HRT

HAM RADIO TODAY

Incorporating SCANNER

OCTOBER 1992 £1.70

Lightning: Precautions for Radio Amateurs

Alan CT-145 2m portable reviewed

AMATEUR SATELLITES Worldwide Communication

AN ARGUS SPECIALIST PUBLICATION

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NOVICE • PACKET • REVIEWS • PROJECTS • SATELLITES

HRT HAM RADIO TODAY

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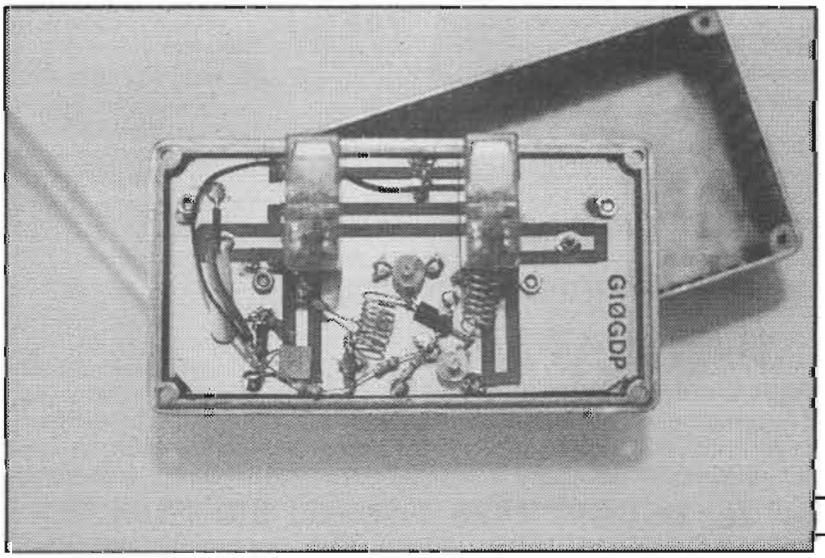
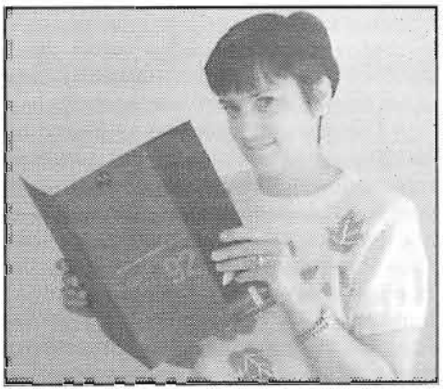


Left; Preamplifier for 2m

Right; Alan CT-145 reviewed.

CQ de G8IYA Editorial

Radiocommunications Agency say 'no' to the censoring of Radio Amateur's views



As I write this, the Radiocommunications Agency have just published their nicely-prepared annual report, you can get your's free from the RA, just phone or write to them asking for a copy. At the 'launch' meeting of this at Waterloo Bridge House in London, our publishing company of Argus Specialist Publications were represented by Chris Lorek of Ham Radio Today and Tony Hetherington of CB Magazine. We're very happy to have a good working relationship with the RA, and following the 'formalities' of the launch, Chris and Tony were pleased to be given the opportunity of chatting with many of the senior officials of the RA over lunch, discussing what will no doubt be the future of our hobby.

Direct Contact with Amateurs

A significant point made by the RA was, that with fewer licensed amateurs in the UK belonging to our national society, they are actively seeking to have a closer degree of *direct* communication with radio amateurs in general. They currently seem to be going 'all out' to achieve this.

One such progression to make things easy for amateurs to communicate with them is that of a central enquiry point at Waterloo Bridge House, where amateurs can phone or write in. Another is the publication of telephone and fax numbers of their many regional offices throughout the UK, allowing the 'local' knowledge and skill of RA officers to be put to the best use possible. In the past, you had to be content with writing to your local RIS office at P. O. Box 2500 in whatever area you were in, now they're also at the end of a phone talking to you, if they're not you'll get an answering machine and they'll ring you back – how's that for service?

No 'Channelling'

The RA have commissioned a review of the 28-470MHz spectrum (see *Radio Today*), and in chatting to them they've asked, again, for *direct* input from radio amateurs. However I can see the significant advantages of a co-ordinated input, especially in this case (although here the independent body commissioned to do the review will be compiling the feedback). But I acknowledge the RA's view that if only one coordinated input from radio amateurs is concerned on matters affecting us all, it's essential for this to represent a balanced view from as many amateurs as possible. They decided this *wasn't* happening, and they *don't* want any active 'channelling' (censoring?) of feedback from us. Can this be a sign of the times?

The 'ideal' answer is, of course, for as many amateurs or groups as possible to support one national society, or maybe a 'licensing section' of this if nothing else, ensuring that these members are all happy with the presentation of their feedback to such bodies. The best way to change is from within, rather than 'shouting' about it, maybe this might happen one day.

Get your repeater licence here

A significant matter of licensing detailed by the RA was that of repeaters. They're considering the question of individual licensing of these to groups, and they've formally asked, again, for your views *direct*, not through any organisation. They also want your views on the transmission of third party traffic by amateurs, following the end of the telecommunications duopoly (phone patch on repeaters?). Get your pens out! One result of 'direct input' was the Novice Licence review, and the RA should soon be finishing their study of your views, we'll be getting together with them again on this to report back to you.

Fascinating figures

An interesting point was the trend of the increase of amateur licences. Yes, our hobby *is* growing, slowly maybe, but it's on the up rather than declining as some 'doom and gloom' merchants may like to think. The number of licensed amateurs given in the RA annual report are 33,280 Class A (32,954 in 1991) and 27,738 Class B (27,930 in 1991). The number of Novice licensees given are 46 Class A and 376 Class B. Now that's quite a bit of a difference between Class A and B Novices! What do you make of that? I know what I do. Maybe this is one reason why the RA asked for direct input on this?

RAE Courses

I'm pleased to receive a large number of RAE course details here, these normally asking for their details to be published in the pages of HRT. I'm very pleased to do this freely within the Editorial sections if the course is run by a non-profit organisation, for example a radio club. I'm all for the voluntary work done by amateurs and go-ahead clubs, and I go all-out to promote this in HRT. If it isn't run by a club or whatever but if any profit from such a course is 'ploughed back' into such an organisation for the furtherance of amateur radio, then all is well and good. Otherwise, I refer them to the classified ads section of the magazine where they're welcome to take an ad out to publicise their commercially 'run-at-a-profit' course, as I'd still like to be able to publicise their efforts. I've taken to replying, personally, to *every single* request I receive for such 'free publicity', asking for confirmation that no-one's pocketing money out of their course. Of all the publicity requests I've received from course organisers in the past two months, not one has told me they're running it voluntarily. Does this mean that some amateurs have found a new 'business venture'? One organisation running a course asked prospective Novices to shell out just under £100 in all, made up of course fees plus the required books etc., to attend their Novice training course. That's a lot of money for a youngster to find. Maybe I should start charging to teach prospective Novices on the (voluntary) course I run.....

LETTERS

Letter of the Month

Dear HRT,

I would like to raise some discussion as to the use and financing of Microsats. For those who have not wished to follow the latest developments in the amateur radio satellite scene, a short explanation may help them to appreciate the reason for the ideas here put forward.

Amateur radio satellites now include those having transponders which operate in either analogue (typically SSB/CW) modes or digital (typically packet) modes, or in the case of the Japanese satellite FO-20, either mode (though only one mode at a time). Oscar 13 operates in the analogue mode, while FO-20 mostly operates in a digital mode, currently with only Wednesday in the analogue mode.

A new breed of satellites, designated 'Microsats' have been launched and these currently use a protocol called 'FTLO'. These need different software in the ground station, and the University of Surrey has made available software called 'PG' and 'PB', which can be regarded as the 'official' operating software, also 'net' software with enhancements by PE1CHL and others will work with some constraints.

There are two Microsats using a 1200 baud system, namely Pacsat Oscar 16 and Lusat Oscar 19, both with FM uplinks and FSK downlinks, and possibly the most advanced Microsat, UoSAT-5, otherwise known as Oscar 22, which operates at 9600 baud with uplinks and downlink both FM. A new Microsat called Kitsat is expected to have been launched in August 1992 which will be similar to Oscar 22.

To use FO-20 and the Microsats, special interfaces between the TNC and the transceiver are necessary, and modifications are needed to the transceiver. Details can be obtained from the various AMSAT groups. A satellite gateway is a means of putting packet messages from the terrestrial packet system to a Microsat for forwarding, rather than using the previously available network. This previous system uses terrestrial links, both VHF and HF and AMTOR. The station originating the packet message is unlikely to know whether the message is being forwarded via a Microsat or by terrestrial links.

The following is the difficulty which I perceive. In recent months UoSAT-5/ Oscar 22 has been increasingly used for mail forwarding by terrestrial packet radio systems. Up to the 4th January 1992, KI6QE stated that there were 32 worldwide satellite gateways serving the packet system, by now there are probably even more. An examination of the current directory list on Oscar 22 indicates that the satellite is being increasingly used for this purpose. This use has significantly reduced the availability of Oscar 22 for other purposes, especially experimentation.

The majority of Gateway stations are automatically controlled so that they are operating on every available pass, even when the times are, hopefully, quiet. This has at least two deleterious consequences for operators wishing to use the satellite for other purposes. Uploading of files becomes more difficult as the uploading channels are difficult to access, and downloading using the PB command software is slowed down to a point which requires several passes for even smaller files. The packet terrestrial system seems to have switched from other forwarding arrangements to the microsats, especially to Oscar 22.

Such easily operated terrestrial links, as those within the United States and between the Republic of Ireland and mainland United Kingdom, now use the Microsats. It would not be unreasonable to forecast that in the near future, the packet system would take over the Microsats to the exclusion of all other users. Is this a requirement for Oscar 22? This dilemma was, in my personal opinion, as far as I can ascertain, never considered when AMSAT-UK contributed money to finance UoSAT 14, now Oscar 22.

The initial users of the packet system, that is those who initiate the messages which are forwarded by the satellite gateways, are unlikely to pay anything to finance the satellites, unless specifically requested. The Gateway SysOps may or may not contribute to their national AMSAT societies. Thus we have what must be an irreversible problem of freeloaders using a system, the details of which they may be totally unaware, and worst of all excluding the genuine satellite enthusiasts from their use of Microsats and of their experiments. Unfortunately there seems to be no international association of Packet operators, unlike those interested in amateur satellites who have their AMSAT groups, and which are in constant communication with each other.

The obvious solution seems to be for the packet lobby to get together internationally, and finance their own dedicated Microsat. Unfortunately this seems to be asking for the improbable. One other possibility is to constrain the number of Gateways that are allowed to use Oscar 22. This would force packet forwarding to terrestrial links where these are available. For example between EI and G, G and PA, F, ON, DL etc. and between many of the internal routes in the United States.

I appreciate that there is a temptation to use the faster facility provided by the Microsats, but international packet mail forwarding was quite effective before this came available. The experiment of using Oscar 22 for packet forwarding has now been proven, so there is little reason for allowing it to escalate. It seems to me that unless something is done, Microsats will become just another part of the packet radio system, and might as well be ignored by those wishing to use them for other purposes.

As a keen member of AMSAT-UK, I would not have wished the donations of the members to be used for providing any finance to enable freeloaders to dominate Oscar 22! I should be delighted to hear where I have misunderstood the situation. Consider these remarks to be those of a devil's advocate, and let us have other divergent ideas.

Roddy Clews,
G3CDK.

Editorial comment;

Well, it's open to discussion, let's hear some views!

(Following the publication of this discussion document *in a recent Oscar News there have been a number of replies contending some of the assumption. G3CDK has recorded his revised questions in Oscar News No. 95).*

"TONE" BURST

by G6MEN

Dear HRT,

The subject of rallies seems to be hot on the agenda these days, and as a dealer who attends many rallies, for once I would like to praise a rally organiser. On Sunday 5th July I exhibited at the York rally (a hefty drive from my Southampton base I might add) and was very impressed by the club's impressive organisational skills.

Upon arriving at the York rally I was greeted by half a dozen burly 'helpers', who promptly emptied my vehicle and took my stock straight to my stand!. A few minutes later one of the organisers thrust a hot cup of tea in my hand and asked me if everything was OK. During the course of the rally the PA system was hardly used, and even when it was I was surprised to find I could still talk to customers above it (York club had actually engaged a professional PA company which clearly paid off). I was also impressed that the club had organised two plain clothes policemen, to keep an eye on the inevitable one or two light fingered brigade.

As I was the only member of my company attending the rally, I was equally impressed by the fact that the rally organiser himself took charge of my stand for a few minutes during the day while I dived off to the gents etc. At the end of the day, that same burly team of helpers reported for duty at my stand and again did all the donkey work for me (loading and unloading on your own is a real chore at rallies).

I would just like to offer my thanks to the York club for their excellent organisation and support. Sadly, I can't recall the last time I was treated like this at a rally, but I hope other clubs take note. To rally organisers who might be reading this, if you want dealers to travel half way up the country to support your rally, here is one way to give us some incentive to do so.

Phil Bridges G6DLJ,
Siskin Electronics Ltd.

Editorial comment;

Such help given is, sadly, rather lacking in the 'larger' rallies. In these circumstances it may of course be rather difficult to organise such help, but it looks like the York rally organisers certainly look after their traders, well done lads!

Dear HRT,

With reference to your letters column about the treatment by helpful dealers. I recently bought a AR2800 scanner from a local dealer, the man in the shop could not care if I bought the receiver or not. When I got the receiver home I noticed that there was a protective film covering the key pad and the control knobs, and there were no instructions with the set to say how to remove it. After the attitude of the shop I decided to ring the manufacturer at AOR. The man I spoke to couldn't have been more helpful, he explained that I needed an Allen key to take the five knobs off the set to remove the film. I was sent the Allen key by return of post, my thanks to AOR for the fantastic service and a wonderful scanner.

Yours faithfully,
D.R. Benfield

Editorial comment;

In these days of 'box shifters', where it's often a case of 'take it or leave it', such an attitude by the odd dealer doesn't surprise us. We know Richard and Tak at AOR (UK) are very helpful indeed every time we chat to them, and a practical example of their good natured help to customers is pleasing to see.

Dear HRT,

I am near 70, disabled, no real memory problems, but I can't say 'heart wise' whether I can go and attend a Novice class say next Tuesday, or even tomorrow! As I understand it, if you can't attend the required amount of class hours, you've had it. For example, if I missed a class on soldering, out!

Perhaps I am class conscious, but surely the elderly and disabled are entitled to help as much as the young? I don't want an easy way to a licence, far from it, but let's be fair. I served my time in the 'radio trade' albeit a long time ago, from a shop floor bench, when dare I say it, wireless was wireless, and not black boxes!

Yours sincerely,
Ray Williams.

Editorial comment;

The current training scheme is based upon voluntary instruction, and there's nothing whatsoever to stop a willing voluntary instructor applying to teach you on a one-to-one basis, in your own home. For example, we (the HRT Ed and Consultant Tech Ed) are registered as Novice instructors to teach two prospective Novices from our own home, as well as teaching a group of children at a local school.

£10 for the Letter of the Month

Do you have something constructive to say on the state of amateur radio today? Perhaps you'd like to put your viewpoint to the readers, get some discussion going, or give an answer to one of the issues raised? We'll pay £10 for the best letter we publish each month. So write in with your views, to Letters Column, P.O. Box 73, Eastleigh, Hants SO5 5WG.

Alan CT-145 Review

G4HCL takes a look at a 2m handheld that doesn't come from one of the 'major' manufacturers

The amateur radio handheld market is almost 'dominated' by a select few Japanese manufacturers. The 'Alan' name is a relative newcomer to the UK, this also coming from the Far East and brought in by the Portsmouth firm of Nevada Communications. When I received a product leaflet on this a short while ago, it wasn't very long until I was there, on a wet and windy day, at their door to pick up the arranged review sample.

My first chance to use the set was on the way home, having the (dubious?) luxury of being chauffeured by the HRT Editor. Within seconds I was listening to the local Portsmouth repeater, which came booming in on R7, but try as I might I just couldn't work out how to switch the repeater shift in! Out came the handbook, and reading through this I thought I'd better 'shut up' until I'd worked out how to use the set properly!

This episode may prompt you to guess a little about the number of functions available on the set – despite its relatively low price of £199 it certainly isn't lacking in functions, second functions, third functions – you name it! After a while I'd programmed my favourite memory channels up, after which I settled down, happy and content in the knowledge I could operate and scan away to my heart's content, after I'd read the manual again of course

Basics

The rig comes as a 2m FM portable covering the usual 144-146MHz range, and you can select the usual 12.5kHz, 25kHz, 10kHz, 5kHz or whatever steps you want the set to QSY in, pressing the side mounted 'Function' key above the PTT switches these to 100kHz steps to help you get from one part of the band to another quickly. The rig comes supplied with two empty battery cases, one holding 4 AA cells, the other holding 6 AA cells. In my case I used 6 AA nicads inside the larger case to provide 7.2V, the rig giving around 2.5W output on transmit with these fitted. The set is rated down to a supply voltage of 5V, the smaller battery case allowing four 1.5V 'dry' cells to be fitted – this could be a useful 'standby' for all-day outdoor expeditions. For mobile or shack use, plugging in an external 12V PSU via a lead into the side mounted socket on the set disconnects the internal batteries, and gives you around 5W maximum output power as a 'bonus' which could be handy in many cases. For more local use, 'Mid' and 'Low' power levels can be switched in, these giving around 2.5W and 0.35W respectively with a 12V supply. The squelch control, rather than being an easily-knocked rotary knob, is a preset 'adjust it with your thumb' type of control, a handy 'Sql Off' button on the PTT extension lets you defeat this momentarily to set the receive volume and so on. The set measures 138mm H x 32mm D x 55mm W (the PTT bar extending this to 60mm), and weighs in at 185g plus the weight of whatever batteries you fit.

Bells and Whistles

The above are, of course, the 'core' details of what the rig does. As well as various scanning modes including 'busy' and 'timed' scan resume, the rig has twenty memory channels arranged in two banks of ten channels each. These can be individually scanned, all scanned, or selected channels from one or both banks scanned. As well as this, a 'dual watch' (priority scan) is available to keep a check on a given frequency every few seconds while the set's doing something else. Together with a programmable repeater shift (e.g. set to 600kHz for normal use) you can also transmit and receive 'cross channel' by using a pair of memories, and you can store two different sets of programmed

shifts in different memories if needed. As well as full-range and 1MHz range scans, a programmed frequency range scan is also available between the frequencies stored in two memories, and switching between a 'fast/slow' scan is available with a single button push. The usual switchable 'battery saver' is fitted, this cycling the set's receiver on/off quickly to extend your battery life on a quiet channel, and a switchable 'Auto-power-off' function saves your batteries going flat if you accidentally leave the set switched on.

Tone Options

A couple of add-on option boards are available for the set, these being a CTCSS (sub-audible tone) encoder/decoder, and a DTMF unit for DTMF selecting calling and paging. These systems have been documented in earlier issues of HRT. However basically, CTCSS allows you to use the 'alternative' access method for 2m repeaters in the UK and other countries such as the USA, as well as allowing a channel to be monitored in 'quiet' mode with your loudspeaker remaining silent until a signal with the correct CTCSS tone superimposed on it pops up. The three-digit DTMF selective calling system has now been 'standardised' by amateur radio manufacturers, this again allowing your rig to remain silent until 'called' by the correct DTMF sequence, including a 'paging' mode where your set bleeps away at you when you or your group is called.

