Amateur RADIO

January 1984 90p

For all two-way radio enthusiasts

Special report: the SSB repeater experiment

Short wave on a shoestring

Build a pulsed noise generator

Half delta loop aerials

On test: EME 23cm high power amplifier

Reviewed: Icom IC 751

MICROWAVE MODULES LTD

In this issue of "Amateur Radio" we are briefly describing our entire range of top quality British-made products, so that our regular customers and the many newcomers to amateur radio can see for themselves the extensive range we have to offer.

Microwave Modules, formed in 1969, is a wholly independent British company manufacturing quality products to professional standards solely for the amateur market, and it is this dedication together with strong customer loyalty that has enabled us to go from strength to strength in expanding and diversifying our product range.

Please note the addition of various new products (marked ●) which are now in full production.

A full data sheet on each product is available free upon request.

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THE ENTIRE RANGE

MML144/100-S PA & PREAMP

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		Price £ inc. VAT	Post Rate
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MMS2	Advanced Morse Trainer	169.00	B

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MMT70/144	4m linear transverter, 2m input, 10w output	129.95	B
MMT144/28	2m linear transverter, 10m input, 10w output	109.95	B
MMT432/28-S	70cm linear transverter, 10m input, 10w output	159.95	B
MMT432/144-R	70cm linear transverter, 2m input, 10w output	184.00	B
● MMT1296/144	23cm linear transverter, 2m input, 2w output	● 199.00	D
● MMK1268/144	1268 MHz Satellite Up Converter, 2w output	● 135.00	B

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		Price £ inc. VAT	Post Rate
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● MMD1500P	1500 MHz 10 prescaler	● 97.75	A
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MMF432	70cm bandpass filter	11.90	A
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MMS1 MORSE TALKER

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MML144/30-LS	2m 30 watt linear/preamp, 1/3w i/p, switchable	69.95	B
MML144/50-S	2m 50 watt linear/preamp, switchable	92.00	B
MML144/100-S	2m 100 watt linear/preamp, 10w i/p, switchable	149.95	C
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MML144/100-LS	2m 100 watt linear/preamp, 1/3w i/p, switchable	169.95	C
MML432/30-L	70cm 30 watt linear/preamp, 1/3w i/p	129.95	C
MML432/50	70cm 50 watt linear/preamp, 10w i/p	129.95	C
MML432/100	70cm 100 watt linear, 10w i/p	245.00	D

RECEIVE PREAMPS

		Price £ inc. VAT	Post Rate
MMA28	10m low noise preamp	19.95	A
MMA144V	2m RF switched low noise preamp, 100w capacity	34.90	A
MMA1296	23cm bipolar low noise preamp	37.90	A
● MMG1296	23cm GASFET low noise preamp	● 59.95	B
● MMG1691	1691 MHz Meteosat GASFET preamp	● 92.00	B

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MMC28/144	10m to 2m up converter	29.90	A
MMC50/28	6m to 10m down converter	29.90	A
MMC70/28	4m to 10m down converter	29.90	A
MMC70/28LO	4m to 10m down converter with 42 MHz LO output	32.90	A
MMC144/28	2m to 10m down converter	29.90	A
MMC144/28LO	2m to 10m down converter with 116 MHz LO output	32.90	A
MMC432/28-S	70cm to 10m down converter	37.90	A
MMC432/144-S	70cm to 2m down converter	37.90	A
MMC1296/28	23cm to 10m down converter	34.90	A
MMK1296/144	23cm to 2m down converter, GASFET preamp	79.95	B
MMK1691/137.5	1691 MHz Meteosat converter	145.00	B

POSTAGE

The above prices include VAT but not postage. Please add postage to the above at the following rates:

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UNITS 'B'	£3.00	UNITS 'D'	£4.50

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Amateur RADIO

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Front cover: ICOM IC751 HF transceiver, photographed by Jay Moss-Powell G6XIB.

We are pleased to announce that the company has recently been appointed U.K. distributors for the TELEREADER range of equipment. Those of you who have seen TELEREADER products will know that outstanding performance allied with ease of operation are the hallmarks of this particular company. The three models in our range are the **TELEREADER CWR685E** combined transmitter and receiver and the **CODE MASTER CWR610E** which not only receives CW and RTTY (Baudot and ASCII) but doubles as a morse tutor.

The **TELEREADER CWR685E** has many outstanding features: CW, Baudot and ASCII receive and transmit: CW at 3-40 wpm, RTTY at 45-300 bauds (six speeds): ASCII transmission/reception of both upper and lower case letters. Built-in 5" green phosphor screen giving a clarity and brightness that I have not seen before.

An external QWERTY keyboard housed in a substantial metal case and supplied with 3 feet of connecting cable. Not a "rubber key or plastic faced touchpad" but a true moving keyboard.
6 Memory channels (63 character capacity each). If required total memory capacity can be allocated to one channel. In addition the 4 standard test transmissions (RY, QBF, Baudot all characters, ASCII all characters) are permanently stored in memory and can be recalled and transmitted in a variety of formats. 480 characters of transmitting buffer memory are also included.
Automatic and manual transmit/receive switching.
Printer output: Centronics compatible parallel interface for hard copy.
The **TELEREADER CWR610E Code Master** is a compact morse and RTTY converter which also includes an audio-visual morse tutor.
Features of the **CWR610E Code Master** are:
*CW, RTTY (Baudot and ASCII reception) *CW: 3-40 wpm. Baudot/ASCII: 45.45-600 bauds (seven speeds) *CW morse practice at 2-30 wpm *Display characters: 612 characters x 2 pages *Centronics compatible parallel interface for printer output *UHF/VIDEO display output *12 volt DC operation
TELEREADER CWR685E £730.94 inc VAT. carr. £6.00
TELEREADER CWR610E £175.00 inc VAT. carr. £6.00

THE POCKE TRA, A NEW DIMENSION IN PORTABLE AMATEUR RADIO

A RIG FOR YOUR TOP POCKET, THEREFORE PERFECT FOR THE ACTIVE RADIO AMATEUR

***The rig you will forget you are carrying .....**
With overall dimensions of 140mm high, 69mm wide, 26mm deep and weighing only 260 grams (including aerial and batteries), the LS-20XE fits easily into your pocket giving perfect portable communication.

***Long range communications ...**
A newly developed dual gate MOS FET is used in the RF stage of the transceiver which considerably improves receiver performance. The internal 50mm diameter speaker ensures clear audio under difficult portable conditions.

***Full coverage of 2 metre amateur band ...**
The transceiver covers 144 to 146 MHz in 5 kHz steps and has repeater shift and automatic tone burst.

***Switchable output power for extended operation ...**
In order to extend portable operation, transmission power level is switchable, 1 W, 500 mW and 100 mW, so depending on the terrain and conditions, the most economical level can be selected.

***Simple to operate ...**
Simplicity of operation is a special feature of this rig and many optional accessories are available. Of major interest is the matching headset SH-2 having built-in vox, this convenient accessory provides simple and safe operation whilst cycling, walking etc.

LS 20XE

£128.00 inc VAT carriage £2.50

Before I buy, I carefully consider the purchase. If the item is not expensive, then probably consideration will not take long, but if the cost is for example, two or three hundred pounds or more, then there are several questions which I would want answering.

what to buy,

The first is whether to buy ICOM, YAESU or TRIO. Obviously, we are convinced that TRIO equipment is the best. Since we import the equipment, you could accuse us of being biased in this view. However, our conviction is based on many years' experience, and the simple fact that the volume of TRIO sales in the UK is extremely high. **Many amateurs are to be found using TRIO equipment, and we are confident that a TRIO rig is its own best advertisement. Why not ask an owner?**

where to buy it,

The second question is where to buy your rig or accessory. Ever since the company began, some twenty years ago, our policy has been one of service. No matter how careful a manufacturer may be, equipment can go faulty and it would be wrong to say otherwise. Having said this, a high priority on your shopping list must be the quality of after sales service that you can expect from the company that supplied the goods. Service that can be asked for with confidence and result in your favourite piece of gear being rapidly repaired. Service of this calibre can only be given if sufficient money has been invested by the company in the necessary test equipment and spare parts. A point worth remembering is that test equipment by itself is useless: the company must also have technically able staff. How many amateur radio shops do you know that have eight engineers whose sole job is the repair of your equipment? **Who other than LOWE ELECTRONICS have sufficient pride in their facilities and expertise to hold an "OPEN DAY" once a year?**

help,

Informative and helpful service is also of major importance. Both the newcomer and the experienced amateur may want to discuss their requirements before making a purchase. They may be seeking advice. They will certainly want to check that the piece of equipment they have chosen does what they want it to do. What a customer does not want is pressure sales. **At a LOWE ELECTRONICS shop you will receive advice and courtesy: the service on which we and all members of the staff pride ourselves.**

LOWE ELECTRONICS accept the fact that everyone cannot travel to Matlock. To make purchase of equipment easy, we have opened our own shops, all with the same high standards, in Glasgow, Darlington, London and soon in Cardiff - the managers of the shops being hand picked for their abilities. For those who are still too far from a LOWE ELECTRONICS shop, then we have the fastest in mail order. Remember, we are the importers of the majority of the equipment we sell - we don't have to take your order and then obtain the goods. In addition to all these facilities, there are selected approved TRIO dealers who offer the same direct link with the TRIO factory as ourselves. A list of these approved dealers is published regularly by TRIO. Please ring us here at any time for information on your nearest approved dealer.

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Yes, we don't give discount. Our price is the price, and takes into account the above services which have to be paid for. **But it is much better than getting 5% off "LOWE'S PRICE" and then finding when you have a problem that you may have bought from a rogue.**

Not everyone can afford a new piece of equipment. To cater for this need, we prepare a weekly list of what is available both here in Matlock and also at the LOWE SHOPS. This list is sent out with all correspondence and to those who request it. Regarding the SECOND HAND LIST, please contact Matlock for your copy.

Credit is also available. We have for your convenience, the LOWE CARD which not only makes purchasing easy, but each quarter along with your statement are details of the "SPECIAL OFFERS." **Ring for a LOWE CARD application form.**

So that's it; simple questions which should receive answers before making a purchase, be it an SWR meter or a new HF rig.

TR9130 TWO METRE ALL MODE TRANSCEIVER

This rig is proof, if one needed it, that TRIO do not bring out new models just for the sake of it. The TR9000 is remembered as a classic rig and today people are still asking for second hand ones, even they are a rarity on our S/H shelf. The TR9130 incorporates the improvements that all amateurs asked for: green display, reverse repeater, tune whilst transmitting, higher power, more memories and of course memory scan. TRIO's answer, the TR9130.

TR9130 ..... £433.32 inc. VAT

TS780 DUAL BAND BASE STATION TRANSCEIVER

The TS780 is the perfect base station VHF/UHF transceiver for the enthusiastic operator. The rig has all the necessary control functions essential for operating on both today's busy two metre band and the wide spaces of seventy centimetres. Full repeater facilities plus reverse repeater are included and the transceiver has the usual memory channels (10), two VFO's, up/down frequency shift microphone. IF shift, two priority channels, memory and band scan etc. A superb rig. I have one myself. Ring for a full enthuse!

TS780 ..... £795.00 inc. VAT

TR7930 TWO METRE FM MOBILE TRANSCEIVER

Those who have used or owned a Trio TR7800 will know what I mean when I say that Trio, with the introduction of the TR7930 have improved on the unimprovable. The Trio TR7930 improves on the TR7800 by giving a green floodlight liquid crystal display, extra memory channels, both timed and carrier scan hold, selectable priority frequency and correct mode selection (simples or repeater). The most significant change is the liquid crystal display, but closely following this must be the ability to omit specific memory channels when scanning and the programmable scan between user designated frequencies.

TR7930 ..... £305.21 inc VAT

R2000 GENERAL COVERAGE RECEIVER

The amateur bands are only a very small part of the radio spectrum, many other transmissions are available for the short wave listener. Broadcast stations provide an alternative source of current information both political and regarding the life style of the country. Fitted with the internal VHF converter the R2000 covers continuously frequencies from 118 to 174MHz giving access to amateur two metre transmissions (am, fm, ssb and cw) plus a lot more. Having 10 memories, memory scan and programmable scan the R2000 provides in one rig the perfect receiver.

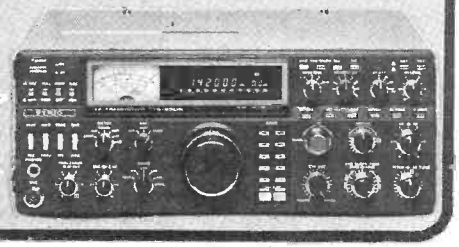
R2000 ..... £398.82 inc. VAT

TS930S HF TRANSCEIVER WITH GENERAL COVERAGE RECEIVE FACILITIES

Much has been said about the TS930G transceiver and it now has a place high in the affection of those amateurs fortunate enough to own one. Indeed it has become the "flagship" of the TRIO range. Providing full amateur bands plus a general coverage receiver (150KHz to 30MHz), the TS930S has every conceivable operating feature for today's crowded frequencies.

TS930S ..... £1,150.00 inc. VAT

NEW PRICE



TR2500/TR3500 HANDHELD TRANSCEIVERS

Two first class hand held transceivers, one for two metres and the other for seventy centimetres. Ten memory channels, band and memory scan, repeater shift, reverse repeater and a low power position make the rigs extremely useful for the radio amateur who wishes to keep in touch with his local scene. A comprehensive range of accessories, base station charger, speaker microphone, mobile mount, etc., can be added to enhance operation. Accessories used with one rig being compatible with the other.

TR2500 ..... £232.53 inc. VAT
TR3500 ..... £250.70 inc. VAT

TS530S HF AMATEUR BAND TRANSCEIVER

A logical progression from the reliable TS520 series the TS530S was the most popular HF rig in the range. I use the term "was" because TRIO decided to cease production and supplies were no more. However, the demand from radio amateurs worldwide for the transceiver has continued and TRIO have re-introduced the rig. A standard HF valve transceiver without the frills but providing today's amateur with all necessary facilities for reliable world wide communications, the TRIO TS530S.

TS530S ..... £595.00 inc. VAT

TW4000A DUAL BAND FM TRANSCEIVER

I have been waiting for this rig for the last three years. Now it is here and I am using one, words fail me. Send for details.

TW4000A ..... £469.00 inc. VAT

just a part of the range

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CURRENT·COMMENT

Introducing you to this month's issue

The idea of a 2m SSB repeater is bound to be a controversial one. Feelings about the FM ones are still strong, even though it is several years since GB3PI came on the air as an experiment. It is difficult to know why repeaters should have been the subject of so much bitterness in the past, but the fact is they have. And that is probably one of the reasons why many people prefer to forget the SSB repeater project.

The original idea of repeaters, which seems to be lost on some people, was to enable people to use VHF from the car and get a reasonable distance. GB3PI was built as an experiment, and the general verdict was that it was a Good Thing.

Since then, a lot has changed. There is a 2m FM repeater for just about everywhere. Also, the majority of us now have a black box, rather than modifying a second-hand Pye blue box, or building our own. Most significant, there has been a huge growth in the number of amateur licences.

There's nothing wrong with any of these developments. But their combined effect is that the 2m band is now congested.

There are only a few things we can do about this congestion. One is to lobby for a wider allocation, say 144 to 148MHz.

But while amateurs continue to use 25kHz FM channel spacing, and the private mobile radio users who occupy 146-148MHz use $12^1/_2$kHz spacing, surely we would be unlikely to get it. We would probably be advised to use our existing allocation more efficiently.

One solution would be to cut our FM channels in half, and use $12^1/_2$kHz spacing. There are two problems with this: first, most equipment currently in use is incapable of working to the $12^1/_2$kHz specification without considerable modification. The second problem is even more serious in the long term: many of the theoretical advantages of FM are lost when the channelling is cut to $12^1/_2$kHz. When private mobile radio was changed from 25 to $12^1/_2$kHz, Pye advised its customers to go for AM rather than FM because of the better quality.

It doesn't look, therefore, as if FM has a lot to offer the 2m enthusiast in the long term. It's just too greedy of bandwidth - especially when it's via a repeater, requiring 50kHz of bandwidth for a single conversation, over quite a large geographical area.

Given this background there is a need for some new system which equals the undoubted convenience, quality and reliability of the FM repeater network, but which is much more economical with spectrum space. Obviously a fundamental change like this would involve a lot of time, planning and money. But the sooner we start to think about the future of the 2m band, the more gradual and less disruptive need any such changes be. That is why we are willing to give the SSB repeater experiment a fair hearing.

This Month

Having got that off my chest, let's have a look at some of the other topics in this month's issue. First, the equipment reviews. Angus McKenzie G3OSS has been examining Icom's new top-of-the range HF machine, the IC751. Actually he's been examining three of them, because it has problems. All is revealed in his article.

The other machine on Angus' test bench is less well known. It is a high power 23cm amplifier, made by the German firm EME (nothing to do with moonbounce, although it could be quite useful for that), and imported into the UK by Piper Communications. Actually, we're planning quite a few articles about 23cm in the next few issues, including a series on 24cm amateur television, starting next month.

John Heys G3BDQ has achieved the near impossible: an *original* article about HF aerials. The grounded half delta loop is the subject this month. It has caused quite a stir in America since its development a year or two ago, and it seems to be the answer to an LF DXer's prayers. Low radiation angle, easy matching, only one support needed .... perfect.

Tony Bailey G3WPO brings us another of his excellent constructional articles: a pulsed noise generator. This is a simple but useful gadget for aligning receiver front ends for best noise performance, rather than the usual maximum smoke.

Amateur television is another part of the hobby that is growing fast. Receiving amateur TV is a doddle - as explained in our article, which is written by John Wood G3YQC, who is the editor of the British Amateur Television Club's *CQ-TV* magazine.

Talking of television, amateur radio seems to be getting quite a bit of coverate on the haunted fish tank lately. First there was the *Tomorrow's World* piece on the Datong Woodpecker blanker. Then there was the Granada regional thing on moonbounce. Moonbounce, meteor scatter and amateur satellites were the main subjects of a Radio 4 programme called "Electromania Lives", which was produced and presented by John Wilson G8KIS, originally for the BBC World Service. (John also wrote the article "Amateur Television - getting started" in the June 1983 issue of this mag.) "Electromania Lives" was an intelligent look at the hobby, which is more than can be said for the Radio 4 continuity presenters, who took the line that radio amateurs (ie you and me) must be eccentrics.

Between me writing this and you reading it, the Space Shuttle will (unless there's another delay) have done its thing. It'll be interesting to see what the media make of *that*.

73 de Richard Lamont

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G4CLX

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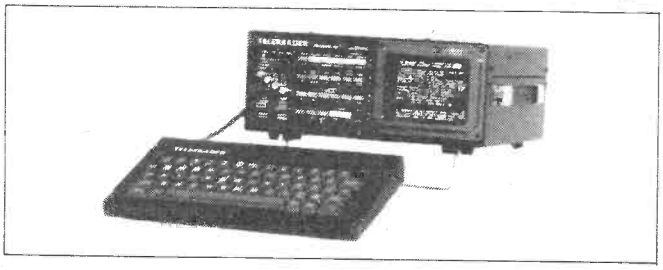
2 METRE FOLDED ½ WAVE ANTENNA



The **TELEREADER CWR685E** has many outstanding features:
CW, Baudot and ASCII receive and transmit: CW at 3-40 wpm, RTTY at 45.45-300 bauds (six speeds): ASCII transmission/reception of both upper and lower case letters.
Built-in 5" green phosphor screen giving a clarity and brightness that I have not seen before.
A 4 page display giving 32 characters x 20 lines.
An external QWERTY keyboard housed in a substantial metal case and supplied with 3 feet of connecting cable. Not a "rubber key or plastic faced touchpad" but a true moving keyboard.
6 Memory channels (63 character capacity each). If required total memory capacity can be allocated to one channel. In addition the 4 standard test transmissions (RY, QBF, Baudot all characters, ASCII all characters) are permanently stored in memory and can be recalled and transmitted in a variety of formats. 480 characters of transmitting buffer memory are also included.
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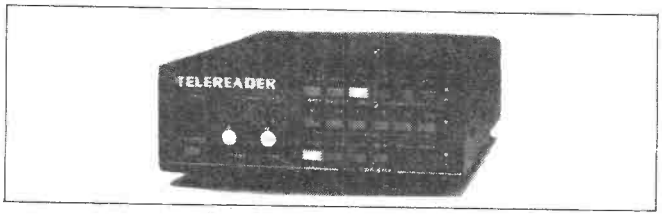
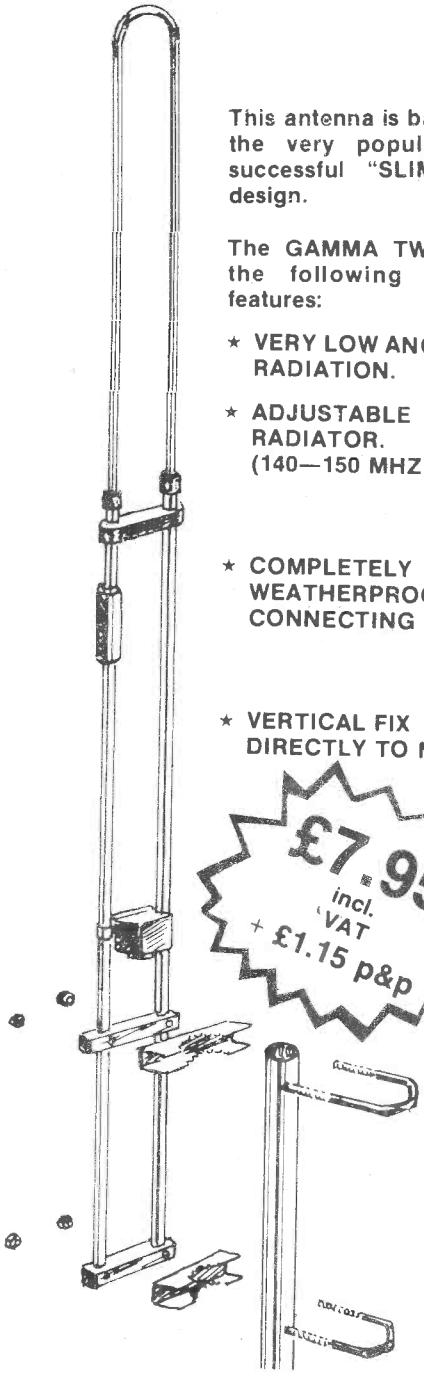


The **TELEREADER CWR670E** has a similar specification to the CWR685E but does not include the transmit facility or the built-in 5" green monitor. The CWR670E provides for both the enthusiastic radio amateur and short wave listener access to both the amateur and commercial world of RTTY as well as providing a visual display of received morse code.

The **TELEREADER CWR610E** Code Master is a compact morse and RTTY converter which also includes an audio-visual morse tutor.
Features of the CWR610E Code Master are:
CW, RTTY (Baudot and ASCII reception)
CW: 3-40 wpm. Baudot/ASCII: 45.45-600 bauds (seven speeds)
CW morse practice at 2-30 wpm.
Display characters: 612 characters x 2 pages.
Centronics compatible parallel interface for printer output.
UHF/VIDEO display output.
12 Volt DC operation.

TELEREADER CWR685E ..... £730.94 inc. VAT. carr. £6.00
TELEREADER CWR670E ..... £335.00 inc. VAT. carr. £6.00
TELEREADER CWR610E ..... £175.00 inc. VAT. carr. £6.00



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L·E·T·T·E·R·S

Petty bureaucracy?

The September issue of *RadCom* contained a notice to the effect that "all existing G5 + 3 letters callsigns will be phased out...!!

The majority of radio amateurs probably won't have paid much attention to this - "Oh yes, of course, they're going to let foreign visitors use their own callsigns - a much better idea, really". Few people seem to realise that this does not just affect a small handful of foreign holidaymakers, but about 600 foreign nationals permanently resident in Britain, some of whom have lived here and held their callsigns for a decade or more, and all of whom have ordinary British amateur radio licences which they renew on an annual basis just like everyone else.

Like most people, we are very attached to our callsigns - and not only that; losing them will also mean

-Piles of QSL cards will go to waste, and a fortune spent on having new ones printed

-We will have to start from scratch on many awards which have to be worked under one callsign

- Worst of all: *we will lose our identity* both on the air and in amateur radio circles off-air.

I was told that the reason we have to give up our callsigns is that the Radio Regulatory Department has introduced a simplified way of issuing licences to foreign tourists - which in itself is certainly not a bad thing. However, why this new regulation should affect us, people who have lived here and held British amateur radio licences for many years, I simply do not understand. *To me, it just looks like an act of petty bureaucracy and discrimination against foreigh-born UK radio amateurs.*

There does not appear to be any *plausible* reason why they should want to rob us of our callsigns. Do they want to re-issue them when the G1 and GO series have run out? It's possible, but not very likely - after all, they *did* say, not long ago, that existing callsigns would not be re-issued (and just imagine the confusion it would cause if they did re-issue our callsigns, especially seeing that QSLs often arrive years after the actual contact).

However, if they *do* want to re-issue existing callsigns after all - *why ours?* Of course they couldn't really revoke all the G3,4,6 and 8 licences - there are just too many of them - but how about G2 + 3 letters...? They are just as much of an "anomaly" as our callsigns, but I am sure no one would dream of revoking them unless all other licences were revoked at the same time.

With the exception of the old TV licences (G6 + 3 letters), no one has ever lost their callsign in this country - and I understand that those who had TV licences had their TV callsign as secondary callsigns, so they only lost one of two calls. (Yes OK, so you get a new callsign when you pass your morse test - but that is an entirely voluntary thing - also you don't lose your old one, as you can always take it out again.

If all radio amateurs in this country were to be given new callsigns, then obviously, I wouldn't mind losing mine. But it seems extremely unfair that a small group of radio amateurs should be singled out and discriminated against in this way.

Angelika Voss (Miss) G5CCI, Manningtree, Essex.

Not accurate

Reference to the *Yearbook* and the article on MOULD and Syledis; your information on these two systems may be quite good, but definitely not so on Navstar.

Navstar (full name "Global Positioning System") is an American military navigation system based on satellites. There are only seven satellites in orbit at the moment, five of which work, but these are all experimental and the full system is not scheduled to be operational until 1989 or so. Even when it is, it will not be capable of anything like the accuracy of Syledis (probably no more than 100 metres vs. 5 metres). And the receivers, at the moment, cost over £100,000 each!

Perhaps you confused this with a company called Navstar that makes a satellite navigator. This is for a different system known as Transit that is 20 years old and is being phased out. Its accuracy is only 300 - 500 metres, although receiver price is quite low (about £1000).

However, Syledis really ought to be phased out - it has served its purpose and there are now other methods of achieving its accuracy that do not need wide bandwidths or use 430MHz; for instance the Racal "Hyperfix" system.

W. Blanchard G3JKV, Dorking, Surrey.

Dreaded RAE

May I briefly reply to G3JDK?

In 1945 Professor Nordhof offered to the British Authorities all the Volksvagen designs, drawings, jigs and tools, factory and materials for nothing. And was scorned by our expert advisors.

Twelve years ago Stan Ovshinsky offered to our experts the Ovshinsky diode produced from amorphous silicon without the sweat of producing crystals; and was scorned by our experts. Ovshinsky went to Japan where the Ovshinsky diode is now in mass production.

I can repeat the same rejections by our academics in other major engineering proposals; even our experts have boobed on other new proposals. These judgements are produced by the same experts who set up the RAE and judge whether I am fit to operate an amateur radio station.

I built my first radio receiver when I was eight years old and your competitive magazine was two old pence and *Wireless World* was sixpence. I now operate six sets: a Panasonic, a Sanyo, a four valve home brew, which is better than the transistors, a Bush, an army Eddystone. Until recently I also owned a thirteen valve GEC receiver covering 9m to 5,500 metres without a break; (and a Vega!).

I designed and built a number of radio frequency welding machines of 5kW aerial power and used these to produce plastic goods: thus if your readers own a Philishave then I made the cases - about six million of them. I also built the *Wireless World* TV set of the 1930 period.

I have been too busy to do the RAE; but I don't think the exams are the right measure. The purpose is simply to check me out to see if I am a responsible and intelligent person who can understand his equipment and use it. The RAE does this not. Of course, I will have to join the band, and will soon have plenty of time!

John. D Berridge, Glamorgan.

Anumber of comments: first, the RAE is set by the City and Guilds of the London Institute, whereas the decision to manufacture a new kind of car or diode is taken by the company concerned. Thus these judgements are not produced by the "same experts", but entirely different ones.

Second, the purpose of the RAE is defined in the international Radio Regulations.
"Administrations shall take such measures as they judge necessary to verify the operational and technical qualifications of any person operating the apparatus of an amateur station." The same document defines the purpose of amateur radio as "self training,

L·E·T·T·E·R·S

intercommunication and technical investigations".

In other words, if you're interested in how radio works, fine. Become a radio amateur; you'll find studying for the RAE painless. If, however, you're not interested in how radio works, then the hobby is not really for you. If you just want to buy and operate a machine that allows you to talk to distant places, then you can always get a CB, or have a telephone installed.

I realise that CB doesn't allow you to use the more useful bits of the HF spectrum. There just isn't any spectrum to spare. Even if the ***entire HF spectrum*** *say from 3 to 30MHz, was allocated to CB in channels spaced 3kHz apart, that would only offer 9,000 channels, even if the whole 27MHz was open to somewhere or other at the time. There would probably be millions of people wanting to use these channels at once.*
So the whole idea is clearly unworkable.

That is one reason for limiting amateur radio to those with a technical interest - Ed.

Fail the RAE?

Dear Naughty Nigel, how prudent of your masters to disclaim responsibility for the effects of your tutorship upon your ardent students, their brains and their batteries. How kind of you to warn us of impending cardiac arrests and other nasties. But I am willing to bet that even you did not consciously set out to destroy what little confidence we have left after reading the letters about the RAE, and the ed's exhortation to "grasp the subject" and "understand radio theory" (in re. Mr R.M. Fumbelow G8UYL etseq.).

This being assumed, how then can one account for all the references lying about on p 42 to *square roots?* They only appear in the text, not in the mathematics. Have you discovered some esoteric fact unknown to Benbow, Hawker and Brian?

(G6UDX - my RAE tutor at Telford and District ARS - you gotta believe it.) Or were you, as all good geniuses (genii?) should, thinking ahead to calculation of resonant frequency in LC circuits?

Honestly, Nigel, little "deliberate mistakes" are part of the game tutors play (as we at Telford found with our Brian), and have value when the student has the blighter eyeball to eyeball. However, time and distance are not on anyone's side in a magazine/reader relationship. Until now I have valued your teaching, but you are beginning to get me a bit worried. It is not seemly for the student to have to mark the teacher's work "careless, needs to pay attention"

I do not wish to rub it in but does the mains AC at 50Hz really change direction 50 times every second? (see p 41 same article).

I promise not to join the "KILL" chorus if you will be more careful in future.

E.E. Lee, Brookside, Telford.

We've received several letters pointing out the mistakes in last month's "Pass the RAE". Nigel Gesley is still wondering how he managed to drop such a prize clanger. I'm wondering how I managed to fail to spot it as well. Profuse apologies and red faces all round. We're both standing in the corner, wearing dunces' hats, pretending not to exist - Ed.

Protest marches

I do like your magazine. As a struggling student with the RAE course, I find the other articles on the general subjects of *all* radio so interesting. Also, I'm beginning to be able to read circuit drawing.

It seems strange to be a student at 53. I wonder if I can go on protest marches? Though I can't stand long hair! RAF days say to that.

Roy Taylor, Alperton, Wembley, Middlesex.

Thanks for the kind comments. I think that you'll find that a lot of today's students can't stand long hair either! - Ed.

STRAIGHT·AND·LEVEL

FCC praises Grenada amateurs

The USA's Federal Communications Commission has praised radio amateurs for their activities during the American invasion of Grenada on October 25th.

Mark Barettala KA20RK, a 22 year old student at St. George's School of Medicine on the island, captured worldwide media attention with his live accounts of the fighting. The amateur radio link provided what the FCC described as "valuable services in relaying information as to the safety of the medical students and their families and as to the general situation existing at the Grenada station".

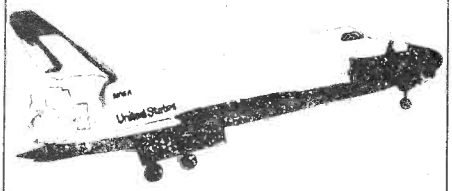
Mark Barretala's reports also inadvertently provided the US military forces with valuable intelligence, which aided their troop movements. This may have been why the FCC gave him special permission to use SSB in the CW frequency segments. (USA licences include a degree of compulsory band planning).

During the invasion conventional channels of communication were cut off, and the only news reports available were the official military ones, jthus attracting further media attention to information coming out of Grenada via amateur radio.

Lancashire clubs TV link-up

The Bury and Warrington Amateur Radio Societies used an amateur TV link between the two clubs for a quiz evening. Contact was maintained by speech on 144MHz and video on 432MHz, with colour pictures being transmitted the 18 miles from Bury to Warrington.

The pictures show Mike Horrocks G8GTP with the colour video equipment at the Bury end, and the Bury 'panel'.



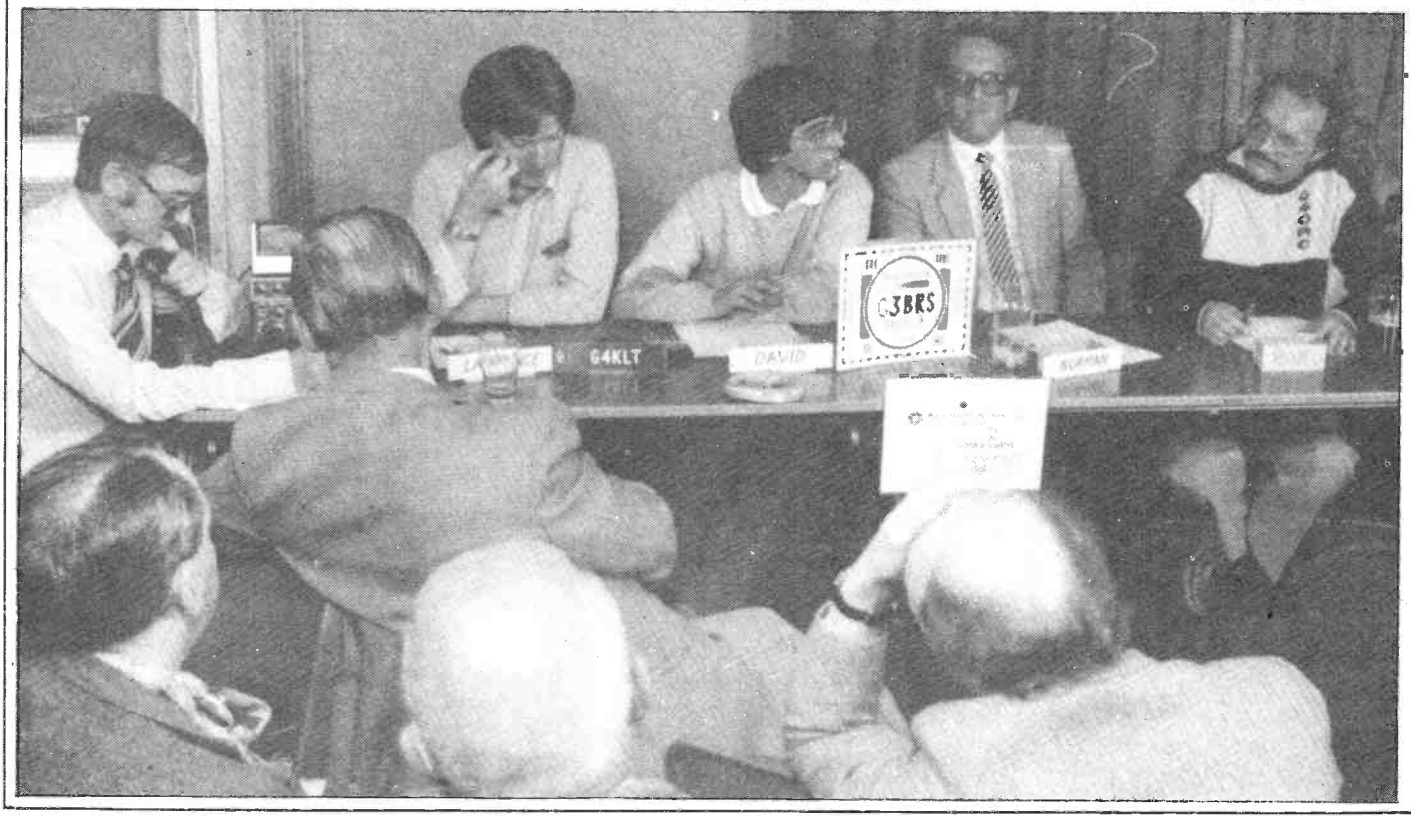
Space Shuttle

The recent flight of the Space Shuttle Columbia was a mixed success from the amateur radio point of view. Although many stations did succeed in getting through, UK amateurs were blighted by what the BBC TV programme "Sixty Minutes" described as "pirate hams", who blocked the 145.55MHz downlink frequency with helpful remarks like "Beam me up Scottie, I'm in Hendon". More interference was caused by licensed stations who were unaware of the correct procedures and uplink frequencies.

More positive TV coverage came from ITN, who reported the contact between astronaut Dr. Owen Garriott W5LFL and King Hussein of Jordan, JY1, with a still photo of JY1 in his shack.

One of the best quality sound recordings of the downlink was made by Angus McKenzie G3OSS. By using a halo aerial only two feet above ground level, he was able to eliminate a lot of local interference. His tape was used by Radio 4 in one of their news programmes.

Amateur Radio has received many letters complaining of the wholesale 'liddery' that the space flight seemed to attract, and we'll publish some of these next month - Ed.



Scopex closes

Scopex products proved popular with amateurs, largely because of their low prices, achieved without unduly sacrificing performance. Scopex also produced the world's first 'solid state' oscilloscope, which used a liquid crystal display instead of a cathode ray tube.

A new company, Mendascope, is offering a repair service to Scopex ownersS: Mendascope Ltd, Otter House, Weston Underwood, Olney, Bucks MK46 5JS, Tel. Bedford (STD 0234) 712445.

Leicester show

The verdict on the Leicester Amateur Radio Show, held at the traditional Granby Halls site on 28/29 October, is that it was a great improvement on previous years.

The exhibition was organised by local clubs, after the Amateur Radio Retailers' Association moved its annual exhibition to Doncaster.

Catering and bar facilities were greatly improved, compared to previous shows at the Granby Halls. This is ironical, because it was largely because of criticism of the catering etc. that the ARRA looked for a new venue.

A new departure for the Leicester show was having a separate area for the various club stands.

Car chase

Staff from Lowe Electronics were involved in a dramatic bid to catch a thief who stole a Trio TR2500 transceiver from their Matlock showroom on November 30th.

The man unscrewed the transceiver's strap to free it from the burglar alarm wire, left the showroom while nobody was looking, and made for the car park. It was only seconds before staff realised what had happened, and they saw him drive off in a red Hillman Hunter. Two Lowe staff got into a car and followed him as far as the Matlock town centre but then lost track.

The stolen transceiver's serial number is 2051977. Lowe Electronics is offering a reward of an identical transceiver for information leading to an arrest and conviction.

Special event station GB4CPF was set up in the ruins of the old Coventry Cathedral for the Coventry Peace Festival. The picture shows the Lord Mayor of Coventry (Joe Thompson), with G4ROA at the controls.

ITU conference

An international conference to plan the future of the HF broadcasting bands begins in January 1984.

The first session, which will be held in Geneva, is expected to last five weeks. Although it will concentrate mainly on frequency planning for existing AM transmissions, it will also consider the feasibility of a gradual changeover to SSB in the long term, without impairing reception of existing AM stations. it will also attempt to draw up plans for the new 13.6 - 13.8MHz band, which was allocated to HF broadcasting at WARC '79.

The second session of the conference is scheduled for October/November 1986.

Although none of this directly affectrs amateur radio, anything that helps to reduce congestion in the HF broadcast bands, or helps to slow down the 'power race' between competing broadcasters, will ultimately ease pressure on the HF spectrum as a whole.

New UOSAT

The University of Surrey is going to build a second UOSAT spacecraft, for launch by NASA in February.

In response to this launch opportunity, the University has submitted a proposal to AMSAT-UK for a second experimental spacefraft. It will be called UOSAT-B, and its purpose is to develop further the mission objectives of the original UOSAT in the fields of amateur radio, education, space science and engineering, including some new and more elaborate experiments. NASA is now considering the proposal.

The Surrey spacecraft would form a secondary payload with a LANDSAT spacecraft; the launch has been brought forward because of the premature demise of the LANDSAT 4 spacecraft currently in orbit.

To built a complete spacecraft as sophisticated as UOSAT in only five months is a very considerable challenge, and any major hitch could prevent completion in time for the launch date in February. The new spacecraft, which will be called UOSAT-B prior to launch, and UOSAT-2 after launch, will be almost identical to UOSAT in size and construction; the design of nearly all the on-board electronics will be either new or greatly reworked. The new spacecraft will be built in the University's Department of Electronic and Electrical Engineering, with the support of the aerospace and electronics industries.

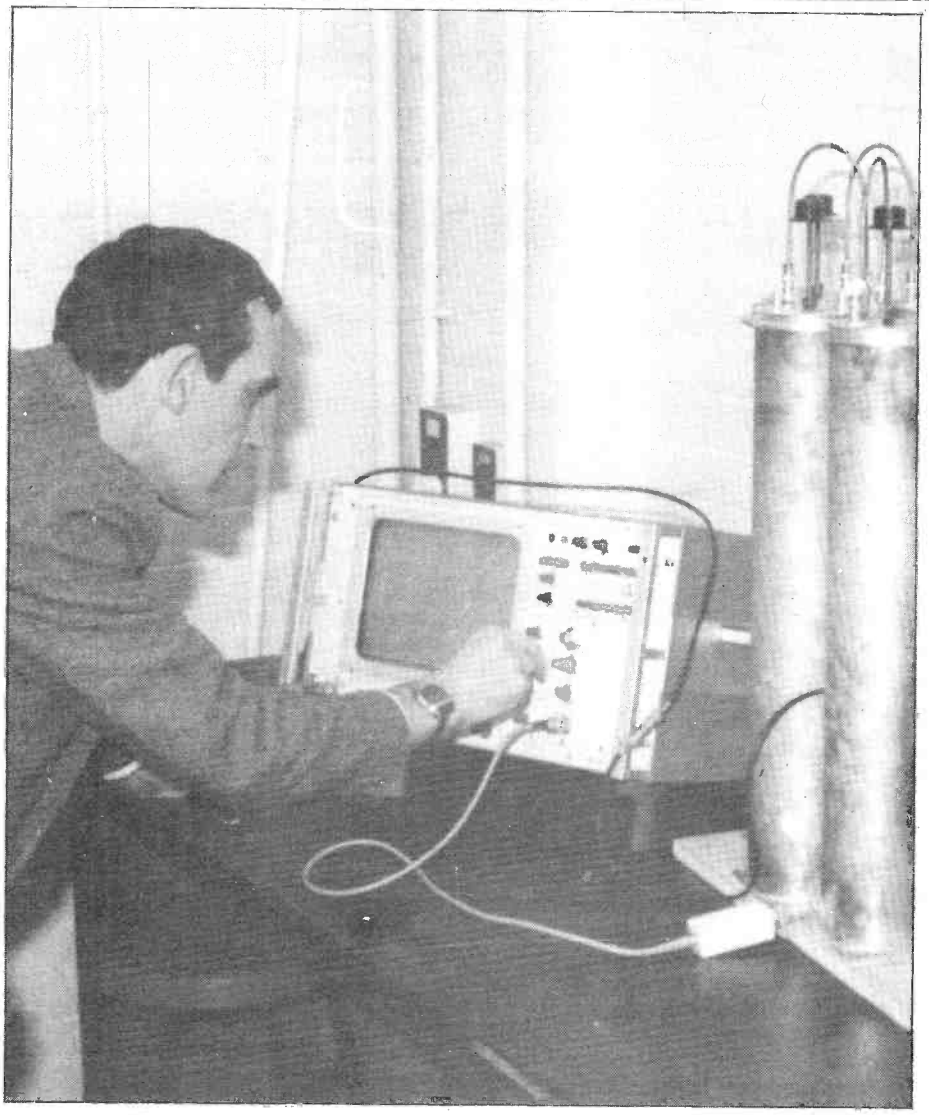
Crowborough

Beacon stations at Crowborough in the 28,70 and 430MHz bands will go off the air soon, until a new site is found for them. The existing site owner wants to use it for other purposes.

Japan to launch

The Japanese Amateur Radio League is sponsoring its own amateur satellite, which is due to be launched by Mitsubishi in 1986. Apparently a 145MHz uplink and a 435MHz downlink are planned.

Scopex, the manufacturer of a range of economical oscilloscopes, has called in a Receiver.



The SSB REPEATER experiment

Can SSB repeaters offer the same quality of service as FM ones, but using much less spectrum? Glen Ross G8MWR investigates.

Over the last few years there has been a lot of heated, and usually ill informed, discussion on the proposal put forward by G3RKL to install an SSB repeater in the Sheffield area as a pilot system to evaluate the feasibility of this type of equipment in amateur service. At first the idea met with the predictable response from the SSB fraternity of "We came down here to get away from repeaters..." and so on. The basic idea in most peoples' minds seemed to be that the repeater was intended as an aid to DX working. They countered that the whole point of SSB was to enable long distance contacts to be made direct and that as the repeater (in common with FM units) could only handle one contact at a time, the whole thing seemed rather pointless, even if it did provide a lot of interest to those who were involved in building it. If it were able to support a band of frequencies, on the lines of satellite working, that might make more sense. Surely if people were able to get into it from all over the country (which seemed to be the idea) then the thing would, in effect, be permanently jammed. And so the arguments went on. Eventually a licence was issued for an experimental period of one year and the repeater should appear on the band within the next three months.

Reality

In the following discussion it will be assumed that operators using the repeater will be doing so using a system similar in power etc to that normally used on FM. It must be obvious that people running high power and large aerial systems will easily exceed the stated figures. One thing that the new repeater will not be is a DX machine. The site will be on a tall building in the heart of Sheffield which is a town built in a bowl of hills. The only really clear path is through the river valley heading North East from the town. If it is not intended as a DX repeater then what is the thinking behind the machine? The answer is simple: it is intended to act as just another repeater! It has one great advantage over all existing repeaters, and that is the fact that it only requires a 5kHz bandwidth instead of the normal 25kHz of the FM repeater.

The British repeater system is based on only seven frequencies, with the outputs in the band 145.6 to 145.8MHz. Because of this we have to have several repeaters on the same frequency if we are going to have adequate repeater coverage. Most of the time this works out fairly well but we all know the problem of working into (say) WR and also bringing some confusion on CF by getting into that at the same time. The problems under lift conditions are even worse.

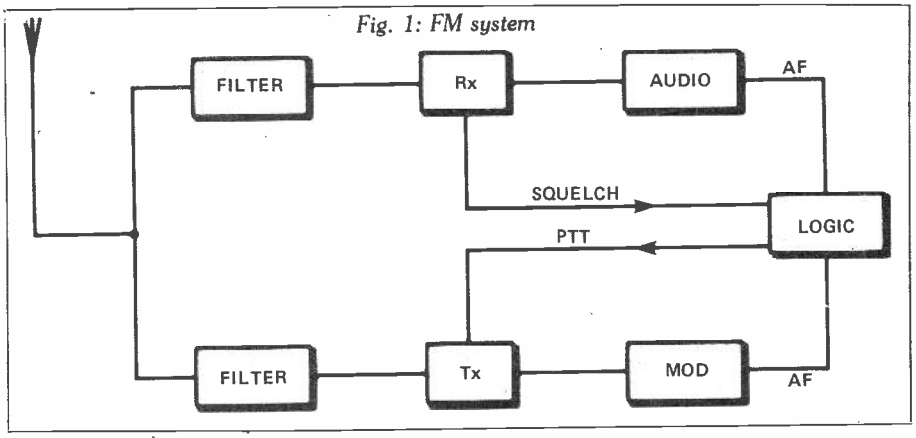
Now let us look at the position if we were using an SSB repeater system. The first point is that, because of only needing 5kHz per repeater, we can now have a total of 40 discrete repeater systems in the same allocation. We may still need to place repeaters on the same frequency but the physical separation of these units

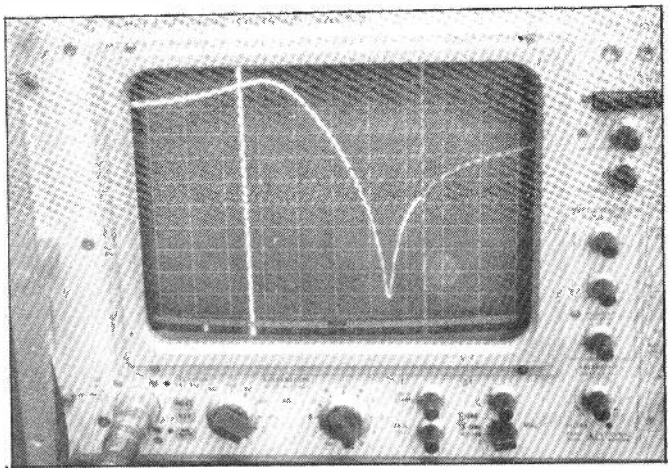
could be very wide, as there would only be a maximum of two repeaters on any one frequency. Because of this the problems of getting into two repeaters would virtually disappear. In practice there would probably be only 35 frequencies used, so as to allow a bit of breathing space, but this would be more than enough to achieve the aims of the system. It all sounds too good to be true, but it could be achieved. We very rarely get something for nothing and this case is no exception to that rule, so what is it going to involve?

