, break-in keying on CW, a 28 volt solid state final amplifier stage, an RF speech processor coupled to the rig's ability to monitor its own transmitted audio and all mode squelch add up to give the TRIO TS940S even greater versatility of operation.

For those with failing sight or a blind operator the TS940S is a dream come true; not only is the operating mode identified by the appropriate CW letter sent in tone (F for FM, U for upper side band, etc) but, when fitted with the VSI board (optional), a digitally encoded girl's voice will announce the operating frequency.

TRIO-KENWOOD CORPORATION

Shionogi, Shibuya Building, 17-5, 2-chome Shibuya, Shibuya-ku, Tokyo 150, Japan

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Division of Trio-Kenwood Electronics GmbH
Rembrücker Street 15, D-6056 Heusenstamm, West Germany

vhf/uhf fm transceivers

TW4000A FM VHF/UHF dual band transceiver

To have both 70 centimetres and 2 metres available in one mobile transceiver has been a desire of the VHF/UHF enthusiast for many years. TRIO with the TW4000A have satisfied that need. The transceiver is well known for having an excellent receiver and as those who already own and operate one know, is a delight to use. Compact and producing 25 Watts on both bands, the TW4000A is the enthusiast's natural choice.

TW4000A . . . £522.00 inc VAT, carriage £7.00.

TR7930 2 metre FM mobile/base station transceiver

A mobile FM transceiver that also doubles as a piece of shack equipment. Producing 25 Watts and having 21 memories, priority alert, full repeater facilities including reverse repeater, programmable band scan, memory scan and keyboard frequency entry, the TR7930 is ideal for mobile operation using the programmed memories, yet is suitable for shack use with the front panel keyboard.

TR7930 . . . £329.00 inc VAT, carriage £7.00.

TM201A and TM401A 2 metre and 70 centimetre mobile FM transceivers

Accepting the fact that there is little space in a modern car for anything other than a radio/cassette unit, TRIO have with the TM201A and TM401A produced the definitive compact transceiver. By removing the speaker and making this separate, TRIO have given you excellent receive audio quality. The TM201A and its 70 centimetre version, the TM401A are ideal for the amateur who wants a high performance rig with ease of operation.

TM201A . . . £265.00 inc VAT, carriage £7.00. (New low price).
TM401A . . . £316.00 inc VAT, carriage £7.00.

TM211E and TM411E FM VHF and UHF mobile transceivers

By taking the popular TM201A and TM401A and adding DCS and a tiltable front panel, TRIO have produced higher specification transceivers. Even easier to fit in tight locations, the TM211E and TM411E are transceivers designed to cope with today's crowded bands.

TM211E . . . £365.00 inc VAT, carriage £7.00.
TM411E . . . £399.00 inc VAT, carriage £7.00.

handheld transceivers

TR2600E and TR3600E 2 metre and 70 centimetre FM handhelds

The latest handhelds from TRIO are a natural progression from the much liked TR2500/TR3500. By adding DCS, the ability to skip particular memory channels, to hold for either timed or carrier when scanning, for the memory to hold whether the channel is simplex or repeater shift and an illuminated "S" meter, TRIO have produced a first class pair of handhelds.
TR2600E . . . £275.00 inc VAT, carriage £7.00
TR3600E . . . £292.00 inc VAT, carriage £7.00.

TH21E and TH41E 2 metre and 70 centimetre FM compact transceivers

The TH21E and TH41E are two simple handhelds, each extremely small yet having full repeater facilities including reverse repeater. Power output is one Watt or 150 mulliWatts in the low position and frequency selection is by means of thumbwheel switches. Very small but still convenient to operate, the two transceivers are just right for the amateur who wants to stay in touch.

TH21E . . . £170.00 inc VAT, carriage £7.00.
TH41E . . . £199.00 inc VAT, carriage £7.00.

vhf/uhf all-mode transceivers

TS780 VHF/UHF dual band transceiver

The TS780 is the ultimate base station for the enthusiastic operator who wants both 70 centimetres and the 2 metre band in one transceiver. Modes of operation are USB, LSB, CW and FM. Full repeater facilities, plus two VFOs, IF shift, two priority channels, memory and band scan combine to make the TRIO TS780 the perfect rig.

TS780 . . . £948.00 inc VAT, carriage £7.00.

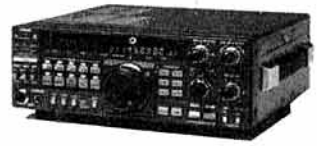
TR9130 two metre all-mode transceiver

The TR9130 is now a classic rig—so popular that to have one on the second hand shelf is rare. 25 Watts on SSB, FM and CW, green frequency display, six memories, two VFOs and memory scan make the TRIO TR9130 ideal for either mobile or base station operation.

TR9130 . . . £499.00 inc VAT, carriage £7.00.
TR9300 (6 metres) . . . **£569.97** inc VAT, carriage £7.00.

TS711E and TS811E 2 metre and 70 centimetre base stations

Following on in the tradition of the TS700 series, the TRIO TS711E and TS811E are perfect base station transceivers. Each produces 25 Watts output and has a full range of operating features. Forty memory channels are available, each of which can be used as a separate VFO. Digital code squelch is also a feature of the TS711E and TS811E.



TS711E . . . £695.00 inc VAT, carriage £7.00. (New low price).
TS811E . . . £795.00 inc VAT, carriage £7.00. (New low price).

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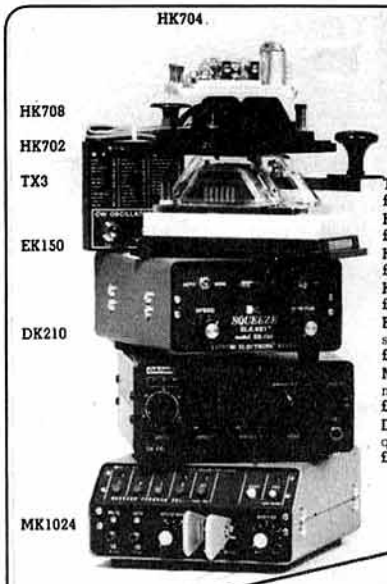

TX3. Morse practice oscillator.
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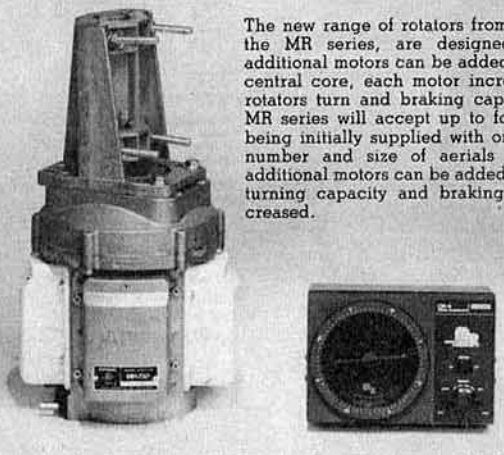
BST1 BLack base, **£67.42. BST2** Chrome base, **£76.97.** VAT inc. carr. £3.00

DAIWA rotators .....



The new range of rotators from DAIWA, the MR series, are designed so that additional motors can be added around a central core, each motor increasing the rotators turn and braking capacity. The MR series will accept up to four motors being initially supplied with one. As the number and size of aerials increases, additional motors can be added, and both turning capacity and braking effort increased.

MR750E	Multitorque rotator (round controller).....	**193.00** inc VAT,
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MR750U	additional motor for MR750E/PE.....	**£64.64** inc VAT,
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Carriage on rotators £7.00, components £3.00

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"as I said to John"

The last article on receiver performance discussed spurious responses and spurious signals generated within the receiver. This month's article describes another source of unwanted signals but in this case produced from off-air signals by INTERMODULATION DISTORTION.

The effect occurs in the front-end of the receiver, usually in the RF Amp or mixer, when strong signals from the antenna cause non-linear operation and mix together to produce unwanted signals. For example, consider a receiver tuned to the 20m band in the vicinity of stations operating at 14·100 and 14·150MHz. Signals from these stations are received with sufficient strength to cause some overloading of the receiver with consequent production of harmonics and sum and difference signals. Most signals produced are well out of band, and will be removed by filtering without problem, but signals generated as the difference between one signal and the second harmonic of the other will be in the 20m band. In this case at 2 × 14·1–14·15 = 14·05MHz, and 2 × 14·15–14·1 = 14·2MHz. So our receiver may struggle to resolve a weak signal on 14·2MHz because of intermodulation.

This combination of frequencies may seem unlikely in normal use, but intermodulation can be a real problem in bands where signals occur at a fixed channel spacing, such as VHF communication bands and HF broadcast bands. Under these conditions, intermodulation products occur at the frequencies of other channels and will often cause unpleasant heterodynes. Also, intermodulation products are produced by each pair of signals that overload the receiver, so if four signals are present at excessive levels, then a total of 24 intermodulation products will be produced.

The intermodulation products described above are known as third-order products because they are derived from a fundamental signal (1) and a second harmonic (2). Other order products are produced in receivers, but third order products are usually strongest, and are often those quoted in receiver specifications.

Because intermodulation is caused by non-linear operation of a receiver, the level of intermodulation products will change more than the level of the incoming signals. In the case of third order products, levels change three times as quickly, so for a 1dB change in signal level there will be a 3dB change in intermodulation level. For this reason, an input attenuator on a receiver can greatly help to combat intermodulation problems. Inserting 10dB attenuation will reduce the wanted signal by 10dB, but will reduce intermodulation effects by 30dB, and thus will improve the signal : intermodulation ratio by 20dB.

How is intermodulation in receivers measured and specified? Two signals with a fixed frequency separation (often 50kHz) and at equal levels are fed into the receiver's antenna connection, and the receiver tuned to resolve one intermodulation product of the two signals. The level of signals required to produce an intermodulation product equal in strength to the receiver's noise floor is determined. The difference between this level and the receiver's noise floor (see article in September issue) gives the intermodulation-free dynamic range (Ifdr) of the receiver.

The Ifdr is an important receiver specification since it tells us the range of signal levels over which the receiver will operate without suffering from intermodulation. Use of the input attenuator of a receiver will not affect the Ifdr, but will simply move the available range up or down to best suit band conditions.

Another specification that is used is Intercept Point. This is the theoretical input level of two signals at which the level of i.m. product is equal to each signal. The intercept point cannot be measured directly, but can be calculated from the noise floor and the Ifdr thus:

Intercept point (ip) = (1·5 × Ifdr) + Noise floor (levels in dB)

If intercept point figures are used to compare receiver performance, then the sensitivity (noise floor) of the receivers should be compared as well. An insensitive receiver will often have a high intercept point. Ideally comparison of Ifdr should be made.

Receivers in the HF band generally require better i.m. performance than their VHF or UHF counterparts because of the large number of strong signals in the HF broadcast bands. Ifdr should be 80dB typically, and over 90dB for a high quality HF receiver. Intercept point should be above −15dBm typically, and as high as +10dBm or +15dBm for expensive receivers. For VHF operation, figures 10dB lower can be accepted in most locations.

Next month we look at the signal processing facilities available in receivers.

HIGHER AND HIGHER WITH

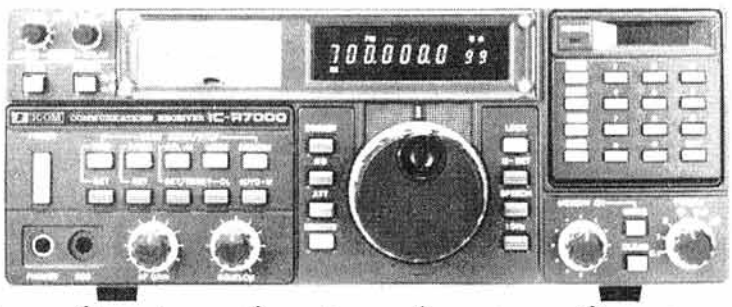
2 New models to raise ICOM Amateur frequencies to 1·2GHz.

IC-1271E Fantastic new multimode 1.2GHz Transceiver

ICOM, a pioneer in 1.2GHz technology are proud to introduce the first full feature 1240 – 1300 MHz base station transceiver. Features include: multimode operation, 32 memories, scanning and 10 watts RF output. The IC-1271E allows you to explore the world of 1.2GHz thanks to a newly developed PLL circuit that covers the entire band, a total of 60MHz, SSB, CW and FM modes may be used anywhere in the band making the IC-1271E ideal for mobile, DX, repeater, satellite or moonbounce operation. The IC-1271E has outstanding receiver sensitivity, the RF amplifiers use a low noise figure and high-gain disc type GaAs FET's for microwave applications. The rugged power amplifier provides 10 Watts which can be adjusted from 1 to 10 Watts. A sophisticated scanning system includes memory scan, programme scan, mode-selective scan and auto-stop feature. Scanning of frequencies and memories is possible from either the transceiver or the HM12 scanning microphone. 32 programmable memories are provided to store the mode and frequency in 32 different channels. All functions including memory channel are shown clearly on a seven digit luminescent dual colour display. The IC-1271E has a dial-lock, noise blanker, RIT, AGC fast or slow and VOX functions. With a powerful 2 Watt audio output the IC-1271E is easily audible even in a noisy environment. The transceiver operates with either a 240V AC (optional) or 12 volt DC power supply.
A variety of options include IC-PS25 internal AC power supply, IC-EX310 voice synthesizer, the TV-1200 TV transceiver adaptor and the IC-EX309 computer interface. The IC-1271E is the most compact and lightest all-mode 1200 MHz transceiver currently available.

IC-R7000 VHF/UHF scanning receiver

Causing quite a stir at the moment is the ICOM IC-R7000. This new receiver is able to give high frequency coverage up to 1.3MHz without sacrificing SSB stability which is maintained throughout the IC-R7000's entire frequency range. For simplified operation and quick tuning, the IC-R7000 feature direct keyboard entry. Precise frequencies can be selected by pushing the digit keys in sequence of the frequency or by turning the main tuning knob. FM/AM/SSB modes, frequency coverage 25-1000 MHz and 1025 – 2000MHz (25 – 1000MHz and 1260 – 1300MHz guaranteed specification). The IC-R7000 has 99 memories available to store your favourite frequencies including the operation mode. Memory channels may be called up by simply pressing the memory switch, then rotating the memory channel knob or by direct keyboard entry. A sophisticated scanning system provides instant access to most used frequencies. By depressing the Auto-M switch. The IC-R7000 automatically memorises frequencies in use, while the unit is in the scan mode. This allows you to recall frequencies that were in use. Scanning systems include memory selected frequency ranges or priority channels, scanning speed is adjustable. Narrow/wide filter selection. Five tuning speeds: 10Hz, 100Hz, 1.0KHz, 10KHz and 25KHz. All functions including memory channel readout are clearly shown on dual-colour fluorescent display with dimmer switch. The IC-R7000 has dial-lock, noise blanker, S-meter and attentuator. Options include RC-12 infra-red remote controller and a voice synthesizer.



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IC-751 The ICOM Flagship

SM-10 Desk-top Mic

The IC-751 is the Flagship of the ICOM range, it is a competition grade ham transceiver with a 100KHz – 30MHz continuous tuning, general coverage receiver and a full featured all mode solid state transmitter that covers all the WARC bands. Utilising an ICOM developed J-Fet DBM, the IC-751 has a 105dB dynamic range and a switchable choice of pre-amp 0-20dB attentuator. The transmitter features a high reliability 2SC2904 transmittors in a low IMD (−32dB @ 100W) full 100% duty cycle. Other features include 32 tunable memories, mode selective scan, frequency scan and memory scan, full break in on CW and Amptor compatibility, Pass band tuning, notch filter, variable noise blanker, Dual VFO's for DX or 10m repeater operation. The IC-751 is fully compatible with ICOM auto units such as the AT500 and IC-2KL. Options include internal or external power supplies, frequency controller, Speech synthesizer, various optional filters and SM6 or SM10 Desk Microphone.

The **SM10** desk top microphone consist of an electret condenser microphone element with a compressor amplifier, plus tunable equalisizer for maximum control of the audio characteristics of your transmitted signal. The SM10 is highly sensitive and produces clean crisp audio.

IC735 compact HF Transceiver

As predicted the ICOM IC-735 has rapidly gained the reputation it deserves. When compared with similar 'top names' transceivers the IC-735 towers above them (despite its smaller size). The IC-735 has a larger number of programmable channels, but notably most important is the superb sensitivity in all modes SSB, CW, AM and FM. This superior sensitivity is due to the excellent front end performance. All amateur frequencies from 1.8MHz to 30MHz are available including the three new bands 10, 18 and 24MHz. RF output is approximately 100 Watts. Tuning ranges from 100KHz to 30MHz, made continuous by using a high-side IF and a CPU control system. RTTY operation is also possible.

Dynamic range is 105dB with a 70.451MHz first IF circuit. Pass-band tuning and a sharp IF notch filter provide clear reception even under duress. Preamp is 10dB and attenuator 20dB. Computer remote control is possible via the RS-232C jack. Options include: the AT-150 automatic antenna tuner, the PS55 AC power supply and the SM-6, SM-8 and SM10 desk mics. Why not find out more about the IC-735 by ringing us or your local ICOM dealer.

50MHz, A New Dimension for the U.K.

IC-505. 50MHz transceiver

The IC-505 is a 50MHz band SSB, CW, FM (optional) transceiver, and has already gained an excellent reputation worldwide. The dual VFO system has been developed using advanced computer and PLL technology. The IC-505 features 6 channel memories and can be used independent of emission modes, memory scan, program scan which searches only specified frequency band. LCD ensures clear visibility even in sunlight. The R.F. amplifier, a dual gate MOSFET features high gain and low noise characteristics. The IC-505 accepts a standard dry cell pack, rechargeable nicad battery pack (BP10) or 13.8v external power supply, 3 watts R.F. output, 0.5 watts low power, 10 watts at 13.8v. Accessory circuits include split frequency operation, noise blanker, squelch and CW break-in. Options include:- EX248 FM unit, PS45 AC Power Supply and LC10 Carrying Case.
All these features make the IC-505 a great transceiver for operation on the 50MHz band.

IC-551. 50MHz Base station

This base station has all mode capability, SSB, CW, AM and FM (when optional FM is installed). It covers 50-54MHz with 80 watts variable R.F. output power (40 watts A.M.), Dual VFO's for split frequency operation. 3 memory channels and memory scan, program scan with adjustable scanning speed and auto stop when a signal is received. A powerful audio output, 2 watts at 8ohms for easy listening even in noisy surroundings.
Other features include a noise blanker, AGC fast or slow RIT, VOX passband tuning and speech processor. Options include:- PS15 20 amp external power supply, IC-EX106 FM unit and IC-HP1 headphones.
These two transceivers allow you to explore this fascinating part of the spectrum. UK stations have worked int VE, VO, W1,2,3,4 and 8. The UK beacon GB3NHQ has been received as far west as Washington State. Please contact Thanet Electronics Limited or your local ICOM dealer for more information on these 6m transceivers.

ICOM

IC-02E/04E Handportables

These direct entry micro-processor controlled handhelds, one for 2 metres, the other for 70 centimetres. Scanning, 10 memories, duplex offset storage in memory and odd offsets also stored in memory. Keyboard entry is made through the 16 button pad allowing easy access to frequencies, duplex, memories, memory scan and priority. They have a LCD readout indicating frequency, memory channel, signal strength, transmitter/output and scanning functions. A range of accessories include the HS10 Headset and boom microphone, HS10SB PTT switch box with pre-amp, HS10SA voice operated (VOX) switch box. The IC-2E and IC-4E still continue to be available.

New Retail Shop

We are pleased to announce that we have moved to a new larger retail shop. This will be managed by Andy G6MRI and is situated at Stanley Road/Kings Road, Herne Bay, Kent. Tel: (0227) 369464. Give it a visit for demonstrations and advice on anything to do with your shack. BCNU.

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Amateur Radio Exchange, London (Ealing), 01-992 5765.
Amcomm, London (S. Harrow), 01-422 9585.
A.R.E. Comms, Earlestown, Merseyside, 09252-29881.
Arrow Electronics Ltd., Chelmsford, Essex, 0245-381673/26.
Beamrite, Cardiff, 0222-486884.
Booth Holdings (Bath) Ltd., Bristol, 02217-2402.
Bredhurst Electronics Ltd., W. Sussex, 0444-400786.
D.P. Hobbs, Norwich, 0603-615786.
Dressler (UK) Ltd., London (Leyton), 01-558 0854.
D.W. Electronics, Widnes, Cheshire, 051-420 2559.
Hobbytronics, Knutsford, Cheshire, 0565-4040. Until 10pm daily.
Poole Logic, Poole, Dorset, 0202 683093.
Photo Acoustics Ltd., Buckinghamshire, 0908-610625.
Radcomm Electronics, Co. Cork, Ireland, 01035321-632725.
Radio Shack Ltd., London NW6, 01-624 7174.
R.A.S. Nottingham, 0602-280267.
Ray Withers Comms, Warley, West Midlands, 021-421 8201.
Scotcomms, Edinburgh, 031-657 2430.
Tyrone Amateur Electronics, Co. Tyrone, N. Ireland, 0662-42043.
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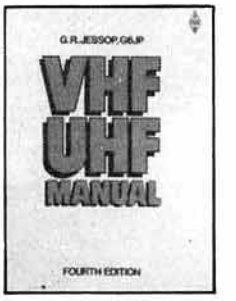

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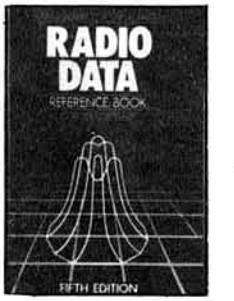

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435 MHz ATV Transmitter

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20 Watts out P.S.P
2 Channel Capability
2 Video Inputs
Internal Test Waveform Generator
Hi.Q Bandpass Filter to ensure spurious free output.

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AND TO LET YOU SEE WHAT'S HAPPENING ON ATV

Features

Ultra Low Noise 1st RF Amp
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Converts Amateur 435MHz ATV
Signals down to any standard UHF TV set.

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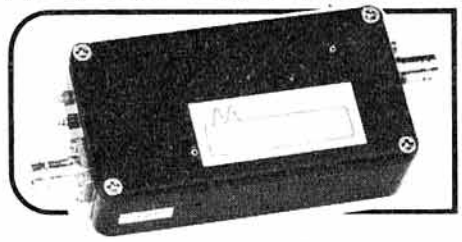

ATV Receive Converter

So this year if you want a change from talking, why not try something new. Our many retailers will give full details of our ATV equipment.

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MML144/100-HS	2m 100W Linear, 25W input	159.85	C
MML144/100-LS	2m 100W Linear, 1 or 3W input	169.95	C
MML144/200-S	2m 200W Linear, 3, 10, 25W input	334.65	D
MML432/30-L	70cm 30W Linear, 1 or 3W input	169.05	C
MML432/50	70cm 50W Linear, 10W input	149.50	C
MML432/100	70cm 100W Linear, 10W input	334.65	D
MMC435/600	70cm ATV Converter, UHF output	35.65	A
MTV435	70cm ATV 20W Transmitter	197.80	B
MM2001	RTTY to TV Converter	189.00	B
MM4001-KB	RTTY Transceiver with keyboard	299.00	D
MMS1	The Morsetalker	115.00	B
MMS2	Advanced Morse Trainer	169.00	B
MMT144/28	2m Linear Transverter, 10W o/p	129.95	B
MMT144/28-R	2m Linear Transverter, 25W o/p	236.90	B

		Total inc VAT	Post Rate
MMT432/28-S	70cm Linear Transverter	195.50	B
MMT1296/144-G	23cm Linear Transverter	258.75	D
MMX1286/144	1268MH Transmit Up-Converter	195.50	D
MMC50/28	6m down to 10m Converter	35.65	A
MMC144/28	2m down to 10m Converter	35.65	A
MMC144/28-HP	2m High Performance Converter	47.90	A
MMC432/28-S	70cm down to 10m Converter	39.90	A
MMC432/144-S	70cm down to 2m Converter	39.90	
MMK1296/144	23cm down to 2m Converter	129.95	B
MMK1691/137·5	1690MHz WX Satellite Converter	145.00	B
MMG144V	2m RF Switched GaAsFET Preamp	37.90	A
MMG1296	23cm GaAsFET Preamplifier	75.00	A
MMG1691	1690MHz GaAsFET Preamp	129.95	B
MMD1500P	1500MHz Divide by Ten Prescaler	119.60	A
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CHASE

FT726R (2) £775 inc VAT

The Yaesu FT726R has been designed and built for the discerning VHF and UHF operator. Up to three modules can be simultaneously installed giving pushbutton band selection. Choose between 6M, 2M, 70cm and 10, 12, 15M.

SSB (with fully adjustable speech processor), FM and CW (optional 600Hz CW filter available) are standard. The CW filter combined with Yaesu's excellent IF shift/width system enables optimum receive performance despite today's crowded bands.

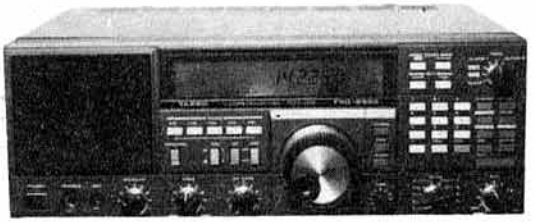
An 8-bit NMOS microprocessor offers a level of control hitherto unsurpassed, dual VFOs-20Hz step tuning, standard repeater shifts including reverse, pushbutton band selection and 25/12·5kHz FM channel tuning knob.

The eleven memory channels store mode as well as frequency and can be scanned for, busy or clear, stop or pause, even on different bands. Programmable limited band scan between memories is provided as well as priority channel checking. All the memories and both VFOs are protected against power failure by a lithium cell.

With the optional 'Plug-in' satellite IF unit installed, full crossband duplex capability is available with independent tuning and mode selection, as well as full metering of both transmit and receive parameters. (Power O/P and signal strength.)

An LED display plus two digit clarifier display are provided with large digits for easy reading at any angle. Standard features also include selectable AGC and Noise Blanker, all mode squelch and RF gain and continuously adjustable transmitter output power.

WITH YAESU'S TWO



FRG8800 £475 inc VAT

FRV8800 £80 inc VAT

Continuous coverage from 150kHz to 30MHz. Two speed spin tuned VFO plus keyboard plus computer interface control.

The FRG-8800 demodulates SSB (USB & LSB) CW, AM (Wide and Narrow) and FM narrow as standard, useful for 10M, CB and for VHF.

The FRG-8800 comes with twelve memories, programmed and scanned at the touch of a single button. Any of the memory channels will accept a frequency including the VHF range (optional VHF unit). The mode is also stored in the memory.

Four filters are fitted as standard (SSB/CW, AM, AM-NAR and FM-NAR) chosen for optimum performance, with switchable AGC and variable tone control.

The back-lit green LCD display incorporates easy to read "any angle" 10mm digits.

A twelve function display indicates the status at a glance. It includes memory channel number mode, and frequency to a resolution of 100Hz. Also included is a two dimensional LCD, graphical SIMPO and 'S' meter. A 12 button keyboard allows quick accurate changes of frequency and band.

Dual accurate 12 hour clocks, with AM/PM indicators uses the main digital display and features full back-up facilities (mains failure) and can activate the receiver or tape recorder via relay contacts. The FRV-8800, extends coverage to include 118-174MHz all with the main frame, allowing monitoring of, PMR, marine and air bands, as well as 2M. 240-220VAC to 110-120V, 50/60Hz mains standard, 12VDC operations optional.

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THE DX

FT757GX £739 inc VAT

The FT757GX is the latest in a long line of superb HF transceivers from Yaesu. The transceiver covers all the amateur bands with a full 0·5–30MHz continuous coverage receiver. Dual VFOs and eight memories all controlled by three microprocessors allow quick and accurate control of all the main functions.

All modes SSB, CW, AM and FM are included as standard along with a 600Hz CW filter, iambic keyer with dot-dash memory, 25kHz marker, noise blanker, AF speech processor and IF shift/width filters. Top panel switch selectable semi-break in or QSK is available for CW operation.

The Yaesu CAT (computer aided transceiver) system is fitted to enable external control of VFO frequency and memory functions from a personal computer via an interface unit for customised band scanning and control of the memories and VFOs.

The remarkable new heatsink design includes a quiet cooling fan with a new duct-flow cooling system incorporating the heatsink into the body of the radio. This gives forced air circulation allowing 100W PEP continuous output at 100% duty cycle in all modes.

The high performance General Coverage Receiver with Yaesu's unsurpassed IF shift/width system, switchable AGC and 20dB attenuator, combined with the switchable, RF preamp provides the FT757GX with a dynamic range in excess of 100dB in CW narrow.

All the presettable controls and connectors are conveniently located on the transceiver rear panel including VOX gain, anti-trip and delay, AM carrier and SSB processor levels, 25kHz marker switch, ext spkr and Hi Z AF outputs, patch input and external ALC, remote controller I/O port and band data for optional microprocessor automatic ATU.

The optional FC757AT is a fully microprocessor controlled antenna tuner which gives fast, reliable automatic tuning of a broad range of SWRs, with manual override for that particularly 'difficult' aerial. Also included is a dummy load, automatic SWR calculating system and meter and a dual range RF Wattmeter.

TOP PERFORMERS

FRG9600 £449 inc VAT

PA-4 (c) £12.65 inc VAT

An all mode scanning receiver covering 60 through 905MHz continuously, with 100 keypad-programmable memory channels.

In addition to FM wide (for FM and TV broadcasts), FM narrow and AM (wide and narrow) the FRG-9600 also provides SSB (single sideband) reception up to 460MHz. A front panel tuning knob simplifies tuning of SSB and narrowband AM. Seven tuning/scanning rates between 100Hz and 100kHz assure fast and efficient scanning while permitting easy tuning of narrowband signals.

The scanning system allows full or limited band scanning and memory channel scanning, with auto-resume. In addition to carrier sensing scan stop, audio scan stop sensing is also selectable to avoid stopping on inactive "carrier-only" channels. Scanning steps are selectable with the wide steps indicated on the front panel display. Signal strength indicated by a two-colour graphic S-meter. A 24-hour clock/timer, recorder output, cpu band selection outputs, multiplexed (FM wide) output, AF and RF mute and other control signals for maximum expansion potential with future options or for own add-on hardware for special applications.

The direct control link to the cpu in the FRG-9600, allowing virtually unlimited customised control functions; such as multiple, organised memory banks; automatic tuning; and customised scanning systems; using most personal computers and a Yaesu FIF CAT Interface Unit.

The FRG-9600 requires 12 VDC.

HANDHELDS

THUMBWHEEL FT203/703R — KEYBOARD FT209/709R/RH

FT203R(5)	Thumbwheel	2m	1·5W	£175 inc VAT
FT203R(3)	Thumbwheel	2m	2·5W	£195 inc VAT
FT203R(4)	Thumbwheel	2m	3·5W	£199 inc VAT
FT703R(5)	Thumbwheel	70cm	1·5W	£215 inc VAT
FT703R(3)	Thumbwheel	70cm	2·5W	£235 inc VAT
FT703R(4)	Thumbwheel	70cm	3·5W	£239 inc VAT
FT209R(5)	Keyboard	2m	1·8W	£219 inc VAT
FT209R(3)	Keyboard	2m	2·7W	£239 inc VAT
FT209R(4)	Keyboard	2m	3·7W	£245 inc VAT
FT709R(5)	Keyboard	70cm	1·8W	£239 inc VAT
FT709R(3)	Keyboard	70cm	3·0W	£259 inc VAT
FT709R(4)	Keyboard	70cm	4·0W	£265 inc VAT
FT209RH(5)	Keyboard	2m	2·3W	£225 inc VAT
FT209RH(3)	Keyboard	2m	3·7W	£245 inc VAT
FT209RH(4)	Keyboard	2m	5W	£249 inc VAT

From £175 inc

KDK FM240

A brand new 25W FM transceiver from KDK, featuring all the latest in microchip technology and incorporating the revolutionary new **MAN MACHINE INTERFACE** (M.M.I.). The alpha-numeric LCD display combined with rotary controls and push button switches allied to new CPU displays prompt messages and command data allowing for maximum flexibility of operation with minimum button pushing! Most of the major functions are simple one button operations including; Simplex, Tx⁺ offset, Tx⁻ offset; Receive Scanning Modes—Skip, Busy, Pause and Delay; 16 Memory channels; Programmable Scan Limits and priority scan. Receive sensitivity of 0·2μV for 12dB SINAD. All this in a small box measuring only 140W × 40H × 170D(mm).

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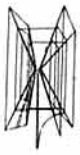

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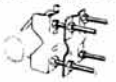

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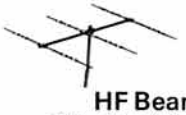

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TB1	1ele 10-20M	£77

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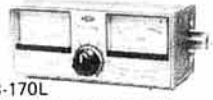

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MAIL ORDER SMC or SHOWROOMS see previous pages

RADIO SOCIETY OF GREAT BRITAIN

THE NATIONAL SOCIETY REPRESENTING ALL UK RADIO AMATEURS

Founded 1913 Incorporated 1926 Limited by guarantee A member society of the International Amateur Radio Union

PATRON: HRH PRINCE PHILIP, DUKE OF EDINBURGH, KG

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

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EDITORIAL

MORSE TESTING—AN UPDATE

As was announced in the January issue of *Radio Communication*, the Society will be responsible for providing the official examination for the amateur morse qualification as from April 1986. Since this announcement was published, work has begun on the many tasks that need to be completed in the short time available. I can report that much of the headquarters administrative system has been designed, and a booklet has been produced which explains how the examiners will be selected and the examinations organized.

It is planned to hold tests at least once every two months in each county or region, together with the main islands, as well as at special events such as exhibitions. One thing must be emphasized: since passing the morse test is important both in its own right and because of the privileges it covers, there is no way in which the tests can be conducted, other than at the highest possible standard. For example, each examiner will have passed a 20wpm morse test administered by someone of official standing; each examiner will be approved by the RSGB Council; and each test will be done in the presence of at least two examiners. All this is to ensure that the status of the morse test is beyond reproach.

To provide the 70 or so test centres which are planned will require a few hundred examiners, which sounds rather a large number. However, we are confident that sufficient experienced volunteers will come forward to ensure the success of this essential service. We have already received considerable support; within a week of the initial announcement over 100 volunteers contacted the Society. Clearly, a happy start to a most challenging opportunity.

David Evans, G3OUF

Amateur Radio News

FROM THE EDITOR

My sincere thanks to all those members, many not known to me personally, who sent "Get Well" cards and messages during and after my spell in hospital in December.

Having made a complete recovery I am pleased to say that I am once again wielding the editorial "blue pencil" with my usual vigour!

Alf Hutchinson

RSGB executive vice-President

At its meeting on 18 January 1986, the RSGB Council elected Mr K E V Willis, BSc, ARCS, CEng, MIEE, G8VR, as the Society's executive vice-President for 1986.

Regional representation

Regions 6 and 20

Following the election to Council of the representatives of Regions 6 and 20, elections will be necessary to fill the vacancies.

Any five corporate members resident in each of these regions may nominate any other qualified corporate member resident in the same region for the office of representative of that region. Each nominator may not nominate more than one person to fill the vacancy. Region 6 comprises Berkshire, Buckinghamshire and Oxfordshire. Region 20 comprises Avon, Gloucester and Somerset.

Nominations must be made in writing and signed by all the nominators, and delivered, together with the written consent of the nominee to accept office if elected, to: Mr D A Evans, Secretary/General Manager, RSGB, Lambda House, Cranbourne Road, Potters Bar, Herts EN6 3JW, on or before Monday 10 March 1986. All nominations will be acknowledged by return of post.

In the event of more than one person being nominated, a ballot will be held, details of which will be published in the May 1986 issue of *Radio Communication*.

"An improved Z-match astu"

The author of this article, published in the October 1985 issue of *Radio Communication*, has sent the following explanation and correction of errors in the figures in Column 6, Table 3.

"It is regretted that the figures for I_{rf} amps output have been found to obtain errors due to a number of factors. These are:

(1) Difficulties in re-setting the Z-match tuning and coupling controls accurately when attempting to repeat measurements; aggravated by the lack of a slow-motion drive on the tuning capacitor.

(2) Difficulty in reading accurately small differences in rf feeder current using a 0-1A thermoammeter in the lower quarter of its scale.

(3) Differences in I_{rf} caused by very slightly offsetting the tuning capacitor in the "standard" (G5RV) astu from the value which produces absolute minimum vswr. Under certain conditions of reactive load this can result in an *increase* of I_{rf} for a fractionally higher vswr which, in itself, is acceptable to the output load requirements of a solidstate power amplifier.

REGION 18 ORM

An official regional meeting of the RSGB will be held on

Sunday 16 March 1986

Commencing at 2pm

at the

Moat House Hotel
Coast Road, Wallsend,
Newcastle upon Tyne

Attending the meeting will be:
Mrs J Heathershaw, G4CHH, immediate past-President;
Mr D A Evans, G3OUF, secretary/general manager;
Mr D Smith, G4DAX, Zone A manager;
Mr B O'Brien, G2AMV, chairman, Finance & Staff Committee;
Dr J N Gannaway, G3YGF, chairman, Licensing Advisory Committee;
Mr M Kennett, G4OVX, member, Planning Panel;
Mr K Fisher, G6LMR, member, Repeater Management Group.

The meeting is open to all licensed radio amateurs in Region 18. Only RSGB members will be able to ask questions. Any questions requiring research or statistical enquiry should initially be submitted in writing on or before 15 February to the chairman of the meeting, Mr Ian Gibbs, G4GWB, Region 18 representative: address and telephone number in "Club News".

As a result of check measurements made, it can be said that the differences in power transfer efficiency between the "standard" (G5RV) astu and the two versions of the Z-match astu averaged over the frequency range covered are approximately as follows:

(i) The original Z-match astu 10 per cent less than the "standard" astu.

(ii) The modified Z-match astu five per cent less than the "standard" astu.

As stated in the article (p771 para 2), by virtue of its design the Z-match cannot satisfy *all* the required circuit conditions for *all* bands. In particular, the relative inflexibility of the coupling to whatever types of antenna system is used results in some reduction of efficiency on certain bands. Nevertheless, the modified Z-match combines an acceptable power transfer efficiency with flexibility of operation on all the hf bands.

How fast can you go?

A member recently wrote to headquarters asking for information on morse sending speeds. In the course of research to find the answers, we discovered that the world record for copying morse code was set by Edward R McElroy on 2 July 1939. He was credited with correctly copying 75·2wpm, equating to 17 characters per second, and the record has therefore stood for 46 years. It was also discovered that the record for using a straight key is held by Harry Turner, W9YZE: he managed 35wpm for 3min on 9 November 1942. Any further information on the circumstances under which these records were set would be appreciated by the membership services department at RSGB headquarters.

Mobile Rallies Calendar

All information for inclusion in this column must be sent to the editor, not to RSGB HQ.

9 February
Hamfeast Mobile Rally, Mosses Youth & Community Centre, Cecil St, Bury. Opens 11am. Talk-in on S20. Admission 50p. Details G1PKO.

23 February
Cambridgeshire Repeater Group's 4th Annual Junk Sale Rally Extravaganza, Pye Telecommunications, St Andrews Road, Cambridge. Open 10.30am. Talk-in on S22 by G3PYE. Free car park. Admission 50p. Details G4HCL, tel 0354 740672.

2 March
Doncaster & D Raynet Group Amateur Radio Rally, Adwick Leisure Centre, Welfare Road, Woodlands, Doncaster. Talk-in on vhf and uhf. Open 11am (disabled 10.30am). Details G8XTU, tel Doncaster 531365 home, or 539446, ext 38 work.

2 March
Welsh Amateur Radio Rally, Barry Leisure Centre, off Hotton Rd, Barry, South Glamorgan. Organized by the Barry C of FE RS. Talk-in on S22. Enquiries GW4FOM, tel 0222 565656 (evenings).

9 March
Northern ARS Association Exhibition & Mobile Rally. Belle Vue, Redgate Lane, Longsight, Manchester. Talk-in on S22 and SU8. Morse test. Details G6MEI or G6CGF.

16 March
Pontefract & DARS Components Fair, 11am-4.30pm, Carleton Community Centre, Pontefract, mid-way between Pontefract and Darrington on the A1. Enquiries for bookings to G4ISU, tel 0977 792784.

16 March
South Essex ARS Mobile Rally, Paddocks Community Centre, Canvey Island. Open 10.30am. Talk-in on S22. Details G4FMK, tel 0268 683805.

22 March
The Bredhurst Receiving & Transmitting Society's first Rainham Radio Rally, Parkwood Green, Rainham, Kent (5min from M2 junction 4). Open 10am-4.30pm. Talk-in by GB2RRR on S22. Bar and catering. 50p entrance. Details G4EGH, tel 0634 388760.

23 March
Mid-Devon Rally, Pannier Market Hall, Tiverton. 10am to 5pm. Details, G6ZMC, tel 0884 254889 evenings.

23 March
Swansea Rally, Patti Pavilion, next to the county cricket ground, A4067 Swansea-Mumbles coast road. Open 10.30am to 5pm. Talk-in on S22, GB2SWR. CW test. Admission £1 adults, 50p children. Details GW4HSH, tel 0792 404422.

23 March
19th White Rose Rally, The University of Leeds. Details G4NDU or Box 73, Leeds LS1 5AR.

13 April
Lough Erne ARC Rally, Killyherlein Hotel, near Enniskillen. Opens 1pm. Talk-in on S22 and SU8. Details from GI4CZW, 9 Tanmon Brae, Enniskillen NI, tel 0365 24500.

5 May
3rd Anglo-Scottish Rally, Tait Hall, Kelso. Ideally situated for G/GM/GI (GW also welcome!). 11am to 5pm. Talk-in on S22. Details GM4UIB or GM3VLB, tel 0573 24654 or 0573 24664.

11 May
Drayton Manor Rally, Drayton Manor Park, nr Tamworth, Staffs (on A4091 one mile south of A5/A4091 junction). Open 11am to 5pm. Talk-in on 144 and 432MHz, G3MAR/A. Details G8BHE, tel 021-422 9787 or G8GAZ, tel 021-357 1924.

11 May
Swindon Rally, Oakfield School, Marlowe Ave, Swindon, Wilts. Open 10am. Talk-in on S22 and SU8/GB3TD. Morse tests, refreshments. Details G8SFM, tel 066689 307.

18 May 1986
29th Northern Mobile Rally, Great Yorkshire Showground, Harrogate. Details G3CQQ, tel 0943 602118.

25 May
10th Annual East Suffolk Wireless Revival, Civil Service Sports Ground, Bucklesham, nr Ipswich. Open 10am. Free parking. Admission 80p. Details

J Toothill, tel Ipswich 44047. Stand space from Colin Ranson, G8LBS, 100 Stone Lodge Lane West, Beacon Hill, Chantry, Ipswich.

1 June
Southend & D RS Mobile Rally, Rocheway Centre, Rochford, Essex. Opens 10.30am. On site parking. Talk-in on S22. RSGB morse tests to be advised. Details G6SOH, tel 0702 713211 or G4RDS, tel 03745 50494.

