HRT

HAM RADIO TODAY

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MARCH 1992 £1.60

Aerial Design by PC

London Show Guide

Construction Build a simple 80m TX

Icom IC-2PET Reviewed

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NOVICE • PACKET • REVIEWS • PROJECTS • SATELLITES

HRT
HAM RADIO TODAY
VOLUME 11 NO 3 MARCH 1992

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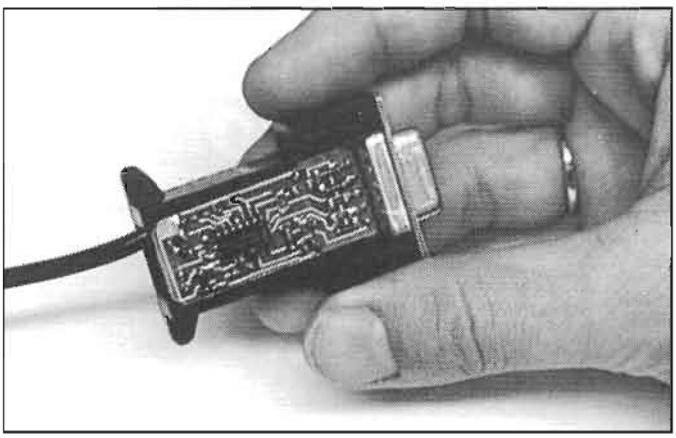

Top right: Mini-Pak Reviewed.

Bottom right: Anchor Surplus help Novices.

CQ de G8IYA

New gear, old gear, or build-it-yourself gear?

Many amateurs bemoan the fact that the 'art' of home construction in amateur radio is dying. Even so, most amateurs, in the UK at least, now use ready-made equipment which more often than not originates from the Far East.

In the 'dawn' of amateur radio, and I'm talking about the late 1800s, you had little choice but to make your own gear. I recently enjoyed reading a few articles published on wireless telegraphy, during this evolutionary period, in the magazine *Model Engineer.* I'm sure that, through magazines disseminating information on the practicalities of radio, that our hobby has progressed. But today few people build their own gear.

The reasons for this are often financial. *What!* you say, surely homebrewing gear *saves* you money? In a few cases maybe, such as for those with well-stocked 'junk boxes'. But for most amateurs, adding up the price of components, chassis, plugs, sockets, knobs and so on for a 100W HF multimode transceiver, often provokes an instant look instead at the prices of ready-made gear. Because it's cheaper.

So for the homebrewer, this leaves homebrew QRP gear, the use of which being a challenge in itself. Take a look in the last few issues of HRT, and you'll see we've been featuring such gear. We've concentrated on easy-to-make, battery-operated equipment which often doesn't justify expensive cabinets, the type where you can indeed use components which are cheap and readily available. Unlike valves and their associated power supplies, which used to be cheap and readily available but aren't any more.

After the Second World War, ex-military gear was plentiful, and the hobby gained a tremendous boost through the disposal of surplus warfare gear at bargain prices. 'Not any more?' you ask? Wrong! The Editorial team were pleased to recently pay the ex-MoD gear suppliers of Anchor Surplus a visit, and you should have seen the piles of ex-MoD VHF and UHF gear! Their Electronics Manager Rob G4ROB was extremely generous in the gift of gear and books to help newcomers (see this month's 'Radio Today'), which delighted our local Novice trainees. Chris G4HCL was similarly chuffed with the surplus SAS clothing he bought there, which even raised a comment from an army Major a few weeks later, but that's another story!

But go to a rally nowadays and most likely you won't see vast quantities of 'surplus' components at giveaway prices. What surplus gear *do* you see? That's right, in between the shiny new black boxes and the not-so-shiny secondhand black boxes, you see ex-PMR rigs and lately also surplus computer gear. Now remind yourself which amateur radio magazine publishes all the ex-PMR conversions. Couple one of these converted rigs to that cheap computer on the next rally stand (my last surplus but modern IBM PC clone with integral 3.5in disk drive cost me less than £100), plug in a packet modem (see this issue for a review of a very low cost system), and you have simple and cheap worldwide error-free communication through nodes, satellite gateways, an orbiting space station.....

Oh, this isn't '*real* amateur radio' is it? No, *real* amateur radio is struggling against the QRM using a piece of wet string on HF of course. Try telling *that* to potential newcomers and watch them perform a vanishing trick. Try telling that also to the governments who give us our frequencies in the hope of getting something in return, like new technologies, just as in the 'good old days'. Oh Henry, pass me that double-pentode over there, I'd like to try a new circuit idea. You don't hear *that* anymore (pity). But you *do* hear of advancements in some new technologies. Oh, sorry, that isn't *real* amateur radio, is it?

On a final note, you may be asking *how does* a person such as I have access to all those early magazine copies of wireless articles in Model Engineer? Well this is yet another of the magazines still going strong and currently published by Argus Specialist Publications, the nice people who also bring you HRT. At the London Show on the 7th and 8th of March, I'll have a pile of a few hundreds of photocopies of some vintage wireless telegraphy articles which appeared in early issues, including issue No. 1, of the Model Engineer. I'm sure these will be collector's items in years to come. Would you like one of these photocopied collections? Well providing they haven't run out (first come, first served) just bring along this copy of HRT, or alternatively make any purchase at the HRT stand, and you'll have some interesting additional reading on the bygone days of amateur radio to take home with you.

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LETTERS

Letter of the month

Dear HRT,
The correspondence regarding the Morse condition of the A class licence continues interminably, however while it continues, there is one factor of this issue which is rarely mentioned and should be more openly discussed.

It is widely reported in the radio press that bad language, deliberately offensive behaviour, and jamming occur regularly on the 2m band. While operators on the HF bands do sometimes become somewhat over enthusiastic in their pursuit of some DX station, and allow their operating standards to fall, there appears to be very little deliberate unsocial behaviour on these bands. In three years as an amateur spending on average some 20 hours a week on the air, I have heard only one such instance and that was not from a 'G' operator.

This hobby depends on the mutual goodwill of all concerned for its enjoyment. Once it ceases to be enjoyable there is little point in pursuing the interest, and the majority will seek other leisure time activities. This has happened to 27MHz CB where, by and large, the bands have been left to the spoilers alone. Is anyone seriously suggesting, that it would be in the overall interest of amateur radio, to allow the spoilers onto the HF bands? It would seem essential that if amateur radio is to avoid the fate of CB, there must be some screening process to separate the genuine operator, from the individual who merely wishes to use radio as a means of expressing his frustration and anger. The present system obviously works well. Having returned to radio after a 30 year absence I would say that, if allowance is made for the greater number on the bands, operating standards on HF are as good as they were in the period from 1948 to 1958 when I was a keen SWL, despite what many 'old timers' say!

No doubt 95% of class B operators could, and perhaps should, be allowed access to the HF bands, yet some method has to be found to screen out the 5% who, in time, would destroy amateur radio as we know it today. Perhaps the ball is in the court of those agitating for the removal of the Morse condition to suggest an alternative screening system. Merely to raise the technical standards of the RAE would be unsatisfactory as this would deter many, like myself, with no technical background, attempting the exam in middle age for who the present system is difficult enough anyway.
Yours sincerely,
Mike, G0KDZ

Editorial comment;
Regarding 'screening people out', yes, the present system *is* working well in dissuading the vast majority of Novices, who are all trained in correct on-air operating techniques, from achieving a Class A Novice licence. So where do we get tomorrow's amateurs from?

Dear HRT,
Whenever one buys a TV set from a dealer, most probably the set will be installed and TV aerial erected, and the dealer will ensure satisfactory reception before forwarding an invoice to the customer. However, if a newcomer to short wave buys an expensive radio, the situation can be a nightmare!

I purchased an Icom R71E from a company, as soon as my money was in their hands, they didn't want to know me! They left me with the receiver and 30 metres of wire plus two insulators. What on earth was a beginner to short wave supposed to do with them? On phoning the company for advice, they replied that it was "so easy sir".

I struggled to fix up the wire, but eventually managed to find another licence holder (TV aerial erector) who fixed up the wire, but by all accounts, has erected it wrongly! The result being that I am swamped with interference from TV sets, switches, etc..etc... After making appeals for help to various radio organisations, I've decided to call it a day and try and sell up!

The hobby of short wave radio would be far more popular if dealers provided an installation and help service for beginners like myself!
Yours sincerely,
Robert Cooper

Editorial comment;
I've sent Robert, with our compliments, a small introductory book on getting started on short wave including simple aerial details and the need for good siting away from sources of interference. Maybe the radio dealer should have recommended such a book?

Dear HRT,
I reply regarding the letter from W. D. Heath (Jan 92 edition). It was most interesting to note that the reason for the writer initially learning Morse code was entirely pecuniary, but at least we were spared having to read how much he enjoys the mode, to the exclusion of phone, packet, satellite, TV, RTTY, AMTOR etc.

I wholly agree with the opinion reported that Morse code should stand on it's own merits. The correspondent in August referred to may have been a 'tender 16 year old', but he has gained his licence using current theory, methods, and technology.

In his letter, Mr. Heath continually refers to the historical aspects of Morse code. History is more than just dealing with the past. My dictionary also describes history as 'the growth and development of a system of ideas'. It is to the future that we must look, and I am not alone in seeing very little opportunity for Morse code to play in the advancement of further communications experimentation. Even Samuel Morse would admit that the system he devised would eventually be superseded. He was after all a man of and with vision.

'Don't ridicule old timers' says our Mr. Heath 'and don't knock the RSGB'. As for old timers, we all know what happened to the dinosaur who wouldn't or couldn't adapt to a changing environment. As for the leviathan . . . it needs new blood and people with new ideas on Council.

Project YEAR, the 'B' licence and the granting of artificial aerial permits were all seen in their time as the knells of doom but are all in the past and have shown to be of very definite value to the *hobby*. We are not searching for

the Holy Grail. We are actually meant to be enjoying ourselves!

As for the future of Morse code, I very much hope that it will still be around in a couple of hundred years time — for those that want it. It should no longer be relied upon as the base for a full, all-frequencies licence. Since when did passing a Morse test provide a better operator?

For the future, well perhaps leave things much as they are. In the case of the Novice licence all is fine — without a Morse test. For class 'B' full licence holders, a year on the current allocation followed by another year all bands low power before gaining the equivalent 'A' facility should suffice. As to the Morse test, so much poorly sent Morse is to be heard that those who wish to use the mode should take an annual test to maintain and improve upon the standard. For the older amateur on air since before everyone else was born, perhaps a re-sit of the RAE would be in order!!

Yours sincerely,
Mike Shread, GM6TAN
Novice Instructor, RSGB Novice QSL Sub-Manager.

Editorial comment;
Here speaks the voice of someone who's shown he's going out and *doing* something about helping newcomers to amateur radio, rather than just *saying* things. As stated in the Nov 1991 'CQ de G8IYA', there are 'sayers' and 'doers', it'll be interesting to see who wins the HRT 'Amateur of the Year' award!

Dear HRT,
In reply to your editorial comment after G7IOU's letter in the December issue of HRT. Some amateurs may consider it an advantage to learn the Morse code, many others however do not see any advantage whatsoever in *having* to learn it as they are at present required to do so.

However on a personal level, I consider that to learn *any* and all operating modes, be it CW, RTTY, Packet, Phone, etc., it is *only* an advantage to every amateur, and potential amateur, if and when the amateur has the *freedom* to choose.

Where Morse is concerned, at this present moment in time, the one and only advantage in learning it is to acquire one's A class licence. Where an amateur has the freedom to choose for one's self, whether to learn and use Morse, should a simpler time- based entry onto the HF bands be forthcoming, then the advantage of learning Morse is quite self evident. Likewise it is to the amateur's advantage to be able to use all of each and every band to the full, should he or she *choose* to do so.

In a hobby, such as amateur radio, it is both an advantage to a new licensee, older licence holders, and amateur radio in general, for users to be able to do both the theory of Morse and the practical, at one and the same time, as hands-on experience is of far greater advantage than just theory alone. I have seen over the past few years, that where people can and do try to practice both sending and receiving Morse on air, their interest continues long after they've passed the test and far more people retain their interest now than ever before due mainly to being able to send as well as receive on air.

I believe that the Morse test has had it's day, and that it is in the best interests of the UK amateur radio scene, for the Morse test to be *scrapped* and replaced with a time-based step-by- step progress, from Novice to class B, then class A, and it should be replaced sooner rather than later. Morse code *will* survive as it has done for decades, but in the future it should take its rightful and honourable place alongside of the newer and latest operating modes.

Yours sincerely,
J. D. Bolton, G4XPP

Editorial comment;
Variations on a time-based principle are used in other countries, would any readers care to offer their thoughts on this?

Dear HRT,
After reading Mr. Venable's 'letter of the month' in the December 1991 HRT, I had to get my handkerchief out and wipe my eyes.

Take a look at J. H. Clifton G7IOU's letter in the same issue, he is 71 years of age and is working hard to pass the Morse test. When I passed the City and Guilds examination I didn't even apply for a B licence, I wanted an A licence and was dedicated enough to work for it, after all that was the rules, I didn't cry about it. Anyone who has a computerised Morse decoder/encoder should be ashamed to admit in an amateur radio magazine that he owns one. I wouldn't like to be playing any shots or board games with some of these people, they would want to change the rules to suit themselves.

Come on lads, dry your eyes and stick to the rules. I can guarantee when you pass the Morse test you will be proud of yourself, proud that you have passed all the necessary examinations, and didn't get it handed to you on a plate.

Yours sincerely,
Mark McIntyre, GI3YDH

Editorial comment;
It looks like the consensus of opinion through these pages has been that there should be *some* distinction in qualifications required between Class A and Class B, and discussions by those who have 'seen the writing on the wall' now centre about *what* should be the 'show of competence', rather than *whether* to scrap it with nothing to replace it. Future published letters on this subject will be limited to constructive discussions one way or the other.

Icom ICP-2ET Review

A handheld with 'Artificial intelligence? Chris Lorek G4HCL gets his thinking cap on and tries Icom's 'intelligence testing' transceiver

Icom describe their ICP-2ET 2m FM handheld, and the matching ICP-4ET 70cm handheld, as having built-in 'artificial intelligence'. With the operating functions of today's handportables becoming more and more sophisticated, this set claims to match itself to your operating needs through a 'trial mode' routine, where it invites you to give a 'Yes/No' response to a set of questions. It then awards itself (you?) a 'star grading' of one star through to five stars in terms of the operating complexity it allows. Could this be a way of 'one-upmanship' down at the radio club? Joking aside, I was very pleased to be able to try this new handheld to see how the functionality actually worked. The set provided for the HRT review was the 2m version, the 70cm set having the same facilities apart from its frequency coverage.

Physical Features

The transceiver is housed in a light-grey case with moulded corners, rubberised top panel knobs being used for on/off/volume, squelch, and channel selection. In common with many of today's handhelds the ICP2ET is a tiny size, fitting neatly into your pocket for carrying around. The nicad battery pack is a 'cartridge' type which plugs into the bottom of the set, the smallest battery (the 400mAh 7.2V BP-111) fitting within the transceiver body. This was the battery supplied with the review set and featuring in the accompanying photographs, larger capacity packs simply increase the overall length of the set. With the BP-111, the set measures 49mm (W) x 105mm (H) x 38.5mm (D), weighing 280g. An optional 12V nicad may be used to increase the transmitter power, the BP-114 12V 400mAh battery extending the set's overall length to 144mm. The set comes with a plug-in wall charger with the correct moulded three-pin plug for UK use, a carrying strap, belt clip, and an 84 page instruction book with circuit and block diagrams, together with a pocket-sized operating guide which you can carry with the set as a 'memory jogger'.

Operating Modes

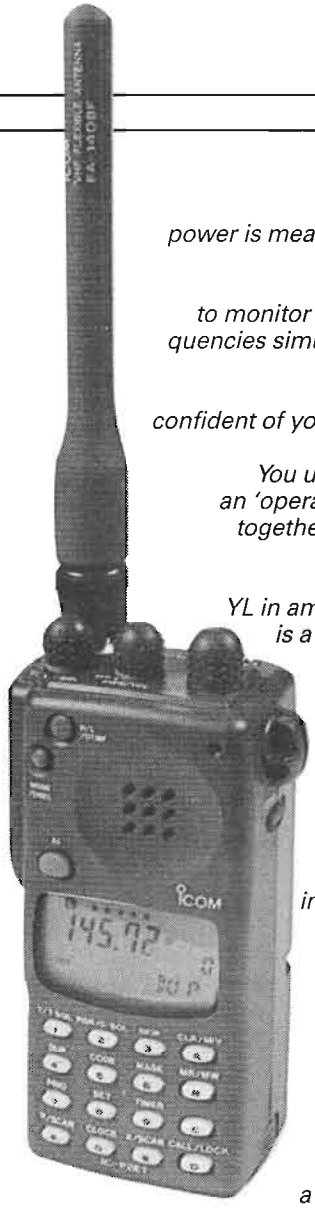
The set has a large number of operating modes, such as direct frequency entry via the keypad as well as click-step rotary channel selection. Up to 100 memory channels may be programmed as well as normal 'VFO' operation, with scan and search modes including memory scan and individual frequency lockout, and optional selective calling systems such DTMF and CTCSS using add-on boards fitted within the set.

However many amateurs don't need nor want sophisticated scanning systems, power-down modes or selective calling, whereas others (such as myself) revel in such things. In my past reviews of sophisticated sets, I've often accidentally pressed the wrong buttons whilst on the move with the result of having to desperately try to get the set back to 'normal' operation, this being particularly annoying when I'm in mid-QSO! With this in mind, the ICP-2ET allows you to either manually set the level of operating flexibility. Alternatively you can let it 'think for itself' to set its functionality according to your answers of the 'trial mode' routine.