Hardware

Before going into detail on the SSB system we need to understand the way that a normal FM system operates. Essentially it is simply the audio output of a receiver being used to modulate a suitable transmitter. The diagram in Fig 1 shows the essential parts of the system. Let us assume that the repeater is not in use and that you wish to use it. Your signal is picked up on the aerial, it goes through the filter to the RX where it opens the squelch. The logic sees an incoming signal, checks for a toneburst and, if everything 'fits', switches on the transmitter and your audio is then used to modulate it. At appropriate intervals the logic inserts the repeater's callsign and looks after all the various 'housekeeping' tasks. At first sight it seems that all this could be achieved just as readily using SSB, and indeed it could; apart from one thing. On SSB we have no carrier available. If you look back at the FM system we find it uses the carrier to determine if a signal is present, and the limiters in the RX effectively use the carrier to provide a form of automatic gain control. This combats the effects of rapid signal strength variation which is a feature of mobile operating. You may not be aware of this 'flutter', but have a look at the 'S' meter next time you work a mobile. To really appreciate the full extent of the problem remember that, due to mechanical intertia, your 'S' meter cannot follow the full depths of the fade. In practice a variation in signal level of greater than 1000 to 1 it not uncommon. It seems as though a lot depends on having a carrier available and yet SSB has not got one. So how do we get around this difficulty? By simply providing one!

Fig. 1: FM system

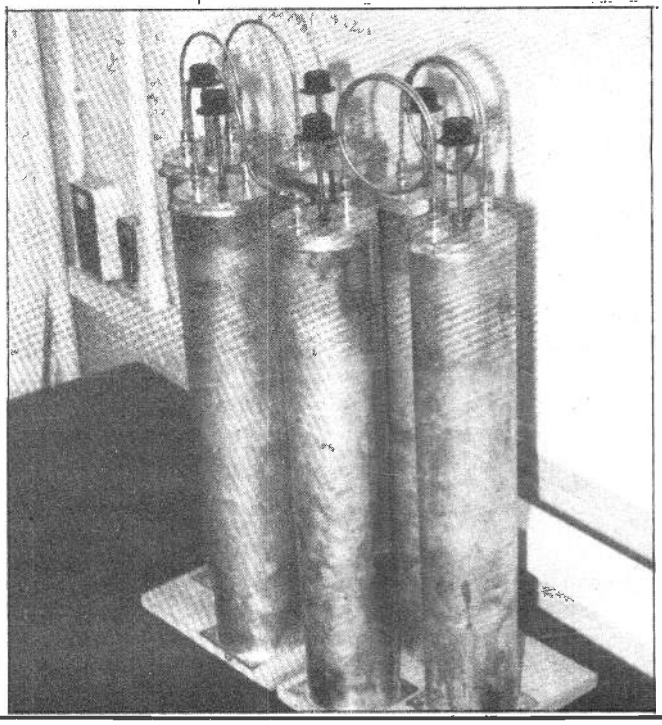




Polyskop display of one filter (six used) shows markers at 145 and 146MHz. The vertical scale is 4dB per division. The display shows a notch depth of 35dB.

Requirements

To recover information from the 'Donald Duck' noises of SSB you normally use an oscillator in the receiver to replace the missing carrier. This is knows as the Carrier Insertion Oscillator or C10 and is essentially the same as the BFO in older receivers. In order to recover speech that is at all natural in sound, the carrier must be inserted with an accuracy of +/- 50Hz. Certainly if a tone burst is to be filtered out, as is usual, then this accuracy is only just sufficient and a tolerance of +/- 20Hz would be desirable. This is easily achieved by manual tuning but the repeater has to do it automatically. Due to the fact that the calibration accuracy of the frequency readout on your transmitter is not 100% correct the repeater has to have the ability to tune over a restricted range, say +/-300Hz automatically. This assumes that the spread in calibration accuracy will not exceed 1 part in 1 million, which is fairly tight. To achieve these requirements we would need to use an oscillator which is controlled by a phase locked loop (PLL) system. In essence this takes the incoming signal, devides it down to some convenient frequency and then compares it to the output of a very tightly controlled reference oscillator. Any variation between the two signals produces an "error" voltage which is then used to control the frequency of the RX local oscillator, (see fig 2) It would not be used to control the C10 because that would move the insertion frequency in relation to the filter system in the receiver, causing a change in the frequency band reproduced by the audio system, and hence changing the 'naturalness" of the voice. The small range tuning requirement is easily implemented by changing the frequency of the reference oscillator slightly, or by changing the



Six filters connected to form the receive/transmit aerial combiner.

The SSB REPEATER experiment

ratio of the divider system by a small amount. A suitable circuit to defeat this swept tuning system could be derived from the receiver AGC system. (Fig 3)

Gain control

If an SSB transmitter is to be used to its best advantage it is essential that the modulation level is maintained close to the point where the rates PEP is achieved. As we have seen, variations in signal level can be very wide, therefore an excellent AGC system is called for. The normal type of AGC in which a voltage is derived from the incoming signal and then fed back to control the gain of the earlier stages of the receiver will probably not give enough control over the audio level to achieve maximum effectiveness. It seems likely that the normal method will have to be used plus a form of audio AGC (Fig 4). This form of AGC has the advantage that the gain of the audio stages is reduced before the signal arrives, unlike the control of RF and IF stages with reverse fed control. The final possibility is the use of a VOGAD type amplifier in the transmitter audio system. The use of speech compression is not to be recommended due to the audio distortion inherent in most types of this sytem, and the increase in the duty cycle of the signal, which might lead to reduced reliability. The AGC system should also have a high degree of immunity from impulse noise, such as ignition interference. It might be thought that this could be achieved in the normal manner by the use of a noise limiter. These devices are frequently based on a gate which is nothing more than a diode in series with the signal path (Fig 5).

A major problem with this type of limiter is that if a strong SSB signal is in the passband it tends to think that the peaks of modulation are in fact the same as impulse noise and chops them. This causes severe distortion of the incoming signal and also 'splatter', or frequency spreading. (As an aside, the next time you think that a local is spreading badly try turning your noise limiter off and see the difference before you give him a report). Because of these requirements the use of a 'Hang' type AGC system is not a suitable solution and a carrier derived system with a fairly fast time constant would be desirable. The AGC voltage could then also be used to determine if a signal was present as in the normal FM system.

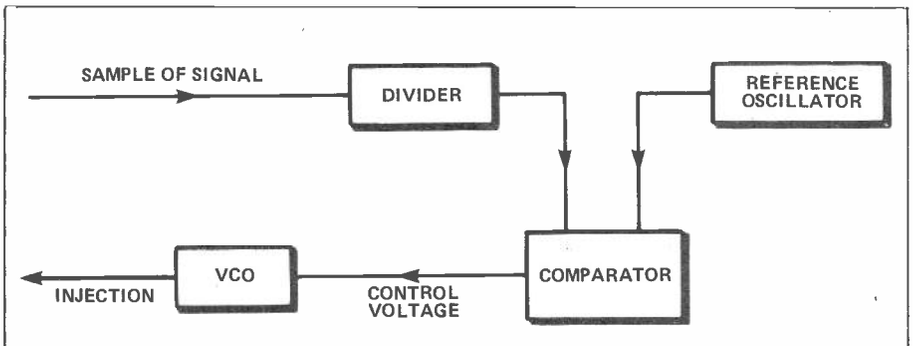


Fig 2: basic PLL system

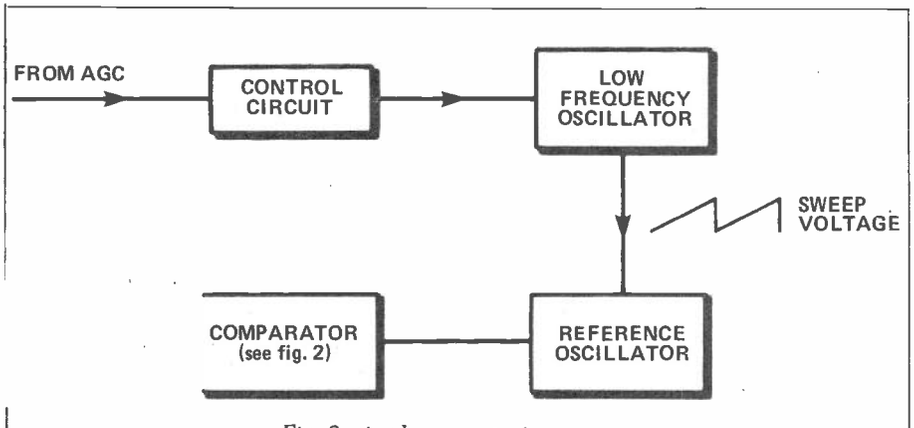


Fig. 3: simple sweep tuning system

Transmitters

The requirements for the transmitter in repeater service are not too different from any other. It will need to have the frequency closely controlled and the stages should be as linear as possible. The stability requirement is easily met by deriving the frequency from a synthesised source, or even from a crystal controlled oscillator. In either case the crystals, at least, should be installed in a temperature controlled environment. It would be sensible to contain all the required oscillators in one temperature controlled case to obtain the maximum stability. Most repeaters will be situated on very favourable sites to obtain the maximum range. It is therefore extremely important that great attention is payed to the linearity and drive levels of the various stages so as to keep IM products and spurious responses to a minimum. The usually accepted -40dB levels for these outputs would certainly not be acceptable to anyone living within several miles of a repeater running, say, 50 watts ERP, and levels of -60dB or better should be aimed for.

Aerials

In line with the idea that an SSB repeater is "just another repeater", the Sheffield installation uses a vertically polarized aerial. This makes it compatible with the usual car type installation for mobile working. It also means that most home based SSB stations will not be able to get into it from vast distances by using the normal high gain horizontal aerial system. There is no reason why horizontally polarized omni directional aerials with gain should not be used on other installations in the future, except that it would add to the confusion of which polarization to use for repeater working. A standardised system would be preferable.

The carrier

So far everything we have discussed has been a requirement to be implemented at the repeater site. We now come to the part of the system which has to be provided by you. The carrier. There are several methods of producing and using this workhorse, some of which will involve you in more work than others. It also depends on just what the repeater is looking for from your signal.

Pilot tone

Up to this point the term "carrier" has been used in a rather loose fashion to help explain what is required of the system. We now need to be rather more specific. These are effectively two ways of generating a 'carrier'. One is to actually use the carrier that the circuitry in your rig has been so carefully adjusted to remove.

The other is to superimpose an audio tone on your transmission. This produces a steady frequency which can be used in all respects as a normal carrier.

Let us look at the genuine carrier method first. This is the easiest option for the repeater builders to take, but leaves you with a few nasty problems to overcome. It is the system which is being used on the Sheffield repeater. Apart from the difficulty of implementing the system at your end the use of a normal carrier is placed on the extreme edge of the signal spectrum, it is very vulnerable to adjacent channel interference. To the point where the PLL system may have some difficulty in deciding just what it is going to 'Lock up' to. Secondly, the reintroduction of the carrier at its correct position, coupled with any non-linearities in the transmission chain, can give rise to a phantom sideband on the other (and in our case lower) side. The level of carrier required is -dB giving a level of 1 watt of carrier on a normal 10 watt rig.

The second system, which overcomes these disadvantages, actually provides some additional help to the repeater builder. An audio tone is added to your transmission and this is then used at the repeater to do the work of the carrier. The great advantage of this sytem is that, unlike the carrier, the audio tone does not need to be divided down in frequency before being checked against the local standard. It can also be used to operate the AGC system and sections of the Logic. The frequency normally used for 'pilot tone' on a 5kHz SSB system is around 1650Hz, but as we already have a 1750Hz signal available (the toneburst) this could be conveniently used for the purpose.

'Carrier' system

There are tow technically simple methods of reinserting the carrier. The easiest to achieve, but the least desirable from some aspects, is to unbalance the "balanced modulator" in your transmitter. A switching system would have to be incorporated to get back to a normal balanced condition when you are not working through a repeater or you will be getting reports of "a lot of carrier, old man". The setting up of a balanced modulator is a very tricky thing to do

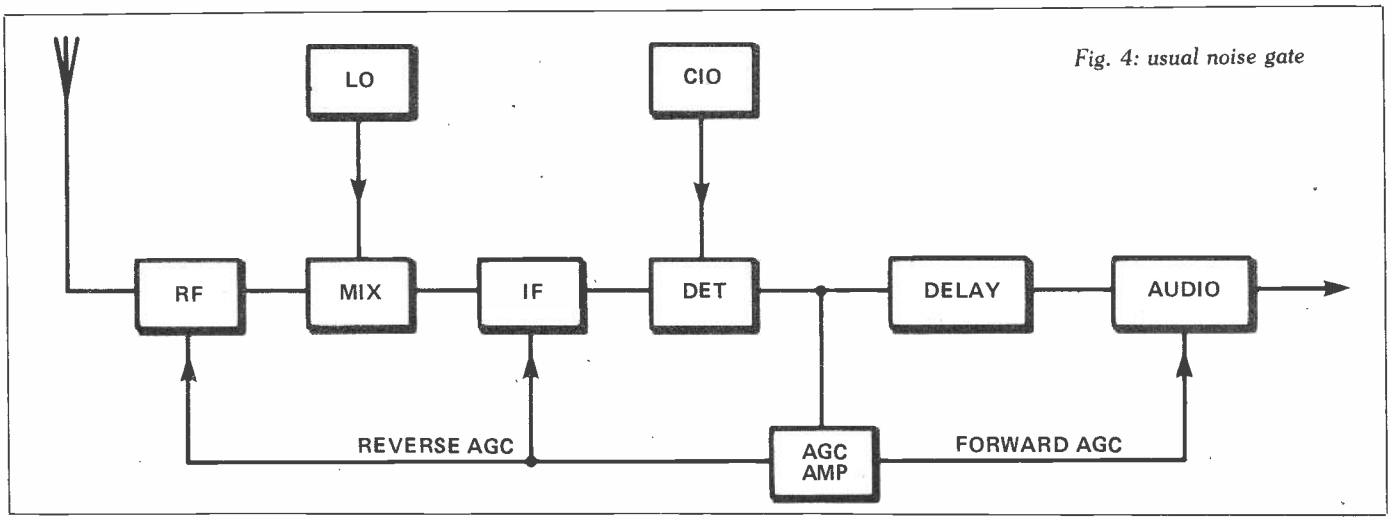
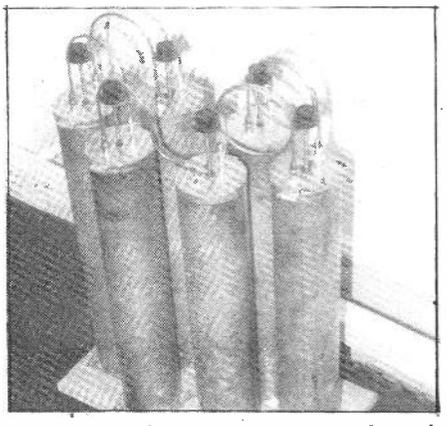


Fig. 4: usual noise gate

The SSB REPEATER experiment



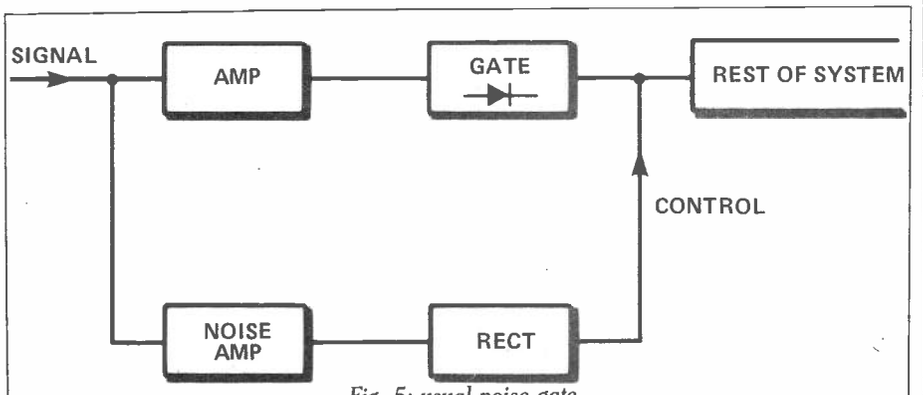


Fig. 5: usual noise gate

unless you have access to a lot of expensive equipment.

The second way is to deliberately 'leak' some carrier around the balanced modulator and filter system in the transmitter. As this filter is also used as the receiver filter any deliberate bypassing has to be done extremely carefully. It is only too easy to mess up your receiver performance. In essence then, this type of work is only suited to a technically competent person with access to the required test gear.

Pilot tone system

The good news is that this system can be implemented as an external 'add on' in your microphone lead. The bad news is that you can't use it on the Sheffield repeater. At its very simplest and crudest level all that would be required is to enable your normal toneburst to run all the time when you are working through a repeater. This means digging in to your rig, which a lot of people are not happy about. So how about the 'add on' way. This would consist of a small box containing a low gain amplifier, a filter and a toneburst oscillator (fig 6). The filter is used to provide a very narrow gap in the audio passband at the frequency of the toneburst oscillator (in this application the oscillator runs continuously), and the low level audio stage would overcome any loss in the filter. Depending on the type of filter used this amplifier may not be needed. A switch is provided to bypass the unit when repeater working is not required. The total cost of building the unit yourself should not exceed £10. It would not require the use of any test gear to set up. It would be easily possible to build it into a box measuring about one inch square and three inches long. The power requirements are very low and could be taken from the rig or a built in PP9 battery.

Summary

The SSB repeater system will without doubt be here to stay. The advantages to be gained from the extra channels which would be available, and the ability of most repeaters to have a dedicated frequency, far outweighs any additional complications. It has been claimed that the "carrier" system will become the standard and that the rig manufacturers will provide the "leak" facility. This may be true, but I doubt it. Most design teams would rather fit the inexpensive audio based 'add on' internally than engineer and set up the RF leak system. Another advantage from the manufacturers' point of view is that, once developed, the 'audio' system could be used in any later models and could also be fitted to current production without the need to modify existing RF boards. From the point of view of the home constructor the audio system has to be the simplest to implement and has the advantage that, if mounted in the microphone cable, it could be used with several rigs. This is a most interesting experiment, in the true tradition of amateur radio, and will be watched with great interest.

Thanks are due to G3RKL for background information on the Sheffield repeater project and for permission to use the photographs of the equipment.

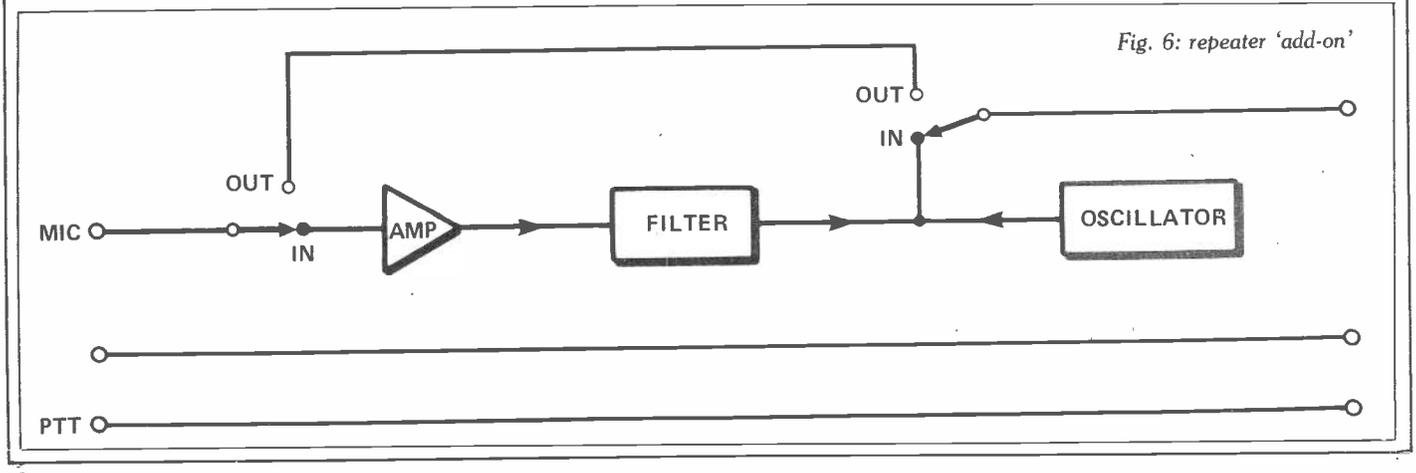


Fig. 6: repeater 'add-on'

A New Look at Wire Aerials 9

GROUNDED HALF DELTA LOOPS

John D. Heys G3BDQ investigates a new type of aerial that's causing a stir among LF DX buffs.

A basic half wave dipole is out of the question unless a couple of end supports at least 75m feet high are available. Such dipoles when less than half a wavelength from ground become most effective at providing high angle radiation, which is useless for DX work. Verticals with some form of inductive or 'capacity hat' loading have been a mainstay for many DX workers on Top Band, but following the publication of a design by John S. Belrose VE2CV much interest in his half delta loop has been generated. My own article which dealt with delta loops appeared in the September 1983 issue of *Amateur Radio*, but when it was being prepared I was not then in possession of all the details regarding the half delta. Since then Peter Weatherall G3MLO, who has been an outstandingly successful user of the new antenna, has kindly given me a lot of valuable information, much of which is included in this article. My thanks must also be extended to a very good friend, Jack Sargent, G3CMN, who has put up a 3.7MHz version of the half delta loop and has also passed along some valuable extra information.

The half delta loop is a vertically polarised antenna which also can be used on the harmonics of its design frequency. The antenna may be likened to a standard full wave delta loop having its apex pointing down and apex fed, but turned through 90 degrees. Instead of using the normal full wavelength of wire, a 'ground image' provides the missing half of its total length. This means that the earthing arrangements have to be excellent and certainly far superior to those found at the average amateur station. The success of the grounded half delta depends almost entirely upon the provision of a very effective low resistance earthing system. If you only have a pocket handkerchief sized garden you had best stop any further day-dreaming and regard this article as just an item of academic interest! A minimum area of 30m x 30m is suggested for the construction of a really good counterpoise system for use on 1.8MHz. Should your plot not satisfy these requirements do not despair, for an earth system in a long rectangular arrangement may also be used; a shape more likely to be available to the average reader. More about the practical aspects involved in the attainment of a good earth will be covered later in this article.

The half delta may be fed directly with 50 ohm coax when it is working on its fundamental design frequency, but an 'L' section ATU located at the antenna feed point is needed for harmonic operation, when the feed impedance can range from 100 to 1000 ohms but never below 50 ohms. The antenna has a very low

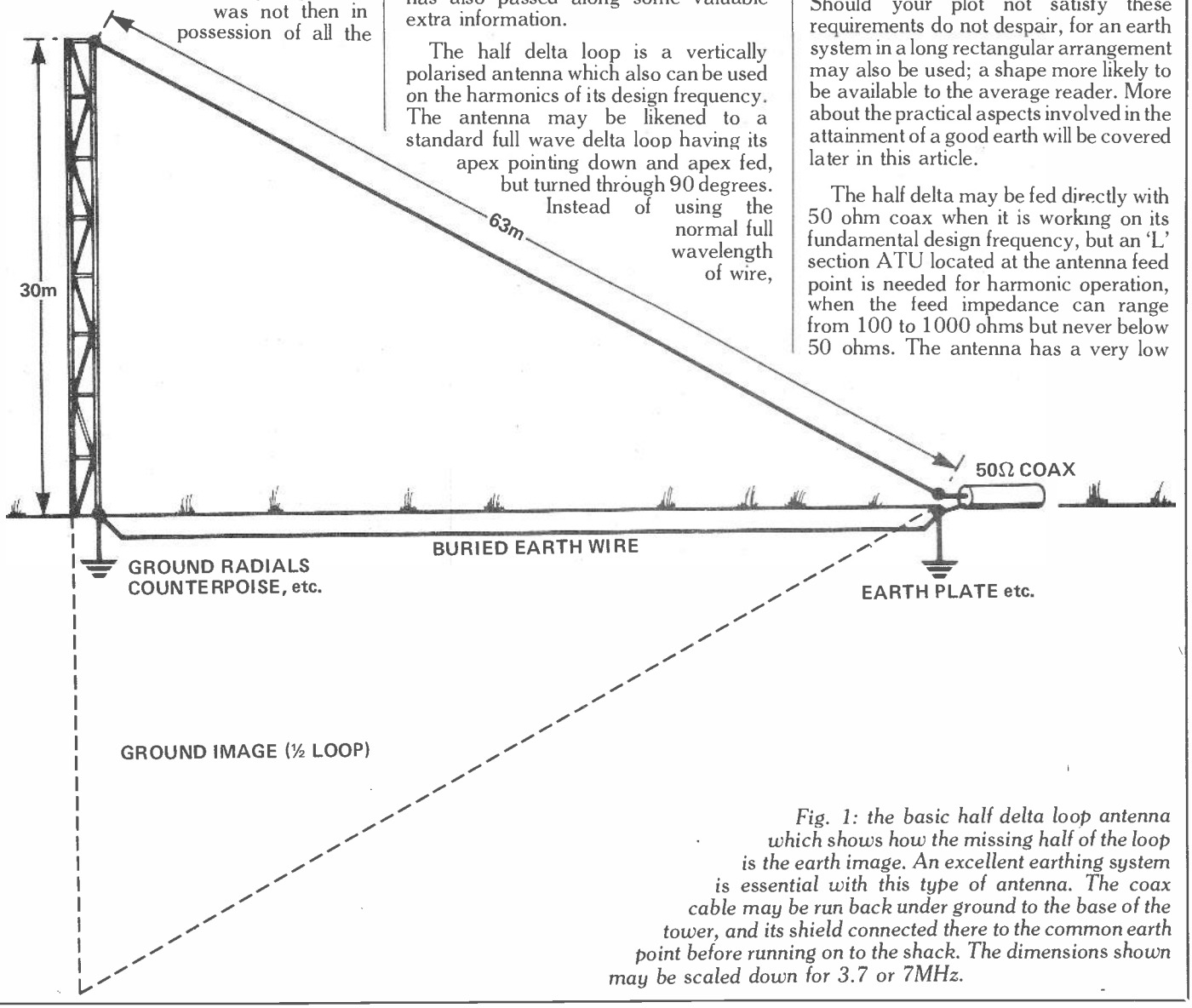


Fig. 1: the basic half delta loop antenna which shows how the missing half of the loop is the earth image. An excellent earthing system is essential with this type of antenna. The coax cable may be run back under ground to the base of the tower, and its shield connected there to the common earth point before running on to the shack. The dimensions shown may be scaled down for 3.7 or 7MHz.

A New Look at Wire Aerials 9

angle of radiation above the horizon (about 10 degrees) and this makes it superb for DX working. Its maximum radiation when used on its fundamental frequency is at right angles to the plane of the antenna, and on all the harmonic multiples the maximum is along the line of the sloping wire in both directions and there are then sharp nulls at right angles to this. At the design frequency the vertical section is about one sixth of a wavelength long and the sloping wire is about one third of a wavelength. The vertical length may be made somewhat shorter than the ideal and the extra length needed to achieve resonance can then be added to the sloping section. VE2CV and Doug DeMaw W1FB made extensive experiments with scaled-down half delta loops at UHF and much of the data relating to these antennas was derived from these experiments. G3MLO discovered that the dimensions obtained from those scaled down antennas were slightly under-estimated and to resonate his antenna at 1825kHz he had to add about 3m to the sloping wire. This is worth bearing in mind should you contemplate putting up a similar antenna.

If you are planning a half delta loop for 1.8MHz you will need a tower or pole at least 27m high. The original VE2CV design data suggested a tower 30m high with 63m of sloping wire for 1.8MHz; a vertical section 15m high with 31m of sloping wire for 3.6MHz and a 7.6m vertical section plus 15.8m sloping for 7.15MHz. Peter, G3MLO has a 29m tower, and another Kent user of the antenna G3MOU uses an 24m tower for Top Band. These dimensions put the Top Band version beyond the reach of many (the writer included!) but the dimensions for the higher frequency bands of 3.6 and 7MHz are quite easily attainable. Another factor to be considered is a need to keep the support tower uncluttered with any other antennas. A beam atop the tower will make the antenna behave more like a shunt fed tower having some top loading and certainly not a delta loop.

Good earthing at the foot of the tower is a must, as is good earthing at the feed point at the lower end of the sloping wire where the coax connects. Here a good earth with counterpoise or quarter wave 'artificial earths' must go the coax shield. A heavy conductor must run from this earthy point to the foot of the mast. This can be the coax cable itself if the tower or other support is at the shack end of the antenna. The sloping wire ought to be of at least 16swg copper and thicker if practicable. A thicker wire here will increase the antenna bandwidth and keep the SWR down over a wider frequency range. A dip-oscillator, together with the SWR readings when transmitting on low power, were used by G3MLO to check antenna resonance. Resonance at exact multiples of the fundamental design frequency will not occur and such resonance will be found to be about 10% lower than one would expect. This means that an ATU right at the antenna feed point is necessary if operation on the higher harmonic frequencies is required. This can prove inconvenient, especially on stormy winter nights, and some kind of remote switching can be devised. Ron Glaisher G6LX, overcomes a similar problem by having a set of ATUs in a plastic dustbin out at the bottom of his 27m vertical antenna. These are band switched by a magnetic device and he assures me that the dustbin keeps out the weather most effectively. W1FB devised a complex motor tuned remote ATU for his half delta.

Jack Sargent G3CMN borrowed the half delta loop design and put up a version for 3.7MHz and its higher harmonic frequencies. He does not boast a tower but has a fine 15m mast at the foot of his garden which supports the top of the 15m vertical section of the antenna. The lower end of this section connects to a good earth and a buried wire runs back to the feed point. His 31m top does not slope down all the way to the feed point, but about half of it comes away almost horizontally from the mast, the remainder falling at a fairly steep angle to the feed point. Instead of using low impedance coax to feed his antenna or an 'L' network for each of the higher frequency bands,

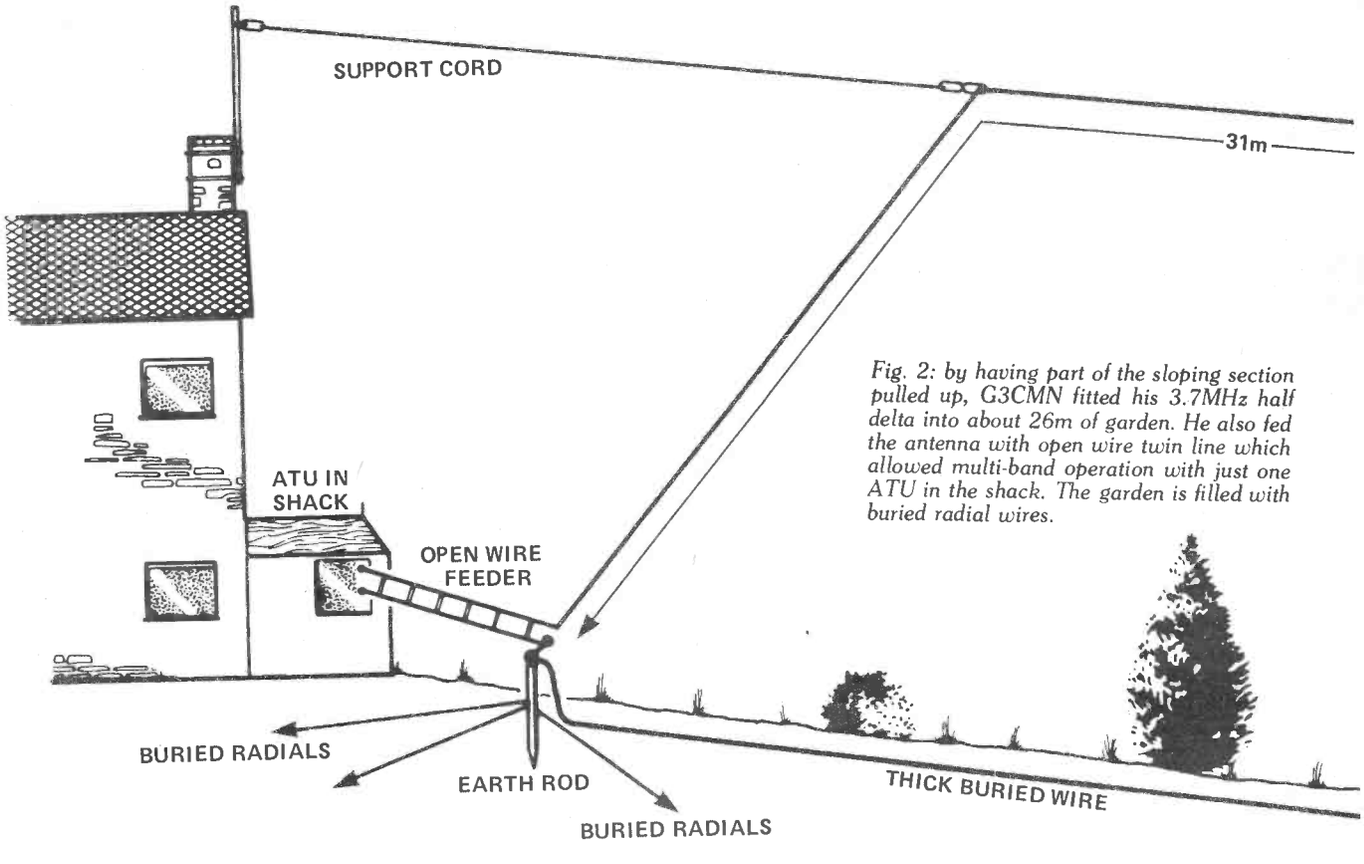
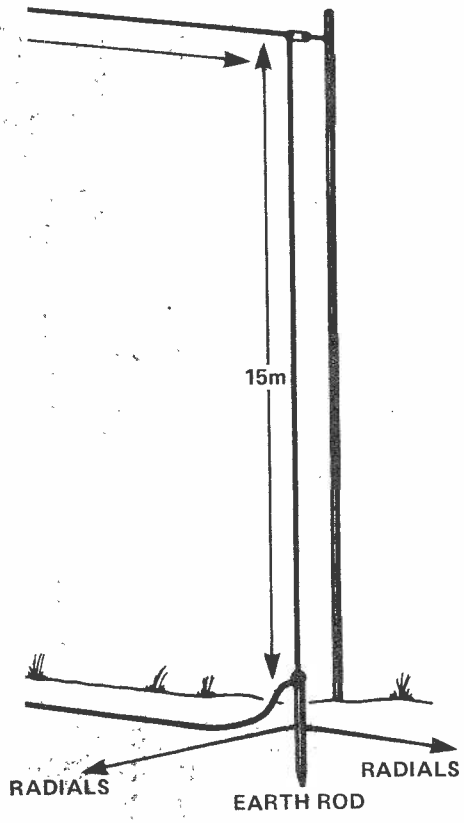


Fig. 2: by having part of the sloping section pulled up, G3CMN fitted his 3.7MHz half delta into about 26m of garden. He also fed the antenna with open wire twin line which allowed multi-band operation with just one ATU in the shack. The garden is filled with buried radial wires.

Jack uses open wire twin feeder between the feed point and his shack-located multi-band ATU. This is an interesting development. It certainly works and his results will be mentioned in a later paragraph!

Earths

The good earthing requirements of the antenna have already been mentioned and this point cannot be over-emphasised. Any type of antenna under a half wave length long used on the lower frequencies such as the basic $^1/_4$-wave Marconi, or its inverted 'L' or 'T' derivatives, must be worked against an excellent earth if the best results are sought after. Of course saltwater is just about the best 'earth' and this may explain why so many Maritime-Mobile stations running modest power put out such fine signals. Your local soil may or may not be a good conductor. Many amateurs just connect to their cold water pipe at its entry point or hammer a few metal rods into the garden and then consider that they have made a good earth system. This is often a delusion and much more must be done to get real efficiency on the LF bands or if one is contemplating putting up a half delta loop antenna. The writer uses a combination of methods; metal earth rods and tubes, sheets of aluminium hammered down edgewise, a large earthing plate down a disused well, buried wires, quarter wave radials and also most importantly a recent development, a large counterpoise.



The difficulty when contemplating an elevated counterpoise (that is insulated wires between 1m and 2m above ground) is arranging that they do not obstruct or 'uglify' the garden or field. Fortunately I am well 'hedged in' and have in all about 240m of hedging which not only runs around my property but also runs across it a few times to divide the garden into different growing areas. This run of mostly privet and box hedge enables an extensive counterpoise system to be contrived with the wires being invisibly located within the foliage. Some 300 plus metres of counterpoise wire has been used this summer. In addition a further four quarter wave radials cut for operation on 1.8MHz have been run out in different directions. All this may seem excessive, but it is in fact quite a modest arrangement when it is compared with the earthing system used by G3MLO! Peter was using 1,500 metres (approaching a mile of wire) of 1.5mm copper buried about 75mm below the ground in 1982, and he planned to double this during the 1983 summer! G3MLO lives up on the chalklands of Kent and such a location presents a very poor natural earth. For him an enormous amount of buried wire is essential. By the way, should your local club wish to run up a high Top Band score in NFD talk them out of using that hill top site up on the chalk downs and instead lead them to your nearest local bit of marshland! G3CMN has several hundred yards of buried galvanised wire all over his garden, but Gavin G3MOU another half delta loop user has done little to improve his earth system.

A point of interest on earthing is that John L. Reinartz used an elevated counterpoise system in 1923 for the successful first amateur transatlantic QSOs. This then 'new' concept was widely adopted by amateurs for ten years (also by commercial stations) until it was again forgotten when the almost universal adoption of resonant 'Hertz' aerials removed the need for a good earth system.

Elevated counterpoises are often shown as symmetrical arrangements rather like spider webs, but almost any arrangement of the wire should suffice. The writer's common 'feed point' for the earthing system is where a stout bunch of aluminium wires descent into his well. From here the counterpoise wires go out in different directions and a single wire connects up to the shack. The quarter wave radials do not connect at this point but instead they all terminate at the metal casing of the station ATU. A suitable and cheap source of wire for a counterpoise is the firm of W.H. Westlake who supply it in convenient 50 metre rolls.

Users of half delta loops seem delighted with the results obtained. W1FB had one which was cut for 80 metres and he found it far superior to any other type of aerials used previously. He worked the world and was often told that he was the loudest signal from the United States. On 40 metres the antenna allowed him to make long path contacts with Japan in the evenings, something he could never do previously. The closed loop characteristics of the antenna also reduced the pick up of man-made noise, and in fact the backgroundd noise was so low that at first he thought he had an open circuit or similar fault!

Although G3MOU did not use a very good earth system he had some fine Top Band results last winter. I heard him call CQ one evening and could hardly believe it when a YB5 in Indonesia came right back to him. Gavin got an S7 report and I jumped in immediately receiving back S6 on my very good Marconi aerial. Gavin also worked VK6 and other DX on the band through the winter. G3MLO with his extensive ground system has perhaps proved more than anyone the effectiveness of the half delta. He worked VK6HD many times on 160 metres and also had many QSOs with stations in the USA and Canada on that band. He worked them on SSB too and received S9 plus reports! On 80,40 and 20 metres the antenna performed beautifully. The 80 metre reports were as good as he obtained earlier when operating with a full sized delta loop which had been arranged to give vertical radiation. Many VK and ZL stations were worked on SSB. As the operating frequency increases the directivity of the half delta seems to be more evident. In its 'best' direction towards South America on the HF bands (28, 21 and 14MHz) the antenna at G3MLO was only 3dB (or half an S-point) down on a 5 element Yagi up a 18m!

G3CMN has had excellent summertime results on 80 metres with his version of the half delta and he has found it particularly impressive on 21MHz where he has received some remarkable reports when using SSB. To date he has not had an opportunity to really test its DX potential on 3.7MHz but is anticipating an interesting winter season.

Conclusions

It is rarely found that the results of a new antenna come up to the expectations, but from all that the writer has learned of the new grounded half delta loop it seems that here is a 'winner'. Admittedly it is a very big aerial which needs a high support at one end together with a better than average earthing system, but if these criteria are met the results can be phenomenal. Finally, there seems to be little to gain in building small ones for 14MHz or the higher frequency hands, for normal full sized Deltas will out perform them. The half delta only has the 'edge' at the lower frequencies where conventional loops are almost impossible to get up. On Top Band a conventional delta loop would have three legs each of 60m and have a centre support at least 45m high! The half delta has also the added bonus of high gain at low angles on its harmonic frequencies together with low noise reception characteristics.

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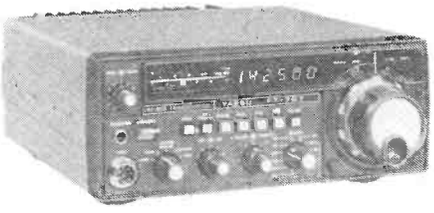

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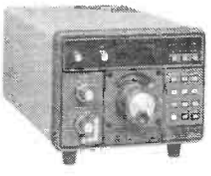

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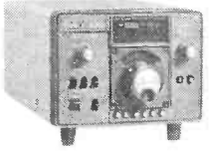

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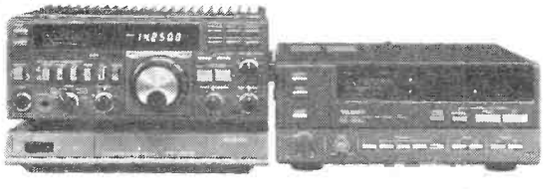

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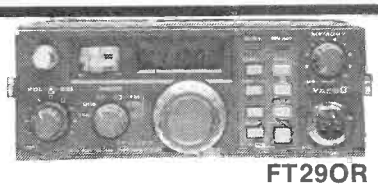

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MMB10	Mobile bracket	6.90
FRG7700	Receiver 0.15-3.0 MHz AM/CW/SSB/FM	335.00
FRG7700M	Receiver c/w 12 channel memory	389.00
DCRG7700	DC modification kit	1.15
MEMG7700	Memory option	98.90
FRT7700	Antenna tuner/switch	42.55
FRA7700	Active antenna	38.70
FF5	Low pass filter 500 KHz	9.95
FRV7700A	Convertor 118-130, 130-140, 140-150 MHz	78.95
FRV7700B	Convertor 118-130, 140-150, 50-59 MHz	84.70
FRV7700C	Convertor 140-150, 150-160, 160-170 MHz	74.75
FRV7700D	Convertor 118-130, 140-150, 70-80 MHz	80.90
FRV7700E	Convertor 140-150, 150-160, 118-130 MHz	83.95
FRV7700F	Convertor 150-160, 160-170, 118-130 MHz	83.95
YM21	Hand 600, 4 pin noise cancel	15.70
YM24A	Hand 2K, 6 pin min, speaker/mic.	18.40
YM35	Hand 600, 8 pin scan	15.35
YM36	Hand 600, 8 pin noise canc	14.95
YM37	Hand 600, 8 pin	7.30
YM38	Stand 600/50K, 8 pin scan	27.20
YM47	Hand 600, 7 pin scan con.	10.75
YM49	Hand 600, 7 pin speaker/mic	16.85
YE7A	Hand 600, 4 pin	7.65
YD148A	Stand 600/50K 4 pin	22.60
YD844A	Stand 600/50K 4 pin	26.85
MH-1B8	Hand 600, 8 pin scan	13.80
MD-1B8	Desk 600, 8 pin scan	49.85
FSP1	Mobile speaker 8 ohms	11.15
FSP2	Mobile speaker 4 ohms	11.15
YH55	Headphones padded low Z	9.95
YH77	Headphones lightweight low Z	9.95
YH1	Lightweight mobile h'set/boom mic	13.80
SB1	PTT switch box for FT208/FT708	14.95
SB2	PTT switch box for FT290/FT790	12.65
SB3	PTT switch box for FT202	13.80
FP4	12V power supply 4 amps	44.45
QTR24D	World time clock quartz	31.45
FF501DX	Low pass filter	25.70
YP150Z	Terminated Wattmeter 5-30-150W FSD	92.00

Prices include VAT and Carriage

SOUTHAMPTON
SMC Ltd
36/38 Rumbridge St.,
Totton, Southampton,
Southampton (0703) 867333
9-5.30 Mon-Sat

GRIMSBY
SMC (Grimsby)
247A Freeman Street
Grimsby, Lincs
Grimsby (0472) 59388
9.30-5.30 Mon-Sat

STOKE
SMC (Stoke)
76 High Street
Talke Pits, Stoke
Kidsgrove (07816) 72644
9-5.30 Tues-Sat

LEEDS
SMC (Leeds)
257 Otley Road
Leeds 16, Yorkshire
Leeds (0532) 782326
9-5.30 Mon-Sat

CHESTERFIELD
SMC (Jack Tweedy) Ltd.
102 High Street
New Whittington, Chesterfield
Chesterfield (0246) 453340
9-5.00 Tues-Sat

BUCKLEY
SMC (TMP)
Unit 27, Pinfold Lane
Buckley, Clywd
Buckley (0244) 549563
9.30-5.30 Tues-Sat

JERSEY
SMC (Jersey)
1 Belmont Gardens
St. Helier, Jersey
Jersey (0534) 77067
9-6.00 Mon-Sat

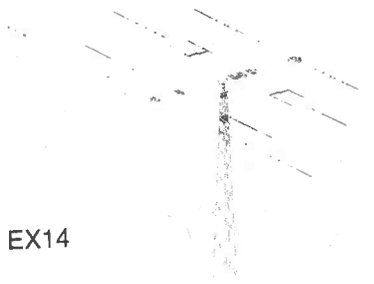
EDINBURGH
SMC Scotcomm
23 Morton Street
Edinburgh EH15 2HN
Tel. 031-657 2430
10-5 Tues-Fri 9-4 Sat

REMEMBER

Only authorised Yaesu dealers have direct contact with the factory in Japan, and only if you buy your radio from an authorised dealer can you be assured of spares and service back up. So BEWARE of grey importers who offer sets a few pounds cheaper, they may not be around if your set goes wrong!

HF ANTENNAS

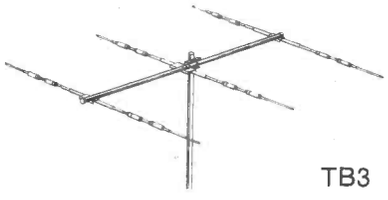
S.M.C. have the greatest range of H.F. antennas eg, Multi Beams/Quads, over 20 models. Shown below is the sensational new Explorer 14 — contact us for full details.



EX14

MULTIBAND BEAMS

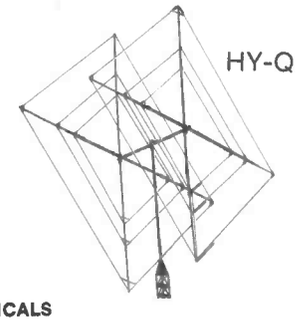
		Inc VAT	P & P
EX14	Explorer 10-20	P.O.A.	
TH3JN	3 Ele 10-20	£202.40	£3.50
TH2MK3	2 Ele 10-20	£169.05	£3.50
TH3MK3	3 Ele 10-20	£274.85	£5.30
TH5DXX	5 Ele 10-20	£419.75	£6.70
TH7DXX	7 Ele 10-20	£511.75	£8.75
TB3	3 Ele 10-20 Jaybeam	£181.70	£5.40
HQ1	Mini Quad 10.20	£139.00	£4.00
G4MH	Mini Beam 1-20	£82.50	£4.00
TA33JNR	3 Ele 10-20 Moseley	£161.00	£3.40
Mustang 2	2 Ele 10-20 Moseley	£177.10	£3.50
Mustang 3	3 Ele 10-20	£220.80	£3.70
GQ2E	2 Ele 10-20 Quad	£189.75	£5.40
GQ3E	3 Ele 10-20 Quad	£313.95	£9.20
GQ4E	4 Ele 10-20 Quad	£446.20	£10.00
Hyquad	2 Ele 10-20	£354.20	£6.00
LP1007	Log Periodic 13-20 MHz	£1474.30	£DIST
3Y1015D20	3 Ele 10-20m	£134.95	£5.00
DB10/15A	3 Ele 10-15m	£198.95	£4.80



TB3

MONO BAND BEAMS

103BA	3 Ele Yagi 10M	£67.85	£3.50
105BA	5 Ele Yagi 10M	£155.25	£3.75
153BA	3 Ele Yagi 15M	£90.85	£3.50
155BA	5 Ele Yagi 15M	£236.90	£5.90
203BA	3 Ele Yagi 20M	£176.25	£4.90
204BA	4 Ele Yagi 20M	£286.35	£7.30
205BA	5 Ele Yagi 20M	£396.75	£9.40
402BA	2 Ele Yagi 40M	£247.25	£6.50
18TD	Dipole Tape 10-80M		



HY-QUAD

VERTICALS

12AVQ	Vertical 10.20M	£50.60	£2.75
14AVQ	Vertical 10.40M	£64.40	£2.75
18AVQ/WB	Vertical 10.80M	£113.85	£2.75
18V	Vertical 10.80M taped	£36.22	£2.75
C4	Vertical 10.20	£59.00	£2.50
SMCHF5	Vertical 10.80	£54.80	£2.50
SMCHF5P	Radial Kit for above	£34.90	£2.50

TRAP DIPOLE

SMCTD/HP	High Power 10.80M	£43.41	£2.50
SMCTP/P	Portable Inc coax	£59.80	£2.50

MOBILE

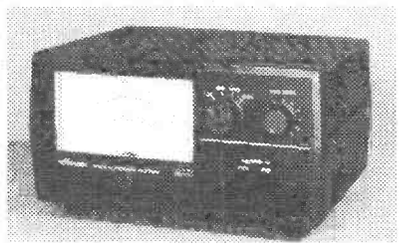
Tribander	10-20M Slide sw.	£25.88	£1.50
Multiband	10-20M	£30.48	£1.50
Flexiwhip	10M only	£18.11	£1.85
Extra coils	for above to 160m	£5.70	£1.00
Flexiten	2, 10, 12, 17, 18, 20, 30, 40, 80M	£49.00	£2.00
Bases	For above	£5.75	£1.00

N.B. PRICES INCLUDE VAT AT 15%
Carriage extra. Mainland rate shown

POWER METERS

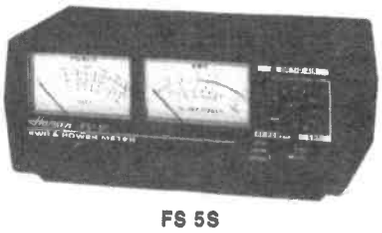
IN LINE POWER/SWR BRIDGES P.E.P., R.M.S. 1 · 8-440 MHz

The Hansen range covers 30 quality models with top-of-the-line the FS710. This is a flat frequency response peak envelope power and average in-line wattmeter with many novel features. Notable being the 'power independent' SWR scale — no forward power calibration knob, just direct reading SWR.