1 June
Spalding & D ARS Rally, Springfields Gardens, Spalding. Opens 10am. Talk-in. Details G4OO, tel 0775 86382.

8 June1986
Elvaston Castle Mobile Radio Rally, Elvaston Castle Country Park, five miles south-east of Derby on B5010. Talk-in by GB2ECR on 144MHz and 432MHz. Morse tests available. Details from G4PZY, tel 0332 767994 or G4CTZ, tel 0332 799452. Trade enquiries to G4HIJ, tel Ashbourne 43241.

15 June
RNARS Mobile Rally, *HMS Mercury*, Leydene, near Petersfield, Hants. Details G4DIU.

29 June
28th Longleat Amateur Radio Mobile Rally, Longleat Park, Warminster. Preliminary enquiries to G4FRG, tel 0272 848140.

13 July
Sussex Mobile Rally, Brighton Racecourse. Opens 10.30am. Talk-in via GB2SMR on 145·550MHz and 3·5MHz. Details from G8JVE or G4UAW, evenings.

20 July
Anglian Rally, Colchester. Further details G6HQI, tel 0206 862403.

20 July
Cornish Radio Amateur Club Rally, Camborne School, Camborne. Open 10am to 5pm. Talk-in on S22. NB new QTH. Details G4MSV, tel 0736 763549.

20 July
McMichael Mobile Rally. Open 11am. Talk-in on S22 and SU8. Enquiries to G0BTY, tel 0494 29868.

27 July
Scarborough ARS Rally, The Spa, Scarborough. Open 11am. Talk-in 144MHz (S22), and 432MHz (SU8) and RB0-GB3NY. Details G4UQP.

3 August
RSGB National Mobile Rally, Woburn Abbey.

3 August
Rolls-Royce ARC Mobile Rally, Rolls-Royce Sports & Social Club, Barnoldswick, Skipton. Access from A59 and A56. Open 11am. Morse tests available. Enquiries to G4ILG, tel 0282 813271 ext 337, daytime, or 0282 812288 evenings.

10 August
29th Annual Mobile Rally celebrating the 75th anniversary of the Derby Wireless Club, Lower Bemrose School, St Albans Rd (off Derby Ring Road A5111) Derby. Open 10.30am. Details G4EYM, tel Derby 556875.

10 August
Hamfest '86, Flight Refuelling Sports and Social Club grounds, Merley, Nr Wimborne, Dorset. Details Ashley Hume, G0CDY, 71 Victoria Gardens, Ferndown, Wimborne, Dorset BH22 9JQ, tel 0202 872503.

24 August
Preston ARS 19th Annual Rally, Lancaster University. Details G3DWQ, tel 0772 53810.

7 September
Lincoln Hamfest, Lincolnshire Showground. Further details to be published at a later date.

21 September
Peterborough R&ES Mobile Rally, Wirrina Sports Stadium, Bishops Road, Peterborough. Open 10.30am to 5pm. Free car parking. Food in the adjacent Tropicana Restaurant. Bar until 3pm. Details G4PNW.

19 October
South Bristol ARC present the Second Bristol Radio Rally at Hartcliffe Youth Centre, Hareclive Avenue, Hartcliffe, Bristol. Open 10am to 5pm. Special event station, GB2BRR. Details G1LDJ, tel 0272 667179.

Special Event Stations

All information for inclusion in this column must be sent to the editor, not to RSGB HQ.

1986, GB4MTR
GB4MTR will be operated during 1986 on the 70MHz band by 13 different stations each in a different county. The callsign will be operated from the stations of: G4VOZ LEC, 1-28 January; G4ENA GLR, 29 January-25 February; GW4HBK GWT, 26 February-25 March; G4ENB BFD, 26 March-22 April. Volunteer (70MHz QRV) stations are required, particularly from the north of England. An award will be available. For further details contact G4WND or G4SEU.

22 February, GB4LPB
N R Higgins will be running this station from his home, 51 Castlerigg Dr, Langley Estate, Middleton, Manchester M24 4LY, in celebration of the Brownies and Guides Thinking Day Worldwide. Operation on hf and vhf. QSL cards for all contacts. Enquiries to G4ZQL. NB The Girl Guides Thinking Day on the Air is an annual event and there will probably be at least 30 stations operated by, or on behalf of, the Guides.

1 March, GB2SDD
The Saint David's Day special event station celebrating the National Day of Wales will be operational from midnight 28 February to midnight 1 March. Activity will be on all hf and vhf amateur bands. QSL cards to amateurs making contact with the station and the BSC Port Talbot Sports & Social Club will be pleased to respond to reports sent in by swls. For details of the special award and further enquiries, contact R R Jones, GW4HOQ.

13-14 March, 1986, GB4PHT
Operating from the Portland Heritage Trust during Portland Carnival, operation will be on 3·5, 14 and 144MHz ssb, cw, rtty, Amtor. A special effort will be made to contact amateurs in the other Portlands worldwide. Details G4RAK, tel 0305 822753.

Other Events

All information for inclusion in this column must be sent to the editor, not to RSGB HQ.

16 March
RSGB National VHF Convention; Sandown Racecourse.

5-6 April
RSGB National Amateur Radio Convention, National Exhibition Centre, Birmingham.

28 September
RSGB HF Convention, Belfry Hotel and Conference Centre, just outside Oxford on the M40.

OBITUARIES

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

Mr H Carmichael, GI6VU
Hugh Carmichael, who died on 21 October aged 83, was one of Belfast's best-known amateurs and originally held the AA licence OIJ. He was well known for his dx work and award chasing, mainly on 28MHz. At the start of the second world war, Hugh was secretly recruited for a vital role in the wartime intelligence battle—radio interception of enemy and other radio traffic. He was on the air daily until shortly before his death.

Mr W Caughey, GW2DZG ex GI2DZG
Walter Caughey died on 13 November. He was a Member of the Royal Signals ARS, the Royal Signals Association and the G QRP Club; the latter being Walters special interest in amateur radio. During the war he served with the Royal Signals and proved a fine amateur in every sense of the word.

Mr G Chambers, GW4TUQ
Gwyn Chambers died on 21 November aged 70. He had been interested in radio since the war years and was a member of the Conway Valley ARC. He was licensed for the past four years and was active on 14, 28 and 144MHz.

Mr B A Cusick, G4MUC
Ben Cusick died on 15 November aged 68. He was very active on all bands, especially on RSARS frequencies controlling the 40m net. Ben was also an active member of RNARS and WAB. To newcomers and old-timers alike he was always kind and helpful.

Mr K P Durnin, G1MDX
Kevin Durnin died on 30 September aged 17. He was a member of the Hinckley Amateur & Electronics Society and was elected as the swl representative on the committee. He had been a keen dxer while still a child, and gradually got more interested until, in spite of his non-stop illnesses, he passed the RAE—a great morale booster and one of the big highlights in his life. His first QSOs were from a hospital bed in Birmingham. His determination and bravery against all the odds were quite remarkable and during his short life he derived a great deal of pleasure from radio.

Mr E Elliott, G4GQN
Ted Elliott died on 13 October. He was a long-standing member of the caravan net and during his annual winter visits to Spain and Portugal, kept in touch with the net on 14MHz.

Mr L Ensor, G4YHD/ZS6BJ (ex G5AQQ/ZT6AB)
Len Ensor died on 18 November aged 81. Len, originally from South Africa, was initially licensed as ZT6AB in 1933. He became ZS6BJ when callsigns were restricted and maintained this callsign until his death. In 1968 he chose to live in the UK and was licensed as G5AQQ, later changed to G4YHD. In his early days he was overland telegraphist with the South African PO and most of the A class licensees in the Havering RC owe their morse test pass to Len. He was also, until recently, principal conductor on the club's slow morse net. Len operated on the hf bands, supporting the club 144MHz nets for slow morse or to encourage newer members on phone. He was active on rtty and constructed many items of shack equipment. Len was a strong supporter of the club HF Field Day and the mainstay of the 70MHz station at the VHF Field Day. He was a respected senior statesman of the Havering club.

Mr S Folland, G3ADK
Stan Folland died on 12 December. He will be remembered by many amateurs in the Luton area for his help and understanding when sorting out interference problems in his capacity as RIS officer for the GPO in the 'sixties. After his retirement he helped many swls and new licensees with equipment problems.

Mr P K King, G2CKK
"Mick" King died on 4 November aged 65. Licensed with an AA call prewar, he served in the RAF as a radio mechanic throughout the second world war. He was a great cw/dx operator who was keen on homebrew equipment.

Mr H Rennison, G4DXC
Herbert Rennison, who died on 9 November, was co-founder and had been chairman of the caravan net on 3·5MHz since 1975. He helped many local amateurs to obtain their licences and was well known on all bands. He was on the air until shortly before his death.

Mr K Taylor, G4XIA
Ken Taylor died on 7 November. He was always helping others in the hobby with informal RAE instruction and was active in the design and construction of many projects. He will be remembered on 28MHz for his informal slow morse sessisons for swls and new licensees. He chose 28·355MHz as the Sunday and Wednesday evening morse nets and these will continue in his memory.

Mr D Wheeler, G3ILX
David Wheeler died on 1 December. He was an amateur in the finest tradition and was active until shortly before his death, despite crippling disability.

Mr B Youens, G2HAR
Bob Youens died on 26 November aged 77. He was a founder member of the Verulam ARC and was a keen cw man, mainly on the hf bands.

Also
Mr H Bolton, G3HTR
Mr R R Jennings, G3IAH, on 29 October
Mr W G McConuille, GI1AFE, on 31 July
Mr G B Merry, RS86925, on 14 November
Mr J J Milne, G3FUM, in August
Mr F Nelson, G1HLD
Mr T F Sawyer,W2JJQ, on 8 January 1985
Mr J A Sparks, G4NZT, on 1 November

Members' Mailbag

The views expressed in published correspondence are not necessarily those of the RSGB, and readers are urged to verify independently any factual statements on which they may wish to rely as it cannot be guaranteed that such statements are correct.

FEEDBACK (1)

Sir—Regarding GM3HUN's comments (*Rad Com* October 1985) concerning applicants for the RAE, I agree that there are some, and only some, "amateurs" who appear to need an instruction booklet to turn their rig on, but these amateurs are not all newly licensed. There are many G3s, G8s etc, who are just as bad as those whom 'HUN commented about, if not worse.

I am a 15 year-old schoolgirl and, while the technical parts of the RAE still puzzle me, I have quite a good knowledge of operating practices, procedures etc. I'm sure there are many people like myself who cannot yet pluck up the courage to take the RAE because of two things. One is the risk of failure, the second is being regarded as an incompetent newly-licensed amateur.

At least, 'HUN states that "not all new members would of course be ex-cb"; whether that is sarcastic I do not know. There are many people who, after trying cb, have found that they want to do something more interesting and creative; of course, they will still use cb language at first, but in time they will become used to amateur radio operating practices.

I suppose a solution to this problem could be regular listening by officials of the RSGB or DTI and warnings issued for bad practice, and even licences taken away.

Nicola Maxfield, RS53596

Sir—I am not normally inclined to write to magazines, but GM3HUN does not seem too sure of what he wants from the RSGB. First, he complains about it doing its duty when the RSGB condemned the illegal actions of the "interloper" Tom McLean, then in the next paragraph asks that the RSGB should spend more time and money chasing off "interlopers"; very hard to please!

As for his derogatory comments on the CGLI, the RAE and the candidates, I am disgusted and angry. Although I am not an ex-cber, and I take my new hobby fairly seriously, I don't think ex-cbers should be put down so harshly. The fact that they are now hams proves their own dissatisfaction with cb. I and these others decided to study for the RAE, and I put in a lot of effort, expecting the RAE to be a fairly stiff exam. I gained a lot of knowledge from my extensive reading and practical projects, and I looked forward to becoming a radio ham. The RAE was not, however, a difficult exam, and did not perhaps justify my efforts, and probably the same was felt by the ex-cbers, but we all did it. Just because we were not asked certain questions does not mean we don't have the knowledge. More emphasis needs to be placed on operating practices and procedures, though not less on the technical side.

On the air we hear a lot of malpractice, and most of this I find comes from people of an earlier era, not from the newcomers alone. It seems to me that GM3HUN thinks all newcomers are interlopers and what he really wants is no new amateurs at all. So perhaps; yes, we should scrap the RAE and leave amateur radio to these old-timers, and let amateur radio die with them when their time comes. I know GM3HUN is an excellent operator, and I hope some day to be able to send cw as well as he does, but to condemn people and their methods and offer no constructive criticism or help to newcomers, only frightens new operators off the air by not giving them time to develop. Please Mr Hunter, give us the benefit of your operating knowledge, and spread the word.

As a final note I would like to say that all radio amateurs should be RSGB members, for who else will speak up for their hobby. The RSGB may not be perfect but it's all we've got, so let's work to improve it and thus improve our hobby as a whole. Also the band plans should be mandatory, not left to gentlemanly behaviour. Gentlemen are about as scarce as hen's teeth these days.

John Mullen, GM0CNP

Sir—Regarding GM3HUN's letter in your October issue, here are my comments for what they are worth.

The sovereignty of Rockall is the subject of an international dispute and under arbitration by the Law of the Sea Conference. In the meantime the use of amateur radio in furtherance of any claim is not to be condoned. While I know Mr McLean's Rockall radio operation was illegal, this is not how it was portrayed on ITN; I for one felt very offended on first seeing the item. GM3HUN seems to think that the subsequent matter "could have been resolved between all parties concerned in a diplomatic manner". Is he not aware of the complexity of international diplomacy? Would he agree that the use of an EI callsign, though bogus, from Rockall could be resolved in a diplomatic manner; or, for that matter, an LU operating from Port Stanley, by an Argentinian "modern adventurer".

Does Mr Hunter really believe that Tom McLean "did not wilfully misuse the amateur frequencies"? In any case the use of these frequencies for furtherance of political aims is not to be lauded.

While not condoning the use of these frequencies by Tom McLean, Mr Hunter seems to think that there were extenuating circumstances in this illegal operation. He then proceeds to criticise legal amateurs, who are not, in his eyes, essayists of his calibre. The style of the RAE is unimportant as long as the candidate is successful. He or she is then as much entitled as is Mr Hunter to the enjoyment of this fine hobby.

For Mr Hunter's information, there are no radio amateurs in EI. We are all essayists and are classed as "radio experimenters". However, we would never look down on Mr Hunter or other radio amateurs.

Anthony T Walsh, EI5EM

Many other letters on this subject have been received, and members are thanked for their comments.

FEEDBACK (2)

Sir—I would like to comment on two letters in your October issue. Regarding the Rockall operation, if Mr Hunter is right that many RSGB members are angry at the Society's stance on this issue, I am not of their number. In my view the RSGB could have taken no other position and I am surprised that any member should question its action. So, as a counterbalance to Mr Hunter's intemperate criticism, please accept my thanks and appreciation.

The question raised by Mr Gordon Lines is one that has puzzled me for over 20 years—and it still does! I think his reasoning deserves a better answer than you gave which sounded a little "lofty". Please, a short article to help people like Mr Lines and myself; I'm sure we are not the only ones who, while not doubting that "there is no information in the carrier", cannot see why.

B J Mitchell, G4MLI

Perhaps the following letter will serve as a reply to Mr Mitchell's second paragraph.

WHAT? NO SIDEBANDS?

Mr Lines certainly started an argument when he put his simple question about sidebands ("Members Mailbag" May 1985) but there is no conspiracy among us in the matter. It must be very difficult for newcomers to absorb some of the ideas which have been conventional for so long that we accept them as obvious.

First, in the matter of the name "amplitude modulation", you can call it what you like as long as everybody agrees what it represents. In this case it was chosen long ago to distinguish it from other kinds of modulation, and this it surely does. Look in our handbook or any suitable textbook and there will be a picture of an a.m. wave, that you can easily generate for yourself with a signal generator and a 'scope (but see later!).

In the matter of semantics it is the use of the words "single sideband" or the degenerate "sideband" that is the real offence, because every form of modulation comprises carrier and sidebands. Even if the carrier is removed before transmission, it has to be put back, in the receiver, before the information contained in the modulation can be extracted.

But the appearance of sidebands in the a.m. case is much more difficult to understand than the picture in the book, because usually it is only explained in terms of two equivalent equations, and requires skill in trigonometry to convert one into the other. However, the sideband version is much more convenient when dealing analytically with the behaviour in circuits. Now, having seen a.m. on the 'scope, put the signal through a good communication receiver with a narrow i.f. filter (narrower than the mod frequency—the old AR88 has a 100Hz filter) and tune across the signal. The carrier and sidebands will appear separately—they are just as real as the a.m. description. Alter the modulation level and you will see that the carrier stays put and only the sidebands change.

To illustrate how difficult it was to understand these things long ago, consider the Stenode "affair" of 1931 (*TT* June: "MM" July), in which I was, to some extent, involved. One should remember that in those days knowledge was very limited. For example, our only determinant of the quality of a tuned circuit was its decrement R/2L or its power factor R/ωL. The much later inversion of the pf to give the "Q" was a great step because it made it easy to determine the bandwidth. The Stenode was published in *The Wireless Engineer* in 1931. It caused a great commotion in the technical press because:

(*a*) Dr Robinson denied the existence of sidebands.

(*b*) He was supported by the establishment, including Prof Ambrose Fleming, but opposed by the young brigade.

(*c*) The description of how it worked was in peculiar terms which nobody understood. To relieve the confusion Mr F M Colebrook, of the National Physical Laboratory, published a memorandum to explain the behaviour of tuned circuits and sidebands.

At that time I was working for (Sir) Isaac Shoenberg. He was a great philosopher and always made it his business to understand technical matters connected with the art. He called in his engineers to thrash the matter out with him. After we had sorted ourselves out he accepted our metaphysical* conclusion: "If the mathematics describes a physical phenomenon in two different ways, then it must be possible to observe these ways experimentally" (for some unknown reason this became known as "Dud's theorem").

With present day understanding it is in fact possible to explain the effect of a high-Q circuit on modulation without introducing sidebands. It is easy to draw a resonance curve and see how various sidebands are affected, but to do it analytically in terms of the rate of change of a "purely" amplitude-modulated signal requires differential equations. So it will be attempted by means of a mechanical analogy.

Consider a series-driven parallel-output tuned circuit. Q is the ratio ωL/R. Since the current is the same in L and R, it is therefore the magnification, the ratio of output voltage V2 to driving voltage V1. Multiplying both voltages by current A, Q becomes a power ratio; the electrician's volt-amp ratio. AV1 is the power dissipated in R while AV2 is the wattless energy circulating in L and C.

It corresponds to a spinning flywheel with

stored inertial energy delivering power to a machine, or the inertia of a moving automobile losing energy by friction from tyres, drive etc. If you want to modulate the speed it is necessary to supply or remove stored energy. This clearly takes time. Hence the faster things are moving the more difficult it is, and if you want to do it quickly (high mod freq) then there is not enough time to do it completely. Look! No sidebands! But because it requires rates of change this way, the sideband method is always used if possible.

F Charman, G6CJ

*When two scientists are talking in terms that the layman cannot understand they are said to be talking physics. When they can no longer understand each other, they are talking metaphysics.

ANOTHER PARADOX

Sir—I was disappointed that your recent correspondence on the truth about a.m. did not really stimulate the learning or humour of your readers, and so might I share with them a little paradox of my own, which has been causing me a few sleepless days in the last few months? (It takes more than this to disturb my nights.)

The forces of attraction or repulsion experienced by parallel, current carrying conductors are well known and easily demonstrated. Their explanation as examples of the interaction between current and magnetic field falls into the realm of schoolboy physics. Likewise, the fact that streams of moving electrons (or other charged particles) experience similar forces is a commonplace of popular science. But consider now the following scenario: two parallel streams of electrons flow with equal velocities and experience a force of attraction according to the usual electromagnetic theories. But if the observer imagines himself to be moving with one of the beams at the same velocity as the electrons, and looks across to the other beam, then those electrons will appear to be stationary. According to this observer there will be no current flowing, hence no magnetic field, and so no force of attraction. The only force observed will be that of electrostatic repulsion between like charges. According to this observer the electron beams will move apart!

None of my learned colleagues here in Bristol has been sufficiently learned (or if learned, interested) in this to restore my normal peace of mind and daytime somnulance, so in desperation I lay the matter before you.

A J Smith, G4OEP

REORGANIZING THE RIS

Sir—In November I received a reminder from RSGB HQ asking me to send another year's membership subscription. Included in the envelope was a leaflet describing, in glowing terms, the RSGB's efficiency in its dealings with the authorities over matters such as frequency allocations, Class B morse experiment, and so on.

While their efforts here are certainly to be applauded, the Society seems to have been caught napping in the matter of the re-organization of the Radio Investigation Service.

Earlier in the summer I discovered, in conversation with an RIS officer, that a call-out charge of £21 was already being levied on the complainant. He also mentioned that complaints of domestic tvi/bci had fallen to almost nil since this charge had been imposed. Scanning through *Radio Communication*, I found several references to proposals to re-organize the RIS. There was no concrete news though, until September's *RSGB News Bulletin* when three short paragraphs were devoted to the outcome of these changes and the implementation of BS905. The re-organization had apparently been carried out many weeks before this date. At no time has there been any mention of the RSGB's involvement, or even interest in what was taking place.

It does not need me to spell out the dire consequences of this change for amateurs who have many and persistent tvi problems, particularly if their neighbours are of the "brick through the window" mentality. Perhaps those who serve on RSGB Council or the relevant committees all live in detached dwellings set in acres of grounds, and to whom the social difficulties posed by tvi are entirely foreign? The loss of the RIS officer merely as an arbitrator in such cases will, I'm sure, precipitate the restriction, or even complete closure, of many amateur radio stations in the more densely populated areas of the UK, simply to avoid social friction. Where a station refuses to appease his or her neighbours, criminal damage could, in some circumstances, be the result.

Even if the amateur has access to the offending tv set, there are further difficulties when the tvi filter and ferrite ring round the mains lead fail to cure the trouble. While the booklet now available from Post Offices is a useful mine of information, I personally will not take the back off someone else's tv set for obvious reasons. The complainant may not wish to pay a dealer to do the work (many dealers are unwilling anyway), and manufacturers are often less than helpful. All this on the authority of the person who, apparently, is the cause of the break-through in the first place!

Is the RSGB unconcerned about a matter which, I believe, affects most of us at some time, and more than perhaps we imagine?

Vaughan Reynolds, G4MVR

The Society is very far from being unconcerned about this matter. By the time these words are read, it is likely that a meeting between the RSGB, the DTI and the BREMA will have taken place at which the issue of immunity will be discussed and some solutions to the problem facing the radio amateur will be urgently sought. There are no simple answers but the Society has also been actively involved in cases of breakthrough in which MPs have taken an interest; it continues to seek solutions.

The Society has strong reservations concerning BS905, and it also has views regarding the future relationship between manufacturers, dealers, the RIS and the radio amateur. We hope to publish a feature item on these matters in a future issue.

For the record, we did not know officially of the plans to reorganize the RIS until we saw the press release from the DTI.

SPARE OR REPAIR

Sir—My experience with the control indicator of a Ham 2 rotator may be of general interest. For some unknown reason the meter went out of order. It was a dc milliammeter with a range of 0 to 1, a very ordinary meter, so I thought a spare should be relatively cheap. Hopefully, I phoned one firm, and after much trouble and delay I was told that a spare meter was available at a price of about £54. I thought this was excessive, and an enquiry made to the makers of the rotator gained a quotation of £35.

Thus it seems that hams are taken for a ride when spares are needed, both in the USA as well as the UK.

Then the penny dropped and I thought, why not get it repaired? A friend gave me some names from his technical lists and one of these (Ledon Instruments Ltd, Folkestone) said that a repair would be no trouble. So I posted my meter, and in a few days I had a phone call to say that the meter was repaired and that the total cost was £6.90 including the repair, postage and all other costs. What a relief!

I have been a ham for nearly 60 years, so possibly a few words of advice from a very old timer may help others in trouble—always repair if possible.

Arland Ussher, GD3TIU and ZS6Z

POST OFFICE PARCELS

Sir—I noted with interest the comments of G4SKS regarding his experiences and lack of compensation when having sent his 101 via Securicor. His further comments that his alternative was to pay the train fare and take the parcel personally set me to investigate for myself. I am totally bemused . . . Has everyone forgotten about the good old Post Office? I must admit they do lack the panache of firms like Securicor (or do they?) but enquiries revealed that the Post Office compensation fee for a parcel up to 25kg (the 101 is approx 15kg) is £4.85p, with a maximum compensation of £350—much less than half the Securicor fee, and seven times the compensation! I also believe that the Post Office will sell you a suitable box for packing. As far as high-speed delivery is concerned, I receive many Post Office parcels in the course of my business, and I find very few take more than three days.

The information I quote is from a free booklet *Royal Mail Inland Compendium* and are current rates. I hope this will help anyone else with the same problem as Mr Bradshaw. One final comment: if you want to make use of the Post Office's reasonable rates, do hurry; rumour has it that they are next on the privatization list!

Pete Walton, G4WAL

QSL CARDS

Sir—I read with interest G6OVO's letter on QSLing and obtaining cards with the correct information printed on them. I sympathise with Mr Hudson, who produces beautifully hand-written cards. It is always with great regret that Mr Hudson's cards find their way to the local rubbish tip for not being claimed after the prescribed period of time.

Mr Hudson is correct in bemoaning the fact that contest stations do not acknowledge cards too often. As G1 series sub-manager I receive whole stacks of cards for a number of stations who do not bother to send envelopes to collect them. Some of these, I know, are contest-oriented stations.

Another point raised in the letter was the lack of information on cards. I did a survey of 100 different G QSL cards to check for county information, as this is no doubt one of the items many seek to have confirmed.

Correct county	55%
Incorrect county	12%
No county	25%
Abbreviated county	8%

Anyone applying for the RSGB vhf/uhf awards has no doubt to double up the QSLing to get counties confirmed, even if stations return cards, unless abbreviations are acceptable and understandable to a foreign station! Very difficult from some of the rarer counties.

Can I make a plea that when producing QSL cards you take account of the requirements of the enthusiasts like Mr Hudson and also our overseas friends. Put on your full address, county (the administrative one, not postal) and country (GB stations are especially at fault here), vhf locator, WAB area etc.

R J Nash, G4GEE

Sir—On 26 October 1985 I received, by hand, a QSL card from VS4VR, now G3FPB, for a contact we had on 19 October 1947 when my call was XZ2HP.

Is a 38 years wait for a QSL card a record?

Harry Pain, G3ATH

Sir—To avoid any disappointment I would like to inform members that twice in October 1985 I received QSL cards from the QSL Bureau for the special event station GV4LIB which was on the air from Guernsey on 9 May. I was the licensee for GB4LIB which was on the air for some weekends in May, and in June I sent QSL cards to all contacts in the log for this station.

I have no connection with GV4LIB and have returned all cards recently to the bureau.

Nigel Le Page, GU4NYT

SPARE A THOUGHT FOR QRP

Sir—Here is a plea to all you ops when conditions are good and the bands are open. Please think about the QRP operator. I operate QRP from choice, and am very pleased with the results, but from my poor location (1m above sea level and 60km inland with only 10m above the ground for my antenna) in Holland, I find dx to be a little difficult. What you may think is only local may be dx to some QRP op on the other side, but usually he can't get through the pile-up of QRO ops anyway.

Take 144MHz for instance, a very interesting band. When conditions are good, dx for me (from JO21NX) is to the west coast of Britain, but the ops there are looking for contacts in OK, OZ, Y, HB9, OE etc, and PA doesn't get a look-in. Please, when operating in a pile-up situation, call for QRP stations now and again. It is most frustrating to hear a wanted square active, and then sit for 30 or even up to 60mins sometimes, trying to get through the pile-up only to have the band close down on you. This is not an unusual occurrence.

This brings me to another point, QRM. One of an op's worst enemies. I suffer from commercially-produced QRM from 1MW of tv, plus three fm broadcast channels, one medium-wave transmitter and a national Portophone transmitter, all within 6km of my QTH. This gives many obscure frequency whistles and bleeps due to saturation and mixing in the front-end of my rig, but nothing as bad as a 400W linear from other hams only a few hundred metres away, if they are on the same band as you.

Have you ever looked at what QRP can do?

Look at these figures that prove it. Say your dx contact gives you 5 and 5 (on 144MHz for example), and you are running 400W. What should your signal report be if you reduced power to 10W? (Yes, 10W.) This reduction is 16dB, but with one S-point being 6dB, you should now be 5 and 2 to 5 and 3. If there is not too much QRM, this is still very workable, less antisocial, no tvi problems for the neighbours, and you don't have to buy that new linear.

Just to prove the point even further, look at the results of the 144MHz QRP contest from another radio magazine. Top station operating QRP/P (that is, with a maximum of 3W) made contact with 34 squares in 8h operation, without any lift conditions. Try it yourself sometime and see.

Hope to catch some of you QRP dx G stations in the next lift.

Godfrey Hands, G6WKK/PB

This applies equally to the 50MHz band. Please use the minimum power necessary to make contact.

THANK YOU, MAC!

Sir—I have learned recently of the retirement of "Mac", G3KGU, from the honorary office of slow morse transmissions organizer. While I did see the office advertised as vacant, nowhere have I seen any reference to thanks for the dedication shown by all the volunteers in the "team".

Mac himself, I believe, was sending slow morse for some 27 years, and I very much appreciated my early instruction and practise on top band.

The service in general is of great use to amateurs, and I, for one, would like to say, "Thank you".

A E Hill, G0AEH

See annual report, Rad Com *November 1985.*

EMERGENCY REGISTER

Sir—I read with interest the letter by G4PIP (*Rad Com* November 1985) on the subject of the Emergency Register and would welcome the opportunity to correct the implication that BARTG supports this.

BARTG is a group which exists to promote all forms of data communication, is an affiliated society of the RSGB and fully supports Raynet. Many members are in Raynet, while others are in both the Emergency Register and Raynet, or neither.

When G3GJW conceived the idea for an Emergency Register he did ask BARTG; not to support and promote the activity, but merely for an opinion and to see if BARTG wished to comment on it. The committee saw no reason why he should not start the scheme, although we envisaged it could become a controversial subject. G3GJW then started to canvas all radio amateurs, not just BARTG members, to join the register. There are always some who, for a variety of personal reasons, will not join a recognized and established society, and the register was a move by an individual person to provide an alternative. BARTG, as a group, has no involvement in the Emergency Register.

K J Young, G3ZCG, BARTG chairman

Sir—With reference to G4PIP's letter, your readers can obtain a copy of the BARTG Emergency Register form by sending a suitable request and sae to me. They will see that the second paragraph recommends amateurs interested in the field use of rtty for emergency communications to contact their nearest Raynet group via G3STG, the Raynet chairman.

Not everybody has the time or mobility to join Raynet or similar organizations. The BARTG Emergency Register is exactly what the name says: it is a *register* of rtty enthusiasts who will contribute of their rtty skills during emergency situations. A quotation from the form: "BARTG is not an emergency organization, nor is it in competition with any such organization."

All radio amateurs throughout the UK are licensed to assist the listed user services during emergency situations irrespective of whether they belong to any organizations or not. Rather than worry about which organization enjoys their help would it not be a better idea to encourage all amateurs to use their specialist skills on behalf of the nation whenever possible, whereby public and authorities alike can see for themselves the good use to which we can put our precious frequency allocations?

Ingemar Lundegard, G3GJW, BARTG president

HAVE YOU A DRAGON?

Sir—I, together with some other Dragon 32, 64 and OS-9 users, am trying to form a user group with the general emphasis on communications and, in particular, OS-9 system software. The group will deal, hopefully, with both the programming and electronics side, and anyone who wishes to join should write to me enclosing a large sae.

Roger Woods, GW8XAN,
20 Heol ap pryce,
Yorkdale, Beddau,
Pontypridd, CF38 2SH

DISCOVERING 28MHz

Sir—I was very pleased to see (*Rad Com* November 1985) the article on discovering 28MHz—a band that is usually forgotten by the majority of amateurs except in years of high sunspot activity. There are adverts urging us to move to 430MHz to get away from the crowded 144MHz band, yet in 28MHz we have a band that can be used for local chats—with ionospheric and other more esoteric modes thrown in.

For award chasers the RSGB has a "40 counties on 28MHz" award, which I expect is intended for overseas stations yet is quite a challenge for UK amateurs. Also you publish a table, in these sunspot minimum years, for countries worked on 28MHz in the year—and it came as a surprise to some to find that DXCC could be worked in 1985 on 28MHz with 100W and a dipole.

At present, people are getting excited, quite rightly, about 50MHz and its potential. However, in 28MHz we have a very similar band—on the junction of hf and vhf with all the potential of 50MHz, and all the modes, and is nearly 2MHz wide—but it is under-used except by cbers. When the majority turn to the 28MHz switch position on their rigs in a few years' time it may well have to be re-labelled "CB"

G3YPZ in his article mentions 28,305kHz as a calling frequency to generate activity. For keeping out cb in the London area this is fine, but for working weak inter-UK stations it is not so fine. For inter-G working I think a frequency well clear of the small segments which are used when there is propagation is better, and I suggest 28,333kHz ssb and 28,111kHz cw as calling frequencies, but others may have a better idea.

Finally, as G3YPZ says, persevere. At the moment, signals are a bit thin, although there is often propagation when no beacons can be heard. Often a better indicator of propagation potential is the amount of cb activity all over the band, rather than the beacons.

P Dixon, G4JBR

"GRENDEL"

Sir—I have recently started a bulletin board (bb) system in Leeds (called "Grendel") and would be grateful if you could give it some publicity. Information on the bb is also available on Prestel page 323000092.

The bb runs my own software (ABBS) on a BBC micro plus 650Z 2nd processor. There is currently room for approximately 700 users. Each user requires a "usercode" (similar to the mailbox numbers on BT Gold). This can be obtained via me on Prestel, or by using the demo usercode "DEMO" on the bb and then the register command.

The bb is mainly for those people interested in computing/networks/pss/information technology etc, but not really games or m.u.d. Private (user to user) and often electronic mailing is supported by a number of special interest groups (SIGs); there are also a lot of files containing news and information that may be read. Users may advertise sales and wants on the bb.

A comprehensive HELP facility is provided for information on all commands. The bb can be configured to work with most terminal types. Advance features are available to VT100 users (or BBC users with Commstar). An 80 column by 24 line display is recommended, but not necessary. The bb operates at 1,200/75 baud with eight data bits and no priority. Terminal software should be scrolling *not* Viewdata. The number is Leeds (0532) 620334, and operation is usually seven days per week between 9pm and 8am. Please do *not* call outside these times.

Commercial advertising will be encouraged to help reclaim some of the running costs. Please contact me if interested.

Mr J Tubby G8TIC (SYSOP)
Flat 6, 26 Oak Road,
Newton Park,
Leeds LS7 3JU
Prestel Mbx 919992633

ANTENNA SPECIFICATIONS

Sir—From time to time I am asked for advice on the structural safety of amateur antenna installations. To make a professional assessment of the effect of wind loading, many factors have to be taken into account, including the geographical location, local topography, the physical details of antenna(s), rotator and mast or tower. Once these data are known, any experienced structural engineer could advise on the overall safety of the actual or proposed installation.

Nowadays, all engineering calculations are made in Système Internationale-SI-units, in this case Newtons, metres, seconds and kilogrammes, whereas pounds and feet will be more familiar to older members. Examining the specifications of antennas from four well-known manufacturers revealed four different ways of presenting wind load data. One specified the loading in kgf at 80mph another in kgp at 25m/s, the next gave an area in m^2 and a wind load in kgf at 160kph, while the last stated Newtons at 120 and 160kph.

I suggest it is time that all antenna, rotator and tower manufacturers agree to adopt a common standard for the mechanical specification of their products using SI units; ie Newtons for all forces, metres per second for wind velocities, and square metres for areas. Since the force coefficients for square tubes used for booms and round tubes/rods used for elements are quite different, the proportion of round and square area should be stated. But in any case, I am uncertain what is meant by "wind area". Is it the total area when looking broadside on to a vertical Yagi as a worst case, and what about crossed Yagis?

Some American manufacturers use the phrase, "Wind survival 80mph" but what does that mean? Would it fail in an 81mph gust? It would equate to such an antenna being just good enough for the outskirts of Liverpool over a 10-year life at a height of 15m above ground. It would not be suitable for similar locations in Scottish cities though.

Rotator specifications are usually rather imprecise, with such statements as, " . . . recommended for medium size communication antennas". The limiting factor with rotators is likely to be the bending moment due to wind forces when there is no alignment bearing on the stub mast above. If this maximum permissible bending moment and the "wind area" of the device were stated, it would enable some meaningful calculations to be made. I hope that the Society will try to persuade advertisers to adopt a common standard in their specifications so that the average radio amateur can compare like with like and that we engineers understand what some of these vague terms really mean.

Norman Fitch, G3FPK,
CEng, MIStructE

This is a point well worth pursuing with the manufacturers.

RSGB NATIONAL VHF CONVENTION

Sandown Park Racecourse, Esher, Surrey

Sunday 16 March 1986

- **One day exhibition and lecture programme**
- **Exhibition by specialist groups**
- **Presentation of trophies**
- **Equipment test facility**
- **Comprehensive trade exhibition**
- **Full lecture programme on vhf, uhf and microwave subjects**

PROGRAMME

1030 **Convention opens.** Entrance through racecourse turnstiles. (Open to exhibitors from 0800 through special exhibitors' entrance) **Refreshments.** Snack bar in the hall will be open from 1100 to 1600, and the licensed bar will be open throughout the convention.

Equipment test facility

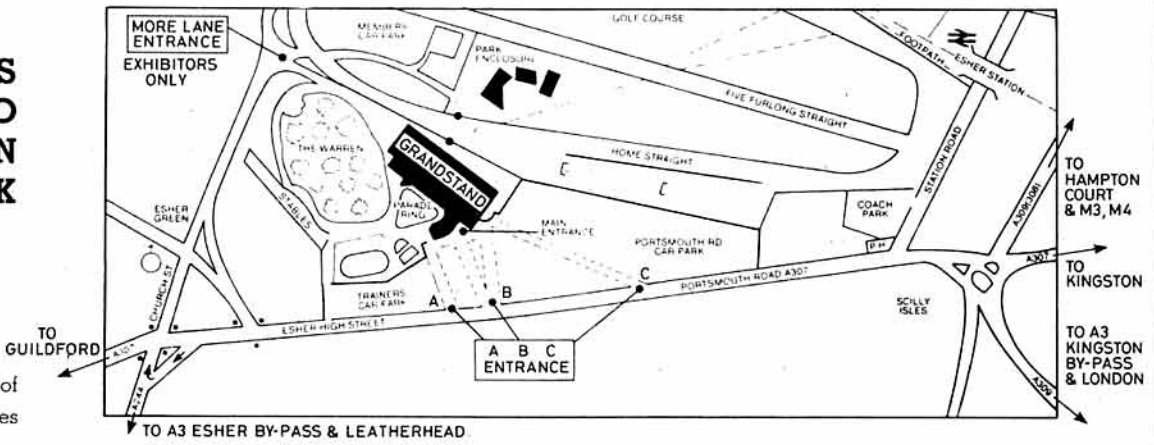
1345 **Convention address and presentation of trophies** by RSGB President Willie McClintock, G3VPK

LECTURE PROGRAMME

Detailed arrangement for lectures will be notified on arrival

	Stream A	Stream B	Stream C
1415	"VHF/UHF Propagation and the weather", Jim Bacon, G3YLA	"Amsat future developments—the way ahead", Ron Broadbent, G3AAJ	"Equipment for 1·3 and 2·3GHz", Chris Smith, G8LMW
1515	"The history of vhf", Ken Willis, G8VR	"Optimizing your vhf/uhf station", David Butler, G4ASR	"Microwave tv", Bob Harris, G4APV
1615	VHF Contests Committee forum	"50MHz results and expectations for the future", Ray Cracknell, G2AHU	"Getting the most out of your dish", Charlie Suckling, G3WDG
1745	Lecture session ends		
1800	Trade exhibition closes. Convention ends		

ACCESS MAP TO SANDOWN PARK



Map by courtesy of United Racecourses

APPLICATION FOR TICKETS

RSGB NATIONAL VHF CONVENTION 16 March 1986

Please supply tickets as under:	Cost	Number		Cost	Number
Convention and exhibition.....	£1.00	.....	**Convention and exhibition (under 18)**.....	£0.50	.....
			Convention and exhibition (under 14).....	Free	.....

I enclose cheque/postal order for £.....

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ACTIVE ELLIPTIC AUDIO FILTER DESIGN USING OP-AMPS

(Part 1)

D H G Fritsch, G0CKZ*

Introduction

Modern shortwave transceiver specifications have driven mixer and i.f. designs to near perfection in applying today's state-of-the-art technology. Nevertheless, the audio stages cannot claim similar advances, and in that respect seem to have been neglected. Perhaps one might argue that hi-fi quality is not needed because of the high atmospheric and man-made noise in this particular spectrum of radio frequencies, or that the extra cost of additional stages brings no meaningful improvement to transceiver specifications, tested under laboratory conditions. Certainly, from an operating point of view an optional state-of-the-art audio filter would be much appreciated, since it could make the difference between either working a station or losing it.

Very few published active filter designs actually describe an elliptic filter, mainly because of the overall complexity in designing and constructing one. Previous articles in *Radio Communication* [1, 2 and 3] inspired enthusiastic home-constructors to utilize inductors and capacitors to realize the elliptic transfer functions. This article is aimed as an introduction to active, fixed frequency audio filters being synthesized by a second method to achieve the elliptic filter characteristic, leading through the design stages and finishing with the construction of a narrow cw bandpass.

The technique employed uses RC active filter sections allowing latitude to the designer in choice of component values. Here, resistors and capacitors are used in conjunction with operational amplifiers to create a better, or at least the same, effect as can be obtained with a combination of passive elements.

The active approach offers many advantages. First, realizing that the inductive component presents the main difficulty in passive filter design. Inductors at audio frequencies tend to be bulky, heavy and expensive, and losses are often high. Non-standard inductance values necessitate winding by hand, which can prove a very cumbersome task.

Dieter Fritsch was born in 1948 in Rehau, a small town in Bavaria near the Czechoslovakian and East German borders, and held the callsigns DK2EIX, DK3OK and DJ3NB. After service as a Merchant Navy radio officer, he spent some years working and studying electronics in Melbourne, Australia (callsign VK3BGJ), and in Auckland, New Zealand, mainly on the introduction of the PAL colour television system.

He joined Racal Communications UK in 1979, and currently heads the calibration laboratory of the data communications group, Racal Milgo at Warrington.

His amateur radio interests are concentrated on the home-construction of filters, direct-conversion third-method transceivers and data communication devices.

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Front view of the cw filter

Conversely, resistors and capacitors are compact and lightweight, also less expensive. The low-noise Texas Instruments TLO74 op-amp used in this design features all required parameters in a quad package, reducing the overall dimensions of the filter to a "handy" size. The op-amp high impedance jfet inputs allow lower-value capacitors to be used, and filter input and output impedance matching is easy, which all LC selective filters so critically depend upon.

The biggest advantage from the designer's point of view is the ability to precisely tune the active elliptic filter by trimming the value of certain resistors to obtain the desired calculated response, whereas LC passive filters are restricted to standard value components only, obtaining at best an approximated response.