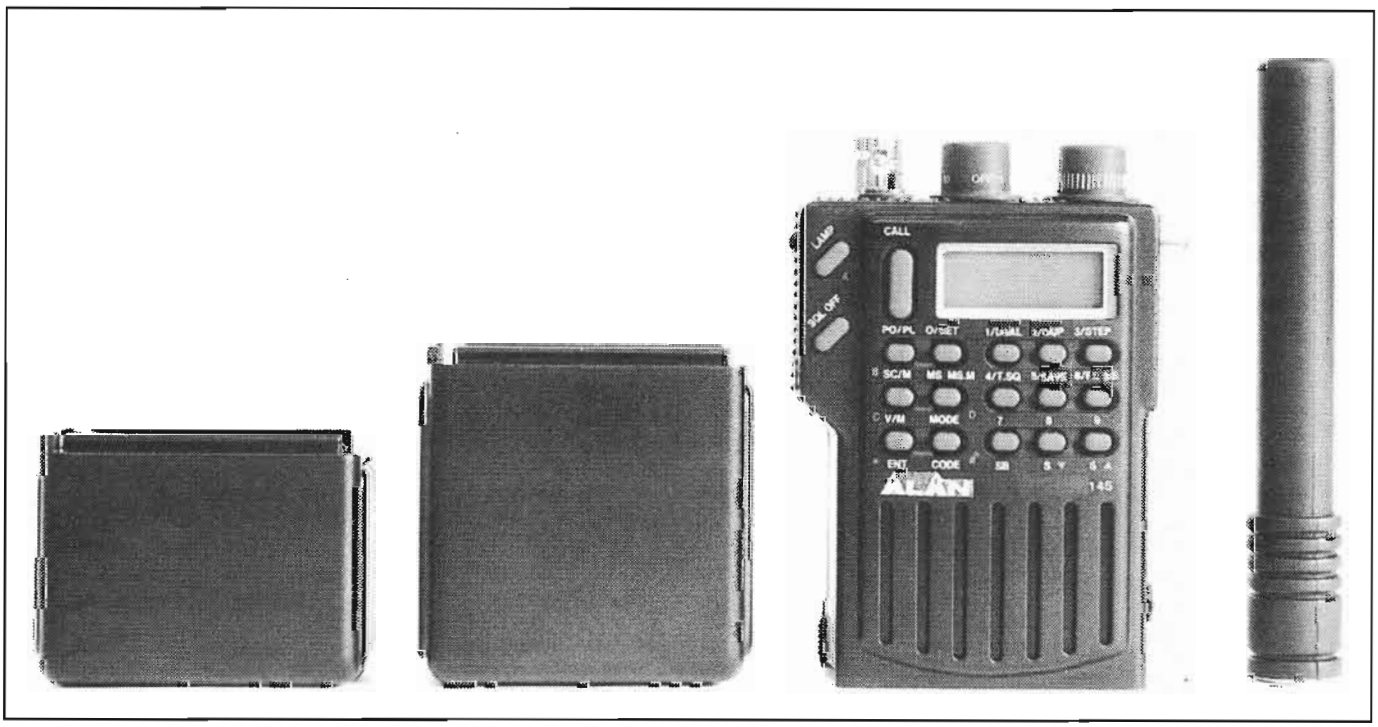
Other options include a 7.2V nicad pack (at £29.95 plus £7.76 for a plug-in charger), a DC car supply lead, speaker/mic, and a protective carrying case.

On The Air

After I'd had a good read of 'the book', I found 'simple' use was OK, but I must confess it did take me some time to get used to the various methods of starting the set scanning on the memory channels I wanted. This involved started the set off, then pressing various buttons while the set was in scan mode – not something I was used to. I suppose it was just a different method to that used by other manufacturers, but even after a couple of week's use I was still getting used to it! I found there were no 'repeater shift' and 'reverse repeater' indications on the keypad, these need a press of the 'Function' bar together with the '7' and '8' keys respectively, which was the cause of my initial puzzlement when first trying the set out.

The rig fitted quite nicely in my hand, and when I used it out and about portable I found the receiver to be very, very sensitive indeed. With this in mind, when I plugged it into my rooftop colinear at home I was all ready to hear plenty of horrible noises caused by the multitudinous strong out-of-band signals around my location. But what was this, nothing, just distant repeaters (which I normally have real problems in copying) coming through loud and clear! One or two other handhelds I'd tried in a similar test just gave up – I was very impressed with this little rig! A quick test on packet with my TNC gave good results, showing the squelch rise time to be adequate for this - again this is sometimes a problem with the odd portable I've tested. The speaker/microphone connections and PTT switching method I found were the same as those used on Icom and Yaesu portables, although the set's manual gives no information whatsoever on this.

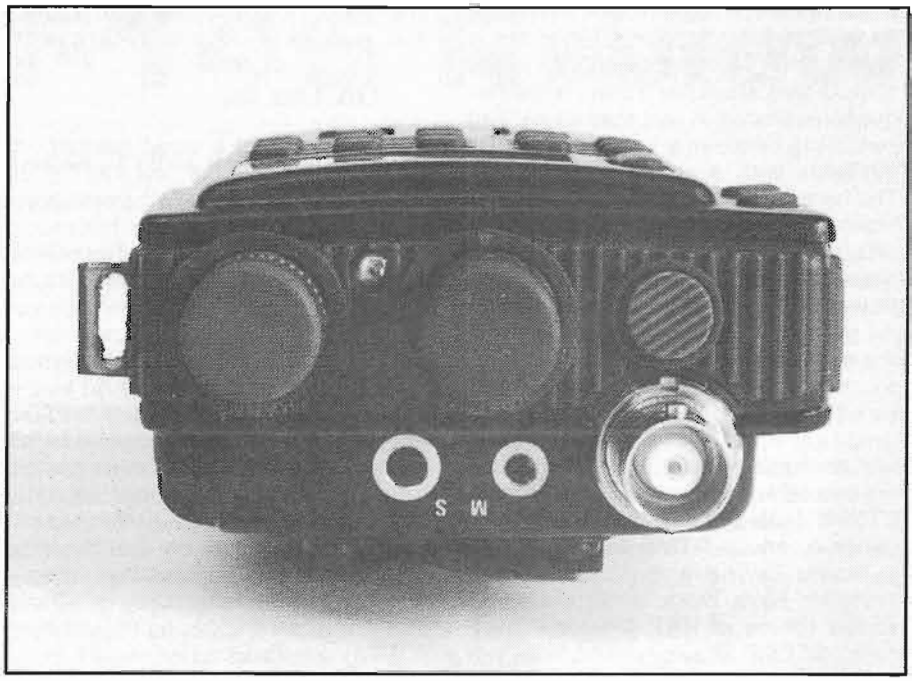
When using the set whilst out mobile, together with it's excellent sensitivity I found plenty of clear receive audio was available, even when travelling at speed. During one sunny day with the sun roof open and windows wound down I did find an extension speaker useful to prevent too much distortion from the set's internal speaker, but this was still quite readable. The microphone picked up very little background noise – a common limitation with some portable rigs. However controlling the set on the move was rather difficult, as the small push buttons I found were rather fiddly to use especially when these needed a double-push to operate (e.g. certain scan modes, and the 1750Hz toneburst is also a two-handed affair needing a press of the 'call' button whilst pressing the PTT). In the end I just used the rotary channel knob to select memory channels manually. I originally found a strange 'fault' with the set, in that when moved about in my hand, the synthesizer would often 'wobble', both in receive and transmit modes. This I found to be poor battery contacts – the supplied 6 AA pack wasn't a rock-solid fit, however bending the sprung contacts a little more effected a quick cure of this. I'm sure the optional nicad pack would have been a lot better here

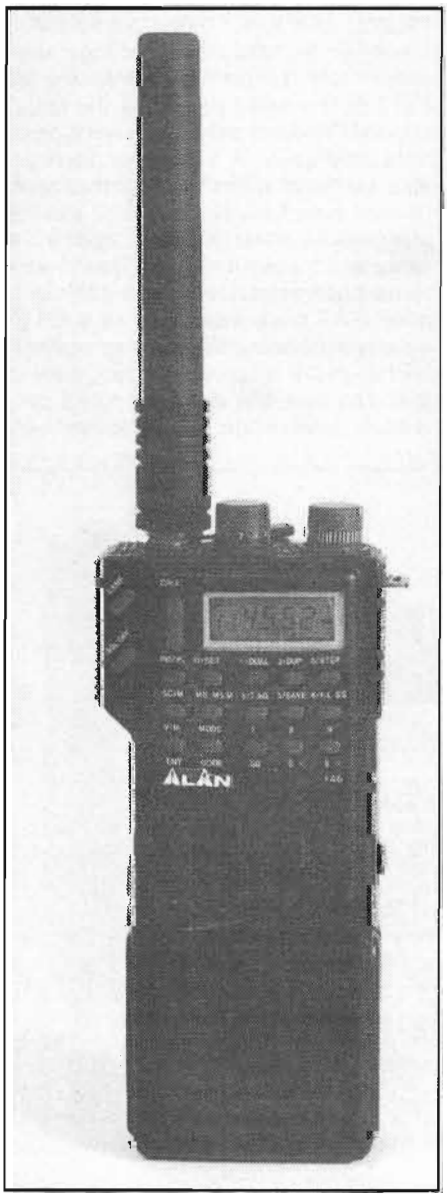


though, the empty pack admittedly being the 'economic way' of powering the set. The external DC lead uses the outer sleeve on the flying connector for +12V, which I didn't feel at all happy using in the car.

Once, when switching the set on whilst driving, I accidentally pressed the raised 'function' bar whilst holding the rig. I soon found this wiped all the memories and reset the rig to its default conditions (145.000MHz, 10kHz steps), which rather annoyed me! Most rigs need at least a two-button push on the keypad whilst switching on to prevent this, and the CT-145 handbook gave no warning of this.

Nighttime control of the rig I sometimes found difficult. Although the LCD had a very good backlight, with an easily located 'lamp' button, none of the buttons were illuminated which again limited me to controlling the set with just the rotary channel knob or having a 'full' memory scan.





Laboratory Tests

These showed the rig to have a good technical performance, very good in fact when considering the price. The Taiwanese manufacturers of this rig certainly don't seem to have cut any corners here! The receiver strong signal performance was very good, and together with its accompanying excellent sensitivity this should prove to be a virtually 'go anywhere' rig RF-wise. The transmitter harmonics were very well suppressed indeed, with ample RF power available, although the TX deviation was set a little 'over the top' of the 5kHz absolute maximum.

Conclusions

The Alan CT-145 appears to provide an excellent technical performance for an attractively moderate cost, and I'm sure this smart looking set will appeal to many users. It's an easily carried rig, fitting into one's hand very comfortably. Remember however to budget for the additional cost of batteries and a charger as these don't come with the set, likewise for a CTCSS unit if you need this either now or in the future for 2m repeater operation in the UK.

I must confess that I didn't like the designer's ideas of controlling the set one bit, and even at the end of the review period I was still fumbling with buttons galore to enable the various scanning modes. But then maybe I should have really been happy with 'normal' operation of the set, as it certainly does provide plenty of available facilities. *My thanks go to Nevada for the loan of the review set.*

LABORATORY RESULTS:

All measurements taken at 145MHz, high power, with fully charged nicad, unless otherwise stated.

RECEIVER:

Sensitivity;

Input level required to give 12dB SINAD;

144MHz;	0.11uV pd
145MHz;	0.11uV pd
146MHz;	0.12uV pd

Squelch Sensitivity;

Threshold; <0.06uV pd (<3dB SINAD)
Maximum; 0.15uV pd (20dB SINAD)

Adjacent Channel Selectivity;

Measured as increase in level of interfering signal, modulated with 400Hz at 1.5kHz deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB on-channel signal;

+12.5kHz;	26.4dB
-12.5kHz;	36.2dB
+25kHz;	64.8dB
-25kHz;	66.2dB

Blocking;

Increase over 12dB SINAD level of interfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12dB SINAD on-channel signal;

+100kHz;	79.7dB
+1MHz;	96.6dB
+10MHz;	97.1d

Intermodulation Rejection;

Increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;

25/50kHz spacing; 67.6dB
50/*100kHz spacing;* 65.2dB

Maximum Audio Output;

Measured at 1kHz on the onset of clipping, 8 ohm load;
274mW RMS

Image Rejection;

Increase in level of signal at first IF image frequency, over level of on-channel signal, to give identical 12dB SINAD signal;
74.2dB

S-Meter Linearity

Reading	SigLevel	Rel.Level
S1	Sq open	–
S3	0.63	-18.5dB
S5	0.98	-14.6dB
S7	2.12	-7.9dB
S9	5.33	0dB ref
S9+	7.05	+2.5dB

Current Consumption

Standby, sq. closed 30.5mA
Receive, mid vol. 52.0mA
Receive, max vol. 108mA

TRANSMITTER

TX Power and Current Consumption;

Freq.	*Power*	*7.2V Supply*	*13.2V Supply*
144MHz	High	2.18W/730mA	4.90W/930mA
	Mid	2.18W/730m	2.49W/715mA
	Low	340mW/380A	350mW/400mA
145MHz	High	2.25W/720mA	5.01W/945mA
	Mid	2.25W/720mA	2.49W/710mA
	Low	350mW/370mA	360mW/395mA
146MHz	High	2.28W/740mA	5.05W/940mA
	Mid	2.38W/740mA	2.55W/720mA
	Low	360mW/370mA	370mW/400mA

Harmonics;

2nd Harmonic;	<-90dBc
3rd Harmonic;	-84dBc
4th Harmonic;	-86dBc
5th Harmonic;	<-90dBc
6th Harmonic;	<-90dBc
7th Harmonic;	<-90dBc

Peak Deviation;

5.32kHz

Frequency Accuracy;

+160Hz

Amateur Satellites – Worldwide Amateur Communication

Arthur Gee G2UK gives an insight to beginners on what the fascinating world of satellites has to offer

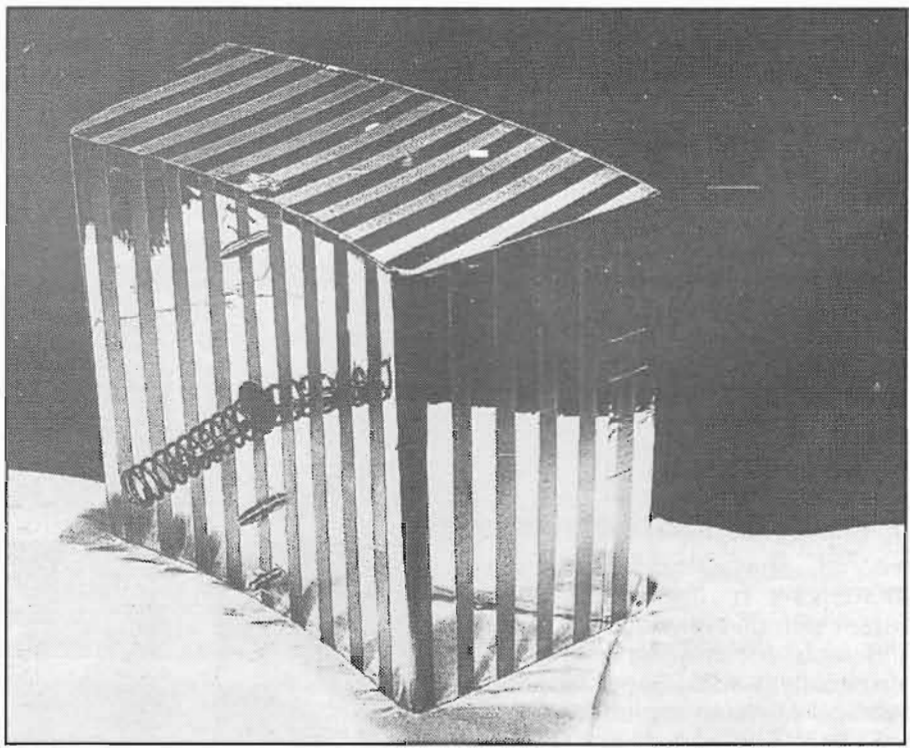
Of the various modes of amateur radio communication, the 'Cinderella' might be considered to be amateur radio satellites. Even though amateur satellites have been coursing through space for 25 years or so, many amateurs still seem quite unaware of their very existence. This perhaps is not unexpected, as amateur radio communication via satellite is a bit of a speciality, and there is much else also going on in our very varied hobby.

For those who have got 'into' satellites however, they very soon become dedicated enthusiasts. Amateur satellites cover a wide field of radio interests such as new technology, new modes, new ideas, the ability to work distant parts of the world more easily and cheaper than the traditional modes, and an enormous field for the experimentally minded.

One of the reasons why it is not as popular as other modes is undoubtedly the idea that it is very expensive in equipment and needs an awful lot of learning up new theory and techniques to participate. I hope to dispel these notions in this article.

The Beginnings

It might be a good idea to recount how amateur radio satellites first came about. Interest in satellites amongst radio amateurs, whose interest had spread into the new space sciences, undoubtedly took a leap forward when the Russians launched their first *Sputnik*. This sent signals down to earth on a frequency around 20MHz, and it is said this frequency was deliberately chosen as there would be plenty of shortwave listeners around the world who already had receivers able to tune into this. This proved to be the case and thousands of SWLs did hear the signals, and a new era for Short Wave Listeners began. This was followed by small groups of radio amateurs, firstly in the USA, giving thought to the possibility of constructing and launching an



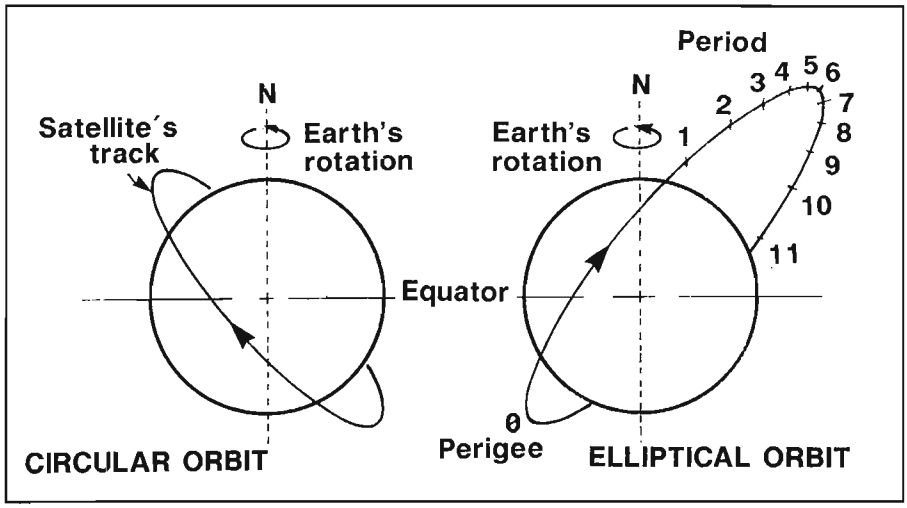
The first amateur radio satellite, OSCAR 1.

amateur radio satellite. This started with a primitive satellite christened OSCAR 1 (*Orbital Satellite Carrying Amateur Radio*), and went right through years of development to the present sophisticated satellites of today. If you are interested enough to read more about this, may I be forgiven for recommending a small booklet I wrote to commemorate the 25th anniversary of the launching of OSCAR 1 entitled *'Amateur Radio Satellites–The First 25 Years'*, available from AMSAT–UK.

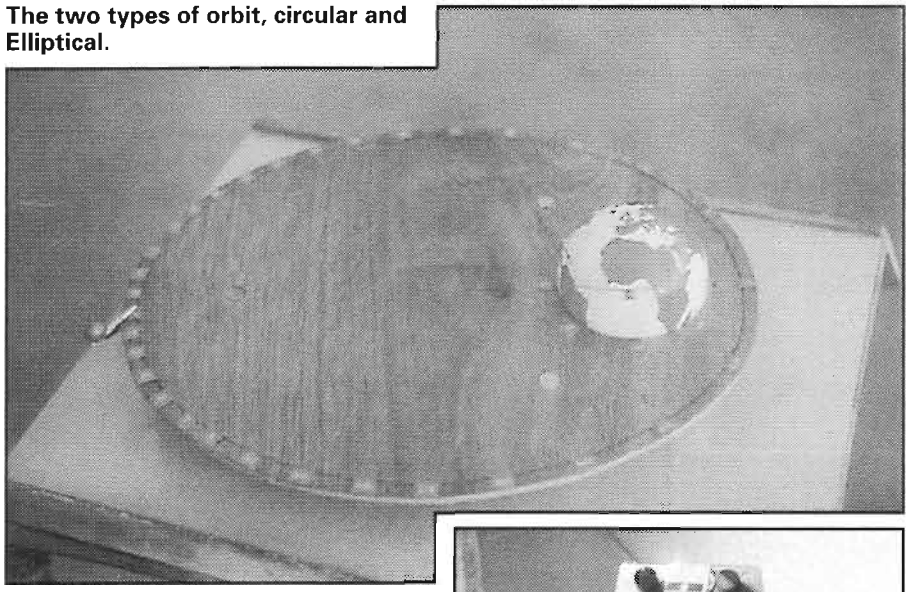
That Magical Sound

Satellite communication has a peculiar fascination about it. It is quite uncanny to hear a satellite gradually coming into range, its signals creep up in strength as it becomes audible, other stations coming within its range so that QSOs become workable, signals slowly fading out becoming inaudible as it goes over the horizon. There is a particular sort of satisfaction in knowing that *you* calculated when and where the satellite orbit would be, and got it right!

