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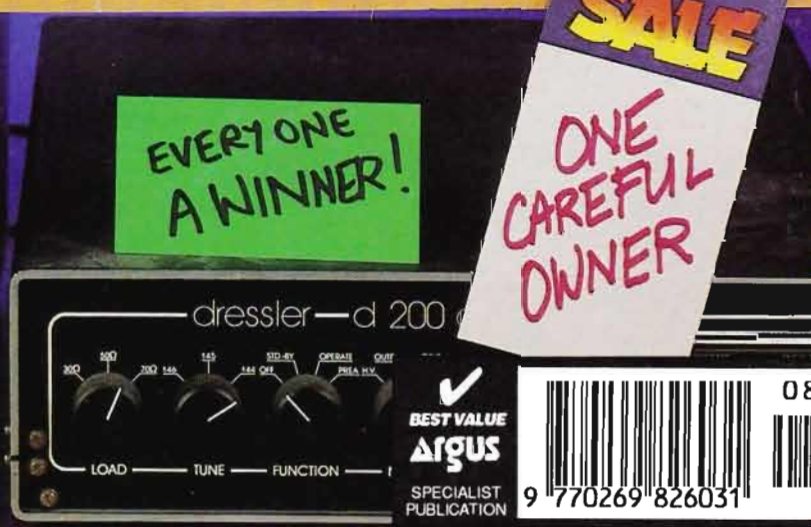
What to look for
and where
to get the
best bargains.



ALINCO
DJ-180EB
VHF HANDHELD
REVIEWED



Build a 'pen sized'
transmitter for
worldwide
communication!



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VOLUME II NO.8 AUGUST 1993

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Left; Alinco DJ-180 2m Handheld reviewed

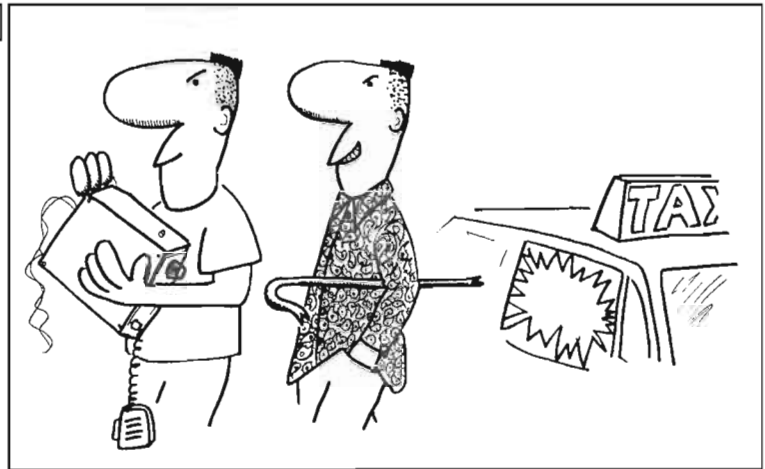
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Below; Bearcat BC700A mobile scanner reviewed



CQ de G8IYA Editorial

*'Ere mate, wanna cheap rig, fell of
the back of a lorry'.....*



'Surplus' PMR gear?

The other day, I overheard a couple of amateurs on my local repeater 'swapping tales' about the antics various thieves got up to in stealing things from building sites. The conversation was obviously rather comical to both of them, as each laughed as the other describing one method or the other of stealing. Very funny. I wonder if they'd be laughing if they were the owners of the gear that had been stolen. Maybe the rig from their car, or the latest HF transceiver from their house.

Surplus PMR gear, not worth stealing?

I often hear the comment 'I like to run just a surplus ex-PMR rig in the car, it isn't worth stealing'. This, of course, is often true, as the gear is so cheap and often doesn't look anywhere near as tempting as the latest shiny black box full of bells and whistles that's also difficult to use on the move.

The Tech Ed's car was stolen several years ago, complete with rigs installed. The humorous part of this was the call on S20 by the arresting policeman "Gee 81 YA, Gee 81 YA, this is..." using the installed 2m rig with my callsign Dymo- taped onto it, the 2m QSO that resulted was quite 'unusual' to say the least. The two young thieves, who were caught 'red handed', didn't think it funny when they were both slung into Borstal.

Watch out, there's a....

This month you'll see a feature on buying secondhand amateur radio equipment, which tells how you can guard against inadvertently being on the 'receiving end' of stolen rigs. For example, if the serial number's missing, or it's been obliterated, don't touch it. You may also like to inform the police of this 'reasonable suspicion', or if you see this at a rally, contact the organiser

immediately. The last thing they want is to be 'tarred' with unscrupulous dealers.

But what if you're offered a 'too-good-to-refuse' bargain one day. There's the problem that stolen gear can be offered as 'genuine' with 'genuine' serial numbers. The thing that should put you on your immediate guard is if it's being offered very cheap. One way of checking is to make a note of the serial number and call the UK distributor of that model, asking for a 'serial number check' to be made. Most dealers are happy to do so as a service if they do indeed keep such records, especially if you call back later at an agreed time.

Likewise if you have some equipment stolen, it would be worthwhile letting the relevant UK distributor know, together with details of any missing items such as the mounting bracket, power lead, manual, etc. The reason for this is that the thief may very well get in touch with them, from the postal area it was stolen from, to purchase such 'missing' items. More than one set to my knowledge in the past has been recovered by following this route! I'm sure the dealers would also welcome the information for their own purposes, they certainly wouldn't like to unwittingly purchase a stolen set!

Central register

This 'ad hoc' method of serial number 'recording' by dealers is all well and good, but a better method would be a central coordination point for details of such stolen gear. The Australian national amateur radio society has a 'stolen equipment register', and they periodically publish this in their journal. Some UK amateurs have tried to do this in the past, including a commendable effort by the late Brian Smith G4NKH in conjunction with his secondhand equipment guides. This requires a great deal of time, and ac-

cess to good database and list distribution facilities, as Brian had, plus cooperation from amateurs and traders.

However, after contacting Pat Lee G0IWL, I found that there's still hope, as Pat intends to 'carry on' Brian's pioneering work. He told us he intends to put together a list each month, which will be a compilation of the description and serial number of all known stolen amateur radio equipment. He'll have all this on a computer file, and plans to upload the text of this into the 'files' area of his local Packet BBS, GB7FCL, for local and semi-local users. Together with this, he hopes to publish the list for amateurs to use as a 'look-up' reference who don't have access to the packet network round his area, in his monthly 'Radio Amateur Advertiser' which details secondhand gear. This really is a welcome move, something I applaud, well done Pat.

You can contact Pat most times of the day on 0253 407437, or by post to Technology Partners, P. O. Box 6, South Shore, Blackpool FY4 4YG. If you'd had some gear stolen in the past, or are unfortunate to have this happen to you in the future, drop him a short description with serial number in the post. This way everyone wins, except the thieves, and you stand a far better chance of seeing justice done.

As a final point, you may already security-code your car radio and windows, your hi-fi, video and so on, why not your amateur gear? UV marker pens are readily available, and more 'permanent' methods are also available. The set in my car has been engraved on its rear panel with ownership details (thanks to my local police who provided this as a free service).

The 'long term' result of amateurs doing this, and supporting a 'central register', will hopefully mean less amateur radio gear is stolen, simply because more people will be wary of purchasing or even owning it. Let's hope this happens.

LETTERS

Letter of the month

Dear HRT,

I am writing to say how much I enjoyed reading the May issue of HRT. I had not seen it for a long time since I allowed my subscription to lapse. I have today taken out a new subscription. I so enjoyed reading HRT I almost missed my stop on the tube having purchased HRT at Paddington Station!

Your Editorial on the cost and availability of RAE courses and exam facilities struck a chord with me. When my wife Lindsey (G7IYH) and I wanted to study for the RAE three years ago, we found it impossible to study at a convenient place or time, i.e., after work and not too far from home. Instead we studied at home using George Benbow's 'RAE Manual' and two books of exam questions and nothing else. Although this is not possible for would-be novices who must study by attending a recognised course (a possible disadvantage of the otherwise excellent novice licence scheme), we would recommend this approach to others. It is very flexible and not as difficult as it might seem, but best done with someone else, you can help to encourage each other, solve those more difficult questions and provide an element of competition.

Taking the exam locally was again impossible, so we opted to go to the City and Guilds in central London, not a particularly cheap or convenient option even for those living in or near London. For those of school age without income or transport there is real difficulty. I suggest that all radio clubs consider establishing an 'education/training fund' to assist junior would-be amateurs to train and take exams as well as to continue to provide practical support by way of a meeting

place for courses, lectures, and advice. Traders may also be keen to offer financial support, in the long run the more amateurs, the more customers!

I'm looking forward to the next issue of HRT now.

Nick Hobbs, G7IYG

Editorial comment;

The HRT Consultant Tech Ed did indeed 'swot up' for his RAE purely from George Benbow's excellent books the 'RAE Manual' and 'RAE Revision Notes', (the HRT Editor did it from an informally-run course with one established amateur teaching three ladies, who all subsequently passed the RAE!). In each case there was no local club who taught the RAE to would-be amateurs.

Following on from the Editorial you mentioned, one of the RAE students on the course in question got in touch to tell us the course tutor had no idea that external candidates were being turned away by the educational organisation, and that he was quite surprised. In the back of my mind I quite believe he might even have been saddened by his employer's attitude in turning would-be amateurs away by not letting them sit the RAE without paying to go on the course they run. On a happier note, I'm very pleased to report that I've had a veritable 'stack' of letters from clubs who've now set themselves up as RAE exam centres, more power to your elbows lads! If you're reading this and wish to become an amateur, take a look in the 'Club News' in this month's HRT and get in touch with your local club. If it's not listed, they're obviously not dynamic - if you manage to find them somehow then let them know they're missing out on new members! Let me know as well, I'll be pleased to drop their secretary a line to 'give them a boot'!

Dear HRT,

Thank you for printing my letter regarding the ex-PMR club. I would like to ask you if you would be so kind as to ask readers if they would write out a list of the information that they have, such as what manuals they have, circuit diagrams, how to mod sets, crystal multiplication factors, intermediate frequencies etc., on receivers, transceivers, test equipment, etc., and how much they would want per photocopy including P&P. If they would send me this information with their address, I will keep it on file, then if someone wants a circuit, for example for a Pye SG-3U signal generator, they could write to me. I could look it up, and say so and so has one, send him a cheque for X amount, here is his address, instead of ringing all over the UK, waiting for weeks sometimes months as I have done in the past.

Someone out there has the info someone else is looking for, if we can bring both parties together so much the better, after all this is what amateur radio is all about. Thanks again for a superb mag, and keep up the good work.

Bob Gant, G0LXP

Editorial comment;

Bob wrote to us telling us he was interested in starting a ex-PMR club. He's willing to do all the work of collating all the information, i.e., keeping a register of who has what sort of item, spares, drawings etc., even to keeping photocopies for people's use. So, if you have any information at all on ex-PMR radios that you could offer him, or if you are willing to help, Bob's address is; 25 Worcester Ave, Garstang, Preston, Lancs PR3 1FJ. Please enclose an SAE of a reasonable size if you require a reply. See also the monthly HRT 'Helplines' in the Free Readers Ads section for amateurs offering help on this.

£10 for the Letter of the Month

Do you have something constructive to say on the state of amateur radio today? Perhaps you'd like to put your viewpoint to the readers, get some discussion going, or give an answer to one of the issues raised? We'll pay £10 for the best letter we publish each month. So write in with your views, to Letters Column, The Editor, Ham Radio Today, ASP, Argus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, or fax your letter on 0703 263429.

"TONE" BURST



By G6MEN



Dear HRT,
Do you plan to do a conversion article on the Pye MX290 series of radios soon? I would like info or conversion details for the MX296 UHF radio, especially the EPROM details for 70cm conversion. What about the PFX handheld, anything on that in the pipeline?

Most impressed with the conversion articles so far, keep up the good work, it's provided interesting and instructive winter evenings so far. MORE PLEASE!
Tony G4CJZ

Editorial comment;
Tony's letter is typical of the many we receive each month. To give you a 'taste' of what's to come, we have a PFX conversion sat here for publication, we're just waiting for the author to provide the required PROM 'stored data' details for the 70cm band, and a 'ready blown' PROM service will also be offered. As for the MX294 and MX296, we've complete conversion details ready for getting these rigs onto 4m, 2m and 70cm using a 'sub board' housing an easily-obtained EPROM to replace the (hard to get and hard to program) fusible-link TTL PROM normally fitted, again a 'ready blown' EPROM service will be offered. If that's not enough, we have a synthesized Storno 5000 conversion here all ready for publication, and coming up are conversions for the Motorola MT500 and MT700 handhelds to 2m and 70cm. Maybe if you add the comment 'please let us have more pages in HRT' in the Reader's Survey this month we'll be able to get them all published even quicker!