Testing You

The 'trial mode' is a purely optional routine which you may select, so there's no question of the set becoming a type of 'big brother'! This mode is initiated if you simultaneously press the 'AI' and 'Light' buttons while switching the set on, the LCD changing to show a question number Q01-Q15 together with a 'Yes/No' display for your answer. Here you must refer to the short 'Star Selection Guide' leaflet provided with the set for the text of the questions, which are;

Q01 *Frequency is measured in Hz*
Q02 *You usually use a transceiver to contact with your friends only,*
Q03 *You often use a repeater*
Q04 *You usually use less than 10 memory channels*
Q05 *You like to be punctual*
Q06 *You have read p.2 of the instruction manual for this transceiver*



Q07
Transmit power is measured in uV
Q08
You want to monitor several frequencies simultaneously
Q09
You are not confident of your memory
Q10
You usually keep an 'operating guide' together with your transceiver
Q11
YL in amateur radio is a young lady
Q12
Your operating frequency is usually fixed
Q13
You often participate in scheduled QSOs
Q14
This is your first experience using a multi-function transceiver
Q15
You have a small-head Phillips screwdriver which can open the rear panel of this transceiver.

You can probably guess which questions, such as the 'operating guide' question Q10, really open up the set's features. Other questions, apart from questionably testing your intelligence, simply find out what you're likely to use the set for. Your operating needs are then matched by the operating features provided on the set, such as memory channel control, 'Call channel' activation using front-panel buttons, selective DTMF call facilities and so on.

Options

If you wish to use CTCSS in line with the UK plan for 2m repeater operation, you can fit an optional UT-51 tone encoder inside the set, alternatively for full CTCSS encode/decode a UT-50 tone squelch unit may be used, the latter providing a 'pocket bleep' function as detailed in previous HRT reviews. For DTMF selective calling, a UT-49 DTMF decoder unit may be added, this allowing the set to be 'woken up' by a suitable DTMF tone sequence for group use and the like. External options include a variety of battery packs and chargers, two versions of plug-in speaker microphones, a VOX headset, and a mobile mounting fitting.

In Use

Looking through the 84 page user instruction manual certainly showed me the set was capable of a wide variety of operating modes, and I must confess it took me some time to read through this to master the operation of the set. As usual I began by programming the memory channels with the usual R0-R7 and S8-S23 FM channels together with other frequencies used in my area, for subsequent use with the rotary channel knob.

Although I don't have large hands, I found the set was slightly too short to hold comfortably, however fitting a longer battery pack would no doubt improve this. The position of the small PTT switch I also found awkward to use. Eventually I became used to this, although I still found it difficult to use when out and about, a larger PTT 'bar' I feel would have been far better. A useful feature of the set was the easily-used 'AI' button, which I could set to initiate a commonly-used feature such as scan mode or whatever, this I found very handy. At night, the backlight facility was very good, as well as this illuminating the LCD panel it also mildly illuminated the translucent push- buttons which I welcomed, some handheld sets not having this advantage.

I rarely make use of a 'band scan' or 'programmed limit scan', where the set searches between two frequencies in the programmed step sizes, halting when a signal is found. This is simply because I often find either an 'annoying' channel with a carrier generated from a local computer when at home, or alternatively a constant beacon or repeater signal when out and about, stopping the search mode operating on signals I want to hear. However one feature I found very useful on the ICP-2ET was a 'frequency skip' mode, where I could start the set scanning, then if any number of unwanted signal are found these I could manually 'lock out', the set ignoring these on the subsequent passes. Programming this on the 'AI' function key then gave me an easy-to-use system, very akin to some of the top-range scanners on the market, very nice!

The set gave a reasonable performance on receive when handheld, although I often found that when I placed it on a desk the lack of ground plane previously given by my hand caused weak but fully readable signals to disappear below the squelch threshold. This was probably due to the 'High-Q' of the helical aerial, i.e., offering good performance but only when correctly matched. On transmit I was surprised to find that my signal into distant repeaters was a lot stronger than I would have expected, this no doubt being due to the efficient helical, and I was able to sustain communication in areas where I really thought I would have been dropping out.

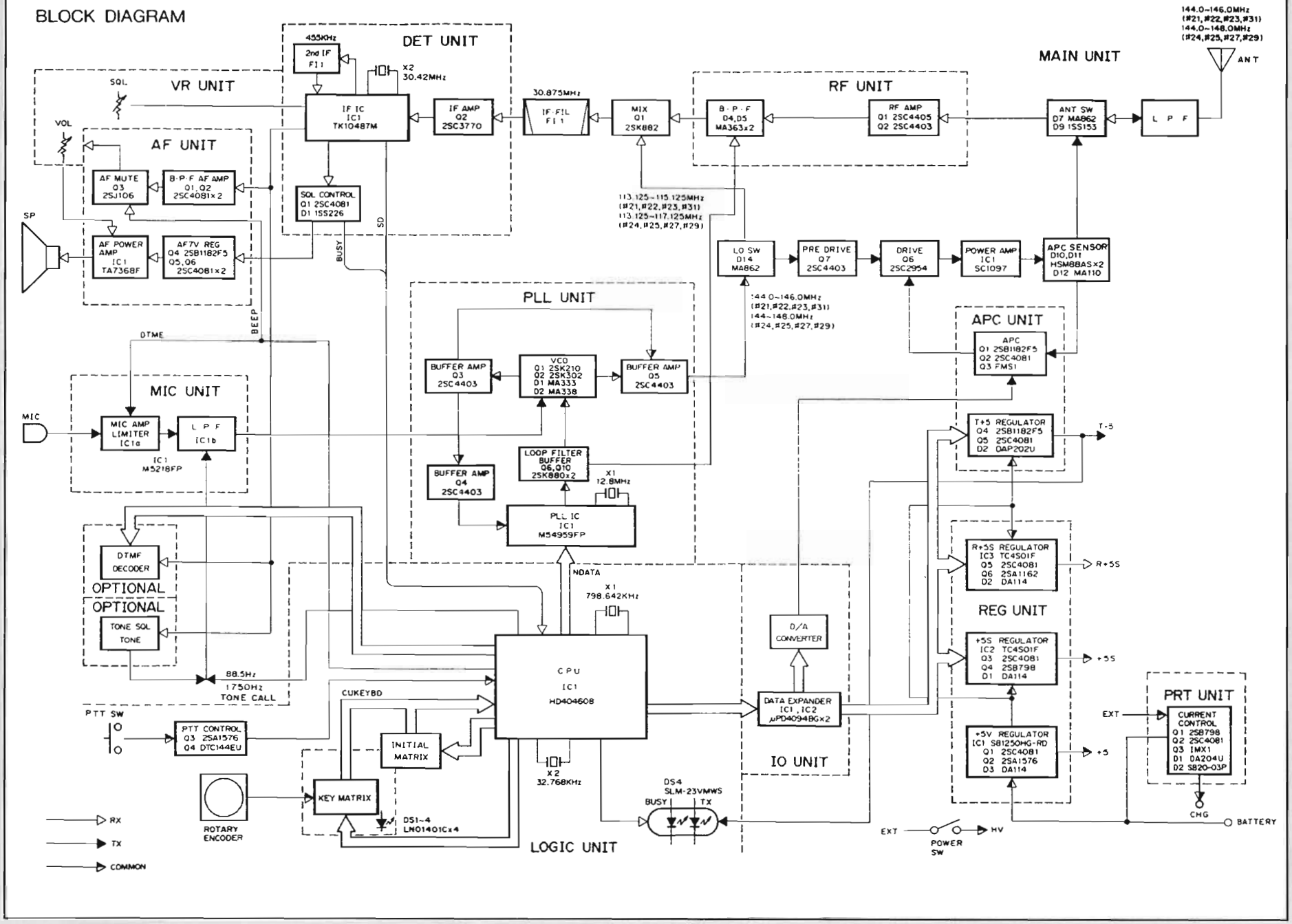
My transmitted audio was reported as being quite good with little background noise — important when out and about, and I found the set's receive audio was surprisingly loud from the tiny front panel speaker. The main problem I encountered was a rather limited battery life using the small nicad supplied in the review set, this lasting just a few hours. If I owned the set I would certainly fit a larger battery.

Insides

The accompanying block diagram shows the receiver uses a high 30.875MHz first IF for good image rejection, the wide front end circuitry no doubt allowing for the USA version's extended receive coverage of 138-174MHz. The usual receiver IF subsystem IC together with a 455kHz second IF is used, and the transmitter employs a modulated final-frequency VCO with the usual 'block' PA module for final amplification.

Opening the set up shows a very compact internal arrangement, with a plastic front panel complemented by a metal rear which is used for transmitter heat sinking. A full circuit diagram is supplied with the set if you either feel confident in attempting a repair when needed, or simply for interest's sake in knowing more about the set's innards.

BLOCK DIAGRAM



Laboratory Tests

The receiver results showed a reasonable performance, and although the maximum audio output was fairly low the efficient built-in speaker made good use of this in providing a reasonably loud output. The measured battery current drain confirmed the set would give only a few hours of operation from the smallest battery pack, so for all-day operation either a larger pack, or a spare pack, would be needed.

On transmit the set gave an impressive power level, with reasonable suppression of harmonics. The transmit deviation was on the high side of the 5kHz maximum level for 25kHz channel spacing although this shouldn't cause too many problems in practice. The frequency accuracy remained very good even when the set was getting noticeably warm on transmit, this always staying within +/-100Hz.

Conclusions

It's pleasing to see Icom have found that a sophisticated, do-everything, handheld, may not be to everyone's taste. By their use of limiting some of the set's features when needed, the ICP-2ET could lend itself to match with the needs of a diverse range of users, the overall functionality being changed at will if and when required. Even so, at the end of the review period I was still finding uses for new modes of operation. In the beginning I feel I would have preferred to have just 'locked' the keypad once I'd programmed the memory channels, and left the set operating just under the channel knob control. Maybe I scored too many 'stars' in the artificial intelligence test!

My thanks go to Icom (UK) for the loan of the review transceiver.

LABORATORY RESULTS:

All measurements taken at 145MHz using fully charged nicad unless otherwise stated.

RECEIVER;

Sensitivity;

Input level required to give 12dB SINAD;

144MHz;	0.150uV pd
145MHz;	0.140uV pd
146MHz;	0.135uV pd

Squelch Sensitivity;

Threshold;	0.10uV pd (6dB SINAD)
Maximum;	0.22uV pd (21dB 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;	31.5dB
-12.5kHz;	36.0dB
+25kHz;	73.5dB
-25kHz;	73.5dB

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;	84.5dB
+1MHz;	87.5dB
+10MHz;	96.5dB

Intermodulation Rejection;

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

25/50kHz spacing;	63.5dB
50/100kHz spacing;	64.0dB

Maximum Audio Output;

Measured at 1kHz on the onset of clipping;

3 ohm load;	159mW RMS
8 ohm load;	192mW RMS
15 ohm load;	165mW 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;

73.5dB

Current Consumption;

Measured with battery economiser disabled

Standby, economiser on;	19.5mA average
Standby, sq. closed;	53mA
Receive, Mid Volume;	106mA
Receive, Max Volume;	161mA

TRANSMITTER

TX Power and Current Consumption;

Low power set to lowest of three preset levels

Freq.	*Power*	*7.2V Supply*	*12.0V Supply*
144MHz	High	2.12W/870mA	5.76W/1.31A
	Low	430mW/390mA	430mW/390mA
145MHz	High	2.12W/890mA	5.76W/1.36A
	Low	430mW/390mA	430mW/390mA
146MHz	High	2.14W/880mA	5.76W/1.38A
	Low	425mW/395mA	430mW/400mA

Harmonics;

2nd Harmonic;	-75dBc
3rd Harmonic;	-72dBc
4th Harmonic;	-81dBc
5th Harmonic;	-88dBc
6th Harmonic;	-85dBc
7th Harmonic;	-81dBc

Peak Deviation;

5.74kHz

Toneburst Deviation;

3.56kHz

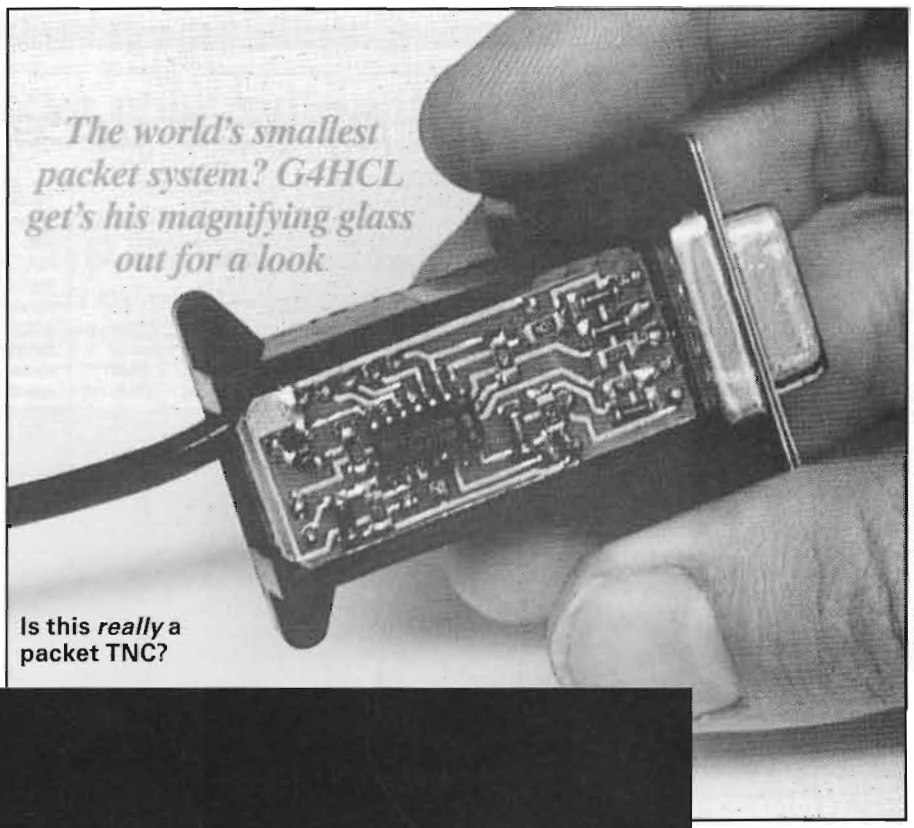
Frequency Accuracy;

+92Hz

Mini-Pak Reviewed

Take a look at the circuitry built into the 9-way D-type connector in the accompanying photograph. Operating as a modem, this simply plugs into your IBM PC clone, the lead plugs into your VHF or UHF transceiver, and you have a complete packet system without a TNC! Nicknamed the 'Mini-Pak' by the UK manufacturers Siskin Electronics, this is a result of their recent agreement with the German 'Baycom' development team of Florian DL8MBT and Johannes DG3RBU. You may have seen Baycom mentioned previously in HRT's 'Packet Radio Roundup' column, this software having been distributed as 'shareware' with a contribution requested from the originators for the use of the program. The associated modem was often a 'build-it-yourself' job, although some dealers have been known to sell completed modems.

This software 'shareware' plus modem arrangement has now been pro-



Is this *really* a packet TNC?

```
 CONNECT CFORD
cluster
list/n
sh/cluster
sh/dx
#
 QRV  G4HCL> Info Transfer        mem=037 In=208 n2=10 o=0 fr= 58 k=0 14:18 3 I
*** No new messages found ***
G4HCL de GB7SMC   31-Dec 1416Z >
 15 nodes, 12 local / 78 total users  Max users 113  Uptime 11 11:47
G4HCL de GB7SMC   31-Dec 1416Z >
 24960.0  ZB2AZ        31-Dec-1991 1413Z                          <GW4BLE>
 24890.0  3B8CF        31-Dec-1991 1348Z                           <DF3CB>
 24947.7  C6A/G4AML    31-Dec-1991 1411Z                          <GW4BLE>
 28470.0  T77T         31-Dec-1991 1407Z                          <PA3DZM>
 14005.8  RI9BQ        31-Dec-1991 1406Z                           <ON6IJ>
G4HCL de GB7SMC   31-Dec 1416Z >
Logging out local user: G4YRV

1:------ 2:------ 3:CFORD 4:------ 5:------ 6:------ 7:------
PC17^G4YRV^GB7SMC^H99^
R 14:18 CFORD>G4HCL>I04,P,F0:
Logging out local user: G4YRV
R 14:18 GB7SMC>G4YRV>DISC,P
I 14:18 G4HCL>CFORD>RR1,F
```

The multi-window system of commands at the top, connected packets in the middle, and monitored packets at the bottom

gressed in the UK to a commercially available 'plug-in' package.

