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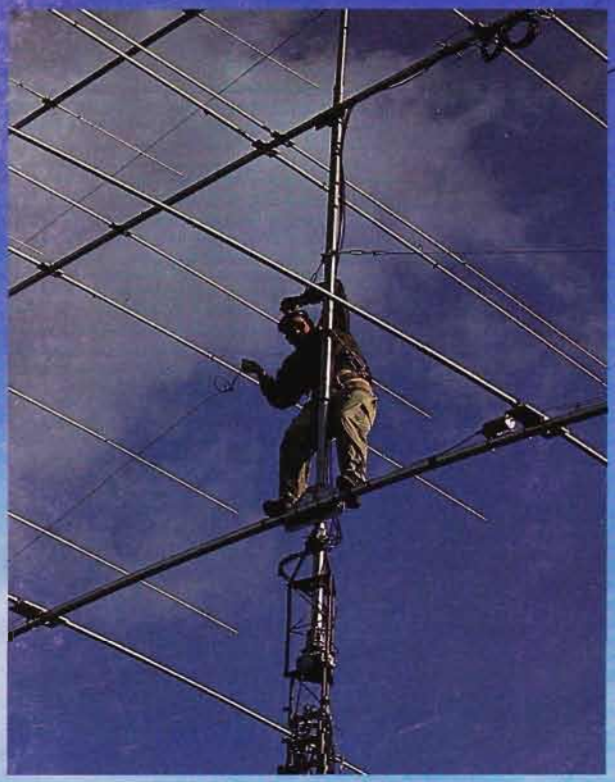

AERIAL SPECIAL

Build an 80m transmitting loop aerial

Guide to selecting the right aerial for your needs

MFJ HF/VHF Aerial Analyzer reviewed

Bearcat BC2500 scanner reviewed

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NOVICE • PACKET • REVIEWS • PROJECTS • SATELLITES

HRT CONTENTS

HAM RADIO TODAY

VOLUME 12 NO.5 MAY 1994

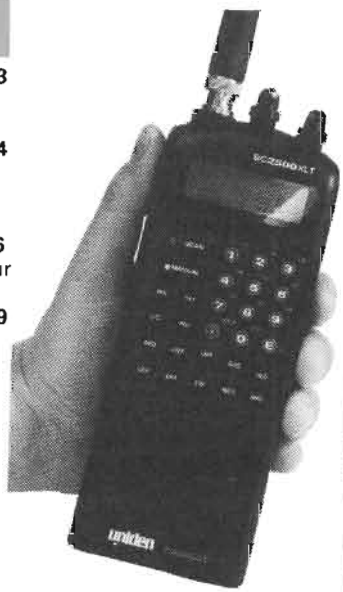
REGULAR COLUMNS

REVIEWS

FEATURES

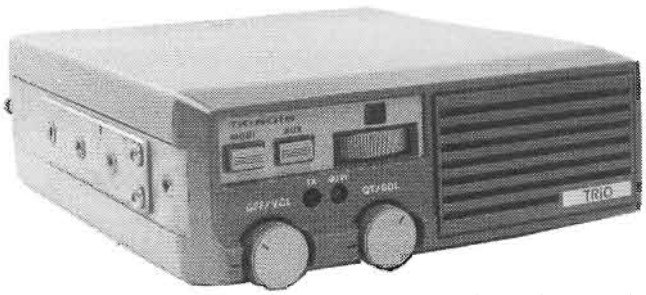
PROJECTS

NEWS AND VIEWS



Bearcat BC-2500 Scanner Reviewed

MFJ-259 Aerial Tester Reviewed



Trio TK801S Ex-PMR conversion

CQ de G8IYA Editorial

You'll be getting a better trade-in price on your gear soon!

Sheila the HRT Editor, and Chris the Showroom Manager of the Herne Bay 'Radio Hamstore', join Dennis G4SOT who drew the winning entries in the HRT competition.