Dear HRT,
I am the proud owner of no less than three Pye 290 series PMRs, each of which I am currently converting to 2m, 4m, and 70cm. All thanks to your marvellous articles in the recent issues of HRT.

Many many thanks again to you and HRT.

Martin Russell G0CAK

Editorial comment;
Thanks for your letter Martin, it's nice to hear from amateurs who've managed to get themselves 'kitted out' without spending a veritable fortune on oriental 'black boxes'.

Dear HRT,
I am writing at the risk of promoting new blood into the hobby through the back door.

Amateur radio is not my main 'hobby', that being Hang Gliding. During cross country flights, sometimes large distances from the launch point, communications between pilots and the ground becomes limited to the vast majority of glider pilots, who do not have access to expensive airband radios or the licence to use them. This is not only apparent in the UK, but when gliding abroad. What simpler solution to the problem than amateur radio 'air mobile'. Not only does it serve to introduce a large block of people into the hobby it leads to greater safety both in the air and quicker cheaper retrieves.

I hope that the RA have the foresight to realise that not all the would be-users of an air mobile station are tied up with monitoring sophisticated instruments that are prone to errors due to spurious emissions as some would have us believe.

E. Peacock, G7JVJ

Editorial comment;
Equipment fitted in many vehicles, when used as a 'mandatory fitment' e.g., for life-saving purposes, must be approved to a relevant technical specification as well as being used by or under the supervision of trained operators. This is one reason why the RA say, for example, that CB equipment on pleasure boats is no substitute for a VHF marine radio.

Amateur radio gear currently doesn't need to meet any mandatory specifications whatsoever (and homebrew gear isn't likely to need to do so in the foreseeable future), and 'full licence' amateurs don't even need to be trained in on-air communication! But we take your point that amateur communication could be a useful 'adjunct' to the hang gliding hobby. Once landed, communication using amateur radio back to the mobile 'retrieval team' could be quite useful! What do other readers think?

Dear HRT,
Since the nature of where, when, and to whom we pay our annual licence fee changed, I have read of the many and varied 'blunders' that have come out of this new (?) concern.

Question; they aren't related to Jeremy Beadle by any chance, are they? Or maybe they're trying for the top spot on Clive Norden's 'It'll Be All Right On The Night' show?

It's my turn this time. Not only has the renewal form arrived two days after the due date, they've even managed, and do not ask me how, to lose the direct debiting mandate that I signed and returned to them in April 1992. I can understand 'teething troubles' and suchlike, but they have not got it right yet. I personally wonder if they are brain dead, or is it just that they can't read and write?
J. D. Bolton, G4XPP

Editorial comment;
We've also heard several other 'horror stories', and we're beginning to wonder when the 'teething troubles' will cease. The RA tell us they are actively seeking feedback from amateurs about the performance obtained from SSL, they've already had a number of comments. If you get no joy from SSL, the people to write to are the RA, their details in the 'Contacts' section following 'Club News' each month.

Alinco DJ-180 Review

Chris Lorek G4HCL tests a beginner's rig at a beginner's price

The DJ-180 from Alinco, selling at £209, has been around for several months now, this being a relatively low cost, 'simple to use' 2m handheld. However a couple of weeks ago I was asked "How does the DJ-180 cope on the air with all the other strong signals around? No-one's done a technical review yet and measured this". "True enough" I thought.

'Beginner's rigs' are often thought to be limited in performance as well as features, and this is often a very mistaken assumption, some 'top of the range' portables even 'curl up' receiver-wise when you connect an outside aerial. In fact I just couldn't use one such set at all from home, it seemed to hear everything *apart* from 2m signals on it! Likewise, I was recently walking across Waterloo Bridge in London with a 70cm handheld, and *every single channel* switched to had a signal on it, and they certainly weren't amateur conversations. Not much good when you're trying hard to have a QSO!

So, while I was at the RSGB's NEC show, I managed to 'twist Jeff's arm' at the Waters and Stanton stand (the UK importers of Alinco equipment) into loaning me one for a couple of weeks to

'play with'! I'm told that a 70cm version at a similar price is also 'on the cards', this having identical operating features, which could be very attractive for novice use.

Features

Measuring 132mm (H) x 58mm (W) x 33mm (D), the DJ-180 is a compact hand-sized rig, and with the supplied 7.2V 700mAh nicad pack it puts around 2W out on transmit, with a switchable low power level for local contacts. If you'd like more power, you can buy an optional (larger) 12V nicad which increases the TX power to around 5W, likewise an optional 'DC in' adaptor for running the set from an external 12V source.

As well as covering the 'normal' 144-146MHz in selectable tuning steps 'as standard', by pushing a couple of buttons whilst switching you can extend the tuning range (on receive and transmit) to 130-174MHz.

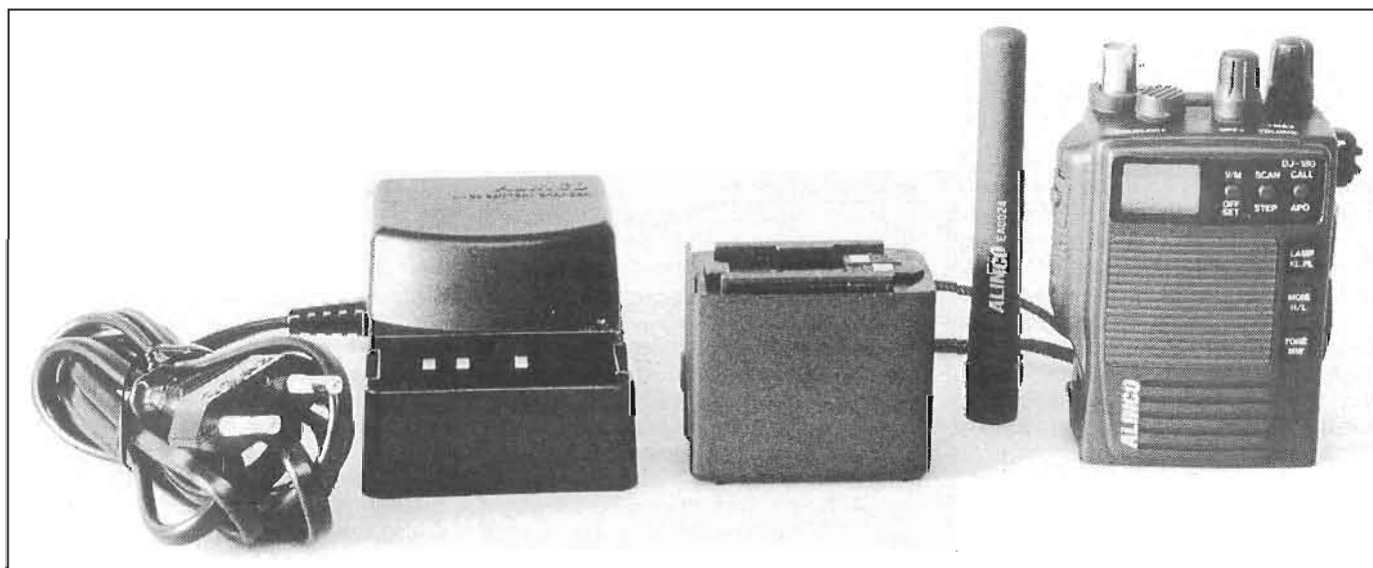
A smart 'pod type' nicad charger is supplied for overnight charging, and a carry strap and metal belt clip are provided as carrying aids. A user manual complete with circuit diagram com-

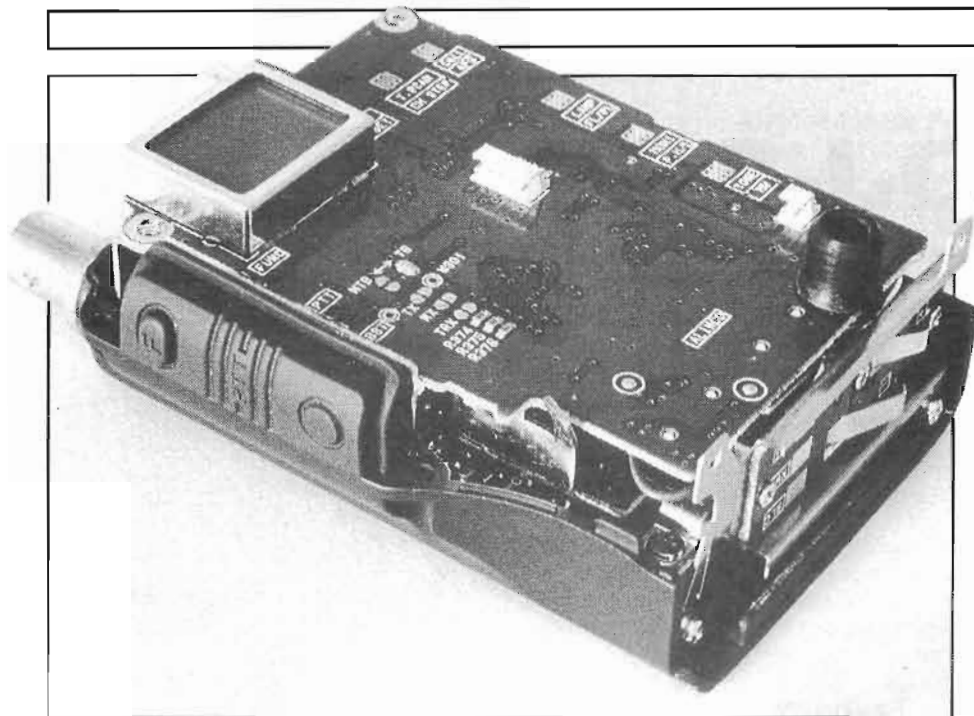


pletes the package.

Controls

The set lives up to its design goals of being easy to operate, with a top panel click-step rotary control controlling the tuning, and the large on/off/volume knob supplemented by a





smaller 'low key' squelch knob, this designed to be pre-set and thus not accidentally knocked. Three dual-function buttons next to the LCD frequency display control VFO/Memory channel switching, 'scan' initiation, and 'Call' channel selection, the latter recalling the information you've programmed in memory channel 0. The 'second functions' are activated by pressing a raised section above the PTT bar, these control repeater shift, channel step programming, and 'Auto Power Off' which automatically switches the set off after a period of no activity to save your batteries going flat.

Three larger buttons along the right hand side of the case again provide a dual function each, controlling the LCD backlight, squelch 'defeat', high/low transmit power, keyboard and PTT lock, optional CTCSS tone switching, and memory channel programming. And that's it, nothing else to worry about – easy eh?

Memories

Ten memory channels are provided as standard, although if you'd like more you can internally fit optional 'extender boards' at £19.95 for 50 channels and £25.95 for 200 channels, the latter providing more channels than any handheld transceiver I've come across to date! All of the memory channels store the frequency, repeater offset, plus the CTCSS tone frequency and status if you've added the optional CTCSS unit at £34.95.

On the air

Well I didn't even need to open the

instruction book before I was having my first contact. Yes, the set *is* easy to use, in today's age of buttons-with-everything this can be a welcome relief to those without a degree in microprocessor technology!

A press of the 'scan' button set the rig off looking for signals, halting for up to 5 seconds each time it found one, this letting me have a quick 'look over' the band after switching on. I'd have preferred this '5 second delay' to have been selectable between that and simply halting when it found a signal until it disappeared, but I suppose this would have gone away from the idea of being 'simple to use'. I found I could look at the LCD from quite a few angles (unlike some other sets), and the backlight illumination after pressing the relevant button was very good, although this didn't light any of the buttons or their functions.

The audio from the set's internal speaker was quite 'punchy' for it's small size, this let me to use the set quite well out of doors without the need for an earphone, and reports on my transmitted audio were quite reasonable. Out and about, walking around the woods outside my home which gives me 'fringe' coverage from two semi-local 2m repeaters, I found the set to be reasonably sensitive although not overly so, however the 2W output just wasn't enough to allow me to have reliable QSOs. Connecting a longer helical helped quite a bit, and the supplied helical is a nice short size at just 100mm long so I must make allowances here.

