SEPTEMBER 1984 90p

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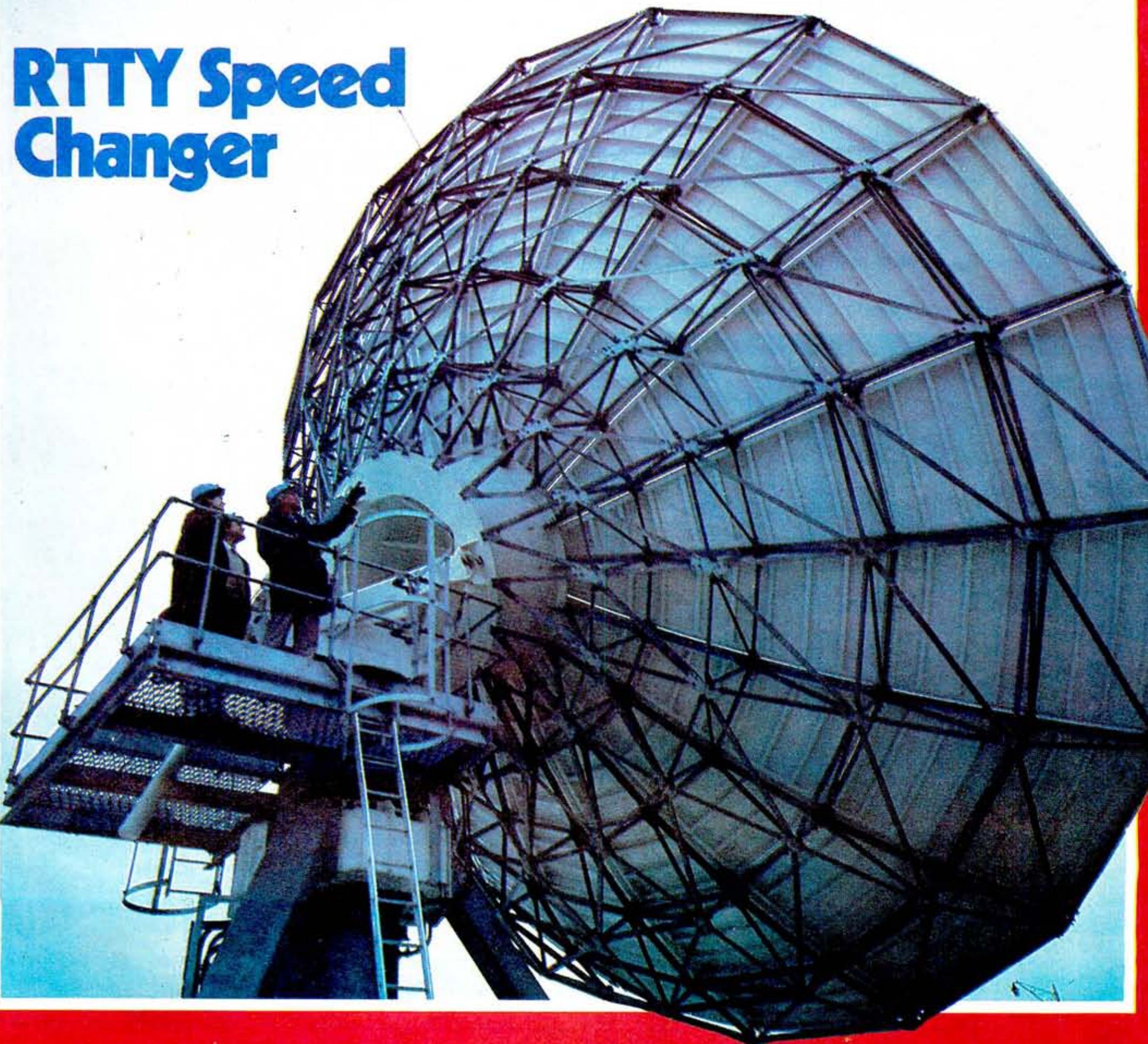
Practical Wireless

THE RADIO MAGAZINE

World-Wide Satellite Communications

RTTY Speed Changer



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Model C
TCSU-D
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Practical Wireless

FOR THE Radio ENTHUSIAST ...

Cover photograph courtesy of British TELECOM showing a recently installed antenna at the London Teleport - British Telecom's newest Satellite Earth Station

SEPTEMBER 1984 VOL. 60 NO. 9 ISSUE 930

Contents

We are sorry that Part 2 of Peter Rouse's series on the FRG–7 has had to be held over this month

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LOWE SHOPS

Whenever you enter a LOWE ELECTRONIC'S shop, be it Glasgow, Darlington, Cambridge, London or here at Matlock, then you can be certain that along with a courteous welcome you will receive straightforward advice. Advice given not with the intention of "making" a sale but the sort which is given freely by one radio amateur to another. Of course, if you decide to purchase then you have the knowledge that LOWE ELECTRONICS are the company that set the standard for amateur radio after-sales service. The shops are open Tuesday to Saturday and close for lunch 12.30 till 1.30pm.

In Glasgow the LOWE ELECTRONICS' shop (telephone 041 945 2626) is managed by Sim GM3SAN. Its address is 4/5 Queen Margaret's Road, off Queen Margaret's Drive. That's the right turn off Great Western Road at the Botanical Gardens' traffic lights. Street parking is available outside the shop and afterwards the Botanical Gardens are well worth a visit . . .

In the North East the LOWE ELECTRON... shop is found in the delightful ma... of Darlington (telephone 032... is managed by Don G3... address is 56 North ... is on the A167 ... huge free car p... supermarket and ... to make a visit to ... the whole family.

Cambridge, not only ... now the location of a ... shop managed by To... dress is 162 High Stree... bridge (telephone 0223 ... A45 just to the north of C... into the town on the A1039, ... park and turn left at the fi... After passing a children's ... your left turn left again into ... Easy and free street parking outside the shop.

The Capital City also has a LO... TRONICS' shop managed by Andy, ... Easy to find, the address is 278 Per... ...ie Road, London N1 9NR (telephone 01-837 6702) and the shop is located on the lower sales floor of Hepworths. That's only a 3 minutes walk from Kings Cross railway station. So, when you're in the Capital City, visit LOWE ELECTRONICS.

Finally, here in Matlock David G4KFN is in charge. Located in an area of scenic beauty a visit to the shop can combine amateur radio with an outing for the whole family. May I suggest a meal in one of the town's inexpensive restaurants or a picnic on the hill tops followed by a spell of portable operation.

The Directors and Staff of
Lowe Electronics
have pleasure
in inviting you, your wife and family
to their 1984 open day
to be held on Saturday 18th August.

We cannot seem to keep the TR9130 in an "in stock" situation. No sooner has a shipment arrived than we are "out of stock". I must say that even I am surprised by its popularity. Based on the renowned TR9000, the TR9130 has additional features that make it the most popular multimode on today's market. We are still getting requests for second-hand TR9000's and even they are a rarity on our second-hand shelf. Having a clear green readout, reverse repeater, the ability to tune whilst transmitting, 25 watts output, 6 memories and of course memory scan: TRIO's two metre multimode, the TR9130.


TR9130

TR9130 **£458.72 inc VAT.** carriage £6.00

There are two schools of thought regarding two metre mobile FM equipment. One group are of the opinion that the simpler the rig the better and refer to the TRIO TR7500 as the ultimate mobile transceiver ever made. There are others who require their mobile rig to have memory channels and all associated facilities in order to gain operational flexibility. TRIO cater for both.

The TM201A and th... A are simple rigs, designed to fit into the smallest of today's ...de the functions ... eration ... and ...


...201A

...**9.00 inc VAT.** carriage £6.00
...**.32 inc VAT.** carriage £6.00

...) frequency readout is also ...ly plugs into the side of the ...ket and velcro pads to ease fixing without drilling holes in the car's dashboard.

FC10 . . . **£42.00 inc VAT.** carriage £6.00

For a mobile transceiver having more operating features the TR7930 is the model to choose. The TR7930 is TRIO's logical progression from the very popular and ...7800. The design of the TR7930 takes into account the minor and ...ble criticisms levelled against the TR7800. You will now find the frequency ...adout is a green backlit liquid crystal display that can be read in the brightest of sunlight. The memory allocation has been increased to a total of 21 channels and the rig can be instructed to hold on the received signal for either a timed period or until the signal disappears. Programmable band scan is also available between user defined limits. To make mobile operation safer the transceiver is preprogrammed so that if you select for example, 145.450 then the rig will adopt the simplex mode, if you select 145.650 then, automatically, you will get repeater mode. Of course TRIO have made it easy to over-ride this feature as you would naturally expect. I can say no more about the TR7930, a comprehensive rig for the mobile enthusiast.

TR7930 . . . . **£323.30 inc VAT.** carriage £6.00

To improve mobile operation there is the TRIO MC55 boom microphone. Not jut an electret condenser microphone but having a transmission timer, up/down frequency shift switch, adjustable microphone gain and fitted with either a 6 or 8 pin microphone plug. To monitor the swr/output power of your mobile installation TRIO have produced the SWR100A/B. (model A: 1.8 to 150 MHz and model B: 140 to 450 MHz) Compact and easily fixed to your dashboard, be the first to know something is wrong with your mobile station.

MC55 . . . . **£39.96 inc VAT.** carriage £2.00
SW100A/B . . . . **£37.97 inc VAT.** carriage £2.50

LOWE ELECTRONICS

Chesterfield Road, Matlock, Derbyshire. DE4 5LE.
Telephone 0629 2817, 2430, 4057, 4995. Telex 377482.
(Delivery of stock items normally by return of post)

For the real VHF/UHF enthusiast there is only one FM mobile rig that in one compact unit has both 2 metres and 70 centimetres. The TRIO TW4000A. Not a cheap piece of equipment, the TW4000A has to be seen to be appreciated. Having many features to assist mobile operation the TW4000A also speaks. Unless you have actually operated the rig with the optional VS1 voice synthesizer fitted, then you cannot really make a considered judgement. It is easy to say that such a feature is a gimmick but I, on my journeys up and down the country, have found that having the frequency, memory number etc announced in clear distinct voice is much better than stealing a glance at the display. A recent review in AMATEUR RADIO magazine (December 1983) tells more.

TW4000A .... **£469.00 inc VAT.** carriage £6.00
VS1 .... **£24.50 inc VAT.** carriage £0.75
(in fact the VS1 is not a voice synthesizer, it is the digitally recorded voice of a Japanese girl programmed into a dedicated chip, her Japanese diction can be had as an alternative by moving an internal switch on the VS1 board from position EN to JA.)

Don't let us forget the two handhelds from TRIO, the 2 metre TR2500 *and the* 70 centimetre TR3500. Both very popular pieces of equipment. Reliable and functional. Each having ten memories, memory scan, programmable scan, repeater and reverse repeater shift and a comprehensive range of accessories compatible to both models.

TR2500

TR2500 .... **£237.82 inc VAT.** carriage £6.00
TR3500 .... **£256.45 inc VAT.** carriage £6.00

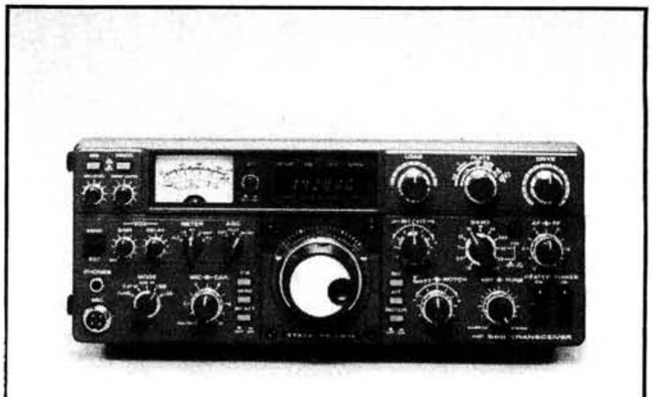
Two general coverage receivers are available from TRIO, the R600 and the R2000. The R600 is the basic model and covers continuously frequencies from 150 KHz to 30 MHz having AM, CW and SSB modes. The R2000 is more sophisticated having the same coverage but FM in addition to the usual modes found on a high quality general coverage receiver. Ten memories, memory scan, programmable band scan between user defined limits all add to the enjoyment to be had from a TRIO R2000. To create the perfect receiver an optional VHF converter covering again continuously 118 to 174 MHz and fitting inside the receiver is available. The nice thing about the VHF converter is that the frequency readout of the R2000 is also corrected so that if you are tuned to 145.600 then that is what the readout displays.

R2000

R600 .... **£263.00 inc VAT.** carriage £6.00
R2000 .... **£421.20 inc VAT.** carriage £6.00
VC10 .... **£113.00 inc VAT.** carriage £6.00

It appears my enthusiasm for the TS530SP has made me forget to keep you informed of the TRIO TS830S HF transceiver. The problem is the number of superb products in the TRIO range. To mention them all each month is impossible.

The TS830S valve transceiver (pair of 6146B valves) is by now a rig which really requires no description. There must be within your sphere of amateur radio operation someone who uses a TRIO TS830S and that person is the equipment's best advertisement. The transceiver covers the full amateur bands and has for its owner, features that will ensure excellent world wide contacts. The variable band width and IF shift system designed by TRIO and now unsuccessfully copied by others, presents the TS830S owner with the ultimate in flexibility. The operator can vary the IF passband width whilst its centre frequency remains unchanged. Much easier than having to constantly retune whilst narrowing the bandwidth. Additionally, whilst keeping the bandwidth at its optimum setting, the pass band of the filter can be moved using the IF shift control. The result, offending adjacent signals are removed and better reception assured. Add to an already comprehensive transceiver a notch filter, audio tone control and RF speech processor and you have the perfect amateur band rig. Take a listen on the bands, find an amateur using a TRIO TS830S and imagine owning one.



TS830S

TS530SP .... **£638.00 inc VAT.** carriage £6.00
TS830S .... **£731.40 inc VAT.** carriage £6.00
TS130S .... **£555.45 inc VAT.** carriage £6.00
TS430S .... **£752.10 inc VAT.** carriage £6.00
TS930S .... **£1150.00 inc VAT.** carriage £6.00

So that a full amateur radio station can be set up, TRIO have a comprehensive range of microphones, headphones, separate VFO's, aerial tuning units, for the TS430S and TS930S, the ATU's can be automatic, etc.
The items are too numerous to list, full details and prices can be obtained from any LOWE ELECTRONICS shop.

★★★★★★★★★★★★★★★★★★★★★★★★

The **LOWE TX40 CB transceiver** is now well known on the band. Many have bought other rigs, only to be dissatisfied. They have then heard about the **TX40** from their friends, bought one and been delighted. The rig performs as a well designed rig should. And for those who think otherwise, the CB frequencies are now populated by operators having pleasant contacts. The band has come of age. The **LOWE TX40** has been available for some time now for the sum of £29.50 inc VAT, carriage £3.00.

For the discerning a deluxe version is available for an additional £8.50.

This rig has an extra filter fitted to enhance listening when the band is busy. Take this opportunity to buy at this special price a LOWE TX40 CB transceiver.

★★★★★★★★★★★★★★★★★★★★★★★★

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FNB3	10.8V NiCad Pack (425mAH)	£33.50
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CSC7	Soft case (FNB4 fitting)	£6.85
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MH-12A 2b	Speaker/Microphone option	£17.69
MMB21	Mobile mounting bracket	£8.00
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NC15	Charger (quick) and Power Unit	£49.95

FT230R & FT730R FM MOBILES

FT230R	2m Transceiver 25w	£269.00
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S — SMC SPECIAL / SUPER SAVER

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FT208R	2M Handheld 2.5W	£209.00
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NC8	Charger (quick) and Power Unit	£56.75
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FLC5	Heavy duty case	£22.00
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Two 5 slot memories A, B, A + B, A × B.
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FOR THE SWL...

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The R-70 also has separate antenna sockets for LW-MW with automatic switching, and a large, front-mounted loudspeaker with 5.8W output. The frequency stability for the 1st hour is ± 50Hz, sensitivity – SSB/CW/RTTY better than 0.32 uv for 12dB (S + N) ÷ N, Am – 0.5 uv. FM better than 0.32 for 12dB Sinad. DC is optional.

Ever since its introduction the IC-R70 has proved to be a popular and reliable HF receiver making your listening hours a pleasure. Please contact us for further details on this excellent set.

IC-R71E, £649.

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OPTIONS:- Synthesized voice readout, infra-red remote controller, 12 V DC kit, mobile mounting bracket, two CW filters 500 and 250 Hz, FM unit, computer interface, headphones.

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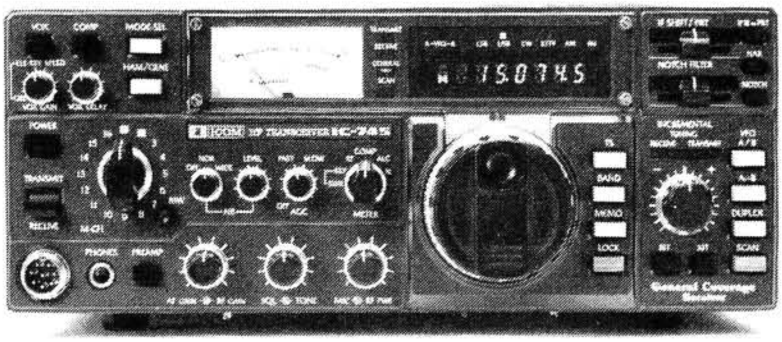
FOR THE DX'er...

IC-745, £839.



ICOM's IC-745 is the all-in-one transceiver featuring an HF all band SSB, CW, RTTY, AM (receive only) ham transceiver, plus a general coverage receiver. Options for FM transceive and an internal power supply make the IC-745 the complete transceiver in an all-in-one package.

The receiver section features a 100KHz to 30MHz general coverage receiver, this allows access to all HF bands plus all the frequencies in between. The IC-745 has an adjustable AGC circuit and DFM (Direct Feed Mixer) giving a wide dynamic range of 103dB with an intercept point at + 18dBm. Exceptionally clean reception is achieved with a low noise PLL circuit and a 70MHz first IF.

The IC-745's features include IF shift, 16 programmable memories with lithium battery back-up, passband tuning, a noise blanker both wide and narrow, threshold level control, notch filter, receive audio tone control and an all mode squelch. Also available is a front end switchable receiver preamp providing 12dB gain. RIT has a ±1KHz range.

We could go on all day about the 745, get in touch with us and we will send you the full story.

IC-271H, £819.

The IC-271H is the most advanced 2 meter transceiver available today, it covers the spectrum from 144-146 MHz with FM, SSB, or CW using the most advanced 10Hz PLL system. The IC-271H is suitable for simplex, repeater operation, moonbouce or satellite work, and has features found on no other transceiver.

Some standard features include 32 tunable memories, a high visibility fluorescent display, RIT readout, scanning, 12V DC operation with optional AC power supply.

The 271H has a speech synthesizer that announces the displayed frequency, ideal for blind operators, this is an optional extra along with the SM6 desk microphone and 22 channel memory extension with scan facilities.

As you can see from this brief description the IC-271H, (and its 430-440MHz brother the IC-471H) are very versatile sets indeed. More detailed literature can be easily obtained from Thanet Electronics Limited.

Agent: Gordon G3LEQ, or telephone Knutsford (0565) 4040.
Please telephone first, anytime between 0900 – 2200 hrs.

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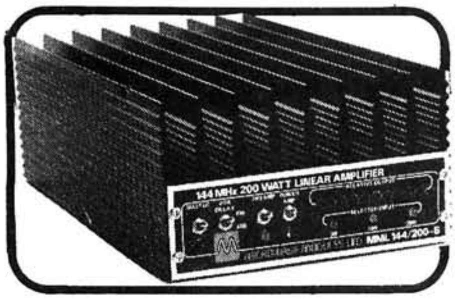

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Output frequency range	: 28-30 MHz	**Input/output Impedance**	: 50 ohm
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Noise figure	: 2 dB	**Power connector**	: 5 pin DIN socket
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Size : 110 × 60 × 31 mm (4⅜ × 2⅜ × 1¼")

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☆ Utilises NE72089 GaASFET.

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The design utilises MOSFETs in the RF amplifier and mixer stages, and the local oscillator is requlator controlled.

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PW Comment

Better Late Than Never!

AT LEAST, I HOPE THAT'S WHAT YOU'RE THINKING. This issue of *Practical Wireless* has been delayed by an industrial dispute within IPC Magazines, but I'm glad to say that this has now been resolved, and things should rapidly return to normal. Computing buffs among you will unfortunately have to wait a little longer for the next issue of *Computing in Radio*. This had been scheduled to come out with the October *PW*, but will now be in the November issue. Apologies also to readers who went to the Mercury, Longleat and Sussex rallies expecting to see us there. Look out for our stands at the Lowe Open Day (18/8), Wimborne (19/8), Glasgow (8/9), Lincoln (23/9) and Blackwood (30/9), and don't forget our Leisuretronics Exhibition at Horticultural Halls, near Victoria Station in London 8-11 November.

The Wireless Telegraphy provisions of the Telecommunications Act 1984 came into force in the UK on 16 July. These should go some way towards giving the powers necessary to stop the worst abuses of the radio spectrum, and also to do away with some of the "sillies" of previous legislation. For example, the situation whereby it is in general illegal to manufacture or import 27MHz a.m. or s.s.b. CB rigs, but perfectly all right to advertise, sell or possess them (so long as you don't actually install and use them!)

We'll be going into the implications of the new Act more deeply in a future *PW*, though exactly how it will work in practice will depend on interpretation and on precedents which will build up from legal actions taken under its provisions. The RSGB is, we understand, in consultation with the Department of Trade and Industry to try to ensure that radio amateurs do not suffer undue restriction in carrying on the normal legitimate pursuit of their hobby. It is never easy to draft laws which are effective against the law-breaker whilst maintaining the rights and freedoms of the law-abiding majority.

One provision which could do a lot to ease the problems of TVI and BCI which beset the radio amateur is one which will allow minimum technical standards to be laid down for interference rejection in radio/TV and associated equipment. Several other countries have had rules of this sort for some years, so we have quite a bit of catching-up to do. Once again a case of better late than never!

Geoff Arnold

PW Services

QUERIES
While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the **Editor, "Practical Wireless", Westover House, West Quay Road, Poole, Dorset BH15 1JG,** giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the "Buying Guide" box included in each constructional article.

PROJECT COST
The approximate cost quoted in each constructional article includes the box or case used for the prototype. For some projects the type of case may be critical; if so this will be mentioned in the Buying Guide.

INSURANCE
Turn to the following page for details of the PW Radio Users Insurance Scheme, exclusive to our readers.

CONSTRUCTION RATING
Each constructional project will in future be given a rating, to guide readers as to its complexity:

Beginner
A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently. Generally this category will be used for simple projects, but sometimes for more complicated ones of wide appeal. In this case, construction and wiring will be dealt with in some detail.

Intermediate
A project likely to appeal to a wide range of constructors, and requiring only basic test equipment to complete any tests and adjustments. A fair degree of experience in building electronic or radio projects is assumed.

Advanced
A project likely to appeal to an experienced constructor, and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Constructional information will generally be limited to the more critical aspects of the project. Definitely not recommended for a beginner to tackle on his own.

SUBSCRIPTIONS
Subscriptions are available at £13 per annum to UK addresses and £14 overseas, from **"Practical Wireless" Subscription Department, Room 2816, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

BACK NUMBERS AND BINDERS
Limited stocks of some recent issues of *PW* are available at £1 each, including post and packing to addresses at home and overseas.

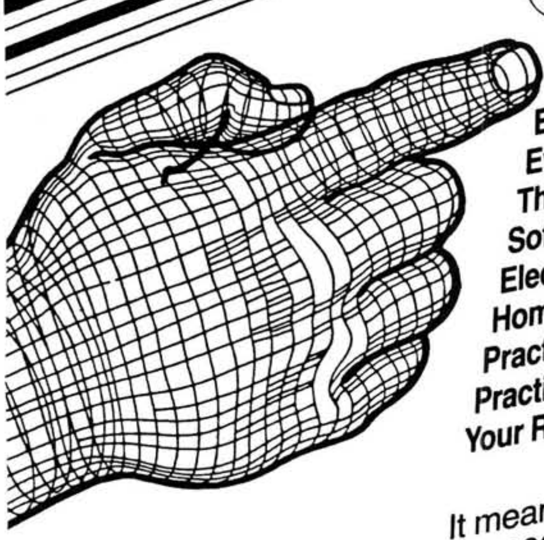
Binders are available (Price £5.50 to UK addresses, £5.75 overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

Send your orders to **Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.** All prices include VAT where appropriate.

Please make cheques, postal orders, etc., payable to IPC Magazines Limited.

LOOK WHO'S BACKING

LEISURE TRONICS



Electronics & Music Maker
Electronics & Wireless World
Everyday Electronics
The Guitarist
Software Index
Electronics & Computing
Home Studio Recording
Practical Electronics
Practical Wireless
Your Robot

It means more than 250,000 enthusiasts, buyers of your equipment and products, will know that this event in the pre-Christmas peak time, offers exciting new ideas for them. Whatever their main interest. If they are making music, building robots, tracking satellites, making the garage door open automatically, re-cording the group's latest offering, talking to their overseas friends, program-ming computers or playing games – at LEISURE-TRONICS they will find that and **plus, plus, plus**. There are seminars and demos lined-up. There are prizes being given away. There's radio. T.V. tube station advertising planned.

LEISURE TRONICS

is all set to EXPLODE in the UK.

Make sure your company is where the action will be in November 8/9/10/11, at the ROYAL HORTICULTURAL HALL, London. Ring David Timmins, Trident International Exhibitions Ltd, 21 Plymouth Road, Tavistock, Devon PL19 8AU, England. Telephone 0822 4671, Telex 45412 TRITAV for details.

RAE Courses

Courses to prepare students for the Radio Amateurs Examination (City and Guilds 765) will be available at the following locations:

Abergavenny—*Nevill Hall Hospital, Abergavenny,* commencing Tuesday 11 September. Morse classes and private tuition are available, for further details contact the Course Tutor D. F. Jones GW3SSY, 80 Croesonen Parc, Abergavenny, Gwent NP7 6PE. Tel: (0873) 78674.

Basildon—*Basildon Adult Education Centre, Fryerns School, Craylands, Basildon. Tel: (0268) 20599.* Commencing in September, further details can be obtained from the Centre.

Bradford—*Bradford & Ilkley Community College, Great Horton Road, Bradford, West Yorkshire BD7 1AY. Tel: (0274) 753111.* Starting in September, enrolment will commence on 11 September. This is a two year course, the first year to prepare for the RAE and the second year for the Post Office Morse test. The second year is optional and is available to Class B holders who wish to obtain an A licence. The Course Tutor will be P. Nurse.

Bristol—*Brunel Technical College Bristol, Ashley Down, Bristol BS7 9BU. Tel: (0272) 41241.* Two courses are to be run, the RAE on Monday evenings and a Morse course on Tuesday evenings. Enrolment is on 3 and 4 September and the courses commence on 17 and 18 September. The Course Tutor will be Phil Brouder G3ZJH and further details are obtainable from the college's Department of Aerospace and Radiocommunications Engineering, telephone extension 64.

Chingford—*Friday Hill House, Simmons Lane, Chingford, London E4.* Commencing at 7.30pm on Thursday 13 September (enrolment to take place on the first night) and the Course Tutor will be Alan P. Foss G8EAY. Further details from the above address or tel: 01-529 3380.

Crawley, Sussex—*Ifield School, Lady Margaret Road, Crawley, Sussex RH11 0DB.* Enrolment between 7.00 and 9.00pm on 10 or 12 September and the course commences on Monday 17 September for 27 weeks. For further details contact the Course Tutor Steve Webb G4GHO. Tel: (0293) 25742.

Derby—*Derby College of Further Education, Wilmorton, Derby DE2 8UG. Tel: (0332) 73012.* Enrolment on 10 and 11 September and the course commences on Wednesday 19 September. Further details are available from the Course Tutor F. Whitehead G4MLL, at the college.

Farnborough, Hants.—*The Wavell School, Lynchford Road, Farnborough, Hants. Tel: (0252) 518305.* The course starts on Thursday 27 September. For details of enrolment etc., telephone the above number.

Halifax—*Whitley Adult Education Centre, Holdsworth Road, Holmfield, Halifax.* Commencing at 7.00pm on Thursday 20 September and the Course Tutor will be Revd. H. Makin G3FDC. Tel: (0422) 244642.

Hemel Hempstead, Herts.—*Dacorum College, Marlowes, Hemel Hempstead, Herts. HP1 1HD. Tel: (0442) 63771 Ext. 56.* Enrolment 10 September and the course commences on Wednesday 26 September between 6.30 and 9.00pm. A further course will be held on Tuedsay evenings, if demand is sufficient. The Course Tutor will be C. B. Burke G3VOZ and details are obtainable from the college.

Huddersfield—*Almondbury Adult Education Centre,* a 30 week course starting in September. Details from Kirklees Adult Education Office. Tel: Huddersfield (0484) 38454. Also a short refresher course to prepare for the December 1984 RAE will commence on 17 September at Greenhead College, Huddersfield. Details from the Course Tutor, Peter Mercer G6CPM. Tel: (0484) 33036 or Kirklees Adult Education Office. Tel: (0484) 38454.

Leamington Spa—*Mid-Warwickshire College of Further Education, Warwick New Road, Leamington Spa CV32 5JE.* Commencing September, enrolment 6 and 7 September and further details are available from Mr C. Evans on (0926) 311711 ext. 258.

London, North—*De Beauvoir Evening Institute, Tottenham Road, Dalston, London N1.* Commencing Wednesday 26 September at 7.30pm, enrolment at the Institute for the week commencing 17 September between 7.00 and 9.00pm. The Course Tutor will be T. C. Clark G4BZW. Tel: 01-249 1843.

London, North West—*Williams Building, Hendon College of Further Education, The Burroughs, London NW4 4BT.* Starting in September on Tuesday evenings between 7.15 and 9.15pm, enrolment 12 September between 2.00 and 8.00pm. The Course Tutor will be Tony Essex G8WCX.

London, Paddington—*Paddington College, Department of Engineering Technology, 25 Paddington Green, London W2 1NB. Tel: 01-402 6221.* Starting in September, this extended course utilises the facilities of the Electrical Engineering Department to the full and subsequently requires students to attend the college twice a week. Enrolments are on 10, 11 and 12 September between 1.00 to 4.00pm, and 6.00 to 8.00pm. The Course Tutors are David Peace G4KKM and David Hunt G6MFR, for further information, contact David Peace. Tel: 01-402 6221 ext. 54.

Loughborough — *Loughborough Technical College, Department of Electrical Engineering & Computing, Radmoor, Loughborough, Leics. LE11 3BT. Tel: (0509) 215831.* Commencing Tuesday 11 September for 26 weeks. This split course will cover Morse code between 6.00 and 7.00pm, and RAE Theory and Regulations between 7.00 and 9.00pm. The Course Tutor will be Doug Doughty G3FLS.

Manchester, Stretford—*North Trafford College of Further Education, Talbot Road, Stretford, Manchester M32 0XH. Tel: 061-872 3731 ext. 45.* RAE on Monday or Thursday evenings, or Wednesday afternoon, with a Morse class on Tuesday evening or Wednesday morning. Enrolment 10, 11 and 12 September. The Course Tutor will be J. T. Beaumont G3NGD.

Manchester, Swinton—*Pendlebury High School, Cromwell Road, Swinton.* Commencing end of September on Mondays at 7.30pm and the Course Tutor will be P. Whatmough G4HYE. There will also be a Morse class on Tuesdays at 7.30pm under the instruction of W. Stevenson G4KKI, who will also run a constructors' class if there is sufficient demand. Details from G4HYE. Tel: 061-794 3706, or from Swinton Adult Education Centre, tel: 061-794 5798.

Newcastle upon Tyne—*Gosforth Adult Association, Gosforth Secondary School, Gosforth, Newcastle upon Tyne.* Starting in September on Tuesday evenings between 7.00 and 9.00pm. Further information from either the Principal of the Association, or the Course Tutor D. R. Loveday G3FPE, tel (0632) 668439.

Nottingham—*Arnold and Carlton College of Further Education, Digby Avenue, Mapperley, Nottingham NG3 6DR. Tel: (0602) 876503.* This college runs a number of courses for those interested in amateur radio. The full RAE course starts on Wednesday 19 September at 7.00pm, with a crash course for the December examination starting on Thursday 20 September at 6.30pm. A later crash course for the May 1985 examination will start on 10 January

continued over ▶

1985. On Tuesday 18 September at 7.00pm a Constructors' Class will start, later in 1985 two courses entitled "After the RAE" and "An Introduction to Amateur Radio" will be available. Enrolment for the courses starting in September will be on 11 and 12 September, and further details of all the courses are obtainable from the college.

Sleaford, Lincs.—*St. George's School, Sleaford, Lincs.* Commencing Monday 24 September. Enrolment may be by post from 7 September (include fee) or at the first session. Further information from the Adult Education Centre, Westholme, Leicester Street, Sleaford. Tel: (0529) 305211 (mornings only from 5 September).

Slough—*Langley College of Further Education, Station Road, Langley, Slough. Tel: (0753) 49222.* Classes are held on Wednesday and Thursday evenings and are divided into three modules, students may select modules to their own requirement. Enrolment 11 and 12 September between 12.30 and 8.00pm. Further information is available from the Course Tutor A. J. Parcell G8BIX, at the college.

Smethwick—*Warley College of Technology, Crocketts Lane, Smethwick, Warley, Sandwell, West Midlands B66 3BU. Tel: 021-558 4121.* Commencing in September, students should contact Mr D. Wilson on ext. 221, as soon as possible, for further details and enrolment details.

Stockport—*Reddish Vale Evening Centre, Reddish Vale Road, Reddish, Stockport.* Commencing Monday 24 September between 7.00 and 9.00pm. A Morse course will start on Thursday 27 September between 7.00 and 9.00pm. Enrolment, for both courses, 17, 18 and 20 September between 7.00 and 9.00pm. Further details from Dave Wood G4UJD at the college on ext. 10 between 9.00am and 4.00pm.

Walsall—*Walsall College of Technology, St Paul's Street, Walsall WS1 1XN. Tel: (0922) 25124.* Commencing in September, enrolment is on 4, 6 and 10 September. The Course Tutor will be F. Fear, and further details may be obtained from tel: Aldridge (0922) 52706.

Weston-super-Mare—*Weston-super-Mare Technical College.* Commencing Tuesday 11 September, enrolment 3 and 4 September. Further details from B. A. Harris G3XGY. Tel: (0934) 514674.

Weybridge—*Brooklands Technical College, Department of Technology, Heath Road, Weybridge, Surrey KT13 8TT. Tel: (0932) 53300 ext. 246.* Commencing Wednesday 19 September between 6.30 and 8.00pm, enrolment 10, 11 and 12 September between 6.00 and 8.00pm. The Course Tutor will be Chris Roberts G4EVA and further information from the college.

Wigan—*Wigan College of Technology, Parsons Walk, Wigan WN1 1RR. Tel: (0942) 494911.* Commencing in September on either Tuesday or Wednesday evenings with the possibility of an afternoon class. Further details from the Course Tutor J. R. Hesford G4UAE. Also G3AVJ will be running a Morse class and constuctors' evening.

Lowe's Open Day

On the 18 August, Lowe Electronics will be holding their Open Day at their Matlock HQ. Practical Wireless will be attending, as will the RSGB, John Birkett and his bits from Lincoln and Strumech with their towers.

In the grounds, other attractions will include a local brass band, hot dogs, ice creams and drinks etc., and of course there will be ample free car parking.

During the day conducted tours will take place, ending in the workshop where demonstrations of their extensive, expensive test equipment will take place.

Finally, if you can't afford to buy anything, you could win a prize in the free raffle.

Lowe Electronics, Bentley Bridge, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2430, 4057 and 4995.

On the Move

Worthing and District Amateur Radio Club have moved venue, they now meet every Wednesday at 7.30pm at Lancing Parish Hall, South Street, Lancing, West Sussex, which is to the East of Worthing conveniently located between the main A27 and the seafront road within easy walking distance of Lancing Station.

New members and anyone with an interest in radio communications are always welcome.

Further information from the Club Secretary: *Eric Sandaver G4KIT, 33 North Farm Road, Lancing, BN15 9BT. Tel: (0903) 766318.*

Eastern Communications have recently moved to new larger premises in the centre of Norwich. The move has enabled them to carry a much larger range of amateur radio products, as well as marine and p.m.r. systems.

Included in the new premises is a fully stocked branch of Amateur Electronics UK, including a servicing centre, covering East Anglia.

Eastern Communications, 31 Cattle Market Street, Norwich.

Taiwan QRV

Taiwan, Republic of China is to legalise amateur radio for any persons having passed the appropriate technical examination, with effect from July 1984. Previously, there was only one legally licensed amateur in Taiwan, whose licence was issued before the Administration moved from mainland China, and more recently a number of unlicensed amateurs had been active in club nets.

Insurance

Readers who are interested in applying to the *PW Radio Users Insurance Scheme* are advised to use the coupon published on page 18 of a previous issue.

Beginners' Morse Code

Beckenham, Kent—*Beckenham Adult Education Centre, 28 Beckenham Road, Beckenham, Kent. Tel: 01-650 4208.* Commencing in September, enrolment 4 and 5 September at the Centre. The Course Tutor will be Fred Henschel.

RAC Amateur Radio Group Scheme—Special Offer

Details of this scheme were published in our June 1984 issue, and the attraction of a discounted membership rate has resulted in many applications to join the scheme.