One of the topics guaranteed to get most amateur's backs up is the low price they get offered for their amateur radio gear from a dealer, for example when buying a new rig. To re-sell this on the dealer's 'second hand' shelf means that, as well as covering his own overheads in selling it, the dealer also has to add a whopping 17.5% on the full price of the gear, to be passed onto HM Customs and Excise. We sometimes 'moan' about the EU, but, as reported in the Reference Book for Importers, issue 26, the Economics and Finance Council (ECOFIN) have agreed on a common system for VAT on secondhand goods and works of art, which will come into force on 1 July this year. These will be taxed only on the seller's profit margin, not on the total cost. This means you should get a far better price for your rig from a dealer, or of course the secondhand price of used gear from dealers will come down in price. Either way, it'll give our hobby a 'boost', hopefully also making it that bit more affordable to beginners looking for a guaranteed, secondhand rig to get on the air with.

School Club Station

Following the MX-294 ex-PMR conversion in the March issue, which readers kept asking me for, our editorial postbox has been overflowing! It really does look like this has been the most popular conversion featured in HRT for many, many years. The offer of ready-programmed EPROMs from the HRT Tech Ed for a £5.00 donation towards a local school club station has also been very popular, with all the donations (that's *all* the cash received, not just the *profit* after expenses,) being put to funding the purchase of this.

I'm happy to report that Chris and I now have been able to provide the Cantell School in Southampton with equipment for a complete amateur radio club station, including a Yaesu FT-227R synthesized 2m transceiver, a packet TNC, suitable 13.8V DC power supply, and a superb WX4 2m/70cm colinear. The WX4 was kindly donated by The G4SMC Radio Club this being a high gain dual band colinear, which we're very grateful to them for providing. This will be erected by Andy G4MYS and Chris G4HCL at the school's CDT block, for use with the station. The Head of CDT at the school, Nigel, is a licensed G7, and Andy and Chris have together also provided a club callsign for the school. Listen out for GX7SOU (SOUthampton), operated by the Novices under Nigel's supervision, plus of course greetings messages from other pupils and teachers at the school.

What about 70cm you may ask? Well, the Novices have all been given 70cm portable ex-PMR transceivers following their Novice course at the school, which they've crystalled up on the band, and Andy and Chris are installing a 70cm repeater, GB3EA (awaiting licensing at the moment), on the roof of the school's other main block at the same site. We're hoping to also provide a 70cm rig for the school's club station in the future, maybe even a HF system later on.

More to Come

The most popular requests regarding future ex-PMR conversions were those for the MX295 (Band III) and MX296 (UHF) – no doubt after readers had seen the MX294 article. Well, there's an MX295 ex-PMR conversion coming up for 2m, and an MX296 conversion for 70cm, you'll see both in HRT as soon as we can fit them in! Also planned are digital readout and scanning 'add-ons' for these rigs, and we're hoping to have a 'universal EPROM' containing all the channel information for virtually any frequency you'd want to use on 4m, 2m, and 70cm with your rig.

HRT Competition

Our free reader's competition for an Icom IC-V200T synthesized 4m rig, and Icom IC-U101 synthesized 70cm rig, also proved very popular. The winners were duly drawn by Dennis Goodwin G4SOT of Icom UK (carefully watched to make sure he gave the entries in the large box a very good 'shuffle'!), with the HRT Editor phoning the lucky winners the same day to tell them of the good news. The 1st winner was Roy G4ZIH from Lewisham, who chose the IC-V200T. Roy's prize was presented to him at the VHF Convention by Dennis Goodwin, who was joined by the Chairman of Icom UK, Paul Nicholson, together with the Editor and Technical Editor of HRT. The 2nd winner was Chris G0PIO from Lincoln, who also happily received his '1st choice' of the IC-U101 for 70cm.

It may be of interest to readers that the most 'difficult' question was the one asking the original name of the company that is now Icom UK. This was Thanet Electronics, which a bit of 'thumbing back' through past issues of HRT will have revealed. Of course, one or two readers *did* take the 'hint' in the competition to give Icom UK a ring to find out!

More Competitions?

What would you like to see in future issues? I featured another free competition in last month's HRT, where you can win a handheld frequency counter for your shack. Would you like some more? Write in, or fax in, and let me know. I'll see what I can do (I may be small but I'm a great arm-twister with dealers!)