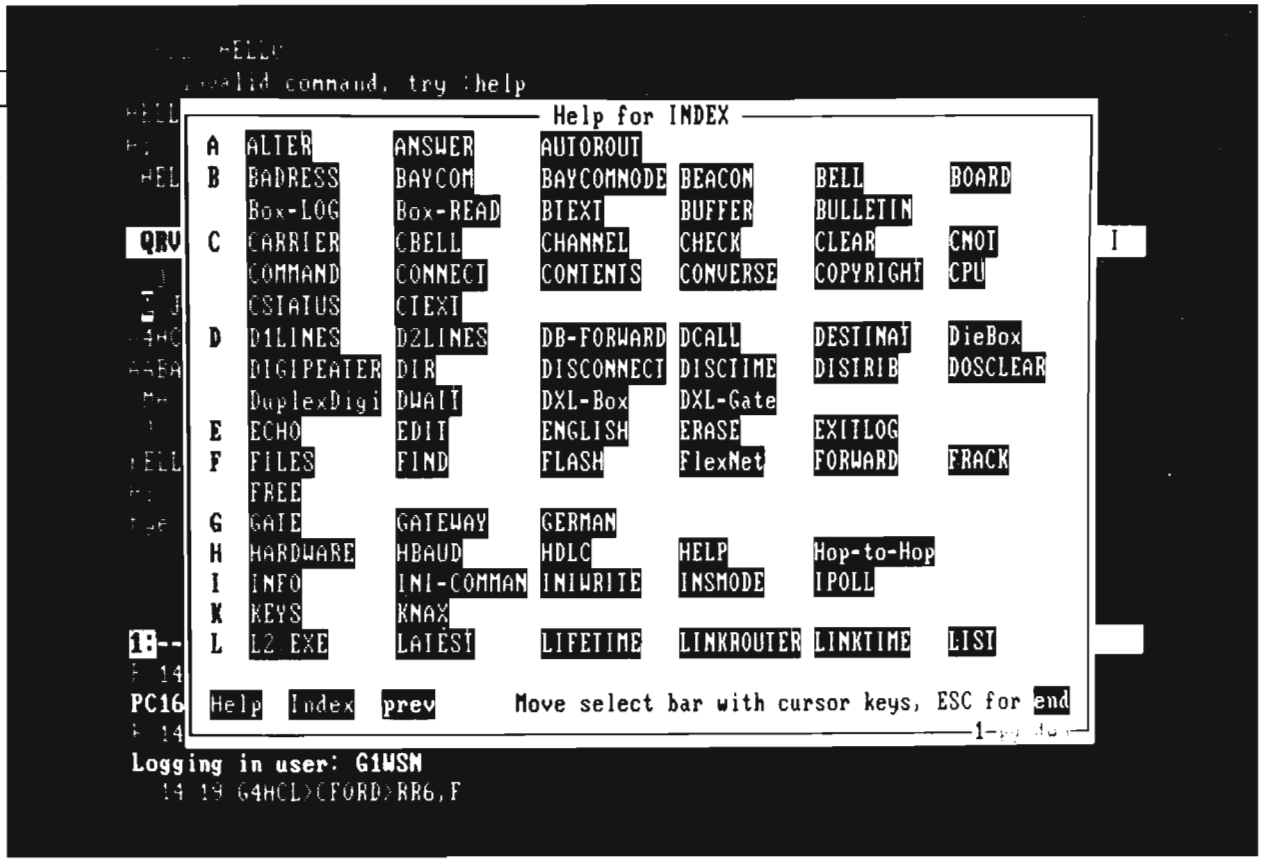
Hardware

The Mini-Pak hardware consists of just a couple of tiny printed circuit boards, wired together and fitted within the shell of a DB9 socket. The power for the unit comes directly from the computer's RS-232 connector, and the first board in the unit handles the supply requirements and necessary RS-232 interfacing with an arrangement of surface mounted 'chip' components. The second board contains a standard discrete TCM-3105 IC modem, as used in many 'normal' TNCs such as the Tiny-2, together with a PCB-mounted 4.433MHz crystal and several associated 'chip' resistors and capacitors. A sub-miniature potentiometer competes the component line-up, this providing an audio output level control to the transmitter. The adjustment slot for this control is accessible from the rear of the connector.

Software

The heart of the system is the software, for as well as acting as a 'user interface' in a similar manner to a terminal program, a TSR (**T**erminate and **S**tay **R**esident) program is used which allows the computing power of the PC to be used to emulate a packet radio terminal node controller. The system requires an IBM PC or clone to run, and a collection of programs are supplied on an MS-DOS disk, either 5.25in or 3.5in to suit your PC drive. The programs amount to around 300k in total, of which almost half is taken up by the *TERMHELP.SCC* program. This, as its names suggests, comprises of 'help' routines for the terminal, giving a first hint as to the user-friendliness of the program.

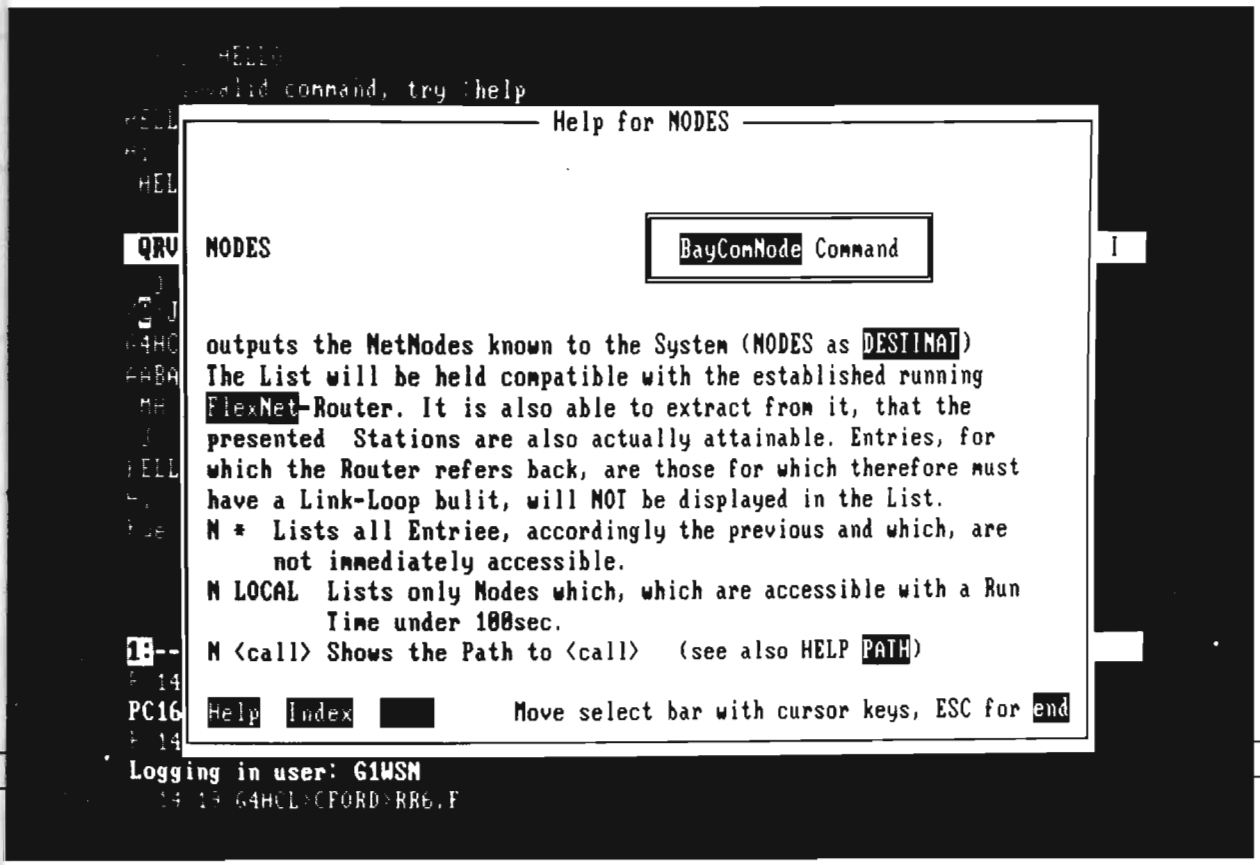
A further program is *L2*, the TSR routine. This takes around 90k of RAM when loaded, So if your PC has 640k RAM then you're left with around 550k for other uses, and with this loaded, a small cursor flashes in the top right of your screen to remind you of its presence. When you wish to actively *use* packet, you load the *SCC* program, there's more of this later. Other files include an *OFF* routine to remove the L2 TSR program from the computer memory if needed, a 'logbook' file where your connections and disconnections may, if you wish, be logged, and an initialisation file where your required parameters such as terminal screen colours, window sizes and the like, together with your required callsigns, are stored. These parameters need to be modified to your needs with a simple text editor, on the review version a suitable text editor was also supplied on the program disk.

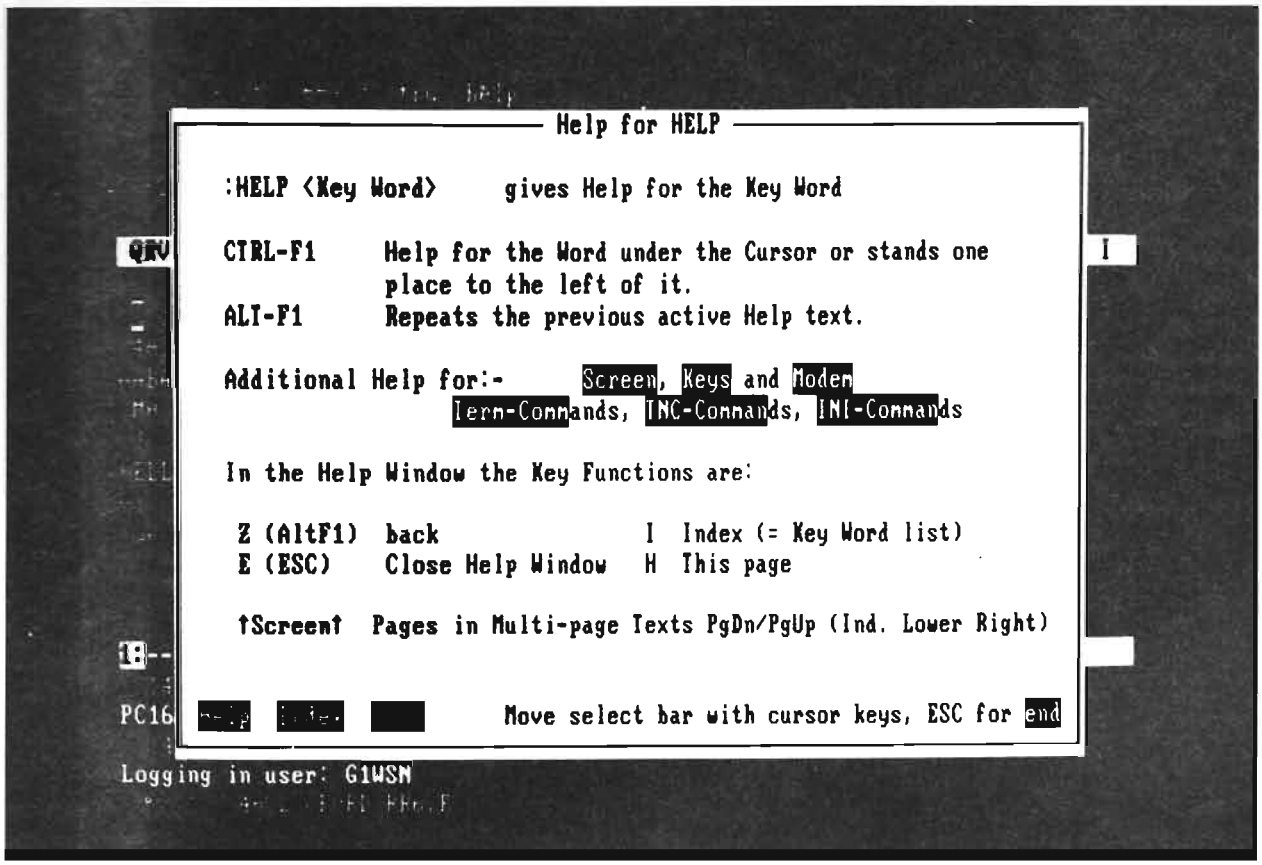


'Help' screens give you guidance when you're stuck.

In Use

To get on the air, all you need to do is just modify the callsign(s) in the 'initialisation' file, alter the COM port number if you want to change this from the COM1 serial port at the back of your computer then off you go. You can of course 'fine tune' the system as well, with changes to parameters such as TXDelay and the like, plus of course the audio output level from the modem to your rig, but there's none of the usual (and often tedious) needs such as matching your terminal program to the speed, parity, number of stop bits and the like to match the TNC, nor any RS-232 leads to be made up or bought, nor any TNC-to-rig leads.





additional cost of leads if bought, is above £150 plus the cost if any of the necessary terminal program for your PC, the Baycom system represents a very attractive solution. I'm seriously considering using it as my main packet setup.

My thanks go to Siskin Electronics, who are the UK Baycom distributors, for the loan of the review system.

If fact, after modifying the callsign (I found the review sample actually came with my callsign already stored) all I needed to do was to type 'GO'. Through the use of a batch file, my computer literally did the rest, and within seconds of simply plugging the ready-made system in, I'd successfully connected into my local DX PacketCluster. I was very, very, impressed with the total simplicity.

But together with this simple-to-use aspect, a factor of *any* system is the versatility it can give, matching the demands of the individual user whether they be experts or beginners. A common problem for many newcomers to packet is the complexity and even the terminology of SSIDs, multiple stream connections and the like, as well as the basic usage of packet. With Baycom, if you're in the middle of trying a connection and you need a 'memory jogger' on how to use a digipeater, download a file from your BBS or whatever, a very comprehensive on-screen 'help' system literally pops up on your command. In use, yet again I was very impressed.

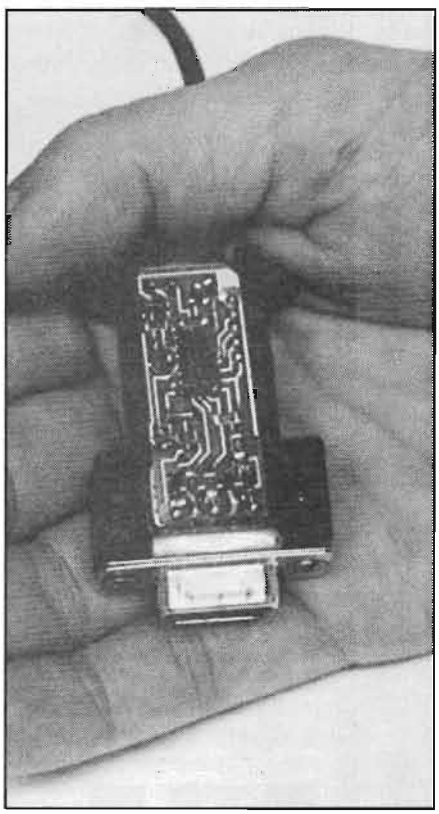
Some packet programs offer 'multiple window' screens, where one section shows your outgoing text, another shows your received text, and so on. The Baycom system goes one further, where an extra 'monitor' window shows what's happening packet-wise on the frequency, whether you're 'connected' or not. You can have up to seven connection 'streams' in addition to the monitor stream, each having their own screen display. The PC's F1-F7 function keys switch between streams to make life even simpler. This means simply that connecting simultaneously to your local node, DX PacketCluster, and BBS is extremely easy. As well as this, Baycom even senses multiple connections and alters your SSID to -1, -2, or whatever is needed — very nice! Other information shows which station you're currently linked to, transmit/receive state, how may outstanding packets are waiting to be acknowledged, and so on.

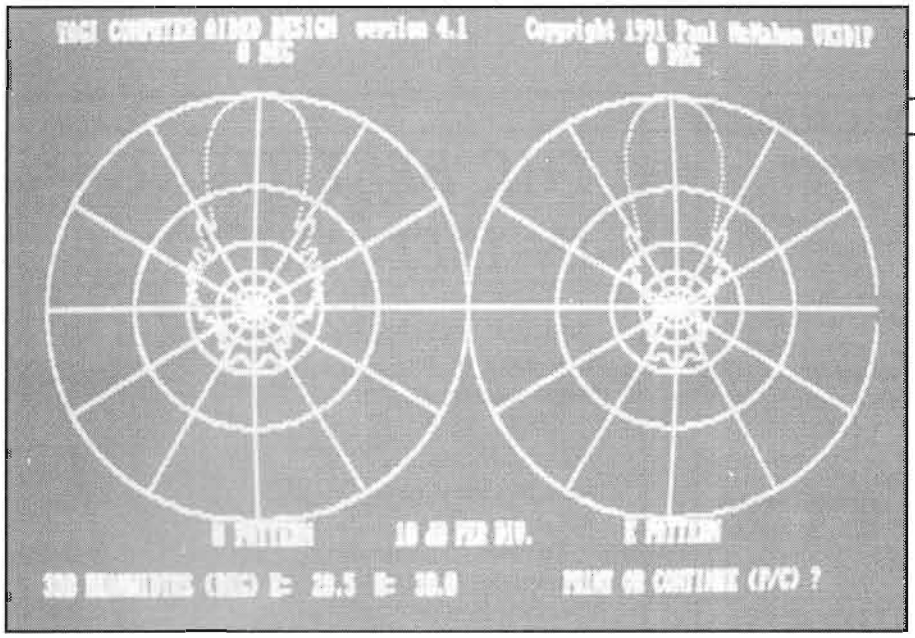
I could go on, but suffice to say I found this one of the most easy-to-use, as well as being one of the most versatile, packet systems I have come across to date. And being a packet reviewer I've tried a lot!

Conclusions

As you may have read, I was very impressed with the system. Although the software version I tested was a preliminary version, I'm told that a 'personal mailbox' will be added to future software versions, together with a CWID for UK use, giving an even more comprehensive all-round system.

The selling price will be below the £100 mark, £79.95 being the suggested price at the time of writing. Considering that the cheapest TNC setup, with the





Yagi Optimiser pattern

Aerial Design by PC

Don Field G3XTT looks at software to help with your next aerial project

Since the arrival of microprocessor-controlled radios, with DSP and heaven knows what else, the average home enthusiast simply cannot design and build his own kit to the same standards. You can build simple QRP gear, of course, but the major area of experimentation open to us is in the area of aerial design. Nowadays this is actually even more in the domain of the home constructor than ever before. The reason for this is that much good aerial modelling software is available to run on your PC. No longer are amateurs restricted to 'cut and try' methods, while the professionals are the only ones able to optimise their designs. Now you can design your dream aerial in the comfort of your shack. What's more, it will be a better aerial than anything you can buy. Why? Simply because if you buy, for example, a 3- element 20m beam, it will be designed as a compromise between the phone and CW ends of the band, with another compromise between gain, pattern and front-to-back ratio. Design your own aerial and you can optimise. For example, you may want an aerial with peak performance at the CW end of the band, and maximum front-to-back ratio within the constraints of a particular boom length. No problem! Just fire up the PC and you are away. You can quickly try out a range of designs and, when satisfied, plot the pattern and performance characteristics of the aerial you want to build.

At the 1990 RSGB HF Convention a group of us demonstrated four aerial design packages. Others have since become available, but offer a very similar range of facilities. Before discussing each in turn a few general comments are in order. Most aerial design software is based on *NEC* (Numerical Electromagnetic Code), a mainframe computer program used for several years by universities, government agencies, etc. NEC works by the 'method of moments. Here the aerial is treated as many small segments, and the program calculates the current in each segment before summing them to work out the overall radiation pattern, feed impedance, etc. NEC is very computer-intensive, but researchers at the Naval Ocean Science Centre (NOSC) in California managed to develop a stripped-down version (dubbed *MININEC*) to run on PCs.