To enhance the discounted rate even more, the RAC is waiving the £3 joining fee for all new members whose application forms are received by the RAC before 31 August 1984. Application forms and details of the scheme can be obtained from: *Mr A. W. Hutchinson, 88 Broomfield Road, Chelmsford, Essex CM1 1SS.*

BASIC QSOs in ITALIAN

Part 3

by G.W. Roberts GW4JXN and Paolo Pellegrineschi I5IJP

Concluding Remarks

May I thank you once more for this call and wish you a very good morning/afternoon/evening/good weekend.	Ti ringrazio ancora per questo collegamento e ti auguro una buona giornata/buon pomeriggio/buona serata/buon fine settimana.	Tea ringratseo ankorapper kwesto koliegamento e ti awgoro wna bwona djiornata/bwon pomayridgow/bwona serata/bwon finay setimana.
Merry Christmas and a Happy New Year.	Buon Natale e Felice Anno Nuovo.	Bwon Natalay ay Faylitshay Anio Nwovo.
I send you my best regards.	Ti invio i miei cari saluti.	Te inveeo i meeayee carry salwtee.
All the best to you and yours.	I miglioro saluti per te ed i tuoi.	I miliori salwti per te ed ee twoi.
I look forward to working you again.	Spero ricollegarti ancora.	Shpero reekoliegartea ancora.
May I wish you 73, 55, 88 and make this my final.	Ti invio i miei settanta-tre, cinquanta-cinque, ottanta-otto, terminando con questo finale.	Te inveeo ee meeayee setanta tray, tshinkwanta-tshinkway, otanta-otto terminando con kwesto finalay.
Back to . . . from . . . who is waiting for any concluding remarks from you.	Il cambio a . . . da . . . chi é in attesa per conclusioni finali.	Il kambeeo a . . . da . . . key ay in atayza per conclwzeeonee finalee.
So best wishes and good DX.	I migliori auguri e buoni DX.	I milioree awgwree ay bwonee DX.
Goodbye until next time/until the pleasure of seeing you again.	Arrivederci al prossimo incontro/al piacere di risentirti ancora.	Arrivaydertshee al prosimo incontro/al peeatshayray dee risentitee ancora.

Stating Future Intentions

This is . . . signing off and clear with . . . and now standing by for a call on this frequency.	Questo é . . . che termina con . . . e resta in attesa di chiamata su questa frequenza.	Kwesto ay . . . kay termina con . . . ay resta in atayza dee keeamata sw kwesta frekventsa.
. . . now monitoring this frequency and waiting for any call.	. . . ora resta su questa frequenza in attesa di qualsiasi chiamata.	. . . ora restasw kwesta frekventsa in atayza dee kwalsiasee keyiamata.
. . . now changing frequency to . . .	. . . ora si sposta di frequenza su . . .	. . . ora see sposta see frekventsa sw . . .
. . . now returning to the calling channel.	. . . ora che ritorna sul canale di chiamata.	. . . ora kay ritorna swl kanalay dee keyiamata.
. . . now going QRT.	. . . ora passa in QRT.	. . . ora passa in Kw-Er-Tea.

Here is a list of the most common radio technical words and phrases. No pronunciation is given this time as it is assumed that if you use them you have some basic Italian!

absorption wavemeter	ondametro ad assorbimento (m)
ammeter	amperometro (m)
amplifier	amplificatore (m)
amplitude modulation	modulazione di ampiezza (f)
antenna	antenna (f)
antenna matching	accoppiatore di antenna (m)
antenna tuning unit	accordatore di antenna (m)
aurora	aurora (f)
auroral	aurorale (f)
balun	unità di bilanciamento (f)
calibrator	calibratore (m)
carrier frequency	frequenza portante (f)
coaxial cable	cavo coassiale (m)
coil	bobina (f)
condenser	condensatore (m)
continuous wave	onda continua (f)
cross-modulation	intermodulazione (f)
dial	quadrante (m)
a digital frequency meter	un frequenzimetro (m)
disturbance	disturbo (m)
dummy load	carico fittizio (m)
earth	terra (f)
fading	evanescenza (f)
feeder	alimentatore (m)
final stage	stadio finale (m)
fixed	fisso
frequency modulation	modulazione di frequenza (f)
ground wave	onda terrestre (f)
high pass filter	filtro passa-alto (m)
indoor antenna	antenna interna (f)
insulator	isolatore (m)
ionosphere	ionosfera (f)
jack	presa (f)
lightning protection	protezione da fulmini (f)
line of sight	linea di visibilita (f)
log book	giornale di stazione (m)
lower sideband	banda laterale inferiore (f)
low pass filter	filtro passa-alto (m)
metal case	cassetta metallica (f)
a meter	uno strumento di misura (m)
modulated wave	onda modulata (f)
operator	operatore (m)
oscillation	oscillazione (f)
parasitic oscillations	oscillazioni parassite
plug	spina (f)
power supply	alimentatore di corrente (m)
preset	preregolato
preset potentiometer	dispositive di pre-regolazione (m)
pulse modulation	modulazione ad impulsi (f)
to radiate	irradiare
the range	portata (f)
readability	comprensibilità (f)
repeater	ripetitore (m)
resistance	resistenza (f)
resistor	resistore (m)
r.f. amplifier	amplificatore r.f. (radio frequenza) (m)
rig	equipaggiamento (m) attrezzatura (f)
rotator	rotatore (m)
satellite	satellite (m)
selectivity	selettivita (f)
sensitivity	sensibilità (f)
shielded braiding	calza schermata (f)
sideband	banda laterale (f)
single sideband	banda laterale singola (f)
skip zone	zona di riflessione (f)
sky wave	onda spaziale (f)
solid state	stato solido
sound frequency	frequenza sonora (f)
speech processor	compressore microfonico (m)
standing wave	onda stazionaria (f)
standing wave ratio	rapporto onde stazionarie (m)
switch	interruttore (m)
transceiver	ricetrasmettitore (m)
transistor	transistor (m)
transmitter	trasmettitore (m)
troposphere	troposfera (f)
tuned circuit	circuito accordato (m)
to tune up	accordare
upper sideband	banda laterale superiore (f)
valve	valvola (f)
variable	variabile
vertical antenna	antenna verticale (f)
vertical rod	stilo verticale (m)
voltmeter	voltmetro (m)
wavelength	lunghezza d'onda (f)

Common Italian first names of operators—this allows you to copy them down sooner in the QRM if you can recognise them

Angelo	Eduardo	Mario
Alberto	Enrico	Marco
Andrea	Filippo	Michele
Antonio	Ferdinando	Pietro
Alessio	Fausto	Raimondo
Augosto	Fortunato	Riccardo
Alfredo	Giuseppe	Roberto
Bernardo	Giovanni	Rinaldo
Bruno	Gabriele	Stefano
Cesare	Giuglio	Sergio
Claudio	Ignazio	Tommaso
Carlo	Lorenzo	Ugo
Donato	Leonardo	Vittorio
Emilio	Leone	Vincenzo
Emanuele	Marcello	Valerio

Numbers with Italian pronunciation

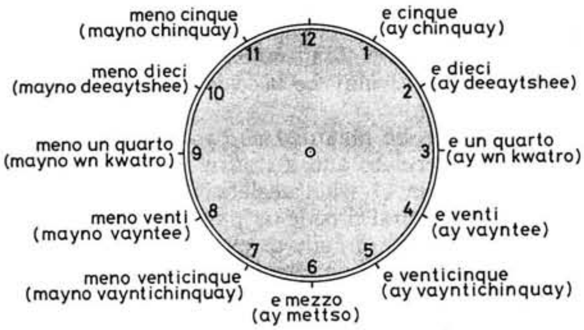
1	uno	oonoh
2	due	doay
3	tre	tray
4	quattro	cooahtroh
5	cinque	chinquay
6	sei	say
7	sette	sayttay
8	otto	otto
9	nove	nowvay
10	dieci	deeaytshee
11	undici	wndeetshee
12	dodici	dohdeetschee
13	tredici	traydeetschee
14	quattordici	cooatordeetschee
15	quindici	queendeetschee
16	sedici	saydeetschee
17	diciassette	deetschiasaytay
18	diciotto	deetscheeotto
19	diciannove	deetshianowvay
20	venti	vaintay
21	ventuno	vaintoonoh
22	ventidue	vaintidoay
30	trenta	trenta
31	trenuno	trentoonah
40	quaranta	cooaranta
50	cinquanta	chincwanta
60	sessanta	says santa
70	settanta	set-tanta
80	ottanta	ottanta
90	novanta	novanta
100	cento	tshaynto
200	duecento	doaytschaynto
1000	mille	milay
2000	due mila	doaymealah

Days of the Week

Sunday	domenica	domaineekah
Monday	lunedi	loonaydee
Tuesday	martedi	marrtaydee
Wednesday	mercoledi	mercollaydee
Thursday	giovedi	joveaydee
Friday	venerdi	venerrdee
Saturday	sabato	satatooh

Time

WRM199



What time is it?	Che ora e?	Kay oarah ay?
It is one o'clock	è l'uno	Ay loon-oh
It is two o'clock	sono le due	sonoh lay doay
It is 2.05	sono le due e cinque	sonoh lay doay ay chinquay
It is 1.55	sono le due meno cinque	sonoh lay doay mayno chinquay

The Italian alphabet is used for stating Q code and also for stating callsigns (nominativi).

Letter	**Italian name**	**Pronunciation help**
a	a	a (as in ask)
b	bi	be
c	ci	tshee
d	di	dee
e	e	ay
f	effe	efay
g	gi	gee
h	acca	akka
i	i	e (as in East)
k	cappa	kapa
l	elle	aylay
m	emme	emmae
n	enne	enay
o	o	o (as in pot)
p	p	pay
q	cu	coo
r	erre	eray
s	esse	esay
t	ti	tea
u	u	oo (as in hoot)
v	vi	v
w	*doppio* vi	dope-eeo v
x	ics	eeks
y	ipsilon	eepsiailon
z	zeta	dzayta

AN RTTY SPEED CHANGER

by Chris Plummer G8APB

Some years ago most of the radio teletype (RTTY) that could be heard was at one of two speeds i.e. 45·45 and 50 baud with amateur mostly on 45·45 baud and commercial on 50 baud. It was therefore necessary to be able to change your equipment's speed at will. This meant changing the motor governor on mechanical machines like the popular Creed 7 type machines.

With the advent of higher commercial speeds, 75 and 100 baud, the availability of such machines to amateur sources, and also the move to cheap and reliable solid-state devices, it became necessary to be able to convert the amateur speed transmissions to a higher speed to obtain hard copy on these newer machines. Unfortunately most of these machines, like the Creed 75, are driven by synchronous motors and to print any other speed of TTY a speed changer is required.

The author built, some while ago, an electronic system based around the G3PLX design giving screen copy only which could not be saved on paper. Having the need at times to save a hard copy and being loath to delve into the clocking of the unit since it was used for transmission as well as reception of 45·45 baud RTTY, another course of action was required. A judicious purchase of a read-only (*sans* keyboard) Creed 75 very cheaply supplied the printer—but only at 50 baud. So either a change of motor gears or a speed changer was required. It was decided that it was more rewarding, versatile and cheaper to use a speed changer than to obtain gears at £8 to £10 per set. Hence the design as presented here.

The Circuit

The design is based on an idea by Brian Hodgeson, G3YKB, and uses a cheaply available Universal Asynchronous Receiver Transmitter (UART), the AY3-1015. The AY5-1013 may be used instead and does not require a −12V rail.

The UART can be regarded as two separate units in one package: a receiver and a transmitter. The receiver, when clocked on pin 17, will translate incoming serial-type code on pin 20 to parallel code on pins 5 to 13 dependent on the number of bits of code as explained later, and the transmitter will translate parallel input code on pins 33 to 26 to serial-type code output at a rate determined by the clock pulse rate on pin 40. Thus if the parallel output of the receiver side is connected to the parallel input side of the transmitter and the input and output clock rates are different, a speed change is achieved. Some other circuitry (IC2) is required to tell the receiver when to clear its outputs and the transmitter when data is available to read etc.

Integrated circuits IC3 and IC4 are the ubiquitous 555 timer arranged to clock continuously. A 556 dual-timer could be used if preferred but is more expensive. The clock rate is 16 times the baud rate, so to input 45·45 baud a clock of 727Hz is used and to output at 50 baud a clock of 800Hz is used. The presets used should be 15-turn types to obtain accurate setting of the clock rates.

The input diodes and resistor network on pin 20 are used to limit the ±12V output of the station RTTY ter-

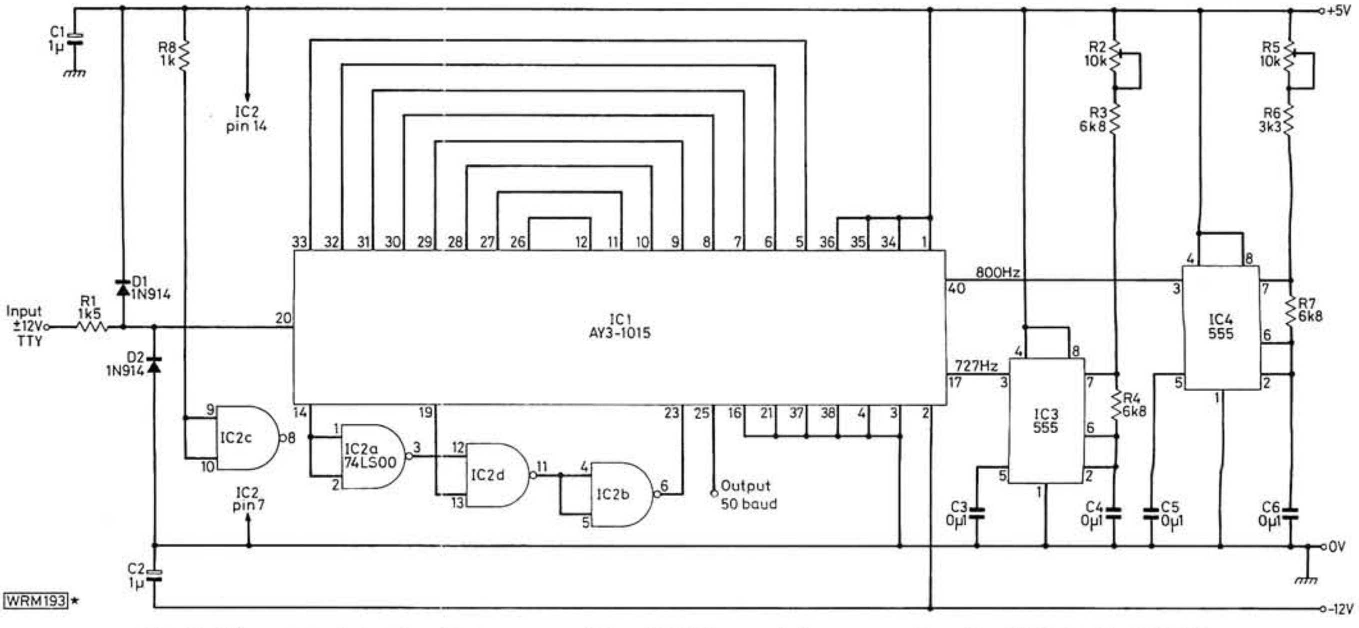


Fig. 1: The complete circuit diagram of the RTTY speed changer using the AY3–1015 UART

★ components

Resistors
¼W 5% carbon film

1kΩ	1	R8
1·5kΩ	1	R1
3·3kΩ	1	R6
6·8kΩ	3	R3,4,7

15-turn Cermet preset

10kΩ	2	R2,5

Capacitors
Ceramic

0·1μF	4	C3,4,5,6

Min. electrolytic p.c.b. style

1μF 50V	2	C1,2

Semiconductors
Diodes

1N914	2	D1,2

Integrated circuits

555	2	IC3,4
74LS00	1	IC2
AY3–1015	1	IC1

Miscellaneous
Veroboard 0·1 inch, 40 holes × 26 tracks; sockets for i.c.s. 8-pin d.i.l. (2), 14-pin d.i.l. (1), 40-pin d.i.l. (1); wire for links.

minal unit to the ±5V level needed by the UART. The ±5V output was sufficient to drive the magnet driver for the Creed 75 as used in the BARTG design derived from the ST5.

As can be seen eight parallel lines are cross connected between the RX and TX sides, for normal Baudot or Murray (CCIR II) code just five lines from pins 5 to 9 and 29 to 33 need to be used, but if the printer obtained happens to be coded in ASCII the eight lines can be used.

Construction

The unit was constructed on Veroboard laid out as Fig. 2 but any layout may be used as convenient.

The speed changer can be used only from a low baud rate to a high baud rate such as 45·45 to 50 baud if full speed is needed. However, if you, like the author, cannot type at 60 words per minute or greater and have to leave long gaps between letters then the unit can be used to reduce the baud rate, say, 50 to 45·45 baud. Therefore a full Creed 75 or equivalent with keyboard, set for 50 baud, can be used at amateur speeds without mechanical changes to the machine. ●

BUYING GUIDE

There should be no difficulties in obtaining the components for this project. The UART can be obtained from several suppliers, including Maplin, who also stock suitable 15-turn Cermet presets.

Approximate Cost
£9

Construction Rating
Intermediate

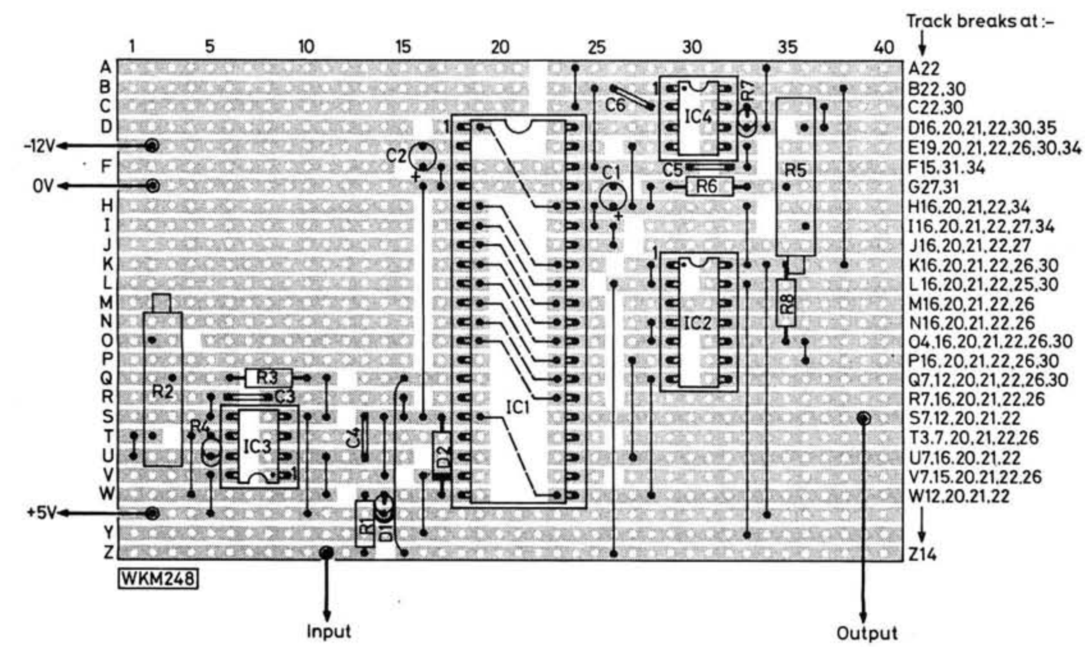


Fig. 2: Full-size Veroboard layout. Note the links under the board shown here as broken lines beneath IC1

an introduction to Antennas

Part 2 by Gordon J. King T.Eng(CEI), AMIERE, G4VFV

How a radio wave is influenced by the earth's local atmosphere and environment and by the upper ionised regions depends on its frequency. Although we don't radiate separate waves as such, it is often convenient to consider a radio wave as being one or more of three separate waves which are sometimes called ground wave, space wave and sky wave. These are illustrated in Fig. 2.1.

The term direct wave is also used to describe the wave which is propagated directly from the transmitting antenna to the receiving antenna as though the two antennas were in empty space. Then there is the ground-reflected wave which differs from the ground wave proper since it is a wave which has been reflected off the earth's surface so that it arrives at the receiving antenna along with the direct wave. The formation of a ground-reflected wave is shown in Fig. 2.2, and it is the combination of the direct wave and ground-reflected wave which constitutes the space wave at the receiving antenna.

From the diagram it will be obvious that the angle of reflection from the earth's surface is a function of the height of the transmitting antenna (ht) above earth. The two components of the space wave do not, fortunately, cancel out but the strength of the space wave does increase substantially linearly with height of the receiving antenna (hr) to the maximum component of the beam, thereafter falling with further increase in height. Which is one reason why antennas for f.m. reception, and CB antennas come to that, should be mounted as high as possible within physical and legal limits. It is unlikely that the height would be such that the signal strength would be in the decline!

Ground Wave

The ground wave proper is utilised essentially for radio communication in the l.f. and m.f. bands up to frequencies of about 3MHz by the use of vertical transmitting antennas which radiate the signal along the earth, following its curvature. Distance of communication so achieved depends not only on the strength of the radiated signal but also on the conductivity and permittivity of the terrain or water over which the wave is travelling. Owing to terrain and water losses, and hence absorption of the signal, ground wave propagation deteriorates rapidly with increasing frequency. For example, over about 300km of relatively "good" conductivity terrain a signal of 1MHz would suffer about 35dB more attenuation than a 200kHz signal. The losses are greater over terrain of poorer conductivity.

What happens is that the wave induces charges in the earth and as they travel along with the wave they represent an energy dissipating current. That portion of the wave which lies in contact with the earth, therefore, is having its energy removed and replaced by diffraction of energy from the part of the wave which lies directly above the earth. Net results are the attenuation, already noted, coupled with cancellation of any horizontally polarised component, and a wave front with a slight forward tilt.

Sea water has a much higher conductivity and hence lower ground wave absorption than ordinary terrain so even fairly high frequency waves can travel with less attenuation over sea. At high frequencies, even when the transmitting station is only a mile or so from the water's edge, the losses can rise substantially due to terrain absorption. For transmitting across sea, therefore, the station is best located on the coast. Amateur and CB operators have discovered this even at their frequencies around 28/27MHz.

The ground wave is utilised almost exclusively for l.w. radio. Less at m.w. with the reflected sky wave then starting to come into action, especially after dark. Less still at h.f. the space wave then coming into play more along with the reflected sky wave for long-distance reception, and hardly at all at higher frequencies. At v.h.f. and above it is the space wave which is mostly utilised, though spurious long-distance reception can occur due to E_s (sporadic E) refraction. Also, as mentioned in Part 1, v.h.f. sky wave signals are returned to earth beyond the geometric horizon distance as the result of tropospheric refraction, scattering and ducting.

Sky Wave

At frequencies up to about 30MHz the ionised regions keep the waves within the confines of our planet. At higher frequencies the ionosphere becomes more and more transparent to sky waves so that they eventually get through the ionosphere and escape into outer space. Sky waves are deliberately produced by special antennas which radiate in the form of a "beam" into the ionosphere at a critical angle. The scheme is to get the waves to return to earth by refraction in the layer which is active at a given time so that they illuminate a point on earth far in advance of the geometric horizon distance or the distance which could be achieved by ground wave propagation. For even longer distance reception the signal may undergo one or more reflections from the earth back to the ionosphere again. This is called multi-hop reception as distinct from the single-hop function of just one ionospheric refraction. The idea is shown in Fig. 2.3.

Hop and Skip Talk

It will be appreciated that to hop or skip to a particular place on earth the angle of radiation of the transmitting antenna needs to be carefully considered, as well as the particular layer in which the refraction is to take place, keeping in mind that the angle of return is the complement of the angle of incidence. Fig. 2.3 also shows that when the ground wave or space wave limit of reception is reached reception does not occur again until the first hop zone is reached. The distance over which the reception essentially fades to nothing is called the skip distance. It might thus be possible to tune over the amateur radio bands and possibly hear just one side of a conversation in a netted link-up. You might, in fact, hear one operator over 4000 kilometres away while the other operator much closer to you may well be inaudible because you are in the skip distance of his transmission.

Similarly, the powerful overseas transmission of the BBC might be coming in at a signal strength of S9 some thousands of kilometres away, while you 150km away may have difficulty in receiving the transmission.

Because different rays of the skyward signal illuminate

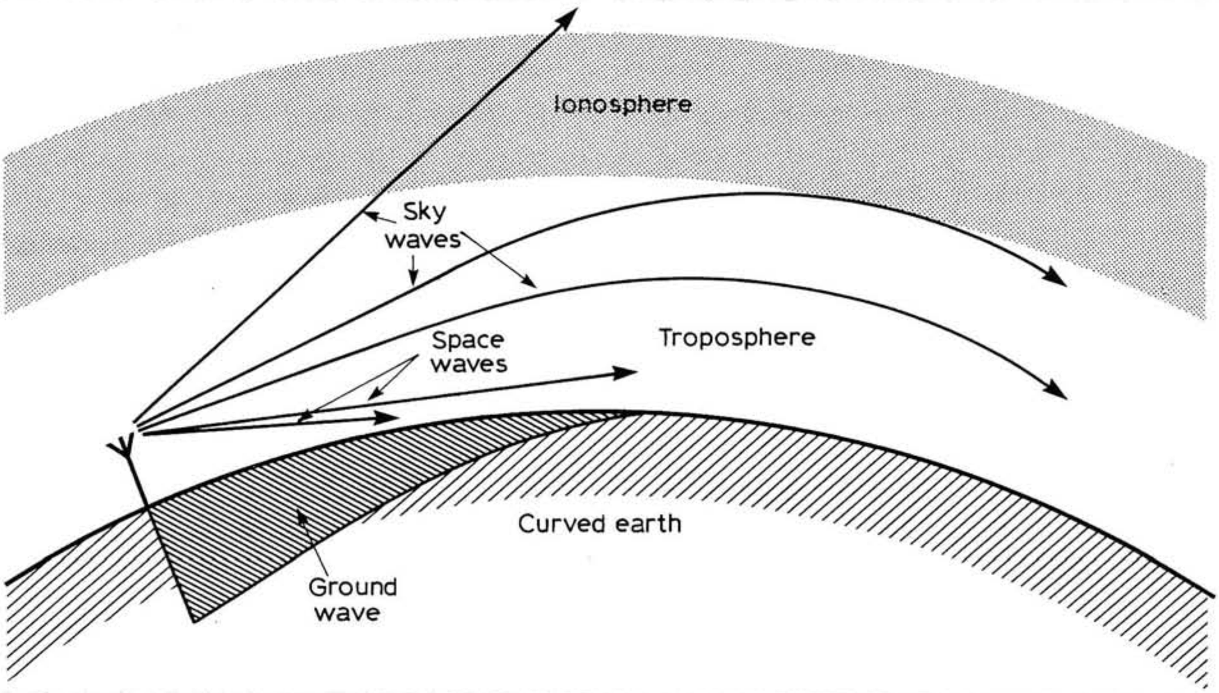


Fig. 2.1

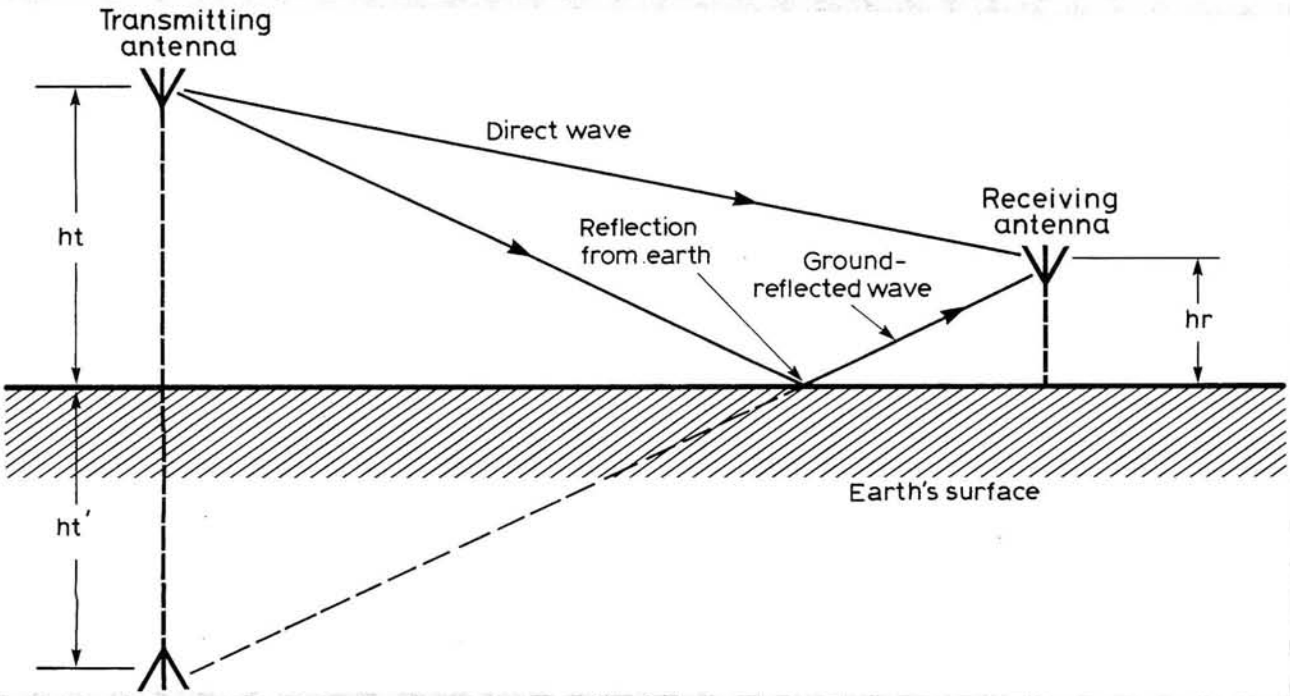


Fig. 2.2

more than a small point in the ionosphere, the returned signal is generally received over a fairly large area as basically defined by the full and broken-line waves in Fig. 2.3. However, there are times, especially when the angle of radiation is high, when the returned signal is more tightly concentrated into a small area, the signal then being quite strong at one point and yet barely detectable at another point 2km or less away.

Fading

Changing and fluctuating conditions in the ionosphere is one cause of amplitude fading, while drifing E_s "clouds" can result in a rapid total fadeout of signal followed by an equally rapid return a short or longer period afterwards. Primary causes of fading are variations in absorption, changes in path lengths and hence signal phase of multiple sky-returned and earth-bound rays, movement of ionospheric irregularities and electron density, and changes in polarisation of the wave returned to earth. To help combat fading two or more antennas spaced at calculated distances from each other (depending on the frequency) are sometimes used in a so-called "diversity" system. One would rarely go to this extreme for domestic applications, but I have used a system like that at the front-end of a wired broadcasting system not only to help combat m.f. fading of a required Continental transmission after dusk, but also at v.h.f. when TV signals were being received well beyond the geometric horizon distance and were thus prone to fading due to variation in the troposphere.

Fading of distant m.f. signals occurs particularly after dusk when the absorbing D layer vanishes and distant signals are then reflected back from the E layer. This is because there is likely to be appreciable energy in the ground wave at the point where the first E layer hop returns to earth. The net signal field then becomes the vector sum of the two or more signal components of which both the phase and amplitude can vary, thereby giving a varying signal field and hence the fading effect. The interference pattern can also be remarkably sensitive to frequency such that even a slight frequency change can cause the relative path lengths to change by an appreciable fraction of a wavelength. This, then, means that the carrier wave and audio sidebands are subjected to different degrees of fading—some components adding and others subtracting. The result is a very distressing kind of distortion which is often heard on Radio Luxembourg. The phenomenon is termed selective fading.

Absorption

We have seen that at the low D layer altitude the gas density is high and the electrons and ions recombine swiftly after sunset so that the layer vanishes as night falls. Because the electron density is not very high, the layer is virtually ineffective in returning radio waves back to earth. However, with increasing frequency radio waves pass through the D region and are then reflected by the layers at higher altitudes.

This means that during the daytime the ionosphere has essentially no influence on l.f. and m.f. signals, the services in these bands then being provided by ground wave propagation—the same being true, of course, at v.l.f. During this time any skybound signals are almost completely absorbed in the D layer. The absorption results from energy being taken from the radio wave owing to inelastic collisions between the free electrons and the ionised and neutral atoms of the atmosphere, when they are excited by the radio wave.

Radio-Blackout

Normal absorption is essentially a daytime occurrence associated with the lower frequencies. However, excessive absorption of signals at low altitudes is sometimes experienced during periods of intense sunspot activity, when there are severe storms on the sun, and this can put paid to all ionospheric propagation. Fortunately, these radio-

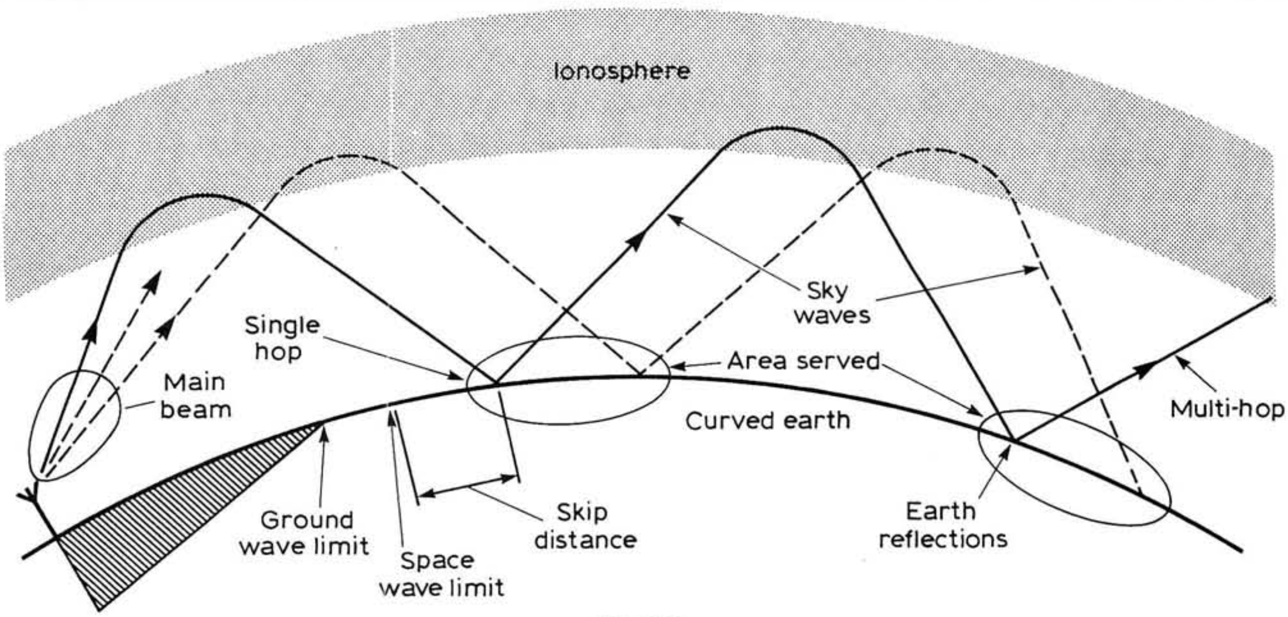


Fig. 2.3

blackouts as they are called are not all that frequent—possibly lasting for little more than 2 per cent of the time even during sunspot maxima—but they do impair the reliability of ionospheric circuits since they can hang on for up to an hour or more and their occurrence is unpredictable.

The most dramatic effect of normal absorption is experienced on the l.w. and m.w. bands, particularly the latter, during daylight when reception is limited essentially to the "local" stations utilising ground wave propagation. The difference in conditions is quite remarkable after dark when the D layer and its absorptive influence disappear. Distant stations then come crashing through by way of the reflective higher ionospheric regions, often interfering with the ground wave "locals" as we have seen.

Ionospheric Refraction

The direction in which the energy of a radio wave moves through the ionosphere depends upon the electron density. The mathematics involved are complex, but basically the wave's electric field causes the electrons to vibrate sinusoidally in parallel with the wave's flux. The electrons then act as miniscule antennas which abstract and re-radiate the energy in a different phase. Net result is that the direction of wave travel is changed such that the wave path is bent away from the region of high electron density to that of lower density. The extent is influenced by the amplitude and average velocity of the electron vibrations, and it decreases with increasing frequency. The ions themselves have a negligible effect because owing to their much larger mass they move only slowly under the same force.

Because the returning wave is not sharply reflected, as is light from a mirror, but undergoes a relatively slow turnround, it is called a refracted wave. The refractive index of a ionised region decreases from less than unity with increase in electron density. The bending due to the refraction thus increases as the wave penetrates the layer, as shown in Fig. 2.4. The altitude which would correspond to total reflection is also indicated, so the effect is often called reflection rather than refraction and the returned wave a reflected one rather than a refracted one.

MUF, OWF and LUF

As the frequency of the wave is increased so it penetrates more deeply into the layer and is reflected back to earth from a more elevated point. With further increase in frequency, however, the bending back is not completed so the wave goes through the ionosphere and into outer space (I often wonder what happens to it then!). The upper frequency of a wave returned to earth via an oblique path is called the maximum-usable-frequency (m.u.f.) for that particular path. Ionospheric soundings using high peak power pulses with return monitoring determine the m.u.f. for long-distance radio circuits, but for long oblique paths the m.u.f.s are higher than those established by vertical-incidence soundings by some 3 to 4 times. The m.u.f. changes with time of day and season and it is significantly higher during sunspot maximum than sunspot minimum. During sunspot maximum the middle of the day m.u.f. can be well above 30MHz, especially during winter, the F2 layer then being responsible for long-distance multi-hop reception.