At home, with the set coupled to a rooftop aerial, I could, of course, access repeaters near and far as well as being

able to have plenty of simplex QSOs, yet not once did I have any problems from other strong signals on the band – very good for a moderately priced set where some manufacturers are tempted to 'skip' on the internal circuitry just to add a few more 'bells and whistles'. Even with the rig in my hand and standing just 100m away from the aerials of my local 2m packet node operating away on 144.675MHz, I could still hear the Portsmouth 2m repeater on R7, rather weak as usual, coming through without any desensitization.

I briefly tested the set on packet, which although all worked OK immediately after I switched on, I found I couldn't disable the battery 'economizer' which often cased the first part

of some packets to be missed. This again is a 'minor' point, and again if this were selectable it would have increased the complexity of the set.

Lab Measurements

These showed the DJ-180 was certainly was a 'mean performer' in terms of both its receiver and transmitter. The receive side was, in fact, quite sensitive when coupled to a signal generator, and the transmitter was putting out a reasonable amount of power, so the poorer 'on air' results were probably due to the losses in the short set-top helical, which probably isn't surprising! In all, quite a good technical performance.

Conclusions

I had fun using the DJ-180, it was easy to use, and should, I believe, appeal to amateurs who don't wish to be confronted with keypad buttons and display functions galore. It had a good technical performance, and the 10 memory channels can be expanded by fitting optional units should these not be enough for you! The DJ-180 is currently priced at £209, and my thanks go to Waters and Stanton Electronics (Tel. 0702 206835) for the loan of the review set.



LABORATORY RESULTS:

All measurements taken using fully charged 7.2V nicad, high power TX, otherwise stated.

RECEIVER;

Sensitivity;	
<i>Input level required to give 12dB SINAD;</i>	
144MHz;	0.15µV pd
145MHz;	0.15µV pd
146MHz;	0.15µV pd

Adjacent Channel Selectivity;	
<i>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;</i>	
+12.5kHz;	36.8dB
-12.5kHz;	44.5dB
+25kHz;	69.6dB
-25kHz;	70.3dB

Image Rejection;	
<i>Increase in level of signal at first IF image frequency (- 42.8MHz), over level of on-channel signal, to give identical 12dB SINAD signal;</i>	
79.0dB	

Squelch Sensitivity;	
<i>Threshold;</i> 0.08µV pd (5.5dB SINAD)	
<i>Maximum;</i> 0.25µV pd (26dB SINAD)	

Current Consumption	
Standby, squelch closed;	49mA
Receive, mid volume;	104mA
Receive, max volume;	195mA

Blocking;	
<i>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;</i>	
+100kHz;	84.3dB
+1MHz;	95.1dB
+10MHz;	96.8dB

Maximum Audio Output;	
<i>Measured at 1kHz on the onset of clipping (10% distortion), 8 ohm load;</i>	
225mW RMS	

TRANSMITTER

TX Power and Current Consumption;			
Freq.	Power	7.2V Supply	13.2V Supply
144MHz	High	1.88W/725mA	5.30W/854mA
	Low	370mW/303mA	390mW/308mA
145MHz	High	1.93W/712mA	5.45W/868mA
	Low	370mW/306mA	390mW/307mA
146MHz	High	1.97W/730mA	5.50W/897mA
	Low	370mW/308mA	390mW/309mA

Intermodulation Rejection;	
<i>Increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;</i>	
25/50kHz spacing;	73.6dB
50/100kHz spacing;	71.7dB

Peak Deviation;	
5.41kHz	

Harmonics;	
2nd Harmonic;	-63dBc
3rd Harmonic;	-70dBc
4th Harmonic;	-69dBc
5th Harmonic;	<-80dBc
6th Harmonic;	-76dBc
7th Harmonic;	<-80dBc

Toneburst Deviation;	
3.76kHz	

Frequency Accuracy;	
-116Hz	

QRP CORNER

Dick Pascoe G0BPS builds a pen sized HF transmitter capable of Worldwide communication!

The QRP gathering at Rochdale in the middle of October is the highlight of the QRP calendar in the UK, and for those who reside in the south of the country the gathering at Yeovil is also well worth a visit, I am told that this year's gathering was well attended and everyone enjoyed themselves.

For those others willing to travel, the gathering at Dayton Ohio is one of the best with over eight countries represented. The show itself is well worth a visit, but for the serious QRP operator the evenings at the hotel are the main interest. Many of the 'big guns' in low power operating turn up, and Randy AA2U (perhaps the first American QRP station that most Europeans will work first) drove for twelve hours including passing through massive snow storm to get to Dayton. Randy is getting very close to DXCC with power levels under one watt!

Many others came, from Australia, Canada, Russia, Sweden, Mexico and of course the UK and more.

The G-QRP club has had a presence at the Dayton Hamvention for several years, I've been for the past four years. The club takes a stand next to the (ARCI) American Radio Club International. This year the three stands were shared by ourselves, the ARCI, the Michigan QRP club, the Czechoslovakian club and a representative from the Australian club. Truly an international showing.

The Ten Tec Scout

There have been rumours about a new compact transceiver from Ten Tec for some time and I heard that it was to be called the 'Scout' just before I left the UK. I was very keen to see it and find out what it was all about. Readers may remember a couple of years ago we took the (then new) Argonaut II back to the hotel to try out in the hospitality suite. Randy AA2U, myself, and several others tried it out and not all of us were happy with its performance. Ten Tec decided to do a few mods.

This time they would not let the new rig out of their sight, certainly not into *our* hands to try out! It was obvious at the first sight of the PCBs that it was a prototype, the boards being un-tinned. The advert put me off as well. "The new Scout Transceiver, variable power, 5 to 50 watts out". Most readers will jump to the same conclusion that I did. This

rig will be of no use to the QRP man if it will not go below the 5 watt level. We were assured though that there was to be a QRP version in the very near future.

This new Scout is a single band transceiver, with plug-in modules to change the band. These plug-ins are very easy to change, just pull out the installed one from the front panel and slot in another, a few seconds work. One nice thing they have added, the rig has both CW and SSB facilities, if the microphone is plugged in the rig will operate in the SSB mode, take out the mic to switch to CW! This radio is about the same size as the lapsed HW7/8/9 series.

The high power version will be available in the USA in early July for about \$500 supplied with one band module. Extra bands will cost about \$25 each. After speaking to a UK Ten Tec dealer, it seems that the manufacturers will be supplying this rig direct from the factory only, so the UK price will therefore be about the same as the dollar price, i.e., £500. The low power version will be a little cheaper and will be available in the USA in the autumn. Watch this space for a greater in-depth report when they reach the UK.

Pen Power

We are often reminded that the pen is mightier than the sword. This tiny unit proves this point yet again. A truly fun project for you to try out and even work a few locals, beware the original by K4TWJ managed to work from the USA into Australia on 30m. Power out will be in the range of 200mW which should be a fairly useful signal on 30m.

Imagine turning up at your local club with this and putting it on the air,

enter it into your club's construction contest or even take it to work and lend it to the boss!

The circuit is straightforward, a single transistor oscillator using a tine clock crystal with the supply coming from any tiny cigarette lighter, camera, or watch battery supplying 12 volts. The circuit is built 'ugly style', meaning without the use of a PCB, the components being soldered to each other. This method of construction is also known as 'bug style' as the resultant circuit often looks like a dead bug lying on the bench!

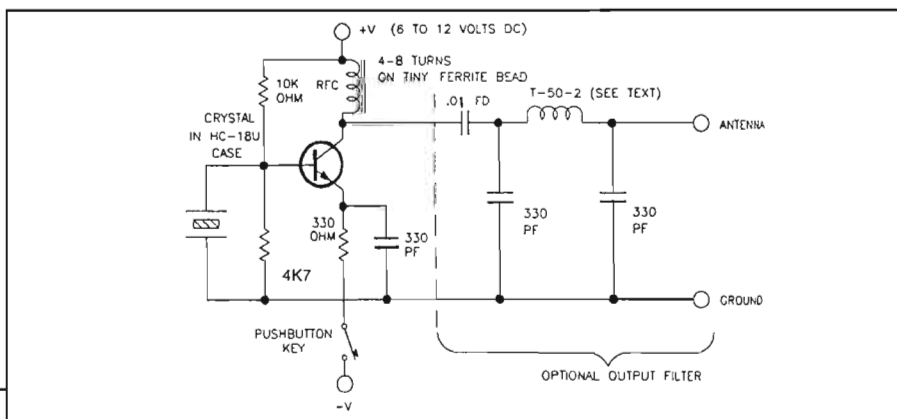
The inner works of the pen must be removed and a small push-to-make switch fitted to the top end. The aerial connection can be made at the other end, use whatever you have or can scrounge!

The internal wiring should be done with great care, as when putting the pen back together again the wires may twist and break.

The resistors may be 1/4 watt but 1/8 watt are much smaller, use the smallest capacitors you can find. As with all transmitters a low pass filter should be used. This will almost certainly not fit into the pen as the toroid required will be far too big, but not to worry, the transmitter will still work.

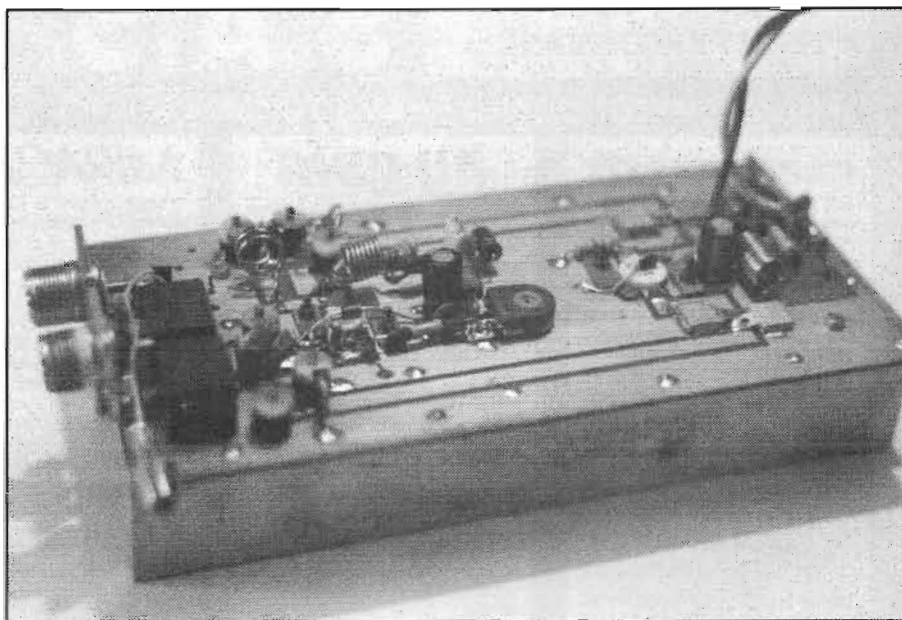
The LPF is shown inside the dotted lines and consists of just four components, the values as shown. The only other part that requires some work is the RFC which is made up of a tiny FX1115 ferrite bead with about 4 - 8 turns of 32SWG wire, each time through the bead equals one turn.

The components values shown are for a 30m version which is the best band for this type of unit. For 40m operation try changing the three 330pF capacitors to 470pF and add three turns to the toroid on the LPF.



A few years ago I built a transverter for the 6m band and joined the ever-increasing numbers using this new allocation. However, with only 0.5 W at the most, it was obvious that an amplifier was necessary. I quickly built a single stage amplifier using an PT8711 device. This produced about 15 W output. This was fine, and made all the difference, but as my aerial system gain was quite low (estimated at about 3-4 dB) I felt that some of the more marginal stateside contacts would be helped if the power was up to the legal limit of 20 dBW ERP. This would therefore require an amplifier producing about 50 W to bring the station up to the legal limit of 100 W ERP (i.e. 50W x 2 (aerial gain 4dB) minus 1 dB of cable losses).

This 5.2 dB increase in power could have been also realized by using better coax and a larger aerial, and would have had the potential advantage on



A 50W Amplifier for 6m

Geoffrey Pike G10GDP describes a 50MHz linear amplifier you can easily build – part two next month will detail the construction and tuning

the receive side also. The amplifier to be described can produce twice the amount of power needed, but because it runs at a lower level, the distortion products are much lower. However, should the licence requirements change, the amplifier can be run at the 90-100 Watt level. The semiconductors used will account for about 70% of the total cost of the amplifier, but still represents good value against any commercially available units.

Circuit description

The unit is basically comprised of two parts, a driver stage using an MRF233, and the output stage using an MRF492. If the driver stage is omitted then approximately 2.5 W will drive the MRF492 to 50 W output. However, as designed and shown, approximately 500mW will give 80 W output. Further drive will produce 100 W, but gain compression at this point is some 3 dB. The 1 dB compression point is at about 70 – 80 W, output and this is really the accepted upper power level consistent with a narrow signal.

