Practical Wireless

JANUARY 1988 £1·20

ISSN 0141-0857

The Radio Magazine

EXPEDITION to the pole

BATTLE of the beams

BUILD the pw 'otter' 50MHz receiver

REVIEW of the 'revex' wave monitor

Yaesu's FT-736R. Because you never know who's listening.

Why just dream of talking beyond earth?

With Yaesu's new FT-736R VHF/UHF base station, you can discover some of the best DX happening in ham radio. Via moonbounce. Tropo. Aurora. Meteor scatter. Or satellites.

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Discover the FT-736R at your Yaesu dealer today. But first make plenty of room for exotic QSL cards. Because you *never* know who's listening.

YAESU

*CW narrow optional

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Prices and specifications subject to change without notice. FT-736R shown with 220-MHz option installed.

Practical Wireless
The Radio Magazine

JANUARY 1988 (ON SALE 10 DECEMBER 1987) VOL. 64 NO. 1 ISSUE 970

THIS MONTH

NEXT MONTH

Beginning *PW* "Orwell" High-performance m.w. receiver

Directivity Gain in Transmitting antennas

The ICOM IC-761 Reviewed

plus

All the usual features

Don't miss it—place your order with your newsagent now!

On sale January 14

Contents subject to last-minute revision

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☎ Poole (0202) 678558 (Out-of-hours service by answering machine)
Prestel 202671191

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* FT711RH †FT2311R

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OA91	10
W005	26

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BC109C	17
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BC178	20
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BC213	14
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BC337	10
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BC547	10
BC548	10
BC549	14
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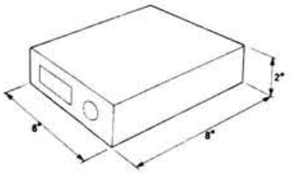

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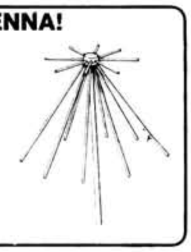

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ECH35	3.00	OB2	4.35	U19	13.75	6BQ7A	3.50	12BA6	2.50
ECH42	3.50	OC3	2.50	U25	2.50	6BR7	6.00	12BE6	2.50
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ECL80	1.50	PC86	2.50	U37	12.00	6BS7	6.00	12E1	20.00
ECL82	1.50	PC88	2.50	UABC80	1.25	6BW6	6.00	12HG7	4.50
ECL83	3.00	PC92	1.75	UBF89	1.50	6BW7	1.50	30FL1/2	1.38
ECL86	1.75	PC97	1.75	UCH42	2.50	6BZ6	2.75	30P4	2.50
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EF41	3.50	PCF82	1.50	UCL83	2.75	6CB6A	2.50	30PL14	1.80
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EF55	3.50	PCF805	1.70	UY41	4.00	6CW4	8.00	811A	18.33
EF80	1.75	PCF808	1.70	UY85	2.25	6D6	3.50	812A	47.50
EF86	3.50	PCH200	3.00	VR105/30	2.50	6DQ5	7.50	813	65.00
EF91	2.95	PCL82	2.00	VR150/30	2.50	6DQ6B	4.75	866A	35.00
EF92	6.37	PCL83	3.00	Z759	25.00	6EA8	3.00	872A	20.00
EF183	2.00	PCL84	2.00	Z803U	25.00	6EH5	1.85	931A	18.50
EF184	2.00	PCL85	2.50	2D21	3.25	6F6	3.00	2050	7.50
EH90	1.75	PCL86	2.50	3B28	50.00	6Gk6	2.75	5763	4.50
EL32	2.50	PCL805	2.50	4CX250B	58.00	6H6	3.00	5814A	4.00
EL33	4.00	PD500	6.00	5R4GY	5.50	6HS6	3.77	5842	12.00
EL34	4.00	PFL200	2.50	5U4G	3.00	6J5	4.50	6080	14.00
EL36	2.50	PL36	2.50	5V4G	2.50	6J6	8.93	6146A	12.00
ELL80	25.00	PL81	1.75	5Y3GT	2.50	6J7	4.75	6146B	12.00
EL81	5.25	PL82	1.50	5Z3	4.00	6JB6A	6.50	6550	10.00
EL84	2.25	PL83	2.50	5Z4GT	2.50	6JE6C	7.50	6883B	12.50
EL86	2.75	PL84	2.00	6/30L2	1.75	6JS6C	7.50	6973	7.50
EL91	7.39	PL504	2.50	6AB7	3.00	6K6GT	2.75	7025	4.50
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STAR £10 LETTER

Novice Licence?

I note from the letters page of October *PW* that there is some discontent with the Radio Amateurs Examination system. I recently "caught the bug" and am writing in support of correspondent Brian Smith, who mentioned Novice licensing. I assume by this that he means a separate class of operator who would, presumably, not have to take the full RAE.

I am all in favour of a proper test of operating procedures and the use of the appropriate instruments and so on to prevent interference, but I am afraid that I cannot really see the point of everyone having to learn basic electrics and electronics and how the insides of transceivers work. After all, it is possible to pass a Driving Test without having the slightest knowledge of what happens under the bonnet when you turn the ignition key.

I feel that the present examination system is inappropriate in this respect, given that sets no longer need to be constructed at home from bits and pieces.

I am sure that the sheer delay that must occur between people taking an interest and finally obtaining a licence must put a lot of people off—but perhaps that is the real object of the exercise?

Chris Charles, Cheadle

Wow! I think we're likely to need some fireproof paper to print the answers to this letter—Ed.

The RAE—Good ...

In October's *PW* you asked for comment from candidates who had sat the Radio Amateurs Examination recently.

I started the course at Scarborough Technical College in September 1986, but was unfortunate in having to have a major operation in January. I rejoined the course at the end of February and sat the exam in May.

I consider that the questions asked were wholly representative of what was taught from the manual. We also had an excellent course tutor in Peter Tipper G3JBR, whose enthusiasm for amateur radio rubbed off on the students.

As I was on holiday when the results came out, I had to sweat it out for three weeks until I got home. I had passed, and was awarded callsign G1ZGD. To all the sour grapes, I can only say: "You didn't try hard enough!"

Bob Lees
Scarborough

We learn from a cutting from the Scarborough Evening News *that 63-year-old Bob continued his studies whilst in hospital and during his convalescence, by listening to tape recordings of the two-hour weekly lectures, made for him by a nephew. Congratulations on your perseverance, Bob—Ed.*

I recently sat and passed the May 1987 RAE. Bearing in mind the stressful situation one finds oneself in during the exam, I found the questions clear and concise (though somewhat easier than I had anticipated), and I cannot recall any question which had several correct

PW COMMENT

Crisis Point

AS WE ENTER 1988, the 75th Anniversary Year of the Radio Society of Great Britain, it is my feeling that amateur radio has reached a crisis point in its development.

The RSGB itself has come in for a lot of stick lately. Much of that criticism has been very definitely "over the top", with genuine grievances being seized upon and manipulated by a vocal few, as is the way of the world. I know that *Practical Wireless*, too, has been criticised in some quarters, in this case for daring to print letters attacking the Society. The views which we have published have been selected as being the more constructive, from among a postbag which also contains some quite unprintable personal attacks on RSGB members and staff.

It is unfortunate that, despite a statement to the contrary, letters critical of the Society still do not appear to be encouraged in the pages of *Radio Communication*, and its discussion feature "I don't agree . . . but do you?" sank without trace after just one airing at the beginning of 1987.

There is an old saying that "the cobbler's children go worst shod", and it is certainly ironic that the RSGB, a communications-based organisation producing a monthly magazine, a weekly news broadcast, Prestel and telephone headline news services, and a Databox, seems to have such difficulties in keeping members informed about what is going on.

Did you know, for example, that a large proportion of headquarters staff with experience in dealing with members' queries, left the Society's employ during the early part of 1987? Or that a major restructuring of the organisation at Potters Bar had been going on during the year? Had this been announced in *RadCom*, with a message along the lines of: "Sorry, this means that there are likely to be delays in dealing with anything other than run-of-the-mill enquiries until everything settles down", members would, I am sure, have felt a great deal more understanding if their letters went unanswered. Which would have helped to promote a very much more positive attitude towards the Society.

The crisis which I see affecting our hobby is more widespread than this, though. There are two questions to be considered: where are we now, and where should we be heading? At present, amateur radio is becoming more and more a means of talking to other people, using "black boxes", rather than a means of experimenting in radio techniques, using at least partly home-built equipment. Whilst talking to other people can undoubtedly make a major contribution to world understanding, is that going to be a good enough reason for holding onto our bands in the face of ever-growing pressure for spectrum space from other users?

Home construction and experimentation, which typified the original concept of amateur radio, requires two things: availability of components, and designs or ideas for putting them to use (plus, of course, the skill to do so). Though there are a few firms dealing in radio components, either by mail order or at radio rallies, it is by no means always easy to lay hands on all the bits and pieces required to complete a project. As for the availability of designs, it is pretty obvious to me, as an avid reader of all the UK radio hobby magazines, that there is a general and growing shortage of useful, well-engineered and interesting constructional articles. I personally find the trend quite frightening—where is the hobby going?

Certainly, whether amateur radio is for communicating or for experimenting, or for a healthy mix of the two, we do need more new blood coming into the hobby. Although I know that there are those who disagree, my feeling is that the RSGB deserves whole-hearted support in its proposal for a "student" or "novice" licence. The idea of a simplified licence giving access to limited power, with limited modes on limited bands, using a home-built transmitter and targeted especially at youngsters of school age, has great possibilities.

One other idea, mentioned to me recently by Richard Marris G2BZQ, is for a segment of a band such as 7MHz to be allotted to d.s.b. 'phone operation with limited power. His argument is that it would bring back the possibility that the casual listener with a short wave receiver, unable to read Morse and without a clue as to how to tune in those "Donald Duck" amateur s.s.b. signals, might experience the thrill of discovering amateur radio.

Dare I suggest, now the band up to 7.1MHz seems at last to have been vacated by the broadcasters, that the segment 7.05-7.10MHz be set aside for d.s.b. amateur transmissions only? Any s.w. broadcast listener will have access to it within his receiver's 41 metre band. With the increasing popularity of short-wave broadcast listening, it could give a very real boost to the fortunes of amateur radio.

Geoff Arnold

answers or indeed had no correct answer. A few questions in the second paper did require some consideration, as two of the possible four answers were partially correct. Mind you, at the time, I thought this was intentional in order to determine what path one would choose when offered alternatives.

I think it was a fair test, designed only to confirm that the candidate had a reasonable idea of what amateur radio was all about.

Ron Greig GMJ1YSL
Kirkcaldy, Fife

. . . Or Bad?

Having read the comments in the October issue of *PW*, concerning the current standard of the RAE, I would like to add my impressions as a successful entrant in the May 1987 exam.

As a secondary school teacher of more years standing than I care to recall, and past examiner for various examination boards at both O-Level and A-Level standard, I regard myself as being well-qualified to judge the standard and efficacy of the Radio Amateurs Examination.

Having spent several months studying the syllabi, and tested myself on the specimen papers in the excellent RSGB publication *Radio Amateur Examination Manual* (which I quite wrongly assumed to be actual past papers), I felt quite confident to attempt the exam.

My first impression of the papers was that I had entered the wrong examination room! The questions bore little or no resemblance to the clear, well-written ones in the RSGB publications. Many of the questions were badly written, grammatically incorrect and ambiguous to say the least. A fair proportion were what I would describe as "trick" questions which gave me the distinct impression that the examiners were trying to cheat me out of a mark which I might easily have gained on a better-written paper.

Surely the purpose of the RAE is to test prospective licensees' understanding of the principles involved in the safe, interference-free operation of an amateur radio station, and not to test his or her pedantic knowledge of trivial data which can easily be gleaned from a reference book when required. Also, without reducing the academic level of the questions, a good examination should attempt to get the best out of its candidates rather than make success as difficult as possible.

The compilation of effective multiple-choice examinations is a well-documented scientific and statistical process requiring the thorough testing of each question beforehand, and it was evident to me that this process had not been carried out on May's examination.

Perhaps the CGLI indulge in the most unusual practice of forbidding the removal of question papers from the examination room in order to avoid the informed criticism which is so desperately needed to bring about an improvement in standards.

Ian James G1ZEH
Birmingham

Send your letter to the Editorial Offices in Poole, the address is on our Contents page. Writer of the Star Letter each month will receive a voucher worth £10, to spend on items from our PCB or Book Services, or on *PW* back numbers, binders, reprints or computer program cassettes. And there's a £5 voucher for every other letter published.

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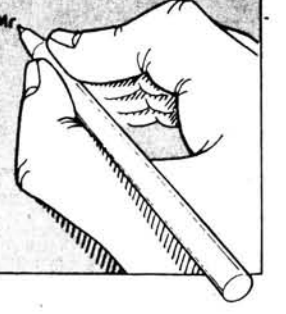

Playnet?

I was very interested to read the replies from David Whiteman and Jeff Goodley (October *PW*) to Mr Taylor's original letter, and must agree with much of what they write.

Some background to the events which RAYNET members undertake for the User Services might be of help to licensees or s.w.l.s who are not familiar with RAYNET's work, and have not yet contacted their local group to find out more.

RAYNET has some 5000 members throughout the UK, and in 1986 they undertook approximately 66000 man-hours of duties on some 650 events where they provided much needed communications facilities for the Authorised User Services. In addition to this, they assisted with many live emergencies, and undertook training on-air, first aid training, map reading exercises, etc.

Just two examples of more newsworthy activity during 1987 have been the ferrying of drugs and supplies to isolated communities in Strathclyde and Norfolk in the winter snows, and the provision of cross-channel links with the Belgians for the Kent County Constabulary immediately after the Zeebrugge disaster.

All these skills and disciplines are only useful if they are constantly rehearsed in team operations. There is no earthly use in saying: "I will be there when you need me", because no-one is going to have time to train you in the event of a real emergency.

So, the marathons and fun-runs of which Mr Taylor was so scornful do serve a vitally useful purpose. They provide situations where RAYNET members have to provide reliable communications in often difficult circumstances. It is difficult to imagine how else group members could regularly experience the high noise levels, low power levels, pressures of traffic density, and operator fatigue after long duty spells which form an inescapable part of disaster relief operations.

The User Services do from time to time involve RAYNET Groups with major disaster exercises, but in some cases unfortunately not as often as we would like. Usually a closer relationship grows from service given following a live emergency. As an example may I quote the County of Suffolk where the Police Computer operator and the RAYNET operator sit side by side at County Police HQ during an operation.

So, far from playing at it, I belive that RAYNET offers the community a very professional service. I will be quite content if they never realise it, because that means that the need has not yet arisen . . . but it will one day!

Will you be ready?

Geoff Griffiths G3STG
Chairman, RSGB RAYNET Committee

Written before the devastating storms which hit the UK in mid-October, this letter was indeed prophetic in its final statement. RAYNET groups gave great assistance to the ▶

Service!

As a newcomer to the world of amateur radio, I have progressed via the tortuous route of "home-brew" into the temptation of owning a black box inclusive of bells and whistles.

Having acquired a secondhand FT-102, my DX-hunting was brought to an abrupt end by Murphy's Law. Not wishing to delve into the black box myself, I set about finding an appropriate specialist through the advertisement pages of *PW*.

A telephone call and a two-hour car journey later, I was in the engineer's workshop describing the symptoms of the fault, which was quickly diagnosed.

The nature of the repair and the availability of the necessary component meant I had to leave my FT-102 for an unspecified period. It felt as if I was losing a friend!

Just a couple of days later, I was invited to collect my equipment, which had been restored to life. The bill was most modest, the service and customer treatment of a standard rarely found in this day and age, especially in the hectic field of electronics.

I would like to commend that specialist, R. Withers Communications, and to thank Mr Ray Withers and his staff.

John S. Baker G0HQQ
Peterborough

"..... THAT BUILT IN KEYER IS A NICE MODERN TOUCH..."

User Services over a prolonged period whilst electric power and telephone services were being restored, and many lessons were learned. We hope to have a report on the RAYNET involvement in our next issue.

Readers interested in finding out how they can play a part in RAYNET may contact either The Senior Membership Officer (RAYNET) at RSGB Headquarters, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE, or Trevor Emery G3KWU, Public Relations Officer, RAYNET Committee, 75 Haig Road, Eastleigh, Hants SO5 6JF—Ed.

RSGB Membership

In November *PW*, Peter Chadwick G3RZP notes that my letter in the September issue made him laugh! That is sad. Had he read my letter more carefully perhaps he would have taken it that much more seriously. Particularly the first two-thirds which he ignores.

My comments on the state of the RSGB offices were based on memory, not fiction. I have indeed been there. If his remarks concerning the current state are to be believed then surely this is supportive proof of lack of good management?

Yes, mine was indeed a divisive letter, but it was written only after many years of waiting for the RSGB to act for its members, not itself. I said as much in my opening paragraphs, and if my postbag is to be believed there are others who agree with me.

If there is small print in the IARU Charter making the RSGB the only body in the UK allowed to run a QSL bureau, then one has to doubt its validity for what must be rather obvious reasons.

One has the feeling that compulsory membership and a joint membership/licence fee might be hovering just in the future. Nice and tidy, simple and very profitable for someone. But would it be what we want? It seems that we might be better served by some form of choice free of official encumbrance.

I repeat my offer to act as a focus for sensible activity, should others of like mind care to contact me.

R. D. Railton GW6RXA
Glas-coed
Rhydargaeau
Carmarthen
Dyfed SA32 7JT

Morse

I read with interest the recent letters from G3BJG and G3ZNF concerning the abbreviation "ES" for "and" in Morse code. In fact this is not an abbreviation at all, but the original American Morse code (i.e. Real Morse!) for an ampersand (&), which was one dot followed by three dots, and has been carried over into the International Morse code we use today.

The source of the above information was the magazine *Morsum Magnificat* to which ***all*** Morse enthusiasts should subscribe!

Stan Barr G0CLV
Moreton, Wirral

I recently came across a somewhat ancient engineers reference book, containing a page on "Radio Signalling Codes" which considers "&" to be the 27th letter of the alphabet in "USA Morse", and gives its code equivalent "ditdi-di-dit". Other listings of American Morse I have seen do not mention it. It's nice to have a mystery solved once in a while—Ed.

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We will always try to help readers having difficulties with a *Practical Wireless* project, but please observe the following simple rules:

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2. We cannot deal with technical queries over the telephone.
3. All letters asking for advice **must** be accompanied by a stamped, self-addressed envelope (or envelope plus International Reply Coupons for overseas readers).
4. Write to the **Editor, "Practical Wireless", Enefco House, The Quay, Poole, Dorset BH15 1PP,** giving a clear description of your problem.
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NEWS DESK ... *compiled by G4LFM and G8VFH*

Catalogues

Five new catalogues have reached us this month: Cirkit, Greenweld, IQD, Maplin and STC.

Cirkit have a competition in their new release, the prize being a 600MHz frequency counter. As always there are plenty of new products, such as a 14MHz direct conversion receiver kit complete with case and a Seno Workstation for p.c.b. prototyping without the mess. The new catalogue costs £1.20 and contains discount vouchers for their products.

Cirkit Distribution Ltd., Park Lane, Broxbourne, Herts EN10 7NQ.

Greenweld have their 1988 electronics component and equipment catalogue out now. They accept a wide range of payment, too: Cheques and Access, but for small amounts, stamps, postal orders, money orders, cash including foreign currency banknotes or book tokens. So I think everyone should be able to find a suitable method of payment. The catalogue costs £1 inc. postage from:

Greenweld, 443B Millbrook Road, Southampton SO1 0HX.

The 1988 Maplin catalogue seems heavier than ever. There is a new section on radio control and they have extended the section on communications. The catalogue is again available from W. H. Smith and Maplin Electronic Supplies Ltd. for £1.60

Maplin Electronic Supplies Ltd., PO Box 3, Rayleigh, Essex SS6 8LR.

IQD have just published the 200-page 1987/88 edition of their crystal catalogue.

Nearly half the pages are dedicated to new products and there is a much larger range of surface mount and MIL specification products.

The application and technical notes, which have been expanded, feature detailed copy and diagrams on the use of crystals, miniature quartz resonators, oscillators and SAW filters in electronic circuits.

IQD Ltd., North Street, Crewkerne, Somerset TA18 7AR.

We don't normally mention catalogues for companies such as STC, but there are some very interesting pieces of equipment available this year. You can order quite easily from them these days, too, with a credit card, using their order telephone number. You can find out more about the catalogue from:

STC Instrument Services, Dewar House, Central Road, Harlow, Essex CM20 2TA.

Desk-Top Chargers

Ray Withers Communications Ltd have a range of cost-effective replacement NiCad battery packs, empty cell cases and desk-top chargers for the Icom, Kenpro and CTE range of handheld transceivers.

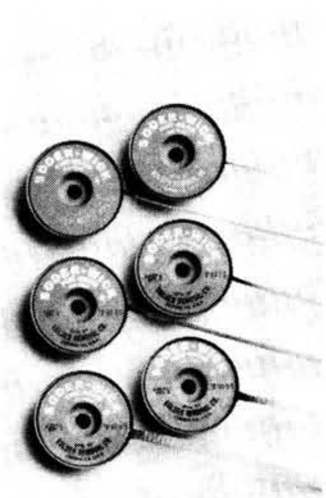
The new Raycom NC580 desk-top charger has been designed to charge all Icom type NiCad packs over 400mAh capacity. It has two switchable charging rates available as standard.

The empty cell cases have a capacity of up to ten AA/HP7 size cells.

Due to business expansion, Ray Withers Communications Ltd is moving to larger premises at ***International House, 963 Wolverhampton Street, Oldbury, Warley, West Midlands B69 4RL.*** Their new telephone number has six lines and is 021-544 6767.

The company will be amalgamated with Raycom Ltd and will be trading under that name. The new location is a few hundred metres from Junction 2 of the M5 on the main Birmingham to Wolverhampton road. There is ample parking for up to 50 cars too.

Anti-Static Braid



Adcola have now got anti-static de-soldering braid in their range of products. The anti-static reels supply the braid in handy lengths of 1500mm or 30m on standard reels.

The range of sizes is from 1.5 to 2.8mm width.

Adcola Products Ltd., Adcola House, Gauden Road, London SW4 6LH.

The FT-712RH

This rig arrived fresh from Japan when it accompanied two Japanese gentlemen who visited the Leicester show to see SMC.

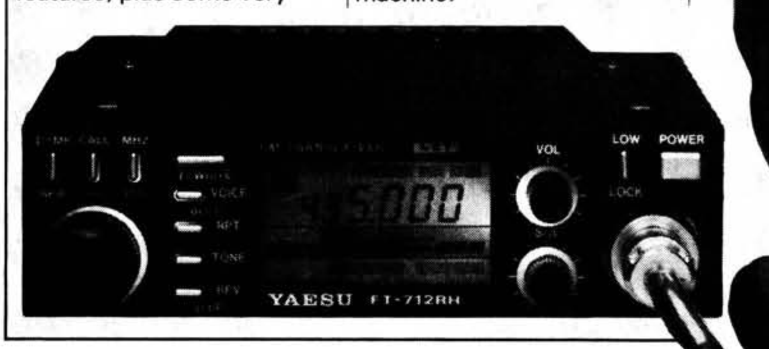
It has the serial number of 00001—so you can see it was quite new! They brought the 430MHz version to the show, but apparently the 144MHz version (the FT-212RH) will be available later.

It's a small rig, approximately the size of an IC-28E, but it has this huge heatsink on the back of the set. That's needed, too, as the rig has an output of 45W. It has all the usual features, plus some very unusual ones too. There is an in-built voice memory, and that's not a speech synthesiser. This stores your voice in up to four of its memory channels. There are four sampling rates, the slowest of which provides three minutes of recording times — eat your heart out CQ loops!

The recording facility can also be used to record incoming signals too. Anyone with a d.t.m.f. mic can call your "selcal" number and leave a message of up to three minutes in their own voice on your rig—just like an answering machine.

You can always get more details about this rig from:

South Midlands Comms Ltd., SM House, School Close, Chandler's Ford Ind. Est., Eastleigh, Hants SO5 3BY.



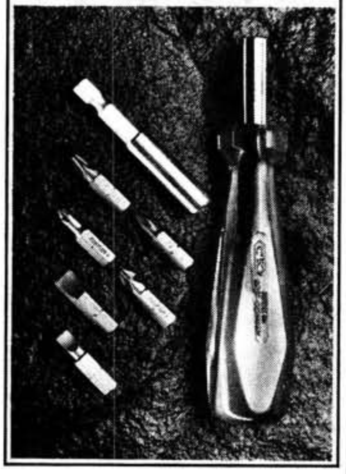
Screwdrivers

Ceka have a "pocket-sized" screwdriver that could be very useful when you don't want to have a heavy tool box with you.

There is a common holder which accepts a selection of magnetic slotted, recessed and Supa/Posidriv bits. Apparently they only take a matter of seconds to change over, too.

All the bits have a $\frac{1}{4}$in hexagon shaft and are manufactured from hardened steel. A Bits Box, which holds six bits together with the adaptor, is also available.

The Magnetic holder drivers cost £6.60, the Bits Box £8.25 and the blister packed pair of bits £2.26. These should be available from hardware stores.



Welsh Awards

Since mentioning the Carmarthen Clubs award, which was assumed to be the first covering all of Wales, we have heard from the TOPS CW Club. They started issuing their "Worked All Welsh Counties" award in 1956 to celebrate their 10th Anniversary.

For this award you need one contact in each of the 13 old Welsh counties. Claims can be all phone or all c.w. but not mixed. Since only 13 contacts are necessary, QSL proof is deemed not unreasonable.

Many thanks to J. P. Evans GW8WJ, the Hon Sec of the TOPS CW Club, for bringing this to our attention.

The certificate shown is a copy of the one issued to the late David Butler GI3JEX.

PSUs

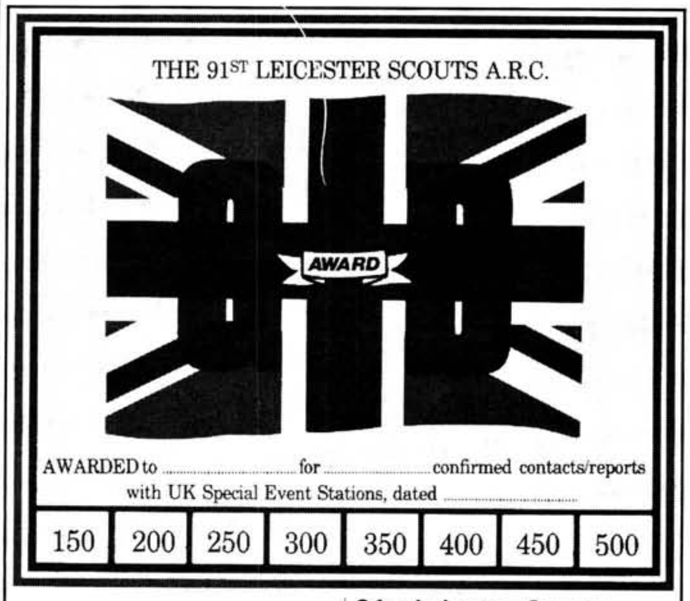
South Midlands Communications have introduced three new models to their range of 13.8V d.c. power supplies. The p.s.u.s have line regulation of less than 1 per cent and r.m.s. ripple of just 2mV.

The smallest unit, the RU120406, is designed for a constant 4A, but will provide a surge to 6A. The RS120810 is suitable for up to 8A constant and 10A surge. It also has over-voltage protection—very useful when you have expensive equipment on the end of it.

The SS122535 is 25A constant and 35A surge. This unit not only has over-voltage protection but also has a pair of terminals for remote voltage sensing. This allows the power supply to adjust and maintain the constant voltage at load.

More details are available from:

SMC Ltd.,
SM House,
School Close,
Chandler's Ford Ind. Est.,
Eastleigh,
Hants SO5 3BY.
Tel: 0703 255111.



The GB Award

This award is available to licensed amateurs, clubs and s.w.l.s. (on a heard basis). It is for confirmed contacts/ s.w.l. reports with UK Special Event Stations GB prefixes (including GE, GV and GK prefixes).

Extracts from the log, signed by two local amateurs or a club official need only be submitted, but all contacts must be confirmed.

A fee of £1.50, $3US or eight IRCs complete with the log extract should be sent to:

91st Leicester Scouts ARC.,
c/o M.J. Harriman G4SJX,
PO Box 49,
Leicester,
England.

The basic award is for 100 confirmed contacts/s.w.l. reports with UK special event stations. There are no band or mode restrictions.

Further stickers are available for quantity endorsements: 150/200/250/300/350/ 400/450 and 500 at a cost of 50p per request, not sticker (maximum of three stickers per 50p).

Clamp-On Tester

TMK have introduced a second clip-on ammeter to their range. The SK-8100 has a 0–1000A current measuring capability with large 52mm jaws.

Other features are rotary current, voltage and ohms scales. There is also a pointer lock facility so you can lock the needle before moving the meter to see the reading more clearly.

The SK-8100 is priced at £75.75 plus VAT. For more details:

Harris Electronics (London) Ltd.,
138 Grays Inn Road,
London WC1X 8AX.

19in Colour Monitor

Northamber have added the Aydin Controls "Enhancer", a 19in colour monitor, to their range of products.

It is a self-adjusting monitor and is fitted with a high contrast, anti-reflect screen.

The photograph shows the Aydin Enhancer in use with an IBM PC AT running Autocad.

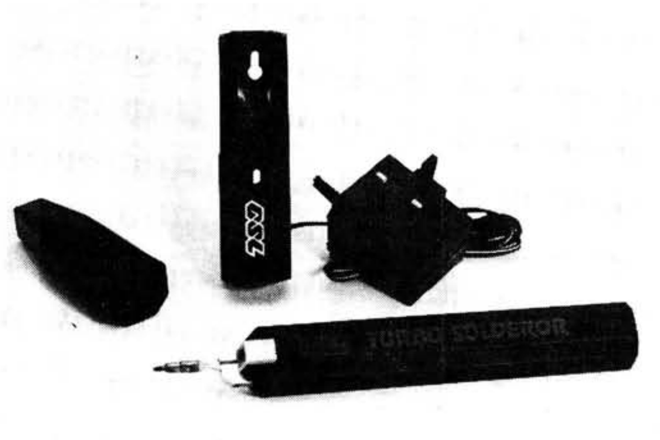
Northamber plc., Lion Park Avenue, Chessington, Surrey KT9 1ST.

Rechargeable Iron

Cirkit have a rechargeable soldering iron which is ideal for soldering c.m.o.s. and other static sensitive devices and for site work where no mains supply is available.

Rated at 12W with fast warm-up and small 2mm diameter tip, the unit comes complete with wall mounted mains charger and a 12V car charging lead which is connected via a vehicle's cigarette lighter. Up to 200 standard joints can be made from one charge of 12 hours.

Cirkit Holdings PLC, Park Lane, Boxbourne, Herts EN10 7NQ.



Can You Help?

A reader has acquired a TR-2100 made by the Totsuko Corporation. It is a 144MHz s.s.b. and c.w. rig. Does anyone have an instruction booklet for this rig? If so, please contact: J.M. Jaffrey GM1VVV, 3 East Lodge Cottages, Ladykirk, Nr Berwick-upon-Tweed, Berwickshire TD15 1SU.

Does anyone have circuit diagrams or other literature for the Yaesu FR-100B receiver and FT-200B transmitter units? This is wanted by the Pembrokeshire Radio Society. If you can help, contact Brian GW0IER on (06462) 2825.

Mike Drew has recently obtained an FT-75B, crystal controlled h.f. transceiver. Has anyone got any information on the v.f.o. unit? He thinks it originally came as an optional extra for the unit. If you can help then ring him on (097888) 621.

Another recent purchase is an Ex-Admiralty receiver made by Murphy, type 62B, it looks like the B40, but this one has suffered much abuse. Can anyone suggest where a valve layout plan and a circuit diagram may be found for this receiver? If you can help, write to R.H. Forsted, "Iona", Gelt Road, Brampton, Cumbria CA8 1QH.

Is there anyone who has or who has had a Trio 9R59DS communications receiver? A reader is trying to find the valve number for the rectifier. Any other data on this receiver would also be welcomed. If you can help, write to: Alexander Wilkinson, 7E Melvaig Place, Wyndford, Glasgow G20 8EY.

We've had a camping club contact us, they have a disco unit that is in need of repair, but can't find a service sheet for it. It's a Saxon Centaur Integrated Stereo Roadshow, Centaur Mk3 1552 D8821. If you can help, contact A.F. Mortimer, 72 Raynham Road, Bury St Edmunds, Suffolk IP32 6ED.

Southern 10m FM Group

I've received another multi-coloured newsletter from the group. They are enthusiastic users of the 28MHz band with particular interest in mobile, portable and fixed station operation on f.m.

The main objective of the group is to keep the band in use during sunspot minimum by publishing a newsletter to act as a focus for information about 10m.

Activity on f.m. centres around 29.6MHz, the international calling frequency, with channelised 10kHz steps between 29.550 and 29.690MHz.

Membership is £3 per year to cover postage and printing costs. Write to: ***Southern 10m FM Group, B. Sharp G0DWZ, 9 Highlands Road, Portslade, Sussex BN4 2BN.***

Broadcasting Services

Following the recent seminar on broadcasting, the DTI and the Home Office announced that the Government have decided to commission feasibility studies into the technical and financial prospects for both multi-point video distribution system (MVDS) and a fifth terrestrial u.h.f. television channel.

The Government will not be reaching decisions without first considering carefully the possible impact on existing and prospective services, including the terrestrial broadcasters, DBS and cable.

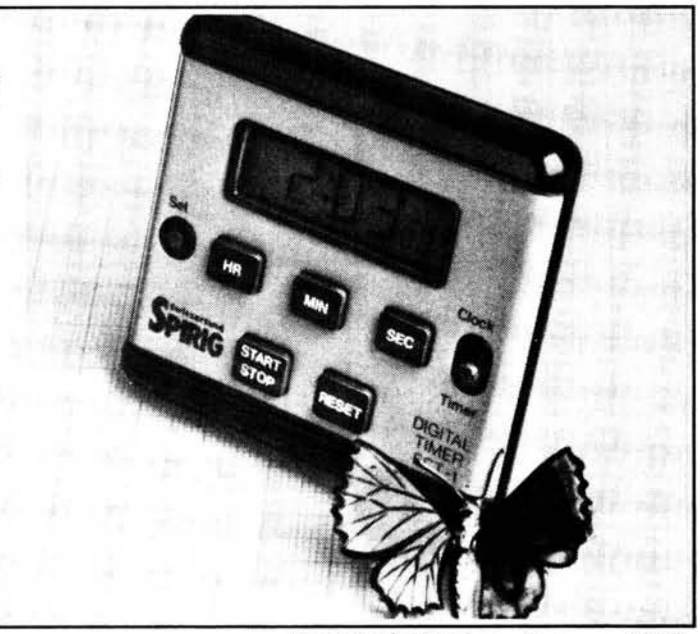
Digital Timer

A clock and timer are always useful in the shack, amongst other places. Cobonic Ltd. have a very neat timer, the ECT-1, which incorporates a stopwatch, a countdown/alarm/countup timer and a clock.

The timer has a memory and does not need to be keyed in again for repetitive identical timer settings.

The clip on the back of the timer will fix it almost anywhere. It is magnetic, spring-loaded and can be used as a stand.

Cobonic Ltd., 32 Ludlow Road, Guildford, Surrey GU2 5NW.



Kent Repeater Group

At the recent AGM, Kelvin Fay G0AMZ was elected as the new secretary. He says that the group was formed in 1974 and at present supports 7 repeaters: GB3KN and KS on 144MHz, GB3CK, EK, NK, SK and RE on 430MHz, and the latest repeater GB3RE.

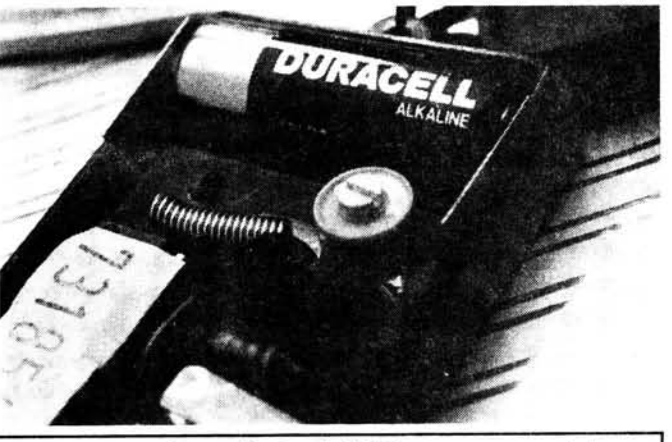
The repeater (GB3RE) was commissioned early in July and covers the Medway Towns on RB11 from a site at Chattenden.

Kelvin also mentions that the group is happy to give lectures to local clubs. Anyone interested should contact Kelvin direct on 0634 376991.

IRTS AGM

The AGM of the Irish Radio Transmitters Society was held recently in the Limerick Inn Hotel, Co. Clare. In his report to members, the outgoing president, Mike Staunton EI3DY, has some good news for EI amateurs. The Irish Department of Communications have granted permission for B licensees to use c.w. and RTTY on the v.h.f. bands.

Further good news was that the Amateur Radio Emergency Network has also been given full approval. The photograph shows the outgoing president (left) and Willie Barron EI6BUB, the new president.



The MN21 Battery

Duracell Batteries Ltd., now have a compact, high voltage battery.

The MN21 has a nominal voltage of 12V and yet measures only 10mm in diameter and 28mm long. It weighs only 4.6g. The nominal service capacity to 7.2V is 28mAh.

The MN21 uses Alkaline Manganese Dioxide technology and has a shelf life in excess of 18 months.

For further information regarding Duracell products and the company's free Battery Advisory Service, please contact
John Bellamy,
Duracell Technical Division,
Duracell House,
Church Road,
Lowfield Heath,
Crawley,
West Sussex RH11 0PQ.

PRACTICAL WIRELESS
144 MHz QRP
CONTEST 1988

The date of this event has now been fixed, and is:
Sunday, 12th June 1988
0900–1700 GMT

Further details and full rules will appear in a future issue of Practical Wireless

Rally Calendar

January 31: The Northern Amateur Radio Societies Association are holding their Belle Vue/Norbreck Radio Rally at the Norbreck Castle Hotel Exhibition Centre, Queens Promenade, North Shore Blackpool. Doors open 11am. There will be plenty of traders, a bring and buy, RSGB Morse tests, free car parking, talk-in on S22 and SU8 and admission is £1 (OAPs 50p, under 14s free). More details from ***Peter Denton G6CGF on 051-630 5790.***

March 13: The Bury Radio Society are holding their 1988 rally at a new, bigger and better venue. That will be the Castle Leisure Centre, Bolton Street, Bury. There will be the usual large number of stands, a large bring and buy, displays as well as talk-in on S22. There is ample space for parking and refreshments will be available.

March 20: The Tiverton SW Radio Club are holding The Mid-Devon Rally at the Pannier Market, Tiverton. There is easy access from junction 27 of the M4 and excellent parking facilities on site. There will be two halls of trade stands, a bring and buy and a mobile snack bar. Talk-in will be on S22. More from G4TSW, Mid-Devon Rally, PO Box 3, Tiverton.

May 29: The Plymouth Radio Club's Mobile Rally will be held at Plymstock School, Church Road, Plymstock. Doors open 10am. There is a large free car park, refreshments, raffle, the usual trade stands, demonstrations and talk-in on S22. Full details from ***Joe G1RXR on (0752) 662511.***

June 12: The Royal Naval ARS have announced the date of their Mercury rally. The venue, as always, is HMS Mercury, near Petersfield, Hampshire. Gates are open between 1000 and 1700. More details from C. G. Harper G4UJR. Tel: 0703 557469.

July 15–17: The RSGB 75th Anniversary National Convention will take place at the National Exhibition Centre, Birmingham. RSGB HQ can give you more details.

July 28–31: The AMSAT-UK Colloquium will again be held in the University of Surrey, Guildford. Details from G3AAJ on 01-989 6741.

August 14: The 1988 Derby Mobile Rally will take place at the usual venue of Lower Bemrose School, St Albans Road, Derby. Doors open 11am. More details from G3KQF, QTHR.

Are you running a rally or special event station during 1988? If so drop us a line

144 to 50MHz

C. M. Howes have introduced a ready-made 144 to 50MHz transverter into their product range. It has a 10W r.f. output and will accept between 1 and 5W of drive as standard—there is also a 5–10W option.