MN

One popular derivative of MININEC is *MN*, from K6STI (available in the UK from IFW Technical Services of Drayton, near Abingdon). MN is an improved version of MININEC 3, and is available in two versions, one of which is specifically designed to benefit from a maths coprocessor to speed up calculation time. MN is a very powerful program, allowing you to analyse aerials of all shapes and sizes, it has excellent graphical plotting facilities to let you see how the aerial's current distribution and radiation pattern will look over a range of frequencies. The program comes with an extensive design library to get you started, and full documentation on disc. When I last checked, the price of MN was £61.61, though this will almost certainly have increased since the increase in VAT. Bear in mind, though, that this is essentially a professional program, with professional support available from the UK distributor.

ELNEC

ELNEC, from W7EL, is another MININEC derivative that, like MN, allows you to analyse a range of aerials from Yagis to quads, phased-arrays, shunt-fed towers, random wires, and so on. Again there are two versions, one specifically for use with a maths coprocessor. The program is perhaps not so fully featured as MN but it has a straightforward menu system, making it easier for the occasional user. ELNEC costs $49, plus $3 p&p to the UK.

Yagi Optimiser

YO (Yagi Optimiser), from the same stable as MN, is a hybrid 'Method of Moments' program developed specifically for the design of Yagis. In this role it is much faster than either MN or ELNEC. YO optimises Yagi dimensions for optimum gain, best pattern and minimum SWR, plotting radiation patterns at the central design frequency and band edges during optimisation. After optimisation, high-resolution patterns may be plotted or printed in several formats. YO includes models for gamma, T, hairpin and beta matching networks, element tapering, element mounting plates, and frequency scaling. A library of Yagi designs and extensive documentation is included. The latest version includes optimisation of single Yagis over actual ground, and optimisation of stacked Yagis in free space. You can also export YO files to MN for more detailed analysis.

YOjr is YO with a basic set of features. It will model Yagis in free space with up to ten elements, minimises E-plane backlobes, optimises across a frequency band, does frequency scaling, and uses the W2PV tapering algorithm. It does not model matching networks or mounting plates, use advanced tapering algorithms, and is without many of the other features of YO. However, it is probably more than adequate for occasional design of HF or small VHF Yagis. Pre-VAT increase, YO was £91.18, with YOjr costing £48.46.

ON4UN Yagi Design

Yagi Design by ON4UN is a rather different type of program, and was demonstrated by John himself at the 1989 HF Convention. Yagi Design is an integrated physical and electrical design software program for Yagi aerials, containing a comprehensive database with 100 different Yagi designs, used in different program sections to solve physical design problems of Yagis. In other words, *Yagi Design* takes over where the electrical design programs leave off, and deals with issues of element design (how much sag, how much wind resistance, taper schedules, etc), matching

system (Gamma, Omega, Hairpin), supporting mast (wind load, bending moments), feedline analysis (loss, SWR, etc), take off angles over sloping ground, and so on. The program also comes with three additional modules; *SMITH* — a fully fledged Smith chart program, *DESIGNS* — allows you to build up your own database of designs, and *FILE* — creates input files for YO or MN to allow the electrical characteristics of your chosen design to be fully evaluated. The documentation comes as a *README* file on disc. I don't have a current price for this package, but if I remember rightly it used to be around the $65 mark.

ON4UN also promised a book to go with his excellent software, I'm looking forward to its appearance in due course.

YAGINEC and ACCUPLOT

For sake of completeness, although I haven't had the opportunity to use them myself, I'll mention *YAGINEC* and *ACCUPLOT*.

YAGINEC, from K4VX, appears the cheapest aerial design program of the lot — just $10 registration fee. Yet again this program derives from MININEC and is optimised for the design and evaluation of Yagi aerials. The program will only model aerials in free space or over perfect ground, and calculates dimensions in feet (so you have to convert tenths of feet to inches or the lot to metric). The program includes utilities for gamma and hairpin match calculations as well as element tapering. The output is in graphical format, to screen or printer. YAGINEC can be used with or without a maths coprocessor.

ACCUPLOT works only with a maths coprocessor. It was developed by N6BV, from whom it's available, and appears to have been developed quite independently of MININEC. Again it is aimed at Yagi aerial design, and allows you to scale for different frequencies, calculate element taper and so on. A unique feature is that it allows the modelling of Yagis with dual driven elements, a feature that's appearing nowadays on many commercial multiband aerials. I have no price for ACCUPLOT.

Choices

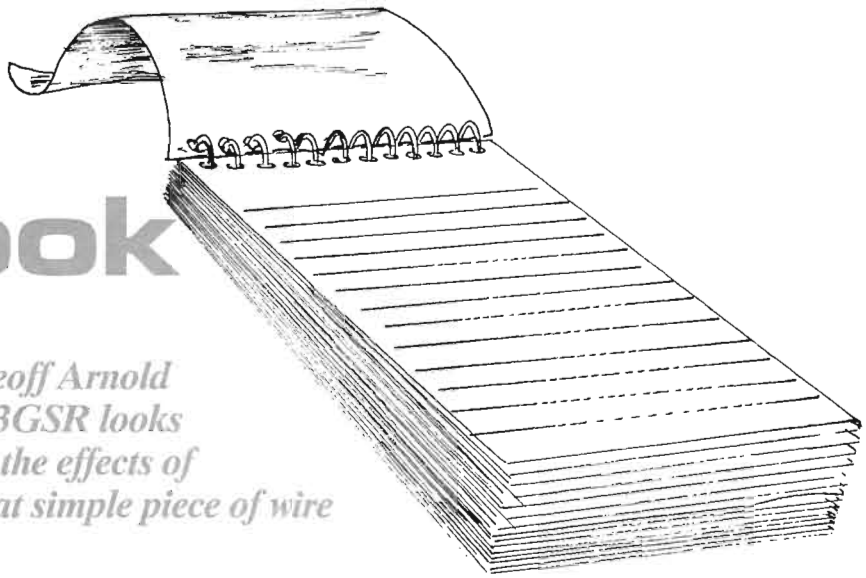
Which to go for? YAGINEC comes cheap and either that or YOjr is a good starting point if you're only interested in occasional design work on Yagi aerials. ACCUPLOT comes next in terms of features and complexity, the algorithms it uses run far more quickly than Method of Moments algorithms, but are limited to free space situations. For serious modelling of Yagi aerials, YO is probably the best bet allowing, as it does, modelling over 'real' ground and the modelling of stacked Yagis, while if you want to model a range of aerials from quads to verticals, bent wires, and so on, then the choice really has to be between ELNEC and MN. By choosing YO and/or MN, you will also be able to take advantage of ON4UN's program for the physical design work.

I can't end this article without reference to the book 'Yagi Antenna Design' by the late Dr. James Lawson, W2PV (published by the ARRL). W2PV did much of the early work on Yagi optimisation that has formed a basis for many current computer programs. Most of the material was published in a seminal series of articles in the US magazine Ham Radio in 1980. I remember reading them with avid interest and rushing to buy the book when it was first published. As background reading before you start your own aerial design work you can do not better *(there's already one gracing the HRT bookshelf — Tech Ed).*

Happy designing!

Tech Ed's note; Some of the above programs are available as shareware, i.e. 'try before you buy', and may be obtained either from amateur sources, or distribution firms such as the Public Domain and Shareware Library (0892 663298) for a nominal copying fee — I've received much useful amateur radio software from the PDSL.

From My Notebook



Geoff Arnold G3GSR looks at the effects of that simple piece of wire

This month, I'm continuing on the theme 'It's only a piece of wire!' which I began in the last issue, but looking this time at the capacitance and inductance associated with a length of wire or other electrical conductor.

Let's look first at capacitance, or capacity as it is sometimes called. Capacitance can only exist between two conductive surfaces. These may be the plates of a capacitor (previously called a condenser), which is of course a component specially designed to provide a controlled amount of capacitance, or they may be two wires, or a wire and the surface of some larger conductive medium.

These last two are really two examples of the same thing, for they merge one into the other. The two wires could be a pair of similar conductors, spaced apart by some form of insulation, and either running parallel side by side or twisted together. Or they could be the centre and outer conductors of a coaxial or screened cable, or of a trough-line, which is in the form of a rectangular coaxial cable with one side left open. Flatten out the sides of the trough and you have a conductor over a metal chassis or screen, or a copper ground-plane on a printed circuit board, even the ground or earth beneath and around an aerial. Often this capacitance is unwanted, an incidental or 'stray' capacitance, but sometimes it forms an essential part of the functioning of the circuit.

If you look in any good radio reference or text book, you'll find formulae which will teach you how to work out the value of capacitance of many of these combinations for yourself, often with tables and charts which save you the hard work involved in the calculations.

The values of capacitance involved are small enough to be of no importance when considering cables carrying power at mains frequencies of 50 or 60Hz. But as you move up to audio frequencies, you certainly need to take cable capacitance into account on long runs such as microphone cables. If you want to use a microphone at any significant distance from an amplifier (and that can be the input preamplifier of a radio transmitter, just as well as a hi-fi or public address amplifier) you need to use a low-impedance model, certainly not above 600 ohms impedance, or one which incorporates a matching amplifier, in the way that an electret does. For shorter runs of screened cable, you can go higher in circuit impedance, though there are circumstances when you can be left wondering where all your treble response has gone. More of that later!

Examples

To give some idea of the figures involved, here are a few examples. An unscreened pair of 7/0.2mm PVC-insulated wires, either on their own or as adjacent conductors in a flat ribbon cable, has a capacitance between cores of around 50pF per metre. A 300 ohm flat twin RF feeder, because of the much greater spacing between its two conductors, will notch up only around 13pF per metre.

Screened cables can vary quite widely in capacitance, depending on their construction, so that a screened single 7/0.2mm can have a core-to-screen capacitance of a staggering 322pF/m, but a low-noise version with the same conductor is only 97pF/m because of the extra spacing provided by the double layer of insulation. With screened twin cables, there are both core-to- core and core-to-screen capacitances to be considered. For a twin 7/0.2mm, the core-to-core figure is something like 120 to 150pF/m, and the core-to-screen 210 to 270pF/m. A heavier cable, with thicker conductors, will have larger capacitances, so that for a 16/0.2mm of similar construction, the figures are around 170 and 290pF/m respectively.

Unlike screened cables, coaxial feeder cables are designed to have a particular value of surge impedance. The formula for cable impedance shows that it depends on the diameters of the inner and outer conductors and the dielectric constant of the insulation between them. Exactly the same factors govern the capacitance between core and screen, so that all cables of the same impedance have a broadly similar capacitance. For a solid dielectric 50 ohm cable, the capacitance is around 100pF/m, and for a 75 ohm cable it is around 68pF/m. In cables which are described by their manufacturers as 'semi-airspaced', or 'air-spaced', using either a cellular polythene (foamed polythene) dielectric, or solid polythene with a star-shaped cross-section, or even a spiral of polythene 'string' inside a polythene tube, the drop in dielectric constant means that a 75 ohm cable will have a capacitance of around 56pF/m.

These capacitance figures are important where you are using a coaxial cable simply as a screened feeder between a source and load which are not impedance-matched. This might be the case if you had an outdoor long-wire aerial connected to a domestic broadcast receiver, but with a length of coaxial cable for the down-lead to give some protection against the electrical noise-field of the house.

Layout Considerations

I promised to come back to the question of the effect of cable capacitance at audio frequencies, something which was brought home to me many years ago. I was building a couple of driver amplifiers to take audio signals from the 600 ohm line output of a preamplifier and boost them to around the 3W level needed to drive a pair of 300W amplifiers installed on board a ship.

This was in the days when valve technology still ruled, so I was using an audio transformer to match the 600 ohm line to the nominal 1 megohm grid circuit input impedance of the first valve in the driver amplifier. For convenience in physical layout, I put the transformer at the back of the chassis, next to the input connector, and took its output to the front of the chassis via. about 200mm of screened cable. The sort of cable I was using would have had a capacitance of around 300pF/m, which meant my 200mm would have put about 60pF in shunt across the 1 megohm. That 60pF equates to a reactance of around half a megohm at 5kHz or 250 kilohms at 10kHz, so it was not surprising that my beautiful new system sounded very 'muddy' indeed! A quick redesign of the layout put the transformer right next to the first valve, so that the screened cable was working in a 600 ohm circuit instead of a 1 megohm one — problem solved!

Before we leave the subject of wiring capacitance, it's worth mentioning one more example — not for conventional wiring this time, but for that very useful product,Veroboard. On the standard 0.1 inch (approx. 2.5mm) matrix Veroboard, the manufacturers specify the capacitance between tracks as 0.51pF per centimetre, which equates to 51pF per metre, not much different to twin 7/0.2mm unscreened cable. The lengths likely to be involved are of course much smaller than for conventional wiring — the longest Veroboard I've ever seen is around 18 inches - but since the product is sometimes used for prototyping at radio frequencies, it's worth bearing this capacitance in mind. A typical board length of 100mm would have a capacitance between two adjacent unbroken tracks of about 5pF, which has a reactance of 4.5 kilohms at 7MHz, 1100 ohms at 28MHz and, should you be so unwise as to try to use it there, just 221 ohms at 144MHz!

Although you will find formulae for it in some textbooks, the value of capacitance that will exist between an aerial and earth, or between an aerial and its ground plane, is very difficult to forecast accurately outside the realms of an aerial manufacturer's test range. In any practical situation there will always be surrounding buildings, trees and so on, all of which add to any calculated value. Measurement by means of an RF capacitance bridge is the usual way of arriving at a figure when it is required, for example when there is a need to know how much power is being fed by a transmitter into a long wire aerial. Capacitance and inductance in aerials is a subject I plan to explore further in a future article.

Inductance

Whereas capacitance is a property which exists between two conductive surfaces, inductance exists in a single conductor, although the value of the inductance will be changed if a second conductor is nearby. In the same way that a capacitor is a component specially designed to provide a controlled amount of capacitance, a component specially designed to produce a controlled amount of inductance is called an inductor. At frequencies up to a few hundred megahertz, that inductor will take the form of a coil of wire, with some form of magnetic core inside it at the lower frequencies, but air-cored at the higher frequencies.

We often use the words inductor and coil to mean the same thing, simply because a coil concentrates the inductance in one component, but even a single straight wire has inductance. For the radio amateur, one of the places where this is particularly important is in the earth connection for a transmitter.

For an effective RF earth, we need a really good low- impedance connection with the ground using earth rods or plates, this isn't easy to achieve. We also need a low-impedance connection between the transmitter *and* the earth rods or plates, so there is the minimum possible voltage drop between the transmitter and earth due to the RF current flowing. Looking at it from the point of view of the resistance of the earth wire, as we were last month, we require a good thick wire. However, for RF currents, something called 'skin effect' comes into play, causing the current flow to be concentrated near the surface of the conductor, with little flowing in its central section. In professional radio installations, earth connections are usually made of one or more copper strips anything up to 150mm wide. The inductance is related to surface area, so thickness has virtually no effect on it. All that's required is that the strip be thick enough to withstand handling at the time of installation, or any subsequent movement or vibration of the equipment. Often, material as thin as 22 SWG is used. Similar factors apply to the aerial connections within the transmitter room, these are often a 6mm in diameter. There's no point in paying out good money for solid copper conductors when the centre of them will never carry any RF current. Instead, 6mm diameter copper tubing with a wall- thickness of 16 SWG is used, supported on ceramic insulators.

Whether a radio amateur will need to go to those sort of lengths will depend on the siting of the shack and how long the RF earth connection has to be. One inexpensive way of getting a low-impedance earth lead is to use a scrap length of heavy (12.5mm diameter) coaxial cable, strapping the inner and screen together at both ends.

Typical Values

What sort of inductance figures are we talking about? Well, 22 SWG wire has an RF inductance of around 1.3 microhenries per metre, for 16 SWG it's around 1.1 microhenries per metre, and for 10 SWG that drops to 1.0 microhenries per metre. As you can see, the law of diminishing returns is in operation as the wire gets thicker. For copper strip, the figures are around 0.75 microhenries per metre for 25mm wide and 0.36 microhenries per metre for 150mm wide.

That may not sound very much, but if you're working down on 160m or 80m with a long-wire aerial, it translates into quite a significant amount of reactance. At 3.5MHz, just one metre of 150mm wide copper strip has an inductive reactance of around 8 ohms, and there aren't too many shacks that have an earth lead as short as that!

An interesting technique I read about once in an American magazine was to put a variable capacitor in series with the earth lead at the transmitter end, where it forms a series acceptor circuit with the inductance of the earth lead, allowing the inductance to be 'tuned out'. I've never had the opportunity to try it. It sounds good in theory, though I'm a little worried about the high voltage that would exist at the junction between the capacitor and the earth lead when the whole arrangement is adjusted to resonance.