HANSEN FS 300H

HANSEN			P&P
FS710H	1.8-60MHz 15/150/1500W pep	£89.70	FOC
FS710V	50-150MHz 15/150W pep	£89.70	FOC
FS50HP	1.8-80MHz 20/200/2000W pep	£89.70	FOC
FS50VP	50-150MHz 20/300W pep	£89.70	FOC
FS500H	1.8-80MHz 20/200/2000W pep	£69.75	FOC
FS50OV	50-150MHz 20/200W pep	£69.75	FOC
FS300H	1.8-80MHz 20/200/1000	£46.40	FOC
FS300V	50-150MHz 20/200	£46.40	FOC
FS200	1.8-150MHz 20/200 pep	£50.60	FOC
FS601M	1.8-30MHz 20/200W pep	£51.35	FOC
FS601MH	1.8-30MHz 20/2000W pep	£51.35	FOC
FS602M	50-150MHz 20/200W pep	£51.35	FOC
FS603M	430-440MHz 5/20W pep	£51.35	FOC
FS210	1.8-150MHz 20/200W Auto SWR	£55.20	FOC
FS301M	2-30MHz 20/200W	£35.65	FOC
FS301MH	2-30MHz 20/200W	£35.65	FOC
FS302M	50-150MHz 20/200W	£35.65	FOC
FS711H	2-30MHz 20/200W Head	£36.80	FOC
FS711V	50-150MHz 20/200W Head	£36.80	FOC
FS711U	430-440MHz 5/20W Head	£36.80	FOC
HB1	FS711H Coupler	£23.75	FOC
VB1	FS711V Coupler	£23.75	FOC
UB1	FS711U Coupler	£23.75	FOC
FS5E	3.5-150MHz 20/200/1000W HF	£37.20	FOC
FS5S	1.8-150MHz 20/200/1000W HF	£37.95	FOC
FS7	145&(432MHz) 5/20/200 144	£41.00	FOC
SWR3E	3.5-150MHz 20/200/1000W HF	£25.00	FOC
SWR3S	3.5-150MHz F/S Meter ant.	£26.45	FOC
SWR508	3.5-150MHz Twin Meter	£26.45	FOC
FS20D	3-150MHz 5/20W	£37.95	FOC
FS800	1.8-150MHz 6/30/150W	£115.00	FOC
JD			
JD110	1.5-150MHz 10/100W	£13.80	FOC
MIRAGE			
MP2	50-150MHz 50/500/1500W pep	£100.00	FOC
SMC			
S3-3OL	Mini CB	£8.80	FOC
T3-170L	3.5-170MHz Relative	£14.95	FOC



FS 5S

NB: PRICES INCLUDE VAT AT 15%
Carriage free by post

SMC-HS

HF, VHF, UHF ANTENNAS MOBILE VERTICALS

SMC-HS Mobile Elements, tabulated below, feature an inbuilt PL259M connector, which mates with the SO239M on any of the four standard mounts. This arrangement is ideal for easy removal — band changes, comparative test, car wash, and anti-vandal, system checks from the feed point, portable operation and for ease of garaging, etc. All models have fold over bases (either lift and lay or locking collar) except the 788 which has an inbuilt ball in case the mount must be fitted askew.

SMC OSCAR 10SE

GCD

SMC258

GCD

SMC-HS MOBILE ANTENNA

SMC6P 2T/PL	Telescopic 2M PL259 fitting OdB¼	£3.45	£0.60
SMC6P2T/ BNC	Telescopic 2M BNC fitting OdB¼	£5.00	£0.60
SMC2H/PL	Helical 2M PL 259 fitting	£3.45	£0.60
SMC2H/ BNC	Helical 2M BNC fitting	£5.00	£0.60
SMCHS430	70cm ½ wave BNC fitting 2.5dB¼	£6.90	£0.60
SMC2QW	2M ¼ wave OdB¼ 1.6'	£2.30	£1.50
SMC2NE	2M ⅝ wave fold 3.0dB¼ 4.3'	£6.90	£1.80
SMC2VF	2M ½ wave fold 3.0dB¼ 3.5'	£11.50	£1.80
SMC78F	2M ⅞ wave fold 4.5dB¼ 5.7'	£13.80	£2.00
SMC788	2M ⅞ wave ball 4.5dB¼ 5.6'	£13.80	£2.00
SMC78SF	2M ⅞ wave short 4.7'	£13.00	£2.00
SMC88F	2M 8/8 wave 5.2dB¼ 6.5'	£18.80	£2.00
SMC118M	Colinear 2M 11/8 wave fold 7dB¼ 9.7'	£29.90	£2.50
SMC258	70cm 2 × ⅝ fold 5.5dB¼ 3.1'	£12.65	£1.80
SMC358	70cm 3 × ⅝ 6.3dB¼ 4.7'	£16.85	£1.80
SMC70N2M	Dual band 2M 2.7dB¼ 70cm 5.1dB¼	£16.85	£1.80
SMCHS770	144/432 Duplexer 50W	£15.35	£1.50
SMC20SE	20M 1.72M 'fold over' 100W PEP	£17.65	£2.00
SMC15SE	15M 1.72M 'fold over' 130W PEP	£14.55	£2.00
SMC10SE	10M 1.72M 'fold over' 200W PEP	£13.80	£2.00
SMC17SE	17M 1.915M 'fold over' 200W PEP	£15.70	£2.00
SMC12SE	12M 1.915M 'fold over' 200W PEP	£14.20	£2.00
SMCGCCA	Gutter clip 4 mtrs cable	£9.95	£1.80
SMCSOCA	Cable assembly 4M	£5.00	£1.20
SMCSOCAL	Cable assembly 6M	£5.35	£1.20
SMCT MCAS	Trunk mount c/w 6M cbl	£8.45	£1.80
SMCSOMM	Magnetic base c/w 4M cbl	£9.95	£1.80
SMCSOWM	Adjustable wg mnt base	£4.20	£0.90
SMCCGCD	Gutter clip deluxe	£4.60	£1.20
SMCBSD	Bumper strap deluxe	£8.80	£1.20
HS888K	Bumper mounted extension for 144 MHz ant.	£18.80	£1.80

HS770

SOMM

NB: PRICES INCLUDE VAT AT 15%

SEND US AN A4 S.A.E. (20p) for our latest 26 page price list and catalogue. Information on Yaesu products, Antennas Towers, etc

SCANNING RECEIVER

MS-8400

New from SMC the MS-8400 VHF/UHF microprocessor controlled scanning receiver with 40 programmable memory channels, keyboard entry of frequency or command, automatic band search, AM and FM selectable 4 selectable scanning steps, priority channel, connections for external antenna and loudspeaker, speaker supplied c/w telescopic antenna mounting bracket, etc.

Frequency Range:
Low VHF 68,000MHz - 88,000Mhz
Air Band 108,000MHz-136,000MHz (Auto AM)
High VHF 136,000MHz-174,000MHz
UHF 360,000MHz-512,000MHz

Scanning Steps: 5, 10, 125 and 25KHz VHF (10, 125 and 25KHz UHF)

Channels: 40 programmable memories

Modes: AM or FM selectable

Scan rate: Approximately 18 channels per second

Scan delay: 2 second

Priority sampling: 4 second

Audio output: 1.2 Watts

Selectivity: Better than - 60dB at ±25KHz

Power supply: DC 12V - 16V/0.6A max

Memory back-up: 9 volt, battery (PP3)

Antenna: Telescopic antenna or External

Loudspeaker: 25" x 4" oval speaker

Size: 190 (W) x 250(D) x 85(H) mm

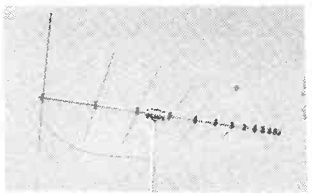
Weight: 1.7kgs

£249.00 inc
price includes free carriage

SMC-HS

HF, VHF, UHF, BASE STATION ANTENNAS

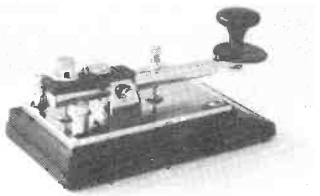
SMC HS range of base station antennas covers from 80M through to 70cm. All have SO239M connectors and are supplied complete with all required mounting hardware.



SQ144	2M Swiss Quad Vertical Mounting	**£57.60**	£2.50
GP2M	2M 5/8 c/w ground plane 3.4dB 1/4	**£18.00**	£2.50
GP144W	2M 2 x 5/8 colinear 6.5dB 1/4	**£27.60**	£2.50
GP23	2M 3 x 5/8 colinear 7.8dB 1/4	**£39.85**	£2.50
GP432	70cm 3 x 5/8 colinear 6.8dB 1/4	**£29.90**	£2.50
70N2V	2M/70cm colinear 2.8dB 1/4/5.7dB 1/4	**£29.90**	£2.50
HS770	2M/70cm Duplexer 50W 30dB isolation	**£15.35**	£1.50
VHFL	65-520 MHz Discone Rx only	**£15.70**	£2.50
GDX1	80-480 MHz Discone 3dB 1/4	**£40.25**	£2.50
GDX2	50-480 MHz Discone 3dB 1/4	**£49.45**	£2.50
GDXA	100-480 MHz Discone 3dB 1/4	**£33.75**	£2.50
LT606	50-500 MHz Log Periodic 7-8dB	**£115.00**	£2.50
HF5V	Trapped Vertical 10-80M 5 bands	**£54.80**	£2.50
HF5R	Loaded Radial Kit	**£34.90**	£2.50
3Y1015D	20 3 ele. 10, 15M Dipole 20M	**£144.90**	£5.00

NB: PRICES INCLUDE VAT AT 15%
Carriage extra, mainland rate shown

MORSE EQUIPMENT



Morse Keys			
BKU1	Squeeze Key	**£30.30**	£1.20
BK703	Straight Key	**£25.70**	£1.20
BK704	Straight Key	**£17.65**	£1.20
HK706	Straight Key	**£14.80**	£1.00
HK707	Straight Key	**£13.75**	£1.00
HK710	Straight Key	**£36.40**	£1.75
HK808	Straight Key	**£45.60**	£1.75
HK711	Key Mounting	**£29.50**	£1.50
BK100	Mechanical Bug	**£22.25**	£1.75
MK701	Single Lever Paddle	**£25.25**	£1.60
MK702	Single Lever Paddle	**£26.45**	£1.60
MK703	Squeeze Key	**£25.96**	£1.75
MK705	Squeeze Key	**£22.60**	£1.75
MK706	Squeeze Key	**£19.50**	£1.75
IKP60	Iambic	**£9.95**	FOC
SR1	Straight Key	**£12.65**	FOC
HK802	Deluxe solid brass key	**£76.00**	£2.00
Morse Equipment			
KP100	Squeeze CMOS 230/13.8V	**£69.00**	£2.00
KP200	Memory 4096 Multi Ch Mem Back Up 230/13.8V	**£156.25**	£2.50
Datong			
D70	Morse Tutor	**£56.35**	FOC
MICROWVE MODULES - RTTY EQUIPMENT			
MM2001	RTTY to demod/convertor	**£189.00**	FOC
MM4001	RTTY Transceiver	**£219.00**	FOC
MM40001KB	RTTY Transceiver c/w keyboard	**£299.00**	FOC
MMS1	'Morse Talker'	**£115.00**	FOC
MMS2	Advanced 'Morse Talker'	**£156.00**	FOC
MM1000	ASC11 to Morse Convertor	**£69.95**	FOC
MM1000KB	ASC11 to Morse conv c/w keyboard	**£89.00**	FOC

PRICES INCLUDE VAT AT 15%
Mainland carriage where applicable

10M FM CORNER

£49.00 inc.
SMC OSCAR 2 10M FM

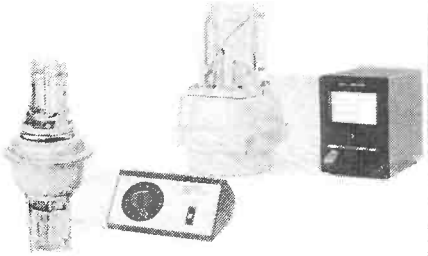
Join the many others who have found that operating 10M FM can be a pleasant alternative to the overcrowded 2M band. The SMC Oscar 2 10M gives you 40 channels, channel 1 being 29.310MHz and channel 40 29.7MHz, a power o/p of approximately 4 watts and a receive sensitivity of better than .3uV for 12db sinad. Also for your enjoyment when the band opens up, we have incorporated a - 100KHz repeater shift (by using the original front panel Hi/Low power switch/ so from the car or at home you can enjoy 10M FM without having to pay £500 for an HF transceiver.

Accessories		**INC**	**P/P**
SMCGP27	1/2x vertical CW radials	**£24.15**	2.50
SMCVP27	1/2x vertical no radials	**£20.70**	£2.50
SMC11V11S	Glass fibre loaded ground plane	**£29.90**	£2.50
SCM100E	10M Mobile whip	**£13.80**	£2.00
SMCGCCA	Gutter mount and cable	**£9.96**	£1.80
SMCSOCA	4M cable assembly	**£5.99**	£1.20
FLEXI 10	G. Whip mobile 10-80M	**£49.00**	£2.00
MULTI-MOBILE	G. Whip mobile 10/15/20M	**£30.48**	£1.85
FLEXIWHIP	G. Whip 10M mobile	**£18.11**	£1.85
GW BASE	Base for all G. Whips	**£5.75**	
SMCT 317OL	Twin meter SWR bridge	**£14.95**	FOC
SMC 100LP30	Low pass filter	**£5.30**	FOC
SMCRU 120406	4 Amp DC power power unit	**£15.00**	£2.00
FSP1	Extension L/S	**£11.15**	FOC
MML28100S	10/100W + pre-amp	**£129.25**	
FS711C	Power/SWR met 10/100W ranges	**£24.55**	

NB: PRICES INCLUDE VAT AT 15%
and carriage by post or Securicor

ROTATORS

The finest range be it Kenpro, C.D.E., Channel Master, S.M.C. has over 19 models to choose from. Ask the experts for the right model to suit your requirements - it should save you money. Write, phone or call.



	Type		
FU200	through	3 Core Light Duty	**£49.00**
AR30	Olfset	5 Core Light Duty	**£56.35**
KP250	Bell	6 Core Lighter Duty	**£54.91**
9502B	Offset	3 Core Lighter Duty	**£56.92**
AR22	Bell	4 Core Medium Duty	**£67.85**
950B	Offset	3 Core Medium Duty	**£80.21**
AR40	Bell	5 Core Medium Duty	**£90.85**
BT1	Bell	5 Core 4 Preset Medium	**£91.43**
KR400	Bell	6 Core Medium matches KR500	**£97.75**
KR500	Thro	6 Core Elevation	**£112.12**
AR50	Bell	5 Position Medium	**£113.85**
KR400RC	Bell	6 Core Medium Duty	**£114.94**
CD45	Bell	8 Core Heavy Duty	**£136.85**
KR600RC	Bell	8 Core Heavy Duty	**£163.30**
HAM1V	Bell	8 Core Heavier Duty	**£258.75**
KR2000RC	Bell	8 Core Heavier Duty	**£314.52**
T2X	Bell	8 Core Very Heavy Duty	**£327.75**
H300	Bell	8 Core Digital Readout	**£493.35**
Control Cable			
RC4W	4 Way	28p/mtr	**carr.£1.80**
RC5W	5 Way	33p/mtr	**carr.£1.80**
RC6W	6 Way	51p/mtr	**carr.£1.80**
RC8W	8 Way	55p/mtr	**carr.£1.80**
9523			
KC038	Lower Mast Clamp KR400/600	**£12.07**	carr.£2.50
9523	Support Bearing 9502	**£15.81**	carr.£2.50

Prices including VAT and carriage, but accessories are extra unless ent with rotators.

JAYBEAM

4 METRES			
4Y/4M	Yagi 4element 7dBd	**£29.90**	£2.20
PMH2/4M	Phasing harness 2-way	**£16.10**	£1.50
2 METRES			
HO/2M	Halo head only OdBd	**£5.90**	£1.20
HM/2M	Halo with 24" mast OdBd	**£6.55**	£1.50
C5/2M	Colinear omnivert 4.8dBd	**£54.62**	£2.50
LW5/2M	Yagi 5element 7.8dBd	**£14.37**	£2.50
LW8/2M	Yagi 8element 9.5dBd	**£17.82**	£2.50
LW10/2M	Yagi 10element 10.5dBd	**£24.15**	£2.50
LW16/2M	Yagi 16element 13.4dBd	**£35.07**	£3.20
14Y/2m	Yagi 14element 12.8dBd	**£36.23**	£3.20
PBM10/2m	10ele Parabeam 11.7dBd	**£44.85**	£3.20
PBM14/2M	14ele Parabeam 13.7dBd	**£55.77**	£3.20
Q4/2M	Quad 4element 9.4dBd	**£29.32**	£2.50
Q6/2M	Quad 6element 10.9dBd	**£39.10**	£2.50
Q8/2M	Quad 8element 11.9dBd	**£44.85**	£2.50
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5XY/2M	Yagi 5ele crossed 7.8dBd	**£28.17**	£2.50
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PMH2/C	Harness cir polarisation	**£9.77**	£1.50
PMH2/2M	harness 2-way 144MHz	**£12.65**	£1.50
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8XY/70	Yagi 8ele crossed 10dBd	**£42.55**	£2.50
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PMH2/23CM	harness 2-way	**£31.05**	£1.50

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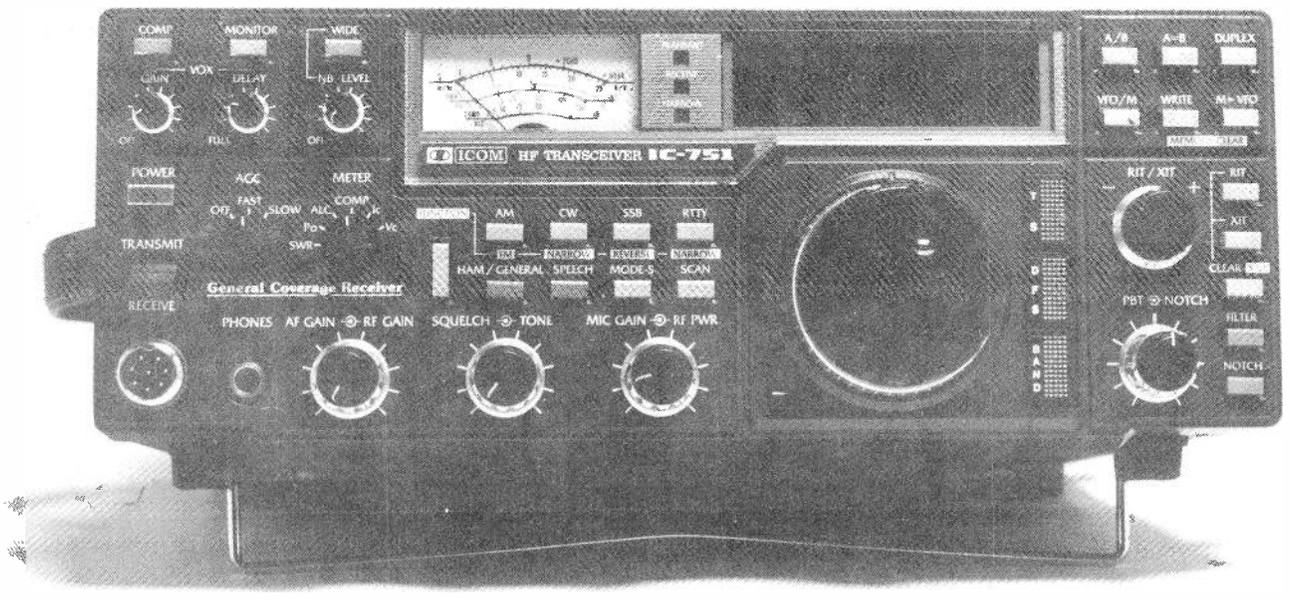


REVIEW:

ICOM IC751

By Angus McKenzie G30SS

The IC740 has established itself as an extremely well designed and very reliable HF rig, but despite its popularity it was discontinued at the beginning of last Autumn, which is quite extroardinary. It has been replaced by the IC745 and the IC751, Icom's latest top of the range model. The 751 transceives on all amateur bands from 160 to 10m, but also incorporates an excellent general coverage receiver covering from 100kHz to 30MHz. USB, LSB, CW, RTTY, AM and FM modes are included, these being available on both transmit and receive. 32 memories are included, storing both frequency and mode. The rig has two VFOs with facilities for duplex working between them, and a button to make both VFO frequencies the same when desired. The usual smooth Icom tuning mechanism is used, and three large buttons select slow or fast tuning rate, VFO or memory, and band switching. In the slow tuning rate 10Hz steps are provided, which changes to 50Hz ones when tuning is speeded up by hand. In the fast tuning rate, 1kHz steps are provided. Not only are there receiver and transmitter incremental tuning functions, but the rig displays on the counter the degree of shift chosen, and by pushing one button the shifted frequency can become the new transceive frequency, while another restores transceive to the original frequency. The incremental tuning has a range of +/-9.9kHz.

The memory facility is very extensive, and any memory can be inserted into either VFO which is remarkably convenient. The VFO tuning knob can be selected to tune around the memories when you are using a previously selected VFO frequency. The frequency display, in 100Hz increments, indicates either memory or VFO as selected for visual monitoring. It is possible to scan automatically through the memories, or to sweep frequency slowly between memories 1 and 2, always sweeping from high to low. If the VFO is set higher than memory 1 or 2, then the 751 sweeps down to the higher memory frequency and then sweeps between one and two again.

Eight small push buttons on the left select mode or other functions, several of them having second functions selected by a vertical bar to their left. Second functions are in brackets, and modes are AM (FM), CW wide (narrow), SSB normal (reverse), RTTY normal (narrow), amateur bands or general coverage, speech synthesiser (optional), sweeping and finally, memory scanning. On the front panel, miniature rotaries control VOX on-off/VOX gain, VOX break-in/delay and noise blanker on-off/level. Additional pushbuttons select processor on/off, TX audio monitor on/off, noise blanker normal/wide. Additional switches select MOX, AGC off/fast/slow, and meter SWR/power/ALC/compression/PA current/PA voltage. Three concentric rotaries are

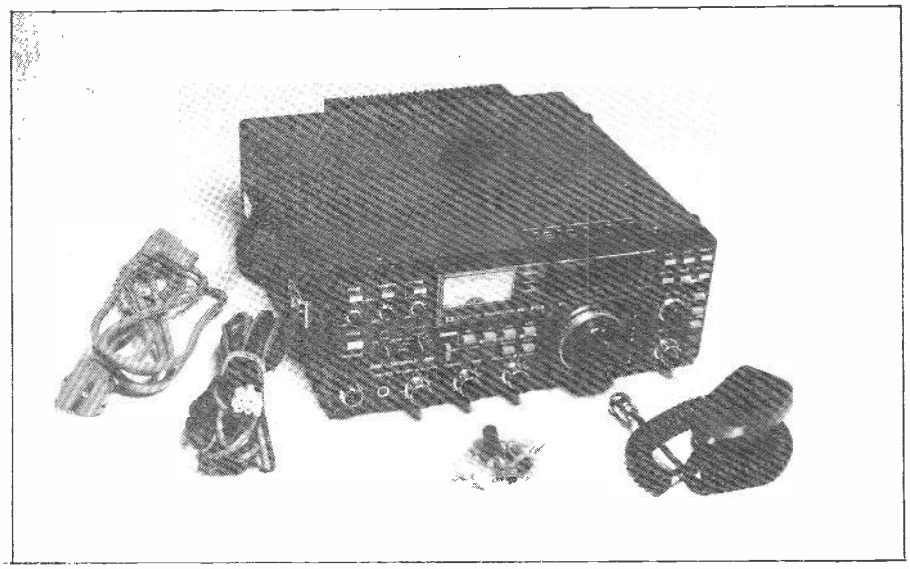
provided for RX audio/RF gain, RX squelch/tone and TX mic gain/RF power level from 1.5W to 100W. A small dial lock button is provided under the VFO. On the right hand side a button selects either of two 9kHz filters, the normal one supplied being 2.2kHz wide for all modes except FM. When this filter button is pushed in, bandwidth is increased dramatically for AM as the filter is bypassed, but if one of many optional filters is inserted, then this is selected instead. The following filters are available for this IF: CW 250 or 500Hz, SSB wide 2.8kHz, and AM 6kHz. Another button brings into action a very sharp notch filter which gives between 20 and 25dB notch over the entire wide SSB passband. A centre indented rotary shifts the CW/RTTY or SSB filter passband across the complete IF in a normal way, and this is extremely effective. The rig has plenty of Blackpool Illuminations showing which of many functions are in use at any time.

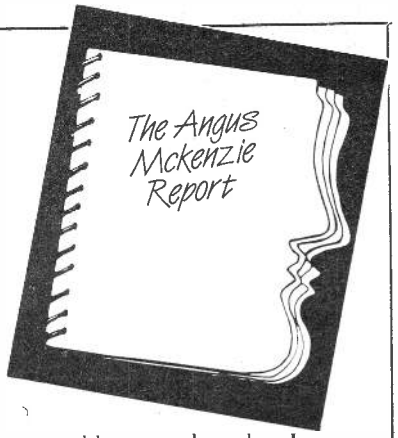
On the front of the top panel are some more fun features, a miniature toggle switch selecting RX RF preamp on or off or 20dB aerial attenuation. Another toggle switch turns on a 10kHz marker. Rotary pots control fine frequency calibration, TX monitor level and anti-VOX level. A $^1/_4$inch headphone jack is provided on the front panel and underneath the front of the rig is a special multi-pin socket for connecting with external logic control, one optional accessory being an external keypad for controlling frequency etc.

The back panel is festooned with sockets providing some excellent features. An oblong multi-pin socket can be connected with the Icom automatic ATU and simultaneously with the Icom high power transistorised linear, both of these therefore being controlled and tuned to the appropriate band by the main rig. The third review sample was fitted with the optional built in switched mode mains power supply, an IEC mains socket being fitted for mains input, and the PSU output being linked with a heavy duty DC plug to a 13V input socket also on the rear. A normal $^1/_4$inch key jack, with connections for bug keys, and a 3.5mm external loudspeaker jack socket are included. On the other side of the back panel is the inevitable SO239 antenna socket accompanied by a bevy of phono sockets for ALC input, TX relay (short on TX), RX/antenna in/out (for using an external preamp or splitter, or for connecting transverter RX return, transverter transmit RF output feed, and a spare socket. Finally at the bottom, there is a large earth wing nut binding post. There is an enormous heat sink on the back, together with a cooling fan which can come on fast if temperature builds up.

Problems

Readers will probably he horrified to know that I went through three review samples before finally being able to write this review, and there is a considerable background of problems, together with around 24 hours of additional work because of continuous aggro with samples one and two. Sample one arrived at the end of August, and the first thing I discovered about it was that all received audio hummed like gorgonzola cheese, all SSB and CW appearing to have around a T3 note! When the rig was driven from an external 13V supply, the fault did not exist. Eventually Thanet Electronics found a cure for this by arranging the switching to cut out the switched mode starter transformer shortly after switch on. This transformer was coupling a hum field to the main VCOs. Hence the hum, which also appeared very badly on TX, which is why I heard so many 751 owners put out transmissions as if they has an incredibly sore throat! I would like to mention here the amazing patience and helpfulness of the importers in not only listening to my grumbles, but in dealing with them most expeditiously. Next, I tried 80m with an external linear, but had very bad RF feedback which made the rig unusable, and in some circumstances I even had a problem when running barefoot. Thanet again came up with the answer, and we applied short circuits to the PTT and audio earths through to the mic plug metal chassis, which fixed that problem.



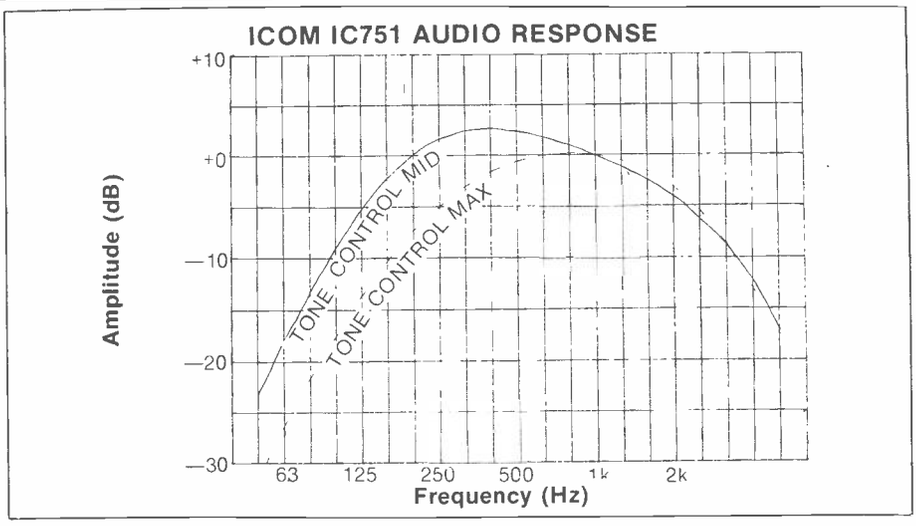


The next problem was that when I was on 10 or 15m, power vanished down to 10W or so when I plugged in the extension loudspeaker and the key, even if this was not on CW. After hours of experimentation, I began to feel that either I or the rig had gone bananas, for altering the location of external leads would change the output power over a range from 10W to around 80W. All was OK into a dummy load, but unfortunately, this is rather an ineffective means of transmitting! My aerials were not at fault for they are perfect with every other rig. The next problem was that while there was only slight talkback from the internal speaker on TX, the external speaker talked back to me most discourteously, this being regarded as thoroughly intolerable. At this stage, I requested sample two, which omitted the mains PSU but did have the mic plus fixed. All the other faults were at least as bad, but another one showed up as permanent, which has been only intermittent in the first sample: bad parasitics when on 15m and sometimes on 10m. I decided to try to ignore this exasperating phenomenon which caused the automatic ATU to do its nut and thus fail to find an SWR minimum, by concentrating on other bands and on the receiver. Shortly after I first used this sample, this slow/fast tuning button ceased to lock in, which was very tiresome. After many hours of fiddling, we took off the lid and found many earthing screws loose, so one of my colleagues spent a happy hour tightening them all up. This seemed to fix the incredible power reduction phenomenon. After an impatient week I sent a detailed letter of all the problems to Thanet to pass on to Icom, and around five weeks later a 3rd sample arrived with mic and PSU fixed, no sticky buttons, audio breakthrough on TX cured almost completely, and no ALC problem, but the 15m spurii were as bad as ever. After begining to think that Icom and I were not quite compatible, I found that FM didn't work, so off came the lid, whereupon my colleague Mike Hatch found that the FM board audio output lead disappeared below the mother board and had never been plugged in to its proper socket, which was on top of the board. He had to take the guts out of the machine to get out the plug, and on reassembling and plugging the lead in, hey presto, FM worked. We noted that the earth screws had been tightened, but I suggest that anyone buying an Icom rig should have a

REVIEW: ICOM IC751

look at earth screws as a matter of course after purchase.

The 15m sprog problem was investigated deeply by sniffing the RF output with a Bird sniffer to an HP spectrum analyser. When the rig was in its parasitic mood, it chucked out spurii at +/-8.3MHz from 21.3MHz, the lower sprog being at -10dB and the higher one at -15dB, give or take a dB or two for the weather. When RF power level was taken down, the spurious levels went down too, and suddenly whapped down below 30W carrier level, and came up again, with slight hysterisis as power was increased. I listened to one of the sprogs on another rig and the sound resembled the bath water running out of a very noisy plug hole, the frequency wobbling up and down as well. Many more hours of lead changing and trying different combinations of interfacing eventually showed that lengthening the coax by



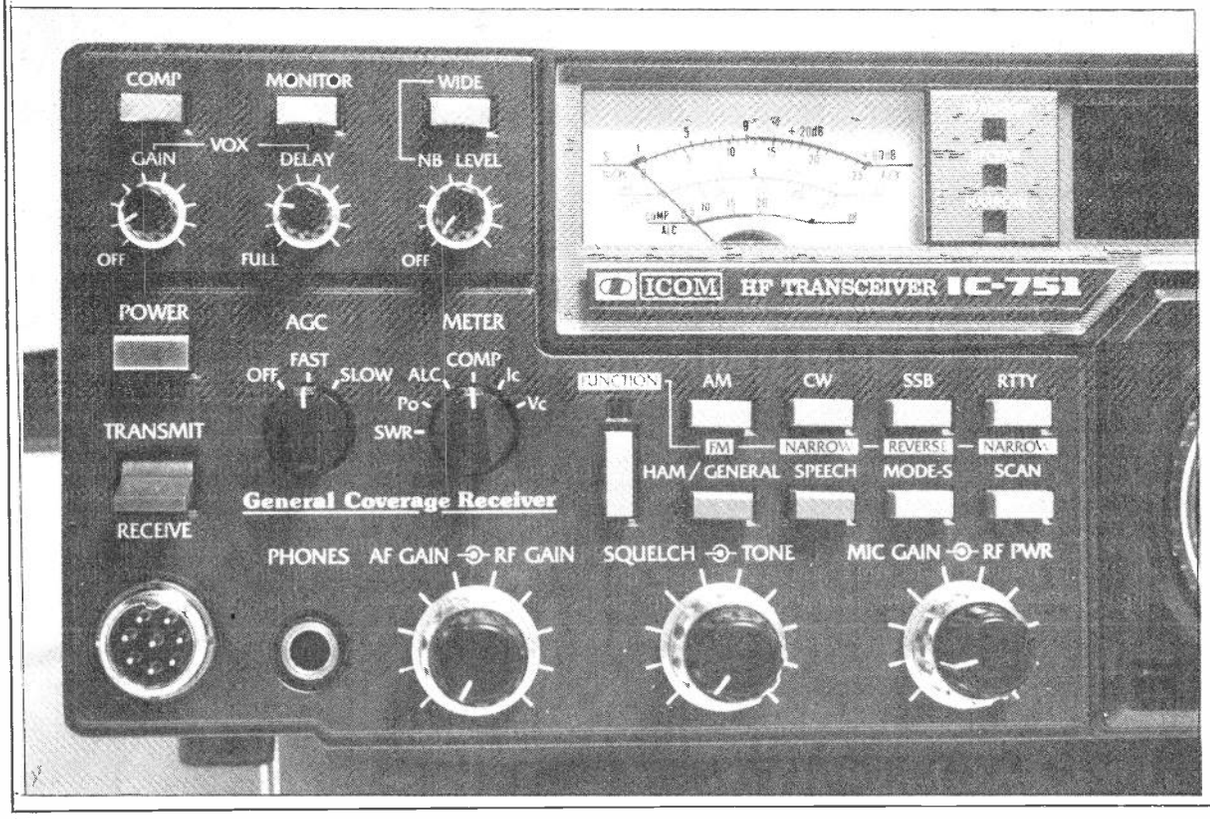
several feet more or less removed the problem. However, the situation is highly fluid dependent upon TX frequency, and the positions of the planets! No problem was noted into a dummy load, other than sprogs being still noticable at around -60dB but at a slightly different spacing, showing that they were always lurking and waiting to appear at the slightest provocation. It is quite clear that Icom will have to take some desparate measures to fix this problem which has also been reported in many other countries. This really is such a pity, for in so many other respects this is a smashing rig which performs better than any other one that I have used, and obviously with Icom's reputation at stake they will fix it sooner or later.

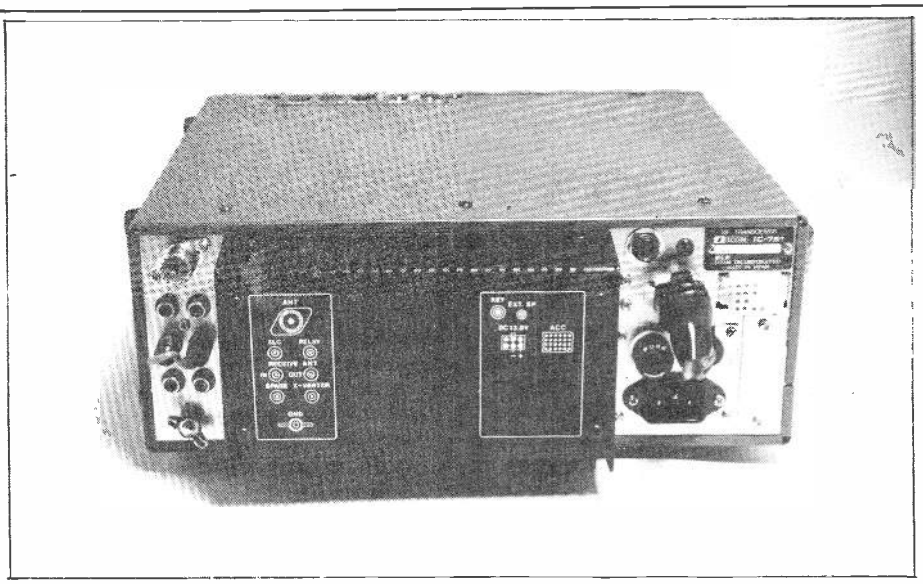
Laboratory measurements

On RX, the first intermediate frequency is 70.4515MHz centre, which explains the excellent image response. The first mixer is an Icom developed double balanced J-FET type. The second IF is at 9MHz approximately, incorporating the band pass tuning, while the third IF is at 455kHz. A fourth IF is at 350kHz on all modes except FM. Optional filters are available for both the 9MHz IFs (previously described) and 455kHz IFs (CW narrow - 250 or 500Hz). The transmitter section is claimed to have a capability of a 100% duty cycle, and it certainly did not grumble when I transmitted 100W continuously on FM on fairly long overs, although the fan came on. The transmit low pass filters, RX input filters and general frequency and band control are all microprocessor operated and no problems were experienced in this region.

Subjective tests

The RF sensitivity on SSB was considered very good throughout on all amateur bands, although the full sensitivity was irrelevant below 21MHz.

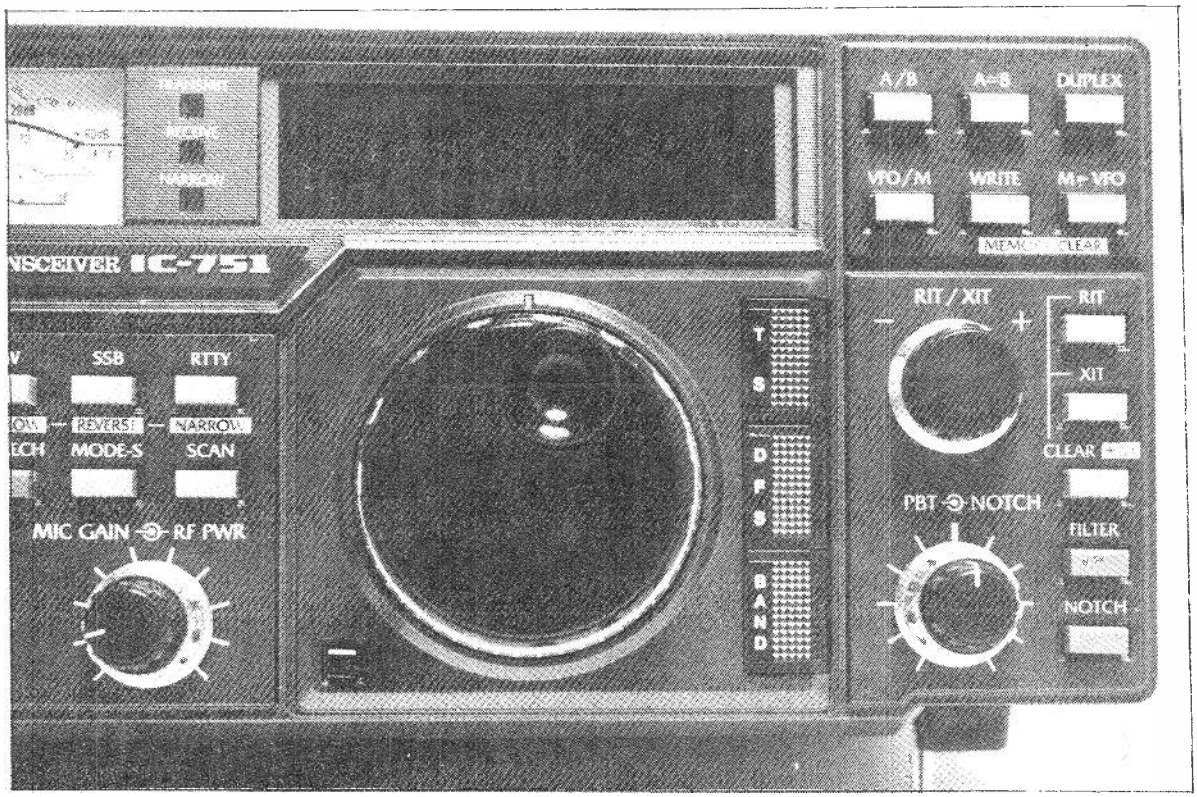




The FM sensitivity was acceptable but not outstanding, an investigation revealing that the FM filter was a little wide at the top although having extremely steep skirts. On medium wave, sensitivity dropped by around 10dB from normal, and below 1.6MHz the RF preamp also switches out. Sensitivity increases again though, if you tune below 500kHz. It is worth noting that the IC740 sensitivity was slightly better and this is a little puzzling. The first mixer performance was outstandingly good, and RFIM was as good as I have measured on an HF band rig. What more need I say than that with the RF preamp in, the RF intercept point was around +14dBm, and 11dB better still with preamp out. We had a deep look at the reciprocal mixing performance, using my new very quiet Mutek crystal oscillator for the measurements. Close in the measurements proved to be very good indeed; whilst beyond 100kHz spacing, they were quite phenomenally good, thus contributing to the very clean reception across the board. The normal SSB filter has an excellent shape factor and a very flat top, although it was just a little narrow for transmitting really comfortable quality. Since the pass band tuning allowed you to position the received bandwidth where you wanted, the reservation was not quite so marked, and in any case you can order the rig with the wider filter. The narrow CW filter (250Hz), was absolutely remarkable, having the best shape factor that I have checked on such a filter, and allowing the rig to knife out weak CW signals that were virtually inaudible on the SSB filter. The AM filter again was remarkable in having almost a flat top to around 5.7kHz bandwidth (2.85kHz audio), whilst being 60dB down by just over 9kHz bandwidth. The S meter had only 2 or 3 dB per S point at the bottom end of its range, but became more realistic above S7 with quite a reasonable law above S9, S9+60 requiring around 7mV! On FM the S meter was nowhere near so good at its top end, although very useful as an indicator, the readings being dissimilar to those of SSB.

The rig has very good AGC characteristics, just about how I like them. Attack time is very fast indeed, gain recovery taking around two seconds. Fast AGC was useful for CW, or when there were DX QSOs with widely different RF levels present from various stations. I did miss the variable AGC of the 740 though. The notch filter was checked in my normal way by notching out in turn either of two carriers spaced 500Hz apart, this being more realistic than looking at the S meter on one carrier. A maximum of 25dB notch was obtained, which is more useful, much better than the 740, but not up to the specification.

Audio distortion on SSB at 100mW output was very low at 0.9%, and on FM it was also very reasonable at between 3 and 4% at normal peak deviations, rising to around 4.5% at as high as 7kHz deviation, which shows the filter to be too wide. It must be said though that the superb shape factor of the filter gave excellent separation of signals separated by at least 15kHz, and transverted signals from 2m sounded as clean as I have ever heard them, bad transmissions sticking out like a sort thumb. The 10kHz separation between channels on 10m FM could not be coped with satisfactorily though. The rig achieved a maximum audio power output of 3.3W into 8 ohms, which is more than average, which is a blessing. It was possible to set the market absolutely bang on with an external standard, and having done this, all frequencies were correct to within 100Hz.



REVIEW: ICOM IC751

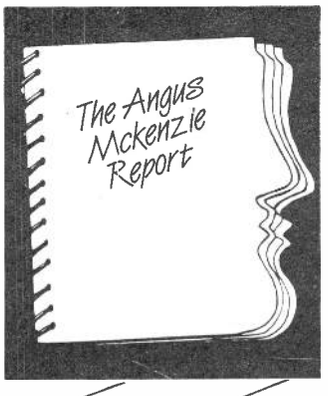


Table 1: Laboratory tests

Receiver

RF Sensitivity, normal SSB filter, 12dB SINAD:

RF preamp in:

1.8MHz - 120dBm; 3.7MHz - 122dBm; 7.05MHz - 122dBm; 14.2MHz - 120dBm; 21.25MHz - 122dBm; 28.55MHz - 123dBm

RF preamp out:

190kHz - 117dBm; 610kHz - 107dBm; 1.07MHz - 106dBm; 1.56MHz - 106dBm

RF Sensitivity, FM for 12dB SINAD: *RF preamp, in 1kHz modulation frequency:*

29.6MHz - 116.5dBm for 3kHz deviation, - 118.5dBm for 5kHz deviation.

RF preamp out 5kHz deviation - 110.5dBm.

RF attenuator switched in, 5kHz deviation - 89.5dBm.

RF Sensitivity, narrow CW filter, for 20dB s/n: *-122dBm.*

Reciprocal mixing ratio from 28.55MHz: *20kHz spacing -87dB; 50kHz spacing -94dB; 100kHz spacing -101dB; 200kHz spacing - 106dB.*

RFIM performance around 28.55MHz

RE preamp in: intercept point +13.5 to +15dBm from several *measurements.*

RF preamp out: +25dBm. Carriers spaced 100kHz apart, equal levels from two generators.

Typical RFIM. *Two carriers at -24.5dBm at anienna input give -100dBm 3rd order product after mixing (RF preamp in), ratio 75.5dB.*

Selectivity, Normal SSB filter: *- 3dB 2.2kHz; -6dB 2.3kHz; -40dB 2.8kHz; -60dB 3.3kHz:*

Shape factor: 1.5:1

Selectivity, narrow CW filter: *-6dB 280Hz, -60dB 430Hz. Shape factor 1.6:1.*

Selectivity, AM filter *-6dB 5.9kHz, -60dB 9.4kHz. Shape factor 1.6:1.*

Selectivity, FM filter *+/- 12.5kHz - 43dB, +/-25kHz -77.5dB.*

FM Capture Ratio: *6.2dB*

FM RFIM for 12dB SINAD product: *25/50kHz spacing, equivalent product level ref. input level -73dB; 50/100kHz spacing, equivalent product level -77dB.*

S meter calibration, SSB: *'S1' - 105, 'S3' -103, 'S5' -99.5, 'S7' -93 'S9 - 86, 'S9+20' -70, 'S9+40' - 54, 'S9+60' - 41, all figures in dBm.*

S meter calibration, FM: *S1-108, S3-104, S5-101.5, S7-98, S9-96, S9+20-88, S9+40-7B, S9+60-63, all figures in dBm.*

FM quieting at -12dB SINAD *(2.5kHz deviation, typical 10m FM) was 16dB (29.6 MHz).*

3dB limiting threshold, on FM, *-122dBm, (29,6MHz).*

Audio distortion, *modulation or beat frequency 1kHz, 125mW output/8ohms, SSB 0.9% THD, FM at 2.5kHz deviation, 4% THD, 250Hz deviation 3.2% THD inc. noise, 5kHz deviation 4% THD, 7kHz deviation 4.3% THD.*

Max audio output power *for 10% THD 3.3W/8ohms.*

FM squelch range, *RF pre-amp in- -124/-115dBm.*

Transmitter section. *Continuous RF output power max carrier into 50 ohms 1.9MHz 97W, 3.7MHz 95W, 7.05MHz 93W, 14.2MHz 95W, 21.3MHz 95W, 28.5MHz 99W.*

SSB PEP power. *1.9MHz 100W, 3.7MHz 100W, 7.05MHz 102W, 14.2MHz 100W, 21.3MHz 100W, 25.8MHz 103W.*

Transmit frequency accuracy ref read out, *all modes except FM within 100Hz, FM-1kHz on 29.6MHz.*

FM peak deviation 4.6kHz (pk-pk/2) 4.6kHz.