Other features include s.w.r. and reverse polarity protection circuits, p.t.t. and r.f. VOX change-over and very low harmonic and local oscillator radiation levels.

An operator's handbook is supplied complete with block and circuit diagrams in addition to the operating and installation instructions.

The HC266 costs £179.90 including P&P and VAT.

For more details on this and other products, contact:
C. M. Howes Communications,
Eydon,
Daventry,
Northants
NN11 6PT.
Tel: (0327) 60178.
Note the new address please.

The HF-125 short wave receiver was conceived, designed and is "Made in Britain" for the DX enthusiast. Its ability to perform on a crowded band with strong adjacent stations was a major consideration in its design. The HF-125 is also easy to use, the controls being simple and sensible. Essential bandwidth filters which are often options on other equipment are fitted as standard. Unnecessary frills are not included and their omission is deliberate. The result is an affordable receiver.

The HF-125 has continuous coverage from 30 kHz to 30 MHz. Operating modes are AM, USB, LSB and CW. An optional board (D-125) adds FM and synchronous AM. Unlike other receivers, the HF-125 comes complete with a comprehensive range of bandwidths; a 2.5 kHz filter for SSB transmissions or for resolving an AM station using SSB mode and ECSS technique (exalted carrier, selectable side band), a 4 kHz, 7 kHz or 10 kHz filter for AM reception, the width chosen dependent on the signal and band conditions (10 kHz for BBC Radio 4, 7 kHz for Vatican Radio on 6185 kHz and 4 kHz to resolve a signal when conditions are not ideal). For the CW enthusiast a 400Hz audio filter is included as standard.

Operating the HF-125 is refreshingly simple. The controls are logical in use and a large back-lit liquid crystal clearly displays the operating frequency.

Two buttons, one marked up, the other down, select the correct magahertz and you tune to the required frequency using a large heavy knob with a thoughtfully provided finger recess. The tuning rates relate to a simple design concept of two stations per knob revolution on each mode. As well as providing the optimum tuning rate whilst you are carefully looking for a weak signal, the HF-125 automatically increases its stepping increment as the knob rotation speed increases. The result is an extra rapid frequency shift to a new part of the band. There is also an optional keypad controller (K-125) for even quicker frequency selection.

To further enhance reception other facilities are included. A noise blanker is permanently in circuit to deal with vehicle ignition interference, 20 dB of attenuation can be switched in when required and an HF or LF cut tone control can be applied to the audio output.

Although memory facilities are not essential in a short wave receiver they are useful. The HF-125 has 30 memories which are available in two banks of fifteen.

The HF125 provides its owner with outstanding performance. Typical values for frequencies greater than 500 kHz are a sensitivity on SSB of 0.3 uVC for 10 dB S/N and on AM, 0.7 uV for 10 dB S/N at 70% modulation. Dynamic range is greater than 90 dB at 50 kHz from the tuned frequency (both IMD and RM) and image and spurious responses have a greater than 80 dB rejection.

Connections are included for both 50 and 600 ohm impedance aerials (SO-239 and a terminal block). The receiver has a 6mm jack socket for headphones on the front panel and two 3.5mm sockets on the rear panel, one for an external loudspeaker and the other for tape recording.

The HF-125 operates from 12 volts DC and, as such, is suitable for use from an external battery whilst caravanning or boating. For home use an AC mains adapter is supplied with the receiver. For truly portable listening, in the garden or on a hilltop, an internal rechargeable battery, charger and active whip aerial option (P-125) is available as well as a tough protective carrying case with shoulder strap (C125). Operation on a fully charged Nicad pack is around 10 hours.

Compact and lightweight, the HF-125 is 255mm wide, 100mm high and 200mm deep, a portable high performance short wave receiver.

HF125 .... **£375.00 inc VAT,** carriage £8.00
D125 .... **£59.50 inc VAT,** carriage £1.00
K125 .... **£59.50 inc VAT,** carriage £1.00
P125 .... **£69.51 inc VAT,** carriage £2.50
C125 .... **£23.85 inc VAT,** carriage £2.50

HF 125 SHORT WAVE RECEIVER

1300HC frequency counter

Small enough to fit into a shirt pocket, the 1300HC frequency counter brings easy and accurate frequency measurement well within everyone's reach.

The 1300HC uses a full 8 digit display, and measures to 1300 MHz, thus being ideal for amateur as well as all mobile radio bands including cellular.

The unit contains its own rechargeable NiCd battery pack which is charged from an external supply. The frequency counter can also be powered from any 9 to 12 volt dc supply, which charges the batteries as well.

The 1300HC has excellent sensitivity, and when used with the optional telescopic whip, easily measures transmitter frequencies of mobile or handheld transceivers, even low powered "bug" devices. When used in conjunction with a simple "dip oscillator", the 1300HC makes checking tuned circuit or aerial resonance an easy task.

The high performance of the 1300HC frequency counter makes it an indispensable tool for every amateur, engineer or technician. Its small size makes it suitable for either shack or "on the move" use.

SPECIFICATION

Range	1-1300 MHz	
Resolution	100 Hz at 2.5 sec. gate	
	1 kHz at 250 mS gate	
Display	8 digit 0.3" LED	
	MHz decimal point	
	Leading zero blanking	
Gate times	Fast 250 mS	
	Slow 2.5 S	
Sensitivity (typical)	1-10 MHz	10-150 mV rms
	10-1000 MHz	3-50 mV rms
	1-1.3 GHz	10-150 mV rms
Accuracy (typical)	+/- 1ppm, +/- 1 count LSD	
Aging	0.1 ppm/month (typical)	
Gate indication	Red LED during sampling	
Input connector	B.N.C.	
Input power	9-12 Vdc at 150 mA	
Power connector	Concentric. Centre positive	
Case	Brushed anodised aluminium	
Size	3.9H × 3.5W × 1D (inches)	
Weight	255 g	
Power supply	Internal NiCd pack (supplied)	
	or external dc source (option)	

1300HC ... Handheld frequency counter
£135.00 inc VAT, carriage £2.00

OPTIONS

PS12 ... AC mains power supply
£8.50 inc VAT, carriage £2.00

BNC6 ... Telescopic whip
£7.46 inc VAT, carriage £0.50

CC12 ... Padded carrying case
£9.90 inc VAT, carriage £1.00

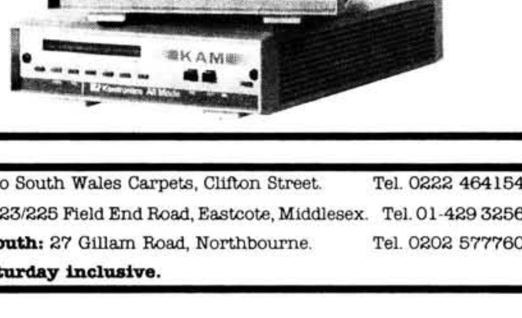
Kantronics packet radio

When I first heard of packet radio, I said "What?", and that is the reaction of many radio amateurs. However, I never expected it to be so much fun, and judging by the demand and the queue to get at our demonstration station here at Matlock, a lot of other people are also finding it truly fascinating.

There are several companies offering ready made packet systems, and the descriptions are usually full of terms you don't understand (including some of our own ads in the past). What for example is "enhanced generic command structure"? Sounds very much like something taught at Sandhurst or West Point.

From the equipment available, we chose to represent Kantronics, because their units are sheer delight to see, to use, and to enjoy. **For full information on this most interesting aspect of our hobby, just send a couple of first class stamps and ask for "Kantronics".**

Prices range from £159 to £298, and I know I haven't told you what packet radio will do – send for the info . . .



Glasgow: 4/5 Queen Margaret Road. Tel. 041-945 2626.
Darlington: 56 North Road. Tel. 0325 486121.
Cambridge: 162 High Street, Chesterton. Tel. 0223 311230.
Cardiff: c/o South Wales Carpets, Clifton Street. Tel. 0222 464154.
London: 223/225 Field End Road, Eastcote, Middlesex. Tel. 01-429 3256.
Bournemouth: 27 Gillam Road, Northbourne. Tel. 0202 577760.

Note. All our shops open Tuesday to Saturday inclusive.

The TS140S from Kenwood

Every once in a while, something comes along which marks a true turning point in amateur radio equipment. Such was the case when **Trio-Kenwood** introduced the **TS120 series;** the first of the small solid state transceivers to appear.

Following the trends of the last few years towards more "sophisticated" equipment (really meaning more and more complicated), we have seen Kenwood engineering directed more towards better performance, particularly in HF transceivers; performance which has become a standard of excellence for others to try to match.

Study of recent reviews of equipment which has been introduced to try to match **Kenwood's TS940S** reveals just how far behind some manufacturers have fallen: I am reminded of some lines from Kipling which run (more or less):
"They stole everything I had, but they couldn't steal my mind, So I left them sweating and stealing, A year and a half behind."

Well, the chaps at Kenwood have not been asleep, and they have come up with a new transceiver which I believe will mark another turning point in HF equipment. This is the **TS140S,** and I can tell you that from a short "hands-on" session which I was given in Germany recently, I am certain that the **TS140S** will satisfy many many users.

The new **TS140S** is about the same size as the **TS430** or **TS440,** and on the face of it is similar (yawn) to other transceivers of the genre in that it gives you 100 Watts of RF on all the amateur bands, in all modes including FM; has a general coverage receiver covering 500 kHz to 30 MHz; and has loads of facilities that you might expect – BUT – Kenwood have studied what the radio amateur has been saying and have refined and simplified the operation of the **TS140S** to make it a real dream to use.

Not only that, they have given the user a receiver section with real performance which matches today's expectations, and remember that Kenwood have consistently set the standards for the last few years.

Obviously it is imposible to describe all the features and facilities of the TS140S in a few paragraphs, so why not drop us a line and ask for complete information. What's that? Oh, the price. Not yet finally determined, but quite a bit less than £950 but not quite as low as the £750 we have been asking for the TS530S and TS430S in recent weeks.

In my opinion, the **TS140S** in combining performance with simplicity at an attractive cost will give real satisfaction to the radio amateur who wants to enjoy his hobby of communicating, rather than counting the buttons on the front panel. And who am I to make this pronouncement? Well, I'm John Wilson and I am one of the original gang of three which became Lowe Electronics Ltd. I haven't written for the magazines for many years, but the **TS140S** really attracted me so I thought I should tell you about it rather than bore you with a specification. Hope you like it too.

73, G3PCY/5N2AAC

LOWE ELECTRONICS LTD.

Chesterfield Road, Matlock, Derbyshire DE4 5LE
Telephone 0629 580800 (4 lines)

Feature

Dipoles Apart

An interplanetary tale with a down-to-earth message, by R. H. Pearson G4FHU

The oddest thing of all, while they watched the spacecraft land, was that it looked so *ordinary*. In all the hullabaloo of the previous few days since contact was first made by radio, no one had got any inkling of what the craft itself looked like. The TV and press had concentrated entirely on the occupants and were at first rather hoping for spherical green monsters with purple eyes, or something equally newsworthy.

Thus it came as something of a disappointment to learn that the visitors from Mars would be so similar in appearance to ourselves. Yet no one had made the obvious guess that the spacecraft might also look quite conventional to earthbound eyes.

All except for Frank that is, the radio amateur who had first made contact with the Martian ship a week before. Despite, or perhaps because of, the great upheaval in his life—the interminable TV and radio interviews and the clamouring reporters at his front door—he had given the whole matter a great deal of thought (there's nothing that concentrates the mind so keenly as having to answer questions from people who take you seriously!).

So, in his place of honour on the dais at the edge of the airfield runway, Frank had all his faculties sensitively tuned for the landing and was as alert as anyone among the thousands of spectators there and the hundreds of millions watching it on satellite TV.

Nothing seemed particularly remarkable about the spaceship as it came into view. It had familiar aerodynamic shapes suitable for the atmospheric phases of interplanetary flight, and experts in such matters no doubt speculated about the compromises needed for the two very different atmospheres on Mars and Earth. But most saw nothing very surprising; even the rocket motors appeared similar to those on Earth developed from WWII weapons and used on spacecraft ever since.

Frank, though, was especially interested to see what radio antennas were visible, since he himself had experimented with such things for over 30 years. He had already mentioned his enthusiasm over the air to the Martian communications expert on board, Diluna, who was herself a radio amateur.

So he already knew that the skin of the craft concealed both fixed slot antennas and, behind the plastic domes, a couple of quite large parabolics. Overcoming part of the language difficulty (achieved mainly by the makeshift English that the Martians had managed to learn) he had found out that a few "dipoles" on the outside of the craft were used for specific purposes, but were retracted during entry into an atmosphere until the speed was subsonic. As they appeared, Frank was the only spectator to realise what they were, and many anxiously thought they might be weapons.

He was intrigued by their shapes. Some were very much like the biconical wideband dipoles seen on military installations; others were quite reminiscent of those quaint brass ball-ended affairs that Hertz used in the first radio experiments here. The largest one, mounted at the front, looked like the horns of a dreadful demon or the optical antennae of some fantastic insect.

It was weeks later, when all the fuss was over and the news value had subsided to the occasional and boring chat show appearance, that Frank had his first real chance to talk seriously with Diluna. The conversation went something like this:

Frank: I'm interested to know why all your dipole antennas seem to be thicker at the extremities than at the centre feedpoint (or at least have some kind of what we would call "end loading"). Are they **all** broadband antennas?

Diluna: Well, I've read some of your textbooks and looked at many of your "aerials" (as some of your old folk call them!) and I'm equally puzzled that you rely so much on purely wire or rod elements—in some cases even with the vital outside ends bent **downwards**, towards the earth. Back home on Mars, when we are short of space, we bend simple wire dipoles **up** at the ends, not down!

. . . Seen on every roof

Frank: But surely I don't have to tell an expert like you that the main radiation comes from the high current part of the dipole, i.e. near the centre; all our textbooks confirm this—and anyway it's common sense.

Diluna: Earth texts, yes! But on Mars our books emphasise the importance of the high voltage outer ends of the dipole. Surely it's common sense that most of the radiation will take place there.

We can laugh now at this odd chapter of technical radio history, because of course the whole thing was sorted out at the important 1999 conference sponsored by the RSGB, the ARRL and the RSAM (Radio Society of All Mars). There it was realised how a bit of half-understood or misapplied mathematics can cause so much confusion. It so happens that on earth we have good mathematics to deal with a short line of electric current and to sum (integrate) the effects over the whole length of an antenna. Because it offered the simplest mathematical approach our attention had become over-concerned with that aspect. On Mars, however, mathematics developed differently and is simplest when an analysis starts in terms of potential difference rather than current.

On each planet the mathematical tail was wagging the practical dog, so that earthlings regarded the high voltage ends as unimportant and Martians viewed the high current middle as just a nuisance needed only to separate the essential high voltage ends! Everyone knew that an electromagnetic field is not at all biased in its electric and magnetic components—they each husband the same energy and each supports the other—but such thoughts were usually put aside because of the mathematical details which obscured the wood for the trees.

At first the conclusion of the conference were widely misquoted or misunderstood (in some cases deliberately, for commercial and military reasons). On earth, the expensive amateur radio emporia sold "Mardipoles" like hot cakes, and on Mars "Terrapins" were all the rage.

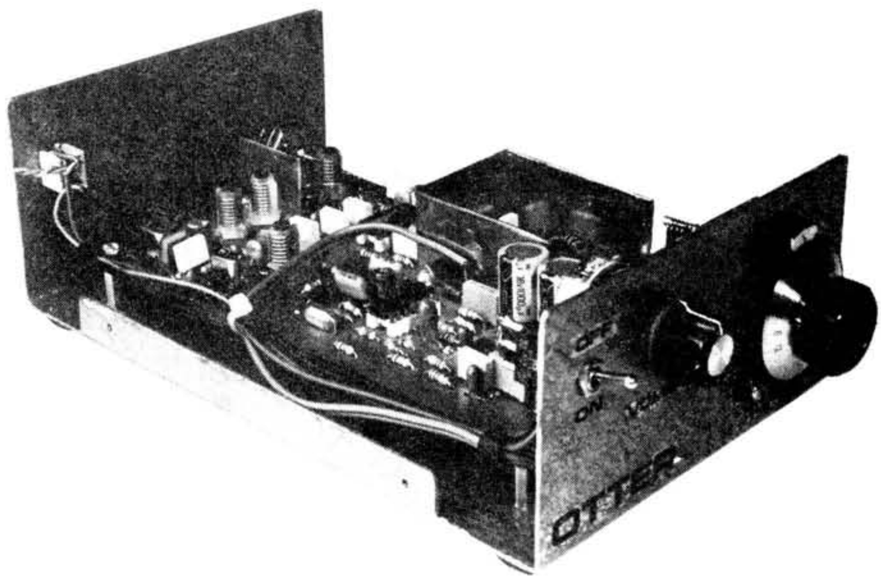
But in the end, as all technically experienced readers will know, sense prevailed and the jointly designed "Emtenna" became the standard for the whole solar system. It's beautiful shape, seen on every roof, is now so familiar to absolutely everyone that there is of course no need to describe it here! **PW**

The PW "Otter" 50MHz Receiver

This little receiver, designed by Mike Rowe G8JVE, is capable of excellent results; during the last Sporadic-E season it yielded signals from LA, VE, W, and all at good signal strength.

The design of this receiver is slightly unorthodox and is best described as a 50MHz crystal controlled converter feeding a 10.7MHz direct conversion receiver. Thus it has all the convenience of a simple receiver with regard to alignment, combined with the sensitivity and performance of a more complex design.

The entire receiver is constructed on one double-sided p.c.b. with only the tuning capacitor, volume control and on/off switch mounted off the board, on the chassis. The receiver may be mounted in any screened enclosure, the prototype was housed in a home-made, two-part aluminium box.



Circuit Description

Transistors Tr1 and Tr2 are both dual gate m.o.s.f.e.t.s type 3N201. Transistor Tr1 is configured as a 50MHz amplifier, and Tr2 as a mixer. Signals from the antenna socket are matched to Tr1 via a single turn of insulated wire, loosely wound on top of L2, a standard S18 Toko inductor. The output of Tr1 is coupled to the mixer stage Tr2, by a band-pass filter arrangement constructed around a further two pre-wound S18 inductors. The signal frequency is fed in on gate 1 of Tr2, while its second gate is used to set the d.c. condition of the mixer, in addition to being the local oscillator injection port. The mixer output is coupled to the next section of the receiver via T1, a 10.7MHz i.f. transformer.

The receiver's first local oscillator frequency is 39.8MHz. This is provided by Tr6 and its associated circuitry. Together they form a third overtone crystal oscillator, the output of which is capacitively coupled to the second gate of mixer Tr2. This choice of local oscillator frequency will provide an i.f. output in the range 10.2 to 11.2MHz, with the receiver covering 50–51MHz. Unfortunately, the bandwidth of a standard 10.7MHz i.f. transformer is far too narrow to accept frequencies in the range of 10.2 to 11.2MHz, so in order to modify the bandwidth of T1, the *Q* must be reduced. This is achieved by connecting a 10kΩ resistor across its primary winding, having the effect of broadening the response and giving the receiver optimum performance around the six metre calling frequency 50.2MHz, where most of the activity takes place.

The second section of the receiver takes the less familiar form of a direct conversion receiver with IC1 as its mixer. The oscillator feeding the mixer is a Vackar type and was chosen for its good stability. It consists of Tr5 and its associated components. Transistors Tr4 and Tr3 form a buffer amplifier which isolates the oscillator from the mixer. The oscillator runs from 10.2MHz to approximately 11.2MHz. This signal beats with the incoming signal from T1 and the resultant audio signal is extracted from Pin 12 of IC1. Here any residual r.f. is filtered by C14, R29 and C27.

The audio signal is then fed through the first of the two volume controls which are ganged together. The reason for using a double-ganged volume control is two-fold. First it prevents strong signals from overloading IC2a, as would be the case if the gain were only controlled by R30b. The second reason for this arrangement is that it improves the signal to noise performance of the receiver. If the gain were to be controlled by R30a alone, the noise in the succeeding stages would be present all the time making strong signals as noisy as weak ones.

Operational amplifier IC2a acts as a linear amplifier whilst IC2b and IC2c are configured as low-pass filters with a cut-off frequency of approximately 2kHz. The last operational amplifier IC2d is again used as a linear amplifier but with the addition of D2 and D3 connected in anti-parallel across its feedback resistor. This has the effect of clipping the signal to a set level, helping to reduce the car ignition noise which is prevalent on 50MHz. Integrated circuit IC3 provides further amplification to loudspeaker level.

Construction

First, wind inductor L5 which consists of 36 turns of 24 s.w.g. enamelled copper wire, closely wound in a single layer on a T50-6 ferrite ring. After winding the coil, tin the two ends and space them sufficiently to fit into the p.c.b.

Next, fit suitable i.c. sockets into the p.c.b. where IC1 and IC2 are to be located. Then fit Veropins for off-board connections as indicated in Fig. 2. Following this, insert wire links into the through-board earth-plane connection points. All through-board connections are shown as encircled crosses. After inserting the wire links solder them both sides and crop any surplus wire close to the p.c.b.

There are some points on the p.c.b. that use component legs to gain through-board earth connections; these are pins 3–5, 7, 10–12 of IC3 and one leg of C7.

Now insert and solder all the resistors and capacitors with the exception of the electrolytic and tantalum capacitors. Next fit all the diodes taking care over their polarity. Following this fit IC3, observing its orientation, remembering that pins 3–5, 7, 10–12 are also soldered to the earth plane. Next insert all the electrolytic and tantalum capacitors, again observing their polarity. Note that many of the components have one leg soldered to the upper "earthy" side of the p.c.b. Before insertion into the board, care should be taken to bend these component leads outwards using fine-nosed pliers, in order to avoid component damage.

Now fit inductor L2 and wind a single turn of insulated wire around its circumference to form L1. Following on, insert L3, L4, L5, L6 and then T1. Note the screening can pins of T1 are soldered both sides of the p.c.b. Finally solder in all the transistors again taking care over their orientation, while making sure that FB1 and FB2 are fitted to the correct leads of Tr1 and Tr2.

Insert IC1 and IC2 into their sockets and then fit the two screens shown in Fig. 2. These can be fabricated from scraps of double-sided p.c.b. material or tinplate salvaged from used food cans. Prepare and fit a short length of miniature coaxial cable where indicated on the underside of the p.c.b. Solder the screen of this cable to the pads provided, as these are through-board earthing points.

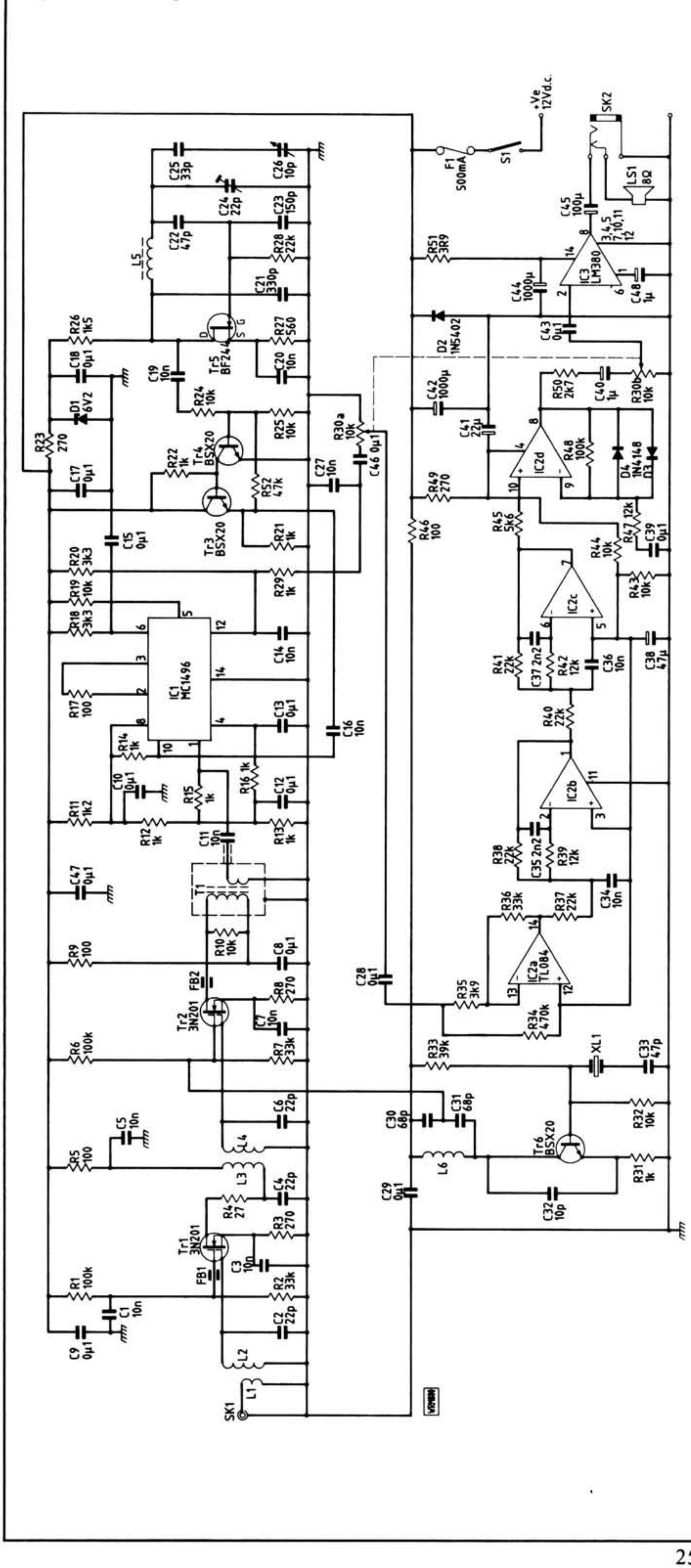
This now completes the construction of the p.c.b. Finally check the p.c.b. thoroughly for any dry joints or short circuits.

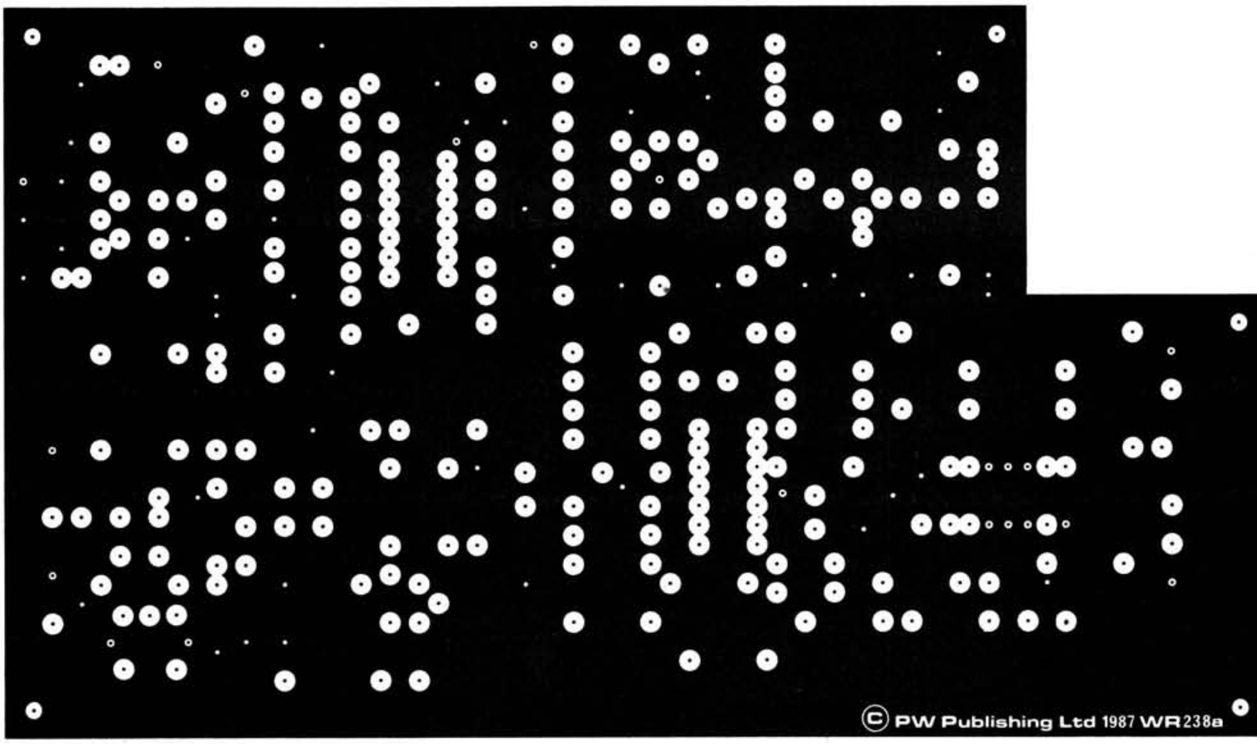
Case Layout

The aluminium case suggested for this project (Maplin AB15) is fabricated in two parts, rather like the one used for the prototype receiver. The bottom half of the case has two panels, one of these should be drilled to accommodate the vernier tuning mechanism, the volume control and the on/off switch. The other end of the case must be drilled to take the 50Ω coaxial socket, power leads, fuse holder and extension speaker socket.

The location of these components and the p.c.b. are shown in the photographs of the prototype. The exact dimensions are not critical, although it should be noted that the p.c.b. is mounted on 12mm 6BA threaded metallic pillars. Once all the components have been fitted to the case, all off-board connections from the p.c.b. can be made. When wiring R30a/b the rear section may be connected using ordinary pvc covered wire, as only short leads are required. The front section, however, must be wired in miniature screened cable because of the relatively long cable run.

Fig. 1: Circuit diagram of receiver





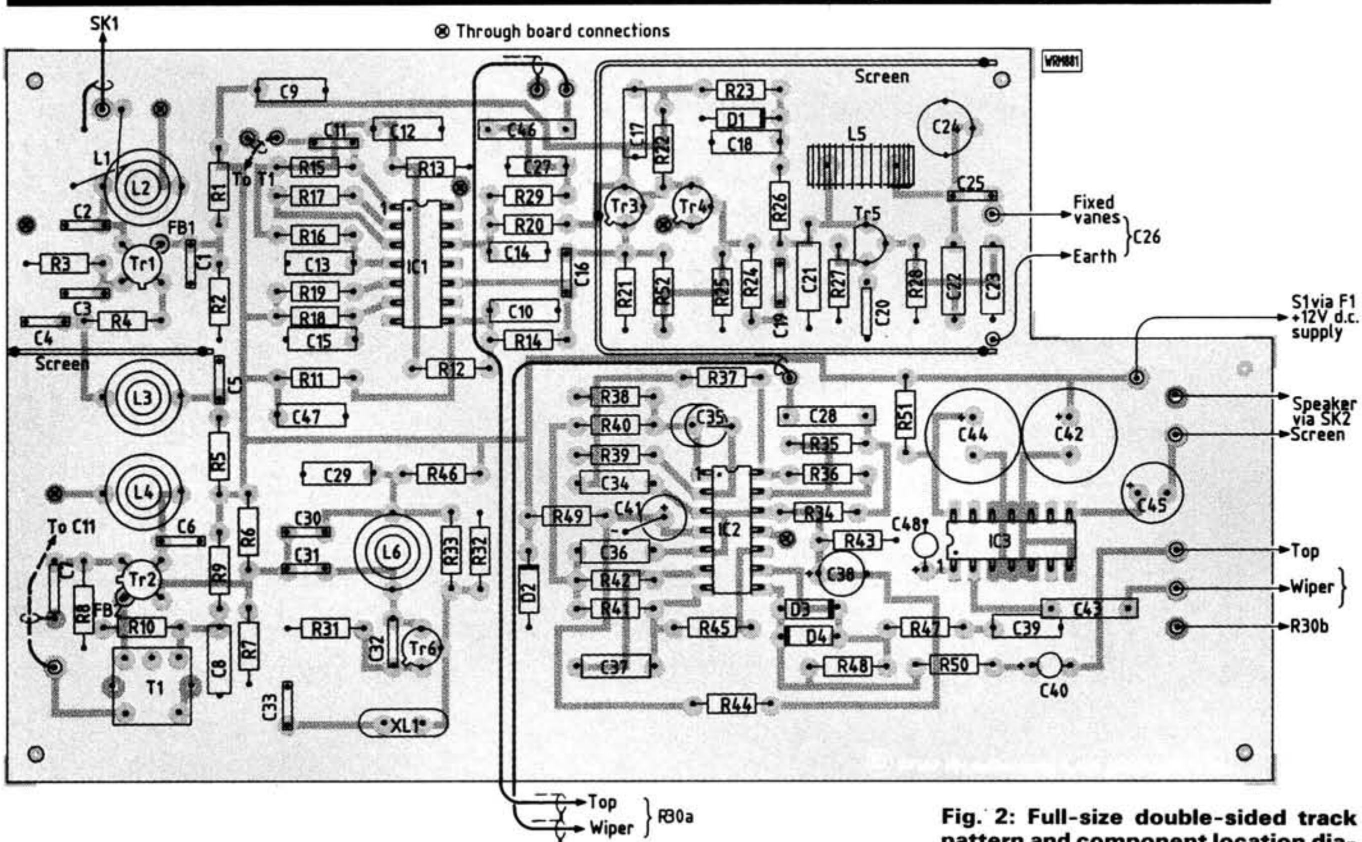


Fig. 2: Full-size double-sided track pattern and component location diagram of receiver

Note that pins 3–5, 7, 10–12 of IC3 and one leg of C7 (coaxial screen connection), are soldered both sides of the p.c.b.

Table 1

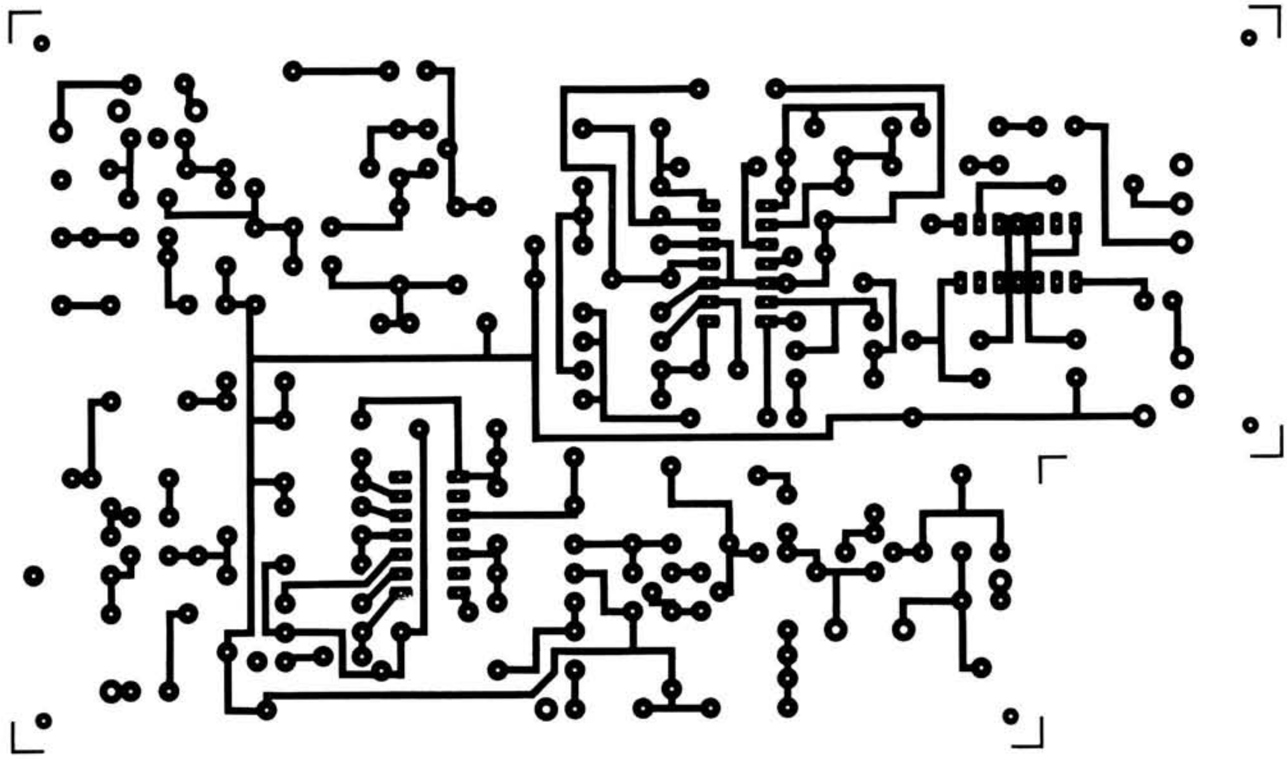
Device	Drain	Gate1	Gate2	Source
Tr1 Tr2	11.5 11.7	0 0	2.9 2.9	1 0.9
	Emitter	Base	Collector	
Tr3 Tr4 Tr6	2.1 6.4 0	2.8 7 0.7	11.9 12 6.4	
	Drain	Gate	Source	
Tr5	3.6	0	1	

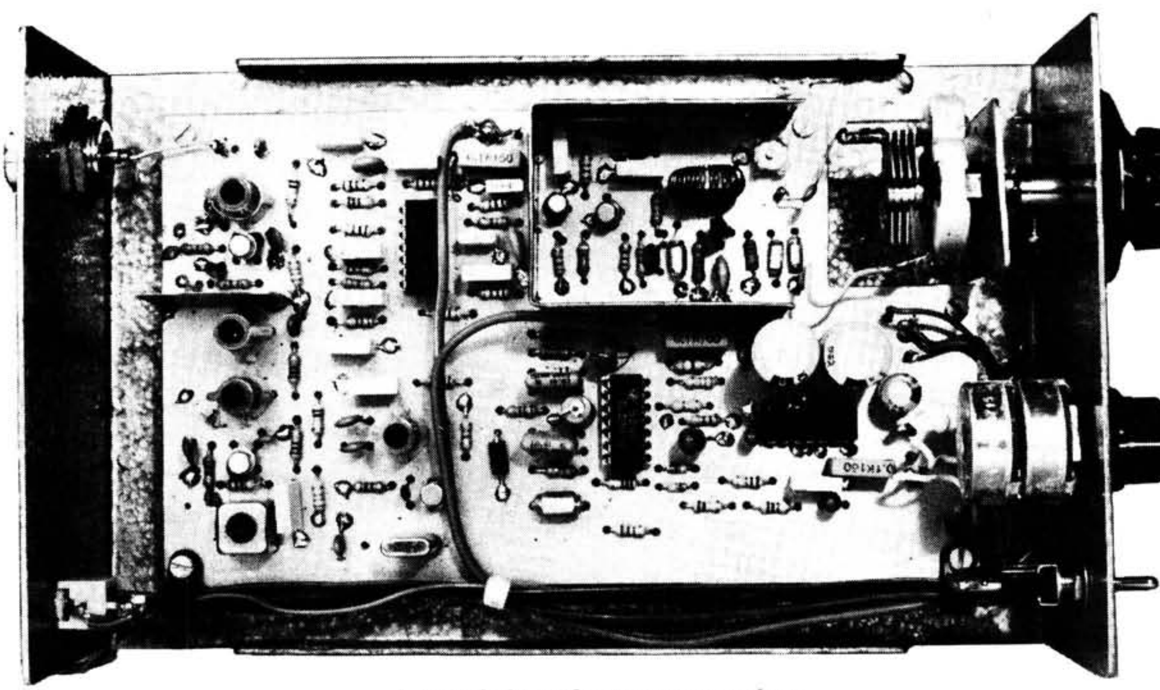
All measurements displayed are in volts

Table 2

Pins	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ICI	3.8	3	3	3.8	1.3	8.8	0	7.5	0	7.5	0	8.5	0	0
IC2	4.8	4.8	4.8	9.6	4.8	4.8	4.8	4.8	4.8	4.8	0	4.8	4.8	4.8
IC3	6.2	0	0	0	0	0	0	5.9	0	0	0	0	0	11.9

All measurements displayed are in volts





Internal view of prototype receiver

Alignment

First of all set the volume control to half rotation and the tuning to 70 on the 0–100 dial. Next, unscrew the cores of L2, L3, L4 and L6 so that the tops of their cores are about 2mm above the top of their plastics formers. Leave the core of T1 alone as this is normally preset by the manufacturers.

Apply 12 volts d.c. to the receiver from a well smoothed power supply, switch on, and if all is well a rushing sound should be heard in the loudspeaker. If not, switch off and investigate; if F1 is blown check the set for either a wiring fault or a short circuit on the p.c.b. After the initial switch-on procedure connect a high impedance voltmeter across R32 and adjust L6 for maximum voltage.