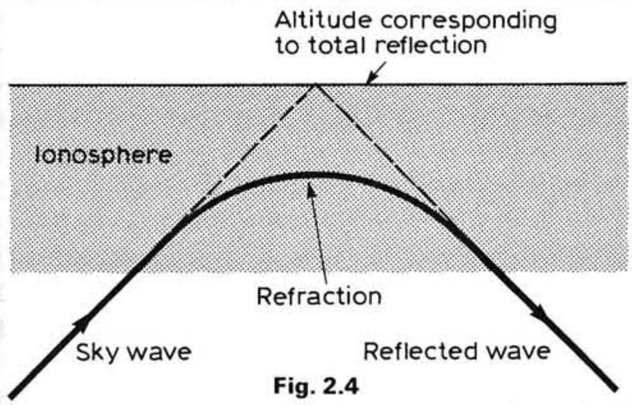


Fig. 2.4

Distance covered per hop can be as great as 3000 to 4000km, so to communicate with the other side of the world (about 20,000km) there would have to be five hops. It is possible to achieve round-the-planet coverage and short-wave enthusiasts will undoubtedly recall having heard an apparent echo on a distant transmission owing to reception first of the signal over one path and then a little later the echo due to the signal arriving over a much longer path, possibly right round the world!

Owing to the changing m.u.f. radio stations and listeners need to change frequency to retain long-distance short-wave communication. To keep the changes down to a minimum radio systems commonly operate at a frequency about 18 per cent lower than the m.u.f. This is called the optimum-working-frequency (o.w.f.).

As would be expected, there is also a lowest-usable-frequency (l.u.f.) which is determined by the lowest acceptable signal/noise ratio. Ionospheric circuits thus operate between the m.u.f. and l.u.f. while endeavouring to gear to the o.w.f. as indicated by the time of day, season of the year and sunspot cycle. Overall, then, the frequency range for serious ionospheric radio circuits lies between 3 and 30MHz, which is the h.f. band.

Sporadic E (E_s) cannot be regarded for serious radio linkage as the propagation is so unreliable and intermittent. It is more of an interference problem than a help (except, perhaps, to amateurs, DXers and CB enthusiasts!) and it occurs mainly in summer during daytime. Owing to its very high intensity it can cause a dramatic increase in m.u.f. while it lasts, and bring in distant stations working as high as 45 to 60MHz, and even into the 144MHz amateur band, often affecting TV Band I transmissions.

Layer-Entrapped Propagation

Another form of ionospheric propagation is also noteworthy. This is where the signals are trapped between the layers and are then propagated with very little loss over remarkably great distances. Although this mode of propagation has not been known anywhere near as long as the classic propagation theory, it is now receiving more detailed attention, mostly arising from propagation anomalies which cannot be explained by the basic theory. This layer-entrapped propagation has something in common with tropospheric ducting, but is seemingly more relevant to h.f. signals than tropo ducting. Investigations suggest that a relatively stable path might eventually be provided by this mode of propagation, but one of the problems appears to be in launching and receiving the signals at ultra-low radiation angles; that is, getting them layer-entrapped and then getting them out again. Perhaps one day we shall pick up signals which have been going round and round the world between ionospheric layers for many years. Indeed, the possibility of the ionosphere having a "memory" cannot be discounted!

an introduction to

Antennas

CB Anomalies

There are other factors of radio wave propagation which, I can't help feeling, we have yet to unfold. We still don't know very much about the D layer, for example, and it seems to me likely that there is more interaction between the troposphere and lower ionospheric layer than is generally thought. There are also those times when 27MHz CB signals are propagated with remarkably little loss over distances up to 1,600km or more while the adjacent frequencies of 26 and 28MHz appear not to be supporting a correlating kind of propagation!

Tropo Again

It has been shown how upper h.f. and higher frequencies are refracted over a greater distance than can be calculated from the geometric or optical horizon distance.

Within the optical horizon distance one can assume a flat, perfectly reflecting earth, especially at the lower end of the v.h.f. range, and possibly including the 28MHz amateur band and the 27MHz CB band, the free-space field E arising from the space wave at distance d from the transmitting antenna can then be expressed as

$$E = \frac{90\sqrt{W\,h_t h_r}}{\lambda d^2}$$

where h_t and h_r are the heights of the transmitting and receiving antennas respectively and W the power in watts radiated by a $\lambda/2$ dipole.

The signal field beyond the optical horizon is influenced by the nature and irregularities of the terrain, diffraction of the signal round the curved earth and from irregularities and ridges and by the degree of tropospheric refraction. Additional factors come into play at higher frequencies, including absorption caused by rain. Radio shadow zones also become more defined as the frequency is raised, thereby producing areas of poor reception—if any direct reception at all—behind hills and other obstructions.

One way by which a v.h.f. signal can appear well beyond the horizon, even when there is an elevated obstruction in the path, is shown in Fig. 2.5. Here small irregularities in the dielectric constant of the air at fairly high altitudes up to about 10km cause an upgoing wave to be scattered and returned to earth over an appreciable distance.

During abnormal meteorological conditions, which are not all that infrequent, the variation in dielectric constant with height of the troposphere departs from the norm. At the lower levels at least the refractive index (n) of the troposphere normally decreases linearly by about 40 parts in 10^6, and it is this which is responsible for the standard k factor of 1·33. One anomalous condition results from a much higher than normal decrease in n in the region immediately above earth, producing super-refraction as shown at (a) in Fig. 2.6, while (b) shows what happens when n decreases rapidly at a higher altitude, this producing refraction, reflection and/or scattering. Lower and higher level ducting also occurs, but usually at the higher frequencies though.

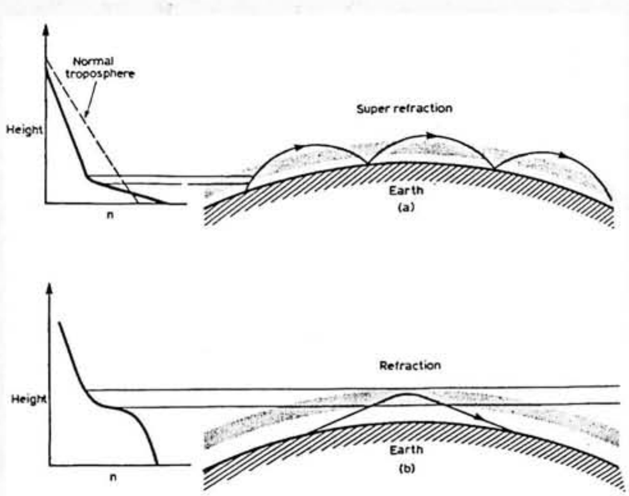


Fig. 2.6

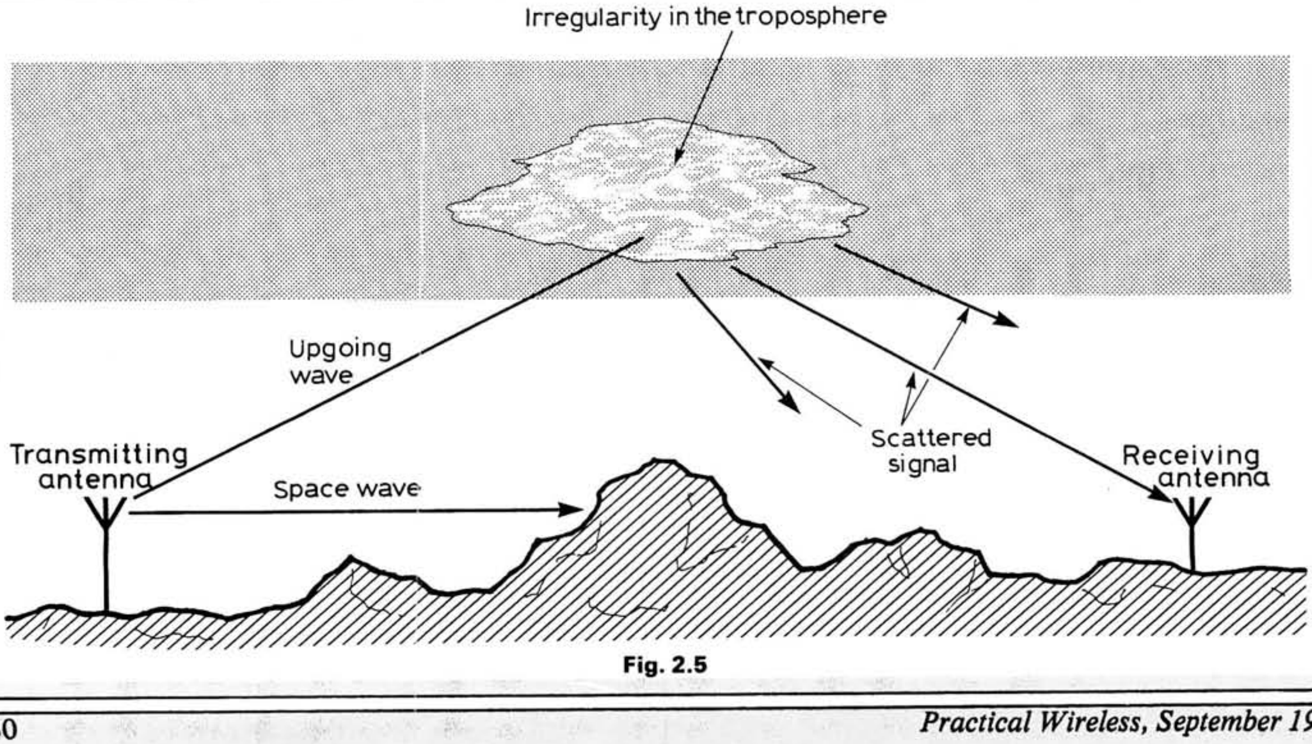


Fig. 2.5

Separately the direct wave and ground-reflected wave—the combination of the two constituting the space wave—suffer little attenuation while travelling through space other than that caused by spreading, so the field strength of each is inversely proportional to the distance from the transmitting antenna (1/d). However, the ground-reflected wave does have a destructive influence on the space wave since it undergoes a reversal of phase. Happily, complete cancellation does not occur because the ground-reflected wave has a longer path length than the direct wave and the phase difference is not exactly 180 degrees under normal reception conditions. The net effect of the two waves is that the field strength of the space wave falls inversely with the square of the distance ($1/d^2$), which is also demonstrated by the space wave signal field expression.

Obstacle Gain

Irregular terrain can sometimes enhance the signal by eliminating the destructive influence of the ground-reflected wave. The signal can also be enhanced when a ridge lies in the path between the transmitting and receiving antennas provided the antennas are not close to the ridge. This, known as obstacle gain, is illustrated in Fig. 2.7.

Isotropic Antenna

At last we can start looking at antennas but to do this we really require a reference, and one that is commonly considered in antenna work is none other than the isotropic radiator. Sorry that this is not a real antenna but it is a start! It is, in fact, a mathematical abstraction which is impossible to construct. It is an antenna which, for calculation purposes, radiates equally in all directions into free space. No practical antenna can do this, for even a simple dipole has a greater radiation at right-angles to its elements than in line with them. The radiation pattern of an isotropoic antenna therefore, is representative of a sphere.

Now, before we go on let us return to our happy radio wave whose electric field is E and magnetic field H. The ratio E/H expresses the characteristic impedance of free space whose value is close to 377 ohms. Product EH gives the power flux per unit area for a plane wave (E and H in phase remember), which is $E^2/120\pi$ or $E^2/377$ (120π equalling 377!). The power flux at any point on a sphere is equal to: $W/4\pi r^2$

so relating this to $E^2/377$ we come up with:

$$E = \sqrt{\left(\frac{377}{4\pi}\right)}\sqrt{\frac{W}{r}}$$

where E is the field strength in volts per metre (V/m), r the distance from the isotropic antenna in metres and W the power in watts.

This can be simplified to:

$$E = \frac{\sqrt{(30G_aW)}}{d}$$

where we have introduced another factor G_a which is the power gain of the antenna relative to an isotropic antenna. The field strength (E) is in V/m when the distance (d) is in metres and the power in watts.

Now, before continuing I think I had better press the point that although transmitting and receiving antennas differ vastly in construction for reasons of power handling and mechanical requirements, their r.f. characteristics, such as impedance, gain and directionality, are just the same regardless of whether they are radiating or receiving a signal.

This reciprocality makes it possible to measure the r.f. characteristics either by arranging for the antenna to transmit or receive a signal; and there are times when studying even an antenna engineered specifically for reception to regard it in the transmit rather than in the receive mode.

We have seen that the field strength E in V/m at distance d in metres from an isotropic antenna radiating power W in watts is equal to:

$$E = \frac{\sqrt{(30W)}}{d}\ \text{V/m}$$

This corresponds to the free-space signal field.

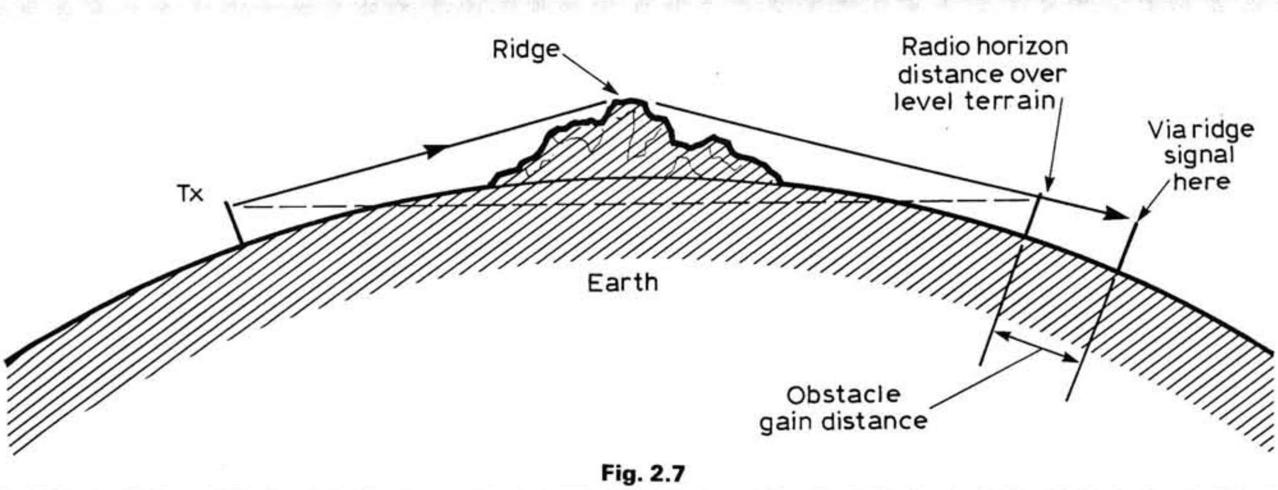


Fig. 2.7

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The effective radiated power (e.r.p.) of an antenna in a particular direction is related to the product WG_a where G_a is the direct ratio (not dB) power gain of the antenna over an isotropic radiator in that particular direction. Now, at this stage I can inform you that a half-wave dipole (about which more later) has a direct ratio power gain of 1·635 times (corresponding to 2·13dB) over an isotropic radiator. The preceding expression can be extended to take account of G_a thus:

$$E = \frac{\sqrt{(30WG_a)}}{d}\ V/m$$

Let's take W as 4 watts, G_a as 4 times power (6dB) and d as 80,000m (80km), then, using your pocket calculator, you can easily find that the distant signal field would be 0·00027V/m or 270μV/m in free space.

Gain Relative to Dipole

In antenna literature the gain of an antenna is often given relative to a half-wave dipole, and the expression can be further adjusted to take that into account as below:

$$E = \frac{\sqrt{(30WG_aG_d}}{d}\ V/m$$

where G_a is now the power gain of the antenna relative to a dipole and G_d a constant equal to 1·635. Taking W as 4 watts as previously but this time making G_a 2·446 times, then with G_d of 1·635 we will find that the signal field at the distant point is just the same as before—270μV/m at 80km distance. The implication, of course, is that the antenna in the first place was said to have a power gain of 6dB over an isotropic radiator and in the second place a power gain of 2·446 times or about 3·87dB over a dipole!

This can be important when looking at the gains of receiving antennas. A gain relative to an isotropic looks bigger than a gain relative to a half-wave dipole!

I suppose that unless we are radio amateurs or, perhaps, CBers we are not particularly encouraged to calculate the strength of the signal field at a distant point from a transmitting antenna. In any case, as we have now learnt, there are numerous physical influences which modify the propagation characteristics of a transmission path, so even if we worked out the signal field at a particular distance the measured result would probably be quite different. The foregoing expressions refer, of course, to radiation into empty space.

Signal Field Contour Maps

We are far more interested in knowing the strength of the signal we are likely to obtain from an antenna in a given signal field. To help make this sort of calculation the transmitting authorities publish service area boundaries in terms of signal field often as a dB ratio where, for example, 0dB corresponds to 1μV. For instance, a ratio of say, 60dB means that the signal field at that particular contour is likely to be 60dB above 1μV, or 1mV/m. You can obtain signal field contour maps for the various TV and f.m. radio stations. The signal field, of course, depends on the height of the antenna above ground, so the values given usually correspond to a height of 10m; but topography can modify the values at specific points, the values thus representing a mean of the area.

If it is assumed that the current is constant over the antenna, which is true of a tuned dipole then, based on a half-wave dipole, which is the sort of antenna we use for f.m. radio reception (as well as TV, of course), one would expect the signal induced to be $E\lambda/2$ in a signal field of EV/m. However, because the current distribution is not d.c. but a.c. (sinusoidal) we must obviously use the average value for calculation which is $2/\pi$, so we now get $E\pi/2$ times $2/\pi$, which works out to $E\lambda/\pi$, or half this value when the antenna is loaded.

In a practical setup we need to take account of other things, like the gain of the antenna relative to a half-wave dipole, the gain of a half-wave dipole relative to an isotropic radiator and the fact that the antenna has to be terminated to a feeder to pass the signal to the receiver or tuner which, in the case of f.m. radio and TV, anyway, should itself be correctly matched to the feeder.

Kindly Note

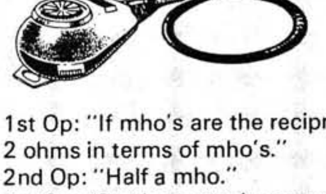
Transceiver Vox Unit—March 1984

The relay used in this project is a Maplin YX94C, Ultra Miniature 12V s.p.d.t. It will be necessary to remove one of the commoned pins to fit the board. On the p.c.b. overlay, Fig. 4, the four pads associated with the transceiver lead/plug PL1, should be annotated C, D, A and B reading from the left-hand edge of the board towards the centre

Simple Top-Band Receiver, June 1984

In Fig. 2, the figures in brackets indicate the number of turns required if the 3·5MHz (80m) band version of the receiver is being built. All windings to be in 42 s.w.g. (or finer) enamelled copper wire.

the things people say



1st Op: "If mho's are the reciprocal of ohm's—express 2 ohms in terms of mho's."
2nd Op: "Half a mho."
1st Op: "But I want to know now."

. . . heard by T. A. Carrick

"I don't believe this according to my s.w.r. meter, I'm getting 140 per cent of my signal back. I'm putting out 40 watts and I'm having 62 watts back down the aerial, very strange!"

. . . heard on 7MHz by I. Davidson

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Drae	3 way SO239	15.40	(0.75)

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Brian DANCE M Sc

National Semiconductor LM1035

Any constructor of audio circuits has at times been faced with the problem of hum pick-up in low signal level pre-amplifier circuits, one of the main sources of such pick-up being the relatively long signal leads which run to the volume, tone and stereo balance controls.

The use of modern integrated circuits enables this problem to be completely avoided by the use of designs in which the signal voltages are not fed to the control potentiometers at all. The potentiometers are merely used to adjust steady d.c. voltages which are fed to an i.c. which changes the gain, tone or balance according to the value of these voltages. Thus the fairly long leads to the controls carry no signals and if there should be any mains hum picked up or other electrical interference, it will not normally reach the output of the i.c.

National Semiconductor's LM1035 device, which was first marketed in 1982, employs this principle for the volume, tone and balance circuits, but it is quite a complex device in which a steady voltage can also be employed to provide "loudness compensation". This means that the relative gain at high and low frequencies can be automatically adjusted so that the listener can reduce the volume without the apparent loss of high and low frequencies caused by his hearing. Small modifications to the component values enable the user to tailor the frequency response characteristics of a circuit using the LM1035 to his exact requirements.

The LM1035 is described as a "dual d.c. operated tone/volume/balance circuit", although it is actually voltage operated rather than direct current operated which strictly speaking the description would imply. It has been designed for use in high quality audio systems using radio, disc and tape signal sources, in-car radio equipment and can also be employed in TV receivers, although stereo sound is not yet normally available with such signals. The device handles both stereo channels in the single i.c. It can be used when the controls are at a distant point from the device itself, since there is no danger of hum pick-up in the control leads.

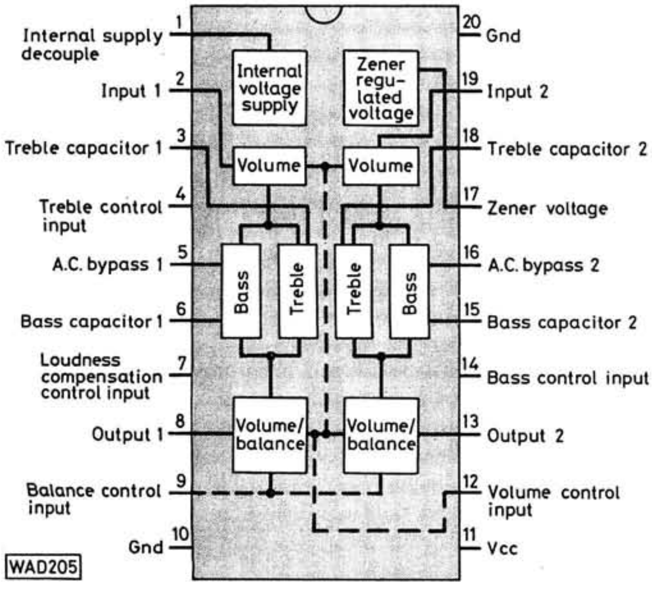


Fig. 1: Block diagram and connections of the LM1035

The LM1035

The LM1035 is a relatively complex device which has the internal circuit shown in block form in Fig. 1. All 20 pins of this d.i.l. device are required to achieve the device designer's aim of making it a very versatile product.

Stereo input signals are fed to pins 2 and 19 in the circuit of Fig. 2 through capacitors, so that the steady bias

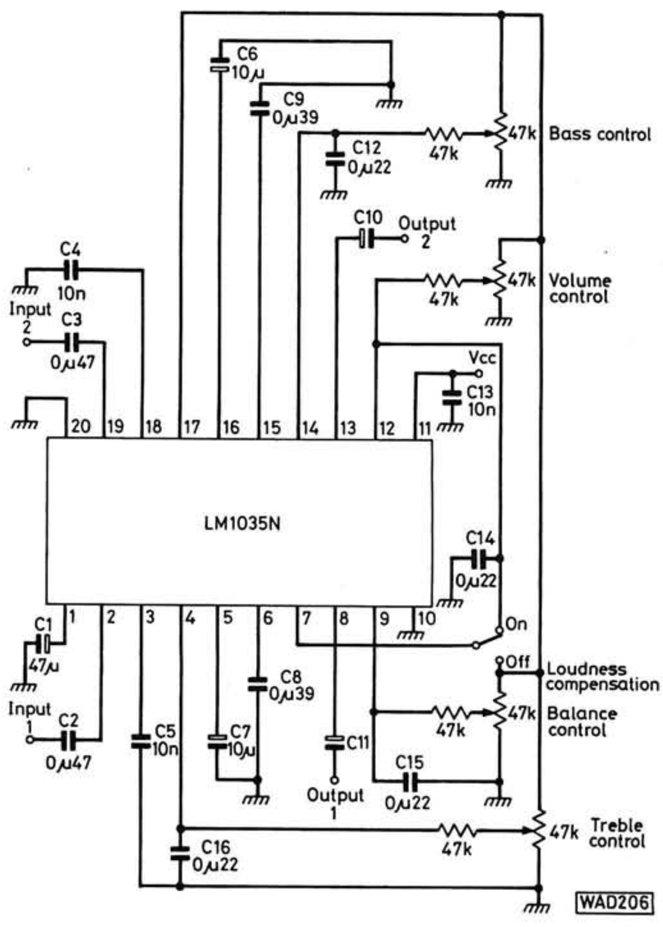


Fig. 2: Normal circuit with standard components values for the LM1035

voltage developed by the internal circuitry at these pins is not affected. Similarly the outputs from pins 8 and 13 are taken through their individual coupling capacitors so that the steady voltage at these pins is prevented from reaching the next stage of the equipment. The values of these coupling capacitors in the pin 8 and pin 13 output circuits depends on the input impedance of the following amplifier stage, but will normally be around a few microfarads each; too small a value will result in a limited low frequency response.

The LM1035 incorporates a Zener diode circuit on its chip which provides an output from pin 17 of about 5·4V. The maximum current which can be taken from this pin is quoted as 5mA. In Fig. 2 this stabilised voltage is used to supply the bass, volume, loudness compensation (if used), balance and treble circuits. The potentiometers employed in these circuits tap off a portion of the Zener stabilised voltage and feed it to the appropriate pin of the LM1035 with suitable capacitor decoupling at pins 4, 9, 12 and 14; the decoupling capacitors should be situated close to the LM1035.

Circuit Conditions

Absolute maximum permissible supply voltage for the LM1035 is 20V and this must not be exceeded even for an instant or the device may be irreversibly damaged. The normal supply voltage operating range is +8V minimum to +18V maximum at pin 11, the supply current being typically 35mA (maximum 45mA for any device) at 12V and 25°C.

Maximum output voltage from pins 8 and 13 depends on the supply voltage fed to the LM1035. Values specified at 1kHz are typically 1·3V r.m.s. with an 8V power supply; 2·5V r.m.s. (minimum 2V r.m.s. for any device) with a 12V supply and 3·5V r.m.s. with an 18V supply. Attempts to obtain higher output voltages will lead to greatly increased distortion. The maximum input voltage to pins 2 and 19 with the controls set for a flat response is typically 2·5V r.m.s. (minimum value 2V r.m.s. for any device). The input resistance at these pins is typically 30kΩ (minimum 20kΩ) at 1kHz using a 12V supply. The output resistance from pins 8 and 13 is only 20Ω at 1kHz, so this facilitates feeding the signal through a fairly long length of cable to a main amplifier unit.

Performance

The total harmonic distortion using a 12V supply at 1kHz signal frequency with an input of 1V r.m.s. is typically 0·05% (maximum 0·2% for any device) at maximum gain. Signal-to-noise ratio is typically 80dB over the range 100Hz to 20kHz (unweighted) at maximum gain and 64dB when the gain is reduced by 20dB. Channel separation is an excellent 80dB at 1kHz under maximum gain settings. The device supplies a rejection of some 40dB of an alternating signal present on the power supply line (measured at 1kHz). The frequency response with the tone controls set for a flat response typically extends to 250kHz before a 1dB fall occurs, so the LM1035 can be used well above the audio band frequencies.

The control currents required at pins 4, 7, 9, 12 and 14 are typically −0·6μA and not more than −2·5μA in any device, so high resistances can be employed in these circuits. Quoted currents apply when the pin concerned is at the potential of pin 20 and the minus signs indicate that current is flowing out of the pin concerned.

Typical gain of the device at 1kHz is unity (that is, 0dB) when pins 12 and 17 are joined, but for all devices this gain value is between −2dB and +2dB. At this frequency the gain in the two channels tracks to *within* 3dB (typically to within 1dB) as the gain is reduced from 0dB to −40dB, although the typical value is 2dB with no specified maximum in the main range −40dB to −60dB.

Characteristics

The graph, Fig. 3, shows how the gain of a typical LM1035 falls as the potential at pin 12 is reduced from the Zener voltage at pin 17 to the negative supply line potential; a variation of about 80dB can be obtained with a minimum of 70dB for any device. From Fig. 1 it can be seen that pin 12 is connected to two volume control stages, one being before the tone control and one after the tone control network. This use of two volume control sections of the circuit improves the signal handling capability and provides a reduction of the output noise when the gain has been reduced.

The part of the volume control circuitry before the tone control provides an initial 15dB of gain reduction so as to ensure that the tone control sections of the device are not overdriven by large input signals when operating at a low volume setting. When adjusting the volume control, it is important that the output signal voltage does not exceed the values stated earlier for the supply voltage used in order to avoid distortion.

Balance is controlled by the pin 9 voltage. As shown in Fig. 4, the gain of channel 1 decreases and that of channel 2 increases as the potential of this pin falls from the Zener output value to that of the negative supply line. In practice balance will be obtained with this pin at about 2·75V.

The typical tone control chartacteristic curve is shown in Fig. 5. As the voltage applied to the treble control input of pin 4 varies, the gain at 16kHz of both channels will vary in the way shown by this curve. The same curve shows how the gain at 40Hz varies with the voltage at pin 14. In all cases the gain is relative to the *gain at the mid-frequency* of 1kHz, so one can have ±15dB (boost or cut) at either high or low frequencies when using the capacitor values shown in Fig. 2 at pins 3, 6, 15 and 18.

The graph, Fig. 6, shows the overall frequency response curves for maximum treble boost and for maximum bass and treble cut.

Loudness Compensation

Simple loudness compensation may be obtained by applying a steady control voltage to pin 7. This voltage operates on the tone control stages so as to produce an additional boosting of treble and bass frequencies at low input levels, provided that the total boosting at either end of the frequency range would not be greater than the available maximum mentioned previously for the treble and bass capacitors employed.

If the switch shown in Fig. 2 is employed to connect pin 7 to pin 17, there will be no loudness compensation. The curves of Fig. 8 obtained when the tone controls are set for a level response show the effect of the loudness compensation on the frequency response. At high gain settings, the frequency response is flat, but as the gain falls to about −20dB below the maximum, the bass and treble frequencies are raised somewhat above the mid-frequency gain. The maximum boost at the extreme frequencies is about 15dB with the component values of Fig. 2.

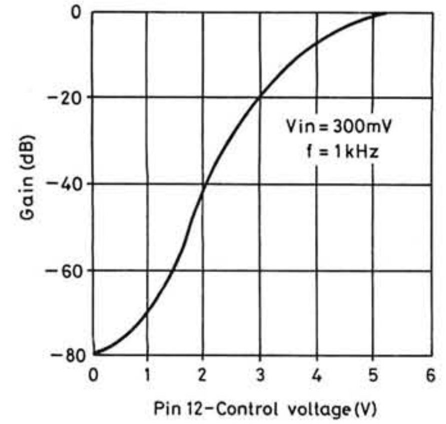


Fig. 3: Volume control characteristic

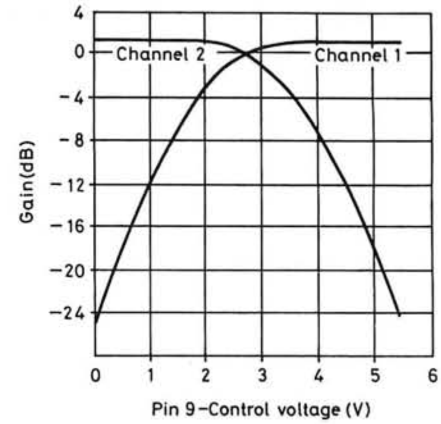


Fig. 4: Balance control characteristic

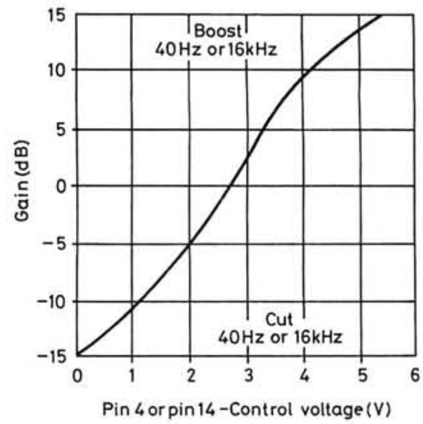


Fig. 5: Tone control characteristic

WAD207

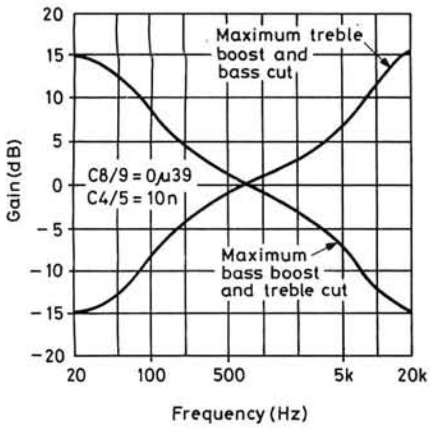


Fig. 6: Gain-frequency curves for maximum treble boost/maximum bass cut and for maximum bass boost/maximum treble cut

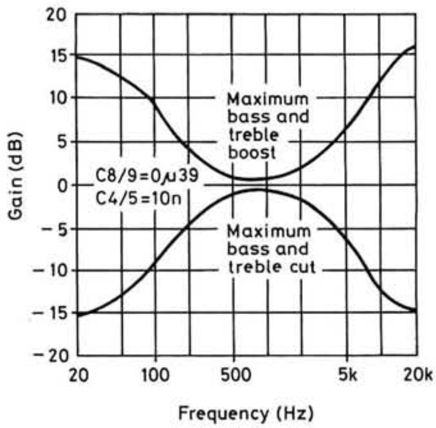


Fig. 7: Gain-frequency curves for maximum bass and treble boost and for maximum bass and treble cut

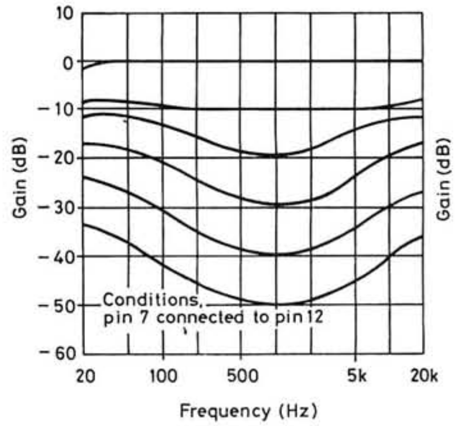


Fig. 8: Normal loudness compensation characteristics

Modified Characteristics

Simple modifications to the LM1035 circuit can be made to enable frequency response curves to be obtained which are somewhat different from the standard ones shown in Figs. 5 to 8 inclusive. Basically an increase in the treble control capacitors in the pin 3 and pin 18 circuits will produce an increase in the treble control range, while a decrease in the bass control capacitors in the pin 6 and pin 15 circuits will produce an increase in the bass range. The characteristics obtained by increasing the value of the treble capacitor by the same factor are shown in Fig. 9. It may be noted that the maximum bass and treble lift and cut are greater than in the standard case of Fig. 6, this being particularly noticeable at frequencies away from the ends of the range.

For example, at 5kHz the maximum boost and cut in the standard case of Fig. 6 is about ±7dB, whereas in Fig. 9 it is about ±17dB. If instead of increasing and decreasing the treble and bass capacitors respectively by a factor of four, they are similarly changed by only a factor of two, the maximum boost and cut at 5kHz is ±12dB approximately.

Similarly the treble and bass control ranges may be reduced by reducing the value of the treble control capacitors and increasing that of the bass control capacitors. The effect of halving the treble capacitor values and doubling the bass capacitor values of the Fig. 2 circuit is shown in Fig. 10. The maximum boost and cut at 5kHz is reduced to only 2 to 3dB.

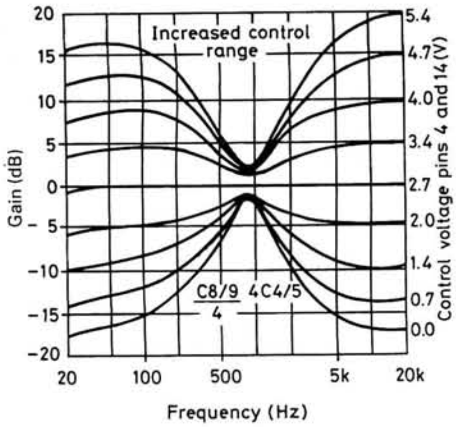
Either the treble or the bass capacitor alone may be changed in value to obtain a greater or reduced range of either the treble or bass frequencies. For example, Fig. 11 shows the effect of halving the bass capacitor values to obtain an increased bass control range while leaving the treble control range unaffected.

Limited Tone Control

It may be desirable to level off the tone control curves above or below certain frequencies. For example, if the treble boost characteristic is limited at very high frequencies, this may reduce noise (hiss) in the channel.

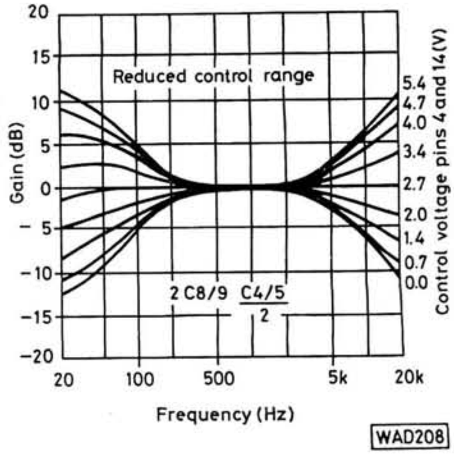
In the case of the treble response, this may be achieved by including a resistor in series with the treble control capacitor in the pin 3 and pin 18 circuits. The treble boost and cut will be 3dB less than the standard case of Fig. 6 for the circuit values of Fig. 2, at the frequency at which the additional resistor has a value equal to the impedance of the capacitor; that is, the frequency at which this additional resistor has a value of $1/(2\pi fC)$, where C is the value of the treble capacitor.