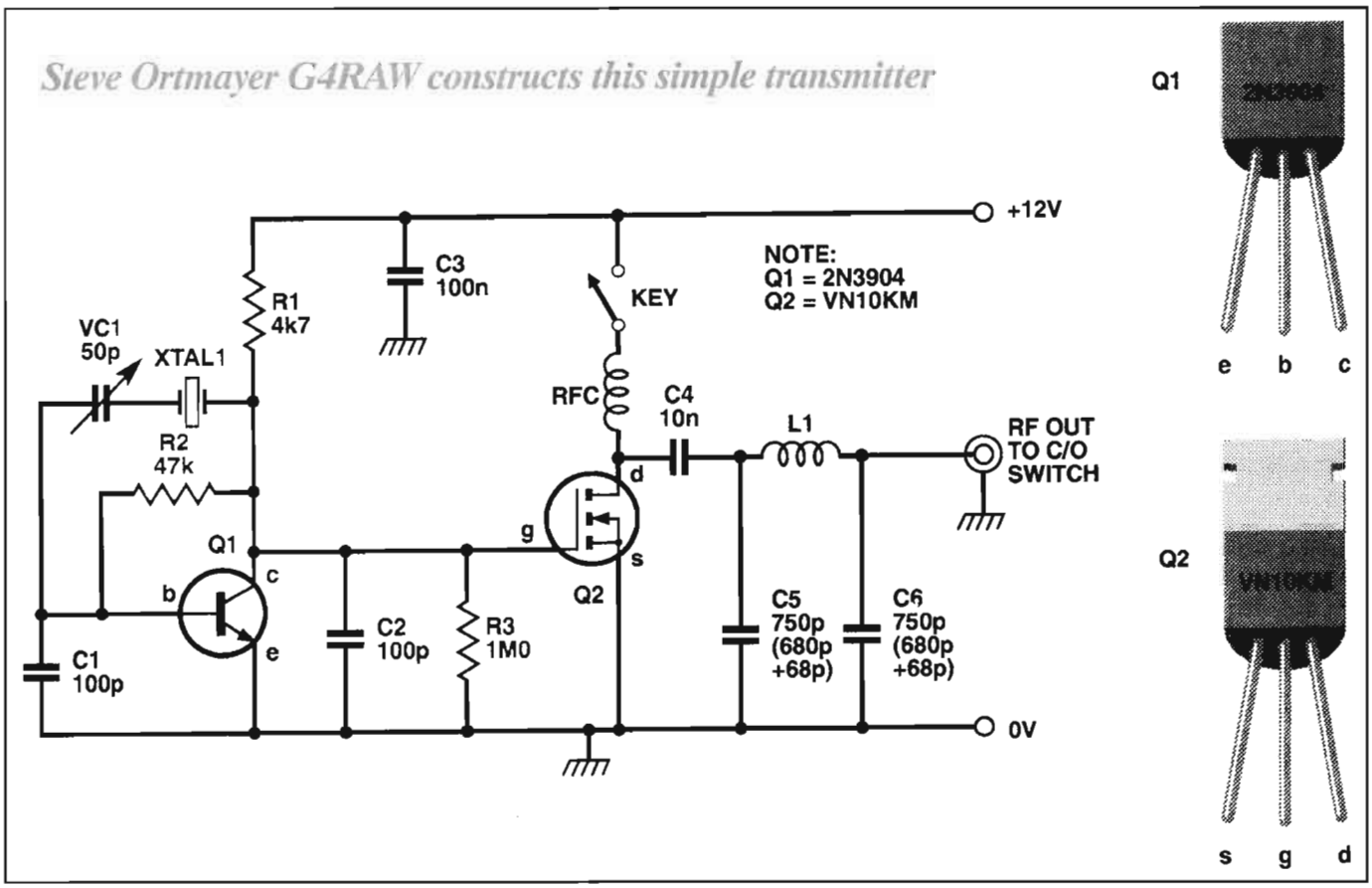
Self Resonance

Another place where lead inductance becomes important is in capacitors used at VHF. You'll find tables of typical values given in radio engineering reference books, but a few examples will alert you to the problem. A typical 1000pF disc ceramic with 6mm leads is self-resonant at 75MHz, or with 12.5mm leads at 42MHz. For a 100pF tubular ceramic, the corresponding figures are 145MHz and 120MHz. When a capacitor becomes self-resonant, it means it no longer behaves as a capacitor, so if for example you're using it for decoupling, it's not going to do the job you expect of it.

Incidentally, the capacitance that exists between adjacent turns or sections of a coil or 'choke' will cause its reactance to vary somewhat erratically as the frequency of the applied signal is varied. The coil designer must aim to minimise those variations if the component is to do its job effectively.

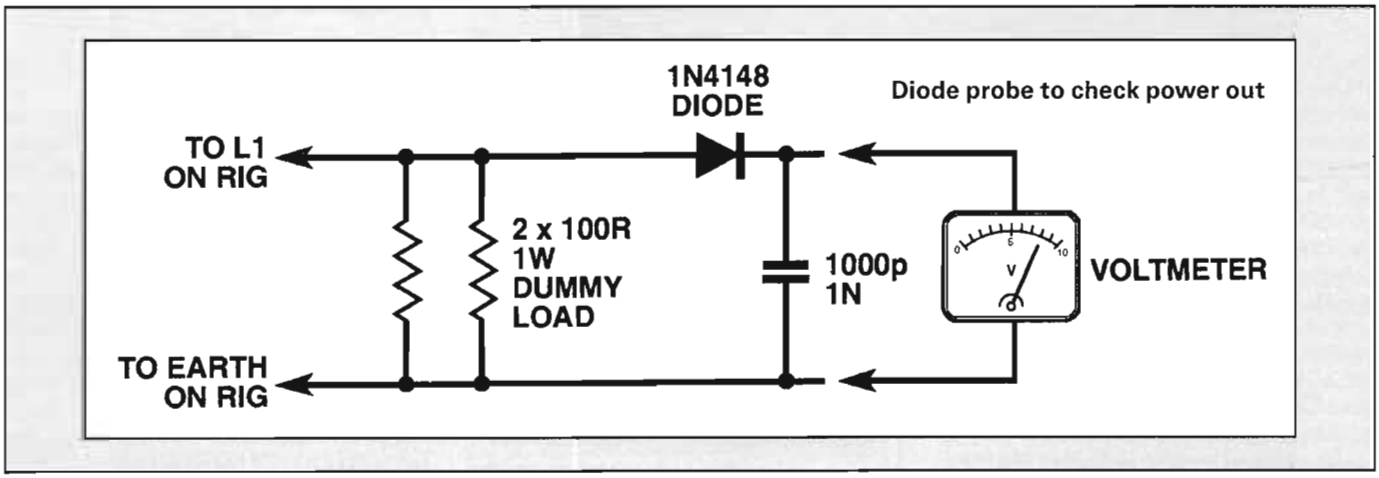
The Halifax 80m Transmitter for the Novice

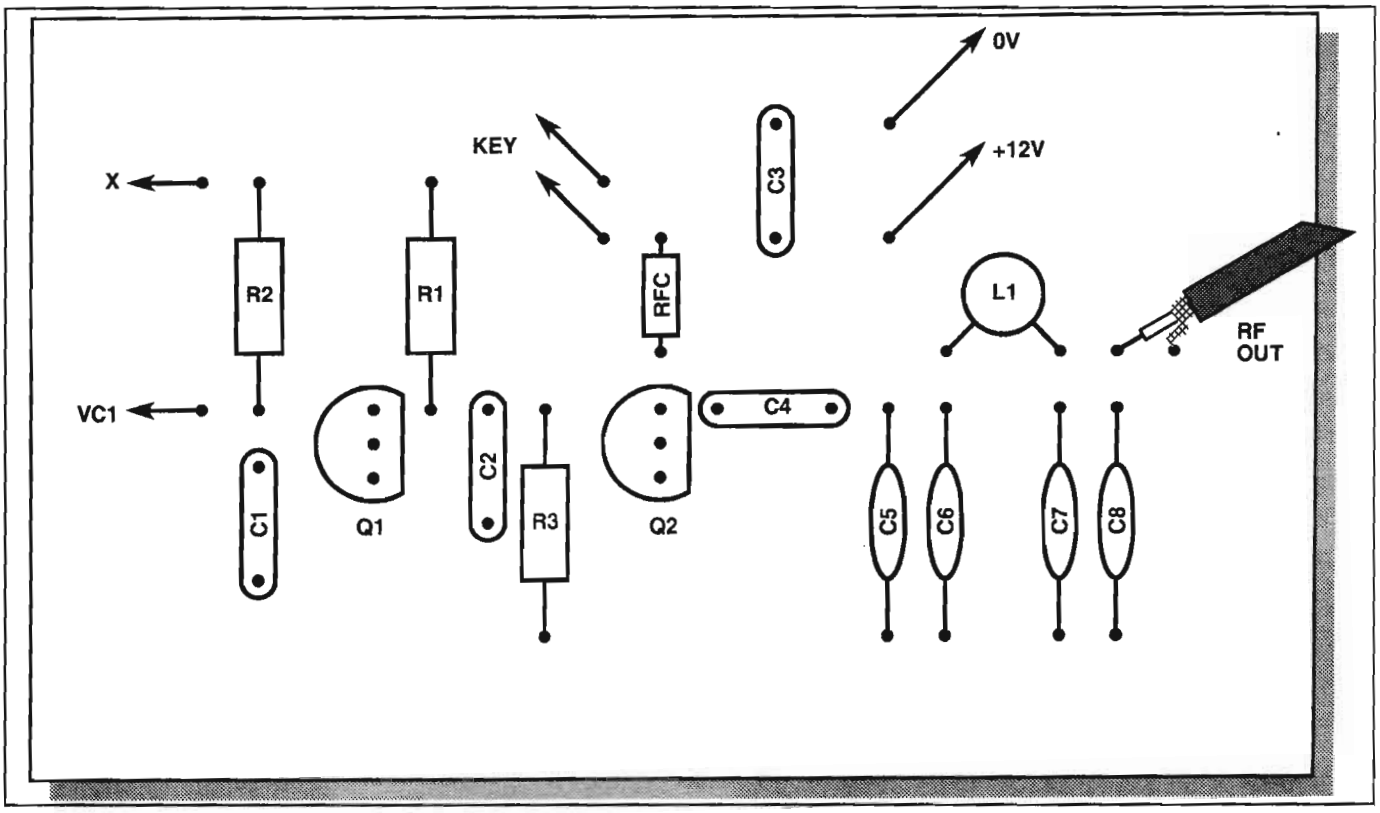
Steve Ortmayer G4RAW constructs this simple transmitter

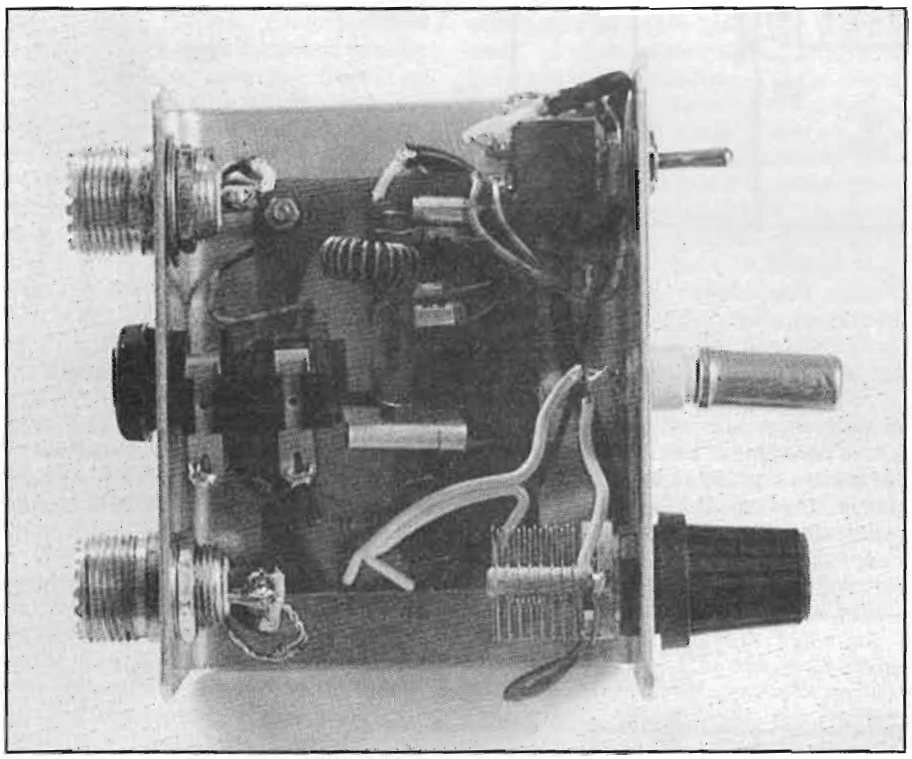


The Halifax and District Amateur Radio Society is one of the oldest in the land, it was formed as the Scientific Wireless Society in 1922. During my year as Chairman of the Halifax Society I made a point of planning a 'home brew' evening, when every member will come on the air with a home made piece of gear. The old hands can dust off their 6V6 oscillators and fire them up, but I thought a simple transmitter was needed for other members to build.

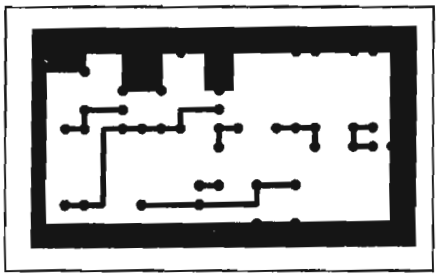
A Novice is allowed to use part of the 80m band on passing the 5 WPM Morse test. The frequencies allowed are between 3.565MHz and 3.585MHz with 5W input or 3W output.







The Halifax transmitter will comply with this specification, and could easily be made by a Novice.



Circuit

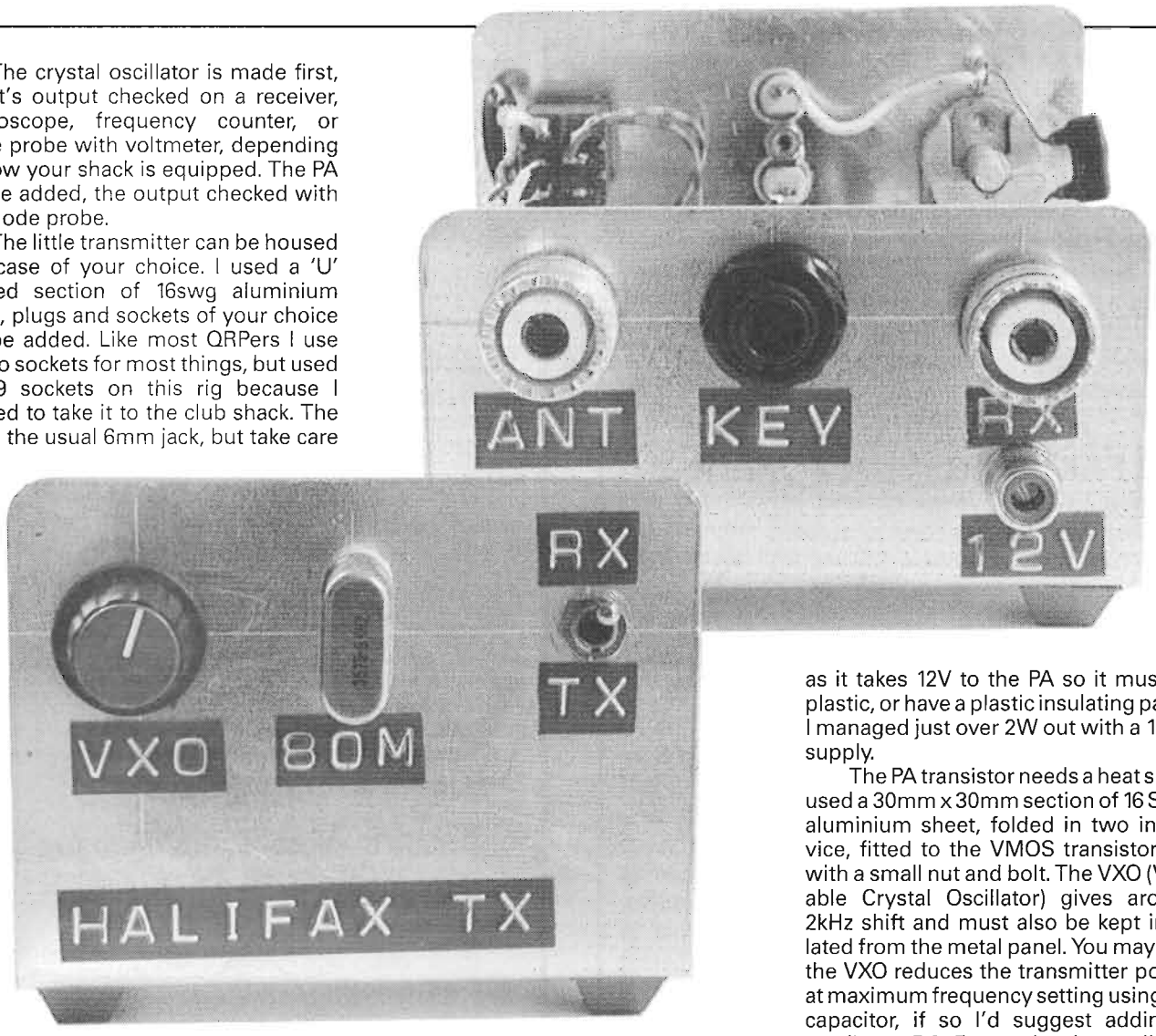
The transmitter is a simple crystal oscillator and power amplifier (PA), the oscillator being adapted from a standard electronics text book circuit. The PA was originally developed in my usual way, by wielding the soldering iron and applying a bit of power. I keep my fingers on the transistors to see if they get hot, does this mean that I can only make things with ten transistors? Well I'll stick to a maximum of five so I have a free hand to switch off! I first tried an 'ordinary' bipolar transistor, but it didn't work and got hot. A 1 ohm resistor in the emitter can help thermal problems but this didn't work either, perhaps the impedance is wrong I thought. I did not know why, but knew that a VMOS had a high impedance, so I tried it and it worked. Calculations by the HRT Tech Editor showed this to be a correct judgment, albeit each of us arriving at our conclusions in a different manner!

Construction

This simple transmitter can be made a number of ways. The first prototype was made on plain perforated board without any copper strips. I've made a lot of projects this way, it is quick and saves etching a board. The big disadvantage is if a component has to be removed, then it is difficult to untangle the wires soldered together at the rear of the board. It could be made on a tag strip, this is quick but the tags need a lot of heat, and care is needed to prevent cooking the transistors when soldering, e.g. by using a pair of tweezers as a heat sink.

The crystal oscillator is made first, and it's output checked on a receiver, oscilloscope, frequency counter, or diode probe with voltmeter, depending on how your shack is equipped. The PA can be added, the output checked with the diode probe.