Next connect a frequency counter between pin 10 of IC1 and ground, then adjust C24 to give a counter reading of 10.7MHz.

If a counter is not available hold a domestic v.h.f./f.m. receiver in close proximity to L5 and adjust C24 until the oscillator is heard as a quieting signal. At this point the hiss normally heard on a v.h.f./f.m. receiver when not tuned to a station will disappear. Finally peak L2, L3, L4 and T1 for maximum receiver noise; note the tuning of T1 is fairly flat due to the damping effect of R10.

Operation

Connect a suitable 50MHz antenna to the receiver and signals should now be heard. Dimensions for a 50MHz antenna can be found on page 41, August 1986 issue of *PW*. Due to the band occupancy of 50MHz in some locations the only reliable source of signals will be beacons, a list of these appear in the front of the latest *RSGB Amateur Radio Call Book.*

Some practice will be needed in tuning the receiver to speech signals, as both sidebands can be tuned through. In effect when tuning through an s.s.b. transmission, two signal peaks will be heard very close together, one will be unintelligible while the other can be resolved to intelligent speech. All that is required is for you to tune to the correct sideband. Due to the fact that the numbers displayed on the vernier dial are arbitrary, a general rule of thumb can be employed, 0–100 represent 50–50.8MHz.

It is suggested that if an accurate signal source is available, constructors should produce a calibration chart

Trouble Shooting

So far two prototypes have been built and both worked without any problems. Should you have any difficulties, the voltages shown in Tables 1 and 2, measured using a high impedance voltmeter on the prototype, should assist in tracing the fault.

In the unlikely event of audio instability as there is a very high gain audio amplifier, reduce the value of R36.

Acknowledgement

The author would like to thank Messrs S.T.S. Communications for the use of test equipment in checking the prototype.

PW

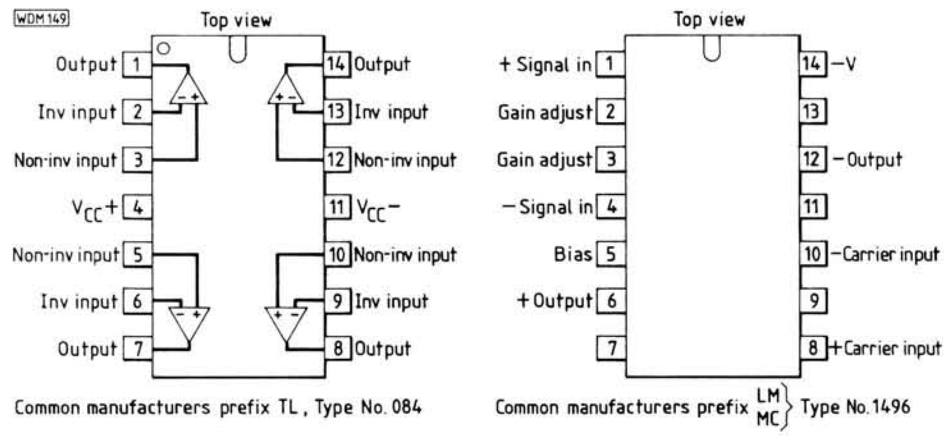


Fig. 3: IC pin-out data

SHOPPING LIST

Resistors

0.25W 2% Metal film

3.9Ω	1	R51
27Ω	1	R4
100Ω	4	R5,9,17,46
270Ω	4	R3,8,23,49
560Ω	1	R27
1kΩ	9	R12–R16,21, 22,29,31
1.2kΩ	1	R11
1.5kΩ	1	R26
2.7kΩ	1	R50
3.3kΩ	2	R18,20
3.9kΩ	1	R35
5.6kΩ	1	R45
10kΩ	7	R10,19,24,25, 32,43,44
12kΩ	3	R39,42,47
22kΩ	5	R28,37,38, 40,41
33kΩ	3	R2,7,36
39kΩ	1	R33
47kΩ	1	R52
100kΩ	3	R1,6,48
470kΩ	1	R34

Potentiometer dual gang linear

10kΩ+10kΩ	1	R30

Capacitors

Sub-miniature ceramic plate

10pF	1	C32
22pF	3	C2,4,6
33pF	1	C25
47pF	1	C33
68pF	2	C30,31

Sub-miniature ceramic disc

10nF	8	C1,3,5,7, 11,16,19,20

Miniature polyester

10nF	4	C14,27,34,36
0.1μF	14	C8–10,12, 13,15,17,18, 28,29,39,43, 46,47

Polystyrene

47pF	1	C22
150pF	1	C23
330pF	1	C21
2.2nF	2	C35,37

Foil trimmer

2–22pF	1	C24

Variable capacitor type C804A series

10pF	1	C26

Electrolytic 16V single ended p.c.b. type

100μF	1	C45
1000μF	2	C42,44

Electrolytic 16V axial type

22μF	1	C41

Tantalum bead 10V

47μF	1	C38

Tantalum bead 35V

1μF	2	C40,48

Semiconductors

Diodes

BZY88C6V2	1	D1
1N4148	2	D3,4
1N5402	1	D2

Transistors

BF244	1	Tr5
BSX20	3	Tr3,4,6
3N201	2	Tr1,2

Integrated circuits

LM380	1	IC3
MC1496	1	IC1
TL084	1	IC2

Miscellaneous

T1 Toko KACS1506A 10.7MHz i.f.t.(1); L2–4,6 Toko S18 0.45μH(1); T50–6 toroid (for L5)(1); 0.5m 24 s.w.g. enamelled copper wire; Double sided p.c.b. material; HC18/U 39.8MHz 3rd overtone crystal(3); 14-pin d.i.l. sockets (2); Miniature toggle switch s.p.s.t.; SO239 chassis socket (1); 3.5mm mono chassis socket with break contact; 768 type 500mW 8Ω speaker LS1(2); Vernier dial with slow motion drive; Miniature screened cable; Wire; Knob; Aluminium box AB15 type(2); Small rubber grommet (1); Plastics cable clips (2); Self-adhesive cabinet feet; Anti-parasitic beads (2); 6BA mounting pillars × 12mm long, nuts, bolts, washers; 20mm panel mounted fuse holder; 1amp 20mm fuse.

(1) Cirkit Holdings plc, Park Lane, Broxbourne, Herts EN10 7NQ
(2) Maplin Electronic Supplies Ltd, PO Box 3, Rayleigh, Essex SS6 8LR
(3) Golledge Electronics, Merriott, Somerset TA16 5NS

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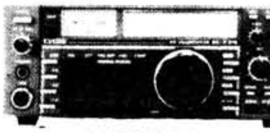

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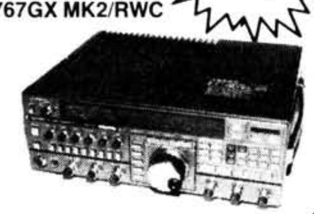

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The Smith Chart—A Practical Transmission Line Calculator

Part 2

This article, written by Captain C. A. King FSERT AMITE of the Royal School of Signals, first appeared in The Journal of The Society of Electronic & Radio Technicians. It has been reproduced here by kind permission.

Using the Chart

Using Fig. 2.1, to study the reactance variations along a short circuit line, you should proceed as follows:

(a) Enter the chart at point A, a short circuit; $Z_L = 0 + j0$.

(b) Move clockwise round the outer circle 0.1λ to point B; use the "collar" as a guide to the distance to move, in this case from "0.25" to "0.35". The reactance at B is read off as $+j0.73\Omega$. Thus the impedance of this length of 100Ω cable is 73Ω inductive. The actual inductance could be found given the frequency.

(c) Move on another 0.1λ to point C. The reactance is now $+j3.1\Omega$.

(d) Move a further 0.05λ to point D. The total distance moved is now 0.25λ. At this point the impedance is very high, similar to a parallel tuned circuit at resonance.

(e) Move on to point E, a further 0.1λ. The reactance is now falling again and is capacitive of value $-j1.37$. If a length of line has an adjustable short circuit, the latter can be moved back and forth to find the exact 0.25λ point; this is equivalent to "tuning" the line. Such a system can replace a normal tuned circuit at very high frequencies.

(f) After further movement, point A is reached after 0.5λ. Moving to point B again would give 0.73Ω. So a 0.1λ and a 0.6λ length of cable both have the same reactance. This is true for any difference of 0.5λ. Naturally the shortest length of cable is used.

(g) The reverse process to the above would be to find the length of cable

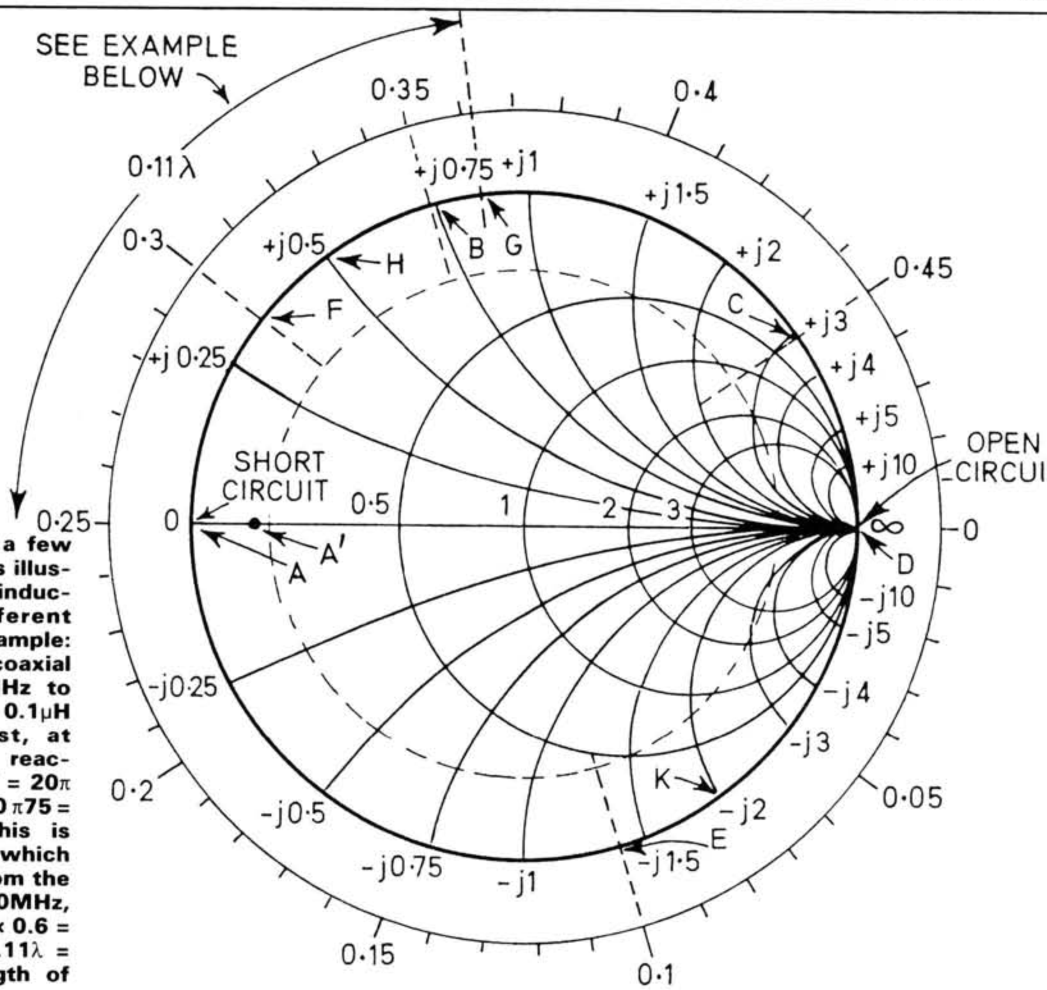


Fig. 2.1: This has only a few resistance circles as it is illustrating the range of pure inductance offered by different lengths of cable. For example: find the actual length of coaxial cable needed at 100MHz to give an inductance of 0.1μH using 75Ω cable. First, at 100MHz, 0.1μH has a reactance of $2\pi \times 10^8 \times 10^{-7} = 20\pi$ ohms. Second, $20\pi\Omega = j20\,\pi 75 = j0.837\Omega$ normalised. This is point G on the diagram which corresponds to 0.11λ from the short circuit. Third, at 100MHz, $\lambda = 300 \times 10^6/100\times 106 \times 0.6 = 1.8$ metres therefore 0.11λ = 0.2 metre. Fourth, length of cable = 0.2 metre

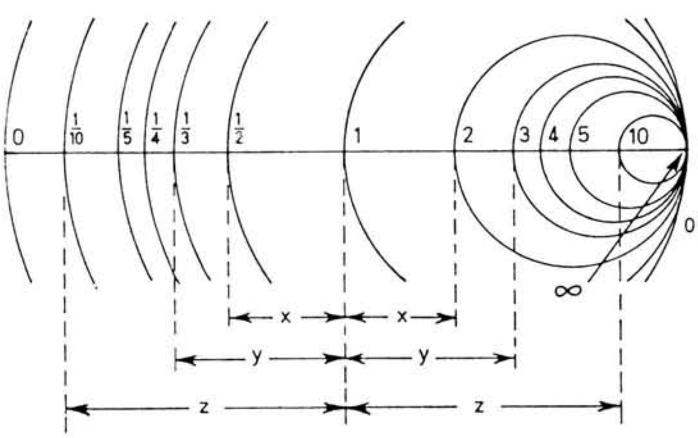


Fig. 2.2: Resistance to conductance conversion

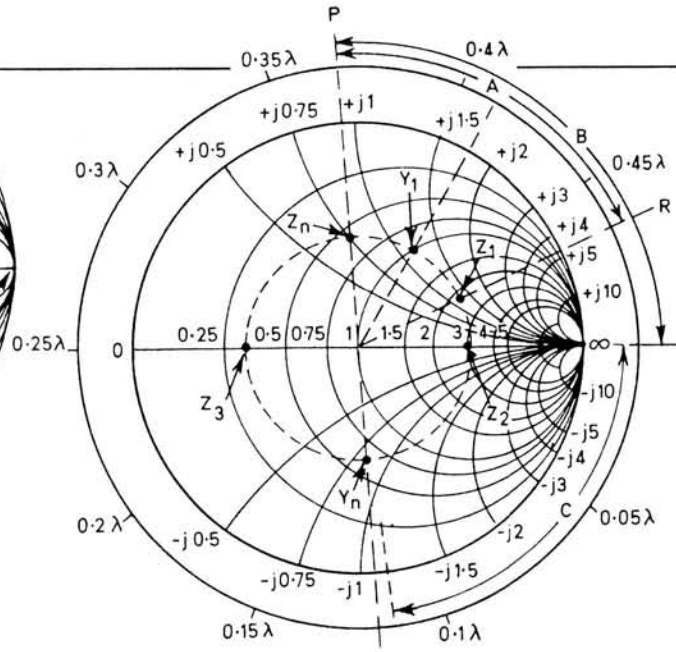


Fig. 2.3: Z_n is a normalised impedance of 0.6 + *j*0.75Ω. Y_n is the normalised admittance of Z_n. Z_1 is the impedance of a 0.1λ length of cable terminated in Z_n. Z_2 is the impedance at a voltage maximum. Z_2/Z_0 is also the s.w.r., 3 in this case. Z_3 is the impedance at a voltage minimum Z_0/Z_3 is also the s.w.r. Y_1 is the first point along the line from the load Y_n that the conductance of the total admittance is 1. (Numerically equal to Z_0). The actual admittance is 1 + *j*1.12. The susceptance at this point is cancelled, or tuned out by adding *j*1.12 in parallel using a length of short circuit line. Arc C shows the required length 0.113λ, measured from ∞ (infinite susceptance is equivalent to zero reactance, or a short circuit)

needed for a given reactance. For example, find the length of 50Ω cable having an inductive reactance of 200Ω.

The normalised reactance is +*j*4 ohms. Starting from point A, the short circuit +*j*4 is found round the outer circle at 0.461λ. The actual distance moved is 0.461 − 0.25 = 0.211λ, the required length.

In practice, line losses will prevent the reactance following precisely the previous route. The actual route will gradually cut into the diagram in a shallow spiral finishing at A′. It will not pass through, but slightly to the left of D. The impedance after 0.25λ will not be infinite but a high resistance. This is just what happens in a tuned circuit with finite *Q*. Similarly, after 0.5λ the impedance will not be zero, but a low resistance. Again similar to a resonant tuned circuit, this time a series resonant circuit.

Translating Impedance to Admittance

The reciprocal of resistance is conductance, G = 1/R siemens (previously called mhos).

Conversion is simple on the chart. On the horizontal axis, resistance is as far to one side of the centre point or origin as the corresponding conductance is to the other. This is illustrated in Fig. 2.2, and can also be clearly seen in Fig. 1.5.

The reciprocal of reactance is susceptance, B = 1/X. Positive reactance gives negative susceptance and vice versa. In this case, corresponding values of B and X lie diametrically opposite each other on the outer circle. In Fig. 2.1, lay a ruler through +*j*0.5 (H) and through the centre of the circle. It will also cut the outer circle at −*j*2, point K. Thus an inductive reactance of 0.5Ω has a susceptance of −2 siemens; similarly, a capacitive reactance of −2Ω has a susceptance of +0.5 siemens.

Either of the above conversions is quite simple without the chart. Impedance to admittance conversion is not quite so easy, involving the use of operator *j*, or messy algebra. Using the chart, the process takes little time.

Once again, corresponding impedance Z and admittance Y values are diametrically opposite each other; they may now occur anywhere inside the defining circle.

Using Fig. 1.5, consider point E. This is an impedance of 1−*j*1Ω. Diametrically opposite E on the same radius is point F. This is the admittance corresponding to Z = 1 +*j*1. Its value is 0.5 − *j*0.5 siemens. A practical way of doing this conversion is to draw a circle through Z, centred at the origin. A straight-edge will then locate Y opposite Z. Such circles are auxiliary to the main diagram, being constructions used for specific problems.

Here is another example, using Fig. 2.1. Consider Z = 0.5 + *j*1.5. The auxiliary circle is dotted in. The value of Y is about 0.2 − *j*0.58 siemens. The exact value is 0.2 − *j*0.6, which demonstrates the limitations of a small diagram.

Now try Z = 3.2 + *j*2.4; the answer is about 0.2 − *j*0.15.

Conversions as before are an important step in using the chart for stub matching problems; these are the final use of the chart to be described.

Matching Cables to Varying Load Impedances

It is always desirable to match a cable such as an antenna feeder to its load. The main reason for this is economy of power. The other reason is that reflected power can cause damage to the transmitter output stage; the reflected power is also responsible for standing waves which can cause flashover in high power systems.

In many situations the load is built on the spot. The most obvious example is a large antenna such as a rhombic. The exact impedance is difficult to predict. However, it is simple to measure. Readings along the feeder route locate the voltage maxima and minima and hence the standing wave ratio can be calculated. The distance of the first maximum from the load indicates the reactive nature of the load. These assessments are made simple by the use of the Smith chart.

Sometimes the load itself is adjusted to improve the s.w.r., other times the matching is done along the line. One such system is called stub matching. An example of stub matching will now be worked out in detail.

A 600Ω open wire line is terminated in a load of impedance 360 + *j*450Ω. A Smith chart can be used to match the load to the line by a stub.

This type of problem is worked out in admittance, rather than impedance. The reason for this is that an expression of admittance such as 3 + *j*2 refers to a conductance in **parallel** with a susceptance. By adding a second susceptance in parallel, of opposite sign and same size (−*j*2 in this case) the total susceptance is zero. This is the same as saying that if a resistor is shunted by an inductance, the effect of the inductance can be tuned out by adding a suitable capacitor in parallel with the other two components.

Stub matching relies on the fact that at some point down the line from the load, the admittance must be of the form $1 \pm jb$. By adding a suitable extra susceptance at the point in question the admittance becomes 1, which makes the impedance 1, or Z_0. It will be shown that there is always some point in the line where $Z = 1 \pm jb$.

Stage 1: Normalise Z_L. This is $360/600 + j(450/600) = 0.6 + j0.75$.

Stage 2: Enter the chart. See Fig. 2.3. The normalised load is marked as Z_n.

Stage 3: Draw the auxiliary circle, shown dotted. This circle traces the impedance variations over a half wavelength. Arc A is a move of 0.1λ away from the load. At point R the line impedance reads $2.3 + j1.1$. And so on.

The point marked Z_2 is important. At this point the line impedance is resistive and is 3Ω. The value 3 is also the standing wave ratio, another useful piece of stored information.

The admittance variation can also be easily traced. Locate the load admittance at Y_n. The same auxiliary circle is used to follow the admittance variations back along the line.

A little thought will show that it is impossible to draw any auxiliary circle that does not cut the 1Ω resistance/conductance circle. In the example, the auxiliary circle first cuts the 1 circle at the point marked Y_1. This is the first point along the line at which the admittance is $1 \pm jb$. In this case, $Y_1 = 1 + j1.12$ siemens. Measurement on the outside scale shows that Y_1 is 0.295λ from Y_n. This is the distance from the load at which the extra reactance must be added to match the load to the line.

The required susceptance is $-j1.12$ siemens, equivalent to an inductive reactance. Reactance can be constructed from a length of short-circuited line. On the diagram, arc C shows that a length of 0.113λ will provide the necessary susceptance of $-j1.12$ siemens. Measurement starts from the right hand side of the diagram because a short circuit has infinite susceptance. To check this, convert the susceptance to reactance, as described previously, and measure from the left hand side of the diagram. The result should be identical.

Stage 3 actually derives two cable lengths. One is the length needed to produce a given reactance, the other is the distance from the load at which the extra reactance is attached. The extra piece is the "stub".

Summary

1: Normalise the load impedance. Enter chart and draw auxiliary circle.

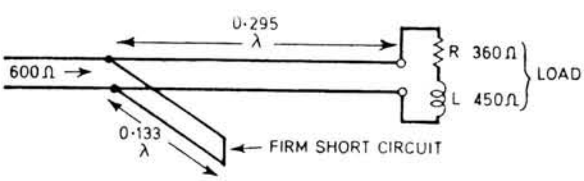


Fig. 2.4

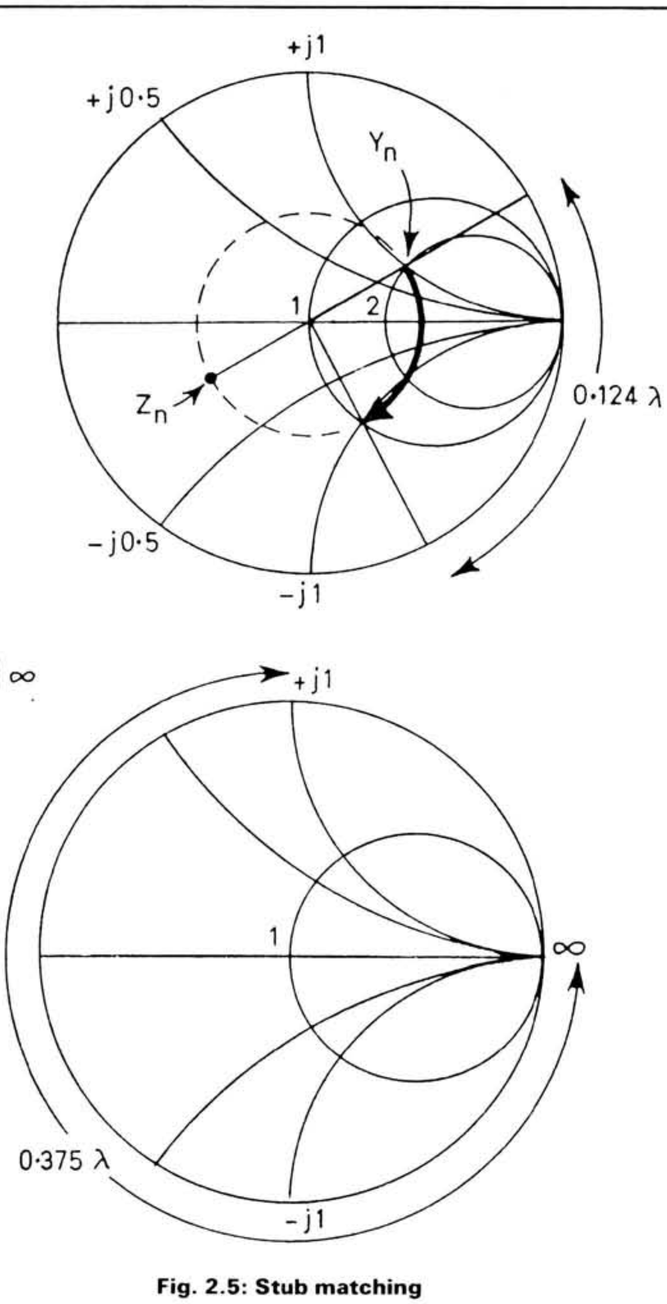


Fig. 2.5: Stub matching

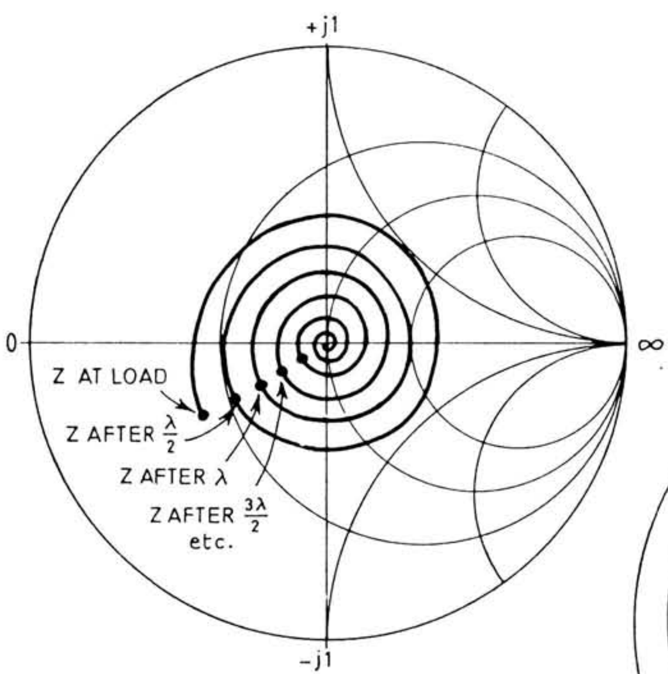


Fig. 2.6: The variation of Z along a lossy line

2: Locate load admittance. Move clockwise round auxiliary circle until it first cuts the $R = 1$ circle. Distance moved is distance from load to stub attachment point.
3: Read off susceptance at attachment point and reverse its sign.
4: From the short circuit point on the right hand side of the diagram, read off the distance to "reversed sign" susceptance. This is the stub length.

Using Fig. 2.5 where $Z_0 = 300\Omega$. $Z_{load} = 120 - j60$

1: $Z_n = 0.4 - j0.2$
2: $Y_n = 2 + j1$
3: Distance to $R = 1$ circle is 0.124λ
4: At this point, $Y = 1 - j1$, so stub susceptance must be $+j1$
5: From the B = infinity point, distance to $+j1$ is 0.375λ

Notes

1: The above method of matching is only suitable for fixed frequency and load. To change either would involve changing stub length and attachment point. A better matching method is to use two stubs at a fixed spacing from the load and each other. By careful selection of stub spacing, and by varying the length of both stubs, most load values can be matched. Readers may like to work out this system on a Smith chart, using a stub spacing of 0.375λ.

2: The effect of line loss has been mentioned previously. If load values are plotted over several wavelengths for a "lossy" line, the auxiliary circle is replaced by a spiral working towards the centre of the chart. This effect is shown in Fig. 2.6. Note that the spiral tends towards the $R = 1$ circle. This supports the idea that in a long line, the impedance seen by the source tends to Z_0 irrespective of the actual load mismatch.

Conclusion

The construction and a few uses of the Smith chart have been described. No mathematical proof of the construction has been given. Printed pads of Smith charts are available for those wishing to construct their own.

ERRORS & UPDATES

Semiconductor Tester December 1987

Capacitors used in this project can be any type providing they have a tolerance of better than 10% and their d.c. working voltage is greater than 60.

"... So signing clear with you and turning the beam north ..."

Whence Came Shack?

The term "Shack" is commonly used to refer to the amateur radio operational area. The derivation of this description can only have one source. Stan Crabtree tells us about the wireless cabin of the first British ship to be equipped with the new invention—a shack.

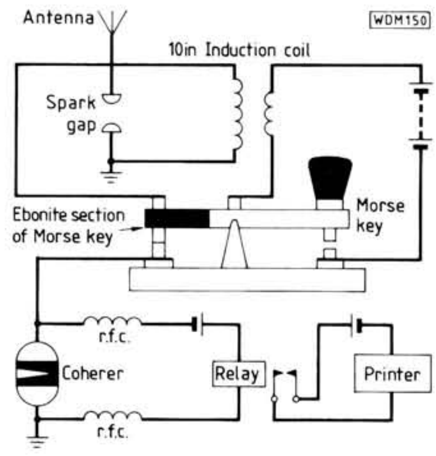
The Beaver Line's *Lake Champlain* was the vessel in question, sailing from Liverpool on 21 May 1901 for Halifax. It was over a year earlier that the first Merchant Ship had been fitted with wireless. The Norddeutscher Lloyd liner *Kaiser Wilhelm de Grosse* had since made many North Atlantic crossings and her wireless apparatus had been put to good use when in range of Southern Ireland, England and the North German Coast. The wireless room on the *Kaiser Wilhelm* was within the accommodation and the raucous note of the spark transmitter could be heard in the nearby 1st class cabins. It may have been the rumours of complaints from passengers that made the Beaver Line management decide to install the *Lake Champlain*'s wireless in an external location.

The term "shack" is perhaps not an apt description. Cupboard would be more appropriate. The structure was made of matchboarding, enclosing an area of length 1.83m and width 1.22m, one end being formed by the iron bulkhead of the upper deck. To a casual passer by it might well have been taken as a small vegetable locker. There were no windows and to obtain sufficient light the door had to be left open. Probably because there was no budget provision for this additional ship's structure the construction cost is recorded as £5.

Mr F. S. Stacey, who was to sail with the ship, assembled the equipment at the Marconi premises established at Hall Street, Chelmsford and proceeded by train to Liverpool with his excess baggage. He also assisted in the installation.

Power supply

The power supply consisted of four sets of 6 volt batteries, two being in use whilst the other two were being charged. Charging arrangements were basic, the mains voltage being dropped by six carbon filament lamps. The lamps, which were screwed to the wall, served a double purpose in dimly illuminating the enclosed area. The transmitter was the then usual 254mm induction coil. Although the "jigger"



The *Lake Champlain's* transmitter/ receiver set-up

coil, providing a certain amount of tuning, had been invented (and patented) by Marconi two years earlier for some reason it was not included in the equipment. The antenna was connected to one side of the spark gap, the other side carrying a cable to the ship's structure (earth). The spark producing components were balls of 15mm diameter with an adjustable gap.

The receiving apparatus consisted of two coherer detectors working a Morse inker via a relay. At this time headphones were not in use and for receiving purposes, the Morse signals were reproduced on paper tape in long and short dashes. A burst of atmospherics would ruin the intelligibility of a received message as at this time the human ear was not given the chance to differentiate between the two types of sound.

At the turn of the century the range of communication attainable was almost entirely dependent upon the antenna installation. On the *Lake Champlain*, two wires were supported vertically, 30.5m above the water line by a sprit of some 3.66m in length. This was hauled up the main mast in much the same way as rigging a sail. The wire used was electric lighting cable, kept apart by 1.83m spreaders.

Perhaps the most novel feature for the time was the send receive switch formed by the transmitting key. An ebonite extension was used to isolate the section holding the key contacts and a further two contacts were used to connect the aerial to the coherer when the key was "up". Upon keying, the receiver input was open.

The £5 capital cost expended did not extend to the operator's seating and for this Mr Stacey was obliged to use the two coil boxes, one on top of the other. The box of the coil in use served as a cupboard for other spares. The equipment was arranged on a shelf running across the width of the cabin. Some attempt at furnishing was made by using a piece of green baize as the table cover.

Set Sail

The *Lake Champlain* sailed from Alexandra Dock with some 1200 passengers on board.

Contact was first established with the coast station at Holyhead and subsequently with Rosslare. Messages were exchanged for the length of time the vessel was in range. Operating speeds were confined to 10w.p.m. as above this the coherer device did not respond. The size of the Morse key gap also limited high-speed signalling.

Once clear of the St George's channel, operations closed down. There were no further stations to contact. Stacey spent the rest of the sea voyage demonstrating the equipment to passengers and crew and found this much harder work than operating? Only two spectators at a time could be accommodated in the wireless cabin.

Arrival of the ship in Halifax, Nova Scotia, gave the opportunity once again of demonstrating the new means of communication. Newspaper reporters descended on the vessel and Stacey was obliged to describe in some detail just what happened. Public interest increased even more when the ship arrived at Montreal. The scene was much the same as a year earlier when the *Kaiser Wilhelm de Grosse* had arrived in New York with the newly fitted apparatus. Scientific Societies and the staff of technical colleges visited the ship. The Government Inspector of Telegraphs travelled from Ottawa and was much impressed with the

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Yaesu FRV8800 VHF converter for FRG8800 118-175MHz		100.00	(3.00)
Icom R71E HF general coverage receiver		825.00	(7.00)
Icom RC11 remote control unit for ICR71E		62.00	(2.00)
AR2002 VHF/UHF scanner 25-550MHz and 800-1300MHz		487.00	(5.00)
FRG9600 VHF/UHF scanner 25-950MHz		509.00	(5.00)
Icom R7000 VHF/UHF scanner, all modes 25-2000MHz		957.00	(7.00)
Icom RC12 remote control unit for R7000		62.00	(2.00)
New R535 VHF/UHF airband receiver		249.00	(4.00)
R537S Air band portable. Tunable 118-136MHz		69.51	(3.00)

NEW

Regency MX4200 Portable Scanner. Covers 60-89MHz, 118-136MHz, 144-174MHz, 380-495MHz and 800-950MHz.	ONLY	328.50	(5.00)
HF125 HF general coverage receiver 30KHz-30MHz (Made in Britain)		375.00	(5.00)

Icom

IC751A	HF Transceiver	1465.00	(—)
IC735	New HF Transceiver	949.00	(—)
PS15	P.S. Unit	158.00	(4.00)
PS30	Systems p.s.u. 25A	343.85	(—)
SM6	Base microphone for 751/745	46.00	(1.00)
IC290D	2m 25w M/Mode	542.00	(—)
IC505	10W/3W 6M multimode, portable/base	459.00	(5.00)
IC3200E	2m/70cms dual band mobile, with built in duplexer	556.00	(5.00)
IC02E	2m H/Held	269.00	(—)
IC04E	70cm handheld	299.00	(—)
BC35	Base Charger	70.15	(1.50)
HM9	Speaker mic	21.85	(1.50)
BP3	Std Battery Pack	29.90	(1.50)
BP4	Empty Battery Pack	9.20	(1.50)
BP5	High Power Battery Pack	60.95	(1.50)
CP1	Car Charging Lead	6.90	(1.50)
DC1	12v Adaptor	17.25	(1.50)
IC48E	10W 70cms FM mobile	449.00	(3.00)
IC28E	25W FM mobile (Tiny)	359.00	(3.00)
IC28H	45W FM mobile (Tiny)	399.00	(3.00)
IC-Micro	2 mini hand portable LCD display 1W	239.00	(3.00)

NEW

IC-275H	2M Multimode Base Station 100W	999.00	(7.00)
IC-475E	70cms Multimode Base Station inc. PSU. 25W	1125.00	(7.00)
IC-1200	23cm FM Mobile, 10W output, style similar to 28E	559.00	(4.00)
ICOM 761	HF general coverage transciever with internal PSU and auto ATU	2459.00	(7.00)
ICOM IC575	6 metre Base Station	999.00	(10.00)
IC-900	Multiband FM Transceiver. Requires optional Band Units	469.00	(5.00)
IIC-UX19	28MHz Band Unit. 10W	P.O.A.	(5.00)
IIC-UX59	50MHz Band Unit. 10W	239.00	(5.00)
IIC-UX29	144MHz Band Unit. 25W	229.00	(5.00)
IIC-UX29H	144MHz Band Unit. 45W	249.00	(5.00)
IIC-UX49	430MHz Band Unit. 25W	269.00	(5.00)
IIC-UX129	1296MHz Band Unit. 10W	P.O.A.	(5.00)

Power Supplies

DRAE			BNOS		
4 amp	48.30	(3.00)	6 amp	75.00	(3.00)
6 amp	71.53	(3.00)	12 amp	125.00	(3.00)
12 amp	95.16	(3.00)	25 amp	185.00	(4.00)
24 amp	137.54	(4.00)	40 amp	385.00	(4.00)

Aerial Rotators

DAIWA MR750E	Heavy Duty rotator. Can have up to 4 motors	254.10	(5.00)
KR400	Med/H Duty	139.00	(5.00)
KR500	6 core Elevation	149.95	(5.00)
KR400RC	5 core Medium Duty	169.00	(5.00)
KR600RC	6 core Heavy Duty	219.00	(5.00)
KC038	lower mast clamps	17.45	(2.00)
KS065	Rotary Bearing	29.95	(2.50)
AR1002	Lightweight VHF Rotator	52.95	(4.00)

Switches

Sigma	2 way SO239	20.20	(1.50)
Sigma	2 way 'n' Skts	22.95	(1.50)
Welz CH20A	2 way SO239	30.75	(1.50)
Welz CH20N	2 way 'n' Skts	54.00	(1.50)
Drae	3 way SO239	17.00	(1.50)
Drae	3 way 'n' Skts	21.95	(1.50)

CW/RTTY/Equipment

BENCHER			P&P
BY1	Squeeze Key, Black base	67.42	(3.00)
BY2	Squeeze Key, Chrome base	76.97	(3.00)
HI-MOUND MORSE KEYS			
HK708	Straight Key	21.50	(2.50)
HK702	Deluxe version of above on Marble Base	42.50	(3.00)
HK706	Straight key	23.00	(2.50)
HK707	Straight key	22.25	(2.50)
MK704	Squeeze paddle	20.00	(2.50)
MK705	Squeeze paddle on Marble Base	32.20	(3.00)

NEW

RTTY-EQUIPMENT

PK-232	Packet, Amtor, RTTY, CW, ASCII, FAX transceive in one unit. Works with any computer equipped with an RS232 interface. 12V operated	269.95	(4.00)
NEW FAX option for existing PK232 users (includes new manual)		49.95	(2.00)
NEW PK-87 1200 Baud Amateur Packet Radio TNC		169.50	(4.00)
NEW PK-90 Commercial Packet Radio TNC		465.25	(4.00)
SOFTWARE PACKAGES			
PK232/C64/128 Cartridge, overlays, cable, handbook		69.00	(1.50)
PK232/BBC-B & Master. E-PROM, overlay, cable, handbook		35.00	(1.50)
PK232/IBM-PC & Compatibles. Disc, handbook		39.00	(2.50)
P87/C64/128. Cartridge, overlays, cable, handbook		69.00	(1.50)
PK87/BBC-B & Master. E-PROM, overlay, cable, handbook		35.00	(1.50)
NEW FAX-1 Radio Facsimile Weather Map demodulator with double screened printer cable. Includes mounting bracket and NEW RTTY receive facility		279.95	(4.00)
CD660	Data Receiver for CW/RTTY/TOR/AMTOR/ASCII	264.97	(5.00)
CD670	As above but with built in LCD display	327.77	(5.00)
KEYERS & ACCESSORIES			
Star Master Key	Electronic Keyer	54.70	(3.00)
NEW Star	Masterkey electronics CMOS memory keyer	95.00	(3.00)
TRX3	Morse Oscillator	13.65	(1.50)
Datong	D70 Morse Tutor	56.50	(2.50)

MFJ

MFJ 989B 3KW Delux ATU	368.16	(5.00)
MFJ 962B 1.5KW Versatuner	241.95	(5.00)
MFJ 949C 300W Delux Versatuner	157.75	(4.00)
MFJ 941D 300W Basic ATU	105.13	(4.00)
MFJ 901B 200W Versatuner	63.07	(3.00)
MFJ 16010 Random wire tuner	42.02	(3.00)
MFJ 1701 6 way antenna switch 2KW	30.72	(3.00)

Aerials

6M Dipole		6.50	(3.00)
6M HB9CV 2 ele beam		12.95	(4.00)
6M 3 ele Beam		22.00	(12.00)
6M 5 ele Beam		32.00	(12.00)
AH-7000	Wideband Discone Antenna. 25-2000 MHz	82.00	(4.00)
Revcone	Wideband Discone Antenna. 25-550 MHz	30.50	(4.00)
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G5RV	Half size 51'	14.25	(2.50)
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HB9CV	70cms	3.95	(2.00)
2 metre	Slim Jim	8.95	(3.00)
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3" Ribbed end insulators (Polypropylene)		0.60	(0.75)
Limpet Mag Mounts		20.50	(3.00)
BOOKS	Confidential Frequency List (NEW Edition)	5.95	(1.00)
	Air Traffic Radio	2.25	(0.75)
	The Complete guide to VHF/UHF frequencies 25-2000MHz (NEW)	4.95	(1.00)
	The International VHF FM guide	2.85	(0.75)
	GUIDE TO FACSIMILE STATIONS	9.95	(1.00)
	Towards the RAE (Questions and answers book)	4.25	(0.75)
	Logbooks	3.50	(1.00)

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Alinco ALM-203E	2M Handheld C/W 30W Amplifier, Nicad, Charger	269.95	(4.00)
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system displayed. He obviously had the ear of the Government as a few days later the Marconi Company received a cable from the Canadian Authorities ordering two complete stations. They were to be installed for signalling across the Straits of Belle Isle, a distance of 35km. It was thought this would provide more consistent communications than the currently installed telegraph cable which was susceptible to damage by icebergs.