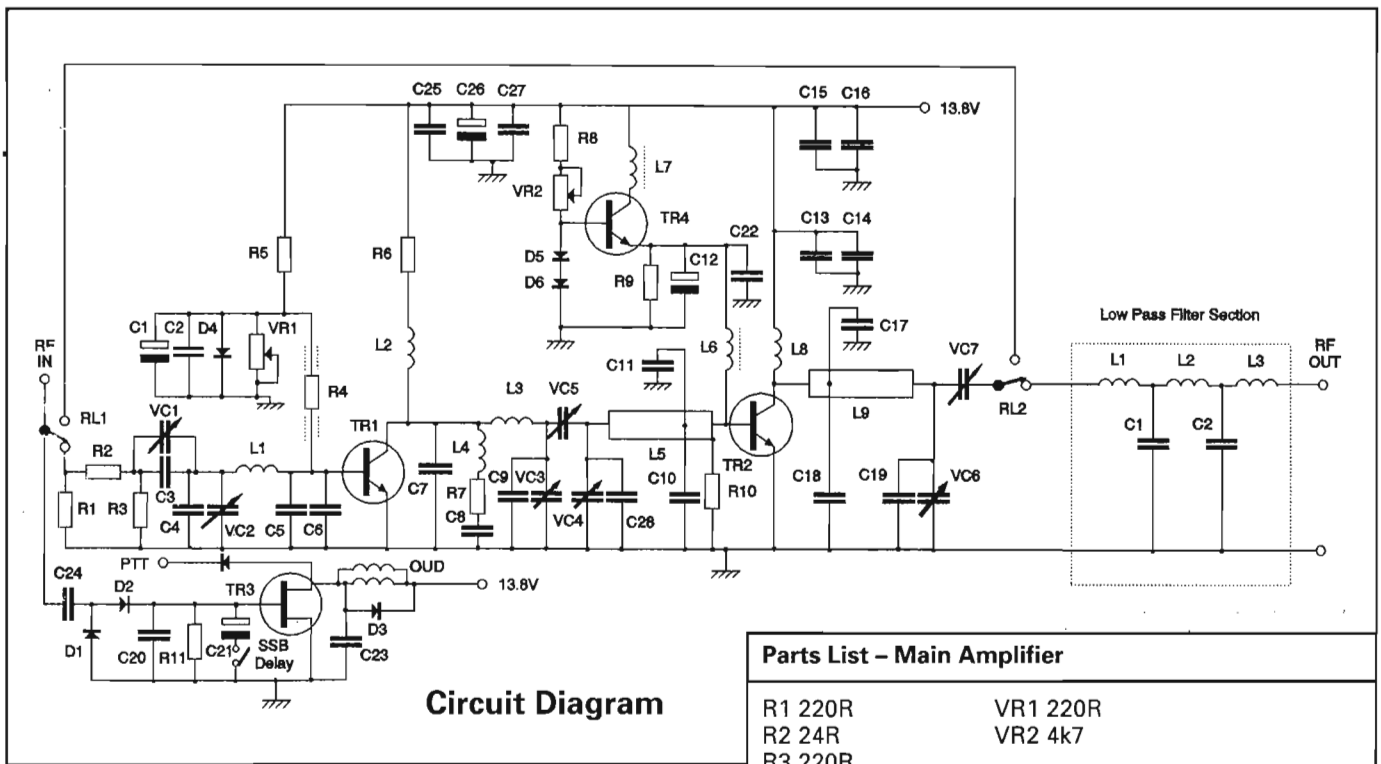
The driver stage is a MRF233 single hole stud mounted device, this is not unlike the more familiar 2N6082. The MRF233 is rated at 15 W at 90MHz, with a quoted gain of 10 dB at this level. I decided against using the 2N6082 in this position because of the excessive gain exhibited by these devices at 50MHz, these devices are not intended for operation at 50MHz and as such stability cannot always be guaranteed. Various steps have been taken to ensure stability, these will be outlined later.

The input from the switching relay RL1 passes through a 4 dB resistive attenuator pad formed by R1, R2, and R3. This ensures that the driving source sees a good 50R port, and also ensures stability. It is better not to omit this pad, and preferably adjust the driver power as a means of setting the output power level. The input impedance of the MRF233 at 15 W output level is 1.15 – j2.4R. This complex impedance is then transformed to 50R by the matching network circuit consisting of VC1, VC2, and L1. Using a single (3 element) network, the circuit Q is high, circa 10. This normally leads to very sharp tuning

with narrow bandwidth, but the 4 dB pad ahead of this network seems to make this less of a problem.

As the amplifier is required to be linear, a small standing current is required. VR1 sets the quiescent current in TR1, this being 30-35mA. RF is decoupled from the network by means of R4, which has ferrite beads on its leads, further decoupling is provided by C2. Low frequency decoupling is provided by C1, and also helps to prevent bias current dips in the network with voice peaks. The output network consisting of C17, C18, C19, L9, VC6, and VC7 transforms the low output impedance of 0.58 – j1.0R to 50R, tuning being accomplished with VC6 and VC7.

The inductor L9 is etched onto the PCB, this is 13 nHz + 70 nHz, which is a total line length of 14.25 cm. L8 provides the necessary decoupling from the supply line for RF currents, decoupling is also provided by C13 to C16. Bias is established using TR4, a medium sized power transistor. This will ensure correct thermal tracking of bias current, irrespective of drive level.



Circuit Diagram

L6, a six hole ferrite sleeve, decouples RF from the emitter of TR4. R10 provides a low resistance path at the base of TR2 for stability. Bias is set at about 80-100 mA, using VR2.

It should be noted that D6 is in thermal contact with the ceramic top of TR2. A small amount of heatsink compound should be used to increase the thermal conductivity. TR4 is mounted using a mica washer onto the top of the PCB, the copper acting as a small heatsink. A VFET is used for TR3, this is used in preference to a bipolar device because it is easier to achieve a good SSB delay, helping to prevent relay chatter. C24 samples a small amount of RF to operate the circuit, direct PTT operation is possible by grounding the relays via an auxiliary set of contacts from the transceiver. If a preamplifier is needed it can be connected by removing the wire link between RL1 and RL2, taking care to interlock the preamplifier power supply with the power amplifier supply, so that you don't transmit into the preamplifier accidentally.

Low pass filter

This is built external to the main board, and is constructed on a small piece of double sided PCB in a small enclosure with SO-239 sockets. It is a 5 element design and provides useful suppression of the 2nd and 3rd harmonics. Insertion loss is very small, in the order of less than 0.5dB. Mica wrapped capacitors are used for C1 and C2, the coils L1, L2, and L3 are wound from 18swg wire.

Heatsink and power supply

To obtain the best results from this

type of amplifier it is really necessary to have a good power supply. Typically 13.8 V at 15 A. This will realize full power if it is needed, and will easily cope under reduced drive levels. When driven to maximum power output, typically 12A is drawn from the power supply, this will vary with examples of MRF492 and also aerial SWR. Large deviations from this will indicate either incorrect tuning or that stability is a problem, this can be verified with a sensitive wavemeter to direct spurious outputs. To protect the transistors it is advisable to use an overvoltage and current limited power supply.

Calculation based on 12 A collector current and 80 W output, would indicate that a heatsink with a thermal resistance of 0.7 deg C/W is necessary, so that the junction temperature of the MRF492 does not exceed 150 deg C in an ambient air temperature of 30 deg C. However, I have used a heatsink which has a thermal resistance of only 1.0 deg C/W and no problems have occurred. When used at the specified output of 50W,

this heatsink will obviously be more than adequate.

Part Two, in next month's HRT, will conclude with PCB placement of components, construction, and alignment.

Parts List - Main Amplifier

R1 220R	VR1 220R
R2 24R	VR2 4k7
R3 220R	
R4 3R3	D1, D2, D3, IN4148
R5 240R	D4, D5, D6, IN4004
R6 0R47	
R7 10R	TR1 MRF233
R8 680R	TR2 MRF492
R9 27R	TR3 VN10KM
R10 22R	TR4 TIP31A
R11 100k	
C1 470µF 10V	C22 1nF
C2 10nF	C23 1nF
C3 220pF	C24 22pF
C4 220pF	C25 10nF
C5 47pF	C26 10µF 16V
C6 56pF	C27 100nF
C7 100pF	C28 100pF
C8 10nF	VC1, VC7, 15-90pF foil trimmers
C9 68pF	
* C10 300pF	L1 2T 20swg 7mm L, 8mm ID
* C11 220pF	L2 8T 18swg 10mm L, 8mm ID
C12 470µF 10V	L3 2T 18swg 6mm L, 10mm ID
C13 10nF	L4 9T 24swg 6mm L, 3mm ID
C14 100nF	L5 stripline
C15 10nF	L6 6-hole ferrite 24swg
C16 1nF	L7 5T 30swg on FB
* C17 220pF	L8 18T 20swg 15mm L, 7mm ID
* C18 470pF	L9 stripline
C19 150pF	
C20 10nF	RL1, RL2, OUD style
C21 10µF 10V	

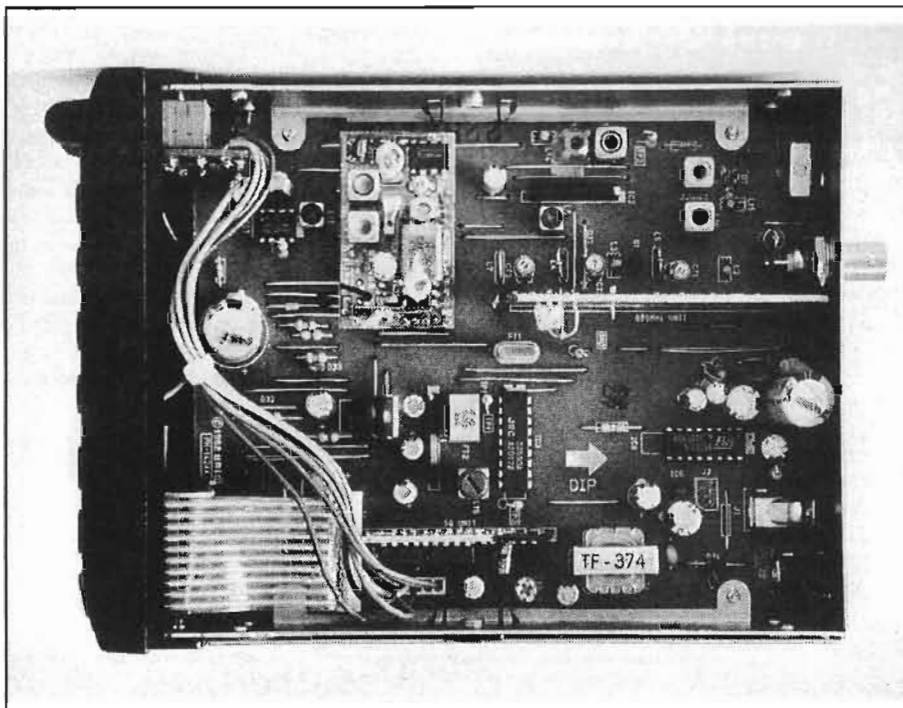
Capacitors marked with a "*" are mica wrapped types, all others are Mullard ceramic type 50V

Parts List - Low Pass Filter

C1 100pF Semco/Unelco
C2 100pF Semco/Unelco
L1 2T 18swg 4mm L 10mm ID
L2 5T 18swg 9mm L 10mm ID
L3 2T 18swg 4mm L 10mm ID

Uniden BC-700A Mobile Scanner Review

Chris Lorek tests a new mobile scanner that's made with ease-of-use in mind



Well, there you are, driving along, and you fancy listening to what the police officer's talking about in the patrol car half a mile up the road. So you switch your scanner on, and press the large 'POLICE' button – the set then scans all the police frequencies used around the country. Come across a warehouse blaze and you fancy listening in to what's happening? No problem, just press the large 'FIRE/EMG' button. He says, tongue in cheek. No, it's not a sketch out of the 'Jasper Carrot Show', as he sits there with a dumb smile on his face which is gently rocking side to side as he pretends to sit behind a steering wheel. This actually happens in some states of the USA, and the BC-700A does all this. It comes pre-programmed with *all* the frequencies used by these services, hence the very 'user friendly' controls on its front panel. For UK use, where we're not allowed to do such things even *if* the stored frequencies somehow coincided (which they do for the AIR Airband and MRN Marine buttons) the 'POLICE' and 'FIRE/EMG' banks have additional 'blank' channels (20 and 10 channels respectively) which you can program with frequencies of your choice, and if you wish, simply 'lock out' all the pre-programmed ones. A further 'Private' bank adds another 20 channels which you fill up with whatever you want within the scanner's frequency range, giving 50 user-programmable channels in all.