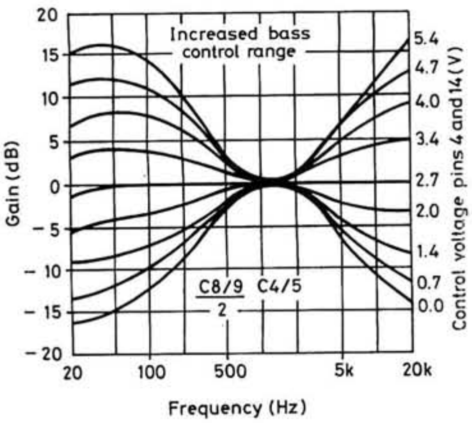
Similarly, the effect of bass boost and cut at the lowest frequencies may be reduced by reducing the values of the



◀Fig. 9: Increased tone control range obtained by reducing the bass capacitors and increasing the treble capacitors

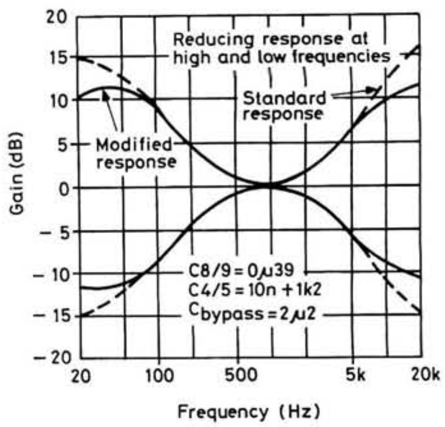
Fig. 10: Gain-frequency curves for a reduced tone control range▶





◀Fig. 11: An increased bass control range with treble unaltered

Fig. 12: Tone control characteristics can be flattened at the extreme audio frequencies▶



bypass capacitors in the pin 5 and pin 16 circuits. The internal resistance at these pins is about 1·5kΩ and bass boost or cut will be about 3dB less than the standard case of Fig. 6, when the capacitor has an impedance of about 1·3kΩ.

The response curves shown in Fig. 12 were obtained by inserting a 1·2kΩ resistor in series with the 0·01µF capacitors in the pin 3 and pin 18 circuits of Fig. 2 and by reducing the bypass capacitors in the pin 5 and pin 16 circuits to 2·2µF. The standard curves are shown in dashed form for comparison.

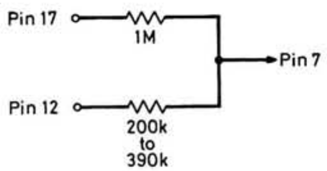
It may be noted from Fig. 9 that the increased control range obtained in this case results in flattening of the curves at the frequency extremes. This effect may be used either with or without the techniques just described to obtain the most suitable control range and response shape for a particular application.

The ability to use steady voltages to control the characteristics of circuits, using the LM1035, raises the possibility of other useful control techniques. For example, the negative going peaks of the output amplifiers may be detected below a certain level and used to bias back the bass control from a high boost condition in order to prevent overloading the loudspeakers with low frequency signals.

Loudness Control Possibilities

The loudness control is achieved by control of the tone sections of the LM1035 by the voltage applied to pin 7; tone and loudness functions are therefore not mutually independent. For example, reducing the value of the bass capacitors in the circuit of Fig. 2 will cause the minimum gain of the loudness curve of Fig. 8 to move to higher frequencies.

When the loudness control pin 7 is directly connected to pin 12, loudness control commences at a typical threshold of −8dB, with most of the control action complete by −30dB, as shown in Fig. 8. If the circuit of Fig. 13 is employed, the voltage at pin 7 is raised towards that at the Zener output of pin 17, with the result that the loudness control becomes effective only at signal levels lower than those at which it is effective in Fig. 9. In addition the curves are flatter, so there is less loudness control. It is possible to extend the active range of this control to below −50dB with this technique.



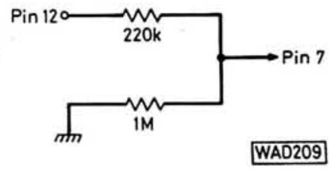


Fig. 13 (left): Circuit for reducing the rate of onset of loudness compensation

Fig. 14 (right): Circuit for increasing the rate of onset of loudness compensation

Alternatively the circuit of Fig. 14 may be used to produce the opposite effect in which the loudness control commences to be effective earlier so that the second (−10dB) curve of Fig. 8 is raised at each end to about −4dB, although the 0dB curve is still flat.

The LM1035 is a complex, but extremely versatile, device which has the facilities for tailoring its response to the needs of almost any user. With bass and treble capacitors of 390nF and 1nF respectively, it can be used in wideband equalisation circuits centred on 10kHz with 15dB boost or cut at about 300Hz and 200kHz! ●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Antennas And

Part 1 by J. J. Fields

The bread and butter of a lawyer is made from arguing the finer points of law, from Alpha-particles to Zululand legislation. This article will take a "light-hearted" look at the Planning Law affecting your antenna and its support and will look a little deeper into how it works out in practice; how to *avoid* the law (*not* I hasten to add how to *evade* the law); what to do to ease the passage of a planning application through and what to do if, God forbid, you fall foul of the Planning Law.

Legal Aspects

The situation legally can be very tight and luckily most Planning Authorities, due I think to the rapid proliferation of TV antennas in their millions in the 1960s, adopt a less strict approach.

An antenna (*aerial* in the solicitor's language) or mast on a dwellinghouse requires planning permission under Section 22(1) of the Town & Country Planning Act, 1971 if it projects above the ridge line of the roof. This is arguable, as all legal documents are, but this view was upheld in various appeal decisions related to the earlier planning acts. The Minister of Housing and Local Government issued a circular in 1968 (No. 29/68) expressing concern regarding the proliferation of radio masts throughout the country and referring to damage to the visual amenities. In my opinion that circular referred to the very large number and size of masts required by utility and police services together with certain types of businesses—road transport, repairs, taxis etc., and not to our humble amateur radio or CB operator. Nevertheless, it has been and will be quoted as ministerial policy designed to curb the unbridled enthusiasm of the 27MHz CB operator or the 1·8 to 1296MHz amateur who requires two towers, four roof masts and a string of $\lambda/2$ long wires, quads, deltas, Windoms etc. for "experimental" purposes.

In practice, however, life is simpler than that and I will suggest an approach which will try to steer a path between the legal public inquiries system with solicitors and irate neighbours, which may necessitate reduction of the proposed antenna to an inadequate size in the end, and an amicably negotiated system which may still not be exactly what you require but adequate for your purposes and soothing to the neighbours and to the Planning Officer.

The Planning Department legal sections generally, not only take the view that the erection of a tower or mast to support an antenna is development requiring planning permission, by virtue of Section 22(1) of the 1971 Act, but furthermore, that it is not development free from planning control referred to as "permitted development," under the latest edition of the General Development Order. The relevant words are found in Schedule 1 Class I(3). The Planning Officer is likely to claim that your tower or mast in the garden is a "building" and does not fall within the class of development permitted within the curtilage of a building under the General Development Order. A "building" is defined in Section 290(1) of the Town & Country Planning Act, 1971.

The appendix given at the end of this article indicates for those who wish to study further the relevant sources of information, but it appears quite clear that any antenna above the ridge of your house (or in front of the house). requires planning permission. "What," I hear you ask "about all the TV antennas then?" Well it seems quite clear also that in normal housing estates almost all planning authorities turn a blind eye to the ordinary domestic TV antenna. Your problem arises because in order to avoid breakthrough to your own or neighbours' equipment it is often better to separate roof-top arrays by a vertical distance (plus horizontal if possible). In other words, if the top of the TV antenna is for example 2m above the ridge (a tolerated relaxation of the rules in most cases) you are likely to want the lower part of your vertical at least 1m higher. Various tolerances above the ridge height are informally allowed by authorities from 2m (a small TV antenna in a strong signal area) to 4·5m (a high TV antenna in a reception "shadow").

For roof top work it is recommended that you draw up your requirements at a scale of say 1:50, illustrate a chimney and/or TV antenna at the side of the drawing to indicate the relationship between them. Arm yourself with the technical arguments as to why it would be unwise to place it lower or use a different array, then carefully think and think again—don't hurry. Don't rush to your neighbour shouting "You're likely to get TVI or audio breakthrough if I can't have this"—play it cool man all the way! Then discuss with the neighbour and/or Planning Officer.

The consultation procedure in recent years has been enlarged and the Planning Officer is very likely to consult your neighbours in any case. Unfortunately, his radio knowledge is likely to be less than yours and he may be unable to explain your case adequately. It is also likely

Planning Law

that he will think that a transistor is a box with knobs, dial, speaker and batteries and a wavelength is something found in Benidorm.

A similar situation exists for back-garden towers and masts. However it is normally taken that any mast or tower not exceeding 3m in height above the ground level does not need consent—anything above that height does. I am aware of the books relating to "hidden antennas" and of course you may well have to retire to those shown in the book. In some circumstances, however, a 3m high mast will be adequate and you need not even ask.

However, in the main, most h.f., v.h.f. or CB operators will require for technical reasons, i.e. the avoidance of breakthrough and for DX purposes, to have the antenna system as high as practical within the general code of safety and good neighbourliness. There are, of course, special height requirements separate from planning regulations laid down for 27 and 934MHz installations. At 27MHz for instance a maximum antenna length, including loading coil, of 1·65m is specified and where chimney or mast mounted, if the base is more than 7m above ground level a 10dB attenuator must be fitted.

The Law in Practice

The Law as practised by the various authorities varies. Some have formal resolutions which tend to date back to the legalisation of CB when it was expected that big 27MHz antennas would be on alternate houses in every street. This has not materialised so far as I can judge from the external appearance of estates, nevertheless they are here in sufficient numbers together with amateur antennas to draw attention to our hobby.

Let us look at some of the diverse ways in which antennas are dealt with, both by planning staff and planning committees. One large authority with a catchment of about a quarter of a million people has no policy at all. Before you throw up your hands in horror let me point out that this lack of policy has both advantages and disadvantages to the radio operator. The main disadvantage is that you are unable to acquire a policy document, allowing you to design your scheme to suit your requirements and those of the planning authority's adopted policy with a reasonable assumption that it will be approved. The other is that each Planning Officer will have a different approach which may help or may hinder you. However, I think that the advantages to the *reasonable* amateur or CB operator, who recognises that he must live in peace with his neighbours, outweigh the disadvantages. You can discuss it with the Planning Officer, explain, demonstrate and maybe show him similar antennas elsewhere. You can modify to suit his and your requirements, together with those of your neighbours, without the benefit of pettifogging restrictive policies (you are still, of course, bound by the general regulations).

Perhaps a greater advantage to an operator with his QTH in an area without clearly defined policies is the fact that exceptions to the views held by the Planning Officer and Planning Committee are more likely to have occurred in the recent past. Whilst in considering a planning refusal on appeal, the Inspector must judge each case on its merits, he must also take into account all other relevant factors if presented to him by either side. That is to say he must take into account clearly defined and adopted policies which may well mitigate against approval for our aspiring enthusiast.

Contrariwise, he must also take into account any *relevant* similar cases which have been recommended for approval in similar circumstances, if they are quoted to him. Whilst considering planning appeals it is as well to mention that an appeal may be made not only against a refusal of planning permission for the antenna and tower, but also against any conditions which the operator may consider unreasonable or onerous. However, always consider that whilst you have nothing to lose except time if you appeal against a refusal—if you appeal against a condition, you are in effect asking the Inspector to put himself in the place of the Local Planning Authority. He is obliged to consider all the issues including any additional points put forward by yourself or any interested party and, based on all the evidence, reach a new decision. Whilst you hope that he may take away the offending condition or at the least modify it slightly to suit your needs, he may consider that the original condition was not strict enough or that the permission, having regard to the new evidence put before him, was incorrect and a refusal would be more appropriate.

A further appeal is not only very costly, involving solicitors and maybe barristers, but can only be made on a point of law or if the Inspector can be proved to have exceeded his powers. You must regard the normal planning appeal procedure as the last chance.

Different Situations

Unfortunately just as there are many different faces behind the microphone there are many different QTH situations to consider. You should really consider these points long before you buy a property, not just look at the height a.s.l. and the possibilities of beaming south at 12 degrees elevation to catch a satellite when you are rich enough to buy the equipment.

Probably the easiest places to obtain planning permission would be the estates built privately between the wars, mainly semi-detached, on undulating ground but not a skyline position. Architecturally there can usually be no case for preservation or conservation orders on such properties or estates—these would prevent you doing almost anything. For instance, in a conservation area you would be unable to demolish the corrugated iron shack down the garden, erected by your father G2 plus two letters, in 19 . . without permission from the Planning Authority.

These inter-war houses usually had gardens of reasonable length as they were erected in "green field" situations. The intimacy of semi-detached and short terrace housing usually means that hobbies must be shared. You are forced to share your neighbour's car repairs (in return he may well tune your engine). You have to share the homing pigeons owned by the man at the back. Mrs. Jones up the road calls at almost every house with her "book" as does the Avon lady. You may similarly be accepted, especially if you know how to fix that filter, how to fit a TV signal booster in a poor reception area or how to fit a new TV antenna. Spread a little happiness: it doesn't always work but it may help.

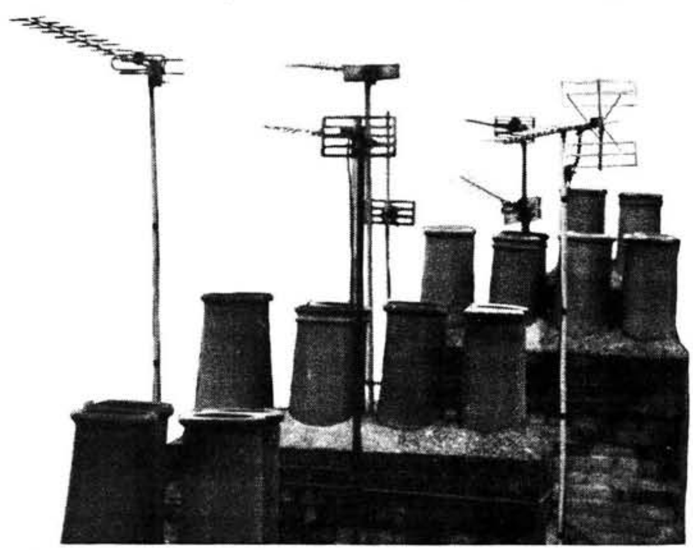
At Radburn, New Jersey in the US, an estate was built before WWII which segregated pedestrians from wheeled vehicles. For various reasons, not the least being the tendency for muggings to be easier on shrub-lined footpath systems and the tendency for children to play on the vehicular cul-de-sac accesses, I don't go much on this type of layout from a practical point of view. However, in the early 1960s they became fashionable in the UK—a fashion which is departing very slowly. Unfortunately, you have in such estates a pedestrian side and a vehicular side to a house—each of which can be called the front. You may remember that a mast less than 3m high in your back garden is permitted development, i.e. no planning permission is needed. However, if the backs and fronts are not easily distinguishable, the Planning Authorities usually take away the permitted development rights on which you rely for a 3m mast in the back garden by inserting a condition on the original planning permission for the estate. Unless you have a very friendly Planning Officer and even more friendly Planning Committee I suggest that such estates are avoided by the DX enthusiast like a plague.

The next type of highly desirable area to avoid is the Georgian, Regency and Victorian groups of buildings most of which will be within a conservation area. Now there are financial advantages for lovers of Georgian buildings—for aesthetics of all types to restore carefully these architectural gems—but the philistine who wires even a 3m mast with 10-element crossed Yagi to a 200 year old chimney will find the heavy book of rules thrown at him. It can be possible to buy a modern house within a conservation area but the same rules will apply. Go one better and buy a listed building and boy you have a problem larger than the tax man! Whilst both planning authorities and Inspectors in any subsequent planning appeal would consider carefully if "the proposed mast and antenna would be ugly and obtrusive in the local scene, to a degree whereby they would be seriously harmful to the appearance of . . .," all the little unofficial allowances up

"Wild kangaroos won't drag him ou

to 2, 3, or 3·5m above the ridge line applicable elsewhere would disappear in respect of this house.

The last one which we all dream about—the QTH on the knoll. The lump of granite left when the ice-age glaciers ground away at all the sandstones and limestones. The bare lump looking out unobstructed in all directions—and dream of dreams, the inter-war bungalow on top which the owner wishes to dispose of cheaply because he has a bad heart and can't climb from the public highway below. Boy, it's a snip and with a 15m tower and a tri-bander atop the world's your oyster—even without Morse. Beware, it may be the southern tip of the Cotswolds (or other range of



"It seems quite clear also that in normal housing estates almost all planning authorities turn a blind eye to the ordinary domestic TV antenna"

to the Crossed Digeridoo homestead again"

hills) all of which is within an "area of high landscape value." Drop it! Apply for permission and you are likely to generate a refusal if anyone can see it with a 12in telescope from 16km away. Put it up without permission and enforcement notices will float round you like the leaves of your log book.

Supports for Antennas

The simplest h.f. antenna and the least likely to attract any attention at all from the Planning Officer is the relatively thin wire between two trees. The main visual obstruction will be two little china eggs, the open wire feeder and the water-filled plastic container to keep the wire tight. It is so inexpensive that it may well be worth while setting it up "experimentally" and if it works satisfactorily then forgetting to remove it.

When you get to the quads, deltas, Zeps, etc. it gets a bit more dicey but again home-brew is mainly about costs and you could chance your arm on arrays below the ridge line and see what happens. The $\lambda/4$ vertical starts to present a problem if it starts at ridge level or above. As the frequency lowers the $\lambda/4$ gets longer and loading coils, caps and radials become necessary. What to you is a beautiful piece of radio engineering becomes to the neighbour and Planning Officer a lot of "old wire junk". Even a neat 50mm diameter alloy pole and stay-wires will appear to offend. We're back to the negotiating table. The pole with 3 element "horizontal rods," drooping a little at the ends due to the length and containing a 150mm diameter "blob," which you explain is to rotate the elements, will raise eyebrows. In the "easy" areas referred to earlier and if you don't go too high above the roof you may not even be asked for an application but woe betide you if you get breakthrough as the neighbours will be more likely to go to the Planning Officer than the "Keeper of the Queen's Frequencies" and he will feel bound to act, not of course, on breakthrough grounds except in Kirklees (see later), but on visual amenity grounds.

That antenna, which was not offensive for the whole year that you have had it erected without permission, suddenly becomes an "electric monster" threatening the security of the neighbour watching his video or listening to Debussy.

In the back garden you are OK up to 3m above ground level. However, to be on the safe side and to avoid the necessity for planning permission both mast and the antenna elements must be below the 3m height which rather limits things. However, if a rear-garden mast of say 7·5m in an "easy" area would suit you, have a go, discuss, amend and make an application.

Lattice masts both telescopic, tilting or fixed must always be the subject of negotiation from the beginning. The main reason for this is the dreadful expense of time and money if you have to remove it or move it. In computer language RETURN—go back to the beginning and read this article again. Cool, calm negotiation despite the time lost is worth every penny and every day wasted.

"Various tolerances above the ridge height are informally allowed by authorities from 2m (strong signal area) to 4·5m (in a reception shadow)"

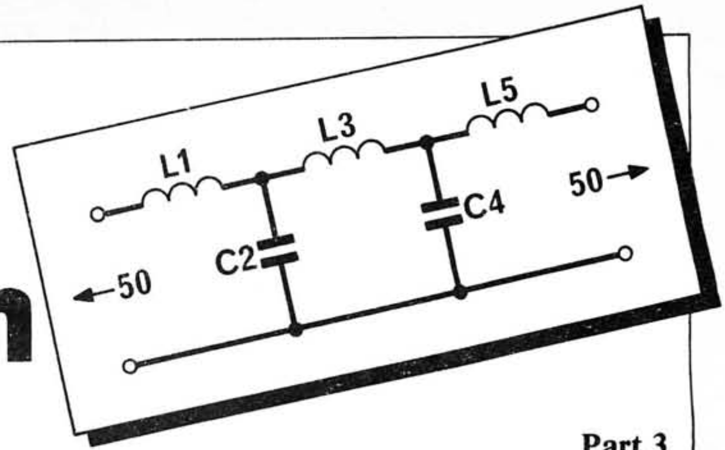
Peace

In my view the most important aspect of the whole of the antenna planning permission scenario is living at peace with your neighbours, your Planning Officer, your landlord and the Radio Interference Service. I have touched earlier the subject of living reasonably with neighbours, getting them to tolerate if not support your hobby in the same way as you tolerate, but not necessarily support theirs.

In a large country these little niceties don't matter. When your neighbour is twenty miles away you have no breakthrough problems nor do you offend his aesthetic sensibilities. The Planning Officer is so "knackered" by the time he arrives to do his inspection after driving the last 25km along that corrugated mud track which you proudly call "The Drive" that all he can do is accept the Bourbon on the rocks, nod OK weakly and face the journey back with the thought that wild kangaroos won't drag him out to the Crossed Digeridoo homestead again. In Liverpool the Planning Officer, landlord or next door neighbour has only to pop out for some ciggies and he sees your beautiful gleaming 20m tower. You'll never get away with it!

TO BE CONTINUED

Practical LC Filter Design



by Edward Wetherhold W3NQN

Part 3

In the first part of this article, the difficulties involved in calculating the component values of a simple passive *LC* filter were explained. When the standard design procedures with normalised tables are used, calculation errors are easy to make and the resulting design invariably will have non-standard capacitor values which complicates the filter construction.

The solution to this problem is to use a new design procedure (the first major advancement in amateur radio passive *LC* filter design in the last twenty years) in which a filter is selected from tables of many precalculated standard-value capacitor (SVC) designs.

Comprehensive tables using 5, 10 and 20 per cent capacitor values are introduced in this article, and procedures will be explained whereby these tables may serve as a universal design aid for obtaining SVC filter designs for virtually any impedance level and any cutoff frequency. Using this new procedure, the radio amateur needs only to scan a few tables to find a suitable design. These SVC tables have been widely published in the US[10–22] and less extensively in the UK[23,24]. This article provides the first complete compilation of SVC filter tables for the UK reader.

Tables for SVC Filter Designs

The SVC tables in this article are for 5- and 7-element 50 ohm lowpass and highpass Chebyshev filters. These designs will satisfy most of the amateur filtering requirements. The more complicated and higher performance Cauer (elliptic) filters will be covered in a future article.

There are six SVC filter tables—four for lowpass and two for highpass (see Tables 3.1–3.6). Each table lists cutoff frequencies covering the 1–10MHz decade with sufficiently small increments so that virtually any cutoff frequency can be obtained. A schematic diagram and a typical attenuation response curve (or a reference to a curve) accompanies each table.

The four lowpass filter configurations consist of either capacitive or inductive input and output. The capacitive input/output configuration is usually preferred because it has a minimum number of inductors (see Tables 3.1 and 3.3). Inductors are usually more bulky, more costly and have higher losses than capacitors. However, there are occasions when bipolar transistor r.f. amplifiers become unstable when looking into a capacitive input filter. In this case, an inductive input/output filter may be necessary, and the designs in Tables 3.2 and 3.4 will be needed[9,14]. The two highpass filter tables are only for the capacitive input/output configuration. The alternative inductive input/output configuration is seldom required and it is therefore omitted.

The six tables of precalculated designs are all based on an impedance of 50 ohms because this impedance level is most frequently used in amateur radio applications. The 1–10MHz frequency range was used for listing the SVC data because it has conveniently tabulated values and the designs can be easily scaled to other decades by inspection.

Table Parameters

The design parameters for each filter are listed in columns. The first column is the identification number of a particular design. Thus, any filter in any of the six tables can be conveniently identified with its table number followed by a dash and its design identification number.

The next four columns list the frequencies at the filter cutoff and at the 3, 20 and 40dB attenuation levels on the filter response curve. This information is usually not available when designing with the customary normalised tables, and the inclusion of this stopband attenuation information in the SVC tables is another example of the convenience associated with this method of filter design.

The next column lists the maximum v.s.w.r. level of the filter design. These range from a minimum of 1·020 (corresponding to a reflection coefficient of 1·0 per cent) to a maximum of 1·273 (corresponding to a reflection

EDITOR'S NOTE

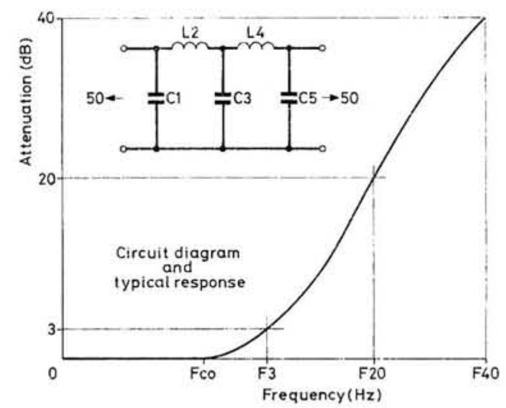
The tables in this article are based on the full E24 (5 per cent tolerance) range of capacitors, which are widely available in the US. On the UK hobbyist market, only the E12 (10 per cent tolerance) range of values appears to be available, although the capacitors offered have a tolerance of 5 per cent.

The intermediate values called for in the tables can of course be made up by paralleling appropriate values from the E12 series. For example, 1000pF and 100pF in parallel to produce 1100pF. The author recommends that this should **not** be done for cutoff frequencies above 30MHz because undesired interresonances between the paralleled capacitors may cause unexpected resonances in the filter stopband or passband. Below 30MHz, the paralleling of capacitors probably will present no problem, except for the additional cost and space required.

TABLE 3.1

5-ELEMENT 50-OHM, LOW-PASS CHEBYSHEV SVC-FILTER DESIGNS, CAPACITIVE INPUT, 5% TOLERANCE SERIES, SELECTED VSWR LIMIT = 1.273

NO.	-----FREQUENCY (MHZ)----- F-CO	3-DB	20DB	40DB	MAX. VSWR	C1,5 (PF)	L2,4 (UH)	C3 (PF)
1	1.02	1.21	1.65	2.45	1.212	3000	10.7	5600
2	1.10	1.32	1.81	2.69	1.196	2700	9.88	5100
3	1.04	1.37	1.94	2.94	1.085	2200	9.82	4700
4	1.15	1.41	1.95	2.92	1.155	2400	9.37	4700
5	1.13	1.50	2.12	3.22	1.081	2000	9.00	4300
6	1.26	1.54	2.13	3.19	1.157	2200	8.56	4300
7	1.05	1.62	2.38	3.66	1.028	1600	8.35	3900
8	1.23	1.65	2.34	3.55	1.076	1800	8.19	3900
9	1.39	1.70	2.35	3.51	1.159	2000	7.75	3900
10	1.17	1.76	2.57	3.94	1.033	1500	7.70	3600
11	1.27	1.77	2.55	3.88	1.057	1600	7.64	3600
12	1.46	1.82	2.54	3.81	1.135	1800	7.28	3600
13	1.65	1.92	2.59	3.83	1.268	2000	6.64	3600
14	1.43	1.94	2.77	4.21	1.068	1500	6.96	3300
15	1.54	1.97	2.77	4.17	1.109	1600	6.79	3300
16	1.76	2.07	2.81	4.17	1.238	1800	6.21	3300
17	1.32	2.10	3.11	4.79	1.022	1200	6.42	3000
18	1.48	2.12	3.06	4.68	1.046	1300	6.39	3000
19	1.75	2.19	3.05	4.57	1.135	1500	6.07	3000
20	1.89	2.25	3.08	4.57	1.206	1600	5.77	3000
21	1.51	2.34	3.44	5.29	1.026	1100	5.78	2700
22	1.70	2.36	3.40	5.17	1.057	1200	5.73	2700
23	1.87	2.40	3.38	5.10	1.104	1300	5.57	2700
24	2.20	2.56	3.46	5.11	1.268	1500	4.98	2700
25	1.75	2.63	3.85	5.91	1.033	1000	5.14	2400
26	1.99	2.67	3.81	5.78	1.072	1100	5.05	2400
27	2.19	2.74	3.81	5.71	1.135	1200	4.85	2400
28	2.40	2.84	3.86	5.73	1.227	1300	4.55	2400
29	1.89	2.87	4.21	6.46	1.030	910	4.71	2200
30	2.14	2.91	4.16	6.31	1.068	1000	4.64	2200
31	2.39	2.99	4.16	6.23	1.135	1100	4.45	2200
32	2.64	3.11	4.22	6.25	1.238	1200	4.14	2200
33	2.05	3.16	4.64	7.13	1.028	820	4.28	2000
34	2.36	3.20	4.57	6.94	1.068	910	4.22	2000
35	2.63	3.28	4.57	6.86	1.135	1000	4.05	2000
36	2.93	3.43	4.65	6.89	1.251	1100	3.73	2000
37	2.34	3.51	5.14	7.88	1.033	750	3.85	1800
38	2.63	3.56	5.08	7.71	1.069	820	3.79	1800
39	2.96	3.66	5.09	7.62	1.145	910	3.61	1800
40	3.30	3.84	5.19	7.67	1.268	1000	3.32	1800
41	2.70	3.96	5.76	8.82	1.039	680	3.42	1600
42	3.06	4.03	5.71	8.63	1.086	750	3.34	1600
43	3.38	4.14	5.73	8.57	1.159	820	3.18	1600
44	2.77	4.21	6.18	9.48	1.030	620	3.21	1500
45	3.14	4.26	6.10	9.26	1.067	680	3.17	1500
46	3.51	4.38	6.10	9.14	1.135	750	3.03	1500
47	3.88	4.56	6.20	9.17	1.241	820	2.82	1500
48	3.39	4.88	7.08	10.8	1.044	560	2.77	1300
49	3.84	4.98	7.02	10.6	1.097	620	2.70	1300
50	4.26	5.14	7.08	10.5	1.181	680	2.55	1300
51	3.61	5.28	7.68	11.8	1.039	510	2.56	1200
52	4.06	5.36	7.61	11.5	1.083	560	2.51	1200
53	4.55	5.54	7.65	11.4	1.167	620	2.37	1200
54	3.96	5.76	8.38	12.8	1.041	470	2.35	1100
55	4.39	5.84	8.31	12.6	1.079	510	2.31	1100
56	4.88	6.01	8.33	12.5	1.152	560	2.20	1100
57	4.40	6.34	9.20	14.1	1.043	430	2.13	1000
58	4.91	6.45	9.13	13.8	1.087	470	2.09	1000
59	5.38	6.62	9.17	13.7	1.154	510	2.00	1000
60	4.81	6.97	10.1	15.5	1.042	390	1.94	910
61	5.43	7.09	10.0	15.2	1.091	430	1.89	910
62	6.00	7.31	10.1	15.1	1.167	470	1.80	910
63	4.86	7.69	11.4	17.5	1.023	330	1.76	820
64	5.51	7.76	11.2	17.1	1.052	360	1.74	820
65	6.07	7.89	11.1	16.8	1.095	390	1.70	820
66	6.77	8.17	11.2	16.7	1.184	430	1.60	820
67	5.26	8.40	12.4	19.2	1.022	300	1.61	750
68	6.04	8.48	12.2	18.7	1.052	330	1.59	750
69	6.70	8.64	12.2	18.4	1.101	360	1.55	750
70	7.33	8.89	12.3	18.3	1.175	390	1.48	750
71	6.69	9.36	13.5	20.6	1.054	300	1.44	680
72	7.48	9.56	13.4	20.2	1.110	330	1.40	680
73	8.25	9.89	13.6	20.2	1.196	360	1.32	680
74	7.21	10.2	14.8	22.6	1.048	270	1.32	620
75	8.18	10.5	14.7	22.2	1.107	300	1.28	620
76	9.11	10.9	14.9	22.1	1.203	330	1.20	620
77	7.82	11.3	16.4	25.1	1.042	240	1.20	560
78	9.02	11.6	16.3	24.6	1.105	270	1.15	560
79	10.2	12.1	16.5	24.5	1.212	300	1.07	560
80	8.66	12.4	18.0	27.6	1.044	220	1.09	510
81	9.64	12.6	17.9	27.1	1.088	240	1.06	510
82	9.22	13.5	19.6	30.0	1.039	200	1.00	470
83	10.4	13.7	19.4	29.4	1.085	220	.981	470
84	9.85	14.7	21.5	33.0	1.034	180	.919	430
85	10.5	16.2	23.8	36.6	1.028	160	.835	390



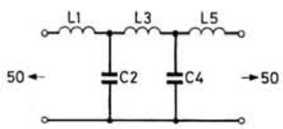
Circuit diagram and typical response

coefficient of 12 per cent). This range of v.s.w.r. was considered to be adequate for amateur radio applications. Filter designs with smaller values of v.s.w.r. have too gradual a rise in attenuation for effective filtering, and therefore designs for v.s.w.r. values less than 1·020 are omitted. Designs with v.s.w.r.s greater than 1·273 are omitted because they are not appropriate for r.f. filtering requirements where low v.s.w.r. characteristics are important. In my *Short Wave Magazine* article, "Low-pass filters for attenuating r.f. amplifier harmonics, Part 1"[24], I recommended the v.s.w.r. should not exceed 1·1; however, in order to increase the number of usable designs, I have

TABLE 3.2

5-ELEMENT 50-OHM, LOW-PASS CHEBYSHEV SVC-FILTER DESIGNS, INDUCTIVE INPUT, 5% TOLERANCE SERIES, SELECTED VSWR LIMIT = 1.273

NO.	FREQUENCY (MHZ) F-CO	3-DB	20DB	40DB	MAX. VSWR	L1,5 (UH)	C2,4 (PF)	L3 (UH)
1	.74	1.15	1.69	2.60	1.027	5.60	4700	13.72
2	.90	1.26	1.81	2.76	1.055	5.60	4300	12.66
3	1.06	1.38	1.94	2.93	1.096	5.60	3900	11.75
4	1.19	1.47	2.05	3.07	1.138	5.60	3600	11.15
5	1.32	1.58	2.17	3.23	1.192	5.60	3300	10.61
6	1.46	1.70	2.30	3.41	1.260	5.60	3000	10.12
7	.91	1.39	2.03	3.12	1.030	4.70	3900	11.38
8	1.08	1.50	2.16	3.29	1.056	4.70	3600	10.60
9	1.25	1.63	2.30	3.48	1.092	4.70	3300	9.92
10	1.42	1.77	2.46	3.68	1.142	4.70	3000	9.32
11	1.61	1.92	2.63	3.90	1.209	4.70	2700	8.79
12	1.05	1.64	2.41	3.72	1.025	3.90	3300	9.63
13	1.29	1.80	2.60	3.96	1.054	3.90	3000	8.83
14	1.54	1.99	2.80	4.22	1.099	3.90	2700	8.15
15	1.80	2.19	3.03	4.53	1.164	3.90	2400	7.57
16	1.99	2.35	3.20	4.75	1.222	3.90	2200	7.23
17	1.34	2.00	2.93	4.49	1.034	3.30	2700	7.89
18	1.68	2.25	3.20	4.84	1.077	3.30	2400	7.15
19	1.92	2.43	3.40	5.11	1.118	3.30	2200	6.72
20	2.16	2.63	3.62	5.40	1.174	3.30	2000	6.35
21	2.43	2.85	3.87	5.72	1.247	3.30	1800	6.02
22	1.66	2.46	3.59	5.51	1.035	2.70	2200	6.43
23	1.99	2.70	3.86	5.85	1.069	2.70	2000	5.93
24	2.34	2.97	4.15	6.24	1.118	2.70	1800	5.50
25	2.71	3.27	4.49	6.68	1.188	2.70	1600	5.13
26	2.92	3.43	4.67	6.92	1.233	2.70	1500	4.97
27	2.01	3.01	4.39	6.74	1.034	2.20	1800	5.26
28	2.52	3.37	4.80	7.27	1.077	2.20	1600	4.76
29	2.78	3.57	5.02	7.56	1.107	2.20	1500	4.55
30	3.34	4.02	5.52	8.21	1.190	2.20	1300	4.18
31	3.65	4.27	5.80	8.58	1.247	2.20	1200	4.01
32	2.35	3.61	5.29	8.14	1.029	1.80	1500	4.38
33	3.12	4.14	5.89	8.92	1.080	1.80	1300	3.88
34	3.51	4.45	6.23	9.36	1.118	1.80	1200	3.67
35	3.93	4.78	6.60	9.85	1.169	1.80	1100	3.48
36	4.37	5.15	7.01	10.39	1.233	1.80	1000	3.31
37	3.10	4.51	6.56	10.03	1.041	1.50	1200	3.51
38	3.65	4.90	6.99	10.60	1.073	1.50	1100	3.27
39	4.21	5.34	7.47	11.23	1.118	1.50	1000	3.06
40	4.75	5.77	7.95	11.86	1.173	1.50	910	2.89
41	5.34	6.26	8.49	12.57	1.245	1.50	820	2.74
42	3.53	5.41	7.94	12.20	1.029	1.20	1000	2.92
43	4.30	5.94	8.53	12.98	1.060	1.20	910	2.68
44	5.09	6.53	9.18	13.84	1.106	1.20	820	2.49
45	5.73	7.04	9.75	14.58	1.155	1.20	750	2.35
46	6.42	7.61	10.38	15.41	1.219	1.20	680	2.23
47	4.40	6.60	9.65	14.80	1.033	1.00	820	2.39
48	5.27	7.20	10.32	15.68	1.064	1.00	750	2.22
49	6.15	7.87	11.06	16.65	1.108	1.00	680	2.06
50	6.95	8.51	11.76	17.58	1.160	1.00	620	1.95
51	7.80	9.22	12.55	18.61	1.227	1.00	560	1.85
52	5.23	7.96	11.67	17.92	1.030	.82	680	1.99
53	6.33	8.72	12.51	19.03	1.061	.82	620	1.83
54	7.45	9.56	13.45	20.26	1.106	.82	560	1.70
55	8.44	10.35	14.32	21.40	1.158	.82	510	1.60
56	9.28	11.04	15.09	22.41	1.211	.82	470	1.53
57	6.41	9.66	14.15	21.71	1.032	.68	560	1.64
58	7.75	10.59	15.18	23.06	1.064	.68	510	1.51
59	8.83	11.41	16.08	24.25	1.100	.68	470	1.42
60	9.97	12.31	17.08	25.56	1.148	.68	430	1.34