The first part of the return voyage was uneventful and Stacey again spent most of his time showing passengers the contents of the wireless shack.

He had asked to be advised by the bridge of the ship's position and as the *Lake Champlain* neared Southern Ireland he "fired up" the rig once again and set the spark gap to its optimum spacing. Checking the coherer he finally wound up the clockwork mechanism that powered the ink recorder. During his time away he knew that a new Marconi station should have been installed at Crookhaven and he expected to be the first vessel to establish contact. He gave a long call and settled back to await a response.

A minute later the receiving relay began to click and he leaned forward to look at the Morse characters endorsed on the paper tape. It was not Crookham replying but another ship asking for a signal report. A few minutes later he was exchanging messages with the *Lucania*, outward bound from the UK and the first Cunarder to be fitted with wireless. At the conclusion of signals, Crookhaven was contacted and messages were exchanged with the owners and with Queenstown where the ship was to berth. After leaving the Irish port, Stacey contacted Rosslare and later Holyhead on his way to the ship's home port of Liverpool.

It was to be another six months before the first wireless signals were to span the Atlantic and a number of years before liners on the North Atlantic sea route were able to rely on continual wireless communication from both sides of the Atlantic. **PW**

Feature

Practically Yours

By Glen Ross G8MWR

This month we were going to have completed our investigation into s.w.r. problems but I have decided to hold that over to a future issue because I have received several letters from people who are looking for a simple way to increase the selectivity of receivers, especially when receiving c.w. transmissions.

The Problem

Any decent receiver manufactured in the last twenty years or so will have a selectivity curve suitable for reception of s.s.b. but very few have the 150 hertz or so bandwidth that is required to really dig out the weak ones at the c.w. end of the bands. Some may have the facility to fit an extra filter but these are usually rather expensive. At the other end of the scale are the people who are playing about with direct conversion receivers which are notorious for wide bandwidth.

The Answer

For the man who is prepared to "roll his own" there is a simple and cheap answer which is also easy for the newcomer to home construction to both build and fit. What is this modern miracle I hear you ask. The solution to the problem is the humble 741 integrated circuit used as an active bandpass filter.

The Circuit

The circuit of the complete filter is shown in Fig. 1. It is designed around the following criteria. The bandpass response of the filter is designed to be centred on 800Hz, which is the pitch at which most people listen to c.w. The gain of the circuit is two and the Q is 6; this gives 3dB down points at 733 and 867Hz or approximately 150Hz bandwidth. The input impedance is high which means it can be connected to nearly any audio circuit and the output impedance is fairly low. In fact it is safest to keep the output load above about 250 ohms so as not to cause problems in the 741.

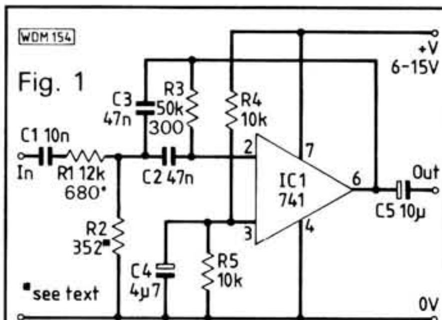


Fig. 1

Note that the resistors R1, R2 and R3 are made up of two resistors in each case. See the text for further details

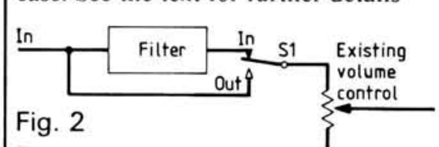


Fig. 2

Fool the 741

This type of integrated circuit is designed to be run from positive and negative rails with respect to circuit earth, but these are not always conveniently found and so a neat little circuit trick is used. By fitting resistors R4 and R5, pin 3 is set at half supply rail volts and is fooled into thinking that this is the circuit earth line. Capacitor C4 is used to decouple this point and ensure that no audio signals appear on the "faked" centre rail.

Building the Circuit

There are no special precautions to be taken when building the unit. The simplest way is to use a piece of Veroboard and set the components up very much as they appear in the circuit diagram. To get the desired results it is imperative to use 5% tolerance components where shown in the parts list. The resistors R1,2 and 3 are all made up of two resistors in series; R1 uses 12kΩ and 680Ω; R2 is made up of 330Ω and 22Ω and R3 uses 47kΩ and 3.3kΩ.

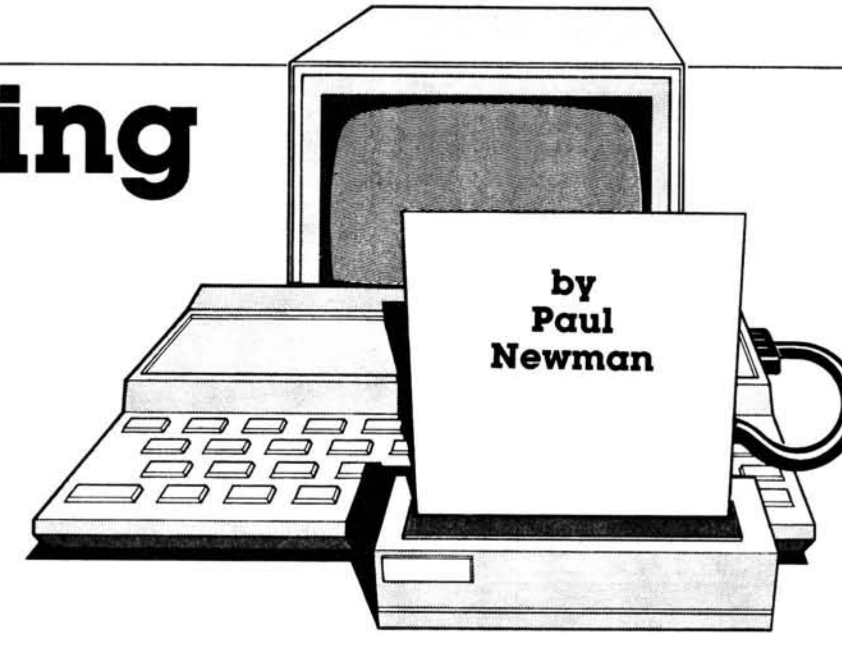
Installation

The installation circuit is shown in Fig. 2. The board is simply fitted at some convenient point in the case and the existing wire to the top end of the volume control is disconnected and taken to the input of the filter unit. Looking at the back of the volume control you will see three connections mounted in a group round the edge of the control. Looking at the back of the control the one you disconnect is the wire going to the most anticlockwise of the three contacts. S1 is fitted to allow you to switch the filter in or out of circuit. Obviously the zero volt line goes to the earth side of the equipment you are going to use the filter with and it should not be too hard to find a point where you can get a few positive volts; try the on/off switch assuming it's a transistorised receiver!

Components

IC1	741
R1-3	5% ¼ watt
R4-5	¼ watt
C2-3	5%
C4-5	15V electrolytic
S1	s.p.d.t.

Computing Corner



We have a lot of ground to cover this time, so I shall start with small items of interest to specific users.

Commodore C64 and C128 users may like to enquire about the Colour Meteosat picture system launched by I2CAB and I2AED[1]. This "interfaceless" system claims excellent colour picture quality and I understand IBM PC and Olivetti M24 versions are available.

I am pleased to pass on information sent by Ken Easum, Capetown, South Africa concerning a C64 FAX decoder. Disk or tape versions are available[6] at around 20 dollars.

The SpectrumWest Autotrack system for automatic satellite antenna tracking mentioned several issues ago attracted considerable interest. Des G8SBU forwarded further information for which I'm grateful. Neill Hill K7NH has left SpectrumWest taking rights to Autotrack. He has boards and software for C64 and Vic20, and software only for Amiga and IBM. If there is enough demand he can supply fresh boards for ZX81/Spectrum.

Neill has a new address[2] so I suggest that you write to him direct. Why not blow the dust off that old ZX81 and use it as a dedicated satellite tracking computer—it's cheap enough?

JEP Electronics[3] forwarded their current catalogue together with a copy of their Amstrad c.w. decoder program (which I'll review in a later issue). Morse-reader programs are available in Spectrum, BBC, MSX-1 Dragon, Vic20, ZX81, Atari 400-800XL and Amstrad 464 and 6128 versions. Sinclair versions operate through the "ear" socket though an odd-on is needed with the Plus-2 Spectrum. Other micros require a simple and cheap interface connected typically via the joystick port.

JEP market the "ear socket" adapter mentioned last time. In order to operate this with devices such as printers you need an expansion lead like that offered by Messrs Hawnt.[4] A Morse tutor is available for the Spectrum or MSX micros together with RTTY, c.w. and SSTV transceive programs for the Spectrum. JEP tells me that further programs are in planning including Amstrad and MSX applications.

G4IDE Microsystems have ceased trading, and none of their products are now available though the G4IDE/G4INP UoSat decoder for Spectrum can still be obtained via myself: I wish Roger good luck and thank him for supplying some interesting items in the radio-computing field.

The TX-3

There are now several transceive systems for single and multimode operation available on a number of micros so I was pleased to be offered the opportunity to review one of these—the Technical Software TX-3 for the Spectrum. The BBC-B version was viewed last month.

TX-3 is a program which uses either an interface or terminal-unit. The Spectrum version also needs an adaptor to supply the hardware which CBM and BBC have built-in. The TS interface is a high performance 2-stage device for c.w., AMTOR and narrow-shift RTTY. Transmit outputs for MIC, PTT and KEY are provided by very generous lead lengths with connectors for your specific rig. Audio input to the filter provides an external monitor-speaker output. Filter and interface are connected by a long ribbon-cable terminated with an IDC connector reducing the weak-points to the customary Spectrum edge-connector.

First, let's bear in mind that c.w. is usually hand-sent by operators each with his own "fist". Whilst most are easily read by an experienced operator, the imperfections can easily mislead a computer program no matter how good it is.

The TX-3 is clearly a complex system so any attempt at "live" operation straight away would almost certainly prove difficult and give a false impression. The TS instructions emphasise that you should understand the system and mode first and I strongly endorse this.

I set the system up using my cassette recorder as a source of pre-recorded c.w. and RTTY and, using the keyboard template and handy reminder-card provided, practised with the keys. Most selections are made using E or C-mode plus another key. The screen is the usual split-screen form. The lower type-ahead buffer area is used for memory and tape operations. Status lines are in the middle and bottom screen. Live-typed, and memory text is scrolled across the central line as it is sent.

Practice with transmit was carried out, again using the cassette recorder. This cannot prepare you fully—only "live" conditions can do this, as you will shortly see.

Next, I set up the program options using the tape-saveable option file. With such a sophisticated system this is highly desirable since so many options are available and various combinations are required for different operating circumstances. Memories are saved in similar fashion as is the QSO-review store (27.5K long!!). "Break" handling during tape operation is automatic, unlike many programs TX-3 won't crash here.

I now felt able to operate on h.f. and, having hooked everything up, set about finding readable stations on 14MHz c.w. My main problem was tuning technique—I was just too clumsy! Using the software 1300Hz filter together with the external filter in "RTTY" I succeeded in getting the program working well. Tuning is critical since correct operation depends on keeping the audio within the filter passband. Clearly, the filters are highly effective and the user should not be put-off by difficulties here.

I copied as many c.w. stations as I could find, gaining as much practice in this aspect as possible. The autotrack is very effective and on all but the noisiest, weakest signals sticks relentlessly to the Morse despite variations in sending speed. Several commercial Morse stations were copied faultlessly, in one case for over 45 minutes.

Operation of autotrack and TX tone/RX filter frequency is by keys 1-7 in E-CAPS and E-SYMB modes respectively. I advise being familiar with these combinations as mix-ups in the narrow confines of the Spectrum Plus keyboard are easy (less so on other micros though, I imagine.)

Having mastered receive, I put out

several CQ calls at a modest 15 w.p.m. (don't be tempted by the faster speeds yet, remember that most operators will be reading you by "ear", not with a micro)!

I had several QSO's across Europe and received complements on my excellent "fist!" It was clear from comments received that computer based c.w. stations are fairly uncommon, and great interest was shown in the TX-3 setup.

I tried TX-3 under a variety of band conditions varying from good to poor and never failed to get a QSO. On average these were as I would expect although several were longer than my unpractised "ear" and "fist" could sustain.

I now moved my attention to the higher-speed c.w. stations on 14MHz, finding some who seem to call "QRZ" or "TEST" for hours on end. I chose several operating at 50w.p.m.+, concluding these were probably micro-based. Their technique was almost contest-like (hurried CQ, listen, etc.) so calling required some smart keyboard operation, but this was fairly easy and contacts resulted. Once locked, receive operation was very good; possibly better than that from slower speed (hand-sent) c.w.

The most complex aspect to me was E-CAPS and E-SYM and I thought it a pity that what are probably the most crucial control-key operations should be so similar. During the learning stages, they are easy to confuse. It's hard to see how TS could have done these differently though perhaps it might be improved by a "lock options" feature.

I felt the significance of word-mode might be lost on the new-user and that a few more words of explanation were needed. Starting an over with a memory won't send anything until <space> is encountered following the end of the memory and although this is word mode doing its job, this could cause a new user a little consternation when transmission doesn't start as expected.

The memories are small (159 characters) compared with some programs although the 1023-character TX-buffer can be loaded from tape, and the QSO review-store can be loaded, saved, printed in part or whole, and retransmitted. The ability to link memories together adequately compensates for shorter individual memories.

The other aspects of TX-3 (RTTY and ASCII) remain largely untried, apart from a few RTTY contacts on 144MHz where operation was faultless. There is a lot of scope in TX-3 and I was particularly taken with the idea of exploring ASCII in more detail—there is a hint at sending computer routines by loading them into the TX-buffer (though I doubt the 1000-odd characters would be large enough). An "RTTY Mailbox" version of TX-3 might be a logical extension too.

Reviewing TX-3 was highly enjoyable; it is practical, nicely designed and full of potential. I found the learning stages difficult but amply rewarded after care in acquiring the right technique with program and transceiver. The would-be user is warned against the hasty approach. TX-3, like any complex system will only give its best after time spent getting to know its facilities.

Given the necessary alterations to operating technique, I found that using TX-3 as a computer-based c.w. system was great fun! I congratulate TS on a very worthwhile system and I'm grateful for the opportunity of reviewing it.[5]

One last-minute final-final! Charles Crane G4YFN[7] announces software for PC1512/1640 and IBM compatibles. Please contact him direct, with s.a.e.

References

(1) G Cameroni I2CAB and G Morellato I2AED, via D Chiesa 26, 27029 Viegvano (PV) Italy.
(2) Neill Hill K7NH, Neill Hill Enterprises, 22104 66th Avenue West, Mountlake Terrace, WA 98043 USA
(3) JEP Electronics, New Road Complex, New Road, Kidderminster DY10 1AL Worcs.
(4) Hawnt Electronics Ltd, Firswood Road, Garretts Green, Birmingham B33 0TQ
(5) Technical Software, Fron, Upper Llandwrog, Caernarfon, Gwynedd LL54 7RF
(6) Gary Sargent WB8TPD, 4227 Willow Run Drive, Dayton OH 45430, USA. Enclose 2 valid IRCs for a reply.
(7) Charles Crane Computing, 2 Pimento Drive, Earley, Reading RG6 2GZ.

ICOM

VHF/UHF FM Handportables

If you want a handheld with exceptional features, quality built to last, and a wide variety of interchangeable accessories, take a look at the ICOM range of FM transceivers, all ICOM handportables come with a nicad battery pack, AC wall charger, flexible antenna and wrist strap.

Micro 2E/4E

These new micro-sized 2 metre and 70 centimetre handportables give the performance and reliability you've come to expect from ICOM. Measuring only 148 x 50 x 30 the Micro fits in your pocket as easily as a cassette tape. The Micro 2E/4E features an up/down tuning system for quick frequency adjustments, 10 programmable memories, a top panel LCD readout, up to 2.5 watts of output (optional).

IC-2E 2 metre Thumbwheel Handportable

This popular handheld from ICOM is still available. For those amateurs who require a straightforward and effective FM transceiver the IC-2E takes some beating. Frequency selection is by means of thumbwheel switches (with 5Khz up switch) simplex or duplex facility. Power output is 1.5 watts or low 150 milliwatts (2.5 watts possible with BP5A battery pack).

IC-02E/04E 2 metre and 70cm Keypad Handportable

These direct entry CPU controlled handhelds utilise a 16 button keypad allowing easy access to frequencies, memories and scan functions. Ten memories store frequency and offset, these handhelds have an LCD readout and power output is 2.5 watts or low 0.5 watt. 5 watts is possible with the IC-BP7 battery pack or external 13.8v DC.

IC-12E 23cm Handportable

Similar in design and style to the 02E/04E this 1296Mhz handheld utilises ICOM's experience in GHZ technology, gained by the excellent IC-1271E base station. Power output is 1 watt from the standard BP3 nicad pack, external 13.8v DC powering is available to the top panel jack. With the growing number of repeaters on 23cm. The IC-12E makes it an ideal band for rag chew contacts.

ALSO AVAILABLE FOR ICOM HAND-PORTABLES ARE A LARGE RANGE OF OPTIONAL EXTRAS INCLUDING A VARIETY OF RECHARGEABLE NICAD POWER PACKS, DRY CELL BATTERY PACKS, DESK CHARGERS, HEADSET AND BOOM MIC, LEATHERETTE CASES AND MOBILE MOUNTING BRACKETS.

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The Battle of the Beams–Part 1

1940 . . . Now, nearly 50 years on from those near-disastrous days, how many of us remember (or even know of) the debt of gratitude owed to one man who confounded the radio experts, overcame officialdom—to earn Churchill's praise as the man who "broke the bloody beams"—and went on to unravel the secrets of German radar and Hitler's "V-weapons": the V1 pilotless flying bomb (the "doodlebug") and the V2 rocket?

But for Professor Reginald Victor Jones our official language today might well be German. D. V. Pritchard Dip Ed G4GVO tells the story.

Born in London in 1911, R. V. Jones was educated at St. Jude's, Herne Hill, and later at the Elementary School in Sussex Road, Brixton, where he won a scholarship to Alleyn's School, Dulwich. Awarded an Open Exhibition in 1929 to Wadham College, Oxford, he worked in the Clarendon Laboratory under the formidable Professor Lindmann (later Lord Cherwell and Winston Churchill's wartime Scientific Adviser), where he turned his talents to infra-red detection—an interest he was to pursue for the next 30 years.

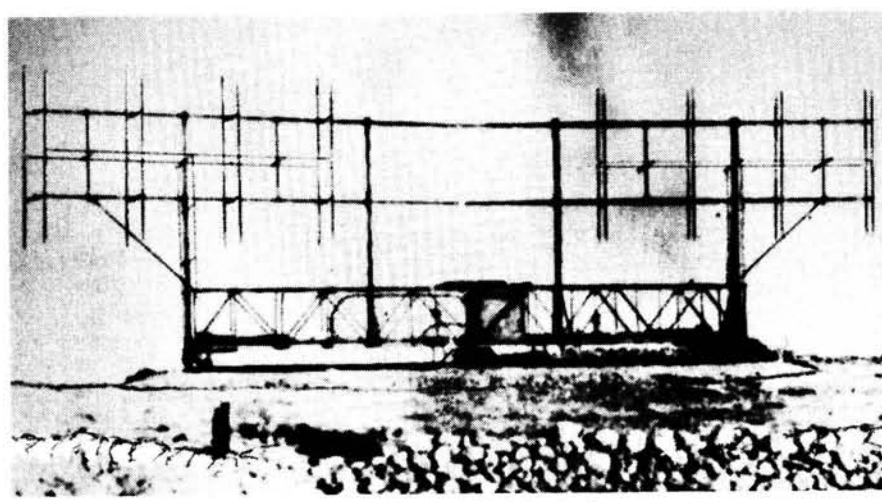
Fortunately for us, in 1939 he was appointed Scientific Officer to the Military Intelligence Service (MI6) to find out what the Germans were doing in the way of applying science to warfare, and in early 1940 he came to believe that they had a radio-navigation system by which they hoped to bomb accurately at night.

Knickebein—The Crooked Leg

From captured documents found in crashed German aircraft he came across the word *Knickebein*, or "crooked leg", The Germans were ridiculously informative with their codenames—it even sounded like a beam. But what kind was it?

Then two prisoners of war in conversation were heard to speak of something called *X-Gërat*, or "secret apparatus"; evidently it was something used in an aircraft and involved radio pulses. A thriller could hardly have a more intriguing title, but what was X-Gërat—and was it the same as Knickebein? Deeply interested, Jones pressed his Intelligence sources for more information and in March he was rewarded with the navigator's notes from a shot-down Heinkel: *Navigational Aid: Radio Beacons working on Beacon Plan "A". Additionally from 0600hr Beacon Dühnen. Light Beacon after dark. Knickebein from 0600hr on 315°.*

Shortly afterwards a co-operative prisoner said that Knickebein was a beam so narrow and exact that two of them could pinpoint a target with an accuracy of less than a kilometre. He also added that Knickebein was in some ways similar to X-Gërat, assuming that we were familiar with both systems!



Front view of a small Knickebein array

From the wreck of another Heinkel a diary was rushed to Jones. It read: *March 5. Two-thirds of flight on leave. Afternoon training on Knickebein, collapsible boats, etc.*

By this time the cryptographers at Bletchley Park performed a near-miracle by breaking the German *Enigma* code. One of the intercepted messages from a German aircraft was sent to him: *Knickebein, Kleve, is confirmed at position 53°24′ north and 1° west.* This meant that the aircraft had reported receiving the beam a few miles south of Retford in Lincolnshire, and Kleve (where Anne of Cleves came from) was on the nearest German soil to England.

But, clearly, there had to be two beams: one along which the bomber flew, and another one—a marker beam—to tell the pilot when he was approaching his target. Evidence of this second beam arrived a few days later in yet more salvaged papers from a crashed Heinkel: *Long-range Radio Beacon: Knickebein (Bredstedt) 54°39′, 8°57′, Knickebein (Kleve) 51°47′5″, 6°6′.*

So Bredstedt in Schleswig-Holstein was the source of the second beam!

Amateurs and Experts . . .

Obviously beams less than a kilometre wide at well over 300km called for very high frequencies—possibly something in the centimetric region —and although this part of the spectrum was in some use at the time, the power generated by valves then available was very low. Certainly the German system suggested they had overcome the problem. (It was only later that we discovered that German radar had been operating on 50cm since about 1930!)

However, Rowley Scott-Farnie G5FI, then a signals officer in RAF Intelligence, showed Jones a report by T. L. Eckersley, the country's leading propagation expert, in which Eckersley had computed the possible range of a 20cm transmitter sited in the Hartz Mountains. If the calculations were correct the signals would bend round the earth and might well be heard by a bomber at 20 000 feet over England. This information, together with the evidence he had already collected, prompted Jones to alert Professor Lindemann to the possibility that the Germans had a narrow-beam system for bombing the country. Lindemann naturally countered with the objection that the frequencies they would have to use could not possibly bend round the earth, but Jones produced Eckersley's calculations and told him that indeed they could.

But how were the Germans doing it? Inspection of captured aircraft revealed nothing unusual and the radio equipment seemed perfectly normal —certainly nothing in the way of centimetric receivers. He pressed for yet more information, especially from the prisoner-of-war interrogation centres. Did their aircraft carry special receivers for beam reception? Had we missed something?

Quite correctly the prisoners admitted nothing. But at one centre a prisoner was overheard to tell his friend that no matter how hard we looked for the equipment we would never find it. This startled Jones, for it implied that it was under our very noses and therefore we would never see it. Methodically he sifted through the captured equipment but the only item that fitted the bill was the receiver marked E Bl 1 (Empfänger Blind 1)—Blind Landing Receiver Type 1—which was used by both the RAF and the Luftwaffe for blind landing on the Lorenz Beam System.

The Lorenz System, however, only had a range of about 8km at best, unless the Germans has somehow dramatically increased its range. Knowing that Farnborough had evaluated the equipment, he enquired if there was anything unusual about the receiver.

"No," came the reply. "But since you mention it, the receiver is many times more sensitive than they would ever need for blind landing."

Could that be it! Dr Jones spoke to Lindemann, who drafted a note to Churchill: *"There seems some reason to suppose that the Germans have some type of radio device with which they hope to find their targets."*

Churchill initialled the note and sent it to the Air Minister, adding: *"This seems most intriguing and I hope you will have it thoroughly examined."*

A committee of enquiry was formed and Squadron-Leader R. S. Blucke was put in charge of flying operations. Three Ansons were fitted with suitable receivers and flown by Lorenz-trained pilots. Rowley G5FI, told Jones that the German pre-set frequencies were likely to be 30, 31.5 and 33.3MHz, and sure enough a few days later a scrap of paper recovered from yet another crashed aircraft read: *Knickebein (Kleve) 31.5.*

On June 20 a Heinkel was shot down and the radio operator, who had baled out, had torn his notes into shreds and was actually burying them when he was captured. An Intelligence NCO unearthed them, gummed them together and sent them to London: *VHF. Knicke 54°38'7"N, 8°56'8"E, 51°0'30"N, Eqms., Stollberg 30mc/s. Kleve 51°47'N, 6°2'E, 55°N, 2°Eqms., 31.5mc/s.*

This seemed to confirm the existence of another Knickebein installation at Stollberg, also in Schleswig-Holstein, and also Scott-Farnie's guesses about the frequencies. Yet after two flights the Ansons failed to find the beams.

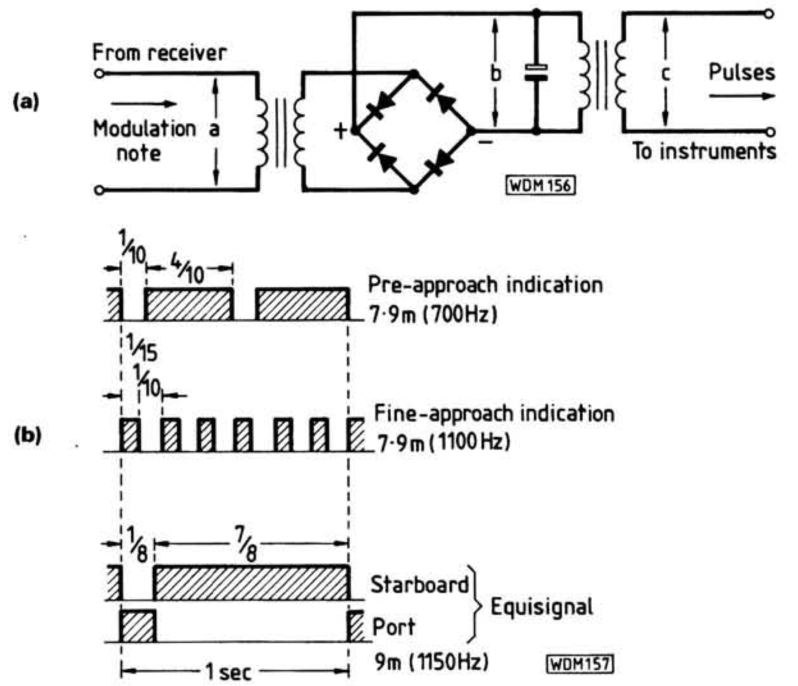
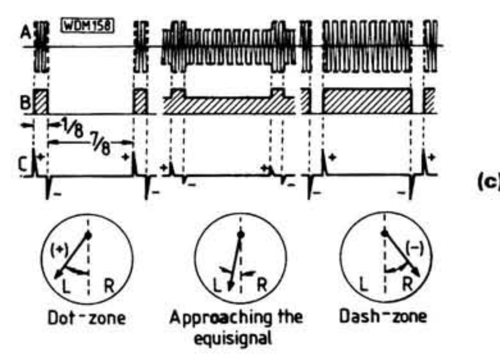


Fig. 1.1: The target-approach indication with the Knickebein system. (a) Pulse rectifying circuit. (b) Pulse-rate timing—distances in metres, tones in hertz (for approach on flightpath)



(c) Pulse-rectification and wave-forms (A) tone-modulated signal. (B) At rectifying circuit and (C) as final pulse

Was Jones wrong after all? Many thought so. Sir Henry Tizard was sceptical (and fell from Churchill's favour as a result); Air Chief Marshal Dowding was doubtful and Air Chief Marshal "Bomber" Harris was scathing. Other military and scientific brains looked askance at the young man who questioned established wisdom. Then suddenly on the same morning Jones was summoned to a meeting at Downing Street.

Thinking the message was one of Scott-Farnie's practical jokes, he arrived half an hour late to find the meeting already in progress. A galaxy of talent confronted him. Churchill sat on one side of the table flanked by Lindemann on his left and Beaverbrook on his right. Facing them was Sir Archibald Sinclair (the Air Minister), Sir Cyril Newall (Chief of the Air Staff), Sir Henry Tizard, Watson-Watt, and Portal and Dowding (Commanders-in-Chief of Bomber and Fighter Commands). Breathing his apologies to the Prime Minister, Jones took his place at the end of the table. An argument was taking place: did the beams exist or didn't they? Soon Jones realised that nobody in the room knew as much about the matter as he did. Suddenly Churchill snapped a question at him, and feeling he couldn't answer it out of context Jones said, "Would it help, sir, if I told you the story right from the start?" Churchill seemed somewhat taken aback but then replied, "Well yes, it would."

For the next 20 minutes Jones outlined his evidence. As he later recalled *"... although I was not conscious of my calmness at the time, the very gravity of the situation somehow seemed to generate the steady nerve for which it called. Although I was only 28, and everyone else around the table much my senior in every conventional way, the threat of the beams was too serious for our response to be spoilt by nervousness on my part."*

When he had finished an air of incredulity filled the room. Sir Henry

Tizard demanded to know why the Germans should use a beam anyway, assuming such a thing was possible —our own pilots found their targets very well by astro-navigation. (They didn't!—*Author.*) Others round the table seemed doubtful. But Churchill was convinced and asked Jones what should be done.

"I told him that the first thing was to confirm their existence by discovering and flying along the beams for ourselves, and that we could develop a variety of countermeasures ranging from putting a false cross-beam for making the Germans drop their bombs early, to using forms of jamming ranging from crude to subtle."

With a typical "Let this be done at once!" Churchill then turned round and tore a strip off the Air Ministry for their tardiness.

And Expert Amateurs . . .

Elated at having convinced the Prime Minister, Jones dashed away to attend a conference in the office of the Director of Signals, Air Commodore Nutting, to discuss the possibility that the Germans might exploit pulse techniques as navigational aids, and on which T. L. Eckersley was to give evidence. However, because Eckersley disagreed with Jones' findings, the subject reverted to Knickebein.

But what about those propagation calculations? Oh, those! Eckersley pooh-poohed them: he didn't believe them himself. He was only trying to demonstrate how far the signals *might* go under certain conditions. He thought he had been stretching theory too far, and doubted if signals in the 30MHz band would curve round the earth.

The Ansons had failed to detect the beams during their previous flights and another one was due that evening. In order to cancel it the Principal Deputy-Director of Signals, Group Captain O. G. Lywood, picked up the phone saying, "Well we have here *the greatest expert on radio propagation in the country* (author's italics) and he says the beam theory is all wrong. We've wasted a lot of time and let's not waste any more. This evening's flight should be cancelled!" But Dr Jones stood his ground. Pointing out that Eckersley's evidence had neutralised itself because he had said one thing a few months before and now said something quite different, and that enough evidence already existed to convince him, he demanded that Eckersley's statement should be ignored. He also told Lywood that if the flight was cancelled he would "jolly-well let the Prime Minister know who had countermanded his orders." Lywood backed down.

From the Chair, Air Commodore Nutting demanded: "And what do we do if we find the beams?" Quietly Jones whispered to Rowley Scott-Farnie, "Go out and get tight!"

Black Night and Bright Dawn

Dr Jones went home to spend one of the most miserable nights of his life. *"Had I, after all, made a fool of myself and misbehaved so spectacularly in front of the Prime Minister? Had I jumped to false conclusions? Had I fallen for a great hoax by the Germans? Above all, had I arrogantly wasted an hour of the Prime Minister's time when Britain was about to be invaded or obliterated from the air?"*

It was a beautiful summer's night—the shortest night of a terrible year for Britain—when Flight-Lieutenant Bufton and Corporal Mackie climbed aboard their Anson and flew over the area between Huntingdon and Lincoln. Neither had been told the Knickebein story, but merely to search for beams with Lorenz characteristics. Suddenly on the Hallicrafters receiver they heard signals on 31.5MHz. Dots!

The aircraft swung to the north. Still dots. Then—a continuous note, and later, as expected, a zone of dashes. When the dashes ceased Bufton and Mackie began intently to plot the beam. The following afternoon Bufton's report was on Jones' desk:

(1) That there is a narrow beam (approximately 400–500yd wide) passing through a position 1 mile south of Spalding, having dots to the south and dashes to the north, on a bearing of 104° (284°T).

(2) That the carrier frequency of the transmissions on the night of 21/22 June was 31.5mc/s, modulated at 1150 cycles and similar to Lorenz characteristics.

(3) That there is a second beam having similar characteristics but with dots to the north and dashes to the south synchronised with the southern beam, apparently passing through a point near Beeston on a bearing lying between 60°+ and less than 104°.

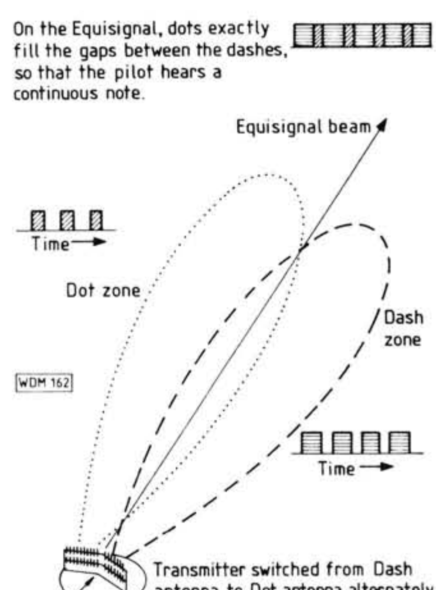


Fig. 1.2

Fig. 1.2: The principle of the Lorenz (Knickebein) beam

Fig. 1.3: The principle of the operating reflectors

Fig. 1.4: The principle of the Lorenz beam system

In other words the director beam was aimed at Derby where the Rolls-Royce factory produced engines for the RAF—as Jones had suspected. The impact of Bufton's report on the meeting that afternoon may well be imagined. Jubilation was in the air. Even "Daddy" Nutting was skipping round the room in delight. All doubts were now dispelled and countermeasures could go ahead urgently.

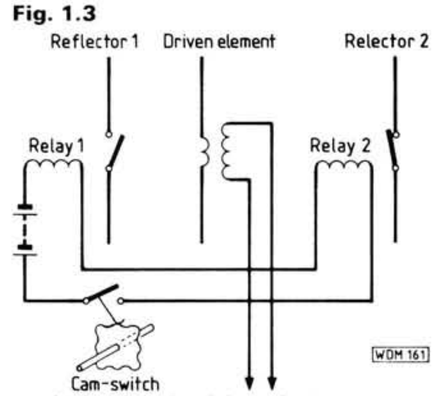
In the midst of the revelry Scott-Farnie button-holed Jones: "Remember what you said yesterday?"

So they bowled across to a pub to celebrate.

The Lorenz System

In 1932 a Dr E. Kramar of the German Lorenz Company began to develop a high-frequency blind-landing system on pre-set frequencies between 30 and 33.5MHz, continuous-wave modulated at 1150Hz. The beacon transmitter and its associated antenna system stood at the end of a runway and had a range of 3–5km (sometimes more depending on conditions) even though the transmitter developed 500 watts. The output was fed to a single dipole, to the left and right of which and at a $\frac{1}{4}$-wave spacing, was a single reflector cut at its centre point. A relay was employed to alternately close and open the reflector, as shown in Fig. 1.3, whereupon a beam was generated at an angle left and right of the driven element composed of dots to one side and dashes to the other (Fig. 1.4). These alternating beams partially overlapped each other centrally to give a narrow zone of about 3° angle in which

Fig. 1.3



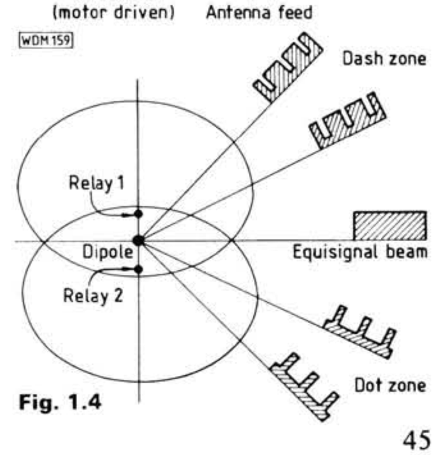


Fig. 1.4

the dots and dashes were heard as a single note, thus telling the pilot he was on the correct approach. A simple presentation unit was also provided in the cockpit which showed the course-deviation on a meter, and a form of range measurement was furnished by an S-meter arrangement.

Two additional transmitters were employed to aid landing (Fig.1.5). At a point 3km before the runway was an early-approach system on 38MHz with a power of 5W, but having a slower keying rate and a lower modulation note. The second system comprised a transmitter at 300m before the runway, with a higher key-rate and modulation tone. Both these systems operated a lamp on the presentation unit to give further visual indication.

The accompanying aircraft receiver was known as the EB 1 (Blind Landing Receiver 1), which was developed from the earlier EBE receiver. The system was made available to Lufthansa in 1934 and the aircraft were fitted with vertical rod antennas, usually ¼-wave whips. Later, the Luftwaffe produced a specification for what was to be called the Blind Landing System FuB 1, and which required two separate receivers: the EB 1 for signals in the range 30–33.3MHz, and the EBL 2 for 38MHz. All multi-engined aircraft of the Luftwaffe were fitted with these up to 1941.

As war seemed inevitable, in 1938 Dr Lohmann of Telefunken developed a much larger system which was called the FuS An 721. This was an antenna array of metal girders 30m high and 90m long which revolved on a circular iron track; in the middle was a 50-watt transmitter for 30–33.3MHz. The framework supported 16 vertical wire dipoles and reflectors and was arranged at an angle of 165° (looking down on the array), so that 8 2-element antennas were in each leg of the framework. From this "broken neck" appearance, *geknickten* in German, came the code-name Knickebein.

Details of the transmitters and receivers used are, unfortunately, no longer in existence, but the antenna lobes were similar to those shown in Fig. 1.6, except that the narrow equi-signal zone was ±0.3° wide and the keying of the dash-dot system had a ratio of 1:7. The improved receiver, another mark of the EB 1 known as the Fu Bl 1, could receive the beam at a range of 500km and a height of 6500m. The principle was that the main beam was directed at a target and the pilot knew he was on course when a continuous note appeared in the receiver; if he strayed to the left a preponderance of dots was heard, and a swerve to the right produced dashes.

By 1940, 10 smaller versions of Knickebein had been built which only required a circular track of 45m diameter, and each leg of the angled frame contained only 4 sets of vertical 2-element arrays which were broadbanded to tune between 30 and 33.3MHz by constructing them from wide-diameter tubing. The range was almost the same in practice as the large Knickebein, although the main beam width was wider at ±0.6°.