SSB carrier suppression, inc noise, mic gain zero, ref full output - 45dB.

AM output power *(carrier) 52W average. AM pep power +80% ref carrier.*

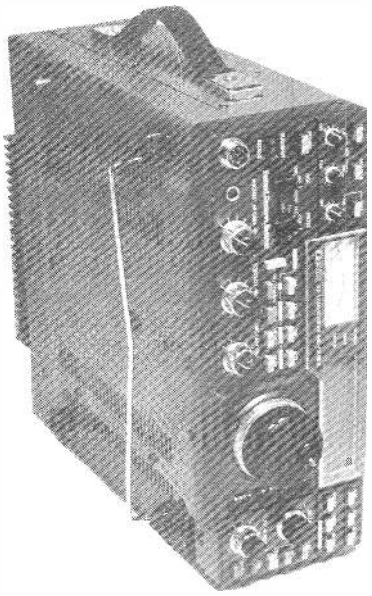
AM average power at near full modulation -20% (decremental).

The transmitter had more than adequate gain for normal microphones, the mic preamp now being fitted within the rig, which is more helpful. The microphone has up and down frequency control buttons, and is of quite good reproduction quality. The processor worked extemely well, and power output was variable over an exceptionally wide range, peak powers being close to 100W on all modes, except AM, at which the maximum carrier power was 50W. Output frequency was again generally within 100Hz although, rather curiously, there was a -1kHz shift on FM TX, compared to the indicated frequency, and this is rather disturbing, presumably caused by a misaligned DC offset on the FM board. I had to remember to use XIT when on FM to correct this. The signal-to-noise of FM and AM carriers measured well, and no ripples were noted on CW or SSB. Carrier rejection and unwanted sideband rejections were superb. Transmit ALC worked well, and PEP outputs were well maintained, particularly when the processor was used. Output frequency stability was excellent.

We looked at harmonic and spurious outputs on the main amateur bands. Second harmonics were always well down but third harmonic was fairly poor on 160 and 80m. On 80m we noticed a lot of upper harmonics, 5th being -45, 7th -45 and higher ones also showing up. The lower harmonics did not decrease much with power reduction, but the higher ones virtually disappeared, showing the 80m harmonics to be probably introduced by an earlier driver stage, which is unusual. 15m sprogs at +/-6.5MHz were roughly at around -63dB when not provoked! On 40m there was an odd sprog at around 34MHz of -55dB, which I cannot explain, although it could be 3x9MHz IF + 7MHz. We measured two tone IM on one or the earlier samples at 7.05MHz, and IPs were at -30dB or better, but at 28.5MHz third order was as high as -20. Reports on my transmissions on the third review sample suggest that it is very clean, and surprisingly narrow, and therefore I don't think that there is a problem now.

The RF RX preamp has around 11dB gain, and the attenuator averaged 20dB loss. The frequency responses on FM show a well controlled normal de-emphasis with the tone control flat out, but the tone control seemed to cut from too low a frequency giving the effect of lower middle boost as it was cut back, rather than HF cut. I would here have preferred a centre indented control which cut bass one way, and top the other.

I have used various samples of the IC751 for two months, and ignoring all the aggros of the earlier samples, and ignoring the 15m parasitic problem, it is definitely the most delightful HF transceiver to use that I have yet encountered. In my particular case, the optional audio speech synthsiser was a boon, although its speak-out speed was still 30% too slow once I had go used to it, even at the faster setting. Unfortunately it



only gives audio read out of frequency, and not memory number, and this is rather a pity, making me realise that perhaps insufficient thought had been paid to its ergonomics (the TW4000A speech synthesiser was far better). In tuning the receiver over all the amateur bands I could find only extremely weak birdies which did not register on the S meter, and there were very few of them indeed. In the general coverage receiver mode there were again relatively few birdies, and only three of any consequence, but not on important frequencies, thus showing superb design. RF sensitivity was good on 10m and excellent on lower bands, and dynamic range was clearly superb. For long wave and medium wave I strapped the feeders of my G2DYM modified trapped dipole (described last month), and tuned against earth with a Yaesu 7700 miniature ATU. This produced reception of amazing quality, the LW performance being quite exceptional, whilst on medium wave the AM filter was so good that one station after another flocked in at 9kHz intervals with almost no traces of RFIM, despite Brookmans Park and two ILR stations coming in at levels of around 0dBm! I found the 20dB attenuator extremely useful at LF, convenient but not absolutely necessary on 160, 80 and 40m, but above 10MHz I did not find the attenuator was required. The absence of general mush in the background was quite significant, and I received many extreme DX signals for the first time on LF. The audio reproduction quality on all modes was superb, and the filter shapes were all just about ideal. I must particularly commend the CW filter which separated out weak signals better than ever. The extensive memory facilities including sweeping and scanning were a delight to use, and it was useful to recover a sked frequency from memory to VFO and then change mode if necessary without aggro, unlike the FT980. The tuning dial was as smooth as silk, but even so I preferred the 740 mechanism which allows rotation of precisely 1,10 or 100kHz per revolution, the 751 tuning knob not having a constant tuning rate.

Technical points

It is worth noting that the switchable 9MHz filter affects TX as well as RX, but while FM, SSB and CW were superb, AM modulation was poor, with decremental modulation, even if the carrier level was reduced. FM TX deviation never exceeded 4.5kHz, which is just about right for normal use. CW break-in keying was excellent, and all the VOX circuits worked very well indeed. It was very useful to alter the power output on all modes right down to 1.5W. Whilst mic gain was normally used at around 10 o'clock, I had to lift it up appreciably to around 3 o'clock for FM, which was puzzling. It was rather nice to have the squelch control operating on all modes, and there was always plenty of audio volume available. The rig worked extremely well with the IC2KL liner, and the ICAT500 automatic aerial tuning unit, connection leads being supplied. The transistorised linear typically gives 500W output on all bands if required, and spreading seems minimal, very comprehensive metering being provided for accurately setting up the ALC levels. The noise blanker seemed to work very well, and normally I found the wide position to be of most use. The multipin interconnection socket includes many additional facilities including ALC and TX relay, which will be found very useful, although some of them are duplicated conveniently on phono sockets etc. The rig is perhaps a little heavy for mounting in in an average cw, but it is ideal for fixed station or portable use, the usual bar type leg coming down at the front to raise the front panel above the bench. The rigs internal layout, and the instructional manual, were excellent.

It is so unfortunate that the only problem that the rig still has is that of the 15m sprogs, but assuming that this will shortly be rectified, I can recommend the rig very strongly indeed. The rig can be set up very quickly for operation, and all controls are very easy to use. A worthy successor to the IC740, I think this rig will eventually establish itself as a masterpiece by which many others will be judged.

S·W·L

By Trevor Morgan GW4OXB

Listening to conversations on the air and chatting to recently licensed 'fours', there seems to be fewer new amateurs who have 'worked their way up' from the world of short wave listening than was the case a few years ago.

This is a pity because these newcomers come onto the bands with little knowledge of what to expect. They have also missed a part of the hobby that is not only a lot of fun but could save a few headaches in examination preparation.

If you haven't a receiver, this first article will outline the requirements for short wave listening, but I will go deeper into receivers and accessories later in the series.

Basic requirements

In the old days everyone, professionals and amateurs alike, used AM (amplitude modulated) signals and you could pick up the amateurs in between the broadcast transmissions. In fact you still can hear a few on 'Top Band' (1.81 to 2.00MHz in the UK).

However, being clever lads, amateurs discovered that the required information could be transmitted using only part of the AM signal.

How come? Well, the normal AM signal consists of a carrier wave and additional frequencies above and below the carrier called *sidebands*. It was discovered that by suppressing the carrier and one of the sidebands, the required information could still be transmitted. Also, as the transmitted power is used to supply the carrier and the sidebands, the suppression of the carrier and the use of only one of the sidebands resulted in a real gain on the required signal. Terrific stuff.

Trouble is, you don't get something for nothing and it requires sophisticated circuitry to suppress the carrier in the transmitter and regenerate it in the receiver.

In the communications receiver, the carrier is replaced by a signal from a beat frequency oscillator (BFO), and the signal is detected by a product detector. The oscillator frequency is usually adjustable or switchable to allow reception of the upper or lower sideband.

If you have a good general coverage receiver covering the amateur bands, you can get a separate BFO unit and either fit it yourself or get someone to fit it for you.

Of course the BFO is not the only difference between the communications receiver and the 'tranny' used for listening to the JY prog! So let's have a look at a simple communications receiver and see what we have.

RF Gain: This control adjusts the radio frequency amplifier gain of the receiver. In use, this control alters the receiver sensitivity and also helps to minimise noise.

AF Gain: This one adjusts the gain of the audio amplifier stage. In your tranny it is marked "volume".

AGC: The automatic gain control is used to hold the AF amplifier output reasonably constant during variations in the level of the received signal, which can vary at times as much as 30dB.

For SSB or CW (Morse) reception a fast acting AGC is needed as there is no carrier between signal peaks.

Bandspread or fine tuning is necessary as the amateur bands are heavily occupied and cover such small portions of the frequency spectrum. Some receivers have two speed tuning to enable fast scanning of the bands as well as a slow rate of tuning for use when 'winkling out' a faint signal. On some models the scale itself rotates while others have a moving cursor or needle. Digital readout is very useful but a good analogue scale can be easily accurate enough.

Noise blankers or notch filters are ways of ridding the received signal of noises such as ignition noise from cars, heterodyne whistles and other interference. There are many types of filter and some are more effective than others. I would not rely too much on these, as one of the excellent purpose built filter systems can give better results and can be added later.

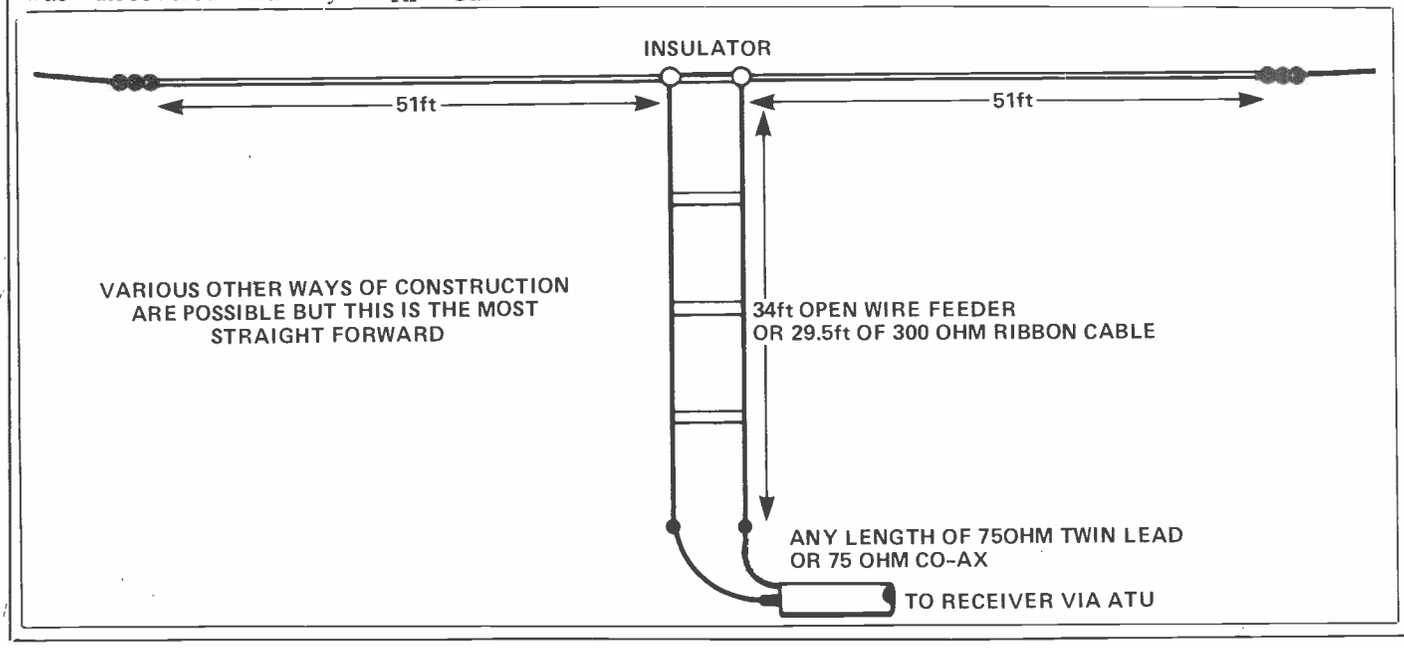
There are many other features to be found on the modern receivers such as scanning, memories etc., but these must be regarded as luxuries. If you can afford them, OK, but you don't need them for good short wave listening.

Once you have a receiver, the next requirement is an aerial of some sort. The old standby long wire put up as high as possible will do fine and will probably give you as good a signal as you will need for starters.

Anyway, the next best bet, to my mind, is probably the most tried and tested aerial around. I refer to the G5RV dipole which is not only a simple aerial to make and cheap into the bargain but can be put up in almost any garden. My own G5RV has one 'leg' up at about 27ft while the other droops down at 45° to a 10ft pole then crosses the garden to a fencepost. This has not stopped me from working Australia with 25W PEP.

There is a lengthy theory of how and why it works - but I'm not going into it here.

The main arms of the antenna should be of good



quality hard drawn copper wire (I used 14swg) and the open wire feeder should be copper wire separated with spacers giving about 4 inch spacing. Make sure all joints are secure and sealed against the weather. The extreme ends should be at least three feet from the support structures if possible and the centre insulator should be as high as possible. The feed from the open wire to the ATU should be good quality 75 ohm twin feeder or coaxial cable. If you have to droop one half of the top section, I have found it better to drop the 'earthy' end ie. the end connected to the coax braid.

Windoms, Marconis, inverted vees, delta loops, verticals, horizontals and almost any configuration you can think of can be tried. The list if endless and you have the advantage over the transmitting amateur in that you can literally 'wire up the bedstead' and see what it can pull in.

But one reminder, aerials, especially horizontal ones, are subject to attack from many quarters. Birds love 'em, neighbours hate 'em, pollution decays 'em but **lightning kills you!** Please either earth your aerials during stormy weather or, better still, use a good lightning arrester in circuit all the time.

Remember, also, that it is illegal to erect an aerial across power cables or telegraph cables without prior permission of the owners - and damned dangerous!

There are, of course, many types of aerial and experimentation will show the one that is best for your use and locality. Aerial sensitivity is affected by many factors including land drainage, building etc., so do try different types and ways of supporting them.

Antenna tuners

The ATU is worth its weight in QSL cards. Whatever the aerial, it has a peak operating point: the resonant frequency. You can compare an aerial to a musician's tuning fork. It struck, it vibrates at a predetermined frequency and, conversely, if a sound source of that frequency is present it will also vibrate. In antennas, this is represented by the transmission or reception of signals, and is known as the reciprocity theory. This simply means that an antenna will receive on a predetermined frequency just as well as it transmits.

Now, this is all very well if we only want to receive one frequency but we want to use our long wire for thousands of different frequencies! This means that we need a gizmo to tune the bit of wire up or down from the resonant frequencies of the set length. To do this we use an atenna tuning unit or ATU. This consists of a couple of widespaced variable capacitors, a tuning coil and a switch to select the required tapping on the coil. ATUs are fairly simple to make, unless you are as hamfisted as me, in which case you buy one of the many available at your local shop.

Right then, we have the receiver, an ATU and a nice long wire up at 30 feet. Now what? Before we start scanning the bands, we should have some way of making a permanent record of our 'contacts' which we can refer to later. There is a version of the amateur log book for listeners which you can still use when you do get your ticket.

Alternatively, you can get sheets of your own duplicated or printed etc. If you happen to own a computer, there are 'electronic log book' cassettes available. However, for years I have used, as well as the log book, a card index system in which I record all the relevant details of the station heard or contacted and can quickly turn up a card during a QSO to remind me of that station's location, rig, antenna or anything else. It surprises some stations when I ask how their dog is!

Well, there you are. Briefly, that is the setup for the listener. Next month I will talk about hunting DX and awards. Good listening.

FLASH OF FINGERS PRIDE OF THE PRESS

David Lazell recalls the great competitions when operators became celebrities overnight

If you think the Miss World Contest grabs some attention, you should have been around when the Morse wire telegraphers came to town for their annual clash of the fast fingers. The excitement began in 1868, and lasted up to the first world war - and beyond. In late nineteenth century America, the telegraphers were professionals proud of their craft, though their idiocyncracies were evident on and off the wire. Some seemed to sense the impending movie industry, becoming 'stars'. So, from 1868, the bragging had to stop. Carefully monitored contests were held in major cities (Philadelphia, New York and San Francisco among them) to discover who really owned the fastest fingers. Morse wire operators competed to see who could transmit by straight key - later by Vibroplex - the greatest number of words straight in five minutes. Legibility of the transmission was as important as the speed, of course.

As the years went by, the radio contest became important, too, with competitors required to copy from automatic transmissions at high speed. The first of these radio contests was conducted by members of the United Wireless Telegraph Company, at Philadelphia, in February 1910. United Wireless had the winner of that event - Robert F. Miller - but an operator from Western Union came second. The Morse code was used in radio at that time, but breaking speed records was often a marginal affair. Needless to say, the desire to add prestige to the company was evident, too, where operators were full-time professionals. RCA, for example, was certainly pleased to note that an employee from its Marshall (California) unit came first in the Pacific Radio Convention at San Francisco, in November 1920. Mr. A.E. Gerhard had only five errors in copying 49.2 words per minute (Continental Code) for four minutes, via Wheatstone transmission. Just over a few months later, in March 1921, Mr. B.G. Seutter of the *New York Times* radio department, copied from automatic transmission at a rate of 48.6 words per minute making only two errors. The competition held at the Pennsylvania Hotel in the 'big apple' was pretty close - Mr. N. Bernstein of Western Union achieved the same speed but made one error more than Nr. Seutter. Battle was joined at the Pennsylvania a year later, when Mr. Jose M. Seron of RCA managed 49.5 words a minute with only two errors. Alas, Mr. Seron's record was short-lived. On May 6th 1922, just two months after the applause had cheered Mr. Seron, a member of the *Boston Herald* staff, Mr. R.T. McElroy, copied at a rate of 51.5 words a minute, direct onto a typewriter. And he copied for three minutes before making a mistake! This record breaking feat was one of the attractions of the 1922 Boston Radio Show. In that golden era, such record attempts received an attention hardly excelled by world heavyweight title bouts today. When a newspaper had a staff member 'in the ring' there was approrpiate media coverage.

Diamond medal

In Mr. T.R. McElroy the *Boston Herald* found a champion. Hardly had he flexed his fingers after breaking Mr. Seron's record, than Mr. McElroy met his rivals, Mr. B.G. Seutter and Mr. Hoseph C. Smythe, at a tournament held at the 71st Regiment Armoury, in New York. Good as these men were, they could not meet the performance of Mr. McElroy - 56.5 words a minute. with four errors. 1922 was a good year for him. In August, he won a diamond medal at a Chicago tournament (52.2 words a minute, perfect copy) and, as an encore, got to 55.1 words a minute perfect copy. The Boston tournament in November saw him getting to 55 words a minute, with six errors. But he was pipped at the post of Mr. Joseph Smythe who achieved the same speed with one less error.

None of these characters of the wire had fan clubs, but it would be surprising if there was no betting ont he side by 'supporters'. Actually, the proceedings were ethical and professional. Today, they would certainly be televised, and along with "Pot Black" and profesional darts, get high viewing ratings. The large corporations were interested too, from the standpoint of possible training standards. As for the hotels involved, it was obviously welcome and prestigious business. The Pennsylvania Hotel in New York was obviously well set up for this sort of thing and in March 1924, say the making of yet another record. Mr. A.E. Gerhard of RCA reached a copying speed of 58 words a minute, with only two errors. In the following year, he gained first prize at a radio convention, getting a speed of 56.1 words a minute, with no errors. RCA had further cause for pride when a young employee, Mr. Edward Adler copied at a speed of 58 words a minute with two errors. He was run close second by another RCA employee, R.C. McPherson, who reached the same speed but with four errors. The event was held (where else?) at the Pennsylvania Hotel in New York.

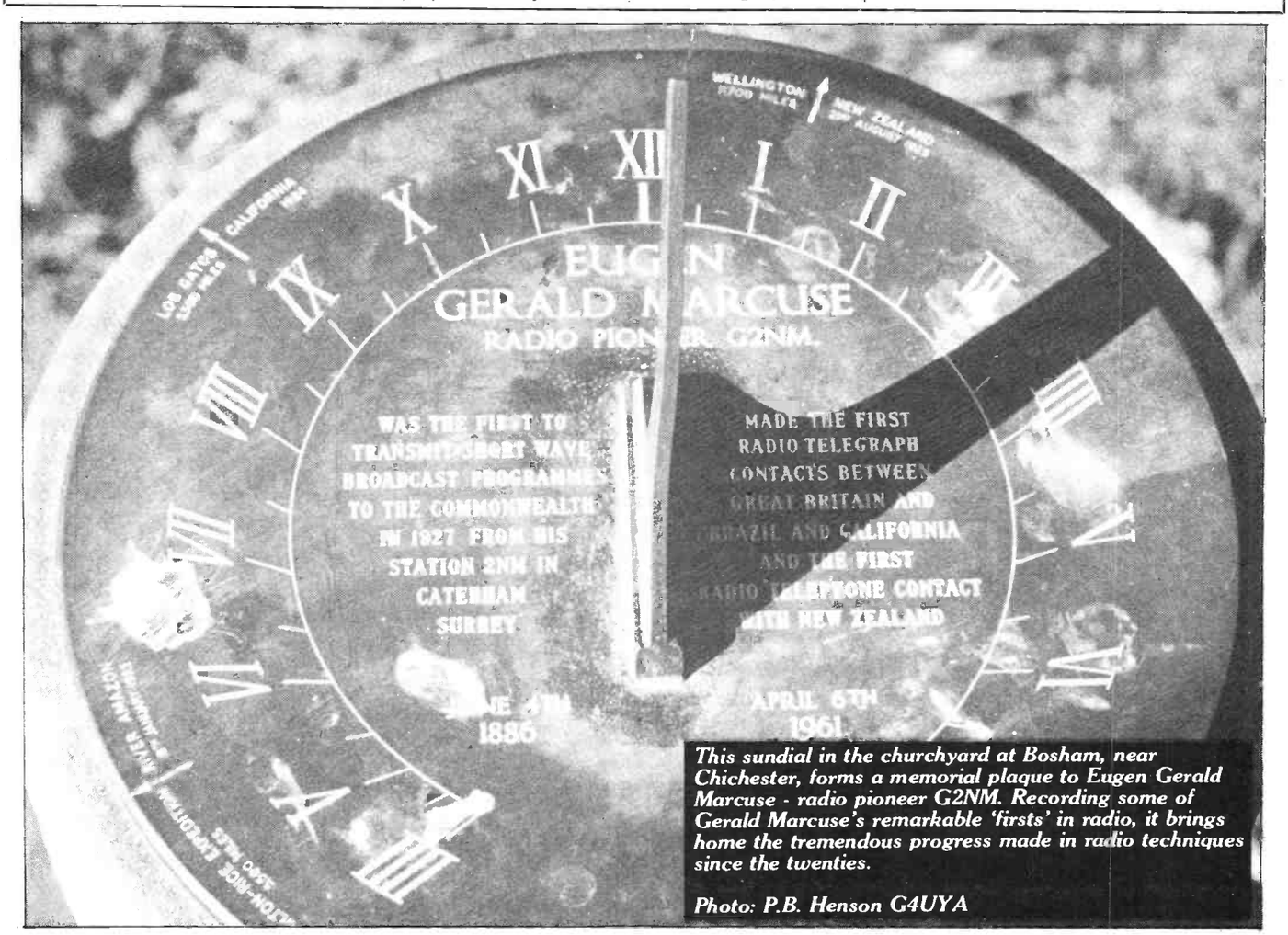
RCA contests

RCA ran their own contests, by the way. R.C. McPhereson copies 48 words a minute at the RCA event in January 1928, with 65 words a minute, perforating tape. The excitement continued through the inter-war period, with various nicknames given to the contestants. Even a highly regarded professional magazine called them 'radio speedsters' - as indeed they were. But the prizes of the twenties and thirties could hardly match the superb Carnegie diamond medal, won at San Francisco in 1915, by Mr. T.R. Brickhouse, a telegrapher employed at a broker company.

Mr. T.R. McElroy was still competing hard in the mid 1930s. At the radio amateurs' convention held in Chicaggo during 1933, he came second to Mr. Joseph W. Chaplin, radio operator for Press Wireless Inc. of New York. Mr. Chaplin's speed of 57.3 words a minute had only elevan errors out of a permitted maximum of fourteen. The worthy Mr. McElroy - whose professional career had by then embraced Western Union and the Associated Press - copied at a speed of 54.1 words a minute with eight errors. This was three more than Mr. Chaplin had at the same speed.

As World War II approached, papers became preoccupied with matters a little more important than radio contests. New communications techniques called for less finger-flipping though - to this day - the early years of telegraphy continue to generate enthusiasm and even wonder ("How did they cope?"). The USA and the UK enjoy a telegraph key collecting fraternity, whilst a Morse Telegraph Club flourished States-side for some year. But the 'stars' of the 1920s and 1930s are almost forgotten, though, as there have been far less promising subjects for the movies, we may hear more of them someday. Heaven knows what they would make of today's electronic key technology - but one of their number would certainly think of a way of creating a contest out of it! It could be a great tourist idea for a friendly hotel, somewhere beyond the last great radio store.

Note: 'Vibroplex' refers to the Horace Martin design for a semi-automatic key, using automatic dots and hand-made dashes. Although Martin's designs were promoted as 'Vibroplex' only from 1904. The original design was improved over the years, culminating in the 'Vibroplex 6' (Lightening Bug) of 1923. When Martin's patent rights expired, carious Martin's patent rights expired, various models appeared to tempt the 1930s enthusiast. But, inevitably they were overtaken by the electronic era. Advertising claims were properly modest, "Shines with Ever Increasing Brilliancy", for example. Fortunately, The Vibroplex Company Inc of New York offered to take 'Your Old Vibroplex in part exchange'. But, remembering the achievements of the men with the fast fingers, it was just another example of the old phrase: The Singer Not The Song..



This sundial in the churchyard at Bosham, near Chichester, forms a memorial plaque to Eugen Gerald Marcuse - radio pioneer G2NM. Recording some of Gerald Marcuse's remarkable 'firsts' in radio, it brings home the tremendous progress made in radio techniques since the twenties.

Photo: P.B. Henson G4UYA

News for HF operators, compiled by Don Field G3XTT

I hope that, with Christmas out of the way, you have now given some thought to your DX objectives for the coming year. Is this going to be the year in which you finish that five-band DXCC award, the year in which you make a serious entry to some international contests, the year in which you put up that tower and triband Yagi? It is always a spur to our activities if we set ourselves specific goals, and DXing is nothing if not a competitive activity. Hopefully, whatever your goals, this column will serve as a stimulus and a source of information, not only to the licensed amateurs among you but also to our SWL readers. Yes, I know you have your own column elsewhere in the magazine, dealing with matters specific to SWLs. But when it comes to contests, expeditions, propagation and so on, we all share the same wavebands and work or listen to the same DX stations.

Well enough of the preamble. There are lots of goodies for you this month and 1984 looks set to be an interesting year on the bands despite the disappearing sunspots.

Malpelo Island

Many will have heard or worked the recent expedition to Malpelo Island and some will have already received your QSL cards. But where and what is the place? It is in the Pacific Ocean at 3°51'N 81°36'W, about 270 miles off the coast of Colombia. It is an inhospitable mound of rock rising 1235 feet above the ocean, and has never been inhabited because there is no earthly reason why anyone would want to live there. It has no useful mineral deposits and is virtually devoid of vegetation, and in any case it is almost impossible to land there. The recent amateur radio group who operated as KK0TU had the help of the Colombian Navy to get there and get ashore. In terms of size, Malpelo is about 1 mile long and $^1/_2$ mile wide and has three peaks. The sides are extremely steep and rugged and there are no beaches. The few living creatures on the island are sea-birds and a number of species of lizards and land crabs. Nobody even seems to know about the island's discovery except that it first appears in print on a map of Peru produced in 1530. "Mal pelo" in Spanish apparently means "bad hair" and this may be how the island got its name, because of its sparsity of vegetation. In amateur radio terms, the last operation from Malpelo was back in 1977, also using the callsign HK0TU, many amateurs have been licensed since then which would explain the enormous pile-ups this time round. British stations managed to work them on all five HF bands (80-10), but it was often hard going. The expedition operators were HK4BHC, HK3BED, HK1AMW, HK1DBO, HK1QQ, HK2YO,, HK3AVA, HK3BAE, HK3DDD, HK4COK, HK4DKR, HK4DUM, HK5LA and HK8BYG. They made21,000 contacts altogether, and if you were one of the lucky ones you can send the QSL to the Colombian bureau (PO Box 584, Bogota) or to HK3DDD, E Rojas M, Apto 25827, Bogota, Colombia.

Countries wanted survey

DX News Sheet has recently completed a survey of countries most wanted by British and European DXers. The top twenty, starting with the most sought-after are: San Felix, Burma, Laccadives, Bouvet, Albania, S.Yemen, Malpelo, Vietnam, Andamans, China, Clipperton, Kingman Reef, Kermadec, Spratly, Palmyra, Libya, Cambodia, N.Yemen, Revilla Gigedo and Aves. Most of the replies were received before the Malpelo Island expedition and also before the news that the recent activity from Cambodia by XU1SS and XU1KC would be accepted by the ARRL for DXCC credit. Four countries have dropped out of the top twenty since last year's poll (Heard Is, Kanton Is, Central Kiribati and St. Peter & Paul Rocks) as a result of major expeditions within that period.

DXCC news

For those who chase countries, the list which is generally accepted as the standard against which to work is that which the American Radio Relay League use to administer their DXCC awards programme. Recently there has been a decision to accept the Cambodian operations (see above) for award credit, though the XZ5A and XZ9A operations from Burma still do not qualify. A decision is awaired on whether the Pribilof Islands (off the Alaskan coast and recently activated by a group of Alaskan amateurs) will count as a separate country. One which will certainly count is Peter 1st Island in the Antarctic, but only when an operation takes place from there which is officially authorised by the Norwegian Government. This is a curious one because at government level the USA does not recognise the Norwegian claim to Peter 1st Island, the reason being that the USA is not a signatory to the Antarctic Treaty (covering territories South of the 60° parallel). It seems that the ARRL is going out on a limb on this one. In any case, it is unlikely that anyone at all will visit the island before the proposed 1984/85 Norwegian Antarctic expedition, so for the time being the total number of countries currently recognised for the DXCC award remains at 315.

Prefixes

For thos who hunt prefixes, or simply want to keep the Geoff Watts' list (published in the August 1983 issue of *Amateur Radio* and in the 1984 *Yearbook*) up to date, here are some snippets which may be of interest. From 1st January, New Zealand will adopt the following prefix allocations: ZLX1-4 New Zealand (as before), ZL5 Antarctic bases, ZL6 Intruder Watch and Emergency stations, ZL7 Chatham Islands (formerly ZL/C), ZL8 Kermadec Island (formerly ZL/K), ZL9 Auckland and Campbell Islands (formerly ZL/A), ZL0 Visitors to New Zealand, and ZK3 Tokelau Island (formerly ZM7). Also from the 1st January Senegalese stations will use the 6V1-0 prefix block instead of the 6W8 prefix with which we are familiar. If, during November, you heard or worked any stations with an RK4 or RX4 prefix, these were to celebrate the 425th anniversary of the union of the Udmurt Autonomous Soviet Socialist Republic (try saying that after a long night at the rig!) with Russia. Many other special prefixes have turned up in the last couple of months, especially in the CQ Worldwide contests, but you should be able to track them down with the aid of the Geoff Watts' list.

Expeditions

Plans for VK9NS' expeditions to Kermadec Island continue apace, but yet again it looks as if Jim has competition on his hands, this time from Ron, ZL1AMO, who also has designs on Kermadec early in 1984. Incidentally, Ron did a very good job of operating from Niue Island as ZK9RW back in October, but CW only. Operators whose morse keys are gathering dust mised out on this one. I already have my ZK9RW QS1 - quick work Ron! Another imminent trip is to

Desecheo Island (a wildlife sanctuary between Puerto Rico and the US Virgin Islands). HI3RST and WP4ATF hope to be there early in January and plan to be active on 80 through 10 metres including 10MHz. These two are still looking for donations to get this effort off the ground, but as they are only expecting to make about 300 contacts, compared with about ten times that number made by the previous DXpeditions to Desecheo, it hardly seems worth bothering. FROFLO, may also be out and about again in January, this time as FROFLO/G from Glorioso Island. The Aves Island trip which I mentioned last month still seems to be going ahead. A special 4MO prefix is a possibility and the group plan to be active on all bands 160-10, both CW and SSB. The QSLs go to Hermes J. Salas Torres, YV5DFI, PO Box 50332, Caracas 1050-A, Venezuela.

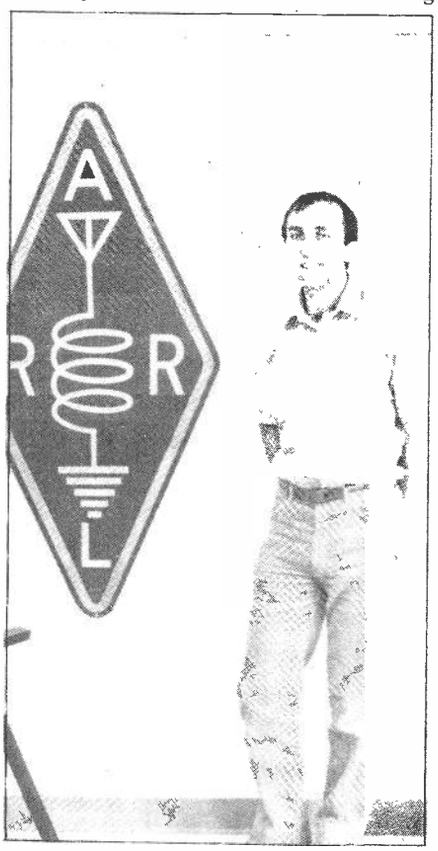
It might be worth making a small point here about DXpeditions. One of our correspondents a few months back asked for information about DXpeditions to be published in Amateur Radio, and that is exactly what I hope to do. However, the mechanics of publishing mean that information must be available well in advance if it is to appear in a monthly magazine. Most major expeditions realist this and try to take it into account in their planning, but inevitably plans may have to change at the last minute and the information is out of date before it gets into print. Other expeditions can be the result of a last-minute decision to take the rig along on holiday. The first the rest of us hear about it is when the station appears on the air.

Of course, half the fun of DXing comes from finding that rare station purely by accident, so there is no cause for despair. But if, like me, the time you have for DXing is limited, then you will want to make the best of it. There is lots you can do to be prepared and I shall hope to cover some of the ground and answer any questions that arise over the course of the next few months. For those who wish to beat me to the fun, you can always start by having a look at one of the several books on the subject. But to start you on the way Table 1 shows the frequencies regularly used by DXpeditions, often referred to in magazines as "the usual DX operating frequencies". Don't panic, its not a plot to assign channels within our valuable spectrum and to stop you or I from using these frequencies. But it does mean that if you have only five minutes to spare between helping with the washing up and going out to polish the car you can check on and around these frequencies rather than having to tune whole bands and yet still stand a fair chance of hearing anything particularly interesting which is around.

Split frequencies

A word of warning. Do *not* call the DXpedition until you have discovered where hs is listening. The world is already overpopulated with amateurs who do just that and cause chaos. *Wait* until you hear the operator announce his listening frequency, or else until you hear where the pile-up of stations calling him is. Sometimes the DX station will listen on his own frequency, but the chances are he will be working 'split' in order to minimise interference. He might, for instance, be on 14195MHz listening "up 5" in which case, obviously, you use the facility offered by your RIT control to transmit on 14200kHz and still be able to listen to him on 14196kHz. He might, on the other hand, say that he is listening 14210-14220. Oh dear, what to do? Well, firstly, your RIT may not enable you to off-tune your receiver by so much. If you have one of the latest synthesised rigs with two VFOs and/or memory channels you are laughing. Otherwise you need an external VFO or a separate receiver. The other point is that he is obviously now not listening on a single frequency but is trying to spread the calling stations around the band in order to make it easier for himself to pick one out. What one will have to do is either to select a spot within the range and call time and again until he happens to tune across your frequency or else be clever and try to find out exactly where he is listening at any given moment (by listening for the station he is working) and call him there. This won't always work; it depends on exactly what approach he is using. It really involves some detective work on your part to get "into the mind" of the DX operator....

Well, I hope some of you found this little diversion to be of value; see you in the pile-up...



Don Field at the American Radio Relay League headquarters in the USA.

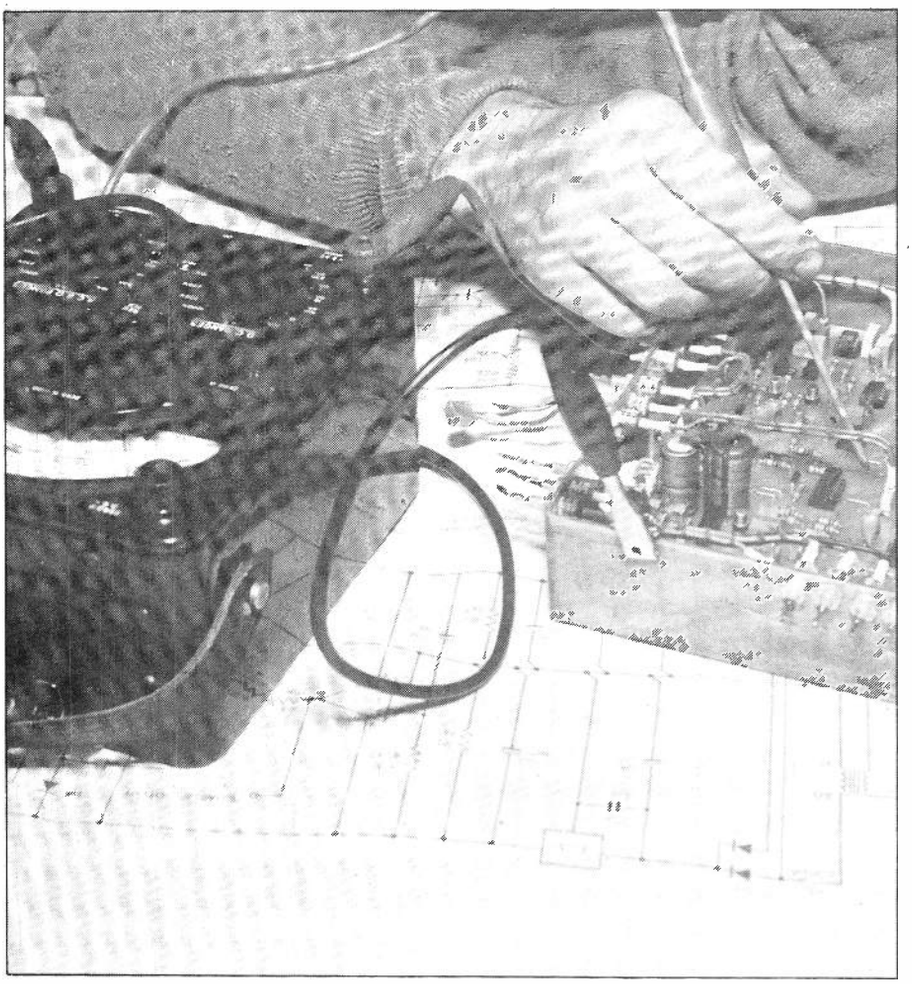
...and finally

As I write this the great moment is almost here, the start of the CQWW CW contest. My morse key is polished and ready for use, the antennas organised, wonder if I can do anything about the propagation? Well, if the SSB leg of the contest was anything to go by it should be an interesting weekend. There were about 150 countries heard and worked in the UK during the SSB contest including well over a hundred on 10 metres and about 60 on 160 metres. Not bad for one weekend. Less rewarding was the November expedition to Jarvis Island by ADIS and friends. Propagation to Europe was poor and they were only rarely audible. Unfortunately this didn't stop them 'working' a number of European stations by way of a list operation run by someone in Hawaii. The whole business was a travesty of amateur radio: it was perfectly clear to anyone listening that the majority of the people on the list could not hear ADIS/KS5 at all, but guessed at their report (which was made easier because ADIS gave them all 59!). If it makes them any happier to have a QSL from a station they couldn't even hear, then so be it. However, I suspect that even some of the strongest advocates of list and net operations must have been squirming when they heard this one.

73 and a Happy New Year.

BAND	SSB FREQUENCIES	CW FREQUENCIES
80	*3795KHz*	*3501 & 3505KHz*
40	*7095KHz*	*7001 & 7005KHz*
20	*14195 & 14295KHz*	*14005 & 14025KHz*
15	*21195 & 21295KHz*	*21005 & 21025KHz*
10	*28495 & 28595KHz*	*28005 & 28025KHz*

Table 1: Frequencies commonly used by DXpeditions



From the lab to the shack

Distortion in transmitter stages is the theme this month. Angus McKenzie G30SS explains about clipping, intermodulation, oscillator spurii and noise, ALC problems and loose screws. Owners of Liner 2s are in for a shock!

Once an intermediate frequency has been generated in the transmitter, it can be processed and clipped with an RF clipper. After this stage, it then has to be brought up to the final transmit frequency. Quite often this means beating down to a lower frequency as well as beating up for HF. Although only one mixer is normally used, there are instances in which a VFO beats with the IF to form a second IF which covers perhaps 600kHz of bandwidth, and then this second IF is taken up to final frequency in a second mixer, in which the local oscillator is crystal controlled either by direct injection of the crystal frequency, or from a frequency generated from a synthesiser. In several rigs, the basic local oscillator frequency is itself obtained by mixing two or more crystal generated frequencies, one of these frequencies being variable over a small range by pulling a crystal. The best known example of this technique is in the dreaded Liner 2, which develops, it would seem, just about every harmonic and intermodulation product that it is possible to generate. It is bad enough if you put a spectrum analyser on the main RF output of a Liner 2, but if you put an RF probe on the local oscillator input of the final mixer, you'll see all the distortion products as a forest around 117MHz. It is possible, with tremendous patience, and by using a spectrum analyser, to adjust all the circuits to make matters a little better, but even the best examples of early Liner 2s have in-band spurii at only 50dB down, and out-of-band spurii that can be worse than this. A bad example of a Liner 2 that I once checked had in band spurii at -30dB all over the place, which explained why the amateur concerned used to be hounded off the band quite regularly. Let's have a look at some problems in the mixers themselves.

Oscillator level

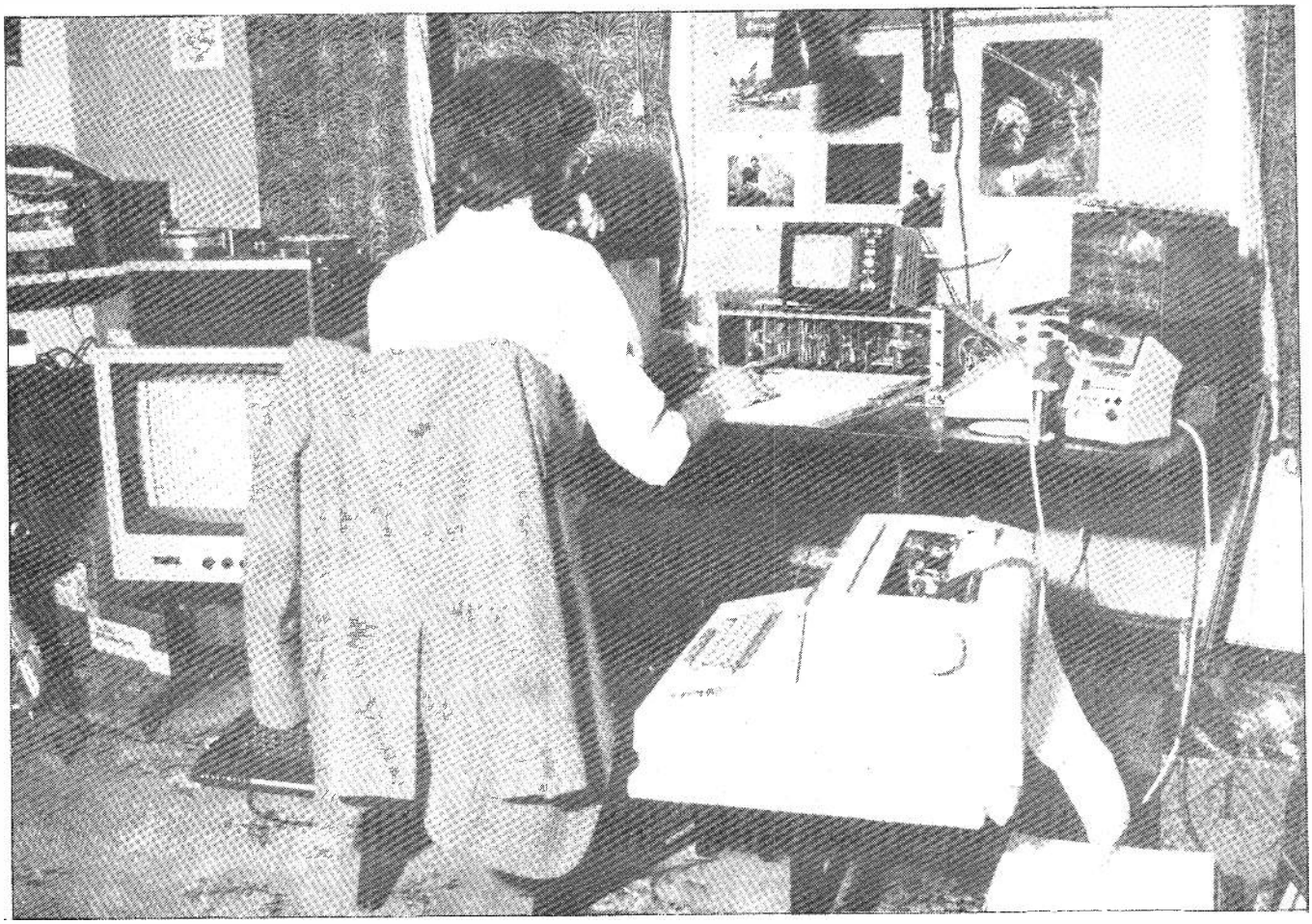
The local oscillator level to the mixer should be at a substantially higher level than that of the IF entering the mixer, otherwise intermodulation products (spreading) will be generated around the final frequency. Excessively wide RF transmissions can often be produced by this process occurring at the mixing stage as well as in the PA, with the mixer generating much worse IM than the final output stage. If you can keep the local oscillator feeds have synthesiser right, IM products should be minimised. It is of course important for the local oscillator entering any mixer to be not only very clean in terms of harmonics and beat products, but the injection should

also not be noisy. Otherwise there will be a noise band produced around the generated signal. Wideband noise, as previously explained, can be generated if there is too much gain after the IF filter, but local oscillator noise can be developed in which the transmission's dynamic range is limited. Some local oscillator feeds have synthesiser sidebands either side, which, although they are way down, can cause problems off channel, especially if the equipment is being used to drive a transverter. The requirements on a 144MHz transverter signal are very tight, especially if a station is amplifying the signal up to 400W PEP. I have known received signals on 144MHz to be as high as 1mV, and yet one may have to receive some very weak CW at substantially below 0.05uV, thus requiring an 86dB dynamic range at least. Assuming the receiver is good enough, then no receiver can cope with a transmitter having a noise floor in say a 2.4kHz bandwidth as high as -86dB off channel. I have heard the noise level on the band bob up and down, or just rise several dB, as far as 50kHz off channel, when some stations transmit.