LETTERS

Letter of the month

Dear HRT,

I have read with interest the letter of the month in the March 94 issue of HRT from G1SEO, and can understand the reasons for the MOT findings. But then has one ever thought of the insurance aspect of attaching transceivers within one's vehicle, without notifying one's insurers. If one was to be injured within the vehicle and the cause found to be from a transceiver on the dashboard and the insurance company were not aware of this, I feel they could escape injury payment if a vehicle was in an accident. The only way left then is for the injured persons to take out a civil action. I feel one has to tread very carefully when attaching radio equipment, and above all, should notify one's insurers to be on the safe side of the law.

This also can refer to aerials placed on gutter and mag mounts. If for some reason it flew off and hit a passer-by, would the insurance company pay out if they had not been informed beforehand, that the vehicle had an amateur radio aerial attached to it? I am not being a scaremonger, but I would dread if any amateur radio vehicle owner was caught out on this one, unknowingly. What his/her fascination was with their insurers, it's of no use being *sorry after* the event, or do we carry on taking the risk that it will not happen to us! It would be nice to know what the insurance companies think on this one.

May I change the subject to ask those who advertise transceivers for sale in the free readers ads, to put the low and high power output (i.e., 1/25 or 5/25 Watt) within the ad, as there are many QRP operators. I for one have been interested in many ads, but only to find on enquiring that high power is stated. This has put me off from making further enquiries as telephone calls are not cheap these days.

M. Marsden, G7NDP

Editorial comment;

A common question in virtually every motor insurance proposal 'questionnaire' is "Has the vehicle been modified in any way from its original specification?". This of course would include the additional fitment of amateur radio gear. If you tell your insurance company about what you've installed, and they accept the proposal, then you should be OK. But, as Mr. Marsden correctly says, if you don't, then you're liable to be uninsured. The HRT Editorial staff have never had a problem with any insurer declining a proposal for their cars with "amateur radio communication equipment and aerials fitted" (although one did want G4HCL to confirm he wasn't running a taxi with the "two-way radio" installed). With many car owners, and insurance brokers, actively 'shopping around' for the cheapest insurance, companies understandably try to offer the best 'deal' which usually means not insuring any more risks than necessary. If readers would like to let us know if they've had any problems with this, we'll then try and investigate.

Dear HRT

Your Editorial in the March 94 HRT (regarding "Aerial" or "Antenna" – Ed) was, as always, interesting and informative.

The British Radio and Electronics Manufacturer' Association was quite correct in their findings as you reported. After consulting the Compact Edition of the Oxford English Dictionary (Micrographically Reduced Edition 1979), The Oxford Dictionary of English Etymology (1966) together with Roget's Thesaurus of Synonyms and Antonyms (University Edition), E. Krois 1972, I have to submit that neither term is correct, factually or actually.

The English language is a compound of many others, Greek, German, French, Latin etc., not to mention a number of regional influences that has resulted in the vernacular that we have today. Old-English is also called Anglo-Saxon which was the form of language until the 12th century. Middle- English was the form between the 12th and the 16th century. We now use an amalgam of these together with other words which have crept into common use. It is of interest to note that the French have a law to protect such from happening, whilst other, often older languages, simply cannot adopt new words as in Gaelic.

As to the word aerial, much can depend upon whether the word is used as a noun or as an adjective. Fundamentally, the word can be discounted as of use in our hobby since it refers to air, or air as a substance or gas, it is described as etherial, unsubstantial and intangible (as are radio waves), but most definitely of pertaining to, or composed of air. Greek and latin forms of the word aereal and aerial have resulted in two spellings both having the same meaning.

With regard to antenna, in ancient use this referred to a sail-yard from a Greek word Avereiv-siv (to stretch out or forth). The modern use seems to begin with the Latin translation of Aristotle by Theodorus Gazd (died 1478) in which the 'horns' of insects is rendered antennae; which is then passed into entomological writings as pertaining to 'horns' or ends of sail yards and has a nautical connection (or connexion). Generically this was subsequently applied to aviation and even flying saucers! An antenna is a sensory object as used by insects; according to Lussock (1879), "there are in the antennae of ants certain curious organs which may perhaps be of an auditory character". Holmes, a poet in 1855 wrote "Go to you tower, where busy science plies her vast antennae feeling thro' the skies".

£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, Angus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, or fax your letter direct to the Editor's desk on 0703 2634229. Please keep your letters short, we reserve the right to shorten them if needed for publication. Reader's views published here may not necessarily be those of the magazine.