As already mentioned, in use the main beam was directed at the target and at a pre-determined point some distance before it was reached it was overlapped by a second beam on a different frequency, thus telling the pilot he was so-many kilometres from his objective. Fig. 1.6 shows the method in more detail.

Although no details remain of the receivers employed, it is known that they were t.r.f. types and, as will be seen later, very susceptible to jamming. For this reason a Dr W. Kloepfer of Lorenz developed a superhet, the EBL 3 H, which needed only slight preparation as it used the same p.s.u. as its predecessor and fitted the same cabinet. This was tunable over a number of channels from 1 to 34 in the spectrum 30–33.3MHz, and could receive the Knickebein transmissions at the same height and range of the earlier model.

Pulling the Crooked Leg

A special unit was set up to counter the beams (which were code-named *Headaches*) under the command of Wing Commander E. B. Addison of No. 80 Wing at Radlett. The technical design of the countermeasures was the responsibility of Dr Robert Cockburn of the Telecommunications Research Establishment at Worth Matravers. Both organisations were accorded the highest priority.

Receivers were placed on top of the masts of certain stations of the Chain Home RDF (radar) system, and the unlucky operators in these dizzy crows' nests were connected by telephone with Fighter Command Headquarters at Bentley Priory.

Professor Jones records how he, too, spent a night on top of one of these towers, listening to the signals which Eckersley had said could not be heard even by a bomber at 20 000 feet over England: *"When about dusk the German beams were switched on, the men in the towers would be able to pick them up and let us know, for instance, if a beam was going between tower 'A' and tower 'B'. That would give us a clue to the beam's position, and one of our chaps would go up in an Anson and fly back and forth until he picked up the beam, which could then be plotted."*

The first jammers were diathermy sets used by hospitals to cauterise wounds. These were requisitioned and tuned to the Knickebein frequencies, and although they only emitted a mush of signals it was thought that they had some effect on the beams. Installed mainly in police stations, they were switched on when ordered by No. 80 Wing.

Fortunately we had acquired the Lorenz licence before the war, so Lorenz transmitters were modified and strategically placed, as were "Meacons", or mock beacons. The Luftwaffe, with more than 80 radio beacons at their disposal in Germany and occupied Europe, began to find radio-navigation an ever-increasing problem. But it was Cockburn's jammers (code-named *Aspirins*) that were most effective. Immensely powerful, they flooded the beams with dashes and the German pilots, flying into their own dash-zones, would steer to find the equisignal only to find Cockburn's dashes. They would continue turning until they found a dot-zone (and Cockburn's dashes) which often synchronised into a false equisignal note. After they had found themselves flying round in circles during bombing raids for a few weeks, they came to realise that we had found and jammed their system. We had, in fact, "pulled the crooked leg". An additional bonus lay

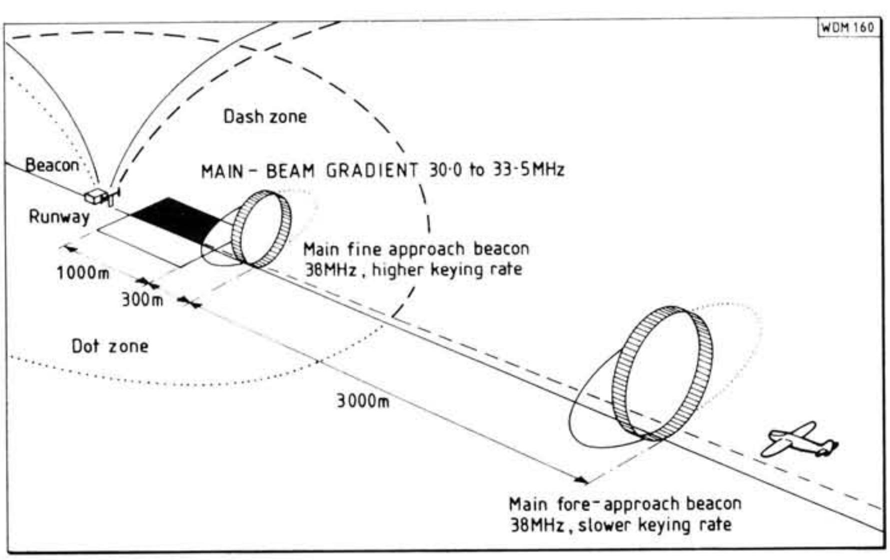


Fig. 1.5: The principle of the Lorenz blind-landing system

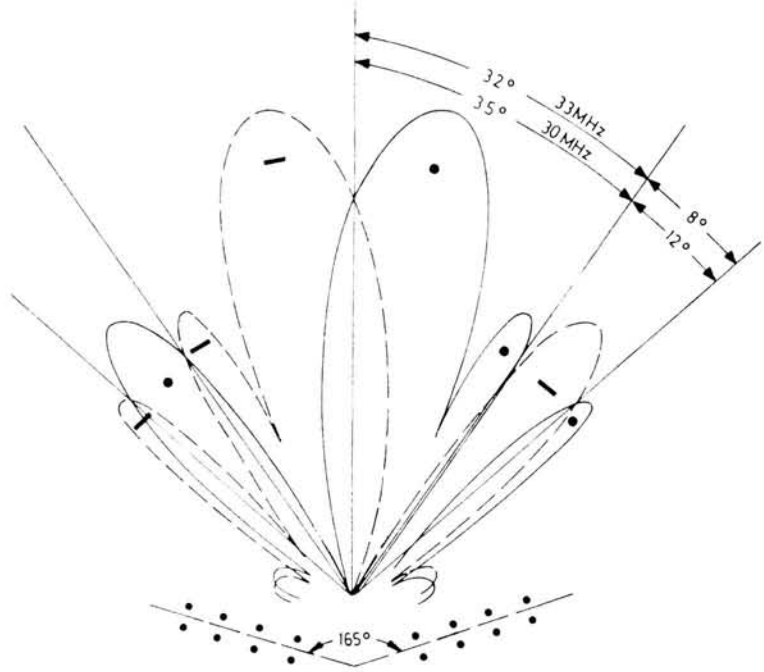


Fig. 1.6: The antenna pattern of the Knickebein array

in the fact that it was several months before the German pilots had the courage to tell Goëring that Knickebein was useless.

Had the system worked successfully a number of bombers could have put a bomb *every 17 metres* into a selected target. As it was our cities suffered a severe mauling from the Luftwaffe: how much worse the loss of life and property would have been but for the efforts of a young physicist who refused to believe the experts, and courageously challenged his superiors.

Today one wonders how many Londoners and citizens of our other major cities have heard of Professor R. V. Jones.

In Part 2 of his series, G4GVO describes how the X-Gerät mystery was unravelled.

IC of the Month

There are a great many audio amplifier integrated circuits on the market which can be used with extremely simple circuits to build a power amplifier unit with a minimum of trouble; however, most of these devices provide only moderate audio output levels. Brian Dance tells us about the Hitachi HA-1397 which can supply up to 20W of audio power to a loudspeaker, considerably greater than most competitive devices.

Twenty watts is about the maximum power level obtainable from a single integrated circuit. The output power level of 20W can be obtained at frequencies over the range of 20Hz to 20kHz, with a total harmonic distortion of 1 per cent. Distortion is considerably less at lower output levels, typically 0.04 per cent at 2W output at 20kHz (maximum value for any HA-1397 is 0.2 per cent).

The HA-1397 Device

This unit is a single-in-line audio amplifier. That means it has a single line of connecting pins (12) instead of the more usual two lines employed in dual-in-line devices. It is backed by a small piece of metal with two holes for bolting the device to a suitable heatsink.

Its internal circuit in block form is shown in Fig. 1, together with a suitable external circuit. The main power supply lines are the positive line to pin 5 and the negative line to pin 12. The absolute maximum permissible values for these supplies are +30V and −30V respectively; higher voltages are likely to do permanent damage. It is strongly recommended that supplies of appreciably lower voltage than these limiting values be employed so as to allow a reasonable margin for supply voltage variation etc. A value of ±22V is recommended and will allow the 20V output level to be achieved; the use of much lower supply voltages will cause a lower maximum output power to be obtained. These main power supply lines need not be regulated.

The quiescent power consumption from the main positive line is in the 20 to 120mA range, with 60mA being typical; maximum quiescent current to be supplied by the negative supply is 152mA. Both the positive and negative supply currents greatly increase when a signal is applied to the device input.

Although large electrolytic capacitors will be used in the power supply unit from each power line to ground, the small non-electrolytic capacitor, C8, is connected between the two lines to prevent possible high-frequency instability. Electrolytic capacitors have a relatively high impedance at high frequencies and there may be unwanted coupling from the relatively long connections to the p.s.u. if C8 is omitted: C8 should be connected directly to the device pins using short leads.

The auxiliary positive supply, +V2, should be a regulated supply about 3 to 5V greater than the main positive supply when the device is delivering its rated output power. This second power supply line operates the internal muting circuit so that pop noise is minimised when the p.s.u. is switched on; the +V2 voltage should rise with a time constant of about two seconds. The absolute maximum value of this auxiliary positive voltage is 30V; under quiescent conditions the current from the auxiliary supply will not exceed 22mA.

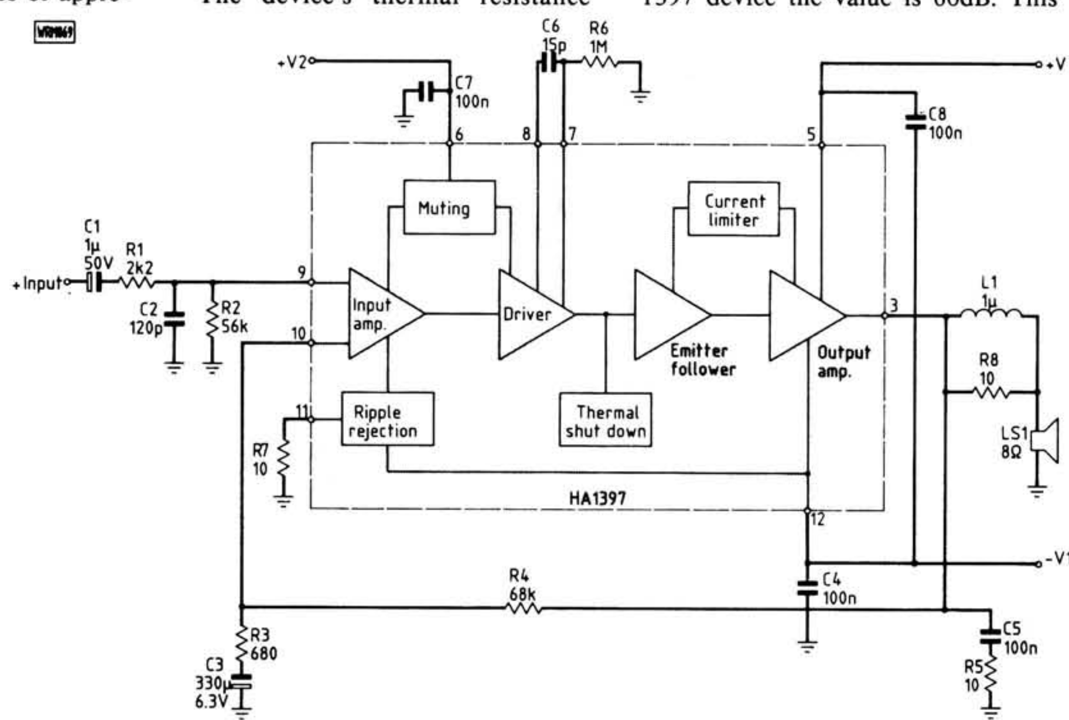
The device's thermal resistance between the junction and the metal tab is 2.5°C/W. Absolute maximum device power dissipation is 30W for a 75°C tab temperature; this corresponds to a junction temperature of 150°C. The absolute maximum output current is 7.5A and maximum permissible input voltage is ±10V.

Thermal Shut-down

Incorporated into the HA-1397 device is a thermal shut-down circuit which prevents damage from occurring if the device becomes too hot. If the temperature of the i.c. exceeds about 150°C, the protection circuit will automatically reduce the output current.

The resistor, R7, between pin 11 and ground is used to prevent excessive transient current when the p.c.b. is tested with imperfect power supply ground on the assembly line; it is recommended that this resistor is used in all circuits.

A ripple-rejection circuit incorporated into the device provides a minimum of 52dB ripple rejection at a frequency of 100Hz when a 5.1kΩ input resistance is employed. In a typical HA-1397 device the value is 60dB. This



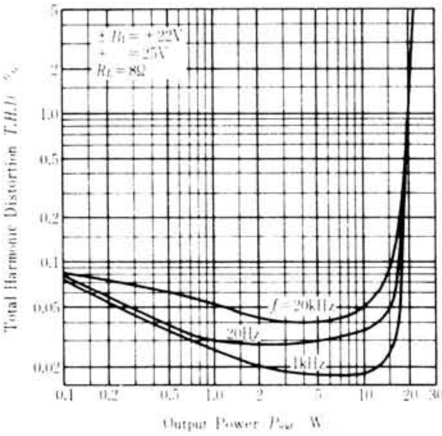


Fig. 2: Total harmonic distortion vs output power

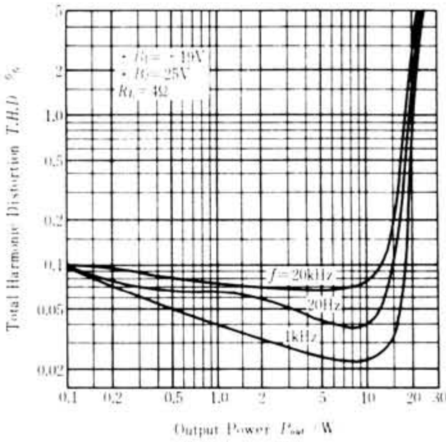


Fig. 3: Total harmonic distortion vs output power

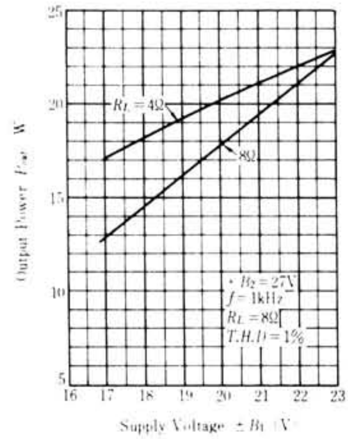


Fig. 4: Output power vs supply voltage

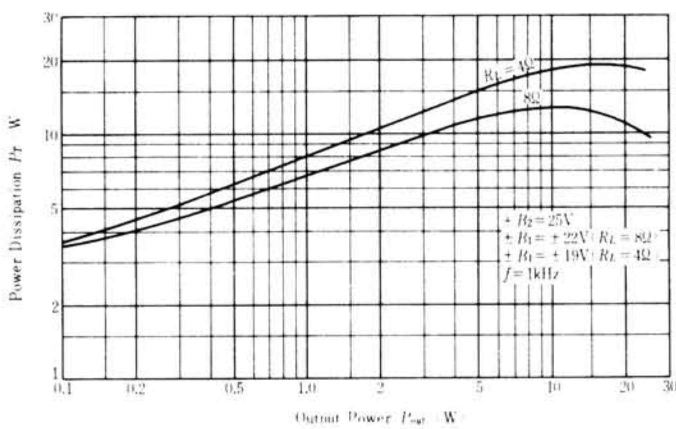


Fig. 5: Power dissipation vs output power

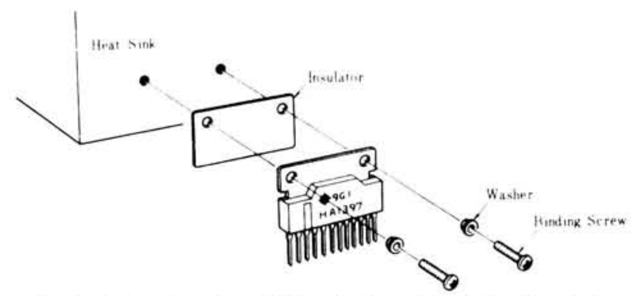


Fig. 6: How the tab of the device should be insulated

means that the ripple at the output pin is at least 52dB below that on the power supply lines to the device.

Gain

The voltage gain provided by the device is set by the ratio of R4 and R3 and is about 38dB with the values shown; reasonable changes in the values of these resistors can be made to alter the circuit gain if desired. The device open-loop gain without feedback (R3 = 0) is typically 88dB.

As is the case with all power amplifiers, the total harmonic distortion at the output varies with the output power level, the supply voltage and the frequency, Fig. 2 shows its typical values for supplies of ±22V +V2 = 25V and an 8Ω load. Similar curves for ±19V supply lines with a 4Ω loudspeaker are shown in Fig. 3. It can be seen that there is a very rapid rise in the distortion level as the rated power output is reached when the Class-B amplifier circuit is driven to the point at which clipping of the peaks of the output waveform occurs.

The output power obtainable at various main power supply voltages is given by the graphs in Fig. 4 for 8Ω and 4Ω speakers. Power dissipation against the output power is shown in Fig. 5 for the same two values of load impedance. Care must be taken that the absolute maximum internal power dissipation of 30W is not even approached or one risks destroying the amplifier device.

Mounting

The device manufacturer recommends that a torque of 4 to 8kg-cm is used on the screws which hold the device to its heatsink, and it is vital that excessive force is not used; on the other hand too little torque will increase the thermal resistance to the heatsink. Oval counter-sunk screws must not be used, since they can subject the HA-1397 to intense stress; if a tapping screw is employed it should have a diameter smaller than that of the holes in the HA-1397 mounting plate, and the torque recommendations for such screws should be observed. The heatsink screw holes should be spaced by 20 ±2mm.

Care should be taken to ensure that the heatsink surface is quite flat, since a non-flat heatsink can result in greatly increased thermal resistance and subject the internal components of the HA-1397 to excessive stress; the heatsink surface should be flat to ±0.1mm over the contact area. The holes should have burred material removed and the fixing hole size should not exceed 4mm diameter.

Thermal coupling grease should be used between the metal tab of the device and the heatsink, but avoiding an excessive amount of the compound. The HA-1397 should be fixed to the heatsink before the leads are soldered as this minimises strain on the connections, etc. If the heatsink is to be electrically connected to ground, the tab of the device should be insulated as shown in Fig. 6.

Radio Use

Hitachi recommend that certain precautions be taken when using the HA-1397 with an a.m. or f.m. radio tuner.

An adequate distance should be allowed between the ferrite antenna of an a.m. receiver and the HA-1397 so that high currents in the power supply lines, and in the output line, do not affect the ferrite; the antenna should be placed near the speaker leads.

The circuit in Fig. 1 provides for operation at frequencies of up to 100kHz or more. For use with a radio receiver it is suggested that the capacitor, C6, between pins 7 and 8 be increased to 22-47pF to reduce high frequency gain; this will improve stability at high frequencies.

The maximum signal from the tuner may produce clipping of the waveform and a harmonic signal return to an a.m. receiver antenna ferrite bar. Over-driving of the power output stage can be prevented by setting V2(+) at a value below 25V.

For high-sensitivity a.m. reception it is suggested that electrolytic capacitors of not less than 47μF (35V) be connected between pin 5 and ground, and between pin 12 and ground; alternatively, an additional capacitor of about 10pF may be connected between pins 7 and 10. Some trial-and-error experiments are clearly required if problems are experienced with unwanted coupling under such conditions.

Inductance L1 may comprise 9 turns of 1.5mm dia. e.c.w. on a 15mm dia. former. **PW**

PW REVIEW

A monitor 'scope can be very useful, Mike Richards G4WNC reviews the Revex MS1.

This rather neat unit from Revex combines the functions of a simple oscilloscope with a useful r.f. monitor-scope. As can be seen from the photographs, the MS1 is attractively styled and looks similar to a modern oscilloscope. An r.f. monitor-scope is a useful addition to the shack and enables many parameters of the transmitted signal to be checked at a glance.

Operation

Connecting up the MS1 is simplicity itself. The prime use is as a monitor-scope and to achieve this the MS1 is connected between the transmitter output and the antenna tuning unit or antenna. This connection is eased by the provision of two SO-239 sockets on the rear panel which are clearly marked ANT and TX. These rear mounted sockets are specified as suitable for use between 1.8MHz and 54MHz which is a very useful range.

The MS1 is mains powered and can be set for either 240 volt or 110 volt operation. The power is supplied via a 1.4m cable which comes complete with a moulded continental two pin plug for connection to the mains via a suitable fused adaptor.

The supplied manual comprised a single sheet of paper folded into four and printed on both sides so making eight A4 sides of text. Although the manual was obviously rather brief, it did cover the basic operation and was adequate for the user who is already familiar with the measurement principles.

My first problem after switch-on was to find the trace! It's surprising how difficult this can be on an unfamiliar piece of equipment. The problem was finally solved by selecting SSB, setting the brilliance (intensity) to maximum and carefully adjusting the horizontal and vertical position controls until the trace appeared!

The MS1 is provided with three basic monitoring modes, each of which are selected by push-buttons on the front panel.

One of the most useful and consequently most used monitoring techniques is the trapezoidal pattern. This technique literally produces a trapezoidal pattern on the screen which, if perfectly proportioned, indicates a good transmission. The display is actually produced by feeding a small amount of r.f. signal to the vertical input and a sample of the audio signal to the horizontal input. The signal samples are derived within the MS1 thus requiring no additional connections which is a good point. The height of the displayed pattern can be adjusted with a stepped attenuator on the front panel, though the sensitivity is perhaps a little low if you are a keen QRP operator. When set to maximum vertical sensitivity I found that the review model required some 2.5 watts of r.f. to produce a vertical deflection of one division on the display. The width of the display is also adjustable by using the horizontal gain control which, incidentally, had a very wide range of operation. Finally the position of the trapezoid pattern on the display can be adjusted both horizontally and vertically by adjusting the appropriate position controls on the front panel.

These various adjustments meant that a good pattern could be obtained for any power level from about five watts up to the maximum of 1kW. One very useful feature when in trapezoid mode is that the display is blanked in the absence of any r.f. hence preventing damage to the display tube through the long term display of a steady line.

The next monitor mode available is the SSB mode. When this mode is selected a sample of the transmitted r.f. is fed to the vertical deflection amplifier, whilst the horizontal deflection is controlled by the internal sweep oscillator. This monitoring technique produces a classic display of the modulation envelope. As with the trapezoid mode the position of the display is fully adjustable. There are however a few more adjustments required in order to achieve a satisfactory display. The main adjustment is to set the internal sweep oscillator frequency so that the audio modulating waveform is clearly displayed. I found that the sweep oscillator frequency range was more than adequate for the purpose and a clear display was quickly established. As well as monitoring the modulation envelope of audio signals the SSB mode can be used very effectively to check for key clicks when using c.w. The presence of key clicks is indicated by a very sharp leading or trailing edge on the displayed pulses of carrier.

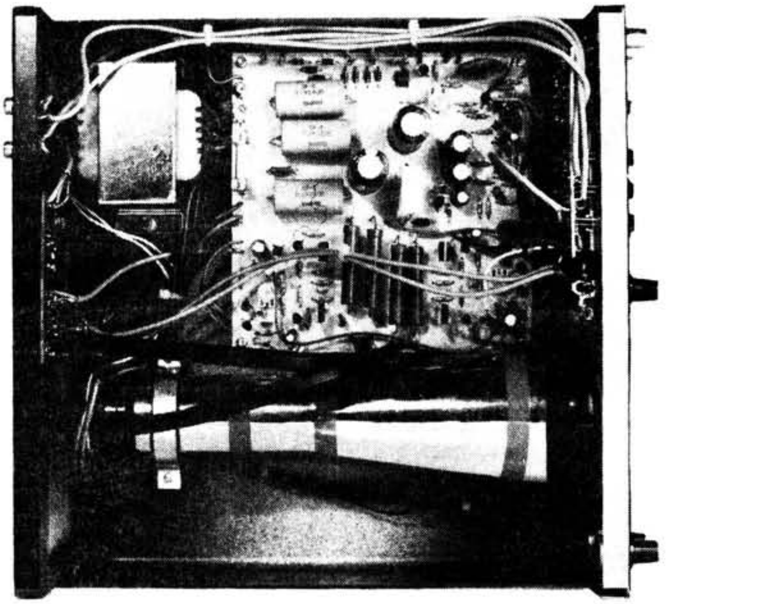
If you are a RTTY operator then this next mode is likely to prove very useful. The RTTY mode allows the connection of the mark and space outputs of your terminal unit to the monitor-scope. This is of course only possible if your RTTY terminal unit is provided with external mark and space outputs! There is a choice of connecting the terminal unit outputs to either the front or rear BNC sockets on the MS1, the rear sockets being the norm. When all is connected up the display will show a cross pattern for a correctly tuned signal and can be used as an effective tuning aid. In order to obtain a clear cross pattern both the vertical and horizontal gain and position controls have to be adjusted. One important point I did note was that the maximum input to both the vertical and horizontal inputs is 1 volt without the attenuator or 10 volts with the attenuator. This means that the terminal unit output voltage should be checked before being connected to the scope. If the input voltage limits are exceeded then the first effect is that the input waveforms are distorted making it impossible to obtain good monitor patterns. Obviously if the limits are greatly exceeded then the scope will probably be rather more permanently damaged.

One final and extremely useful facility is the ability to use the MS1 as a simple audio oscilloscope. To do this the MS1 is set to SSB mode and the signal to be viewed is connected to the vertical input via the BNC connector on the front panel. The internal sweep oscillator provides the horizontal movement of the trace and the sweep frequency is adjustable over a very wide range in three bands. The width of the display also has a very wide range of adjustment which can prove very useful. One point to watch is the input sensitivity of the vertical amplifier which, as described earlier, is limited to a maximum input of either one volt or 10 volts depending on the attenuator setting. This limitation needs to be carefully observed otherwise the displayed results will be meaningless. One other limitation of the vertical amplifier is the frequency response which only extends to about 40kHz making it suitable only for audio work. The input impedance of the vertical amplifier is 1MΩ which is good as it means that standard oscilloscope probes can be used. As none of the controls had calibrate positions the MS1 could not be used as a measuring instrument in the same way as a conventional oscilloscope. Of course if an accurate signal was applied to the MS1 the various controls could be adjusted to give a temporary calibration to enable measurement over a limited range. In practice probably the most common use of an oscilloscope is as a signal tracer and for this use the MS1 is perfectly adequate. When used as an audio oscilloscope I found that I could easily obtain a steady display of frequencies between about 30Hz and 20kHz. Although higher frequencies could be displayed it was difficult to obtain a steady trace above about 20kHz.

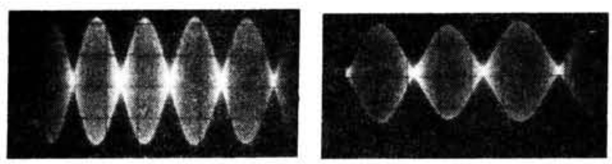
Performance

During the review period the MS1 has been in daily use in my shack and has been connected between my trusty Icom IC-720A h.f. transceiver and the a.t.u.

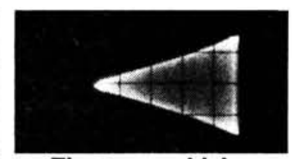
The 75mm cathode ray tube display had a very good range of brilliance adjustment and the focusing was very sharp giving a good clear image regardless of the ambient light conditions.



The internal view of MS1



Two waveforms showing a typical modulation envelope



The trapezoidal waveform

I found that the most used monitoring mode was the trapezoid facility as the display was easily interpreted whilst on the air. The other good point about this mode was that the display was blanked during reception. I also found that once initially set-up the trapezoid mode required no further adjustment unless the r.f. output was drastically changed. The facility to view the modulation envelope was particularly useful for checking non-speech transmissions, i.e. RTTY and Morse, etc.

Although the MS1 is specified for use up to 54MHz, the current UK power limitations on 50MHz combined with the MS1's sensitivity means that the monitor display on this band will be rather small.

I also noted that the MS1 introduces a certain amount of frequency dependent mismatch when using the antenna and transmitter connections on the rear panel. This mismatch gave a s.w.r. which ranged from 1.1:1 at 3.5MHz to 1.3:1 at 29MHz.

When used as a simple audio oscilloscope the MS1 performed well, but the input overloading mentioned earlier can easily catch you out if you're not careful.

The general control layout and mode selection was very well designed. I particularly liked the fact that the MS1 could be left permanently connected both to the antenna and the terminal unit, using the front panel switch to select the front or rear inputs for scope or RTTY use.

Overall I would sum-up the MS1 as a useful addition to the shack for the h.f. orientated amateur who requires a monitor scope and simple oscilloscope in one neat unit.

The MS1 monitor-scope is available from ***Waters and Stanton, 18-20 Main Road, Hockley, Essex SS5 4QS*** price £269 inc VAT plus £3 carriage. My thanks to them for the loan of the review model.

Specification

RF Section:
Frequency range: 1.8MHz to 54MHz
Maximum power: 1000 watts p.e.p.
Impedance: 50 to 75Ω

Vertical Amplifier:
Input Impedance: 1MΩ
Frequency Response: 10Hz to 40kHz.

Horizontal Amplifier:
Input Impedance: 1MΩ
Frequency Response: 10Hz to 300kHz.

Sweep Generator:
Frequency range: 100Hz/1kHz/10kHz

CRT: 75mm round monitor.

Power requirements: 100-117V or 220-240V a.c. 30 watts

Dimensions: 270 × 116 × 305mm

Weight: Approx 4.2kg

In the first part of this series we saw how electrical energy was turned into an electromagnetic wave and radiated into space. What I would like to show now is how to extract some of the energy by reconverting it to an electrical signal, says A. J. Harwood C Eng MIERE G4HHZ.

Making Waves—A Guide to Propagation

Part 2—Are You Receiving Me?

To do this of course we need a receiving antenna and so in this month's article we'll look at some aspects of antennas. The easiest one to start with is our old friend the half wave length dipole.

If we can recap on Part 1, the important results were that the wave carries energy in the form of an electric field E and a magnetic field H and the energy flows at a rate of $E^2/120\pi$ watts per square metre. So what happens when we put our dipole into the wave; perhaps the first question to ask is how do we place it in relation to the wave? The answer is that we put it parallel to the electric field which also means it is at right angles to the magnetic field. With this orientation, the dipole intersects the magnetic and tries to "short-out" the electric field. It is these actions which induce a voltage in the dipole. The next question is how much voltage?

At first sight if the length of the dipole is $\lambda/2$ metres and the field strength is E volts per metre, we might expect the answer to be

$E \times \lambda/2$ volts

However, it's a little more complicated than that, (but not much more). The voltage induced on the dipole is not evenly distributed along its length, but assumes the familiar sinusoidal (strictly speaking cosinusoidal) distribution being maximum at the ends and a minimum at the centre terminals and it is the average value of the voltage which in fact drives a receiver. Now the average value of something which has an overall distribution of a half sinewave is $2/\pi$ times the maximum. So if the voltage has a sinusoidal distribution with a peak value of $E \times \lambda/2$ then the voltage at its terminals, V volts, has an average of:

$(E \times \lambda/2) \times (2/\pi)$ so,

as shown in Fig. 2.1, we have

$$V = E \times \lambda/\pi$$

This isn't all the story though; if we want to make the received signal do something useful, such as drive the front end of a receiver, we need to consider the dipole as a generator and to know its internal impedance.

To find this, it is necessary to resort to a mathematical analysis which shows that it is 73.2 ohms. This is also known as the radiation resistance since, when the dipole is used as a transmitting antenna, the power radiated can be considered to be dissipated in a resistance of 73.2 ohms. Now, any generator delivers the maximum power possible to a load when the load is equal to the internal impedance of the generator; to get the most out of our dipole we must therefore connect it to 73.2 ohms. Under these conditions the voltage across the load is equal to half the generator voltage. So to deliver the greatest possible signal power to the receiver, the input voltage is

$E \times \lambda/2\pi$ across 73.2 ohms.

It is therefore possible to calculate the power into the receiver by means of the usual calculation, $P = V^2/R$, which gives

$(E \times \lambda/2\pi)^2/73.2$ watts

Another way of looking at this is to say that a matched dipole can extract

$(E \times \lambda/2\pi)^2/73.2$ watts

from a wavefront with a field strength of E volts per metre. This point is illustrated in Fig. 2.2.

This result also allows us to consider the dipole from another aspect, that of an aperture. Since the wavefront carries energy at a rate of

$E^2/120\pi$ watts per square metre

we can calculate how many square metres of wavefront must be intercepted to provide the power delivered by the dipole to the receiver simply by dividing this power by

$E^2/120\pi$

The answer we arrive at is an area, usually denoted by the letter A, given by:

$$A = \frac{\lambda^2}{4\pi} \times \frac{120}{73.2} \text{ square metres}$$

and substituting for the numbers gives:

$A = 0.13 \times \lambda^2$ square metres.

The matched dipole behaves in effect as an aperture or window of cross sectional area 0.13 square wavelengths and all the energy flowing through this aperture is passed to the receiver.

The more inquisitive reader, (assuming there still are some) may wonder why I've left the fraction to the right (120/73.2) on its own. Working

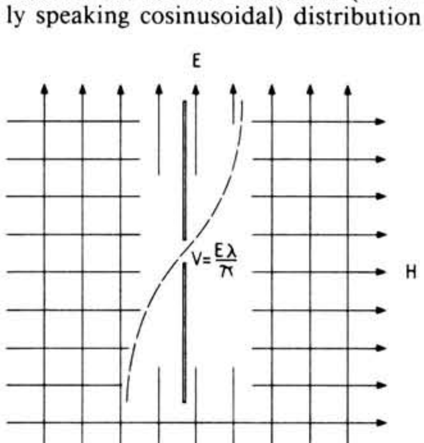


Fig. 2.1

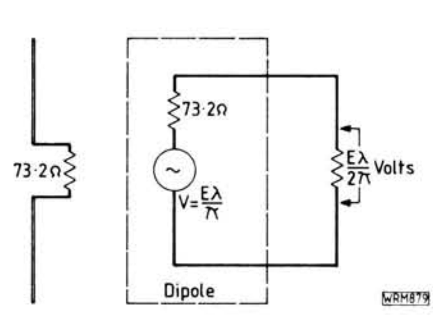


Fig. 2.2

out its value shows it to be 1.46, which is a number we used in Part 1. It is the gain of a dipole over an isotropic source, the theoretical antenna which radiates equally well from all directions. As we shall see although we can't go out and buy one, the isotropic source is a very useful idea if only because it makes the sums easier.

Going back to the concept of aperture we can easily see that the aperture of an antenna is directly proportional to its gain. Perhaps we'd better remind ourselves just what we mean by an antenna's gain. In the transmitting case, if one antenna produces a given field strength E at a given location for an input power of one watt, whilst a second antenna requires an input of G watts to produce the same field strength then the first antenna has a gain of G times the second. In the receiving case, if an antenna receives G times the power of another when placed in a given field strength then it has a gain of G over the other. However we can also say that it is intercepting G times the area of wavefront and so its aperture is also G times greater. Note the gain is always quoted as a power gain, if we want to calculate the relevant voltage across the two antennas then they will be proportional to the square root of the gain of one compared to the other.

Considering the dipole and the isotropic source, if the dipole has a gain of 1.64 over the isotropic source then the aperture of the isotropic source must be 1/1.64 times that of the dipole which is $\lambda^2/4\pi$.

We can also see that if we use our isotropic source as a reference, (even though we can't get hold of one), we can say that the aperture of any antenna whose gain is G with respect to the isotropic source is given by:

$$A = \frac{G \times \lambda^2}{4\pi} \quad \text{or} \quad G = \frac{A \times 4\pi}{\lambda^2}$$

Knowing an antenna's gain over an isotropic source we can easily calculate its aperture and the power (P_r) it delivers to a matched receiver is given by:

$$P_r = A \times E^2/120\pi \text{ watts}$$

One point worth noting is that the received voltage is proportional to the wavelength so the output voltages from a number of dipoles placed in a set of fields of different frequency, but all having the same field strength decrease as the frequency increases. Similarly, the received power decreases in a manner which is inversely proportional to the square of the frequency. This is one reason why, in general, we need higher gain antennas in order to communicate at higher frequencies. Many people believe that propagation is inherently worse at high frequencies. In fact, in free space it isn't, it's getting the signal out of the wavefront that is more difficult.

We now have two interrelated ways of measuring the energy taken out of the wavefront, we know how to calculate the voltage at the input to a matched receiver and the power delivered to the receiver. Both are used in practice depending on the problem under consideration.

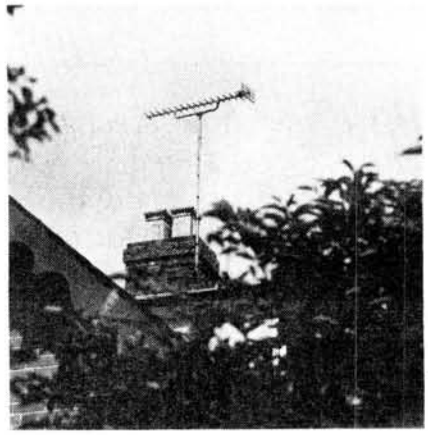


Fig. 2.3: A typical TV antenna

Let's just have a look at how we would use these two methods in practice. Most people have a television receiver, so let's start with that. (I know in the last episode I specified a system out in space to avoid the complication of effects arising from the proximity of the earth but I promise that in the case I'm about to consider there are no such effects. I'll deal properly with what happens in the real world in a later article).

An average receiver needs about a half a millivolt of signal at the input socket if it is to give a noise-free picture. At 600MHz, the lower end of Band V used for television broadcasting in the United Kingdom, the wavelength is a half a metre.

Well inside the service area of a transmitter, we would expect a field strength of 4 millivolts per metre, or as the broadcasters would be more likely to quote it 72dBμV/metre. If we were to put a dipole (correctly orientated of course) into this then we would get an output voltage (into a matched load) of:

$$\begin{aligned} V &= E \times \lambda/2\pi \\ &= 4.0 \times 0.5/2\pi \\ &= 0.32\text{mV} \end{aligned}$$

In practice, the attenuation of the feeder connecting the antenna to the television receiver would reduce the signal to about half this value or about 0.16mV at the receiver input. To get 0.5mV at the receiver we need 0.5/0.16 times this voltage so we have to use an antenna which has a power gain of $(0.5/0.16)^2$ which is 9.77 times or about 10dB. It's important to note that this gain is that over a dipole and can be realised by a Yagi antenna with about ten to twelve elements of the type shown in Fig. 2.3.

At the microwave frequencies used for satellite transmission it is more usual to use the received power and aperture approach, so let's see how we go about a receiving problem in this case. The antenna is usually a dish which is shaped so that it focuses the energy to a point where it can drive the receiver front-end. The power it intercepts is simply that carried by the wavefront in an area of the dish. Not all of this power is passed to the receiver, mainly due to an effect known as spillover, and in practice the dish will be something over 50 per cent efficient, that is at least half the energy arriving at its surface will be transferred to the receiver.

Fig. 2.4: A satellite TV dish

As an example I'll use the sort of receiving dish that is being thought of for the television direct broadcast satellite services which will be starting in two or three years time. They will operate at frequencies of about 12GHz with a wavelength of 2.5 centimetres or 0.025 metres. The plan that's allocating frequencies for this band assumed the use of dishes with an average diameter of about 0.9 metres, illustrated in Fig. 2.4, which means a cross sectional area of 0.64 square metres. Allowing for 50 per cent efficiency the effective aperture is 0.32 square metres. The gain of the antenna can thus be calculated and is:

$$\begin{aligned} G &= A \times 4\pi/\lambda^2 \\ &= 0.32 \times 4\pi/(0.025)^2 = 6434 \end{aligned}$$

This is equivalent to 38dB and it is the gain compared to an istropic source.

The convention at microwaves is to quote power flux densities rather than field strengths and for a high power direct broadcast satellite this is planned to be at least 50 picowatts (0.000 000 000 05 watts!) per square metre (for the dB merchants—103dBW per square metre). Power delivered to the front end of a satellite receiver will be 0.32×50 or 16 picowatts. In practice dishes of 0.6 metres diameter having an effective aperture of 0.14 square metres and a gain of 2860 (38dB) will give good results delivering about 7 picowatts to the receiver.

Well, by now we should know a bit about receiving antennas and how they interact with an electromagnetic wave. In the next article we'll consider how the transmitting end, the propagation path and the receiving end can be considered as a system which we can design to give us the results we want for a communications link.

Expedition to the Pole

In late February, 1988, a small team will be returning to the Arctic region to undertake the Polar Universal Natural Science Expedition 1988 (PUNS). Among them will be Laurence Howell GM4DMA, who wrote this report of the last expedition in 1986.