Screw loose

In a number of cases, various synthesiser frequencies will be present in the earth paths between different sections of a transmitter chassis, and these signals can mix in with local oscillator signals and add to the confusion. Really good earthing of all parts of a transmitter is absolutely essential, but the designer has to be careful to avoid inappropriate double or multiple earths as, once again, RF earth currents can be induced. I have found that perhaps one transistorised HF rig in three has been delivered to the customer with internal screws anything but tight and many an instability problem, or strange breakthroughs both on transmit and receive, which have been produced by loose earth screws. When you buy a rig, I suggest you take the lid off and check that all the separate chassis earth screws are reasonably tight. A slightly loose screw can easily become oxidised, and can therefore rectify an earth current which thus can double in frequency to produce a harmonic which may well bring up more hairy problems. I have met with two specific examples of inadequate screw tightening in the last year or two which serve well to demonstrate the problem. When I first took delivery of my Trio TS130S mobile LF/HF band rig, I experienced bad instability and RF feedback on the 10m band. The PA driver board has 6 screws connecting it with the general earth plane and almost all of these were not even finger tight as supplied. Tightening these, but not ridiculously so, completely fixed the problem which has never recurred. The Icom IC751 sample that arrived first also had several screws that were not tight enough, and this showed up as a strange ALC fault which produced a loss of power to about 15W or so on 10m and 15m when a CW key and extension loudspeaker were both plugged in. Slight pickup of transmitted RF got back into the set and the inadequate earthing caused the ALC line to back off the drive. This problem seemed to disappear almost completely when all the screws were tightened.

The ALC circuits of a transmitter are usually taken from the final to a much earlier stage, sometimes to one immediately before the mixer. In this way, the IF level reaching the mixer is held down to reduce IM products. If

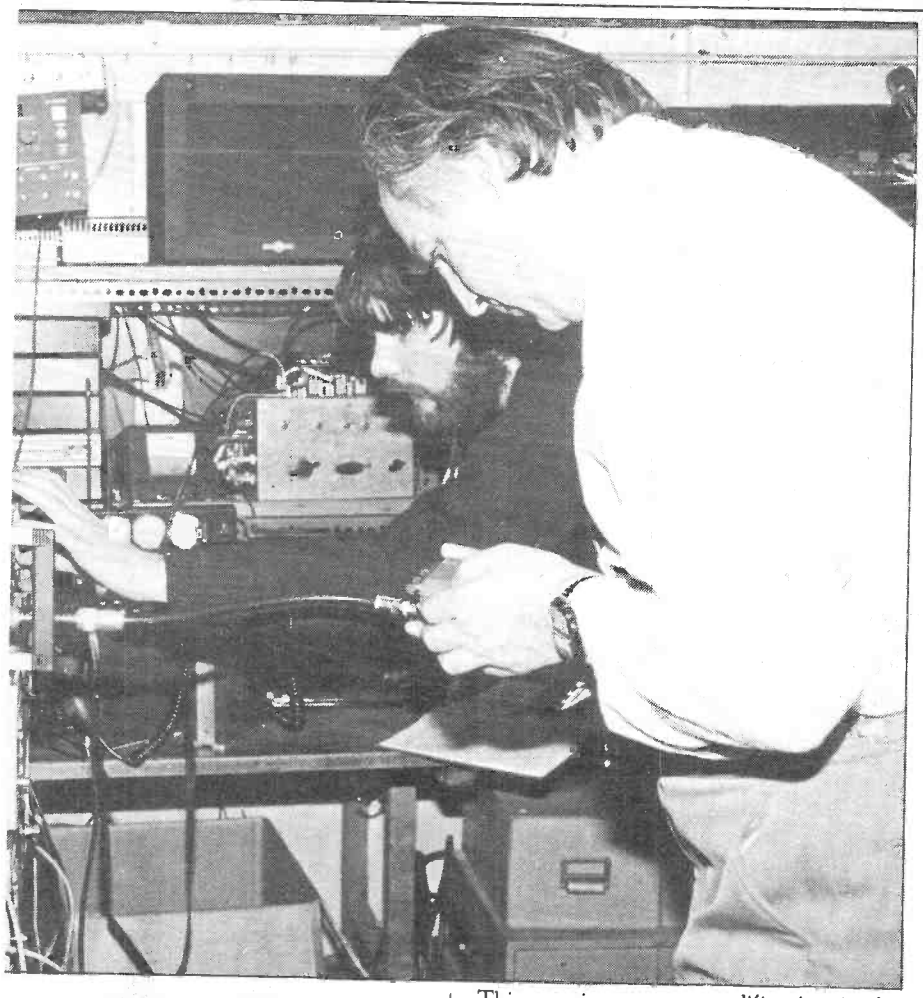


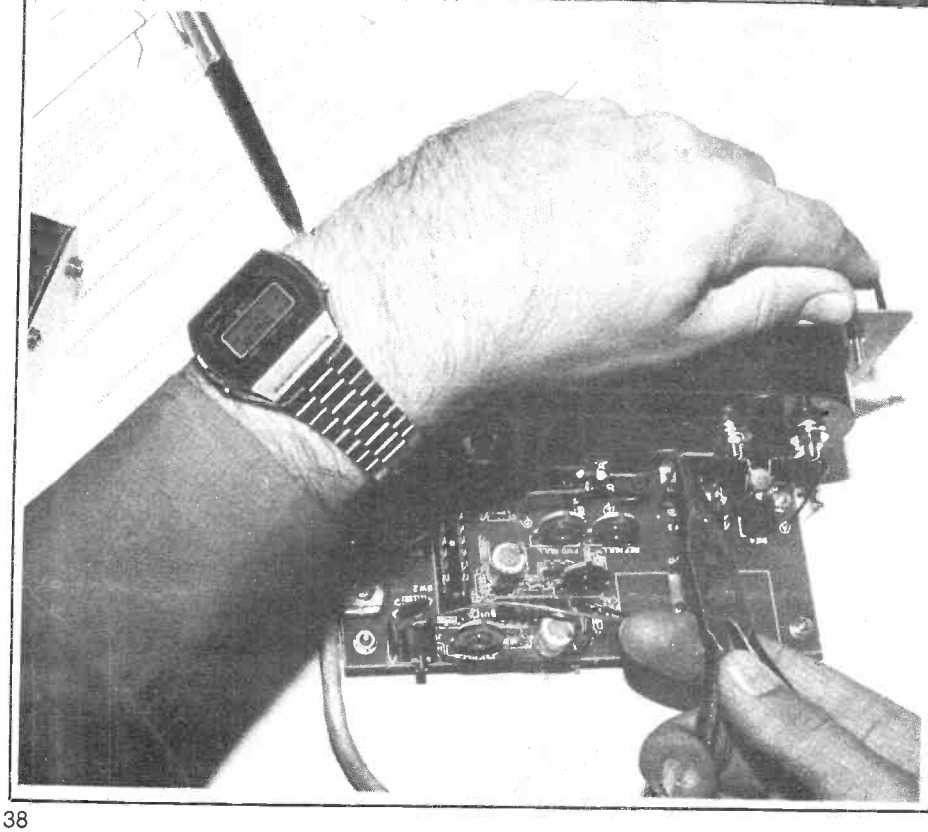
however, in the case of some rigs, the PA is completely disabled when a transverter is in use, no ALC voltage is generated and there is a considerable danger that the mixer, let alone later stages, can be over driven, thus causing the transverter feed to clip, thus widening the transmission appreciably.

I prefer to see ALC derived from both the driver transistor and the PA, so that if the PA is shut off, there is still ALC applied to earlier stages. The trio TS820, and 830 models for example, shut off the PA by taking the screens either to earth or even to a negative potential, thus leaving the heater cathode circuit intact. ALC voltage is still present in this configuration when the driver valve is feeding a transverter, which is extremely useful.

Transverter sockets

It is useful to look at a transverter output feed on the 28MHz band to check whether ALC is present or not. An HF scope driven from the transverter output feed socket will soon show up any problems from a two-tone source connected to the microphone input. The transverter feed level on many rigs is ridiculously low, often as low as 200uW.





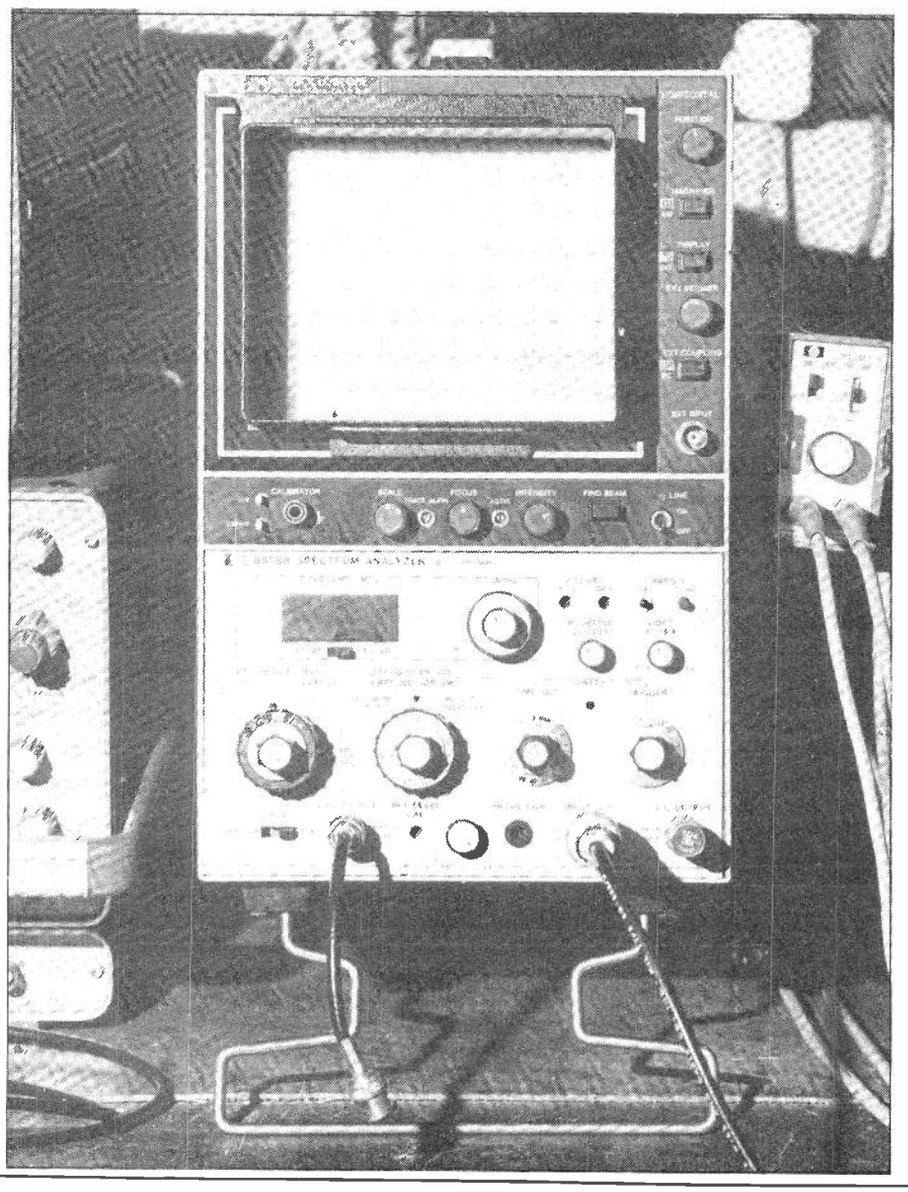
This requires more amplification in the transverter, and I don't feel that this is good practice as the input noise of the transverter has to be at a very low level to avoid noise floor problems. The ideal level at this point is around 5mW, which is easy to deal with, as it is compatible with a much wider range of transverters. The transverter drive on many a rig is fed from a tap on the input or output coils of the buffer stage, and this tap usually feeds through to the transverter drive socket via a very low value capacitor of perhaps 10pF. The output socket often has a resister to deck of around 75 ohms, and this restricts the maximum voltage. I have removed it on my TS830 and now get around 50mW drive which I can then attenuate as required for various transverters, an unmodified 830 giving very much less than this. I have not noted any degradation in performance of the rig on LF and HF bands, incidentally, by making this modification.

Time constants

Almost all rigs have an ALC input socket for backing down the IF gain when an external linear is in use. The ALC socket

can also of course take an ALC voltage from a transverter. It is worthwhile having a look at the ALC circuitry because many linears' ALC outputs are not fully compatible with many rigs. The ALC attack and decay times are quite critical, and while a degree of ALC may well stop a linear from developing excessive power, there may well be problems in the audio recovery at the receiving end. In quite a number of cases I have found ALC leakage from a linear when it is switched on but on bypass, or even when switched off. There is sometimes enough RF around inside the linear to rectify on the ALC line, and feed back an ALC voltage. Rigs that have a very high impedance input on this line are more prone to problems, because diodes in a linear can easily produce an ALC voltage if the current drain is very small.

Returning to mixers again, I have a feeling that many transmit mixers have an inadequate margin between the normal operating level point and the clipping point. ALC can only act when the signal reaching the ALC detector has already reached a very high level, and the ALC has to back this off before it reaches an even higher level. Some rigs seem to clank or crack with the onset of ALC, and one can best see this by examining a transmitted signal derived from an audio toneburst being delivered into the microhone input socket. If a very good Schottky diode ring mixer is employed with a carrier inserted as local oscillator at around 10mW, and the RF input level to the mixer held right back to reduce IM products in the mixer, the output can either be taken direct to the scope, or to a very linear AM detector whose output then feeds the scope. We have used a Nicolet 3091 storage scope for looking at audio tonebursts very successfully, the scope storing some 4000 samples of 12 bit resolutions. If the first sine wave of the toneburst is badly clipped, followed by succeeding sinewaves of the first complete burst being at a reduced level, the ALC circuit is not acting quickly enough, for the first sine wave should be attenuated down on its leading 90 degrees well before it reaches peak amplitude.



HF distortion

It is quite often rather enlightening to listen to an SSB transmission with around 6kHz RX bandwidth, for evils are more easily heard in the receiver. A good transmitter should sound very clean on a wide bandwidth, but bad ones show some quite nasty HF distortion in the reconstituted audio. The IC751 with the AM filter switched in on SSB reception has been particularly fascinating to use, for too many transmissions are very nasty on virtually all bands; but just the odd one is really superb.

One current design practice is to provide all stages after the mixer with an extremely wide frequency response, without tuned collector circuits, a series of low pass filters being switched in on the output of the PA. I am deeply concerned about this (see IC751 review) for it needs comparatively minor problems in circuitry, or as a fault condition of some kind, for spurii or parastic oscillations to develop. I have found that quite frequently upper harmonics are generated just as much, if not more, by earlier stages than by the PA. It is fascinating that in the amateur radio licence there is no specification given for harmonic distortion, and although the words "must not cause any undue interference etc." may appear to be vague, they are in fact very strong ones, as you can be clobbered by the DTI if you produce any harmonic or spurious output which causes any other user of the spectrum any interference at all.

Bearing in mind the introduction of wide response output amplifiers in modern rigs, it is obvious that the final mixer design has to be extremely good, and the local oscillator feed to is has to be very clean indeed. This now seems to be posible in completely transistorised designs, which have improved so dramatically in the last few years. It is generally acknowledged that valve drivers and output stages are more linear, but they really are so awkward to use and costly to replace whereas a transistor PA, if used properly, should last almost for ever.

ON THE BEAM

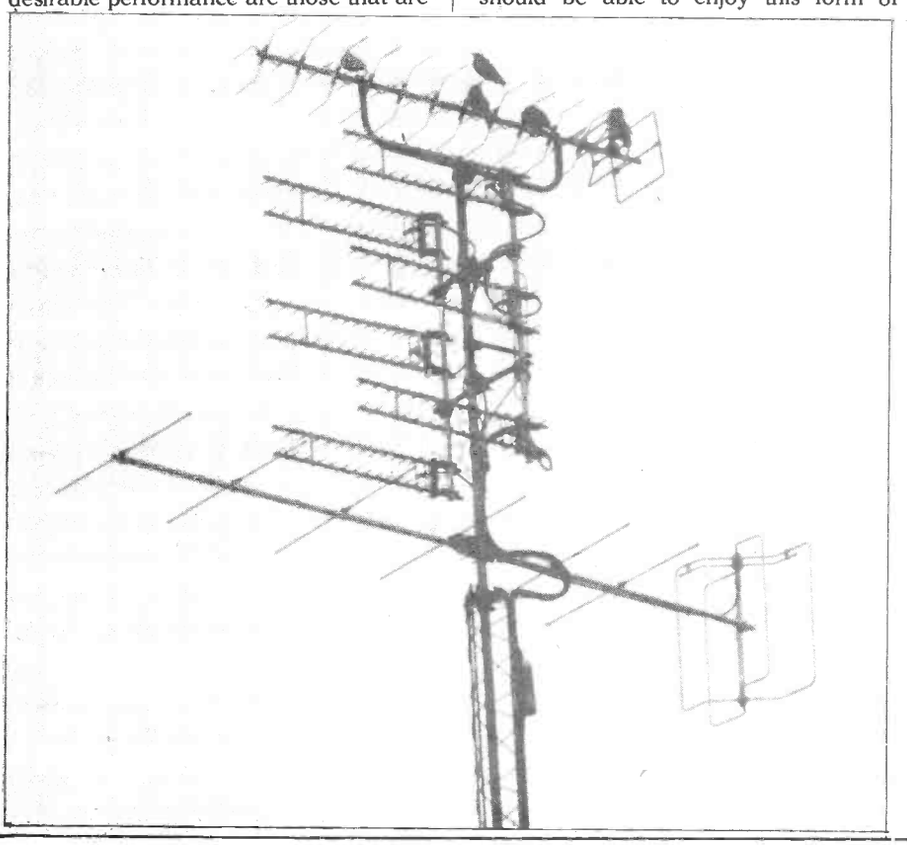
VHF UHF MICROWAVE

By Glen Ross, G8MWR

News and topics of interest for the bands above 50MHz

High resolution

Well you do not get much higher than Oscar 10! Two facts are now obvious about Oscar 10. First, the satellite is now working very adequately but nowhere near as well as originally hoped. Second, it would be a lot more effective if only people would take note of the advice from AMSAT as to the power levels to be used. Taking point number one, it will be remembered that we published information on the power budget which was based on the information from AMSAT. The required system specification should have produced a signal to noise ratio of 20dB in your two metre receiver. This in practice means pretty well noise free. In fact the only signals to achieve this desirable performance are those that are running very high power. To prevent overloading, the machine has an automatic gain control system and the telemetry shows that when some of these strong signals are on the gain is reduced by 20dB or more. To try and get through under these conditions it is natural to think on the lines of increasing your own power to the point where you can compete. Now we get into the ever increasing spiral syndrome because the effect of all these high power signals is to keep the AGC system permanently engaged so making sure that no normal signal gets through. The only sensible answer is to obey the rules. There are a lot of exciting contacts to be made via the satellite but at the moment people who should be able to enjoy this form of operation are being squeezed out by the 'bully boys'.



Good news dept.

Hands up all those who think that working on 10GHz means a range of only a few miles and a lot of hill climbing? Rethink time is on us. The latest 10GHz distance record is 1663 km and was set up by I0SNY/EA9 who operated from Ceuta in Spanish Morocco and I0YLI/IT9 on the island of Ustica. The path is completely over water and the sites were nearly all at sea level. The gear used ran about 30 milliwatts of wideband FM to 3ft dishes. Most of us would be happy to work those sort of distances on two metres, leave alone 10GHz. I0SNY has also held the previous records for the band at 757, 860, 1,101, 1,117 and 1,166km. A really remarkable achievement. I wonder what he will achieve if he ever tries SSB?

As if that was not enough he also raised the European 23cm record to 1,963km by working I8TUS at Calabria on the southern tip of Italy. Perhaps the most interesting thing about all this is that the 23cm record is now only 300km ahead of the 10GHz one.

We mentioned some time ago that the Swedes have obtained limited permission to use the 3.4GHz band, and this has resulted in a new record for this band when SM6HYG worked G3ZEZ over a distance of 978km (perhaps they should have used 10GHz). SM6HYG also worked G3LQR on 5.7GHz over a 924km path which looks like another record.

More good news

There is now a lot of interest in amateur TV on the bands above 70cm with a lot of people moving on to 24cm and even some intrepid souls going as high as 10GHz. All this is a nice way to bring us to the subject of yet another world record. VK6WG worked VK5QR over a

distance of 1,872 km path. This TV contact beat the existing 23cm SSB record.

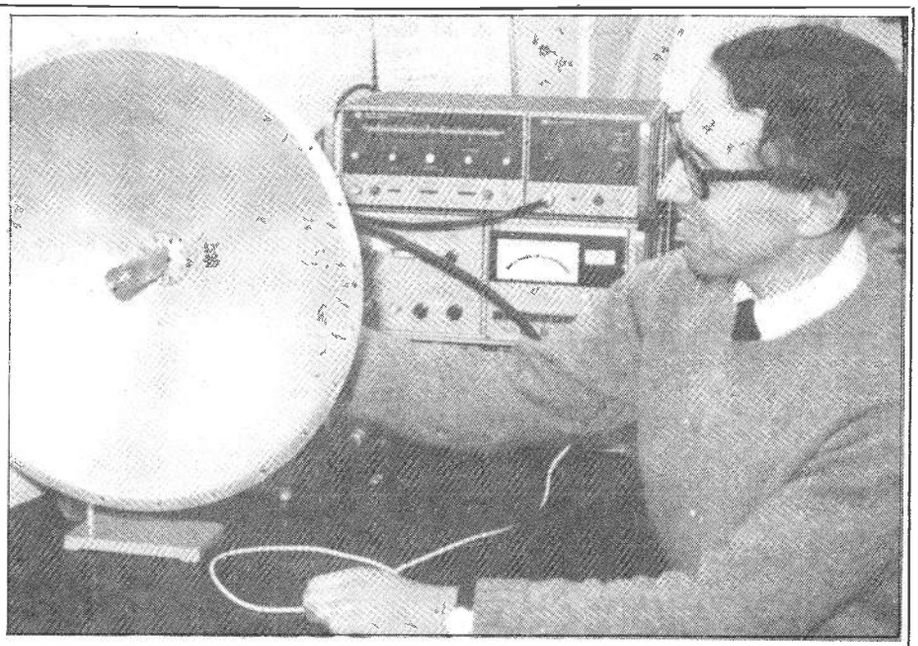
Staying on 23cm and continuing the 'small is beautiful' theme, you may be interested to hear of some moonbounce results using, for this mode, very low power levels. G4CCH has been doing some tests on this mode using only 100 watt to an eight foot dish. With this system he has worked K2UYH and also ZS5JJ. He has also heard signals from at least five other countries, a really remarkable achievement and one which must encourage other people with limited resources to have a go.

Meteor scatter

This is a mode which is getting a lot more attention as people discover its possibilities. The one thing you really need is a lot of time and patience. Having listened to a lot of the activity this year one thing that stands out is the number of people who claim a contact they believe they have made, when in fact the station they think they have worked was actually working someone else. This does not amount to deliberate cheating on their part but highlights the difficulty of reading what, by the very nature of the mode, is usually a very intermittent signal. It is very easy to 'hear' your own callsign if the DX station is calling someone with a similar call to your own. It is also very easy to mistake say YO for YU. It seems that a fair number of accidentally fraudulent claims are being made as to stations worked, particularly in the more active showers such as the Perseids. The way to avoid this to some extent is to make skeds before the event rather than work in a random fashion. This would then leave random working for use outside the major events where confusion would be far less likely.

News from space

Regular news broadcasts are now available on Oscar 10. These are part of the RSGB's GB2RS news service. The frequency to listen on is 145.973 USB. The times of the broadcasts vary from week to week, depending on where the satellite is, so it is not possible to give advance information. Listen on the normal news for details and then try your luck on Oscar. Results so far have been rather variable depending on just how many overpowered signals are on the satellite (see the remarks at the front of this column). At the moment it looks as though the RSGB and AMSAT will have to give in and use more power if this service is going to be of any practical use. Results in the first three weeks have certainly been very dissappointing. Back to the spiral staircase effect.



UOSAT B

It has been found possible to launch another satellite in the UOSAT series. A providional launch date has been fixed for early in March. This will lead to some burning of the midnight oil by the group responsible for building the beast. Imagine trying to get a satellite designed, built, tested and ready to fly in a matter of six months. The original UOSAT had a number of teething problems and has never achieved the original aims of the group. It has, however, provided a massive amount of data and practical experience in using an 'educational' type system. If most of these problems can be overcome on the new machine then we really will have something impressive to play with. Details of the unit and the devices to be carried are not yet available. It would be nice if the 'Digitalker' and the 'TV' systems are included, as these have provided a lot of interest on the existing package.

Fuller details are available on all matters relating to the satellites by sending a large SAE to AMSAT UK, London, E12 5EQ.

Build a satellite

This year's Faraday lecture, which has been touring the country for some weeks, has been on the subject of "let's build a satellite". The lecture assumed no previous knowledge of the subject, or even electronics for that matter, and provided a very interesting and amusing insight into what makes a satellite. Congratulations to all concerned and if you missed seeing it you missed a great show.

The final

That seems to be it for another month. Not too much gloom and despondancy and a lot of good news. What can we look forward to in the coming year? Certainly as the conditions on the HF bands continue to decline we shall hear a lot of callsigns coming back onto the bands that have been missing for a long time. Probably a lot more activity on 70 and 23cm. Why struggle on two metres when there is all that lovely space to play with on the higher bands? It would be nice to see more people putting up better aerial systems so as to exploit the bands more fully. How about trying a new band or a new mode this year? There really is a lot to play with at this end of the spectrum. Last year's increase in 10GHz operating will surely continue. One thing we can be sure of is that whatever your own interest may be, you will certainly get a lot of fun out of amateur radio this year.

A last resolution

Why not write to "On the Beam" and let us know what you or your club are doing? The address is 81 Ringwood Highway, Coventry.

Good luck for 1984.

Left: aerial system of G8MWR. Above and right: the Microwave Society's stand at the Leicester Amateur Radio Show.

We don't
of ours

The new IC-02E
Push-button Perfection

ICOM introduces the new top-of-the-line IC-02E to compliment its existing line of popular handheld transceivers and accessories. The new direct entry microprocessor controlled IC-02E is a 2 meter handheld jam packed with excellent features.

Some of these features include: scanning, 10 memories, duplex offset storage in memory & odd offsets also stored in memory. Internal Lithium battery backup and repeater tone are of course included.

Keyboard entry is made through the 16 button pad allowing easy access to frequencies, duplex, memories, memory scan and priority. The IC-02E has an easy to read custom LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions.

A battery lock, frequency lock and lamp on/off switch are also featured, as is an aluminium case-back, providing superior heat sinking.

A variety of batteries will be available for the IC-02E, including new long-life 8.4 volt and 13.2 volt packs. Charging may be done from a top panel connector for 13.8 volts which will also power transceiver operation. The IC-2E continues to be available, and its complete range of accessories work with the new IC-02E.

The IC-02E comes with the BP3 Nicad battery pack, BC25E wall charger, flexible antenna, wrist strap and belt clip as standard equipment. A truly excellent product destined to a great future.

"We don't sell any of our sets until we know them inside-out." A bold claim, but as our engineers have been trained by ICOM in Japan we can guarantee the best after-sales maintenance service available.
As well as the 02E, 751, 745, 271, 471, R70, 290D, 490E, 25H, 45E, 2KL, AT100, AT500, 120, 2E, 4E in the ICOM range we also stock such famous names as Tono, Telereader, Cue Dee, Versatower, Yaesu, Jaybeam, Datong, Wetz, G-Whip, Western TAL, Bearcat and RSGB Publications. Thanet Electronics can offer you the most comprehensive and thorough service.

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t sell any ets until...

IC-751, £969. HF Transceiver

The IC-751 supercedes the already popular IC-740. Improvements such as the addition of 36 memory channels, doing away with mechanical bandswitching and adding full HF receive capability (0.1-30 MHz), which is even better than the IC-R70, gives you some idea just how sophisticated the IC-751 is. The IC-751 is fully compatible with ICOM auto-units such as the AT-500 and IC-2KL. A computer control option can be added. There is also a digital speech synthesizer option which is ideal for blind operators. Power supply options are the IC-PS35 internal, or the PS-15/PS20 range for external use.

As you would expect, the IC-751 has a built-in speech processor, switchable choice of a J-FET pre-amp, straight through, or a 20dB pin diode attenuator and two VFOs allowing split frequency operation. More information on request.

IC-271E/471E, £569/£659. VHF Multimode Base Stations

The IC-271E (2 meter VHF) and IC-471E, 430-450 MHz are the 'terrific twins' in Base multimodes at the moment. The design is based upon a new CPU chip that is easy to operate and offers the maximum number of functions available. Power can be adjusted up to 25W on all modes, squelch works on all modes and a listen-input facility has been added for repeater work. RIT shift is shown on the multicolour fluorescent display. 10Hz tuning facilities are included on both machines. Options for the 271E and 471E include – switchable front-end pre-amp, SM5 desk microphone, speech synthesizer announcing displayed frequency, 22 channel memory extension with scan facilities and an internal chopper PSU. If you would like to learn more specific details for the 271E or 471E, don't hesitate to ask for a brochure.

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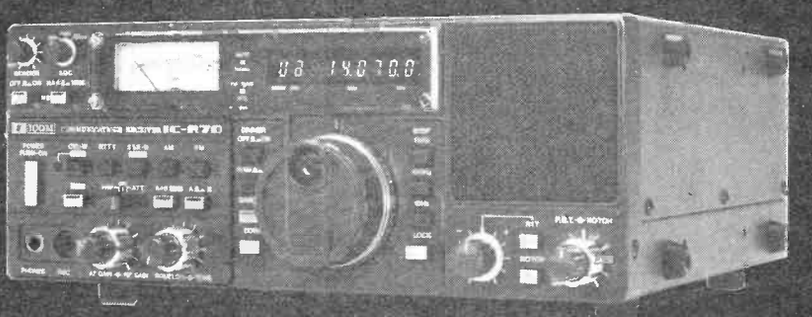
...we know insid

IC-R70, HF Receiver, £499.



The R70 covers all modes (when the FM option is included), and uses 2CPU-driven VFOs for split frequency working, and has 3 IF frequencies. 70MHz, 9MHz and 455KHz, and a dynamic range of 100dB. It has a built-in mains supply. Other features include input switchability through a pre-amplifier, direct or via an attenuator, selectable tuning steps of 1KHz, 100Hz or 10Hz, adjustable IF bandwidth in 3 steps (455KHz). Noise limiter, switchable AGC, tunable notch filter, squelch on all modes, RIT, tone control. Tuning LED for FM (discriminator centre indicator). Recorder output, dimmer control.

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

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

IC-25H/45E, £329/£289. VHF, FM Mobiles

These two mobiles are amazingly small but have a powerful voice, 45W (2 m) 10W (70cm). Their lack of bulk helps a great deal when fitting into modern motor vehicles, often having very small spaces left for this type of mobile accessory.

The sets have 2 VFOs, five memories, priority channel, full duplex and reverse, LED S-meter, 25KHz or 5KHz step tuning. The 25H and 45E have multi-scanning functions from the mic or front panel. These are still the best 2M and 70CM FM mobiles ICOM have made ..... so far!

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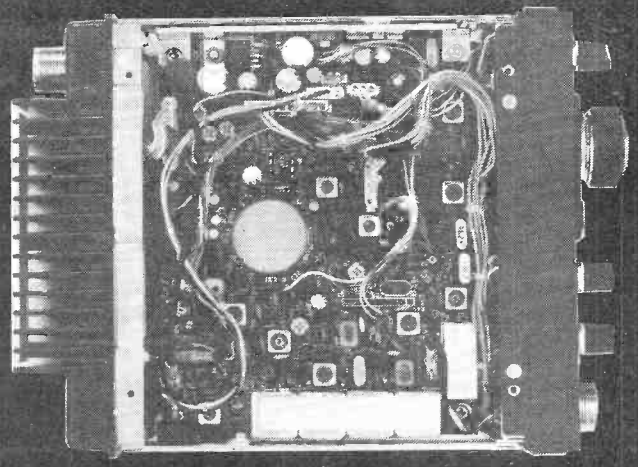
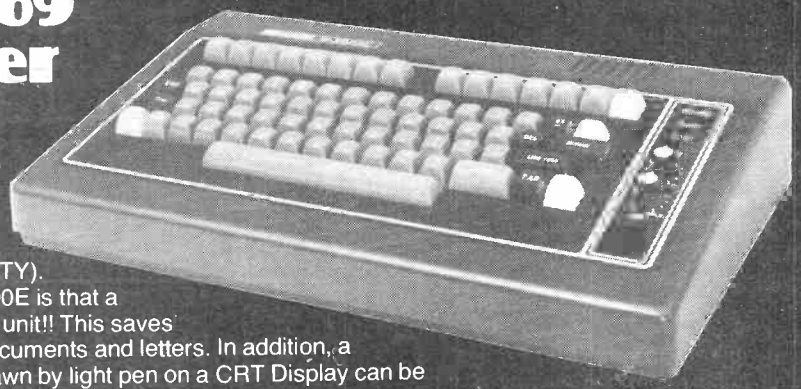


Tono 9000E, £669 Sender/Decoder



TONO 9000E, appearing as a highly sophisticated and amazingly improved 7000E, is the Micro-processor-controlled Communications Terminal which features completely automatic Send/Receive of Morse Code (CW), Baudot Code (RTTY) and ASCII (RTTY).

The most attractive feature of the TONO 9000E is that a WORD PROCESSOR is now built into this super unit!! This saves a tremendous amount of time when preparing documents and letters. In addition, a high-speed Send/Receive of graphic patterns drawn by light pen on a CRT Display can be easily operated.

By introducing these exciting developments to the amateur radio world, TONO 9000E could build a strong reputation for up-to-date performance. Battery-Backed-Up memory, which was one of the most popular characteristics of 7000E, has been enhanced by a dramatic expansion to 256 characters by 7 channels. Large Capacity Display Memory, which can cover up to 14,000 characters and Screen Format contains 80 characters line by 24 lines. The easy-to-use, multi- applications, remarkable TONO 9000E provides all the features you could desire.!

Please contact us for more detailed information on the TONO 9000E, the best way to keep up with todays technology.

IC-290D/490E, £433/£459. VHF Multimode Mobiles

The IC-290D is proving to be an extremely popular 25 watt 2 meter mobile. It boasts a bright green display, 5 memories, scan facilities on either memory or across the whole band, an instant input for repeaters, there is also a tone-call button on the microphone. The IC-490E is the 70CM version and has similar features, but only a 10 watt voice in this case.

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

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BARCLAYCARD VISA

Short wave on a shoestring

Can't afford a black box? No problem - simple CW gear is quite capable of working the DX

By Ken Williams

Not very long ago, I was listening to a couple of fairly recently Class B licensed amateurs discussing the merits and demerits of taking the Morse test, obtaining a Class A licence and the equipment which they would need.

After talking for over an hour on the merits of synthesisers, processors, memories and a host of other complexities, I was saddened to hear them decide that it was not worth their while attempting to learn the code for, when they passed the 12wpm test, they would not be able to afford several hundred pounds for an HF transceiver, aerials, etc. Like so many others, they had obviously come to believe that HF operation is impossible without all the features found in modern highly complex (and expensive) communications equipment.

Yet if, instead of dicussing the host of desirable features available in the differing makes of equipment, they had gone to grass roots and considered the *minimum* requirements for HF operation, they could have well reached a different conclusion.

Morse code

Firstly, to gain a Class A licence requires a knowledge of the Morse code. If it has been learned, why waste the effort spent? A minimum cost equipment for HF bands will operate CW only, for to include other modes increases complexity which costs money. For the outlay necessary to construct a QRP (5 watt) SSB transmitter it should be quite possible to build an equipment capable of running legal maximum power on CW - a beastie with very considerable DX potential!

Having decided to construct a CW transmitter, the next problem is the receiver. This could be built, but there are many advantages in obtaining a ready made item. Fortunately, on HF atmospheric conditions limit the maximum sensitivity which can be used and consequently almost any of the good commercial or ex-service equipments are perfectly adequate in this aspect. Also important are the frequency stability and second channel rejection characteristics. Again, most commercial and ex-service equipment is adequate. The final problem to consider is the selectivity. With perhaps only three exceptions (the Radiovision Commander, the DST100 and the Drake 2B), any receiver without a crystal filter will not be suitable.

The filters fitted before the days of SSB usually used a single crystal circuit fitted with phasing controls brought out to the front panel. By careful adjustment of these, the bandwidth could be reduced to a few tens of cycles and good single signal reception obtained.

Some ex-service sets, such as the BC348, although fitted with such filters, have only preset adjustments, so for our purposes it is necessary to either delve in the back of the receiver and preset the controls for optimum with a trimming tool, or use some flexible drives and a lot of ingenuity to 'remote' these adjustments onto the front panel.

Other receivers such as the AR88 and the R1475 have switched selectivity positions, at least one of which will be suitable for CW operation. Finally, a calibrated general coverage HF receiver is one of the most useful pieces of test equipment which an amateur can possess, for it enables him to check oscillator frequencies, examine his transmission for harmonics or spurious radiation and generally act as a poor man's spectrum analyser in addition to its main job of resolving incoming signals.

The transceiver problem having been considered, let us now try and differentiate between the necessary and the desirable features of a transmitter. Essential to all transmitters is the master oscillator, which may be free running, crystal controlled or synthesiser techniques, but for home construction the advantages are questionable for they are complex and if not built to a very high standard can be very noisy.

Crystal control can be excellent - but only if you want only a single frequency. Even if a VXO (Variable Crystal Oscillator) is used, the variation possible is only a few kilohertz. As we are intent on producing a transmitter at minimum cost, we are therefore left with the free running oscillator. We will return to the choice of circuit later in the article.

Whilst it is quite possible to operate on the lower frequency amateur bands using only a high power master oscillator (MO) feeding the aerial directly, this has disadvantages and it is better to follow the oscillator with a power amplifier which will allow the oscillator to be run at a modest power level with consequent improvement in stability.

Suitable power supplies for both these stages must, of course, be provided, also means whereby the output can be keyed and some method of transferring the aerial from the transmitter to the receiver during reception.

If these requirements seem a little sparse compared with the hundreds of different circuits in a modern transceiver, remember that we are only discussing the barest essentials. Such a transmitter will

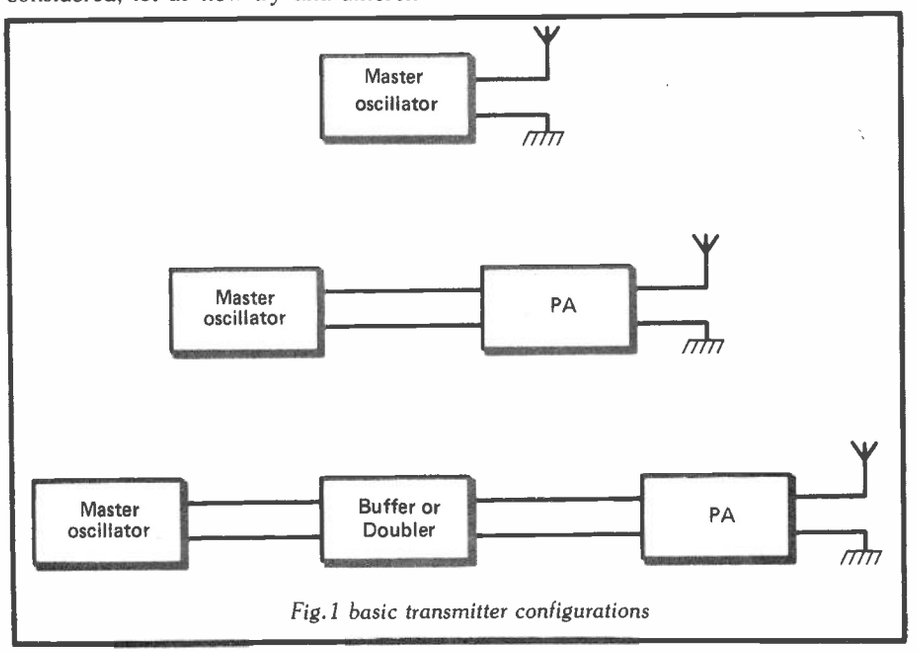


Fig.1 basic transmitter configurations

only operate on one band (two if the PA is also used as a frequency doubler) and will probably have other disadvantages such as the PA 'pulling' the oscillator frequency or a slight 'chirp' on the radiated signal. Nevertheless it was with such simple circuitry that long distance HF communication was proved possible and the author, in common with many other amateurs has had many contacts and countless hours of pleasure.

From the basic VFO - PA circuit, further additions can improve both the quality of the radiated signal and expand the capability of the equipment in terms of output power and frequency coverage.

If an intermediate buffer amplifier is fitted between the oscillator and the PA, this will serve to provide both a degree of isolation between these stages and give additional driving power for a more powerful PA. Alternatively, two stages may be used, the first being designed for maximum isolation and the second to provide maximum drive to the PA or frequency multiply to give additional wavebands.

More than one frequency multiplier may be used. In fact, many years ago a friend of the author operated his VFO on 160 metres and followed this with a string of multipliers to cover all bands down to ten metres.

Mixer VFO

The disadvantages of this system is that any frequency drift in the oscillator is also multiplied and in consequence, the mixer VFO gained popularity.

In this circuit the oscillator is tuned to a frequency outside the amateur bands and its output is mixed with that from a crystal oscillator whose frequency is such that the resultant beat frequency lies within the desired amateur band. For example, if the variable oscillator is tuned 5.0 - 5.5MHz and this is mixed with 9MHz from a crystal, then the outputs available are:

$$9 + (5.0 - 5.5) = 14.0 - 14.5\text{MHz}$$

and

$$9 - (5.0 - 5.5) = 4.0 - 3.5\text{MHz}$$

With this combination two bands, eighty and twenty metres, are covered by the use of one crystal. By choice of suitable crystals all HF bands could be covered except 10MHz which is the second harmonic of the VFO, and would be better served by leaving out the crystal and using the mixer stage as a doubler.

Having now discussed what is essential and separated this from what is merely desirable in a CW transmitter, let us look a little deeper into the individual circuits.

There are three basic types of variable frequency oscillator: the Hartley, the Colpitts and the Franklin and each may be constructed using either valves or solid state. For convenience however, the diagrams with this article all show the valve versions. All other circuits such as the Clapp-Gouriet, the Vackar or the Seiler are variants of one or other of the basic designs.

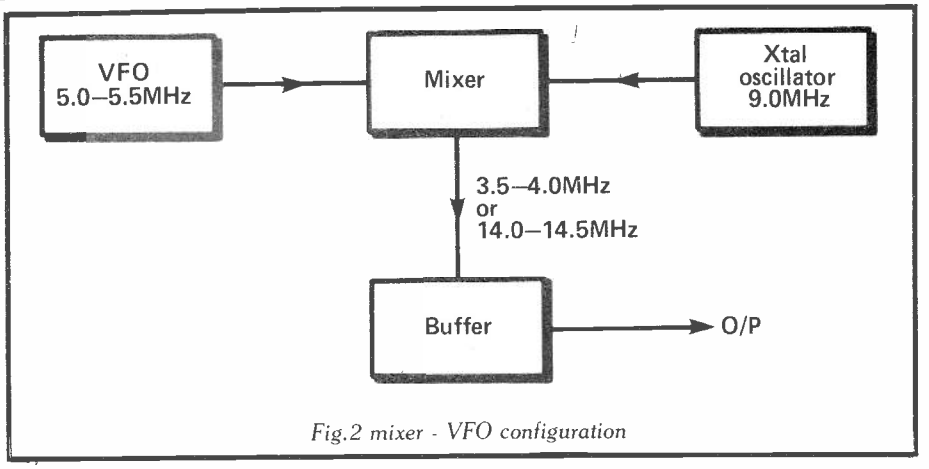


Fig.2 mixer - VFO configuration

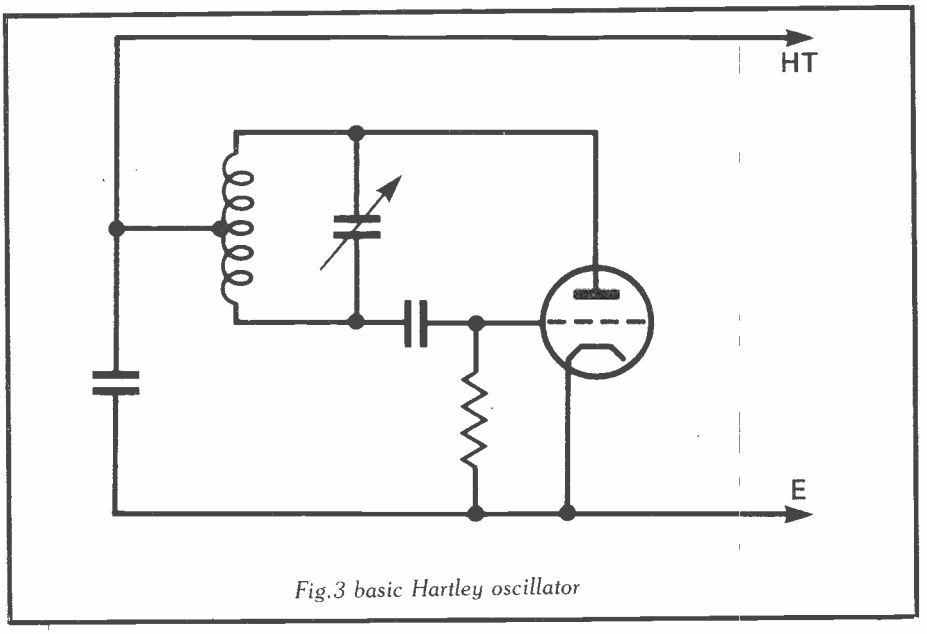


Fig.3 basic Hartley oscillator

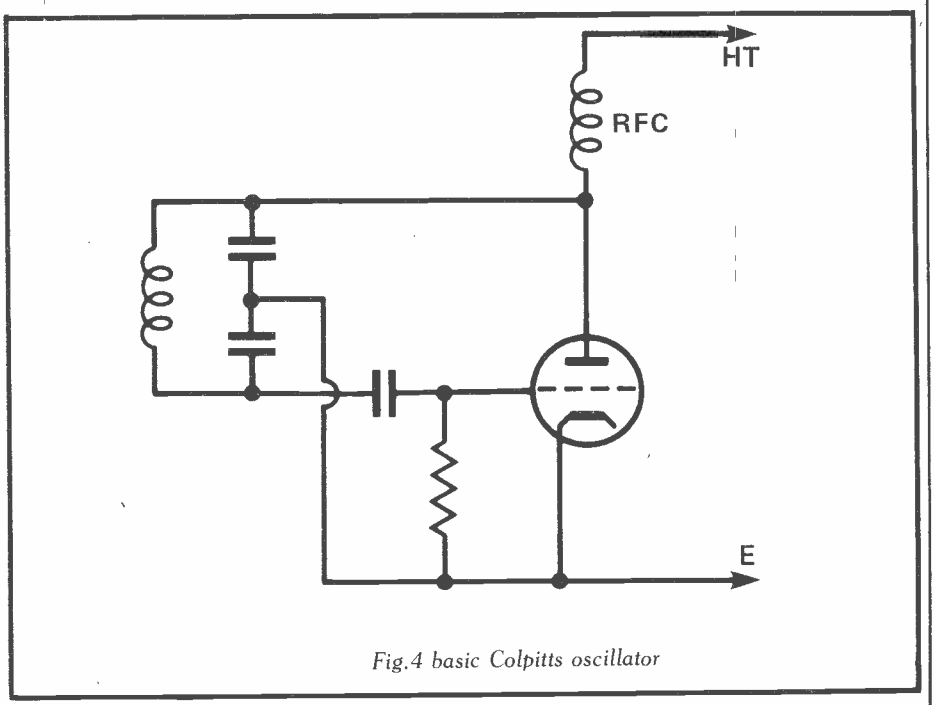


Fig.4 basic Colpitts oscillator

The principle of operation of any oscillator is that a high stability tuned circuit is connected to a high gain amplifier, an output of which is fed back in the correct phase and at the correct level to the tuned circuit so that oscillation is initiated and maintained. The various types of oscillater only vary in their method of achieving this end.

Before looking at the circuits let us consider the requirements of a VFO. First and foremost, all agree that it should be stable. But what do we mean by stable? Ideally the frequency generated should remain perfectly constant from the instant of switch - on to the time when it is switched off, be it minutes, days, weeks or even years later. In real life, nothing, not

Short wave on a shoestring

even the rotation of the earth, is so stable. In practice, after switch on, the components gradually warm up until thermal equilibrium is attained. This may take anything from a few seconds to an hour or so; depending on the design of the circuit. Thereafter the frequency will stay constant except for perhaps a slight drift caused by variations in the ambient temperature etc. Over a much longer period, measured, perhaps, in years, further slight variations will occur due to aging of components.

What, therefore, is the VFO requirement for amateur operation? Firstly, the initial warm-up drift should be completed within a reasonably short period, for while at the beginning of an operating session, few would object to waiting a couple of minutes for the VFO to settle, a wait of an hour or so would eliminate most of the operating time available.

Secondly, once this warm-up drift is complete, the frequency should stay constant within a hundred cycles or so for the remainder of the operating session to avoid the need for constant renetting.

Audio Valves

Very long term stability measured in weeks or years is not really important because, in general, operating sessions rarely last more than a few hours.