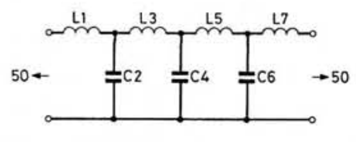
See Table 3.1 for typical response

TABLE 3.4

7-ELEMENT 50-OHM, LOW-PASS CHEBYSHEV SVC-FILTER DESIGNS, INDUCTIVE INPUT, 5% TOLERANCE SERIES, SELECTED VSWR LIMIT = 1.273

NO.	FREQUENCY (MHZ) F-CO	3-DB	20DB	40DB	MAX. VSWR	L1,L7 (UH)	C2,C6 (PF)	L3,L5 (UH)	C4 (PF)
1	1.01	1.18	1.44	1.87	1.081	5.89	4300	13.4	5100
2	1.09	1.29	1.60	2.08	1.059	5.06	3900	12.0	4700
3	1.20	1.40	1.73	2.24	1.071	4.81	3600	11.2	4300
4	1.33	1.54	1.88	2.43	1.087	4.58	3300	10.3	3900
5	1.42	1.68	2.07	2.70	1.064	3.95	3000	9.27	3600
6	1.53	1.85	2.31	3.02	1.045	3.36	2700	8.32	3300
7	1.63	2.06	2.59	3.41	1.029	2.83	2400	7.41	3000
8	1.86	2.27	2.83	3.70	1.042	2.71	2200	6.78	2700
9	1.91	2.07	2.46	3.12	1.238	4.31	2400	8.19	2700
10	2.14	2.52	3.11	4.04	1.064	2.63	2000	6.18	2400
11	2.29	2.78	3.46	4.52	1.045	2.24	1800	5.54	2200
12	2.45	3.09	3.88	5.11	1.029	1.89	1600	4.94	2000
13	2.85	3.37	4.15	5.39	1.064	1.97	1500	4.64	1800
14	2.86	3.11	3.69	4.68	1.238	2.88	1600	5.46	1800
15	3.13	3.84	4.79	6.27	1.039	1.59	1300	4.00	1600
16	3.27	4.12	5.18	6.81	1.029	1.41	1200	3.70	1500
17	3.47	3.90	4.70	6.02	1.140	2.00	1300	4.17	1500
18	3.99	4.61	5.64	7.28	1.087	1.53	1100	3.43	1300
19	4.27	5.05	6.22	8.09	1.064	1.32	1000	3.09	1200

NO.	FREQUENCY (MHZ) F-CO	3-DB	20DB	40DB	MAX. VSWR	L1,L7 (PF)	C2,C6 (UH)	L3,L5 (PF)	C4 (UH)
20	4.63	5.53	6.85	8.91	1.056	1.17	910	2.81	1100
21	5.05	6.11	7.60	9.92	1.047	1.03	820	2.53	1000
22	5.58	6.70	8.31	10.8	1.052	.953	750	2.31	910
23	6.23	7.41	9.16	11.9	1.059	.880	680	2.10	820
24	6.79	8.12	10.0	13.1	1.055	.795	620	1.91	750
25	7.46	8.97	11.1	14.5	1.051	.710	560	1.73	680
26	8.18	9.85	12.2	15.9	1.050	.644	510	1.57	620
27	9.21	10.8	13.2	17.1	1.074	.633	470	1.46	560
28	10.1	11.8	14.4	18.7	1.081	.589	430	1.34	510
29	10.9	12.9	16.0	20.8	1.059	.506	390	1.20	470

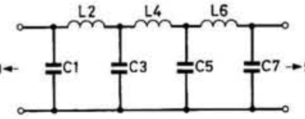


See Table 3.1 for typical response

TABLE 3.3

7-ELEMENT 50-OHM, LOW-PASS CHEBYSHEV SVC-FILTER DESIGNS, CAPACITIVE INPUT, 5% TOLERANCE SERIES, SELECTED VSWR LIMIT = 1.273

NO.	-----FREQUENCY (MHZ)----- F-CO	3-DB	20DB	40DB	MAX. VSWR	C1,7 (PF)	L2,6 (UH)	C3,5 (PF)	L4 (UH)
1	1.02	1.10	1.31	1.65	1.254	3300	11.2	6200	12.6
2	1.04	1.16	1.40	1.79	1.142	2700	10.9	5600	12.6
3	1.13	1.23	1.45	1.84	1.264	3000	10.1	5600	11.3
4	1.05	1.23	1.51	1.96	1.071	2200	10.3	5100	12.3
5	1.12	1.26	1.53	1.96	1.123	2400	10.0	5100	11.7
6	1.23	1.34	1.59	2.01	1.247	2700	9.29	5100	10.4
7	1.03	1.30	1.63	2.15	1.030	1800	9.52	4700	11.9
8	1.12	1.33	1.64	2.13	1.064	2000	9.50	4700	11.4
9	1.21	1.37	1.66	2.13	1.119	2200	9.27	4700	10.8
10	1.29	1.42	1.70	2.16	1.200	2400	8.82	4700	10.0
11	1.10	1.41	1.79	2.36	1.023	1600	8.68	4300	11.0
12	1.21	1.45	1.79	2.33	1.058	1800	8.71	4300	10.5
13	1.31	1.49	1.81	2.33	1.114	2000	8.50	4300	9.91
14	1.42	1.56	1.86	2.36	1.202	2200	8.06	4300	9.14
15	1.25	1.57	1.97	2.59	1.031	1500	7.90	3900	9.85
16	1.32	1.59	1.97	2.57	1.050	1600	7.91	3900	9.62
17	1.44	1.64	1.99	2.56	1.109	1800	7.73	3900	9.04
18	1.57	1.72	2.05	2.60	1.205	2000	7.30	3900	8.27
19	1.44	1.73	2.14	2.78	1.056	1500	7.29	3600	8.82
20	1.52	1.76	2.15	2.78	1.086	1600	7.22	3600	8.54
21	1.66	1.84	2.20	2.81	1.176	1800	6.86	3600	7.83
22	1.51	1.86	2.33	3.05	1.037	1300	6.69	3300	8.27
23	1.68	1.93	2.35	3.03	1.099	1500	6.58	3300	7.72
24	1.77	1.98	2.38	3.05	1.147	1600	6.40	3300	7.37
25	1.56	2.02	2.56	3.38	1.021	1100	6.04	3000	7.68
26	1.68	2.05	2.56	3.35	1.042	1200	6.09	3000	7.47
27	1.79	2.09	2.57	3.33	1.073	1300	6.05	3000	7.21
28	1.99	2.20	2.64	3.37	1.176	1500	5.72	3000	6.52
29	2.11	2.28	2.70	3.42	1.257	1600	5.42	3000	6.08
30	1.75	2.25	2.84	3.75	1.023	1000	5.45	2700	6.89
31	1.89	2.29	2.84	3.71	1.048	1100	5.48	2700	6.68
32	2.02	2.34	2.86	3.70	1.086	1200	5.41	2700	6.40
33	2.15	2.41	2.90	3.72	1.141	1300	5.26	2700	6.06
34	2.01	2.54	3.20	4.21	1.027	910	4.86	2400	6.09
35	2.17	2.59	3.20	4.17	1.056	1000	4.86	2400	5.88
36	2.33	2.66	3.24	4.17	1.104	1100	4.77	2400	5.59
37	2.49	2.76	3.30	4.21	1.176	1200	4.57	2400	5.22
38	2.16	2.76	3.49	4.60	1.024	820	4.44	2200	5.61
39	2.35	2.82	3.49	4.55	1.053	910	4.46	2200	5.41
40	2.52	2.89	3.52	4.54	1.099	1000	4.38	2200	5.15
41	2.72	3.01	3.60	4.59	1.176	1100	4.19	2200	4.78
42	2.38	3.04	3.84	5.06	1.025	750	4.04	2000	5.09
43	2.57	3.09	3.84	5.01	1.050	820	4.06	2000	4.93
44	2.78	3.18	3.88	5.00	1.100	910	3.99	2000	4.68
45	2.99	3.31	3.96	5.05	1.176	1000	3.81	2000	4.35
46	2.67	3.38	4.26	5.61	1.027	680	3.64	1800	4.57
47	2.89	3.45	4.27	5.56	1.056	750	3.65	1800	4.41
48	3.09	3.54	4.31	5.55	1.100	820	3.59	1800	4.21
49	3.35	3.69	4.42	5.62	1.188	910	3.40	1800	3.87
50	3.07	3.82	4.80	6.30	1.033	620	3.24	1600	4.03
51	3.30	3.90	4.81	6.25	1.064	680	3.24	1600	3.88
52	3.55	4.02	4.87	6.26	1.120	750	3.15	1600	3.67
53	3.81	4.19	4.99	6.34	1.204	820	3.00	1600	3.39
54	3.17	4.05	5.12	6.75	1.024	560	3.03	1500	3.82
55	3.45	4.13	5.12	6.68	1.053	620	3.04	1500	3.69
56	3.69	4.24	5.17	6.66	1.097	680	2.99	1500	3.51
57	3.99	4.41	5.28	6.73	1.176	750	2.86	1500	3.26
58	3.81	4.72	5.90	7.74	1.036	510	2.64	1300	3.26
59	4.10	4.82	5.93	7.69	1.070	560	2.62	1300	3.14
60	4.43	4.98	6.02	7.72	1.133	620	2.54	1300	2.94
61	4.78	5.21	6.19	7.85	1.230	680	2.39	1300	2.70
62	4.13	5.11	6.39	8.38	1.035	470	2.43	1200	3.01
63	4.40	5.20	6.41	8.33	1.064	510	2.43	1200	2.91
64	4.72	5.35	6.49	8.34	1.116	560	2.37	1200	2.76
65	5.12	5.60	6.67	8.48	1.214	620	2.23	1200	2.52
66	4.49	5.57	6.98	9.15	1.035	430	2.23	1100	2.76
67	4.82	5.68	7.00	9.09	1.066	470	2.22	1100	2.66
68	5.12	5.83	7.07	9.10	1.112	510	2.18	1100	2.54
69	5.52	6.07	7.24	9.21	1.196	560	2.07	1100	2.35
70	4.93	6.12	7.67	10.1	1.034	390	2.03	1000	2.51
71	5.33	6.26	7.70	10.0	1.069	430	2.02	1000	2.41
72	5.69	6.44	7.80	10.0	1.122	470	1.97	1000	2.29
73	6.08	6.68	7.97	10.1	1.198	510	1.88	1000	2.13
74	5.49	6.75	8.43	11.0	1.038	360	1.85	910	2.28
75	5.84	6.87	8.46	11.0	1.068	390	1.84	910	2.20
76	6.28	7.09	8.58	11.0	1.126	430	1.79	910	2.07
77	6.75	7.39	8.80	11.2	1.213	470	1.69	910	1.91
78	5.68	7.39	9.37	12.4	1.020	300	1.65	820	2.10
79	6.17	7.52	9.36	12.2	1.043	330	1.66	820	2.04
80	6.60	7.68	9.41	12.2	1.079	360	1.65	820	1.96
81	7.01	7.89	9.53	12.2	1.131	390	1.61	820	1.86
82	7.59	8.27	9.82	12.5	1.233	430	1.51	820	1.70
83	6.72	8.21	10.2	13.4	1.042	300	1.52	750	1.87
84	7.23	8.40	10.3	13.3	1.080	330	1.51	750	1.79
85	7.72	8.66	10.4	13.4	1.138	360	1.46	750	1.69
86	8.24	9.00	10.7	13.6	1.222	390	1.39	750	1.57
87	7.36	9.04	11.3	14.8	1.039	270	1.38	680	1.70
88	7.98	9.27	11.4	14.7	1.082	300	1.37	680	1.62
89	8.58	9.59	11.6	14.8	1.148	330	1.32	680	1.52
90	9.23	10.0	11.9	15.1	1.247	360	1.24	680	1.39
91	7.91	9.86	12.4	16.2	1.032	240	1.26	620	1.56
92	8.67	10.1	12.4	16.1	1.075	270	1.25	620	1.49
93	9.39	10.5	12.7	16.2	1.145	300	1.20	620	1.39
94	10.2	11.0	13.1	16.5	1.254	330	1.12	620	1.26
95	8.86	11.0	13.7	18.0	1.036	220	1.13	560	1.40
96	9.49	11.2	13.8	17.8	1.068	240	1.13	560	1.35
97	10.4	11.6	14.0	17.9	1.142	270	1.09	560	1.26
98	9.72	12.0	15.0	19.7	1.036	200	1.03	510	1.28
99	10.5	12.3	15.1	19.6	1.071	220	1.03	510	1.23
100	10.3	13.0	16.3	21.5	1.030	180	.951	470	1.19



See Table 3.1 for typical response

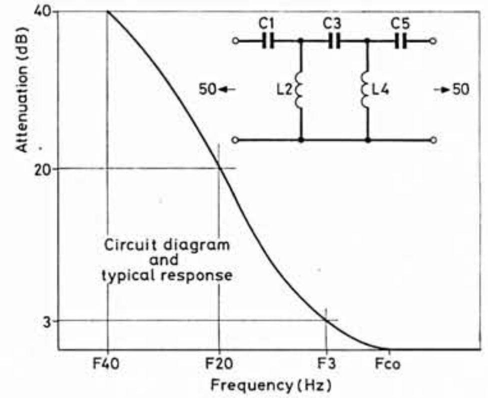
raised the upper limit on the v.s.w.r. parameter to 1·273. The corresponding range of maximum passband attenuation ripple amplitudes are 0·000434 and 0·0630dB. The v.s.w.r. fluctuates in the filter passband between 1·000 and

◀ **Table 3.4 on facing page**

TABLE 3.5

5-ELEMENT 50-OHM, HIGH-PASS CHEBYSHEV SVC-FILTER DESIGNS, CAPACITIVE INPUT, 5% TOLERANCE SERIES, SELECTED VSWR LIMIT = 1.273

NO.	-----FREQUENCY (MHZ)----- F-CO	3-DB	20DB	40DB	MAX. VSWR	C1,5 (PF)	L2,4 (UH)	C3 (PF)
1	1.04	.726	.501	.328	1.044	5100	6.45	2200
2	1.04	.788	.554	.366	1.081	4300	5.97	2000
3	1.17	.800	.550	.359	1.039	4700	5.85	2000
4	1.07	.857	.615	.410	1.135	3600	5.56	1800
5	1.17	.877	.616	.406	1.076	3900	5.36	1800
6	1.33	.890	.609	.397	1.034	4300	5.26	1800
7	1.12	.938	.686	.461	1.206	3000	5.20	1600
8	1.25	.974	.693	.461	1.109	3300	4.86	1600
9	1.36	.994	.691	.454	1.057	3600	4.71	1600
10	1.54	1.00	.683	.444	1.028	3900	4.67	1600
11	1.14	.978	.723	.490	1.268	2700	5.09	1500
12	1.28	1.03	.738	.492	1.135	3000	4.64	1500
13	1.43	1.06	.738	.486	1.068	3300	4.44	1500
14	1.61	1.07	.730	.476	1.033	3600	4.38	1500
15	1.35	1.14	.841	.567	1.227	2400	4.29	1300
16	1.55	1.20	.853	.566	1.104	2700	3.94	1300
17	1.75	1.23	.848	.555	1.046	3000	3.81	1300
18	1.45	1.24	.909	.614	1.238	2200	3.99	1200
19	1.60	1.29	.923	.616	1.135	2400	3.71	1200
20	1.84	1.32	.921	.605	1.057	2700	3.54	1200
21	2.14	1.34	.906	.587	1.022	3000	3.50	1200
22	1.57	1.34	.989	.669	1.251	2000	3.69	1100
23	1.75	1.40	1.01	.672	1.135	2200	3.40	1100
24	1.93	1.44	1.01	.664	1.072	2400	3.27	1100
25	2.27	1.46	.992	.645	1.026	2700	3.21	1100
26	1.71	1.47	1.08	.734	1.268	1800	3.39	1000
27	1.93	1.54	1.11	.739	1.135	2000	3.09	1000
28	2.15	1.58	1.11	.730	1.068	2200	2.96	1000
29	2.41	1.60	1.10	.714	1.033	2400	2.92	1000
30	2.09	1.69	1.22	.812	1.145	1800	2.83	910
31	2.36	1.74	1.22	.802	1.068	2000	2.70	910
32	2.68	1.76	1.20	.783	1.030	2200	2.66	910
33	2.12	1.81	1.33	.898	1.241	1500	2.73	820
34	2.28	1.86	1.35	.902	1.159	1600	2.58	820
35	2.61	1.93	1.35	.890	1.069	1800	2.43	820
36	3.01	1.96	1.33	.866	1.028	2000	2.39	820
37	2.57	2.06	1.48	.985	1.135	1500	2.32	750
38	2.76	2.10	1.48	.978	1.086	1600	2.25	750
39	3.21	2.14	1.46	.952	1.033	1800	2.19	750
40	2.69	2.23	1.62	1.09	1.181	1300	2.17	680
41	3.17	2.33	1.63	1.07	1.067	1500	2.01	680
42	3.44	2.35	1.62	1.06	1.039	1600	1.99	680
43	2.99	2.46	1.78	1.19	1.167	1200	1.96	620
44	3.27	2.53	1.79	1.19	1.097	1300	1.87	620
45	3.93	2.59	1.76	1.15	1.030	1500	1.81	620
46	3.37	2.74	1.97	1.32	1.152	1100	1.75	560
47	3.72	2.81	1.98	1.31	1.083	1200	1.67	560
48	4.10	2.85	1.97	1.29	1.044	1300	1.64	560
49	3.69	3.00	2.17	1.45	1.154	1000	1.60	510
50	4.11	3.09	2.17	1.44	1.079	1100	1.52	510
51	4.59	3.14	2.15	1.41	1.039	1200	1.49	510
52	3.95	3.24	2.35	1.57	1.167	910	1.49	470
53	4.39	3.34	2.36	1.56	1.087	1000	1.41	470
54	4.94	3.40	2.34	1.53	1.041	1100	1.38	470
55	4.24	3.52	2.56	1.72	1.184	820	1.38	430
56	4.77	3.65	2.58	1.71	1.091	910	1.29	430
57	5.36	3.71	2.56	1.67	1.043	1000	1.26	430
58	4.72	3.89	2.83	1.90	1.175	750	1.24	390
59	5.22	4.02	2.84	1.88	1.095	820	1.17	390
60	5.93	4.10	2.82	1.85	1.042	910	1.14	390
61	5.01	4.18	3.05	2.05	1.196	680	1.16	360
62	5.60	4.34	3.08	2.04	1.101	750	1.09	360
63	6.23	4.42	3.07	2.01	1.052	820	1.06	360
64	5.44	4.55	3.33	2.24	1.203	620	1.07	330
65	6.03	4.72	3.36	2.23	1.110	680	1.00	330
66	6.78	4.82	3.35	2.20	1.052	750	.970	330
67	7.70	4.87	3.30	2.14	1.023	820	.962	330
68	5.94	4.99	3.65	2.46	1.212	560	.978	300
69	6.66	5.20	3.70	2.46	1.107	620	.910	300
70	7.43	5.31	3.68	2.42	1.054	680	.882	300
71	8.56	5.36	3.62	2.35	1.022	750	.875	300
72	6.69	5.58	4.07	2.74	1.196	510	.870	270
73	7.43	5.78	4.11	2.73	1.105	560	.817	270
74	8.39	5.91	4.08	2.68	1.048	620	.792	270
75	7.84	6.38	4.61	3.08	1.155	470	.752	240
76	8.59	6.55	4.62	3.06	1.088	510	.719	240
77	9.64	6.66	4.58	3.00	1.042	560	.702	240
78	8.53	6.95	5.02	3.36	1.157	430	.690	220
79	9.43	7.15	5.04	3.33	1.085	470	.658	220
80	10.4	7.26	5.01	3.28	1.044	510	.644	220
81	8.53	7.33	5.42	3.67	1.268	360	.678	200
82	9.36	7.64	5.52	3.70	1.159	390	.628	200
83	10.4	7.88	5.54	3.66	1.081	430	.596	200
84	9.69	8.24	6.06	4.09	1.238	330	.597	180
85	10.7	8.57	6.15	4.10	1.135	360	.556	180



Circuit diagram and typical response

the maximum value listed for each design. Normally, it is not necessary to know the exact value of v.s.w.r. for a particular passband frequency because it is sufficient to know that it will never exceed a particular maximum value.

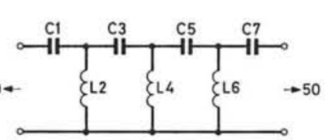
The concluding columns list the filter component values in picofarads (pF) and microhenries (μH). In all the tables, all capacitor listings are standard values. All inductor values are whatever values are required to cause the capacitor values to be standard, except for Table 3.2 where the advantage of standard values is also extended to inductors L1 and L5. The fact that most of the inductor values are non-standard presents no problem because

TABLE 3.6

7-ELEMENT 50-OHM, HIGH-PASS CHEBYSHEV SVC-FILTER DESIGNS, CAPACITIVE INPUT, 5% TOLERANCE SERIES, SELECTED VSWR LIMIT = 1.273

NO.	-----FREQUENCY (MHZ)----- F-CO	3-DB	20DB	40DB	MAX. VSWR	C1,7 (PF)	L2,6 (UH)	C3,5 (PF)	L4 (UH)
1	1.02	.826	.660	.504	1.036	5100	6.16	2000	4.98
2	1.00	.880	.724	.563	1.109	3900	5.67	1800	4.86
3	1.08	.905	.732	.563	1.058	4300	5.55	1800	4.60
4	1.16	.922	.734	.558	1.030	4700	5.55	1800	4.45
5	1.00	.924	.780	.617	1.257	3000	5.53	1600	4.93
6	1.09	.971	.806	.630	1.147	3300	5.15	1600	4.48
7	1.16	1.00	.819	.634	1.086	3600	4.99	1600	4.22
8	1.23	1.02	.824	.632	1.050	3900	4.93	1600	4.06
9	1.34	1.04	.825	.625	1.023	4300	4.95	1600	3.92
10	1.13	1.02	.853	.669	1.176	3000	4.92	1500	4.31
11	1.22	1.06	.871	.676	1.099	3300	4.70	1500	4.01
12	1.30	1.09	.879	.675	1.056	3600	4.63	1500	3.83
13	1.39	1.11	.880	.670	1.031	3900	4.63	1500	3.71
14	1.34	1.20	.994	.776	1.141	2700	4.17	1300	3.62
15	1.45	1.24	1.01	.780	1.073	3000	4.03	1300	3.38
16	1.57	1.27	1.02	.775	1.037	3300	4.00	1300	3.24
17	1.41	1.28	1.07	.836	1.176	2400	3.94	1200	3.45
18	1.55	1.34	1.09	.845	1.086	2700	3.74	1200	3.16
19	1.68	1.37	1.10	.841	1.042	3000	3.70	1200	3.01
20	1.54	1.39	1.16	.912	1.176	2200	3.61	1100	3.16
21	1.65	1.44	1.19	.921	1.104	2400	3.46	1100	2.95
22	1.80	1.49	1.20	.919	1.048	2700	3.39	1100	2.78
23	1.97	1.52	1.20	.908	1.021	3000	3.41	1099	2.68
24	1.70	1.53	1.28	1.00	1.176	2000	3.28	1000	2.87
25	1.82	1.59	1.31	1.01	1.099	2200	3.14	1000	2.67
26	1.95	1.63	1.32	1.01	1.056	2400	3.08	1000	2.55
27	2.15	1.67	1.32	1.00	1.023	2700	3.10	1000	2.45
28	1.85	1.67	1.40	1.10	1.188	1800	3.01	910	2.64
29	2.00	1.75	1.44	1.11	1.100	2000	2.85	910	2.43
30	2.15	1.80	1.45	1.11	1.053	2200	2.81	910	2.31
31	2.31	1.83	1.45	1.10	1.027	2400	2.81	910	2.24
32	2.03	1.85	1.55	1.22	1.204	1600	2.74	820	2.42
33	2.22	1.94	1.59	1.24	1.100	1800	2.57	820	2.19
34	2.41	2.00	1.61	1.23	1.050	2000	2.53	820	2.08
35	2.61	2.03	1.61	1.22	1.024	2200	2.54	820	2.01
36	2.26	2.04	1.71	1.34	1.176	1500	2.46	750	2.16
37	2.38	2.10	1.73	1.35	1.120	1600	2.38	750	2.05
38	2.60	2.17	1.76	1.35	1.056	1800	2.31	750	1.91
39	2.83	2.22	1.76	1.34	1.025	2000	2.32	750	1.84
40	2.40	2.20	1.85	1.46	1.230	1300	2.31	680	2.05
41	2.69	2.34	1.92	1.49	1.097	1500	2.13	680	1.81
42	2.82	2.39	1.94	1.49	1.064	1600	2.10	680	1.75
43	3.10	2.45	1.94	1.47	1.027	1800	2.10	680	1.67
44	2.66	2.43	2.04	1.61	1.214	1200	2.08	620	1.84
45	2.84	2.52	2.09	1.63	1.133	1300	1.98	620	1.71
46	3.16	2.64	2.13	1.63	1.053	1500	1.91	620	1.58
47	3.33	2.67	2.13	1.62	1.033	1600	1.91	620	1.54
48	2.98	2.71	2.27	1.79	1.196	1100	1.86	560	1.64
49	3.19	2.82	2.32	1.81	1.116	1200	1.77	560	1.52
50	3.39	2.89	2.35	1.81	1.070	1300	1.73	560	1.45
51	3.81	2.98	2.36	1.79	1.024	1500	1.73	560	1.37
52	3.27	2.97	2.49	1.96	1.198	1000	1.70	510	1.49
53	3.53	3.10	2.55	1.99	1.112	1100	1.61	510	1.38
54	3.76	3.18	2.58	1.99	1.064	1200	1.58	510	1.31
55	4.01	3.24	2.59	1.98	1.036	1300	1.57	510	1.27

NO.	-----FREQUENCY (MHZ)----- F-CO	3-DB	20DB	40DB	MAX. VSWR	C1,7 (PF)	L2,6 (UH)	C3,5 (PF)	L4 (UH)
56	3.51	3.21	2.69	2.12	1.213	910	1.58	470	1.40
57	3.79	3.35	2.76	2.15	1.122	1000	1.49	470	1.28
58	4.07	3.45	2.80	2.16	1.066	1100	1.45	470	1.21
59	4.35	3.52	2.81	2.14	1.035	1200	1.45	470	1.17
60	3.79	3.47	2.93	2.31	1.233	820	1.46	430	1.30
61	4.12	3.65	3.02	2.35	1.126	910	1.37	430	1.18
62	4.42	3.76	3.06	2.36	1.069	1000	1.33	430	1.11
63	4.77	3.85	3.07	2.34	1.035	1100	1.33	430	1.07
64	4.20	3.85	3.24	2.55	1.222	750	1.32	390	1.17
65	4.52	4.02	3.32	2.59	1.131	820	1.24	390	1.07
66	4.89	4.15	3.37	2.60	1.068	910	1.21	390	1.01
67	5.27	4.24	3.39	2.58	1.034	1000	1.20	390	.969
68	4.48	4.13	3.48	2.75	1.247	680	1.23	360	1.10
69	4.86	4.33	3.59	2.80	1.138	750	1.15	360	.999
70	5.20	4.47	3.65	2.82	1.079	820	1.12	360	.942
71	5.64	4.58	3.67	2.80	1.038	910	1.11	360	.899
72	4.87	4.49	3.79	2.99	1.254	620	1.14	330	1.01
73	5.26	4.71	3.91	3.05	1.148	680	1.06	330	.924
74	5.67	4.87	3.98	3.07	1.080	750	1.03	330	.864
75	6.07	4.98	4.00	3.06	1.043	820	1.02	330	.829
76	5.32	4.91	4.15	3.28	1.264	560	1.04	300	.930
77	5.80	5.18	4.30	3.36	1.145	620	.965	300	.838
78	6.22	5.36	4.37	3.38	1.082	680	.933	300	.787
79	6.71	5.49	4.40	3.36	1.042	750	.923	300	.752
80	7.25	5.58	4.40	3.33	1.020	820	.931	300	.731
81	5.98	5.50	4.64	3.66	1.247	510	.926	270	.824
82	6.46	5.77	4.78	3.74	1.142	560	.867	270	.752
83	6.98	5.97	4.87	3.76	1.075	620	.837	270	.703
84	7.50	6.11	4.89	3.74	1.039	680	.831	270	.675
85	6.94	6.32	5.29	4.16	1.200	470	.798	240	.704
86	7.41	6.55	5.41	4.21	1.123	510	.762	240	.656
87	7.95	6.75	5.48	4.22	1.068	560	.742	240	.620
88	8.61	6.90	5.50	4.19	1.032	620	.740	240	.595
89	7.56	6.88	5.77	4.54	1.202	430	.733	220	.646
90	8.11	7.16	5.91	4.60	1.119	470	.697	220	.599
91	8.63	7.35	5.98	4.61	1.071	510	.681	220	.570
92	9.28	7.51	6.00	4.58	1.036	560	.677	220	.548
93	8.30	7.56	6.34	4.99	1.205	390	.667	200	.589
94	8.97	7.90	6.51	5.06	1.114	430	.632	200	.542
95	9.59	8.11	6.58	5.07	1.064	470	.618	200	.515
96	10.2	8.26	6.60	5.04	1.036	510	.616	200	.498
97	9.42	8.51	7.11	5.57	1.176	360	.590	180	.517
98	10.0	8.80	7.24	5.63	1.109	390	.567	180	.485
99	10.8	9.05	7.32	5.63	1.058	430	.555	180	.460
100	10.0	9.24	7.80	6.17	1.257	300	.553	160	.493
101	10.9	9.71	8.06	6.30	1.147	330	.515	160	.447



See Table 3.5 for typical response

these components are usually hand-wound anyway to the exact design value. Inductors L1 and L5 in Table 3.2 have standard values because this particular configuration requires only one value for C2 and C4, and another design variable is still available for control. To simplify construction, the variable for the value of L1 and L5 was programmed so it is standard. This concludes the explanation of the table column headings.

Selecting a Suitable Design

These SVC designs can be used for both audio frequency and radio frequency filtering; however, most audio filtering applications require an attenuation rise that is more abrupt than that available in the 5- and 7-element Chebyshev designs. For r.f. applications, it is generally sufficient that 30dB or more of attenuation occurs at about one octave above the cutoff frequency. In this case, the 5- and 7-element Chebyshev filters will be adequate. For those audio and r.f. filtering applications requiring a more abrupt rolloff and higher levels of stopband attenuation, the 5- and 7-branch Cauer designs must be used.

Before selecting a design, you must know the filter type (highpass or lowpass), the impedance level and the cutoff frequency. You should also have a good idea of the required stopband attenuation. For example, assume a 50 ohm lowpass filter is needed and a capacitor input/output will be satisfactory. Scan the "F-CO" column of Tables 3.1 and 3.3 and select those designs that have the cutoff frequency just slightly above the desired cutoff frequency. Read the frequencies vs. attenuation, the v.s.w.r. and the component values, and if they are acceptable, the filter selection is finished. For receiving applications, a high v.s.w.r. is not important and a high v.s.w.r. design can be used for maximum selectivity. For transmitting applications, designs with low v.s.w.r. are preferable. If the capacitor values are not convenient, search for other designs that may have more convenient values. For example, if a 5-element lowpass filter is desired, designs 3.1-1 to 3.1-11 are suitable, but design 3.1-3 may be preferred because the capacitor values of 2200 and 4700pF are more readily available.

NEXT MONTH—SCALING TO DIFFERENT FREQUENCIES AND IMPEDANCES

References

References 1–8 were listed in Part 1, and 9–11 in Part 2

12. E. Wetherhold, *Elliptic (SVC) lowpass filters for transistor amplifiers, Ham Radio,* January 1981.
13. E. Wetherhold, *7-element Chebyshev filters using standard-value capacitors, RF Design,* Vol. 3, Nos. 2 and 6, February and June 1980.
14. E. Wetherhold, *Lowpass filters with inductive input/output, RF Design,* Vol. 4, Nos. 4 & 5, July/August and September/October 1981.
15. E. Wetherhold, *Design 7-element lowpass filters using standard-value capacitors, EDN,* Vol. 26, No. 1, 7 January 1981.
16. E. Wetherhold, *Lowpass Chebyshev filters use standard-value capacitors, Electronics,* Engineer's Notebook, p. 160, 19 June 1980.
17. E. Wetherhold, *Highpass Chebyshev filters use standard-value capacitors, Electronics,* Engineer's Notebook, p. 140, 27 January 1981.
18. E. Wetherhold, *Standard C, L-input filters stabilize h.f. transistor amplifiers, Electronics,* Engineer's Notebook, p. 155, 3 November 1981.
19. *Electronic Designer's Casebook No. 5,* prepared by the editors of *Electronics, Lowpass and highpass (7-element) Chebyshev filters use standard-value capacitors,* pp. 94–97, McGraw Hill, 1982.
20. *Electronic Databook,* 3rd edition, edited by Rudolf F. Graf, *Passive LC Filter Design,* pp. 117–143, TAB Books Inc., Blue Ridge Summit, PA, 1983.
21. E. Wetherhold, *7-element Chebyshev filters for TEMPEST testing, Interference Technology Engineers' Master (Item), 1981;* published annually by R & B Enterprises, West Conshohocken, PA.
22. *The 1984 Radio Amateur's Handbook,* 61st edition, Chebyshev and elliptic lowpass and highpass (SVC) filter tables, pp. 2-41 to 2-45, published by ARRL, Newington, CT.
23. E. Wetherhold, *50-ohm lowpass filters for transmitters, SPRAT,* The Journal of the G-QRP Club, Issue Nr. 37, Winter 1983/84.
24. E. Wetherhold, *Lowpass filters for attenuating r.f. amplifier harmonics, Parts 1 and 2, Short Wave Magazine,* December 1983 and January 1984.

Swap Spot

Have about 40 miscellaneous back issues of *PW* and *Television* mostly around 1972–1974. Would exchange for ZX Spectrum software or w.h.y. D. Wilson, Flat 2, 14 Kidderpore Gardens, London NW3. *V262*

Have 2000 service sheets and manuals, TV and radio, also 290 new boxed TV valves. Would exchange for good comers, or any good radio gear—w.h.y. W.E. Stedman, 133B Lynton Road, Bermondsey, London SE1 5QX. *V263*

Have 48K Spectrum. VTX5000 modem, ZX-printer plus 8 rolls of paper, Sony recorder, over £120 software and several books. Would exchange for 144MHz or 430MHz transceiver (prefer multimode) or good communications receiver. Tel: 041-637 0808 after 6pm. *V276*

Have Commodore Vic20 complete starter pack and Home Computer Course (bound), u.h.f. TV sound tuner. Would exchange for any u.h.f./v.h.f. scanning monitor. Jarvis, 204 Lewis Trust, Warner Road, London SE5 9LY. *V300*

Have hi-fi and cash. Would exchange for small modern dual-beam 'scope and 50MHz frequency counter. J.W. Johnson, 6 Waveney Grove, Clayton, Newcastle, Staffs. Tel: 0782 634780. *V301*

PW "SWAP SPOT"

Got a camera, want a receiver? Got a v.h.f. rig, want some h.f. gear to go with your new G4? In fact, have you got anything to trade radio-wise?

If so, why not advertise it FREE in our new feature SWAP SPOT. Send details, including what equipment you're looking for, to "SWAP SPOT", *Practical Wireless,* Westover House, West Quay Road, Poole, Dorset BH15 1JG, for inclusion in the first available issue of the magazine.

A FEW SIMPLE RULES: Your ad. should follow the format of those appearing above; it must be typed or written in block letters; it must be not more than 40 words long including name and address/telephone number. Swaps only—no items for sale—and one of the items MUST be radio related. Adverts for ILLEGAL CB equipment will not be accepted.

Products

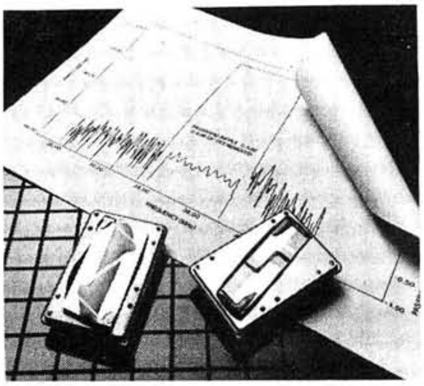
SAW Technology

On very rare occasions we get an invitation to join the technical press and visit a "high-tech" industrial complex to see the latest developments. Recently Signal Technology opened its new factory in Swindon and we went along to have a look at what they are doing in the world of Surface Acoustic Waves (s.a.w.).

Surface acoustic waves are an interesting phenomenon which has been known for a long while but which has only been exploited in recent years. The technology used is compatible with i.c. technology as far as device production goes and Signal Technology claim to be at the forefront of s.a.w. development.

Because s.a.w.s propagate with a velocity some five orders of magnitude slower than electromagnetic waves they offer a very useful means of signal processing. Filters, resonators and delay lines can be produced with precision and ease using production tech niques from the i.c. industry.

The s.a.w. device is a planar structure fabricated on a piezo-electric substrate onto which a metal film is deposited. This film, only about 2000Å thick, is then photo-etched to produce the patterns making up the interdigital transducers. These provide the means by which the surface waves are excited onto the substrate surface as well as picked off further along the surface.



By altering the form of the i.d.t. the designer of the s.a.w. device can change the characteristics of the device to achieve the desired performance.

The single-layer photo-lithographic process used lends itself to repeatable high-volume production and s.a.w. delaylines and filters find their way into colour television sets in large numbers. In fact Signal Technology claim to have about 8 per cent of the market worldwide, for TV i.f. filters.