Search Bands

As well as these memory channel, twelve 'search bands' are provided, each or which you can search across for active frequencies, the set halting when the receiver squelch raises and continuing a couple of seconds after the squelch closes, each time. The bands provided are; 29-30MHz, 30-50MHz, 50-54MHz, 108-137MHz (AM, for civil aircraft monitoring), 137-144MHz, 144-148MHz, 406-420MHz, 420-450MHz, 450-470MHz, 470-512MHz and 806-956MHz (the latter with small sections 'missing' which correspond to frequencies used by US cellphones, these not being used in the UK).

Paperwork

I've come across many so-called 'instruction books' for scanners, most of these assume you already have an in-depth knowledge of the subject! The one that came with the BC-700A was a smart, professionally produced affair, this indeed being printed in the UK. It really does give a good 'step by step' guide on what you can and can't listen to, how to operate the scanner correctly, and how to ensure you don't accidentally listen to things you shouldn't when the scanner comes across them. I've seen manuals provided with some scanners which say it's illegal to install the scanner in your car in some areas, which of course isn't the case in the UK, and one 'horror manual' which unbelievably advises users to write the frequencies down which they've stored in the scanner memory channels, in case

it lost them electrically. Try telling that to the UK scanner user who was sentenced to 5 years imprisonment for doing just that (as reported in these pages last year).

As well as this, the set comes complete with the latest copy of the 'VHF/UHF Frequency Guide' by Spa Publications, this giving a useful further guide for the more 'enthusiastic' of us as well as providing an excellent list of frequencies typically used in the UK.

In use

Installing the scanner indoors was very easy, it came with a plug-in mains adapter and even a telescopic whip aerial for 'get started quick' use. For mobile use, a DC lead fitted with a cigar lighter plug comes with the set, again for 'get started quick' use.

After having a 'play' with the buttons and pre-programmed banks, I set about programming the various non-UK banks up with my local 2m and 70cm amateur repeater channels. As the set doesn't have a keypad (rather dangerous to use when on the move!), you must first get to the frequency you want to store from the relevant 'search' band, then store that into the memory channel you want by simply hitting the relevant 'bank' button, the set automatically choosing the next free channel for you. Indeed in 'search' mode, you can simply let the set search away, manually storing active frequencies as they come up into one of the banks, very easy!

On the move, using the set was very, very easy indeed to use. Connected to a rear window mounted dual band whip (which certainly 'opened up' the set's receive performance) I could happily operate the set by touch alone. I've had problems in the past with some mobile scanners in selecting various 'memory banks' on the move, and have often just waited until I'd stopped before trying to change things.

Another useful asset I found was that the set would always 'start up' in the mode it was switched off at, saving a lot more button-pushing each time I switched on again (some start scanning all banks when you switch on - annoying when you're listening to a given frequency in 'hold' mode and you've just nipped into a shop to buy a paper with the ignition switched off).

Technical Performance

I found there was plenty of audio available from the set's built-in speaker, this also being quite readable 'punchy' than the 'tinny' sort I sometimes come across. When in 'search' mode, the set would often halt on the channel step (5kHz, 12.5kHz or whatever) below the centre frequency of the received signal, due to the squelch raising, however another quick press or two of the 'search' button brought distortion-free reception. At home using my rooftop aerial, I did often find, as with other such sets, that I could sometimes receive signals at two places, these being separated by twice the 1st IF (Intermediate Frequency),

although the 'blocking' rejection from other strong signals on adjacent bands was quite good, far better than some other sets! Neither did I have problems with out-of-band signals 'mixing together' (*intermodulation* for the technical whiz-kids amongst us), which I was quite relieved at as I do live in a very 'RF polluted' area!

Conclusions

The BC-700A is very, very easy indeed to use on the move, and it's clearly aimed at both the 'beginner' to scanning as well as the enthusiast who wants a set for use primarily in the car, possibly as a second such set to leave permanently under the dashboard. After I'd 'locked out' the unwanted pre-programmed channels in the two scanning banks (which took me several minutes each), pressing the 'POLICE' button to hear radio amateurs on my local repeater did certainly raise the odd eyebrow from passenger friends!

The set looks very good in a car, unlike

some of the 'oversized calculators' you sometimes see, and it performed quite well. On the other hand, in not having a keypad, some users could find initial programming of frequencies takes longer than usual, but once in, they stay in. The set was obviously designed for the 'consumer' market, and with its smart looks and ease of use it could certainly make a handy accessory for those who want to keep an ear open on the move.

The BC-700A sells for £249.95, complete with a copy of the 'VHF/UHF Frequency Guide', and is available from Network Ltd., Unit 13, Harestaines Industrial Estate, Braidwood, Carlisle, Strathclyde, Scotland ML8 5PP, to whom my thanks go for the loan of the review sample.

LABORATORY RESULTS:

Sensitivity;

Input signal level in $\mu\text{V pd}$ required to give 12dB SINAD:

Freq.	Sens.
29MHz	0.24
50MHz	0.21
108MHz	0.45 (AM)
125MHz	0.43 (AM)
136MHz	0.49 (AM)
137MHz	0.47
145MHz	0.51
160MHz	0.54
174MHz	0.53
406MHz	0.39
435MHz	0.37
450MHz	0.51
470MHz	0.47
806MHz	0.15
850MHz	0.24
900MHz	0.32
935MHz	0.18
956MHz	0.34

Squelch Sensitivity;

Level of signal required to raise receiver squelch

Threshold;	0.49 $\mu\text{V pd}$ (11 dB SINAD)
Maximum;	1.14 $\mu\text{V pd}$ (23 dB SINAD)

Image Rejection

Difference in level between unwanted and wanted signal levels, each giving 12dB SINAD on-channel 145MHz FM signals, 1st image at -21.7MHz, 2nd image at -900kHz;

	145MHz	435MHz	935MHz
2nd Image;	11.7dB	6.5dB	6.3dB
3rd Image;	54.0dB	50.4dB	57.4dB

Intermodulation Rejection;

Measured on 145MHz FM as increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;

25/50kHz spacing;	67.1dB
50/100kHz spacing;	63.9dB

Blocking;

Measured on 145MHz FM as 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;	76.1dB
+1MHz;	88.6dB
+10MHz;	91.5dB

Adjacent Channel Selectivity;

Measured on 145MHz FM 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;

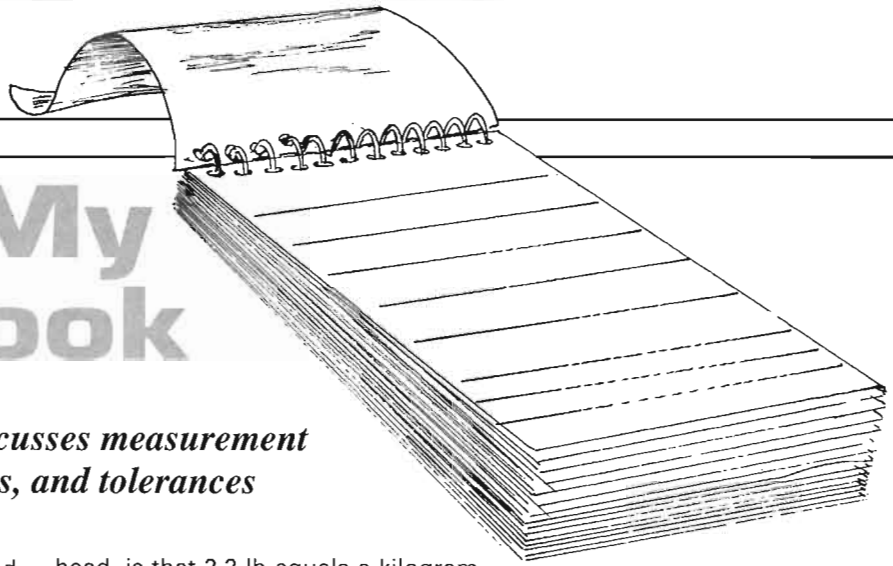
+12.5kHz;	11.9dB
-12.5kHz;	9.4dB
+25kHz;	63.8dB
-25kHz;	63.8dB

Maximum Audio Output

Measured at speaker/earphone socket, 1kHz audio at the onset of clipping (10% distortion), 8 ohm resistive load;

645mW RMS

From My Notebook



Geoff Arnold G3GSR discusses measurement standards, conversions, and tolerances

Continuing my theme of numbers, and especially conversions, I shall kick off this month with the next most commonly-used dimension after length, which is weight (or mass to use the more scientifically correct term).

The weight of that super new rig you're thinking of buying is important when considering whether your bench or shelf is likely to support it safely, or even whether you're risking a hernia if you try to lift it into position single-handed. Going back to the idea of a mental 'hook' or memory aid which I talked of last month, my remembered number for weight conversions comes from years of gazing at the information written on the jar of marmalade on the breakfast table. Our house is not so 'posh' that we decant the marmalade into a dish or marmalade-pot, I'm afraid!

For many years, marmalade and jam jar labels told us that 1 pound was equivalent to 454 grams, and that figure became engraved on my mind. I suppose that I was helped by 454 kc/s being one of ship's working frequencies in the marine medium-frequency W/T band, with which I was well acquainted from my seagoing days in the 1950s.

With the passage of time and the increase of bureaucracy, it was apparently decreed that 454 grams to 1 lb was not a sufficiently accurate conversion factor, and the marmalade jar began to tell us that it was really only 453.6 grams – a whole 0.1 per cent difference! I still use the 454 figure, together with my pocket calculator, as the basis to cope with the whole range of conversions from a fraction of an ounce up to several hundredweight and more. How many grams in an ounce? Just divide 454 by 16 on your calculator and out comes the answer 28.375.

You do have to remember that there are 16 ounces in a pound, 112 pounds in a hundredweight (cwt) and so on, but if you were brought up on Imperial measure, these would have been drummed into you.

With the aid of a calculator, it's easy to make conversions in the opposite direction as well, but a useful figure to remember for doing the sum in your

head, is that 2.2 lb equals a kilogram, which is accurate to within 0.2 per cent. If you are visiting your DIY super-store to purchase several bags of cement for the base of your new aerial mast, you'll find sizes up to 50 kg, but if you're more used to judging what you can or cannot lift in terms of hundredweights, how much is 50 kg? Multiplying 50 by 2.2 gives the answer 110 lb, just 2 lb short of a hundredweight – in other words, pretty weighty! It also shows that 50 kg is equivalent to 1 cwt to an accuracy of better than 2 per cent.

I shall come back to percentages later, but maybe that statement 'better than 2 per cent' worries you, perhaps prompting you to ask yourself 'how does he get that?'. Well, if the error had been 2 in 100, it would have been exactly 2 per cent, but as it's 2 in 110 that's less than 2 per cent (close to 1.8, in fact).

Area and Volume

These two dimensions are used far less in radio engineering than are length and weight. Area comes up if you are considering wind loading on an aerial array, or perhaps how large an aerial farm a garden will accommodate! The only other applications that immediately spring to mind are in decorating the shack, where coverage of paint and such things as carpet tiles is usually quoted in area.

An easy figure to remember to form the basis of area calculations is to say that 1 m² (one square metre) is equivalent to 1.2 yd², which is in fact only around 0.3 per cent in error.

Volume is even more difficult to find examples of radio applications for. Air-flow when selecting a fan for ventilation; how much transformer oil you need to refill a high-power dummy load; after that I run out of ideas.

Squares and Roots

That figure of 1.2 yd² being roughly equivalent to 1 m² illustrates an interesting point. I hope that you will recall from my column in last month's *HRT* the 1.1 factor for conversions between yards and metres. Now, we are talking

about square yards and square metres, and the factor has become 1.2. Why so? Well, if you check with your calculator, you will find that 1.2 is the square of 1.1, within an accuracy of better than 1 per cent. In other words, we've squared the dimensions, and squared the conversion factor at the same time.

Squares and square roots can cause problems in calculations at times. At school, you were no doubt taught that the square of a number is equal to that number multiplied by itself, so you naturally feel that the answer should be bigger than the original number. This is true only providing that the original number is greater than one. We have already seen that 1.1² is around 1.2 (it's 1.21 to be exact); you should also be happy with the statement that 5² is 25. However, if instead we took the example of 0.52, this means 'a half, squared' or 'half of a half'. Looked at like that, it's fairly obvious that the answer in this case is a quarter (0.25), which is smaller than the original number.