So nowhere will you find in a dictionary any reference to those things we shove up in the air with which to contact our fellows and upset our neighbours. The nearest correct word would be wire; hence wire-less (of telegraphy and telephony). This comes from the Greek, piece or length of metal in the form of a slender rod. I regret that my typewriter lacks the characters to provide the actual word.

Once erected, our antenna becomes an aerial device, yet since it is a sensory device what do we call it when used for transmission? A WIRE! Now as to a 'whip', since this is obviously an item of flagellation.....

So at last we know, and I bet you will regret asking.
Michael G. Shread GM6TAN

Editorial Comment;
So now our readers know as well!

Dear HRT,

For many years now the thought of becoming a radio ham has always interested me, but there have always been a few nagging questions that I haven't been able to answer for myself properly, which in turn have stopped me in my tracks to gaining my amateur radio licence. An anxious, worrying mind about examinations has done its fair share to stop me as well. Please can you do your best to answer my following questions.

1) Is there a club in my area. 2) Are there different levels of examinations, as electronics and Morse code I'm not 100% interested in, I understand that for your Ham ticket you need to be able to do both. 3) Would you advise a home study course and what prices do they start at, or a good book to read up on.

Thank you for taking the time to read my letter and for trying to understand it. In the meantime I await in anticipation for your reply, as I would consider it a life long achievement passing the Radio Ham's exam in 1994 after so many years of dreaming about it.
Yours sincerely, Mr. A. S. Bateman

Editorial comment;
I was very touched by your letter, you should have received my reply by now. The Burton on Trent and District ARC is your local club and I'm sure if you go along to their meetings they will do their best to help you, they may even run Novice and RAE courses. There are different levels of Ham Radio licences, Novice Class B (without Morse) which is the most popular at the moment, Novice Class A (with Morse test at 5 wpm – words per minute), full licence Class B (without Morse), and full licence Class A (with Morse test at 12 wpm). It depends on the type of licence you gain as to which bands you can operate on and at what maximum transmit power levels. The Novice licence has been aimed at beginners to the hobby, one lad who passed this at 9 years of age. There are companies who advertise home study courses in HRT for the 'full' licence, and a very useful 'home study' guide is the 'RAE Manual' published by the RSGB (details in the 'National Organisations' section of HRT each month). For the Novice licence you need to attend a series of practical based sessions given by volunteers, successful completion of this course then lets you go on to take the written exam, so it's more difficult to do at home unless you can arrange for an instructor who will come to visit you.

Dear HRT,

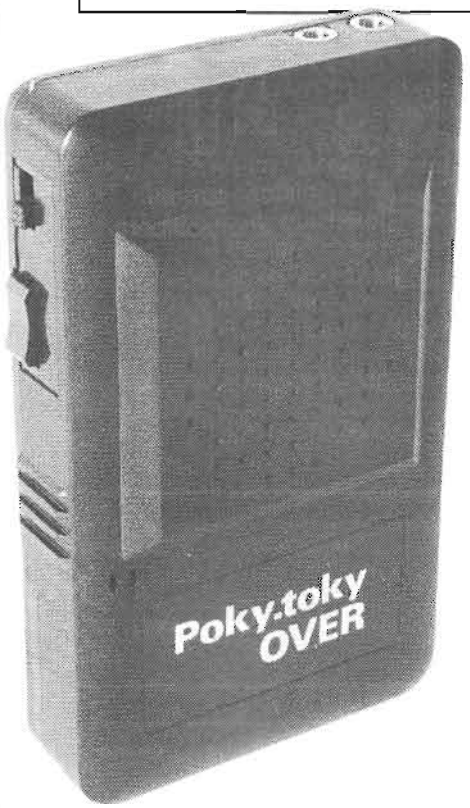
I am very enthusiastic in the hobby of Amateur Radio, however, I have no knowledge of the subject at all. I do know that there are exams and that you have to buy a licence, other than that I know nothing. I am 13 years old and only earn £12 a week, so the kind of money involved will take a while to save up, however I believe its worth the effort.