In 1986, GM4DMA was active as G4DMA/P.VE8 from a canvas hut located on Ward Hunt Island, which is located at 83° 05'N 74° 06'W, just north of Ellesmere Island NWT. Tiny Ward Hunt Island is popular with explorers as a starting point for attempts on the Pole, being one of the closest points to the geographic North Pole.

From early March until early May 1986, amateur and commercial communications were radiated from ruggedly built Racal transceivers using QRP only. Power was obtained from a 24 volt battery system, charged by two 4 amp wind turbine generators. Temperatures varied from −20°C to a cool −52°C, with a winter low of −67°C. This caused no problems for the radio gear, despite it often being covered by a layer of frost, though the operator had to be fairly careful that moisture from his fingers did not freeze onto the controls, causing great pain when pulling them off!

Below about −45°C, interconnecting wiring such as coaxial cables takes on a new physical state. "Normal" cable such as RG8/UR67 becomes brittle, and even a slight breeze can snap and tear the insulation off an untethered length, rendering the cable useless. Special silicone-coated cables were employed for most of the antennas, and no problems were experienced, apart from the local Arctic fox and wolf populations taking a liking to the taste of the cable to supplement their meagre diet.

Wire antennas were employed for point to point links, "vee" beams being the most successful, but a vertical or two for the l.f. bands seemed very effective, stations on Top Band from the UK being very strong from early on in the evening. The transition from being completely dark to twenty-four hour daylight takes only a few weeks, after which it becomes very difficult to judge the time of day without the aid of a 24-hour watch.

Being only some 300 miles to the north of the North Magnetic Pole, radio conditions tended to be very erratic, with rapid deteriorations in communication. This was mostly on transatlantic links back to the UK, though the large commercial arrays of British Telecom International's Portishead Radio kept in touch through very bad disturbances. Optimum working frequency charts for different point to point locations were provided by Racal Communications, which compared well with the actual values calculated at Ward Hunt Island. Daily communication was established with the Phillips Petroleum Maureen Alpha platform (GM4DMA's normal place of work), situated in the North Sea, and great pleasure was obtained from both ends keeping abreast of the state of play of the expedition.

Tests of the radio paths from Pole to Pole were also carried out with the British Antarctic Survey base at Halley Bay, Antarctica, links being established with just 10 watts p.e.p.

Scientific Tasks

The expedition had been given a number of scientific tasks to complete. Most of these were "earth science" based, such as drilling by hand a number of 10m holes into the ice shelf around the island. Each hole took two days to complete. The core samples were returned to Ward Hunt for onward shipment by air for analysis. A detailed make-up of the ice shelf is being compiled, as large sections keep breaking up and floating either eastwards or westwards, possibly jeopardising oil drilling operations far to the south.

A full meteorological programme was also carried out, with twice-daily reports being sent by radio for inclusion in the world weather forecasting system. Snow and lichen samples were taken from "clean" areas in the locality, to be shipped away to a university for analysis. The results will show the level of industrial contamination present even in these remote areas.

A study was also carried out of the problem of Arctic haze. The high pressure that tends to sit over the high Arctic in the winter causes air to sink, so that the pollution coming from heavy industrial areas far to the south gets compressed into a dirty smog, greatly reducing the visibility. Air sampling was carried out using evacuated flasks, far from the base and away from any local effects.

To the Pole!

In addition to the scientific programme, an expedition left from Ward Hunt to travel towards the Pole to try to beat the existing record for unsupported travel Polewards, that is, no air support nor any help from mechanical or animal means. The two men who left the base pulled their heavily laden sledges, weighing over 136kg, northwards towards the Pole over the very rough terrain of the ever-moving Arc-

Base-camp hut, Ward Hunt Island, 83N 74W, April 1986

Frost-covered radio equipment in hut operating at −52°C, March 1986

Hand-drilling ice-cores to 10m takes two days at −45°C, east of Ward Hunt Island

The author holds a smoke-flare giving navigational aid to a ski aircraft at Ward Hunt Island, March 1986

ic Ocean. Travel is not easy, for winds and currents cause the polar ocean ice to shift and break up, smashing large areas of ice together and making pressure ridges appear within minutes to a height of 10 metres. This compounds the difficulty of working physically very hard at these low temperatures, when stopping for a break allows perspiration to freeze within seconds, making movement extremely uncomfortable.

After travelling for over twelve hours a day, the "ice-group" made camp and used the 1 pint of fuel allowed per day to cook their dried rations and hopefully dry out their clothing. However, their sleeping bags gradually became more and more wet, increasing the weight to be carried and causing sleeping to become more uncomfortable night after night. Getting into a frozen sleeping bag after a hard day's pull is not the most pleasant feeling in the world. Averaging an astonishing 16km a day, the ice-group managed to break the record before returning to base camp.

Watchkeeping

For fourteen days, a continuous 24-hour radio watch was kept by GM4DMA for the ice-group. On the hour, every hour, a 10-minute watch was mounted in case of difficulties, using just a dipole laid out on the polar ocean ice. The ice-group link back to base camp proved to be excellent, their lightweight Racal transceivers taking all the physical punishment, plus the extremes of temperature, and not failing once.

The only problem was static interference from charged particles as they passed over the respective antennas. Very good localised lightning displays were noted within the base hut, with huge blue and red flashes plus the associated bang. Tracking occurred down the side of the canvas hut adjacent to the antenna cables, causing some concern!

An Extra Dot!

The Ward Hunt radio station was the most northern land-based radio station in the world, and thus interest was quite high from radio amateurs. However, operating time was limited because of the scientific work to be carried out, plus the added problems of running a base camp single-handed. Sleep was very broken, being limited to 50 minutes between the hours. This could explain why the Morse from G4DMA/P.VE8 was augmented by the occasional extra dot—it wasn't his teeth chattering.

PUNS 1988

In February 1988, the same team will be going back north to continue the scientific work, and will have an attempt at reaching the pole without any support.

This time it is planned that three men will travel north, as it was decided that they can carry and distribute the weight far more easily than two. Sir Ranulph Fiennes, Oliver Shepard and Dr Mike Stroud will depart from the Ward Hunt area around the first week in March, this being the earliest that they can fly into Ward Hunt Island. The first day the sun rises over this area is around March 4. Base communications will be run again by Laurence Howell GM4DMA.

The duration of the expedition depends very much on the state of the ice towards the Pole, which varies from year to year. If everything goes according to plan, the three-man ice-group hope to reach the Pole within 90 days. G4DMA/P.VE8 should again be active throughout this period on all bands from 1.8 to 30MHz and possibly 144MHz too, that is if the polar bears, wolves and Arctic foxes leave his coaxial cables alone. Operation will take place from Ward Hunt Island (Locator FR23WB) and from Axel Heiberg Island (80°N 90°W—Locator ER50AA). ***PW***

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This is Thames Coastguard

This article, by J. D. Harris G3LWM, describes the specific operational requirements and equipments in use at Thames MRSC at Walton on the Naze.

"All stations, All Stations, All Stations—This is Thames Coastguard, Thames Coastguard, Thames Coastguard". That broadcast announcement often heard on channel 16 (v.h.f Marine Band) is, in many cases, made by a Coastguard Auxiliary. The author, a radio amateur of many years standing, as can be seen from his callsign, spotted a request in the local paper that the Coastguard at Walton were seeking to recruit further Auxiliaries into the service. After an initial meeting attended by 18 men and women from all walks of life and all age levels everyone elected to go on for the training programme.

Unlike other examinations we were only allowed to attempt the Auxiliary Coastguard Examination once, failure is FINAL and you are not allowed to have any further attempts! The final goal after training is the Department of Transport HM Coastguard Certificate of Qualification as a Radio Telephone Operator. It is pleasing to note that everyone passed and obtained their Radio Certificates. Whilst familiarity with radio from an amateur standpoint was useful, the use of specific procedures and terminology had to be learnt and put into practice. The operating disciplines are strict and bear little relationship to the generally relaxed conditions on amateur radio. Accurate log keeping and message handling are, of course, also of prime importance.

Like many other British organisations the HM Coastguard is a compromise between operational requirements and available budgets. Total regular staff are about 560 whilst the Auxiliary strength is over 8500. Auxiliaries perform many other functions as well as Operational Room Assistants, such as Mobile Shore Patrols, Rescue Companies and CG Boat Crews, etc.

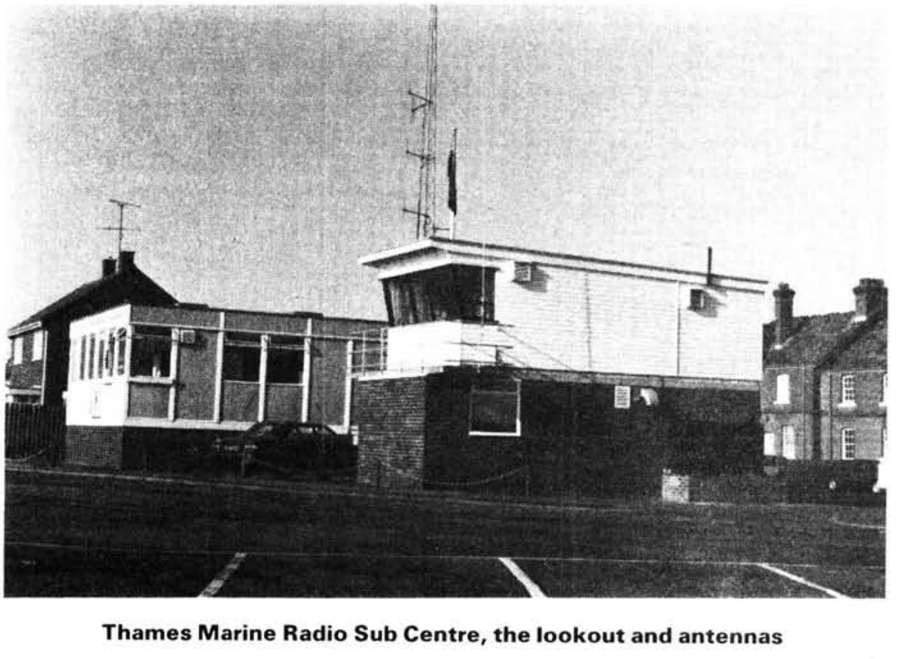
Round the shores of the UK there are six MRCC's (Maritime Rescue Co-ordination Centres) and a further 18 MRSC's (Maritime Rescue Sub Centres) all dedicated to SAR work. As all these units are on a 24 hour watch at all times the requirement for the Auxiliary staff can be appreciated. Depending on the location of the MRSC or MRCC each area has unique responsibilities. For instance Dover MRCC is responsible for CNIS (Channel Navigation Information Service) and employs both radar and aircraft to carry out this function. This article describes the specific operational requirements and equipments in use at Thames MRSC at Walton on the Naze. The Coastguard Service are the co-ordinators, their responsiblities can be summed as follows:

HM Coastguard is the authority for initiating and co-ordinating all Civil maritime search and rescue measures for vessels or persons in need of assistance in the United Kingdom Search and Rescue Region.

Naturally in the communications area radio plays an important and vital part. The great majority of radio traffic is conducted in the v.h.f. Marine Band although facilities exist for communications on m.f., v.h.f., a.m. (Aeronautical) and certain other frequencies to enable direct communication to be maintained with other services if required.

The following frequencies are utilised by HMCG:

Channel 0 (156.00MHz)	Primary Working channel only for use by HMCG or other organisations providing SAR (Search and Rescue) support to HMCG such as RNLI, etc.
Channel 6 (156.30MHz)	Primary Intership. SAR use for communication between vessels and helicopters at scene of search
Channel 10 (156.50MHz)	Intership frequency. Also used as counter pollution frequency.
Channel 16 (156.80MHz)	International Distress safety and calling frequency. Used for distress and urgency signals and traffic for safety signals.
Channel 67 (156.375MHz)	Intership frequency. Small vessel safety channel between HMCG and small vessels. Also used for safety and weather information after preliminary announcement on channel 16. Can also be used as first alternative to channel 0.
Channel 73 (156.675MHz)	Inter-ship frequency. Used by HMCG as a second alternative to channel 0 if that frequency becomes congested.



Thames Marine Radio Sub Centre, the lookout and antennas

It is the responsibility of the HMCG to guard the integrity of channel 16 throughout the 24 hours and a radio operator will be detailed for this purpose on each watch. Apart from audio recordings that are maintained a written Log is an important duty of the channel 16 operator.

At the Walton site of Thames MRSC there are four control desks. The general layout of these control units is identical as in fact are all the radio control desks through the Coastguard service. Some control positions are provided with certain unique functions such as v.h.f., d.f. and m.f. transmitter/receiving unit. In addition to radio, telephone lines are also connected to each desk and this enables 'split' (telephone/radio) working to be carried out if required.

In order to ensure full radio coverage of the area covered by Thames Coastguard antennas/transmitter-receiver units are located at various places on the coast. These units can be controlled in various ways by the radio operator at the Thames MRSC. At the control desks audio signals are all available and it is up to the operator to select the best depending on the location of the vessel and/or other radio conditions.

Two basic systems are in operation. Firstly there is the dedicated system where the equipment and antennas are only operational on one channel, and secondly multi-operation where the operator can select the required channel. Thames Coastguard covers the area from Southwold in the North to Reculvers on the North Kent coast. Radio/Antennas are installed as follows:

Bawdsey: Dedicated Ch. 0/16 Multi on 0,6,10,16,67,73

Walton on Naze: Dedicated Ch. 0/16 Multi on 0,6,10,16,67,73

Bradwell: Multi only on 0,6,10,16,67,73

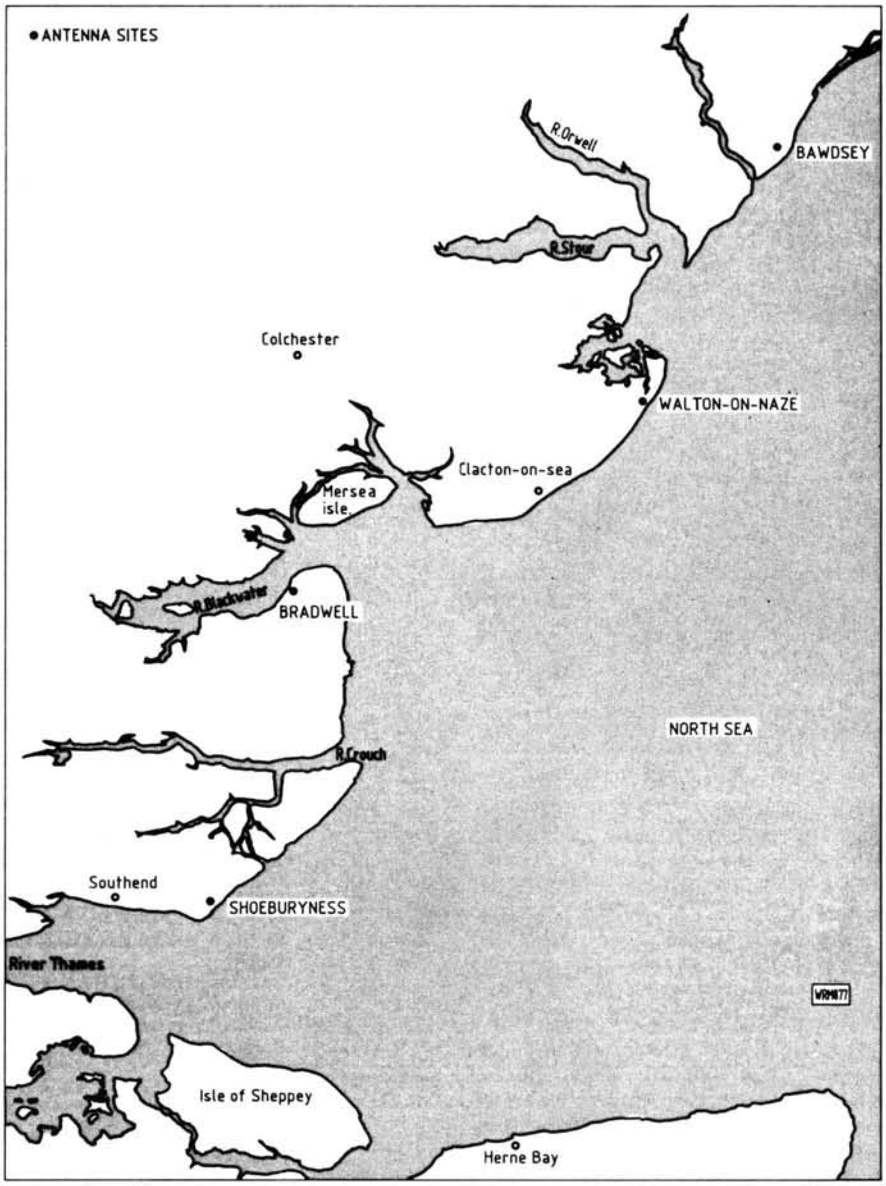
Shoeburyness: Dedicated Ch. 0/16 Multi on 0,6,10,16,67,73

As can be expected all antennas have vertical polarisation with coverage tailored to meet the requirements of marine traffic.

Whilst the majority of traffic is with vessels at sea HMCG vehicles for rescue and patrol purposes are also equipped with the required v.h.f. channels. Handportables are also widely used by cliff and shore patrols. During the summer months local lifeguards are equipped with handportables to enable them to rapidly summon assistance if required to a beach/shore casualty situation.

Certain other vessels and aircraft also have the facility of channel 0 such as SAR helicopters and police launches.

Although the majority of work carried out by the UK Coastguards is concerned with SAR activities in Coastal waters HMCG are also part of a Worldwide SAR activity and via MRCC Falmouth can be linked to INMARSAT (International Maritime



The map showing the location of the antennas and sites used by the Thames Coastguard, all remotely controlled from Walton on Naze

As a Radio Amateur who has operated on 160 (Top Band) it was of interest to learn the full significance of the following phrases often heard on marine radio.

MAYDAY: A vessel in distress will preface all Distress Calls with the spoken word "MAYDAY". This will be broadcast on Ch. 16 v.h.f. or 2182kHz.

MAYDAY RELAY: This is Mayday information rebroadcast by another station giving specific details of a "Mayday" situation.

PAN PAN PAN: This is the urgency signal and is used where the transmission of the distress signal is not justified. It indicates a very urgent message concerning the safety of a vessel or a person.

SECURITY: This is the safety signal and indicates that the station is about to transmit a message containing an important navigational meteorological warning.

Typical operation position. The photograph shows Keith Purves, Coastguard Officer, Clyde *DTI HMCG*

Plotting table scene *DTI HMCG*

Coastguard Rescue Centres

	Regions and Districts	Address	Telephone number
MRCC	ABERDEEN	Blaikies Quay, Aberdeen	Aberdeen (0224) 592334
MRSC	Shetland	Lerwick, Shetland	Lerwick (0595) 2976
MRSC	Pentland	Kirkwall, Orkney	Kirkwall (0856) 3268
MRSC	Moray	Peterhead, Aberdeenshire	Peterhead (0779) 74278
MRSC	Forth	Fifeness, Crail, Fife	Crail (0333) 50666
MRCC	YARMOUTH	Great Yarmouth, Norfolk	Great Yarmouth (0493) 851338
MRSC	Tyne Tees	Priory Gardens, Tyne and Wear	North Shields (0632) 572691
MRSC	Humber	Spurn Point, near Hull, North Humberside	Spurn Point (0964) 50351
MRCC	DOVER	Langdon Battery, Swingate, Dover, Kent	Dover (0304) 852515
MRSC	Thames	Hall Lane, Walton-on-Naze, Essex	Frinton-on-Sea (02556) 5518
MRSC	Shoreham	Shoreham-by-Sea, West Sussex	Shoreham (07917) 2226
MRCC	FALMOUTH	Castle Drive, Falmouth, Cornwall	Falmouth (0326) 317575
MRSC	Brixham	Brixham, Devon	Brixham (08045) 58292
MRSC	Solent	Totland Bay, Freshwater, Isle of Wight	Freshwater (0983) 752265
MRSC	Portland	Grove Point, Portland, Dorset	Portland (0305) 820441
MRCC	SWANSEA	Mumbles, Swansea, West Glamorgan	Swansea (0792) 66534
MRSC	Hartland	Hartland, Bideford, Devon	Hartland (02374) 641
MRSC	Milford Haven	Castle Way, Dale, Haverfordwest, Dyfed	Dale (06465) 218
MRSC	Holyhead	Holyhead, Anglesey	Holyhead (0407) 2051
MRSC	Liverpool	Crosby, Liverpool	Crosby (051) 931 3343
MRCC	CLYDE	Navy Buildings, Eldon Street, Greenock, Renfrewshire	Greenock (0475) 29988
MRSC	Ramsey	Ramsey, Isle of Man	Ramsey (0624) 813255
MRSC	Belfast	Bangor, Co. Down	Donaghadee (0247) 883184
MRSC	Oban	Boswell House, Argyll Square, Oban, Argyll	Oban (0631) 63720
MRSC	Stornoway	Stornoway, Isle of Lewis	Stornoway (0851) 2013

MRCC: Maritime Rescue Coordination Centre MRSC: Maritime Rescue Sub Centre

In an emergency, for coastal or sea rescue, DIAL 999 AND ASK FOR THE COASTGUARD

List of Coastguard Rescue Centres

Note: Whilst you are welcome to visit all these stations please do telephone for an appointment before calling. If an emergency is in progress when you arrive it is unlikely that you will be allowed in the operations room until the emergency is over.

Maritime VHF Radio

The allocation of frequencies and standard usage of the radio channels so allocated in the Maritime v.h.f. Band (156–174MHz) has been Internationally agreed.

Extensive fitting of v.h.f. radio telephone equipments operating within the band has proceeded among ships of most maritime nations.

Specific allocations are made for ship/ship, port operations and public correspondence use. As well as being available for these uses many port and harbour authorities now operate navigation or port operations service to advise shipping in the port or its approaches of docking programmes, movements, visibility, tidal data, radar assistance or other general information as required.

All Coastguard channels are single channel simplex but a number of other services within the Maritime v.h.f. Band use split frequency simplex working.

Originally the band had 50kHz channel spacing but as traffic increased this has now been reduced to 25kHz. At the moment the highest frequency in use is channel 88 157.425/162.025.

Satellite Organisation) that can provide instant communications from suitably equipped ships almost anywhere in the world.

Thames Coastguard at Walton covers a busy section of the UK coastal waters and every watch is full of interest. During the summer months as many as 10 incidents can be in progress at once and it takes little imagination to see the requirement for tight control and coordination of the available rescue services.

Radio discipline by all users is most important and it is pleasing to note that in general this is well conducted. All users of marine radio have to obtain a licence from the Home Office and a short examination has to be taken even for small pleasure craft owners who fit v.h.f. radio. This exam gives the Restricted Certificate of Competence in Radiotelephony v.h.f. Only to successful candidates. This ensures that in an emergency communications are established and maintained in order that all rescue operations can proceed with the maximum efficiency. Emergencies at sea can happen with terrifying speed and in many cases seconds are vital to safety.

If any readers in Coastal Districts are interested in becoming Auxiliary Coastguards they should in the first instance contact their local Coastguard station. I can assure that if they do eventually 'join' they will be carrying out a useful and interesting function within the UK and Worldwide Search and Rescue organisations.

Finally my thanks are due to the District Staff Officer (Training) for his patience, to the regular Coastguard Officers for their forbearance and to the other Auxiliaries for their mutual assistance.

On The Air
On The HF Bands

Reports to Paul Essery G3KFE
Practical Wireless, Enefco House, The Quay, Poole, Dorset BH15 1PP.

Last time around I expressed doubts about the SORASD expedition; no sooner was the copy gone beyond recall when the expedition appeared on the bands, with Martti Laine OH2BH having taken the place of an operator who dropped out. OH2BH is a chap who likes things done properly; and so it was. The group were not operational 24 hours daily as they were very much into training locals, and already the training work has borne fruit with activity from the Director of Telecommunications who is to be issued the call SOIA and promises to be very active; he has fluent Arabic, French and Spanish and enough English to make a QSO.

Rhubarb Corner

On the other hand, I hear that one of the recent Mount Athos DXpedition has recently been openly saying on the air that there will be a charge of five US Dollars, without which Mount Athos QSLs will not be forthcoming. Against this blatant commercialism, it is clear that to require payment beyond the cost of return postage is against DXCC rules as indeed the DXCC desk itself has confirmed. My advice would be not to bother to QSL this one, at least until the question of payment for QSLs has been clarified—in any case their documentation has not reached ARRL HQ so it cannot be claimed for DXCC yet. My own feeling is that the DXCC rules should be amended to make one IRC the standard, with "green stamps" only allowable if the expedition can demonstrate an inability to encash IRCs, or where a DXer is in a country where IRCs cannot be obtained. The rules should then be enforced; if the requirement for ever-increasing numbers of dollars for a QSL against the contact goes on, one will require to be a millionaire to reach Honour Roll status!

The Andamans activity this time was a great success, although surprisingly enough they were to be heard on 3.5MHz calling CQ with no takers—until the gang rumbled the situation and came l.f.!

CQ Zones

Arising from the increasing amateur radio operation from China, *CQ Magazine* has announced an alteration of Zone boundaries to Zone 23 and 24. The new definitions are: Zone 23, Central zone of Asia comprising; Mongolia JT, Tannu Tuva UA0Y, Tibet, Peoples Republic of China BY3G-L (Inner Mongolia), BY9A-F (Ningsia or Ningxia), BY9G-L (Tsinghai or Qinghai), BY9T-Z (Kansu or Gansu), and all BY0. Zone 24, Eastern Zone of Asia, BV, XX9, VS6, BY1, BY2, BY3A-F (Tianjin or Tientsin), BY3M-S (Hebei or Hopeh), BY3T-Z (Shanxi or Shansi), BY4, BY5, BY6, BY7, BY8, BY9M-S (Shanxi or Shansi).

Talking of *CQ Magazine*, the CQ WW SSB contest produced the usual crop of amusements from the non-contesters. For example, the chap in the middle of a pile-up yelling for the DX's "name, for my log!" or the hopeful innocent heard giving out, from Zone 14, an exchange of "RS5953".

The Bands

The autumnal lift in conditions this time was marred to an extent by the seemingly over-frequent days of below normal or disturbed conditions; but on the other hand there were several good days too. No doubt at all, though that the rising band conditions are notable as compared with this time last year.

I worked VK2AU and in a later letter he told of his antenna set-up. He has a VK2ABQ beam part way up the tower which is 21m tall. He says he spent two weeks getting the matching right—no wonder he is such as good signal on the band!

G0CNO wrote from Radlett. After a summer in USA, Michael came home with an Icom IC-735 and SB201; he reckons the pair cost him around £700, even after paying VAT on them after returning home. He runs a Butternut HF4B at 15m. However, now we come to the bitter bit. The tower went up, bolted to the side of the house with no guys, on October 15—readers may recall there was a spot of wind that night . . . The 3.5MHz dipole was shredded, and six trees on the plot came down; the greenhouse took off and landed three gardens away, and the borrowed TH2 came down suffering a bent boom. However, the tower and the beam stayed up—but needless to say, after such an experience, the tower is now guyed securely!

New Bands

G4ZAU (Oswestry) mentions some interesting QSOs on 10MHz; Dudley uses a TS-930S at 50 watts input, to a dipole. Earlier c.w. QSOs included K8XF/MM in the Gulf; K5HK/MM in the Caribbean, near 20N 85W, KP4DJ Rio Pedras, Puerto Rico, and UA0AG. During the current period under review Dudley rang the bell with LZ1KX, OE5NKL, OE5WLL, OF3ES, OF8NKQ, OH1XX, OH2BEJ, OH2BT, OH2BY, OH7OI, OK1DAV, OK2PGG, OZ1JKL, OZ5DX, SM4BQI, SM7CEH, VE1BB, VK6AKG, EA2CIN, lots of Fs, FG5XC, several Gs including GM3SWK, Stornoway, HB9s, Italians including IQ5MR (QSL via I5KYC), K4BX, K4CNZ, KB4UGI, WA2RCA, W1FNY, W1FZY, W1UN, W3GG, W3PEI, W4BW, W8MTC, and KA8VLW, LA5LBA, LA6XEA, LA8HF, three East Germans, a brace of YUs, 18 West Germans, and from USSR, UA3AOE, UA6UF, UH8DC, UA9CQ, UB4KWA, UB5BAZ, UW3WZ, UY5GM, UY5UZ, UZ4HWV, RA2FD, UV9UWW; leaving just PA0VG/EA3 and JA1IFP to be mentioned. Now that for a month's crop, on a band where people complain of lack of stuff to work, is a pretty persuasive argument to the contrary!

GW0IER tried the band for the first time on September 16, between 1500-1600Z; the result was a contact with successively DL8SBV, F6IJL and HB9LO.

Reports in by Dec 23, Jan 27, March 2

The 1.8MHz Band

The long wires which are required for this band are particularly vulnerable to high winds, so the gales have probably "seen off" a high percentage. On October 13 and 15, **GW0IER** made his debut on the band, with his 60m of wire fed by a "T" match; to the time of his letter the activity had netted him OK1FDY, RB5BE, DL7AA, Y27QH and GM3PPJ for the first five towards a Top Band DXCC.

The 3.5MHz Band

Since his last report, says **G4CFS** (Doncaster), he has continued to run three watts of home-brew into a G5RV; 166 UK stations were worked, of which 80 were two-way QRP, plus DK6ZZ, DF3DR, DJ3TS, DL0RSF, DL8EAH, DL8VK, DK6KW, DJ4ST, DL5CYI (two-way QRP), DH1OAD, ON6JW, ON4OA, ON4AGJ, EI9K, OZ1LGB (two-way QRP), F5ZW, EA1JO, PA3DUS, UQ2GRP, IS0JMJ and Y31ZB/P. Glyn notes that he has been to visit G3NOF to see the new tower and beam, which impressed him mightily, and in spare time is preparing for some activity on 10 and 14MHz.

GW0IER reports from Milford Haven, and wonders whether there is a conspiracy against his 50 watts . . . on the evening of September 27, he worked on c.w. some half-dozen stations, and it turned out ALL were using QRP between two and five watts!

G0HGA (Stevenage) is still QRP, and on 3.5MHz she has managed to hook ON4PS, DJ3TS, GM3TMK, LA3X, GM3HBT, and UQ2GR.

Leighton Smart listens to most bands, and on 3.5MHz he noted OX3SGA, VK3DZM, VO1FG, KA4DOD5RH, H25JE, VO1SA, OH3VV/CT3, W1QUW, OD5VT and VO1FB.

The 7MHz Band

GW0IER started his amateur career on this band, and the liking has never diminished. Most evenings after 2300Z some W and VE stations are worked around 7.020-7.030MHz on c.w. The highlight was the night of October 16, when between midnight and 0344Z, some 17 were worked in a string as they queued up for the chance! So, neglecting that, other contacts included VE1BN, KW2P, N2MM, K3QIA, KE4Y, KA5YCM, UZ1AWO, UP2BF and UB5DAL.

Leighton Smart seems to have just one look at the band, at 2259 on September 25, when he heard HI8IH.

The 14MHz Band

Where it all happens—or so they tell me! For me, the indoor array continues to "do its thing" and also to maintain its stubborn refusal to net decent reports from the west, although it is undoubtedly radiating the r.f. in the required directions. However, on c.w., QSOs were completed with various eastern and middle-west Ws, UA9 and UA0. On a different tack, I recently went to visit the SMC (TMP) establishment at Buckley—a pleasant day out, albeit somewhat hard on the wallet. However, while there I managed to obtain most of the raw materials for the next outside Secret Weapon—I will have an RS59 report from a W at this QTH if I bust in the attempt!

G0CNO (Radlett) had a basinful in JOTA, under the GB8TE call; on 14MHz, they raised W1, W2, W3, W7, W8, W9, W0, VO1, VE1, VE2, VE3, VE6, VE7, VK1, VK2 both on long path, ZB2IP, 4X4, mainly of course s.s.b. but a few c.w. stations, not to mention Gotaways ZL, ZK2JB, VK0LH and WP4JQ. On a totally different tack, Michael comments on the difference the extra height has made to the strength of incoming signals—going from 9m to 16m has made some 10dB or so of difference.

G0HGA (Stevenage) is still QRP and found time for contacts with UB4XWA, I6ANZ and UA3LAY.

Leighton Smart (Trelewis) says he is being pressed by his locals to take RAE since he joined the local club—and why not? Leighton uses a Grundig 1400SL Professional, a home-brew a.t.u. and some thirty metres of wire, end fed. On September 29 at 2220Z, Leighton heard J79MD, followed a few moments later by ZD8RP and then 8P6FX; and on October 11 4X1KT was noted, followed by W4PSN/MM in Region 1.

The 21MHz Band

G0CNO exercised the GB8TE call on Sunday October 18 to the tune of: JR3BOT, JH2MQT, UA9CRF, W4MGX, EA7GGM, KM3T, 9K2DT, UI8CAJ, W1NG, W8AH, 9H3TGG, KT2V, ZS6UW, KI4EZ, KD0JL and KJ4OM. All were on s.s.b.

Leighton Smart listened to the band several times, and his log notes 5N9SRC, N4EXR/TA2, ZS6ADM, 5N0GAA, TA3C, UB4MXR and VP2EZ.

G0HGA seems to do far better on 21MHz; the log from her QRP this month shows IK3DNX, RA4CLY, UB5MTN, RW3WO, UA1OLL, UB4MOF, U3DR for a nice prefix, UA3DUS, RA3RND, UA3SDY, UO5OCI, OI7AX for another nice prefix addition, UA1ZEN, RB5ZB, UZ6AXF, UA3LHA and UB4QHA.

The 28MHz Band

G0CNO says that from the GB8TE efforts arose contacts with ZS6WRS, 4X77BSA, LU4DM, LU7DID, PY, YV, and Europeans. Michael notes, with an element of surprise that the 4X77BSA was for the Boy Scouts of AMERICA!—tricky negotiations on callsigns involved there I reckon!

Odd Points

VK2AU notes that he is always to be found on the long path, and sometimes on the short path, looking for Gs. From the end of December to the end of January, John will be operating from Western Samoa 5W1 and American Samoa KH8, using 3.5-28MHz for sure, and maybe 1.8MHz if time permits.

As an aside in her letter, G0HGA mentions a c.w. club called FISTS, for all the c.w. addicts; details can be obtained from G3ZQS who is QTHR.

Final Thoughts

An amusing letter from **G4YDO** notes in passing that SW2MO was on from Mount Olympus, QSLs via SV2AEN. Another genuine one was FF1BSR. As to why the latter prefix, Bren suggests maybe old friend from years ago, MO1FFI might have some aids for such cases . . .

VHF Up

Reports to Norman Fitch G3FPK
40 Eskdale Gardens, Purley, Surrey CR2 1EZ

A smaller than usual postbag this month, no doubt due in part to the uninspiring tropo conditions but more likely to the after effects of the phenomenal hurricane which struck the south eastern corner of England on October 16. On the positive side there have been a few Auroras and the first 50MHz contacts between the British Isles and Botswana have occurred.

The Hurricane

Barometer watchers knew that some dirty weather was likely in the late evening of October 15. At 2220 at my QTH the pressure (QNH) was 973 millibars with the wind from the south at about five knots and a temperature of 12°C. An hour later the figures were 971, 20 and 17 respectively.

In my profession we adopt a basic wind speed for London of 85m.p.h., this being the maximum velocity of a three seconds gust occurring once in fifty years. The London Weather Centre reported 94m.p.h.; such a gust, according to statistics, could be expected once in 200 years. I have no doubt that gusts in excess of 100m.p.h. occurred in the London area and these would happen once in 500 years.

It certainly was a testing time for antenna installations. Although my v.h.f. and h.f. ones were unscathed, many were not so lucky. Ironically some readers' antennas were wrecked by trees falling on them rather than by their own failure. Probably the weakest links were rotators, though.

By contrast, some were very fortunate, like **Ken Miles G8GGK** who has a rather exposed QTH in Selsdon similar to my own. He left his tower fully extended at over 18m with the 144 and 430MHz Yagis and the installation survived intact.

It would seem that most household insurance policies cover the cost of replacing collapsed antennas attached to the house. Whether separate tower type installations are covered, other than for third party risks, will depend on the proverbial small print in the policy.

Annual c.w. ladder

Station	Band (MHz)				Points
	70	144	430	μWave	
G4ZEC	—	601	—	—	601
G4XEN	—	300	15	—	315
G4NZU	2	243	4	—	249
G4ZVS	—	166	—	—	166
G4OUT	—	151	—	—	151
G4WHZ	—	139	—	—	139
G0HGA	—	128	—	—	128
G4VOZ	102	—	23	—	125
G4ZNI	—	112	—	—	112
G4YIR	—	105	—	—	105
G0GKN	—	84	—	—	84
G0DJA	—	83	—	—	83
EI5FK	—	29	35	—	64
G4YTR	—	56	—	—	56
G4AGQ	15	21	14	1	51
GM4CXP	—	51	—	—	51
G2DHV	15	28	1	—	44
GU4HUY	—	31	—	—	31
GW4HBK	27	—	—	—	27
G0HDZ	—	9	—	—	9

Number of different stations worked since January 1.

Awards News

Congratulations to Swiss reader **Yves Margot HB9AOF** from Lully (DG61f) who is the 82nd member of the 144MHz QTH Squares Century Club. His application was processed on Oct 24 and he has 114 confirmed out of 141 worked.

He was first licensed in Aug 1969 at the age of 20 years and has always operated on 144MHz, never using more than 120W to a single Yagi antenna. Yves has used m.s. mode on s.s.b. since 1986 to increase his score but finds it difficult to get some of the QSLs. In particular he cites G8BBG (ZM) and G5KW (WJ). He is also QRV on 430 and 1296MHz and enters the Squares table.

99 squares were worked on s.s.b., the rest on c.w. 90 QSOs were on tropo mode, 16 via Es, seven on m.s. and one by f.a.i. I had to reject three cards, two of which were for contacts prior to 1/1/1975, the other being for a mobile QSO.

That champion of 70MHz **John Jennings G4VOZ** from Ullesthorpe in Leicestershire was elected to membership of the v.h.f. Century Club on Oct 30. His certificate number is 16. All contacts prior to March 1987 were made with a rotatable dipole antenna, the station comprising a Yaesu FT-480, Microwave Modules transverter and 80W solid state amplifier.

G4VOZ has also achieved the first Worked All Britain Basic Award for 70MHz which is for contacting 400 areas, and the Class 2 Counties Award which requires working 55 counties. This news was passed along by John Fitzgerald G8XTJ who handles publicity matters for the WAB group.

Any reader wanting information on *PW* v.h.f./u.h.f. awards should send an s.a.e. to Practical Wireless, Enefco House, The Quay, Poole, Dorset, BH15 1PP marking the envelope "Awards" in the top left corner.

About the tables, a list of the county abbreviation codes with other information is available from Poole on request, but please send an s.a.e.

A letter from new contributor **Jason Bowen G1YOY** (ESX) raises the perennial queries as to what you can count. He asked about the Squares Table and yes, Jason, you can count NFD stations, club stations, special event stations worked from home. However, you cannot claim for your own station anything worked while you were operating any such station from a different QTH.

The tables are for achievements from one fixed QTH, almost universally the home QTH. However, if you are lucky enough to have two fixed QTHs you can submit an entry for each, separately. Incidentally, there is no need to send in a complete list of everything worked if you wish to enter the tables; if you claim you have worked 50 counties, 12 countries and 78 squares on 144MHz, that is all I need to know.

Beacon News

The Cornish beacons GB3CTC are back on again, albeit temporary installations, on 70.03 and 144.915MHz. The 430MHz one is not operational pending the installtion of a new TX. Thanks to the Mid-Cornwall Beacon and Repeater Group for restoring this very useful service, which is well received in London again.

The Irish beacon EI2WRB on 144.920MHz continues to provide a very consistent signal at G3FPK and proves that this 500km path should be workable by 50W single Yagi stations in flat conditions, provided they are in reasonable locations. With increasing activity from EI it is worthwhile putting out CQ calls in that direction. After all, there is no sense in everyone just listening all the time on the calling frequencies; somebody has to start the ball rolling.

Contest Notes

Reminders that the last session of the 432MHz Cumulatives is on Dec 11, and the 1.3/2.3GHz Cumulatives on Dec 19, both 2030–2300. The 70MHz c.w. contest is on Dec 13 but it seems that the RSGB wants to keep us all in the dark. As of Nov 1, I can find no details of this one. Last year it started at 0900.