The little transmitter can be housed in a case of your choice. I used a 'U' shaped section of 16swg aluminium sheet, plugs and sockets of your choice can be added. Like most QRPers I use phono sockets for most things, but used PL259 sockets on this rig because I wanted to take it to the club shack. The key is the usual 6mm jack, but take care as it takes 12V to the PA so it must be plastic, or have a plastic insulating panel. I managed just over 2W out with a 13.8V supply.



The PA transistor needs a heat sink, I used a 30mm x 30mm section of 16 SWG aluminium sheet, folded in two in the vice, fitted to the VMOS transistor tab with a small nut and bolt. The VXO (Variable Crystal Oscillator) gives around 2kHz shift and must also be kept insulated from the metal panel. You may find the VXO reduces the transmitter power at maximum frequency setting using the capacitor, if so I'd suggest adding a small, e.g. 5.6pF, capacitor in parallel to give a greater overall minimum capacitance.

Components list

Resistors;
All 1/4 Watt carbon film

R1	4k7	
R2	47k	
R3	1m0	

Capacitors;

C1, C2	100pF	ceramic plate
C3	100n	polyester
C4	10n	polyester
C5a, C6a	680pF	polystyrene
C5b, C6b	68pF	polystyrene
VC1	50 or 100pF variable	

Transistors;

Q1	2N3904
Q2	VN10KM

Other items;

L1	21 turns 22SWG T-50-2 core
RFC	10 turns 32SWG on ferrite bead

Crystal plus holder
DPDT changeover switch
Coax for signal path between board switch and sockets (RG174 OK at these low powers).

Operating

I coupled the transmitter to a home made receiver and used my inverted V dipole cut for this band. A 20m length of wire is a quarter wave on this band, and can be used without an ATU provided a suitable earth is used. Take care not to operate into a large mismatch or you might damage the PA. My first CQ brought a 579 report from Mike G0IYY near Norwich, reporting a fine TX signal. Reg GW4BUS from Caernarfon gave the 2W 589 and said "top marks on the home brew TX". Reg was on 3.565kHz which is calling frequency used by the Royal Signals Amateur Radio Society. A Novice can hear some good CW here, somewhat faster than 5 WPM though! (I wanted to join the RSARS but only had a Boy Scouts semaphore badge and this was not good enough to gain membership!) 3.570kHz which is in the Novice part of the band is used by QRPers using 5W as an alternative to the QRP calling frequency of 3560kHz.

SCANNERS INTERNATIONAL

From the Editor's Desk

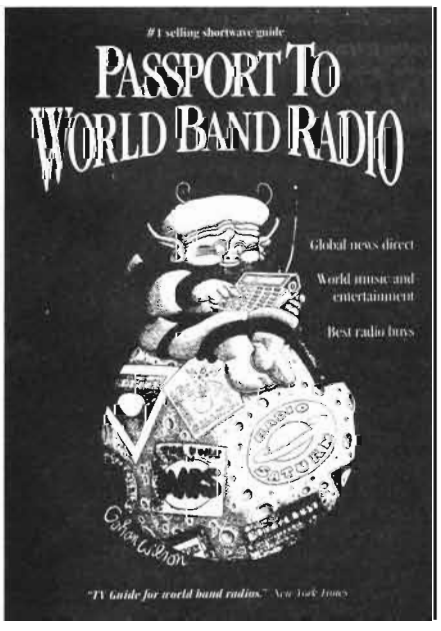
Remember how *Scanners International* warned that even listening into CB on your scanner was illegal? Yes, it *does* seem daft, but an interesting snippet regarding this was reported in the latest issue of 'Mid Sussex Matters', the journal of the Mid Sussex Amateur Radio Society;

In the small hours one day, a doctor in the West End of London was listening on 27MHz using his HF receiver when he tuned into a conversation between two men. They were talking about the difficulty they were having with burglar alarms and locks, very strange! From their conversation the doctor decided this was rather suspicious and contacted the police who subsequently went to investigate, catching the two men in the act of breaking into a store near to the doctor's house. One man was inside the store, the other waiting outside in a car, each using a handheld transceiver for communication.

A happy ending you'd think, at least for the doctor if not for the two criminals? You may even believe this could show the usefulness of scanners? But *no*, soon after the incident the doctor received a warning letter from the radio licensing authorities for unauthorised listening! It makes you wonder.

A reader's letter received this month shows that some authorities are even going all-out to trap scanner users. It takes all sorts I suppose!

Book Review – 1992 Passport to World Band Radio



Many scanner enthusiasts have access to HF (Short Wave) on either their scanner or using a separate dedicated receiver. If you'd like to explore the world of HF broadcast stations, then the latest edition of 'Passport to World Band Radio' is in my opinion an invaluable addition to your bookshelf. With a comprehensive 'frequency finder' for broadcast stations around the world, including many clandestine stations as well as authorised broadcasters, a large section of the book is also devoted to appraisals of dedicated short wave receivers which could help you make your choice of model.

A useful chapter entitled 'What's on Tonight?' offers an hour-by-hour guide to 'prime time' short wave programming in North America, East Asia and the Pacific, Asia and Western Australia, and finally (but not least) Europe. Together with a selection of easily-read articles on choosing and testing radio equipment, this book should provide several happy hours of evening reading as well as being an excellent reference guide to have next to your HF broadcast bands receiver.

Available from Lowe Electronics Ltd. (0629 580800) at £12.95 plus £1.55 p/p, and my thanks go to Lowe for the provision of the review copy.

ScanMail

Dear Sir,

I am a keen SWL and have been for the last 15 years. I listen to HF, public broadcast, and radio amateurs, I am also studying to do my RAE this year. I thought you might like to share this joke with me that I saw in a national newspaper.

It says; "People illegally tuned in to police calls rushed to see a UFO in Holland, and were nabbed by cops who'd put out a hoax radio message". Good one Dutch police!

Keep up the good work you have a great mag.

Yours sincerely,
Mr. S. Gandy

Which Scanner Aerial?

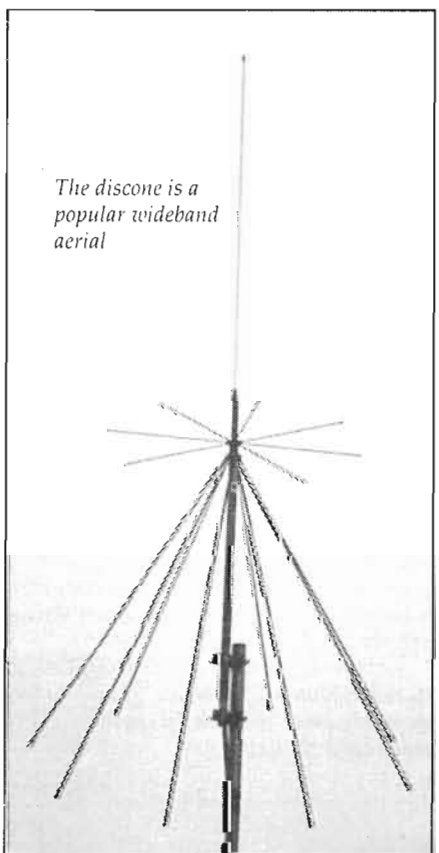
So you have your shiny expensive scanner sitting there on your desk, maybe it's a handheld type or even a purpose built desktop or mobile version. But are you getting the best out of it? A scanner is only as good as the aerial it's connected to, remembering the only way it can receive anything is through the aerial. When a handheld scanner is used out and about, you sometimes have little choice but to use the attached flexible aerial, but when you're at home, or in a car, a significant increase to what you can hear can be made by connecting a suitable and well-sited aerial to your scanner.

This short feature is designed to give you an introduction to some of the types of external scanner aerials available, with their individual merits and uses.

Basics

The most important feature of a scanner aerial, as far as most uses are concerned, is having an acceptable performance over a wide frequency range. Aerials for a given frequency band, i.e., the 2m (145MHz) amateur band, often have a poor performance on other frequency ranges. But if you *do* already have something like this available, or even an outdoor FM radio aerial, then try connecting it. This may certainly be better than just using the scanner's set-top whip.

For optimum performance over a wide bandwidth, a specially designed wide frequency range aerial is needed, and as most of the signals we're interested in use vertical polarisation, i.e., mobile units and the fixed stations they communicate with, a vertically polarised aerial is needed.



The discone is a popular wideband aerial

Sometimes you may be interested in just one or two frequency bands, civil and military airbands for example, and dedicated aerials for these could be used to advantage. In the case of airband, take a look at *Scanners International* December 1991 for a DIY airband aerial design by Alan Gardner.

Discone

This is a popular wideband scanner aerial, being made up of a 'disc' and 'cone' array of rods. Most popular discones cover from around 100MHz to 500MHz, and the lower frequency limit is sometimes extended by the addition of a vertical whip element. Although the 'disc' is made up of horizontal elements, the discone offers omnidirectional (i.e., all-round), vertically polarised, coverage.

Wideband 'Rod' Aerials

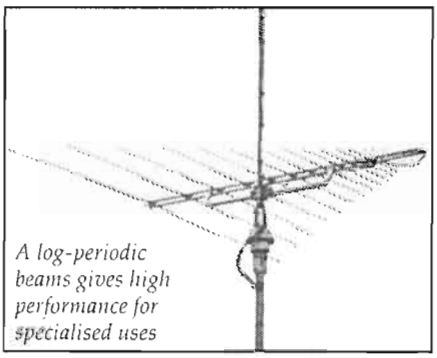
An often-raised objection to a discone is the fact that it does look rather conspicuous on your house! It also seems to act as an excellent bird perch. Multiple vertical dipoles, each normally covering a finite frequency band, can be connected in parallel to provide wideband coverage. A typical arrangement would be shielded in a thin tubular enclosure for outdoor mounting. One of these is easy to build, take a look at the 'Wideband Wastepipe' aerial project by Bill Wilson in the July 1991 issue of *Scanners International*.

A commercial offering using paralleled lengths of quarter wave verticals, encapsulated in a plastic tube, comes in the 'Scanrod' aerial. This offers a low-cost option for those who don't wish to buy or build a higher performance wideband aerial.

One of the several types of multi-band amateur VHF/UHF fibreglass-encapsulated aerials can prove useful as a wideband scanner aerial, these also provide good transmission capabilities on the specified frequency bands. Types available from manufacturers Comet provide coverage of 50/145/435MHz, or 145/435/1296MHz (see review in Jan 1991 issue of Ham Radio Today), as well as several dual-band 145/435MHz twin-band aerials. These are available in both fixed station and mobile mount versions, and I would heartily recommend one of these as a 'do-everything' aerial for VHF/UHF scanners.

Directional Aerials

The aerials we've discussed up to now offer omnidirectional, i.e., all-round, coverage. Sometimes you may want higher gain in a particular direction, for example to pull in



A log-periodic beams gives high performance for specialised uses

weak signals from a distant station but rejecting stronger signals from other local transmitters. Here's where a 'beam' aerial scores, the most common type for wideband use being a log-periodic. The Create CLP5130-2 (105-1300MHz) is a popular model used by devoted scanner users, or for extended frequency coverage the larger CLP- 5130-1 which covers 50-1300MHz can be used. For vertical polarisation (i.e., most uses) you'll need to mount this on its side with the elements vertical. If however you're interested specialised uses such as long-distance amateur signals on SSB and CW, horizontal polarisation is normally used by the transmitting stations.

If you're only interested in signals from a given direction, the beam may be fitted pointing in that direction, otherwise you'll need to use a rotator or some other means to turn the beam. The CLP5130-2 log-periodic was reviewed in the April 1989 issue of *Ham Radio Today*.

Mobile Whips

If you use your handheld scanner in the car, then plugging in a external aerial will help prevent screening effects from your car's bodywork as well as offering better gain than the small flexible aerial in the first place. For starters you may like to try simply connecting the car's existing radio aerial via a coax switch, or possibly making a car radio aerial splitter unit as in Alan Gardner's constructional article in the February 1991 issue of Scanners International. A commercially-made splitter is now available from Realistic. Several firms also manufacture dedicated scanner aerials for mobile use, such as the Diamond D-505 reviewed in the December 1990 issue of *Scanners International*, and both Comet and Diamond make a range of multi- band VHF/UHF mobile whips.

Indoors or Outdoors?

You may find that you can't get an outdoor scanner aerial erected, due to planning limitations or just for aesthetic reasons. In this case, loft mounting could be an option to consider. The important thing to do is to get the aerial away from sources of electrical noise, such as TVs, computers and

indeed the scanner itself. Try to get the aerial as much 'in the clear' as possible, to improve your chances of receiving signals from distant transmitters. Water tanks, pipes, and of course the roof tiles will all have an adverse effect to the aerial's performance, but if you can't get the aerial outside then the loft is often 'next best'.

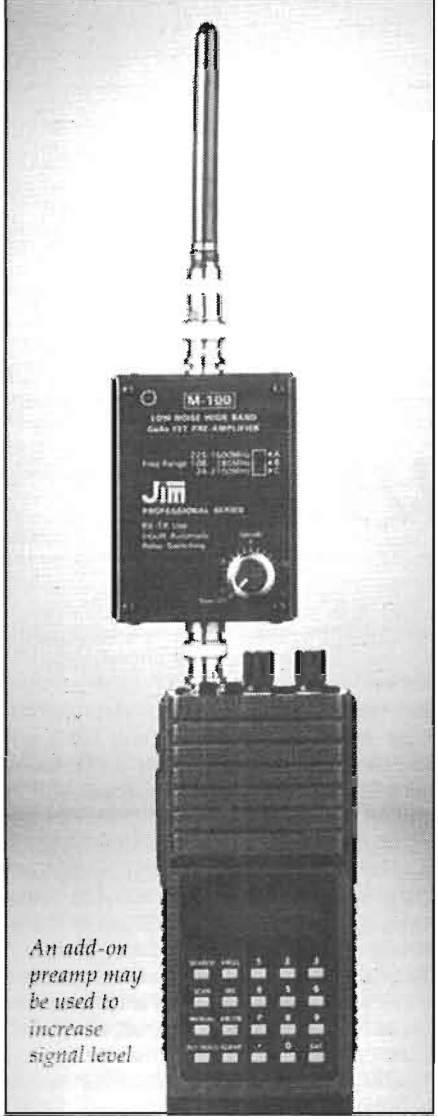
Amplified Aerials

For locations where you don't suffer from very strong signals, and you need high gain from an aerial but you're not be able to get a large system erected, then an amplified (or 'active') wideband aerial may prove to be an acceptable compromise. Here, a physically small aerial is used in conjunction with a radio frequency amplifier circuit, this normally mounted at the aerial itself, to boost the received signals. As well as giving a more discreet appearance, an active aerial can be useful in overcoming coax feeder loss. Typical base station versions are available from Maldol and Diamond, e.g., the Diamond D-707 as reviewed by Alan Gardner in the December 1990 issue of *Scanners International*.

However do note that this additional amplification can sometimes increase the problems of blocking, overload and intermodulation caused by local and thus very strong off- frequency signals (see HRT 'Novice Notes' October 1991 and November 1991 issues). Thus active aerials can sometimes cause problems rather than improving performance if you live in an 'RF congested' area.

Add-on Preamps

Bearing in mind the possibility of strong-signal problems, if you need signal amplification with your existing external scanner aerial then an add-on preamp may be an answer. To gain the advantages of overcoming feeder loss, the preamp should ideally be mounted at the aerial itself, suitable types often have their power fed through the aerial coax for simplicity. See *Scanners International* issues January 1991 for a design by Peter Rouse, and August 1991 for a matching preamp to the 'Wideband Wastepipe' by Bill Wilson. A high-performance commercially-made preamp is available from Solid State Electronics in the form of the M-100, this having switchable bandpass filtering and automatic relay switching for transceiver use, the unit being designed for local set-top mounting.



An add-on preamp may be used to increase signal level

Coax Cable

Coaxial cable is normally used to feed the signals from your aerial to your scanner, and there are many 'grades' of this. Although thin coax such as UR76 is more flexible and easier to install, it will also give a greater loss of signal than thicker coax such as UR-67 or H-100. The actual signal loss any particular type of coax gives is proportional to its length, i.e., double the length and you double the signal loss. Also as the reception frequency increases, so does the loss. If you're only interested in HF (Short wave) signals and the like, you'll notice little difference between thick and thin coax, especially over short runs. But get up to VHF (around 145MHz) or UHF (around 435MHz) and frequencies such as 935MHz, and thicker low loss coax is a 'must' unless your length of coax is just a few metres or so such as in a car.

This feature has been a brief introduction to scanner aerials, I hope you found it useful. Scanners International will of course be continuing to feature reviews and constructional projects of scanner aerials in future issues, watch this space!

New Products

From Realistic — Car Aerial Coupler and PRO 9200 Scanner

Link Electronics tell us their latest offering from Realistic is an aerial coupler priced at £14.95, which enables a normal car radio aerial to be used for both AM/FM radio reception and scanner reception.

Also from Realistic is the PRO 9200 base scanner, covering 68-88, 118-135.975 (AM), 136-174 and 380-512MHz. Priced at £129.95 it operates from an AC mains supply, featuring 16 channels with two-speed scanning and search modes together with priority and lockout. Further details from Link Electronics in Peterborough (0733 45731).

News from AOR

AOR (UK) tell us their new *AR-3000A* has evolved from the popular AR3000 scanner, with new features including a 'free running' tuning knob, x10 buttons for more convenient tuning, and a larger LCD now containing all information rather than requiring additional LEDs for status indication. Many scanner enthusiasts will appreciate the significantly faster scan and search speeds on the newer set, these made possible by new microprocessor firmware. A new version of AOR's multi-function software for external computer control is now also available for controlling the set, this being *ACEPAC3A*. Note the earlier *ACEPAC3* will not function with the AR3000A.

Also from AOR (UK) comes the new WA5000 active receiving aerial for HF use, this covering from 30kHz (VLF) up to 30MHz. To complement this for VHF/UHF use, a new discone in the shape of the DA3000 covers from 25MHz to 2000MHz. Further details on the above from AOR (UK) Ltd. (0629 825926).