Similarly for square roots. A square root is slightly more involved in its definition, as one thing that it **isn't** is a number divided by itself – the answer to that is always 'one'! The square root of a number is that number which, when multiplied by itself, will produce the original number. You might therefore expect the square root of a number to be smaller than the number itself. Again, this is true only for numbers greater than one. Doing a little juggling with the numbers from the example at the end of the last paragraph, we can see that the square root of 0.25 is 0.5.

Fractions, Decimals and Percentages

To satisfy any mathematical purists who may be reading this, I should really say vulgar fractions (meaning those expressed in conventional manner, for example ¾) and decimal fractions (meaning those expressed as a string of numbers with a decimal point somewhere in them), such as 0.75 – the equivalent of ¾. For simplicity, I shall refer to them here just as fractions and

decimals.

It is very useful at times, in calculations using mental arithmetic, to know and remember the decimal equivalents of some of the most commonly-used fractions. The fractions I'm thinking of are thirds, quarters, fifths and eighths, extending perhaps to sixteenths if you're a real glutton for punishment!

For thirds, the decimal equivalents are 0.33 for one-third and 0.66 for two-thirds. In fact, the 3 and the 6 in these two figures are recurring, meaning they repeat for ever. Quoting them to just two places of decimals, as here, is sufficient for many purposes.

For quarters, the decimal equivalents are 0.25, 0.5, and 0.75 for one-quarter, two-quarters (a half), and three-quarters.

For fifths, the decimal equivalents are 0.2, 0.4, 0.6 and 0.8 for one, two, three and four-fifths respectively.

For eighths, we need only to fill in the gaps in the quarters series, so that 0.125 is one-eighth, 0.375 is three-eighths, 0.625 is five-eighths and 0.875 is seven-eighths.

Sixteenths fill in the gaps in the eighths series, 0.0625 (half of the 0.125 which is equivalent to one-eighth) is one-sixteenth, and so on – I'll leave you to work those out for yourselves.

Every decimal figure has a percentage equivalent, of course. A few examples to help you on your way: a quarter is 0.25, which is 25 per cent; a third is approximately 0.33, or exactly 33 and a third percent – a strange but useful combination of percentage and fraction.

All a bit academic, you think? Well, maybe, but such knowledge can be useful in all sorts of ways. These include technical applications, such as in helping you to understand and remember decibel ratios when talking about the power or sensitivity of a rig, and financial ones.

Perhaps you have your heart set on a rig which has a list price of £800. One dealer offers to sell you one at £100-off; another haggles a bit and finally says he'll give you 12½ percent discount. Which is the best price? The answer is that they're both the same, as £100 is one-eighth of £800, and 12½ per cent is also an eighth. Armed with that knowledge, you can base your decision solely on which dealer appears to offer the best back-up service.

Tolerance

When components such as resistors and capacitors are made, natural variations in the manufacturing processes will mean that the values of resistance and capacitance made cannot be guaranteed in advance. A batch of a

given type and target value will be produced and the resulting components measured, sorted and marked according to their actual values.

You will have come across the preferred number series for resistors and capacitors. That known as the E6 series (having six values per decade), which is for components with a tolerance of plus-or-minus 20 per cent, has the possible values of 10, 15, 22, 33, 47 and 68, and their decade multiples such as 100, 150, etc., and 1000, 1500, etc.

Then there is the E12 series (12 values per decade), for components with a tolerance of plus-or-minus 10 per cent, with values 10, 12, 15, 18, 22, 33, 39, 47, 56, 68 and 82 and their decade multiples. There is also an E24 series (24 values per decade) for 5 per cent tolerance components and an E96 series (a staggering 96 values in each decade) for 1 per cent tolerance components.

These strange series of numbers are directly related to the variations in the manufacturing process which I already mentioned. They stem from the desire of the component makers not to have to throw away a part of their production simply because the values of many of the individual components don't lie within the permissible range of values for each nominal value.

In the E6, 20 per cent series, a resistor marked 10 ohms can legitimately be anything from 8 ohms (-20 per cent) to 12 ohms (+20 per cent), whilst one marked 15 ohms might be anything from 12 ohms (-20 per cent) to 18 ohms (+20 per cent). If you work out the remainder of the figures, you will find that any value of resistor can be accommodated by the system, so none have to be thrown away in the selection process (assuming that they all meet the required specifications for temperature stability, noise, etc.). Similar calculations apply to the other series.

In these days of so much radio nostalgia, you will find other, strange values for the resistors and capacitors used in old sets. Even now, old-timers still talk about sticking in a quarter-megohm (250,000 ohm) resistor, despite the fact that there is no such value, even in the E96 series!

No measurement is absolute in its accuracy – there is always some degree of uncertainty, no matter how expensive and 'high-tech' the instrumentation available.

Achieving close tolerances costs money, and you should always remember that fact. If you are talking about physically fitting two objects or components together, they must both have been marked out and cut to length sufficiently accurately to achieve the closeness of fit required for the job. Last

month, I mentioned fitting a module onto a printed circuit board – in radio engineering, perhaps one of the tasks requiring the greatest degree of accuracy in terms of measurement of length.

Usually, the measurement has to be related to some standard. You must use a ruler or scale, or a voltmeter or a frequency source which has been calibrated against some other standard. That's how we pre-tune a modern receiver with a digital readout to a given frequency, turn up the gain and find the station right there, perhaps even an immediately intelligible SSB signal. To do so requires the frequency standards in both the transmitter and the receiver to have been set against another standard, probably even a standard frequency broadcast such as MSF or WWV. Frequency, incidentally, is the physical property most easily portable and most closely maintained as a standard in the world today. Anyone with an HF communications receiver has immediate access to standards of accuracy of one part in a hundred thousand million!

For some applications, such reference to a remote standard is unnecessary. If you have already bought that tuner module I talked of, then instead of marking off your PCB design with the distance between terminal pins by using a ruler, you can place the module on the board and make marks where the pins actually come.

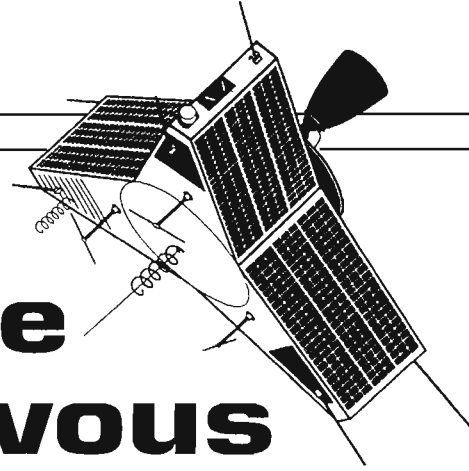
Similarly, if you are fitting a bookshelf into an alcove in your shack, you can offer up the piece of wood for the shelf to the front edge of the alcove and mark the cutting point in pencil. You don't have to use a tape measure to make the measurement, because you have direct access to the master standard, the width of your alcove. You may find that the walls at the back of the alcove are closer together than they are at the front, and have to do a bit of judicious trimming to length afterwards, but that's another story!

In Conclusion

I know that much of what I've talked about last month and this, will be dismissed by some of you as totally obvious. To many people it is, but not everyone has had the benefit of the right sort of training and experience, and some are absolutely terrified by the simplest arithmetic.

What I've tried to do is to explain the background to some of the figures, and why they relate to other figures in the way that they do. I hope that at least a few readers may feel that they have a better understanding, and may not be quite so frightened next time they encounter some calculations.

Satellite Rendezvous



Richard Limebear G3RWL with AMSAT-UK news including details of new software

UoSats

UO-22's software was reloaded on 20th April, and full operation was restored after only one orbit. The reload brings in some minor new features:

1) 'Sked', which produces a periodic status message, is a facility which allows the command station to schedule command operations at any time in the future.

2) *PBP*, the broadcast server has had some new features added.

2.1) *CL files* which keep track of all the stations who have issued broadcast requests each day.

2.2) *BL file structure* has been extended and the BL file format has been changed slightly.

2.3) The *PBLIST* message has been slightly modified. The list has two functions; it is an invitation to transmit, and it is an indication of who is on the list. In the past, all list messages were transmitted to 'PBLIST.' From now on, there will be three possible callsigns:

PBLIST; Invites all groundstations not listed to send their pending requests.

PBFULL; Shows the list, but is not an invitation to send new requests.

PBCTRL; Indicates that PBP is in control mode. Only the control station can send requests.

All versions of PB will respond correctly to these messages. All other groundstation software should conform to this standard. The 'PBFULL' packet will be transmitted whenever there are more than X stations in the list. X can be varied from the ground, and will be used for some experiments.

UoS are now considering removing the use of connected mode for downloads and directories from UoSAT-OSCAR-22. These facilities are only used by a vanishing minority of stations, but nevertheless consume valuable connect time (and processing time) over populated areas. For instance, 20% of all connect time used so far in April was used for these functions.

If anyone objects to the removal of these functions, they should send their arguments to UoS.

MicroSats

There's a new version of WeberWare (1.3) due out by now. It will be available on two 360K floppies, one 720K floppy, one 1.2M floppy, or one 1.44M floppy. The 720K, 1.2M and 1.44M media will have more sample files and perhaps more executables. Features will include; better documentation, up to 40 menu items, about three times faster than WW1.0 and WW1.1, telemetry and Whole Orbit Data decoding and improved graphing, support for double field PHOTOS, spectrometer and Hercules graphics. Some of the programs they use to communicate with and command WO-18 will be furnished, so (when the satellite software is upgraded) you can fill those last few missed packets of the current PHOTO. Better colorization is a possibility, but they can't promise its availability by that date.

If you are a registered user, you may upgrade for \$5 US. Send your request with size of media desired, your original serial number, and payment to; Centre for AeroSpace Technology, Attn: WeberWare Upgrade, Weber State University, Ogden, Utah 84408-1805; USA. Non-upgrade copies will be available for a suggested donation of \$35, through the normal channels.

Phase-3D

Phase-3D is starting to come together. They had a design meeting recently and the shape is looking like a hexagonal cylinder with dimensions of 2240mm across the points and 1120mm across each face. The height is 675mm. Two of the faces will accommodate about half the spacecraft's complement of solar cells. The remainder will be mounted on unfolding panels. Total weight of the satellite will be 400kg.

The high gain aerials will be mounted on the top, along with the motor nozzle. Initial concern that the nozzle might impair the operation of the antennas has been alleviated through computer modelling. An additional consideration, heat from the nozzle, is not expected to present a significant problem in the design of the aerials. The reason the aerials were relocated to the nozzle side of the spacecraft is because additional height is available, greatly facilitating antenna design.

They expect to start the fabrication of the flight spaceframe beginning this autumn and complete it during the spring of 1994. At another meeting in Germany, the frequencies in the accompanying table chosen. All bands except the 29MHz band are switched in a matrix, and allow any configuration of operational modes. Minor last minute changes or additions are still possible if necessary depending on transponder builders. A more detailed frequency plan is to be distributed as soon as all final technical details are available.

New InstantTrack utility software

KB5MU has recently released a collection of small programs that may be useful to InstantTrack users. Most of the files on the Utilities Diskette are ready to use and can just be copied into the InstantTrack directory of your hard disk. The utilities are;

ITPASS; outputs a table of upcoming satellite passes, giving AOS and LOS times and the maximum elevation angle for each pass.

ITSORT; an InstantTrack Keplerian Element Database Arranger - which lets you move satellites around in the database.

ITSTAMP; is for people who are trying to analyze any kind of satellite-related log file.

DISPANG; displays OrbitDRV Antenna Angles on Screen if you run the Kansas City Tracker (or compatible).

IPMDRV; a KCT-compatible RotorDRV if you use the WB5IPM Controller. Two files on the disk contain technical information about the Kansas City Tracker.

KISS2ASC; allows you to convert the contents of a KISS log file to readable ASCII, so you can see just what is in the log file.

KISSFILT; allows you to selectively keep or discard KISS packets from the log file, based on criteria such as the to and from callsigns in the packets. All of these are available on a disk from the Amsat-UK office, the price is of the order of £15.00 but call first to get the finer details.