For those who are quite new to this interest, we should touch on, briefly, one or two essential basic facts about satellites in general. In a way, they can be regarded somewhat as a terrestrial repeater station, but instead of being fixed in one place on earth they travel round the earth in various orbits. There are two types of orbit, *circular* ones at a fairly low height, and elliptical orbits where the satellite travels thousands of kilometres right out into space, returning to Earth to a lower orbit and out again into space. Fig.1 illustrates these two types of orbit. A model I made, to a design by Jim Miller G3RUH, illustrates very well the scale of distance of an *elliptical* orbit and the size of the world. From these it is apparent that with the

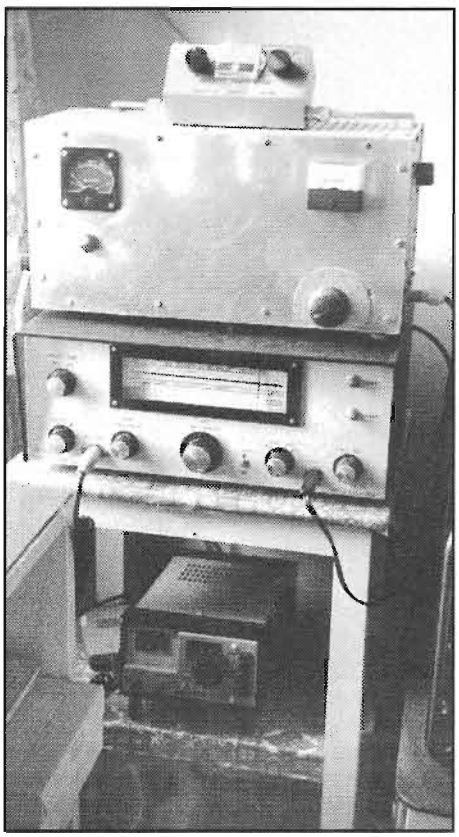


The two types of orbit, circular and Elliptical.



Model showing relative size of the earth and the track of the satellite out into space.

earth rotating once every 24 hours, and the satellite remaining in the same orbital path above it, some quite complicated astronomical calculations do become necessary to find out just where the satellite is during its orbit, so that when necessary we can direct an aerial at it. It is the thought that having to do such calculations puts some folk off 'getting into satellites'. It is however, not as difficult as it might first seem. The problem can be solved either by a neat graphical gadget called the *Oscarlocator,* or by computer (*see HRT March 91 – Ed*). AMSAT-UK produces an *Orbital Prediction Calendar* which is published every two months in 'Oscar news', giving data in tabular form which makes the process very easy, and the satellite Keplerian Elements are published each month in HRT's Satellite Rendezvous for you to use for calculating the positions at any time.



The author's satellite gear first used for the 2m uplink, 10m downlink. 10m receiver at the bottom, 2m transmitter above, and home built 2m linear on top.

What's Up There?

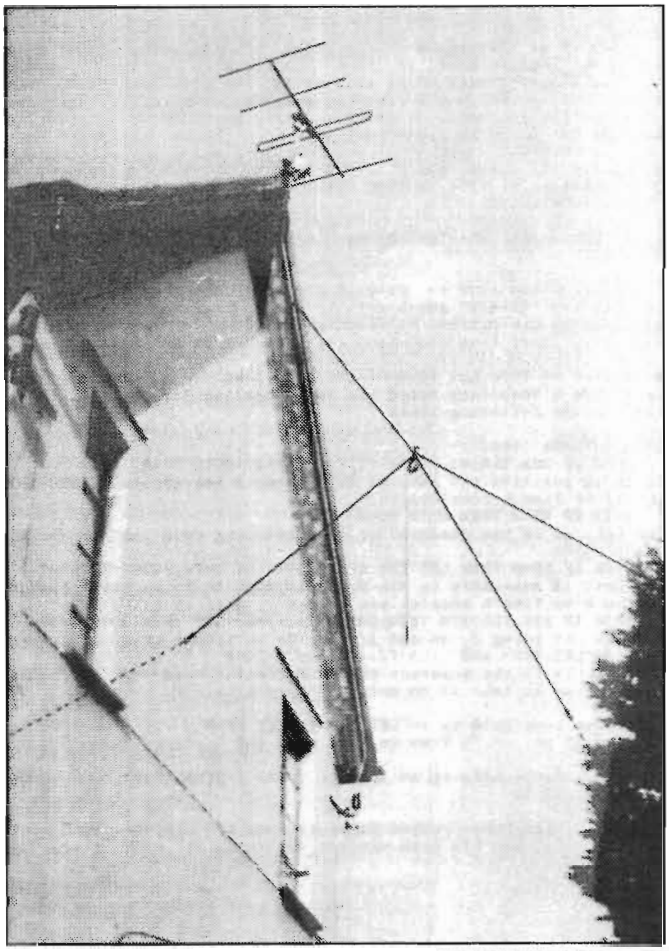
What satellites are in orbit now, and to what use can they be put? How are they used? Let's deal with the last point first. In a typical case signals are sent, either CW or SSB, from your amateur radio station which we call the 'ground station' up to the satellite. This receives it, converts it into another frequency, and transmits it back to earth. VHF or UHF frequencies are usually used, though recently an excellent Russian satellite, RS 12/13, has been launched which uses HF frequencies. The signals to the satellite are called the 'uplink' and those down from the satellite the 'downlink'. In this way, VHF or UHF transmissions can be made to cover far greater distances than by the more usual terrestrial paths.

There have been about 25 satellites launched since the first one in December 1961. The earlier ones lasted only a few days, as they used only batteries for their power supply. Later on, solar cells were used to keep the batteries charged, which enabled later satellites to continue in service for several years. The earlier satellites provided a minimum of signals, sending Morse telemetry giving data on conditions on the satellite such as charge rate and voltage, temperature and so on. These were picked up by many amateurs and produced much interest and excitement. Present day satellites use SSB, CW, FM, Data and Packet, RTTY, and CCD camera pictures and a whole host of sophisticated data and memory systems, there is something available for *all* tastes and interests. If you just want to communicate with another satellite station you can do so with a minimum of equipment and expense, or if your interests are technical matters you can go for this – if you have a long enough pocket!

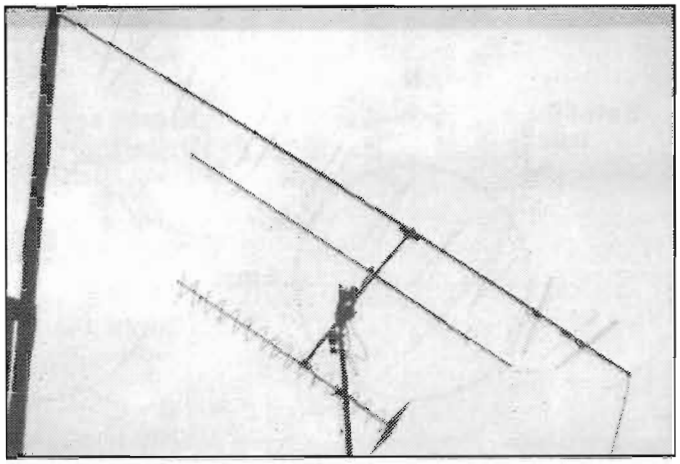
First Steps

For an example of the straightforward communication system, let's take the case of the RS 12/13 satellite. It is an ideal one to 'cut your teeth' on. It has an uplink in the 21MHz band and a downlink in the 28MHz band, has a good strong signal and facilities for CW or SSB. All you need in the way of gear is your normal station transceiver and a separate 10m receiver. Your usual transmitting aerial for 21MHz and a 10m dipole will do. An Oscarlocator and an Orbital Calendar from AMSAT-UK, and away you go!

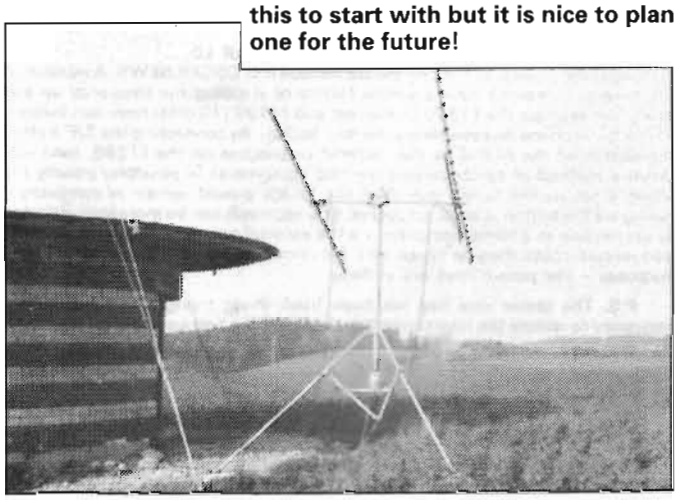
Going up the scale a bit, the next



The first satellite aerial system used by the author, a 4 element Yagi on a azimuth rotator on the end of the roof, and a 10m ground plane beneath.



This is the ultimate satellite aerial system! Crossed dipoles for 2m and 70cms and a helical. You don't need this to start with but it is nice to plan one for the future!

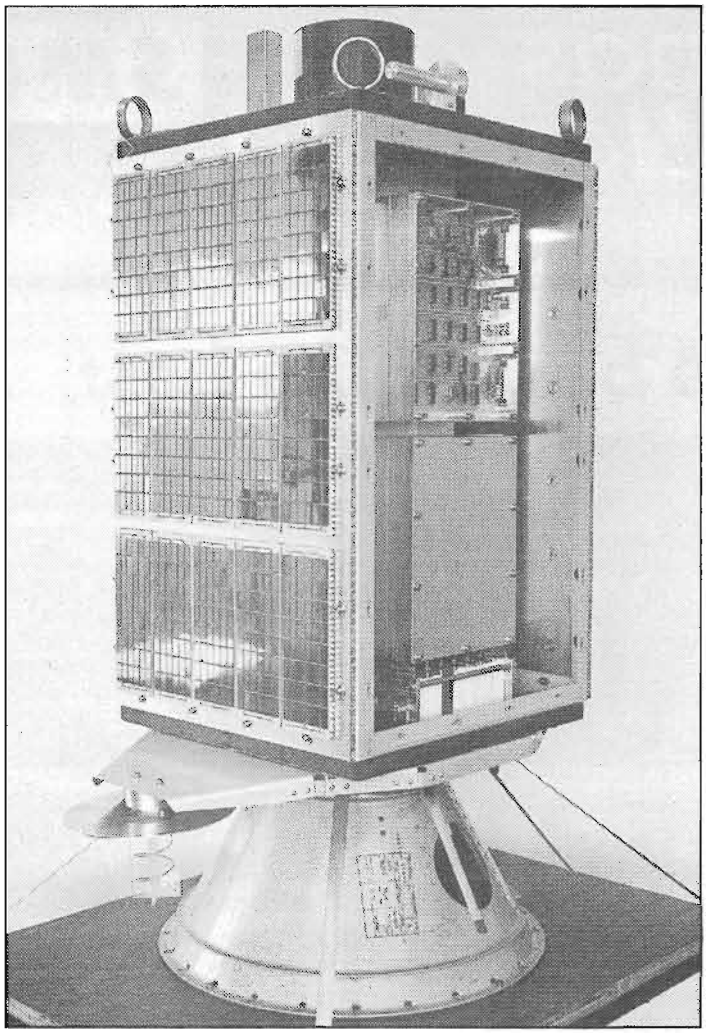


You don't need to mount the aerial array on a huge mast, a tripod mounting like this will work quite well.

The Tonna FT-9 OSCAR aerial system.

group of satellites will use 2m for uplink and 70cm for the downlink – or vice versa. These need more elaborate aerial systems and more complex transmitting and receiving equipment. But once you've got a bit of experience with the simpler satellites you'll soon want to try something more elaborate, so your next choice should be *Oscar 13*. This is quite a step forward, and this is the satellite you can work DX on, but it needs a good deal more equipment than RS 12/13. It is in an elliptical orbit, going out into space for distances of thousands of kilometres. It takes about two and a half hours to circle the earth, which gives two orbits a day of about six hours 'in view'.

First of all is the aerial. This will need to be a beam, with at least a means of horizontal rotation so that it can be moved around to point to the satellite as it passes along its orbit. As a luxury it could be provided with vertical directivity as well, but this adds considerably to construction difficulties and expense and is by no means essential. As two bands are used, you need to have arrays for 2m and 70cm. I use a 'Tonna' FT-9 OSCAR aerial, which has 9 elements for 2m and 19 elements for 70 cm. As can be seen from the photos this makes a very neat array, quite effective enough to work Oscar 13



Typical latter day amateur satellite, see the progress made in 25 years.

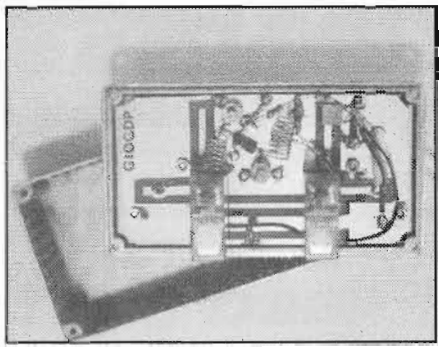
in most circumstances, and not so obtrusive as to be 'noticed' by the neighbours! It doesn't have variable vertical facilities, but is 'cocked-up' about twenty degrees which is a good all-round elevation for most Oscar 13 orbits. Oscar 13 has been in orbit since June 1986, and apart from a few hitches due to radiation problems because of its passage close to the Van Allan Belt, has given excellent service, which it looks like giving for several years yet.

Plenty More

There are numerous satellites available of varying complexity, providing everything from the UoSATs, the Microsats, Satellites with CCD camera facilities, and packet radio and 'Gateway' services etc. These will give the enthusiast an enormous amount of interest and technical know-how over the years to come. It seems very apparent that amateur radio satellites may well become the favourite means of working long distance worldwide amateur radio communication, in much the same way as the commercial satellites now provide most of the long distance TV and speech communications.

For further information, see Arthur's two part series 'Getting Started on Satellites' in the January and February 1991 issues. Photocopies are available from; HRT Photocopies, Reader Services Dept, ASP, Argus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, £1.50 per article (i.e £3 for both parts, cheques payable to ASP). Please state the article title and issues it appeared in when ordering. If your interest has been aroused, it's well worth contacting the UK amateur satellite organisation AMSAT-UK, c/o Ron Broadbent, 94 Herongate Rd, Wanstead Park, London E12 5EQ, a large SAE gets you full membership information.

Project – 2m Preamplifier



Geoffrey Pike G10GDP constructs a switched 2m preamp for remote mounting

For many people considering building a 2m preamp for their set up, I have found that very few existing designs would be ideal. This is mainly due to over-complication of design, these often being aimed at very high performance levels, and also requiring delicate and expensive devices requiring a complex printed circuit layout (not ideal for home construction).

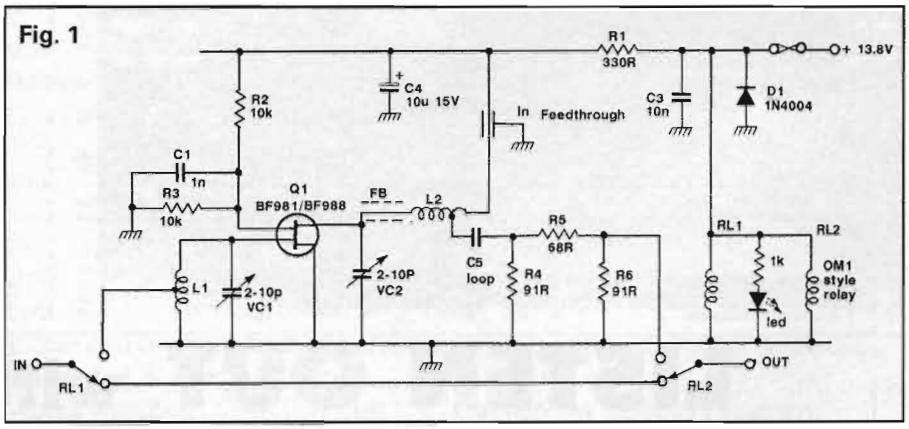
The following is a simple and well tried system based on a BF981, or the BF988 which has also become available. The emphasis has been placed on simplicity of construction and repeatability, yet retaining acceptable results for all but the purists. It is intended for either masthead or shack use. It is of course at the masthead that any preamp will give its best results, here the loss in coax comes after the preamp and therefore doesn't significantly degrade the system noise figure. If it is used in the shack, a reasonable increase in system performance may still be noted on weak signals.

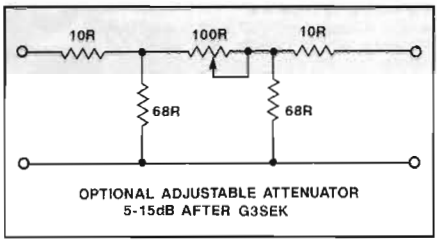
Circuit description

The circuit in Fig. 1 is very conventional and straightforward, the only point to note is that the DC supply is fed not via the coax feeder, but uses a separate lead to the preamp. Also due to the very high gain of the BF981, a 10dB attenuator pad is included in the output of the BF981. This will not only reduce the stage gain, but will also provide a good 50R termination for the transceiver input. If desired the attenuator can be changed to a layout due to G3SEK, which gives a variable 5-15dB change, which may be more flexible in use.

The variable pot should be a good quality carbon or cermet type. In the original designs the G2 decoupling capacitor C1 was a chip type, however I have found a conventional leaded ceramic type with short leads to be satisfactory. D1 provides the usual reverse polarity protection for the unit, with C2/C3 providing supply line decoupling. C2 is a feedthrough type soldered directly to the earth plane of

Fig. 1





the printed circuit board, this ensures that L2 is held at ground for AC signals. R1 enables the current in TR1 to be estimated by measuring the voltage drop across it, rather than having to open circuit L2. With R2/R3 set at 10k this should result in about .01 x 330 volts drop (3V3), this equates to about 10mA Idd in Tr1. This will vary between samples of the BF981/BF988, and it is advisable to adjust the R2/R3 ratio to achieve this. A small ferrite bead is placed on the drain lead as a precaution against instability. RL1 and RL2 provide changeover from preamp in to preamp out, and are arranged so that when no power is on, the preamp is bypassed. This makes it difficult to transmit into the preamp and cause damage to the 10dB attenuator pad.

Construction

This has been kept as simple as possible. A single sided printed circuit board (Fig. 2) carries all the components and fits inside a standard diecast box of 95mm x 50mm x 30mm. All the components are soldered onto the copper side of the board, no holes are necessary. I laid the printed circuit board out using car stripes to cover the area of printed circuit that wasn't needed, then sprayed the entire board with a cellulose based primer paint. The stripes were then removed to reveal the exposed copper which is etched in the normal way in warm agitated ferric chloride for about 10-15 minutes, until all the exposed copper has gone. After cleaning the board and removing the cellulose paint with cellulose thinners, the board should be dried, I subsequently sprayed mine with 'damp start' to give a protective finish and prevent tarnishing.

It is necessary to drill two holes 63mm apart to take the SO239 sockets, but before soldering, place the board into the lid of the box and drill through these holes, all the way into the lid. This will then allow matching up the positions of the board and sockets into the lid later on.

On the printed circuit layout, a '+' indicates the position of the BF981 body, this can be held in place with a spot of 'super glue'. Wind the coils L1 and L2 on a 6mm drill and stretch these to approximately 10mm in length. If you use either silver plated or tinned copper wire for L1/L2, this makes attaching the taps easier. It should now be possible to assemble all the components directly onto the board as in the placement diagram Fig. 3.

Having completed this, and ensuring that the ferrite bead doesn't touch the board, RL1 and RL2 can be fitted. The unused pins on the relays can be

cut back to clear the board, also make sure you add a link between the relays and earth. When the board is finished, the SO239 sockets should be fitted to the lid and then soldered to the board (see Fig. 4).