Passive filters always introduce an insertion loss of some amount, whereas its active counterpart may exhibit gain, making it quite attractive for applications like the direct-conversion concept, where selectivity must originate at audio frequencies, and very high amplification is needed in a single section. Active filters require at least one single voltage rail, proving less of a constraint to the biquad elliptic type, since voltages between 6V and 36V at a few milliamps are easily tapped off existing equipment.

Virtually every transfer function may be performed, including the lowpass, highpass, bandpass, band-reject or notch, as well as the allpass, functions. For design and construction purposes perhaps the most interesting point to mention beforehand is that the basic building block of an active elliptic filter, a second-order stage (detailed in Fig 1(a)), always remains the same—only the RC components change in value to determine whether it becomes an lp, hp, bp, br or ap. One pcb layout caters for all types and possible combinations thereof.

The active elliptic lowpass filter will be considered first.

The biquad elliptic lowpass

A lowpass is a filter that passes signals with low frequencies and blocks those with high frequencies.

There are many types of lowpass filters; the four most popular being the Butterworth, Chebyshev, inverse Chebyshev, and Cauer or elliptic filters. The circuit of Fig 1(a) represents a biquad elliptic filter of second-order (N = 2) which is similar in complexity to a voltage-controlled voltage source (vcvs) elliptic or to a three-capacitor elliptic circuit. The biquad is easier to tune than a vcvs and has the advantage over the three-capacitor circuit that the gain may be set without having to trim one capacitor value. Also, as the name of the latter implies, it needs one additional capacitor.

The biquad gets its name from the input integrator or "area-under-the-curve device" using R4 as a damping resistor in parallel with capacitor C1. The second integrator with C2 does not have a damping resistor, and the remainder of the circuit is made up of a two-input, inverting current-summing amplifier. The gain (K) of this second-order stage is an inverting gain of -K. The elliptic or Cauer filter has an amplitude response showing ripples in both the pass- and stopbands, and a null just outside the passband. Each further second-order stage produces another zero in the stopband. These notches could, for example, be put where unwanted harmonics appear. The elliptic filter gives the fastest possible fall-off, in that for a given order (N) and allowable passband ripple width (prw) and minimum stopband loss (msl), it has the shortest transition width (tw).

An example of a fifth-order (N = 5) elliptic amplitude response is shown in Fig 2, where the following terminology applies:

(*a*) The transfer function of a realizable filter is a ratio of polynomials, where the degree n of the denominator polynomial is defined to be the "order" of the filter.

(*b*) The passband is the range of frequencies where the amplitude is greater than some specified number A1.

(*c*) The passband ripples are equal in magnitude and may be characterized by the maximum allowable deviation, which is called passband ripple width, prw = $-20 \log A1$ (dB).

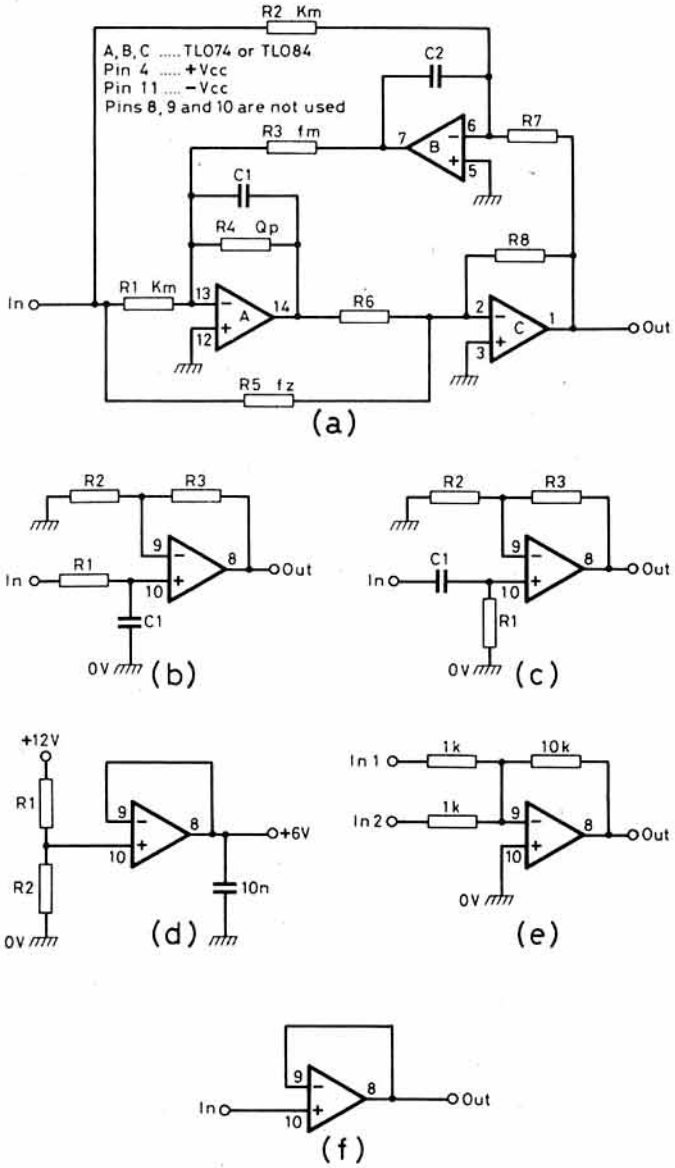


Fig 1. (a) Biquad elliptic second-order stage. (b) First-order lowpass. (c) First-order highpass. (d) Rail divider. (e) Gain-of-10 inverting summing amplifier. (f) Non-inverting unity gain buffer

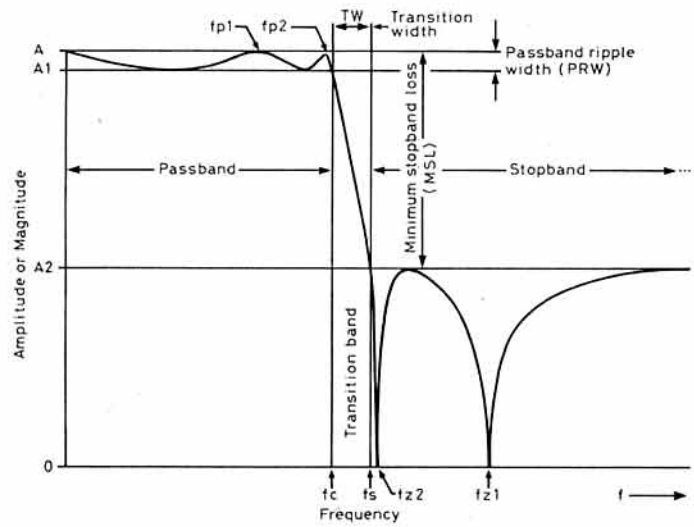
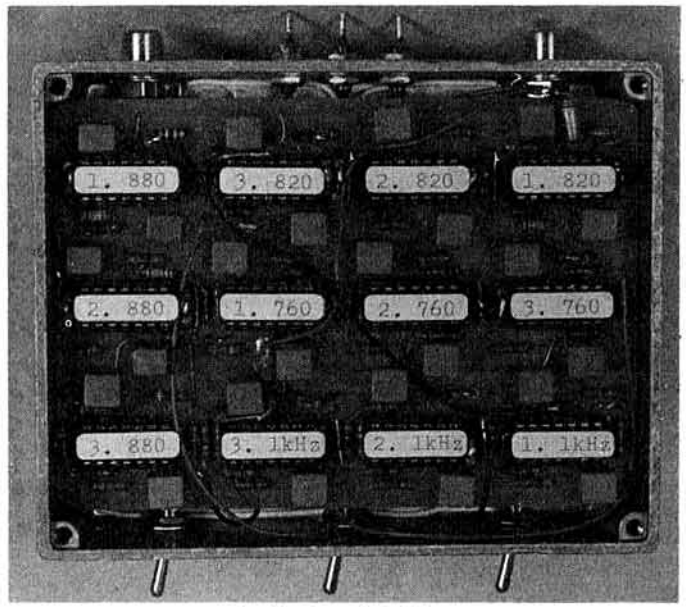


Fig 2. Elliptic lowpass response



Inside view of the filter

(*d*) The stopband is the range of frequencies where the amplitude is less than some specified amount A2.

(*e*) The stopband ripples are also equal in magnitude (although not necessarily equal to prw) and are characterized by the minimum stopband loss, msl = − 20 log A2 (dB).

(*f*) The transition band is the interval in which the response continually decreases from the passband to the stopband.

(*g*) The transition width is given by tw = fs − fc, as the band of frequencies in hertz, asserting the steepness of a filter. In its normalized form tw is given as a coefficient.

(*h*) The cut-off frequency is specified at the point of maximum passband ripple excursion, compared to other filter types, where the − 3dB-point characterizes the cut-off frequency. In the elliptic case a − 3dB-point only coincides if the passband ripple width is 3dB. (Elliptic filter example: prw = 0·5dB, then fc starts at − 0·5dB).

The amplitude or magnitude is usually expressed in decibels, where the prw cannot exceed 3dB and typical values for the msl or attenuation are considerably larger, possibly in the range between 20dB and 100dB, in which case we have the corresponding factors from 0·1 to 0·00001.

The optimum filter is the one whose amplitude response satisfies the following condition:

For a given order N and ripple prw and loss msl, to produce a minimum

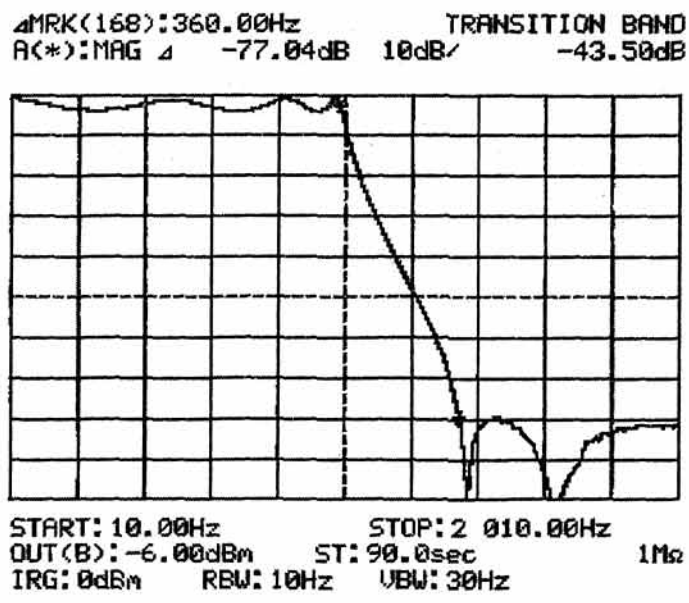


Fig 3. 1,000Hz lowpass response, transition width 360Hz. N = 7, prw = 3dB, msl = 80dB, fs = 1,360Hz

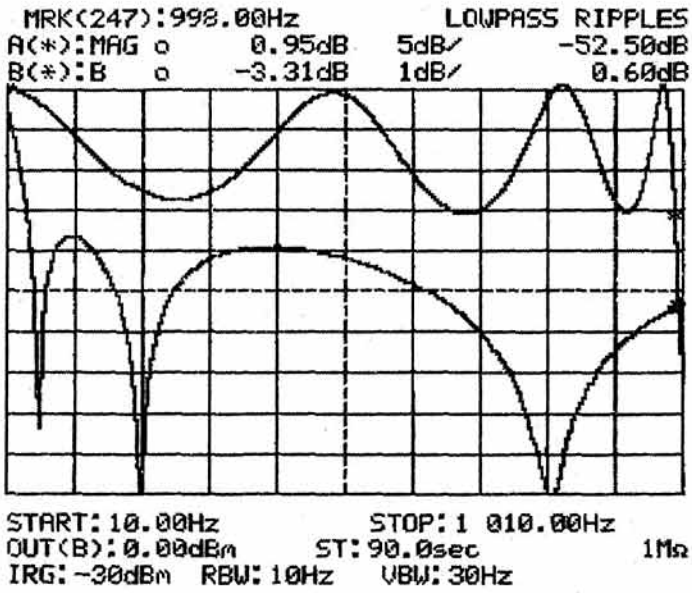


Fig 4. 1,000Hz lowpass ripple responses: top, 3dB passband ripple; bottom, >30dB stopband ripple

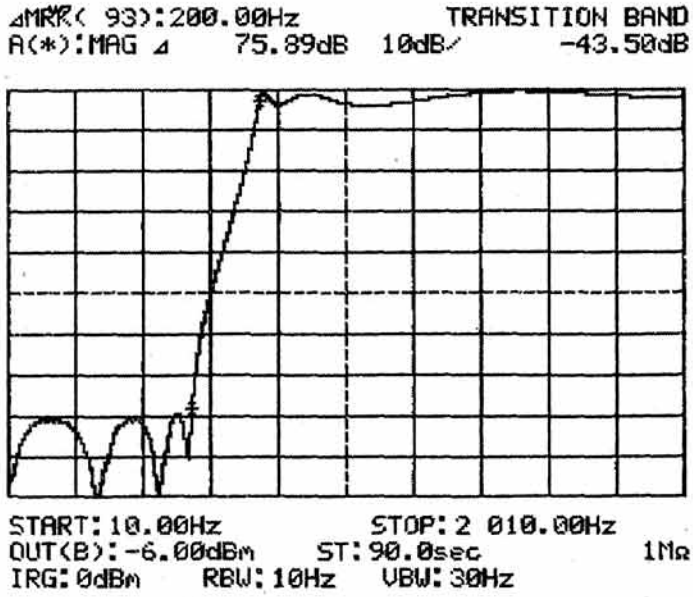


Fig 6. 760Hz highpass response, transition width 200Hz. N = 7, prw = 3dB, msl = 80dB, fs = 560Hz

transition width tw. That is, if A, A1, A2, N and the cut-off frequency fc are given, then the stopband frequency fs is a minimum.

In the all-pole case, the optimum filter is the Chebyshev. However, in the general case, the elliptic filter is optimum and far superior to the Chebyshev filter. For example, to match the transition with tw = 0·03 of a 12th-order elliptic filter, a Chebyshev filter with 39 orders would be required, as would a lot of compromising.

A typical lowpass response and its associated ripples are shown in Figs 3 and 4.

The biquad elliptic highpass

A highpass is a filter that passes signals with high frequencies and blocks those with low frequencies.

The transfer function of a highpass may be obtained from that of a lowpass filter using the process of mathematical transformation by 1/f, which will produce the mirror image of its lowpass counterpart. The information given and terminology used earlier in describing the biquad elliptic lowpass filter, also applies to the highpass, apart from some minor detail; ie the transition width in terms of frequency can be obtained by subtracting the smaller value stopband frequency from the larger cut-off frequency, or tw = fc-fs. Using tw as a coefficient, its frequency then becomes tw(hp) = tw/(1 + tw)*fc, in hertz. As in the lowpass, tw is a more preferred term for the elliptic filters, rather than decibels/octave, used in more shallow designs.

All the formula changes have been made, and we can use the result in a later chapter dealing with the calculation of the individual highpass elements.

Theoretically, a highpass should retain a flat passband response to infinite frequency, but in practice the active highpass has an upper frequency limit imposed on it, appearing as a second cut-off frequency, and normally determined by the gain/bandwidth product of the op-amp in use. A "natural" bandpass response is created. This effect can be seen in Fig 5, where the active highpass starts to roll off just below 1MHz, and reaches a minimum level (70dB down) at 4·6MHz. For audio applications this natural phenomenon leaves the frequency range of interest unaffected.

A typical highpass response and its associated ripples are shown in Figs 6 and 7.

The combination biquad elliptic bandpass

A bandpass is a filter that passes signals within a band of frequencies and blocks those below and above that band.

Normally, the bandwidth (bw) is given, which is centred approximately about the centre frequency fo. The actual centre frequency fo = SQR(fl*fu),

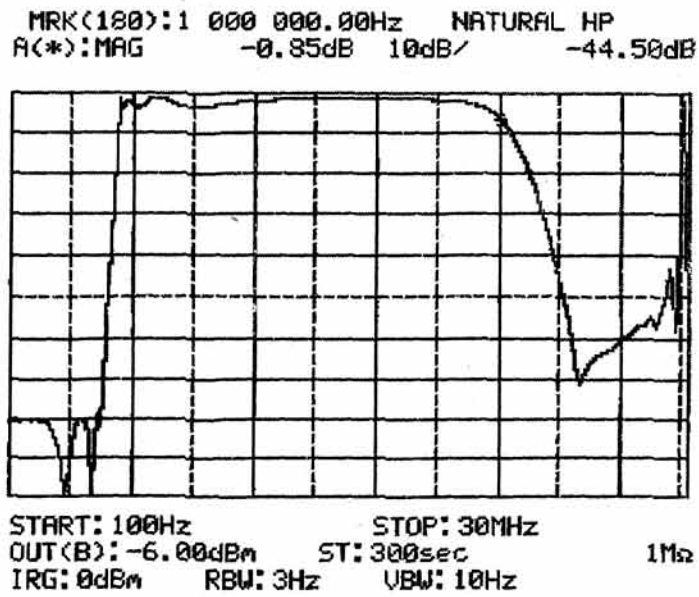


Fig 5. Active highpass natural response. 1MHz at −6dB, 4·6MHz at −70dB

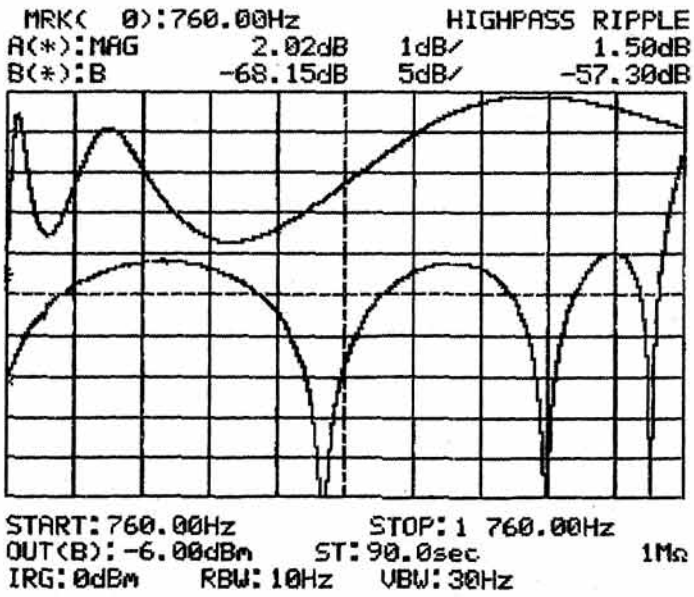


Fig 7. Highpass ripple responses: top, 3·6dB passband ripple; bottom, >30dB stopband ripple

where fl is the lower, and fu the upper cut-off frequency of the bandpass filter. The ratio Q = fo/bw is the quality factor of the bandpass and is a measure of its selectivity or sharpness. High values of Q correspond to a relative narrow bandwidth, and low values of Q to relative wide bandwidth —not to be mistaken for the Q of capacitors, as mentioned later, or the pole-pair quality factor Qp, as a measure of sensitivity to component tolerances for lowpass and highpass filters. As a rule of thumb, a true bandpass should be chosen if the percentage bandwidth is smaller than 75 per cent. A combination or overlapping bandpass, made up by cascading a low- and highpass, should be chosen if the percentage bandwidth is greater than 75 per cent.

As a practical example, suppose our centre frequency fo = 1,000Hz, and the bandwidth bw = 600Hz; the true bandpass should be chosen as pointed out above, since the percentage bandwidth is 600/1000*100 = 60 per cent, which is smaller than the rule of thumb figure of 75 per cent.

However, the calculations for a true biquad elliptic bandpass filter are rather more involved, and the tuning of its stages becomes more delicate, so that a separate article would have to be written to cover this topic in detail. Here we use the combination bandpass to great advantage, and aim for much smaller bandwidths than 600Hz, as can be seen later.

If we chose the highpass to be on the signal input side and the lowpass on the output, then capacitive coupling from the signal source to the first-order highpass stage will provide dc separation (see Fig 1(c)). Therefore, ground return resistors on the filter inputs are no longer needed, since each input stage will be driven by a low-impedance op-amp output. Putting the lowpass last has the added advantage of very low noise and harmonic distortion. The measured noise floor within the filter passband, when no signal is applied, was smaller than 80dB down against a reference level of 0dBm (0·775Vrms into 600Ω). This means that the internally-generated filter noise was smaller than 75μV.

A combined bandpass response is shown in Fig 8, where two narrow filter curves are superimposed on to the same graph, displaying steep slopes and very high stopband attenuation on a linear frequency scale. Fig 9 zooms in on the passband ripples of the two filters, where one vertical division on the graph represents 0·5dB. The top trace, with its wider bandwidth, has a maximum passband ripple excursion of 2·2dB, and the narrower trace below only totals 0·4dB. Originally, the biquad elliptic low- and highpass filters had a calculated prw of 3dB, but in cascading them, where the resulting ripple could have been anywhere between 0dB and 6dB, they complemented each other and produced a lower than calculated ripple response. This effect was a function of the chosen cut-off frequencies and cannot be found in the true bandpass design.

In order to compare the performance of various bandpass filters, a more descriptive term has been defined, called skirt selectivity or shape factor (rather than using Q = fo/bw). The shape factor of a bandpass is usually expressed as the bandwidth ratio at different attenuation levels, and is always greater than one. Preferred levels are the 30/3dB and 60/6dB bandwidths, but any other levels may be selected, as long as they remain the same for the purpose of comparing bandpass filters. See "measured results" for details on the shape factor filter performance figures.

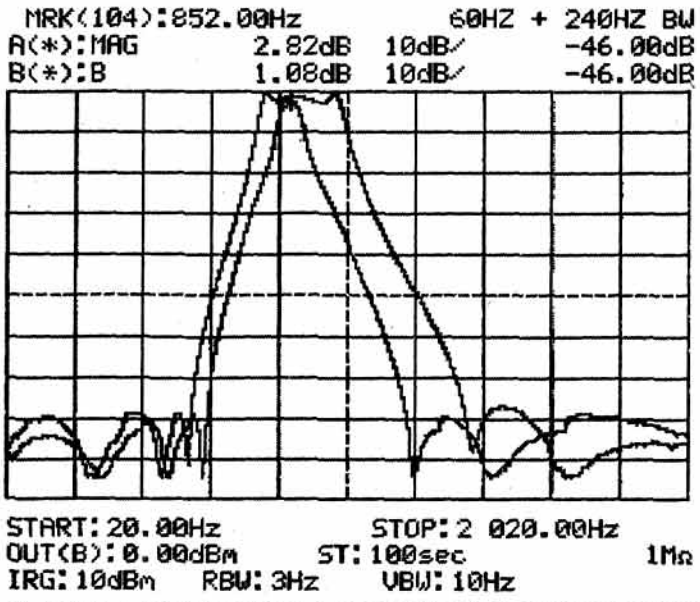


Fig 8. 60Hz and 240Hz bandpass responses (linear), cascaded lowpass and highpass filters. N = 7, prw = 3dB, msl = 80dB

Practical design considerations

To take a practical example for amateur radio use, let us assume the overall selectivity for cw in our receiver is lacking because the superhet was designed primarily for ssb with an i.f. bandwidth of approximately 2·4kHz, and its passband in the range from 300Hz to 2·7kHz. Since we are keen cw operators on the 7MHz amateur band, the need for an optional audio filter is immediately justified to reduce the effects of QRM.

Before quickly deciding on the final filter shape, let us look at some of the more important practical points.

The optimum listening frequency produced by received cw characters will greatly depend on the individual operator's hearing ability, and has been found to be a note or tone from as low as 400Hz to greater than 1,200Hz. It is also affected by QRM, which will push it to one or the other extremes, or by working a net with more than one station involved, each having a different pitch. In general, every cw operator will have his own preferred listening frequency, which should coincide with the transmitter's sidetone (normally adjustable). In my case that optimum frequency is about 850Hz. For reasons just mentioned above, the ideal design would be that which provides continuous variable tuning across a specified range of audio frequencies without changing the shape factor. This is possible with biquad elliptic filters using analogue switches being enabled by a variable duty-cycle generator. The solution in our case, dealing with fixed frequency types, is to provide switchable bandwidths using the combined biquad elliptic bandpass.

The first switch position should be a direct path, without any filters in circuit. This position is particularly useful for tuning, or monitoring of activities on the band. At the same time it can provide, for comparison, checks on the performance of any selected filters. To make a cw filter user-friendly, at least two different bandwidths should be available; a narrow one for normal cw traffic on a crowded band, and a very narrow one for when the going gets tough.

How narrow can we actually make the bandwidth of a cw filter? Theoretically, only a few hertz are needed for fast manually-sent morse, so a limit is imposed mainly by the technology utilized. Here the aim is to reproduce a clean note without any overshoot or ringing plus any other unwanted side-effects. On the other hand, it would be of little help to have a super-narrow filter, to find that the signal you were listening to has drifted outside the passband. Drift, therefore, is another factor, both your own and the other station's.

In the age of phase-locked loop synthesizers, where signals should remain stable over the full length of a cw QSO, a practical limit can be set below 100Hz. My first choice fell on 240Hz for the narrow bandwidth and 60Hz for the very narrow bw; primarily because when two combined bandpass filters are constructed from one highpass and one lowpass in each, two secondary bandwidths are created by cross-combination, as will be seen from the block diagram in Fig 13. It now remains to select the appropriate cut-off frequencies for each individual bandpass, bearing in mind that the preferred listening frequency and sidetone of 850Hz should be allowed to pass through any of them. The chosen frequencies are as follows:

	BW (Hz)	HP + LP, fc (Hz)
Primary	240	760-1,000
Secondary	180	820-1,000
Secondary	120	760-880
Primary	60	820-880

Switching is straightforward and has been arranged using single-pole changeover toggles, where the "direct" switch is positioned farthest left and the other two switches follow in line from the lowest cut-off frequency to the highest, as the furthest right toggle. Care should be taken when the actual connections are being made, since the wanted contact is usually in the opposite direction to the pointing-switch lever. The position of these switches and their marking can be seen on the photograph showing the front view of the cw filter, where each toggle points in the direction of its selected function.

Measurements have confirmed that the human ear is fairly tolerant to changes in amplitude within the passband, therefore we choose our prw to be the maximum possible, 3dB. Due to the high power density spectrum on 7MHz, 40dB of unwanted signal rejection is not going to do the job satisfactorily. Imagine you are listening to a weak station of −40dB, and a strong interfering station puts its carrier on the air at a level of 0dB; in other words, it is 100 times stronger. Should the interfering signal fall into the stopband of a 40dB filter, we could hear it at a level of −40dB, just the same as the wanted signal. Therefore, we should aim for rejection levels equal to or greater than 60dB. We select the msl at 80dB, which constitutes a compromise, because as the msl reaches its maximum at 100dB, the filter slope becomes less steep. Taking a closer look at the graphs in Figs 10 and 11 or the listed figures in Tables 1 and 2, where a set of parameters is offered for 3dB ripple filters, we can find out how complex, low down, steep and trimmable an envisaged filter is going to be.

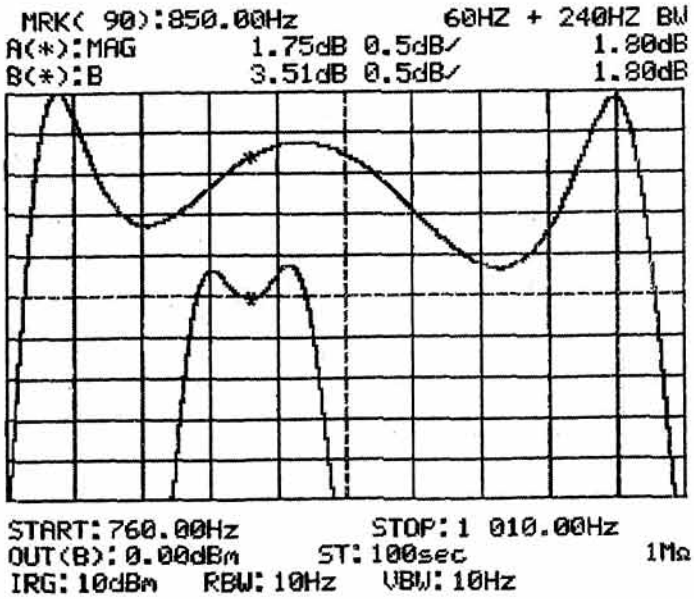


Fig 9. 60Hz and 240Hz bandpass ripple responses: top, bw = 240Hz, 2·2dB passband ripple; bottom, bw = 60Hz, 0·4dB passband ripple

Fig 10 and Table 1 give the starting point for 103 possible solutions if the problem had to be solved from a particular shape or steepness of the slope, whereas Fig 11 and Table 2 provide the same number of solutions if it had to be solved from a quality factor (Qp) point of view. The highest Qp is found in the last of the individually-cascaded second-order stages.

The normalized tw coefficient in Table 1 for an msl of 80dB can be read across, starting with 7·5859. A rather gradual roll-off would be experienced with only a third-order (N = 3) elliptic filter, and the stopband frequency (fs) will only reach its 80dB attenuation level at fs = (fc*tw) + fc = (1,000*7·5859) + 1,000 = 8,586Hz, an unacceptable shape in our case.

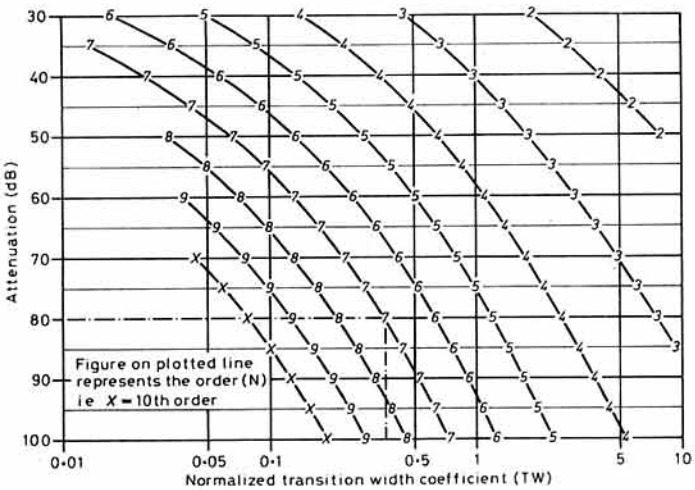


Fig 10. Attenuation versus tw. Transition width for elliptic filters with 3·0dB passband ripple (prw)

Table 1. Transition widths (tw) for elliptic filters with 3·0dB passband ripple (prw)

MSL	N=2	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10
30	1·9032	0·4581	0·1454	0·0502	0·0178	—	—	—	—
35	2·8202	0·6878	0·2331	0·0878	0·0344	0·0137	—	—	—
40	4·0558	0·9802	0·3466	0·1393	0·0589	0·0254	—	—	—
45	5·7129	1·3460	0·4884	0·2058	0·0923	0·0425	—	—	—
50	7·9300	1·7986	0·6615	0·2885	0·1353	0·0657	0·0324	—	—
55	—	2·3547	0·8692	0·3885	0·1888	0·0955	0·0493	—	—
60	—	3·0347	1·1160	0·5071	0·2533	0·1325	0·0710	0·0386	—
65	—	3·8638	1·4067	0·6459	0·3294	0·1771	0·0980	0·0550	—
70	—	4·8725	1·7475	0·8068	0·4180	0·2297	0·1304	0·0754	0·0441
75	—	6·0981	2·1453	0·9918	0·5198	0·2908	0·1687	0·0999	0·0599
80	—	7·5859	2·6085	1·2032	0·6357	0·3607	0·2130	0·1288	0·0790
85	—	9·3907	3·1465	1·4440	0·7668	0·4399	0·2637	0·1623	0·1015
90	—	—	3·7706	1·7173	0·9143	0·5290	0·3210	0·2005	0·1275
95	—	—	4·4936	2·0267	1·0796	0·6285	0·3852	0·2437	0·1573
100	—	—	5·3307	2·3763	1·2640	0·7391	0·4568	0·2921	0·1908

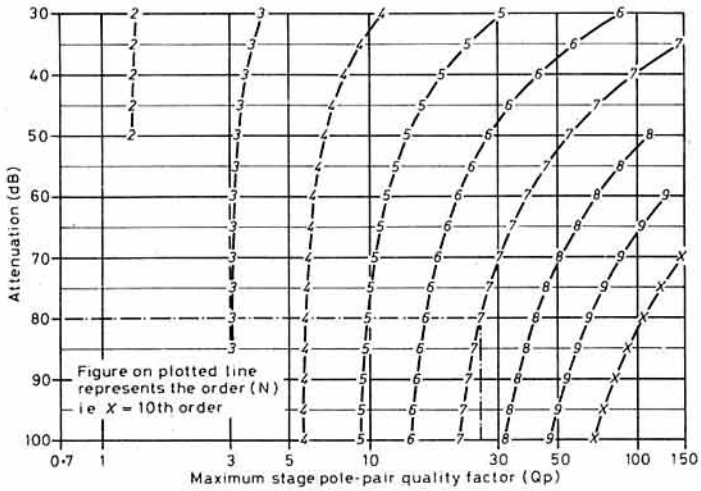


Fig 11. Attenuation versus Ap. Maximum space pole-pair quality factors (Qp) for elliptic filters with 3·0dB prw

Table 2. Max stage pole-pair quality factors (Qp) for elliptic filters with 3·0dB prw

MSL	N=2	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10
30	1·3566	4·0264	11·268	31·264	86·646	—	—	—	—
35	1·3333	3·6811	9·3237	23·253	57·845	143·84	—	—	—
40	1·3206	3·4687	8·1408	18·653	42·541	96·928	—	—	—
45	1·3136	3·3335	7·3776	15·790	33·540	71·123	—	—	—
50	1·3097	3·2455	6·8649	13·901	27·838	55·588	110·92	—	—
55	—	3·1873	6·5101	12·600	24·018	45·586	86·421	—	—
60	—	3·1485	6·2594	11·675	21·349	38·801	70·394	127·63	—
65	—	3·1224	6·0796	11·001	19·421	34·007	59·388	103·62	—
70	—	3·1048	5·9491	10·500	17·992	30·508	51·537	86·950	146·62
75	—	3·0929	5·8536	10·123	16·911	27·885	45·757	74·944	122·67
80	—	3·0848	5·7833	9·8351	16·080	25·879	41·391	66·040	105·26
85	—	3·0793	5·7312	9·6142	15·432	24·316	38·023	59·267	92·258
90	—	—	5·6926	9·4432	14·922	23·084	35·380	54·010	82·303
95	—	—	5·6639	9·3100	14·517	22·098	33·273	49·856	74·539
100	—	—	5·6425	9·2060	14·193	21·303	31·576	46·528	68·367

To the far right of Table 1 we read 0·079 as the tw for the attenuation msl = 80dB. Going up on the vertical axis it shows that we need N = 10; in other words, five second-order stages to get the stopband frequency fs = 1,079Hz. A very near ideal shape, only 79Hz away and 80dB down —fantastic. Here the total stage count would amount to 4*5 = 20 second-order stages or, in terms of components, a total of 20 ics plus passive components—rather complex as an introductory project.

Also, if we look at Table 2 under N = 10 and across to msl = 80dB, we find that in this case the fifth second-order stage has the extremely high pole-pair quality factor (Qp) of greater than 105. Because high values of Qp will have a large spread of element values and become more sensitive to component tolerances, these stages would not escape elaborate tuning and therefore are not recommended for this project. As a rough guide, consider the following figures for Qp as an indication of how much trimming or tuning might be necessary in order to bring the constructed filter into agreement with its calculated response.

Qp	Component tolerances	Tuning or trimming requirements
0–10	R 5% and C 5%	Practically none
10–40	R 1% and C 2·5% or 5%	Very little
40–100	R 1%, measure C	Necessary
100–150	R 1%, measure C	Elaborate

The instruments required for the tuning process would consist of a set-up including: audio generator, oscilloscope and frequency counter.

If we search for Qp to be in a safer region, we find a seventh-order filter (N = 7) at 80dB down will have a pole-pair quality factor of 25·879, say 26. The accompanying transition width factor for N = 7 is given as tw = 0·3607 and will put the stopband frequency at fs = (fc*tw) + fc = (1,000*0·3607) + 1,000 = 1,360·7Hz; a much better practical solution to our problem, since N = 7 only needs three ics, and the total ic count falls to a reasonable figure of 4*3 = 12.

Odd-order filters (ie N = 3,5,7, or 9) offer a better performance for less components, and for this reason are more popular than even-order filters. Also, less calculations will be asked for. To build a seventh-order filter we simply cascade three stages of second-order as in Fig 1(a), and add one single or first-order stage, see Figs 1(b), 1(c), and 12.

The audio output from either a headphone or loudspeaker terminal already has sufficient amplitude, so no further gain from the filter is required. Therefore, the overall filter gain (K) is chosen to be one or unity.

So far we have gathered the following design parameters:
fc = 1,000Hz, as the LP1 cut-off frequency at minus 3dB;

fs = 1,361Hz, as the LP1 stopband frequency at minus 80dB;
fc = 880Hz, as the LP2 cut-off frequency at minus 3dB;
fs = 1,197Hz, as the LP2 stopband frequency at minus 80dB;
fc = 820Hz, as the HP2 cut-off frequency at minus 3dB;
fs = 603Hz, as the HP2 stopband frequency at minus 80dB;
fc = 760Hz, as the HP1 cut-off frequency at minus 3dB;
fs = 559Hz, as the HP1 stopband frequency at minus 80dB;
N = 7, seven orders are required, three second-order, plus one first-order;
prw = 3dB, maximum selected passband ripple width;
msl = 80dB, minimum stopband loss or attenuation;
K = 1 or 0dB, unity filter gain (same out as in);
tw = 0·3607, normalized transition width factor, common to all filters selected.

Normalized lowpass filter data and calculations

The mathematical process to arrive at an elliptic filter response requires the use of Jacobi elliptic functions [6], which are extremely tedious to calculate. For convenience, the normalized case (wc = 1 radian/s) of the transfer functions in factored form is tabulated as lowpass data for the orders n = N = 2 to 10. See extracted lowpass data in Table 3. (*To follow in Part 2.*) Available passband ripples are prw = 0·1, 0·5, 1, 2 and 3dB, and the msl, in most cases, is 30dB to 100dB in steps of 5dB.

TW is the normalized transition width which results, and A, B and C are the actual lowpass filter coefficients or second-order factors, where the first line or row of data corresponds to the first second-order stage or factor, the second line to the second factor, and so on. In the case of an odd-order filter (ie N = 7), the first-order factor is given in the last line of data under C.

The next five columns contain valuable information for component selection and the precise tuning or matching of the individual responses. Presented are the pole-pair frequency coefficient (Fp), the pole-pair quality factor (Qp), the stopband zero frequency coefficient (Fz) and, in the case of passband peaking, the peak frequency coefficient (Fm) and its appropriate level (Km) at which it occurs. If the peak frequency (fm) is an imaginary number, then there is no passband peaking.

Altogether there are 545 listed filter solutions, containing 33 pages of lowpass data like the one in Table 3, from which any elliptic filter may be calculated to fit a particular response, including hp, bp and notch filters. I can supply lowpass data printouts for a small charge to costs.

From our given design parameters we can now find the appropriate coefficients A, B, C and Fp (look up Table 3, under N = 7, prw = 3, msl = 80).

There are 10 individual filter elements or component values to be found for each second-order stage, four of which are arbitrarily chosen (C1, C2, R6 and R8) and six resistor values (R1 to R5, and R7), where the formula below apply. The calculations will have to be repeated three times (N = 7 has three second-order stages plus one first-order stage). Again the process seems a tedious one, and you may want to skip this part and have a look at Table 4, where all component values, design parameters, lowpass coefficients, tuning data and comments are presented as a computer printout for the 1kHz lowpass. Table 5 summarizes the 760Hz highpass results in detail. (*Tables 4 and 5 to follow in Part 2.*)

In view of the intricate complexity of these calculations (minimum maths), I am prepared to provide printed results like those in Tables 4 and 5 for readers who cannot get involved. A suggested format of info required for a customized active elliptic audio filter design can be found in the appendix, from which these printed results can be generated.

Biquad elliptic lowpass calculations

Calculate each second-order lowpass stage in turn, as per the following step-by-step example: LP fc = 1,000Hz.

(1) Find the circuit's angular frequency wc = W = 2*pi*fc = 6,283·18Hz (for ease of repetitive use).

(2) Find the pole-pair frequency fp = Fp*fc = 0·52445*1,000 = 524·45Hz.

(3) Find the stage zero frequency fz = Fz*fc = 1·626828*1,000 = 1,627Hz (rounded figure for tuning purposes).

(4) Select a standard value for capacitors C1 and C2. For moderate K and Qp let C1 = C2, preferably near 1E4/fp. C1 = C2 = 10,000/524·45 = 19·07nF.
Selected C1 = C2 = 10nF for all stages, because of size and availability.

(5) Select a standard value for resistors R6 and R8, preferably near 1/(W*C1).
R6 = R8 = 1/(6,283·18*10*1E-9) = 15,915Ω.
Selected R6 = R8 = 20kΩ for all stages, because this choice brings all other resistors very close to preferred standard values.

(6) R1 = A/(K*B*C*W*C1).
R1 = 2·646568/(1*0·244509*0·275048* 6,283·18*10*1E-9) = 626·33kΩ.

(7) R2 = 1/(K*Fp*W*C2).
R2 = 1/(1*0·52445*6,283·18*10*1E-9) = 30·35kΩ.

(8) R3 = 1/(Fp*W*C1).
R3 = 1/0·52445*6,283·18*10*1E-9) = 30·35kΩ.

(9) R4 = 1/(B*W*C1).
R4 = 1/(0·244509*6,283·18*10*1E-9) = 65·09kΩ.

(10) R5 = (A*R6)/(K*C).
R5 = (2·646568*20,000)/(1*0·275048) = 192·44kΩ.

(11) R7 = (C1*R3)/C2.
R7 = (10*1E-9*30,350)/10*1E-9 = 30·35kΩ.

Repeat calculations for the second and third stages, starting at (2), since fc remains the same. The formulas above are used for all biquad elliptic lowpass filter calculations.

The first-order stage in our case has unity gain, therefore the inverting input to the selected op-amp can simply be linked to the output of the same, (pins 8 and 9, see Fig 1(b)), where C1 is selected to be 10nF.

(12) R1 = 1/(W*C1*C) = 1/(6,283·18*10*1E-9*0·152661) = 104·25kΩ.
R2 and R3 are only necessary, should more than unity gain (K > 1) be asked for.

(13) R2 = (K*R1)/(K-1).

(14) R3 = K*R1.

A first-order stage only produces a pole and no zeros, where the frequency is:

(15) fp = Fp*fc = 0·390719*1,000 = 391Hz.

Select standard value resistors and capacitors as close as possible to the calculated values.

TO BE CONCLUDED

A DX TRAILER

David A Reid, GM0BZF*

WHEN I DECIDED to build this trailer, I thought that it was going to be a difficult and painstakingly expensive job. But I was wrong, it has turned out to be an easy (or relatively so) and enjoyable experience.