By contrast, the Derby and District ARS is not so reticent, its Contest Sub-committee secretary G1DHQ having already forwarded details of its National 144MHz Contest on March 13, 1300–1700. For the complete rules send an s.a.e. to the society at 119 Green Lane, Derby, DE1 1RZ. Last year saw the first DADARS 144MHz event and it was very successful.

Meteor Shower Information

Last month I covered the Geminids shower which should provide good opportunities for m.s. QSOs in the period Dec 12–14. Another very useful shower in December is the Ursids on the 22nd. It lasts about 12 hours and, with a declination of +76°, is above our horizon all day. The Right Ascension is 217°.

The Ursids are particularly good for east/west contacts with an efficiency of about 70 per cent or more. The peak time for NE/SW is centred on 1500 and for NW/SE on 0200, but both these are very broad peaks. The N/S path is the least effective, dropping out at about 0900 and 2100. Best times would be 0300 and 1400 when the efficiency is about 40 per cent.

The Quadrantids shower has the highest number of reflexions per hour of any of the normal showers and should be very useful on Jan 3/4. Its Dec/RA are +48° and 230° respectively and it does not set in the UK. Prime times would be: NE/SW 1400 with a lesser peak around 0600; E/W 1400–0300 at an average of 50 per cent efficiency; NW/SE 0300 and N/S 0400 and 1300 when the efficiency is around 90 per cent.

Times to avoid are: NE/SW 0100 and 0900; E/W 0600 and 1100; NW/SE 0800 and 1600 and N/S 0900 and 2100. All the above times are for the centre of mainland Britain and are local times, i.e. UTC. This information was derived from my computer program based on one by DL5MCG which was published in edition 1/86 of Dubus Magazine, by the way.

DXpedition Report

In spite of very heavy seas and poor radio conditions, the OZ1EVA/MM team did operate across the North Sea as planned during the period Oct 8–10. The ship was the *DFDS Dana Anglia* ferry of 14 500 tonnes on the Harwich/Esbjerg route.

The equipment consisted of an Icom IC-271E with MuTek board, 100W to a 4-ele Tonna Yagi on 144MHz, and an IC-475, 25W to a 10-ele Tonna Yagi on 430MHz. A 5m antenna mast was attached to a railing on the top deck 24m a.s.l. and substantially guyed. The team were afforded the luxury of a large boardroom immediately under the mast but even so, there was a long feeder and rotator cable run.

Unfortunately the rotator jammed at the beginning. The antenna was obscured by a very large funnel which blocked signals from the NE on the outward trip and to the SW on the return leg. The ship's position was followed using an Admiralty Chart with frequent updates from the bridge. They marked the locator squares on the chart.

Some 700 contacts were made on 144MHz and 60 on 430MHz from squares BM, BN, CN, CO, DO and DP. On 144MHz only one GW was worked, from BM, the rest being either Gs or continentals. 18, 22 and five respectively Gs were worked from CO, DO and DP. Best DX on this band were DK3TT at 913km and DJ0XR/P at 622km from DP, and SM6CMU at 516km from CO.

On 430MHz 9 Gs were worked from BM and one from BN. Best DX were OZ1GMP at 343km from CO and DL2KBB at 307km from BN. Flemming G4MJC/OZ1EVA and Jan G4XNL are ex-Merchant Navy so coped well with the heavy seas and gales but they report that sea sickness was a problem for the other two operators G4MDZ and G6VYH.

They wish to thank all those many stations who stayed on the bands with them throughout the nights and report that operating procedures were generally excellent and disciplined, enabling them to work most in the inevitable pile-ups. Total time ashore in Esbjerg was only four hours. A similar trip on another route is likely later this year as they are keen to do it again.

The 50MHz Band

The most important news this month is the first 50MHz QSOs between Britain and Botswana which took place on Oct 22. The DX station was A22KZ in Maun and the first to work him was **Eric Parvin G2ADR** (YSN) in IO93KX who told me he made the contact at 1537. They also worked cross-band 50/28 and 28/50MHz. I understand A22KZ is in KG19RX which makes the true ellipsoidal QRB 8530km.

When first heard A22KZ was T7 but later T9 on c.w. He was using 75W to a 5-ele Tonna Yagi at 9m but G2ADR was only running 9W to a dipole at 8m and it was not ideally aimed either. The most likely propagation mode was Es to the Mediterranean latitude, thence t.e.p. or trans-equatorial to the uninitiates, to Botswana.

Subsequently G3CCH (HBS), G4GAI (LNH), G4HBA (YSW) and GM4DGT (CTR) contacted the A2 station, and the QRB to GM4DGT (IO86CD) is 8221km. Stations south of about latitude 53.7° north listened to the aforementioned working A22KZ but heard absolutely nothing of him.

The short contest on Oct 18 was favoured by some Es propagation. Robert Stennett G0HFN (BRK) heard the beacon CT0WW at S7 at 0915 so put out a CQ call on 50.110MHz to be answered by CT4KQ (IN60BP). G0HFN uses a Yaesu FT-690 Mk 2 with 15W amplifier to a 2-ele Sandpiper antenna in the loft facing west.

Geoff Brown GJ4ICD made 60 QSOs in

QTH Locator Squares Table

	Band (MHz)			
Station	1296	430	144	Total
G3JXN	82	129	175	386
G3XDY	81	137	185	403
G6DER	70	105	182	357
G4NQC	63	99	250	412
G3UVR	63	113	217	393
G4FRE	63	136	84	283
GJ4ICD	59	119	253	431
G4NBS	59	99	92	250
G8PNN	58	94	128	280
HB9AOF	55	80	141	276
G6MGL	50	89	135	274
G3COJ	44	102	186	332
G4DEZ	44	38	246	328
G8ATK	42	89	138	269
G4RGK	36	94	251	381
G1EZF	32	86	234	352
G6YLO	32	104	128	264
G8GXP	30	140	307	477
G1DOX	28	34	53	115
G1KDF	27	86	144	257
G4MUT	24	88	144	256
G6HKM	22	101	172	295
G6XVV	20	64	194	278
G8XVJ	18	88	236	342
G3IMV	17	116	405	538
G4FVK	17	43	71	131
G4ZTR	17	15	37	69
G6MXL	10	36	66	112
G6AJE	5	57	95	157
G8LHT	2	31	81	114
G4AGQ	1	41	102	144
G2DHV	1	4	27	32
G4KUX	—	80	345	425
G4XEN	—	102	250	352
DL8FBD	—	69	274	343
G4DHF	—	—	307	307
G4SWX	—	—	293	293
G4TIF	—	106	184	290
G0DAZ	—	91	183	274
I4YNO	—	—	270	270
G4SSO	—	67	190	257
G6DZH	—	82	143	225
G1LSB	—	118	106	224
G4IGO	—	—	223	223
G3FPK	—	—	222	222
G4SFY	—	—	222	222
G4MJC	—	33	184	217
GM4CXP	—	30	182	212
G3NAQ	—	68	143	211
G4MEJ	—	—	211	211
G1EGC	—	44	166	210
GW8UCQ	—	81	128	209
G8LFB	—	—	200	200
G4HGT	—	52	142	194
G4YCD	—	36	155	191
G1GEY	—	48	139	187
G8MKD	—	49	133	182
G4XEK	—	—	178	178
GM0BPY	—	54	123	177
G4YUZ	—	—	177	177
EI5FK	—	35	137	172
G8ZDS	—	43	129	172
G4DOL	—	—	172	172
GJ6TMM	—	31	128	159
ON1CAK	—	—	154	154
G4CQM	—	52	100	152
GW8VHI	—	48	102	150
GW4FRX	—	—	126	126
G6XRK	—	1	117	118
G4TGK	—	—	113	113
GW6VZW	—	6	98	104
G8XTJ	—	—	104	104
PA3EUS	—	17	56	73
G0FEH	—	—	65	65
GM0GDL	—	13	48	61
G1CRH	—	—	59	59
G0HDZ	—	—	55	55
GU4HUY	—	—	54	54
G1NVB	—	—	49	49
G8PYP	—	—	47	47
G1VTR	—	23	6	29

Starting date 1 January 1975.
No satellite or repeater QSOs.
"Band of the month" 1296MHz.

the contest and confirms Es propagation throughout the period with S9 signals from CT0WW. He heard no EA or CT stations though but best DX was GM0FRT (IO87) at 871km via Es. TV timebase QRM made things very difficult on reception.

Paul Thompson G6MEN (SPE) runs 25W to a dipole and reports Es cross-band QSOs with EA4CN at 1305 on Oct 24 and EA3ADW at 1214 and EA3DLV at 1240 the next day, the EAs being on 28.885MHz.

Derrick Dance GM4CXP (BDS) has found several Ar events these past few months. On Oct 3 he worked GM0HNX, GM3JIJ, GM3ZBE, LA3EQ, G4HBA and G4CMT. The event was still in progress, weakly, at 2138 when he closed down.

Simon Lloyd Hughes GW8NVN (GNS) wrote about the operation from Flatholm Island in the period Aug 28–31 using the callsign GB2FI. On 50MHz the group used an Icom IC-290ES, MM 50/144MHz transverter and 5-ele Tonna Yagi. They had a continuous pile-up and notable contacts included G1HYD (HWR) using one watt, G3RSX (WMD) running 0.5W and GW3JXN/A (DFD) with one watt, each using dipoles. The trip was to celebrate the 90th anniversary of Marconi's tests from the island and had BBC radio coverage including the World Service.

The 70MHz Band

After a four years' absence **Paul Turner G4IJE** (ESX) is back on the band. Next to **Dave Meadows G4TGB** (NOT) who has worked eight new stations on s.s.b. and six on f.m. since his last report. But he reckons there are still not many B licensees QRV yet. He was on for two hours in the contest on Oct 25 and worked 26 stations in 18 counties. He would like to try some RTTY on the band but would rather avoid 70.3MHz as he transverts from 144MHz so there could be breakthrough as it is the calling frequency. He is QTHR if anyone would like to arrange tests. Dave mentioned that the Rolls-Royce Club in Hucknall (NOT) is QRV on 70 and 50MHz but did not know the club call.

John Jennings G4VOZ (LEC) used c.w. in the contest and has now boosted his ladder total to 102. All the regulars answered on c.w. but the "visitors"—those who only seem to appear in contests—nearly all came back on 'phone. Usual excuses were no key or they were a Class B licensee apparently using a "callsign of convenience".

G4VOZ operates mobile a lot using f.m. simplex and often gets asked how to get going on the band. His usual response is that all you need to do is plug in a soldering iron, but that induces a "shock, horror" comment it seems.

GW8NVN and his friends had 70MHz equipment during their GB2FI trip but, although it had survived a week-long soak test the previous week, it became faulty on Flatholm leaving many addicts very disappointed.

The 144MHz Band

Johan Van De Velde's ON1CAK letter was written in mid-October and lists some good DX worked from Liedekerke in September including GWs in XL and XM and EIs in WN, plus G4XBF/P (XJ) on the 23rd. In an Ar event on Oct 3 he contacted GM3TSL (YR) and heard other GMs and GIs. He contacted OZ1EVA/MM in BM, BN, CO and DO squares in the Oct 8/9 period and on the 10th Y35O and Y23KO in GM and Y32CL (GL). Johan is now up to 154 squares worked.

Annual v.h.f./u.h.f. table
January to December 1987

Station	70MHz Counties	70MHz Countries	144MHz Counties	144MHz Countries	430MHz Counties	430MHz Countries	1296MHz Counties	1296MHz Countries	Total Points
G1KDF	—	—	98	16	70	12	28	8	232
G4NBS	54	7	68	17	53	18	*42*	*10*	217
G6HKM	—	—	74	26	54	13	27	7	201
G1LSB	—	—	75	25	62	22	—	—	184
G1SWH	—	—	97	12	58	11	—	—	178
G1GEY	—	—	74	26	47	12	—	—	159
G6XVV	—	—	70	13	50	8	12	2	155
G1EHJ	—	—	58	12	53	9	—	—	132
G8LHT	—	—	66	22	29	10	3	1	131
G6AJE	—	—	54	17	40	8	7	2	128
G4SEU	58	6	43	16	3	1	—	—	127
G4DEZ	—	—	34	10	42	11	13	5	115
G4ZTR	36	5	32	11	24	6	*21*	*6*	114
G4MUT	26	1	45	14	19	3	*7*	*2*	108
G4VOZ	61	6	—	—	34	7	—	—	108
G6MXL	22	5	42	11	18	7	*8*	*3*	105
GW4FRX	—	—	77	27	—	—	—	—	104
GW6VZW	—	—	68	24	9	2	—	—	103
ON1CAK	—	—	72	31	—	—	—	—	103
G3FPK	—	—	76	21	—	—	—	—	97
G4WJR	—	—	78	10	—	—	—	—	88
G4TGK	—	—	66	19	—	—	—	—	85
G8XTJ	—	—	65	16	—	—	—	—	81
G4AGQ	15	1	31	12	13	4	*1*	*1*	76
G4YIR	—	—	60	15	—	—	—	—	75
G1CRH	—	—	64	11	—	—	—	—	75
G6OKU	—	—	53	9	1	1	—	—	64
G0HDZ	—	—	53	11	—	—	—	—	64
G6MGL	—	—	25	6	25	2	1	3	62
GM4CXP	2	2	32	13	3	3	—	—	55
GW4HBK	48	7	—	—	—	—	—	—	55
G0HGA	—	—	43	9	—	—	—	—	52
G1VTR	—	—	16	2	22	5	—	—	45
G2DHV	11	2	21	5	3	1	—	—	43
G3EKP	13	3	12	3	7	3	—	—	41
G4WND	25	4	—	—	—	—	—	—	29
GU4HUY	—	—	21	6	—	—	—	—	27
G6XRK	—	—	8	6	—	—	—	—	14

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

Before the hurricane, **Antony Wayland G1HJW** (ESX) worked OZ1EVA/MM in BM, BN, DO and DP squares but his antennas got blown away a week later. However, he has already replaced them and hopes the new ones work as well as the old ones did.

Maurice Williams G1NVB (LCN) wrote to update his squares table figure listing the new ones worked in the summer. He finds his signals are swamped out by those using much greater e.r.p. though. However, he has worked into LA and HB with OE heard.

John Quarmby G3XDY (SFK) reports that all his antennas survived the hurricane but that there is not much to report as tropo conditions have been poor this autumn. He did get a couple of new squares, CO and DO, from the OZ1EVA/MM voyage.

Ian Cornes G4OUT (SFD) always sends in a very neat computer-printed log of the c.w. stations worked, now at 151 for this year. His work shift pattern was due to change on Nov 1 which should have enabled him to take part in the 24 hours c.w. contest on Nov 7/8. Ian is one who has only had temporary planning permission for his antenna mast so hopes that this time he will get full permission.

John Palfrey G4XEN (NHM) caught the Ar event on Sept 25, 1710–1830, and tried very hard to work GM0EWX (WR) on c.w. He did contact LA2AB near Oslo at a beam heading (QTE) of 350° with the LA's QTE being 300°. Square number 250 was worked on Oct 10, OZ1EVA/MM in BM and the next day, in another Ar, John worked LA6VBA, GM4ILS and G4CJG/A but no SM or UQ stations heard in Wellingborough.

He was in Ibiza from Oct 2–9 and met EA6FB and his wife, and husband and wife team EA6QB and EB6MC. With José EA6FB he had visited the site of the beacon EA6VHF (AY07j) at 458m a.s.l. from which the view was superb. It is also the v.h.f./u.h.f. contest site. The beacon QRG is 144.918MHz.

Ela Martyr G6HKM is now minus the 18m tower which supported her 144MHz Yagi and her husband's tri-band h.f. beam. On its way down in the hurricane it smashed the 430MHz beam. The only antenna to survive was the 42-ele 1.3GHz one on the small Altron mast. Prior to the disaster, BM and BN squares were added to her total.

Mervyn Rodgers GM0GDL (CTR) has written after a long time to update his squares totals. During this period he has worked into F, GU and I and has put up two 10-ele Yagis. He mentions several recent Auroras but these tend to be non-events in Alva due to there being 763m of granite just 200 yards to the north.

GM4CXP cheerfully admits that Auroras are certain to bring him out of hiding, so Derrick has been pleased to discover several recently. He reports events on Aug 3 and 31 and on Sept 22 when GB3LER was copied weakly at about 1700. On Sept 25 OH2NQ (KP22GE) was heard at 1614 and RQ2GAG (KO26AW) six minutes later. He worked LA9BM (JP40CM) at 1629 at RST55A each way.

On Oct 3 another one was detected at 1327 and Derrick contacted two PAs, four Gs, two DLs, OZ1FGP, UQ2GMD, SM1MUT, EI5FK and GM4AWA. On Oct 11 GB3LER was auroral at 1502 and he worked two GMs, OZ4VV and LA9FY before the event faded away at 1846.

The GB2FI team's trip to Flatholm Island coincided with a period of excellent tropo and GW8NVN reports that many continentals were worked including OK1FM/P, OZ1FTU and HB9STY/P in spite of inadequate RX facilities. This was in the Aug 28–31 period.

At G3FPK the only tropo contacts worth reporting were with OZ1EVA/MM in BN and DO squares, neither new, though. On the Ar scene, **John Eden GM0EXN** (HLD) telephoned at 1535 to report an Ar in the north of Scotland and I also found it audible in ZL60j and worked GM4ILS (IO87IP) on c.w. at 1556 and heard John at RST51A shortly afterwards; this on Oct 11.

My notes are ambiguous but I believe there was an Ar in Scotland on Oct 27 as I have a note in the log for that day that GM4IPK worked 20 stations. **John Nelson GW4FRX** (PWS) telephoned at 1415 on Oct 28 to report reception of SK4MPI (HU46d) on 144.960MHz and GB3LER, albeit very weakly. GM0EXN advised me at 1620 that he was copying GB3VHF aurorally but I heard no Ar signals through the computer noises—it was half term and the local schoolchildren were apparently playing computer games all day long.

My thanks to **Derek Turner G4SWY** (HFD) who sent me a tape of "Various Auroras" received from GM0EXN. The reason he got it was because the latter copied a c.w. signal from G4SWY but it was actually G4SWX sending a duff X. I have played the tape through and it makes me very envious since only rarely do we hear so many strong Ar signals in the southerly latitudes.

One sound piece of advice from GM0EXN is that on c.w. stations spread out well away from the 144.050MHz region which gets very cluttered. While we may only be copying a few of the stronger stations in the south, up in Scotland they will probably be receiving lots of the more modest signals from SM, etc. So a weak G signal will almost certainly be covered up.

John suggests to go above 144.075MHz in five kilohertz steps as they tend to search those frequencies. It would make sense to call CQ in the higher parts of the c.w. section, even up to and above 144.150MHz, he reckons. Another factor to consider is the Doppler shift whereby the Ar signal will not be on the same frequency as the actual transmission. This is of great importance if you are using a narrow c.w. filter, of course.

On occasions when I have been able to copy the direct tropo signals from distant stations as well as the Ar ones, I have measured shifts of up to 2kHz, sometimes l.f., at other times h.f. So you really do need to use the r.i.t. control in case someone is calling you zero-beat to your Ar signal.

To put some figures to Doppler shift, if you observe a shift of 1.2kHz, this implies that the auroral curtain is moving at a velocity of about 2.5km/sec or 5600 m.p.h. Since signals are being reflected from many different parts of the curtain, or curtains, your signals will be coming back at umpteen different frequencies. This is because an Ar is not a static thing but in violent motion as anyone who witnesses these events will know. The net result is a great spread of the received signal.

The 430MHz Band

Paul Brockett G1LSB (LCN) reports below average conditions in October but he did work G4YPC/P (XJ) on the 2nd. In the u.h.f. contest on the 3rd he worked DK0VKG/P (DL), DK1KN (DK) and PI4EME (DN). The following day brought ON1KBV (CK), DF0AP (DJ), DL8PC (EK), F1GTR (ZH) and F1ARR (ZI). Paul did not hear OZ1EVA/MM in the Oct 8–10 period, though.

Phillip Stanley G3BSN (LDN) lists overseas stations heard/worked as DG2BRW, DJ9DL, DK0VS, DK0VPG, F6CTT, F6HMG, FF6KDG, ON1BLY, ON4FI, PA0GUS, PE1CJW, PE0MAR and PI4KML. In the UK, G1LGG (WMD), G3GIM, G8STY and G6YLW (KNT), G1GVA and G3IMV (BKS), G1JGS/P (IOW), G4APA (CHS), G3FVA (DYS), G6WZA (SOM) and G8HDS (LNH). All those on s.s.b with G4DZU (YSW) on c.w. G4XBF and G4YPC operating portable from the Lizard (CNL) were also mentioned.

Phillip's antennas were brought down in the hurricane but the 430MHz ones only suffered minor, bent element, damage. He plans to replace the array with a box of four with AZ/EL facility as he has found that, in good tropo conditions, signals can be improved by up to 12dB with some elevation.

G3XDY added OZ1EVA/MM on Oct 8 when they were in BM and BN squares, both new, but John did not hear them from CO. G6HKM had added a BNOS 100W amplifier to her station and used it for the first time in the Oct 8 leg of the Cumulatives making 47 QSOs. One new 1987 county, GNM, came out of it.

GM0GDL should have finished a 4CX250B amplifer for the band by now and planned to erect two 23-ele Yagis which ought to make him a good signal from the rather rare Central Region.

The Microwave Bands

On 1.3GHz G3BSN lists as heard/worked PE1CJW (JO32FI), GW4IGF/P (IO83JA) and, from England, G3GIM and G8XIR (KNT), G3IMV (BKS), G8CHW (HFD) and G8OHM (WMD). Phillip's antennas suffered badly in the hurricane. The problem with the Tonna product being the plastics stand-off insulators which hold the elements in place. He suggests these should be re-designed.

G3XDY reports average conditions in the contest on October 3 and he made 13 contacts on 2.3GHz including one in AK square, which was new. John now has 25 on this band. In the contest, **John Tye G4BYV** (NOR) worked two stations on 3.4GHz (9cm) in AL and AN squares. On 2.3GHz a new one was XK square, making it 53 on the band. He made about 60 QSOs in the contest and only gave the European QTH locator. He says that those calling CQ were giving their E-QTHL too. He heard G4BRK/P (XK) working PE1GHG (CL) on 2.3GHz in the contest.

For G6HKM, the only new one for the Annual Table was G8OHM/P (OFE) in one leg of the Cumulatives bringing Ela's counties total to 27 this year on 1.3GHz. GW8NVN, referring to the GB2FI operation, mentions an unsuccessful 10GHz test with GW3PPF because, "... a seagull did not like the equipment and dive-bombed it, knocking it off the roof."

Reports by Dec 23, Jan 27, and March 2

Interference Problems

Tony Collett's G4NBS (CBE) has been having continual trouble with one neighbour with TVI or rather a defective audio circuit in the set which causes breakthrough when he is on 430MHz. Only channel 21 is affected it seems.

The RIS is involved and he writes, "... this time I have been threatened that I must not cause any interference to the main TV, or else!" Therefore, he is limited to a mere 10W when beaming in the direction of the affected set.

Now in cases where the RIS engineers have proved conclusively that interference is only due to r.f. being rectified in audio circuits—i.e. no interference to the u.h.f. or i.f. ones—I think we should politely, but firmly, tell the RIS folk that we will not accept this QRP solution. By all means offer to restrict the power for a week or two while the complainant gets his set fixed, as a gesture of goodwill, but we must make it quite clear that we refuse to accept power limitation as the final solution.

One of our licence conditions is that we must not cause any undue interference to other wireless telegraphy. Quite right. But surely it is stretching the matter a long way to regard purely a.f. circuits as wireless telegraphy?

Tony's 70MHz transmissions have caused genuine TVI in the past and he has found the cause. In the output circuit of the PA there is a little diode to rectify a whiff of r.f. to drive a meter to indicate relative power output. Said diode, since removed, was generating harmonics in Bands IV and V which were being radiated directly, even though he has a low-pass filter between TX and antenna.

This is nothing new, of course. GW4FRX had a similar problem years ago from an "el cheapo" so-called s.w.r. bridge. Replacing the germanium diodes with Schottky ones cured the problem and also improved the linearity of the device.

Sign Off

Please note the next deadline and make sure you get your final annual table scores to me as near the year end as possible. Meantime, a Very Merry Christmas to all readers and contributors. Thank you all for your support and I look forward to an even better 1988.

RTTY

Reports to Mike Richards G4WNC
200 Christchurch Road, Ringwood, Hants BH24 3AS.

This month has been quite a good one for RTTY and I have logged a few new prefixes, which are always welcome.

The first was ZL1AHA (New Zealand) on 14MHz at about 1000UTC on October 9. Although New Zealand is hardly rare, it's the first I have logged on RTTY. When I first heard ZL1AHA he was working OF1WF, which is another unusual prefix: this turned out to be OH1WF using a special call to celebrate the Republic of Finland Independence Day, so that was rather a unique QSO. The next interesting burst of activity was on October 14 and 15 when I logged 9Q5BG (Senegal) on 14MHz and 21MHz; at the same time there were a lot of South American stations coming in with very strong signals. One final notable

call was YO4AVR/MM; this Romanian station was maritime mobile off the South East coast of Brazil and was putting out a very good signal.

My biggest problem this month has been a severe lack of reports from readers. Just a few notes or a photo-copy of your log is all that's required and would help to make this column more representative. If you have any comments on the development of the column then please write and let me know, as my objective is to please you!

FAX

How many of you worked or heard some interesting DX during the FAX contest on the weekend of October 31/November 1? Unfortunately I was away at the Computercations Rally so I missed most of the action. This rally was the first where I have tried to set up a live FAX demonstration so quite a lot of experimentation was required.

I took along my trusty Icom IC-720A transceiver, Epson RX-80 printer, power supply and the ICS FAX-1. The antenna comprised a coaxial feeder from the rig to the roof of the building, which was connected to a long wire antenna about 30m long. I was hoping to be able to receive some good amateur FAX from the contest that was running on November 1. After sorting out the earthing problems all seemed to be working well and I managed to receive signals from DJ4SR, which was a good sign. Then the trouble started. First I found that the h.f. demo station was overloading the front end of the Icom and causing splatter all over the h.f. bands; this is not surprising as they were running at least 100W and their antenna was less than 30m from my long wire! My next problem was more QRM from all the computers which were running on site. So unfortunately I had to give up amateur FAX and revert to weather broadcasts on v.l.f. Despite the problems I think the whole experiment was worth doing as mine was the only live demo running and did seem to attract a lot of interest.

My activities at Computercations meant that I missed the FAX activity night on November 2, so how did it go? Your reports would be very welcome.

Packet

As can be seem from this month's chart, I have spent a fair amount of time monitoring h.f. packet on 14MHz. The level of activity is really quite amazing. Whilst listening on October 24 I logged Senegal for the first time when I heard 6W1FJ at 0854UTC on 14MHz. The operator's name was Malick and the QTH is Dakar, so I should watch out for that one.

On the equipment front I have just received some hot news from Siskin of a new TNC-2 clone. It is called the Siskin TINY II and is about half the size of the earlier TNC-220 (that's small!). There's only one port (v.h.f.) but h.f. can be obtained by plugging in a header. It is to be fully TNC-2 software compatible and will be supplied built and tested with a 12 month guarantee. The cost, £99.95, which sounds pretty reasonable.

I also have news that the AMRAC TNC driver r.o.m. v 3.01 for the BBC B is now available from AMRAC. I have only had time for a quick play with it but it looks good. The program has now been produced as a Public Domain package and as such is unlikely to be updated. The software is normally supplied as a r.o.m. image on disk, so contact AMRAC for supply details.

The latest addition to the packet operator's armoury is NET/ROM which adds a much needed additional layer to the AX-25 packet protocol. The main benefit offered is greatly improved throughput of information when using paths with one or more intermediate stations.

The existing technique for operating via intermediate stations is known as digipeating. This technique is fine providing all the radio links used are free from noise and congestion, a rare occurrence these days. The use of digipeaters can be a great help, especially if you have a QTH like mine which is in a valley at sea level! Anyone who has tried to work through more than one digipeater on today's crowded bands will, I'm sure, have found the link to be very slow and very often failing miserably. In order to understand why the link fails a basic knowledge of the AX-25 protocol is required.

To help newcomers the following is a simplified account of the error correction system used in packet radio.

The characters typed at your keyboard are assembled into packets by the TNC (Terminal Node Controller) and then transmitted. These packets comprise the actual characters that you typed plus some extra information added by the TNC for routing and error correction purposes. The TNC will then wait for an acknowledgement from the distant station to confirm that the packet was received error free. Once the acknowledgement has been received the next packet can be transmitted and so the QSO continues.

If for some reason the packet arrives at the distant station corrupted, then instead of sending a simple acknowledgement the distant station will ask for a repeat of the packet. Another possibility is that the acknowledgement from the distant station is either corrupt or missing entirely. In this case the originating TNC automatically re-sends the packet after waiting a pre-set time. If a packet still fails after ten of these re-tries then the TNC will normally abandon the connection.

As can be seen from this description, the error correction system is pretty fool-proof and ensures that the original message either arrives at the distant station complete or not at all!

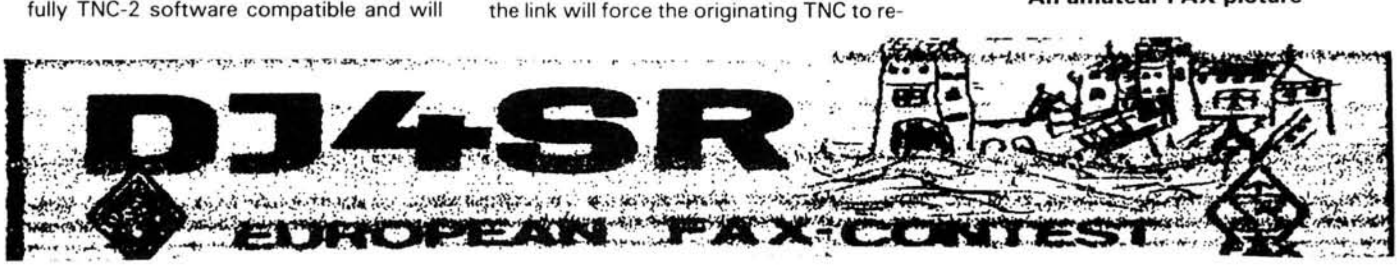
When using this system via a digipeater the result is often failure as the digipeater merely repeats the packet or acknowledgement and does not have an error correcting system between it and the stations using it. Even on a simple route with just one digipeater, corruption of any part of the link will force the originating TNC to re-send the whole packet. Obviously if you extend this to a route with more digipeaters the result is a very slow and virtually unusable link.

Prefix (Country)	Band (MHz)				
	3·5	7	10	14	21
A, K, W (USA)		P		APR	
CT (Portugal)				P	
CX (Uruguay)				R	
DA, F, J, K, L, (W. Germany)	R	R		APR	
D4 (Cape Verde)				R	
EA, C (Spain)		P		R	R
EA8 (Canary Is.)				A	
F (France)		P		PR	
G (England)	AR	R	A	APR	
GI (N. Ireland)				P	
GM (Scotland)	R			P	
GW (Wales)	R			PR	
HA (Hungary)				PR	R
HB (Switzerland)			A	P	
I (Italy)		P		PR	
JA, G (Japan)				PR	
KX6 (Marshall Is.)					R
LA, B (Norway)	R		P	PR	P
LU (Argentina)					R
LX (Luxembourg)				R	
LZ (Bulgaria)				R	
OE (Austria)				R	
OH (Finland)				PR	
ON (Belgium)	R			R	
OZ (Denmark)				R	
PA (Netherlands)				R	
PP, Y (Brazil)				R	R
SG, K, L, M (Sweden)				APR	
SO, P (Poland)				R	
SV (Greece)				P	
SV5 (Rhodes)				R	
SV9 (Crete)				P	
UT (Ukraine)				R	R
VE (Canada)				P	
YB (Indonesia)				R	
YO (Romania)				R	
YU (Yugoslavia)				R	
Y2 (East Germany)	R				
ZL (New Zealand)				R	
4K1 Antarctica)				R	
4X (Israel)				P	
6W (Senegal)				P	
9H (Malta)				P	
9Q5 (Zaire)				R	R

What is needed to correct this situation is complete error correction on each part of a route so that in the event of corruption only the link suffering the corruption has to resend the data. This is where NET/ROM comes in as, if this facility is available on the digipeaters, then all parts of the link can be made error correcting.

The procedure is to first connect with the local NET/ROM digipeater. Once this connection is established you then issue another connect instruction to the NET/ROM digipeater within range of the station you want to contact. The route between the two NET/ROM digipeaters is then automatically set up. When the route is complete the originating station receives a message saying that connection with the final NET/ROM digipeater has been established. All that is required now is to issue a final connect command to the destination

An amateur FAX picture



station and the QSO can begin. This may sound rather complicated but in practice it's really very simple.

Any TNC-2 or clone can have the NET/ROM fitted, though for best results the TNC may need to have the clock speed increased and the memory expanded. For more information I would recommend that you contact your TNC supplier.

Free Software

Are any of you using IBM PC compatible computers or machines that use the CP/M operating system? If so, you ought to know about the **Public Domain Software Library**[1]. I originally joined the library whilst looking for a source of software for the Amstrad PCW computer and have since been delighted by the software and service offered by the library. The software isn't actually completely free as there is a small copying fee, postage and V.A.T. An alternative is to download software from the bulletin board.

To give you an idea of the amount of software available, the library currently holds more than 2000 disks each containing about 360K of software! Within this vast range of software there are quite a few which are of particular interest to the radio amateur. I have contacted the library and will shortly be reviewing some of these programs in this column. If you can't wait or would like to find out more, then you can contact the library direct, enclosing a s.a.e. for the reply.

Don't forget I need those reports either direct to the address at the head of the column or to my **Prestel mailbox: 425470071.**

(1) Public Domain Software Library, Winscombe House, Beacon Road, Crowborough, Sussex TN6 1UL.

Amateur Satellites

Reports to Pat Gowen G3IOR
17 Heath Crescent, Hellesdon, Norwich, Norfolk NR6 6XD.

RS-1

Radio-Sport-1, launched over ten years ago, was the forerunner of the RS series of satellites. The very fact that it prematurely lost its battery capacity means that now it is the longest surviving audible amateur-radio satellite. A cell of the rechargeable battery supply went open circuit, allowing the beacon to operate whenever a sufficiency of voltage resulted from the illuminated solar cells.

Many letter and telephone reports result due to the rather sporadic appearance of the beacon on 29.401MHz, with most observers excitedly reporting what is believed to be a new satellite sending numbers. The original telemetry, which sent the callsign "RS" followed by a series of letter prefixed numbers indicating housekeeping values, has become corrupted with each letter sent as a figure "5", so that now we hear "55 5015 5015 . . . . 5015 55" in a run. This has been heard with regularity by those looking for the RS-10 upper beacon on 29.403MHz, but occasional reports also came in of a strange "ticking" on the same frequency.

A little calculation of the old RS-1 orbit, and the close following of a number of passes, resulted in discovering that the "ticks" were the dots and dashes of RS-1 itself, with the tiny power capacity as it approached a low sun angle near solar eclipse causing power exhaustion so severe that a full duration dash or dot could not be sustained, only permitting the tick of the make of the character before the power fell. The space between the pulses permitted enough charge to accumulate before the next "tick".

An interesting experiment is evidenced here, as although we understand (to the best of our knowledge) that RS-1 is never on in darkness, it is not always on when calculated to be fully illuminated by sunlight. A possible explanation results from the awareness that solar illumination is not just a matter of "on" and "off", as earth's atmosphere content gives considerable scatter and light attenuation, particularly in the blue end of the visible spectrum. Pollution can give very red sunrises and sunsets. It could prove valuable as a research project to observe the beacon of RS-1, as it is obviously very sensitive to changes of light intensity, in order to attempt to relate this to terrestrial and ionospheric events.

The figures in Fig. 1, from the GM4IHJ "eqxer" computer program, give the acquisition times of RS-1 for the Sundays of December 13 and 27, when the satellite first comes into our range. The printouts (i), (ii), (iii), (iv), (v) and (vi) (Fig. 2) are from the GM4IHJ "SATSOL" program which graphically shows the passage of an orbit of the satellite in shadow or in sunlight, the main black area indicating the period of an orbit when not eclipsed by earth's shadow. If we look at Fig. 2 (i), the first pass for December 13, commencing at 0031, we find the satellite in eclipse, having been so for some fourteen minutes, and not coming back into sunlight until after we lose the pass. The beacon is thus most unlikely to be heard.

RS1 ON 13/12/87

AOS	0031	AZ	193
AOS	0235	AZ	242
AOS	0444	AZ	295
AOS	0652	AZ	331
AOS	0855	AZ	344
AOS	1057	AZ	347
AOS	1259	AZ	346
AOS	1502	AZ	339
AOS	2042	AZ	91
AOS	2236	AZ	148

RS1 ON 27/12/87

AOS	0141	AZ	256
AOS	0351	AZ	307
AOS	0558	AZ	336
AOS	0801	AZ	345
AOS	1002	AZ	347
AOS	1204	AZ	346
AOS	1944	AZ	108
AOS	2140	AZ	161
AOS	2341	AZ	210

Fig. 1

Fig. 2(i)

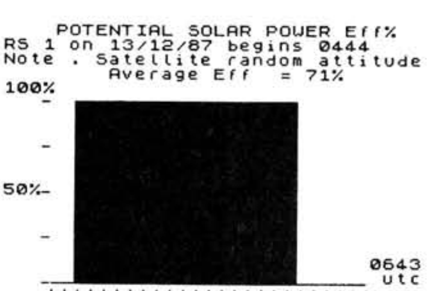


Fig. 2(ii)

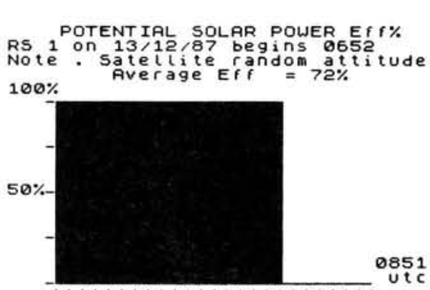


Fig. 2(iii)

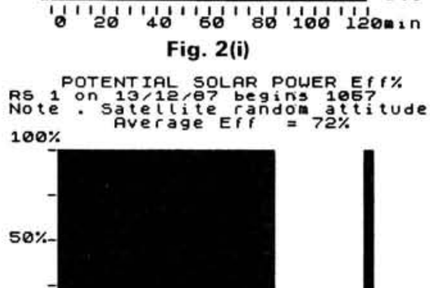


Fig. 2(iv)

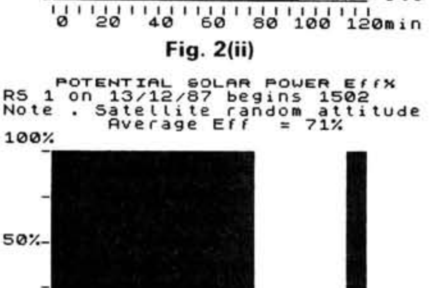


Fig. 2(v)

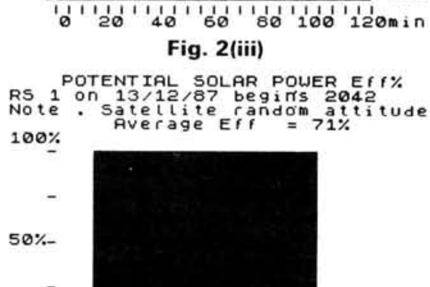


Fig. 2(vi)

If we now jump to the pass commencing at 0444UTC, Fig. 2 (ii) shows that the satellite comes into the sun four minutes into the pass, and we may hear it start to tick, and later send its full content. At 0652UTC Fig. 2 (iii) puts the satellite into the sun from the moment it comes into range, giving an ever greater chance of hearing the beacon commence. On Fig. 2 (iv), at 1057UTC, we first have AOS after RS-1 has been out of solar eclipse for four minutes, whilst with the AOS at 1502UTC on Fig. 2 (v) it has been in the sun for eight minutes, each stage increasing the opportunity of actuating the beacon. Finally, at 2042UTC, on Fig. 2 (vi) the solar cells have seen no sun for some 22 minutes, again giving little likelihood of operation. Unfortunately, in this particular period, we have no passes in range of the UK where it enters eclipse after sustained solar illumination, though these will result later. If readers wish to follow up this interesting project and need precise long term tracking and insolation values, both of the programs are available from SARUG (G4INP QTHR) and run on the Spectrum computer.