Setting up

As the unit defaults to 'bypass' (i.e., preamp off) with no power connected, it is necessary to check that the relays introduce minimal SWR, you'll probably find around 1.2:1 will be measured in the system. To check this, set up the preamp with no supply, a dummy load, and an SWR meter as in Fig. 5. If this test is satisfactory, increase power and check again. A slight rise in SWR may be noted at very high power levels due to the heating losses in the relays, as these are only suitable for 100W continuous carrier. Tuning of the preamp is best done with a very weak constant-level off-air signal, initial tuning is made easier using a local repeater or beacon for maximum S-meter deflection. When finally optimizing on a weak signal, ignore the S-meter and adjust C1/C2 for best quieting of an FM signal, or best S/N on a weak SSB/CW beacon signal.

It should be realised and appreciated, that when other strong signals are on the band, 12-15dB of gain ahead of the transceiver can cause problems. It is advisable to use the preamp with some common sense and only switch it on when band conditions permit. Ideally the attenuator can be made variable remotely, giving a typical variation of 5-15dB in gain. It should be possible to fit a model control servo to drive the cermet pot directly, the servo pot then being controlled remotely from the shack.

Fig. 2

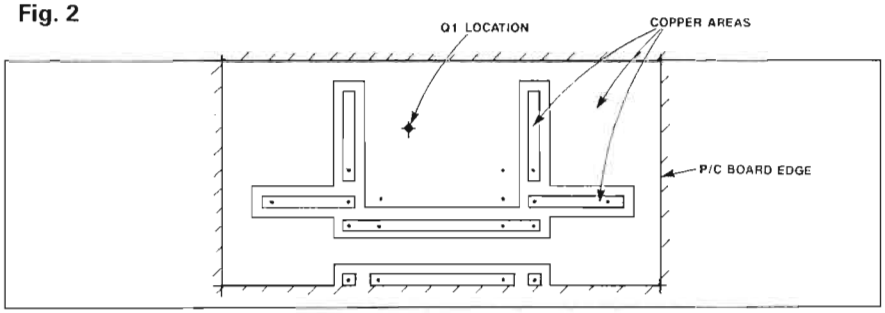


Fig. 3

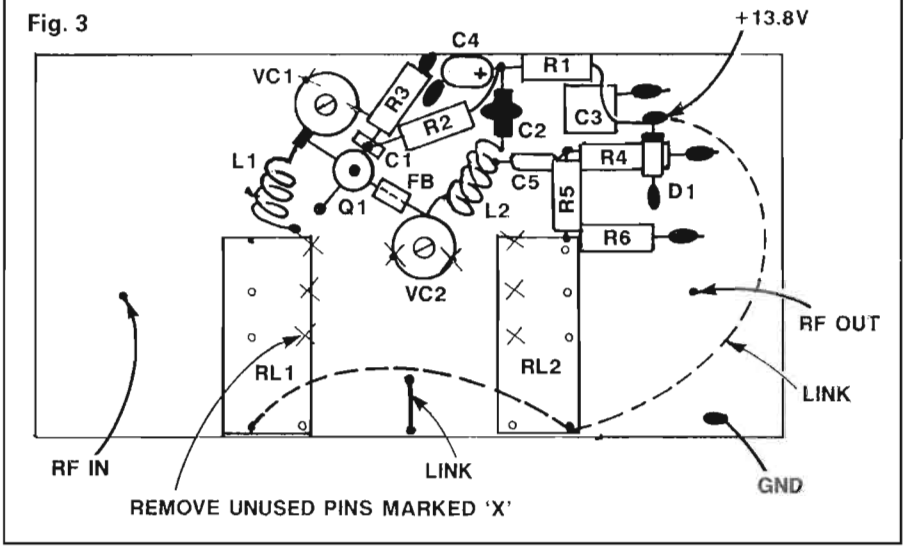


Fig. 4

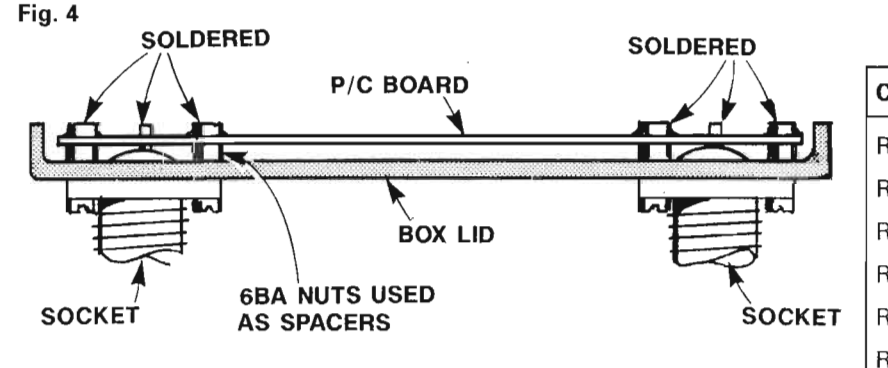
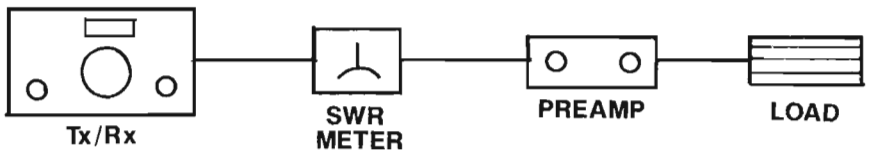


Fig. 5



Modifications for the 4m band

I also recently used a version of this preamp in conjunction with some ex-PMR equipment for 4m, with the following changes; 1) Add 12pF across VC1 and VC2. 2) Change L1 and L2 to 10T, 22 swg, 6mm ID, approx 10mm long. 3) Taps are made at 2.5T on L1 and L2. 4) It may be necessary to change the 10dB pad to give greater attenuation, due to the increased gain of the BF981/BF988 at 70MHz as opposed to 144MHz.

Components list;

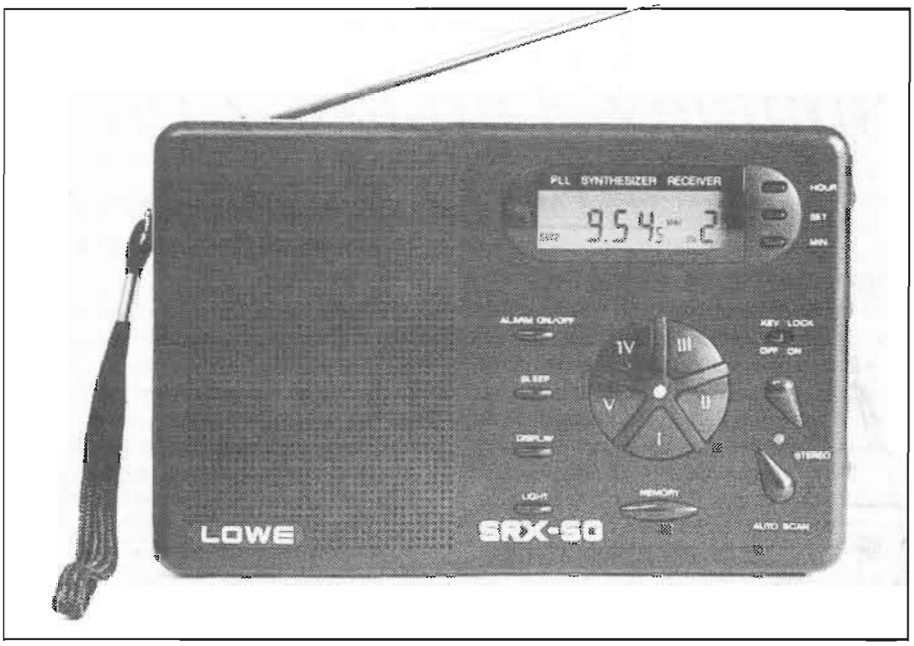
R1 - 330R	C1 - 1nF (chip if possible)
R2 - 10k	C2 - 1nF feedthrough
R3 - 10k	C3 - 10nF
R4 - 91R	C4 - 10nF 15V
R5 - 68R	C5 - 100pF
R6 - 91R	
RL1 - OM1	VC1 - 2-10pF (yellow Mullard)
RL2 - OM1	VC2 - 2-10pF (yellow Mullard)
D1 - IN4004	TR1 - BF981/BF988
L1 - 22 swg tinned, tapped 1.5 turn	
L2 - 22 swg tinned, tapped 1.75 turn	
Diecast box (see text)	

SCANNERS INTERNATIONAL

Lowe SRX-50 Review

A 'User Review' of the latest low-cost HF receiver from Lowe Electronics

Lowe Electronics have been getting a well-deserved reputation over the last few years for bringing out appealing HF receivers, including their recent *HF-150* receiver (reviewed in *Scanners International* last month), this giving superb reception. It looks like Lowe have also recognised the need for an 'basic' radio to provide an economic but effective access to the world of Short Wave, something available at a 'budget' price but offering an easily-used entry to world band radio. They came up with the SRX-50, an overseas product made to Lowe's requirements. A feeling of 'deja-vu' struck me on seeing the set, as I've seen a few other radios of outwardly similar specifications to this on the market also. However, there's also a wide range of quality and performance to be found in the market, and I'm told that Lowe took this initiative of launching a set under their 'own brand' very carefully, ensuring their product had a definite 'edge' (which doesn't surprise me - I know their reputation for performance!).



Offerings

Measuring 180mm (W) x 115mm (H) x 32mm (D) it's a handy portable size, it even comes with a wrist strap to save you dropping it when carrying it around. The set covers the HF frequency range of 5.9-15.5MHz in synthesized 5kHz steps, plus LW (153-281kHz), MW (531kHz-1602kHz) and FM (87.5-108MHz), a large LCD on the front of the set showing you the tuned frequency. Five memory channels in each band are available for you to store your favourite frequencies in, these you program very simply by using the up/down buttons to initially set the frequency, a quick press of the 'memory' button followed by one of the memory buttons (I-V, Roman numerals for a change here!), and it's stored. As well as being a self-contained receiver, it has a 24hr time display and you can also use the set as a digital alarm clock/radio, in fact the alarm bleeper is extremely piercing which should be useful for heavy sleepers! This of course makes it more appealing to a domestic environment, yet another handy use of the timer can be to switch the receiver on at a given time to remind you of a certain short wave broadcast. The set runs from either three AA size cells, these fitting at the rear of the set, or from an optional 4.5V DC external mains adapter. A short hinged telescopic aerial comes fitted, and a 3.5mm headphone socket is provided - when you plug in the supplied stereo earphones you get stereo reproduction on VHF FM when you're tuned into an appropriate station, the green front panel 'stereo' LED glowing to indicate this.

In Use

I quickly mastered the set's method of tuning, the 'Up/Down' buttons acting as 'search' controls if I held them down for longer than a second or so, the set stopping when it found a signal. Keeping one of the buttons pressed increased the 'step rate' to let me get from one end to the other of the provided HF coverage, or indeed from band to band, reasonably quickly.

I programmed the HF memories up with some of the various frequencies used by Deutsche Welle, testing the set on this plus other stations throughout the day. Selecting the best reception of the programmed station (depending upon the time of day or night) was very easy - I just pressed the memory buttons in turn to 'cycle through' my stored frequencies until I found the best one. I occasionally found a limitation in the set's frequency coverage here, as it cut off at a lower edge of 5.9MHz it sometimes didn't let me receive the wanted station's particular frequency which what was coming through loud and clear on my 'usual' (albeit larger and more expensive) portable HF receiver.

Casual 'listening around' however was very fruitful. As soon as I found an 'interesting' station, I just checked the displayed frequency against the information in my copy of the 'Passport to World Band Radio' (an excellent book - an ideal partner to a HF broadcast receiver in my opinion) to get an idea of which station it was. Other similarly priced HF receivers commonly have analogue rather than digital displays, hence only giving you a rough idea of what frequency you are tuned to which can be very frustrating sometimes!

Travelling Around

As well as using the set from home, its compact dimensions suggested it should be quite useful as a travelling companion, so it duly came with me on my recent trip to the Baden Württemberg area in southern Germany. Here, from my hotel room, it gave me perfect reception of the BBC World Service on 12.085MHz, as well as many other HF worldwide and local AM/FM stations. (The MW tuning steps of 9kHz provided on the set are fine for European use, but USA travellers should note that 10kHz steps are used over

there.) I was also pleased with long wave range included on the set - many 'budget' receivers don't have this - which again opened my 'listening horizons' from Europe.

'What are the limitations' you ask? With the set's economic price, you can't expect everything of course. Although the receiver has a useful 'key lock' switch to save accidental pushes of the various buttons, for example when travelling, the side-mounted slider switch which powers the set on/off can be knocked (it isn't recessed) thus flattening your batteries, I found that removing the batteries to prevent this also removed the set's memory frequencies. The performance of the set was quite reasonable considering its intended use, although the set had to remain upright (and hence easily knocked over) for the telescopic aerial to also be upright - the swivel on its base was just a couple of millimetres short of letting it do this with the set placed flat on a table. Finally, although this is probably a measure of how 'handy' I found the set, five memory channels on HF just wasn't enough - instead I took to keeping a record of my commonly-tuned frequencies on notepaper attached to the side of the set for manual tuning (more memories would I'm sure have pushed the price of the set up).

Conclusions

All in all, with the set's economic price of just under £40 in my mind, I found the SRX-50 pleasing to use and a handy companion both in the home and when out and about in Europe. At home it performed a dual role, sometimes as a 'kitchen radio' offering both local FM and worldwide AM reception, and sometimes as a bedside radio/alarm clock which helped me to practice my foreign language recognition over a morning coffee (it's said the mind can sometimes be most active in the morning!).

The SRX-50 currently retails at £39.95, and my thanks go to Lowe Electronics for the loan of the review sample.

Simplex, Duplex, and Talkthrough

Chris Lorek explains the difference in these communications modes used on the air

Have you ever wondered why, on some VHF/UHF channels on your scanner, you only hear one half of a conversation? On others, you can hear both halves with a 'gap' in between, yet on others you can hear both halves 'clear as a bell'. If this has left you in puzzlement in the past, as I know it has many readers, hopefully this short article will explain all. This of course assumes you're *allowed* to listen to these - as many readers are, if not then please take the following as purely educational rather than anything else!

Single Frequency Simplex

This is when the radio communication you're listening to takes place on one frequency, let's say 145.550MHz. Station 'A' has his say, then releases his microphone push-to-talk to let station 'B' reply. Station 'B' uses the same frequency to transmit on as station 'A', and if station 'C' wants to join in, then providing he's in range of both all he has to do is 'butt in' between transmissions. Typical examples are aircraft communication and CB operation. This is all nice and simple, so why can't it all be like this. Surely for 'push to talk' communication it would make sense for each user just to use a given frequency for this?

Dual Frequency Simplex

What's this, *dual* frequency *simplex*? That's right, one user transmits on one frequency, the other on a different frequency, with their corresponding receivers set accordingly. You'd think that with the shortage of frequencies (some of the bands are getting *very* congested) this is rather a waste of a valuable resource - the radio spectrum. But it's not always that simple.

Take the case of a PMR (Private Mobile Radio) service. The base station aerial is often well-sited, communicating with mobile and portable stations with their (normally) lower power transmitters and aerials at ground level. Here, the base station would typically transmit on one frequency, and receive in the same band but on a different frequency, with the mobiles/portables operating on the reverse of these. The communications range of a base station to another base station sharing the same frequency would be fairly large, but not for the mobiles/portables, which often only need to communicate with their 'own' base. So, with a bit of careful planning of frequencies by individual country's licensing bodies, taking hills and so on into account, better frequency re-use can be achieved than with a 'simplex' system.

You may sometimes happen upon a transmission on one 'half' of such a system, apparently communicating with someone else you *know* you should be able to receive. In this case, you now know you need to look for the 'other half' on a different frequency.

Talkthrough

But what happens when two mobiles want to communicate with each other? As they transmit and receive on different frequencies, this would be rather difficult without 'external help'. This comes in the form of the base station where it has radio frequency filtering circuits added to allow simultaneous transmission and reception on its separate frequencies. With its receiver audio linked to the transmitter audio, this allows it to relay the signals received on its well-located aerial system, using the higher power base transmitter and the same well-located aerial. This is commonly called, quite simply, a 'repeater'.

This can allow users to communicate even when there's no operator present at the base station desk, for example out of office hours. If a night watchman for example is issued with a portable radio, he can use the repeater to communicate with other employees who are also 'on the radio'. At other times, the base station control operator can switch 'talkthrough' on and off depending on operational requirements, thus explaining why you can sometimes hear both sides of the conversations, and sometimes not. Again, you may happen to stumble on the 'input' frequency of such a system, with users apparently communicating with each other - in this case you'll need to look for the 'output' frequency.

Community Repeaters

A well-sited repeater system doesn't need to be restricted to a single user. Many PMR users only require short periods of communication throughout the day, so a better use of such a valuable resource is often 'shared' amongst several different groups of users, with the 'base station' operator of each simply having a radio transceiver on the same transmit/receive frequencies as the mobile and portable units, the repeater relaying the audio of all these. To prevent disturbance and maintain a degree of privacy between groups of users, CTCSS (Continuous Tone Controlled Squelch System) is commonly used. Here, the transmitters of each group automatically radiate a low sub-audible CTCSS tone, typically between 67Hz and 250Hz in audio frequency, along with their speech, which the repeater regenerates. The accompanying receivers have decoder circuits fitted which only enable the receiver audio when the correct tone is present, keeping it quiet otherwise (i.e., when no signal, or a signal with a different tone, is received). To prevent interference between users, each user's transmitter circuit is disabled if the receiver senses an incorrect tone, preventing one user from accidentally transmitting 'on top of' another.

Many such repeater systems are in use,

and although a casual monitoring check may reveal several different users, they're all communicating in relative privacy from each other.

Interconnection

A community repeater is fine for communication in a given area, but what about users who want communication over a larger area, one which can only be given by a number of such base station sites? One way is to have a number of simultaneously interconnected base stations, all operating on the same frequency (these actually operate with a carefully controlled few Hz difference in frequency between them). Here the mobile user's transceiver stays on a given channel, and the base station's messages (and the relayed 'talkthrough' audio from other mobiles/portables) is transmitted over all the base stations simultaneously. The few Hz difference involved in this 'quasi-synchronous' system can sometime be heard as a semi-rapid 'fading' in the received signal if the receiver is stationary - this effect all but disappears when the user becomes 'mobile'.

Cellular Trunking

An alternative method, making use of 'intelligent' multi- channel radios operating under microprocessor control, makes use of a technique called 'trunking'. Here, multi-channel two- frequency base stations are sited at strategic points in the required coverage area, each covering an individually defined area 'cell'. They transmit a continuous 'system control' data stream on one of their operating channels, with several other channels at each base station being used as needed for actual communication. The mobile set automatically searches out this 'system' channel for the area it's in and locks onto it, automatically sending a short 'I'm here' data signal to the base station giving the mobile's identity. When a call comes in, the 'system channel' sends out a data sequence to the mobile, typically instructing it to automatically shift its channel to one of the communication channels in use at that base station, where communication takes place. Each base station is linked to the other, so conversations can take place between sites, or of course in the case of cellular telephony also between a landline system and the radio network. As the mobile unit travels around, its channel can be automatically controlled by the base stations to 'move' to that of a neighbouring site, this often happens without the user realizing he's being 'handed off' between base station 'cells'.

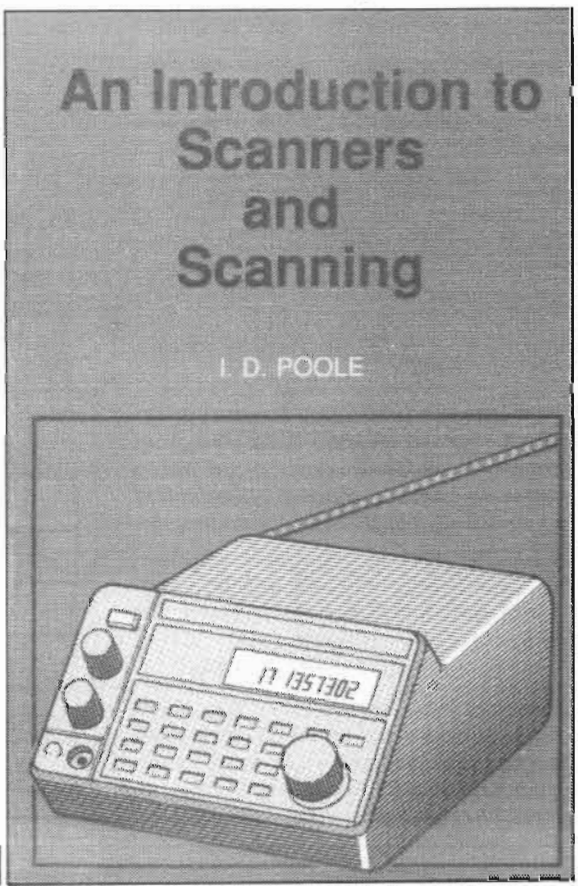
Did the UK get it wrong?