Thirdly, the output should have, as near as possible, a pure sinusoidal waveform. If it is not so, this is due to incorrect operation of the oscillator, for every circuit is quite capable of giving an excellent output waveform.

Considering now the circuit to be used in our minimum cost transmitter, we now have the choice of valve or solid state, three basic oscillator circuits with, perhaps, half a dozen variants to choose from. For the initial choice between valve or solid state, there is no doubt that a solid state VFO can be made far more stable than a valve, for heating effects are far less and solid state construction can be far more rigid. Furthermore the whole circuit can be built in a diecast aluminium box, which can also be thermostatically controlled for long term stability. However, such a circuit gives only a relatively low output, necessitating a further stage of amplification, adding both complexity and cost.

Valve oscillators, on the other hand, give more than adequate output to drive a succeeding stage, be it a buffer, frequency multiplier or even a low power power amplifier. For example, many WW2 equipments used simple circuits with a fairly high power oscillator driving a PA - often to powers of several hundred watts. Frequency stability, while not as

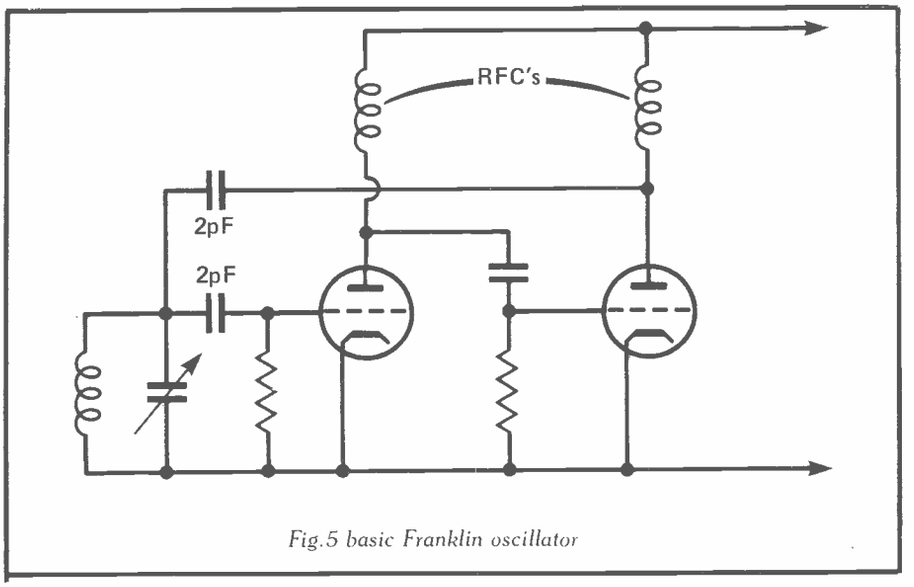


Fig.5 basic Franklin oscillator

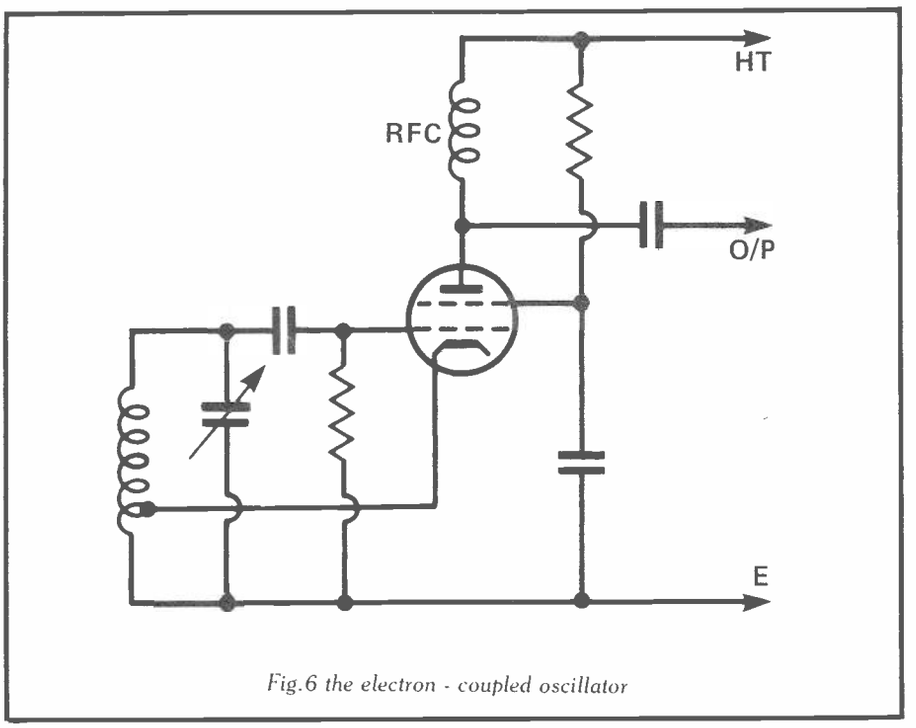


Fig.6 the electron - coupled oscillator

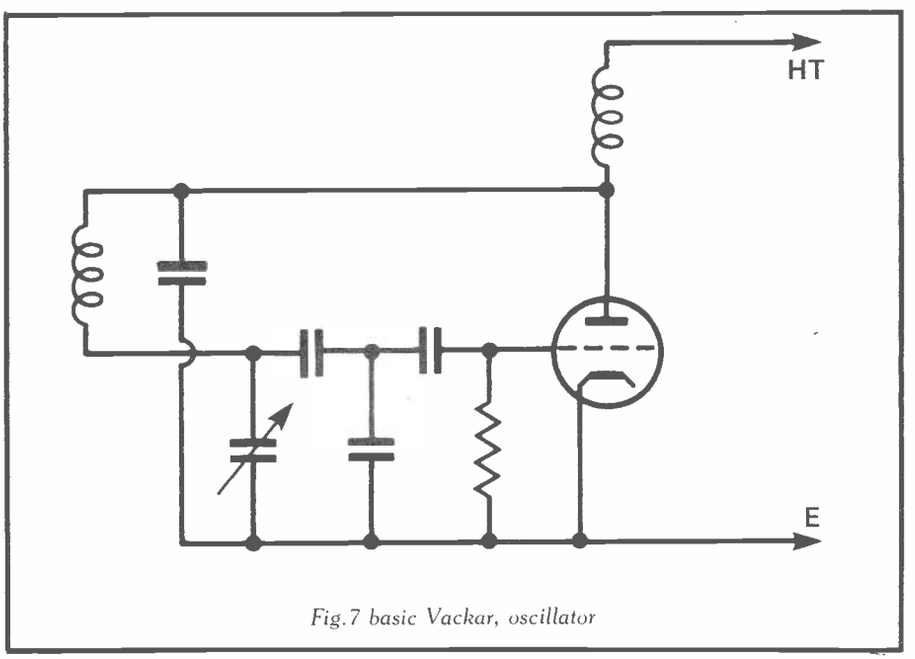


Fig.7 basic Vackar, oscillator

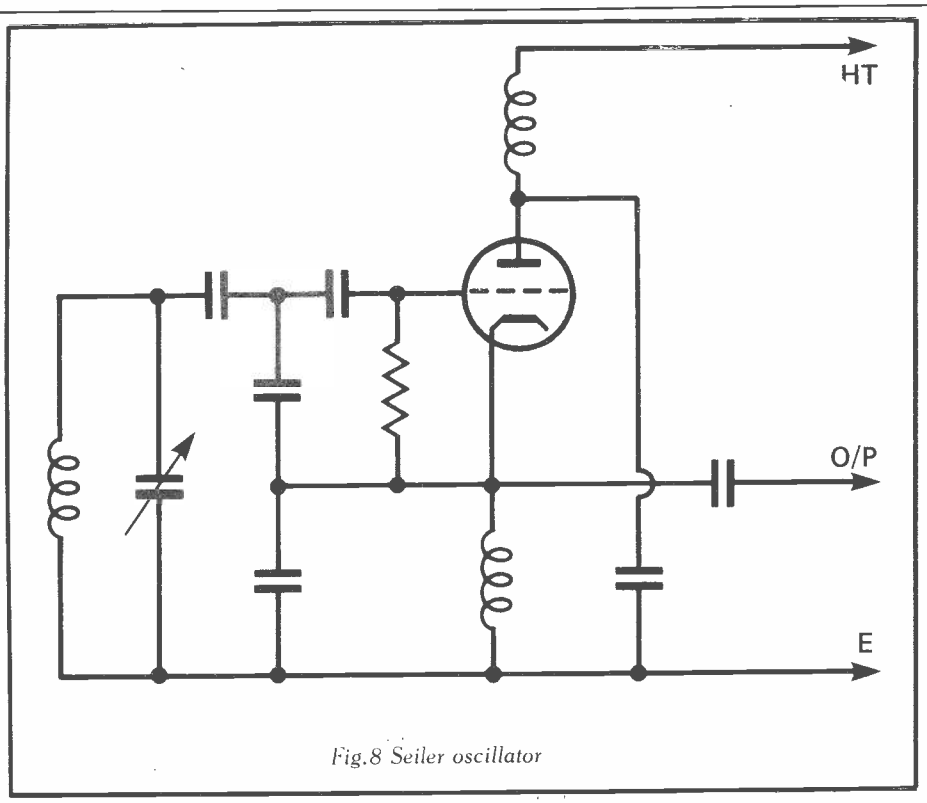


Fig.8 Seiler oscillator

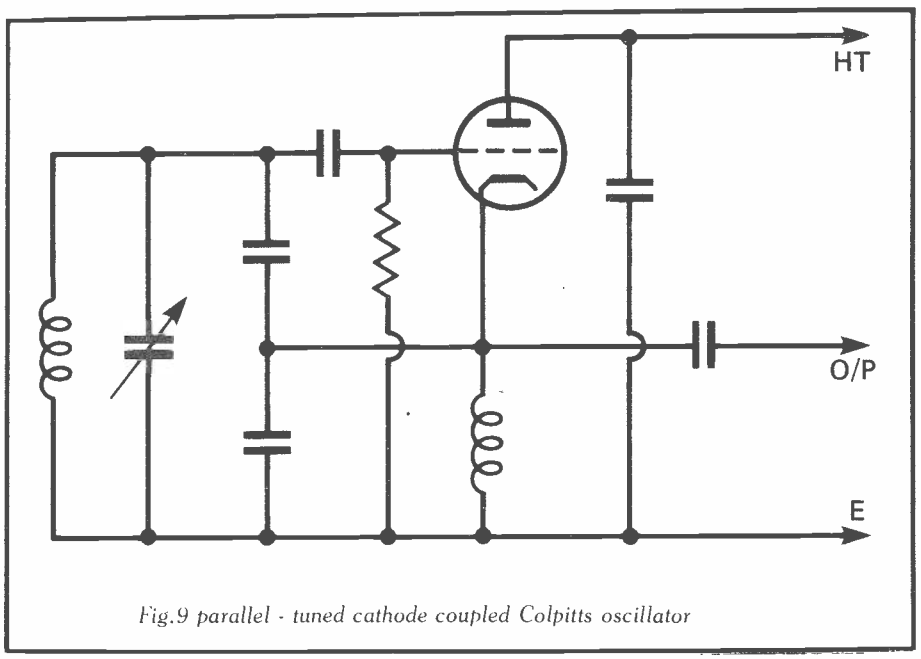


Fig.9 parallel - tuned cathode coupled Colpitts oscillator

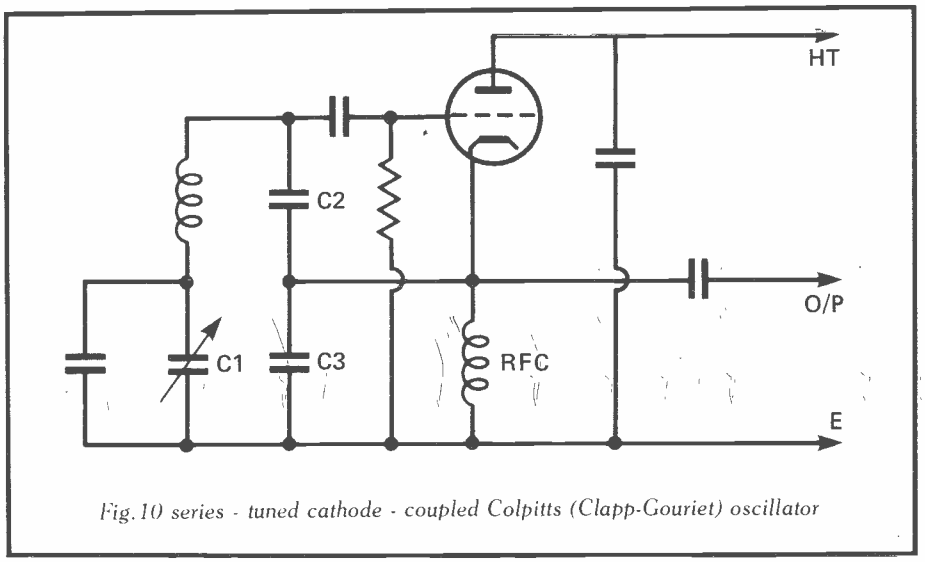


Fig.10 series - tuned cathode - coupled Colpitts (Clapp-Gouriet) oscillator

good as a solid state VFO, can still be more than adequate for amateur operation.

For choice, therefore, I would select a solid state VFO for the 'ultimate' transmitter, but a valve for an economy equipment.

As said before, there are three basic types of oscillators: the Hartley; the Colpitts and the Franklin, all of which have their advantages and disadvantages.

The Franklin circuit gives a highly stable output with an excellent waveform, but the circuit uses two valves, and the output is low, thus requiring a further amplifier stage. It is therefore no good for our economy transmitter. The Hartley oscillator can also be excellent but the positioning of the tap on the coil and the selection of the screen grid voltage are critical, so, on the grounds of ease of construction, this circuit too falls by the wayside.

This leaves only the Colpitts, a long time favourite of the radio amateur fraternity. For constructional convenience I would select the cathode coupled variant of which there are two versions; The parallel tuned and the series tuned which is usually known as the Clapp - Gouriet oscillator.

The frequency determining element of any free running oscillator is the tuned circuit comprising: the coil, the tuning capacitor and any padding capacitors either fixed or variable. Additionally the attachment of the remainder of the circuitry will provide further capacitance.

For maximum stability, the coil should be wound tightly with the thickest possible wire on a low temperature coefficient former such as ceramic. The tuning capacitor should be of high quality with the rotor suspended at both ends and the stators mounted on ceramic pillars. In keeping with this, the fixed padding capacitors should be of good quality and variable padders should be either ceramic or beehive types. Compression trimmers are not suitable.

Ideally, the tuned circuit should have a high L to C ratio. However, the external variable influences on the circuit (such as internal valve or transistor capacitances) may vary quite widely and are frequently the major cause of frequency drift. The circuits are therefore designed, as far as possible, to swamp this by placing a high capacitance between cathode and grid which is directly in opposition to the requirement for a good L/C ratio. In the Clapp-Gouriet variant of this circuit, this problem is overcome in a very neat way. Looking at the circuit diagram, you will see that the tuning capacitor (C1) is in series with the coil but the two high value capacitors (C2,C3) which provide the feedback and also swamp the valve inter-electrode capacitances are across both coil and tuning capacitor. Thus the actual capacitance across the coil is the effect of

Short wave on a shoestring

C1, C2 and C3 in series, which is relatively low and consequently maintains a good L/C ratio in the tuned circuit.

Throughout the construction of any VFO, mechanical rigidity is of utmost importance. All components should be attached to ceramic standoffs or low tagstrips with the shortest possible leads. All wiring should be of the heaviest possible gauge wire in order to minimise vibration and movement.

The output is taken from the cathode in order to minimise loading of the circuit by the succeeding stage.

The output of the Clapp - Gouriet oscillator is quite sufficient to drive a small output valve such as 6V6, 6AQ5, 6BW6 or a 5763 to about ten watts output, but in the interests of better stability and gaining an additional waveband, the inclusion of a buffer/doubler stage is worthwhile. This can be a small HF pentode such as the EF80 or EF91 which will give sufficient drive for the power amplifier in either a buffer or doubler mode.

Pure waveform

The circuit is quite straightforward and apart from the precaution of keeping all wiring to a minimum length, no problems should be encountered. The anode circuit constants can be calculated so that the higher frequency band is tuned around minimum capacitor setting and the lower band around maximum. Alternatively, switching arrangements could be introduced to select separate tuned circuits for each band.

The selection of a suitable valve for the power amplifier depends largely on the output power required. If only 5-10 watts are necessary, almost any of the audio output type valves are suitable. These include 6V6, 6F6, 6AQ5, 6BW6 or, if available, the purpose designed 5763. For higher powers (say 25-50 watts) the choice narrows to the 807, 6146, 5B254M or similar. In the final analysis there is little difference between any of these in drive requirements or RF output, only their physical size varies to any great extent.

The circuit for a single ended PA can be entirely conventional. However, it should be noted that it is *not* a linear amplifier. It should be operated in Class C and will in this way give considerably more RF output for the same DC power requirement - an important consideration when constructing a minimum cost transmitter.

RF drive is fed via a capacitive or inductive coupling from the preceding stage. This will be at sufficient level to drive the grid positively to several milliamps grid current. The return path for this current is via the grid leak which is of several thousand ohms value. A considerable voltage will therefore be developed which biases the PA valve into Class C operation.

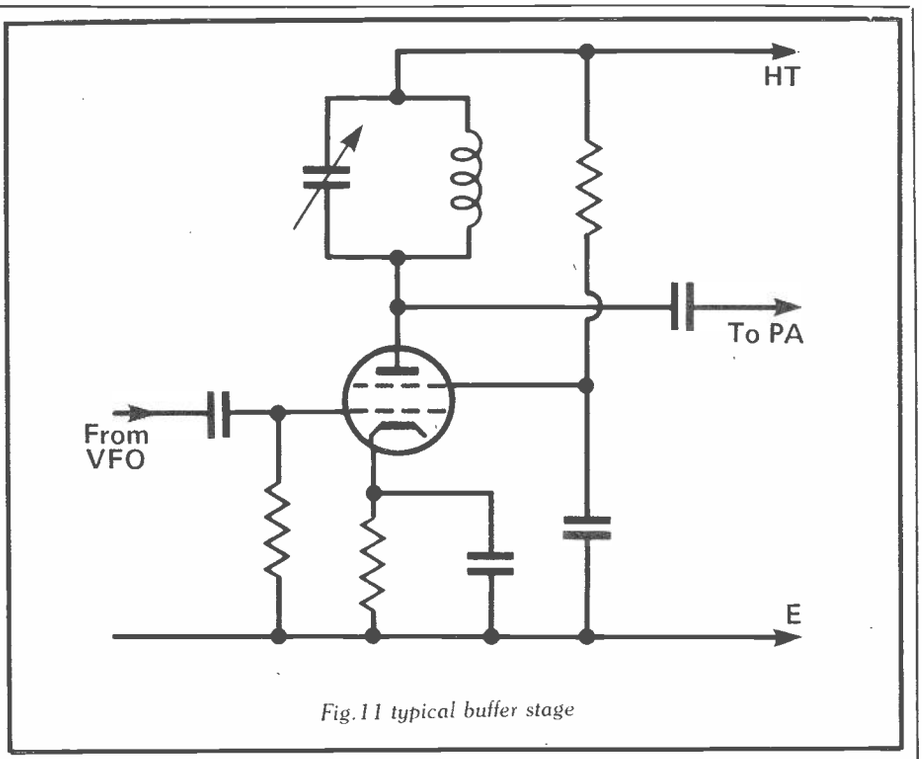


Fig.11 typical buffer stage

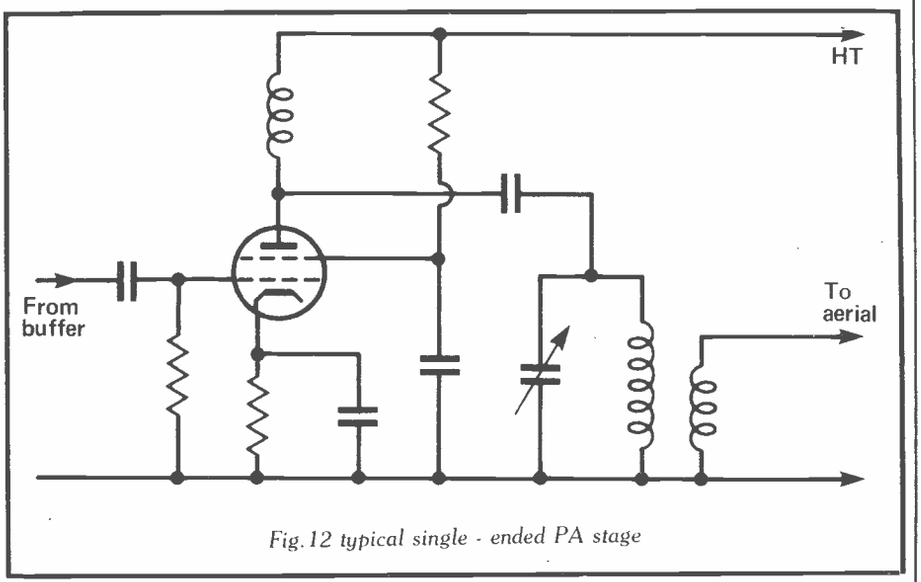


Fig.12 typical single - ended PA stage

The cathode circuit comprises a conventional bias resistor and capacitor, however this is not intended to bias the stage into any particular operating conditions but rather to safeguard the valve when there is no drive by ensuring that at such times the rated anode dissipation is not exceeded.

The output circuit is again conventional. The author prefers a parallel feed in order that the rotor of the tuning capacitor may be earthed for safety reasons. There would seem little point in using a Pi output circuit, for such a simple transmitter should always use an antenna tuner in order to reduce harmonic radiation.

In an Article in the May *Amateur Radio*, I described several power packs constructed from ex-broadcast set transformers. For a low power transmitter using 6V6s or similar in the PA, the simplest design would suffice, but if an 807 etc., is used, the dual output voltage circuit would be preferable.

Throughout this article I have been intentionally vague from time to time. This is because the whole art of construction on a shoestring is to use components which are at hand or can be obtained cheaply. It does not matter which combination of valves is used provided that the end result is satisfactory.

In a future article I will describe a minimum cost transmitter for the lower frequency bands which can be constructed using; octal, B9A or B7G valves or any combination, yet is capable of working the whole of Europe and, under good conditions, the whole world.

Receiving Amateur TV

Amateur television is, without doubt, a part of the hobby that is rapidly growing in popularity. It isn't only established radio amateurs who are interested in it, but also those who are 'into' radio and television generally. In this article, John Wood G3YQC describes several simple ways of receiving amateur TV pictures.

Imagine the thrill of tuning into a private TV station based in someone's radio shack or bedroom. OK, the pictures will probably lack the professional polish that we are used to, and in many instances will be relatively weak in signal strength. But imagine being able to see the chap at the other end, to see his shack and have a conducted tour of the station and its equipment. Sometimes the cameras are taken outside and you can see the operator's house and garden as well. Video tapes are often shown covering many subjects such as holidays, expeditions, radio rallies and shows, demonstrations and displays; local events etc. The range of subjects is limitless, and all are made more interesting by, knowing that they are solely produced by amateurs. It's a far cry from 'soap opera', but I guarantee that receiving it will give you more lasting pleasure, and a sense of technical achievement.

Standards

Amateur television (ATV) is primarily in the 70cm amateur band, the vision carrier frequencies usually lying between 435 and 437MHz. As a general rule, TV amateurs both in this country and on the Continent adopt the system used by their countries' public broadcasting networks. In the UK, 625-line System 'I' standards are used, which is rather convenient since it means that we can use domestic TV sets without having to modify them. Transmissions may be in either colour or black and white but, owing to the limited amount of band space available, intercarrier sound is not often used on 70cm. Don't despair though, because there is an international ATV talkback and calling channel in the amateur 2-metre band on 144.750MHz, on which the sound may be heard. The sound is mainly FM, although SSB is also used especially on 'long haul' contacts.Since 144.750MHz is a calling channel, it is normal practice for stations to move to another frequency once contact has been established. Other frequencies are normally in multiples of 25kHz from the calling channel and are mostly grouped around it.

The usual practice is to monitor the calling channel as much as possible and wait for ATV stations to come on. Once heard, you can 'beam up' in their direction in order to try for the vision signals. If you are licensed then of course you can contact the TV station yourself, who can then make sure that he is beaming in your direction.

Equipment

There are two main points to remember when considering the reception of ATV pictures.

1. Unless the station is near to you, amateur transmissions will be much weaker than broadcast ones. Great care must be taken with the receiving equipment to ensure minimum signal loss and maximum sensitivity.

2. Amateur contacts (QSOs) are essentially point-to-point since the radio amateur is not permitted to make broadcasts. Therefore only directional aerials are used. To give the best chance of receiving ATV signals you should be equipped with a directional, rotatable aerial.

In order to meet the above requirements it is desirable to install an aerial specifically designed for 70cm operation. Such an aerial should have good forward gain and sufficient bandwidth to accommodate a wideband vision signal (at least 8MHz). Two popular aerials used widely by ATVers are the J-Beam 18-element Parabeam, and the 48 or 88-element Multibeams. Many other types are available, some of which are suitable. Always go for the one with best forward gain.

The aerial should be sited as high as possible and as far away from other objects (roofs, trees, buildings, other aerials etc) as is practicable. This is to ensure that you receive the strongest possible signals, with the minimum chance of 'ghosting' caused by reflections. It is tempting - especially if you are a TV DXer - to try and use a domestic wideband UHF aerial in order

that it may be used for broadcast reception as well. Such aerials, although often specified to cover 70cm, are of necessity a compromise since they are designed for general wideband operation, and you will find that the forward gain will be very low at 70cm (often much less than 10dBd). To give the best chance of receiving ATV a custom aerial is a must. All ATV aerials are mounted horizontally polarised.

Feeders

The coaxial feeder is part of the system which is often given very little thought, even though it is here that much of the incoming signal can be lost. Don't forget that just 3dB (not much in coax at 440MHz) will reduce the received signal power by fifty percent. Greater loss will give even weaker signals. It is useless to install a 'super sensitive - low noise' receiver in the shack when most of the signal has disappeared in the feeder before it even reaches the receiver. Installing a preamplifier, or the converter itself, at the mast head will undoubtedly overcome the problem, but for practical purposes it is better to install good quality coax at the outset.

As a general rule the larger the cable diameter the better the performance at high frequencies. Although this is not always the case it can be used as a guide. UR67 50-ohm cable is very popular and has been around for a long time. A new one on the market is Pope H100. This is a very low-loss modern cable which performs well up to over 2GHz. What's more, it doesn't cost too much. Both of these cables are about 10mm diameter, so you need to use 'N' type connectors (which are the best), or series UHF (PL259) with somewhat reduced performance.

As with aerials, domestic 'low-loss' coaxial cable is not to be recommended. Remember that it is designed to carry very high level signals to the TV set, so it doesn't matter if a few dB are lost. In amateur TV one is dealing with very much weaker signals, therefore we need every dB we can get.

Now the business end. There are several ways in which you can provide the necessary equipment needed to receive 70cm ATV pictures, so I will deal with each method individually.

The domestic TV

Many domestic TV sets, particularly the portables, will tune directly to the 70cm band (around channel 17) as will many video recorders without modification. However (there's always a snag!) the sensitivity at this extreme end of the receiver's tuning range is likely to be poor, mainly due to a falloff in tuner gain. A simple way to boost the signal is to add a good quality, low-noise 70cm preamplifier between the aerial feeder and the set. This will improve the performance greatly and make a good receive system.

The modified tuner

In many TV sets it is possible to modify the tuner to enable coverage of the 70cm band. In general the modern 'varicap' tuners are the most suitable for this purpose. The Mullard ELC1043 series is popular, although some of the later versions (suffix 05 and 06) may not take kindly to modification and some experimentation may be needed.

Fig.1 shows the ELC1043 tuner's internal layout. There are two ways of changing the operating range; the first is quite simple. Since we need to shift the tuner down in frequency, it follows that if the tuned lines were made longer, then their resonant frequency would decrease. The question here is can we lengthen them enough? Well, tuners vary somewhat in their range but in the majority of cases the following is all that is needed: Refer to Fig.1a and locate the mixer and oscillator lines (marked with an 'x'). Locate the ends of these lines where they pass through the printed circuit board. Using a small soldering iron melt the solder and withdraw the line at each end as far as possible out of the board whilst still maintaining a good soldered joint. It should be found that the total extra length thus gained should be between one and three millimetres. Both mixer and oscillator lines should be lengthened in this way but, unless you have access to suitable test equipment in order to monitor tuner performance, the two RF amplifiers should remain untouched.

The object of the second modification technique is to reduce the resonant frequency by adding capacitance to the tuned lines. Fig. 1b shows the underside of the tuner. Locate the ceramic ship

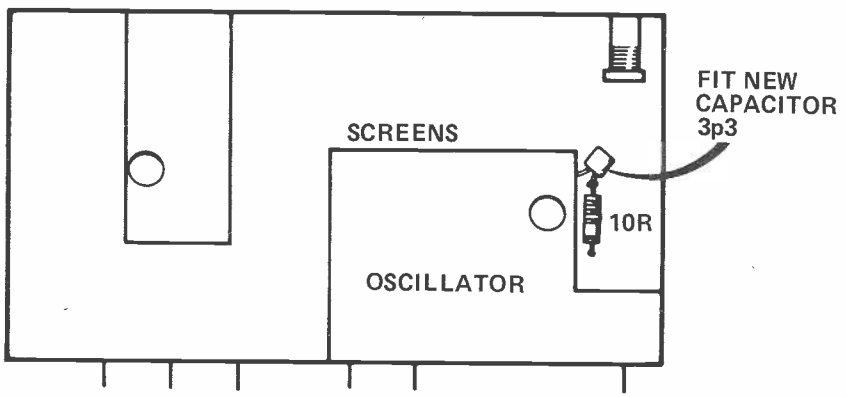


Fig. 2: modification to U321 tuner for 70cm coverage

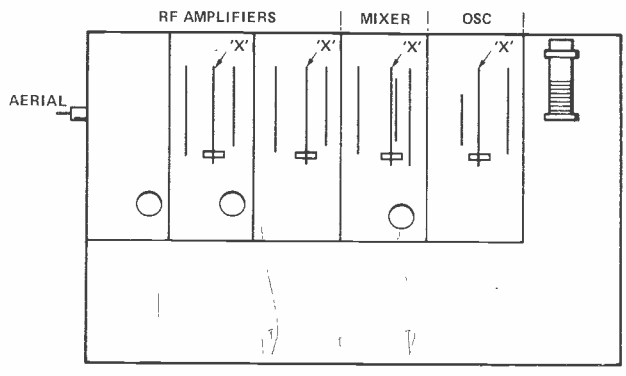


Fig. 1A: top view of ELC1043 tuner

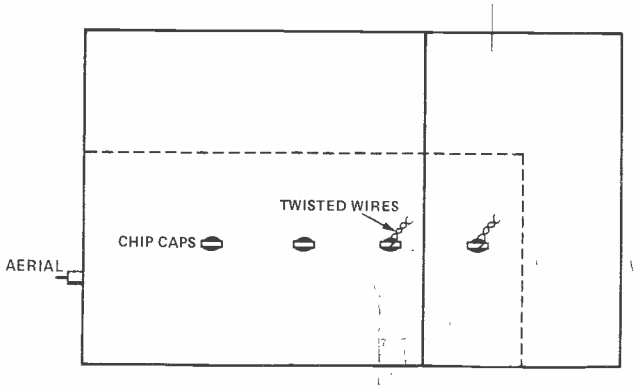


Fig. 1B: bottom view of ELC1043

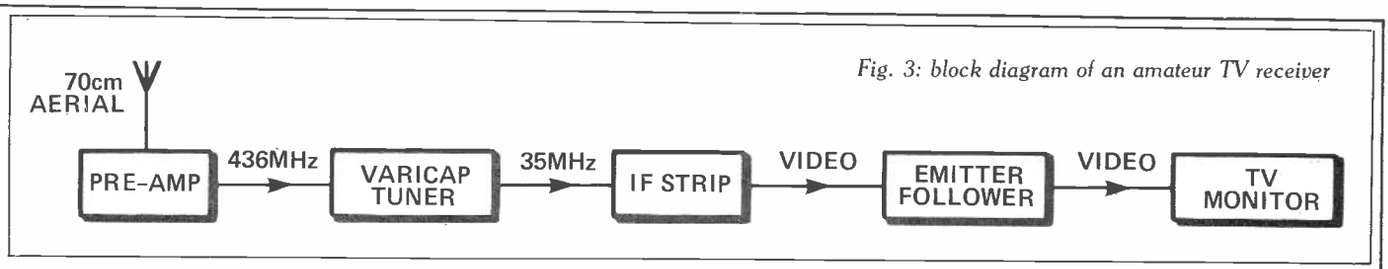


Fig. 3: block diagram of an amateur TV receiver

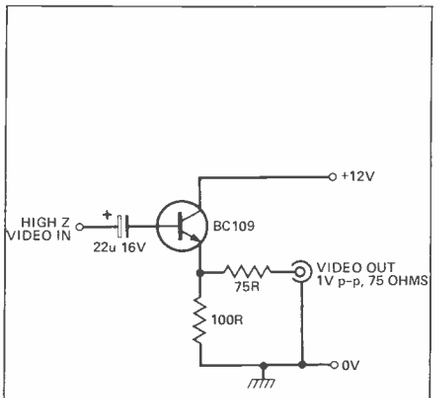


Fig. 4: video emitter follower

capacitors at the ends of the oscillator and mixer tuned lines. These protrude through the print side of the board. Take two pieces of thin, insulated hookup wire about 20mm long and solder one to each side of the oscillator and mixer chip capacitors. Set the tuning voltage on pin 3 to about 0.3 volts and, with the aid of a strong 70cm signal, twist together the oscillator wires a little at a time until the signal is tuned in. In a similar manner adjust the wires on the mixer for best signal. It is important to use as little extra capacitance as possible since too much may stop the oscillator.

A more recent varicap tuner is the U321. It is widely used in domestic TVs. The U321 is much easier to modify, although some units have been found to cover 70cm without modification.

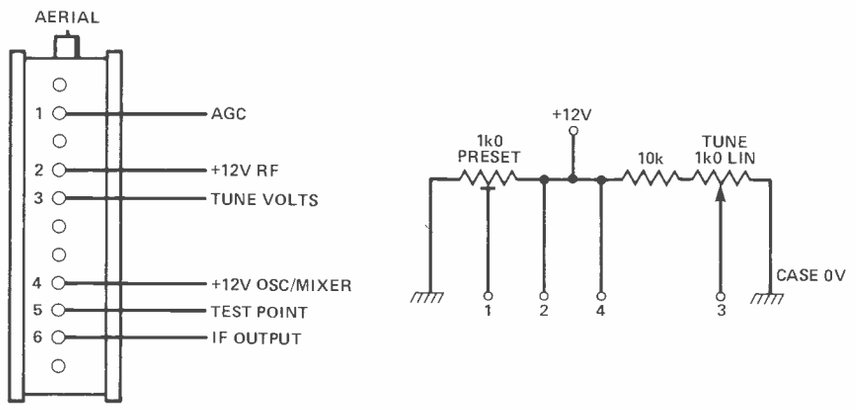


Fig. 5: ELC1043 pin connections and wiring

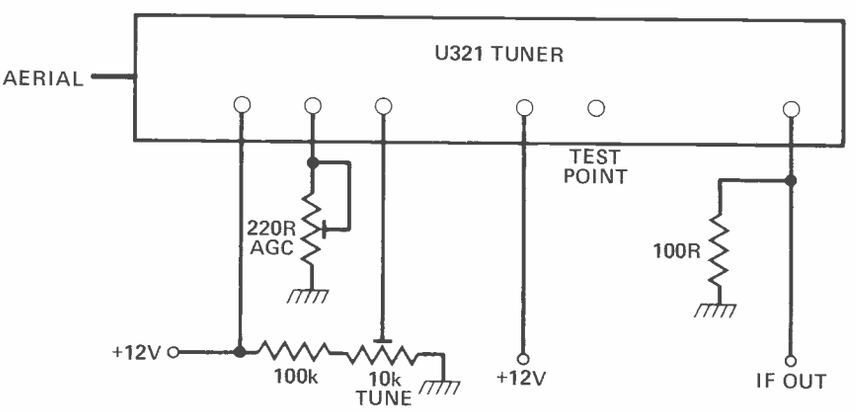


Fig. 6: U321 wiring for 70cm operation

Fig.2 shows the top of the printed circuit board. The modification is simply to wire a sub-miniature plate-ceramic capacitor of around 3.3pF from the 10-ohm resistor indicated to ground (adjacent metal screen). This should bring the tuner frequency down enough to enable the unit to tune below 70cm.

The ELC2000 and ELC2060 multi-band DX-TV tuners often tune 70 without modification but, as with all domestic tuners, a good 70cm pre-amplifier up front will improve reception dramatically.

It is quite possible to use these tuners external to a TV set, in which case a separate TV IF strip will be needed. Many such surplus IF strips are available quite cheaply from those retailers who supply varicap tuners.

Fig.3 shows the block diagram of such a 'custom' TV receiver. Many IF strips deliver around one volt of video, which is ideal. However, the output impedance is often around 1000ohms, making it unsuitable for feeding a video monitor, which requires 1V peak-to-peak across 75ohms. If this is the case then a simple emitter follower such as that shown in Fig 4 will be needed between the IF and monitor.

Fig.5 shows the ELC1043 type tuner's pin connections. A circuit for wiring up the unit is also shown. The 1k potentiometer is the main tuning control and should, if possible, be mounted on a reduction drive. The tuning voltage range in this application is limited to between zero and just over one volt. In practice 70cm appears with around 0.3V on pin 3.

Fig.6 shows a similar arrangement for the U321 tuner.

The up-converter

Probably the most effective way of receiving ATV is to use a custom built up-converter. This, as its name implies, converts the incoming 70cm signal to a frequency within the UHF TV broadcast band. Such converters are available commercially from specialist manufactuers such as Microwave Modules, Fortop Ltd and Wood & Douglas, at modest cost.

It is however quite possible to build your own converter using a minimum amount of equipment and expertise. A very straightforward converter, originally designed by John Hopkins G4DYP, has been used by ATVers for some years

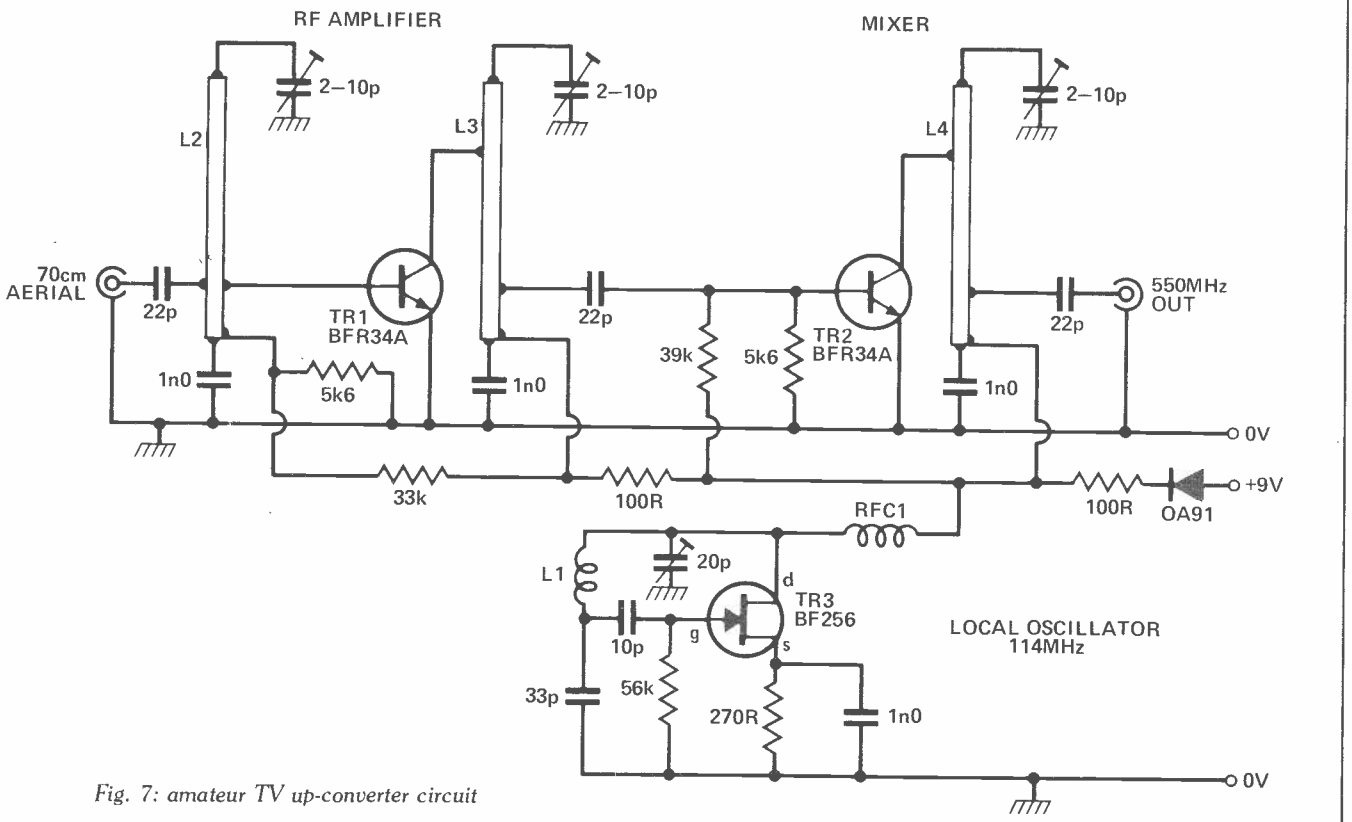


Fig. 7: amateur TV up-converter circuit

and, although its performance is perhaps not quite up to the best commercial designs, it is nevertheless a very sensitive converter which will not let much escape it on the air.

The unit is designed to convert amateur television signals to the UHF TV broadcast band thus enabling any domestic TV set to be used for ATV reception without modification. The converter is connected directly to the TV aerial socket. The design has been kept simple and uses a minimum number of components to enable more inexperienced constructors to build and adjust the unit without needing a printed circuit board (although one is available) or elaborate test equipment.

Fig.7 shows the complete circuit diagram. The 70cm aerial is coupled to the input tuned line via a 22pF capacitor. The line is tuned to 70cm by a 2-10pF trimmer at one end. A second tuned circuit is used at the amplifier output to further improve the selectivity of the converter, and to provide a low-impedance feed to the mixer. The mixer's collector circuit is tuner to the chosen IF. Although the tuned line L4 is the same length as L2 and L3, there is sufficient range on the trimmer capacitor to accommodate the higher frequency.

The local oscillator employs a standard L/C circuit tunable over an approximate range of 100 to 150MHz. Other frequencies could be used by varying the coil L1 and/or the 2-20pF trimmer. Local oscillator injection is somewhat unconventional in that it relies on stray coupling into the mixer. This is achieved by the proximity of the components, especially L1 and for this

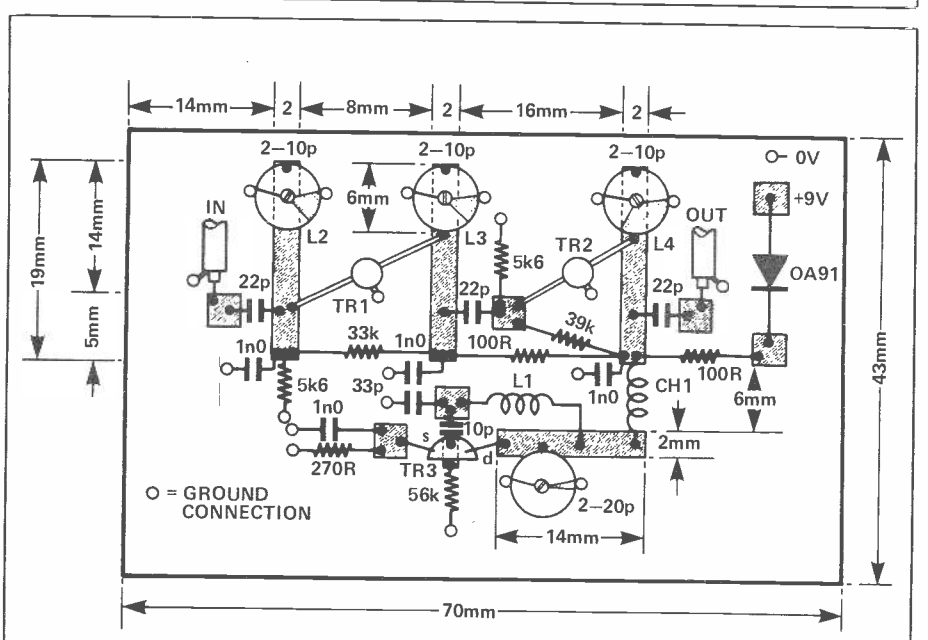


Fig. 8 converter printed circuit layout

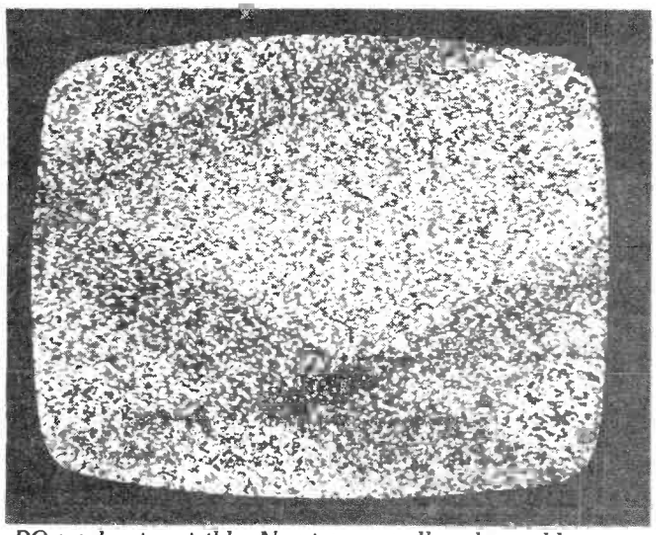
reason the layout shown in Fig.8 should be closely followed.

All capacitors should be good quality small disc or plate ceramics and resistors should be 0.3W or smaller. Trimmer capacitors may be good quality film dielectric or ceramic types. Choke RFC1 is made by close winding as many turns of 34swg enamelled copper wire as will fit on a single layer wound onto a 0.3W 1M resistor. L1 is 6 turns of 20swg enamelled copper (wound with the aid of a 5mm drill), 10mm long and self-supporting. If difficulty is experienced in obtaining BFR34A transistors then a BFR90 or BFR91 should prove a suitable alternative.

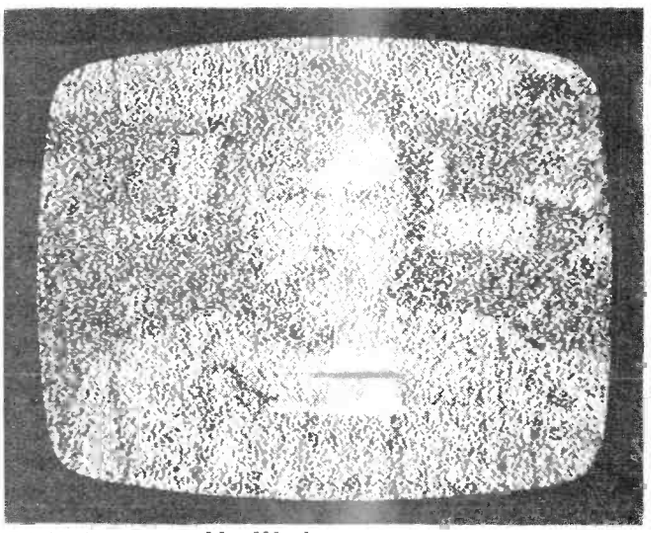
Construction

A printed circuit board is available from the British Amateur Television Club's Members Services Dept. (£2.55 inc. postage). However, if you don't wish to go to this expense the following technique may be adopted.

Take a piece of single-sided fibreglass copper laminate board 70mm x 43mm and place it copper side uppermost. Now cut out the pieces indicated by the shaded areas in Fig.8 from another piece of similar board, using a small saw. Glue these pieces, copper side up, to the main board so that the copper is insulated from



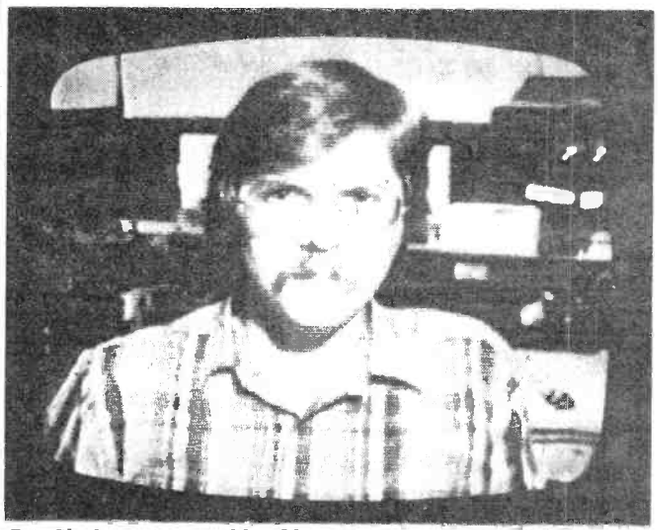
PO total noise visible. No picture at all or detectable video syncs.