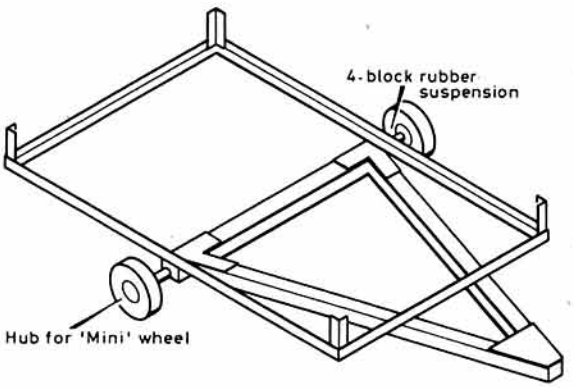


Fig 1. The basic chassis

David Reid was licensed as GM6JLQ in 1982, and became GM0BZF in June 1985. From 144MHz dxing in 1982, his interests now cover the range 3·5MHz dx to 1·3GHz—rtty on 144MHz; cw on all bands, receiving on 50MHz, and transmitting on 3·5, 14, 21, 28, 70 and 144MHz. He received the G-QRP Club award as the first Class B to work 50 stations with his variance as GM6JLQ. He is a member of the Clyde Coast Raynet Group; and the Helensburgh ARC, of which he is secretary. He is a microelectronics engineer by profession and is very interested in computers and radio interfacing.

*28 Bainfield Road, Cardross, Dumbarton G82 5JQ

Like most hams who enjoy working dx from the nearby local hills, I had dreams of having a portable tower system, and I set about the task by finding a suitable chassis. This didn't take long—a visit to the local pub to pick the brains of the experts on the subject (and of course the good ale) proved very worthwhile. By the next weekend I was the proud owner of a 4 by 6·5ft (220 by 980mm) maze of angle-iron and mini wheels (Fig 1). I had already decided to look for a chassis with mini wheels, rather than trailer wheels, because they are much cheaper and more plentiful. High-pressure tyres were not really necessary, as the total weight was estimated to be less than 500lbs.

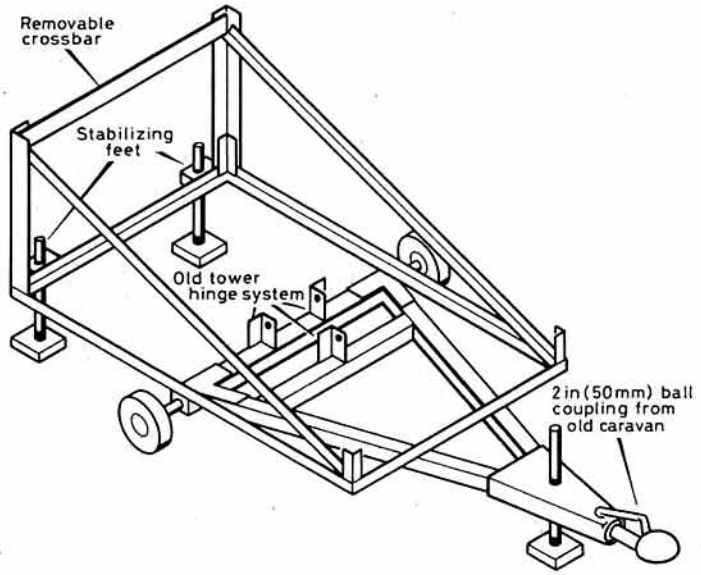


Fig 2. The first design

The owner of the repair shop from whom I had bought the chassis let me work on it there, so I had access to some tools and knowledge. Within a few days the beast was ready for the road, and I tied a numberplate to the back and slowly drove the four miles to my home QTH. On the following weekend I went to the local scrapyard to find some suitable angle iron. Then the big job started. After asking a lot of questions about design, weight, size and feasibility, I decided on the design (Fig 2), and based the trailer around the material I had on hand.

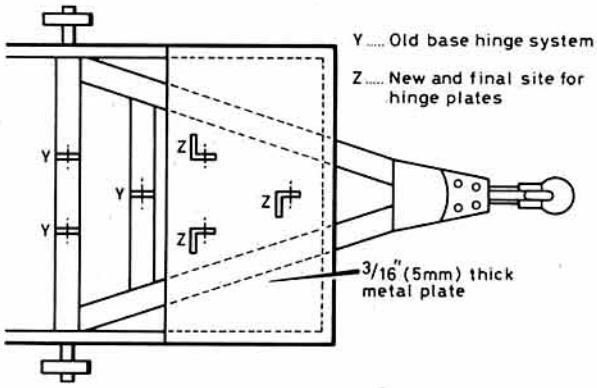


Fig 3. The modified design after relocating the tower base

At first I wanted the tower in the middle of the trailer, but that proved difficult from a balance point of view. So I changed the design and put the tower base at the front of the chassis in the "A" frame (Fig 3). The next step was to weld the chassis and the two back uprights together; I used a 100A electric arc welder which seems to have done quite well. I must stress that if you have done little or no welding, do not attempt to do this job yourself; find someone who can weld to do it for you—your trailer depends on the joins staying welded together.

With the two uprights in position I measured the angle and length of the last two pieces of 2·5 by 0·25in (63 by 6·3mm) angle-iron and cut them appropriately. I used a gas welder, but it is possible to do the job with a hacksaw. When they were ready I placed them in position, checked that the uprights were true, and welded the sides in place; thus providing a sturdy framework. Next I cut the 2 by 0·5 by 48in (50 by 12·6 by 220mm) resting bar of hard steel to fit in the slot made by the uprights and the angle-iron meeting at the back of the trailer.

The flooring and sides were next. I measured the number of 6 by 0·75 by 72in (152 by 18·9 by 1,830mm) standard sized boards required, and obtained them from the local sawmill. I placed the boards where I wanted them: eight on the floor of the trailer; two on each side; two at the back and, because of the slope on the front, four boards for that. One of the floorboards had about 2in (51mm) cut off so that there was a breathing space between every board. The side boards were cut at the front to match the angle of the framework on each side, and the back and front boards were cut to size. All the holes for fixing the nuts and bolts were drilled, and the boards were then given three coats of wood preservative.

The lights were mounted on the bottom piece of wood at the back of the trailer, and the two red triangles were put on the top board. These boards are both removable so that the tower can lie flat on the floor of the trailer. The tower itself is made up of two sections of galvanized steel triangular lattice, 10ft long by 18in (3·730 by 457mm) wide. When in the transport position, the tower sections lie along each side, tied to the frame with the guy ropes.

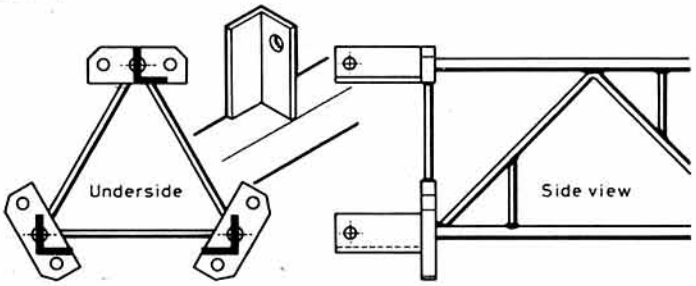


Fig 4. Site and base view of lower end of tower

The base of the tower is a hinge system devised by Paul, GM6PZ, for the Helensburgh ARC tower, and as it had proved very sturdy and reliable, I used the same system on the trailer. It consists of three legs welded onto the bottom section of the tower (see Fig 4) and likewise on the baseplate with bolts as hinge-pins. The base, a sheet of 0·25in (6·3mm) plate steel, was welded to the "A" frame chassis and is very sturdy.

The whole trailer is stablized by feet which drop down and are tightened when the trailer is level. The tower is usually guyed for safety, though it is quite stable when freestanding (Fig 5). The trailer is universal, as it can be used as a normal trailer by just removing the towers and bolting on the front panel, and (excluding the tower) cost less than £100.

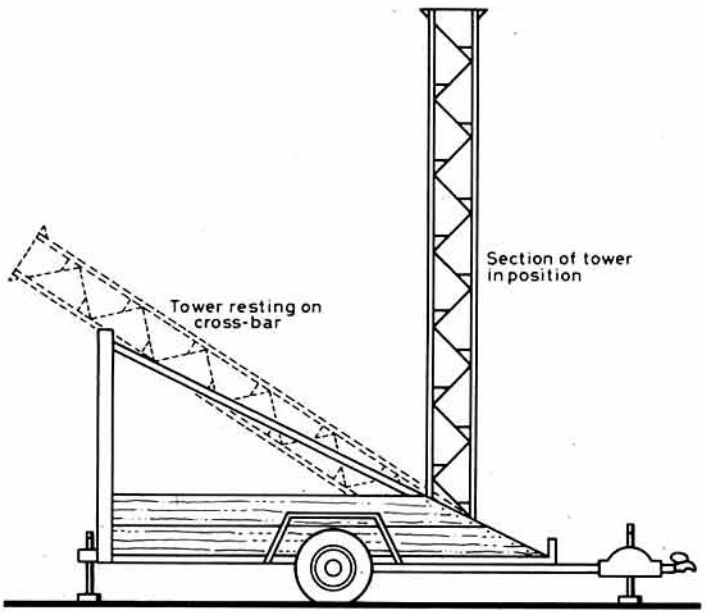


Fig 5. The positions of the tower when raised and when lowered

My sincere thanks to Paul, GM6PZ; Allan, GM6JOA; Kip and the Helensburgh ARC for letting me use them as a guinea pig for my experimental models of the trailer. Anyone wishing to build a trailer and who wants advice or help, should contact me at the address given at the foot of page 103.

Technical Topics

by Pat Hawker, G3VA

AMATEUR RADIO means different things to different people and I would not wish to give the impression that only the do-it-yourself, home-constructor is the true inheritor of the legacy of the experimental era. Indeed I would readily admit that it is the enjoyment of manual cw operating that primarily has maintained my own interest in the technical aspects of radio communication over the years.

Morse and the deaf

Then again there is the special bonus that the hobby can give to handicapped persons, including the house-bound, the blind and the deaf and hard-of-hearing. In each case, two-way radio provides the means of communicating virtually on an equal basis with the rest of the world.

In the December "Mailbag", Professor Alex Comfort stressed the potential value of the morse code in the field of medical robotics for the severely handicapped. Morse, he stressed "has a far greater potential as a language interface for the disabled than most of the experimental systems seem to realize." If you missed his letter "Radio and medicine" turn to the December issue, p922.

By coincidence, a few weeks before it appeared I received a very long letter from Nigel Neame, ex-G2AUB, who urged me, on the basis of his experience over many years of increasing deafness, to stress the international importance of cw communication for the deaf. For many of the hard-of-hearing, morse is the only aural means of communication. Even for the profoundly deaf it is possible to receive morse by means of a vibrating sensor etc. Nigel Neame would like to see morse taught in schools, at the very least in all schools for the deaf. Because of their handicap many of the profoundly deaf cannot afford all-singing, all-dancing transceivers, but could manage a simple cw-only hf rig of the classic "beginners style" that I have often suggested in *TT*, which can still bring plenty of interesting cw contacts on the lower hf bands.

He writes: "CW enables a licensed deaf amateur to communicate *on equal terms* with any other person virtually throughout the world. The words 'on equal terms' are most significant, since there is no other means of direct *human* to *human* communication available between the deaf and non-deaf apart from 'signing' and lip-reading—and how many non-deaf people learn those skills?"

He would like to see frequencies reserved for deaf operators, though this would, I suspect, not be necessary except perhaps on 14MHz.

It is extremely good news for all handicapped persons that the RSGB intends establishing some 70 local centres where it will be possible to take the morse examination. Ex-G2AUB feels that more information should be published on simple, "kiss" receivers, transmitters and transceivers that could be built within the limited budgets of many handicapped people.

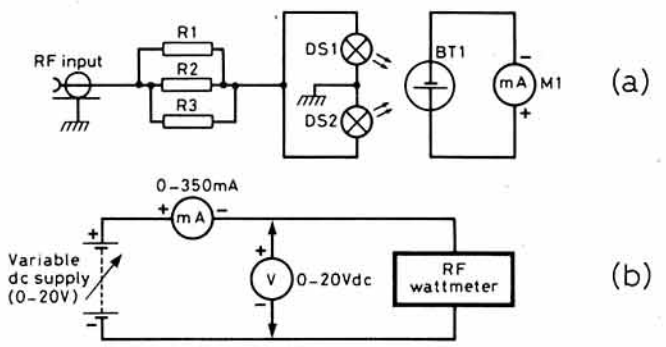


Fig 1. The simple rf wattmeter described in *QST* (November 1979) by James Kennedy, W7MID (see *TT* February 1980). Suitable as shown for use up to about 30MHz at powers up to 5W. Two small pilot bulbs (6 to 9V, 0·15A) form part of a 50Ω dummy load and are mounted in a lightproof enclosure about 3in from the face of a solar cell. M1 is 1mA fsd meter. R1, 2 and 3 are 100Ω 2W carbon resistors. Calibrated against dc as shown in (b). The scale is likely to be compressed towards fsd and maximum sensitivity at fairly low output above a minimum threshold

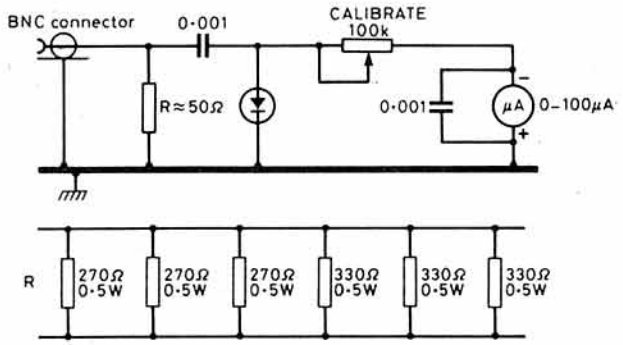


Fig 2. W9QB's 5W rf wattmeter suitable, with careful construction, for use to 144MHz and above

Dummy load/power meters

While all must admire the sheer ingenuity of the design by Ian Braithwaite, G4COL, of his "Accurate rf power meter for the hf bands" (*Rad Com* December 1985, pp924–930), I could not help feeling that it offended against the "kiss" concept (keep it simple, stupid). With a component list filling half-a-page, digital read-out *et al* it seemed to require a lot of effort to achieve the claimed accuracy of ± 10 per cent for a range of 40 to 400mW.

How much simpler, yet providing reasonable accuracy, is the technique of measuring the voltage across a matched dummy load—provided the analogue meter scale is calibrated correctly. Alternatively, if you want to use optical methods, there is either the traditional "grease-spot photometer" or simply the use of a solar cell calibrated against dc: Fig 1.

A number of dummy load/power meters have been described in *TT* and *ART*, and a recent design by Harry Neben, W9QB, specifically intended for 144MHz handhelds, appeared in *QST* March 1985: Fig 2. With care, W9QB reports that even with paralleled 0·5W carbon-composition or film resistors it is possible to obtain low swr (indicating minimal inductance in the load) throughout the vhf range. At hf, construction would be even less critical. Many years ago Dick Halls, G3EIW, provided very useful notes on this type of combined power-meter/dummy-load, that can indicate power output to within about 10 per cent of true value and is capable of being used from 50Hz to about 144MHz: Fig 3.

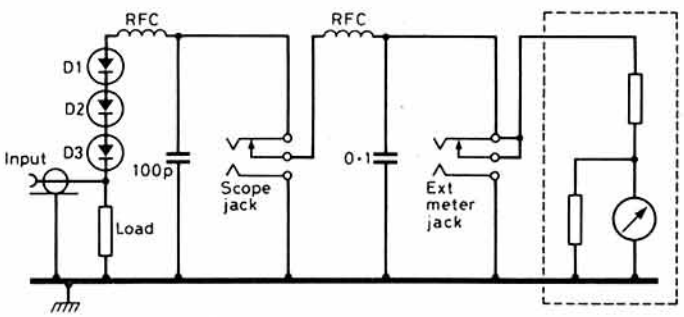


Fig 3. G3EIW's general-purpose power meter/dummy load. A single diode of suitable piv could be substituted for D1, D2 and D3. The scope jack will be found useful for ssb applications

He simply measured the peak voltage developed across a non-inductive matched dummy load. In order to convert the voltage into watts, a high-resistance voltmeter can be built into the unit and calibrated in watts. Alternatively, it is quite practical to use an external test meter with a conversion table as shown in Table 1.

It was pointed out at the time that the only constructional precautions are to make the load "look" like lossy co-axial cable to the transmitter; to screen the detector from the load resistor to avoid direct pick-up; and to provide effective decoupling to prevent pick-up on the meter wires.

Table 1
$WR = V^2$

W	R	V^2	V	V peak
1	70	70	8.32	11.6
5	70	350	18.7	26.2
10	70	700	26.2	36.8
20	70	1400	37.4	51
30	70	2100	45.8	63.5
40	70	2800	52.9	72.5
50	70	3500	59.2	83
60	70	4200	64.8	91
70	70	4900	70.0	98
80	70	5600	74.8	104
90	70	6300	79.3	111
100	70	7000	83.6	116
120	70	8400	91.6	127
150	70	10,500	102.5	143
200	70	14,000	118.3	165
0·75	70	52	7·2	10·05
0·5	70	35	5·8	8·05
0·25	70	17·5	4·05	5·65

From the basic power relationship, $W = I^2R$ and $W = I \times V$ it follows that $W \times R = V^2$. A typical table of values is constructed as in Table 1, extending over the power range to be measured, the final value being the peak V to be used as an indication of power. If a built-in meter is to be used this should have an fsd current not greater than 200μA, and a suitable series resistance can be calculated from volt range required/fsd current in amperes. For small increments of meter deflection and to take any inaccuracy in the series resistor, the damping resistor across the meter coil could be varied by up to 10 per cent of its nominal value.

A new scale can be constructed once the fsd is known in terms of volts and will be linear.

In his original unit Dick Halls used a 67·7Ω Morganite non-inductive high-wattage resistor. However, it is quite possible to make a 100W load using six 1W resistors in an oil-filled jam-jar, as described by F Lees, G3PD, (*TT* May 1984, p404). For low-power, as in the W9QB unit, the resistors can be air-mounted.

A note about this general type of unit has come recently from Chris Trayner, G4OKW. He writes:

"One often uses a dummy load with an attenuator attached and a diode rectifier and capacitor following that. This allows one to 'take a snifter' and measure the power dissipated. With a built-in meter the scale can be calibrated to provide a reading in watts. But, commonly, use is made of a general-purpose multimeter and then it is necessary to perform a calculation to deduce the power.

"My suggestion is simply that a suitable choice of the attenuation ratio simplifies the arithmetic, by making the power in watts numerically equal to the attenuated voltage (in volts) squared. For a 50Ω load, for example, the ratio should be 7·07:1, for a 75Ω load 8·65:1. In practice these ratios can be approximated.

"The maths can readily be verified; in general the ratio should be the square root of the impedance in ohms. Fig 4 shows the use of 5·6kΩ and 3kΩ resistors with a 50Ω load."

Fuses and safety

At one time it was common practice with mains-operated equipment to use twin mains-lead, no earth-wire, and a fuse in each lead to cope with the reversible mains plugs. Mains practice on the Continent differs in several respects from UK practice, and the use of two fuses continues to be a common, indeed sensible, precaution where plugs can sometimes be reversed.

In the October *TT* (Fig 7, p785) Robin Greenwood, G3LBA, who is licensed also as PA3ACQ and operates normally from Holland, incorporated two fuses in his high-current "hexfet" psu, one in the live ("phase") lead and one in the neutral lead.

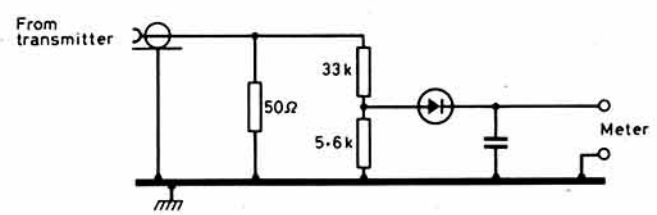


Fig 4. G4OKW suggests that a suitable ratio attenuator can simplify the arithmetic of a simple power meter

This has prompted Chris Trayner, G4OKW (64 Sydney Street, Brightlinsea, Essex CO7 0BE, telephone 0206 303931) to comment as follows:

"This practice may be sensible on the Continent where often plugs can be reversed, but could represent a safety problem in the UK: if the 'neutral' fuse blows first it could still leave mains voltage reaching the equipment, etc. But I have been unable to verify that this practice is 'dangerous' and possibly even illegal. Neither the IEE's Wiring Regulations nor BS415 appear to cover this point, and indeed there are still UK designers continuing the practice (possibly on the grounds that not all ac mains sockets are correctly wired —*G3VA*). Although most of my colleagues agree that there is a safety hazard, nobody can quote any specific regulations. Can anyone point to an official regulation covering this practice?"

Old technology that doesn't die

One of the difficulties that arise from all the new technology that has flooded into the amateur radio world in the past couple of decades is that it has not entirely replaced the old.

The thermionic valve power oscillator completely displaced, in a matter of a few years, the spark coil. But the valve is still very much with us, at least for high power, even though all-solidstate radio and television broadcast transmitters are now available up to about 50kW mf and 5–10kW and even 50kW vhf. However, the manufacturers, if pressed, will admit that many problems have marked the development of solidstate broadcast transmitters, not least the vulnerability to the effects of lightning discharges. There also remains an economic cross-over that still makes the valve approach less costly beyond a certain level—Marconi for instance in relation to vhf television put this at around 2·5kW. For amateur linear amplifiers it is probably a few hundred watts p.e.p.—and it is still possible to make a low-cost valve linear more linear than a low-cost solidstate linear!

One consequence of all this is that not only old-timers but also many newcomers, more especially those interested in hf, still need to know a good deal about valve principles and practice. And as valves, particularly high-power valves, steadily become more and more costly so it becomes more and more advisable to learn how to ensure that we get the maximum life from them. *TT* June 1982, p498 had something to say about "the use and abuse of valves" with emphasis on careful control of the voltage applied to thoriated tungsten filaments.

But it is perhaps appropriate to recall how excessive heat and electrode dissipation affects the life of valves and to note that the gradual and almost inevitable loss of cathode or filament emission is not the only problem.

"Soft' valves

Basically, as cathode emission falls, so does the gain (mutual conductance). In many applications this means that to restore the gain, the bias applied to the grid is lowered—automatically or manually—and current rises.

This not only increases the rate of cathode deterioration but the added heat will tend to liberate the traces of gas which inevitably remain "bound" to the metallic parts of the valve, producing positive ions which may poison the cathode or cause negative (reverse) grid current. In other words, the valve becomes increasingly "soft" with a tendency for the anode current to rise causing further overheating.

Early valves and cathode-ray tubes tended to be "soft" even when new. But quite early on techniques were introduced that made it possible for valves to be produced that had a "hard" vacuum and a "getter" to maintain this under normal conditions.

In order to provide as near a vacuum as possible, valves were heated by passing them through a heated chamber, and by the use of rf heating while the air was being withdrawn. Despite this, a small amount of gas usually remained occluded in the assembly, and later may be released when the valve becomes hot in operation. To remove virtually the last traces of free gas, some barium or magnesium called the "getter" was usually evaporated within the valve envelope just before sealing, fired by hf eddy currents. After evaporation this tended to condense on the envelope near the getter-holder (the small metal holder welded to the electrode assembly). In the 'forties and 'fifties the glass "foot" with connecting wires pinched in, gave-way to the pressed-glass base with stouter wires moulded into the glass base serving as lead-in wires and valve pins.

Even with correctly applied gettering a small amount of gas usually remains and can be released by overheating.

Normally the flow of grid current through the mandatory grid resistor produces a negative bias on the grid. But should a negative grid current flow, the grid resistor produces a positive bias (or reduces the negative bias) resulting in an increased space current and internal dissipation within the valve.

To quote from a long-out-of-print 1948 RSGB publication, *Valve*

Technique, reversed or negative grid current can arise from three causes: **(a)** Internal leakage paths within the valve or its base. **(b)** Positive ion current, due to faulty vacuum as traces of free gas are released from the metal structure (ie the valve becoming "soft"). **(c)** Electron emission from the grid (grid emission). All these factors tend to increase with an increase in the valve operating temperature. As increased temperatures result from increased dissipation, such defects, once developed, tend progressively to become increasingly serious.

The first signs tend to be excessive anode current (sometimes rising progressively after the valve has been switched on for a time) and/or heavy damping of the input circuit, so that there will appear to be lack of drive from the preceding stage. By the time the problem is spotted it will usually be irreversible and the valve has to be replaced. But it needs to be stressed that the problem is unlikely to arise if due attention has been given to the following points:

(a) Ensure the filament or heater voltage is within the specified tolerance. This is usually ±5 per cent but it is better to keep to ±3 per cent for thoriated tungsten filaments and longest life is achieved by careful regulation and management of this supply, at 95% of the nominal voltage. Such a procedure, while specifically aimed at delaying loss of emission, will also help prevent the valve becoming "soft".

(b) Do not permit excessive dissipation. Make sure you understand particularly in Class C stages the difference between power input and power output (power dissipated internally is the difference between the two). In other words check that the valve is operating within the correct characteristics for the application concerned.

(c) Limit the total dc resistance of the grid-cathode path to a safe value. This need may be less obvious.

Valve Technique suggested that where a safe value is not included in manufacturer's data, a rule-of-thumb guide is:

Fixed bias: total cathode current (mA) times grid resistance (in megohms) should be less than 15.

Automatic cathode bias: total cathode current (mA) times grid resistance (in megohms) should be less than 25.

Where several valves are connected in parallel or push-pull with a common grid resistor clearly the total cathode current of all must be considered.

With, for example, a set of three matched 6146 valves for an FT102 now costing around £40, it is prudent to pay attention to the type of good operating practice that prolongs active life. Valves, properly treated, can give good, rugged service over many years. I recall the old Dollis Hill Post Office Research Station developing valves for ocean cable repeaters having a guaranteed continuous life of 20 years. I suspect that many ordinary valves are still giving good service after 40 or 50 years use in receivers (certainly some are at G3VA!).

There is a growing interest in collecting and restoring early broadcast receivers. One of the best private collections is that of Gerald Wells (Vintage Wireless Museum, Rosendale Road, West Dulwich, south London). Recently, at an IEE lecture on "The history of sound broadcasting" given by Dr G.J. Phillips, Mr Wells announced that he hopes soon to have the necessary equipment for rebuilding old valves, including replacing burnt-out filaments and re-vacuuming. It created more interest than any new semiconductor device could hope to arouse!

"Project 6L6"

It is not only in the amateur radio field that the younger generation is showing a diminishing interest in "kitchen table" home-construction of equipment. It applies virtually to all electronic hobbies, particularly since the large-scale introduction of personal computers, and is reflected in falling circulations of many long-established magazines.

Conversely there is a growing nostalgia among old-timers for the days when a simple transmitter could be put together in an evening and an 0-v-l or l-v-l receiver could cope with band conditions (as indeed direct-conversion can still do reasonably well on the lower frequency bands).

Dean Manley, KH6B, writing from Hawaii, draws attention to the fact that 1986 is the 50th anniversary of the introduction of the once highly popular 6L6 beam tetrode valve by RCA Radiotron. It rapidly became popular not only for its intended audio applications but also as a crystal-controlled power oscillator which when run at about 20 to 25W input could put out a very effective signal on 3·5, 7 and (in a tritet configuration) on 14MHz. *QST* May 1936, mentioned the 6L6 for the first time; the following month showed the use of a 6L6 as a crystal oscillator. As KH6B puts it: "The rest is history". The 6L6 soon led to the 807 beam tetrode intended for either af or rf applications and the host of later single and double beam-tetrodes.

KH6B is seeking to encourage a Project 6L6, not only to mark the golden jubilee but also to revive interest in simple ("kiss") rigs as club projects etc. He writes: "It seems only natural for amateurs to build and experiment. A simple rig with a 6L6 would fill this bill. Building your own rig is half the fun. The other half is putting it on the air and convincing the disbelievers that you've really a metal 6L6 or glass 6L6G in the final, then taking the rig along to the local club and enticing others into the homebrew game."

Such rigs are not necessarily confined to cw. Amplitude (Heising) modulation of a crystal oscillator is not recommended practice, but many did it. A few brief contacts, just to prove it still works (and can be received as ssb), would hurt nobody. Indeed there is little reason why a.m. should not be reintroduced more widely on 1·9MHz or 29MHz. The 6V6co 6L6/807pa combination is better than a power oscillator.

One would like to see Project 6L6 extended to include, as a next step, "kiss" forms of solidstate. One has to accept, even if reluctantly, that the old order changeth. Even RCA, itself responsible for so many major contributions to radio engineering (not to mention the AR88D!), is being merged with General Electric (USA).

Axeman spare that tree!

Les Moxon, G6XN, has been busy developing a delta-loop beam intended for the long-path to Australia on 7MHz ssb, subject to constraints imposed by lack of space and the need to minimise visual impact. In this connection he writes:

"Compared with my previous QTH, results with vertical polarization have been poor. I estimated my signal to be at least one S-point worse, relative to horizontal polarization, and sometimes considerably more depending on the placement of the vertical element.

"The factors involved are trees and sandy soil. I feel there is an urgent need for more research into the effect of trees near a vertically-polarized antenna. I did a few crude experiments, scaled to 28MHz, and found marked 'shadows', often to one side of a tree rather than directly behind it, although proximity of pylons and power lines may have confused the issue.

"Even with an array of two vertical elements on 7MHz, I was not able (except for one or two dubious reports) to improve on the performance of a simple inverted-vee dipole with its apex at 37ft.

"This has led me to investigate the design of horizontal (fixed) beam arrays suitable for 'burying' in trees, and I have been surprised by the completeness with which the tree appears to have 'swallowed' the antenna without absorbing the power.

"In this antenna, which is along the lines of my earlier contributions to *TT*, 33ft horizontal tubing elements, 44ft above ground, are end-fed with 41ft of 18swg aluminium alloy wires dropped to a point 6ft above ground.

"With the current nulls coming in the centre of these wires all radiation should effectively come from the horizontal element 'top'. (See *TT* March 1985). "This involved a tricky bit of tree climbing but I was able to enlist the services of a tree-surgeon's apprentice who works on his own account at weekends; an idea that I recommend to others having 'unclimbable' (to them) trees in their gardens.

"To use such assistance to best advantage it is necessary to adopt an antenna array that is basically simple and does not require tuning before erection, hence my use of loops with open-wire stubs. By good planning in advance of the entire operation, the antenna cost me £25 (three hours work) a lot less than a conventional, commercial 'beam' antenna. And although my initial requirement was for 7MHz only, the loops are, in effect, 10MHz loops, so there is no problem on that band; on 14MHz performance (gain) equals that of my 'Claw' array (*TT* March 1985) at the same height. I hope shortly to phase the two arrays together and so get an extra 3dB gain".

It is hoped to discuss this "claw in a tree" antenna in more detail over the next few months. The point we are trying to make this month is the significant effect of trees on vertically polarized signals, yet they have very little effect (and can be very useful as supports) with horizontal polarization.

Vertical antennas and real earth

How many times have you read articles that start off by emphasizing that vertical antennas provide omni-directional low angle radiation and are therefore ideally suitable in the absence of a beam array for dx operation. Indeed if you listen with a good vertically-polarized antenna you can be reasonably sure of hearing any good dx that's going. It's only when, too often, the dx fails to come back to you and instead works someone with a horizontally-polarized dipole that doubts begin to creep in.

There's nothing basically wrong with a quarter-wave monopole, a half-wave vertical dipole or a $\frac{5}{8}\lambda$ vertical etc. With radials, earth mats or counterpoises there is no reason why it should not put out most of the power you feed into it. Often the ground plane proves a really excellent medium-distance antenna and gives you the added bonus that the reports you are given are often two or three S-points above those you hand out to the stations you contact.

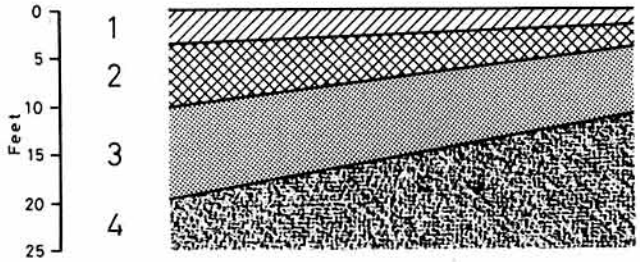


Fig 5. Typical section of earth's crust showing geological strata with several layers of different electrical conductivity. (1) Alluvial soil having relatively good conductivity (about 20 × 10^{-14} emu. (2) Sandy soil about 4 × 10^{-14} emu. (3) Chalk about 10 × 10^{-14} emu. (4) Young rock about 1 × 10^{-14}. Sea water has conductivity about 4 × 10^{-11}, ie about 4,000 × 10^{-14}. Effective conductivity depends upon depth of penetration of the earth currents and is thus a function of frequency: the higher the frequency the more the current will be concentrated in the uppermost levels. (From "The ground beneath us" G3HRH, 1966.)

If you operate maritime mobile you are likely to find that a 30-ft all-band vertical really does live up to the claims of excellent dx performance. By now the penny will have dropped. With a ground plane consisting of conductive salt water you can confidently expect to achieve excellent low-angle radiation. In country areas in those parts of the UK that have good earth conductivity, or for the chap who can establish an earth mat stretching out for several wavelengths towards a desired direction, the 14/21/28MHz vertical is an excellent dx performer. See Fig 5 and Fig 6.

It is for the many of us who live in urban areas, or areas of poorish earth conductivity that the low angles are not achievable on transmission, though remaining reasonably unaffected on reception—a notable exception to the theory of reciprocity of antennas that seldom gets mentioned.

It is difficult, of course, to find out (except by frustration) the vertical radiation pattern of an antenna above "real earth". The professionals who measure such patterns by flying aircraft around the area take care not to locate their vertical antennas for long-distance working in areas of poor conductivity or where the signals are likely to be affected by the many vertical structures that clutter our sites (trees, houses, electricity pylons etc).

On 14MHz and above, provided you can get a horizontal dipole 25ft or more above ground and in the clear, it will generally out-perform a vertical antenna unless you live in an area of extremely good earth conductivity or, conversely, in an area of extremely poor earth conductivity (where effectively the supergain "image" is not formed). This can apply also to antennas for 1·8 to 7MHz. Peter Chadwick, G3RZP has pointed out that

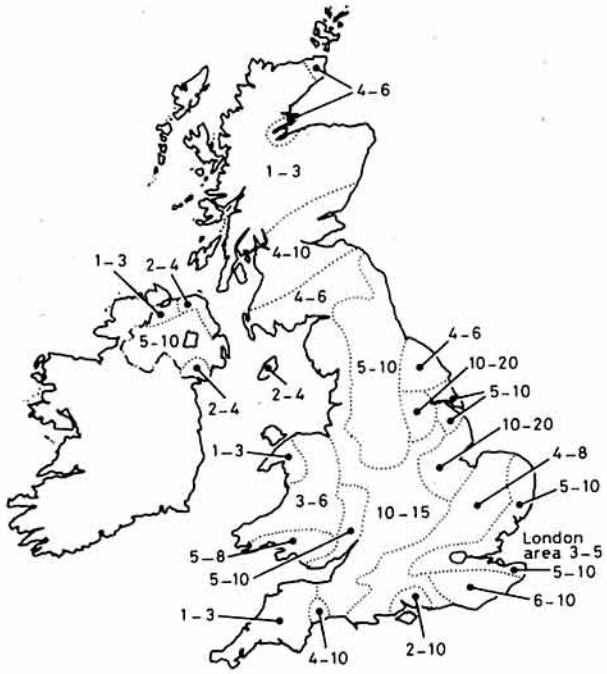


Fig 6. Rough ground conductivity map of the UK (figures quoted are for 1·5MHz). Conductivity is moderate to good in central and southeast England, poor in London, west and northwest. Urban areas tend to be of lower conductivity than farmland and rural areas

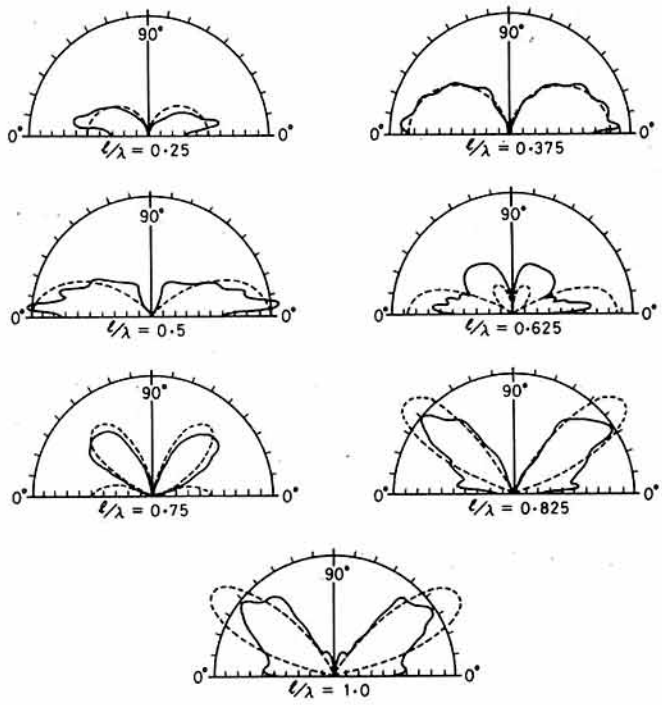


Fig 7. Vertical plane radiation characteristics of small-scale model antenna with effective groundplane

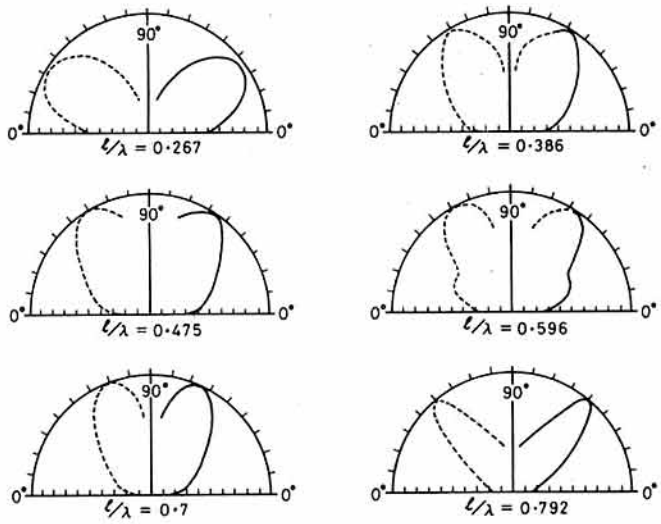


Fig 8. Vertical plane radiation characteristics of full-scale model of the biconical monopole antenna of Fig 10. Ground conductivity 8 × 10^{-3} mho/m. Note the much higher angle of maximum radiation

his late father's "G8ON" antenna tends to perform better in areas of very poor conductivity, than in more conductive areas. The problem with verticals is mainly in areas of medium or poorish ground conductivity or where there are trees and other vertical structures.

Digging back in the literature to 1963, before the days of computer simulations, I found a set of diagrams relating to a broadband hf biconical monopole developed for the Royal Navy that does show very clearly that low-angle radiation is not an inherent feature of vertically polarized antennas: compare Figs 7 and 8.

This design, and the associated vertical radiation patterns, come from "Some factors influencing the design of broadband hf monopole aerials" presented by H P Mason at the 1963 IEE Convention on hf communication *(IEE publication ED4*, pp114-20). This antenna was designed to cover the range 10 to 26MHz with a support pole of the order of 25ft and 36 ground radials: Fig 9.

The conductors were 7/19swg cadmium copper wire to a total semi-perimeter length of 25ft 10in, including the terminating sections. The wires were spaced equidistant around a concentric steel supporting mast of 1in

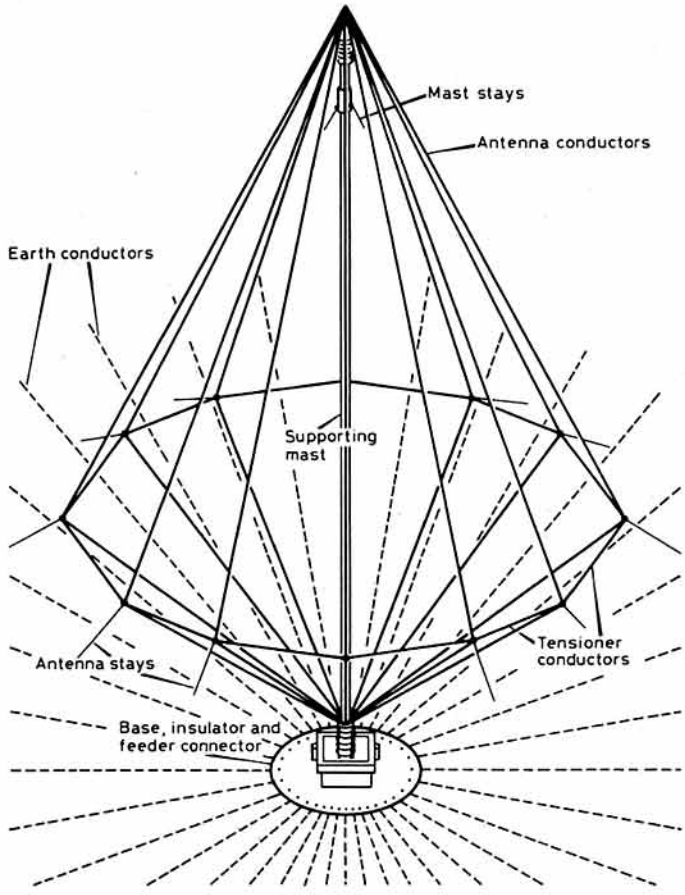


Fig 9. General arrangement of biconical monopole antenna designed for broadband operation

radius . . . for structural reasons it was found to be of advantage to make the height of the lower cone less than the upper, in this instance the slant height ratio of the upper to lower cones was 2·6:1. Added rigidity was given to the conductors by fitting horizontal wires at the point of maximum diameter and maintaining the correct section by the use of insulated radial stays. The whole structure was supported upon a special low-loss insulator and base-plate assembly, designed to produce minimum discontinuity to the terminal characteristic. Connection to the feeder was made by means of a conductor, mounted concentrically within the insulator. The associated ground conductor system consisted of 36 equally spaced radial wires of 7/19swg. It was claimed the system could be designed to match either 50Ω (lower cone half-angle 38·5°) or 75Ω (lower cone half-angle 23·2°) to cover bandwidths of the order of 2·6:1 without any matching or tuning units with swr not exceeding 2:1. Operational designs covering also 4 to 11MHz and 2 to 5MHz were developed.

Polarization and meteor scatter

The increasing use of meteor scatter burst systems by professionals as well as by amateurs is causing a number of research establishments to look more closely at the propagation characteristics. John Wilson (ex-G8KIS) draws attention to a recent report (*Electronics Letters*, Vol 21, No 24, 21 November 1985) from H Nes of the Shape Technical Centre at The Hague. Nes notes that several of the finer details of this type of forward scatter remain either unpredictable or unexplored. He writes:

"One such area of uncertainty relates to the polarization properties of the echoes. Classical theory predicts that the performance should be the same for horizontal and vertical polarization, but definitive experimental support for this has been lacking.