In the UK and Ireland, base stations operating on UHF typically transmit lower in frequency than their receive frequency by a pre-defined amount. Guess what the UHF base stations do in Europe - that's right, they operate on the reverse of these! So all the careful frequency planning goes to pot as soon as a 'lift' in radio propagation comes about, or indeed when, say, a well-sited French UHF base station is in range of a well-sited UK UHF base station! This even extends to UHF amateur radio repeater channels, where these operate on 'RB' channels and European repeaters operate on 'RU' channels, both with the same frequencies and 1.6MHz transmit/receive splits but exactly the opposite sense.

Right now, the results of a study are being investigated on what to do in the professional radio side of things. This could mean careful base station aerial coverage 'tweaking', or possibly even a forthcoming complete reversal of operational dual-frequency channels in the UK. We'll have to wait and see...

Book Review

An Introduction to Scanners and Scanning



An Introduction to Scanners and Scanning

Scanner receivers seem to be more and more popular amongst both public and dedicated enthusiasts, within the space of a few years they have become commonly available in the 'high street' as well as just in specialist shops. A further apparent increase in interest is that of general 'listening around' as the public become more and more aware of the vast numbers of radio signals surrounding them, on Short Wave particularly as we become more 'internationally minded'.

Despite its title, Ian Poole's book isn't restricted to scanners, which it does cover to a limited degree. Instead, the book provides an introduction to the technicalities of radio waves and how they travel, to different forms of transmission such as Morse, AM, SSB, FM, Data modes, Television and Fax, introduces scanners and their functions, different types of aerials, the radio spectrum and the various uses of this. Separate chapters are devoted to broadcasting, amateur radio, and CB. The book details HF and VHF/UHF amateur radio to a large extent, with an introduction to each amateur band and its characteristics. Likewise for HF and VHF broadcasting, where each band is detailed together with its propagation details.

If you're after frequency lists of where to listen to PMR services you may be out of luck, likewise if you're after a comprehensive guide on buying your first scanner. However if you'd like an introduction to radio in general, with applications to the use of a scanner for listening, then this book should provide an easily-read introduction. The pocket- sized 151 page book is published by Bernard Babani at £4.95, available through bookshops, ISBN 0-85934-256-5.

Lightning

Nature's QRO Transmitters, by Brian Kendal G3GDU

The Ancient Greeks considered thunder and lightning as instruments of the god Zeus and to hear thunder on the right before a battle was considered a favourable omen. The Romans, on the other hand, believed that these phenomena were from their god Jupiter and their good omen was to hear thunder on the left before conflict.

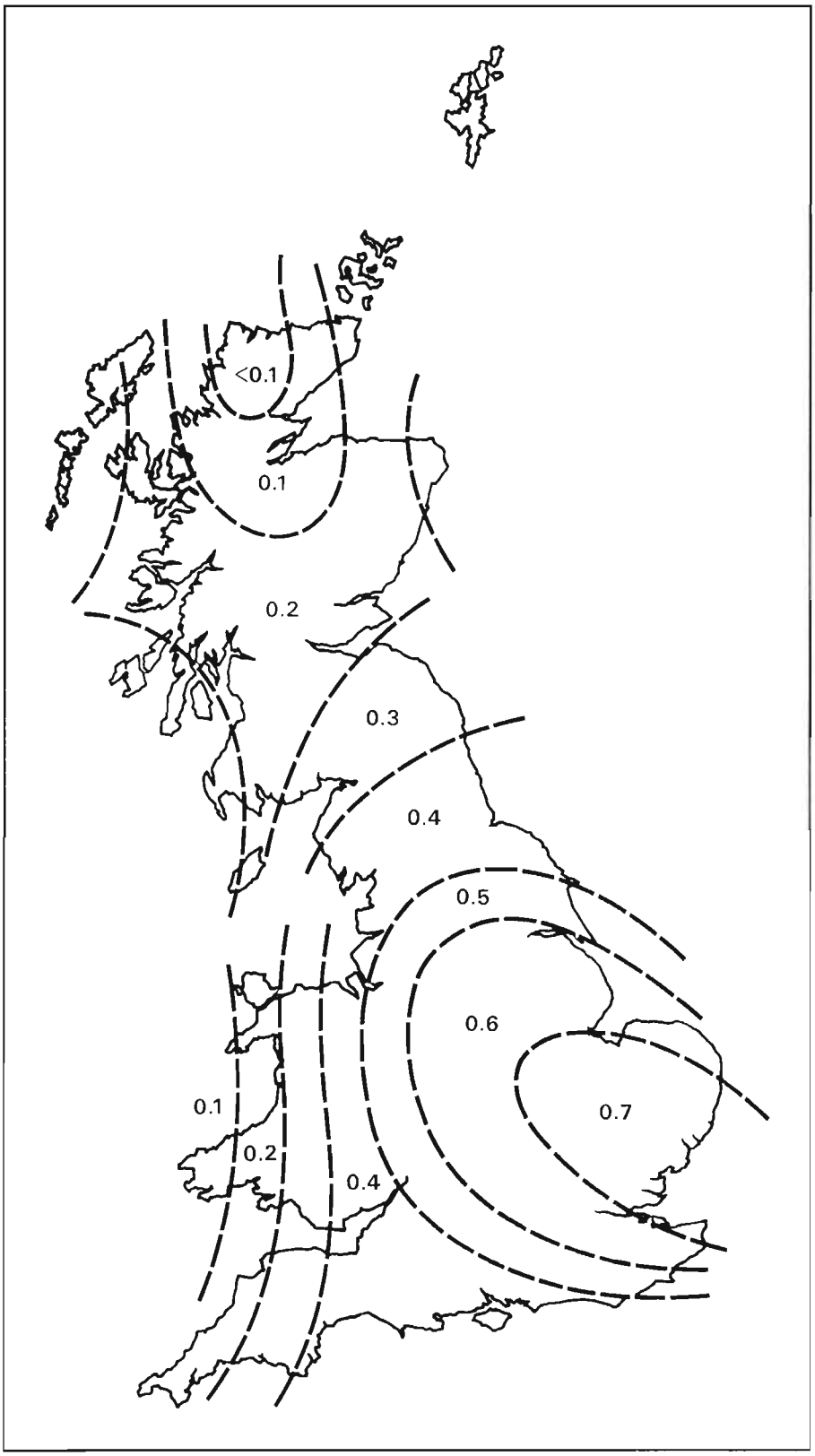
To the present day radio amateur, however, the approach of an electrical storm from any direction brings on a sense of foreboding, for aerial systems are considered particularly liable to lightning strike, with consequent damage to equipment or even the house. Serious accidents due to lightning are fortunately rare, but even this knowledge gives little comfort when the flashes of lightning are illuminating the whole sky and the associated thunder is loud enough to drown even the most powerful Hi-Fi.

Lightning

Lightning, basically, is a very long electrical spark which extends between one centre of electrical charge in a cloud and another centre of opposite polarity on the ground, in another cloud, or even in the same cloud. Whilst most types of cloud are electrically charged to some degree or other, it is only the giant, anvil shaped, cumulonimbus which can act simultaneously as a generator and a capacitor, developing electrical forces sufficient to produce lightning. The mechanism by which these clouds become electrically charged is still not fully understood, but current theory considers it to be associated with the violent updraught of air in the centre of the cloud and the resulting impact of super-cooled water droplets on ice crystals.

In an active cloud, the ice crystals develop a positive charge while the water droplets acquire the opposite polarity. The thundercloud is therefore positively charged in the upper regions and negative in the lower. The total charge for a cloud cell has been estimated at 1000 coulombs distributed over 50 cubic kilometres. In fine weather the

Fig.1 Number of lightning flashes to the ground per square kilometre per year for the UK.



Earth carries a negative charge with a corresponding positive charge residing in the upper atmosphere, the whole forming a large spherical capacitor. The intermediate atmosphere is subjected to an electrical field which is positive at a level of about 100 Volts per metre.

St. Elmos's Fire

The thundercloud, as we said before, carries a heavy negative charge in its lower levels which reverses the polarity of the atmospheric charge. The level of this may well reach or exceed 20,000 Volts per metre beneath the charge centre and may exceed 5000 Volts per metre at distance of five kilometres. A vertical conductor, such as a metal radio mast or a lightning conductor, will short circuit part of this field with the result that an intense field concentration occurs at the tip. If the field strength is sufficiently high, ionisation by collision occurs resulting in a current passing through the conductor into the atmosphere. This is called a point discharge current and may vary from a few microamperes in open country to several milliamps in mountainous areas, this being a function of the electrical fields, the height of the conductor and the wind velocity.

These discharge currents cause a slight luminosity, which is well known to mariners as St. Elmo's Fire, and may be seen at night from the raised tips of the hand, from ships masts or even aircraft wingtips. Whilst in themselves quite harmless, these phenomena are indicative of a highly charged atmosphere with consequent risk of sudden lightning strike.

The Lightning Strike

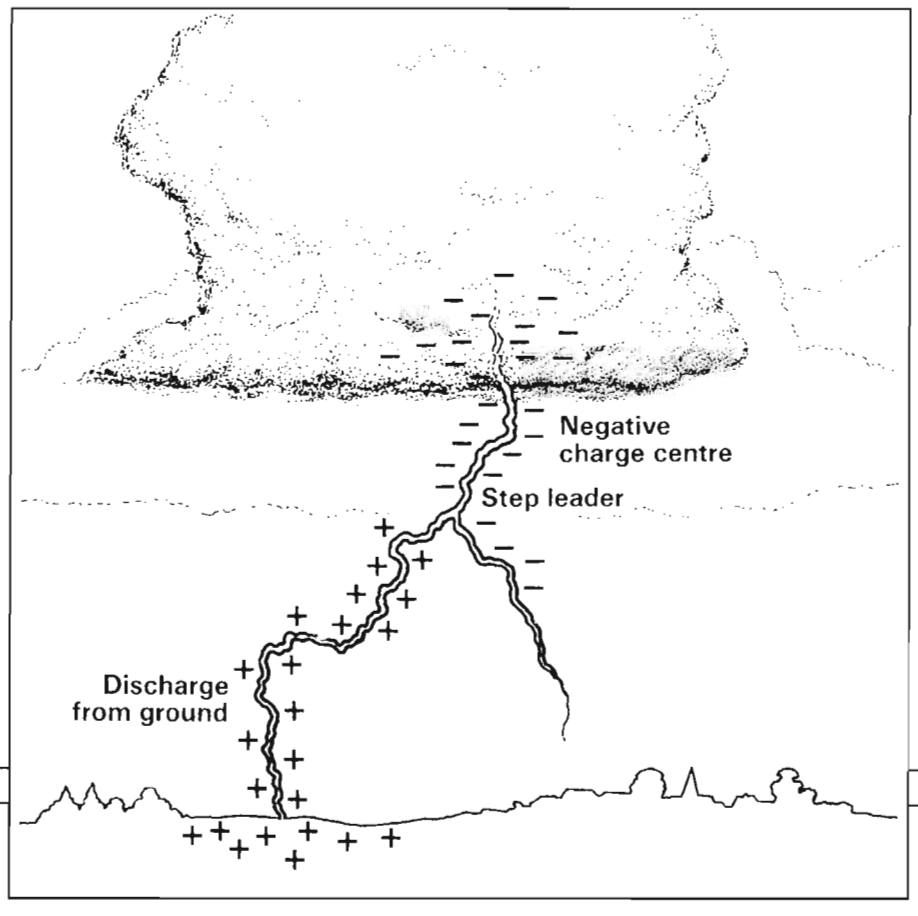
When these fields become sufficiently intense, there is an electrical breakdown and a luminescent channel grows out of the cloud, advancing in steps towards the ground along a tortuous path which shows frequent branching. This is called the *'stepped leader'*. When the leader reaches the ground, it forms a bridge and a heavy current pulse flows upwards. This is called the *first return stroke* and is usually of between 8,000 and 10,000 amperes. This heavy current causes intense and rapid heating of the channel which becomes extremely bright and expands rapidly as the pulse passes. This expansion causes the thunder.

Sometimes, a few tens of milliseconds later, a further, faster leader appears followed by another return stroke. This may be repeated several times, the highest number recorded being thirty, but three being more typical. The peak current of the restrikes is typically 10,000 amperes. After the last return stroke, a current of several hundred amperes continues to flow for a few tenths of a second. This may also appear between earlier strokes.

The individual discharges occur at intervals of 3 to 100 milliseconds (typically 40mS), have a rise time of 10 — 15 microseconds, hold for a few microseconds and decay, dropping to 20% in typically 200-300 microseconds. Although, as a rule, all the strokes follow the same path, in high winds the channel can be blown sideways giving rise to a number of parallel luminous ribbons. This is called *'ribbon lightning'*. A complete sequence of strokes is called a *'lightning flash'*.

The power in a lightning flash averages 30 coulombs but the highest recorded is 415. The current flowing is typically about 10,000 amperes but at times this may exceed 250,000 amperes.

Fig.2 Cloud to ground lightning starts with a stepped leader



Protection

Lightning may cause both physical and electrical damage to installations. The physical damage is due to the shock wave developed by the rapid expansion of the air around the lightning flash channel, this is frequently of sufficient intensity to lift roofing or crack walls. The electrical damage may be due to the heavy currents involved in a direct strike, from currents induced into signal lines or power cables by near ground strikes or from high static levels induced into aerial systems.

In the simplest of terms therefore, the requirement is to intercept the lightning before such damage can be caused and conduct it safely to earth.

To achieve this, three elements are needed:

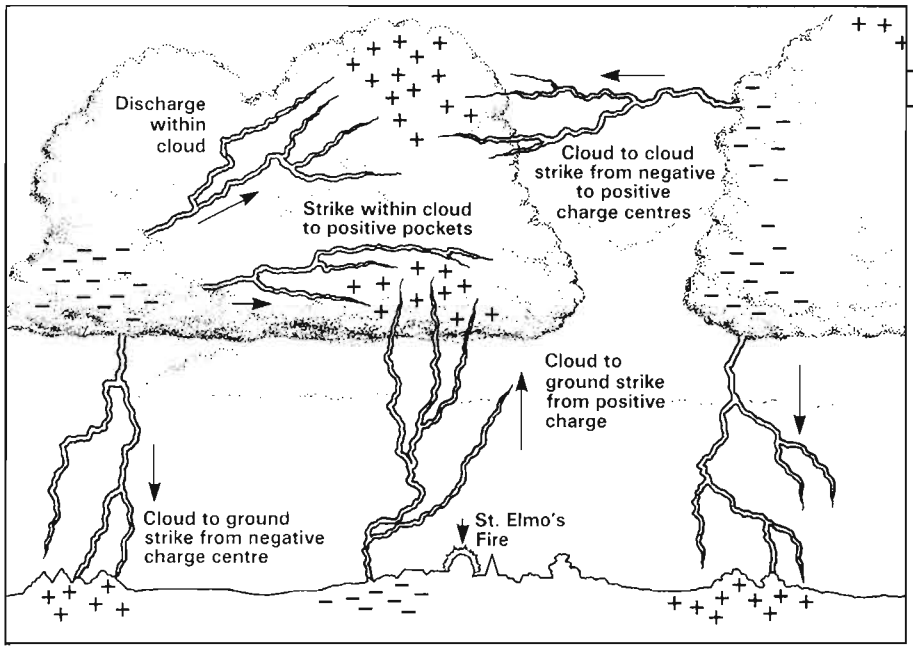
a) *The Air Terminal,*
b) *The Down Conductor,*
c) *The Earthing System,*

each of these is of equal importance.

The Air Terminal

This is the point at which, hopefully, the lightning will strike, it should be 1 to 2 metres higher than the structure which it is protecting. It may be vertical or horizontal or a combination of both in order that the building or structure may be best protected. Around the air terminal extends a *Zone of Protection* (ZP). This is a volume of space in which lightning would prefer to strike the Air Terminal rather than any objects or the ground. This is not, however, a volume of complete protection, for it varies in size with the intensity of the strike, i.e. the more intense the strike, the greater the ZP.

The ZP is defined in various ways by different authorities, but in general this amounts to a cone defined by a line drawn at an angle of 45 degrees from the ground to the Air Terminal. Where the ZPs of two Air Terminals overlap, the protected angle may be considered to be 60 degrees in the area between the terminals. All metallic projections, chimneys, water pipes, tanks etc. in the vicinity should also be bonded to the lightning conductor system.



Arrows show direction of electron flow

Fig.3 Lightning variations showing electron flow

The Down Conductor

The Down Conductor is the link between the Air Terminal and the Earthing System, it should be of sufficient cross section to present a low resistance path to earth. For this reason it should be made of aluminium or copper strip, 20mm by 3mm, or 10mm diameter rod. The run should be as straight as possible from Air Terminal to Earthing System, as any bends will introduce inductance into the system which may cause sufficient back EMF to cause the discharging strike to jump to an alternative earth. This is known as a 'Side Flash'.

The Earthing System

The purpose of the earthing system is to dissipate the energy of the lightning in such a way as to prevent injury to persons, property or equipment. In view of the extremely heavy currents involved, it will be realised that a single short rod will seldom provide a sufficiently low resistance and therefore a minimum of several spikes connected in parallel are necessary. These should be separated by a distance at least equal to their length, and care should be taken in the connection to avoid long leads for these could well introduce a high inductive impedance.

An alternative is to bury one or more long strips of conductor some 600mm — 1m below the ground. When the earthing system dissipates the electrical energy of a lightning stroke, its potential is considerably raised. As the electrical charge discharges into the surrounding ground, so a potential gradient is set up across that ground. This is frequently steep enough to generate a potential across a distance of a metre or so sufficient to kill an animal. A human being, however, being bipedal and usually wearing shoes with some degree of insulation, would not normally be killed but may suffer a severe electrical shock.

This also implies that in a radio installation, amateur or professional, a severe potential gradient could exist across the room which could be detrimental to equipment or the occupants. This can be overcome by an additional strip, bonded to the main earthing system and passing around the external walls of the building. The potential across the building will then remain sensibly constant and consequently safeguarding personnel and equipment.

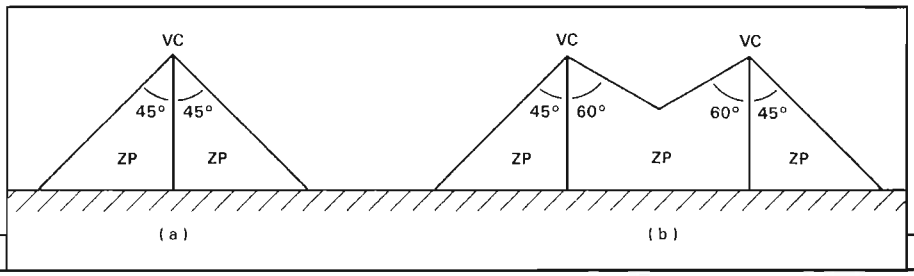
Protection of Equipment.

Electronic equipment can be damaged by lightning in four different ways:

a) *From direct strike of the aerial system*
b) *From high static levels induced into the aerial system*
c) *From surges in the mains electrical supply*
d) *From transients in signal lines induced by near ground strikes.*

During a severe storm damage may be due to any, some or all of these causes. During 1981, as part of his work, the author researched and prepared a report on protection of aviation telecommunications facilities from lightning. The following paragraphs are based on this report which paid regard to the experience of over thirty Commonwealth aviation administrations.

Fig.4 Zone of protection (ZP) from (A) a single vertical conductor (VC), (B) Two vertical conductors in close proximity.



Protection Against Direct Strike

As by its very nature an aerial system has to be in an exposed position, there is no way in which it can be protected from lightning strike. The problem therefore resolves into providing the maximum protections for the equipment to which it is attached.

Masts

All metal masts, whether mounted at ground level or above (such as on chimneys) should be connected to an effective earthing system such as described earlier. Thus, in the event of a strike, the energy will hopefully prefer the direct earth route, reducing that which is conducted to the equipment. If the mast is supporting a beam, either HF or VHF, then assuming that the beam is not insulated from the mast it will merely act as an extension to the mast and come to no further harm. Any traps, however, may be damaged.