Compatibility with other semiconductor manufacturing processes means that s.a.w. devices can be combined with other components to produce complex hybrid packages which find their niche in military as well as civil radars for pulse compression and expansion.

The company also reckon to have upwards of 10 per cent of the expanding world market for signal shaping and coding in the cable and satellite TV areas.

This technology offer low cost, definable signal processing and Signal Technology, which is, unusually, owned 50/50 by The Plessey Company plc and the Anderson Group Inc., will undoubtedly be in the forefront of both development and production.

Giga Counter

As a state-of-the-art look at a new instrument, intended for the high-technology workshop or laboratory, the latest compact Microwave Counter, type 2440, from Marconi fits the bill.

Ideal for production testing and maintenance work on all types of communications equipment, the instrument has a frequency range of 10Hz to 20GHz with a maximum resolution of 0·1Hz.

The instrument is supplied complete with integral g.p.i.b. facility and can acquire and indicate a frequency in 200ms, speeding a.t.e. system tests. The display rate can be set independently of resolution so that optimum measurements of 1Hz resolution in one second can be achieved.

The microwave channel covers 600MHz to 20GHz with high sensitivity between −25 and −15dBm dependent on the frequency range and with overload damage level of +27dBm. The wide tolerance to f.m. and a.m. allows measurements on modern microwave links, and the small size and weight provide easy portability. Also featured is automatic amplitude discrimination, where only the largest signal is displayed and all others ignored.

This microprocessor controlled instrument can accept the keyboard entry of offset frequencies to 0·1Hz resolution to easily measure small frequency drifts, self-check and diagnostics provide easy servicing capability.

Marconi Instruments Ltd., Longacres, St Albans, Herts. AL4 0JN. Tel: (0727) 59292.

DPM with Digital Hold

Lascar Electronics have announced the introduction of a low-cost, low-power l.c.d. digital panel meter with true digital hold of displayed reading.

Consuming only 1mA from a 7 to 15V supply, the meter, entitled DPM10, features auto-polarity, auto-zero, 200mV f.s.d., low-battery indication, 12·5mm digit height and programmable decimal points.

Connection to the 0·1in board pins can be by direct soldering, or with a connector (supplied). The meter can be easily rescaled by the user if required to indicate different voltages, currents or other engineering units.

With its good accuracy, the DPM10 is supplied with a bezel, mounting clips and connector, and is priced at £17.95 plus VAT and £2.00 p&p.

Available from: *Lascar Electronics Ltd., Module House, Whiteparish, Salisbury, Wiltshire SP5 2SJ. Tel: (07948) 567.*

Products

Icom Microphone Matching

Of particular interest to owners of the latest Icom series of transceivers, who may wish to use an alternative low-impedance dynamic microphone, is a new accessory, manufactured by Adonis, entitled the AP-1 Microphone Adaptor.

The function of the unit is to match the impedance of normal (low-impedance) microphones to the level of Icom products.

As the photograph shows, the device is an 8-pin microphone plug, which is fitted with an amplifier that is wired to marry identically with the Icom 8-pin microphone socket on the transceiver. All that is now required is to wire the microphone to be used into the other end of the plug unit.

Priced at £10.95, the AP-1 microphone adaptor is available, post free, from: *Waters & Stanton Electronics, Warren House, 18/20 Main Road, Hockley, Essex SS5 4QS, tel: Southend-on-Sea (0702) 206835 & 204965, or, 12 North Street, Hornchurch, Essex RM11 1QX, tel: (040 24) 44765.*

If you please

Please mention this column when applying to manufacturers or suppliers featured on this page.

New Generation DMM

Electronic Brokers have introduced an unusual hand-held digital multimeter with a claimed accuracy and performance equal to more expensive bench models.

Entitled the PM2518X/11, the instrument offers: automatic electroluminescent display; auto and manual ranging; extended 4-digit display with user information; nine functions including true r.m.s. to 50kHz, current to 20 amps, resistance to 100MΩ, relative reference and dB mode, self diagnosis and automatic battery power down. A comprehensive range of optional accessories to increase the versatility of the instrument are also available.

Manufactured by Philips, the PM2518X/11 complete costs £199 plus VAT, and the PM2518X/01 (a standard version without illuminated display costs £165 plus VAT). Both models are covered by a 5 year guarantee against manufacturing defects.

For further information, contact: *Electronic Brokers Ltd., 61/65 Kings Cross Road, London WC1X 9LN.*

Please Note!

A number of our advertisers have asked us to advise readers that the prices of imported products are likely to change from month to month.

The reason behind these changes is fluctuating international exchange rates. So, readers are therefore advised that they would do well to check prices with suppliers prior to sending off orders.

OBITUARY

Harold Cottam

Readers with maritime connections will be saddened to learn of the death, at the age of 93, of former Marconi Ships' Wireless Operator, Harold Cottam.

Mr Cottam was the sole Wireless Operator aboard the Cunard ship *Carpathia* at the time of the *Titanic* disaster in April 1912. He was then only 21 years of age. By great good fortune he had remained on duty longer than necessary and happened to overhear a message from the shore station Cape Cod intended for the *Titanic* to warn her of the danger of icebergs. He attempted to relay the warning, but received in return the doomed ship's distress signals. Mr Cottam at once alerted his captain, who was at first unable to believe that the giant luxury ship could be in trouble on what was a calm, clear night. However, he ordered the *Carpathia* to set course for the *Titanic's* reported position, at full speed. Mr Cottam sent this welcome news to the *Titanic* and remained on duty to receive reports from the fast-sinking liner and to give details of his own ship's progress. By the time the *Carpathia* had reached the scene *Titanic* had gone to the bottom, but the Cunard ship was able to rescue 711 of the 2,201 souls who had been aboard her.

Mods

No.30 Roger Hall G4TNT(Sam)

IMPORTANT—The ideas presented here are suggestions only, and as they are untried by this magazine, we cannot accept responsibility for any resultant damage, however caused. Before alterations are attempted, care should be taken to ensure that any guarantee is not invalidated, and it should also be borne in mind that modifications usually have an adverse effect on resale prices. In cases where specialist skills or equipment are needed, most dealers will undertake the work for a reasonable fee.

Yaesu FT-230R

Both of this month's mods were sent in from Merseyside by John G8NOO. His first is for his Yaesu FT-230R. Although he likes the automatic tone burst facility, he has found that the disable switch, which is mounted on the back of the rig, is impossible to reach when the set is installed in a car. This means that he has the choice of not having the tone burst at all or of having it on all the time, even on simplex.

To overcome this problem John has come up with a mod that automatically disables the tone burst on simplex, regardless of the position of the BURST ON/OFF switch. John decided to provide a "semi-intelligent" tone burst, as opposed to the "fully intelligent" one described for the Yaesu FT-290R in Mods No. 25, because he has found that several repeaters still require a tone burst to re-access them.

The mod itself is very simple as it only involves running one wire from the unused simplex position on the SHIFT switch to the BURST ON/OFF switch. First remove the top and bottom covers. Then check to make sure that the wires on the BURST ON/OFF switch are connected as shown in Fig. 1. If they are not, swap them over. Access to this switch is made much easier if the six screws that hold the front panel on are removed and it is eased forward. Now use an ohmmeter to find the tag on the SHIFT switch that is earthed in the SIMPLEX position. Solder a new wire to this tag and then run it around the back of the rig and solder the other end to the vacant tag on the BURST ON/OFF switch. Re-assemble the rig and you will now find that the tone burst does not operate when the SHIFT switch is in the SIMPLEX position. Thanks for passing on a very useful mod John.

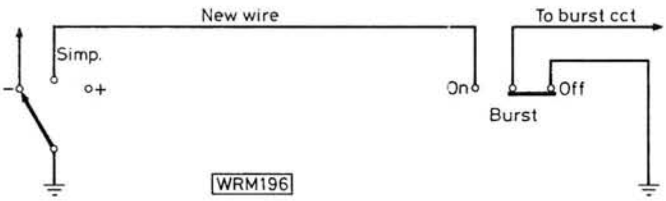


Fig. 1

Trio TS-770E

In Mods No. 10 (November 1981) I published a reverse repeater mod for the Trio TS-770E. Unfortunately Trio, along with most Japanese manufacturers, often change the specifications, layout and components inside their radios in the middle of a production run. This means that early and late models are usually markedly different. This happened with the TS-770E and the result was that some people could carry out the mod because their set matched the

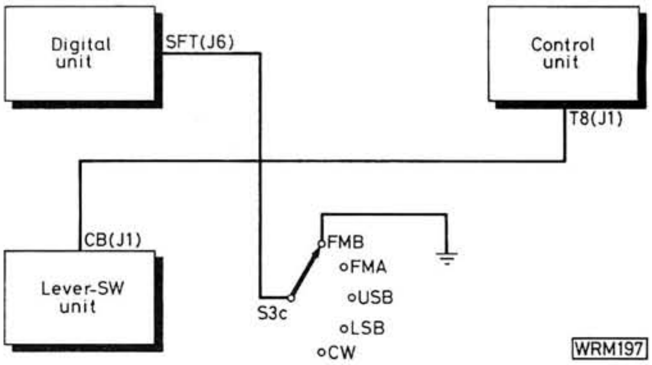


Fig. 2

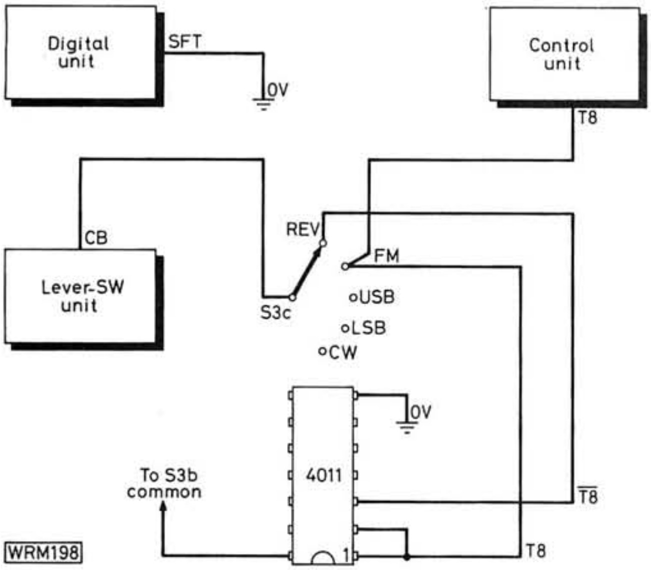
one in the article, but others couldn't because theirs didn't. Fortunately, John really wanted reverse repeater on his radio, even though it was one of the ones that didn't match and now he has come up with another way of achieving semi or full reverse repeater.

First find S3c. This is one pole of the five way mode switch. The common of S3c is a yellow wire that goes to the SFT connection on J6 on the digital unit and it is this wire that determines whether the European or British shifts are used. Disconnect this wire at S3c and then connect that end to 0 volts. This gives a fixed British shift and leaves S3c spare. The FM-B tag on this switch, which is currently connected to 0 volts, should be disconnected by cutting the link.

Now locate the white/grey wire that runs from T8 on the Control Unit to CB on the Lever Switch Unit. This wire now has to be cut but it is important to make sure that you cut it in such a place that BOTH ends will reach to S3c. Cut the wire and connect the end that goes to the CB unit to the common of S3c. Connect the other end (the one that goes to T8) to the FM-A tag on S3c. The rig will then work normally except that FM-A now has to be used for all f.m. working, including repeater operation—with the Shift switch ON. The FM-B position is now going to be used for reverse repeater and you have a choice of having this facility on transmit and receive or just on receive.

For semi reverse repeater (listen input) simply run a wire from the common tag of S3b to the FM-B tag of S3c. The FM-B position now provides listen input whenever it is selected.

For full reverse repeater it is necessary to locate an 8 volt supply that is only present on receive. Unfortunately John has not been able to find one so he has used a c.m.o.s. 4011 i.c. to invert the voltage on the T8 line which is only present on transmit. This line, which he calls appropriately enough "not T8", is connected to the FM-B tag on S3c. The i.c. is mounted on a small piece of Veroboard that can be fitted alongside the Control Unit, directly behind the Mode Switch. The fixing screw is used to pick up 0 volts and the 8 volt supply comes from the common tag on S3b. T8 comes from the FM-A tag on S3c and the "not T8" signal goes to the FM-B tag on S3c. When this position on the switch is now selected, the set will give full reverse repeater. Thanks again John for passing on another interesting mod.



Wanted

This month I had intended to publish a mod from Mick, G8JVE. He sent in a very detailed description of a mod for using a relay in place of the switching diodes in his Icom IC-211E. Unfortunately it was not until I had half written the article that I realised that Mick's instructions are not completely clear. There seems to be a wire that does not go anywhere. I've tried to figure it out but, as I don't have an IC-211E, I failed. Mick, I would like to publish this mod so please write in again and perhaps you can tell me where I have gone wrong.

It would also be nice if Roger Haddock could contact me as I have lost his address and I have a lot of paperwork sitting in my desk just waiting to be posted to him.

◀Fig. 3

Pass it on...

If you have a mod that you would like to pass on or if you have a request for a mod that you would like to carry out, please write to me at this address: R. S. Hall, Practical Wireless, Room 204B, Hatfield House, Stamford Street, London SE1 9LS.

Swap Spot

Have JIL SX200 scanner plus FRG-7. Would exchange for best communications receiver offered. Tel: Kidsgrove (Stoke-on-Trent) 75682. *V302*

Have Sharp MZ80B computer with BASIC, FORTH and PASCAL language tapes. Would exchange for h.f. transceiver FT-102 or similar (modern) rig, or Icom R-70 receiver. G4HSX, 28 Mountpleasant Street, Todmorden OL14 7EL. *V317*

Have Nikon FT2, 135mm telephoto, 35mm wide angle, close up lens X2, electronic flash, starburst and graduated filter, locking release cord plus holdall. Would exchange for R-2000, Icom R-70, FRG-7700 (with FRT-7700/FRV-7700). Tel: 0604 47717 after 6pm (Northampton). *V383*

Have Dragon 32 computer, joysticks, recorder, tapes, games and instruction manuals—little used. Would exchange for Code Master CWR610 or MBA-RO RTTY/c.w. reader. J. Le-Cornu, 17 Chaplewood Grove, Perry Barr, Birmingham B42 2LL. Tel: 021-356 8773. *V398*

Have AOR 245 1-5 watt 144MHz handheld (similar to IC-2E), repeater shifts, helical and telescopic whips, mobile and base chargers and p.s.u. Would exchange for IC-2001 or similar (CR-2021, DX400). Phil Bridges G6DLJ. Tel: 0703 891975 (Southampton). *V425*

Have Panasonic DR31 digital readout receiver 150kHz-30MHz, 3 months old. Would exchange for Sony 220 or 230 with analogue dial or similar. R. Lawrence, 10 Cobhall Close, Red Hill, Hereford HR2 7LL. Tel: 271091. *V437*

Have Jerrold 900C sweep signal generator, covering 0MHz-1·2GHz; Solartron a.f. signal generator covering 25Hz–250kHz; Avo transistor analyser MK2. Would exchange for v.h.f. and u.h.f. scanner (Bearcat or similar). A. Patrick. Tel: 0909 564639 (Sheffield). *V438*

Have Olympus 2Mn with Vivitar Series 1 28–90mm zoom, Macro lens. Would exchange for 144MHz multimode transceiver. GW1EWX. Tel: 0766 3445 (Porthmadog). *V440*

Have Sinclair Spectrum 48K plus W.H. Smith Data recorder, both 6 months old. Also over 100 commercial programmes—Hobbit, flight simulation, assembler, compiler etc. Total worth £275. Would exchange for solid state h.f., v.h.f., u.h.f. gear; FT-7B or FT290R or FT790 with possible cash adjustment. G4GMT. QTHR. Tel: 0484 643124 (Huddersfield). *V443*

Have Myford Super 7 lathe on cabinet with accessories. Would exchange for modern double trace 10MHz 'scope or 430MHz mobile G3MGX, Roche, St. Austell, Cornwall. Tel: 890 414. *V451*

Have GB stamp collection with two penny blacks, many commemorative sets, 2 albums. Would exchange for genuine PO double current key circ. 1915, must be in good condition. R. Holland G3BPE, 42 Elizabeth Court, St. James's Road, Gravesend, Kent. Tel: 23372. *V456*

Have HRO 5T receiver with nine general coverage coils 50kHz–30MHz in wooden container, p.s.u. and handbook. Would exchange for a Trio 9R59DS with external speaker and manual. K. Pullen, 210 Hollett Road, Treboeth, Swansea SA5 9ER. *V474*

World-Wide Satellite Com

The demand for instant and reliable international communications continues to grow at a very rapid rate as trade between nations advances. Many years ago the only form of long distance communication was by means of short wave radio, but the number of channels available was very limited, the cost very high and the reliability very poor. Sub-oceanic metallic cables have been laid to provide excellent telephone communications, but the number of speech channels provided by a cable is limited and they are unsuitable for television.

Satellites

In 1945 Arthur C Clarke, then a British Post Office engineer, proposed the use of satellites for relaying radio signals between distant parts of the globe. He has since become famous as a science fiction writer, but freely admits that he did not expect to see his proposal put into practice during his lifetime. In fact the first of the INTELSATs (International Telecommunications Satellites) known as Early Bird or INTELSAT I was launched some 20 years later. Since then enormous research efforts have resulted in a greatly increased signal carrying capability and hence in cheaper trans-world telephone calls and television links.

The real problem in conveying signals between countries on opposite sides of the earth is that no means has yet been found of sending any kind of signal through the earth itself. One therefore has the three possible methods of using the ionosphere to bend radio waves around the earth, sub-oceanic cables to guide the signals or of transmitting signals to a satellite which relays them back to earth.

Geosynchronous Orbits

In his 1945 proposal, Arthur Clarke saw that only three satellites above the equator at a distance of 42 000km from the centre of the earth could provide communications coverage for the whole earth. At this altitude, they would rotate around the revolving earth with a period of 24 hours and would therefore remain at a constant position in the sky, as seen from any point on the earth—never rising nor setting like the heavenly bodies. It followed that a suitable dish antenna on the earth pointed towards such a satellite would remain pointing in the same direction continuously. Satellites synchronised with the earth's rotation in this way are known as geosynchronous or geostationary satellites.

Early experimental work was carried out in 1960 with Echo, this being merely a balloon 30m in diameter which was aluminised on its outer surface so that it acted as a reflector of radio waves when at a height of about 1600km. In 1962 the Telstar satellite was able to receive and re-transmit signals from the earth, but it could be used only for short times when it was above the horizon at both earth stations. By 1964 it had become possible to place a satellite into geosynchronous orbit, Syncom being the first of such satellites.

An international consortium known as INTELSAT was formed in 1964 for the purpose of providing an international communications satellite system. There are now over 100 countries that are members of INTELSAT. The satellites are owned by INTELSAT, but the ground stations are owned by the telecommunication authorities of the countries in which they are situated. As the satellities are situated at such a high altitude, they can

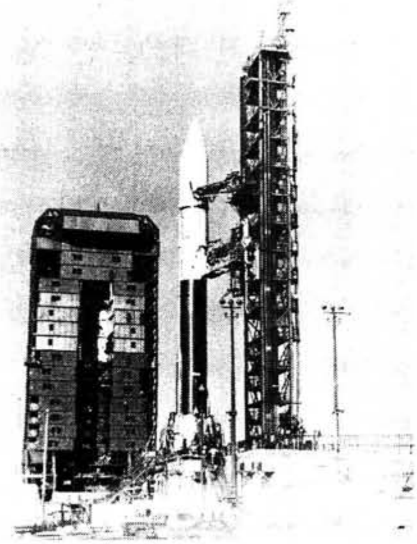


Fig. 1.1: An Atlas Centaur rocket ready to lift an INTELSAT craft into orbit *Hughes Aircraft Company*

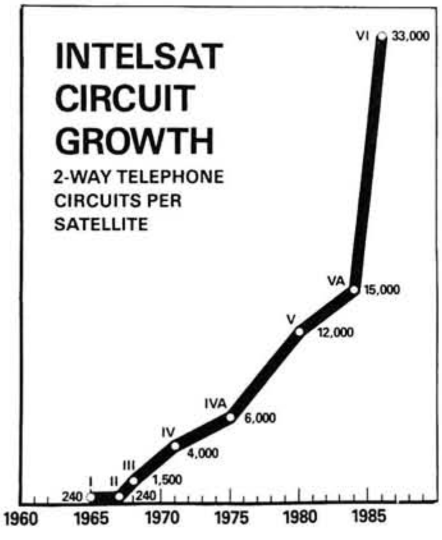


Fig. 1.2: Graph indicating the continuing increase in use of satellite telephone links

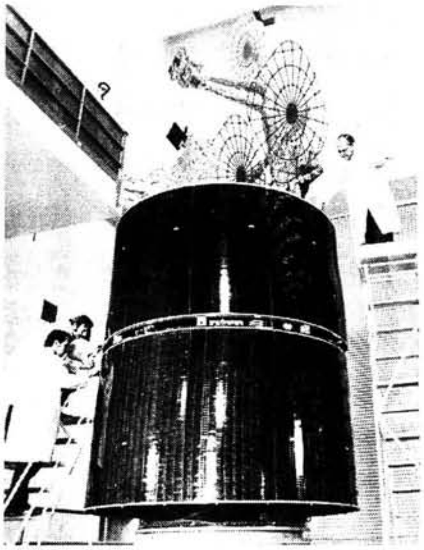


Fig. 1.3: An INTELSAT IVA cylindrical spacecraft being prepared for launch *INTELSAT*

by Brian Dance

Part 1

mmunications

communicate with ground stations anywhere on the half of the earth over which the satellite concerned is located.

Three Oceans

The INTELSAT satellites are positioned over the Atlantic, Indian and Pacific oceans—the positions proposed by Arthur Clarke in 1945. They are all geosynchronous, but carry small gas jet systems which allow them to be moved back into position if they stray from their correct location.

The highest traffic requirements for telephone and other work is found in the Atlantic region, especially between North America and Europe, whilst the Indian Ocean satellite connects Europe and Africa with Australia and the Far East and the Pacific Ocean satellite connects Australia, Japan, etc. with the American Continent.

It is interesting to note that the radio signal from a ground station has to travel a distance of not less than 35 800km up to the satellite and the signal from the satellite has then to travel a similar distance to the other ground station. The total distance is over 70 000km and even at the speed of light (300 000km per second), this necessarily involves a delay of nearly one quarter of a second. Thus if one speaks over a satellite link, one cannot receive a reply in appreciably less than half a second; this is acceptable for speech signals, but not necessarily for some forms of data transmission. If two satellite links in tandem are used, the delays tend to be unacceptable for speech links, so such tandem connections are avoided. The delay arising from even the longest sub-oceanic cable links is much shorter than with a satellite link. Indeed, echo suppressing circuits must be used in satellite links to prevent the speaker from hearing an echo of his own voice after it has travelled a distance of some 140 000km via the satellite to the other earth station and back again.

Signals

Let us follow the path of a particular signal to understand basically what is involved. If someone picks up a telephone and dials a number on the other side of the world, this call is first mixed or "multiplexed" with several thousand other calls or signals and is passed either to a sub-oceanic cable or, in the case we are discussing, to an earth station for transmission to a satellite in geosynchronous orbit.

At the earth station the signal is first amplified and modulated onto a carrier wave at a typical power level of some 12kW. The standard type A INTELSAT earth stations employ a huge parabolic reflector dish approximately 30m in diameter. This reflector focuses the radio wave into a narrow beam directed at the satellite; although the construction of such a huge movable reflector is enormously expensive, it increases the signal strength at the satellite by a factor of around 50 000 and is an essential part of the system. The frequency of the microwave radio beam carrying the signal up to the satellite is normally in the 6GHz band, but recently frequencies in the 14GHz band have been introduced.

The signal received by the satellite is extremely minute, only a few million-millionths of a watt, owing to its enormous distance from the ground station. Signals received

Fig. 1.4: An INTELSAT V satellite under construction at Ford Aerospace *Ford Aerospace*

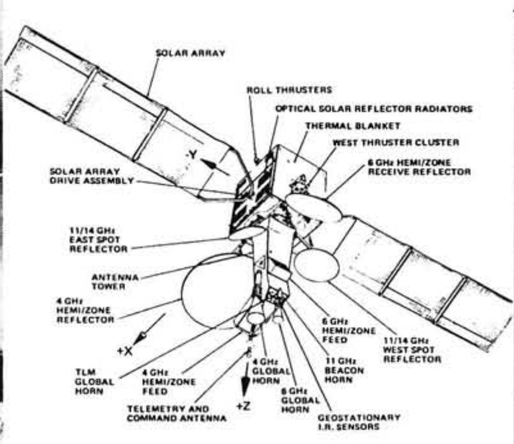


Fig. 1.5: INTELSAT V general arrangement

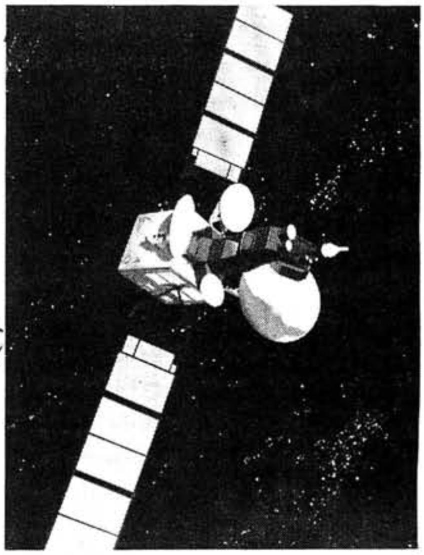


Fig. 1.6: An artist's impression of the INTELSAT V body-stabilised satellite *Ford Aerospace*

by the satellite are amplified before being converted to another frequency for return to earth. Signals received in the 6GHz band are converted into the 4GHz band for the down-link back to earth, while up-link signals in the 14GHz band are returned via 11GHz down-link.

The power level at which the signal is transmitted from the satellite is typically of the order of some tens of watts. The satellite derives its power from solar panels which convert the energy of sunlight into electrical energy, so there is no possibility of the satellite transmitting with a power comparable to that which earth stations can transmit. However, the satellite uses a directional antenna system which concentrates the power into the region where it is to be received on the earth and this may increase the signal level by perhaps a factor of 50. It has not yet been possible to construct enormous reflector dishes in space to provide a highly directional beam (such as that transmitted up to a satellite), but space scientists are currently working towards such structures.

The signal level received at the earth station is fantastically small. However, the same 30m diameter reflector used for transmission is employed to concentrate the received radiation, but even the huge area of such a reflector can collect only a few pW (10^{-12}W) of the power transmitted by the satellite. The signal is then fed to a very low noise amplifier cooled in liquid helium so that the movements of electrons within the devices of the amplifier do not contribute further to the noise in the signal. Further amplification up to the mW level occurs before demodulation and processing so that the signal can be fed into the telephone system of the receiving country and hence to the person to whom the call is directed.

It is interesting to note that overall the signal is amplified by a factor of about 10^{40} (some ten thousand million million million million million million times) during its journey from the input of one earth station system to the output of the receiving earth station system!

The Satellites

One of the most important considerations in the design of a communications satellite is that it shall be able to carry as many telephone channels or other forms of communication as possible so that the cost per channel is kept reasonably low.

The first INTELSAT craft could accept *240* two-way telephone circuits, whereas the current INTELSAT V series of satellities can carry some 12 000 circuits. The weight of the satellites has risen from 38kg to 967kg to allow for the greater complexity required in the current satellites with their higher traffic handling capability. The figures quoted are for the weights in their orbital position, but the weight at launch is considerably greater. Satellites have been launched by rockets, but the Space Shuttle will doubtless be used for many future satellites when it has been fully tested and proved.

Types of Satellite

Although the size of the satellites used from 1965 until 1980 gradually increased, they were all of a rather similar cylindrical construction. The outside of the cylinder was covered with solar cells to provide the power needed by the satellite, but on top of the spinning cylinder was an antenna system which had to be stationary so that it directed its beam towards the earth. Thus one had a de-spun platform on the spinning cylinder.

The main disadvantage of such a spinning satellite is that only a fraction of the total number of solar cells on the cylinder are receiving full sunlight at any time. Therefore the power developed is much smaller than if all of the solar cells were in full sunlight. Nevertheless a total power level of approximately 500W was obtained with the latest of these spinning satellites, the INTELSAT IVA series.

The new INTELSAT V spacecraft are body-stabilised and have quite a different appearance to that of the earlier types. The solar cells of the INTELSAT V craft are fitted to extended arms which can move so that all of the solar cells are perpendicular to the rays from the sun at all times. At launch the arms of a body-stabilised craft are folded so that they do not occupy more space than is available in the launch vehicle.

Fig. 1.7: Early Bird, shown here in front of a life-size painting of an INTELSAT VI craft
Hughes Aircraft Company

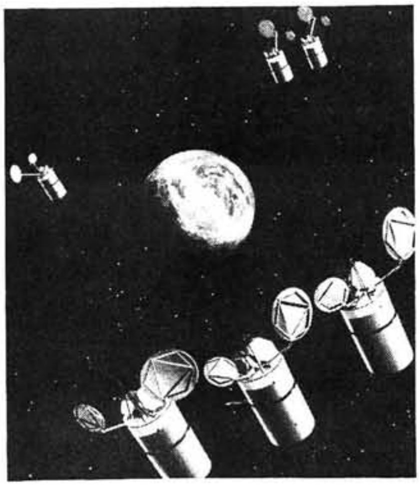


Fig. 1.8: INTELSAT VI satellites will surround the earth during the 1990's
Hughes Aircraft Company

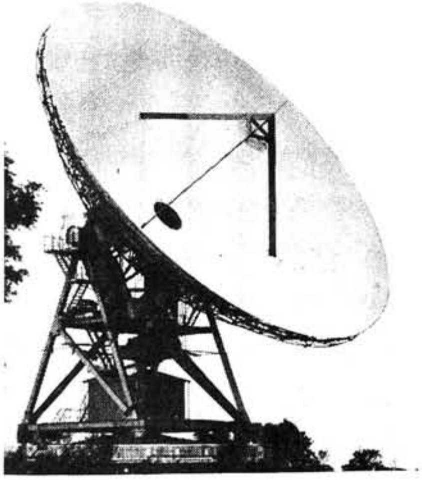


Fig. 1.9: One of British Telecom's earth station antennas at Madley
British Telecom

It is much easier to stabilise a spinning satellite in relation to the earth, but the power output from its solar cells is reduced by a factor of $1/\pi$ relative to the power which can be obtained when the rays from the sun strike all of the cells perpendicularly. In addition, a body-stabilised satellite can more easily support a complex, high gain antenna than a spinning craft.

At present NASA can see no clear preference for spinning or body stabilised craft, each having its own advantages for certain applications. Ford Aerospace, which manufactures the INTELSAT V craft, also makes spinning satellites, whereas the Hughes Aircraft Company, which manufactured many of the earlier INTELSAT craft, has concentrated mainly on the spinners. It seems likely that there will be a place for both types for years to come until it becomes possible to construct huge space platforms for communications work.

The design lifetime of all of the INTELSAT craft launched in the past decade has been seven years. Although an electronic failure can kill off a satellite and render it useless, such failures are very rare and it is the ability of the satellite system to detect and correct any orbital shifts which determine the design life. Satellites correct their position in geosynchronous orbit by means of hydrazine thruster jets. The longevity of a satellite is determined not only by the amount of hydrazine carried, but also by the chance of any faulty thruster sensors or servo-systems developing.

Having examined the historical background and development of the INTELSAT communications systems, the concluding part of this article will provide functional details of the INTELSAT VI network which will form the mainstay of international communications well into the next century.

Swap Spot

Have FT-208R and FT-708R plus NiCad charger, mobile charger/adaptor and one speaker mic. Would exchange for IC451 or other u.h.f. multimode equipment considered. Barry Jackson. Tel: Halstead 475929. *V490*

Have small two berth Cavalier caravan complete with full awning, toilet tent, spare wheel etc. All in first class condition, approximate value £400. Would exchange for any 144MHz or other amateur transceiver. Tel: Woodstock 812278. *V520*

Have SX200N scanner. Would exchange for FT-290R or FT-790R w.h.y. G8BJS. Tel: Tadley 71278 after 5pm. *V524*

Have Marconi (WW-II) radio transmitter plus microphone, Philips portable reel to reel recorder, clip-on capacitor microphone and other bits and pieces. Would exchange for ZX-81 or anything of use to s.w.l. Joe Earley, 3 Whitworth Tce, Drumcondra, Dublin 3. *V535*

Have Pye base station antenna or high speed 8 channel paper tape reader. Would exchange for cabinet and front panel for AR88LF. Tel: West Drayton 441031. *V537*

Have a MM-2000 RTTY to TV converter. Would exchange for scanner a.m./f.m. SX200N or similar, must be in working order. Tel: Abingdon 33177 anytime. *V544*

Have Realistic DX-302 communications receiver, digital readout etc., and Global AT1000 a.t.u. Both in excellent condition and boxed with instructions. Would exchange for 430MHz TX/RX (mobile/handheld). Tel: Oxford 66075. *V545*

Have Icom 255E 144MHz f.m. transceiver, Drae wavemeter, 5-element antenna. Would exchange for 48K Spectrum, mirror or very wide angle lens for camera (42mm mount) or w.h.y. Cash adjustment if needed. Tel: Ramsey (Cambs) 841047. *V546*

Have Icom IC-25E 144MHz f.m. transceiver, 25W output, 5 memories and scanning etc. In very good condition. Would exchange for SX200N or w.h.y. Ian. Tel: 0509 502989 (Shepshed, Leics.). *V571*

Have AR88LF receiver and KW77 receiver, both working with manuals. Would exchange both for Eddystone 680X or 730 or similar. G4MNB. Tel: Swindon 826325 evenings after 7pm. *V593*

Have B40 general coverage 600kHz/30MHz plus sidebands in good condition (with circuit diagram). Would exchange for any home computer with at least 16K RAM p.s.u., leads etc. Tel: Dinnington 563186 after 5pm. *V623*

Have SX200 scanner plus Norcom antenna element. Would exchange for Canon T50 camera fitted with Canon 75–125mm zoom lens or w.h.y (interested in FRG-7700). B. Tobias, 108 Baysdale Road, Scunthorpe, South Humberside. Tel: 0724 841586. *V624*

Have ZX-81 plus 16K RAM and JWR CB converted to 28MHz f.m. Would exchange either or both for RTTY terminal unit, general coverage receiver or 144MHz linear. G6SRE. Tel: Ashford (Kent) 25991. *V641*

Have Garelli Tiger Cross, M reg, not used since 1978, reconditioned engine, spare engine, wheels and tyres, plus manual. Would exchange for v.h.f. marine/amateur band receiver. G.A. Croft, 48 Glynne Way, Hawarden, Deeside, Clwyd CH5 3NL. *V648*

Have Trio JR310 amateur bands receiver, 1·8-28MHz, narrow filter, manual, good condition. Would exchange for battery/mains type h.f. bands receiver (Satellite etc.) or 144MHz f.m. mobile or portable rig. Cash adjustment if necessary. G4VLB. Tel: 061-480 1549. *V673*

Have York model 863 mobile 40-channel CB, new and complete with full guarantee, also Fidelity model 2000, as above. Would exchange for telephone answering machine or w.h.y. in radio or electronics. Walker. 23 Forest Hill, Yeovil. Tel: 25225. *V332*

Have Eumig Viennette super-8 cine camera with motorised zoom lens. Also Eumig super-8 projector, also Eumig film splicer. Would exchange for Commodore 64 computer or Bearcat 250FB. Tel: Swanage 425509. *V333*

Have vintage radio items, all valve 1939–50, Vidor portable, dual-beam oscilloscope, frequency generator, ultra-sonic generator, multimeter, amplifier, original telephone answering machine. Would exchange for word processor. Haines, 9 Sharpleshill Street, London NW1. Tel: 01-722 7877. *V353*

Have Avon Les Paul Copy, electric guitar plus 15-watt amplifier with tremolo and reverb. Would exchange for any general coverage receiver 150kHz–30MHz, l.e.d. display with 144 or 70MHz converters. Can make reasonable cash adjustment if required. Howard. Tel: Abingdon 20698 evenings and weekends. *V373*

on the air

AMATEUR BANDS *by Eric Dowdeswell G4AR*

Reports to: Eric Dowdeswell G4AR, 57 The Kingsway, Ewell Village, Epsom, Surrey, KT17 1NA.
Logs by bands in alphabetical order.

I would be pleased if readers, club secretaries, etc., would kindly note my correct address, above. In spite of notifying all concerned of my change of QTH last November the new RSGB callbook still managed to publish my old address in Ashtead!

A very brief note from "SWL South Humberside" asks if the "thickness" of the wire used in an antenna has any influence on the strength of the incoming signal. Very briefly indeed, no. However the diameter of the wire is a much more important factor because if it is too small then it will tend to stretch and break especially if it is a relatively long length, and will present a hazard to birds who may collide with and break it. The general preference is for copper wire 18s.w.g. (0·048in dia.), or more, up to 14s.w.g. (0·08in dia.) at which point the wire becomes very heavy to handle easily, needing strong supports if the wire is to be pulled up reasonably horizontal. A centre-fed wire will be even worse with the weight of the coaxial or flat feeder unless the centre is supported by a pole.