"A 40MHz carrier was transmitted from Tangen Fort, near Oslo and received in The Hague, a distance of 850km. The transmitting station comprised a 1kW transmitter, a power splitter and a crossed Yagi antenna on a glass-fibre mast on a 40m cliff overlooking the sea. One 5-el Yagi was mounted for horizontal polarization and one for vertical polarization, arranged for horizontal, vertical or circular (90° delay) polarization. An identical crossed Yagi on a 40m tower overlooking flat countryside, a two-channel receiver and an oscilloscope in the x-y mode (Fig 10) with the dynamic patterns video recorded and studied in detail.

"Measurements in June 1985 included about one hour of video recording for each of the three modes . . . For transmission with horizontal polarization the received echoes were typically also horizontally polarized with a deviation of about ±20°.

"Long-lasting echoes (as usually exploited by amateurs not using computer-controlled probing systems—*G3VA*) were characterized by the reception of random polarization, the randomness starting approximately one second after the creation of the echoes.

"With vertical polarization, vertical polarization was usually received for the first second, then random polarization. With circular polarization, ellipses predominated, the ratio between horizontal and vertical axes being approximately 1·5, corresponding to 20 log (1·5) = 3·5dB.

"Conclusions to be drawn are: **(1)** typically (on short echoes) the received echoes have the same polarization as the transmitted signal; **(2)** horizontal polarization performs 3–4dB better than vertical polarization."

Most amateur ms is already made with horizontal polarization, but these measurements confirm the advantage so gained, particularly on short echoes.

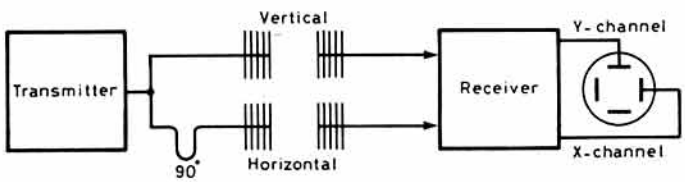


Fig 10. Measurement system used to check polarization of signals received via meteor trails. Arrangement shown for circular polarization

More signal-frequency crystal filters

Since the item on signal-frequency crystal filters (*TT* July 1985, pp541–2) Peter Haylett, G3IPV, has continued his work and, like a true experimenter, has introduced a number of variations and second thoughts. The most important of these has been directed towards making the front-end crystal filter tunable over a limited section of a band using the crystal "pulling" techniques associated with variable crystal oscillators (vxo). A steady stream of ideas have come from him to the extent where it becomes a little difficult to determine which ideas have been carried forward and which have been abandoned!

However it seems safest to start at the end, and report his latest technique for a 3·5MHz tunable filter that uses electric-field coupling between two toroids spaced about 2in apart. Fig 11 shows his basic arrangement, together with winding details etc, for tuning ranges of 25kHz and 50kHz. He believes this arrangement should prove to be the end of the road in basic design, though he intends to continue work on more complex multi-section filters.

It would be interesting to know the insertion loss of such a loosely coupled filter, although in view of the high external noise level on 3·5MHz, insertion loss is of only minor importance on that band when used with a low-noise receiver: it is signal-to-noise that matters on 3·5MHz and the insertion loss affects external noise and signals equally.

G3IPV has also been experimenting on the use of tunable signal-frequency filters for ssb operation, using stenode-type boosting of the

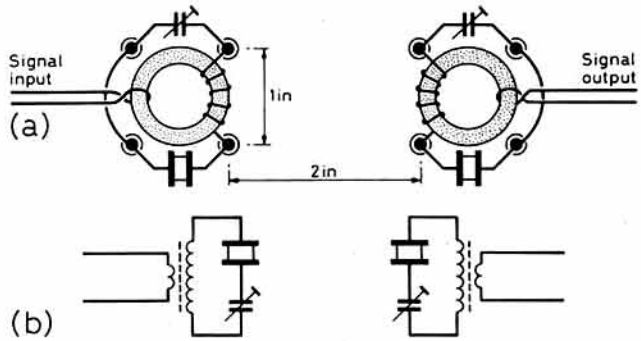


Fig 11. Latest version of G3IPV's tunable signal frequency crystal filter for 3·5MHz. Toroids Siemens KO618X001 from Electrovalue, Surrey. For a tuning range of 25kHz wind 5ft 24swg enam copper wire (about 50 turns). For a tuning range of 50kHz wind 7ft 24swg enam copper wire (about 70 turns). Trimmers 25pF airspaced vane. Crystals 3·5 to 3·810MHz (as required) HC6U holder McKnight, Southampton. Note that tuning range varies with different crystal manufacturers etc. Latest experiments show that highest voltage appears across the coil and not the crystal so that filters should be constructed as above rather than as shown in Photo 1 of an earlier version.

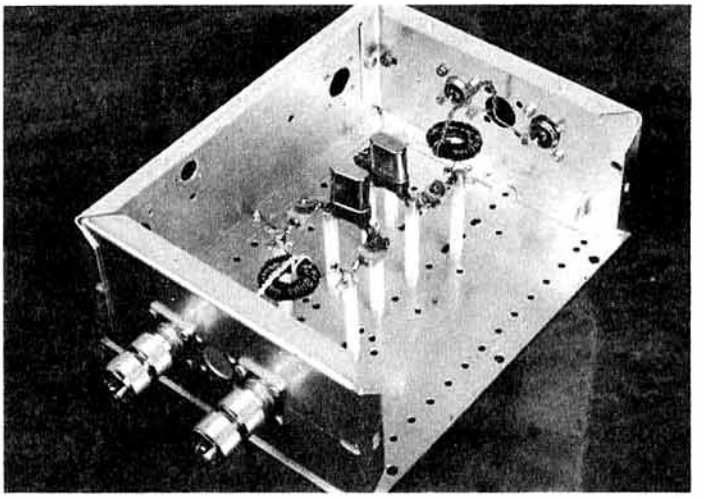


Photo 1. Example of a G3IPV basic crystal filter showing the use of earth-isolated rf technology. This is an earlier version of the filter shown in Fig 11 which has electric field coupling between the coils rather than the crystals. Greater attenuation can be obtained with more filter sections

higher audio frequencies. It would appear that the prime consideration in sf filters is to minimize rf leakage around the filter, requiring careful isolated-earth construction. In this case a minor problem had to be overcome due to leakage between the metal holders of the crystals (possibly forming a loop with stray capacitors and the metal box).

To achieve "stenode-mode" operation the af output from the receiver is modified by placing an 0·47μF capacitor in series with the low-impedance headphones (possibly 100pF in series with high-impedance headphones). G3IPV reports that it has proved possible to tune ssb filters over several kHz giving improved reception by attenuation of adjacent channel interference and (presumably) also helping to reduce intermodulation problems etc. For tunable cw filters a two-crystal filter does not provide particularly high off-resonance attenuation but it is possible to add extra crystals and achieve higher attenuation.

300W dc/ac inverter

The general use of 12V dc equipment has tended to reduce the requirement to generate 110, 220 or 240Vac in locations where there are no public supply mains. Where the need arises it tends to be met by the use of petrol-electric generators.

But it should not be forgotten that an alternative approach is possible unless extended periods of operation are required. In the old days there were the rotary converters which could achieve an efficiency of around 50 to 60 per cent with outputs of from about 50 to 350W ac from large capacity lead-acid vehicle batteries. The rotary converter has been long superseded by the higher-efficiency solidstate inverters using power transistors or silicon-controlled rectifiers (thyristors). Unfortunately simple switched-mode inverters tend to provide a square-wave rather than a sine-wave output, and this can cause problems with communications equipment. However, it is possible to obtain near sinusoidal waveforms by tuning the primary winding of the transformer or synthesized by switching on, in an ordered sequence, a series of silicon-controlled rectifiers. A compromise is a simple stepped-waveform such as that shown in Fig 12.

An interesting design for a compact 12/230V 300VA inverter, with full constructional details, appears in *Electronics Australia* (September 1985, pp40–44, 46–47, 50–52). The 50Hz frequency is derived from a 4MHz crystal with ic dividers and then buffered to drive four 2N3771 in a parallel push-pull switching arrangement with a voltage step-up transformer. This may seem simple but the complete unit features the use of a compact toroidal transformer, automatic starting, voltage regulation, current limiting and thermal overload protection with about 10 ic devices, a dozen transistors and assorted diodes, l.e.d indicators etc. It delivers a waveform of the type shown in Fig 12.

This is one of those units for which it would be virtually essential for a constructor to consult the full text and diagrams of the original article by John Clark.

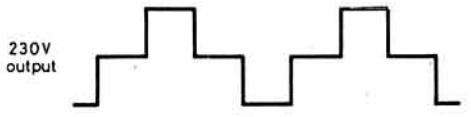


Fig 12. Output wave form of the 300VA 12/240V inverter

For a 40W load the input current from the battery is 4·6A, so that a 40Ah/20h battery could provide about 4h operation without recharging. For a 200W load the input current rises to 21·7A and battery-life reduces to 50min. At 300W it's down to 28min since the current drawn is a massive 30·3A. A kit from Altronics Pty Ltd is offered at $A199.

A lower-power, less complex inverter has been described in *Electronics Australia* (August 1985).

Stabilized 11GHz oscillator/mixer module

The growing use of low-power 11GHz distribution satellites for providing satellite programme feeds to cable networks has led to the development of television receive-only terminals (tvro) for use in leisure centres, hotels, and even homes with parabolic dish antennas of about 1·6 to 2·5 metres. It is now possible to obtain a licence for their use.

Stuart Jones, GW3XYW, has built an 11GHz tvro along the lines described by Hugh Cocks in *Television* (February 1985) and featuring the use of the Mitsubishi FO-UP-11K oscillator/mixer module developed initially for radar. This incorporates a dielectric resonator oscillator, as discussed on several occasions in *TT*. GW3XYW writes:

"I am not a 10GHz enthusiast, my interest being in 11GHz tvro, but it does cross my mind that this receiver unit might be useful for the amateur band. The oscillator can be tuned from about 10·4 to 11·4GHz, so that with a first i.f. of 432MHz the 10GHz band could be received. These units are relatively cheap for microwave devices: the FO-UP-11K is about £24.32, and the FO-UP-11KF (with flange) about £27.60. I must stress I have not tried this myself as my interest is with television reception. Charles Suckling, G3WDG, has borrowed my unit and is getting good pictures off Intelsat."

The local oscillator is a GaAsfet with dielectric resonator. A Schottky diode is used as the mixer. Noise figure is about 7·5 to 8dB and reasonable pictures can be received with this unit without a low-noise-amplifier on a 1·8m dish. Adding an 1na/bandpass filter reduces the noise figure to 2·5–3·5dB in the 10·95–11·7GHz Ku-satellite band and can give excellent pictures with that size of dish. For anyone building such a unit, Hugh Cock's article is essential reading.

Computer propagation predictions

In my notes (*TT* November 1985, p864) on the work at the Rutherford Appleton Laboratory aimed at improving hf propagation predictions, I questioned whether it would be possible to write a program for use on a personal computer based on past ionospheric measurements rather than sunspot numbers.

Richard Limebear, G3RWL, writes to say that he has a "maximum useable frequency program" that he downloaded from an American amateur radio bulletin board. This program was originally developed by the US Navy to allow almost any mini or micro computer to be used to determine the muf between any two points. It was initially derived from a much larger program designed to run on very large computers, which has been extensively tested. The original sounder data base encompassed 196 path months (4,784 test points) of observed mufs measured over 23 different hf sounder paths.

The mini-muf program was found to have an rms of ±3·8MHz for muf predictions out to 6,000 miles but accuracy degrades for paths less than 250 miles. It is a single-layer F-region model. Because of lag in F-layer response to 10·7cm solar flux activity, it is best to use a 5-, 15- or 90-day running average of the 10·7cm flux. The flux value can be acquired from WWV at 18min after each hour. The conversion from 10·7cm flux to sunspot number has been accomplished by breaking the curve of the graph which accompanied the reference article into five sections, and deriving a formula for each section and then using that formula to convert from solar flux number to sunspot number. The original program is used from that point onward. Note that any intervention by E-region modes of propagation are not predictable by this program, but represent only a very small percentage of cases. The original author was Robert Rose, K6GKU (*QST* December 1982, p36), adapted to MBASIC by Jerry Hale, K0JH, and again by J W Barron, WA4LHT. Various modifications were introduced by G3RWL during 1984.

Richard Limebear (60 Willow Road, Enfield, EN1 3NQ) adds that the program is written in Microsoft Basic and is available for public use. It runs to about 400 lines (18 kilo-bytes). He would be willing to pass on copies via 8in disc, 300-baud modem, or even a printed listing. In effect, as his sample run shows, you can end up with a read out of the predicted muf based on current WWV data or, say, *Radio Communication* predictions for each hour of the day. In this case Falkland Islands to UK with a minimum muf at 0600gmt of 11MHz and maximum at 1500gmt of 29MHz. □

NEWS & VIEWS

DATA COMMS

*Ian Wade, G3NRW**

Packet radio primer (part 1)

One of the most difficult things I find about packet is to describe its many features clearly and simply in just a few paragraphs. Nevertheless here goes. What follows is a brief description of the most common packet protocol, AX.25 (other systems do exist, and most of them work in roughly the same way, but unfortunately they are not compatible with each other).

The first feature is that packet is a "handshaking" method of dc. That is, the transmitting station sends a block of data and expects the receiving station automatically to acknowledge its receipt. In other words, there is continual to-and-fro traffic between the two stations, similar in some ways to Amtor, except that Amtor is restricted to a fixed message block of three characters, whereas a packet block (known as a frame) can contain up to 256 message characters. Handshaking allows each station to keep track of how the other is copying the traffic, and controls the retransmission of any frames which were not received intact.

How does the receiving station know how long a frame is? After all, a frame is just a stream of bits, and the number of bits can vary from frame to frame. The answer lies in the flag character at each end of the frame (see Fig 1). The flag is a unique pattern of eight bits (01111110) which is never allowed to appear anywhere except at the beginning or the end of a frame. Thus all the receiving station has to do is look for this pattern to find out where a frame starts and finishes.

Error-free data

How does the receiving station know whether the frame has been received intact exactly as transmitted, or whether it has been corrupted somehow, perhaps by interference? The answer here is to do with the frame check sequence (fcs). The fcs is a 16-bit binary number whose value depends on the actual data in the frame, and which is sent immediately before the trailing flag (see Fig 1). As the frame is being received, the receiving station calculates its own version of the fcs following the same computational rules as the transmitting station, and then this calculated value is compared against the value actually received. If the two values tally, the frame is assumed to have arrived intact. If not, the receiving station waits for the transmitting station to send the frame again (this is different from Amtor where the receiving station explicitly requests retransmission of a corrupted block).

The use of the fcs gives packet a very real advantage over rtty and Amtor; the chances of corrupted frames getting through undetected are infinitessimal, and the method of calculating the fcs is exactly the same as used in commercial packet networks. Thus packet is ideal for sending data which must be received without any errors—computer programs, or emergency messages, for example. RTTY (with no means of detecting errors) and Amtor (with a crude error detection mechanism) just cannot compete.

Another interesting application of packet is meteor scatter (ms). With packet, there is no doubt or argument about whether the message got through. If it appears on your screen, you received it—if it doesn't, you didn't! Experiments in the USA have shown that the 50MHz band is one of the most fruitful for ms, particularly for stations separated by around 600–1,000 miles, which bodes well for packet ms QSOs between Scotland and southern England in our new 50MHz allocation.

Binary data

With packet there is no technical restriction on the data you can send; any format may be used. It may be a recognised code such as Ascii, or it may be pure binary data. This gives us interesting possibilities for experimenting with such techniques as packet sstv. By converting the analog sstv picture to digital form, sending it as packet data, then converting it back to analog at the receiving end, the received picture is guaranteed to be clean and interference free. Burning question: what happens if the binary data happens to contain the pattern 01111110, will it be mistaken for a flag? Burning answer: no. Burning explanation: stay tuned to this column, or read up about "bit stuffing".

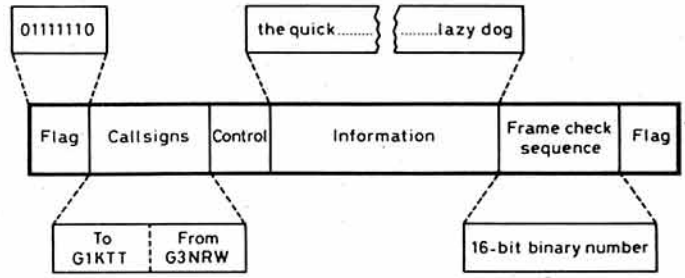


Fig 1. Simplified AX.25 information frame format

QSOs on the same frequency

Packet allows several completely independent QSOs to take place at the same time on the same frequency. Imagine you are in packet QSO and you are typing the next line of your message. All the time you are doing this (which may be several seconds, or even minutes), absolutely nothing is transmitted. Only when the line is finished does the transmitter send the text, as a short high-speed burst of data lasting typically one or two seconds. The receiving station responds with a short acknowledgement frame, then the channel goes quiet again for another long period while you are composing the next line of your message. This is quite unlike rtty, where a continuous mark tone is transmitted when you are not actually typing, and also quite unlike Amtor, where idle "filler" characters are automatically inserted in the gaps between your typed characters to keep both stations in sync.

There is now a situation where the channel is occupied for only a few seconds every minute. So why not let another QSO take place in the remaining free time? This is exactly what packet does allow. Now comes the question of identifying individual frames—how do you know whether a particular frame is meant for you, or whether it belongs to another QSO? This is where the callsign part of the frame comes in (Fig 1). When a frame is transmitted the callsign of each station in the QSO is automatically inserted into the frame. Thus all the receiving station has to do is check these callsigns—if they belong to the current QSO, the frame is accepted, but if not, the frame is simply ignored.

The result is a real saving in rf spectrum. In areas of high activity it is commonplace for half a dozen packet QSOs to be taking place at the same time on the same frequency, all completely independent of each other. When eavesdropping on the channel it is quite uncanny to watch all this criss-cross traffic going on!

Next month

So much for the nuts and bolts of getting packet frames from A to B. Some of the advantages of packet over rtty and Amtor have already become evident (ie error-free communication, no restriction on data formats, channel sharing), but this is only half the story. The much more interesting half follows next month when I look at packet networks, followed by a summary of the actual equipment required to perform all this magic. In the meantime, try to read some of the references listed below.

References

[1] "An Introduction to Data Communication," P J Cadman, G4JCP. *Radio Communication,* August 1984.
[2] "Digital Communications", *ARRL 1985 Handbook,* Chapter 19.
[3] "Packet Radio", Margaret and Dan Morrison. *Practical Wireless,* December 1983 and January 1984.
[4] *Proceedings of the First, Second, Third and Fourth Amateur Radio Computer Networking Conferences,* (1981/3/4/5). State of the art papers on amateur packet. The first three are available from RSGB, the fourth from ARRL.
[5] *AX.25 Link Layer Specification.* Available from RSGB and BARTG.

And finally

I got a fan letter! As I complete this column, the December issue of *Radio Communication* (containing the first "Data Communications" column) has just landed on the door-mat, together with a letter from Roy, G3IDW. He says that he recently bought a TS940S which has a data socket, but there is nothing in the handbook about how to use it. Can anyone help? □

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SWL

*Bob Treacher, BRS 32525**

WITH the 1986 HF Contest Championship getting off the ground this month with the 7MHz contests, and the success of the HF SWL Contest and the Town & County Contest last year, I hope listeners will try their hands at some of the other contests in the calendar. The 7 and 21/28MHz events have suffered from a reduced entry in the last couple of years, and they could do with a shot in the arm. In particular, 7MHz can be a fascinating band which has remarkable dx potential if time is spent carefully tuning the band, especially during contest conditions. It is true that hf conditions are such that the 21 and 28MHz contests have not been particularly inspiring of late, but if the listener sections are not supported we might lose the events. So, make an effort to spare some time to each of the listener events this year. Remember, even eighth place in some contests will give you points for the HF Contest Championship. We look forward to receiving your entries.

Pre-Christmas hf review

The vhf bands having returned to their slumbers waiting for summer, our reporters have had to struggle to find something worthwhile on hf. The main event of the period was CQWW CW. I have no full reports, but several CW buffs who were active advised me that conditions were good, but not as good as for the ssb leg.

CY0SAB was particularly active on all bands, 7MHz provided KL7s at 1100, JAs at 1400 and a KH0 at 1415. The 3·5MHz band boasted HS0A again, but 28 and 21MHz were very poor, with 14MHz closing early.

Michel Monteil, FE8957, referred to 28MHz and the good propagation job which the beacons do, especially at this time of the sunspot cycle. 5B4CY, ZS6PW and Z21ANB had regularly been heard. 3 October provided TZ6BKY (QSL via EA5CTP), ZP and PY; 15 October accounted for ZS6, 5N2, CE5; and on 20 October conditions were good, with ZD7JAM, A22BW, TL8CK and 4X6IF heard outside Europe, and some sporadic-E signals from HA, DL, Y2, G, OK, EI, LZ, GW and DL. Mike Dawson, BRS44083 turned his attentions to 21MHz and felt that in November there had been some improvement, with the band remaining open a little later. Notable loggings included ZC4MR, C53FS, 7P8CI, 7O7LW, J28EL and 5H3BH. On 14MHz CY0SAB was new, and S79CW was heard. On the QSL front C21BD and TZ2XN were gratefully received.

Ron Clarke, BRS87725, had a query regarding the countries table. Yes, Ron KG1, WB1, N1 etc count as W1 but only one station in the USA can count on each band. It is countries heard, not prefixes heard. On the Russians, the DXCC list is the best guide. Each republic counts separately, eg UB4, UC1, UF7 etc.

Brad Bradbury, BRS1066, provided a thumbnail sketch of CQ WW CW. 1·8MHz was good, providing TK5VN, OH2BEN/C56, 3 DLs/CT3, V2A, 4 YOs (yes, they seem to appear during CQ WW CW and no-one hears another for 12 months!), CN8ES, CY0SAB, JY9MG, UI8VAA and SV0AA. Several of these were new, and took Brad to 88 countries all-time, with 70 in 1985. 3·5MHz produced TK0KC/CER (Cerbicales Is) for the IOTA chasers, with JAs at 1100 on 7MHz and JW0A on 21MHz.

At the '32525/'62088 residence, the antennas are now up permanently for hf, and they have been put through their paces, especially on 3·5 and 1·8MHz by the om. A definite improvement has been noticed over those in use at the old QTH, mainly due to the new QTH being slightly higher and the garden 50ft longer! Although neither band had yet produced anything exceptional, the JAs on 3·5MHz had been strong—JF1IST and JA6CXX in particular; the Ws were good copy, and J28EI was 57 at 2200 on 9 December. The 1·8MHz band managed VE1ZZ, 6Y5IC and 5N8BAV, but nothing new there.

Malcolm Harrington, BRS20249, reported ON5OS/VS6 on 3·5MHz ssb, VK9ND on 14MHz, and 9Y4AT on 7MHz—all new ones on their respective bands.

Post-Christmas news

With this piece being written among mince pies and turkey legs, the party spirit is well and truly in evidence—to the detriment of amateur radio. There is a little news, however.

Robert Small, BRS8841, reported activity up to the holiday, mentioning XT2BR for a new one on 3·5MHz, and TU2JT for a new one on 7MHz.

1985 HF COUNTRIES TABLE
(Updates only)

Station	DXCC	28	21	14	7	3·5	1·8	Total
BRS32525	190	37	94	116	114	140	76	577
BRS1066	166	36	100	141	110	80	70	537
BRS20249	128	8	45	98	52	57	13	273
BRS44083	137	22	47	125	21	51	4	270
FE8957	125	37	88	51	37	56	0	269
BRS87725	—	0	11	75	7	35	1	129

A25/G3HCT was new on 21MHz. On the QSL front, a batch received just before the holiday included DL0MAR/9G, 3D6BU, J34UEE, FO0KW (from 1979!), KH6/OE6BVG (7MHz) and UM8MBA (18MHz).

Dave Whitaker, BRS25429, also is reaping the rewards of his 432MHz activity with December returns from HB9AEN/P (DG), 0Z1CFT (HP), LA7BI (ES), SM7BHM (HQ), DK2NH (FN) and OZ6CE (FP).. On hf 6Y5NR/KP1 had been secured for 1·8MHz, while 3D6BQ was new for 7MHz.

The lower frequency bands have not produced anything startling so far, although KH0AC was heard on 3,805kHz at 2110, and AA6AA, NA6T and K6UA were heard at around 0130 on Christmas Day. AA6AA was 58 at my QTH. Elsewhere conditions appeared to be about average, plenty of Ws on 3·5MHz, not much from the Caribbean, little from Africa and plenty of JAs; while on 7MHz, the Pacific openings at our sunrise have so far failed to occur with the regularity which marked last winter. On 1·8MHz, little ssb dx had been reported, although a VU station was heard at good strength at around 0130 on Boxing Day. As mentioned earlier, however, 1·8MHz should be in good shape to the Caribbean by the time this is read.

A final reminder to all listeners to monitor the Society's 7MHz contests. Submit an entry, however small. A good placing will secure points for the 1986 HF Listener Championship.

Finale

News, views and tables scores for inclusion in the April issue should reach your scribe no later than Tuesday 18 February. □

MICROWAVES

*Mike Dixon, G3PFR**

The Sheffield round table

This event, held at the Department of Electronic & Electrical Engineering on 30 November, courtesy of Dr Barry Chambers, G8AGN, was a roaring success. It was attended by no less than 47 guests from as far afield as Surrey, the Midlands, Cheshire, Lancashire and the northern metropolitan counties. Four members of the Microwave Committee were present, including the microwave manager, Dain Evans, G3RPE, whom we were particularly pleased to welcome.

Trade on the test instrument facilities was particularly brisk; so-much-so that a strict 20min booking timetable had to be instituted, otherwise there could have been chaos! Equipment brought for "fettling" ranged from 1·3 and 2·3GHz transverters to wavemeters and 10 and 24GHz wideband equipment, and it was most gratifying to see such a variety of equipment being worked-on by both beginners and old-hands alike. The standard of equipment varied from simple, fairly roughly built (but, at the end of the day, functional) gear to sophisticated, well thought-out and immaculately constructed equipment.

It is very pleasing to see the efforts of some of the newer recruits to microwaves (and, indeed, amateur radio) bearing fruit in this way. All-in-all a very successful day and the informal approach seemed to be appreciated by most attendees. Our thanks to Barry for another excellent event.

Fundamentals (10)

It is some time now since this feature appeared, largely because there have been many other matters to occupy available column space. So far some aspects of simple, wideband 10GHz equipment have been covered, and it is perhaps now appropriate to discuss some aspects of narrowband operation on that band.

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The question "what has happened to narrowband in the UK?" has often been asked, and the answer seems to have been that many operators have been put off by the relative complexity and low power output of the mixing approach, especially when using multiplication from 384MHz and JVL filter techniques. A few "green-fingered" cognoscenti have coaxed perhaps a milliwatt or two from the design, but the majority have only succeeded in getting around 200 to 500μW from their equipment. Without being critical of the design, which is technically very elegant, it is perhaps now worthy of a rethink.

There are several ways in which this output can be significantly increased using fairly simple modifications to existing equipment:

(1) By multiplying from 1,152MHz (nominal), a factor of ×9 rather than ×27 when using 384MHz.

(2) By concentrating on *direct* generation of nbfm or fsk cw, using existing equipment retuned, but still multiplying by 27.

(3) By using GaAsfet amplifiers which, at the moment, are not commonly available.

The former approach is the more difficult in that, for many people, it will mean building or acquiring a 384/1,152MHz tripler, solving the fairly difficult task of "cascading" multipliers and constructing a suitable 1,152MHz input network to the final waveguide-mounted multiplier. This approach needs, perhaps, 10W at 384MHz to result in 3W or so at 1,152MHz, allowing a 3 to 6dB attenuator to be inserted between the multipliers; perhaps a little like taking the proverbial "sledge-hammer"?

I recently unearthed and dusted-down a three cavity JVL multiplier filter built for beacon purposes, attached a 1W 384MHz source and multiplier and optimized the filter at 10,380MHz; the result was nearly 5mW of crystal controlled output. The source can be simply modulated to provide nbfm or fsk cw. The original filter-mixer is still a good narrowband receiver, and direct generation of the transmit signal means that it can be monitored in one's own receiver. Connected to a dish via a waveguide switch, this represents quite a potent combination and one which should be capable of working much more difficult paths than the conventional wideband gear. An even better idea, if the experimenter has a circulator, would be to lock a 20 to 30mW Gunn oscillator to the crystal source as outlined in "Microwaves" *Rad Com* April 1985. I would be very pleased to hear of other peoples' experiences using such techniques which seem to offer the chance to revive narrowband techniques at a minimum of expense and complication, until such time that GaAsfet amplifiers come into more general use on both receive and transmit. Details of nbfm and fsk cw circuits to suit the Microwave committee driver board were given in the *Microwave Newsletter* (May 1981).

Guide sums for the added potency of narrow-band look something like this:

	WBFM*	NBFM	FSK	System gain (dB)
Reduce rx bandwith	200kHz	20kHz		+10
			2kHz	+20
Improved mixer (NF)	14dB	7dB	7dB	+ 7
Power output	2mW	4mW	4mW	+ 3
Image rejection	0	+ 3	+ 3	+ 3

* Typical "in-line" transceiver performance figures using surplus or home-constructed modules.

Thus the advantage to the narrowband mode could lie in the range from about 20 to 30dB, even using this simple approach. This is a lot of system gain to be had by relatively simple means, enough to overcome many single and some multi-obstruction paths. Happy experimenting.

Microwave Committee business

Nominations for the 1985 Mullard and Fraser Shepherd Awards to be presented at the Society's annual general meeting were received and discussed. The Mullard Award went to Ray Jones, G3NKL, for his consistent work (in conjunction with Dennis Bagshawe, G3FNQ) on both 10 and 24GHz from fixed station to fixed station and from portable to fixed station. It is hoped that an account of this work, extending over several years, will appear in a future issue of *Radio Communication*.

The second committee award, the Fraser Shepherd, went to Frederick Smith, G6FK, again for the consistency of his work on 1·3GHz, both in operating and recording/reporting of results and for his continuous encouragement to other operators on the band. The presentations will be covered in more detail elsewhere.

For international award purposes, new distance objectives were agreed as follows: 10GHz, 2,000km; 24GHz, 500km; 47GHz, 100km; above 47GHz, any contact over 10km. All claims for these awards must be fully documented with an account of the work leading up to the result.

Operating news

Allan, G8BJG, the keeper for the microwave beacon(s), GB3NWK, sent in the following details: the beacons are situated 160m asl at Chelsfield in northwest Kent (JO01BI). The 1·3GHz beacon, on 1,296·81MHz beams WNW with an erp of 100W and has given almost continuous service since it was installed in March 1982. On 12 October 1985 it was joined by a second beacon on 2,320·85MHz utilizing an omni-directional Alford slot and with an erp of 5W. As is the case with most beacon projects, the financing has come mainly out of the small groups' own pockets and, with an estimated annual electricity cost of £50 to say nothing of maintenance, any donations toward the service would be gratefully received by the treasurer, G8CIU, QTHR. Reception reports would be most welcome and should be sent to the technical manager, G4GLN, or via the QSL Bureau.

Frederick, G6FK, back in circulation "after a rather severe bout of 'flu", reported a total of some 31 stations heard/worked on 1·3GHz during the period 1 September to 2 December 1985, adding "that I'm sure that you will have had all the details of the lifts": no, indeed I haven't! Some results have been reported, but many more have gone unreported, largely because the participants appear to be too busy working the dx to report their results!

Frederick's news included details of many operators planning to increase their power output on 1·3GHz, the existence of several regular skeds on both 2·3 and 3·4GHz and the fact that Russ, G4PBP, (better known to most by his old callsign, G8BHH) is updating his 1·3GHz gear and is also almost ready to appear on 2·3GHz. Several other Midlands stations are reported as being almost ready to fire up on 2·3GHz.

10GHz cumulatives 1986

The general and special rules for the 1986 10GHz cumulatives will appear elsewhere in *Radio Communication*. While every reasonable attempt has been made to avoid clashes with other RSGB and non-RSGB events, the task becomes increasingly difficult and apologies are made, in advance, if serious clashes occur. The dates are as follows:

April	13	(plus 3·4GHz)
May	11	(plus 5·7GHz)
June	15	(plus 3·4GHz)
July	13	(plus 5·7GHz)
August	17	(plus 3·4GHz)
September	14	(plus 5·7GHz)

It will be noticed that 24GHz has been excluded from the "optional" bands this season. This is because the committee is considering giving the 1986 Fraser Shepherd Award to the station(s) submitting the best documented account of effective work and contacts achieved on 24GHz between 1 May and 31 October. The allocation of several "special" 24GHz days last year did not elicit much response, and it is hoped that by associating the Fraser Shepherd award with 24GHz activity, this will encourage more stations to have a go on this band. □

VHF/UHF

Ken Willis, G8VR*

THIS MONTH WILL take its place in the record books because it heralds the release of a generous allocation of spectrum space to amateurs at 50MHz. The restriction imposed by the Licensing Authority making the band available initially only to Class A operators is bound to result in much controversy, but it must not be overlooked that to have been granted an allocation in this part of the spectrum at all is a major break-through for the UK in the face of a good deal of opposition from non-amateur services and contenders for frequencies in this part of the spectrum. Both DTI and RSGB headquarters are to be congratulated on the result of much negotiation which commenced years ago; the DTI for taking so positive an attitude, unlike certain other overseas radio administrations, and the RSGB for being seen to represent the large body of amateurs and recognized as a responsible organization, able to confer and negotiate with a government department, in the knowledge that any facilities granted would not be abused by its membership. This last point is crucial; if amateurs observe the power and other restrictions set out in the initial terms of the allocation, then there will be a strong case for extending the use of the band to both classes of licensee when the DTI reviews the situation later. Meanwhile, see

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the January issue of *Radio Communication* if you are in doubt as to what power you should feed to your particular antenna to produce an erp within the terms of the licence. If this seems small, it may come as a surprise when you find what you can do with a few watts, even using meteor scatter, on this band, and tvi will be much less of a problem. The recent decisions on cross-band working will mean that Class B operators need not entirely be excluded from experimenting with this (for many) new band which will be found to provide much of interest to anyone who likes to ponder the means by which vhf/uhf radio waves are propagated.

Transatlantic on 144MHz?

Over the next month or two I will be airing the subject of possible contacts across the Atlantic by any mode other than eme. The contacts between G and W stations on 50MHz during the hours of darkness during 1985 have caused several people to wonder about the mechanism of propagation which made this possible, and G4GLT, a long-time 50MHz specialist, has pondered on the sporadic-E pattern which would have to be present if indeed these contacts were achieved "multi-hop" by that mode. As we approach the Es season, some suggestions will be put forward for some co-ordinated tests which might throw some light on the situation and . . . maybe . . . allow some 144MHz contacts "across the pond". Meanwhile, G4GLT mentioned that he would look into the distances covered by USA stations during their own Es openings in an endeavour to find out whether single or multiple "hops" of 3,000 miles had been achieved over land in that continent. Fortunately, when someone poses a question through this feature, there is usually a response from a reader who can come up with some relevant information, and on this occasion, G4BWP, (Bury St Edmunds) has sent some data which appeared in Joe Reisert's column (W1JR) in *Ham Radio*, July 1985. This suggests that they don't actually get 144MHz coast-to-coast Es openings in the USA, the record being S Dakota to New Brunswick, a little over half-way across (2,947km or 1,832 miles) in a contact between K0UDZ and VE1UT. There is a useful field for experiment this summer if we can arrange co-operation on both sides of the Atlantic, and it may be that 50MHz conditions provide some sort of indicator to what might be possible on 144MHz. More of this anon, but in the meantime comments please, bearing in mind that if you write in February it will probably not be published before the April issue and the Es season will be due to start on the lower bands about a month or so later.

Repeater news

What used to be known as the North Cambs Repeater Group Newsletter has now appeared as the GB3WI Newsletter, being less of a mouthful. Wisbech repeater on RB15 signs GB3WI of course. However, the group is seriously interested in adding a 144MHz repeater to its repertoire, and if this comes about, the newsletter title will require further modification. Group members are being asked for suggestions. Incidentally, like many repeater groups, North Cambs would not be averse to receiving some subscriptions or donations, which could be sent to the treasurer, G6XMU, QTHR. They put out a nice newsletter with some technical articles not related to repeaters, and the current issue No 7 (winter 1985) contains an interesting circuit for a wide-band preamplifier, suitable as a hearing-aid for a deaf general-coverage vhf receiver or scanner and within their capabilities of all but the totally clumsy builder to put together in an evening at the kitchen table.

Repeater *afficianados* will recoil somewhat at the suggestion put forward by Martin Swift, G4NCE (Great Barr) who questions the need these days for repeaters on 144MHz in urban areas where they appear to have killed simplex fm operation, and no longer fulfil their original rôle of providing car-to-car communication over difficult terrain. He comments that "the days of few mobiles have long gone". Having moved recently from one region in the south-east to another, I find that in my new location, like the old one, certain repeaters are "hogged" by fixed stations much of the time, communication mostly being between stations sufficiently close to work one another on simplex, so maybe Martin has a point. He also wonders why we need calling channels (see elsewhere in this feature this month) since where he lives, 144·300MHz is used more as a "paging" frequency, with few CQ calls being copied on this channel. He asks whether the original aims of the calling channel have become outmoded or if it is simply that a new generation of radio amateurs has been wrongly "educated" in the use of this channel.

Central Scotland and Borders FM News Number 55 for winter 1985 contains its usual wealth of repeater and general news, mainly of an fm nature, though there is a lot of information in this issue on a proposed amateur tv repeater in the Glasgow-Paisley area to be the first in Scotland unless some other group beats them to the post. The editor of course is GM8LBC, QTHR, who has back copies available at 50p (1985 copies 25p). I will try to find space soon to reproduce a map of the coverage of Scottish 144MHz repeaters used as a cover-picture for the No 55 issue. Anyone planning to drive through Scotland with 144MHz equipment on board would be well advised to have such a map available, considering the nature of the terrain.

An interesting piece of repeater news, comes from Ron Roden, G4GKO, who is liaison officer of the Israel Amateur Radio Club (though his QTH is in Hassocks, W Sussex). Ron says that following the gift by Motorola Israel of two repeaters, the opportunity has been taken to re-organize the repeater network in Israel as follows:

Zfat	R14
Haifa	R3
Haifa	R12 (rtty)
Ariel	R0
Tel-Aviv	R7
Jerusalem	R1
Beer-Sheva	R13
Eilat	R3

In addition to these vhf repeaters, two uhf units are available in Tel-Aviv (R70) and Haifa (R76) (these, I assume, being IARU Region 1 wide-separation channels). Ron says that a surprising number of visitors and tourists from many countries can be heard on the Israeli repeaters since temporary permission to operate there is easily obtained at quite short notice, and without charge.

Meteor scatter

At the time of writing, both the Geminids and the Quadrantids showers have just passed. No reports have been received to date, but at this station, still with no antennas up at the new QTH other than a low indoor dipole on 144MHz, some listening on the band around midnight on 13 December showed modest activity on both sked and random channels. Reflections were sometimes of great strength, even on the indoor antenna, but of very short duration so it was difficult to read full callsigns. Hopefully we shall get some reports later which will indicate whether it was a good year for these showers.

Dave Butler, G4ASR, who edits the *VHF Newsletter,* has asked me to publicise the activity periods for ms operation for the year 1986. These are periods promoted by the newsletter, aimed at increasing band activity on random ms frequencies throughout the 12 months rather than to have stations use this mode solely during major showers. The information has been passed to vhf managers and societies throughout IARU Region 1, so there is a good chance that there will be stations active on the dates and at the times listed. These are:

	Saturday 2200 to 2400gmt	Sunday 0600 to 0800gmt
January	11	26
February	8	23
March	8	23
April	12	27
May	10	25
June	7	22
July	12	27
August	9	24
September	6	21
October	11	26
November	8	23
December	6	21

This means that there are two activity periods each month throughout the year: the Saturday period is between 2200 and 2400gmt, and the Sunday event from 0600 to 0800gmt. Calls should be made on the random frequencies 144·100MHz for cw and 144·400MHz for ssb, with 5min cw periods and 1min for ssb. The editor of the *VHF Newsletter* would appreciate hearing of any successes or otherwise from those using these activity periods; send to: Box 73, Hereford HR2 9EW.

I wonder if anyone can suggest how a very strong but very short meteor reflection might come about. During the Geminids, some of the reflections were S9 but less than 1s in duration. I would have expected a very strong reflection to be caused by intense ionization (a bigger than average meteor or a faster one?), and if this is the case, why does recombination not take longer, giving a more drawn-out reflected signal?

Calling channels

Correspondence from readers queries the need for a calling frequency "since they do not use them on the hf bands", and the VHF Committee has discussed this matter recently. In certain parts of the UK, band occupancy is sufficiently high to suggest that CQ calls might be made anywhere in the appropriate part of the band, avoiding the need to QSY once contact is established; again, much like procedures on the hf bands. When the band is particularly quiet, or if one lives in a location where calls are rare (I should be so lucky!) then the calling frequency has great merit, but with high activity a call off the usual channel would be just as likely to receive a response if we were all wooed away from the present magic frequency.

After all, in days gone by when we were all crystal-controlled, you had to tune the entire band looking for a reply after a call, but we still managed to make contacts. You will probably have noticed, too, that in an aurora or an Es event, most of the dx being worked is way off the calling frequency, having started a pile-up by a CQ in some random part of the band. Having said all this, there are definite merits in being able to leave the receiver on, say, 144·300MHz while doing jobs around the shack, since any burst of activity usually signifies that something unusual is happening. What do readers think? The VHF Committee would like to know your views.

If you do use the calling channel, then be a bit original in choosing a frequency on which to QSY. There is a tendency for everyone to go up or down in tens of kilohertz which simply results in QRM off the calling frequency when the band is busy, so try some random numbers for a change.

Beacons

Lee Herterich, K1VZI, writing from Wellesley, Mass, has some useful information on 50MHz beacons. He says that the Connecticut beacon K1NFE, which *was* on 50·440MHz, has moved to 50·0605MHz, and is "0·5 up" because the USA beacon band on 50MHz has its bottom end at 50·060MHz. This will be a much more useful spot for those monitoring the band. (See also the 50MHz band plan on p3 of the "Operating Guide", *Rad Com* January 1986). Lee reports a new beacon on Cape Cod, Mass, on 50·070MHz "which we hope will be heard in Great Britain". Its transmitter runs 22W into a vertical antenna and is operational 24h each day with the following message format "V de W2CAP/B Cape Cod Mass FN41 BT QSL to W2CAP/1 BT", all sent in cw at 13wpm. Reception reports will be verified and should be sent to Steven B Wilson, 14 Elishas Pond Drive, Yarmouth Port, Mass 02675, USA. The very strong USA 50MHz contingent is clearly interested and delighted at the prospect of 50MHz operations from Europe and Scandinavia.