To safeguard the equipment it is necessary to minimise the current which will be induced through the aerial circuit. For this, ensure that the coaxial feeder is laced closely to the mast to near ground level. This will reduce the possibility of side flash. Lead the feeder at or below ground level for some distance before rising to enter the shack where further precautions can be taken.

If the mast itself is being used as a radiator, in some cases it may not be possible to provide a direct earth path. However, provided that an effective earthing system is available, spark gaps or gas filled surge arrestors between the base of the mast and the earth should provide considerable protection. These should be set to the closest possible tolerance consistent with the RF voltage normally present. For amateur installations, this would certainly be less than a millimetre. The RF choke fitted to most commercial vertical aerials provides no protection to direct strike for it is only intended to provide a leakage path for high static levels. Again, if possible, the feeder should be run underground for some distance away from the mast.

Wire Aerials

There is little protection which can be given to a lightning strike on wire

aerials. By its very nature, the least protection can be given to the dipole, for it is usually constructed using coaxial or balanced twin feeder from the aerial centre to the aerial matching unit. Consideration may be given, however, to arranging that the feeder droops to ground level below the feed point, where the insulation can be broken and a spark gap or surge arrestor fitted between there and the earthing system. Similarly, twin spark gaps or arrestors could be fitted to any systems using open wire feeders and also between a long wire and earth, close to the point where it enters the shack.

Precautions in the Shack.

When an aerial system suffers a lightning strike, despite any precautions which are taken outside, considerable power will be still induced into the shack. The exercise is therefore one of damage limitation. The unit in the shack which takes the brunt of the shock is the aerial matching unit, and in many cases the damage will be sufficiently severe as to require replacement. However, beyond this point, damage can be limited and any further damage reflected to the input circuits of receivers or the PA units of transmitters may well be repairable.

For the best protection, the Aerial Matching unit should be well separated (at least 1m) from other equipment and connected with coaxial cable of the lightest possible grade consistent with adequate power handling capacity. In strike conditions this could fuse, inner to outer, providing a measure of protection to the main equipment. Zener diode protection for transmitter and receiver could provide a further safeguard. Experience in tropical transmitter sites has also shown that whereas solid state power amplifiers frequently fail under lightning strike conditions, this rarely happens with large ceramic PA valves.

It has been suggested that fitting a fuse directly in series with the aerial circuit assists in damage limitation. Although the rise time for the first strike is less than that necessary for the fuse to rupture, nevertheless a measure of protection will be given in subsequent multiple strokes. At VHF there would seem few precautions which can be taken, but, from correspondence received from several countries, it would seem that cavity resonators in line with the aerial provide a considerable measure of protection.

Static Protection

So far, we have only discussed protection against direct lightning strike.

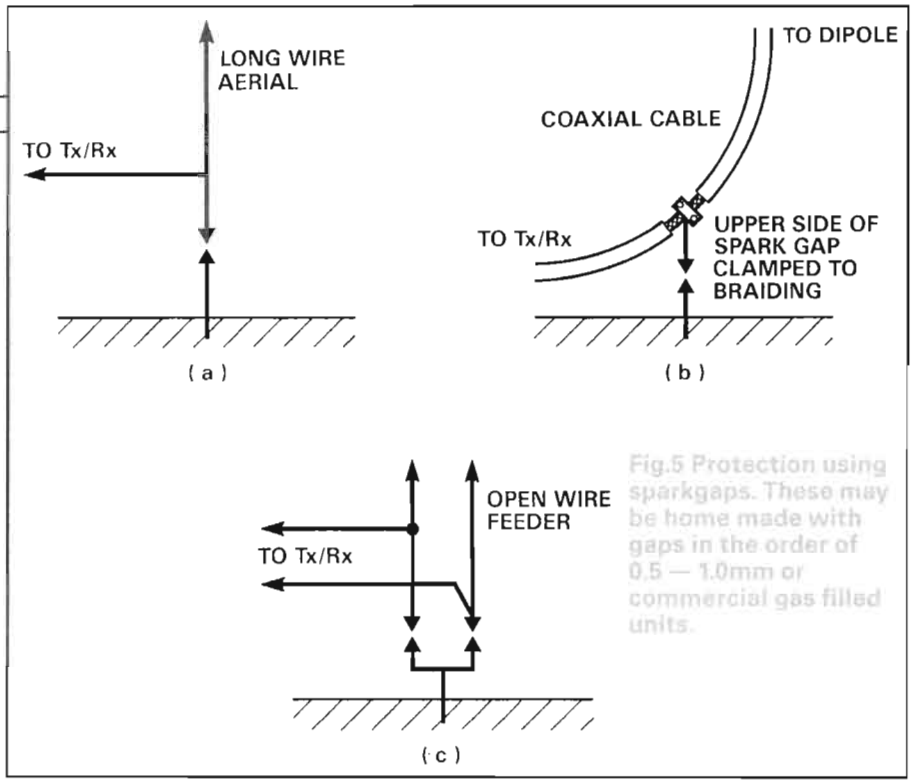


Fig.5 Protection using sparkgaps. These may be home made with gaps in the order of 0.5 — 1.0mm or commercial gas filled units.

Consideration, however, must also be given to protection from high static levels induced into the aerial system. Although lightning strikes to amateur installations is rare in the UK, static damage is more common, particularly in mountainous or coastal areas. The author well remembers a night while living on the coast of Western Scotland when he managed to connect a VR105 neon stabiliser between his 170m long wire and earth. The neon lit and remained alight for over eight hours. Such static levels would destroy almost any present day unprotected receiver front end.

Probably the most satisfactory protection in such circumstances would be back to back diodes across the input of the receiver or, if very long aerials are being used, a two stage device such as the author described in March 1989 HRT could be installed. If the equipment uses a solid state power amplifier, consideration should also perhaps be given to similar protection using zener diodes of suitable higher voltage rating.

Near Earth Strikes

A further risk of damage comes from induced potentials caused by near earth strikes. Under such circumstances high potentials can be induced into any unscreened wires, which may cause semiconductor failures at almost any stage of the equipment. The precautions against this are basically good installation procedures and good housekeeping. All equipment should be individually earthed with all panels securely bonded to equipment cases, interconnections should be made with screened cable and earthed. Test leads should never be left attached to equipment when not in use.

Surges

Two further causes remain for possible damage from lightning. The first is surges in mains voltage due to strikes elsewhere and the second is due to surges on incoming lines due to near earth strikes. Few amateur stations use line remote control of equipment, so the latter will not be considered further.

The first line of defence against a mains surge is, obviously, taken by the power pack. Provided that it is robustly constructed, little harm should befall it, particularly if surge arrestors are fitted to the input. However, under such circumstances it is possible for spikes of voltage to be transferred to the equipment which could cause damage to semiconductor circuits. The only apparent protection against this would seem to be rapid acting, close tolerance crowbar circuits.

Much of the information in this article has been derived from tropical countries where lightning strike is relatively common. In contrast, in the UK this is relatively rare. Nevertheless, the power in a strike is awesome and in view of the possible consequences, taking precautions during installation of equipment would seem prudent.

With 44,000 thunderstorms occurring daily around the world, or up to 1,800 at any one moment, the installation of lightning protection should not only be seen as an equipment damage limitation exercise but a matter of personal safety, for the power induced in a direct strike is also quite capable of demolishing a chimney, cracking a wall or setting the house on fire if not conducted safely to earth. Perhaps it may also encourage a stronger belief in Thor, the god of thunder.

QRP CORNER

Dick Pascoe G0BPS shows how to build a simple device to measure low power levels

It's good to hear that, after a lot of misconceptions, the power level for international QRP levels has at last been qualified and cleared. It amazed me how many of the 'Extra' Class licensees in the USA thought that 100 watts was QRP. Because they have permission to use levels up to one and half kilowatts, I suppose that a mere 100 watts may seem like low power!

Many UK operators were not pleased to see the QRP level being raised from the long standing three watt level to the higher five watts accepted throughout the world today. A slightly higher level *does* have many advantages though, and although I am not advocating a further rise in power levels, a five watt level may encourage *more* people to try using low power. The more operators that are encouraged to 'have a go', the more the world's QRM will reduce.

Little is ever said about the use of SSB with QRP levels of power. Most would think that it cannot work, and that satisfactory contacts cannot be made. I only have to mention the experiments of Ian G3ROO to convince most doubters. Whilst testing a homebrew transceiver, he answered the 'CQ' call of an amateur on the east coast of the USA. They were having a chat when Ian suddenly realised that he had not connected the PA and was conducting the contact using the driver only! This was later measured at a massive 23mW, although the two element Cubical Quad aerial used must have helped.

Measurement

This brings us neatly onto the next part, how do we measure low power levels. In Ian's case he had to use his oscilloscope to measure this low power level, but how many amateurs have an oscilloscope in their shack? The average operator will not need to measure power levels of this degree, and it is a sad fact that most commercial power measuring devices will not work accurately below a level of about 2 watts. Many operators will want to know their power precisely for various awards.

The 'standard' dummy load can be used with the addition of a few components, as shown in Fig. 1, as a power measuring device. It can be used as a terminal power meter or just as a dummy load. It does need to be set correctly by comparison with another known accurate meter, but once set this unit can be used for many years with complete satisfaction. The QRP operator can just use standard 1/4 watt resistors for power levels up to five watts, but for higher power up to 100 watts then 2 watt resistors should be used.

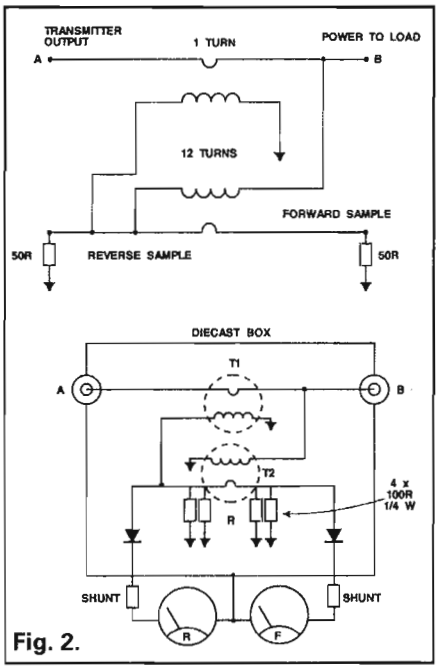


Fig. 2.

A Power Meter

A design appeared in *SPRAT* some time ago from David Stockton (see Fig. 2), this unit was also described in an article in HRT some two years ago. It acts as a twin transformer power meter with excellent accuracy. No setting-up procedure is required, and for LF single-band use, almost any dust iron ring can be used. Just select the mix for the band required.

Construction of both of these units is easy, the dummy load can be set out between two PCBs, or the ends of the resistors soldered together in a bunch. If the whole arrangement is encased in transmission oil or dry sand, then much higher power levels may be used. The power meter should be cased, and of course both can be used together, with the power meter connected to the dummy load on the output of the transmitter.

Just a reminder, the power levels for QRP use are not set at five watts for a carrier signal such as CW, FM, AM etc, for SSB use the level has been agreed at 10 Watts PEP.

'Low Power Communications' Book

Another book on QRP has just arrived on my desk, this time from the pen of Rich Arland K7YHA. Rich is the author of the QRP column in the American journal *World Radio*, and has put together his book entitled 'Low Power Communications' Volume 1 (2 to follow later) for the beginner and newcomer to QRP operating. It covers those radios available specifically for this aspect of the hobby. Aerials get a special mention, and it was good to see that he also agrees with my comments of last month on aerials. I am not sure how soon this book will be available in the UK but keep your eyes open for it. It is a 'good read'.

That's it for this month, comments and ideas to me please via HRT Editorial or to 3, Limes Road Folkestone CT19 4AU. 72...

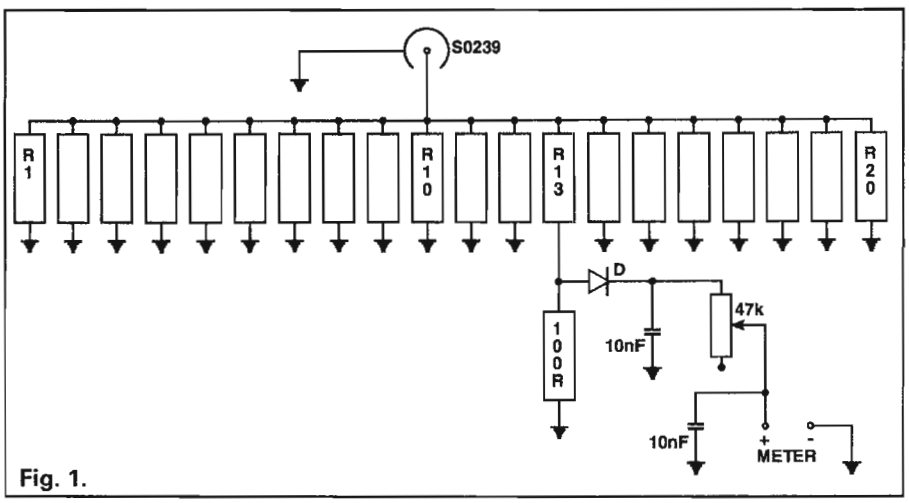
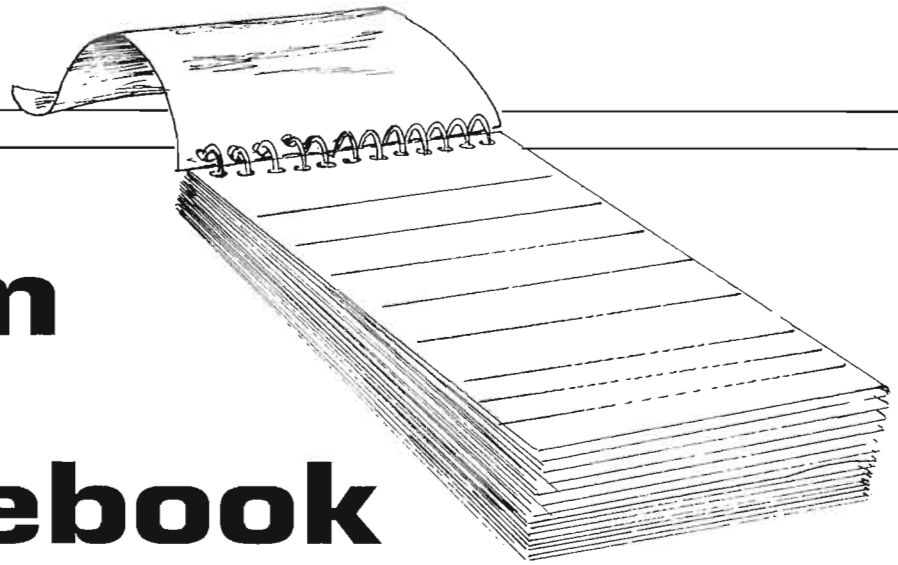


Fig. 1.



From My Notebook

Geoff Arnold G3GSR continues this month by looking at advanced superhet receivers

Oops! In last month's 'Notebook' I was concentrating so hard on choosing an example of a station frequency that didn't run the risk of being producing an ambiguous result in the calculations, I totally forgot that BBC Radio 3 is no longer broadcast on medium waves. I think it's all part of a fiendish master plan to save public money by doing away with BBC sound broadcasting – make the service so poor that only a few people listen, then close it down on the grounds that the small audience no longer justifies the cost of providing it.

But I digress! The real subject this month is advanced superhets, by which I mean anything other than the basic single-conversion type which I described last time. In a double superhet, the arrangement basically is of a superhet with a high IF followed by one with a low IF, giving you as far as possible the best of both worlds, but at the expense of added complication, and increased scope for spurious responses. This circuit arrangement is also sometimes called dual-conversion.

The wanted input signal is roughly selected by the RF tuned circuits in the input stages of the receiver and applied to the first mixer, together with a signal from a variable local oscillator. From among the various mixing products at the output of this first mixer, the wanted output frequency (the first IF), typically around 9MHz in present-day amateur equipment, is selected by a tuned circuit or filter. The image response of this first conversion process will occur at 2 x 9 = 18MHz above the signal frequency, and the tuned circuits between the aerial and the first mixer should be able to do a good job of rejecting it. The IF signal at 9MHz is passed to a second mixer, where it is heterodyned with a second local oscillator (usually fixed in frequency) to produce an output at the second IF, typically 455kHz. In this example, the second local oscillator would be at 9.455MHz

Almost all of the selectivity in a double superhet is concentrated in the filters and tuned circuits of the second IF amplifier, and it is these that define the receiver's overall bandwidth and how well it will reject unwanted signals on frequencies close to that of the wanted signal.

The bandwidth of the first IF filters don't have to be particularly tight or well-defined, as all that they are called upon to do is to reject any signals at the image frequency of the second conversion process, which will be 9 + (2 x 0.455) = 9.9MHz. In fact, the first IF bandwidth is sometimes made quite wide, and the second local oscillator made tuneable over a limited range, say 100kHz. The second LO tuning can then act as an electrical bandspread control for fine tuning, expanding any selected 100kHz section of a band across the entire swing of the second LO tuning capacitor.

In some dual-conversion receivers, the first IF filters are 500kHz wide, and the second LO is tuneable over a 500kHz range. In this way, the first LO tuning becomes a 'Band Set' control, which in use is set to the scale-mark for the lower edge of the 500kHz-wide segment containing the frequency of interest. In an amateur bands receiver this means that the second LO tuning or 'Band Spread' would cover in one sweep the whole of each HF amateur band apart from 10m (28-29.7MHz) which would have to be covered in four segments. A variation on this system is to make the first oscillator crystal-controlled, with one crystal for each amateur band (four for 10m), selected by the range switch.

Why 9MHz?

This is perhaps a good point to explore the reason for the choice of a frequency around 9MHz as an IF in amateur receivers and transceivers. There appear to be several reasons, apart from the fact that it is high enough to give good image rejection, but not so high as to complicate circuit design. Look first at the 80m band, which is 3.5-3.8MHz in ITU Region 1 (that includes Europe, Africa and the CIS). When heterodyned with a local oscillator signal in the range 5.5-5.2MHz, the 'sum' output of the mixing process will be at 9MHz (for both 3.5 + 5.5 = 9MHz and 3.8 + 5.2 = 9MHz). 'So what?', you ask.

Well, consider now the 20m band of 14.0-14.35MHz. When heterodyned with a local oscillator in the range 5.0-5.35MHz, the 'difference' output of the mixing process will be at 9MHz (14.0-5.0 = 9MHz and 14.35 - 5.35 = 9MHz). To build ourselves a simple superhet receiver covering the 80m and 20m bands, all we need is a local oscillator tuneable over 5.0-5.5MHz and an IF amplifier tuned to 9MHz, plus RF tuned circuits between the aerial and mixer to select the desired signal frequency. Crafty, eh?

Another reason for using a frequency around 9MHz is that it sits nicely in a gap between amateur band allocations. One thing which a superhet cannot do is to tune to a frequency equal to its IF (or the first IF in a double superhet), or even very close to it. Apart from the complications of choosing a suitable LO frequency to achieve this (I shall leave you to do some sums on that for yourself), the received RF signal would feed straight through the mixer and beat with its own IF mixing product. Looked at in another way, the IF rejection provided by the RF tuned circuits in the front end would be zero.

To design an HF receiver of the type described as 'general coverage', one covering say 1.6-30MHz without gaps, the traditional way was to use different (first) IFs for different bands. In one example, a first IF of 1.5MHz was used for the frequency range which included 4.5MHz, and a first IF of 4.5MHz was used on all other HF ranges.