Scanmaster II

From EMP comes 'Scanmaster II', offering remote control capabilities for any one of the following scanners; IC-R7000, IC-R7100, IC-R9000, FRG-9600, AR3000 and AR2002. Priced at £249.99 it comes as a stand-alone 'black box' connecting to any computer or terminal having an RS-232 port. The system offers various scanning and search operations including activity reports containing a text list of the frequencies and percentage time of activity on each. The unit itself runs from an external 12V DC supply, and optional add-ons include *Romcard* to permit several scanners to be driven by one Scanmaster II unit, *Cellcard* to decode signalling used by UK TACS and optionally USA/Australian AMPS cellular traffic, and *Tonecard* to decode and encode DTMF, Selcall, and Band III signalling. Further details from EMP (0305 826900).

QRP CORNER

A few letters this month, including a nice long one from Errol G4MET who also uses an Argonaut 515 with great success. He is also secretary of his local club, the Hereford ARS, and writes to say that he tried the CQWW DX SSB contest, going for a single band entry and choosing 10m using an HB9CV aerial. He managed 271 QSOs, 24 zones and 61 countries, earning him a total of 50,745 points. At the end of the day, he managed 19th out of 41 entries for the world QRP section for the band! Not bad at all for a very modest station with just 5W, less than half of the permitted power levels for QRP SSB!

Errol also tried the RSGB 21/28 contest, again with the HB9CV for 10m and a doublet for 15m. He managed 27 QSOs on 15m and 48 on 10m. He writes that "I will probably finish last, but have suggested to their committee that they might care to consider a QRP section for next year".

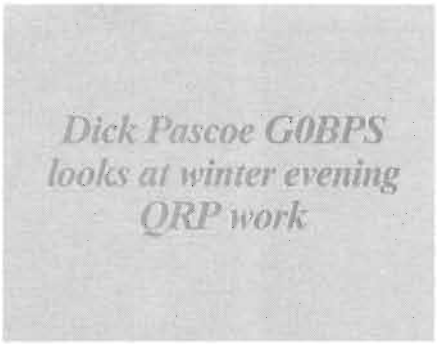
Many people just will *not* acknowledge that any distances can be worked with QRP power levels, especially on SSB, but these comments from Errol prove the point once again. His points total for his single band entry is excellent. He adds.."If conditions are good, it is not too difficult to work plenty of DX using just 3-5W of SSB and modest aerials". Of course in these QRO contests it's of no real use to sit and call 'CQ Contest' with just 5W output. You will not get a pile-up unless you add to your low power a real nice DX type callsign.

Even for those who hate contests it does give the QRP SSB operator a chance to work a few more countries. The other contesters really *do* want to work you. They need the points and the multipliers which you may be able to give them, many of the rarer ones may not even acknowledge your existence with the same power levels in a normal situation. The other advantage with a contest situation is that the pile-up will almost certainly be less than on a non-contest day.

Winter Projects

The coming of March always reminds me of the Mad Hatter and the March Hare, I always imagine these two together hanging off a pitched roof, struggling to repair a broken aerial or damaged feeder in the bad weather of winter.

The long dark evenings are very conducive to construction, especially if sitting by a warm fire, and holding a hot



cup of tea in one hand and the soldering iron by the other. Perhaps now is the time to complete that half-built project for the summer holidays. You know, that small transceiver you promised yourself to keep in your pocket, or carry in the caravan.

The fundamental thing about homebrew is that it's the forte of the home builder to experiment and try different components. The greatest benefit of this experimentation is in the sharing of ideas. The old motto 'Two heads are better than one' is still very pertinent in today's scramble for new ideas. Many new circuits appear in the amateur press just because of this experimentation. So what have *you* been building lately, why not send me your ideas to share with others?

Top Band DX

The long nights are also the time to go hunting on Top Band or 80m. It's quite surprising what can be worked on 160m with a modest aerial. I have heard of the ubiquitous G5RV being loaded for the band, by just strapping the feeder together it's often enough to provide contacts over fairly reasonable distances.

If space is at a premium and even a G5RV can't be erected, then a vertical aerial could be the answer. Unless this vertical is greater than 1/4 wavelength long, and on 160m this means a pole 40m high it won't work too well. It doesn't mean that it won't work at all, just not as well as a 1/4 wavelength. The longer (higher) the better, and contacts can still be made with much shorter aerials.

On 160m, most CW DX will be found in the bottom 30kHz of the band, and G-QRP club members can be found around 1.850MHz chewing the rag and also working some DX. Don't be afraid to join in one of these 'ragchews' as the entrance of a newcomer often brightens the conversation.

One other great thing about Top Band is that it is perfectly acceptable to use AM on the band, and many local club nets use this mode for their club nets. The Bredhurst ARC have just put together such a rig for their club's winter project. Another thing about 160m is that many of the UK operators using AM or SSB are QRP operators, so these can often count towards any QRP awards you may be working towards.

For those who prefer mobile operation, Top Band can also provide for good mobile working. Short, heavily loaded aerials are the norm, take a good look at the cars parked at the local rally next time you go! I'm working on getting on Top Band mobile, hands free of course, on my motor cycle. It's quite surprising how many motor cyclists are operational on the air too, and not just on 2m.

Soap-Box Corner

In the ever-increasing fight for spectrum space by businesses and other commercial users, we must be very careful of our use of our allocated frequencies, remembering that we are 'tolerated' on our bands by our government. I'd suggest this is just one very small reason to go QRP (I know, you were waiting for the connection!). The less EMC caused from high power amateur transmissions, overdriven speech processors and so on, the more chance we have of retaining the bands we enjoy now.

Rallies

QRP enthusiasts will be taking part in a few future events, the first, as you may already have noticed is the show at Picketts Lock. I plan to be at Dayton again this year with the club, once again with George G3RJV and several other club members. Watch for a report later this year. The RSGB have decided to avoid clashing with this magnificent event and we understand that the show at the NEC will now be on the last weekend in May. Once again the club will have a small stand at this show, any offers of help with the above to me please!

That's it for now, news, views and ideas to me please, either via. HRT Editorial at P. O. Box 73, Eastleigh, Hants SO5 5WG, on packet to GB7SEK, or to 3 Limes Road, Folkestone, CT19 4AU.

Satellite Rendezvous

Richard Limebear of Amsat-UK tells of a different Oscar-22

Doug Loughmiller was elected Chairman of the AMSAT-NA Board of Directors. Seen here with *HRT* Editor, Sheila.

Oscar 13

In the latter part of 1991, eclipses were reaching 59 minutes which necessitated mode B transponder being switched *off* from MA 10-40, however from December 24 this should be back to normal. On Nov 16 Oscar-13's argument of perigee passed 270 degrees, so its apogee is now moving southwards! The command stations have indicated that they have received sufficient responses to their request for transponder schedule input. They thank all who have responded and will announce the new winter schedule in a few weeks.

The ZRO Memorial Technical Achievement Award Programme, or just 'ZRO Test' is continuing on AMSAT-OSCAR-13. This activity is a test of operating skill and equipment performance. The schedule of Mode B and JL tests were chosen for convenient operating times into the USA but can all be heard over here. The B tests can be heard on 145.840MHz and the JL test on 435.945MHz. N5EM will run the JL tests while WA5ZIB will continue with B runs.

Recently updated ZRO brochures are available from WA5ZIB, Andy MacAllister, AMSAT V.P. User Operations, 14714 Knightsway Drive, Houston, TX 77083 USA for an SASE with two units of postage or suitable IRCs. The brochure characterises test procedures, means for obtaining certificates and gives some historical background about the programme. Listener reports with date of test and numbers copied should be sent to WA5ZIB via. Amsat-UK. Reports will be returned verifying the level of accurate reception.

Oscar 10

This one's still currently available for Mode B operation when it is view. But as usual, *please do not* attempt to use it if you hear the beacon or the transponder signals FMing.

I also manage to get myself seen with the *HRT* editor!

MicroSats It's a different Oscar 22!

According to a US Army newsletter, a US Navy Transit Satellite known as Oscar 22, will be blasted in a test chamber by aluminium projectiles to simulate the effect of space debris collisions on a spacecraft in Earth orbit. The test will occur on the ground as part of a US Defence Nuclear Agency experiment.

The Oscar 22 spacecraft to be used in this experiment is a 'spare' satellite that was never launched. But it should not be confused with UoSAT-OSCAR-22 built by the University of Surrey!

STS-35 SAREX QSL Cards from A4SIR

The long awaited custom QSL cards commemorating the Ron Parise WA4SIR space shuttle flight should be sent out soon.

Space Symposium

As I write this, the annual AMSAT-NA Annual Meeting and Space Symposium has just been held in Los Angeles. It attracted similar numbers as the British Colloquium; over 200 people came from all over the world, and the following information came as a result of the meeting;

N4HY spoke about loading the speech software for DOVE, in this he emphasised the difficult nature of the task in the light of the hardware problem in the modulator for the S Band transmitter. This prevents automatic acknowledgement of packets and requires that the receipt of each packet sent be judged by ear by listening to a slight change in the S Band downlink signal. However, Bob feels that he will be able to have DOVE speaking in a few weeks.

Satellite:	PHASE-3D
Epoch time:	91080.00000000
Inclination:	63.4349 deg
RA of node:	225.0000 deg
Eccentricity:	0.6774378
Arg of perigee:	270.0000 deg
Mean anomaly:	0.0000 deg
Mean motion:	1.50000000 rev/day
Decay rate:	0.0e-07 rev/day^2
Epoch rev:	0001

Table 1. Possible Phase 3-D Orbital Parameters

Another paper was a study of possible orbital parameters for the PHASE-3D satellite. They have worked out what they believe are the optimal orbital parameters for an OSCAR; one of the major criteria in this study was an orbit that didn't require amateurs to make radical beam heading changes. Also, they wanted an orbit that would come up in the same place everyday, same time, and would have the same ground track. This led them to an orbit with a mean motion of 1.5 orbits/day, an inclination of 63.43 deg, perigee height of 4000 km, argument of perigee of 270 deg, and eccentricity of 0.677437757. Discover for yourself what this orbit would be like by putting the elements in Table 1 into your satellite tracking program, and see for yourself.

At the AMSAT-NA Board of Directors meeting the following officers were elected for the coming year: Chairman of the Board, Doug Loughmiller KO5I; President, Bill Tynan W3XO; Executive Vice President, Ray Soifer W2RS; Vice President Engineering, Jan King W3GEY; and Vice President Operations, Keith Pugh W5IU.

Amsat-UK News

If you were a member of Amsat-UK last year and you haven't renewed yet, get that renewal form out! Also if you use the amateur satellites, or are even just interested, then you'll find membership of Amsat-UK useful. As well as members benefiting from a discount on books and other information, the group prepare a bi-monthly journal 'Oscar News' which is devoted to the satellite aspects of our hobby. The cover of issue No. 92 shows a happy group of visitors to the annual Amsat-UK colloquium which the group organises (you'll find me there each year, with the HRT Tech Ed normally propping the bar up in the evening). Finally, thanks to whoever sent me a 3.5in disk with space news on it, there was no name on it hence the 'general' thanks!

For further information about Amsat-UK contact: Amsat-UK, c/o Ron Broadbent, G3AAJ, 94 Herongate Rd, London, E12 5EQ. A large SAE gets you membership info, and SWLs as well as licensed amateurs are most welcome.

Keplers

An extended number of satellite Keplerian elements this month, to update your tables of other satellites.

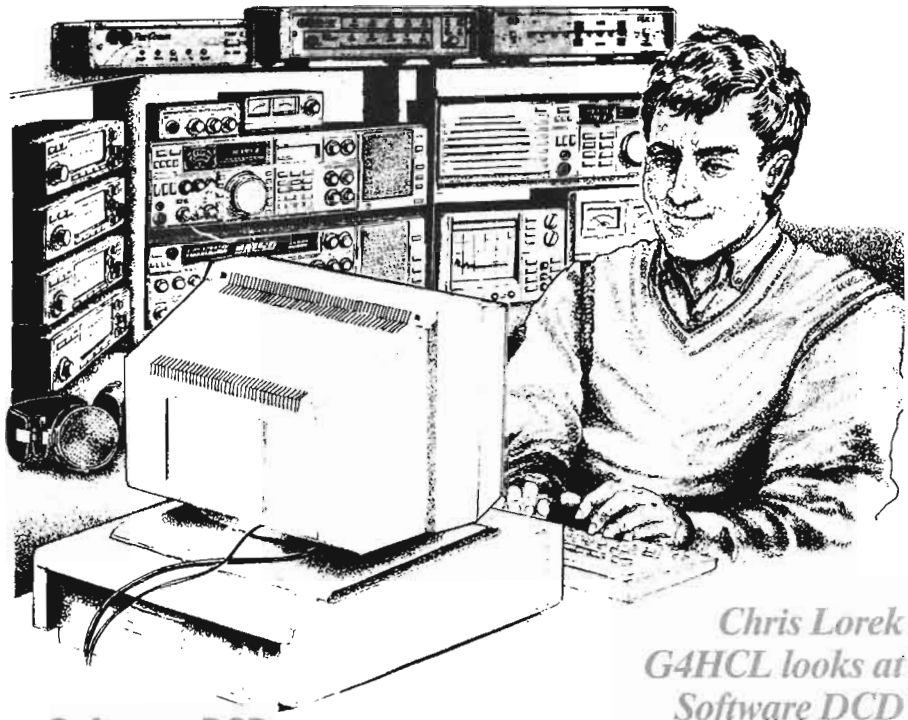
SAT:	OSCAR 10	UoSat 2	AO-13	UO-14	NOAA 9	NOAA 10	NOAA 11	NOAA 12
EPOC:	91312.44187316	91323.56626498	91310.60757627	91325.73792533	91325.82037333	91325.76960228	91324.21220559	91323.48303435
INCL:	25.9057	97.8784	56.7146	98.6556	99.1614	985528	99.0518	98.7203
RAAN:	115.4097	2.6201	62.2382	44.1963	343.0990	345.9173	280.3136	351.1087
ECCN:	0.6067273	0.0012732	0.7235702	0.0011885	0.0014565	0.0013403	0.0011048	0.0014289
ARGP:	291.5986	37.5725	269.3641	64.3029	345.8519	183.8141	256.3362	80.9563
MA:	16.1497	322.6366	15.2670	295.9357	14.2210	176.2937	103.6603	279.3223
MM:	2.05882356	14.67751126	2.09704227	14.29376639	14.13201185	14.24397178	14.12410204	14.21710163
DECY:	-7.2E-07	3.271E-05	-7.2E-07	7.66E-06	4.64E-06	7.72E-06	8.38E-06	9.02E-06
REVN:	3521	41223	2604	9549	35778	26898	16249	2682

SAT:	PACSAT	DO-17	WO-18	LO-19	Meteor 2-16	Meteor 2-17	Meteor 2-18	Meteor 2-19
EPOC:	91325.34410352	91325.45400891	91325.70043894	91325.52630091	91320.83636692	91320.44623678	91320.62464225	91320.81176400
INCL:	98.6620	98.6620	98.6619	98.6621	82.5555	82.5412	82.5228	82.5472
RAAN:	44.2490	44.4322	44.7293	44.6380	239.9439	299.2114	176.1286	237.7159
ECCN:	0.0013034	0.0013120	0.0013689	0.0013874	0.0010635	0.0016425	0.0015459	0.0014753
ARGP:	67.4112	67.3108	66.0207	67.1435	243.3104	317.3632	357.7392	280.4310
MA:	292.8406	292.9440	294.2406	293.1209	116.6967	42.6255	2.3677	79.5185
MM:	14.29453471	14.29558575	14.29578136	14.29657514	13.83865113	13.84557788	13.84209866	13.84042617
DECY:	9.37E-06	1.018E-05	9.09E-06	9.21E-06	4.41E-06	1.89E-06	3.83E-06	4.57E-06
REVN:	9544	9546	9550	9548	21457	19175	13714	7011

SAT:	FO-20	INFORMTR-1	UO-22	RS-10/11	Meteor 2-20	Meteor 3-2	Meteor 3-3	Meteor 3-4
EPOC:	91316.36319594	91319.88841553	91316.65612695	91325.41201369	91320.60995836	91319.89708669	91320.77152259	91320.82355020
INCL:	99.0469	82.9428	98.5319	82.9248	82.5287	82.5405	82.5539	82.5450
RAAN:	270.5212	121.5063	29.3621	302.6686	176.6608	271.8407	212.9099	116.7173
ECCN:	0.0541242	0.0034272	0.0006397	0.0013110	0.0013030	0.0017894	0.0016760	0.0018700
ARGP:	325.9272	194.8282	241.1285	106.2990	167.3180	99.5305	117.6862	33.0404
MA:	30.8161	165.1874	118.9312	253.9609	192.8308	260.7861	242.5963	327.1882
MM:	12.83196283	13.74430028	14.36305531	13.72233914	13.83420921	13.16935004	13.15967888	13.16692526
DECY:	7.9E-07	2.25E-06	1.446E-05	1.75E-06	3.13E-06	3.9E-07	4.3E-07	4.4E-07
REVN:	8256	3986	1702	22115	5728	15896	9902	2720

SAT:	RS-12/13	Mir	Meteor 3-5	Feng Yun1-2
EPOC:	91320.55459458	91326.01505528	91324.02152533	91326.03381737
INCL:	82.9237	51.6006	82.5575	98.9225
RAAN:	351.1524	215.1245	60.7089	356.1960
ECCN:	0.0027982	0.0004719	0.0014252	0.0016711
ARGP:	213.8196	124.7224	31.5265	95.2219
MA:	146.1176	235.3311	328.5078	265.0853
MM:	13.73943866	15.59231086	13.16781660	14.01167867
DECY:	1.95E-06	3.0191E-04	-2.01E-06	1.44E-06
REVN:	3906	32977	1272	6231

Packet Radio Roundup



Chris Lorek G4HCL looks at Software DCD

Software DCD

Many packet operators realise that when their TNC is receiving a signal, it automatically inhibits the station transmitter to reduce the possibility of a packet 'collision' occurring. This is done by the TNC's 'DCD' (Data Carrier Detect) circuitry, normally with a front panel LED showing the state of this. In the majority of current TNCs, this is triggered by an audio signal being present, whether this be packet data, CW idents, open squelch noise, computer 'hash' and so on. This means you simply need to set your receiver squelch correctly to open on valid signals, but remain closed the remainder of the time. Now this sounds fairly straightforward, but there are hidden problems.