Brian Bower, G3COJ, has written to follow up his comment that FX0THF sends a "B" in its format when on battery power. Little information of a descriptive nature has come to hand since correspondence was received back in 1977 from F9QW, who was then vhf manager for France, but later relinquished the post. This correspondence stated that FX0THF was on 144·895MHz ±5kHz with 20W output to a big-wheel antenna producing 30W erp, the antenna being 898ft asl. The locator, AI46h, does not seem to coincide with latitude and longitude data. The letter "B" in the format does indicate that the beacon is operating on battery power. For those who like to drive through France during the summer, FX0THF is located near Chartres, although it is generally known at the "Paris Beacon" in the UK.

Expedition time

With some news coming in from an expedition group, summer can't be all that far off. The Five Bells Dxpedition Group has just released a most interesting summary of their activities during 1985 when they visited WR and WQ squares. This group, which grew out of the successful vhf contest group G4SIV/G8ZHP, comprises: Keith, G4ODA; David, G4DHF; Julian, G4YHF; and Ian, G1DXI, and it is hoped that their report can be published somewhere in its entirety since it makes very interesting reading and raises a number of points which other budding expeditioneers would be wise to note. For the present, however, let me simply quote the final paragraph of the summary which reads: "We are now preparing for our next expedition in July 1986, and would welcome comments from our European colleagues as to which squares they would like us to activate. How about some vhf/uhf activity from the Shetland Islands (ZT/ZU)?". Anyone with suggestions should contact David, G4DHF, QTHR. The group has gear for 144, 432 and 1,296MHz as well as vhf-net capability on hf bands.

Information on an expedition by EI2CA to VP square last October came in rather too late to be hot news, but it was based on the use of meteor scatter on 70MHz with crossband facilities to 50MHz. It was, by all accounts, very successful, and Paul says that at times 30–40 stations were all calling together. However, he plans another expedition for 5/6 May and promises to let us have details in advance (by end of February please Paul!).

Conventions

Last month a picture taken at the Midlands VHF Convention in October appeared. This event proved so successful that the new location in Telford is to be used again next year. Some 175 vhf/uhf enthusiasts attended the convention, the highlight being a series of specialist lectures by well-known vhf personalities. Angus, G3OSS, spoke of the problems associated with the testing of commercial equipment developed for the amateur market, and responded to a wide range of questions on this topic. Dave, G4DHF, explained the difficulties encountered in staging a vhf expedition, notably

If these vhf types enjoying a quiet drink at the Midlands VHF Convention seem to be very relaxed, they may not have been aware that a major tropo event covering most of Europe was in progress at that very time!

the need to survive appalling weather conditions. He illustrated his talk with colour slides, and had some interesting comments to make on the non-use of skeds for ms work. Finally, Charlie, G3WDG, presented a comprehensive compendium of do's and don'ts for the equipment-builder in the 2,320, 3,456 and 5,760MHz bands, though much of what he said would be applicable to 1,296MHz constructors. A vhf forum at which vhf personalities faced a bombardment of questions ended the technical programme, after which many of those attending settled down to a social evening supported by a buffet and well-stocked bar (see picture).

Even if Telford is a bit far from your location, think seriously about this event next October, for it is fast becoming one of the highlights of the year for the true vhf/uhf addict. Tentative 1986 date is 11 October.

Next month (16 March) the RSGB VHF Convention will be held at Sandown Park, and remember it is to be held on a Sunday this year. Full details are published elsewhere in this issue. Please make every effort to attend this event to meet vhf personalities and fellow enthusiasts, and to take advantage of a full three-stream lecture programme. Hot on its heels will be the RSGB National Convention at the NEC, scheduled for 5/6 April, 1986.

How good is your receiver?

Last May I was fortunate enough to attend the Eastern VHF Conference at Nashua, New Hampshire, USA, where some interesting tests were carried out on a variety of front-ends, and thanks to W1GXT, who has sent me the information, some of the figures are listed to show what a state-of-the-art front-end should be like on your favourite band. Only the best performers are listed. As only fractions of a decibel separated the bulk of the devices tested, I have shown as many different devices as possible in this short version of the list, and I have included the 1,296MHz figures, with apologies to Mike Dixon, G3PFR, for encroaching just this once on his terrain since I am sure the figures will be of wide interest. These, then, are the front-end figures:

Band	Call	Device	Gain	NF (dB)
50	WA1AYT	MGF1402 (commercial)	25·2	0·65
50	W1JR	NE95432 (homebrew)	9·12	0·85
50	WA1AYS	NE41632 (homebrew)	9·04	1·06
144	K3MKZ	MGF1202 (commercial)	26·2	0·38
144	VE2DFO	MGF1202 (homebrew)	26·0	0·39
144	W1AIM	MGF1202 (homebrew)	27·4	0·40
432	W1VD	MGF1412 (commercial)	16·0	0·29
432	K1LPS	ALF1203 (homebrew)	19·1	0·48
432	WA1TFH	NE720 (homebrew)	17·6	0·49
432	K1FO	MGF1402 (commercial)	20·60	0·50
432	VE2CRU	MGF1202 (homebrew)	19·14	0·52
432	WA1RWU	MGF1412 (commercial)	14·10	0·56
432	W1JR	D3501 (homebrew)	16·0	0·66
1,296	WA1WXV	MGF1411 (commerical)	13·70	0·61
1,296	W1JR	ALF1028 (homebrew)	14·11	0·71
1,296	K3MKZ	MGF1402 (commercial)	14·55	0·82
1,296	W1AIM	HXTR-2101 bipolar (homebrew)	10·05	3·44

Some of these figures are mouth-watering. Next month I will publish some antenna gain figures measured at Dayton, again supplied by W1GXT. Anyone requiring the full list, which includes several items of vhf/uhf interest, please send me an sae and a couple of further stamps to cover the cost of photocopying and I will send you a list which will make you want to tear the station apart and take up marquetry!

From here and there

Irwin Brown, GI1JUS (Co Antrim) reports an opening to Spain on 15/16 December which appeared to favour GI, EI, GW and west-coast G stations. It was better further south on the second day (16 December). Irwin worked EA1QJ (VD), EA1TA (VD), EA1CYE (YD), F1GXB (XI), EA1BLA (VD), EA1OD (XD), all on 15 December, and EA1NU (NU), F6GEX (IN97NA), F6GIF (BI) and FC1GXX (ZF) next day. All the Spanish stations worked were at a QRB of about 1,250km. I wondered at first if this was one of the December sporadic-E openings, but the duration of the event makes this very unlikely. The moral is, don't assume that it has to be hot and sunny, nor even summertime, for tropo openings for some real dx to occur. Incidentally, Irwin has worked 88 squares and 22 countries on 144MHz in a spell of less than eight months using 100W to a nine-element Tonna.

Alan Marwood, G8SSL (Nottingham) is very keen on 70MHz listening and cross-band working. He uses a dipole antenna "knocked up in half an hour", and a converter feeding a FRG-7 receiver. (Here at G8VR I use a 50MHz converter into a similar general coverage receiver; you have to "watch the birdies" but otherwise it is quite good, enabling a good coverage to be obtained frequency wise.) Alan hears GB3BUX and EI4RF most days, and he is anxious to support the GB4MTR project, monitoring 70·26MHz ssb, am and fm most of the day ready to set up cross-band contacts to 144 MHz. A beam will be installed shortly, probably by the time this appears in print.

Dubus subscribers should make sure that they get their cheques to Ken Hatton, G4IZW, Thorneycroft House, Shield Hill, Haltwhistle, Northumberland NE49 9NW as soon as possible so that Ken can assess how many copies he needs for this year. New subscribers will be welcome to this somewhat specialist vhf/uhf publication (which is non-profit making, written and produced by bonafide vhf addicts), and it is proposed to print more homebrew constructional articles starting with a new vhf/uhf transmitter designed by Claus Niei which "leaves the Japanese black boxes way behind". You can phone Ken Hatton on 0498 21372.

I have again been asked to publish my deadlines though I usually avoid this since space is at a premium. However, copy for the April issue should reach me not later than 20 February (very late copy 25 February).

Ron Howe, G3PLB (Basildon), seeks help to solve a problem with his FT290 fitted with a Mutek board front-end which suffers from breakthrough "from the synthesizer" and which affects signals "S5 and upwards". It was present before the Mutek board was fitted, so there is no suggestion that this modification which so many have introduced so effectively is in any way the cause. If anyone has experienced radiation from the synthesizer (or elsewhere) in this rig which degrades performance, could they please write to Ron, QTHR. Let's see if our "human computer" can solve this one!

Recent correspondence suggests that readers may have overlooked the fact that G8VR is the area ARRL vhf awards manager for the UK, especially for handling the VHF/UHF Century Club (VUCC) award based on squares worked and confirmed since 1 January 1983. Certificates are awarded for confirmed contacts with 100 different squares on 50 and 144MHz, 50 squares on 432MHz and 25 squares on 1,296MHz. Endorsements are issued to up-date scores after the original issue of a certificate. Contact me if you require further information or wish to submit a claim, but please enclose an sae. Send no cards initially.

For a forthcoming lecture at the 1986 VHF Convention, slides of early vhf/uhf equipment or events would be much appreciated on loan by G8VR. Can you help please, especially some of you who were in at the beginning of vhf activity.

For a chance to work BN square, listen for PA2GFL/MM who works on an oil-rig platform on a two-week shift. Although the band is not mentioned it is no doubt 144MHz, but no spot frequency is known. Incidentally, when I use the "old" notation instead of the "Locator" version, it is because my correspondent has used that form. If I adopt this principle it will soon become clear how the change to "Maidenhead" is progressing.

Our overseas readership seems to be on the increase, and it was with very great pleasure that I received a letter from Holger (Sam) Granholm, OH0NC (KP00AB) in Aaland Island. During the big tropo event in October he worked 16 UK stations on 432MHz (IO92, IO93, IO95, JO01 and JO03), best dx being G8OHM at 1,598km. Sam favours the new locator system, as you can see, and feels we should all be able to become conversant with it in about six months. He also reported that OH0AZY worked eight G-stations on 144MHz in the same event (IO92, 93, 94, 81 and JO02). His only regret was that it coincided with a 432MHz contest which "kept stations from operating on 1,296MHz". Sam mentions another opening on tropo, this time to his east, when he worked on 432MHz KO23, 45, 59, 64, 84, 85, 88, 95, 96, 97, 98 and LO07, best dx this time being 1,243km in a contact with UA3PC in KO84. □

COMPUTING

*John Morris, GM4ANB**

National grid conversions

Program 1 contains subroutines to convert from national grid to latitude and longitude and back again. It is based on information contained in the Ordnance Survey pamphlet: *Transverse mercator projection, constants formulae and methods*. This pamphlet contains Basic subroutines for national grid calculations, but these are explicitly designed for similarity with the associated formulas rather than speed.

The routines in Program 1 are based on the same formulas, but are heavily optimized for speed and brevity, and work in kilometres rather than metres. They are written in Microsoft, but will run on the BBC, or on the Spectrum with LETs added.

The true origin of the national grid is at 49°N, 2°W. However, national grid references are taken from the false origin, a point 400km west and 100km north of the true origin. If you look at the grid numbers at the corners of any 1:50,000 OS map you will see, in a mixture of small and large print, six figure numbers for both the eastings and northings. These are the distances in metres east and north respectively of that corner of the map from the false origin.

Often the small leading digits, representing the hundreds of kilometres, are omitted, or represented using a system of lettered squares. To use Program 1 you will have to re-insert the leading 100km digits.

As usual the interest is in the subroutines, with the main program being an illustration of their use. The subroutine at line 100 initializes a few constants needed for the calculation. It should be called once at the start of the program.

The routine at line 200 converts from national grid to latitude and longitude. On entry the grid eastings and northings, in kilometres east and north of the false origin, should be in GE and GN. On exit the latitude north and longitude east, both in radians, are in N and E. The opposite conversion, from N and E to GN and GE, is performed by the subroutine

Program 1

```
 10 GOSUB 100
 20 INPUT "Eastings"; GE
 30 INPUT "Northings"; GN
 40 GOSUB 200
 50 PRINT "Lat: "; N*180/PI; "   Long: "; E*180/PI
 60 GOSUB 300
 70 PRINT "Back-conversion: ";GE;", ";GN
 80 GOTO 20
100 F1 = 6364.37594:    F2 = 31.9469744
110 F3 = 3.34088711E-2: F4 = 4.34054618E-5
120 E2 = 6.670539762E-3: A1 = 6375.020481
130 N0 = 49*PI/180: E0 = -2*PI/180
140 RETURN
200 N = GN + 100: K = N/A1 + N0:  GOSUB 400
210 K = K+(N-M)/A1: GOSUB 400
220 K = K+(N-M)/A1: GOSUB 450
230 J = (GE-400)*F: J2 = J*J: J4 = J2*J2: J6 = J4*J2
240 N = J2*360 - J4*30*(4 + H2 + T2*(12 - 9*H2))
250 N = K - TK*H2*(N + J6*(61 + T2*90 + T4*45))/720
260 E = J4*42*(5 + T2*28 + T4*24)- J2*840*(H2 + 2*T2)
270 E = E + 5040 - J6*(61 + T2*662 + T4*1320 + T6*720)
280 E = J*E/5040/CK + E0
290 RETURN
300 K = N: GOSUB 400: GOSUB 450
310 P = E - E0: PK = P*CK: P2 = PK*PK: P4 = P2*P2
320 V = PK/F
330 GN = 360 + P2*30*(9*H2 - 4 - T2)
340 GN = GN + P4*(61 - 58*T2 + T4)
350 GN = M - 100 + P*SK*V*GN/720
360 GE = P4*(T4 - 9 + 40*T2 + 14*H2 - 58*T2*H2)
370 GE = 400 + V*(GE + 120 + 20*P2*(H2 - T2))/120
380 RETURN
400 C1 = COS(K-N0): C2 = COS(K+N0): T1 = 4*C2*C2-2
410 M = F3*C1*T1 - C2*(F2 + F4*(4*C1*C1 - 1)*(T1 - 1))
420 M = F1*(K-N0) + SIN(K-N0)*M
430 RETURN
450 SK = SIN(K): CK = COS(K): TK=SK/CK
460 T2 = TK*TK: T4 = T2*T2: T6 = T4*T2
470 F = 1-E2*SK*SK: H2 = F/(1-E2): F=SQR(F)/A1
480 RETURN
```

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```
Eastings? 100
Northings? -100
Lat: 48.9272059    Long: -6.09648231
Back-conversion: 100, -100
Eastings? 650
Northings? 1500
Lat: 63.2896859    Long: 2.98929777
Back-conversion: 650, 1500
```

Fig 1. Example run of Program 1

starting at line 300. The two subroutines at lines 400 and 450 perform calculations common to both conversions.

The main program, lines 10 to 70, asks for a grid reference, converts to latitude and longitude, and then back again to eastings and northings. It is intended to allow you to test that the subroutines have been entered correctly, and will no doubt be replaced by more interesting input and output sequences in due course.

For positions inside the UK the loop, from grid reference to latitude and longitude and back, should return the numbers you first thought of within a millimetre or two. The latitude and longitude figures agree with examples given in the Ordnance Survey leaflet to within a few thousandths of a minute of arc, or about the length of a cat's whisker. This should be adequate for most amateur radio purposes.

Fig 1 is an example run. Depending on your computer you can expect some differences in the last digit or two when you run the program—the ultimate accuracy is determined more by the varying rounding errors of different machines than the formulas themselves.

The notes attached to 1:50,000 OS maps describe how to find a point's full grid reference, consisting of two letters and six digits. To convert such a reference to latitude and longitude you first need to derive the 100km units from the grid letters. For an example of how to do this see Program 1 in the article "The New Locator System" (*Rad Com* October 1984, p865). Lines 500 to 670 of that program perform the required conversion, starting with a grid reference in N$ and finishing with the distance from the false origin in N and E. These correspond to GN and GE in this month's program.

Spherical direction finding

In December I asked for a neat method to calculate the position of a station, given bearings to it from two others. The first and by far the most elegant entry came from James Miller, G3RUH. Program 2 is a Microsoft version of his program. It will run on the BBC without change or on the Spectrum with LETs added.

Once again the calculation is performed in a subroutine, lines 100 to 250. All angles are in radians. E1 and N1 are the longitude east and latitude north of station 1, and Z1 the bearing to the unknown station. The corresponding values for station 2 are in E2, N2 and Z2. On exit a flag, ER, is set to 1 if the bearings do not cross. Otherwise one of the crossing positions is given by N and E. The other point is exactly opposite, as shown in line 90.

The method used by G3RUH is very neat, and in retrospect blindingly obvious (I have twenty-twenty hindsight). The unknown station is at the intersection of two great circles. Each great circle can be uniquely described by the direction of its normal. The first step is therefore to calculate the vectors representing the two great circles. This is done for station 1 in lines 100 and 110, and for station 2 in lines 120 and 130. Directions are in geocentric rectangular co-ordinates, with the z-axis pointing at the north pole, the x-axis at 0°N, 0°E, the y-axis at 0°B, 90°E.

Because the unknown station lies on both great circles, it must be offset by 90° from both normals. That means that its position is given by their vector cross product, which is calculated in lines 140 to 160.

The rest of the subroutine takes the resultant vector and converts it to latitude and longitude.

The main program is straightforward. The positions of the two known stations are set in lines 10 and 20, and should be changed as necessary once you have got the program running correctly. Three functions are declared, which on many computers can be replaced by built-ins. FND converts radians to degrees, FNR converts degrees to radians, and FNS calculates the arc-sine function. If your computer has DEG, RAD and ASN you can use those instead. If it supports IF . . . THEN . . . ELSE lines 190 and 200 can be combined, as can lines 210 and 220. □

Program 2