P1 High noise visible. Weak picture

P2 High noise visible. Fair picture. Fair detail.

P3 Noise visible. Strong picture. Recognizable detail.



P4 Slight noise visible. Very strong picture. Good detail.

P5 No noise visible. Closed circuit picture. Excellent detail.

the earth plane (position as shown in Fig.8). The small pads are approximately 6mm square. Their actual positions on the board are not too critical but should be close to those in the illustration. The layout diagram should be closely followed, and for that reason key dimensions are also shown. Those using the printed board should treat Fig.8 as a component location plan.

The above technique of printed circuit construction may of course be used for other projects. It is particularly useful where prototypes are being made prior to a final printed board design.

Above: Reporting chart showing levels of video noise for PO to P5, reproduced from A5 ATV Magazine, courtesy of Mike Stone WBOQCD, QCD Publications, Iowa.

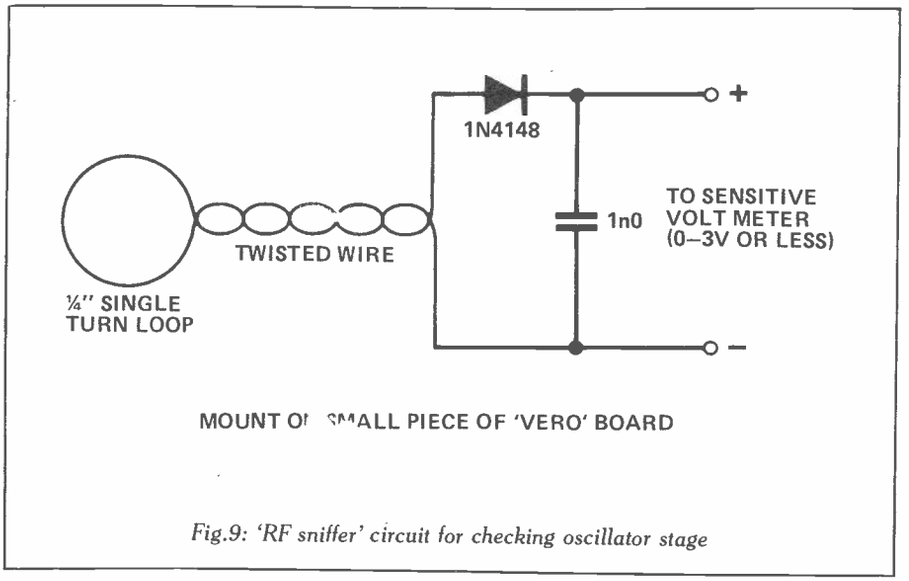
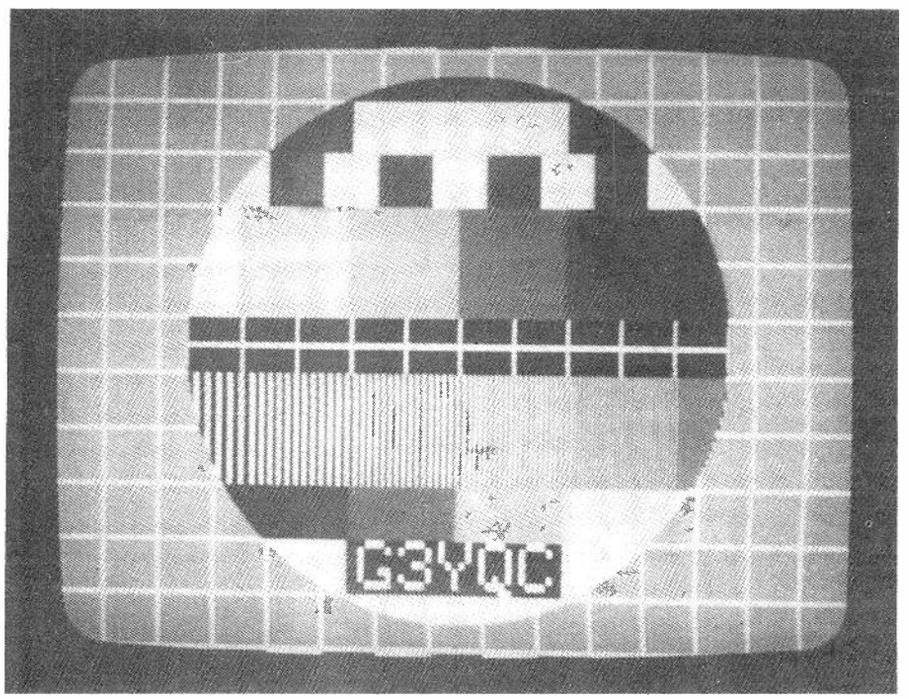
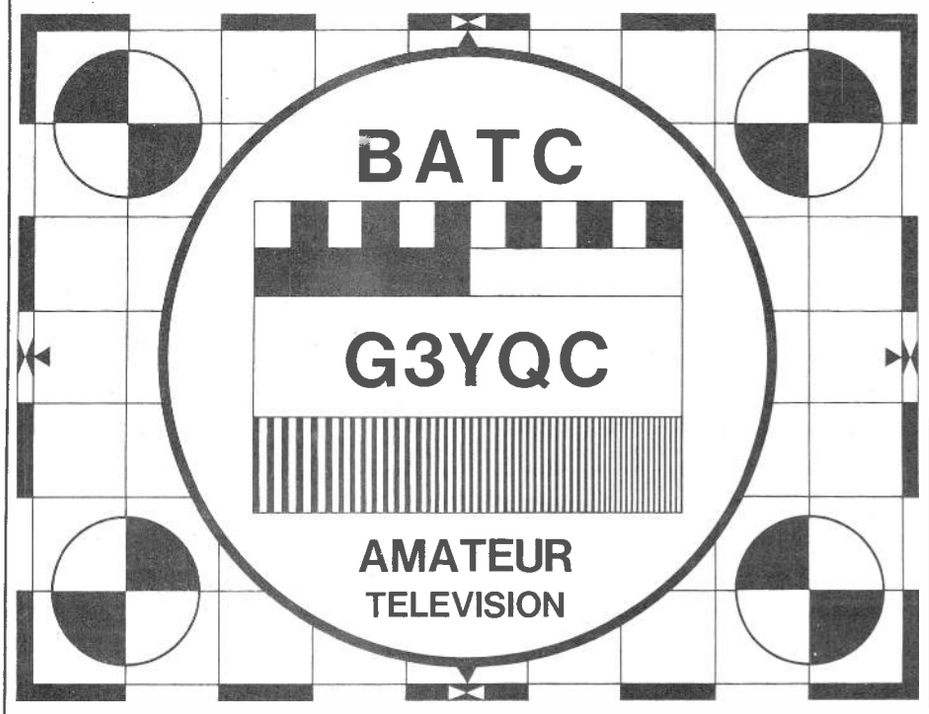


Fig.9: 'RF sniffer' circuit for checking oscillator stage





Alignment

First check that the oscillator stage is working correctly and that it will tune to the required frequency. In order to check for oscillation the 'RF sniffer' shown in Fig.9 may be used. Connect it to a suitable volt or current meter and bring the loop close to L1. Oscillation will be indicated by a reading on the meter scale.

Connect the converter output to the aerial socket of a domestic TV set adjusted to a convenient free channel around number 30. Switch on the unit and adjust the oscillator and mixer trimmers for maximum noise on the screen. Connect a signal generator to the 70cm input (a local amateur TV or 70cm sound signal may be used or, if neither of these are available, the third harmonic of a 2 metre transmission could be used). Carefully tune the oscillator trimmer to receive the signal, finally peak the RF amplifier and mixer trimmers for maximum signal - indicated by minimum noise (snow) on the picture.

A small improvement in performance may be realised by preceding this converter with a low-noise preamplifier.

The unit should be housed in a suitable screened box fitted with good quality coaxial connectors (N or BNC).

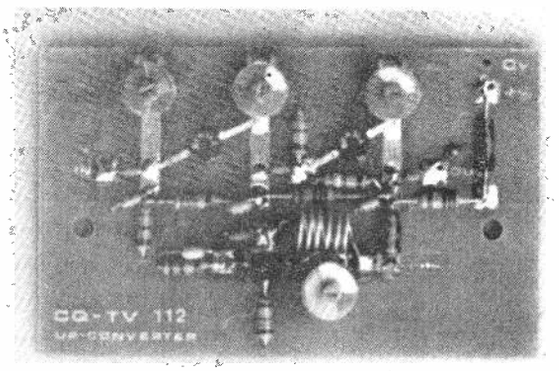
24 centimetres

As previously stated ATV is mainly found on the 70cm amateur band. However television also has allocations in the 24/23cm band (1240-1320MHz) where, so far, there are not so many active amateurs. 24cm is very exciting since it enables full intercarrier sound transmissions and the use of FM rather than the usual AM for vision, with all the advantages inherent in that system. At the time of writing (November 1983) licences for five amateur TV repeaters are expected to be issued at any time. These repeaters - the first in this country - will be located in Bath, Leicester, Luton (Dunstable Downs), Stoke-on-Trent and Worthing in Sussex, and will provide a boost to the use of 1.3GHz for ATV as well as an exicting technical challenge.

Further observations

Under good propogation ('lift') conditions it is quite possible to receive pictures from the Continent at very good strengths, although you should watch out for the French amateurs whose video will normally be inverted causing a negative, unlocked picture on the screen. If you wish to resolve these pictures the video signal should be inverted in your TV receiver at a convenient place after the demodulator. If possible it is a good idea to incorporate a switch so that you can change between the two standards.

It is difficult to estimate the distances over which you can expect to receive



Right: the completed up-converter board. Below left: electronic and optical test patterns used at G3YQC.

amateur TV since there are so many factors governing the system performance: receive system, aerial height, location, terrain between you and the transmitting station, propagation conditions etc. As a guide, taking a hypothetical 'typical' situation you could expect to obtain results with stations up to around 50 to 100 miles distant. Pictures from the more distant stations will probably be very weak, but it is all part of the fun trying to gain a positive station identification of a weak picture.

If you wish to send reports of reception to stations seen you will need to be able to define the strength and quality of the picture. Many years ago the BATC devised a points system based on a 1 to 5 scale, much like signal strength reporting on sound. The illustration of Fig 10 shows a typical reporting chart. The photographs show whole picture points. In practice, pictures will often fall between two steps, in which case half-point steps may be used. These half-steps are not illustrated but with a little practice may be easily judged.

Due to the photo reproduction processes involved, some of the differences in picture noise may not appear too evident (for example, little difference may be noticed between P4 and P5). In this case an approximate estimation should be made. Such a reporting procedure can be useful for other TV activities such as DX-TV.

When looking for ATV stations don't expect there to be lots on the band all the time. There are probably no more than a thousand active TVers spread throughout the whole of the UK, and they don't all come on at the same time! It is difficult to say where the pockets of activity are since some will invariably be left out. However, in general, high population areas such as London and the Home Counties, Birmingham and most areas of the Midlands, much of Southern England and some in the North will be found to be most active.

There will probably be some TV amateurs within range of your location and if you live in a 'hole' or a valley then perhaps some portable equipment could be put together to enable you to work from the local high spot.

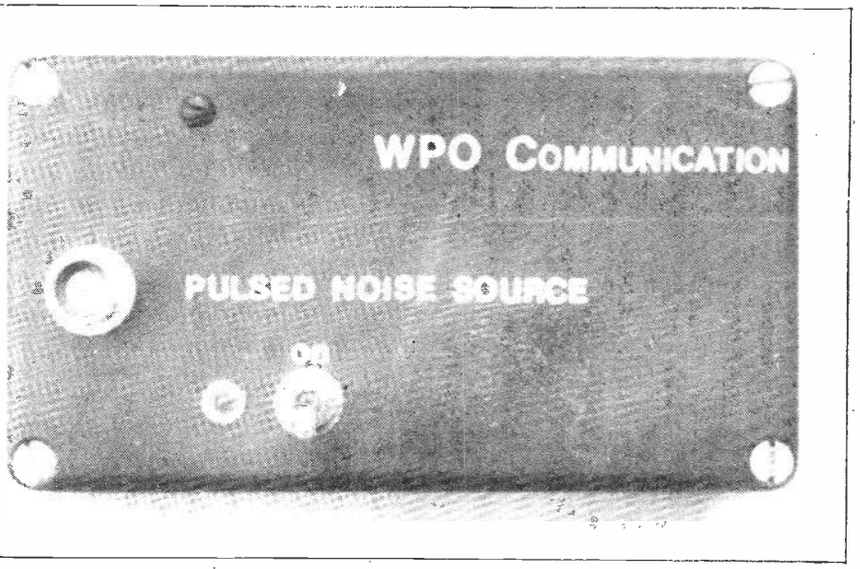
Tropospheric band openings as well as TV contests are good times to be on, since you can be sure that many stations are sending video.

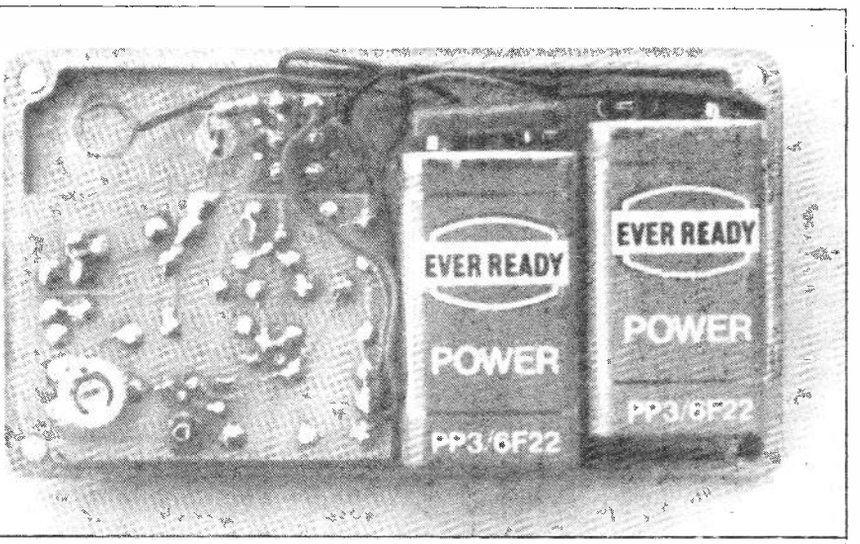
ATV is not a hobby for those who want lots of action all the time - unless, that is, you live in a high activity area. Most operators run an ATV setup alongside their other communication equipment and this is probably the best approach.

The British Amateur Television Club caters for amateur TV enthusiasts, and it publishes a quarterly magazine *CQ-TV* among other things. For more details of the BATC, send an SAE to the Membership Secretary, BATC, 13 Church Street, Gainsborough, Lincs.

Next month Andrew Emmerson G8PTH will be describing the amateur TV 'growth band', namely 1240MHz (24cm).

Pulsed noise generator





Built a new VHF preamp recently? Or tried modifying an old Pye box for two metres? If so, chances are that the front end is aligned for maximum gain. However, this means that it almost certainly isn't set up for minimum noise.

A noise figure meter is of course way beyond most amateurs' spending power. But a simple pulsed noise generator, such as the one described here by Tony Bailey G3WPO and Chris Gaston G4EEI, makes it possible to align VHF and UHF front-ends for best noise figure using an audio tone.

The noise generator described here is good up to 70cm, and kits and ready made printed circuit boards are available.

Circuit

The standard way of using a manual noise figure meter is to calibrate the system and then apply some excess noise from a generator. The effect of this additional noise is then noted, and an adjustment made to the amplifier. The process is then repeated until the best ratio of original noise to excess noise is obtained.

This circuit automates this process to some extent and has the advantage of not needing any form of detector other than your ear, and a receiver system which the converter or amplifier under test is attached to.

The noise is generated by a Zener diode (ZD1), with a potential of 18V derived from dry batteries applied to its anode via Q3. VR1 allows adjustment for maximum noise output from the actual diode in use. (Zeners are useful wideband noise sources without going to the expense of special diodes, but each has to be set up individually.)

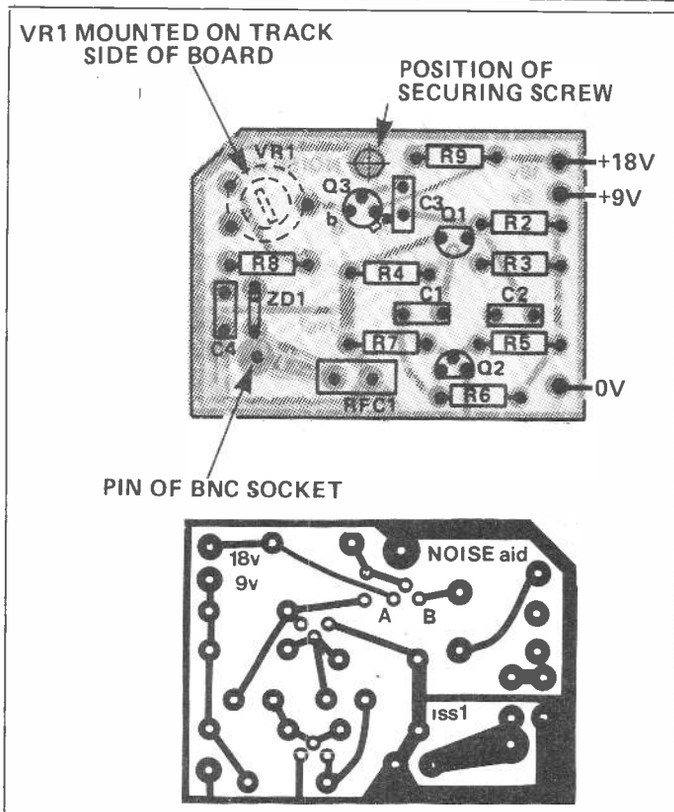
Having got our noise output, we need to do something which will help automate the process of calibration. This is achieved by turning the noise source on and off at an audio rate, in this case about 700Hz, using the multivibrator Q1/Q2.

As we are looking for the best noise figure, or the point where the ratio of noise + excess noise to noise is highest, then adjusting the amplifier under test for the greatest audio output from the receiver speaker (a 700Hz audio tone) will achieve this requirement. Put another way, the louder the 700Hz, the more the difference in levels between the ordinary noise and the increased noise level.

The 700Hz waveform from the collector of Q2 is used to switch Q3 on and off at this rate, thus pulsing the noise output at 700Hz by switching the Zener voltage on and off.

There is one problem however. Because we are looking for noise output the unit needs an AM detector in the receiver in order to detect and rectify the noise. An FM detector will not work as you will not hear the noise, and an SSB receiver is no good either as a product detector also fails to detect the noise output.

Needless to say there are ways round this. The first is to use an oscilloscope coupled to the output of the IF amplifier, but ahead of the detector, and observe the pulsed noise output on this, adjusting for maximum vertical deflection. Some receivers do have scope outputs already on them, but it should not be a difficult job



R1	4k7
R2, 6	470R
R3, 5	22k
R4, 7	10k
R8	390R
R9	47R
All 5% carbon film 0.25W	
VR1	4k7 horizontal preset
C1, 2	0.22uF polyester or mylar
C3	1uF tantalum bead 25V
C4	10n ceramic disc
Q1, 2	BC238 or BC239
Q3	BCY71
ZD1	6.2V zener diode 400mW
RFC1	10uH RF Choke Toko type 7BA (marked 100)
LED	miniature red LED
S1	2 pole c/o miniature toggle
Batteries	2 x PP3 with snap connectors
Case	RS Diecast Box Type 509-939

Printed circuit layout and components list

to find the right point using the circuit diagram. Alternatively, a simple AM detector using a germanium diode can be made, and coupled to the IF amplifier Its output is then monitored on a sensitive millivoltmeter, or could even be coupled back into the AF amplifier in the receiver itself, with the normal volume control turned down.

The circuit requires +18V for the noise source (to develop sufficient noise at the higher frequencies) and +9V for the rest of the circuit. This is derived from two PP3 batteries, switched via S1. Providing the unit is switched off when not in use, the battery will last a long time.

Construction

The whole of the circuit is built on one small single sided board. The PCB is available if you don't want to make your own, or it can be fabricated by any of the normal methods.

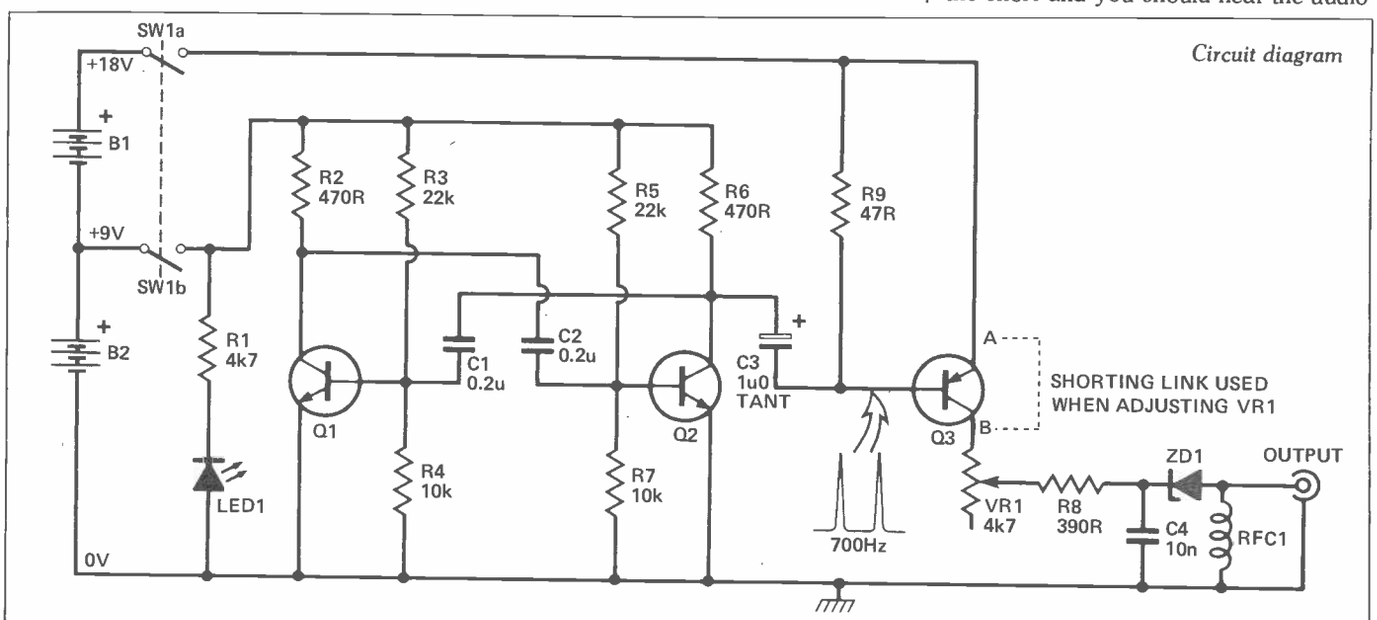
There is nothing unusual about the construction, except that the preset RV1 is mounted on the underside of the board. Thus it is accessible when the board is mounted in its case, so this should be put on last. The rest of the components are simply soldered into place as shown in the photo, keeping the components close to the board. The leads around R8/C4 and the Zener diode must be kept as short as possible for best performance.

Make sure that the orientation of the transistor cases agrees with the layout, and that ZD1 is the right way round.

Alignment

Before mounting the unit into a case (it must be cased) you need to adjust the diode current for maximum noise output. To do this, short out point A and B on the board using a piece of wire, connect up the circuit temporarily following the diagrams and turn VR1 fully anticlockwise. Switch on, and monitor the output at the highest frequency you will be using, using one of the methods described earlier. Then adjust VR1 for maximum noise output at the receiver.

There won't be any audio tone at this stage as the switch (Q3) has been disabled by the temporary short from A to B. When you have done this, remove the short and you should hear the audio



Circuit diagram

Pulsed noise generator

tone. If you don't, then something is wrong with the circuit around Q1 and Q2, most likely a component wrongly inserted, or possibly a short somewhere on the PCB.

Casing the unit

The completed PCB should be mounted in a metal case for good screening. The drawings and photographs show how to do this using a diecast box (RS type 509-939). The PCB has been made in such a way that the BNC output connector attaches to a hole in the PCB when mounted as shown. When you have drilled all the holes in the lid, and possibly painted and lettered the case if you want a good appearance, screw the BNC output socket into place. Then insert a 20mm long 6BA bolt from the top of the lid where shown, and fix in place with a nut. Then screw on another nut, with a lockwasher on top of it, down the bolt. Push the PCB into place upside down (ie. components towards the underside of the lid - you may have to bend C1 and C2 over slightly) until the tip of the BNC connector is through the board. Then screw up the loose nut until it contacts the PCB and level the whole thing up. Solder the connector in place, and add another nut and lockwasher to finish off.

Mount the switch in position and connect up as shown. The LED is mounted in a small bezel on the lid, with the negative (short) lead soldered directly to the PCB earth foil nearby, and the positive (long lead) via R1 to the switch. One end of R1 should be clipped off short and soldered directly to the switch lug, the other can then be bent to meet the LED lead, and the two soldered together.

The batteries fit next to the PCB on the lid, and are held in place with double sided adhesive tape. Cut the connecting wires just long enough to make the connections.

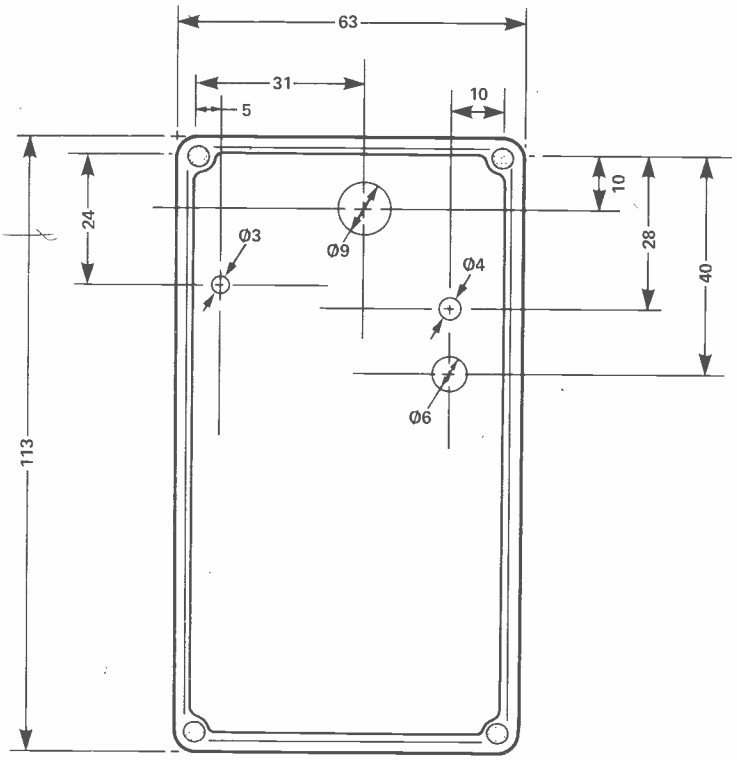
Using the unit

You should now be able to sort out your preamps with this test unit. If you find that the noise output is too high for your receiver to cope with, then all you need to do is adjust RV1 for a comfortable level. The actual level will depend on the characteristics of the Zener diode in use - and possibly in some instances you may not get enought output in which case the diode will have to be selected from a batch. The unit should certainly work up to 2 metres, and usually at 70cm although the noise output will be down. Again, selection of the diode should help.

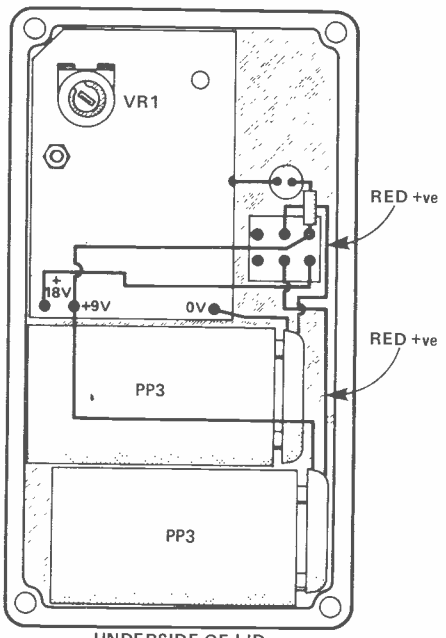
The output impedance is reasonably close to 50 ohms, but purists may want to use a pad on the output to ensure an accurate match. This is not, however, essential.

A complete kit of parts for the above project, including drilled PCB and all parts in the component lists except batteries is available from WPO Communications for £12.95 inc VAT and P&P. The PCB alone costs £1.90 inc.

Drilling and mounting details for the diecast box.



DRILLING DETAILS
DIE CAST BOX LID UNDERSIDE



UNDERSIDE OF LID,
SHOWING WIRING AND POSITION
OF COMPONENTS

NOTE: 2 x PP3 BATTERY, SECURED TO LID WITH
DOUBLE SIDED ADHESIVE TAPE RS No. 554–844

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NEW SERIES: 24cm amateur TV

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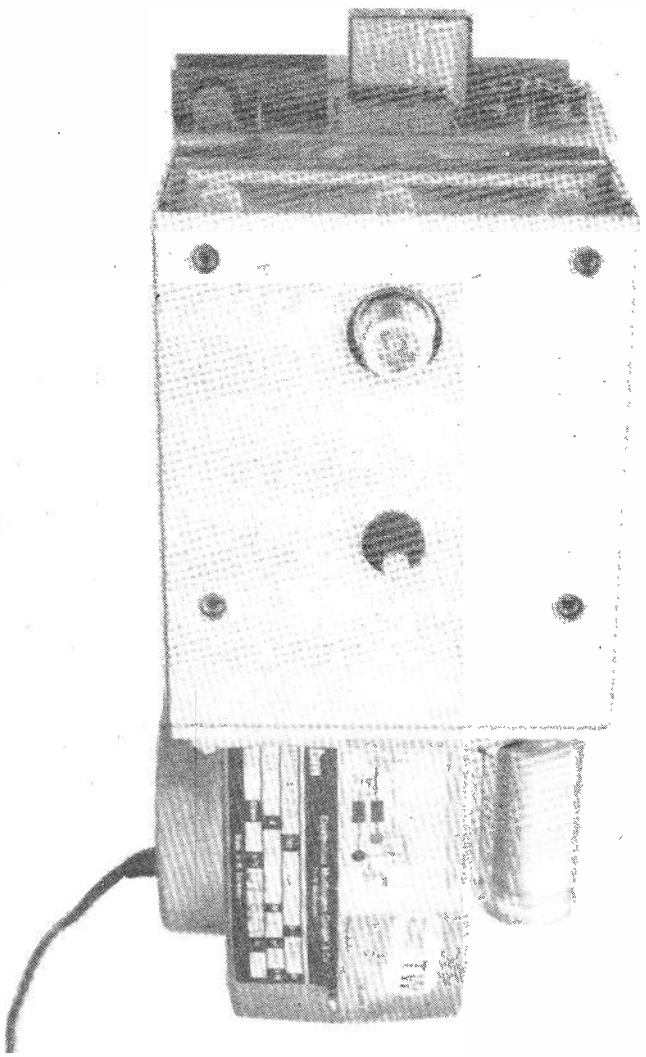
ON TEST

EME high power 23cm amplifier



By Angus McKenzie G3OSS

With aerials pointing in exactly the right direction, 23cm stations can make some remarkable contacts, running low power, particularly when the band conditions are extremely good. 23cm aerials are so directional, though, that low power stations have to fight extremely hard to get the other station to beam their way, and often have to ask help from neighbours to make that rare DX contact. A station running a barefoot 23cm transverter with only 2W output may well get very frustrated when he hears an elusive SM or OK station calling with a received signal of only, say, 5&2. The problem is to get the DX station to turn his beam onto the low power station so that a contact might result. I have found that it is exceptionally rare that once beams are aligned, very high power is actually required to complete the QSO, and probably around 25W output is ideal for the average DX QSO. For some years I have been running 50W PEP from a linear using two 3CX100A5s, the first valve driving the second straight up from my MM transverter, an old one giving only 1.3W. There have been many occasions when a high power DX portable station has just not heard me, so I was delighted to get delivery of the EME 23150 recently which enabled me to shout much louder! It has made all the difference in both establishing and maintaining DX QSOs on the band, and I will detail subjective results later.

The EME linear is normally delivered in chassis form, without valves, although the importer, Piper Communications, (G8DVK, Dave Aram, QTHR) can supply these to special order. The chassis includes the complete input and output circuitry with silver plated cavities and lines, together with bases, two speed blower, and the complete DC biasing circuit acting on the cathode current. Very high quality N type sockets are used for input and output, the linear being designed to work with two valves in parallel, valves of the 2C39 family being chosen. There is much debate as to which valves are best, the normal 2C39A having a glass envelope below the anode which therefore limits its operating temperature, and hence, DC input. There are however, ceramic 2C39As, as well as 2C39BAs, but many users have chosen 3CX100A5 or 7289 valves which are usually found better as they tend to have more gain and more output capability, particularly when the HT voltage is high. The review sample was fitted with ceramic 2C39As, although we tried a pair of 3CX100A5s with poor results, eventually establishing that one of the new valves was quite clearly duff.

Circuit description

The valves are operated in the conventional grounded grid configuration, and the RF input feed comes through a capacitor into the cathode cavity which is tuned from the side of the amplifier. The cathode chamber is made from 1mm brass sheet and fixed onto the chassis. The cathode circuit, (using 1.5mm brass sheeting), is mounted on PTFE. A high quality lockable thumb wheel screw, is used for input alignment. SWR was below 1.5:1 under normal operation, which is excellent. The bypass capacitor is made from 3mm brass. The coaxial valves are mounted in holders which allow a very fast air flow for cooling. The low vibration blower can be used at two speeds, so that on transmit much more air can be blown through, which is all to the good for temperature stability. The air stream cools both the cathode and anode sections. The anode cavity is tuned by allowing a disc to screw up and down inside the cavity thus altering its volume. The tuning adjustment is superbly engineered, and the knob can be rotated round and round with no noticable intermittency. The loading circuit is by means of a coaxial pick up line being screwed in and out of the cavity, the feed line ending up as the centre of an N socket which rotates, and which is lockable after adjustment.

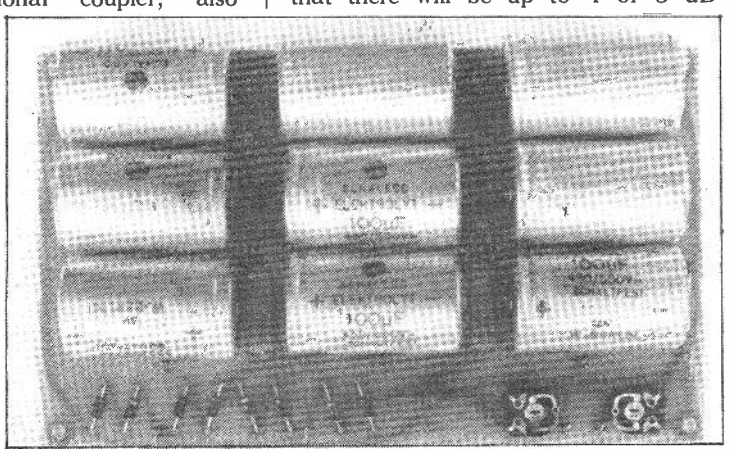
The bias supply is conventional for a microwave linear. The cathode is connected to the bias line through an RF choke and via a zener diode which is short circuited on TX. The bias line then goes down to the collector of an NPN

transistor, and to the top of the bias control pot. The slider feeds the base and bottom of the pot works its way down to deck, whilst total cathode current is read across a low value resistor betwen emitter and earth. The bias voltage on the cathode, with reference to the earthed grids, is of course [illegible] potentiometer. On RX, the zener diode causes sufficient bias to be established on the cathode to effectively reduce the standing current to zero, and thus cut off the valve.

The linear is designed to work at HT voltages up to 1200V, although not more than 800V is recommended for television, or continuous carrier use. Under such conditions no more than 200mA DC current is recommended. The filament voltage is rated from a minimum of 5.2V to an absolute maximum of 6.0V, and it is extremely important that this voltage be set at the low end when high HT voltages are in use. We set the heaters at 5.3V for an HT voltage of 1.05kV. Absolute peak current for the two valves should be 500mA, although in normal operation 400mA maximum is recommended. Many amateurs have pointed out that it is much better to run these valves at a high HT and a lower current, rther than the other way around, to preserve valve life and output linearity when at high power.

The HT power supply can be provided as an optional extra incorporating a bank of electrolytic capacitors, bleeder resistors and rectifier diodes. Piper Communications can also provide special mains transformers for the power supply.

With the valves in use we would suggest that around 15W input drive is required to give 100W output carrier, and on SSB I estimated the output power rose to around 135W PEP for 9W PEP drive. At this stage I should mention that I went to exhaustive efforts to measure output power as accurately as posible, and found many nasty measurement snags en route. While various low power Bird thruline plug-ins seem to be very accurate, the 250J plug-in, designed to work normally from 960 to 1260MHz, seemed hopelessly inaccurate around the 100W level. A brand new one was borrowed and this was only slightly more accurate. At the 120W level, my original plug-in read around 75W, and the new one around 85W. We used an SSB Products directional coupler, also obtainable from Piper, for making power measurements, and for adjusting my original Bird Thruline plug-in itself so that it would read correctly. The highly recommended directional coupler is a thruline device, fitted with very high quality N type sockets and having



Optional power supply board. The mains transformer is separate.

reverse power, each terminated with a precision low power 50 ohms dummy load and BNC output socket. The directional coupler was checked for accuracy at lower powers with a very accurate Racal power meter and Narda attenuator, and the stated attenuation of 21dB on 23cm was found to be correct. The coupler gives approximately -30dB output on 70cm and - 14dB on 13cm which is useful. We then checked a 1W Bird thruline plug-in and found this to be within 3% accuracy, ref. our Racal, at FSD on 1296MHz. A small Bird Termaline power meter type 6257 was also within 4%, despite its accuracy only being quoted to 1000MHz. I then checked an ancient, but remarkably accurate Bird TS118A Termaline (?) with built in termocouple (?) power meter and this too tied in within 4%. It thus seemed odd that the 250J plug-ins were hopelessly pessimistic, so I dared to recalibrate the plug-in by allowing it to soak upside down in a solvent for some hours, then lift it off the cap very gingerly, thus exposing a pot adjustment in the centre of the plug-in which could be adjusted through a hole in the top underneath the glued cover. This procedure is not recommended by the importers, and was only undertaken after power was checked in many other ways, as explained. It must be emphasised that despite all my care, I will probably be lucky if the quoted powers are even within 5%, for they are probably nearer 10% accuracy.

For the general tests the directional coupler was placed on top of the output socket, using a precision male back to back adaptor, with the output of the directional coupler feeding through a Bird thruline, the output of which was fed directly into a Bird high power termaline load with another back to back adaptor. SWR was seen to be around 1.03:1 on the installation.

The specification that claims that 150W can be obtained, using suitable valves and a high HT, but EME admit that there will be up to 4 or 5 dB compression at this output level. Up to 15W input power is allowable, but it is my opinion that power output should be kept down to around the 130W level on SSB, if severe spreading is to be avoided. At the 120W level, my transmissions were said to be decidedly cleaner than average to around 100W output improved linearity quite considerably. Around 400mA current was drawn on full output carrier, the heater current totalling just under 2A.

At the early stages of tuning up and testing we tried 6.0V heaters, with a standing current totalling around 100mA. There was considerable temperature drift and constant retuning was necessary. We then reduced heater volts to 5.3V, and reduced standing current to around 80mA, and then adopted a completely different system for tuning up. Originally, we turned on the linear and drive and tuned for peak output after around 8 seconds. We found that every time the transmitter was switched on, several seconds elapsed before peak output power was given, and after another seven seconds or so, the power began to drop again. We never transmitted carrier at high power for more than 20 seconds as we did not want to blow up the valves. I changed the tuning up method to what seems to be an unusual one, but which in practice gives far better results. I went to TX and began talking in a normal way and every 8 seconds or so, whilstled a blast of carrier for 3 seconds, then returning to speech again. We found it was possible to obtain a loading and tuning position which produced 120W output consistently every time I whistled, or quickly went over to CW key down. What is more fascinating, is that higher power was available from TX switch on even on an early whistle. The reduced heater voltage and standing currents seemed to make the whole linear infinitely more temperature stable, and from one day to the next I have only really needed to make a very small adjustment to tuning. The bandwidth, when correctly tuned, is claimed to be at least 8MHz, and I have no reason to doubt this, although I could not check it.

Whilst the input and output tuning was simple, output loading was awkward as you couldn't adjust the N socket with a cable connected, so you had to stop and start experimenting with separate loadings. It is worth taking very considerable trouble setting up this linear, as the results using it are most dependent upon all the adjustments being exactly right.

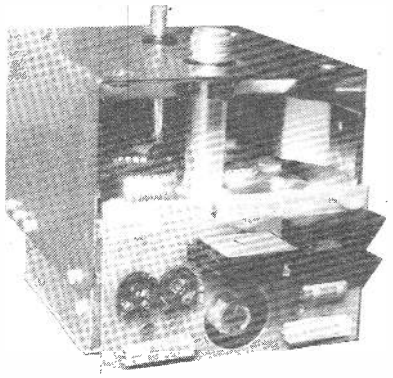
Subjective trials

All DX stations that I have worked with this new amplifier have stated that the power increase was fairly obvious compared to the strengths established with the old linear, bearing in mind band conditions. The transmission quality was extremely clean, as I took care to ensure that the entire system up to the linear was

well under driven, the Microwave Modules transverter being set to give well below 0.7W, which fed into an SSB Products 2310 transistorised linear. This linear is capable of delivering 10W drive power from an 13.8V DC supply, but was only required to give half this under my normal operating conditions.

The linear was fitted with elaborate switching protection circuitry, so organised, that when the PTT line was depressed, the masthead preamp was disabled and then the TX/RX relay changed over, and only then did power switch through to the SSB Products Linear and EME PA. The entire equipment was extremely reliable, once set up properly, and I have not heard anyone have any problems with it; quite a number of them are now being in use in the UK.

Over a period of a month or so, I estimate that I have had at least three times the number of contacts over a fixed time period that I would have had, from experience, with my old 50W machine. Far more frequently, distant stations have heard me calling CQ, when one of us was beaming in the wrong direction. Once contact was established, QSOs were far more solid, and it is fascinating that I have almost always been receiving better reports than I had been giving. This is significant, since the receiving set up is reasonably good, using an SSB Products GaAsFET at the masthead. When I have heard another station calling CQ very weakly, I have almost always managed to get that station to turn the beam towards me, with a QSO resulting. There seems to be the world of difference therefore between running high and low power on the band, and one fascinating realistation is the fact that there are far more tropo ducts on the band than I originally suspected. It is amazing how frequently a station has called me back from a distance of 200 miles or more, even if I have not been calling CQ precisely in his direction.



Quite a few stations have found that by very carefully selecting a very good pair of valves, they can achieve at least 70W output when the linear is driven from one of the new Microwave Modules transverters at a 2W level. Although in the past almost everyone has had to make their own PAs, not everyone possesses mechanical skills, and the EME will therefore be most useful for those who don't want to roll their own, and yet who want a very good high power linear. I strongly recommend the EME, and it is obviously very successful since it is now being used by many of the top DX 23cm stations including G8TFI, G4NQC, G8KAX, G8HQM and very many others. EME also produce a linear for 13cm which is claimed to give 25W output from a single valve.

I would like to emphasise that by reducing the filament volts right down, there seemed to be no loss of effective emission, and no power seemed to be lost. I very strongly recommend this reduction therefore. Different valves, let alone valve types, can have very different gains on 23cm, and a really hot pair of valves is both more sensitive and gives more power output than I have obtained with my 2C39As. G4NQC obtains around 100W output carrier for approximately 4W drive. There are many valves of this family that are secondhand, and whereas some of them are poor, others have found that by buying six at £5 each, two will almost always be excellent!. It seems that the only reliable and inexpensive supplies of new valves are from the US, prices of around £25 each being fairly typical. New valves from manufacturers can cost up to £60 each, so there is clearly a lot of busines for somebody who can buy a stack of brand new ones in the US from a Government surplus organisation and advertise them in the UK!

CLUB CALENDAR

Tell others about what's happening in your club - give us the information and we will try and print it here.

Axe Vale

The Axe Vale Amateur Radio Club meets on the first Friday of every month at the Cavalier Inn, Axminister at 7.30pm. RAE classes are held at St Clare's Centre, Seaton. Further details are available from Peter Reach G3GOS on Axminster 34259.

Barry College

The Barry College of Further Education Radio Society meets on Thursday evenings at the Annex, Waycock Cross, Barry starting at 7.45pm. There are Morse classes as well as a lecture or demonstration.

Bath

The Bath and District Amateur Radio Club meet every other Wednesday at the Englishcombe Inn, Englishcombe Lane, Bath at 7.45 p.m. Details from Trevor Whitehead (PRO) on Bath 319150, or Mike Mason (Secretary) on Bath 311046.

Biggin Hill

The Biggin Hill Amateur Radio Club meets at the Biggin Hill Memorial Library at 8pm on 24 Jan for the AGM.

Bishop Auckland

The Bishop Auckland Radio Amateurs' Club meets at the Travellers Rest, Evenwood on Monday evenings at 7.30pm. They operate an RAE course, and Morse tuition is also available.

Braintree

The Braintree Amateur Radio Society meets on the first and third Fridays of each month at the Braintree Community Centre in Victoria Street at 7.45pm. 2 Jan: *Power Supplies, Theory and Practice. 16 Jan: DX Operating* by John Saunders G3OLU. Further information from Pat Penny G6TAF on Braintree 26487.

Brighton

The Brighton and District Amateur Radio Society meets at the Marmion Road YMCA at 7.30pm on alternate Wednesdays. They have a Morse class on Mondays. For further information contact Wendy Firmager, 26 Brownleaf Road, Brighton.

Bromsgrove

The Bromsgrove Amateur Radio Society holds its meetings on the second Tuesday of each month at Rigby Lane School. Details from Alan Kelly on 021-445 2088.

Burton-on-Trent

The Burton-on-Trent and District Radio Society meets once a week on a Wednesday evening at the Stapenhill Club and Institute in Main Street, Stapenhill.

Bury

The Bury Radio Society meets each Tuesday evening at 8pm in the Club Room at the Mosses Youth and Community Centre, Cecil Street, Bury. Main meetings are on the second Tuesday of each month. Jan 10: Fault Finding Techniques by Fred Burnett G3RSM. More details from Brian Tyldsley G4TBT, on Burnley 24254.

Cambridge

The Cambridge and District Amateur Radio Club meets each Friday at 7.30pm in the Visual Aids Room, ground floor, Coleridge Community College, Radegund Road, Cambridge. Jan 20: informal meeting, Morse Class, on air. More details about the Club are available from David Wilcock G2FKS, on Cottenham 50597.

Cambridgeshire Repeater Group

This Group has recently found itself faced with site rentals for its repeaters, after getting them free of charge for many years. The bill could reach £600 a year. Membership applications should be sent to Mike Watson G4CWI, 25 High Street, Haddenham, Cambs.

Cheshunt

The Cheshunt and District Amateur Radio Club meets at the Church Room, Church Lane, Wormley every Wednesday evening at 8pm. Further details from Roger Frisby G4OAA on Hoddesdon 464795.

Denby Dale

Denby Dale (Pie Hall) and District Amateur Radio Society meets at the Pie Hall every Wednesday. More details from J. Clegg G3FQH on 0484 862390.

Derby

The Derby and District Amateur Radio Society usually meets on Wednesdays, at the Oldfellows Hall (top floor), 119 Green Lane, Derby at 7.30pm. Some meetings are restricted to members only. Details from Jenny Shardlow on Derby 556875.

Droitwich

The Droitwich Amateur Radio Club meets on the first Monday of each month at the Scout HQ, North Street, Droitwich.

Echelford

The Echelford Radio Society meets every second Monday and the last Thursday in the month at 7.30pm, for an 8pm start, at The Hall, St. Martin's Court, Kingston Crescent, Ashford, Middx. Club nets (non-members welcome) are on Sundays, 1000 local time on 1.93MHz, and on Wednesday 2000-2100 local on 144.575MHz FM.

Edgware

The Edgware and District Radio Society meets at 145 Orange Hill Road, Burnt Oak, Edgware on the second and fourth Tuesdays of each month at 8pm. Jan 1: straight key evening. Jan 12: AGM. Jan 26: informal - display of Club's archive material. On Jan 1 there is a net on 3.775MHz± at 9.15am.