I would be very grateful if you could tell me how to start off, what I need to know, how to get enrolled in the exams, what I need to study etc. Also what is the best type of radio transceiver to start off with, bearing in mind that it can't be too expensive.
Yours faithfully, Matthew Perry

Editorial Comment;
We did a 'Beginners' issue of HRT last year, the October 93 issue, where most of your questions were answered in the article 'How to get Started in Amateur Radio', including what type of radio to make a start with. A good step would be to find your local radio club and pop along, usually the members will be only too willing to give help and advice if they can. We list active clubs, who regularly send us details of what they're doing, in our 'Club News' pages each month, some of them run Novice and RAE classes and are registered exam centres. The Radiocommunications Agency have free publications 'How to Become a Radio Amateur' and 'Novice Licence Information Sheet'. Just give them a ring (details in Club News), or write to them, and they'll send you these free of charge. Thanks for writing in Matthew, you should by now have had my letter in reply including photocopies of the relevant beginners article in HRT.

A Low Cost 2m Packet Rig

Our Tech Ed shows how to use the economic 'Poky Toky' as a low cost 2m packet rig



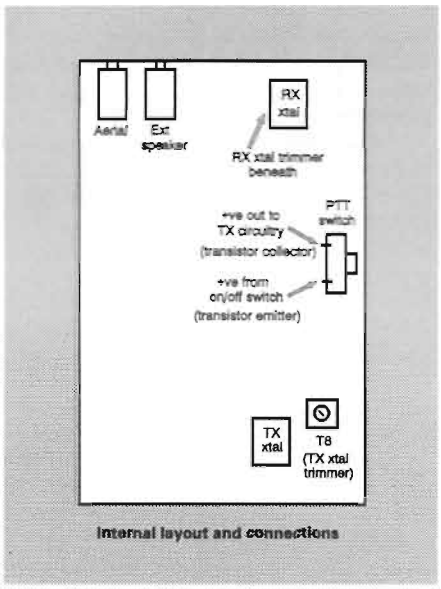
The uniquely named 'Poky Toky', or the WKX-1200 to give it its 'official' name, is a handheld 2m low power crystal controlled transceiver. It's supplied ready-crystalled on 144.550MHz, which has been formally documented as the alternative 2m packet BBS access frequency for use in the UK. As such, this little set, which currently sells for around £39, could prove to be rather popular!

Performance

The UK suppliers, SMC Ltd., specify a 10mW transmitter which I would imagine to be 10mW ERP from the supplied helical, I measured over 80mW RF output on 144.550MHz into an external RF power meter on the sample I tested. This was perfectly ample for me to get into my local 2m packet system with. On receive I measured a sensitivity of around 1µV pd for 12dB SINAD, around the same as a dedicated commercial 2m packet transceiver I reviewed some time ago.

You can of course, change the crystals to give whatever 2m frequency you'd like. After fitment, T8 next to the transmit crystal trims the transmit frequency, and the trimmer capacitor below the receive crystal trims the receive frequency. The crystal specifications you'll need to quote to your crystal supplier are; HC-49/T, 7th overtone, 32pf load capacitance, 60 ohm ESR, The TX crystal frequency is the TX frequency, RX crystal frequency is the RX frequency minus 10.7MHz.

Used as a handheld, you shouldn't have problems, but when you start connecting external devices, you need to be careful in what you're doing....



Internal layout and connections

Packet Connections

Receiver audio to your TNC is available from the earphone socket. Connecting external TX audio and TX PTT needs the addition of a 10k resistor, a 1µF 10V capacitor, and any small PNP switching transistor (to switch 100mA), e.g. a 2SA733 or equivalent. For negative PTT switching from your TNC, connect a PNP transistor with emitter to the permanent +9V side of the PTT switch, and collector to the switched +9V side, with your TNC's PTT connected to the transistor base in series with a 10k resistor. The internal mic is has one side clearly connected to the set's PCB 'ground', the other being microphone 'live', connect your TNC's audio output to this point via a DC-blocking 1µF capacitor of at least 10V working, the positive side connected to the microphone element end. Be careful in setting your TNC output level, there's no deviation limiter in the set. You'll typically need around 15mV RMS from your TNC for 2.5kHz deviation from the set.