```
 10 N1=FNR(56):  E1=FNR(-3): REM Station 1 N, E
 20 N2=FNR(-20): E2=FNR(45): REM Station 2 N, E
 30 INPUT "Bearing from station 1";Z1: Z1=FNR(Z1)
 40 INPUT "Bearing from station 2";Z2: Z2=FNR(Z2)
 50 GOSUB 100
 60 IF ER()0 THEN PRINT "No intersection": GOTO 10
 70 PRINT "Bearings intersect at:"
 80 PRINT "Lat = ";FND(N);", Long = ";FND(E)
 90 PRINT "Lat = ";-FND(N);", Long = ";FND(E)-180: GOTO 10
100 X = -SIN(N1)*SIN(Z1): Y=-COS(Z1): AZ=COS(N1)*SIN(Z1)
110 AX = X*COS(E1) - Y*SIN(E1): AY = X*SIN(E1) + Y*COS(E1)
120 X = -SIN(N2)*SIN(Z2): Y=-COS(Z2): BZ=COS(N2)*SIN(Z2)
130 BX = X*COS(E2) - Y*SIN(E2): BY = X*SIN(E2) + Y*COS(E2)
140 CX = AY*BZ - AZ*BY
150 CY = AZ*BX - AX*BZ
160 CZ = AX*BY - AY*BX
170 SI = SQR(CX*CX + CY*CY + CZ*CZ)
180 IF SI=0 THEN ER = 1: RETURN
190 IF ABS(CZ)()SI THEN N = FNS(CZ/SI)
200 IF ABS(CZ)=SI THEN N = PI/2*SGN(CZ)
210 IF CX()0 THEN E = ATN(CY/CX)
220 IF CX=0 THEN E = PI/2*SGN(CY)
230 IF CX(0 THEN E = E+PI
240 IF E(0 THEN E = E+2*PI
250 ER = 0: RETURN
900 DEF FND(X) = X*180/PI:          REM DEG(X)
910 DEF FNR(X) = X*PI/180:          REM RAD(X)
920 DEF FNS(X) = ATN(X/SQR(1-X*X)): REM ASN(X)
```

SATELLITES

*Bob Phillips, G4IQQ**

MY APOLOGIES for the non-appearance of this column last month; it was caused by the simultaneous failure of several pieces of equipment, both radio and computer, on which I have come to rely to gather and process information at the latest practical date to make it as current as possible. All now seems to be working well again so on with this month's news.

RS satellites

There is little new to report on the status of the satellites in the series. RS5 and RS7 continue to provide the only mode A transponders, and RS8 is essentially non-operational due to difficulties in establishing telecommand control.

Turning to the future, the outlook for additional Soviet satellites is very encouraging. In fact within a matter of weeks from the date you read this, it is possible that both RS9 and RS10 will be in orbit. There have been a few problems with the testing of RS9 which may cause its launch to be delayed, but looking on the bright side both satellites will be placed in orbit at the same time.

The orbits are planned to be circular with a period of around 120min, as for the RS3-8 series. RS9 will only carry a mode A transponder, 145MHz uplink and 29MHz downlink, but RS10 will carry a much more extensive payload. There will be a mode A transponder as for RS9, together with one transponder with 21MHz up and 29MHz down (mode K) and another using 21MHz up and 145MHz down (mode T). The precise frequencies are not yet available but there is clearly scope for conflict between the mode T downlink and that from Oscar 10. Two beacons will be carried; one at 145·557MHz and the other at 435MHz.

These satellites will make a very welcome addition to those already in orbit, and the new modes should provide a good opportunity to get some use out of the 21 and 29MHz bands at a time when terrestrial propagation is close to its minimum.

Oscar 10

This piece is being written in the middle of December, during what promises to be a good period of activity on the satellite over the Christmas break. In spite of the generally lower elevation angles and shorter periods of availability in the UK, operating conditions have been somewhat better than during the late summer of 1985, when the attitude of the satellite caused the antennas to be directed in a less than optimum direction. At the time of writing, the operating schedule for the satellite provides two off periods with mode L active before and after apogee. The schedule is:

Mode B	055-119
Mode B	120-136
Mode B	137-203
Off	204-239
Mode B	240-019
Off	020-054

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The latest developments, for both the schedule and other news on the satellite's health, are carried on the various bulletin transmissions on the general beacon on 145·810MHz.

Amsat has published a book entitled, *AMSAT Phase III Satellite Operations Manual*, which provides a great deal of information about the satellite and how to operate through it. At present the only way to obtain a copy is directly from Amsat, Box 27, Washington, DC 20044, USA.

When preparing the satellite visibility chart for February I had to do some double checking for the period around the middle of the month. The normal computer program, which simply gives the beginning and end of the visible period, showed some unexpectedly long periods between the 15th and 19th. On further examination it turned out that this was indeed the case; the satellite achieves two peaks in elevation angle about half an hour after the beginning and before the end of the pass. For the majority of the orbit the elevation angle is quite low to the UK, but ideal if you only have azimuth rotation. These rather unusual conditions allow operation during up to 245ma units out of 256 for the total orbit.

Please bear in mind that Fig 1 is drawn for the London area and that such low elevation passes are rather critical on operator latitude. The further north from London the worse the access around apogee, ie ma = 128.

Uosat

It never ceases to amaze me how much effort must go into experimentation and providing bulletin information on these satellites. Uosat Oscar 9 still maintains its weekly schedule which provides the detailed bulletin on Saturdays and Sundays, and while there is still no formal schedule for Uosat Oscar 11, its 145·825MHz transmissions now carry a considerable amount of data, including the ephemeris for all active satellites. Oscar 11 is also used to provide a newsflash bulletin which is updated as and when a news event occurs, so it is worth monitoring the satellite on a regular basis.

Efforts by Harold Price, NK6K, and Jeff Ward, K8KA, have produced considerable advances in the development of software for the digital communications experiment which is seen as a forerunner to an operational packet radio service via satellite. Tests with a limited number of stations located around the world are planned to demonstrate the service.

It is worth noting that during periods when software is being loaded into the on-board computer, the 145MHz beacon is usually switched off. As I mentioned above, there is not yet a schedule for the satellite and it is unlikely that one will be established for some time, since it would make experimentation rather difficult.

Other news

A new initiative has been taken to increase awareness of satellites in schools and colleges. A publication entitled *Satellites in Education* provides a very useful resumé of the topic, with emphasis on what satellites are available and how to receive their signals. Uosat 1 and 2 are covered, as well as Oscar 10 and weather satellites. The booklet gives practical tips on antenna construction, orbit prediction and suitable sources of hardware, and is particularly useful to the newcomer to the subject. Details from G3AAJ, Amsat-UK, London E12 5EQ, on receipt of the usual sae.

Many operators write asking for information concerning satellite software that will work on their particular breed of micro, so I am always happy to include details of new packages as they become available (though I should add that even with four micros in commission at this QTH I cannot test everything that comes along!). The latest offering that has been brought to my attention is a Uosat telemetry decoder which runs on the 48k Spectrum. The software from G4IDE Micro Systems decodes the 1,200 baud data and displays it on the screen. It will also interpret the data into the corresponding satellite parameters using the standard algorithms. Further details from G4IDE, 79 South Parade, Boston, Lincs.

The first UK to Kenya contact via Oscar 10 was made between G6GZZ and 5Z4DJ on 19 August 1985. Mike, G6GZZ, has an impressive equipment line-up at his QTH with a 4 × 19 element array for transmit and 2 × 9 element crossed Yagis for receive. At the other end of the link Tony, 5Z4DJ, who is the only Oscar 10 station active in Kenya, uses 40W to a 19-element circularly-polarized antenna.

I am grateful to Ted Mathewson, W4FJ, who sent me a very comprehensive list of stations active on the Oscar 10 mode L transponder. The list which was compiled by Korz also indicates, in most cases, the equipment in use at each station. Ted indicated that his first mode L activity was with 7W cw, but many stations have "big ears" and were able to carry out a QSO. If you would like a copy of the list please send an sae to the address given at the foot of page 117.

The final news item this month concerns a possible future satellite construction project to be undertaken by Amsat-UK. The organization recently established a technical group to look at options for future activity in this area, and concluded that there is a demand for a relatively simple type of transponder perhaps along the lines of Oscar 6. Further work will be carried out to define a specific mission, after which will begin the long process of fund raising, negotiation for a launch or piggy-back ride on another satellite and last, but not least, the construction of the package itself. There is a strong desire to have a wide participation in the project while recognizing the potential problems of co-ordinating activities over a large area of the country. The possibility of using balloons to carry out pre-flight tests will be explored, and this in itself should lead to some very interesting possibilities for experimentation. If you have any views I would be happy to feed them to the group. In the meantime stand by for a rather large fund-raising exercise; the likely cost of the project is of the order of half a million pounds. □

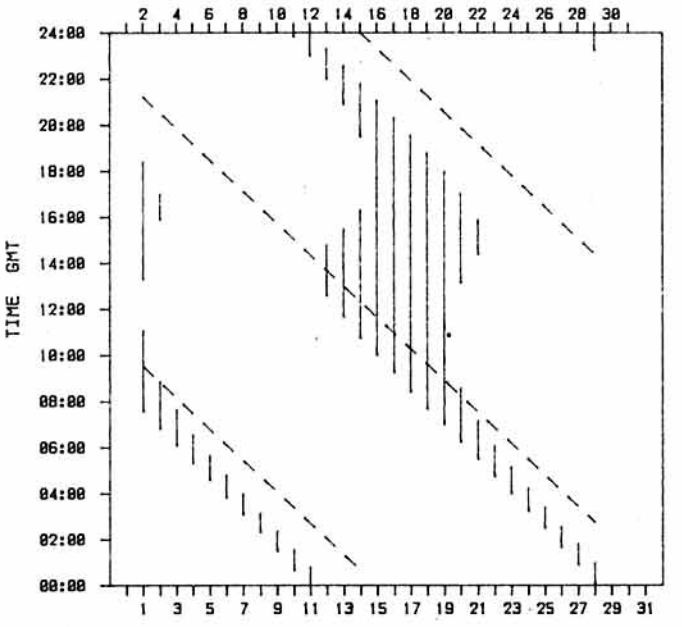

Fig 1 OSCAR 10 VISIBILITY (London area) - FEBRUARY 1986

HF

*John Allaway, G3FKM**

DURING many years of interest in international amateur radio, I have always suspected that many licensed amateurs have little or no idea of the purpose or even existence of the International Amateur Radio Union. Since my election to the post of secretary of IARU Region 1, my worst fears have been confirmed! No apologies therefore for reproducing here a short article which IARU president Dick Baldwin, W1RU, wrote in *QST* September 1985, entitled "The Objectives of the International Amateur Radio Union":

As defined in the new constitution of the IARU, its objectives are:
(*a*) representation of the interests of amateur radio at and between conferences and meetings of international telecommunications organizations;
(*b*) encouragement of agreements between national amateur radio societies on matters of common interest;
(*c*) enhancement of amateur radio as a means of technical self-training for young people;
(*d*) promotion of technical and scientific investigations in the field of telecommunications;
(*e*) promotion of amateur radio as a means of providing relief in the event of natural disasters;
(*f*) encouragement of international goodwill and friendship;
(*g*) support of member societies in developing amateur radio as a valuable national resource, particularly in developing countries; and
(*h*) development of amateur radio in those countries not represented by member societies.

*10 Knightlow Road, Birmingham B17 8QB.

In these pages we have many times emphasized the importance of IARU participating in World Administrative Radio Conferences (WARCs) held by the International Telecommunications Union (ITU), especially those general WARCs in which the table of frequency allocations is subject to revision. And to participate in a conference means that IARU must take part in the preparatory work, as it is now doing in anticipation of a general WARC that might be held as soon as 1991. For example, by the time this column appears in print an IARU team consisting of W1RU, YU7NQM, SP5FM, I1RYS and W0BWJ will have been present for all or part of ORB-85. (ORB-85 is the short title—the full title of this ITU conference is the World Administrative Radio Conference on the use of the Geostationary-Satellite Orbit and the Planning of the Space Services Utilizing It.)

If any amateur radio matters come before the conference, the IARU team will be prepared to handle them. Otherwise the IARU team members will be keeping IARU visible at this ITU conference and becoming acquainted on a personal basis with delegates from the many administrations present—delegates who can be expected to play important roles in other ITU conferences where we will want and need their support for the amateur service.

Then there is the matter of encouraging agreements between national amateur radio societies on matters of common interest. In Auckland, New Zealand, in November, there will be the Sixth Triennial Conference of the IARU Region 3 Association, during which the amateur societies in Region 3 will work out common agreements on band plans (that is, the use of the spectrum by mode), operating matters such as contests, handling reports of interference to stations of the amateur service etc. Because there will be observers present from the other two IARU regions as well, it will be another opportunity for IARU to display its international character.

We are, after all, highly interdependent. In our unity there is the strength to defend the amateur service at international telecommunications conferences. And in our unity there is the realization that any major action taken by an individual member society has an impact on other member societies. More about the objectives of IARU another month.

Dick refers to his intention to write more later, and it is certainly my intention to do likewise! One point should be borne in mind when reading the above—that is that when the amateur service is referred to this applies equally to the amateur satellite service—a service defined separately in the Radio Regulations but often perhaps unfortunately included under the generic title of amateur service.

Please note that final tables for the 1985 10 and 28MHz scores will appear in the March issue. The 28MHz table will be continued, starting again from 1 January 1986.

Award applications

Clarification of just how to make an application for an award might possibly be helpful to anyone just beginning this fascinating facet of amateur radio.

First of all it is important to read the requirements carefully. Some sponsors ask for lists of claimed QSOs, others for lists of QSLs held, and yet others for a list certified by two other amateurs (often referred to as a "GCR list"). The more stringent ask for a list of QSLs held which has been certified by the awards manager of a national society (in the UK/RSGB this is G3KDB). *CQ* magazine uses G3FKM as a check point in the UK for its awards (WAZ and CQDX) and he checks no others. If a special application form is available it should be used but, if not, a neatly-written or (preferably) typed list should be made out and should note the name and class of award being applied for, the details as required, and a declaration that licence regulations have been obeyed together with callsign and signature. If anything is enclosed which has to be returned, sufficient postage must be enclosed and a large sae if appropriate.

Copies of ARRL DXCC application forms and WPX, WAZ and CQDX forms are available from G3FKM, but DXCC applicants must send the QSLs and list to ARRL as they cannot be certified anywhere else. When filling in CQDX award forms please note QSLs in alphabetical order by prefix, this helps considerably—and finally please note that *CQ* charges US $10 per award now, but only US $4 to its magazine subscribers.

News from overseas

Peter Ebsworth, G8CKB, has reported on a recent visit to Spitzbergen. While there he met Tom, JW6VDA; Arvid, JW6WDA; and Thor, LB6EC/JW. Both Tom and Arvid had suffered damage to their antennas during a severe storm on 15 November, but fortunately the club station JW5E escaped with its five-element beam (which is at 100ft) intact and only minor damage to a rope supporting a dipole. JW5E has an IC745 and SB221 linear and also an RA117 receiver; most operation takes place near 14,175 or 14,220kHz. Auroral absorption and noise hinder propagation during the northern winter but the auroral displays are superb! Other amateurs on Spitzbergen include Svea, JW1LK; JW1CY (at a meteorological station at Hopen), and JW0A which is the Polish research station at Hornsund. Peter visited JW5E and enjoyed listening to the pile-ups—he hopes to return this year.

G3VHE, who is now officer-in-charge of the RAF Gutersloh ARC (DA2YV), has asked for publicity to be given to the fact that QSLs for contacts with ZC4AK for any dates after December 1981 cannot be provided by him. He asks those having QSOs after that time to apply directly to the operator concerned. He has already returned over 100 applications and this is becoming rather expensive.

David Dyer, G4WUK, has written about a holiday visit to Romania last autumn. He contacted YO4PX the day after making his reservation and found that Fery was in Constanta, his holiday destination. This began a series of skeds during which several YO awards were achieved. On arrival in YO4, David and wife were given great hospitality and the club station was visited. This contains much home-built gear, including a computer and rtty equipment. Radu, YO4HW, who is chief member of the club, is a QRQ morse expert and holder of 5BDXCC. David urges UK amateurs to look for YO amateurs and work for their awards which he considers well worth the effort.

Bill, G3MCS, was in Egypt during October and met SU1AL and daughters SU1AA and SU1AB, as well as an old friend of the Society—Ezzat, SU1ER, and daughter Magi, SU1MR. He was fortunate to operate for a short while on 1 November but didn't work any UK stations. There is a big problem with QSLs in Egypt as the government insists on direct QSLing only and four ircs are needed to cover the cost of the postage. A list of members of the Egypt ARS contains 26 callsigns and the information that Egyptian activity tends to take place particularly on Fridays and Saturdays around 1600 and 2200 with special emphasis on the band segments 3,775-3, 790, 7,075-7,090, 14,225-14,275 and around 21,275 and 28,575kHz. Noted as active on hf are SU1s AA, AB, AC, AH, AL, BA, CR, ER, HK, IM, MA, MI, MK, MR, RR and SR.

Barry Woodcock, G4XPG, is in Zimbabwe with the callsign Z21GT, and active on 14, 21 and 28MHz ssb particularly looking for QSOs with Yorkshire. Steve Craggs, G0BAU, is at present in the VP8 area as VP8BGO and will be there until August.

DX news

It is reported that Roland, FR7AI, is likely to be at Tromelin Is as FR7AI/T this month and possibly next. J52UAG has been worked but is believed to be confined to 14MHz ssb only. DJ6QT is believed to have a licence to operate from Comoro during spring 1986. From Malagasy, 5R8AL keeps a schedule with QSL manager WA4VDE at 1600 on Fridays on 21,330kHz. He also appears at weekends at 0200 on 3,505 and 7,045kHz alternately. ON7IP/ST2 was in Sudan during December but returned home; however, he should be back by now and be active for six months or so providing the first official operation from Sudan for some time. Zaire is represented almost daily by 9Q5MA who appears on 14,183kHz from 2000. Sao Tomé's S92LB often appears between 14,165 and 14,195kHz around 1900 before moving to "Snooky's Net" on 14,183kHz at 2030.

VR6JR may have left Pitcairn Is by now and will reply to QSLs from his home (G3OKQ) QTH when he returns. ZL7AA has been worked on 7MHz ssb at around 0730 in the UK. ZM8OY, on Kermadec Is, has also been reported on 7MHz in the ZL2AAG net. VK9ZB, from Willis Is, has now left. *DXNS* reports information from VK9NS that the next operator on the island will have a full amateur licence and will operate on cw. His callsign may be VK9ZG.

ZL1AMO encountered impossible problems during his planned visit to Tokelau late last year. He abandoned the attempt but hopes to be more successful in March.

VS6CT will be visiting Macao between 7 and 12 February and his callsign will be XX9CT. VU2GDG and VU2DVP have been very active on 3·5MHz between 0045 and 0115 on 3,696kHz and also listening on 3,800kHz. The *DX Family News Letter* reports on a visit by JR1AIB to YI1BGD following which 3,000 QSLs were sent for use by the station. Only direct cards can be sent and at least three ircs, dated within the past three years, are needed for airmail postage. Surface mail is very unreliable and should not be used. YI0BIF is a special station at the international fair site and may occasionally allow guest operation. YI4SC is located at the Scout camp. YK/OE7RKH is located with the UN Peace Keeping Forces on the Golan Heights and appears almost daily near 14,026kHz at 1830. He is willing to make schedules on other bands.

VP8BGX will be active for another six months and may sometimes be found on 14,275kHz after 2030. CE9HOP, who is on Greenwich Is and on 14,200kHz daily from 2300, intends to operate on rtty soon and has antennas for 3·5 and 7MHz. The rumoured visit to Peter 1st Island by JF1IST has been abandoned. There is no news of any other expedition being planned to the island.

KB6DAW/KH2 now has the call AH2BE and often works on 14,175kHz at 1600. KH0AC prefers 14,195kHz at 1400 and 14,227kHz at 2100.

LA5VAA is now on Bear Is as JW5VAA and will be there until May. JW6HAA should also be there now and will be there until June.

Welcome

To the following who became RSGB members during November last: DA4BM, DK3RI, F6FLB, K2AW, SM6BJK, SP9MRO, SV2WT, VK3BM, W7SX, W0VB, YB0IP and 5N8ZHN. Listener members include D Debacker (YB), M O'Donnell (DL), and S Hasan (AP).

Awards

Six Counties Award
Submit satisfactory evidence of having made two-way communication with at least one licensed amateur in six counties in Liberia on at least two different bands since April 1964.

West African Countries Award
Submit satisfactory evidence of having made two-way communication with at least one licensed amateur in eight W African states and at least five in Liberia on two different bands since 1 January 1962.

Work ECOWAS Countries Award
Submit satisfactory evidence of having made two-way communication with at least one other licensed amateur in 12 member countries of the Economic Community of West African States, including Liberia, on at least three different bands since 28 May 1975.

For any of the above awards, QSLs are not needed. A certified list of claimed contacts, signed by an officer of a national society, or two general-class licence holders, should be submitted. This should indicate station worked, date, time, band, mode ad signal reports. The fee for each award is US$5 or 20 ircs, and applications should be sent to: Awards Manager, PO Box 987, Monrovia, Liberia. (Note that ECONWAS countries are the following: Benin, Burkina-Faso, Cape Verde, Gambia, Ghana, Guinea, Guinea Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.)

Worked All Britain Islands Award
As from 1 January 1986 the WAB Awards are issuing an Islands Award and contacts with islands from this date will qualify. Listeners may also apply. A certificate will be issued for contacts with 25 islands, and endorsements will be available for 40, 50, 60, 70, 80, 90, and 100 islands. The award costs £2, and endorsements are supplied in exchange for an sae. An "island" for WAB purposes is defined as a naturally-formed piece of land-lying off-shore from the mainland of Great Britain ad N Ireland, and the Channel Is, and which at some time is surrounded by the sea. The construction of a man-made bridge or causeway does not negate the status of an island. Islands must be shown on the 1:50,000 Ordnance Survey map. Where a group is named on the map and individual islands are not, only one may be counted. Claims should be made on the record sheets available from Brian Morris, G4KSQ, 22 Burdell Av, Sandhills Estate, Headington, Oxford OX8 8ED, in exchange for an sae or ircs.

Great Western Steam 150 Award.
Following the success of the GB4GWR special event stations held at Didcot Railway Centre since 1982, the Great Western Society and the Vale of White Horse ARS are co-promoting this award. It is an A4-sized certificate in GWR chocolate and cream colours, and will be individually numbered and signed by the chairmen of both GWS and VOWHARS. Requirements are to have worked (or heard) 20 amateurs in 20 different locations formerly served by the GWR, plus GB4GWR representing Didcot. Copies of log entries, with the claimed locations underlined should be countersigned by two licensed amateurs. Band and mode endorsements are available. The fee is £2 (or 10 ircs) which includes a small donation to the Didcot Railway Centre. Cheques should be made payable to the VOWHARS, and applications sent before 31 December 1986 to: John O'Hagan, "Brubell", 27 Colne Close, Grove, Wantage, Oxon OX12 0NN.

Jubilee 150 Award
The colony of South Australia was founded on 28 December 1836 and to celebrate the 150th anniversary of this event the Wireless Institute of Australia (S Australian Division) Inc announces this award. It has been supported financially by the S Australian Tourist Bureau, Qantas and ESTROW. It is issued on payment of £1 or four ircs handling fee. Licensed amateurs must work stations in the VK5 call area to accumulate 150 points during the calendar year 1986. Listeners also need 150 points and must log the VK5 call and that of the station being worked. Points values per QSO/report are as follows: 1·8MHz = 6; 3·5MHz = 5; 7MHz = 3; 14MHz = 2; 21MHz = 3 and 28MHz = 4. Satellite and eme count 5, and WARC band QSOs also five. Those with WIA affiliated club stations count double—these are VK5s WI, WIA, ALE, ALM, ARN, APC, ARC, BAR, BWR, LZ, RCN and SR, and with jubilee station VK5JSA 15. Send log extracts and handling charge to Mr R J Bruce, VK5OU, GPO Box 1234, Adelaide 5001, S Australia.

WAZ 50th Anniversary Award
To commemorate the 50th anniversary of the WAZ award, *CQ* is offering a special WAZ certificate for those working the 40 zones during 1986. QSLs should be submitted directly to the WAZ Award manager, Leo Hiijsman, W4KA, 1044 SE 43rd St, Cape Coral Fla, 33902 USA. The awards will be numbered sequentially and the first to achieve one will receive a plaque. The usual WAZ application form should be used (available from G3FKM—sae please). Contacts may be on either cw or ssb and no separate mode certificates will be issued. QSOs must be on 3·5, 7, 14, 21 or 28MHz only. Applications should be sent to W4KA together with US $10 (or ircs at the rate of one irc = $0.37).

Zurich 2,000 Award
This celebrates the 2,000th anniversary of the city of Zurich. The sponsor is the Zurich branch of USKA, and European applicants need to make contact with at least five different stations in Zurich canton, including three located in Zurich city. Non-Europeans require four and two respectively. QSOs with club station HB9Z (which will be very active during the year in contests etc) count double. Any bands/modes may be used, and listeners may also claim the award. All QSOs reports must take place during 1986. Send log data, verified by two licensed amateurs plus CHF 5 or four ircs to: USKA Sektion Zurich, Awards Manager, Fritz Zwingli, HB9CSA, Eugen-Huberstr 25, CH-8048 Zurich, Switzerland.

Bermuda Contest winners 1985. L to r: G4BWP, VE1NG, VP9HK, VE1NK (xyl Judi), VP9KG (President of RSB), K2UR, DF9ZP (FR Germany winner) and DK8ZB

Contests

Results of the **1984 CQWWDX Contest (cw section)** are now available. In the **single-operator single-transmitter** section UK scores were as follows:

G3FXB	(All band)	1,489,714 points		G2AJB	(All band)	42,840 points
G3WPF	..	1,376,781	..	**GM8SQ**	..	21,948 ..
G4BUO	..	881,781	..	G3XRX	..	18,320 ..
G4BUE	..	874,470	..	**GW4TTU**	(21MHz)	69,120 ..
G3VMW	..	858,476	..	GW3KYA	..	26,649 ..
G3MXJ	..	690,850	..	**G6QQ**	..	5,016 ..
G4CP	..	642,492	..	G3URA	..	3,531 ..
G3LNS	..	608,580	..	**G3TBK**	(14MHz)	56,862 ..
G4UPS	..	534,145	..	**GM3RAO**	..	22,310 ..
G3PDL	..	533,235	..	**GW4PXQ**	..	13,095 ..
G4BKI	..	377,370	..	**GW3MPB**	(7MHz)	26,598 ..
G3KDB	..	351,175	..	**G4IUF**	..	10,688 ..
G3ESF	..	218,816	..	**GW3NYY**	(3·5MHz)	33,701 ..
GW3JI	..	182,952	..	**GD5AVF**	..	7,000 ..
G3JKY	..	80,342	..	**G3XWZ/A**	(1·8MHz)	22,034 ..
G4UOL	..	51,000	..	G3ZRH	..	8,325 ..
GU4WTN	..	45,182	..	G4OBK	..	1,012 ..

Certificate winners are listed in bold type.

In the **multi-operator single-transmitter** section **GJ0AAA** scored 2,111,472 points, **G4OTU,** 309,980, and **GU3HFN** 69,564.

A dreadful omission from the results of the phone section given in December *MOTA* was that of the two Welsh entrants, **GW4BLE**, who scored 931,635 points to be the leading UK entry in the all-band section (single-operator), and **GW4RHW** who scored 22,724 points on 7MHz and who led the UK entry on 7MHz. One final apology—G4TXM should have read G4XTM.

The Bermuda Contest
0001 15 March to 2400 16 March
Open to all licensed amateurs in Canada, the USA, the UK and FR Germany only. Actual operation may not exceed 36h maximum, and off periods must be clearly logged and each of not less than three consecutive hours. All stations must be single-operator only and must operate from their own private residence or property. Top winners of the 1981 to 1985 contests (inclusive) will be eligible for area awards only. The contest covers 3·5 to 28MHz (no WARC bands) phone and cw but no cross-band or cross-mode QSOs allowed. Exchange RS/T plus province (VE), state (W), county (UK) or DOK (DL). VP9 stations will send parish (SAN, SOU, WAR, PAG, PEM, DEV, SMI, HAM and STG). UK stations work only VE, W and VP9. Each complete QSO counts five points and a phone QSO and a cw QSO with the same station on the same band counts provided that they are made at least 30min apart. The multiplier is the total number of VP9 stations worked on all bands, and a multiplier may be counted only once on each band. Logs must be in gmt and separate sheets used for each band, duplicate check sheets must be enclosed with all entries with more than 200 QSOs, and each page must be clearly marked with the callsign, band and date. All contestants must sign a statement that they have observed the rules of the contest and terms of their licence. Excess duplicates or illegible logs may result in disqualification. All logs must be received by the Contest Committee, RSB, PO Box HM275 Hamilton 5, Bermuda, no later than 2000 31 May 1986. Entries should be sent by air-mail and should include sae and ircs for acknowledgement of receipt. Top scorers in each country will be invited to Bermuda to receive their awards in October 1986 with transport and hotel provided. Other winners in each county (UK) will receive a printed certificate.

ARRL DX Contests
0000 15 February-0000 16 February (cw section)
0000 1 March-0000 2 March (phone section)
Single-operator, single- or multi-band, multi-operator single- and multi-band sections. There is a QRP section for those running less than 10W input. Exchanges consist of RS/T plus figures indicating the power input. USA/Canadian stations will give their state or province. Each QSO counts three points, and the multiplier is the total number of contiguous USA states and Canadian provinces worked on each band added together. Certificates will be

QTH CORNER

BV0CRA Box 30-547, Taipei, Taiwan.
FT8XB BP 83, Argenteuil, F-95101, France.
GJ0AAA via G3TXF, Holt Cottage, Kingston Hill, Kingston-upon-Thames, Surrey KT2 7JH.
J5UAG via YU1AHI, R C N Tesla, Timocka 18/1 11000 Belgrade, Yugoslavia.
TA2D Box 37, KDZ-Eregli, Turkey.
TA2G Amd Sokak 3, Ankara, Turkey.
TN8CK via F6EWM, 6 Rue Voltaire, Sevron, F-93270 France.
VK9LM (formerly VK9NM/LH) Box 5, Lord Howe Is, 2898, Australia.
VK0AK via VK2DEJ, J M Saunders, 8 Toni Cresc, Ryde 2112, NSW, Australia.
VK0DJ via VK6DYL.
VP8BGO S Craggs, G0BAU, Arrochar, High Pit Rd, Cramlington NE23 6RB.
XX9CT PO Box 12727, Hong Kong.
Z21GT Barry Woodcock, 8 Kent Cresc, Gweru, Zimbabwe.
5T5LW DH1LAV, Box 288, D-6730, Neustadt, FR Germany.
5T5SL DL8DF, W Siebert, Koehlesrain 123, D-7950 Biberach 1, FR Germany.
7P8KG YASME Foundation, Box 2025, Castro Valley, Cal, 94546, USA.

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awarded to the leading stations in each country, and to all making more than 500 QSOs. The latter must include duplicate sheets with their entries. Contest stationery is available in exchange for a large sae and ircs from ARRL DC Contest, 225 Main St, Newington, Conn, 06111 USA. Entries must be postmarked within 30 days of the contest and sent to the same address. Note that entries containing more than two per cent of duplicate QSOs will be disqualified, and that for each duplicate or incorrect callsign a penalty of three QSOs will be deducted. Photocopies of the rules are available from G3FKM (sae please).

During the **CQ WW DX (CW)** contest on 23-24 November, GJ0AAA (operated by Roger, G3SXW, Nigel, G3TXF, and Ian, G3WVG) made 3,800 QSOs (gross), This was the fifth successive visit made by the same team to the Channel Is for this annual contest. Previous operations were: 1981 GU3SXW (Alderney), 1982 GU3TXF (Alderney), 1983 GJ3SXW (Jersey) and 1984 GJ0AAA (Jersey). The net total (excluding duplicates) of QSOs made during the five 48h contest weekends exceeds 15,000.

Third BYLARA Contest
1900-2200 27 February
1000-1300 1 March
3·53-3·55MHz and 7·007-7·02MHz (cw) and 3·62-3·65MHz, 3·72-3·8MHz, and 7·05-7·09MHz (phone). QSOs may also be made on 144 and 432MHz. Copies of rules are available from G3FKM (sae please).

Around the bands

The latest report from G8KG arrived just before Christmas and says: "There was a moderate recovery in solar activity during October and November, with the provisional monthly sunspot numbers reaching 18·5 and 16·6 respectively and with the 27-day average of solar flux rising above 70 and reaching 78 before levelling off at around 75sfu. The overall effect of the data for 1985 has been to halt the headlong descent of Cycle 21 with the longer-term averages levelling off at around 18 and 75sfu respectively, typical values for a cycle which is now 9·5 years old.

"Data for the 12 most recent cycles is generally regarded as reliable, and four of those lasted less than 10·5 years, the shortest being just 10 years long. On this basis the end of Cycle 21 could arrive at about the middle of 1986. The data does not preclude the possibility of an earlier minimum, but it is also within the probabilities that it could be delayed until the beginning of 1989! All that can be said is that things will probably be somewhat clearer by this time next year."

Reports this month are few and far between due to the various problems associated with the holiday season. Thanks are particularly due to G2HKU, G5JL, G3s GVV, LOL, YRM, G4s EHQ, MUW, NXG/M, UOL and RS10906, who managed to defeat the obstacles and send in reports. As always calls listed in italics were those of stations using A1A.

1·8MHz 0000 *EA9IE, LX9BV, VE1ZZ.* **0400** *VE3OMR, YV5AVR.* **0600** *CN8ES, DF8ZH/CT3, KH8AC/I, W8JI.* **2300** *F8IHIEA, OH0BA, SP1PEA.*
3·5MHz 0000 KP2AH, W5SZ. **0400** HK6IID, PJ2HB, W1-W5, W8-9. **0700** K6NA, *ZL3GQ.* **1900** J28EI, TV6CEE. **2200** EA9KF, J28EI, W1-2. **2300** J37AH. VO1MP.
7MHz 0400 *V2A.* **0700** *JA*, JA7EAI, *PY, TU2JT, VK, ZL.* **0800** *W6.* **1500.** *JW0A.* **2100** *UA0BAP, N9AG/V2A.*
10MHz 0800 *VK2-3.* **2000** *TA1C.*
14MHz 0800 HL9CW, *J28EI. JH4EIY/5NI* **0900** *CV0D KS0C/KH2, KL7HPR,* VK, ZL. **1200** VK2-3, VI5ZN, VK6. **1500** OX3SG, AI5P/TF, VK6ABW, W6. **1600** S79CW, S83H, VK0DJ, W6-W7, 7P8KG. **1700** FT8XB. **1800** FM4DP, KP2AH, VK0AK. **2100** A71BJ. **2300** CV0U.
18MHz 0900 *ZL1AOM, ZL3RK.*
21MHz 0800 *ZS3/W6QL.* **0900** *HI0A, HZ1HZ, OD5LX, VK4, VK6, YB0ARA, 5L2EQ.***1000** *YC8ZAB.* **1200** *VI5DP, VS6DO, VU2BK.* **1300** FM5WD. **1400** 3B8FP, 7P8KG, 9Y4GR. **1600** *CP6IB,* K6VU.
28MHz 1500 ZS6USA.

Thanks also to the following for items extracted: the *Lynx DX Group Bulletin* (EA2JG/EA3CBQ), *DX'press* (PA0GAM), *CQ Magazine* (W1WY), *DXNL* (DL3RK), *Long Island DX Bulletin* (W2IYX), *DX News Sheet* (G4DYO), the *Ex-G Radio Club Bulletin* (GI3OEN/W6), and *Long Skip* (VE3XN).

All news for the **April** issue must reach G3FKM no later than **28 February** please. □

HF f-layer propagation predictions for February 1986

Using the table

For each route, the **bands** appear vertically and the **time** horizontally, as indicated in the left-hand **KEY** blocks of the top two rows.
The probability of signals being heard is given on a 0 (indicated by a dot) to 9 scale; the higher the number the greater the probability, with 1 meaning 10 to 19 per cent of days, and so on. Additional 50 and 1·8MHz openings are indicated by a plus (+) sign in the 28 and the 3·5MHz rows respectively.

KEY TO BANDS	MOSCOW	MALTA	GIBRALTAR
28 MHz .	.....	.....	.....
21 MHz .	....1342....	....24442...	.....1221...
14 MHz .	...177776...	...1877883..	....577774..
10 MHz .	21.566567511	341665567842	.21176667841
7 MHz .	873333335767	997643335888	787654334787
3.5 MHz .	++42....25++	+++4....25++	++++2...24++

KEY TO TIMES GMT	ICELAND	OSAKA	HONGKONG
000001111122	.....	.....	....23.....
024680246802	.....36652..	....43.....	....564.....
.....	....3666771.	...153113...	....333221..
.....	34.164445773	....21.12421	1....1.12534
.....	++++3...24++	.....35.	353

BANGKOK	SINGAPORE	NEW DELHI	TEHERAN
.....	.....1.....	.....1.....	....111.....
....354.....	....4553....	....4551....	....5554....
...14653....	...136664...	...23565....	...444565...
1...133322.1	1...133352.1	31.112332..2	521311335313
3....1.12546	2....1.12556	73.....12458	8771...12668
.....35+	354	5.....35+	+4.....35+

COLOMBO	BAHRAIN	CYPRUS	ADEN
...111.....	....1111....	....2222....	....2211....
....4554....	...15555....	....77773...	...156662...
...224565...	1..433564...	21.6666783.1	1..4224672..
.1...1335413	6332..235324	774643446866	7.22..135644
32.....12668	972....12678	996311124789	952.....2678
4.....35+	+4.....35+	++4.....4++	+5.....35+

SUVA/B	SUVA/L	WELLINGTON/S	WELLINGTON/L
.....	.....	.....	.....
.....	....31.....	.....	.....
.....244....	.1..7531.22.	....14531...	.11.52...23.
....133332..	..135322252.	....43334...	.121531.1531
....211123..	...221..23..	...1211123..	...121..131.
.....	.....	.....	.....

SYDNEY/S	SYDNEY/L	PERTH	HONOLULU
.....	.....	....111.....	.....
....2411....	.....	....5653....	.....
...176552...	....241...4.	...246565...	.....1..
...2533351..	....5321.251	1...13335412	.....12124..
....21.1351.	....21..142.	1....1.12663	....211122..
.....3..	.....2..	.....35.	.....3.....

SEYCHELLES	MAURITIUS	NAIROBI	HARARE
.....121....	....2222....	....2322....	....12331...
....45662...	....56673...	....56674...	....4667o...
1..3224672..	1..2224672..	1..4222574..	11.33225751.
7.11..135644	741...135745	7322...35755	6622...25775
931.....2678	841.....2688	983.....2588	983.....2588
+2.....35+	+.....35+	++.....25+	++.....25+

CAPETOWN	LAGOS	ASCENSION Is	DAKAR
.....1442...	....14443...	.....3223...	.....2333...
....357771..	....577771..	....376563..	....277673..
1..24334672.	.3.16323673.	.22.7422364.	.22.7533474.
64231..13785	68243...3686	588241...375	478252..1485
9841....1488	8884.....488	88962....168	87962....168
++2.....5+	5++.....5+	+++3.....3+	+5+4.....3+

LAS PALMAS	Stn SHETLAND	FALKLAND Is	R DE JANEIRO
.....1211...	.....1...	.....122...	.....1.....
....267663..	.....13453..	.....36663..	.....54243..
.11.8766784.	.22.3555452.	.12.4653342.	.12..632233.
578475434786	3662532212222	37825321.122	4782331..134
9997421124 79	455521.....1	588621.....2	889621.....15
+++5.....5+	.222.....	2554.....	+++4.....2

BUENOS AIRES	LIMA	BOGOTA	BARBADOS
.....1.2...	.....	.....	.....
.....26363..	.....5443..	.....4432..	.....4443..
.12.1653332.	.....53221.	.....154222.	.....553333.
3682432...22	135.1.31...1	123.3331...11	134.233...32
689621.....2	488421.....1	588331.....2	787431.....4
4+++4.....	2+++4.....	4+++4.....	++54.....

JAMAICA	BERMUDA	NEW YORK	MEXICO
.....	.....	.....	.....
.....2332..	.....2332..	.....221..	.....221..
.....55322.	.....155442.	.....45451.	.....5421.
.12.2132..11	.11..3321132	.1...1332231	.1..11232...
577231.....2	677221....13	466111....13	265121.....
4+++4.....	+++4.....	4+++4.....	.5+4.....

MONTREAL	DENVER	LOS ANGELES	VANCOUVER
.....	.....	.....	.....
.....221..	.....1...	.....1...	.....
.....45551.	.....354..	.....83..	.....23..
.....1332331	.....3321.	.....2421.	.....1431.
465111....13	253.2...1...	132.21.11...	131.1..121..
4+++4.....	.4+4.....	.2+4.....	.253.....

The provisional mean sunspot number for November 1985 issued by the Sunspot Index Data Centre, Brussels, was 16·6. The maximum daily sunspot number was 48 on 15 November, and the minimum was 0 on 1-4 and 24-30 November. The predicted smoothed sunspot numbers for February, March, April and May are respectively: (classical method) 8, 7, 6 and 5; (SIDC adjusted values) 0, 0, 0, 0.

Contest News

28MHz Phone Cumulatives results

There was a high level of activity from UK stations during all five sessions of the contest with some high scores being recorded. Some entrants, mainly those in built-up areas or with simple wire antennas, suffered from high noise levels. Others complained of the difficulties of completing contacts due to the weak signal levels of many entrants, particularly during periods of deep QSB. Very few overseas contacts were made and those that were shown in the logs were confined to nearby Europeans. Possibly, due to these factors, only one third of those that were active sent in logs for checking.

The winner, G4BLX, from Ditchling in East Sussex, managed to contact 38 different counties and ON4 from 109 QSOs during the session on the 10 October. The runner-up, G4NOK/P, a single-operator entry from the North Wakefield Radio Club, 1,750ft up on Holme Moss, also found the same session best with 25 counties and 90 contacts. G3YPZ, in third place, using a 3-element beam 150ft high in Essex, missed out on that session, but worked 26 counties on 24 September. Compared to previous years when verticals and fixed wire arrays were favoured, most of the leaders used rotary beams. It seems from their logs that this proved to be the right antenna to use under the prevailing conditions.

As there were only two club entries, both in the single-operator section, no separate club listing is included. There were three entries in the receiving section, with the highest score from G1JJA in Redditch. He found the second session to be best and heard 19 stations in 13 counties, using a R1000 receiver and a 45ft wire antenna.

Logs were generally very good and this made the checking so much easier. A few stations will find that their published scores differ from those claimed due to incorrect callsigns and other errors. Your adjudicator was very pleased to receive so many letters and pleasing comments. The inclusion of the county bonus is generally liked, as is the additional session, and these will be retained for future contests. The HFCC will review the 1986 contests calendar to see if it is possible for additional sessions to be slotted-in during the spring or early summer.

G4RWW

TRANSMITTING (SINGLE-OPERATOR) SECTION

Callsign	16 Sep	26 Sep	2 Oct	10 Oct	18 Oct	Total (Best 3)
1 G4BLX* (SXE)	—	475	401	517	—	1,393
2 G4NOK/P* (YSW)	CK	355	372	395	CK	1,122
3 G3YPZ* (ESX)	354	370	291	—	—	1,015
4 G4NLZ (DYS)	256	288	—	310	—	854
5 G3VOF (ESX)	—	285	—	313	227	825
6 GW4HSH (GNW)	207	259	CK	224	CK	690
7 G4SZI (HFD)	CK	273	168	167	—	608
8 G4BJQ (SRY)	166	208	CK	174	CK	548
9 G4VCO (HFD)	CK	176	150	171	—	497
10 G4PEL (LEC)	—	182	161	—	126	469
11 G3JYP (CBA)	—	164	75	CK	84	323
12 G4JTR (BRK)	105	95	—	105	—	305
13 G4OGB (HBS)	131	—	—	170	—	301
14 G3UHU (ESX)	CK	93	CK	117	93	298
15 G4OTU (DOR)	80	125	79	—	—	284
16 G4XKR (LNH)	70	103	107	CK	CK	280
17 G4EZA (LDN)	83	104	83	CK	CK	270
18 G3WBM (ESX)	81	98	83	CK	CK	262
19 G4UZN (YSW)	CK	111	56	84	CK	251
20 G4PUR (HFD)	—	—	65	125	51	241
21 G3KSH (YSN)	—	79	53	—	63	195
22 GM3ULG (FFE)	CK	70	CK	72	47	189
23 G4RMC (HFD)	33	87	33	CK	—	153
24 G4OBK (LNH)	—	—	—	82	38	120
25 G4XYX (DOR)	34	30	22	—	CK	86
26 G4PTE (KNT)	—	—	—	—	50	50
— G2HLU (BRK)	—	CK	CK	CK	CK	CK
— G4ILK (DVN)	CK	CK	—	CK	CK	CK
RECEIVING SECTION						
1 G1JJA	—	122	—	94	87	303
2 RS20249	111	—	—	92	93	296
3 G6DSA	—	67	54	40	—	161

* Certificate winners

1·8MHz Town & County Contest rules

TRANSMITTING SECTION

1. Eligible entrants. All fully paid-up members of the RSGB resident in the British Isles (G, GD, GI, GJ, GM, GU and GW) holding a Class A licence. Single-operator entries only. All entrants must operate within the terms of their licence.

2. Period. From 2100 to 2400gmt Saturday 15 March 1986.

3. Frequencies/mode. 1·915–2·0MHz phone only.

4. Contest exchange. RS and serial number (starting at 001) together with operator's town and three-letter county code (as published in the "Operating Guide" supplement, *Rad Com* January 1986). In the case of "country" entrants the nearest town in the same county must be given. Scottish entrants should use their region code.

5. Scoring. Three points for each completed contact with a station in the British Isles, with a bonus of five points for the first contact with each new county/region. Contacts with stations outside of the UK will not count for points.

6. Logs. All logs must follow the standard RSGB contest log-sheet format, with 40 contacts per page (one side only). Columns should be headed: date/time (gmt); callsign; RS/serial number sent; RS/serial number received; town/county code received; bonus points; QSO points. The entry must be accompanied by the following declaration: "I declare that this station was operated strictly in accordance with the rules and spirit of the contest and I agree that the decision of the Council of the RSGB shall be final in all cases of dispute." The declaration must be signed and dated. The entrant must give details of the equipment and the antenna used and show the town and county code sent. (RSGB log sheet HFC1 and cover sheet HFC2 fully meet these requirements).

7. Address for logs. HF Contests Committee, c/o Mrs R L Glaisher, G4RWW, 279 Addiscombe Road, Croydon CR0 7HY.

8. Closing date for logs. Logs must be postmarked no later than 31 March 1986.

9. Awards. Certificates of merit will be awarded to the leading three stations.

RECEIVING SECTION

1. Rules 1, 2, 3, 5, 7 and 8 as for the transmitting section will apply.

2. Logging. A station may only appear once in the column headed "station heard". The callsign of the stations being worked may only be repeated once in every five contacts logged. Entrants should log the callsign of the station heard, RS/serial number and town/county code given by that station, and the callsign of the station being worked.

3. Awards. Subject to a minimum of 10 entries, certificates of merit will be awarded to the leading three receiving entries. If less than 10 entries are received, certificates will be awarded at the discretion of the HF Contests Committee.

4. Holders of British Class B transmitting licences may also enter the receiving section.

IARU Region 1 SSB Field Day 1985 results

The 1985 event produced a slightly smaller entry than that of the previous year; this is disappointing, especially when one considers the amount of feeling for a separate field day generated within the membership over the past year. The closest finish in the open section that this event has known occurred this year, and very careful checking was carried out before arriving at the final scores. It is interesting to note that had any of the top three stations managed only another 12 portable QSOs or another two multipliers, the final figures could have been very different. In the restricted section this year's winner was a first-time entrant in this contest, and deserves a special mention with a score which would have earned fifth in the open section.

The standard of log keeping showed an improvement but the HF Contests Committee is surprised at the number of computer- and home-produced logs submitted which do not conform to the standard HF Contest log sheet.

The following is the list of callsigns whose entries did not comply with the rules:

(*a*) no separate list of countries worked on each band:
G4PVO, G4PRS, G3WOR, G4GCT, G3FJE, GM4HEL, G3KUE, G6HC, G3FYQ.
(*b*) no operator's callsign against each contact:
G3FJE, G6HC, G3FYQ.

This year's list contains fewer callsigns than last year's, although three appear in both years' lists.

The HF Contests Committee thanks all entrants for their comments received with the logs, and those stations who submitted check logs.

G3KDB

Equipment used by the leading stations

G4MBC: TS830, TL922, R1000, TH6 at 60ft, 7MHz slopers, 3·5MHz delta loop.
G3WAS: FT102, SB220, TH6 at 60ft, delta loops for 3·5 and 7MHz.
G3RCV: FT101Z, MLA2500, TA33 at 60ft, 204BA at 50ft, loop and slopers on 7MHz, loop and dipole for 3·5MHz.
G0AAA: TS930, 270ft c/f with open wire feeders.