However, the electrical considerations are quite interesting. If a wire is carrying a direct current (d.c.) then the current flow is fairly even over the diameter of the wire but if an alternating current (a.c.) is applied then when one reaches the higher frequencies, such as the h.f. amateur bands, then the flow of electrons tends to take place in the outer layers of the conductor, creating what is generally known as "skin effect", Fig. 1. This represents a loss which is higher as the frequency increases. For this reason inductances (coils) used in radio equipment at v.h.f. may be silver-plated copper wire as silver is a better conductor than copper. Obviously cost is an important factor here. Years ago the skin effect in coils used on the medium and long wavebands was offset by winding them with "Litz" (Litzendraht) wire, comprising many strands of very fine enamelled copper wire twisted together to form the required gauge of wire. The task of cleaning off the enamel of every one of the wires before soldering them can be imagined! In practice it was usual to dip the end of the wire into methylated spirits to remove the enamel.

The conductivity (resistance per unit length) of the antenna wire is also important, in theory anyway, so silver is the first choice but practically speaking copper is used universally. Other possibilities are brass, aluminium and iron, or stainless steel. The aluminium wire sold on reels for use in the garden is a good source of antenna wire but it does stretch a lot if a long length is used, and making satisfactory joints in the wire is almost impossible as it cannot be soldered by conventional means unless a special flux is used.

For transmitting purposes the wire should be the heaviest gauge feasible and all joints must be properly soldered and then protected with the self-adhesive type of insulating tape to prevent corrosion of the joint. Remember that points of maximum current on the antenna can mean several amperes even at comparatively low powers, so minimum resistance at these points is imperative for maximum radiation efficiency.

Thin-walled aluminium or dural tubing is ideal for rotary beams and vertical self-supporting antennas, combining reasonable conductivity with mechanical strength. You v.h.f. enthusiasts may wonder why stainless steel elements are becoming popular in commercial v.h.f. beams when copper or aluminium may seem preferable. Going back to the discussion on skin effect at high frequencies, it also happens that when the resistivity of the antenna material increases, as it does with steel over copper, then the layer of molecules conducting the r.f. currents increases in depth tending to nullify the increased resistivity. Because of the difficulties of forming stainless steel the radiating element in a Yagi beam, generally a folded dipole, may be of aluminium and the straight directors and reflectors of stainless steel.

In the December 1983 issue of *RadCom,* in the deservedly popular feature *Technical Topics* by Pat Hawker G3VA, there was included an inverted-L type of antenna as described by DL2FA in the German magazine *CQ-DL*. Known now as the electromagnetic groundplane antenna (EMGA), Fig. 2, it is a bent over familiar design with a total length of a quarter wave. It is claimed "to come close to the effectiveness of the conventional monopole vertical antenna".

So what, you may well ask. Well, if the designer of the EMGA had looked up the *Admiralty Handbook of Wireless Telegraphy 1938* (six shillings!) he would have found the same antenna and a table (a shortened version is given here) in which the ratio of horizontal length to height is given as "aerial form factor AFF". The AFF multiplied by the actual antenna height gives the effective height. If, for example, the antenna was as in Fig. 3(a) with equal height and length the AFF would be 0·90 and the effective height 9m.

If the antenna configuration is as Fig. 3(b), a more likely occurrence, then the AFF is 0·99 and the effective height is virtually the same as the actual height, namely about 3·4m.

The final paragraph on the subject makes lovely reading today. "This factor (AFF) gives a fair approximation to the radiation or effective height for shore station aerials, and for merchant ships with wooden topmasts of equal height, small superstructures and the feeder well away from the funnel"!

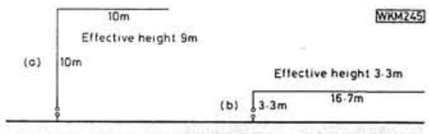


Fig. 3: Two examples of the inverted-L antenna to show effective height against actual height, in this case a quarter wave for 3·5MHz (80m), or 20 metres long

Fig. 1: Looking at the cross section of a conductor carrying direct current, left, the theoretical electron flow is even across the wire but with high frequency currents the flow is confined to the outer part, left

Fig. 2: The EMGA antenna is just the conventional quarter-wave vertical antenna formed into an inverted-L, the ratio of length to height determining the effective height

Length Height	AFF	Length Height	AFF
0·0	0·64	4·0	0·98
0·5	0·80	6·0	0·99
1·0	0·90	10·0	1·00
2·0	0·96		

General Notes

Latest *Council Letter* from the RSGB reveals that to coincide with the 23rd Olympic Games, and to celebrate the 20th anniversary of the gift of the Kennedy Memorial site at Runnymede to the American people, the Chiltern DX Club will be using the "special" Special event callsign GK0JFK with DTI approval. This unique operation will run from Friday, August 3 to Sunday, August 5 inclusive.

At very short notice the Sefton ARC (G4RAQ) has been able to lay on a special event station at the International Garden Festival in Liverpool until October 14. Operation will be on all h.f. bands, 144 and 432MHz and via satellite whenever feasible. Calls are GB0IGF, GB1IGF, GB2IGF and GB6IGF, with special QSL cards for QSOs and SWL reports. Assistance with expenses will be most welcome and sponsors will be noted on the QSL cards. Mike Webb G6ICR, 46 Hollytree Road, Gateacre, Liverpool L25 5PD is the source of info on this project as is G4VKV QTHR.

Ian Abel G3ZHI who is running the AR Novice Licence campaign writes to say that there seems to be a widespread idea that the campaign is to get CBers who cannot pass the RAE on to the amateur bands. Ian says this very definitely is not so. The proposed ticket would, he says, put the self-training aspect back into AR. Briefly he wants 10W c.w.-only operation on the 3·5, 7, 21 and 28MHz bands with a licence valid for two years during which time it must be upgraded to the "A" or "B" licence or it would be lost for one year. (What is wrong with the 160m band which has always been regarded as a band par excellence for the beginner on c.w. and the existing 10W limitation?) Ian deplores the Black Box syndrome of today and reckons the proposed novice licence would be like an apprenticeship in radio, learning by doing.

A touch of glamour comes to amateur radio! John Jackson, otherwise G3TZZ, became Mayor of Enfield, Middlesex, in May and his wife Sylvia, none other than G8SZZ, the Lady Mayoress. John and Sylvia are appealing for funds for the Greater Benefits for Enfield Mayoral Charities and the Southgate ARC will be running special event radio station GB4EMC on several occasions in support of the appeal

DX Bands

A distinct lack of reports this month, not entirely surprising I suppose in view of the wonderful hot weather we are enjoying at the moment. Much better out in the field helping the local club to get its antennas up and the tea brewing!

A first letter from **R. Edwards** of Barnes, London SW13, who has been SWLing for a couple of years and has a Yaesu FRG-7700 with an Amtech 300 antenna tuning unit fed from long wire antennas. He also indulges in TV DXing with a Vega 402D receiver and has "seen" France, Spain, Holland and the USSR which can't be bad. In addition, part of the RAE has been passed and hopefully the second part went ok in May. On 3·5MHz only station of any rarity value was KA7AW/HB0 in Leichenstein. On to 14MHz and HL1ASN, VU2AGI, A92EB, C6ANU and on 21MHz it was HK0HEU, PZ1AP and 5H3VB.

Andrew Hamon was first licensed as GU6TDE when only 14½ years old and now, at age 15, he has got his "A" licence as GU4WTN. First ambition is to work 100 different countries and to get QSL confirmation for the DX Century Club award. Andrew lives in St Saviour, Guernsey, Channel Islands

Regular correspondent **Marcus Walden** of Harrogate, N. Yorks, has had to share his spare time with school exams but still managed to send a log. His outfit is a Realistic DX302 and a 20 metre-long wire antenna in the attic. A good catch on 3·5MHz was CP8HD with, on 7MHz, CO2HQ, HK0HEU (QSL via HK0FBF), ZL2BT, 5N3ECA and 8P6OV. The faithful 14MHz band showed up with HP1AZI (Box 743 Panama City), JW1CY, S79DF (Box 174, Mahè), VE3JGC/VP9, XT2BR (Box 116, Ougadougu, Upper Volta), VP2MCG, 3X4EA, followed on 21MHz by AP2P, A92DQ (QSL K21JL), J28EB (Box 2417 Djibouti), J37AH (QSL W2GHK). Still on 21MHz, obviously the band of the month, OE8HFL/YK with cards to OE5JTL, TR8CR, TU2NA (QSL K2IBW), VQ9AC (QSL to KA3EDN), YI1BGD (QSL Box 5864 Baghdad), 5H3BH (QSL SM0EAI), 5Z4DJ (QSL G4NJP), 6W1AR (QSL DJ3AS or Box 3285 Dakar), 9J2TJ, 9K2BE, 9L1SL, 9M2PV, 9Q5JE (QSL DJ5TY), 9U5JB (QSL ON5NT), 9Y4AT and on 28MHz 5N3RTF (QSL DK2IF).

It is interesting to note the large number of stations in Marcus' log for which he has provided the address for sending a QSL card to the DX station logged. This is extremely useful information for the s.w.l. and the licensed amateur alike especially if chasing some of the worthwhile certificates of achievement where cards are required in confirmation of s.w.l. reports or QSOs. It is not enough just to log as many stations as possible and ignore other useful information.

Another regular, **Pat Cullen** of Saltburn-by-Sea, Cleveland, used his Panasonic DR48 to good effect with AP2P, BY4AA (yes, China, QSL Box 205, Shanghai) for an excellent very rare country, C53EZ, VP2MDG, XE1JC, 5N8HEM, 5Z4JD, 9J2DJ all on 21MHz. Followed by HR4GM, J39BS, KH6FKG, VP6TC (not reported for some time), 3X4EX, 5T5RY and 9L1JW for good measure and logged on 14MHz.

QRP enthusiast **Steve Ortmayer G4RAW** of Halifax complains of a lack of QRP c.w. stations on the 10MHz band, otherwise contacts there have been restricted to Europeans mainly. New constructional project has been the Cadet direct conversion receiver for the 21MHz band, described in *RadCom* some eight years ago. Steve uses it with a simple crystal oscillator transmitter. Only QSO with his PW7 rig has been with PA0KJF, also using low power. Steve says he often calls CQ on the QRP calling channels 3·560 and 7·030MHz but replies from other QRPers are few and far between. Personally speaking I think calling CQ with low power is a waste of good time and prefer to call other stations, then you know that there is someone listening on the frequency even if they are not QRP.

All s.w.l.s could do worse than keep an ear open on these and other QRP frequencies and polish up their code at the same time. An accurate report would certainly ensure a return QSL card which is more than can be said for the run-of-the-mill s.s.b. stations on 14MHz. It might also prove a strong incentive to get on with the study required for the RAE.

Club News

Our apologies to clubs and readers that, due to delayed publication of PW, some dates given here have already passed.

A while ago it was suggested in this column that a spot frequency be nominated in the 3·5MHz band on which club stations could expect to find other club stations active especially during club on-the-air sessions. It seems only logical that clubs should want to communicate with each other to exchange ideas on forthcoming events, arrange reciprocal talks and lectures and co-operate on such matters as field day sites, etc. It is not unknown for two, or more, clubs to turn up in the same field for NFD! Waiting for the club sec to write off to another club to ascertain its intentions and to get a reply can take months.

So any ideas on a Club Net general calling frequency? As there are clubs meeting every day of the week it only remains to state a starting time for the net and I'd like to suggest 7pm local.

308 ARC Normally meets Tuesdays at 8 at the Coach House, St Mark's Church, in Church Hill Road, Surbiton, Surrey, but in August there will be an outside venture in the form of a d.f. foxhunt and in September an invasion of the Kingston ARS is planned. Morse code practice plus tea or coffee are among the other attractions which Dave Davis G6YQD of 13 Maple Road, Surbiton, Sy, will be glad to tell you about.

Acton, Brentford & Chiswick ARC G3IIU The venue as always is at the Chiswick Town Hall, High Road, Chiswick, London W4, at 7.30pm with Tuesday, August 21 taken up by G6XPC on "The Expert Radar Users—Bees". New members and visitors assured of a good time, says sec W. G. Dyer G3GEH, 188 Gunnersbury Avenue, Acton, London W3.

Ainsdale ARC Don't overlook the Woodvale Rally at RAF Woodvale with GB2WR expected to be active on s.s.b. and RTTY plus ATV with a mobile unit wandering round the rally relaying pics to the base marqueé. Radio controlled cars and planes will also be on view, QRM permitting! David Norris G4TUP is on Southport 35947 and has more details of this big event including the date which I have been unable to ascertain!

Axe Vale ARC First Friday at the Cavalier, West Street, Axminster, at 7.30 with foxhunt laid on for August 3, and note the microwave evening on October 5 in your diary. The talk by G3GC on the use of computers in plotting radiation patterns was very popular and well-attended. Your contact is R. W. Jones G3YMK, 10 Oak Tree Close, Upottery, near Honiton, Devon or Upottery 468.

Aylesbury Vale RS G4VRS "Alternate Tuesdays" makes it August 7 and 21, at the Haydon Hill Community Hall, Dickens Way, A'bury at 8pm, with Cathy Clark G1GQJ on (0844) 51461 available to give you more details of what will be happening on those evenings. On other Tuesdays there is a club net at 8pm on both S22 on 145MHz and around 3·6MHz on 80m s.s.b.

Banbury ARS Normally last Thursday at St Paul's Church Hall, Banbury, but during the summer d.f. foxhunts on both 144 and 1·8MHz will be held on Friday evenings with full details of these from G4DLB on (0295) 65492 who is the organiser but general club information from sec John Burrell G8OZH, 6 Blenheim Croft, Brackley, Northants on (0280) 702900.

Basingstoke ARC G3TCR G8JYN Second Tuesdays at the Swan Inn, Sherbourne St John, near B'stoke, Hants, at 7.30. Mondays at 8pm is club net time on 145·475MHz f.m. More from sec Eddie Thompson G4SQZ, 21 Wigmore Road, Tadley, B'stoke, Hants.

College of Technology, Belfast GI2BX Looks like the last Wednesday of the month at the Millfield complex in Room B10 (lecture theatre) at 7 sharp. Meetings open to any amateur or s.w.l. as well as to the public. Contact sec Jim Barr GI1CET on Belfast 227244 ext 243 any workday except Thursday.

Biggin Hill ARC G4RQT G6TBH A chat on construction techniques by G4VTD is promised for Tuesday, August 21 with a special note to be made of a visit by Louis Varney G5RV on Tuesday, September 18, to talk on you know what! So third Tuesdays at 8.30pm, St Mark's Church Hall, Church Road, Biggin Hill, Kent, with sec Ian Mitchell G4NSD, on (09598) 376, that's Westerham, Kent, around to answer queries.

Bridgend & District RC Second Wednesdays at the NCB HQ, Tondu, with sec T. C. Morgan GW4SML, 4 Rhiw Tremaen, Brackla, Bridgend, Mid Glamorgan, willing to fill in the details of forthcoming features and events.

Bury RS The latest edition of the club journal *Feedback* is mainly devoted to the second part of a series on converting CB radios to AR operation in the 29MHz f.m. band, the result of much work by a number of members of the society. Another useful device shown is a low-pass filter enabling illegal CB "burners" to be used satisfactorily on 29MHz. Meetings every Tuesday at 8pm, the Mosses Centre, Cecil Street, Bury with principal gathering on second Tuesday, the others being more or less informal. More from Brian Tyldsley G4TBT, 4 Colne Road, Burnley who will be glad to hear from newcomers. Oh, yes, second Tuesday in August, the 14th, sees a foxhunt in full cry.

Carmarthen ARS Second and fourth Fridays at West Wales Social Club, The Quay, Carmarthen, a general meeting and an activity night respectively. The club will run a special event station at the Pembrey Country Park on Saturday, August 25 starting at 9am, all welcome of course. Your contact is Millie Meredith, 50 Caecoed, Llandybie, Ammanford, Dyfed. Hope you did well in the RAE, Millie!

Cheshunt & District ARC G4ECT G6CRC Wednesdays at 8, Church Room, Church Lane, Wormley, Herts. Natter nights in August are on the 8th and 22nd with a visit to Baas Hill Common, Broxbourne, on the 29th for a 144MHz operation. The 15th will be an equipment evening. Successful code classes meant seven out of nine candidates passing in one session. The East Herts College at Turnford starts an RAE course in September, details from club chairman Jim Sleight G3OJI on Ware 4316, while a code class for beginners will start in the Cheshunt area, also in September. Contact Jim on this also. Otherwise it is Roger Frisby G4OAA, 2 Westfield Road, Hoddesdon, Herts (0992) 464 795.

Chester & District RS G3GIZ G8GIZ Every Tuesday except the first in the month, 8pm at the Chester RU Football Club, Mare Lane, Vicars Cross, Chester with half an hour of code classes beforehand, courtesy G4MOU. The club h.f. rig is being supplemented with a v.h.f. outfit very shortly. PRO is Dave Hewitt G8ZRE, 31 Broadmead, Vicars Cross, Chester or (0244) 316673.

Civil Service ARS Meets regularly at the CS Recreation Centre, Monck Street, Westminster, London SW1 at 12.30 on first and third Mondays with an operational station on the air, by now I imagine Tuesday evenings there is a net on 144·575MHz at 7.30pm QSYing to 3·720MHz at 8pm, using callsign G3CSR/A. Sec George Costin is on 01-632 3875 or try Bob Treacher on *01-212* 4846 or even Phillip Woolley on 01-698 4437.

Coulsdon ATS G4FUR Venue is St Swithun's Church Hall, Grovelands Road, Purley, Surrey, second Monday and last Thursday of the month and be there by 7.30. A return quiz with Sutton & Cheam RS is scheduled for August 13 with the 30th devoted to club constructional projects and Morse code tuition. Your contact is Richard Goring G6VYT on 01-684 0610.

Crawley ARC Meetings divided between members QTHs and Trinity Church Hall, Ifield, Crawley, Sx, usually around 8pm. Sorry details are so sparse so contact sec David Hill G41QM on Crawley 882641.

Derby & District ARS G3ERD G2DJ G8DBY The 27th annual Derby Mobile Rally takes place on Sunday, August 12 at Lower Bemrose School, St Albans Road, Derby, with free admission and adequate parking facilities. Imagine there will be a talk-in available on S22. More from G4EYM/G3SZJ on (0332) 556875.

Derwentside ARC (Consett) Every Monday at 7.30 the RAFA HQ, Sherburn Terrace, Consett, where regular features include Morse code classes and a Raynet group. New members most welcome says sec June Wallis G1AAJ who will reply on (0207) 520477.

Dudley ARC G4DAR The Allied Centre, Greenman Alley, which is off Tower Street apparently, second and fourth Mondays at 7.45pm. More info from sec Cheryl Wilding G4SQP on Codsall 5636.

Dunstable Downs RC G4DDC G4ARD G8DDC Seems some of the previous info published on club events was incorrect but current sec P. Morris G6EES, 10 Seamons Close, Dunstable, Beds, assures me the following is ok. Meetings at Chews House, High Street South, D'stable, on Fridays at 8pm, with August 10 devoted to computers in radio, and on the 31st G3BNL will deal with microwave matters. On September 14 G3NRW will cover the wide field of RTTY, AMTOR and packet radio.

Edgware & District RS G3ASR Second and fourth Thursdays at 8, 145 Orange Hill Road, Burnt Oak, Edgware, Middx, with code classes supplemented by slow Morse via G3ASR on 144MHz and Top Band during

and a QRO activity session on the 29th. This is followed by the AGM on September 5. Len Baker G4RZY. 62 Court Farm Road, W'church, Bristol is the hon sec for more details, or buzz (0272) 834282.

South Manchester RC G3FVA G3UHF G8SMR August 5, a Sunday, is the RSGB Top Band DF qualifying event for the club so good wishes for your success. Normally every Friday at 8, Sale Moor Community Centre, Norris Road, Sale, Cheshire, but there is always a nattering session there on Monday pm. QRO Miscellany is the title of a talk by G2HW on August 10 but for details after that contact Dave Holland G3WFT, 32 Woodville Drive, Sale or ring 061-973 1837.

SE Derbyshire ARS Tuesday evenings during term time at SE D'shire College, Ilkestone Road, Heanor, with 7.30 a good starting time, with talks and discussions programmed. The sec is W. F. Peck G4VNB, 2 Sandfield Avenue, Ravenshead, Nottingham.

South Lakeland ARS Laurel and Hardy fan club will be holding its world convention in Ulverston, birthplace of Stan Laurel, in early August with the club running special event station GB2SL for the occasion, on both 144MHz and the h.f. bands. When things are normal the club meets on first Tuesdays and third Thursdays in Barrow but only sec Dave Warburton G6LKB, 36 Bigland Drive, Ulverston, Cumbria can tell you precisely where. He is to be found also on (0229) 54982 or 23366 ext 4892 during office hours.

Southgate ARC G3SFG According to newsletter *Bandspread* meetings second Thursday at St Thomas's Church Hall, Prince George Avenue, Oakwood, London N14. It's general open meeting on August 9 but Monday, August 27 there is a d.f. hunt in Trent Park and a "Social Extravaganza" to follow! That's the Bank Holiday, I think. A laugh on September 13 when it's Bird Nest night when members are asked to bring along their prototype projects for inspection. Special event station GB4EMC will be active in summer months in support of the Great Benefits for Enfield's Mayor's Charity with Mayor and Mayoress just happening to be radio amateurs! See photographs elsewhere. PRO is Bob Snary G4OBE, 12 Borden Avenue, Enfield, Middx.

Spalding & District RS G4DSP Second Friday at 8pm, the White Hart Hotel, Spalding, Lincs, with a member's bring-and-buy junk sale on August 10 and note now September 4 when G4OO describes operating on the h.f. bands. Betty Whiteley G6YBL is sec and can be found on (0775) 2781.

Stanford Le Hope & District ARC This small club of only around a dozen members is anxious to recruit more local enthusiasts so what about Monday nights at 8 at St Joseph's Parish Rooms, Scratton Road, Stanford Le Hope, Essex. More details from sec J. R. Thompson G4OVG, 61 The Sorrells, S-L-Hope, Essex or ring S-L-Hope 642312.

Stockton & District AR Group G4XXG A new entry in this column I think, so welcome. Every Wednesday in the Billingham Community Centre from 7.30 to around 10pm. The c.w. classes are run under G4PVN, and G3DXP and G6DJO will be starting RAE course for members in August. A 2m award is also issued by the club. So drop a line to sec John Walker G6NRY, 7 Widdrington Court, Stockton-on-Tees, Cleveland or ring (0642) 582578.

Sutton & Cheam RS New sec is Alan Keech G4BOX, 26 St Albans Road, Cheam, Surrey. Meetings either at the Sutton College of Liberal Arts or the Downs Lawn Tennis Club, Holland Avenue, Cheam, with details from Alan. However there are also nets on Mondays at 8pm on 144·390MHz s.s.b., Tuesdays 10.30am on 3·770MHz s.s.b. and Sundays at 11am on 145·5MHz f.m., from which you can glean the latest info. Meetings generally on third Friday of the month.

Thames Valley ARTS New chairman David Foster G3KQR (I'd love to give all his medical qualifications but there isn't room!) says the club is seeking new blood (!) and will be concentrating on helping newer members with their technical problems. Every first Tuesday at 8pm, Thames Ditton Library, in Watts Road, TD, near to the Milk Marketing Board, off the Portsmouth Road. David Foster in on 01-399 1289.

Todmorden & District ARS Still very new and anxious to enroll new members. Meetings on first Mondays at the Queen Hotel, T'morden, Lancs, with sec Janet Gamble G6MDB on hand to help, or write to 283 Halifax Road, Todmorden, Lancs.

Torbay ARS G3NJA G8NJA Every Friday at club HQ, Bath Lane (behind 94 Belgrave Road, Torquay, for the informal stuff but monthly on last Saturday of the month except in August as that is the STC Rally time Sunday, August 26 at the STC Social club, Old Brixham Road, Paignton, with talk-in on S22 and all the usual family favourites. Margaret Rider is secretary to the club and can be reached at 7 Kingston Close, Kingskerswell, S. Devon.

Vange ARS G3YCW Another newcomer to the feature, meeting every Thursday at 8, the Barstable Community Centre, Basildon, Essex, with a junk sale once a month, visiting lecturers and talks from club members. The club's Mobile Rally takes place on Sunday, September 16 at Nicholas School, B'don, with further details on this and general club matters from Mrs. D. Thompson (call?), 10 Feering Row, Basildon, Essex.

Verulam ARC Meets at RAFA HQ, New Kent Road, off Marlborough Road, St Albans, second and fourth Tuesdays with further info from Brian Pickford G4DUS on (0923) 720616 at home or 773168 at the salt mine.

Vale of White Horse ARS G4VWH G6VWH Much summer activity in contests out in the field but otherwise at the Lansdown Club, Milton Trading Estate, at 7.30 for an 8pm start, but no meetings scheduled it seems for August. Nets are on 28·750MHz on Thursdays at 7.30pm and on 145·2MHz Sundays at 8pm. Sec is v.h.f. expert Ian White G3SEK, 52 Abingdon Road, Drayton, or (0235) 31559.

Wakefield & District RS G3WRS Meets "alternate" Tuesdays which seems to be August 7 for an on-the-air session and general natter night and August 21 for a pitch-and-putt competition at Holmfield Park. Club venue is Holmfield House, Denby Dale Road, W'field, starting at 8pm with Morse code tuition available from 7.30. A Datong Morse tutor is available for hire to members. More from Walter Parkin G8PBE on W'field 378727.

Welland Valley ARS G4WVR An inaugural meeting was held in June and the new club is looking for members possibly from the Leics and Northamptonshire areas. Club station G4WVR is already operative and meetings will be on Mondays at 7.15 at the Welland Park College and programme of visits, lectures and demos is being formulated. Sec is Dave Lunn G3LSL and chairman Alan Faint G4TZY but enquiries please to PRO Judith Day G6OFZ at 11 Warwick Close, Market Harborough, Leics.

Wimbledon & District ARS G3WIM Club net from G3WIM/A Mondays at 9pm on 145·250MHz helps to disseminate club info to members. Meetings at St John Ambulance HQ, 124 Kingston Road, London SW19 at 8pm with a natter night plus c.w. instruction on August 10 and a talk on kite flying by G8VCL on the 31st. If you've heard GB0WIM lately it is the club's special 21st anniversary call used at the club's annual camp at Chessington, Surrey. More from Geoff Mellett G4MVS, 26 Paget Avenue, Sutton, Surrey otherwise 01-644 8249.

Winchester ARC Third Saturdays at 7.30 the Log Cabin, Stockbridge Road, W'chester although nothing is scheduled for August. Net info is 145·275MHz at 8.30pm Wednesdays and 9am on 3·630MHz on Sundays. RAE classes start at Peter Symonds' College in August and there are c.w. classes at the club. Sec would like to hear from prospective members and visitors on Twyford 713003 and is Brian Epps G3SHQ.

Worcester & District ARC Highlight of meeting on Monday, August 6 is a video show of W5LFL operating from the space shuttle, at the Oddfellows Club, New Street, W'cester, at 8pm. An informal meeting will be held in the alternative venue of the Old Pheasant Inn in the same street, on the 20th. That makes it first and third Mondays of the month. Hon sec is Alasdair Lindsay G4NRD, on Evesham 41508. Before it is too late note the talk on What's Cooking in Microwaves by G8MWR on September 3.

Yeovil ARD G3CMH G8YEO Thursdays 7.30, Recreation Centre, Chilton Grove, Yeovil with August 2 discussing effective operation of an AR station, 9th with G3MYM on making a simple s.w. receiver, 16th same G3MYM on harmonic mixing, and a natter night on the 30th. Further details from Eric Godfrey G3GC, on (0935) 75533.

Please make a special note of the Hamfest by the RAIBC in conjunction with the Flight Refuelling RC at the latter's HQ, the Sports & Social Centre, Wimborne, Dorset, on Sunday, August 19 with something for everyone and even better facilities than last year, so I'm reliably informed. A good cause well worth your support if you can make it. Details from G4YTA on (0202) 882271.

Our apologies to clubs and readers that, due to delayed publication of PW, some dates given here have already passed.

the week. Much concentration by members on the various field day events at this time of the year. More from sec John Cobley on Hatfield 64342.

Fareham & District ARC G3VEF G8KGI Portchester Community Centre, Westlands Grove, P'chester, 7.30 of a Wednesday evening with August taken up by portable operation. Note however the talk on satellite communication on September 5. Contact Brian Davey G4ITG, 31 Somervell Drive, Fareham, Hants or try F'ham 234904.

Farnborough & District RS Meetings at 7.30, the Railway Enthusiasts' Club, Access Road, off Hawley Lane, F'boro, Hants. Ray Flavell G3LTP is down to address the club on August 22, and it looks like the second and fourth Wednesdays normally. Advance warning of the annual construction contest slated for a decision on September 26. It's Bob Taylor G4MBZ for more info at 12 Dunbar Road, Paddock Hill, Frimley, Camberley, Surrey also F'boro 837581.

Glenrothes & District ARC GM4GRC/GM3ULG Meets at Provosts Land, Leslie, Fife, and the only meeting noted is on Sunday, August 19 with a film and then a discussion on future plans. The singularly uncommunicative *"Newsletter"* has no contact information so all I can give is the QTH in the new callbook, c/o A. B. Givens, 41 Veronica Crescent, Kirkcaldy, Fife.

Gloucester ARS Every Wednesday at 7.30, St John Ambulance HQ, Heathville Road, Gloucester, plus much outside operation during the summer. Special event stations are planned, hopefully attracting new members. Write to Tony Martin at 12 Redwood Close, Podsmead, Gloucester for the finer details.

Halifax & District ARS First and third Tuesday at 7.30, the Running Man, Pellon Lane, Halifax, with a warm welcome extended to visitors and new members. On August 21 David Keitch of Radio Calderdale will address the assembled multitude and don't forget the AGM on September 18. Sec is D. L. Moss on (0422) 202306.

Radio Society of Harrow Fridays at 8pm the Harrow Arts Centre, High Road, Harrow Weald, Middx, in either the Belmont or Roxeth Room. During August the meetings are mainly of an informal nature with code classes and club projects and suchlike. However on the 31st there is the G2UV Memorial Quiz to entertain members. Listen for the club net around 1·925MHz on Sundays at noon. Try Chris Friel G4AUF on 01-868 5002 for more details.

Hastings Electronics & RC G6HH G1HHH Meetings third Wednesday at 7.45 at the West Hill Community Centre, Croft Road, with Friday gatherings at 8pm, the Ashdown Farm Community Centre, Downey Close off Harrow Lane (which, it seems, is just before the DOE) where there is also a Morse and basic micro course on Tuesdays and a film on the last Friday of the month thrown in for good measure. There is a Town and Country Fair in August at which the club presumably will be running a station but get on to sec Dave Shirley G4NVQ, on Hastings 420608 for the latest info.

Haverhill & District ARS Meets every Friday but as for the venue you'll have to contact Proctor G4PZW, 10 Hunts Hill, Glemsford, Sudbury, Suffolk or on (0787) 281359 to find out. The meeting on August 17 will deal with Interference while Lightning is the subject for the 31st.

Horndean & District ARC G4FBS "Suppressing car electrics" by a rep from Lucas should get a full house on August 6 at 7.30. It's the first Monday of the month at Merchistoun Hall, London Road, Horndean, Portsmouth, Hants, with talks, demos and the like. Club nets are on S16 at 8pm Wednesdays and 9am Sundays on 28·3MHz. The PRO is R. E. Tribe G4SAQ, 32 Sutton Road, Cowplain, Portsmouth.

Hornsea ARC Every Wednesday at 7.30, The Mill, Atwick Road, Hornsea, Yorks with full details from sec Norman Bedford G4NJP on (0262) 73635.

Horsham ARC First Thursday at the Guide HQ, Denne Road, H'sham, W. Sx, and you might get this issue in time to get along to a talk on Automated Noise Figure Measurement by G4EUG on August 2. Otherwise contact PRO Pete Head G4LKW on Horsham 64580. Note the Grand Autumn junk sale on September 6. All meetings start at 8pm.

Ipswich RC G4IRC GB2IRC Second and last Wednesdays at 8, the Club Room of the Rose & Crown, 77 Norwich Road, Ipswich. Wednesday, August 8 sees final planning for the demonstration at the Ipswich Carnival on the following Saturday. Latest issue of excellent mag *QUA* carries articles on hotting up the Pye Pocketfone by G8LBS, AMTOR using the TRS80 computer, and the ultimate contest aid, VODD, the voice-operated drinks dispenser, from the pen of N1II! A useful idea on filing QSO information by G4VSM/KE5NQ deserves wider coverage. More from sec Jack Tootill G4IFF on Ipswich 44047.

Inverness ARC GM4TPF GM1DZU New sec is David Jones GM4SXD, Beachan, Farr, Inverness, on (08083) 240. Meetings every Thursday at 7.30, Cameron Youth Club, Planefield Road, I'ness. Coming up in October is a special event station GB2MOD celebrating the Gaelic Mod in Inverness. More info nearer the time.

Lincoln SWC G5FZ G6COL Second and fourth Wednesdays at 8pm with other Weds devoted to c.w. and RAE classes. A provisional talk on home-brew gear is scheduled for August 22 but check with sec Pam Rose G4STO at the club HQ c/o City Engineers Club, Central Depot, Waterside South, Lincoln. Looming up is the Lincoln Hamfest '84 event on September 23 at the Lincs showground, four miles north of the city on the A15, on the Scunthorpe Road, with many attractions for the family.

Magherafelt ARS GI4MFT First Tuesday at 12 Garden Street, Magherafelt, Co Derry, NI, with code classes every Tuesday plus an RAE course being held in the local tech on Monday evenings. More from sec Jack Chapman GI4LVC, 55 Greenvale Park, M'felt, Co Derry, NI. Not too happy about the 12 Garden Street as letter is headed "10"! See from the callbook that "10" is correct!

Medway AR & TS G5MW G8MWA Talk on August 3 already notified is followed by a demonstration of satellite working by G8XLH on August 17 while the 31st sees a rep from KW Communications giving a demo and talk. So, every Friday at 7.30, St Luke's Church Hall, King William Road, Gillingham, Kent, with sec Andy Wallis G4TQS available on (0634) 363960 for fuller info on club activities.

Nene Valley RC G4NWZ G6GWZ The Dolben Arms, Finedon, near Wellingborough, Northants, at 8pm Wednesdays. Solar Factual Data is the subject for G8AFN on August 8, SSTV in colour and monochrome by G4ENB on the 15th, natter night on the 22nd, and G4BAO dealing with the 50MHz band on the 29th. That's enough to be going on with but for more info contact Lionel Parker G4PLJ at 128 Northampton Road, Wellingborough, Northants.

North Bristol ARC G4GCT Highlight for August is the junk sale on the 10th with ragchew sessions on the 24th and 31st while Horizon Electronics put on a show on the 17th. So that makes it every Friday at the Self-Help Enterprise, 7 Braemar Crescent, Northville, Bristol, from 7pm. The club committee is already engaged on drawing up a comprehensive programme of talks for the winter period. AR TV enthusiasts within the club have formed a separate group affiliated to the NBARC. Ted Bidmead G4EUV, 4 Pine Grove, Northville, Bristol will gladly answer any questions on the club.

Radio Club of Thanet G2IC Second and fourth Tuesdays at the Grosvenor Club, Grosvenor Place, Margate, Kent, says Ian Gane G4NEF of 17 Penshurst Road, Ramsgate, Kent, chairman but ready I'm sure to put you in touch with the secretary of the club for more information.

Rolls Royce ARC G3RR Mondays at 7.30 the RR Sports and Social Club, Barnoldswick, with Morse code classes among other attractions plus construction and natter sessions on Sundays at 11.30am. Visitors very welcome says sec L. Logan G4ILG, 19 Fenton Avenue, Barnoldswick, Colne, Lancs otherwise (0282) 812288.

Rhyl & District ARC The 1st Rhyl Scout HQ is the gathering place for the club on first and third Mondays with an RSGB film show on August 6 and an activity night on the 20th. Ring and ask for details from John McCann GW4PFC on (0745) 583467 or write to 67 Ashley Court, St Asaph, Clwyd.

Salisbury Radio & Electronics Society Meets at Grosvenor House under the chairmanship of Sir Evan Nepean G5YN every Tuesday at 7.30 with a busy programme of talks, lectures, demos, d.f. hunts and competitions, according to Bert Newman G2FIX, 74 Victoria Road, Wilton, near Salisbury, Wilts or ring S'bury 743837.

Salop ARS G3SRT Thursdays at 8pm, the Albert, Smithfield Road, Shrewsbury, with August 9 a natter night, and a picnic, courtesy of G6AKE, on the 16th. Discussion night on the 30th looks like an investigation into the moans, groans, and suggestion department of the club! Note the d.f. foxhunt on September 13 so get that old d.f. receiver working again. It's on 70MHz by the way. Sec Diane Parslow is at 1 Willington Close, Little Harlescott Lane, Shrewsbury, and now G4XBI. Was G6UDB but the QTHR under that call is incorrect in latest callbook. Other club activities include constructional projects for the club and code classes every Wednesday at the Drill Hall, Coleham.

South Bristol ARC G4WAW Wednesdays at 7.30, the Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol, with a pocket-phone rally on August 8 run by G4SDR, a v.h.f. c.w. activity night on the 15th

MEDIUM WAVE BROADCAST BAND DX

by Charles Molloy G8BUS

Reports to: Charles Molloy G8BUS, 132 Segars Lane, Southport PR8 3JG.

"Last November I participated in a competition organised by the East West Radio Club in Germany. The object was to log as many Arab stations as possible in one week" reports **Albert Moulder** of Rainham. "Some like Radio Algiers on the long wave are very easy to pick up any time but others are much more difficult" concludes our reader.