External Aerial Connection

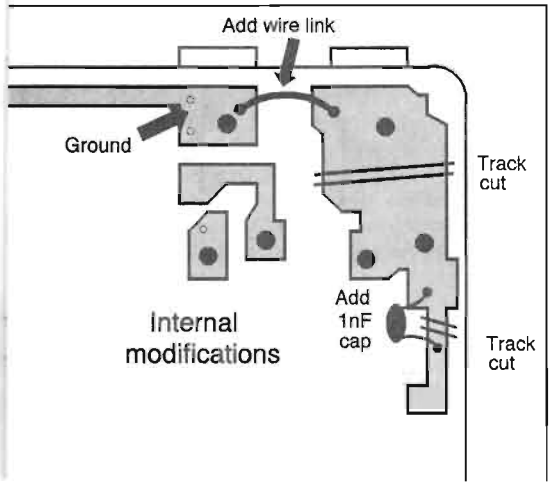
The inner and outer of the 3.5mm aerial jack connector are joined together, no doubt to provide rigidity in the set- top aerial. More importantly, the +ve of the battery supply voltage is connected to this, so connecting an external aerial, which you may also have connected via external equipment to the battery negative, could cause a number of problems!

To connect an external aerial, using the jack socket inner for coax inner and sleeve for coax outer, add a 1n series capacitor for 'DC blocking', with PCB track cuts as shown. You won't be able to use the supplied helical aerial after these changes, unless you also modify that to suit. Alternatively, just directly solder your coax to the aerial connector pad via a 1n capacitor, the screen going to the adjacent earth.

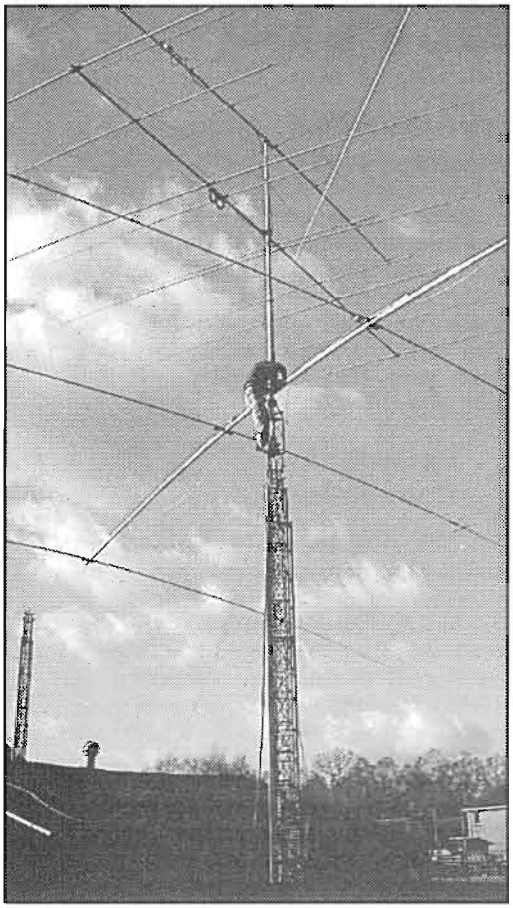
Power Supply

A word of warning for those thinking of powering the set from a 12V or 13.8V supply. Don't! The set is designed to operate from a 9V PP3 battery, there's no reverse polarity or over voltage protection – the electrolytic capacitors across the supply rail are indeed only rated at 10V. So don't use more than a 9V supply, and be very careful not to connect this or your battery the wrong way round. Either of these is likely to cause the poor set to curl up and breathe its last, possibly preceded with a bang and some smoke!

I hope these notes show how you can obtain a low cost set for packet use, rather than tying that expensive all-singing all-dancing 'black box' up! My thanks go to SMC Ltd., from whom the Poky Toky is available, for the loan of the set used for these modifications.



Getting The Aerial Up!



Ever put a 'monster' aerial up? Richard G4CVI tells us of the mechanics involved in getting that huge yagi up in the air

This month's front cover features one of the tower-mounted aerial systems at the station of Richard, G4CVI, near Southampton. That rather large beam you see at the bottom of the array is a 40m 4 element monoband yagi! HRT thought readers might like to hear a little about Richard's experiences in getting it installed. He related his tale;

The featured aerial system comprises, from top to bottom, of an 8 element 10m boom Create 6m yagi, a HyGain 5 element 20m monobander with a 15m 5 element monobander interleaved on the same boom, and finally a Create CL40DX 4 element monoband 40m yagi with a 15m boom. The array is supported on a 24m heavy duty Strumech tower, with a further 6m 63mm o/d, 6.3mm wall, pole above it. When the time came to erect the 40m yagi, some considerable thought and preparation took place!