GM4TOQ: TS180, 3·5MHz loop.
G3NJA: TS530 W3DZZ antenna.

Operators of the leading stations

G4MBC: G4BWP, G4DRS, G4GIR, G4JQL.
G3WAS: G3KDB, G3LNS, G3NAS, G3NLY.
G3RCV: G3VLX, G4BUO, G4FAM, G4KNO.
G0AAA: G3SXW, G3TXF, G3WVG.
GM0TOQ: GM4CXM, GM4TOQ, GM0CHM.
G3NJA: G3LHJ, G4EDG, G4ELZ, G4SBH, G4VPM.

Multipliers worked on each band

OPEN SECTION

3·5MHz		7MHz		14MHz	
G3RCV	27	G3RCV	39	G4AAX	67
G4MBC	26	G4ANT	33	G3WAS	59
G3XEP	24	G4IRC, GW4NZ	29	G3RCV	50
G3WAS	23	G3WAS, G3XEP, GW2OP	23	G4MBC	49
GD3AHD	21			GD3AHD, G4HRS, G4HSF, G8JC	43

21MHz		28MHz		All bands	
G3RCV	28	G4MBC	10	G3RCV	150
G4MBC	22	GM4AGG	8	G3WAS, G4MBG	127
G4IRC, G3ASR, G3WAS	16	G3SFG, G4ADM	7	G4AAX	111
		G3RCV, G3WAS, G4HRS	6	G3XEP	102

RESTRICTED SECTION

3·5MHz		7MHz		14MHz	
GM4TOQ	21	GM4TOQ	26	G0AAA	39
GD3RFH	20	G0AAA	25	G3NJA	34
G0AAA	19	GM0ADX	19	GM4TOQ	33
G4WVR, GM0ADX	18	G3WSC	18	GD3RFH, GM3NEQ	31
		G3NJA	17		

21MHz		28MHz		All bands	
G0AAA	20	G4RUR	7	G0AAA	109
G3NJA	18	G4TMI, G0AAA	6	GM4TOQ	94
G3WSC	13	G3NJA	5	G3NJA	91
G4TMI	11			G3WSC	76
				G4TMI	70

OPEN SECTION

Posn	Callsign	Group	NUMBER OF POINTS/MULIPLIERS 3·5MHz	7MHz	14MHz	21MHz	28MHz	Total pts/mults	QSOs claimed	Score
1	G4MBC/P	Mid Beds Contest Assoc	1,114/26	959/20	1,922/49	209/22	89/10	4,293/127	1,193	545,211
2	G3WAS/P	Lichfield ARS	1,070/23	835/23	2,017/59	258/16	52/6	4,232/127	1,175	537,464
3	G3RCV/P	Cray Valley RS	990/27	1,033/39	1,362/50	147/28	23/6	3,555/150	988	533,250
4	G4AAX/P	Northumbria RC	794/13	532/16	1,632/67	326/14	6/1	3,290/111	928	365,190
5	GM4AGG/P	West of Scotland ARS "A"	1,279/17	786/17	1,231/39	97/8	50/8	3,443/89	925	306,427
6	GW4NZ/P	Port Talbot ARS	761/16	710/29	1,342/35	93/9	30/5	2,936/94	842	275,984
7	GD3AHD/P	Liverpool & D ARS	932/21	681/17	1,185/43	158/12	—	2,956/93	786	274,908
8	G4HRS/P	Horsham ARC	836/17	585/15	1,161/43	136/11	79/6	2,797/92	759	257,324
9	G3NWR/P	Wirral ARS	921/19	889/19	625/37	248/14	—	2,683/89	690	238,787
10	G4IRC/P	Ipswich RC	936/18	891/33	450/30	129/17	2/1	2,408/99	657	238,392
11	G3XEP/P	White Rose ARS	882/24	693/23	606/37	132/13	20/5	2,333/102	588	237,966
12	GU3HFN/P	Guernsey ARS	524/11	435/16	2,292/34	59/7	—	3,310/68	952	225,080
13	G4ANT/P	East Anglian Contest Club	532/16	892/33	914/36	45/5	—	2,383/90	673	214,470
14	GW2OP/P	Pembroke & D ARS	570/16	669/23	823/39	184/11	34/5	2,280/94	614	214,320
15	GW4CC/P	Swansea ARS	716/17	313/16	1,161/33	245/13	55/5	2,490/84	695	209,160
16	G3ASR/P	Edgware & D RS	990/16	874/22	396/25	180/16	2/1	2,442/80	576	195,360
17	G4HSF/P	Merseyside Special Event GP	459/10	557/22	1,028/43	155/12	—	2,199/87	638	191,313
18	G6CW/P	ARC of Nottingham	828/16	383/11	1,570/37	3/1	—	2,784/65	773	180,960
19	G8JC/P	Worcester & D ARC	550/11	331/11	1,179/43	112/9	2/1	2,174/75	598	163,050
20	G3SFG/P	Southgate ARS	711/20	802/15	368/23	198/10	43/7	2,122/75	573	159,150
21	G3GIZ/P	Chester & D RS	184/12	286/8	1,410/40	259/14	—	2,139/74	605	158,286
22	G3WIM/P	Wimbledon & D ARS	1,135/16	459/9	671/29	73/8	5/1	2,343/63	617	147,609
23	G4EKT/P	Hornsea ARC	724/15	1,276/22	383/22	—	—	2,383/59	623	140,597
24	GM0BRS/P	Borders ARS	818/17	561/16	328/35	89/8	2/1	1,798/77	466	138,446
25	G3GHN/P	Clifton ARS	811/14	370/10	492/34	61/4	2/1	1,736/63	410	109,368
26	G3FYQ/P	Pontefract & D ARS	641/18	243/12	791/27	24/3	—	1,699/60	450	101,940
27	G3BPK/P	Douglas Valley ARS	472/15	471/16	546/28	33/5	—	1,522/64	389	97,408
28	G4ADM/P	Sutton & Cheam RS	459/10	107/8	313/19	116/11	110/7	1,105/55	295	60,775
29	G4ECT/P	Cheshunt & D ARC	598/17	283/11	204/20	69/3	—	1,154/51	322	58,854
30	G4PVO/P	Droitwich ARC	1,070/19	80/2	337/17	5/1	—	1,491/39	373	58,149
31	G0AER/P	Dynamics ARS	539/12	496/13	242/20	—	—	1,277/45	298	57,465
32	GI3XRQ/P	Bangor & D ARS	221/10	126/10	343/22	113/9	2/1	805/52	203	41,860
33	G4PRS/P	Poole Radio AS	128/8	350/11	282/22	11/4	—	771/45	182	34,695
34	G0CGG/P	Grimsby ARS	242/10	233/12	99/2	13/4	—	587/38	136	22,306

RESTRICTED SECTION

Posn	Callsign	Group	NUMBER OF POINTS/MULIPLIERS 3·5MHz	7MHz	14MHz	21MHz	28MHz	Total pts/mults	QSOs claimed	Score
1	G0AAA/P	Three As Contest Group	1,003/19	959/25	614/39	171/20	75/6	2,822/109	676	307,598
2	GM4TOQ/P	West of Scotland ARS "B"	1,006/21	662/26	607/33	167/10	22/4	2,464/94	645	231,616
3	G3NJA/P	Torbay ARS	1,015/17	402/17	578/34	186/18	25/5	2,206/91	523	200,746
4	GM3NEQ/P	Windy Yet Group	882/16	706/12	845/31	21/4	9/3	2,463/66	612	162,558
5	G3WSC/P	Crawley ARC	811/15	665/18	406/29	161/13	14/1	2,057/76	475	156,332
6	GM0ADX/P	Kilmarnock & Loudoun ARC	865/18	771/19	557/24	83/6	—	2,276/67	560	152,492
7	GD3RFH/P	Western ARC	1,122/20	411/10	609/31	27/5	—	2,169/66	545	143,154
8	G4TMI/P	Toucan Group	760/17	628/13	315/23	102/11	88/6	1,893/70	476	132,510
9	G4RUR/P	Newbury & D ARS	890/11	843/14	174/22	34/8	96/7	2,037/62	491	126,294
10	GW4EZW/P	Newport ARS	870/17	513/13	628/27	11/4	—	2,022/61	522	123,342
11	G4WVR/P	Welland Valley ARS	1,184/18	373/13	405/20	83/5	2/1	2,047/57	560	116,679
12	G3FVA/P	South Manchester RC	691/14	410/13	542/24	96/7	2/1	1,741/59	448	102,719
13	G3YDD/P	Hereford ARS	552/14	560/13	372/22	130/10	17/3	1,631/62	386	101,122
14	G3WOR/P	Worthing & D ARC	677/14	716/13	280/19	59/7	32/4	1,764/57	458	100,548
15	G4GCT/P	North Bristol ARC	722/15	436/13	225/21	101/10	—	1,484/59	412	87,556
16	G3FJE/P	Shefford & D ARS	852/17	734/15	183/14	5/1	—	1,774/47	426	83,378
17	G3SRC/P	Surrey Radio Contact Club	538/12	239/8	471/29	190/6	5/1	1,443/56	351	80,808
18	G4FOX/P	Melton Mowbray ARS	685/13	381/13	332/26	2/1	—	1,400/53	345	74,200
19	GM3STU/P	Unst ARC	287/11	226/11	693/24	101/10	—	1,307/56	333	73,192
20	G6UQ/P	Stockport RS	906/17	379/13	229/12	66/4	—	1,580/46	429	72,680
21	G6HH/P	Hastings Elecronics Club	383/14	325/11	394/27	51/8	—	1,153/60	280	69,180
22	G3KUE/P	Preston ARS	842/16	218/8	385/18	19/5	—	1,464/47	369	68,808
23	G3MDG/P	Chesham & D ARS	646/13	254/15	264/21	56/5	12/1	1,232/55	282	67,760
24	G4MUR/P	—	492/14	486/18	276/21	—	—	1,254/53	299	66,462
25	GM4HEL/P	Help Contest Group	406/13	542/13	348/23	—	—	1,296/49	299	63,504
26	G4UCR/P	—	149/9	286/11	319/25	86/7	70/3	910/55	231	50,050
27	G6HC/P	Coulsdon ATS	157/5	46/4	98/9	111/9	12/1	424/28	103	11,872
28	G3XBF/P	Barking Radio Society	138/8	40/6	120/11	10/2	—	308/27	77	8,316
29	G4VCO/P	—	—	—	288/27	—	—	288/27	85	7,776

Check logs received from: G3RBP, G3XQP, G4SDZ, LZ1BJ, LZ1TR, LZ1WL, OZ5EDR, YU7SF.

HF National Field Day 1986 rules

Please note that the starting time has been brought forward to 1500gmt at the request of Continental societies.

Packets of contest stationery will be sent to prospective entrants during May.

1. The general rules for RSGB hf contests, published in the "Operating Guide" supplement, *Rad Com* January 1986, will apply.

2. **Notification of the site.** Each group intending to compete must send details of the site to be used to: RSGB HF Contests Committee, c/o Mr D J Lawley, 220 Shipbourne Road, Tonbridge, Kent TN10 3EL, to arrive not later than Saturday 26 April 1986. Details must include name of the person responsible for the entry; the address to which contest stationery should be sent; section to be entered; name of group; callsigns to be used; national grid reference and sufficient access information for an inspector to be able to locate the site.

3. **When.** From 1500gmt Saturday 7 June 1986 to 1500gmt Sunday 8 June 1986.

4. **Eligible entrants.** Any group of RSGB members within the prefix zones G, GD, GI, GJ, GM, GU and GW. NFD is a multi-operator contest.

5. Operation must be from a portable station not located in a permanent building or semi-permanent structure such as a Portacabin etc, and not using a mains supply. No equipment or antennas may be installed on the site prior to 24h before the start of the contest. This does not apply to the storage of equipment.

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

7. **Sections.**

(a) Open section. The station shall consist of a transceiver (or transmitter and receiver) with an additional receiver if desired, which may only be used for monitoring purposes. There is no restriction on the number or type of antennas, but the maximum height must not exceed 60ft (18·3m).

(b) Restricted section. The station shall consist of a transceiver (or transmitter and receiver) with one antenna which must be a single-element such as a dipole, vertical, long wire, etc, having not more than two elevated support points and not exceeding 35ft (10·7m) above ground at its highest point.

Both sections. Standby equipment may be at hand but not powered or connected in any way simultaneously with the main equipment.

The presence on the site of any amplifiers or modified commercial equipment capable of excess power, will result in the entry being disallowed, and in the event of such an infringement being proven, **all operators** listed as being associated with the group in the operation of the station will be barred from entering any RSGB contest organized by the HF Contests Committee for **five years.**

8. **Scoring.** Points will be scored as follows:

(a) Fixed stations in Europe (including the British Isles)	2 points
(b) Fixed stations outside Europe	3 points
(c) Portable and mobile stations in Europe (including the British Isles)	4 points
(d) Portable and mobile stations outside Europe	6 points

The contacts on 1·8MHz and 28MHz should be scored as above and the totals multiplied by two to obtain the claimed score.

9. **Group contacts.** Points must not be claimed for contacts made by a competing station with members of its own group.

10. **Entries.** These are to be in accordance with general rule 7 with the following exceptions:

(a) Separate logs must be used for each band using the standard RSGB hf log and NFD cover sheets.

(b) An additional standard cover sheet, summarizing the overall multiband entry, must be included.

(c) Entries must be postmarked no later than Monday 23 June 1986 and sent

to RSGB HF Contests Committee, c/o Mr D J Lawley, 220 Shipbourne Road, Tonbridge, Kent TN10 3EL. Entries sent to RSGB headquarters or having insufficient postage will not be accepted.

(d) Duplicate contacts must be marked as such without any claim for points. Unmarked duplicates will be penalized at 10 times the claimed score and logs containing in excess of five, regardless of band, will be disqualified.

11. Trophies.

(a) The National Field Day Trophy to the station having the highest checked score, regardless of section.

(b) The Bristol Trophy to the station having the highest checked score in the other section.

(c) The Gravesend Trophy to the group having the second highest checked score in the section with the largest number of entries.

(d) The Scottish NFD Trophy to the Scottish group having the highest checked score.

(e) The Frank Hoosen Trophy to the group having the highest checked score on the 14MHz band.

(f) Certificates of merit to the groups in each section with the highest checked scores on the 1·8, 3·5, 7, 14, 21 and 28MHz bands.

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

13. Inspections. All stations are subject to inspection by nominated representatives of the HF Contests Committee. The inspector's brief will be to ensure that the rules and spirit of the contest are being observed. Should the inspector be unable to locate the site due to inadequate or incorrect information being given, the entry will be disallowed. In the event of a last-minute change of site, it is the responsibility of the members of the group to make suitable arrangements for the inspector to find the new site. The inspector must be given *immediate* access to all parts of the site with the right to stay as long as desired, and the ability to return at any time during the contest.

Contests Calendar

1 Jan-31 Dec	UBA SWL *(Rules in December* SWL News)
1, 2 February	7MHz SSB *(Rules in October issue).*
1, 2, 22, 23 Feb	7MHz *(Rules in October issue)*
2 February	144MHz CW *(Rules in January issue)*
8, 9 February	First 1·8MHz *(Rules in January issue)*
9 February	70MHz Cumulative *(Rules in January issue)*
15-16 February	ARRL DX CW *(Rules in February* HF)
16 February	432MHz Fixed *(Rules in January issue)*
22, 23 February	7MHz CW
23 February	70MHz Cumulative *(Rules in January issue)*
27 February	BYLARA *(Rules in February* HF)
1 March	BYLARA *(Rules in February* HF)
1-2 March	ARRL DX Phone *(Rules in February* HF)
1, 2 March	144/432MHz and SWL
8, 9 March	Commonwealth *(Rules in September 1985 issue)*
9 March	70MHz Cumulative *(Rules in January issue)*
15 March	Town & County *(Rules in February issue)*
15-16 March	Bermuda *(Rules in February* HF)
23 March	70MHz Cumulative *(Rules in January issue)*
6 April	432MHz CW
13 April	Ropoco 1 **(NOTE DATE CHANGE)**
20 April	70MHz and SWL
20 April	Low Power Fixed *(Rules in February issue)*
May-Sept	Microwave Cumulatives
May-Sept	10GHz Cumulatives
3, 4 May	432MHz-24GHz
17, 18 May	144MHz and SWL
18 May	Region Round-up
31 May	1,296MHz Trophy
1 June	432MHz Trophy and SWL
7, 8 June	HF NFD *(Rules in February issue)*
28, 29 June	Summer 1·8MHz
5, 6 July	VHF NFD and SWL
12, 13 July	HF SWL
20 July	Low Power FD
26 July	144MHz Low Power and SWL
27 July	432MHz Low Power and SWL
3 August	Hopscotch
24 August	1,296/2,320MHz
31 August	Ropoco 2
6, 7 September	144MHz Trophy and SWL
6, 7 September	IARU Region 1 SSB FD
21 September	70MHz Trophy and SWL
4, 5 October	432MHz-24GHz
7 October	432MHz Cumulative
12 October	21/28MHz SSB
15 October	1,296/2,320MHz Cumulative
19 October	21MHz CW
23 October	432MHz Cumulative
26 October	70MHz Fixed
31 October	1,296/2,320MHz Cumulative
1, 2 November	144MHz CW
8 November	432MHz Cumulative
8, 9 November	Second 1·8MHz
16 November	1,296/2,320MHz Cumulative
24 November	432MHz Cumulative
2 December	1,296/2,320MHz Cumulative
7 December	144MHz Fixed and AFS
10 December	432MHz Cumulative
14 December	70MHz CW
18 December	1,296/2,320MHz Cumulative

144MHz CW and Marconi Memorial Contests November 1985 results

Conditions were about average for this contest with some stations experiencing a slight lift early on Sunday morning and others finding poor patches. Activity was high, although many more stations were operating than actually entered the contest. The number of sections for the UK contest were reduced from four to two so that a direct comparison with 1984 cannot be made. However, the impression is that the overall level was about the same, with the 6h section attracting more entrants than the 24h.

Most significant of the comments received were in opposition to the Maidenhead locator system. G4SFY, the 24 hour leader, comments at length, one quote being, "I would very much like to see the return of the *real* QRA and begrudge being forced to use the new system in contests." He is supported by G4WET/P, G4SIV, G4NDG/P and others. Operating standards were high with one or two exceptions. G3CCZ found no problems with poor quality signals while G4VXE commented "some disappointing operating standards".

Overall the contest was much enjoyed and the useful comments will be fed back for consideration in framing rules for 1986.

Certificates go to the winners of each section, and all entries both 6h and 24h have been forwarded to ARI (Italy) for the IARU Regional Marconi Memorial Contest. Many of the 6h entrants have done sufficiently well for a good placing in the 24h IARU Contest. Check logs were received with thanks from G3HCN/P, G4ZPP, G3OGY and G4EZA.

G3FZL

NOVEMBER 1985 144MHz CW CONTEST—6H

Posn	Callsign	Score	QSOs	QTH	Best dx	Km
1	G4DCV	36,978	125	JO01QD	DF0CT/P	665
2	G4VXE/P	23,944	117	IO81XU	DL2OM	682
3	G4HVC	17,463	78	IO93QA	DK0BN/P	673
4	G4ARI	16,563	93	IO92IQ	DF1JM	597
5	G4XBN	16,355	81	IO92PK	DJ9UX	552
6	G3SCZ	14,887	69	IO91KI	DL2OM	612
7	G4TLH/A	14,524	72	IO83QP	F6HPP	644
8	G4ERG	14,274	67	IO93SR	DL2KAL	580
9	G3VIP	13,733	53	IO93XN	DK0BN/P	670
10	GM3LKY/P	13,012	38	IO74MQ	ON4ASL/A	700
11	G4BLX	13,001	66	IO90WV	DK2YI/P	580
12	G2VJ	10,675	56	IO92CK	DL2KAL	614
13	G4EKT	9,030	47	JO93VV	F6HPP	568
14	G4XYW	8,999	73	IO91QE	G0CLP/P	388
15	G4OEI	8,109	45	IO83UB	F6HPP	573
16	G0CDA	7,879	47	IO83RJ	F6HPP	611
17	G4UJS	7,859	50	IO83RB	ON4ASL/A	488
18	G3ISL	7,389	25	IO94SH	F6HPP	617
19	G3YDY	6,020	42	JO01FQ	DL2OM	510
20	G4HZF	5,971	26	IO93WN	DK3KD/P	545
21	G4XPE	5,844	44	IO92GU	PA0FHG	428
22	G5UM	3,430	30	IO92MP	GM3LKY/P	348
23	G4WVD/P	1,032	5	IO70PM	G4ARI	388
24	G2DHV	510	12	JO01BK	G4WET/P	148

NOVEMBER 1985 144MHz CW CONTEST—24H

Posn	Callsign	Score	QSOs	QTH	Best dx	Km
1	G4SFY	51,030	152	JO02SS	OK1KTH/P	831
2	G4WET/P	43,563	222	IO92CA	DK8SG	812
3	G4SIV	39,029	140	IO92TR	DK8SG	762
4	G4NDG/P	38,869	137	IO80AQ	DL0BI/P	863
5	G4PIQ	30,658	122	JO01MM	GM3ZBE	643
6	G3WKS/P	24,296	138	JO01CF	DL0BI/P	566
7	G4RGK	23,039	116	IO91ON	DK0BN/P	627
8	G4AGQ	20,805	109	IO91OF	DL0BQ	688
9	G0CLP/P	20,783	92	IO84IG	F6HPP	648
10	G4NBS	17,744	93	JO02AF	DK0BN/P	595
11	G3CCZ	17,619	83	JO01JV	DK8SG	649
12	G3ILO	14,782	68	IO81VQ	DL3EBX/P	636
13	G4GGV	7,816	62	IO91PM	DL2OM	585
14	G4MWS	3,967	38	IO83WG	G4NDG/P	313

Low Power Contest 1986 rules

1. Aim of contest. To encourage QRP operation.

2. Eligible entrants. Single-operator stations only. UK entrants must be fully paid-up members of RSGB.

3. When. Sunday 20 April. 0700-1100gmt.

4. Sections. (a) British Isles stations using 5W input or less.
(b) Overseas stations using 5W input or less.

5. Frequencies. 3·5 and 7MHz bands only.

6. Mode. CW (A1A) only.

7. Contest call and exchange. CQ QRP. Exchange RST and serial number starting at 001, plus input power (eg 599001 3W).

8. Scoring. 15 points for each completed contact with another QRP station. Five points for all other contacts. Overseas stations may only claim points for UK contacts.

9. Logs. Separate logs must be submitted for each band. All exchanges should be shown.

10. Declaration. Each entry must be accompanied by the following declaration: "I declare that my station was operated in accordance with the rules and spirit of the contest and in the event of any dispute the decision of the Council of the RSGB will be final." The declaration must be signed and dated.

11. Address for logs. RSGB HF Contests Committee, c/o E J Allaway, G3FKM, 10 Knightlow Rd, Birmingham B17 8QB.

12. Closing date for logs. Logs must be postmarked no later than 12 May 1986.

13. Awards. The 1930 Committee Cup will be awarded to the leading station in Section (a). Certificates of merit will be awarded to the leading three stations in each section, and to the highest placed entrant in each section using 1W input or less.

144/432MHz & SWL Contest rules
1400-1400gmt, 1-2 March 1986

The general rules, published in the "Operating Guide" supplement, *Rad Com* January 1986, will apply. There will be two sections for transmitting entrants, single-operator (section S), and multi-operator (section M), and one section for all swl entries. Single-band entries for 144MHz only will not be accepted. Single-operator entrants must use the same callsign on both bands.

All entries and check logs to: VHF Contests Committee, c/o B J Morton G4HWA, Fielders, Horton Park, Horton, Northants NN7 2BJ.

432MHz CW Contest rules
1300-1700gmt, 6 April 1986

The general rules, published in the "Operating Guide" supplement, *Rad Com* January 1986, will apply. Entrants may transmit only A1A (CW) or F1A (FSK) and contact only other stations transmitting these modes. There will be one section for all classes of station.

All entries and check logs to: VHF Contests Committee, c/o G M C Stone, G3FZL, 11 Liphook Crescent, Forest Hill, London SE23 3BN.

Club News

The following is the latest information received by RRs from RSGB affiliated societies, clubs, and groups in time for inclusion in this issue. Basic unchanged information on other affiliated organizations will be published again in **July 1986.**

RSGB affiliated organizations are requested to report all programmes and new items to their regional representatives regularly. Information for inclusion in the April issue should reach them by 18 February and for the May issue by 13 March.

Club programmes are given in order of date, subject, time and place of meeting. All callsigns of club secretaries and other contacts are QTHR (correct in the current *RSGB Amateur Radio Call Book*) unless otherwise stated.

All clubs welcome visitors and would be pleased to hear from potential new members.

REGION 1—RR B Donn, G3XSN, 7 Thurne Way, Liverpool L25 4SQ. Tel 051-722 3644.

Barnoldswick (Rolls-Royce ARC)—5 February (Film show by Harry Garlick), 5 March (Construction contest). 8pm. Rolls-Royce Sports & Social Club. G4ILG, tel 0282 812288.

Bury (BRS)—11 February ("Installing your hf station avoiding the pitfalls, G4JAG). 8pm. Details G1PKO, tel 061-764 5018. NB The Hamfeast takes place Sunday, 9 February at The Mosses Youth & Community Centre, Cecil St, Bury. Minutes from the M66. Doors open 11am. Admission 50p. There will be talk-in on S20.

Chester (C&DARS)—4 February (Committee meeting), 11 February ("HF antennas", G3EWZ), 18 February (Talk by G3VYB, of Microwave Modules), 25 February (TBA). 8pm. Chester Rugby Union Football Club, Hare Lane, Vicars Cross, Chester. Morse Classes 7.15pm. Details G6IFA, tel 336639.

Leyland Hundred (LHARG)—Meetings second and fourth Monday of each month, 7.30pm. Astley Park Sports Club, Chorley. Details G4YSU, tel 0772 600239.

Liverpool (L&DARS)—4 February (Natter nite), 11 February (Quiz), 18 February (The face behind the callsign). 8pm. The Churchill Conservative Club, Church Rd, Wavertree, Liverpool 15. Details G1EXJ, tel 051-728 8811.

Manchester (SMRC)—7 February (DF event), 14 February ("Dxpedition to Lord Howe Islands", video), 21 February (TBA), 28 February ("An intro to fets", G4HON), 7 March (Visit to Jodrell Bank Radio Telescope). 8pm. Sale Moor Community Centre, Norris Rd, Sale. Details G3WFT, tel 061-973 1837.

Morecambe (MBARS)—3 February ("Wood & Douglas kits" G Rouse), 10 February (Morse class, G3PER and G4NEN), 17 February (VHS film show), 24 February (Morse class). 7.30pm. Canteen of Luneside Engineering Co, Mill Lane, Halton, Nr Lancaster. Details G3PER, tel Heysham 52659.

Stockport (SRS)—12 February ("WAB", G3WWX), 26 February ("Equipment", C Lingard). 8pm. The Magnet Inn, Wellington Rd North (A6), Stockport. Details G4FFW, tel 061-224 7880.

Thornton Cleveleys (TCARS)—3 February (Club auction), 10 February (Informal/club on air), 17 February ("Astronomy and the radio amateur", G3KEN), 23 February (Informal/club on air). 7.45pm. 1st Norbreck Scout HQ, Carr Rd, off Fleetwood Rd, Bispham, Blackpool. Details G4BFH, tel 0253 853554.

Woodford (RATEC)—3 February (Discussion evening), 10 February ("Valves and antique rigs", G4WCE), 17 February (Discussion evening), 24 February (Visit by G3XSN, RR1 RSGB). 8.15pm. British Legion Club, Moor Lane, Woodford. Details G4SFU, tel 061-485 3912.

My thanks to Ormskirk and DARC for their consideration on my visit 5 December. Would clubs in region 1 who would like me to visit them please contact me. *RR1.*

REGION 2—RR P R Sheppard, G4EJP, 9 Elvington Crescent, Leconfield, N Humberside HU17 7LX. Tel 0401 50397.

Doncaster (D&D Raynet Group)—11 February (Monthly meeting), 2 March (Doncaster Raynet Radio Rally, Adwick Leisure Centre, 11am). Sypte Club North Bridge. Details G4NZX, tel 0302 854985.

Halifax (H&DARS, G2UG)—18 February ("Conversion of cb rigs to 10m fm", G4YDI). Running Man PH, Pellon Lane. Details G0DLM, tel 202306.

Goole (GR&ES, G8HSG)—7 February (Natter night), 14 February ("Developments in computing", T Cook), 21 February (Film night), 28 February (Discussion on df events). 7.30pm. The Pavillion, West Park, Goole.

North Wakefield (NWRC, G4NOK)—6 February (Social night), 13 February (On the air), 20 February (Coach visit to Jorvic Museum, York), 27 February (Monthly meeting). White Horse PH. Details G4RCH, tel Morley 536633.

Pontefract (P&DARS, G3FYQ)—5 February (Homebrew show), 13 February (Project evening). Carleton Community Centre. G0AAD, tel 0977 43101.

Spen Valley (SVARS, G3SVC)—6 February ("Small ideas resurface", G3SDY), 20 February ("Chassis bashing", G4PHR). Old Bank WMC, Mirfield. Details G4PHR, tel Mirfield 499397.

White Rose (WRARS, G3XEP)—5 February (Video, "DXpedition to VU7"), 12 February (Natter night), 19 February (Surprise night), 26 February (Natter night). Moortown RUFC, Moss Valley, Kings Lane, Leeds. Details G6NIZ.

UK FM Group Northern—2 February (Monthly meeting). 7.30pm. Royal Hotel, Barnsley. Details G4UNA.

REGION 3—RR G Ross, G8MWR, 81 Ringwood Highway, Coventry CV2 2GT. Tel 0203 616941.

Atherstone (AARC)—10 February ("Aaand Is expedition", G4IWA, G8SYE), 24 February (Night on the air). Sixth Form College, Long St, Atherstone. Sec G6YQU, tel Chapel End 393518.

Bromsgrove (BARS)—11 February (Severn Valley Railway), 25 February (Open evening). 8pm. Hundred House, Stourbridge Rd, Bromsgrove. Sec G4LVK.

Dudley (DARC)—10 February (Surplus sale), 24 February (Microwaves). 7.45pm. Allied Centre, Greenman Alley, Tower St, Dudley. Sec G4NRA, tel 0384 278300.

Evesham—It is intended to form a club in the Evesham area. Would all those who are interested please contact G4UXC, tel 831508.

Halesowen (MEB RC)—11 February (Informal meeting), 25 February (Natter night). 8pm. MEB Social Club, Mucklow Hill, Halesowen. Sec G4RWH, tel 021-747 8784.

Hereford (HARS)—7 February (AGM), 21 February (Informal evening). 8pm. Civil Defence HQ, Goal St, Hereford. Sec G3WRQ, tel 0432 54064.

Kidderminster (KARC)—4 February ("70cm repeaters", G8NTU) 12 February (Committee meeting), 18 February (Surplus sale). 8pm. Vice Presidents Club, Harriers Football Ground, Hoo Rd, Kidderminster. Sec G8WOX, tel 0562 751584.

Oswestry (O&DARC)—4 February (Natter night), 21 February (Annual dinner). 8pm. Bell Hotel, Oswestry. Sec GW6YIY.

Rugby (RATS)—18 February (Radio Interference Services). 7.30pm. Cricket Pavillion, "B" Entrance, Rugby Radio Station. Sec G4TWH.

Shropshire (Salop ARS)—6 February ("Basically speaking", G4FJQ), 20 February ("30 years of mobile radio", G6FHM). 8pm. Old Bucks Head, Frankwell, Shrewsbury. Sec G6OMJ, tel 0743 67799.

Solihull (SARS)—20 February ("Morse techniques", G3MRP). The Shirley Centre, Stratford Rd, Shirley. Sec G8AYY, tel 021-783 2996.

Stone (Brit Tel ARS)—British Telecom staff and students only. Tuesdays, 7.30pm at College. 4 February (Open meeting). Sec G8ATB, tel 0785 762593.

Stourbridge (SARS)—3 February (Natter night), 17 February (Crime prevention). 8pm. Robin Woods Centre, School St, off Enville St, Stourbridge. Sec Mr Williamson, tel Stourbridge 392006.

Stratford (SuA ARC)—10 February (RSGB films), 24 February ("VHF aerials", G4ABS). 7.30pm. Baptist Church, Payton St, Stratford-upon-Avon. Sec G8OVC, tel 750584.

Willenhall (WARS)—4 February (TX testing), 11 February (Committee meeting), 18 February (Discussion night), 25 February (Night on the air). 8.30pm. Cross Keys, Willenhall. Sec G4LWI, tel 0902 782036.

Worcester (WARC)—3 February (Talk by D Yates), 19 February (Informal). 8pm. Oddfellows Club, New St, Worcester. Sec G4RBD.

REGION 5—RR J S Allen, G3DOT, 77 Rosslyn Crescent, Luton LU3 2AT. Tel 0582 508515 or at work on 0582 21151.

Bedford (B&DARC)—6 February (Club project, the building of a 12V psu for the club's new premises), 20 February (Junk auction). The Queen's Engineering Works Social Club, Hurst Grove, Bedford.

Cambridge (C&DARC)—7 February (Talk by J Worsnop, G4BAO), 14, 28 February (Informal), 21 February ("A blind man's bluff", G4ZZJ). Colleridge Community College, Radegund Rd, Cambridge. Sec G4TRO.

Dunstable (D Downs ARC)—7 February (AGM), 14 February (Talk on Air Traffic Control, provisional), 28 February (Visit to MK TV, provisional). Room 3, Chews House, High St South, Dunstable, Beds.

Milton Keynes (MK&DARS)—10 February ("Modern multiscreen cinemas"). The Community Centre, Hodge Lea Lane, Hodge Lea, Nr Wolverton. Sec G3ZPA.

Shefford (S&DARS)—27 February (Junk sale). The Church Hall, Shefford, Beds. Sec G4PSO.

Daventry (DARC)—6 February (AGM). The Dunn Cow PH, Daventry. Sec G1JDZ.

REGION 7—RR R Sykes, G3NFV, 16 The Ridgeway, Leatherhead, Surrey KT22 9AZ. Tel 0703 812435.

Biggin Hill (BHARC)—18 February at 8.30pm. NB new venue; Downe Village Hall, Downe, Kent. Sec G0AMP, tel 0689 57848.

Croydon (SRCC)—3 February, ("Seeing by wireless", G2KU). 8pm. TS Terra Nova, 34 The Waldrons, South Croydon, Surrey. Sec G8IYS, tel 01-657 0454.

Crystal Palace (CP & DRS)—15 February (AGM and constructional contest). 8pm. All Saints Parish Room, Upper Norwood SE19. Sec G3FZL, tel 01-699 6940.

Staff of the bookstall at the Hornsea ARS rally ELHOEX 85. L to r: George, RS86415; Joan G4CHH, (RSGB President and a founder-member of Hornsea ARS) and Mike, G4MWE.

Guildford (G&DRS)—14 February (Natter night). 28 February, (Junk sale). 8pm. Model Engineers HQ, Stoke Park, Guildford. Sec G4KXA.
New Cross (Clifton ARS)—7 February (Quiz), 21 February (video evening). 8pm. Telegraph Hill Community Centre, Kitto Rd, New Cross SE14. Sec R Hinton, 42 Sutcliffe Rd, Welling, Kent.
Redhill (RATS)—17 February ("Old radio equipment", G3IEE). 8pm. Constitutional and Conservative Club, Warwick Rd, Redhill. Sec G8JXV.
Sutton and Cheam (S&CRS)—15 February (37th annual dinner), 21 February (Junk sale). 8pm. Downs Lawn Tennis Club, Holland Ave, Cheam, Surrey. Sec G4BOX.
Wimbledon (W&DRS)—14 February ("Reminiscences of field days", G3PVA), 28 February ("All about top band", G3XTC). 8pm. St Johns Ambulance HQ, 124 Kingston Rd, Wimbledon SW19. Sec G3DWW tel 01-540 2180.

REGION 8—RR M Elliott, G4VEC, 20 Haysel, Sittingbourne, Kent ME10 4QE. Tel 0795 70132.

Canterbury (East Kent ARS)—6 February (Toroidal transformers and power supplies: ILP Electronics), 20 February (Natter night). 8pm. The Cabin, Kings Rd, Herne Bay. Details G4RIS, tel Whitstable 262042.
Dartford (DDFC)—4 February (Pre-hunt meeting, Horse & Groom PH), 9 February (Club hunt, Dartford Heath), 22 February (4-station night hunt, South Manchester). Pre-hunt meetings after 9pm. Horse & Groom PH, Leyton Cross, Dartford Heath. Details G8DYF, tel Greenhithe 844467.
Eastbourne (Southdown ARS)—3 February (RSGB presentation, RR8). 7.30pm. Chaseley Home, South Cliff, Eastbourne. Activities Tuesdays and Fridays at Hailsham Clubrooms. Details G4XNL, tel 638653.
Swale (SARC)—17 February ("Data Protection Act/ARC records", G4NPM). 7.30 for 8pm. Ivy Leaf Club, 52 Dover St, Sittingbourne. Details G4NPM, tel Minster 873147.
Tunbridge Wells (West Kent ARS)—7 February (Surplus equipment sale), 21 February ("Introduction to contesting", G4BUO) 8pm. Adult Education Centre, Annex, Quarry Rd, Tunbridge Wells. Details G4KIU, tel 33586.

REGION 9—RR A H Hammett, G3VWK, Rosehill, Laddock, Truro, Cornwall TR2 4PQ. Tel 0726 882 758

Axe Vale (AVARC)—7 February (G6CJ's antenna circus demonstration, with video). 7.30pm. The Cavalier PH. Details G3VW.
Exmouth (EARC)—12 February (Open meeting). 7.30pm. The Scout Hut, Marpool Rd. Details G8SBU.
Newton Abbot (Torbay ARS)—22 February (Meeting). 7.30pm. ECC Social Club, Highweek, Newton Abbot. Details G1EUA, tel Teighmouth 78554.
Plymouth (PARC)—3 February ("Crime prevention", Sgt Willis), 17 February ("St John Ambulance", Mr Marks). 7.30pm. Plymouth Albion RFC, Beacon Park, Peverell, Plymouth. NB this club meets first and third Mondays of each month. Details G4SCA.
Plymouth (P Polytechnic ARS)—12 February (Foxhunt). 10am. Outside Student's Union. Details G1ERM.
Plymouth (P&D West Devon ARC)—Meet over the air on 144MHz S9, Sundays, 7pm.
Redruth (CRAC)—6 February ("Impedance matching", G1AJB), 10 February (The Computer Section. "The Commodore 64 and some radio programs", Ricky.), 17 February (Constructors' evening). 7.30pm. Treleigh Church Hall, Treleigh, Redruth. Details G4RVP.

REGION 10—RR (*Post vacant*)

Cardiff (CRSGBG)—10 February ("The Radio Interference Service", Alan Cleverly of the DTI, RIS). 7.30pm. Pantmawr Hotel, Tyla Teg, Pantmawr Estate, Whitchurch, Cardiff. Sec GW0CUM, tel Cowbridge 3212.
Rhondda (RARS)—6 February (Junk sale), 20 February ("Measuring ssb transmitter power", GW3NWS), 22, 23 February. (Contest, tx and swl), 6 March, ("Worked All Britain", with slides, GW3XHG). 7.30pm. National Union of Mineworkers' Club, Tonypandy. Sec GW4BUZ, tel Tonypandy 432542.
Swansea (SARS)—6 February. ("Traffic control in and around Swansea", Traffic Engineer of the WGCC), 20 February ("World War 2 radar" with illustrations, David Hansen). 7.30pm. Lecture Room N, Applied Science Building, Swansea University. Morse practice until 8pm when meeting starts. Sec GW4HSH, tel 404422.

Please note the tel code for my number has been printed incorrectly in the last few issues: it is 0222 not 022. *GW4HWR*

REGION 11—RR B H Green, GW2FLZ, 1 Clwyd Court, Tan-y-Bryn Road, Colwyn Bay Clwyd LL28 4AH. Tel 0492 49288

Colwyn Bay (Conwy Valley ARC, GW6TM)—13 February ("Test equipment", GW3JGA). 8pm. Green Lawns Hotel, Bay View Rd, Colwyn Bay. Sec GW4VVW, tel 0492 636376.
Deeside (Alyn & Deeside ARS)—17 February (Presentation evening to club members). 8pm. Shotton Social Club, Shotton Lane, Deeside. Sec Mrs E Smith, GW1ILZ, 1 Devonshire Rd, Broughton, Chester.
Porthmadog (P&DARC)—20 February (Video film evening). 8pm. Harbour Cafe, Ffestiniog Railway, Porthmadog. Sec GW4WKQ, tel 0758 740445.
Wrexham (WARC)—4 February (Homebrew on view), 18 February ("Basically speaking", G4FJQ). 7pm. Friends Meeting House, Holt Rd, Wrexham, Clwyd. Sec G4HRH, tel 0948 5161.

REGION 17—RR T Emery, Wilverley, Old Lyndhurst Road, Cadnam, Southampton SO4 2NL Tel 0703 812435.

Amateur Radio and Computer Club (AMRAC)—7 February ("The RSGB", G3KWU) 8pm. The Crown, Bishops Waltham, Hants. Sec G1NIM, tel 0705 38106.
Basingstoke (BARC)—3 February (Talk by Wood & Douglas). Forest Ring Community Centre, Sycamore Way, Basingstoke. Sec G4WIZ, tel Tadley 5185.
Blackmore Vale (BVARS)—11 February ("Telecoms", BT Rep). 7.45pm. The Bell and Crown, PH Zeals, (on the A303). Club sec G1GRS, tel 0963 70969.
Eastleigh (Itchen Valley ARS)—3 February ("Signature recognition by computers"), 28 February ("Crystals", The McKnight Crystal Co.) Note advance notice of AGM to be held on 14 March. The Scout Hut, Brickfield Lane, Chandlers Ford, Hants. Sec G6DIA, tel 0703 863039.
Fareham (F&DARS)—5, 19 February, (Natter nights), 12 February ("Project box presentation", G4ITG), 26 February ("Component types", G4ITF). 7.30pm. Portchester Community Centre, Portchester, Hants. Sec G4ITG, tel Fareham 234904.
Farnborough (F&DARS)—12 February ("My favourite piece", members). 26 February (Open evening for RAE and cw students). Railway Enthusiasts Club, Access Rd, off Hawley Lane, Farnborough. PRO G4SBU.
Gosport (Rowners & DARS)—5 February and every alternate Wednesday. 7.30-8pm. Morse tuition followed by meeting at Scout Headquarters off Grange Rd, Rowners. Sec G6OTY, tel Locks Heath 2541.
Liphook (Three Counties ARC)—5 February ("Satellite tv", G8CMQ), 19 February ("Steam railways", G8ZRM). 8pm. The Railway Hotel, Liphook. Sec G0BTU, tel Petersfield 66489.
Poole (PARS)—28 February ("50MHz", G3OBD). 7.30pm. Commander's House, Constitution Hill Rd, Poole. NB change of meeting place. Sec G4XYX.
Swindon (S&DARC)—6 February (Junk sale), 13, 27 February (Natter nights), 20 February ("Tuning of hf transmitters", G3RZP). 7.30pm. Oakfield School, Marlowe Ave, Swindon. Sec G4YQZ.

REGION 18—RR Ian Gibbs, G4GWB, 61 The Gables, Widdington, Morpeth NE61 5QZ. Tel 0670 790090.

Berwick (Borders ARS-G0BRS)—7 February (50MHz experiences, GM4CXB), 21 February (Safety in the shack). Tweed View Hotel, Tweed St, Berwick. Sec GM1IRM, tel 0289 82491.
Consett (Derwentside ARS, G4PFQ)—3 February (Natter night), 10 February (Worked all Britain, G4LGA), 17 (Natter night), 24 February (QSL night, bring along your favourite card and tell why), 3 March (Natter night). Consett Assocn FB Club, Belle Vue Park, Consett. Sec G3KMG, tel 0207 504198. NB new club secretary.
Easington (EARS, G4APN/G6APN)—February basically informal except for an outing on 27 (info on the visit from the new sec). RAE & cw tuition available on request. Easington Workmen's Club, Seaside Lane, Easington. Sec G4RIK, tel 0783 815331.
Morpeth (Northumbria ARC, G4AAX G6AAX)—6 February (AGM), 20 February ("Chip technology, the latest thinking", G4KHC). Old Telephone Exchange, Cresswell Rd, Ellington, Morpeth. Sec G6IIA, tel 0670 513026.
Whitley Bay (Tyneside ARS, G3ZQM)—5 February (Informal), 12 February (Pie & pea supper), 19 February ("HF linears", G3RB), 26 February (Activities evening including club station). Community Centre, Earsden. Sec G4KOT, tel 091 2340170.

REGION 20—RR (*Post vacant*)

Bristol (BRSGBG)—24 February (Visit by Les Hawkyard G5HD, chairman RSGB EMC Committee). 7.30pm. Small Lecture Theatre, Bristol University. Details G4SQQ, tel 0272 508451, or G4ROX, tel 0272 513573.
Gloucester (GARS)—5 February ("Nuclear power", Dr Streetfield of CEGB), 12, 19, 26 February (Natter nights), 5 March ("Radio interference", DTI). 7.30pm. St John Ambulance HQ, Heathville Rd, Gloucester. RAE and morse classes every Wednesday, 7pm. Details G6AWT.
Weston-super-Mare (WsMARS)—10 February ("Work of the RNLI"—talk and film). 8pm. Rugby Club (off Drove Rd), Weston-super-Mare. Details G1DJW, tel 0934 514429.
Yeovil (Y&DARC)—6 February ("Aerials for QRP", G3MYM), 13 February ("Plotting jFet characteristics", G3MYM), 20 February ("Using relays to control amateur equipment", G3GC), 27 February (Natter night), 6 March ("Semiconductor diodes", G3MYM). 7.30pm. The Recreation Centre, Chilton Grove, Yeovil. Club sec G3GC, tel 0935 75533.

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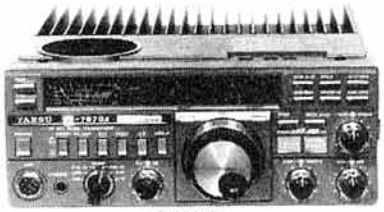

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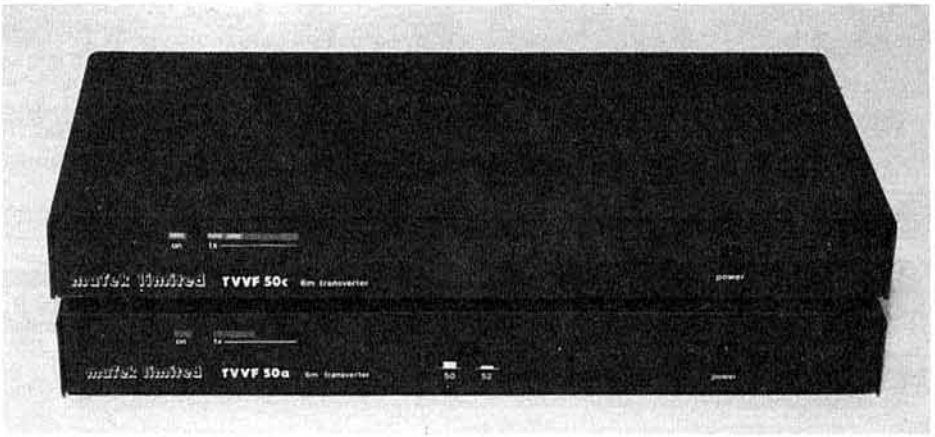
SIX APPEAL!

(I'm sorry, I couldn't resist that!)



As I write this there are pretty strong rumours that the London Gazette announcement regarding the release of the 50MHz band is imminent . . . For that reason, I'm going to concentrate on our transceivers for the band this month. It might also be worth your while reading to the end of this if you are thinking of buying one!

We make two transverters for 'six': both are capable of very high performance and have the benefit of having been specifically designed for the band. They're not (unlike some!) hastily cobbled together adaptations of transverters for other bands.

As I've frequently said in the past, transverters can be a rather questionable way of getting on to new bands, particularly with regard to strong signal performance on receive. However, IF the transverter is properly designed and used with a suitable transceiver, it's possible to get very high performance indeed. Needless to say, our transverters are properly designed, and benefit from our many years unique experience in the design and manufacture of high performance vhf receiver front ends. Unlike the authors of at least one published 50MHz transverter design (which has a remarkable similarity to the circuitry of our RPCB 144ub FT221 front-end!), we've moved forwards over the years, pioneering many new techniques in order to offer improved performance.

For 50MHz we make two separate transverters: both provide 10W pep with low distortion and spurious product levels.

The TVVF 50c provides a very simple means of transverting to '6' from 144MHz. Having tried both 28 and 144MHz as i.f.'s when transverting to 50MHz, I'm strongly in favour of the use of 2m. The reason is simple: 28.885MHz! The facility to work crossband to hf is very important if you have ambitions to work dx on six. If you have a reasonable 144MHz transceiver (ie. one fitted with a muTek front-end!!), this system will work at least as well as one based on a 28MHz if, and rather better than the majority of dedicated 50MHz transceivers!

If you want to use a 28MHz transceiver, the TVVF 50a is for you! It has been designed using the same philosophy as our TVVF 144a two metre transverter and has much the same superlative performance. It covers the whole international 50-54MHz band in two switched ranges, with low distortion and spurious product levels on transmit, along with a superb receiver signal path. Useful facilities such as internal alc and external alc tie-back to the transceiver are also incorporated.

We don't have room here to give full data, but if you'd like more information, a telephone call will send a copy of our data sheet winging on its way. By the way, your reward for reading this far is that as a special offer to welcome the new band, for orders received in the month of February only, we're reducing the price of the TVVF 50a to **£224.90** and the TVVF 50c to **£189.90**. As most of our prices will have to rise at the beginning of March, this represents very good value for money!

Chris Bartram G4DGU

The range

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TVHF 230c	Very high performance 2m to 9 hf bands transverter	334.90
TVVF 50a	Very high performance 10m to 6m transverter	224.90
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SLNA 144ub	Unboxed version of the SLNA 144u	13.70
SLNA 145sb	Transceiver optimised preamplifier for the FT 290	29.90
SBLA 144e	Masthead-mounting 2m low-noise high dynamic range preamplifier. 250W through-power	Ring
GFBA 144e	Ultra-high performance masthead-mounting GaAsFet 2m preamplifier using advanced noiseless negative feedback for low noise figure and superb dynamic performance. 1000W pep (ssb) through-power. Supplied with ATCS 500 sequencer-controller	Ring
GLNA 432e	Masthead-mounting 430-440MHz high performance GaAsFet preamplifier. 0·9dB typical noise figure, 250W through-power. Supplied with ATCS 500 sequencer-controller	149.90
GLNA 433e	Masthead-mounting 430-440MHz high performance GaAsFet preamplifier. 1dB typical noise figure. Rf switching, 50W through-power	79.90

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BLNA 432ub	Sub-miniature 430-440MHz preamplifier. 1·3dB typical noise figure. Requires external filtering.	13.70
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RPCB 251ub	Complete replacement front-end for the IC211 and IC251	84.90
RPCB 271ub	Complete replacement front-end for the IC271 (e and h)	89.90
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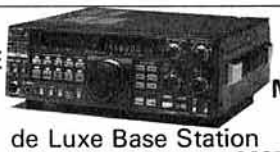

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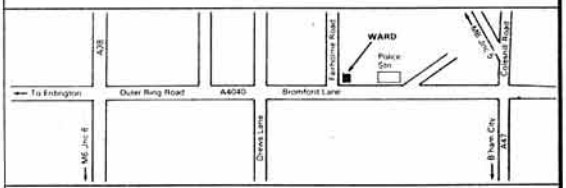

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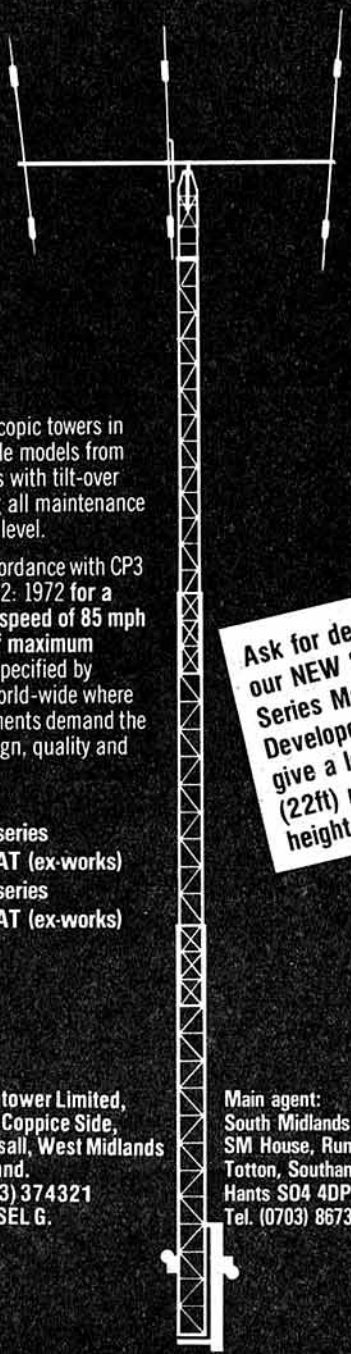

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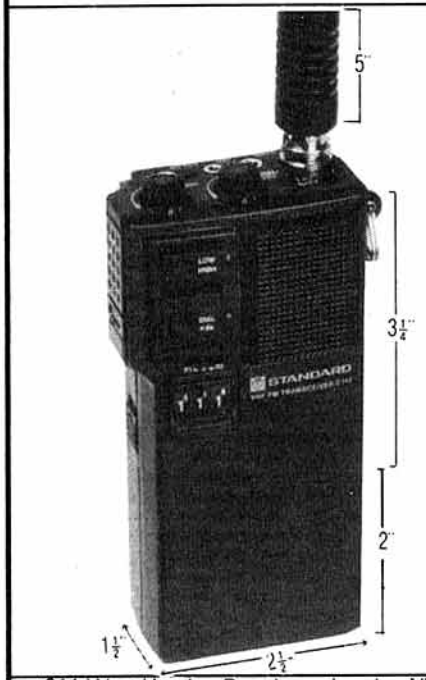

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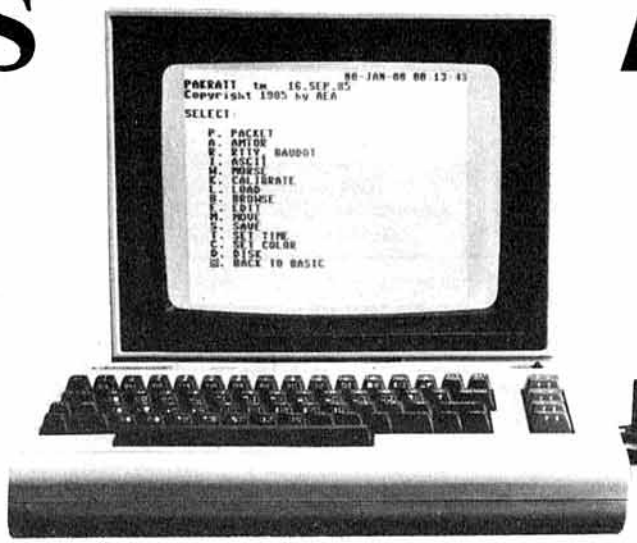

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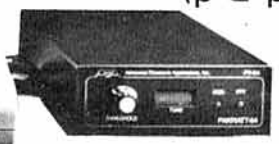

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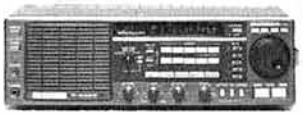

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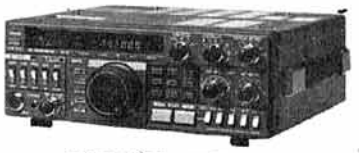

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Talk-in on 2 metres (S22) and 70cm.

Attractions include Amateur Radio electronics, computers, tools, club stands, bring & buy, raffles, competitions and club quiz. Also attractions for ladies and entertainment for children.

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UK Beacon List	42p	36p
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Radio Communication bound volume, 1983	£17.90	£15.22
Radio Communication bound volume, 1984	£17.90	£15.22
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RSGB hf contest log sheets (100)	£3.69	£3.14
RSGB vhf contest log sheets (100)	£3.69	£3.14
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Amateur Single Sideband (Ham Radio)	£5.78	£4.91
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THE NEW PROFESSIONAL "MINI" WHIPS

Now you can make your hand-held even more compact with one of the new professional "rubber ducks".

Highly efficient this new 2m helical whip is only 11.5cm long and yet has amazing performance. Fitted with BNC connector it is a direct substitute for your regular whip. VSWR is 1.5:1 between 144-146MHz.

SLIM 2 £7.95

Similar to the 2m version this whip covers the 70cms band and is only 8cm long. Just like the professionals this whip has amazing efficiency for its size. Better than 1.5:1 VSWR between 420-440MHz it is fitted with BNC for direct plug-in to your rig.

RUBBER DUCK 2 £7.95

THE SUPER RODS

The super-rod 2 is back! We've sold hundreds at rallies around the UK and its improvement in performance to the normal hand-held whip is astounding. Use it telescoped down for normal quarter wave operation or extend it to its full length for 5/8th wave performance.

SUPER ROD 2 £10.95

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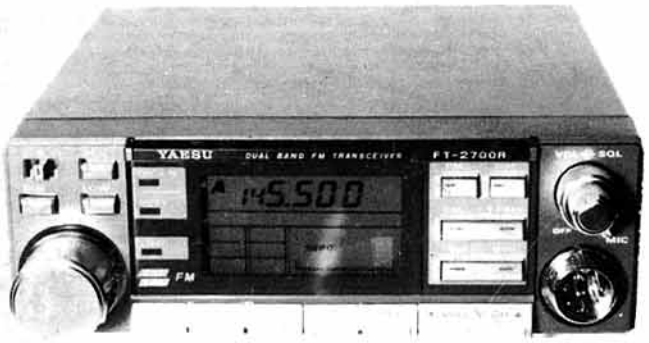

2M & 70cm FULL DUPLEX FT2700RH

The FT2700R, virtually two transceivers in one case, is designed to be the ultimate in convenience, for FM mobile or base station operation, on the 144 *and* 430MHz bands. Using Yaesu's new one piece die-cast aluminium chassis concept, the FT2700R provides 25 Watts continuous output on either band, for full duplex (or simplex!) operation whilst obtaining optimum circuit shielding and efficient heat dissipation.

SCANNING
Two 4-bit CPU's provide convenient control together with simple operation of the dual VFO's, 10 channel memory with back up and two calling frequencies.

Dual, receiver front ends, local synthesisers, IF's and transmitter RF stages make this the first mobile transceiver capable of *true* full duplex cross-band operation.

PRIORITY
Comprehensive scanning features include "PMS" (programmable memory scan) which permits continuous or skip-scanning between two memory channels in the same band. A MHz 'stepping' switch is fitted for quick transition from one band to another. Priority channel monitoring is available whilst on the same or another band!

CROSS BAND
Independently programmable transmit and receive frequencies, standard repeater shifts (with reverse facility), offers total freedom of operation.

READOUT
The large green back-lit dimmable LCD offers an aesthetically pleasing and easy to read display of the complete operating status of the transceiver, including memory and reverse repeater indications at a glance. The PO/S meter incorporated in the main display is a distinctive graphical two colour type. (Optional Voice Synthesiser available, see FT270R/RH text.)

GENERAL SPECIFICATIONS

Mode	: FM (F3, G3E)	Antenna	: 50ohms, unbalanced
Supply	: 13.8V ± 15%	Modulation	: Variable reactance
Circuit	: Double Conversion	Deviation	: ±5KHz
	: 21.6MHz, 455KHz	Tone Burst	: 1,750Hz
Sensitivity	: 0.2μV @ 12dB Sinad	Spurious	: −60dB (or better)
	: 1.0μV @ 30dB Sinad	Maximum BW	: 16KHz
Selectivity	: 14KHz −6dB	Microphone	: 600ohms, nominal
	: 28KHz −60dB	Temperature	: 10°C + 60°C
Image	: −60dB (or better)		
Audio	: 4 to 16ohms	**OPTIONS**	
	: 2W in 8ohms (10% THD)	FVS-1, MF-1B3B, SP55, YH1, SB10	

The FT270R/RH is constructed on a unique massive diecast aluminium ducted heatsink which enables significantly larger output powers to be obtained from a transceiver substantially smaller than any similar radio to date. The FT270RH, with fan assisted cooling provides 45W RF output whilst the conventional R version offers 25W. Both FT270R and RH are fitted with a "low" power switch which provides around 10% of full output.

DISPLAY
The FT270R/RH uses a high visibility back-lit LCD, with large 5mm digits, providing a readout of frequency and all important transceiver functions. Pleasant green illumination and newly developed wide angle LCD ensure easy visibility day or night from most angles.

MICROPROCESSORS
The dual 4-bit microprocessors of the FT270R/RH provide maximum ease of use combined with an extremely wide range of operating functions. Dual VFO's, ten memories and programmable band scan limits are all easily selectable from the front panel.

MEMORIES
The FT270R/RH can memorise a number of scanning parameters for maximising performance. Upper and lower limits may be set (for quick scanning of the band). The ten memories may be scanned for a busy channel or for monitoring a priority channel. The scanning can be either manually or carrier controlled.

VOICE SYNTHESISER
For easier and safer 'eyes on the road' mobile operation an optional voice synthesiser (FVS-1) is available to give an audible indication of frequency, memory channels and VFO selections at the touch of a convenient microphone mounted button. The FVS-1 is of course ideal for those with impaired vision.

45 WATTS OUTPUT FT270RH

FT2700RH		FT270R/RH	
Frequency	: 144-146MHz : 430-440MHz	Frequency	: 144-146MHz
Power out	: 2m 25/3W : 70cm 25/3W	Power out	: RH: 45W/5W : R: 25W/3W
Supply	: 7A (25W Tx) : 3A (3W Tx) : 0.6A (Sq Rx)	Supply	: RH: 9A/3.5A Tx : R: 6A/2.5A Tx : 0.6A (Sq Rx) R/RH
Stability	: 2M ± 10ppm, −5 + 50°C : 70cm ± 5ppm, −5 + 50°C	Stability	: ±10ppm (−5 + 50°C)
DIMENSIONS (Ex/Inc Projections) 150W, 50H, 130/185D mm, 1.6Kg		DIMENSIONS: (Ex/Inc Projections) 140W, 40H, 143/175D mm, 1.25Kg	

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Rumbridge Street
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