Africa on Long Waves

As Albert says, the 1500kW broadcaster on 254kHz, which is located at Tipaza in Algeria, comes in well in the UK, even during the daytime. Tipaza is part of the French network and could easily be mistaken for a French station. After dark try 209kHz for the 800kW outlet at Azilal in Morocco. It is rather close to BBC Radio 4 on 200kHz but the programming in Arabic does come through. Tune up-frequency from 209kHz to pick up the upper sideband of Azilal. This will help to reduce the splash from 200kHz. If you are using a portable then try turning the whole receiver to make use of the directional properties of the internal antenna. Depending on location you may be able to reduce or even null out the QRM from BBC R4.

There is a third, new African on the long waves. This is Radio Mediterranean No 1 located in Nadar in Morocco. It is to be found on 173kHz, a frequency it shares with Radio Moscow. Once again try to make use of the directional effect of your receiver's antenna.

Africa on Medium Waves

It is easy to pick up Africa on the medium waves, especially in the late evening when a number of European broadcasters will have closed down for the night. Interference from other stations on the same frequency (co-channel QRM) is not too much of a problem as the DX we are looking for is to the south of the UK while much of the QRM on the band is from other directions. A loop antenna or the internal one of a portable will often solve the problem.

After dark listen on 891kHz for the Arabic Service of Radio Algiers. Find BBC Radio 2 on 909kHz, tune slowly down to Milan on 900kHz and then to Algiers on 891. If you overshoot you will find BBC Radio Wales on 882kHz, which may cause problems for listeners in some locations. Try nulling it out. Radio Algiers is often a strong signal and should be audible on a portable.

If Arabic programming is not to your liking then tune to 981kHz. Locate the strong Dutch station on 1008kHz, then the UK local radio channel 999kHz and finally Radio Algiers French Service on 981. The best time to listen is at 2000 UTC at the start of the daily half-hour programme in English which can also be heard on 254kHz long wave. There is some QRM from a Swedish station on 981 though it should not be troublesome at this time of year. It can be nulled out at my QTH.

EAST AND WEST RADIO CLUB

نادي الشرق والغرب للراديو

XYL/YL/OM A. MOULDER hat am 5. INTERNATIONALEN MIDDLE-EAST-DX-CONTEST 1983 des E A W R C teilgenommen und erreichte mit 185 Punkten den 100. Platz!

Köln, 11.11.1983–16.11.1983

(Hardy Berger) (Adolf Schwegler)

East West Radio Club Certificate sent in by A. Moulder

At 2200UTC (2300 in winter) listen for Oujda in Morocco on 594kHz, Tenerife in the Canary Islands in Spanish on 621, Batra Egypt on 819, Sebha Libya on 825. There are two Swiss stations that close down at 2300 throughout the year, clearing their channels for DX. The French-speaking Sottons on 765kHz makes way for Radio Dakar in Senegal which broadcasts in French as well as local languages. The signal is of moderate strength, the programmes often including music of African origin. The address for reports is BP1765, Dakar, Senegal. The 300kW German-speaking Sarnan on 1566kHz vacates its channel to Sfax in Tunisia though there is some co-channel QRM from the USSR, which can be disposed of with a loop or ferrite rod antenna.

DXers who have a communications receiver and loop may care to try something more difficult. When Wolvertem in Belgium on 927kHz signs off around 2130 (an hour later in winter) listen for the 20kW propaganda station at Timimoun in Algeria. Aimed at disputed territories in the Western Sahara, the programmes are of a patriotic and emotive nature with drums and announcements in Arabic and Berber. Once Flevoland in the Netherlands on 747kHz goes off at 2300UTC listen for the weak Ougadougou in Upper Volta. It is on the air 24 hours a day with a power of 100kW in French and local languages. If you do get enough material for a report then send it to BP 7029, Ougadougou, Upper Volta, along with return postage in the form of an International Reply Coupon.

Reader **E McDonnell** refers to the illustration of my Hitachi 1160 d.f receiver in the May issue of *PW*. He asks if improved reception is the result of using a larger than usual ferrite rod antenna. The Hitachi uses a standard 180mm by 9mm ferrite rod inside a plastics box fitted on top of the set. It is not increased pickup but the use of an r.f. amplifier that produces increased sensitivity. The ability to switch off the automatic gain control and replace it with a manually operated "level control" enables one to obtain a much better null than usual. I can suppress Droitwich 200kHz completely from my QTH!

What our reader implies though is correct. A larger rod would provide a more sensitive antenna but unfortunately they are unobtainable. The largest I have been able to find is 200mm by 15mm. It is possible to make a bundle out of a number of rods or even to stick two together end to end. Someone wrote an article on ferrite rod antennas some time ago which claimed that the optimum ratio of length to diameter was about 20 to 1, a figure that fits commercially produced ferrite rod antennas.

I have experimented with ferrite rods and have constructed an antenna using two 200 × 15mm rods fixed end to end. They were inserted into a 250mm length of Paxolin tubing whose internal diameter was slightly greater than 15mm. The rods met at the centre and were held in position by adhesive around the ends of the tubing. The main winding consisted of 150 turns of plastics-covered hook-up wire wound on top of the tubing and tuned with a 330pF variable capacitor. The wire spacing was approx one wire diameter. If you place this antenna close to a portable receiver you can give a station a boost by adjusting the antenna tuning control. Alternatively it can be used like a loop by fitting a 10-turn coupling winding over the main winding and leading this off to the receiver's A and E inputs.

Although pickup from this antenna was a lot less than from a standard one metre square loop it did provide a useful alternative when space was limited. It is not put forward as a fixed design but as an indication of what the experimenter can achieve using a little ingenuity.

Readers' Letters

"Reading about Medium Wave DXing in *Practical Wireless* (May issue) the other day I decided to have a go myself," writes **Andrew Hill** from Cheslyn Hay in Staffs. "Using IBA's *Television and Radio 1984*, I tuned quite easily into many local radio stations around the country." Using a Vega Selena along with a 20m random wire antenna Andrew pulled in Capital Radio on 1548kHz and County Sound on 1476kHz. "On my first attempt at mw DXing I was pleased with the results. A QSL from Capital Radio is enclosed."

The best time of day for this sort of DXing is during the hour before and the hour after sunrise as the ionosphere is changing over from day to night state. Sometimes distant stations *will* be heard at good strength without the usual local QRM.

In reply to **Damien Read,** sorry, but I cannot publicise Pirate Radio stations in this column.

SHORT WAVE BROADCAST BANDS *by Charles Molloy G8BUS*

Reports: as for Medium Wave DX, but please keep separate.

Last month we examined the different bands allocated to broadcasting on the short waves but we only made passing reference to what could be heard on them. Now we will have a look at each in turn, to find out what can normally be heard and the best time to listen, starting with 6MHz and 7MHz.

6MHz Band

Also known as 49 metres, this band is dominated during the day by short-range signals such as Prague on 5·930MHz, Austria on 5·945, Holland on 5·955, Belgium 5·965, BBC World Service 5·975, Berlin (relay of medium wave service) on 6090, Austria 6·155, Switzerland 6·165, Bremen (relay on 936kHz) on 6·190. During the evening the range increases, Radio Australia often being a good signal on 6·035, Aden can be heard on 6·005, Libya on 6·010, Algiers on 6·160. The Voice of Hope in Lebanon on 6·215, The Voice of Peace on 6·240. During the night some useful Latin American DX appears such as Nicaragua on 5·950MHz, HCJB in Ecuador on 6·050, Venezuela on 6100.

7MHz Band

There is more DX to be heard on 7MHz (41 metres) during the day than on 6MHz. Listen for Radio Australia on 7·135 and 7·210, for Japan on 7·140, Tashkent 7·335, Delhi on 7·412 and 7·260, Pakistan 7·235, Israel 7·465, China 7·165, Nigeria 7·255. During the evening Madrid comes in well on 7·450 and 7·105, BBC Cyprus relay on 7·130, Turkey on 7·155 Tunis on 7·225, R. Afghanistan 7·290, Dubai 7·185, Korea 7·550, Teheran 7·230. If you hear Radio Canada International on 7·130 then it is coming from Daventry in the UK which acts as a relay for RCI on occasion. At night search for WYFR Family Radio in the USA on 7·355, Radio Havana Cuba on 7·485 and Radio Beijing on 7·505.

On the Bands

Richard N Carrick on Barrow-in-Furness uses Panasonic DR48 and DR49 plus a Marconi CR100 valved receiver along with two indoor antennas. There is a Datong AD270 running East-West in the loft and a Joystick located next to the receiver. With this set up he has managed to pull in KYOI in Saipan regularly in Japanese and English between 1200 and 1600 on 11·900MHz whenever Radio Moscow isn't using the channel. Other broadcasts heard, all in English, were Radio Korea at 2200 on 15·575, Radio Beijing at 2100 on 9·860 and 11·500, Radio Uganda around 1930 until sign off at 2100 on 5·029MHz (60m band) and Radio Australia at 1430 on 9·770.

The Caribbean Service of Radio Canada International was heard at 0100 on 9·755MHz by **Colin Watson** although the RCI programme schedule lists it from 2320 to 2400. An Eddystone 680X valved receiver and 20m random wire antenna are in use at Chesham by **Rupert Bulloch** who reports hearing Radio Australia from 0730 to 0830 on 11·910, Radio Nigeria from late evening until 0100 on 4·770MHz in the 60 metre band, and Radio Clarin in the Dominican Republic at 2130 in Spanish on 11·700. An Hitachi TRK-7800E stereo cassette which has a four-band radio with telescopic antenna, pulled in WYFR Family Radio Florida at 2100 on 15·440 and WRNO in New Orleans at 2100 on 15·420 and again at 2200 on 11·965, for **Richard M Coutts** of Redditch. Reader **D J Garner** of Hinckley, who uses a DX200 receiver along with a 10 metre length of wire which runs from the bedroom window to a post in the back garden, pulled in Nairobi Kenya at 1800 on 4·805MHz, Radio Australia at 0900 on 11·910 and Radio New Zealand at 0840 on 15·485.

"As you will see, most of my listening is in the 6MHz and 7MHz bands" writes **Barry Harper,** who uses an old 19 set presented to him by his father-in-law. "He bought it as ex-government surplus in 1956, got tired of the hobby (!), let someone remove the v.h.f. section and consigned it to the cupboard under the stairs. That was in 1957. I brought it home, put together a power supply and it worked." Barry's log includes Radio Bucarest at midnight on 5·990, Radio Australia at 2000 on 6·035, Vatican Radio at 2050 on 6·190, Voice of Turkey at 2000 on 7·155, Radio Israel at 2000 on 7·465.

QSLing

"I read with interest the query from Glen Hocking (about QSLs) in the June issue" writes Richard Carrick, who continues, "there are ways to increase your QSL returns providing you are prepared to take a little more time and care. I put into each report the date, time in UTC, frequencies. I always report on all the announced frequencies for a particular transmission whenever possible, SINPO for each frequency, plus relevant information on QRM, fading, etc. Twenty minutes of programme details, a short introduction to myself and the area where I live and of course, comments on the programmes. Always say what you really think of a programme and if reception is poor, say so. Always write down the type of radio and antenna as this plays as important a part in the report as the rest of the details." In three years Richard has mailed out 350 reports and has had replies to 322 of them.

"On the subject of QSLs, the stations all seem very friendly but perhaps that's because I'm new to it all" says Barry Harper who has received QSLs from Holland, Poland, Australia, Voice of America, Prague, Switzerland, Vatican, Turkey, Canada, Israel. Broadcasters do want to hear from their audience so perhaps a friendly letter to them may improve QSL returns. "Please note, to receive an airmail reply from WYFR two International Reply Coupons are required" reports Richard Coutts who mentions that IRCs are unnecessary when reporting to Radio Korea.

Readers' Letters

"With reference to your column asking for information on the National Micro 009" writes **V Sambucci** from Wendover. "This receiver is known as the Panasonic RF9 in North America, RF9L in Europe and the National Micro 009 in Japan." Our reader has a Sony ICF 7600D which he is very pleased with. "One thing which surprises me was the difference in the number of signals to be found when using the long-wire antenna supplied with the set."

"When searching the 90 metre tropical band with my Trio R600 I came across a signal on 2·870MHz. It was extremely distorted but I could make out that it was News at Ten" reports **Thomas Blamey** of Tonyrefail in Mid Glamorgan. "I found out the signal was from HTV. Could you or any of your readers explain this puzzle to me as I am baffled" Sounds like a harmonic from the receiver's local oscillator

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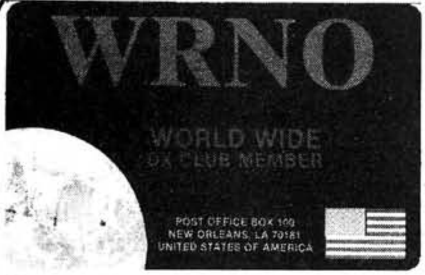
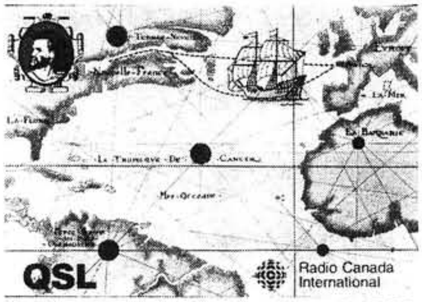


WRNO QSL sent in by Andrew Hill



Radio Canada International QSL sent in by Andrew Hill

Radio Netherlands Car Sticker

mixing with radiation from a TV set. Can anyone work out this one?

What are the best buys in receivers over the £300 price range?" asks **Andrew Hill.** Suggest you write for a free copy of the Receiver Shopping List from Media Network, Radio Netherlands, PO Box 222, 1200 JG, Hilversum, Holland. This booklet gives some general hints on choosing a receiver as well as details of sets currently available.

"I recently purchased a Toshiba F11L pocket portable with the view of taking it abroad on holiday" says **Martin Whittington** of Dartford. "I was really surprised to find so much power and sensitivity could be included in such a small set, it weighs 630g with batteries and covers the short wave bands from 13m through the new 22m band to 49m as well as long wave, medium wave and f.m. coverage."

Radio Netherlands Booklist

The latest, 7th edition of this useful 24-page booklet is now to hand. Split into seven sections it covers Listening Guides, Mass Market Periodicals, Books and Pamphlets for the s.w.l., Tape Recordings of interest to short-wave listeners and DXers, Technically Orientated Books, Miscellaneous Titles and Reviews. As well as the title a source of supply is given plus the price in the local currency of the country of origin of the item concerned. The booklist, which is free of charge can be obtained from Radio Netherlands at the same address as for the Receiver Shopping List.

VHF BANDS *by Ron Ham BRS15744*

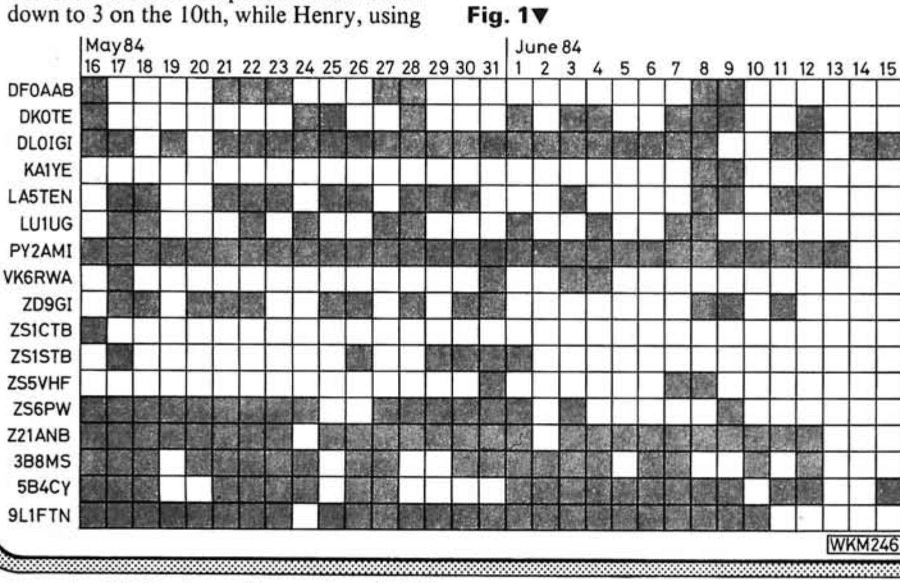
Reports to: Ron Ham BRS15744, Faraday, Greyfriars, Storrington, West Sussex RH20 4HE.

A predominance of middle-distance beacons on the 28MHz (10m) band, a super sporadic-E and a mild tropo livens up Band II, the installation of the Orkney repeater, and a possible first on 144MHz (2m) RTTY are among the main talking points this time.

Solar

When **Ted Waring,** Bristol, reported 36 sunspots on May 23, it was little wonder that **Cmdr Henry Hatfield,** Sevenoaks and I recorded a radio noise storm that day on 136 and 143MHz respectively. Ted also counted 12 spots on June 3 and down to 3 on the 10th, while Henry, using his spectrohelioscope, saw a long train of spots near central meridian and three small flares on the 24th, one double spot on CM and a slightly active plage on June 8 and three small groups with one active on the 15th. "My own magnetometer suggested activity on May 30", writes **Ron Livesey,** Glasgow, Auroral co-ordinator for the British Astronomical Association. This activity no doubt caused the burst of solar radio noise I recorded on June 1. Similar bursts were also recorded on the 10th and 14th. Like many of us, **Dave Coggins,** Knutsford, saw the partial eclipse of the sun during the evening of May 30, by projecting the sun's image, via a telescope, on to a white card.

Fig. 1▼



The 50MHz (6m) Band

"ZB2VHF has been coming through quite well on some days in early June, often at good strength", writes Dave Coggins. Technical Editor, **John Fell** G8MCP, using a prototype 144/50MHz converter, also heard the Gibraltar beacon and signals from the UK beacon GB3SIX, via meteor scatter.

28MHz Beacons

On working days, Chris van den Berg makes his first check on the 28MHz beacons after 1500 and refers to May 14 as "an interesting afternoon and evening". Between 1500 and 1800 he noticed the band gradually open, first came the Gough Island and South African beacons ZD9GI and ZS1CTB, followed later by the beacon signals from Bermuda VP9BA, Cyprus 5B4CY, Sierra Leone 9L1FTN, South Africa Z21ANB which appeared suddenly at 1715, and the USA KA1YE. By associating the ebbing and flowing of the beacons with the coming and goings of amateur stations in the band, Chris has proved the value and interest that is gained from regular beacon observation, as did Dave Coggins when he reported an echo on the signal of PY2AMI on May 14 and that the signals of 5B4CY did not fade out until

2050GMT on the 27th. **Greg Lovelock** G3III received signals from LU5EB and LU2FFV on May 21 and reports a poor tone on ZD9GI.

This month's beacon chart, Fig. 1, made up from the logs of Chris van den Berg, Dave Coggins, John Coulter, **Norman Hyde** G2AIH, Epsom, Henry Hatfield, **Bill Kelly,** Greg Lovelock, **Ted Owen,** Ted Waring plus my own log, shows a lack of 28MHz DX and a predominance of middle-distance beacons, which I suggest is due to the amount of sporadic-E which manifested during the period. Ted Owen, Maldon, has installed a Lowe SRX-30 receiver and long wire antenna for his beacon and meteor studies and has been receiving bursts of signal from the UK beacon GB3SX via meteor trail reflection.

28MHz Satellites

Bill Kelly, Belfast, received orbital data from the Russian satellites RS7 and 8, signals via these satellites from stations in DK, DJ, LZ and W between May 19 and 31 and the orbit he logged on 29·420MHz at 1830 on the 31st, he described as "very active". I received signals through RS5 at 0823 on the 29th and orbital data for RS5, 6, 7 and 8, at 1905 on June 6 and 7. "Usual Europeans and Russians working through the satellites", writes John Coulter, and he lists the UK stations G3EDD, G3EMU, G4DCV, G4LZD, G4RLW, G4UPG, G4VEW and G4VHZ as heard.

"On May 19, I received a CQ message from RS3A, a leader of the RS-net", writes Chris van den Berg and adds, "The message was also sent via the Robot-TX of RS7 (29·341MHz) and on the 20th via the Robot-TX of RS5 (29·331MHz). In the CQ, RS3A announced that from May 21 up to and including June 25, a certain system, indicated as RTRRS5, would be active. I assumed that this abbreviation stood for transponder, perhaps shortening the word re-translator. The message was repeated during the whole week-end and I was sure about the RTR group. On May 21, my supposition was confirmed, the RS5 transponder was active and the Robot switched off". A good bit of detective work by Chris, who logged SM6MNS and UP2BCG on the 21st and GW6JMV on the 25th.

Sporadic-E

Members of the Flight Refuelling Amateur Radio Society entered a station, G3PFM/A, in the 70MHz (4m) contest on June 3 using home-brew equipment into a 12-element Yagi, built by John Fell G8MCP with a 10 metre-long boom, installed at 12m a.g.l. Although their noble efforts were thwarted by force 5 winds and very strong Polish f.m. stations in the band due to sporadic-E, they did work 41 stations, with a best DX of 330km from Dorset to G4CAX in Cheshire and heard a 59 plus 40dB signal, via meteor scatter, from GM4JLD. Unfortunately, due to the strength of the broadcast stations they had to give up at 1200.

During sporadic-E disturbances at midday on May 23 and at 0829 on the 24th, I counted 18 and 35 respectively, very strong signals from eastern European f.m. broadcast stations between 66 and 73MHz. While a super event was in progress on June 8, Harold Brodribb counted 48 of these stations at 1730. Two hours later I counted 53, and at 2235 12 of them were still audible. This disturbance must have hung about all night because at 0740 on the 9th the number was up to 22. At 1200 on the 15th another sporadic-E disturbance, deflected at least 16 strong signals toward the UK and many more, at the higher end of the range, were just audible through rapid QSB. While most of these sporadic-E disturbances were in progress a variety of European radiotelephones were heard between 40 and 50MHz.

Tropospheric

The atmospheric pressure measured at my QTH hovered between 29·5in (998mb) and 29·9 (1012) from May 15, when this period began, to midnight on June 8 when it climbed back above 30·0 (1015) where all v.h.f. operators like to see it. The pressure settled around 30·2 (1022) from the 10th and was still at this level when this month's report closed on the 15th. As usual a mild tropospheric opening occurred at the change and on June 8, **Simon Hamer,** New Radnor, heard signals from Guildford via the Leamington Spa 144MHz band repeater GB3YJ on R7.

Band II

It is now well-known to DXers that the reception of broadcast signals within the Band II frequency range of 88 to 108MHz can be disturbed by a mild tropospheric opening or an extensive sporadic-E event. **Andrew Guy** and **Damien Read,** both from Newport, found this around 1700 on June 8 when they received stations from Bulgaria, Germany, Greece, Italy, Russia and Yugoslavia for about two hours. Early on the 9th, via tropo, Damien logged France Cultur, Inter and Frequence Nord and BBC Radio Sussex. During the previous fortnight, while v.h.f. DX was almost non-existent, Damien was experimenting with cheap-to-make loft dipoles, and at 0235 on May 31, he received a good signal from France Inter. Damien has now received a QSL card, Fig. 2, from the ILR station in Birmingham, BRMB, acknowledging his report on their v.h.f. signals.

Simon Hamer also received the French stations plus BBC Radio Northampton on the 8th and 9th, and tells me that he refers to his Aiwa 9700 and Grundig S1400 receivers with digital readout and Grundig Melody-Boy 500E and Pioneer SX450 receivers with manual readout as his "BAND II's Gang of 4". "There was a sudden explosion of v.h.f. activity" writes Andrew Guy, who was in on the sporadic-E on the 8th and also logged a German station at 0720 on the 8th and a variety of French stations and BBC Radio London, via tropo on the 9th using his Crown music centre and ribbon dipole antenna. Both Andrew and Damien heard Russian TV sound, Ch. R4 91·75MHz and were delighted to hear the bells usually heard from Radio Moscow. After the event they held a DX conference on the phone and agreed that the Russian station was up for about three hours. Between June 4 and 10, **Harold Brodribb,** St Leonards-on-Sea, received a few Belgian, Dutch and many French stations via tropo and on the 9th, he added BBC Radios Cymru and Devon to his score.

RTTY

"It has not been a bad month for RTTY" wrote **Peter Lincoln** BRS42979, Aldershot, on June 14, having copied North American stations late in the evenings and found South Americans around at midnight. Peter has been receiving RTTY signals since early in 1981 and has awards from the British Amateur Radio Teleprinter Group, but he had to wait until 2100 on June 10 this year to copy GM3ITN, his first RTTY station from Scotland. "I suppose being this far south it is not too often that the skip is short enough for GM" said Peter, who now also has CX4AAU confirmed for this mode.

Despite just a casual look around the h.f. RTTY bands on most days during the month prior to June 15, I logged 19 call areas, DK, DL, EA, EA8, F, HA, HB9, I, LX, OH, OK, SM, UA, VE, VK, Ws 2 and 4, YO and 9H1 on 20m around 14·090MHz and only 6 areas, EA, F, I, UZ, W1 and YU on 15m around 21·090MHz. Among the good catches were QSOs between DL3IR and VK2BQS at 0805 on May 17 and EA1ATR and HB9AQA at 0810 on June 2, all at good copy.

Alan Taylor, Coventry, has purchased a RTTY interface for his ZX Spectrum computer, and Peter Lincoln enclosed a photograph of his Sharp MZ700 computer and Fidelity 14in monitor, Fig. 3. On May 26 and 27, **Kevin Coleman** G6SSX and **Ray Lowes** G4NJW, set up portable 144MHz stations on a mountain top in XM square and for the following 3 days at The Lizard in XJ square. By pre-arrangement the pair made two-way contact on RTTY from their respective sites with **Phil Hodson** G8RBY in Leicester, so increasing Phil's v.h.f. RTTY QSOs to 11 countries and 39 QTH locator squares. According to several opinions this is the first time that RTTY has been operated from The Lizard area.

TELEVISION *by Ron Ham BRS15744*

Reports: as for VHF Bands, but please keep separate.

Although the number of sporadic-E events seemed less for the early part of the season, the quality of most events was good and there was much enhanced activity, typical of June, when a massive sporadic-E disturbance coincided with a mild tropo which, for a few hours, opened up the best part of the domestic television bands.

Sporadic-E

"Antennas installed this morning", writes **Keith Chaplin** from Leicester on May 31 and adds, "Spain on Ch. E2 and Italy on IA this afternoon". What a good start for Keith who uses Luxor 5636 and Vega 402D receivers fed by a wide-band dipole for Band I, a 6-element Triax for Band III and twin Triax with Labgear pre-amplifier for the u.h.f. bands. Keith's antennas are mounted on a Hirschmann rotator with an alignment bearing. "I got my first taste of sporadic-E this year on May 17", writes **Alan Taylor,** Coventry, having received pictures from RAI Italy and TVE Spain, and during a disturbance at midday on the 23rd, I received a test card scribed TVE-1 from Spain and others labelled Galicia, Gamonterio-1 and Santiago 4, on Chs. E2 and 3. I also saw an orchestral programme, followed by news from the USSR with HOBOCTN and TACC captions on Ch. R1. Sporadic-E hung about for most of the 24th and at 0756 I saw a film about sculptures followed by an orchestra, possibly from Poland on Ch. R1, a Russian test card on Ch. R2 at 0830 and a ballet and chess on R1 at 1422. **Fraser Lees,** Ringmer, received pictures from Roumania on the 24th, Spain on the 25th, Norge Melhus and the USSR on the 26th and for June 3 he remarked, "a very good day" when he received pictures on Chs. R1, 2 and 3, R4 sound on 91·75MHz, a football match, a film from Poland and an Italian children's programme.

Between May 20 and 31, **Mike Bennett,** Slough, received pictures in Band I from Austria, Belgium, Hungary, Italy, Norway Hemnes, Gamlem and Steigen, Portugal, Spain Andalucia, Galicia, Gamontereo, Navacerrada, Madrid and Santiago, Sweden and the USSR. During this period Mike saw clocks from Hungary, Portugal and Sweden, cycle racing and news from Russia and adverts, cartoons, farming and sports from Italy. On the 28th, **Owen Jones,** Blurton, using a Vega 402D received pictures from Spain on Ch. E2 and on June 3, like Fraser, he watched the football match at midday on Ch. R1. Owen, who has been experimenting with a variety of antennas, saw the caption Television Espionala at 0850 and a newscaster showing a farming item at 1850 on the 9th, football during the afternoon of the 10th and adverts from an unidentified station on the 11th.

On May 31, **Tony Palfreyman,** Sheffield, received pictures on Ch. E3 from Portugal, and for about three minutes on Ch. E3 at 2226 on June 3 he saw men canoeing. In addition to seeing the football on June 3, **Paul Drinkwater,** Sutton Coldfield, received test cards from Sweden TV1 Sverige at 1255, and pictures of a YL singer between 1255 and 1310. Paul uses a Hugh Cocks v.h.f./u.h.f. up-converter into a GEC 2047 receiver fed by a half-wave dipole. From New Radnor, **Simon Hamer** reports seeing a world map from Austria and farming, football and news from Russia on May 25, pictures from Italy and the USSR on June 2, idents from Spain, Sweden and Russia on the 8th and from Spain and Russia on the 9th. **Harold Brodribb,** St Leonards on Sea, identified pictures from Italy on June 7, 8 and 9, mainly cartoons, a panel game from Spain on Chs. E2, 3 and 4 on the 9th, and a test card from Sweden at 1411 on the 12th had a digital clock showing 1611.

Between 1200 and 1330 on the 15th, I watched a film on Ch. R1 about farming and industrial science followed by news from the USSR, with a male presenter, which carried the usual HOBOCTN and TACC C006WAET captions. Owen Jones also received a test card on Ch. E2 from Sweden at 1530 on the 12th.

Tropospheric

At 0900 on June 8, I received a Nederland-1 clock caption, in colour, showing 1000 on Ch. E5 followed by the programme Teleschoalboerd and at 0910 their Pauze caption appeared. For most of the morning I also received colour test cards from DR Danmark on Chs. E6 and 8 and during the day, Tony Palfreyman received PTT NED 2 on Ch. 45 and the German stations NDR, WDR and ZDF on several u.h.f channels. "The quality of these were very good, in the early morning they were strong and stable but later they suffered from a lot of slow fading", writes Tony, who on the 9th found all the u.h.f. channels were subject to multi-images of UK stations and added, "Our local station was unwatchable at times". **Adrian Butcher,** Washington, using a Plustron TVR7 and loft dipole watched BRT Belgium on Ch. E10 until close-down on the 9th, and at 0750 on the 10th Harold Brodribb received test cards from RTBF-1 on Chs. E5 and 8 and BRT on E10. Between 0845 and 1600 Harold logged several French FR3 stations in the u.h.f. bands.

SSTV

"I have not found the SSTV parts of the bands very active", wrote **Peter Lincoln** on June 14, although he did catch pictures from A92NH, Fig. 1, EA8RP, Fig. 2, F6CLZ, Fig. 3, YO8FR, Figs. 4 and 5 and some from other countries including Germany, Italy and South America and would have copied a signal from Argentina but the QRM was too strong. As usual, Peter sent a comprehensive reception report, including a photograph, to Nabeel Alhamer A92NH in Bahrain which resulted in a telephone call from Nabeel to Peter to say how delighted he was with the report.

Amateur Television

"There has been a splurge of new ATV stations on 430MHz", writes **Norri Macdonald** GM4BVU, publicity manager for the British Amateur Television Club and these include GM1FAI, GM4OMT, GM6AOJ and GM6HFH and among those now able to receive ATV signals are GM1BXG, GM3KXQ, GM4PSV, GM4WTS and GM6KDN. "Established ATV stations will wish to congratulate the Bristol TV Group G8GLQ/P for their win in the recent ATV Summer Fun Contest which showed a further increase in interest in the south-east" said Norri, who tells me that the big ATV contest this year takes place from 1800GMT on September 8 to 1200GMT on the 9th and the Winter Cumulative events for the New Year will be held on January 17 and 25 and February 2 and 10. Further details for the September event are available from G. Shirville G3VZV, 18 Church End, Milton Bryan, Milton Keynes, Bucks MK17 9HR. Good luck to all contestants and don't forget lads and lasses, I am always pleased to hear about your ATV activity.

DX in India

During sporadic-E disturbances, **Major Rana Roy** watched a film about children, Fig. 6, on Ch. 2 between 0920 and 1000 on April 29, news and a caption, Figs. 7 and 8, on Ch. 4 from Bombay TV at 1935 on May 8 and writes, "We watched Bombay till 2030 when their signals faded away". At 2030 on the 9th Rana saw a YL announcer on Dubai TV, Fig. 9, on Ch. 2, followed by prayers, Fig. 10, an American film The World's Sportsman, Fig. 11, from 2045 to 2115 and at 2120 he saw the start of a programme about animals, Fig. 12, which faded away at 2130. "On May 6 we had a tropospheric opening and watched the Davis Cup matches between Pakistan and Thailand, Fig, 13, from Rawalpindi on Ch. 8 in Band III. Early on May 10 another sporadic-E took place and Rana received pictures from the USSR, Fig. 14, on Ch. 3. An interesting report Rana, I hope you enjoy reading about our events, as we like to hear about yours and see your photographs.

Fig. 1

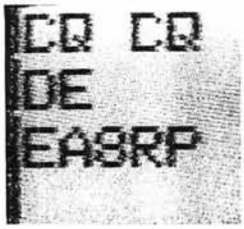


Fig. 2


Fig. 3


Fig. 4

Fig. 5


Fig. 6


Fig. 7

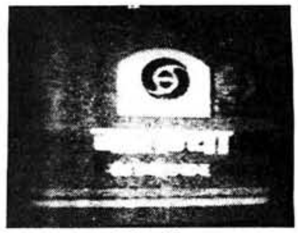


Fig. 8


Fig. 9


Fig. 10

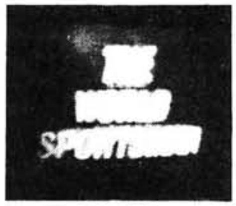


Fig. 11


Fig. 12


Fig. 13

Fig. 14

Station Reports

At 1300 on May 28, **George Garden,** Laurencekirk, took his car containing a Sony 405/625-line v.h.f./u.h.f. receiver to a site on Cairn o' Mount some 460m a.s.l. for a spot of TVDXing. On 405, he received a strong signal on Ch. B1 which he proved was vertically polarised by adjusting the position of the rods on his set-top antenna. George thinks the signal was coming from Ashkirk. Later, he tuned around the u.h.f. band and on Ch. 49 he saw a different sports programme to those scheduled for his four local channels. However, he waited for the adverts to appear and after seeing something around Newcastle on one he decided the signal was coming from Tyne Tees TV at Chatton. Detective work seems to be an important part of TVDXing.

Benny

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Cat. No.	Type	Description	Price £
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1328	R-600	Receiver	259.00
1333	DCK-1	DC Operation Cable kit	8.26
1332	R-1000	Receiver	299.00
1333	DCK-1	DC Operation Cable Kit	8.26
1335	R-2000	Receiver	415.00
1337	TR-2400	Transceiver, 1.5W FM, 10CH Mem.	195.00
1301	ST-1	Base Stand	45.00
1309	MC-30S	Hand Microphone	14.00
**1322	AT-250	Automatic ATU	280
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1304	ST-2	Base Stand	52.00
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1306	SMC-25	Speaker microphone	17.00
1361	BT-1	Manganese Battery Case	6.50
1311	PB-25	Nicad Battery	26.00

Cat. No.	Type	Description	Price £
1305	SC-4	Soft case	14.00
1343	TR-8400	70cm Transceiver	279.00
1369	SP-40	Compact Mobile Speaker	15.75
1371	MC-46	Auto-patch Up-Down microphone	41.50
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1373	SP-120	External Speaker	34.00
1370	BC-1	AC Adaptor for memory back-up	6.43
1341	TR-9500	70cm All Mode Transceiver	429.00
1307	PS-20	DC Power Supply	59.00
1316	TL-922	2KW HF Linear Amplifier	929.00
1340	SM-200	1.8-150MHz Station Monitor	250.00
1351	HC-10	Digital World Clock	65.00
1350	PC-1A	Phone Patch	50.00
1303	RA-1	Antenna	8.00
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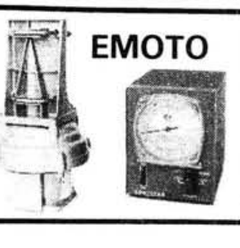

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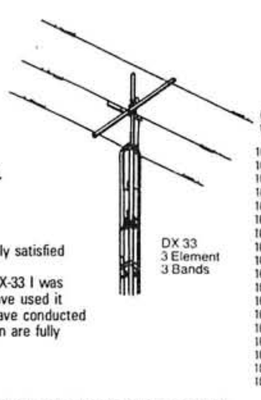

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1081	DX 31	Dipole 10/15/20m 2Kw p.e.p.	83.95
1082	DX 32	2 element 10/15/20m 2Kw p.e.p.	128.80
1083	DX 33	3 element 10/15/20m 2Kw p.e.p.	188.60
1084	DX 34	4 element 10/15/20m 2Kw p.e.p.	264.50
1085	DX 31/32	Conversion Kit	51.75
1086	DX 32/33	Conversion Kit	65.15
1087	DX 33/34	Conversion Kit	78.20
1089	DX 103	3 element 10m Yagi	93.15
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Hi-Fi	Woofer	12in	80	8	**£25**
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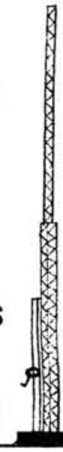

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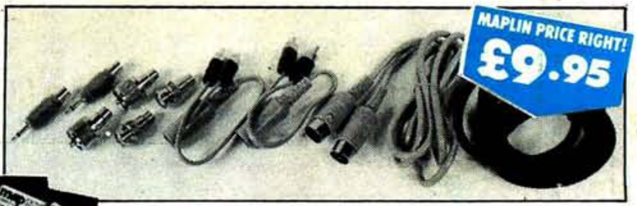

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