After the yagi had been assembled at ground level, which according to the Create instructions would give resonance on 7.06MHz without adjustment, a 'shin up the tower' was made with pulley and rope in hand, the 40m yagi being at the bottom end of the rope. After the pulley had been fixed as high up the stub pole as possible, the rope was passed through this and tied to a handy Range Rover (on the ground), with suitable driver already installed (good planning, this). With a third person giving 'stop/go' instructions, the car was very carefully driven along, with Richard 'walking' the aerial up the mast, until it met with its required 'resting place'. This, Richard tells us, is when things became interesting, and the laws of physical momentum became very apparent.

Standing aloft a tower, manhandling a 15m boom length, 18m element length, yagi weighing around 75kg, getting it in the right position and fitting the three U-bolts was quite a job, single handed. Despite the physical effort needed to start turning it to point in the right direction, getting it to stop once it was moving was also quite a feat. The 20 knot wind blowing at the time didn't help matters. In Richard's words, it was "an interesting observation"! Certainly not what you'd attempt without the appropriate personal safety harness, as was sensibly used in *this* exercise! As a matter of interest, the installation handbook showed a diagram of a single person pulling the aerial up on a pulley – a little optimistic maybe!

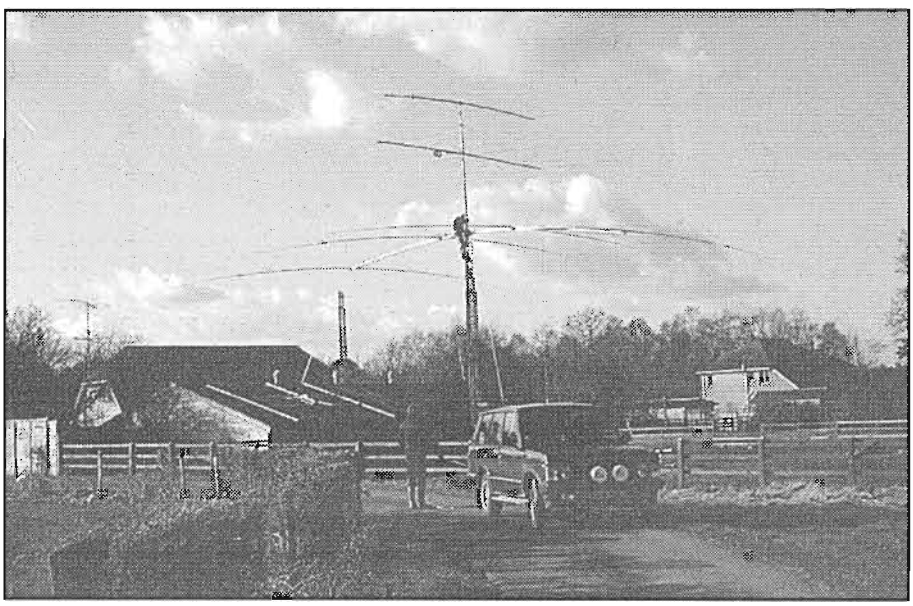
With the aerial up, and the tower at its retracted height, the beam resonated at 7.03MHz, but with it wound up to full height the beam's minimum SWR was 'spot on' at 7.06MHz, just like the book said! With a further check showing the SWR across the band being less than 1.3:1, transceiver control fingers naturally started to become itchy! A dive into the shack duly resulted.

It was now 3.30pm, and the first 40m call brought back a UA0, the second call brought back a BV. The beam was then swung round to the south east, and a string of W6s were worked via long path. Later on, a VK gave an S9+30db (yes!) signal report from the beam!

That evening, the HRT Tech Ed was giving a lecture at the Itchen Valley Radio Club, complete with 'live demo', on the DX PacketCluster system. Needless to say, the assembled audience were rather impressed at the 40m DX 'spots' appearing during the talk, coming from a certain local station who was trying his new 40m aerial.