Encore OSCAR-10

Recent observation of OSCAR-10 shows that the battery charge is slowly increasing, and that the transponder is still functional, although current indications suggest that the beam-antennas have probably not automatically switched in during the power-off period as hoped. Nevertheless, W6WNH performed a transponder test, and found strong signals resulting.

Peter Guezlow DB2OS, in consultation with fellow command stations VK5AGR and ZL1AOX, indicates his delight at the discovered recovery. He believes that use of the transponder might now be possible from November 20 onwards on the proviso that the lowest possible power required for communication is employed and that the eclipse period following perigee is kept free of all use. For November 16, the solar eclipse is from 0657 to 0824UTC, so use from Mean Anomaly 74 to 106 must be avoided at all costs. The periods recommended for transponder employment are from Mean Anomaly 0 to 059, and from 131 to 255 for November 16 to 23, and from MA 0 to 69 and 141 to 255 for November 24 to 30. Later periods, and the confirmation to commence transponder operations will be given out on the AMSAT nets to ensure topicality.

Recognising that we are in holiday time, and the dark days and long nights are very conducive to being in the shack, we offer some passes for you to try, in the confident hope that full operation will re-commence. The print-out of the AMSAT AMS-81 program is shown in Fig. 3 and gives a listing of OSCAR-10 signal acquisition and loss of signal times for the period December 12 to January 6 inclusive for Britain. The final columns give the time of maximum DX (normally apogee), the maximum distance (DX) possible, and the azimuth at which this occurs. Note that the use is dependent upon the time of the mean anomaly determining the use schedule, and not merely over-the-horizon satellite presence.

The apogee of OSCAR-10 is at its most northerly point again on January 7, so it is not surprising to find that we can "see" the tops of both apogees each day, giving a coverage of all of the northern hemisphere, and most of the south as well (only that area immediately proximate to New Zealand has no mutual access for the UK). The elliptical orbit and the earth rotation give passes that seem rather unexpected to the circular satellite observer, resulting in two passes per day from Christmas Day to December 29 inclusive, and even three separate signal acquisitions as the satellite appears over our horizon on December 27.

The print-out, Fig. 4, from the GM4IHJ OSCAR-10 calendar program called "CAL", gives us on-the-hour azimuth and elevation positions for central UK for the holiday days of December 28 and 29. Under the callsign headings, e.g. KH for Hawaii, W6 for California, etc, an indication is given by an asterisk if OSCAR-10 has mutual access.

It can be seen that all areas except ZL are workable, and although ZS is not marked, it will be available on other days when the satellite apogee is closer. On December 29, we can work Hawaii (KH) by both "short path" to the west in the morning and on "long path" in the afternoon!

AMSAT-UK Services

The requirements of satellite enthusiasts are somewhat wider and different from the radio amateur and short wave listener that keeps to terrestrial communications, and aids for the space specialist are not always easy to come by. AMSAT-UK run a membership service organisation that is available to all satellite fans, and to members at 10 per cent discount rates. Profits from sales have resulted in funding for the satellites themselves, as needed finance toward OSCAR-10, the UoSAT spacecraft, and to the next Phase III satellite planned for launch soon.

Among the many reasonably priced items are "Oscalator" trackers for RS-5, 7, and 10/11, FO-12, the UoSAT pair OSCAR-9 and 11, and the NOAA-9 and 10 Weather Satellites, as well as frequency translation cards to help translate uplinks to downlinks. Printed circuit boards with specific components are available for pre-amplifiers at 29MHz (RS satellites) and 145MHz (OSCAR-10, RS-10/11, Phase III-c) with pre-amplifiers fully built and aligned for 145MHz and the 137MHz Weather Satellites.

Circuits and p.c.b.s for Phase IIIb and c demodulators, demodulators for UoSAT 1 and 2 and FO-12 can be supplied, as well as a host of books covering the needs of satellite operation, technical handbooks, data books on the various satellites. Alignment tapes and even satellite QSL cards with your own callsign are among the stocks held. Add to this software programs for the Apple, Amstrad, BBC and BBC (B), and Commodore C-64 computers, and most needs can be covered.

Readers interested should send a 9 × 6in self-addressed envelope with 20p in stamps to Ron Broadbent G3AAJ, Secretary AMSAT-UK, 94 Herongate Road, Wanstead Park, London E12 5EQ. In return, by request, they will receive a list of all accessories available, a copy of *Oscar News*, an AMSAT-UK information sheet, a latest "hot line" news sheet, and a membership form.

Keplerian Elements

You are reminded that some of the satellite computer programs do not auto-

Fig. 3

AMSAT AMS-81 TRACKING SYSTEM
ACCESS SKED FROM: 13DEC87 000000
>>G3IOR VIA OSCAR 10 <<

DAY	AOS	LOS	MAX	DX/EL	AZ
12DEC	2137	0748	0229	14597	254
13DEC	2051	0707	0148	13997	245
14DEC	2005	0626	0107	13424	233
15DEC	1920	0545	0025	12925	219
16DEC	1835	0502	2344	12561	203
17DEC	1751	0418	2303	12394	184
18DEC	1708	0335	2222	12464	165
19DEC	1626	0251	2141	12753	147
20DEC	1544	0206	2100	13203	132
21DEC	1503	0120	2019	13750	120
22DEC	1424	0034	1938	14343	109
23DEC	1347	2346	1856	14945	100
24DEC	1318	2257	1815	15532	092
25DEC	0304	0605	0555	18006	302
25DEC	1301	2206	1734	16090	085
26DEC	0137	0717	0514	17531	296
26DEC	1303	2112	1653	16610	078
27DEC	0034	0741	0433	17069	289
27DEC	1323	2015	1612	17095	071
27DEC	2334	0758	0351	16582	282
28DEC	1346	1910	1531	17555	064
28DEC	2239	0759	0310	16059	275
29DEC	1434	1747	1450	18032	057
29DEC	2149	0735	0229	15499	267
30DEC	2059	0701	0148	14909	259
31DEC	2012	0623	0107	14306	250
01JAN	1925	0544	0026	13713	240
02JAN	1839	0503	2345	13168	227
03JAN	1755	0421	2304	12722	212
04JAN	1711	0337	2223	12443	194
05JAN	1627	0255	2141	12385	175
06JAN	1544	0211	2100	12563	156

28/12/87			KWWPGZ9VJZ
UTC	AZ	EL	H62Y SMKAL
0000	269	8	.****.....
0100	271	17	*****.....
0200	274	19	*****.....
0300	278	19	*****.....
0400	281	17	*****.....
0500	284	14	*****.....
0600	285	10	*****.....
0700	284	6	*****.....
0800	276	0	*****.....
OUT OF RANGE			
1300	59	-4	......***.
1400	59	0	......***.
1500	62	3	....*.***.
1600	65	6	....*.***.
1700	68	7	....*.***.
1800	71	6	....*.***.
1900	73	1	....*.***.
OUT OF RANGE			
2300	261	8	.****.....

29/12/87			KWWPGZ9VJZ
UTC	AZ	EL	H62Y SMKAL
0000	262	21	.****.....
0100	266	25	.****.....
0200	269	25	.****.....
0300	273	23	*****.....
0400	276	20	*****.....
0500	278	17	*****.....
0600	278	13	*****.....
0700	272	8	*****.....
0800	251	-1	.****.....
OUT OF RANGE			
1400	54	-2	*.....***.
1500	57	0	*.....***.
1600	60	2	....*.***.
1700	63	1	....*.***.
1800	65	-2	......***.
OUT OF RANGE			
2200	254	6	.****.....
2300	253	25	.****.....

Fig. 4

ALLSATS EQX ON 13/12/87

SAT	UTC EQX	Brg W	Next +min	Orbit +inc	Next +min	Day +deg
F12	0034	254	115.7	29.2	64.3	20
RS5	0039	280	119.4	30	113.4	30
RS7	0149	306	119.1	29.9	108.7	29
Mir	0040	137	91.1	23.1	19.1	11
Sal	0029	335	94	23.8	64.6	22
RS1	0026	8	120.3	30.2	3.9	3
UO1	0055	85	94.1	23.5	65.9	16
UO2	0052	45	98.4	24.6	37.2	9
NO9	0021	132	102	25.5	90.2	23
N10	0141	91	101.2	25.3	78.4	20
M13	0039	152	104	26.1	16.6	6
M14	0055	130	104	26.1	16.9	6
M/1	0019	180	109.3	27.4	90.8	25
R10	0016	159	104.9	26.3	29.5	9
ERS	0032	346	89.5	22.6	82.7	25
M15	0009	204	105.6	26.5	38.4	11
Aji	0047	258	115.7	29.2	64.3	20

ALLSATS EQX ON 27/12/87

SAT	UTC EQX	Brg W	Next +min	Orbit +inc	Next +min	Day +deg
F12	0154	330	115.7	29.2	64.3	20
RS5	0124	312	119.4	30	113.4	30
RS7	0132	323	119.1	29.9	108.7	29
Mir	0021	218	91.1	23.1	19.1	11
Sal	0115	67	94	23.8	64.6	22
RS1	0131	46	120.3	30.2	3.9	3
UO1	0049	83	94.1	23.5	65.9	16
UO2	0133	55	98.4	24.6	37.2	9
NO9	0112	145	102	25.5	90.2	23
N10	0137	90	101.2	25.3	78.4	20
M13	0116	186	104	26.1	16.6	6
M14	0135	165	104	26.1	16.9	6
M/1	0139	223	109.3	27.4	90.8	25
R10	0020	184	104.9	26.3	29.5	9
ERS	0034	38	89.5	22.6	82.7	25
M15	0031	234	105.6	26.5	38.4	11
Aji	0011	305	115.7	29.2	64.3	20

Fig. 5

matically update for the new year, so some of you may have incorrect tracking information until the sidereal to solar time corrections are made. If you hit trouble, then you may call January 1 1988, December 32 1987 until your program is updated, but better to update the sidereal time, under "G2" (e.g. LET G2 = 0.2753606) in your programs. These are as follows:

1987 — 0.2753606
1988 — 0.27469296
1989 — 0.27676777

Apologies to the pair of erratic apogees and perigees that slipped by in our October listing. We gave the figures for FO-12 as 2479.774 and 2459.757 respectively, when of course we know the mean orbital height to be some 1500km. RS-10/11 was given as 488.0103 and 473.894, at which it would have been a spectacular meteor! It orbits in fact at some 1000km.

The latest fortnightly equator crossings for all satellites appears as Fig. 5. NOAA-11 is not included, as at writing time we are awaiting launch, originally set for October 29.

RS-10

Our latest system pair continues well, alternating between RS-10 and RS-11 on around a six week basis, mainly on mode "KA" whilst the 150MHz COSMOS NAVSAT remains quiet.

Bill Kelly of Belfast sends in a long list of regulars, and has been getting equator crossings directly from the onboard Codestore transmitted memory at the lower end of the passband. The format taken is "... RS10 (or 11) .... WSEM de RS3A — OPORTNYE ORBITY DLA RS10 — 24 OkT NR 1684 0114UT 89 ZAP — 31 OKT NR 1780 0117 UT 102 ZAP ..." and so on for many equator crossings ahead. The orbit date leads, followed by the orbit number, then the EQX in UTC time, followed by "ZAP" (!) which is degrees west.

Gordon Cowey G3DDG of Peterlee, Durham, has been testing the ROBOT, and finds that even at meteor scatter speeds close to 100w.p.m. the ROBOT can still copy his c.w., and come back almost as fast! The lower range seems to be around 6w.p.m., both extremes being very effective on the proviso that perfect c.w. is sent.

OSCAR-9

UoSAT-1 alias OSCAR-9 was six years old on October 6, and despite early calculations showing it would fall to earth in 1986/7, due to the low solar flux and lack of drag over the past few years, it still goes strong. Although its original 550km orbit is now down to 483km, it is expected to be with us until 1991/2.

The reason for the concern expressed over it being off the air from October 14 to 19 were not due to age, nor to a birthday celebration hangover, but because of damage to the UoS command antennas from the severe hurricane that swept across southern and eastern England, destroying thousands of amateurs' antenna systems!

Moscow Meeting

To celebrate the 30th anniversary of the launch of Sputnik-1 on October 4, a "Space Future Forum" convened by the Soviet Academy of Space Research was held in Moscow from 2 to 4 October 1987. Over 180 scientists attended, and AMSAT was represented by President Vern Riportella WA2LQQ. Other amateurs in the US contingent included Dr. Owen Garriott W5LFL, Dr. Ken Kellerman K2AOE, and Dr. Richard Moore W0GYS. Leonid Labutin UA3CR was among the Soviet attendees.

Reports in by Dec 23, Jan 27, and March 2

The forum included many topics on the peaceful use of space, with talks by Karl Sagan, Dr. Bernard Lown on the medical uses of space, including AMSAT's PACSAT project, and many other notable figures.

Project "HAART"

Even before the days of satellites, many amateur groups in the USA, Germany, France and South Africa launched balloon-borne transponders to give skills in tracking and extended v.h.f. and u.h.f. communications. It was by balloon testing that AMSAT-Italy developed the separate AGC passband split to help overcome the QRO "Alligator" problems. Most of these projects have been flown to high altitude on their own or on unmanned research and weather balloons.

Now G3RWL and G3AAJ have got together to provide project HAART, an AMSAT-UK experiment (standing for High Altitude Amateur Radio Transponder). Already the system is working on the bench, and a licence for flight testing is awaited. It consists of a 435.040–435.050MHz uplink receiver, with a non-inverting 145.840–145.850MHz downlink transmitter, with a beacon on 145.852MHz transmitting at 10w.p.m. c.w. the callsign plus an ascending serial number from 000 to 255 sent every 80 seconds. The beacon will run 60mW, and the transponder transmitter 300mW e.r.p. The antennas will be vertically polarised, as they will dangle below the balloon, and the batteries should last for longer than 10 hours.

The intention is to fly the package with Danielle Bridge, a brave young lady out to break the ladies' balloon ascent record, just as soon as the licence and some good weather arrives. It is confidently expected that she will ascend to an altitude of greater than 30 000 feet, which will give a considerable range between the transponder users.

Propagation

Reports to Ron Ham
Faraday, Greyfriars, Storrington, West Sussex R20 4HE

From his observatory in Bristol, **Ted Waring** counted 9 sunspots on October 6, a dozen on the 12th, 22 on the 17th and 7 on the 22nd. In Sevenoaks, **Cmdr Henry Hatfield** recorded bursts of solar radio noise, at 136MHz, on October 5, 6, 8, 14, 15 and 23.

"Sunspots continue to be seen and the geomagnetic field has been more disturbed," wrote **Ron Livesey** (Edinburgh) on October 10. Ron is the auroral co-ordinator for the British Astronomical Association. He reports that the magnetometer used by Karl Lewis (Saltash) was unsettled to very unsettled from September 24 to 30. Magnetic storm-aurora was reported from northern-America on the 24th and such reports as "active auroral storm", "active rayed arc", "active light", "active storm" and "quiet arc" came from auroral observers in Belfast, Birr Castle, Culbokie and Edinburgh for the period September 22 to 30. Ron also pointed out that the AP indices reached 32, 54 and 37 on days 22, 25 and 29, respectively.

Henry Hatfield, using his spectrohelioscope, located the results as shown in Table 1.

I see in the October issue of *Solar News*, the journal of the London Solar Society, that they are selling kits, for £6.50, to make a Jam-Jar Magnetometer which looks interesting. More details about this product and society membership are available by sending an s.a.e. to the Editor at "Brindles", Mill Lane, Hooe, Battle, East Sussex TN33 9HT.

The 28MHz Band

Although **Bill Kelly** (Belfast) logged an Italian station at 1040 on October 10, he found the band generally quiet. In Storrington, **Fred Pallant G3RNM** found a good path between South America and the USSR at 1813 on October 3. He reports that the Brazilian beacon (PY2AMI) was RS59 at 1009 on the 11th but was gone by 1015.

Dave Lingard G0CLH (Soham) logged signals from CX, KB4, TU and W9 on October 9; AL7, HK, KA2, W1 and 5 and 6W6 on the 12th; FM5, KP4, W4, YB0 and 6W7 on the 13th; FR4, W0, 1, 2 and 5 and ZS on the 19th and CX, K3 and VE1 on the 22nd. "A very good Sporadic-E opening on the 21st with a lot of short hop stations including GI, GM and plenty of big signals from Europe plus A92, H25 (special call from Cyprus) and 8P9," said Dave.

Table 1.

Date	Time	Flares	Filaments
Oct 1	1000	0	10
Oct 3	1036	0	12
Oct 4	1347	1	13
Oct 6	1447	0	10
Oct 8	1135	0	7
Oct 11	1035	0	14
Oct 12	1100	0	10
Oct 22	0932	0	16
Oct 25	1130	0	16

John Levesley G0HJL (Bransgore) logged CT, CU, DJ, EA, I, JY4, LU, LZ, PT, UA, UT, YC and 3B1 on the 10th; CT, DJ, EA, EA8, FY, I, NP4, OD, SV, UA, V0, ZS, 4X5 and 9J2 on the 11th; HG on the 12th and CX, EA, EA8, F, HB9, I, OE, OD, SV, SV5, UA, WD4, ZS, ZY and 5B4 on the 18th, which is a good haul.

The 21MHz Band

It is well known that **Gerry G3WMU and Margaret Brownlow G4LCU** are the licence custodians and the prime operators at the amateur station GB2CPM. That is installed in the wireless exhibition building at the Chalk Pits Museum, Amberley, Sussex. Their voices are usually heard, on Sundays during the season, on the upper h.f. bands.

Around midday on September 20, 21MHz was open to the Far East and Margaret, Fig. 1, worked four Tokyo stations in succession, much to the delight of a Japanese lady who saw the log when she visited the museum later that afternoon. "They were giving me RS59," said Margaret.

Fig. 1

Propagation Beacons

First, my thanks are due to **Chris van den Berg** (The Hague), Henry Hatfield, **Don Hodgkinson G0EZL** (Hanworth), Bill Kelly, Dave Lingard, **Greg Lovelock G3III** (Shipston-on-Stour), **Ted Owen** (Maldon), Fred Pallant and Ted Waring for their 28MHz logs from which I compiled the chart of international beacon signals, heard in Holland and the UK between September 26 and October 25, Fig. 2.

Most observers heard a good number of South African beacons, Chris and Don logged the Bermuda beacon VP9BA on October 12 and 13. Don also found KD4EC on the 13th and WA4DJS on the 3rd and 11th. Fred heard WB8UPN on the 9th and 10th and WA4DJS on the 11th.

"I heard 14 beacons on October 12," wrote Don but added sadly, "unfortunately my beams were blown down during the storm on the 16th, when my barometer bottomed out, so I'm back to listening on the vertical ground plane which remained unharmed". My chimney mounted Revcone survived as well Don.

Tropospheric

The atmospheric pressure readings taken at noon and midnight during the period September 26 to October 25, Fig. 3, shows how my barograph fluctuated from a peak of 30.4in at the end of September to a low of 29.1in on October 7 and a very low of 28.8in, Fig. 4, while the hurricane swept through southern England in the small hours of October 16. Similar barometer plots showing this dramatic pressure change came from Ted Owen and John Raleigh.

I understand that weird things happen to v.h.f. radio signals during such extraordinary conditions, but unfortunately I could not check the bands because the power lines in my area were severely damaged by the wind and I was without electricity from about 0200 on the 16th to 1115 on the 27th.

Life without electricity is not easy and my thanks are due to the Brownlows for

Fig. 2

September 1987 / October 1987 — WRM882

Beacon	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
DF0AAB																	X									X				
DK0TEN									X														X			X	X	X		X
DL0IGI				X	X		X	X	X			X		X	X	X	X	X	X	X	X	X	X		X	X	X	X		X
EA3JA		X													X	X	X	X					X							
EA6RCM	X	X										X		X			X			X			X		X	X				X
IY4M				X		X	X		X	X					X	X	X						X		X	X	X	X		X
LU1UG		X		X				X			X					X	X	X	X	X										
PY2AMI		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X
PY2GOB	X	X		X				X		X	X	X		X	X	X	X	X	X	X	X							X	X	X
VP8ADE			X			X		X							X	X	X	X	X											
VP9BA																X	X													
ZS1LA	X		X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
ZS6PW	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X
Z21ANB	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
3B8MS	X														X															
4N3ZHK			X	X			X							X			X								X		X	X		X
5B4CY								X				X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

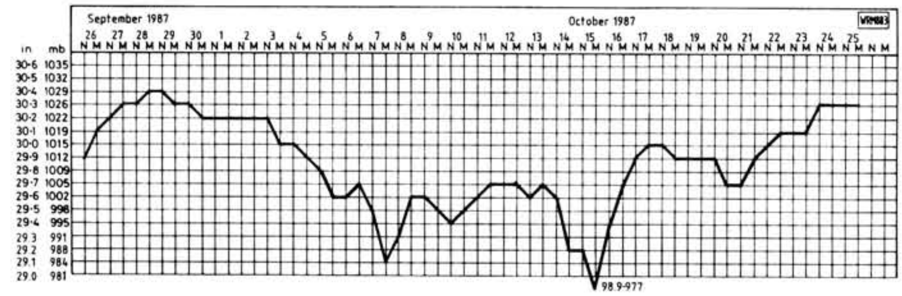


Fig. 3

the loan of a large 12V battery and a couple of fluorescent fittings and to the engineers from the SWEB (Bristol) who restored my supply. We are also grateful to the "army" of electricity and telephone engineers who immediately came south, from many parts of the UK, to help our local engineers repair the extensive damage to these systems.

934MHz

Between September 20 and 26, **Les Jenkins GB-37** (Godalming), operating from his holiday QTH in Deal, made contact with 20 stations, on 934MHz, located in Broadstairs, Canvey Island, Detling, Felixstowe, Gillingham, Hockley (near Rayleigh), Hungerford, Ipswich, Margate, Rochford, Thanet and Southend. Les used a Nevada Delta-One transceiver, a Crestbyte pre-amplifier for the receiver and a PA7 collinear antenna, mounted some 3m a.g.l. He was back in Deal for a while after October 17 and made 21 new contacts including a maritime mobile on the MV *Pepita* at Shoeburyness on the Thames Estuary.

"At 2330 on September 18, Fred Mills TL-01 worked two stations on The Wash, some 96km from his home in Kempston," wrote **John Raleigh DW-04** (Bedford). He noted a slight fall in atmospheric pressure at the time. John is secretary of The Four County 32cm Club and reports that at

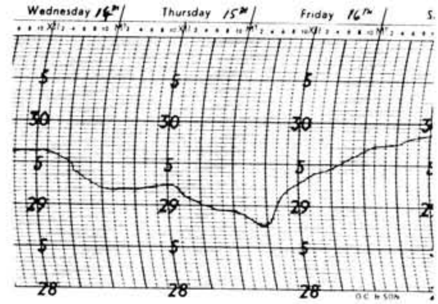


Fig. 4

2000 on the 21st, Bill Ellis WE-641 (Houghton-Regis) worked into London during another slight fall in pressure.

"On September 27, I went to the UK-934 Club rally, on Butser Hill, organised by the Portsmouth area group," wrote John Levesley UK-627. He met many old and some new friends among the 50 or so stations that attended. During the Club's national contest on October 18, he had QSOs with stations in Dorset, Hampshire, IOW and West Sussex from his mobile location at Stoney Cross in the New Forest. John is the Club's national contest manager and Dorset area representative and is expecting a lower number of logs this time due to the hurricane and power failures of the 16th.

Broadcast Round-up

Peter Shore

The time change in the UK heralded the start of the medium wave DX season as winter conditions took over. It is now possible to scan the band even during the day and hear stations from quite far away. Radio Sweden on 1.179MHz comes in well even is southern parts of the country during daylight hours. VoA Europe can be heard in the early morning and late afternoon with its programming on 1.197MHz from Munich, too. The BBC 648 service coverage area has increased too, with excellent reception well south of Paris during the mid-afternoon. However, the transmitter at Orfordness went on to just 50kW on Friday October 16, the day the hurricanes hit southern England, as both the 11 and 33kV lines were damaged. The station went up to 250kW by the end of the weekend, but it was still some days before the full 500kW service was operational.

New transmitters continue to come into operation. Radio Monte Carlo is using a new 1000kW transmitter for its m.f. transmissions on 702 and 1467kHz. The comprehensive antenna array at Roumoules, 100km west of Monaco, has a five tower system. That has four main directional beams possible, including a 320 degree north-westerly beam for transmissions to northern Europe in French, English, Dutch and so on.

Meanwhile, Radio Moscow is considering starting a Russian language World Wide Service for Russian speakers and students around the world. It will be interesting to see how, if the plan actually succeeds, this will affect Moscow's usage of the h.f. bands. More Soviet usage perhaps . .?

Finally, an over-the-horizon radar station is to be built in Alaska by the US military. It is hoped that this will not cause any interference to the h.f. bands, as there is apparently already a site in the eastern USA operating without complaint.

Europe

Note: all times are UTC (GMT)

The English broadcasts from radio Austria International can be heard at:

0630 on 15.41, 6.155 & 6MHz
0830 on 15.41, 11.915 & 6.155MHz
1230 on 15.32, 11.915, 9.685 & 6.155MHz
1400 on 11.915, 9.665 & 6.155MHz
1530 on 11.915, 9.61 & 6.155MHz
1830 on 12.015, 11.825, 6.155 & 5.945MHz
2100 on 9.655, 7.205, 6.155 & 5.945MHz

The Austrian Shortwave Panorama programme is now heard on Sundays at 0200, 0815, 1230, 1430 and 1805.

Radio Prague's English service has introduced a weekly programme heard in the 1900 transmission on 7.345 and 5.930MHz called *The Voice of Believers in Czechoslovakia*. This programme is introduced as "Christian comment from Czechoslovakia" and perhaps reflects a new openness towards religious beliefs in the Eastern Bloc countries.

Once again it shows that international radio often gives remarkable insights into what is happening in different parts of the world.

Radio Finland's transmissions continue to be dogged by problems. Certain frequencies have been cut for periods whilst maintenance work is undertaken at the new Pori site. There has also been trouble with the link between the Helsinki studios and the transmitter site. However, the 963kHz medium wave channel puts in a reasonable signal in the UK, with interference from the Radio Monique transmitters.

Voice of Greece English transmissions have been heard at 1920 on 11.645, 9.425 and 7.430MHz.

Radio Netherlands dropped its additional feeder channels for its Madagascar relay in early November once work at the satellite ground station was completed. Channels used included 13.7 and 13.77MHz and my information is that the station may well use a 13MHz frequency for its services before too long. *Media Network* during December will have a Christmas Preview on December 17, including an interview with Dutch electronics specialist Willem Bos who has been looking at active antennas for the 1988 *WRTH*. On December 24, there's a special Christmas Party with a look back at the year from a propagational viewpoint, whilst the last edition of the year—on December 31—promises a "Burst of the Worst" with more mistakes from the world of radio broadcasting.

Two frequency changes for Radio Netherlands: at 0400, 9.895MHz is replaced by 9.85 and at 1830, 9.54 is replaced by 15.18MHz.

Radio Exterior de Espana is heard to Europe:

1830–1930 & 2030–2130 on 7.275 & 9.765MHz.

Additional frequencies for the Middle East and Africa at 1830 are 11.840 and 15.375MHz.

The Spanish service can be heard in Europe as per:

0600–0700 on 7.45 & 6.02MHz
1030–1630 on 12.035 & 9.875MHz
1630–2230 on 7.45 & 6.02MHz

Radio Sweden International's first transmission of the day is now at 1400, instead of 1230 as during the summer months. Radio Sweden's current English schedule is:

0930 On 9.63MHz
1100 on 6.065 & 9.63MHz (not Sat or Sun)
1600 on 6.065 & 1.179MHz
2100 on 6.065 & 1.179MHz
2300 on 1.179MHz

The European Service of Swiss Radio International can be heard with English at 0830, 1400 and 1900 on 3.985, 6.165, 9.535 and 12.03MHz with an additional placing at 2330 on 6.16MHz. Relays of radio Suisse Romande can be heard at 0900 Monday to Friday and 1000 Sunday on all four day-time frequencies, and music programmes are on the air at 1200, 1800 (Mon–Sat) and 1830 (Sun) again on the day-time channels.

The relay agreement between Swiss Radio and Radio Beijing is now in operation, with Radio Beijing's programmes carried from SRI transmitters at Lenk and Saarnen on 3.985 and 6.165MHz. The 3.985MHz frequency carries German at 2100, French at 2130, Italian at 2200 and English at 2230, whilst 6.165MHz has Chinese, Serbo-Croat, Spanish and Portuguese. It seems that this signal cannot be heard in most parts of Europe, though, as Radio Havana Cuba uses the same channel!

A mystery surrounds a further relay of China on 9.77MHz from 0000 to 0300. This channel carries English and Chinese and reports suggest that the relay transmitter is located either in North America or Portugal. Further details soon.

Radio Tallin in Estonia has resumed programming in Esperanto on two Sundays a month at 0925 and on two Thursdays at 2225 on 6.085 and 1.035MHz.

Middle East

Radio Cairo has started test transmissions between 1730 and 1800 on 9.90MHz for a new service in Albanian, due to start on November 4. Reports on reception were requested to PO Box 566, Cairo, Arab Republic of Egypt.

Egypt's Domestic Arabic service can be heard from:

0330–0800 on 11.905, 11.88 & 9.77MHz
0800–1400 on 15.285 & 11.98MHz
1400–1800 on 15.285MHz
1800–1900 on 15.285, 11.785 & 9.7MHz
1900–0030 on 11.785, 11.665 & 9.7MHz

Kol Israel's programmes have been off the air since October 7 following a strike by journalists. Frequency changes took place on November 1, although no programming is carried, and it has therefore been impossible to verify the schedule.

The Voice of Turkey in English at 2300 on 7.12, 7.135, 9.445 and 17.76MHz. At 0400, 9.56 is also replaced by 9.445MHz.

Africa

RTM in Morocco uses 9.685 between around 0200 until 0500. Radio RSA has made some frequency changes:

0300 on 11.9, 9.58, 7.295 & 4.99MHz
0400 on 11.9, 9.58, 9.295 & 4.99MHz
0630 on 17.825, 17.79, 15.125 & 7.295MHz
1500 on 17.81, 15.125 & 9.75MHz

Asia

A new 1000kW transmitter has been opened by Radio Afghanistan's *First Programme* on 1.107MHz. The transmitter, which is on the air between 0130 and 1930, has reportedly been logged in northern Europe. Radio Bangladesh announces that the English broadcast at 1230 will be carried on 15.525 and 11.75MHz, with the 11MHz channel possibly replacing the long established 12.03MHz frequency.

Radio Pyongyang in English to Europe at 1300 on 9.345 and 9.325MHz with the programmes at 1500 and 1700 on 7.29 and 9.325MHz. In addition, transmitters beamed to Africa and the Middle East at 1500, 1700 and 2000 have frequencies of 9.64 and 9.977MHz.

The Voice of Vietnam in English to Africa at 1600 has new frequency 12.019 to replace 15.01MHz, in parallel with 9.84MHz.

Australasia

Radio Australia now has a listener *Open Line* for comment, questions and so on —dial 010 61 3 2352360.

Australia is also bugged by industrial action, with some bulletins of Australian news not broadcast by the station at the beginning of November. Budget cuts have also meant a rationalisation and re-organisation of some programmes. Australian News is no longer broadcast for ten minutes at the half hour, but appears as a three minute segment at the end of international news every two hours, and *International Report* is extended from 20 to 25 minutes. This means that many features aired after the international news and Australian news bulletins, which now last for thirteen mintues, will be three minutes shorter. This includes the regular Sunday media programme, *Talkback*.

The BBC World Service programmes were carried on 15.11MHz via the Shepparton transmitter site at 2200–0030 from October 5 following the second coup in Fiji.

North America

Radio Canada International now has a transmitter exchange agreement with Radio Japan whereby its programmes are relayed from Yamata, and Radio Japan uses Sackville to reach North America. For Europe, programmes in English are as follows:

Mon–Fri
0615–0630 on 6.05, 6.14, 7.155 & 9.76MHz
0645–0700 on 6.05, 6.14, 7.155 & 9.76MHz
1930–2000 on 5.995, 7.325, 11.945, 15.325 & 17.875MHz
2100–2130 on 5.995, 7.13, 11.945 & 15.325MHz
2200–2300 on 9.76 & 11.945MHz
Sat–Sun
2100—2200 on 5.995, 7.13, 11.945 & 15.325MHz

A new station from Salt Lake City, Utah called KUSW is due to go on the air from December 1 with a schedule of:

0000–0300 on 11.68MHz
0300–0600 on 9.755MHz
0600–1100 on 6.135MHz
1100–1600 on 9.85MHz
1600–1900 on 15.225 MHz
1900–2200 on 17.715MHz
2200–0000 on 15.58MHz

WCSN has made some frequency changes with the 2000 programme on 9.495 and at 2200 the station is on 9.85MHz.

The latest WRNO schedule is:

1600–2200 on 15.42MHz
2200–2400 on 9.495MHz
0000–0400 on 7.355MHz
0400–0600 on 6.185MHz

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4-432N	4 way 432MHz N female	41.40
6-432N	6 way 432MHz N female	83.95
9-432N	8 way 432MHz N female	93.15

MONOBAND YAGIS

27G	7MHz 2 ele 5.6dBd	581.90
37G	7MHz 3 ele 7.0dBd	861.35
314G	14MHz 3 ele 7.0dBd	216.20
414G	14MHz 4 ele 8.0dBd	249.55
414	14MHz 4 ele 8.0dBd	294.40
514G	14MHz 5 ele 9.0dBd	364.55
614G	14MHz 6 ele 10.0dBd	515.20
321	21MHz 3 ele 7.0dBd	148.35
421	21MHz 4 ele 8.0dBd	169.05
521	21MHz 5 ele 9.0dBd	264.50
621G	21MHz 6 ele 10.0dBd	331.20
721G	21MHz 7 ele 10.3dBd	416.30
328	28MHz 3 ele 7.0dBd	93.15
428	28MHz 4 ele 8.0dBd	116.15
528	28MHz 5 ele 9.0dBd	161.00
628G	28MHz 6 ele 10.0dBd	207.00
628	28MHz 6 ele 10.0dBd	249.55
728G	28MHz 7 ele 10.3dBd	309.35
928G	28MHz 9 ele 10.6dBd	416.30

DUOBAND YAGIS

DUO2G	14/21MHz 5/4 ele 9/8dBd	483.00
DUO3	21/28MHz 4/4 ele 8/8dBd	264.50
DUO4	14/21MHz 4/4 ele 8/8dBd	426.65

VERTICALS

VA40	7MHz inc guy wire & ground mount	93.15
2VA40	7MHz full 1/4 wave, complete	323.15
VA80	3.5MHz inc guy wires & ground mount	324.30
2VA80	3.5MHz full 1/4 wave, complete	796.95

PHASING HARNESSES FOR CIRCULAR POLARIZATION

IC144	10 × 144A & 15 × 144A	37.95
IC144N	10 × 144AN & 15 × 144AN	52.90
IC432N	17 × 432AN	51.75

SHF PRODUCTS

SHF ANTENNAS

SHF 9644	1296MHz 44 ele	123.05
SHF 9667	1296MHz 67 ele	148.35
SHF 1693	67 ele (meteosat)	167.90
SHF 2320	2300-2350MHz 67 ele	202.40

PKW PRODUCTS

VHF/UHF ANTENNA'S

2GP58	144MHz 5/8 groundplane 3.2dBd	39.10
2GP258	144MHz 2 ×5/8 groundplane 5.7dBd	70.15
7GP58	432MHz 5/8 groundplane 3.2dBd	39.10
7GP258	432MHz 2 × 5/8 colinear 5.7dBd	59.80

HF DIPOLES

DP 01	3.5/14MHz	59.80
DP 02	3.5/7MHz	59.80
DP 03	1.8/7MHz	59.80
DP 04	1.8/3.5MHz	101.20
DP 05	14/21/28MHz	70.15
DP 06	1.8/3.5/7/14/21/28MHz	110.40

HF MULTIBAND BEAMS

THF 1E	1 ele (dipole) 14/21/28MHz	83.95
THF 2E	2 ele 14/21/28MHz	213.90
THF 3E	3 ele 14/21/28MHz	264.50
THF 5E	5 ele 14/21/28MHz	384.10
THF 6E	6 ele 14/21/28MHz	571.55
THF 7E	7 ele 14/21/28MHz	741.75
THF 8E	8 ele 14/21/28MHz	878.60
SPQ 2E	2 ele Spider Quad 14/21/28MHz	408.25
LPO 12E	12 ele Log Periodic 13-30MHz	918.85

HF GROUNDPLANE

GP 3B	14/21/28MHz	81.65

HOW TO ORDER

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COAXIAL CABLE: POPE H100....**80p p/metre.** RG213 (UR67)....**62p p/metre**

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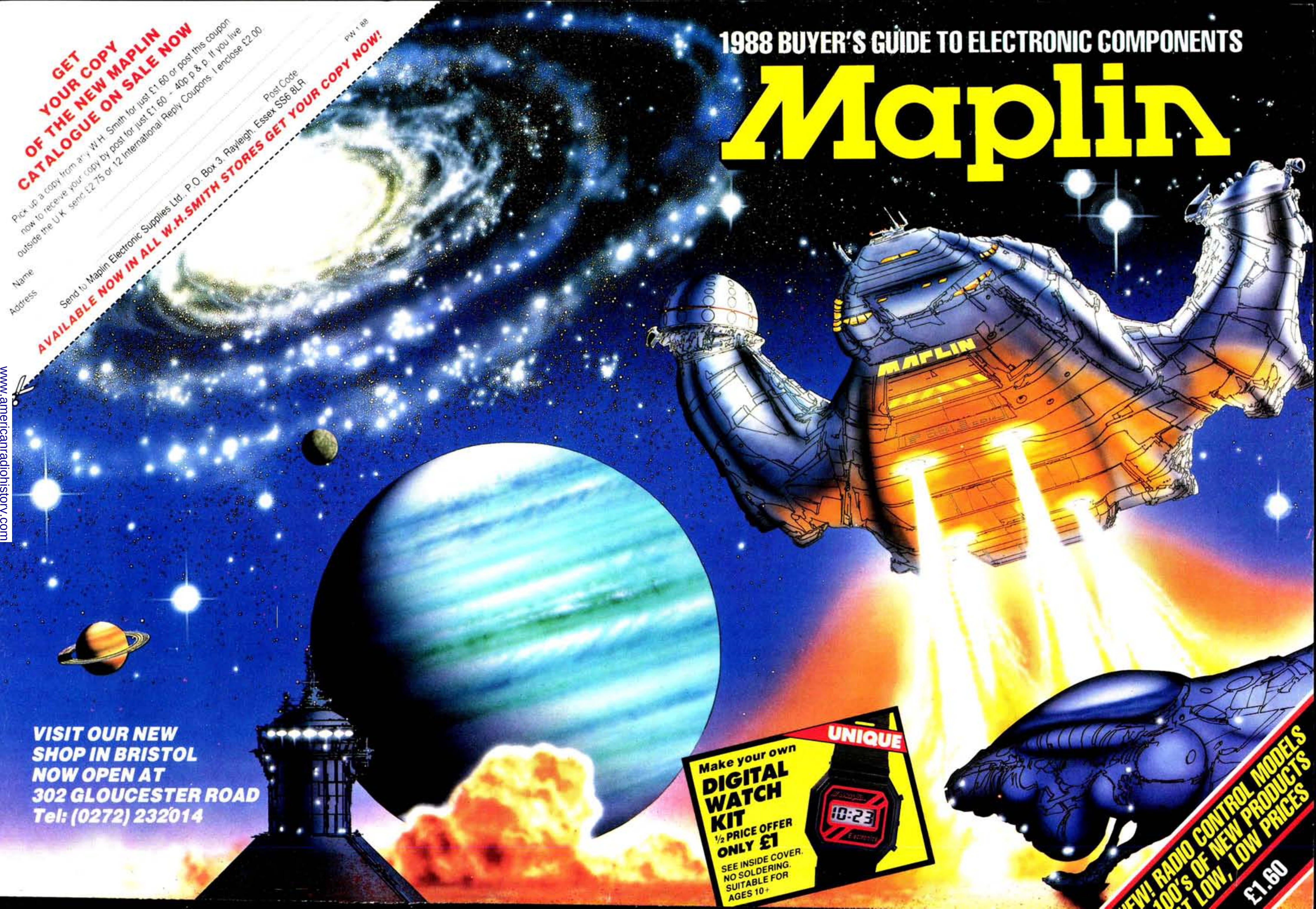
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