SAREX shuttle mission

The STS-56 SAREX Mission is all over now bar the shouting. Only three British packet stations made contact with the SAREX; G0NKA, GU6EFB and myself (a first for me!). SAREX also heard, but did not work, G1EIL and G6HMS. Many others doubtless heard the shuttle and if you would like a QSL card then send to the following address; STS-56 QSL, c/o Vienna Wireless Society, P.O. Box 418, Vienna, VA 22183, USA. Please include a self-addressed-stamped-envelope, non-US stations should include the appropriate number of IRCs with your QSL (I sent 3 IRCs). Report should include callsign, whether worked/heard, date, UTC time, mode, frequency, and QSO number for packet connects. One of the major goals of the SAREX part of this mission was to hold classroom discussions with school children from all over the world. In fact, more than 18 schools were involved in these question and answer sessions with the shuttle astronauts. The school children were from countries that included the U.S., Portugal, Great Britain, Australia, and South Africa.

Another SAREX first was the contact made between Mike Foale (KB5UAC) and Alexander Pollischuk (R2MIR) on the Mir space station. This historical 2m contact occurred on 11th April at 00:35 UTC when the orbits of Mir and the Shuttle Discovery came within 135km of each other while both spacecraft flew over the South Atlantic just west of Chile.

A brief note about keplerian elements

Due to the lead time for publications such as this, the keplerian data will often be out of date by the time you get to see it. As mentioned recently in this column, please note that I am always glad to supply up-to-date keplers to anyone via post or modem (if you're on packet then you won't need them). I can supply them in printed form or, if you have one of the many tracking programs that accept elements from a

Oscar 13 Transponder Schedules

May 31 – Aug 02

Mode-B : MA 0 to MA 256 Attitude changes; Jun 28 – 140/0
 Mode-S : Jul 12 – 150/0 Mode-LS :
 Mode-JL:
 Mode-B :
 Omnis : MA 170 to MA 10

Aug 02 – Aug 30

Mode-B : MA 0 to MA 40 |
 Mode-S : MA 40 to MA 50 | <- S transponder, B is off
 Mode-LS: MA 50 to MA 55 | <- S beacon plus L transponder
 Mode-JL: MA 55 to MA 70 |
 Alon/Alat 180/0
 Mode-B : MA 70 to MA 256 |
 Omnis : MA 170 to MA 10 | Move to attitude 210/0 Aug 30
Please don't uplink to B during MA 40-50, it interferes with mode S.

Note that these schedules are provisional, continuous up-to-date information about AO-13 operations is always available on the beacons, 145.812MHz, 435.658MHz and 2400.646MHz in CW, RTTY and 400 bps PSK.

Phase-3D frequencies

Downlink frequencies (satellite to Earth)

- | | |
|----------------------|--|
| 1. 10 GHz (3cm) | 10.451000 – 10.451500 GHz |
| 2. 2.4 GHz (13 cm) | 2400.500 – 2400.900 MHz |
| 3. 435 MHz (70 cm) | 436.000 – 436.400 MHz |
| 4. 29 MHz (10 m) | 29.310/29.320/29.330/29.340/29.350 MHz |
- one frequency selected by the control station.

Uplink frequencies (Earth to satellite)

- | | |
|----------------------|----------------------------|
| 1. 1.2 GHz (23 cm) | A: 1269.000 – 1269.500 MHz |
| | B: 1269.500 – 1270.000 MHz |
| 2. 435 MHz (70 cm) | A: 435.200 – 435.700 MHz |
| | B: 436.000 – 436.500 MHz |
| 3. 145 MHz (2 m) | 145.800 – 145.975 MHz |

disk-file, on an IBM-compatible floppy disk that you send to me pre-formatted (360K/720K/1M2/1M4).

The full set usually consists of between 150 and 200 element sets so please don't ask for a *printout* of the lot unless you really mean it – it means I can't use my computer for anything else for about an hour if I have to print the lot! Just ask for 'all amateur' or 'amateur and weather' etc.

Of course, if you don't send return postage and enveloping then don't be surprised when you get no reply. My address is OK in RSGB callbooks for the past 20 years and my telephone number is not ex-directory.

AMSAT-UK news

Remember that AMSAT-UK hosts its 8th Annual Colloquium later this month, from 29th July through to 1st August. The last issue of *Oscar News* included membership forms printed on yellow, red, or black paper. Ron is still getting requests for membership forms and asks that you use the one included, photocopying it if need be.

For further information about Amsat-UK contact: AMSAT-UK, c/o Ron Broadbent, G3AAJ, 94 Herongate Rd, London, E12 5EQ. A big SAE gets you membership info, SWLs are welcome.

KEPLERS

SAT:	OSCAR 10	UoSat 2	AO-13	PACSAT	DO-17	WO-18	LO-19
EPOC:	93110.83020735	93111.55828724	93105.54243488	93108.24222238	93106.69796634	93103.23793545	93104.64323764
INCL:	27.0593	97.8162	57.7595	98.6225	98.6252	98.6245	98.6258
RAAN:	29.4473	140.4510	321.9747	194.0101	192.6811	189.2833	190.8418
ECCN:	0.6005901	0.0011630	0.7247958	0.0011790	0.0011769	0.0012859	0.0012813
ARGP:	75.0293	172.7910	312.8860	2.2555	5.5210	15.5494	11.6396
MA:	340.9550	187.3460	5.7215	357.8675	354.6103	344.6081	348.5063
MM:	2.05885733	14.68958297	2.09719719	14.29822555	14.29956664	14.29936559	14.30025641
DECY:	-7.9E-07	4.07E-06	-8.9E-07	2.21E-06	2.33E-06	1.88E-06	1.77E-06
REVN:	4611	48840	554	16887	16866	16817	16838
SAT:	FO-20	AO21	UO-22	KO-23	RS-10/11	RS-12/13	Mir
EPOC:	93104.62795728	93111.92446036	93109.74923692	93099.07674678	93111.86932329	93111.61252696	93111.573209024
INCL:	99.0503	82.9382	98.4773	66.0778	82.9211	82.9223	51.6199
RAAN:	332.8302	94.4666	186.7939	108.8845	280.2363	324.0792	143.7824
ECCN:	0.0540219	0.0034805	0.0008086	0.0008156	0.0012877	0.0028556	0.0000348
ARGP:	230.5473	175.9115	109.7335	208.2379	109.6041	200.3485	130.9463
MA:	124.6636	184.2315	250.4724	151.8198	250.6492	159.6531	229.1549
MM:	12.83218756	13.74515869	14.36813214	12.86277837	13.72314731	13.74020349	15.58313978
DECY:	-1.7E-07	8.4E-07	2.19E-06	1E-08	8.8E-07	8.3E-07	1.0511E-04
REVN:	14916	11171	9227	3095	29212	11075	41030

Packet Radio

Roundup



Chris Lorek G4HCL looks at new software, firmware, hardware, and a Space Shuttle packet QSO

After last month when I featured *Maxpak*, the Midland AX25 packet group, I was pleased to meet up with many of their committee at their stand at the RSGB's NEC show. It's good to see this active group are going strong and 'spreading the word'. I'm always pleased to publicize what your group are doing - just drop me a message or a line in the post.

New 1.14 MSYS

A new version of MSYS, version 1.14, is now available. Possibly the most significant addition is that of compressed forwarding, this reportedly being compatible with FBB systems. It also add YAPP protocol support, extended memory support, and revised documentation (written by Don K8EIW who rewrote the MSYS manual, and Steve NO8M who wrote the user manual). The software disk also mentions that future additions may include a windows version of MSYS that won't be memory restricted as the current version is, and Pactor support.

Information from Brian G8ASO @ GB7TIC says that he's been using version 1.14 for his PMS, which has given no trouble in operation with GB7TIC running Version 5.15 FBB Bulletin Board software, although it does require a little more memory than version 1.13. Brian adds that the program MSYS114.EXE is 337,511 bytes long, and MOPT114.EXE the support files, 240,784 bytes, there is also included a YAPP terminal program. MSYS 1.14 available on the landline Packet BBS run by Ted Batts G8LWY, Tel 081-547-1479, and also on TUG-II BBS on 0905-775191.

New PacComm Firmware 3.1

With the latest recommended ver-

sions of 'best' parameters for TNC settings now going around to make TNCs more 'traffic friendly', these often varying from those supplied in TNCs as 'standard', PacComm have made the sensible move of programming these in as 'default' settings in their latest EPROM-based firmware. This is now supplied with all new TNCs from them, in Version 3.1, and is available free to owners of the earlier version 1.1.D4. For this you'll need to send your old EPROM suitably packaged (the pins stick through normal envelopes - use some expanded polystyrene!) to Siskin Electronics together with you address and return postage. If you'd like a completely new EPROM for your TNC with the latest firmware, this is also available from them at £7.50 inc. UK p/p.

Baycom Modem with licensed software

Following the review of the Ramsey packet modem, where it was mentioned that the suppliers provided (quote) "free" software for which a further payment was requested upon running the software, J&P Electronics have contacted me to say they supply a modem capable of both 300 baud and 1200 baud operation, together with a *licensed* copy of the latest Baycom software (Version 1.5), the Baycom team receiving their fee direct from J&P. This is very pleasing to note, as I strongly feel that the work of such amateurs should not be 'freeloaded' on by other amateurs who simply use their work every day and don't cough up! The Baycom system is truly superb, and I can say from personal experience that the Baycom team themselves are also a great bunch of guys. The J&P system, ready-boxed as shown at £55.00 for the 'standard' modem, or £61.00 for the 'watchdog' modem (which incorporates a watchdog timer to prevent continuous TX in case your computer locks up) with £3 p/p in each case, is also quite economic.

In addition to Baycom for the PC compatible range of computers, J&P also offer a

similar system for use on the Sinclair Spectrum, Commodore 64, and the Atari ST/STE. Copies of the programs are supplied free of charge, although they point out that the authors of the Atari program would welcome a small donation. You can get further details from J&P Electronics in Kidderminster, Tel. 0562 753893.

Space Shuttle Packet

This month, I add my congratulations to HRT Satellite Rendezvous contributor Richard G3RWL, as being one of only three British packet operators to successfully contact the packet station aboard the recent STS-56 SAREX Space Shuttle mission. He kindly sent me his 'screen save' display, showing the QSO number 458. My congratulations go also to G0NKA and GU6EFB who also made contact, and G1EIL and G6HMS who were heard by the shuttle station but not worked. No doubt many other packet operators copied the shuttle, so if you'd like a QSL for your wall then send your reception report with the callsign, date, time, mode, frequency, whether worked or not and if so the QSO number given, to; STS-56 QSL, c/o Vienna Wireless Society, P.O. Box 418, Vienna, VA 22183, USA, enclosing sufficient IRCs (International Reply Coupons) for return postage.

CTRL-Z, End of message

Again, following a recent mention in this column, an update from the CIPAK (Channel Islands) group is that they'd appreciate getting in touch with any well-sited node SysOp who like to set up a dedicated 70cm trunk link with them, with an eventual aim of 23cm linking. Contact Chris GU4YMV @ GB7GUR if you're interested. So, until next month 73 from Chris G4HCL @ GB7XJZ, or via post c/o the HRT Editor at the HRT address.

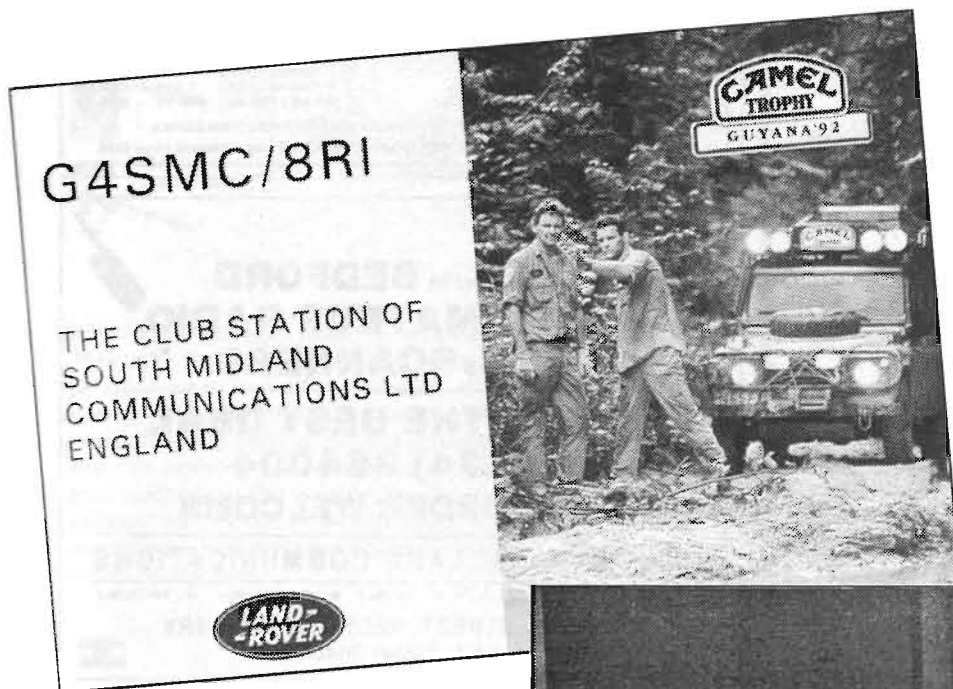
Space Shuttle packet screen-save from G3RWL

```
cmd:c w5rrr-1
*** CONNECTED to W5RRR-1
#458-is your STS-56 SAREX QSO number.
```

```
*** DISCONNECTED: W5RRR-1
cmd:W5RRR-1*>G3RWL <D,P>
```

VHF/UHF Message

Geoff Brown GJ4ICD dishes up an idea for trouble-free ground level Meteosat reception



The 50MHz 8R1 expedition cards are now all sent

Conditions I'm pleased to say have been a little better just recently. George, F8OP, near Lyon in France, reports what has now become a rarity for UK stations, in that TEP openings occurred on a few occasions to 7Q7 and ZS6 on 50MHz between 1700-1800z (this has also been heard in Jersey but very weak). George also sends information that the French calling frequency on 6m is now 50.210MHz, this has come about as to encourage more French activity. He says that he is monitoring 50.210MHz every day from 1800-1900z on CW (just as the TEP dies for him!).