Firstly, what about the opening time of your receiver's squelch. No receiver squelch can open at the exact time a signal appears, there is always *some* delay, whether this be a few milliseconds or a few hundreds of milliseconds. With some settings of TXDelay, this can cause problems. Let's take an example to illustrate. If you've set your TNC for a TXDelay of 30 (300mS), and allowing 100mS for the switching and rise time of your transmitter sending the packet signal, this leaves a 'preamble' of 200mS worth of packet signal going out on-air. If the distant receiver's squelch rise time is 150mS, then all is well, but if however it's 250mS the squelch simply takes too long to open up and doesn't correctly receive the first few bytes of packet information. The result? Not *one* packet is correctly received. If the receiver squelch is left permanently open, it'll receive almost everything, but the resultant squelch noise in the absence of a signal won't allow the system to transmit anything.

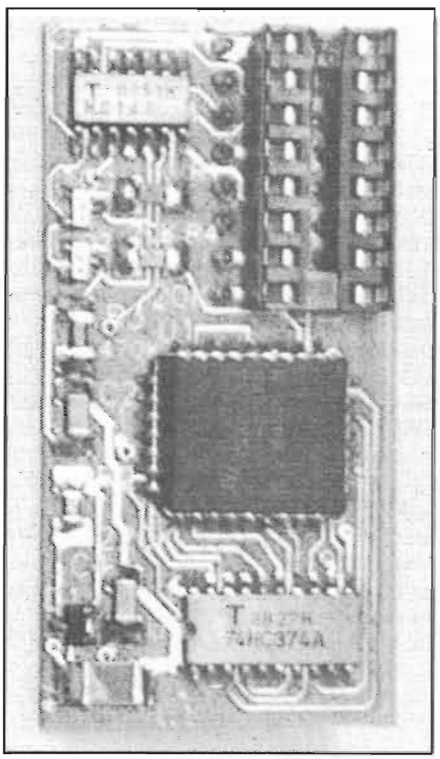
Secondly, how about an unattended station on a band such as 6m or 4m? The band noise may vary throughout the day, with the result being that you must 'wind the squelch up' on your receiver to remove the possibility of it being permanently open under any band conditions. This may stop it receiving weak signals even when they could otherwise be perfectly readable, but wind the squelch down to threshold level and you risk missing 'connects' to your station in your absence due to your transmitter being inhibited by an opened squelch over an extended period.

The answer? Instead of decoding simply any kind of audio, an alternative method is to decode only genuine packet tones as being valid data. We're now finding the occasional TNC with this fitted as standard, however for those without this facility an add-on 'State DCD' board is available for most common TNCs using a TCM3105 modem IC. This system has been mentioned some time ago in this column, and I make no excuses for mentioning it again as I get asked about it so often! To fit the add-on unit, you simply unplug the existing modem IC, plug the small PCB into the original socket, then plug the IC back into the empty socket on the PCB. Simple as that, and you may then just leave your receiver squelch wide open. I use this to very good effect on the 6m and 4m ports of the node system I run, allowing all signals that would be receivable, to actually be received.

Group of the Month — ClackPak

This is the packet radio user group of the Clacton Amateur Radio Club, hence the appropriate name! As I write this, their Chairman Terry G7DNS has today been in touch to tell us that the group's second project, GB3PKT which is a 10m packet beacon, is due to start operation at midday on 29th December 1991. This is the first packet beacon to be issued with an experimental licence by the UK licensing authorities, and indeed I'm told by Terry this is the first of its kind in the world. The intention is for other regions throughout the world to follow, with around 4 or 5 such beacons eventually in operation to provide propagation results for packet against other data modes. To conform with the licence conditions, the beacon will not acknowledge any connect request, apart from those from the beacon keeper (G0PKT) to remotely remove the weekly results. The beacon will operate on a frequency of 28.196MHz LSB, using a mark/space of 2110/2310Hz and will run 100W ERP, vertically polarised.

The group is entirely self-sufficient, their operating costs being met from proceeds of the rallies they help organise. Their next two rallies are scheduled for 23rd February in Clacton and 27th June in Brentwood, and ClackPak will have a stand at both events. With this 'self-sufficiency', the group is happy to provide the beacon, and their existing G0PKT-3/4 node system, to amateurs without the need for solicitation of subscriptions or membership requirements. If you'd like details on the group's projects, or of course the rallies, you can contact their Chairman Terry Lovelock



The 'State DCD' board simply plugs into your TNC.

G7DNS on 0255 222207, or Treasurer Tony Horseman G0MBA on 0255 422843, or via. the GB7DNS BBS run by Terry.

23cm Transceiver Kit

News from Tim G4WIM is that of his forthcoming 23cm transceiver PCB kit, of possibly significant interest to node SysOps. This will provide selectable 1W or 2W transmit power using a block module, the receiver using a GaAs front end for good sensitivity. Operating on 25kHz channel spacing it has the facility of five diode-programmed channels as standard and a total frequency coverage of 1280-1300MHz, making it useful for simplex packet links in the upper portion of the band. With minimal RF alignment needed through the use of the modules and ready made filters, this sounds just like the synthesised 2m and 70cm transceiver projects to be published soon in HRT. The double- sided PCB measures 125mm x 182mm to fit inside a standard die- cast box, and it's planned that a complete kit of parts excluding case and connectors should set you back around £180.

Tim says it is suitable for 1200 baud packet, but the synthesiser would need modifications to cope with 9600 baud use. You can contact Tim G4WIM @ GB7LWB if you'd like more information, packet node and BBS SysOps take note!

Network Extensions

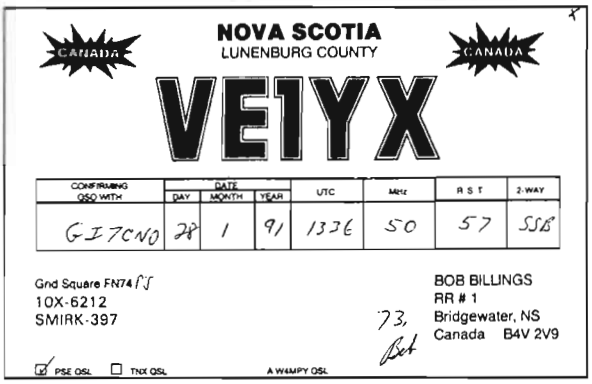
Dave G0OES is investigating the possibility of setting up a new DX Packet-Cluster to the north of Birmingham, and is trying to get an idea of the level of support, also of how it would fit into the network. Why not leave him a message on the Cluster system if you're interested?

As mentioned this month in Geoff GJ4ICD's column, together with the Isle of Wight packet group I'm currently setting up a long-haul 4m link from the Isle of Wight to the Channel Islands, it may even be on air by the time you read this. The system will also provide a local user-access port on 2m for Isle of Wight amateurs, and it will provide a further link on 23cm, using a high gain omnidirectional vertical aerial, with mainland nodes and BBSs along the south coast already linked on 23cm, 10GHz, and 6m. It looks like we're starting to get there in terms of extending the boundaries of 'real time' linking.

CTRL-Z, End of Message

That's it for this month. As always you can contact me either via. P. O. Box 73, Eastleigh, Hants SO5 5WG, by phone on 0703 262105, or on the BBS and PacketCluster network. So let's hear what *your* group are up to. Until next month, 73 from Chris G4HCL @ GB7XJZ.

VHF/UHF Message


NOVA SCOTIA
LUNENBURG COUNTY
CANADA CANADA
VE1YX

CONFIRMING QSO WITH	DATE DAY	MONTH	YEAR	UTC	MHz	R S T	2-WAY
GI7CNO	28	1	91	1326	50	57	SSB

Grid Square FN74 ∫∫
10X-6212
SMIRK-397

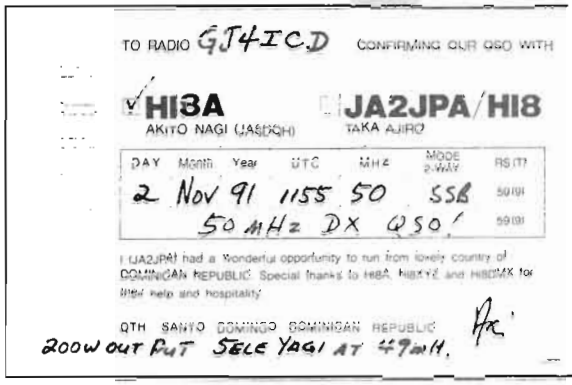
BOB BILLINGS
RR # 1
Bridgewater, NS
Canada B4V 2V9

73, Bob

☑ PSE QSL ☐ TNX QSL A W4MPY QSL

VE1YX QSL card

Geoff Brown GJ4ICD, reports on the big Aurora


TO RADIO GJ4ICD CONFIRMING OUR QSO WITH

HI8A AKITO NAGI (JA5DQH) JA2JPA/HI8 TAKA AJIRO

DAY	Month	Year	UTC	MHz	MODE 2-WAY	RS(T)
2	Nov	91	1155	50	SSB	59(9)
			50 MHz DX QSO!			59(9)

I (JA2JPA) had a wonderful opportunity to run from lovely country of DOMINICAN REPUBLIC. Special thanks to HI8A, HI8XYZ and HI8CMX for their help and hospitality.

QTH SANTO DOMINGO DOMINICAN REPUBLIC

200W OUT PUT STELE YAGI AT 47m H.

QSL from the Dominican Republic. I've been waiting two years for this one!

Just as last month's column was being written, a very large Aurora took place, so I have some interesting reports on the activity 'further down the log'.

First comes a note from Derek GI7CNO, who you may recall has done extremely well on 50MHz with his 200mW. In fact, being so successful has caused a few people to doubt his claims! Derek however has supplied HRT with the QSL card from Bob Billings VE1YX, clearly showing the report of 5/7 on SSB, maybe this will silence the disbelievers.

General Propagation in November

Starting with the lowest frequency band, 50MHz saw good F2 openings along the southern TEP. The band opened up to the VK6 area many times in the earlier part of the month, and VK6PA became just like a local station, appearing regularly day after day. F2 openings also occurred to the west, to the Caribbean and North/South America, with Sporadic E also on many days throughout the month.

Aurora was in full swing in early November on 6m, 2m and 70cm, and a severe disturbance from the sun in early November brought one of the year's best auroras. I'm usually busy working 18 hours a day at that time of the year, so unfortunately I missed out on this one. Towards the end of November the solar flux levels fell, and the 'A' and 'K' indices became quieter, so did the bands!

50MHz died a death from around the 27th with little enhanced propagation reported. Apart from the 9L1, ZD8, and V51 beacons heard from time to time, the whole world was reporting a down trend of F2 activity. Towards early December solar flux levels started to climb again, from the 130s to a level of 209 on the 8th and still there was no propagation of any distance reported. This is more than likely because the 'prime sun angle' has passed, but this should be back with us for the spring equinox in Feb/March proving again that we are 'missing a vital factor' in order to determine reliable propagation on this band.

144MHz Report

As noted earlier, aurora was in full swing here, 144MHz QSOs reported into the UK including IK3ITS, SP5, DL, PA, OZ, SM, and LA, even 432MHz was getting it's fair share of aurora with G8GXP reporting G4CVI on the south coast at S9+A. Even on the 8th Dec there was again a report of an aurora in progress.

Dave G0DJA (Yorkshire) reports on his activities during the month, Dave tells us; "The aurora occurred on the night of Friday 8th to Saturday 9th. This should have been the last 144MHz CW cumulative, but it was a little difficult making 'contest' QSOs with an aurora in progress". However, Dave did work GI4KSO and F6DWG, together with many PAs and DLs on the 8th. On the 9th December Dave continued with more DLs, PAs, HB9s, and OZs, and the GB3LER beacon on 2m ranged from 52A to 59A during the period. Continuing to burn the midnight oil, Dave made it with SP4MPB who was 59A, and had a very large pile up on him (you guys up north are very lucky with aurora) with more DX worked in the shape of EI and OK.

Ela G6HKM also joined in the fun on the 8th and 9th working many stations on 2m, including SM7RZF (JO65), SM6TZL, OZ7APX (JO66), lots of DLs and PAs, plus GM and EI. Apart from the aurora, general conditions on 2m and 70cm were down somewhat on previous years, tropo events are not what they used to be. I did however receive a report that G3LQR worked into HG in late November/early December on 70cm!

50MHz Happenings

Early November was dominated by the massive opening to South America in last months column, but Ela G6HKM had missed my deadline due to my pressure of work. Ela had a very good day on the 2nd with WA4RLO/PJ4, LU8AJK, LU3DCA (GF05), CX8BE (GF15), PY3DSC, PY2ZS, and PY2DJC (all in GF66) being worked. Others heard were PY0LSB, PY2OZF, PY2GR, HC5K, PP5WL, and PY2PD, some signals being S9+. The 5th brought 'Es' QSOs with OE4WHG (JN87), YU3EA (JN76), IV3VFP (JN66), and I7CSB (JN71). On the 6th, KP2A was coming into GJ along with W6JKV/PJ7, I also worked HC5K at S7.

The 7th was unusual to say the least. I received a phone call from Chris G3WOS, tipping me off that HS5SEA (Thailand) was on the band working JAs, and that nobody could break the pile-up. I worked VK6PA at S9, and VK6JQ at 599 at 1000z. The morning of the 8th brought JAs into the UK and later an 'Es' opening to 4X1IF, this occurred during the very large storm on the sun. I worked VE1YX via. backscatter or sidescatter at 240 deg, and then the path went direct to W1/2/3. This was the time I went QRT, just as the very large aurora started!

Ela had better results on 6m than 2m during the aurora, accomplishing 54 QSOs in all with LA, DL, F, G, GD, GU, OZ, PA, and SM with a couple of new squares being added, these being SM6HYG (JO58) and DL5BBL (JO42). On the 14th, ZD8VHF was in at S3 on its frequency of 50.0325MHz, and later that day VE1YX and VE1XDX were worked via F2.

The 10th brought VK4s into the UK, and later around 1130z a TEP opening to 9L1, TR8CA, TU2OJ and 'Es' to CN2JP. During the next few days openings occurred to VK6, JR6, KG6UH/DU1, W6JKV/PJ7 and weak VE/W signals were reported. On the 14th things were much more lively, at 1330z there was a big opening to W1/2/3/4/7/8 with very strong signals reported all over the UK. The 21st was another exceptional day, with HC5K working VK8s at 1200z when the 'K' index was at 5!

Another massive opening took place on the 23rd, with a new country for many operators in the shape of YN1CC. Others reported that day were FY3 and HI8A, and CO2KK was also worked from northern France along with an XE in Mexico. On the 25th VK3OT was reported by G3WOS in Hampshire, and later at 1145z the FY7 beacon was logged at S3. Things then took a dive, in fact as I write this, to date no major openings have occurred on 6m, so it looks very bleak for the next few months. But you never know what can transpire on this strange band, as I have just had a report of HC5K into the UK.

Beacon News

Mike VE1XDX informs me that he has found some equipment to put a 50MHz beacon on the air. This will have the call VE1DXA and will be located in grid square FN85, hopefully this should prove very useful for double hop 'Es' openings in the summer of 1992. GJ3RAX is currently building the logic/keyer board, which should be ready by the new year.

An agreement between Lawrence GJ3RAX and myself to build and supply five 50MHz beacons has now been finalised. Lawrence will build the logic unit and pre-driver, and I will finish off the rest of what is needed with filters and driver/final. The costs are being born by myself towards the studies of 50MHz research, any contributions?

2m EME

Richard G4CVI has responded to the HRT Editor's 'arm twisting' techniques mentioned earlier in this column regarding my request for news of stations worked on EME. To show just what can be achieved, on the 23rd November Richard received the following reports; K1FO 449, SM4IVE 549, N4GJV O, OH2PO O, DL9KR 559, PA3CSG 559, F1FEN 449, F1FHI 559, LA8LF 549, UT5DW O, DF3RU O, F9FT 439, OZ7UHF 549, HB9SV O, OE5JFL 559, and F6KSN 529. Going into the morning of the 24th gave DK3BU O, WA9FWN O, WB0TEM 559, W7FN 549, and a brief spell in the evening gave JA2ORP O and RB5LGX O. Makes the mouth water doesn't it? Richard runs an FT- 1000 feeding a transverter, an MGF1412 masthead preamp, LDF550 heliax feeding four 35 element DL6WU yagis on 10m booms, phased using rigid airspaced lines. The PA is an 8938 (a coaxial 8877 1500W anode dissipation triode), producing 1000W at the aerials.

VHF Convention

A note for your diary is March 14th, this is the National VHF Convention at Sandown Park, Esher, Surrey. There will be the usual trade stands, lectures, plus the AGM of the UK Six Metre Group, and no doubt Chris G4HCL with his camera gear. I of course as always will be there to meet you all in the bar for a pint.

4m Access to South Coast Clusters

News from Chris G4HCL is that he will be extending the coverage of the GB7SMC DX Cluster, this having been originally placed on the air primarily for VHF/UHF propagation reports. This will be done by installing a 23cm link node at the superb site of St. Boniface Down on the Isle of Wight, linking GB7SMC up with other southern cluster nodes on 23cm including GB7DXS and GB7DXH. Also planned at St. Boniface is a co-sited node on 4m beamed towards the Channel Islands, great news for us foreigners down here! *(It's all a contrived plot to get Geoff linked into all these 6m/2m/70cm DX 'spots' — Tech Ed).*

That's it for this month. Please send your VHF/UHF news (I must have my column prepared by the 10th of each month, so any reports must reach me at least a few days before then) to me Geoff Brown GJ4ICD, TV Shop, Belmont Rd, St. Helier, Jersey JE2 4SA Tel. 0534 770067 or 0860 740727.