Exeter

The Exeter Amateur Radio Society meets at the Exeter Community Centre, St. David's Hill for formal meetings on the second Monday of each month. Informal meetings are held on every other Monday at the Scout Hut, Emmanuel Road, St. Thomas. All meetings start at 7.30pm, and further details are available from Andy Lake G8YOA on Exeter 39597

Fareham

The Fareham Radio Club meets on Wednesdays at 7.30pm at the Porchester Community Centre, Room 12. Dates for the month are Jan 4: *Preamplifiers by* G6BBS. Jan 11: natter night/on air. Jan 18: *Power Distribution* by G8GNB. Jan 25: AGM. Details from Brian Davey G4ITG on Fareham 234904

Farnborough

The Farnborough and District Radio Society meets at the Railway Enthusiasts Club's clubhouse off Hawley Lane, on the second and fourth Wednesdays of every month. Information: I.F. Ireland G4BJQ (Farnborough 543036)

Glenrothes

The Glenrothes and District Amateur Radio Club has a lecture entitled *The Art of Soldiering* by John GM4AQO for Dec 16, but we have no details of the time or venue.

CLUB CALENDAR

G-QRP

The G-QRP Club is having its second QRP Winter Sports (CW) event on Jan 1. Full details from Fred Garratt G4HOM, 47 Tilshead Close, Druids Heath, Birmingham, B14 5LT.

Harrow

The Radio Society of Harrow holds its meetings at the Harrow Arts Centre, High Road, Harrow Weald at 8pm on Fridays.

Inverness

The Inverness Amateur Radio Club meets every Thursday at the Cameron Youth Club, Planefield Road, Inverness at 7.30pm. Morse classes are also held each week. For further information call Bob Irwin on Inverness 221956.

Ipswich

The Ipswich Radio Club meets on the second and last Wednesdays in each month at 8pm, in the Club Room of the Rose and Crown, 77 Norwich Road, Ipswich. Morse classes are usually held on the other Wednesdays, but check beforehand with the Secretary Jack Toothill G4IFF on Ipswich 44047.

Jersey

The Jersey Amateur Electronics Club meets at the Communicare Centre, St. Brelade at 8.15pm. Jan 11: *The BBC Micro* by GJ4TBW. The Club's Secretary is Phil Johnson GJ8KNV. Tel: Jersey 53333.

Kelso

The Kelso Amateur Radio Society has weekly meetings on Mondays at 7.30pm in the Kelso Community Centre. For further information contact either Bruce Cavers GM4UIB on 0573 24654, or Andre Saunders GM3VLB on 0573 24664.

Lincoln

The Lincoln Short Wave Club holds formal meetings every second and fourth Wednesday of the month beginning at 8pm. Jan 11: *Aurora - What Causes It* by G2FKZ (slides/tape). Jan 18: Morse/RAE. Jan 25: activity night/on air.

Magherafelt

The Magherafelt Amateur Radio Society meets at 12 Garden Street, Magherafelt on the first Tuesday in each month, and a varied programme of events is being planned for the coming season. Morse classes are held each Tuesday evening and an RAE class is held in the local Technical College on Monday evenings.

Visitors and new members are most welcome. Further details and programme are available from the Secretary, Jack Chapman (G14LVC), Tel: 0648 32096.

Maltby

The Maltby Amateur Radio Society meets every Friday evening at 7pm at the Methodist Church Hall, Maltby, Rotherham. The Club has a regular Morse Class and a computer enthusiasts' corner.

Milton Keynes

The Milton Keynes and District Amateur Radio Society holds its meetings at the Lovat Hall, Silver Street, Newport Pagnell, at 8pm on the second Tuesday of every month. Contact: David White on Milton Keynes 501310.

Newbury

The Newbury and District Amateur Radio Society meets monthly (2nd Tuesday of the month), usually at Newbury Technical College.

North Bristol

Meetings of the North Bristol Amateur Radio Club are held at SHE 7, Braemar Crescent, Northville. Dates for January are: Jan 6: Committee meeting/natter night. Jan 13: junk sale. Jan 20: Horizon electronics open. Jan 27: AGM. Meetings are held every Friday from about 7pm to 9pm, and RAE and Morse classes run at the same time.

North Devon

The North Devon Radio Club meets on the fourth Wednesday in each month at 7.30pm, at Pelton Community College in Barnstaple ('even' months), or Bideford Community College ('odd' months).

Northern Heights

The Northern Heights Amateur Radio Society meets at the Bradshaw Tavern, Bradshaw, Halifax. On the second and fourth Wednesday of the month they have a lecture, and a 'noggin and natter night' every other Wednesday, all at 8pm. Further information from Brian Aspinall G6CJL on Bradford 83442.

Peterborough

The Greater Peterborough Amateur Radio Club holds its meetings at Southfields Junior School, Stanground, Peterborough at 7.30pm, usually on the fourth Thursday of each month, depending on schools being in session or not. The Club has a net on Mondays at 8pm, on 21.200MHz or thereabouts.

RATEC

The Radio Amateurs Technical Engineering Club exists to promote the constructional side of the hobby, and it meets every month at 8pm at the British Legion Club, Moor Lane, Woodford, Cheshire.

Reading

The Reading and District Amateur Radio Club meets at the Clubroom, The White Horse, Peppard Road, Emmer Green, Reading on alternate Tuesdays. Details

Rhyl

The Rhyl and District Amateur Radio Club meets on the first and third Mondays of the month at the lst. Rhyl Scouts' Hut, Tynewydd Road, Rhyl at 7.30pm. Information from John McCann GW4PFC on St. Asaph 583467.

Shefford

The Shefford and District Amateur Radio Society meets at 8pm every Thursday in the Church Hall, Shefford.

Skelmersdale

The Skelmersdale and District Amateur Radio Society meets every Thursday at 7.40pm at the Dunlop Sports and Social Club, White Moss Road (next to the football ground).

Smiths Industries

The Smiths Industries Radio Society meets at the Club House, Newlands, Bishops - Cleeve. From Jan 12, they will meet every fortnight.

Although the Club was formed to bring together amateur radio enthusiasts working in the Smiths factory membership is open to the public.

South Bristol

The South Bristol Amateur Radio Club meets at the Whitchurch Folkhouse, East East Dundry Road, Whitchurch, Bristol every Wednesday 7.30pm to 10pm.

Jan 4: *Early Radio* Jan 11: *CW Operating* Jan 18: metre night. Jan 25: *Homebrew Equipment.*

All enquiries to Len Baker G4RZY on Bristol 834282.

South Cotswold

The South Cotswold Amateur Radio Society meets at the Scout HQ, Dr. Browns Road, Minchinhampton on the second and fourth Wednesdays of each month. Details: contact R.J. Burnett G4RJB on Nailsworth 2874.

Southdown

The Southdown Amateur Radio Society meets on the first Monday of every month at the Chaseley Home for Disabled Ex-Servicemen, Southcliffe, Eastborne, at 7.30pm for an 8pm start.

South East Kent

The South East Kent (YMCA) Amateur Radio Club meets at the Dover YMCA, Godwynehurst, Leyburne Road on Mondays for RAE classes, Tuesdays for Morse practice, and Wednesdays for main Club meetings (all at 7.45pm).

Club nets are held on 3.745MHz and 144.395MHz, both at 1100 local time on Sundays.

Stevenage

The Stevenage and District Amateur Radio Society meets on the first three Tuesdays of the month at: T.S. Andromeda, Fairlands Valley Park, Shephall View, Stevenage. Jan 3: to be confirmed. Jan 10: constructors evening. Jan 17: Grand Auction.

Morse classes are held before each meeting at 7.15pm, and there is a weekly net on Sundays at 7pm on 145.250MHz FM. Further details are available from the Club's Secretary Cliff Barber G4BGP, on Baldock 893736.

Stockton

The Stockton and District Amateur Radio Group meet every Wednesday at 7.30 p.m. in the Billingham Community Centre. RAE classes, construction evenings and visits by guest speakers are among their activities. Membership is 50p and entry to meetings costs 20p.

Stourbridge

The Stourbridge and District Amateur Radio Society normally meets on the first and third Mondays of each month. Jan 2: informal meeting. Jan 16: Annual Constructors' Contest. The Society meets at The Garibaldi, Cross Street, Stourbridge at 8pm.

Stratford-upon-Avon

The Stratford-upon-Avon and District Amateur Radio Club meets at the Control Tower, Bearley Radio Station, Bearley on the second and fourth Mondays of each month starting at 7.30pm. (Talk-in available on 145.55MHz).

Swale

The Swale Amateur Radio Club meet
Nino's Restuarant, 43 High Street, Sittingbourne. More details about the club can be obtained from B. Hancock G4NPM on Minster 873147.

Thanet

The Radio Club of Thanet meets on the second and fourth Tuesday of the month at the Grosvenor Club, Grosvenor Place, Margate at 8pm, with a Morse class at 7.30pm. Club nets are on 28.4MHz at 9.30am on Sundays, and on 145.575MHz at 8pm on Thursdays

Vale of White Horse

The Vale of White Horse Amateur Radio Society meets at the Canteen and Social Club, Milton Trading Estate, Nr. Abingdon, on the first and third Tuesday of each month. Club nets: Thursdays 7.30pm 28.750MHz, and Sundays 8pm 145.200MHz.

Wigston

The Wigston Amateur Radio Club meets every Friday at the United Reform Church in Long Street, Wigston, Leicester at 7.30pm. The Secretary is Alan Faint G6GWH, Tel: Market Harborough 62827

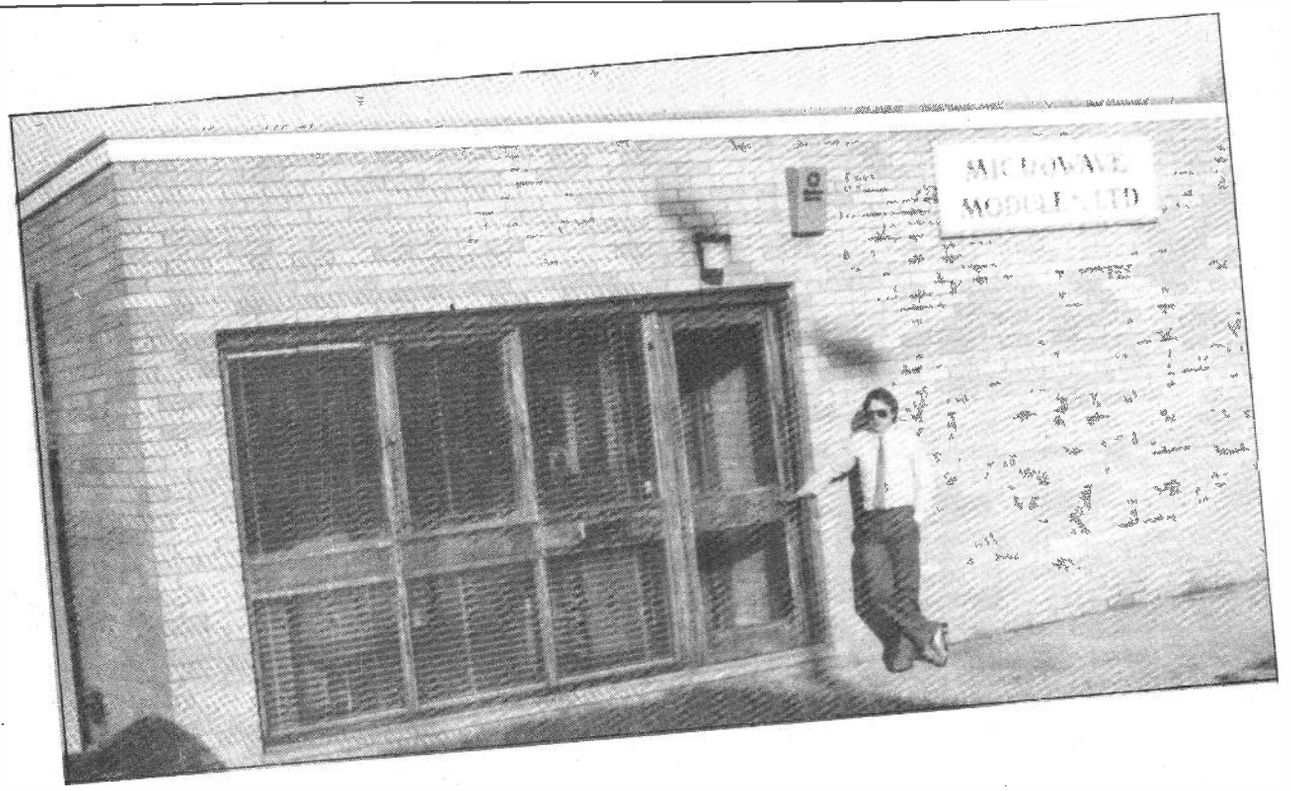
Worcester

The Worcester and District Amateur Radio Club meets at 8pm at the Oddfellows Club, New Street, Worcester on Jan 9 for a discussion evening. On Jan 23 they have an informal evening at the Old Pheasant Inn, New Street, Worcester.

DODSON ON THE ROAD. The eighth of a series of profiles of distributors who serve the amateur radio fraternity.

DEALER PROFILE

Instead of visiting an amateur radio retailer, this month Peter Dodson makes a house call on a manufacturers of communications equipment - radio consultants Microwave Modules Ltd - one of the few British organisations operating in this field.



It is was possible to categorize a highly technical producer of electronic devices as a 'cottage industry', then Microwave Modules must surely be one of the nearest to qualify. But if over the past fourteen years the firm has expanded to embrace two companies and three separate establishments, it has managed to retain the almost family-type environment which belies a thriving and competitive organisation. Microwave Modules are not in the business of mass production.

annual turnover of £1½ million

Their range of 60 products manufactured for the amateur and commercial market (using British components wherever possible) is designed and produced by a work-force of about 40, based at Aintree and nearby Knowsley. The sister company, Castle Microwave of Henley, has the franchise for NEC microwave devices and is confined to the marketing of their components. And through their 65 UK and 35 overseas distributors, Microwave Modules and Castle Microwave (under Director Mike Cunningham) have expanded their activities to net an annual turnover of £1½ million with a growth rate of around 15%.

The history of Microwave Modules goes back to 1969, when co-director Richard Porter B.Eng, and Richard Butterfield B.Sc., were working for the Plessey organisation as designers, but who had some rather special ideas on frequency converters. But like many others in the electronics industry who have endeavoured to run a private business in conjunction with 'the day job', it soon grew too big to handle as a part-time occupation. So, in 1972, the two Richards left Plessey to devote all their time and efforts towards their own project: within two years, the duo had moved into the Aintree premises on Brookfield Drive with a couple of assembly assistants.

By early 1975, it had become abundantly clear that the Porter/Butterfield conception of preamplifiers and frequency converters was a winner, and the partners took on more staff, including development engineers, to cater for a rapidly expanding product-range. In fact, the design of many of the

rapid growth

Microwave Modules products has changed little over the years, such was the quality of design. Indeed, such was the popularity of their transverters, to quote but one example, that their Antree base had to be doubled in size in 1979. By then the payroll had been increased to include six engineers and an administration staff.

Yet again, space became a problem (and for that matter, still is!). In 1980, with the addition of government and commercial contracts, the Knowsley factory opened to accommodate other aspects of Microwave Modules, with a corresponding increase in staff. Today, the firm employs two research and development engineers, Eric Grossmith and Bill Marsden, six test engineers, four managers, nine administrative staff, 16 full-time and 18 part-time assembly staff. These 18 work at home, putting together kits as supplied by Microwave Modules, and the vast majority are technically orientated: one lady part-timer even has a B.Sc. degree, but with three children, full-time working is out - that's higher education for you!

If media coverage is to be believed, Liverpool is a depressed area. The recession, however, has scarcely touched on the activities of Microwave Modules. Sales Manager Mike Wood (who, in 1974, was the first to be employed by the two Richards) finds the electronics industry - particularly the amateur aspect - unpredictable. Amateur radio, a leisure activity, *should* have been the first to suffer in a slump - but it didn't - possibly due to redundancy payments. Similarly, commerce had demanded electronic and communications equipment that grows more sophisticated every year: Microwave Modules' 1.5GHz microwave link terminal is a typical example of a commercial 50-mile range, point-to-point single channel speech system.

Left: Sales Manager Mike Wood outside the company's Aintree offices. Above: MM's METEOSAT weather satellite receiving package. Right: (from left to right) Richard Butterfield, Richard Porter and Mike Wood.

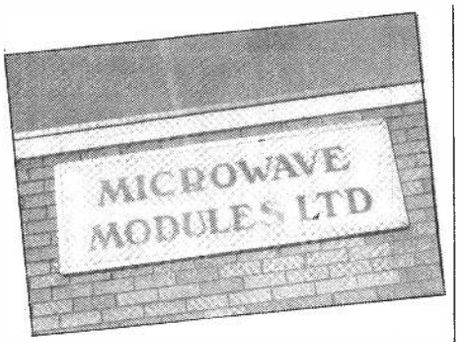
500MHz digital frequency counter

For the radio amateur, Microwave Modules produces a wide range of products - their transverters to adapt HF equipment to VHF, and even UHF proved to be extremely popular with amateurs if only to attain the flexibility of band-availability for only £100. Conversely, a frequency converter for a receiver could cost as little as £25: amplifiers come a bit dearer at £65. But in 1977 and 78, the firm saw the biggest increase in product range to date. This growth included the manufacture of a 500MHz digital frequency counter which, at the time, was the cheapest on the market. The secret of Microwave Modules' success lay in the fact that their product range was unique: any company could produce any single item from the Aintree firm's range, but none could produce them all.

At the same time that Microwave Modules produced their frequency counter, they also launched their first linear amplifiers (1979). Starting with the two metre and 70cm versions, variations on the theme were added to be compatible with a wide range of amateur equipment. And from then on, the range has been extended continuously. Having captured the enthusiasm of amateurs for transverters, Microwave Modules then set about the resultant demand for amplifiers: the world, it would appear, had gone power mad, and to this day, 65% of demand is for these units.

The Knowsley factory of the organisation opened two and a half years ago, and houses some 14 souls, mainly on microprocessor equipment - a wise move to keep the dangerous RF of the Aintree factory away from these sensitive units. Among the available microprocesor-type products made by Microwave Modules are two Morse training units - both unique in their way. Although many similar types of equipment can product random Morse characters, they can't do what the Microwave Module version can - it tells the student what the Morse characters are, through its speech synthesis system. With a 'linear recyclative ratio' of a couple of parts to a million, the average amateur will have learned Morse by the time it comes round again. Taken a stage further, the de-luxe version will train you in the art of sending as well.

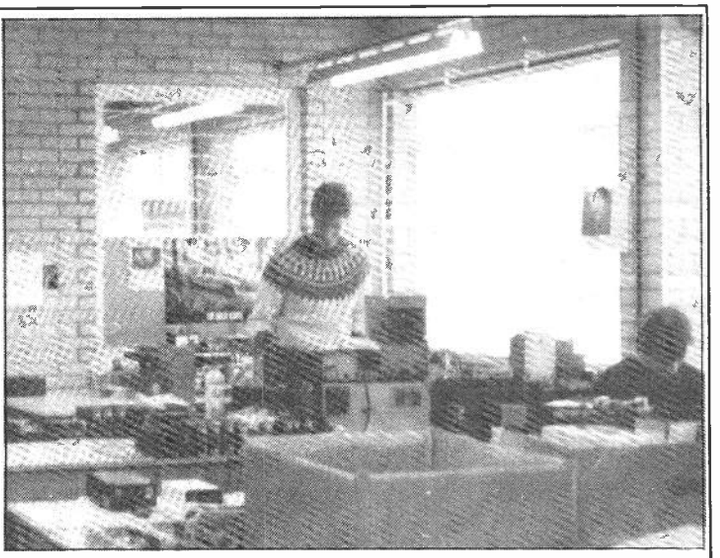
In the experience of Mike Wood, trends in the amateur radio world are almost unpredictable. For the big outfit, with its production-line techniques, there is a problem of possible over-stocking of items. Not so for Microwave Modules with its relatively low-volume (and virtually hand-made) output. Any switch in popular demand, or the production of special-order equipment, can be catered for with a minimum of disruption. It can cause delivery problems on a new



product in that demand is often difficult to foresee, but in the main, the Microwave Modules production system works well: better that then a stock-room full of unsaleable equipment!

Further Mocrowave Modules development in the microprocessor field is their RTTY equipment which gives a visual display on a VDU of any RTTY signal including ASCII, and provides hard-copy. On the other hand, their MM4001 will transmit or receive signals up to 1200 bauds speed. Supplied complete with membrane-type keyboard, all it needs is the attachment of a transceiver and monitor - and a small matter of £299!

In 1982, Microwave Modules introduced a fast-scan TV transmitter on 435MHz with a matching converter for use on a domestic TV at a cost of £159 for the transmitter, and £29 for the converter. But for the real hi-tech buff, the Aintree firm has introduced a Meteosat receiving system - capable of picking up the weather satellite which looks at the world from 26,000 miles away and tells you when (not if!) it's going to rain. Microwave Modules make the RF and converter systems, and the complete package is available at a cost of £1375 - half the price of any other system. The pack comprises a one metre dish, pre-amp, converter, VHF receiver, digital frame store (the clever bit) and video monitor. As the satellite is geostationary, there are no problems with tracking and the unit can provide a constant update on weather maps.



Inside the Aintree workshops: testing the finished product.

And the future? Microwave Modules is in the process of producing a 200W amplifier for two metres. It has been on the stocks for some time, but due to pressure of work, delay was inevitable. There is also an improved 1296MHz transverter with a very low noise figure. It is reckoned to give the best yet in signal/noise ratio. And last but by no means least, Microwave Modules has launched a unique piece of equipment to operate through the new Oscar 10 satellite: it will convert a two metre transmission to the necessary 1268MHz needed for L-mode operation - for just £135.

•**WANTED** F.M. Board for FT101ZD also narrow C.W. Filter, cash waiting. Ring Nick G4UKO Maidstone 859129.

•**TRIO** DFC230 without microphone, only £75.00 ono also VFO120 at £50.00 ono, both suitable for TS120/130 Jaybeam 12XY with harness, suitable 70cms only £38.00 Orpington (0689) 29230 (evenings). Graeme, G6CSY QTHR.

•**REALISTIC** Patrolman 10 Channel scanner receiver, mains, 12 volt, will cover 70MHz, 144MHz and 432MHz FM, only £22 ono requires crystals. Graeme G6CSY Orpington (0689) 29230 evenings QTHr Callbook.

•**LISTENERS** Short wave rig YAESU FRG7700 with 2 metre airband. Marineband converter and aerial tuner, mint condition, 240V.AC 12 V.DC. £320 ono G6XGC phone Leeds (0532) 585806.

•**OPTIMIST** seeks Marconi morsekey also Yaesu FC901 or FC902 ATU also Good Five Band Vertical Trap Dipole can collect within 100 miles. Tel. Barrie, Herne Bay (02273) 3511 evenings or weekends.

•**ROBOT** 800 RTTY morse sender/decoder with green screen monitor only £425. B. Joiner 25 Garston Lane, Watford, Herts. Tel. 0927 376489.

•**SWAN** 700CX TCVR 80/10M with matching PSU and crystal oscillator (10XYLS) £250. Spare valves available ring Reg 0202 579115.

•**FOR SALE** DX200 communications receiver 0.15MHz - 30MHz SSB, CW, AM excellent condition £90. Tel. 041 8875702 anytime.

•**ICOM** IC24G 1/10 watts FM with spare powerlead and Heatherlite mobile mike £155. FDK multi 750E 1/10 watts multimode £205 both unmarked in makers cartons. Wilberfoss (York) 325.

•**SAS** cw Transceiver 123 set 2.5 - 20MHz with new hand dynamo 5 - 25 watts also 220 - 240 vac HW8 Tx beautifully bult and lots or full all Amateur Bands £115 ono. Tel. Cromer 761612 after 1800.

•**FOR SALE** Grundie satellite 1400 SL radio unwanted prize, never used £135. Tel. Northampton 582550.

•**BIG SHACK** clearance! Wave meters, capacitors, meters ... A4 lists 10p stamp each & SAE Titles: Electronic Valves, Tools, 16MM Vintage Films, Car Accessories, Photographic, Slide/Cine projectors and Lamps, Meters, Measuring Gadgets. Williams 25 Glenmore Rd, Birkenhead.

•**LOG** sheets ideal for CB or Amateur. 10 sheet for £1. Each sheet holds 27 copies. Fit in ring binder. Mr. J. Robinson, 10 Clement Avenue, Balderton, Newark, Notts.

•**SALE** FDK TM56B 2M monitor Rx crystalled R1-7 S18, 19,20 S21,22, 23, S32. plus Raynet £50 ono. No Mods. R. williams, 62 Kingscliffe Rd., Grantham, Lincs. Tel. Grantham 66047.

•**HELP,** Does anyone have parts/info/complete unit/ for the frquency meter TS-174/V 20-250 Megs. Similar in appearance to BC221. Please contact 0782 612868.

•**YAESU** FRG7700 original packing. Mint £240 ono. Yaesu FT290R. original packing. Mint with 2-2Ah Ni-cads and charger £210.ono. Please Tel. Bernard 0538 372917. Leek, Staffs.

•**WANTED** mains power transformer for Telequipment scope type D33R, or possibly D43 type might do, desperate!! Sensible price for right part, also require service manual for Telequipment S54A scope. R. D. Hills, 51 Charter St., Gillingham, Kent. Tel. 0634 573139.

•**ICOM** IC202 SSB portable Xtals 144-144.6 ex cond. £85 ono. 35mm compact camera, Ricoh auto manual little used as new £18.50. Wanted FM mobile rig 2 mtrs, e.g. IC240. G61YD, Tel. Ashford 0233 22506.

•**FOR SALE** touch pad microprocessor unit for Trio 7600/7625 transceiver £30. ono. or WHY also 18.5ft cabin cruiser and 9.5hp Johnson outboard fair condition. Needs cleaning and painting, complete with accessories £95. ono. R. D. Hills, G8STO 51 Charter St., Gillingham, Kent. Tel. 0634 573139.

•**WANTED** Mosley TA31Jr rotary dipole. Also HQ1 mini quad Tel. Hull 0482 852216.

•**WANTED** Drake VC4C remote VFO price and details PSE QTHR G3VDU Nuneaton 349461.

Classified Ads

• **FOR SALE** new FT102 plus FC102, SP102, MD1BS microphone HF-5 antenna all in perfect working order. all equipment with long guarantee reason for sale failure of licence £900ono. Delivery may be possible. Mr. B. Webb, 1 Debden Green, Langdon Hills, Basindon Essex 418513.

• **YAEUSU** CPU2500 F.M. transc. with keypad microphone etc. Mint condition plus accessories. 2 mtr. colinear, wallbrackets, rawbolts, 15 metres UR67 allitube SWR mtr. Ideal basestation £200. Wanted valve communication received Trio TR-599 or similar. Good condition. Telephone Locks Heath 84340.

• **WANTED** Trio 9R59DE any condition but working will pay £20. Telephone Matthew 0428 3200.

• **EXCHANGE** Sharp MZ80K computor as new cost £445 for any tmtr equipment or Grundig "professional" receiver could deliver reasonable distance. L. Findley, 27 Keytes Lane, Barford, Warwick.

• **WANTED** to buy or borrow complete manual and circuit diagrams for Treo-JR500S communications RX- all expenses refunded. Mr. P.Bishop 10 Mountpleasant Road, Saffron, Walden, Essex, CB11 3EA.

• **FOR SALE:** rarely used FDK Multi 750 E SSB 2m rig plus 7/8 gutter mount plus 12v 13amp power supply. All new and boxed for £225 Tel: Bracknell 52518 evenings.

• **WANTED;** tuner unit AT7672/24 for labgear signal strength meter type E5188 Phone Ferndown (0202) 8777920 evenings or weekends.

• **TONO** 9000E £500 BBC programs Morse TX/RX tutor £4.50 RTTY adjustable speed auto CR/LF messages £5 Oric Morse tutor £4.50 QTH locator £4.50. T. Tugwell 11 the Dell, Stevenage, Herts 0438 354689.

• **EXCHANGE** Harvard 40 channel CB K40 antenna SWR matcher F. Strength meter power supply also Philo 100-300X microscope with accesories all in very good conditioon for 2 metre mobile multimode IF possible. Phone Chris Deeside 811687.

• **STRAIGHT SWAP:** Silver-Reed EX44 electronic typewriter with matchine memorymatic Unit-M44 for quality transceiver with full HFRX capabilities. Wanted: General coverage RX mains/batt, will exchange for Twin Cassette GPO approved phone-mate. Hemel Hempstead 45649 evenings.

• **ZX-81** 16K Scarab RTTY all built into case with full size QWERTY keyboard plys software £75ono. Phone Windsor 63577 after 6pm.

• **FOR SALE** FT290 MML 30 watt linear amp 7 amp power supply 8 element Jaybeam 7/8 mobile whip mobile microphone good condition under one year. H. Stewart, 57 Harcourt Road, Fareham. Fareham 41098.

• **TRIO R2000** general coverage receiver 200kHz - 30MHz purchased in April absolutely mint conditioon class B ticket forces sale bargain at £300 no offers. Phone Ritchie on Daventry 77664

• **REALISTIC** DX200 communications receiver 0.15MHz-30MHz AM + SSB mint condition £90 Sentinel 2 meter converter £12. Telephone 041 887 5702.

• **KWYY** 160-10m receiver with circuit and handbook all valve good working order excellent xtal filters suit SWL or collector £30ono buyer collect G4UYW. 38 Victory Road, Whiteshill, Stroud, GL6 6BD.

• **WANTED** US BC611 'Walkie-Talkie' BC659 also A41 Larkspur and manuals for above and B40 WHY will pay cash or swap for other WD radios. Paul 061-998 8440.

• **KATSUMI** electronic keyer EK150 mains or batt. never used. Shop price £87. quick sale £60. Ring Burnley 51416.

• **AR88** good condition with spare valves and info £55ono. Skipmaster 42000 basemike £10 wanted LCD frequency meter also DX160 receiver. Bring a friend for AR88 its heavy. Buyer collects callers after 6pm please. Philip Howlett, 41 Preston Road, Toddingjton, Nr. Dunstable, Beds.

• **STANDARD** C78 70cm handheld Nicads charger carrycase CPB78 PA & Preamp mobile colinear. CMB8 mobile mount all boxes as new with manuals & leads £200. Ken Hastings 0424 444952

• **REALISTIC** 2002 auto manual scanner receiver fifty channel programmable excellent condition boxed with instructions £165 OUNQ. Realistic DX200 communications receiver frequency from 150kHz to 30MHz also in excellent condition boxed with instructions £85 OUNO. R.G. Baker 29 Old Glebe, Fernhurst, Haslemere GU27 3HT. Haselmere 52085.

• **YAESU** FL2100Z all new bands unmarked £300 Tel: Caston (Norfolk) 095383 520.

• **FRG7700** vgc. plus ATU £275.ono. also Yaesu filter £7. and active antenna £30. or the lot for £300. any offers call John 01-688 8502 evenings and weekends.

• **WANTED** FDC copy of amateur radio for March 1983. Mr. F.C.M. Maitland Flat 3, 2 Griffiths Road, Wimbledon, London SW19 1SP.

• **WANTED** Instruction manual and two metre conversion data for Burndept BE201 transceiver. Brian Robinson, 68 Langholm Drive, Heath Hayes, Cannock, Staffs. WS12 5GZ. Tel: Heath Hayes (0543) 77581

• **PYE** FM Cambridge Boot model two metres R5 R7 S20 S22 4S mic control box toneburst loads spares £35. AM Cambridge Highband Unmod Wanted info Major M360 Multimode circuits layouts block. Ray Bastin (G3 LVA) 40 Stamford Avenue, Stivichall, Coventry CV3 5RX. Tel: 0203 414333

• **KENWOOD** TS130SE 200WQ PEP 9 bands HF mobile transceiver 3 months old, operator and service manual £460 ono. Sandown I.O.W. (0983) 402273

• **COLLEGE** lecture notes. Typed on A4. Loose leaf binders (2), full theory syllabus marine radio general certificate. Plus batch Govt. exam papers. Suit student radio officer. Offers around £30 invited. Tel: 061-794 5394

• **TRIO** 2200GX 2M Rig, fully crystalled, charger spare nicads carrying case, original box with bits and pieces. Some spare crystals. mobile mount, ideal new licensee £70. Phone Uxbridge 70772 after 8.00 p.m.

• **2M LINEAR** amplifier, 3 watts in 30 watts out £25. Lightweight antenna rotator up to 50kg. £25. 13-EL 2M Beem £15. G6TYP not QTHR. Tel: Kings Langley 65823

• **WANTED** HRO bandspread coils would exchange ex-Govt. 33 ft. fibreglass reinforced vertical antenna in approx. 4ft. screw in sections complete with base mount or a pair of 7MHz 1kw. dipole traps G4FEQ QTHR or telephone Castleford (0977) 552862

• **WANTED** back issues of QST 1950-1979. Wanted Eddystone Panoramic display unit Type EP15. Phone Wokingham 782236

• **SWOP MY SHACK** FT290R 25watt linear SME Preamp Daiwa CN620A SWR meter radar XY band detector plus much more. Wanted FRG7700m and ATU, £200. £1000 in good condition for above items asap. Ring anytime Pat 047/385/526.

• **QUAD SPIDER** on 2ft boom. Suitable for 10-15-20m stone enamelled steel three bold on sections needs heavy duty rotator £15ono. R. McTait G2BKZ Stevenage 721418.

• **WANTED** to buy or copy service manual circuit diagram for RCA AR 88D radio. Bridgewater 0278 423288.

• **SELLING** Icom IC2E little used since new July 1982 with charger external speaker/mic £99 telephone Basingstoke 770421.

• **WANTED** Trio GR-59DS must be good working order. No mods with manual reasonable please. 14 Cambria Close, Bosham, Chichester, PO18 8QT.

• **YAESU** FT22IR 2 metre multimode with muter front end board and matching speaker £330. Datong FL1 filter £35. Datong morse tutor £35. G2DAF receiver £65. Microwave modules frequency counter £55. Ring Dursley 811454

• **YAESU** FT208R including accessories base station extra Nicads speaker mike mobile aerials SMC co-linear with lashing kit plus much much more, all boxed, hardly used. Offers please. Harrogate 0423 885551.

• **FOR SALE** or exchange Wood & Douglas IV. Tranceiver with 30 watt linear and camera and MBM88Ele aerial. Swap for Multi-band H.F. Transceiver or transmitter or W.H.V. or sell for £190. G4VEL QTH NOT R. Tel: Thetford (0842) 4415

• **FOR SALE** S.S.M. Europa 2 metre transverter, very good condition, new coaxial relay fitted spare P.A. tube, instruction manual, approx. 40 watts, output £39. Ring Terry G40XD 0462 35248

• **FOR SALE** Sony ICF short wave scanner £45 or exchange for good quality 2 metre Tonna antenna. Mr. A Cocking, 31 Dryden Crescent, Stafford. ST17 9YH

• **FOR SALE** Drake R4C T4XC MS4/PSU new bands 250Hz and 500Hz filters £525 ono. D.M. Hill, 16 Hollow Lane, Snodland, Kent. Tel: Medway 240520

• **SONY** ICF2001 for sale. Complete with Nicads (six) charger earphone aerial, manual £120. Anderson, 44 The Spring, Market Lavington, Devizes, Wilts. SN10 4EB. Tel: Lavington 2450

• **S.S.M.** Europa 2mtr. transverter, spare P.A. tube, 40w O/P inst. manual £39 W2AU Balun 1:1 plus 30ft. copper wire £15 AVO 8 MK5 latest model £65 or exchange for MMT 144/28 or MML 144/100LS or 700 EX 2mtr. FM Transceiver. Terry G40XD. Tel: 0462 35248 after 6.00 p.m.

• **HEATHKIT** solid state 5in. oscilloscope DC to 5MHz model 10-102 complete with manual PWO £75. Amstrad Stereo Amp model EX330 PWO £30. Tel: 01-467 5351

• **HARVARD** 40 channel FM CB 2 identical available at £20 ono. each, both very little used. Phone Garsington 475

• **HEATHKIT** 2M-FM synthesized repeater shift £100. Liner 2 fitted pre-amp £75, DX200 receiver 0.15-30MHz £65. A.V.O. V.V.M. old but good £15. PYE 9in. video monitor £15. Tel: 0427 5848 (North Lincs)

• **ICOM** IC R70 receiver, 6 months old. Sensible offers. Telephone 0482 831924. evenings.

• **HAVE** Korg mono/poly synth less than 12 months old. will swap for 2m Multimode in vgc. Phone 061 766 4121.

• **COMPLETE** 2m station FT480R 14 element parabeam colinear rotator 5/8 whip and cutter. Mount £350. 01-952 5709.

• **WANTED** Digi scan 400 frequency expander with fitting instructions. Would swap Rollei 35 pocket camera and flash unit. value £100. or purchase for cash. Mr. N.E. Suffolk, Tel: Leicester 782711.

• **YAESU** FRG7 Mint. 2 metre Microwave MMC144/28 Converter new 2 metre Yagi aerial. New £150ono. S.C. Whale, Park Haven, 6 Overstrand Road, Cromer, Norfolk, Cromer 511465.

• **DX 200** communications receiver OTO 30MHz with MMC/144/28 2 meter converter and super Jim antenna also FT1012D AM board never used all very good condition exchange for 144MHz transceiver or sell £120. Telephone Lincoln 43642.

• **TONO** 9000E £500 Electron BBC Oric programs morse tutor £4.500 QTH locator £4.50 BBC RTTY £5. FT 290R Nicads Helical and 25W linear £255. T. Tugwell, 11 The Dell, Stevenage, Herts. Tel: 0438 354689.

• **FOR SALE** CR100/B28 receiver 50kHz-30MHz with handbook good cond. re-aligned £35. Also TCS13 receiver by Collins complete with power pack and handbook and spare valves £40. Buyers collect. Thomson, 2 Wilton Hill, Hawick. TD9 8BA. Roxburgh, Scotland. Tel: 0450 75089.

• **R1155A** unmodified Ex WD. R1155N modified Ex.WD. receiver type R1949 10D EXWD. AM-FM 27-150 3 bands. power pack receiver type PCR Ex.WD all working offers. M.E. Stockwell, 131 Holt Road, Fakenham, Norfolk. 0328 3208.

• **MICROWAVE** modules 432/144 MH2 transverter as new with 10dB attenuator and info £89. Jaybeam 4EL Quad 2m £15. Jaybeam 8/8 Yagi. 70cm £15. G4JXK Fareham 230737.

• **FT107M** int PSU GW filter memories Dentron MLA 2500 linear plus MT3000A HVY duty ATU Telrex S EL tribander Sony GRF320 comms RX FDK Multi 700 2m FM offers. Tel: Leicestrer (0533) 355313.

• **HY-GAIN** 14 AVQ Multi band vertical, As new. £39. /1-310 vertical, as new £39. 01-310 2067

• **WANTED** Trio 9R-59D receiver general coverage must be good working order with manual reasonable price. Farley, 14 Cambria Close, Bosham, Chichester PO18 8QT.

• **FT290R** Nicads charger and case plus FL2010 both virtually unused in original packing. Lot including mag mounted 7/8 £325ono. MR110 10 Xtal scanning RX £45ono G6TEJE. Tel: Robert 0604 714218 evenings.

• **EXCHANGE** for receiver HiFi system Wharfedale Linton speakers Rotel tuner/amp 25wpc. Akia cassetts deck 710 transcription turntable with Shure cartridge. Reel to reel tapereceorder with 50 7" tapes 50 LP records plus translinear series headphones, will consider anything any age but must be decent condition. Please ring 0900 65614

• **ICOM 720A** all mode TXRX as new £700 sommerkamp PSU67 6 months old 70 sommerkamp ATU mobile 6 months old 65. Ring Knottingley 88600 night. Day Tom York 414277.

• **ICOM** ICB 1050 working on ten £30ono Airmec deviation meter model 210A complete with manual £45ono. Minimitter Homebrew Top 7 CW/AM transmitter £20ono. telephone answering machine made by ITT £40ono. telephone G4AQZ Clacton 861632 evenings..

• **YAESU** FT290R £175 Heath VVM £10. Heath res/cap bridge £10. Wavemeter Class D Mark 2 £7.50 Z match coupler with SWR £15. G3RCO Seaton 21016.

• **YAESU** FRG7700 £200 Harrier Homebase £60. Piezo Desk Mike £15 power pack £5. Telephone Atherton 873373 after 6pm.

• **EDDYSTONE** 770/R VHF/UHF receiver 19-170MHz SSB/CW/AM/FM 6 bands recently re-valued with instruction manual good working order £130. Phone Bournemouth 27466 anytime also available photocopts of Racal RA17 technical handbook.

• **WANTED** to buy or borrow handbook for Layfayette HA 230 also any mods. Steven Rake, 80 Cripps Ave, Tredegar, Gwent NP2 3PB.

• **SONY** ICF2001 Mint condition extras and service manual £90ono. Sony CRF 320 RX also mint condition wioth service manuals etc. £490ono. Gould and Farnell 10amp. 12 volt switched mode PSUS 12 volt £50. Phone Paul (Surrey) 0932 48070.

• **REALISTIC** DX200 communications receiver 150kHz to 30MHz AM/SSB/CW crystal calibrator mint condition. Original packing £120. Ring Chris, Burnley 27710.

• **TRIO** TS520-SE excellent condition £310. Acorn-Atom microcomputer 16K RAM. 12K-RAM Amtor/RTTY/FAX/GW programs manual PSU ETC. £150ono. MNT 144/28 transverter £65. Icom ICB 1050 CB rig modified for 10M £15. tel: Keith (G4ENY) 01-205 9172.

• **POWER** SWR meter Homebrew reads PEP and RMS power 1.5 - 50 MHz up to 400w automatic calibration High SWR alarm reads power digitally £60. Kings Langley 65823.

• **DRAE** Morse tutor 6 months use £30 ono. It helped me to obtain my G4. K40 speech processor mike £15. Mr. A. G. Berry, 22 The Venn, Shaftesbury Dorset SP7 8EB. Tel: 0747 3579

• **HEATH** Monitor Oscilloscope SB610E works needs attention £20 CDE AR30 rotator complete £25. Z match coupler £10. G3RCO QTH R Seaton 21016.

• **BEARCAT** 100FB hand-held 5 months old as new with leather case and 6AA Ni-cad and AC adaptor charger £250 buyer collects. L. Haworth, 11 Joffre Ave, Castleford, W.Yorks. WF105AZ.

• **LOUDSPEAKER** Black crackle metal cabinet $8^5/_8$ x $8^5/_8$ x $7^1/_2$" deep, Rola 8" 3-ohm suit AR88 etc £6. Tuning condensers Air spaced, mixed, spindles, pre-set, twin gang, 500pF. 10 for £5. Edwards 01-445 4321 (Nth London).

• **FOR SALE** Microwave modules 144MHz to 432MHz transverter, as new, £110. 8 over 8 Slot Yagi, 70cms, £8 5 over 5 slot Yagi, 2m, £10 both good condition. Phone 01-751 2262 after 6pm.

• **FOR SALE** 5/8 2m whip with mag base £5. Heathkit M14 line printer, 132 char per line, 100lpm, bargain at £130, ASC11 Keyboard in case with PSU & display electronics £20. Phone 01-751 2262 after 6pm.

• **TRIO** TR2200G R0 R1 R2 R3 R4 R5 R6 R7 S20 S21 S22 S23 Nicads mic charger charry.ng case space xtal £70. Prefer buyer collect G2HKU Minster Sheppey (0795) 873100.

• **WANTED** Yaesu receiver FRG7700 or FRG7700M prefered and FRT7700 antenna tuner in perfect condition if possible nearly new. Up to £280 offered - also needed FRV7700A converter - prefer to collect. Phone East Grinstead 28278.

• **YAESU** FT200 HF transceiver with matchine PSU speaker plus FC707 ATU £250. complete. Phil 051 260 8939.

• **READY** to operate. AZden PCS300 2mFM handheld. One owner. Band/memory scanning. LCD read-out handbook. Cartonned as new new. Sacrificing at £155. tel. (0373) 64694 (Nr. Bath) Post extra.

• *KENWOOD* TR7800 2mtr FM mobile boxed with Nicads £140 daytime 2128114 evenings weekends 691 2040.

• **TRIO TS520S** fitted CW filter and shuire 444 Mike £300. Trio AT230 - 200 watts ATU to match above £60. SST electronics 150 watts ATU to match above £12. Medco low pass filter to match above £6. Reace RT50F Freq meter 1 to 50MHz, 5-500MHz £30. Oscar Block SWR and power meter £12. jor the lot, no offers £400.. H.W. Medcalf, 12 Centre Drive, Summer Lane Park, Banwell, Weston-super-mare 73S24 6JQ. 0934 823000.

• **SBE24** transceiver four band 80-15mtrs. Fitted Collins mechanical filter good working order with microphone all leads £85ono. WHY apply Paul 147 Linden Road, Reading Berks.

• **TRIO** TS520 with matching 2 metre SSB transverter £360. Yaesu FT7 £190 Adonis compresor mike AM502 £15. Wanted Crank-up tower. Willmott Tel: Watton 883217.

• **FOR SALE** Yaesu FT102 CW filter. FM Board FV102 DM Scan memory VFO 7 months old. Little used £750. Reason for sale have to get smaller rig. M.P. Baylis, 2 Albion Street, Kenilworth, Warks CV8 2FW. Tel: Ken. 58615.

• **YAESU** FT480R used as base station only immaculate condition £295. Yaesu FT230R. Bracket missing, otherwise as new £190. Tel: Boston-Spa 844153 or Leeds 456370 (Daytime).

• **SELLING** standard C78 70cm portable, with case, Nicads and mobile whip £95. G. Braund 17 Ye Meads House, Marsh Lane, Taplow, Maidenhead SL6 ODH.

• **SEA-VOICE** marine VHF radio with Nicads. Complete mountings plus marine antenna, also aqua-marine djepth sounder with alarm. Sell or exchange for 2 metre multimode. Unwanted gifts used only once. Thornes, 32 Cornhill Drive, Liversedge, Yorks.

• **HEWLETT** Packard 608E VHF signal generator 10-440MHz excellent working order £295 phone 0276 63128.

• **R107** receiver complete unmodified working but needs improving £25ono. wireless-set No. 19 with 12volt power supply, cable & mike Mk2 version with Russian & English markings £30ono. Wanted: any AR88D/LF info. Chassis, case, bits etc. St. Albans 39908.

• **COMMUNICATIONS** receiver realistic DX300 from tandy. 10jHz to 30MHz USB/LSB/AM/CW digital readout 240v/12v or batteries complete with 3 sets of Nicads 24 'C' cells. £170 will swap part ex. for bird thruline elements. Phone with details Mr. D. Kirkby, 01-521 0727.

• **SELLING** Yaesu FT680R 50-54MHz six meter transceiver all mode. G13ZSC. QTHR. 08494 72378.

• **WANTED** any info on Howard 450 RX circa 1938 wanted Racal RA17L SSB adaptor WD. RX's HRO 348 1155 etc. wanted 144 M/Cs 28m/cs converter FL2 ATU verticle 2m ANT. Milton Keynes 314095 after 3pm.

• **YAESU** FT200 transceiver with two metre europa transverter A200 with service manual £30. after 6pm B. Elliott STD 0767. Sandy 80043.

• **MINT** Azden PCS300 2m FM. Handheld cartoned with attachments supplied from new. Band/memory Scan. LCD readout handbook. Ready to operate. Outputs 1 or 3W. £155. post extra. Tel: (0373) 64694. near Bath.

• **WANTED** Panasonic DR31 or DR49 selling DR28 £100 or part exchange. Indoor UHF TV aerial booster. AC mains operated as new, not required. £4. 01-959 7715.

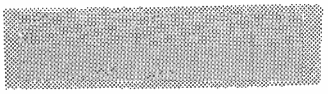
• **WANTED** Racal RA17L in exchange for FRG7700 with memory and Grundig Statalit 3400 professional superb receiver £260. Absolutely mind receiver £260. Absolutely mint condition both. R. Simpson, 20 Blythswood Road, Tyseley, Birmingham.

• **FOR SALE** AR88D receiver handbook. Two AR88 speakers spare set of valves. Many spares for set. AR88 S. meter £80. Two field telephones £6. the pair. R. Richardson, 84 The Drive, Isleworth, TWT 4AD. 01-560 7150.

• **NATIONAL** Panasonic 32 band sythesised double superhet RX type RF3100 FM88 108MHz LW MW plus 29SW bands 1.6-30MHz BFO wide/narrow selectivity Digital readout portable battery/mains. As new £140. C.J. Graham, 8 Oaktree Drive, Ecclefechan, Dumfriesshire. 057 63 494.

• **WANTED** Clandestine "spy-sets" B2 suitcase set transmitter MkXV receiver Mk XV A MkIII polish BP3 AP4 etc. also early amateur equipment national Hallicrafters, Hammerbund etc. Quality valve amplifiers, Leak, Lowther, Quad etc. Please Tel: John 01-450 6449.

• **WANTED** operating instructions circuit diagrams modifications etc. for Belcom Liner 2 SSB 144MHz transceiver copies for loan or buy any reasonable price paid. Tel: 0302 8415320 or write John 12 Ingram Crescent, Dunscroft, Doncaster DN7 4JG.



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