Although this solution works well, it adds the complication and expense of additional wafers on the range switch, plus a second set of IF coils or filters, and having to align them during manufacture. The modern way round the problem is to use an IF that is totally outside the required operating range,

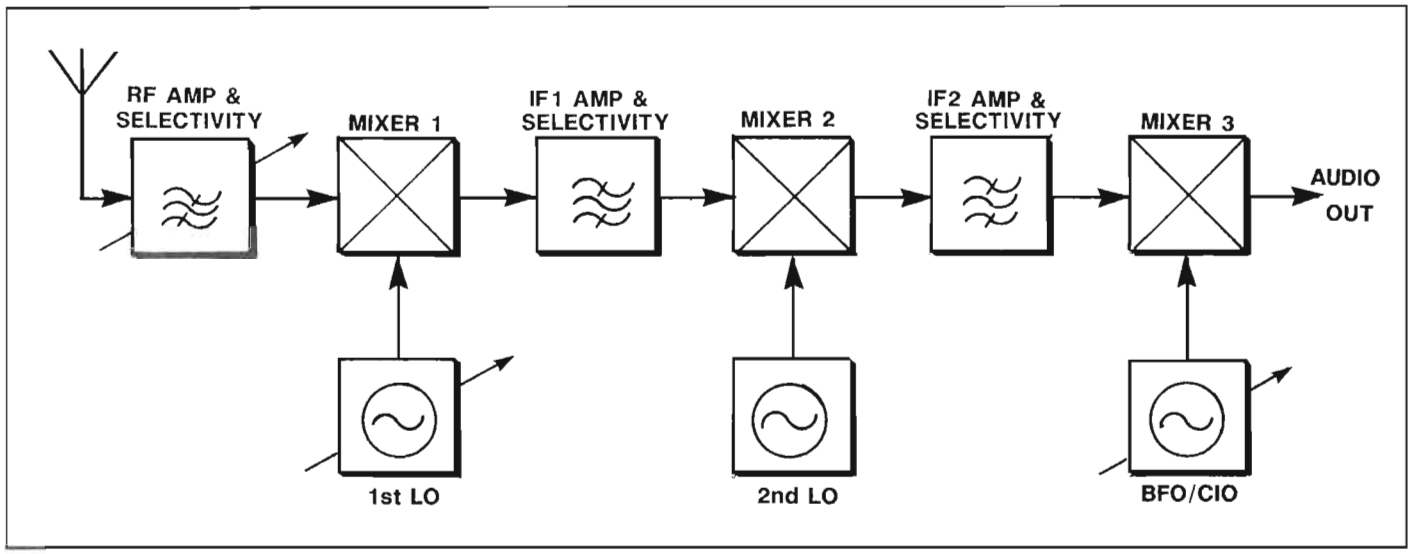


Fig. 1. Frequency processing in a dual-conversion superhet

an IF between around 40 and 70MHz being a popular choice for HF receivers. This is the 'up-conversion' receiver.

Up-Conversion

The benefits of using such a high IF are obvious, it allows continuous frequency coverage and the image rejection is good. The problem is that the first local oscillator has to operate in the VHF region, at anything up to 100MHz for a receiver tuning to 30MHz with a 70MHz IF, not conducive to good frequency stability if a variable first oscillator is used.

One solution is to use the crystal-controlled first oscillator plus variable second oscillator arrangement already mentioned. However, to cover the whole of the HF bands in this way requires a large bank of expensive quartz crystals. An alternative solution was adopted in the Wadley Loop frequency control system, a triple-conversion system used in such well-known receivers as the Racal RA-17, the Yaesu FRG-7 and the Lowe SRX-30. This basically uses the variable first oscillator as a 'megahertz tuning' control, where a sample of the first LO is mixed with a 'comb' of harmonics from a 1MHz crystal oscillator, and one of the resulting products is selected by a band-pass filter for use as the second LO. Any drift in the first LO, resulting in an error in the first mixer output, IF1, will also appear in the second LO. Thus, the error will be cancelled in the second mixer output, IF2, which is usually chosen to be in the range 2-3MHz.

A variable third LO functions as the 'kilohertz tuning' control, giving interpolation between the megahertz points. This third LO operates at around 2-4MHz, depending on the particular receiver design, and is quite stable. The output of the third mixer, IF3, is at 100kHz in the RA-17 and 455kHz in the FRG-7.

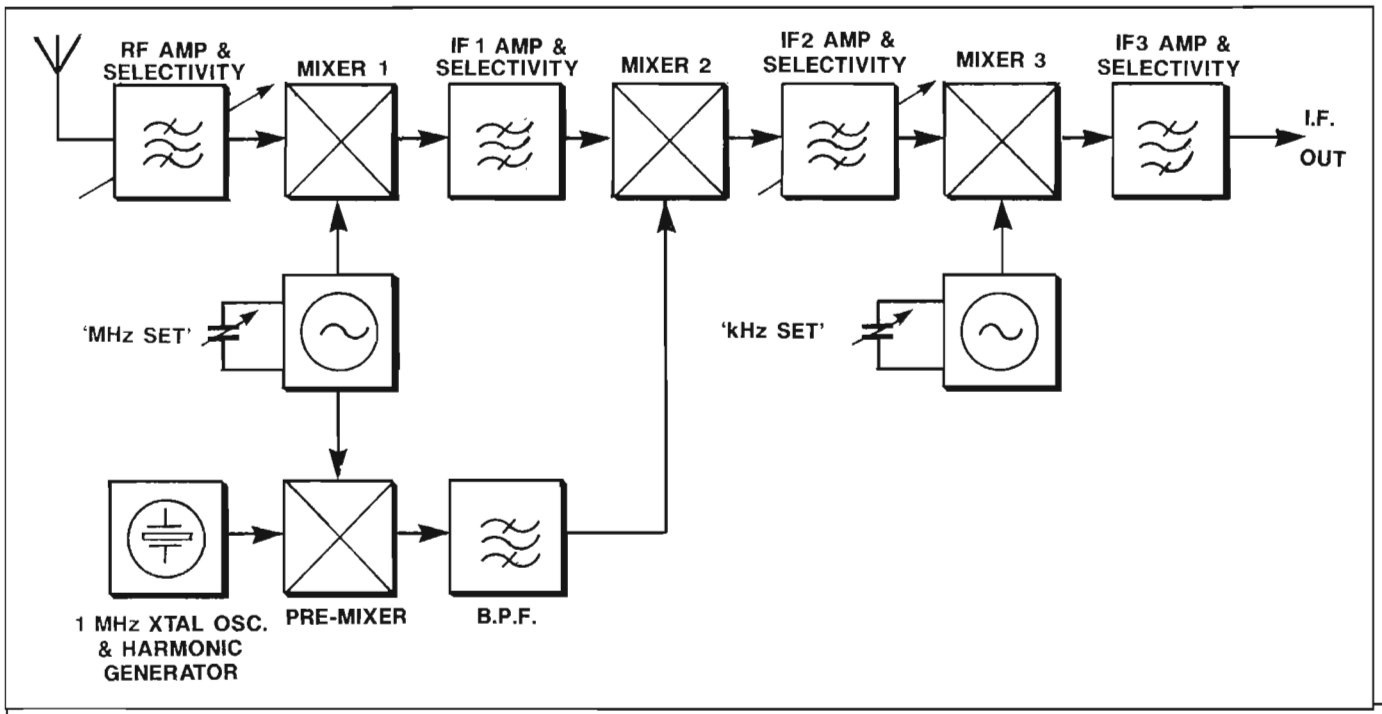
The Wadley Loop is a very clever system, but the large number of mixing stages employed, plus the use of a 1MHz harmonic generator, means that extremely efficient screening and filtering are required if the receiver's performance is not to be spoilt by a succession of 'birdies' as you tune through the bands.

The Synthesizer

The use of such a high IF has been made easier by the almost universal use of a frequency synthesizer to generate the local oscillator signals in present-day receivers. In fact, it might be said that up-conversion and frequency synthesis were made for each other!

A synthesizer has been described as a circuit capable of producing any frequency you want, plus a whole host of frequencies which you don't want! In fact, modern synthesizers are a lot 'cleaner', producing far less in the way of spurious outputs than their forebears of thirty years or so ago. A synthesizer is based on a crystal-controlled oscillator, and by a process of frequency division, mixing and phase comparison, produces an output at some other frequency, selected by the operator.

Fig. 2. Frequency processing in a Wadley Loop receiver



In a synthesizer-controlled receiver there are no mechanical tuning capacitors to be turned. Instead, the operator selects the operating frequency either by pressing several buttons on a keypad, or by turning a tuning knob coupled to a device which sends a series of pulses to the synthesizer, instructing it to change the ratio of its frequency dividers. Because there are no tuning capacitors to 'gang', HF receivers often use switched, fixed 'octave' bandpass filters in the front end. These filters cover a frequency span of one octave, say 2-4, 4-8, 8-16 and 16-32MHz, or in a better receiver they could be 'sub-octave' filters, in other words covering less than an octave span. The advantage of a narrower band-pass filter is that it passes less noise than a wider one, and also that there will be a smaller number of very strong signals within its passband to cause intermodulation products or 'blocking' of the receiver. The wider the filters, the more the attention that must be given to strong-signal handling characteristics of the front end circuits.

In one or two of the earliest synthesised up-conversion receivers, the designers actually used a low-pass filter to cover all frequencies below 2MHz. Whilst this sounds all right in theory, it meant that for a user living close to a medium wave broadcasting station, Top Band (160m) reception was impossible without the addition of external filtering or an aerial tuning unit.

Multi-Superhets

Some modern receivers (and a few older ones too) use three or more different intermediate frequencies in succession. For example 45MHz, 9MHz and 455kHz. The 45MHz first IF gives excellent image and IF rejection, but at the expense of a fairly wide-open door for noise and strong signals on frequencies near to the wanted one; the 9MHz second IF filters provide a narrower doorway, cutting out some of the noise and interference; the 455kHz third IF defines the operating bandwidth, which might be anything from a few hundred hertz for CW reception to several kilohertz for SSB, AM, etc.

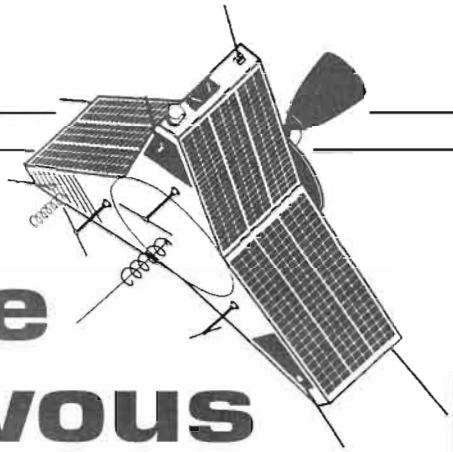
In a transceiver, some or all of the receive frequency conversion chain will be used 'in reverse' to generate the transmitted signal, so that the SSB or CW signal will be generated at 455kHz, then converted in steps to the final transmitted frequency, before being applied to a linear amplifier and finally to the aerial.

Converters and Transverters

A variant of the multi-superhet is often used by amateur operators as an inexpensive means of getting on the 2m band, 144-146MHz, when they already have HF equipment. If only reception of VHF is required, a unit called a *converter* is connected between the 2m aerial and the HF receiver aerial input. In the converter, the incoming signal is passed through a 144-146MHz bandpass filter to a mixer stage where it is heterodyned with the output of a 116MHz crystal-controlled local oscillator. At the output of the mixer, one of the products will be the signals in the 144-146MHz range, transposed to 28-30MHz (144 - 116 = 28MHz, etc.).

The overall set-up is exactly similar to the double superhet with fixed first oscillator and tuneable second local oscillator which I described earlier. The HF receiver has become a tuneable IF.

If transmission on 2m is required as well, a unit called a *transverter* is used instead of the converter already described. As well as being able to do exactly the same job as the converter for reception, the transverter can also work in reverse, taking the output of the HF transmitter in the range 28-30MHz, mixing it with the 116MHz crystal oscillator signal, selecting the 'sum' product in the range 144-146MHz at the output of the mixer and applying it to a VHF linear amplifier and aerial.



Satellite Rendezvous

Richard Limebear G3RWL with this month's collation of AMSAT-UK News

Oscar 13

The next re-orientation, as this is being put together, will have commenced on July 20 from 210/0 to 150/0 via an interim attitude of 180/15. When at 150/0, which will last until September 21, apogee access for Southern Hemisphere stations will be all but useless. There is absolutely nothing we can do about this, other than reposition the Sun's orbit, which unfortunately is beyond AMSAT's budget at present. see last month's issue for a calender of OSCAR-13's events until the end of this year.

The schedule shown here, which reverts to the old everyday routine, was determined at a meeting of AO-13 Command Stations during the Phase 3D Design Conference held in Marburg in May. The decision to discontinue the experimental alternate day schedule is dictated entirely by spacecraft security.

The primary AO-13 management requirement is to maintain the health of the spacecraft *and* to provide the best operating conditions for users of the spacecraft's transponders. It is always a 'juggling act' for the Command Stations to try and balance these often opposed goals. Faced with deciding between health versus performance, the Command Stations will always choose the conservative approach and give priority to the health issues.

The extended 2.25 hour long Mode J/L/S periods drained the battery too heavily, resulting in uncomfortably low battery charge and regularly tripped under-voltage software 'fuses'. This practice is undesirable and has to be avoided. A second reason is that commanding on Mode-B is virtually impossible due to suspected radar interference on 70cm; alternate days of Mode B therefore reduced the Command Stations' daily control capability by 50%, and we found this an untenable situation to be in.

Up to date information about AO-13 operations is always available on the beacons, 145.812MHz or 435.658MHz in CW, RTTY and 400 bps PSK.

Russian Satellites

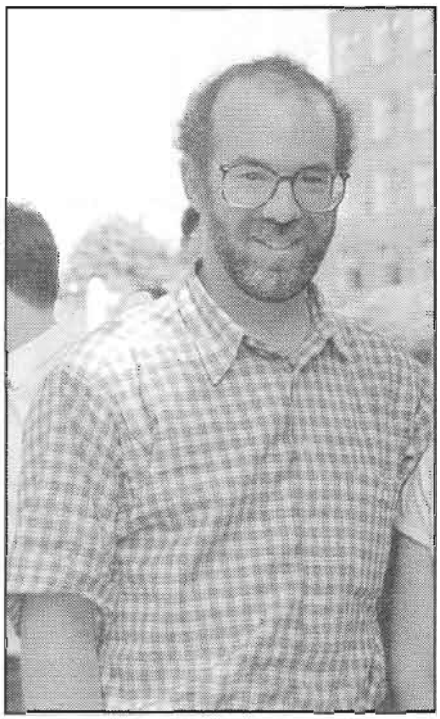
AO-21 has, as this is being prepared, been going through several different modes of operation; sometimes its in the FM-repeater mode, sometimes the RUDAK BBS is on, occasionally the transponder is on and sometimes they're experimenting with different settings including the voice mode. Since AO-21 is primarily a developmental spacecraft the modules in operation are likely to change their modes frequently. Scheduled changes are announced by AMSAT-DL over the packet network and digital satellites.

The experimental FM voice repeater has an uplink frequency of 435.016MHz and the downlink is 145.987MHz, both plus/minus Doppler shift. Any groundstation for FO-20 and the 1200 Bit/s PSK PACSAT's can also be used to access the RUDAK BBS System. Same frequencies, uplink 435.016MHz, Downlink 145.987MHz.

Many users noticed that sometimes much higher power was necessary to get packets uploaded to RUDAK/AO-21. The spacecraft controllers don't know if this is from radar QRM (or other interferences) specially over Europe, or if it is a problem in the RX section of AO-21, but the AO-21 receiver unit includes a 12dB attenuator which may be switched on; they've been playing with this setting.

MicroSats

The **DOVE** Recovery Team are not sure of the exact cause of the voice message change but they have several theories that they are looking into. The most probable cause is the presence of a software bug, however, that is only one possibility which is being investigated. DOVE listeners are reminded that in trouble- shooting this problem, DOVE may leave 2m for testing purposes so keep an eye on messages



Eric Rosenberg WD3Q, known to HRT readers through his work with VITA, was proposed for an AMSAT-NA seat.

broadcast through the telemetry stream.

They did a reset on the spacecraft and reloaded it. Apparently the next voice test load will alternate between the original voice message program and a DSP program for the Voice CPU, which is a simple direct digital synthesis oscillator. It will be generating a sine wave through the digital to analog converter. These tests are to assure us that all the hardware is functioning properly after being dormant for over two years, and to test the fixes for several compromises and minor faults. After this process is completed the software development team will implement the file system, and upload large files of digitized waveforms, not all of them being speech. A few surprises from DOVE's owner, PY2BJO, are in store.

After a summer 'break', the **AO-16** command team have announced that *Experimenter's Day* activities will resume in September.

KitSat

This satellite should, if all went to plan, have been launched on Aug 10th on board the Ariane V-52 mission along with the primary passenger for this mission which was the oceanographic satellite TOPEX/POSEIDON. A reminder following on from last month's feature; the target orbit is nearly circular, with semi-major axis 7700km and inclination

66 degrees. The uplink frequencies are; 145.850MHz (Primary access channel) and 145.900MHz (Secondary access channel), with a downlink of 435.175MHz.

Arsene

Arsene was supposed to be on the flight after KITSAT, along with HISPASAT. However, an *unconfirmed* report from a usually reliable source says it has been 'bounced off' the HISPASAT flight and is now looking for a new ride.

F6BVP recently gave me the following information: Final orbit: equatorial with apogee = 36,000km and perigee = 20,000km; period 17.5 hours with an orbit inclination of 0 degrees (no change). Launch probably in November 1992 with Ariane flight V55.

GaAs solar panels from Italy will provide 60 watts. The spin-stabilised satellite will use nitrogen gas for attitude control; Satellite N/S axis will be perpendicular to equatorial plane. Lifetime expected is three to five years. The six-sided body is 785mm in diameter, 618mm high. Overall dimensions are 958mm diameter for the lower plateau and 1110mm high from the top of VHF monopole to the lower plateau. Weight is 150.6Kg before kick motor firing.

The communications payload have a 70cm uplink and use 145 and 2445MHz for downlinks; the two modes, B and S, will NOT operate simultaneously. Mode B operation has three uplinks at 435.050/.100/.150MHz and a single downlink at 145.975MHz (maximum doppler 3Hz / min.). VHF power output 15 W (42dBm) and 2 W (33dBm) when in low power mode; Standard (fm) 1200 bauds digipeater with 1200Hz/2200Hz tones are specified; There will not be a mailbox. Mode S will be a linear transponder, uplink 435.100MHz and downlink 2446.540MHz (bandwidth 16kHz). SHF output power 0.8 W (29dBm). Arsene successfully passed vibration test a month ago at the Aerospatiale integration centre.

KEPLERS

SAT:	OSCAR 10	UoSat 2	AO-13	UO-14	PACSAT	DO-17	WO-18
EPOC:	92173.76516272	92172.14888819	92151.59699146	92176.73523992	92177.52062736	92169.42529597	92169.39123337
INCL:	26.4523	97.8490	57.0668	98.6396	98.6440	98.6442	98.6443
RAAN:	77.1364	207.8513	22.4235	258.5068	259.8805	251.9645	251.9769
ECCN:	0.6035873	0.0013168	0.7300681	0.0010937	0.0011601	0.0011381	0.0011854
ARGP:	354.3377	73.2214	267.1532	148.0000	143.7461	167.3713	168.3563
MA:	1.2126	287.0439	9.9428	212.1851	216.4509	192.7759	191.7894
MM:	2.05882475	14.68587409	2.09617044	14.29649782	14.29715347	14.29833686	14.29830754
DECY:	-1.7E-07	5.54E-06	6.6671E-04	1.56E-06	1.41E-06	1.51E-06	1.33E-06
REVN:	3987	44357	3036	12635	12647	12532	12532
SAT:	LO-19	FO-20	AO-21	UO-22	RS-10/11	RS-12/13	Mir
EPOC:	92169.41515596	92171.23377425	92176.99107918	92169.74011051	92176.96422972	92178.02766651	92178.08572278
INCL:	98.6444	99.0756	82.9449	98.5082	82.9260	82.9236	51.5983
RAAN:	252.1128	89.3958	317.1479	244.9906	142.6388	186.2037	202.2013
ECCN:	0.0012341	0.0540465	0.0034328	0.0007320	0.0010263	0.0028755	0.0016745
ARGP:	167.9905	188.2008	298.8941	312.2130	226.8867	319.5203	211.5544
MA:	192.1577	170.9976	60.8731	47.8435	133.1370	40.3812	148.3033
MM:	14.29914077	12.83210959	13.74487435	14.36665311	13.72288557	13.73995151	15.55930772
DECY:	1.46E-06	-4E-08	7.8E-07	1.84E-06	1.75E-06	3.8E-07	-2.0127E-03
REVN:	12533	11076	7037	4833	25085	6961	36366
SAT:	NOAA 9	NOAA 10	NOAA 11	NOAA 12	Meteor 2-16	Meteor 2-17	Meteor 2-18
EPOC:	92177.87655479	92177.87280788	92177.86963226	92177.88975832	92177.72358381	92170.93605916	92177.96336671
INCL:	99.1428	98.5352	99.0938	98.6949	82.5560	82.5429	82.5187
RAAN:	205.0615	197.1275	141.6367	207.6649	64.0264	127.8432	358.8973
ECCN:	0.0016014	0.0012198	0.0012160	0.0013405	0.0012479	0.0018591	0.0015701
ARGP:	91.8474	276.3148	5.8056	161.0713	345.0848	65.8100	88.2171
MA:	268.4514	83.6637	354.3236	199.0966	14.5941	294.5007	272.0785
MM:	14.13406730	14.24675584	14.12787043	14.22061521	13.83952139	13.84638305	13.84289975
DECY:	5.4E-07	1.93E-06	2.38E-06	3.79E-06	1.25E-06	4.8E-07	5.8E-07
REVN:	38844	29969	19336	5800	24526	22157	16790
SAT:	Meteor 2-19	Meteor 2-20	Meteor 3-2	Meteor 3-3	Meteor 3-4	Meteor 3-5	
EPOC:	92177.74279247	92177.93057947	92173.85255780	92177.69927731	92177.92231789	92172.83466571	
INCL:	82.5472	82.5252	82.5426	82.5525	82.5425	82.5580	
RAAN:	61.4937	359.8090	116.9363	56.3756	319.8526	269.7018	
ECCN:	0.0017075	0.0012029	0.0016394	0.0014897	0.0017423	0.0013193	
ARGP:	16.4480	272.8072	279.4617	288.7699	196.5233	267.4151	
MA:	343.7230	87.1711	80.4850	71.1810	161.5256	152.8389	
MM:	13.84129385	13.83502132	13.16948800	13.15997438	13.16808961	13.16805770	
DECY:	1.11E-06	6.2E-07	1.9E-07	4.3E-07	4.3E-07	-4.15E-06	
REVN:	10081	8802	18778	12821	5643	4086	

More Licensed Astronauts

Three more NASA astronauts have passed their US amateur radio 'Technician' licence examinations. All three took the test at the Ham Com convention in Houston on the weekend of June 6, and are scheduled to join pilot Ken Cameron, KB5AWP, on a shuttle mission in March 1993. The three new ham-astronauts are Ellen Ochoa, Mike Foale, and Ken Cockrell. Mike Foale is reported to have bought a 2m rig at the convention, and is gnashing his teeth waiting for his ticket to arrive!