Mal Z23JO reports a little 50MHz action from Zimbabwe, he contacted EH7, CT3, 9H, 9K2, CN8, F5, EH6, EH3, IT9, 4X1, SV1, 7Q7 (via 'ES?'), I, and CU1EZ during March but there was no 'ES' at the time to link up the UK. Speaking of Zimbabwe, the beacon Z21SIX on 50.052MHz has now left Jersey and is on its way to Mal.

Hatsuo JA1VOK reports fantastic TEP conditions from Japan on Six, just look at this list; XQ3, VK4, XU0, T30JH, FK8, PY, VK3, 7Q7, ZP5, DX1HB/B, VS6, VK2, LU8, 5ZR, KH6, HL9, DU7, KG6, V73, P29, V85PB, FR5, BV2, 5R8, VK8, the list goes on and on showing that the



World 50MHz DXers (l-r) JR3HED, JA1BK, JI1DLZ, DL7AV, JA1RJU, in Tokyo.

UK is much too far north!

April 27th saw the first major opening of sporadic 'E' on 50MHz for the season, stations reported that the band was open from 1400z to 1700z with an MUF of 75MHz, areas worked were SV, IT9, I0 and S59. It's been a long time since 50MHz had any action and this 'E' opening sure did the trick, pileups were unbelievable after the last six months of silence! However, by the time you're reading this you'll have probably got fed up with working 'ES', but keep those

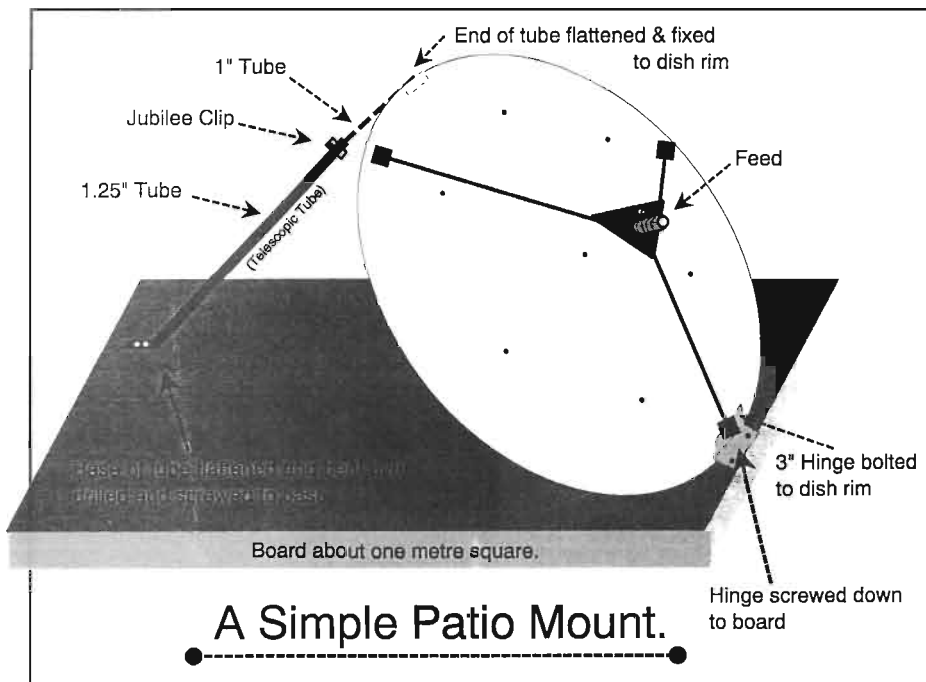
reports coming in.

A very interesting report came from G2ADR near York which was passed to the RSGB reporting club (10m and 6m), edited by G2AHU Ray Cracknell. Eric G2ADR apparently heard J37AV (Jim W6JKV) in Granada on the 4th April at 1400z on 50.100MHz, the beam heading experienced was 190 degrees instead of 250 degrees so it's not known if some joker was playing around or we had some very strange propagation. Anything is possible on six and further enquiries on the opening are continuing. After all, I have experienced many openings beaming to the south or southwest and worked stations in the Caribbean area during the past few years, did anybody else experience strange propagation that day?

Dish up this idea!

Do you remember last month I spoke of the quad loop yagis and dishes that would be required for Meteosat on 1691MHz? Well here's a good tip for those thinking about installing a Met system or in fact any other fixed dish system.

I had initially installed a quad loop yagi aerial for my met system and for about three weeks things were going fine, until one day we had a real downpour and the system increased its noise level and the signal nearly vanished. After many tests I had decided that there were problems at



the aerial end, so the yagi was dismantled and taken indoors for inspection. I found that the manufacturer had inserted a small amount of foam inside the feed point, this had obviously become waterlogged and detuned the aerial! After a dry out with a hair dryer and a spray with WD40, all was back to normal, well for another few weeks or so.

I eventually became fed up with climbing onto the roof and having to dismantle the aerial, so I contacted several companies in the UK regarding a dish and feed for 1691MHz. There were plenty of feeds and dishes, but nobody could supply me with a mount for a patio.

The 1 metre dish eventually arrived and I set about making a very simple mount. A stainless steel hinge was fitted to the front lip of the aluminium dish with brass hardware, and then screwed firmly down to the marine ply base I had acquired. At the rear, a telescopic tube arrangement about 1 m long was fabricated from 25mm and 30mm aluminium tube with the ends flattened and bent to suite the angles. Where the two tubes met, saw cuts were put in the larger of the tubes for about 50mm and a jubilee clip was used to give a telescopic arrangement. Up went the dish, on with the receiver, a quick swing to 180 degrees and about 31 degrees elevation and perfection was achieved with masses of gain. So the moral is, if you have room in the garden, install a dish rather than a quad loop yagi, and also save yourself a lot of money and hassle.

23cm News

Bill GW6ZMN phoned with information on a 23cm contact he had on the 2/1/93. Just after he had finished his contact with a UK station, OZ1KLU

called in to say he was a "good signal" into Denmark. The distance was 958km, and Bill wonders if it was a GW first - Bill now has the QSL card, any challengers? Also, whilst still on the subject of 23cm, nobody has replied to my request for the UK DX record on this band. I have asked many prominent 23cm DXers but nobody can come up with any info, does anybody know? Anyway, Bill's contact above looks good

for starters!

Loss of a very prominent DXer

Roger Thorn, G3CHN, unfortunately passed away in late April. In March on my return from the VHF Convention I managed to visit him in hospital in Southampton where he was in good spirits, but obviously very ill. Roger was well known especially in the south west of England, as he worked as an RF engineer for Decca navigation at Bolberry Down before retiring to the Isle of White. In the 70's, Roger was always 'tail-ending me' during 144MHz sporadic 'E' events. He was a fine builder and designer of amateur radio equipment, especially linear amplifiers and top band equipment, and will be sadly missed by all his family and friends.

Well another month has gone by without any really good openings, but I am sure next month things will be humming. Thanks go to the UK Six Metre Group for the QSL listing, and to G2AHU and many more for the info. Please send any reports to; Geoff Brown, GJ4ICD, TV Shop, Belmont Rd, St Helier, Jersey. C. I. or Fax/phone 0534 77067.

QSL Listing

QSL info - Past and Present

- C6AGN - Via KAIDIG. Louis D Cable Jr, 11 Marple Dr, Prospect, CT 06712
- C9RJJ - Via W8GIO. Paul Vest, Rt 1 Box 140-42, Bunker Hill, WV 25413
- EH1DDU - Domingo Alvarez, PO Box 411, Gijon 33280, Spain
- EH3DUW - Pedro Rodriguez, Albeniz 2, 17600 Figueras, Gerona, Spain
- EH5BZS - Juan Cardona, Box 401, 12080 Castellon de la Plana, Spain
- EH5DY - S. Fernandez, Ave Valencia 38, 03700 Denia, Alicante, Spain
- EH5OE - Antonio Villanueva, Ave del Ciudad 144 1, 46014 Valencia, Spain
- EH7AG - Andres Ivorra Jimenez, Box 664, 04080 Almeria, Spain
- EH7AJ - Juan Caro Perez, Hermanos Pinzon 8, Jaen, Spain
- EH7CZR - Francisco Gomez, Box 675, 11080 Cadiz, Spain
- EH7UH - M.Naranjo, Ave Reyes Catolico 18, 21740 Hinojos, Huelva, Spain
- FD1NH - Phil Thierry, 63 Rue de Rozolea 29000, Quimper, France
- FP4EK - Via KIRH. Ralph Hirsch, 172 Newton Rd, Woodbridge, CT 06525
- JX3EX - Via LA5NM. Mathias Bjerrang, Svalbard Lufthavn, Postboks 498, N-9170 Longyearbyen, Norway.
- OK1FAV - Jaroslav Spacil, Kounice 771, 357 31 Horni Slavkov, Czech Rep
- OK1MDK - Josef Cernik, Husova 244 9, CS-54100 Trutnov, Czech Rep
- OM31D - Jan Gavora, Lediny 21, CS-84103 Bratislava, Slovak Rep
- OM3LQ - Palo Kosinoha, Febr. Vitazstva 24, 901 01 Malacky, Slovakia
- OM3OM - Julius Cajka, Podhradik 1 Zamok, CS-08001, Presov, Slovakia
- OY6A - Via OY6FRA. Box 343, FR-110 Torshavn, Faroes, Via Denmark
- PY2CDS - R Bela Flor 246, Vila Mariana, 04739 Sao Paulo, SP, Brazil
- PY2ELZ - Geza Szabo, PO Box 3226, 01060970 Sao Paulo, SP, Brazil
- SORSAD - Via EA2JG. See S01A.
- S01A - Via EA2JG. A Bardeci, Las Vegas 69, 01479 Luyando, Alava, Spain
- S53VV - Stane Jeric, Ul. Vena Piona 4, SLO-66000 Koper, Slovenia
- TF/LA6HL - J. Baardsen, Risabergstien 29, N-4056 Tananger, Norway
- UC2AAA - Via F6AML: S. Chojnacki, Box 40, F-77120 Coulommiers, France
- UTSUQN - Igor Schevchuk, PO Box 142, Kiev-187, 252127 Ukraine, CIS
- UZ2FWA - Via U. Mueller, Kreutzacker 13, D-3550 Marburg 1, Germany
- ZF8AA - Via W5ASP. 10031 Meadowlake Ln, Houston, TX 77042, USA
- ZP5HSB - Hernando "Nando" Bertoni PO Box 2837, Asuncion, Paraguay
- ZP5JCY - Luis N Kemper P, Box 416, Asuncion, Paraguay
- ZP5YV - Emilio Vaesken D, Box 1341, Asuncion, Paraguay
- 4N4VO - Via 9A2AJ. Polak Tomislav, Brace Domany 6/19, Zagreb 41000, Croatia.
- 5R8DG - Via F6FNU. A. Baldeck, BP 14, F-91291 Arpajon Cedex, France
- 9A1EZA - Trg Zrtava Fasizma 26/1, Box 9, 42230 Ludbreg, Croatia
- 9K2ZR - VIA K8EFS. Box 54 R 4 S, Cochran, Charlotte, MI 48813, USA
- 9K2WR - C/O Amy Nutt, 5005 Willow Rock Way, Sacramento, CA 95841-4912 USA
- 9K2USA - VIA K8EFS. See 9K2ZR.