AO-13 Transponder Schedule 1992 Aug 17 - Sep 21

Mode-B	:	MA	0	to	MA	40	!	from 1992 Aug 17 until Sep 21
Mode-S	:	MA	40	to	MA	50	!	<- S transponder; B trsp. is OFF!
Mode-LS	:	MA	50	to	MA	55	!	<- S beacon + L transponder
Mode-JL	:	MA	55	to	MA	70	!	This schedule operates
Mode-B	:	MA	70	to	MA	256	!	every orbit, every day.
Omnis	:	MA	160	to	MA	10	!	Alon/Alat 150/0

Please *don't* uplink to Mode-B during MA 40-50, this interferes with Mode S.

Joe Kasser W3/G3ZCZ (that well-known software writer) was also nominated.

AMSAT-NA Nominations

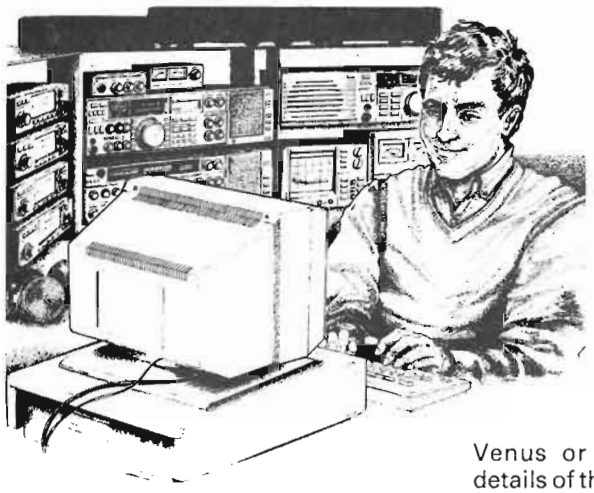
The following AMSAT-NA members have been nominated to run for the three seats which will expire this November '92 on the AMSAT-NA BOD. The following names will appear on the ballot; Joe Kasser (W3/G3ZCZ), Tom Clark (W3IWI), Eric Rosenberg (WD3Q), Dick Daniels (W4PUJ), Mike Crisler (N4IFD), Joe Holman (KA7LDN), Bob Diersing (N5AHD), Andy McAllister (WA5ZIB). Each elected board member serves a two year term. If you're a member of AMSAT-NA, then look for your ballot to be included in an upcoming issue of the AMSAT Journal.

AMSAT-UK News

The 'big event' of the year, the AMSAT-UK Colloquium held over the 30 July to 2nd August 'long weekend', will by now have taken place. If you managed to get along we hope that you enjoyed yourself, and hopefully even learned a little (or a lot) more about amateur satellites *(if you didn't visit, you'll have missed a great time - Tech Ed)*. We'll have some photos from this in next month's issue.

As always, you can get further information about the organisation from; AMSAT-UK, c/o Ron Broadbent, G3AAJ, 94 Herongate Rd, London, E12 5EQ. A big SAE gets you membership info, and SWLs are welcome.

Packet Radio -Roundup-



Chris Lorek G4HCL looks at a talking packet program

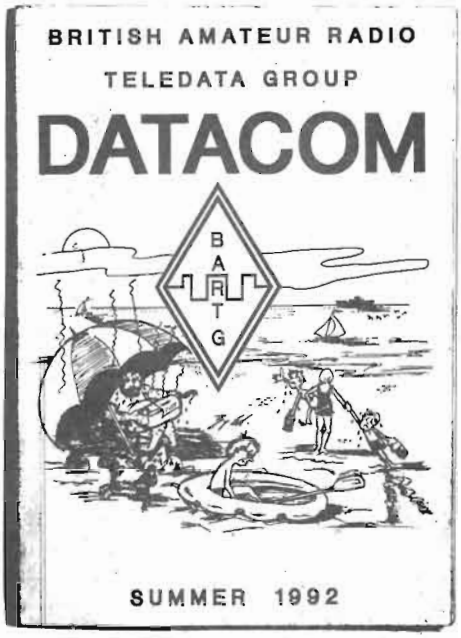
I've recently been testing a couple of interesting programs for packet. The first is Lan-Link version 2.00 from G3ZCZ/W3, the latest version of the shareware packet terminal program which configures your multimode TNC for the optimum configuration for each mode of your TNC. Another one I recently received is very interesting, this one's Superkiss version 5.5, a commercial program from Germany. The 236 page manual I have is also written in German, which I'm getting through (slowly), and although I understand an English version may soon be available the program allows you to install it in either English or German. A few novel features of this are 'duplex digipeating', data compression capabilities, and even the capability for the program to speak to you, a genuine voice! I'll be detailing both of these soon in HRT.

'Free' Software Available

A common question I'm asked is *Where do I get all this 'free' software for packet?* 'Shareware' PC software, i.e., a 'try before you buy' system, may be freely copied with a registration payment expected if you decide to use it, and I often spend long hours copying such for visitors to my shack. No, I can't do it by mail order (sorry!), however a few companies have organised themselves especially for this, charging just a nominal fee for copying and for the disks. A couple of my favourite companies for amateur radio software are the Public Domain and Shareware Library, Winscombe House, Beacon Rd, Crowborough, Sussex TN6 1UL (Tel. 0892 663298), and Venus Electronics, 26 Pevensey Way, Frimley Green, Camberley, Surrey GU16 5YJ (Tel 0252 837860. Another company who distribute G3ZCZ/W3's amateur radio software are Readycrest Ltd., P. O. Box 75, Chatham, Kent ME5 9DL (Tel. 0634 687168). The PDSL catalogue costs you £2, but a large SAE to Venus or Readycrest will get you details of their amateur radio software.

Duplex Crossband Packet?

With the proliferation of dual band 2m/70cm FM transceivers, here's a possible idea for one-to-one high speed packet. On a clear channel, packet can. of course, be very fast. The problem comes when you get 'collisions', but another is that it's often used as a 'simplex' mode, with your rig transmitting, then going to receive and waiting for an 'Ack', then transmitting, then back again and so on. Coupled with long TX delays to overcome RX squelch and TX rise times, large file transfers can often get boring! A few stations local to me have been testing full-duplex packet for such applications, with excellent results. It's one of those simple ideas that makes you wonder why no-one had thought of it before (I'm now going to be barraged with messages telling me amateurs have been using this for years!). I'll soon be setting up an additional port on my node system for a crossband system on an experimental basis, adding to the existing 6m/4m/2m/70cm/23cm/10GHz system (I'll squeeze it in somehow!). But here's a question. With Novices not currently being allowed to use 432.675MHz, and with all other 70cm frequencies requiring site clearance for unattended use such as for nodes, what's the reason for not using a 'Novice network access' node with a receiver on a 433.xxxMHz frequency and a transmitter on 2m (possibly using the existing 2m node system TX)? This means the user must add a 2m RX (a simple scanner receiver will suffice) to the 70cm rig, but it might mean the difference between BBS/node system access, and no access at all, for our radio amateurs of tomorrow.



The BARTG quarterly journal 'Datacom'

The Cluster Duster

UK Cluster Working Group

As well as information dissemination via the 'network', several groups do of course exist for the benefit of packet users and SysOps. One such is the UK Cluster Working Group, who are to my knowledge the only national body uniting SysOps. It was formed to coordinate and advise on the setting up and running of DX PacketClusters in the UK, as in the ever-growing world of packet radio it was thought that the setting up of PacketClusters shouldn't take place haphazardly. Hard lessons have been learned in the past from setting up of the BBS network! It's hoped that anyone contemplating running a cluster will contact the UKCWG with a view to getting their advice – they don't claim to be experts in everything but they do have experience in the PacketCluster field! They are represented on the RSGB Data Communications Committee, so they do have a 'voice' where it counts. Membership is open to Cluster SysOps, and you can contact them with a message on the Cluster network to GB7DXC, which will reach the Chairman John G4PDQ (the GB7DXC SysOp). If you'd rather just keep in touch with Cluster 'goings on', then UKCWG. All amateurs are welcome to subscribe, this costing £4 per year in the UK, £5 to other EEC countries, $10 airmail to US, payable to 'UK Cluster Working Group', sent to Maurice King G3XKD, 15 Glebe Road, Prestbury, Cheltenham, Glos. GL52 3DG.

Shareware programs are readily available

Maurice G3XKD distributes the Cluster Duster, the quarterly newsletter of the

CTRL-Z, End of Message

The latest issue of the BARTG's journal Datacom recently dropped through my letter box, as usual it's packed with information of interest to amateur radio data enthusiasts. Later this month is the BARTG rally at Sandown Park, the year's 'specialist' gathering for data minded amateurs, if you're 'into' this field of the hobby then don't miss it, I won't! My computer's started speaking to me again (Superkiss 5.5, see above) so I'll see who's left me a message! Please keep your information and ideas coming, either on packet or via. post to P. O. Box 73, Eastleigh, Hants. SO5 5WG. Until next month, 73 from Chris G4HCL @ GB7XJZ

VHF/UHF Message

Geoff Brown GJ41CD reports Albanian QSOs with UK on 144MHz

The new 1296MHz amplifier by Tokyo

June's propagation continued as May's left off regarding 50MHz, and double hop ES openings to the Middle East were plentiful. There were some spectacular double hop openings to the USA that lasted for many hours as well as Africa and South America. But even good openings can sometimes be frustrating, more about this later.

144MHz also had some choice openings via *ES*, which is typical as I have just taken my beam down!. The 6/7th and 21st/22nd were the best days, and even ZA (Albania) and EA8 were worked along with virtually the whole of Europe.

Solar flux figures finally dropped under the 100 mark, showing that cycle 22 is now declining as expected. But please don't pack up your 50MHz radio and put it in the cupboard for another several years, as, within a few days of the decline, flux levels picked up again to the 130+ mark, due to a small group of five spots appearing.

Spain now on 6m

The latest news is that a number of amateurs in Spain have been granted the use of 6m. I understand that around 80 permits have been issued, and I've heard stations using the prefix of EH in place of EA. As I write this, I've just this afternoon managed to work EH5CJ on 6m.

Contest news

The UK Six Metre Group (UKSMG) held it's annual contest on the weekend of 6/7th June, good propagation was booked to coincide with the contest and luckily it turned up on time.

DX was plentiful with 3Z4PAR (the Polish experimental 50MHz station) booming into the UK. Chris SP4TKK, the main organiser and operator, worked more Gs than any other prefix, which goes to show how many people really are active on six.

Sporadic 'E' continued for the whole two days, and even through the night, at 0200z, 0300z, and 0400z, I copied the OH, 4N, and 9H beacons at good strength, proving again that 50MHz can be supported in darkness hours via Sporadic 'E'.

3Z4PAR, Confused?

3Z4PAR was QRV on six for a ten day experiment (TVI etc.), this experiment which was legally licensed by the P.A.R. in Poland, was a step closer for Polish Amateurs obtaining the 50MHz band. Considerable work involving the UKSMG in providing vital information to the authorities on European licensing conditions in general were forwarded, this as a result provided Poland with it's first 50MHz station from June 5th for ten days only.

Some special thanks must go here, to Neil G0JHC for the help with an FT690R, and to Nevada Communications for their donation of an amplifier. QSL info for this special event is SP4KM whose address is; W. Krassowski, P. O. Box 21, PL 10-950, Olsztyn 1, Poland.

Further experiments will be considered by the P.A.R. and it is hoped that in the near future all Polish class 'A' holders will have access to 6m. In a letter to me dated the 16th June, Poland's VHF manager SP5CCC noted that licences may be issued at the end of July.

Thanks from Shamir OD5SK

Shamir, OD5SK, sends his thanks to Nick G3KOX for supplying him with a 50MHz 25W amplifier free of charge, and also to Tom DL7AV for the five element beam also free of charge. These were shipped with the beacon supplied by yours truly (the PA being donated via Nevada Communications) during the end of June, so, look out for *OD5SIX* on 50.0785MHz.

Siggy, YO2IS, also sends his thanks to all HRT readers who sent components onto me for the electronic 'food parcels', especially to G8APZ and John G8PKN.

Sporadic 'E'

I wonder how many of you read the July edition of HRT on this debatable subject by Charlie Newton (a real expert in propagation) and Jim Treybig W6JKV (whom I had the pleasure of meeting a couple of years ago at the RSGB VHF

QSL card from UL7GCC on Six

QSL just received from Ray 7P8SR, now that's rare!

Convention at Sandown Park). However, there are a couple of points to be looked at.

In the article Charlie states "If we look world-wide, there is much more sporadic 'E' over Asia and very little over South Africa". But really is this a fair comment?, after all, the northern hemisphere land mass is vast compared with the south. How can we prove that 'ES' in the Southern Hemisphere is less prominent than in the Northern Hemisphere, when, with less amateur population, lack of activity, plus commercial television transmitter popularity is by far much smaller and therefore probably not noticed as much as in Europe?

The other point to also note here is that, during our winter months, the Southern Hemisphere does exhibit more 'ES' openings than the Northern Hemisphere, and probably many more openings are missed, but again due to the geographical situation of countries in the Southern Hemisphere they are probably not noticed or monitored as we do in Europe.

The other point of contention, which I stand to be corrected on, is that sources of wind shearing are more local than anything else. Well I'm not too sure on that one, but if so, then why when we have 'ES' openings in Europe do openings sometimes occur in the USA (widespread) and Japan at the same time, or during the country's daylight time, and, even linking SV to JA on 50MHz a few summers ago?. The covering of Sporadic 'E' has been reported 'blanketing' the Northern Hemisphere on several occasions, plus proof of a 28 day return of 'ES' events like June/July.

Some years ago I came across what I term as 'The Radio Bible', the correct name is the *Radio and Television Engineer's Reference Book*, put together with the work from by 36 specialist contributors, it is around 50mm thick. In the first published 1954 edition in the propagation section, F. D. Bolt, B.Sc., M.I.E.E. states "The 'E' layer is also produced directly by the sun's radiation and tends to disappear during the night time". Well, why not?. Maybe we are missing some vital factor from the Sun, as this theory would explain that when the Sun crosses the Equator, a reversal is seen from south to north or visa versa. This, incidentally, is just like the F2 propagation we see on 50MHz of which could be attributed to the Sun, as it is the only common denominator (Solar) for Solar Solstice and the Equinox.

Another point raised by readers was 'why does 'E' seem to build from day to day (something I have noticed for years), and then after the 144MHz openings, dies for days and starts to rebuild?'. It will be interesting to find out the results of work that is being carried out by the University College of Wales, we look forward to some answers and maybe predictions for Sporadic 'E'. Good luck.

Band Reports – 50MHz

It was very surprising that many readers worked up to ten new countries on six during late May and June. Neil G0JHC (Lancs) reports just that in a four week period, which is very good considering his geographical location. He lists D68, FR/G, 3Z4, UZ2, TA5, 5B4, ZC, OH0, ES, OD5, 4X4, plus many more.

Ela G6HKM also reports an increase in her country count with TA5ZA, OD5SK, 3Z4PAR, LY2WR, and UZ2FWA all being new ones. However, Ela worked EA1AST on the 17th June but I'm sorry to say that EA is still not legal (at the time of writing), and yet EA8 has been accepted by ARRL for DXCC!

There were many reports regarding the openings on the 6/7th and the 20th-22nd of June. Unfortunately I cannot report on all individual reports due to space, but here is a list of countries readers worked or heard during these very big double hop 'ES' openings; SV, YO, OK, OE, IT9 (this does count for a new country with RSGB), 9H, YU, TA, 5B4, ZC4, OD5, 9K2, DL, ES, 3Z4, 4N, PA, ON, SM, LA, OH, OZ, OY, LY, FM5 (!), CN, EA, VE1/2/3/5, W1/2/3, UZ2, LZ, Z23, 7Q7, 7P8, 4X4, LU, CX, F, and all the UK prefixes via backscatter, plus I bet a few have been missed off the list.

The highlight of June was 9K2TC, whom I heard calling for over one hour. But I could not crack the QRM and pile-up, and closed down the station with the thought 'ever had one of those days?'.

July also started off well, ZA1A blessed most peoples' logbook, QSL via OH2BH. 9K2ZR was into the UK on the 3rd, those known to have worked him were G3WOS, G4MKF, G3HBR, G4CCZ, G3NVO, G3SVD, G3VYF and yours truly got in on the act, QSL via Andy K8EFS.

The weekend of the 4th/5th July brought a massive return of 'ES' (28 days after the last big opening!) at the beginning of June, this time UX1A (KP40) in Vybourg operated by OH2BC, OH2DD, OH1ZAA, and OH2TI plus others appeared on the band mid-morning, and Chris G3WOS was the first 'G' to work them. Many UK stations reported a QSO, and again even I managed to snatch him before QSB set in and propagation moved to LA, SM, and then to OY6A (IP62) who was S9+ for hour upon hour.

During the 5th, double hop 'ES' returned in the afternoon with 4X1IF in at S9+20dB, and during the big opening OH1AYQ reported G3XBY on 70MHz calling CQ contest (field day).

Albania on 144MHz

The 6th/7th June opening on six also made it to 144MHz, Ela G6HKM worked Italian stations in JN70 at 0951z, and later in the morning LZ1UH (KN11), Ela also picked up I8TUS/JM89 for a new square. Again the large 'ES' opening on the 22nd June on six made it to 2m, but this time in style. G8GXP was reported to work ZA6AVV (nice one, Dave), GJ0JSY had a field day with OKs, 4N, I, HA, HG, SM0 and UT5DL between 1850z and 2008z. David G4ASR also had a ball on the 22nd, he worked 103 stations, 60 of which were YUs (he even managed time to QSY to six to work 9K2ZR and UZ2FWA for new ones.

70cm and 23cm

Conditions were poor during the month, even VHF Field Day suffered the usual poor weather and radio conditions. However, Ela G6HKM found OZ9FW (JO65), DG9BDV (JO33), and DD9LW (JO44) in a surprising opening on the 20th June, Ela also made it with OZ1DOQ (JO65) and OZ6HY (JO45) on 23cm. That's it, please do send any reports, photos or QSLs to *Geoff Brown, TV Shop, Belmont Rd, St Helier, Jersey, Channel Islands*, or phone 0534 77067 day, switched to fax after 1730 local.

QSL card from 1991 ES0SM now well activated on 50MHz by ES6QB, ES1CW, and ES5RY