We're reliably informed that the next hoped-for 'addition' to join the array is the AFA75 two element 80m yagi from Create, although we've heard that David G3FPQ has beaten Richard G4CVI in getting one of those up.

Getting the yagi up took a degree of motorisation!



Choosing The Ideal Aerial System For Your Station

Don Field G3XTT gives a guide to choosing the best aerial for your individual circumstances

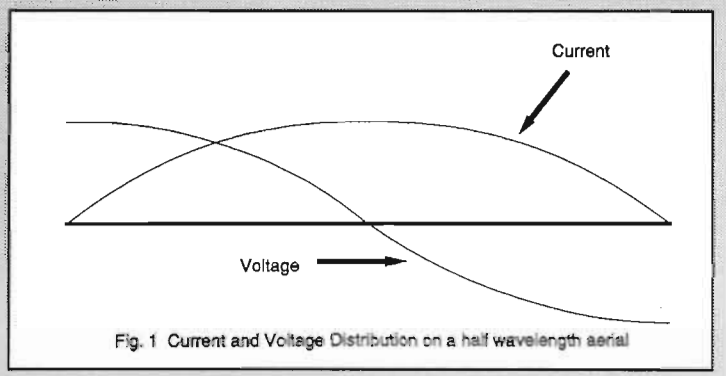


Fig. 1 Current and Voltage Distribution on a half wavelength aerial

This hobby of ours always used to be called *Wireless*, because it achieves the feat of allowing communication through air and through space without wires. To manage this, though, we need to be able to launch our signals on their way with some sort of aerial.

The purpose of this article is to introduce you to some of the basic varieties of aerial, to explain how to select which is most suitable for you, and to say something about the limitations of the different sorts. This last point is important because if you are looking to purchase an aerial rather than to build your own, it is easy to be misled by the manufacturer's claims. Aerial theory and practice is a very broad subject, and aerials are a field in which it is still possible to experiment and come up with new variations, especially since computer modelling became commonplace. If you want to take the subject further, there are lots of suitable books around, of varying degrees of complexity. As a starter, I would always point towards the ARRL Antenna Handbook, marketed in the UK by the Radio Society of Great Britain and others.

Time To Dispel The Myths

A lot of myths have built up over the years in the context of aerials. Listen to the discussions on 80 metres or over the local two metre repeater to hear radio amateurs claiming almost magical properties for their favourite aerial, insisting that quads are always better than Yagis (or vice versa), or that nothing can touch a G5RV multiband dipole. The straightforward fact of the matter is that *any* conducting object can be made to radiate as an aerial, whether it is a metal drainpipe, an old corrugated iron barn or the latest multi-element 23cm killer beam. Of course, some will be more effective than others and one of the reasons aerial myths have sprung up is that it isn't always obvious which will work best in a given situation. The textbooks and computer programs can help, but most aerial theory is based on the performance of aerials in "free space" or over "perfect ground". Needless to say, in my garden and no doubt in yours as well, free space and perfect ground are as alien as Martians.

An aerial will normally only behave as if it were in "free space" if there are no other objects within its "near field" which, effectively, means within one or two wavelengths of it. On the 160 metre band there aren't many of us who can put our aerial several hundred feet above the ground, and that far away from surrounding objects. Even on 2 metres, you may well have a 70cm aerial mounted on the same mast within the near field of your 2m aerial. As for "perfect ground", unless you are operating from a ship surrounded by salt water this is equally unlikely. As a result, your aerial will rarely work exactly as per the textbook and, what's more, comparative performance measurements will usually be impossible so the only way you will be able to tell how well it works is by the results you get on the air. Of course, these will depend as much on day to day band conditions as they do on the effectiveness of your aerial.

All Is Not Lost

Of course, despite what I have just said, over the years certain aerial types have become popular among radio amateurs because on the one hand they give the kind of results we are looking for and, on the other hand, they are relatively easy to build or install. For the most part they are variants on three basic types, the end-fed wire (and this includes vertical aerials), the centre-fed wire (often a half-wave in length) and closed loops (usually of one wavelength in circumference). In all cases, so-called parasitic elements may be added. Parasitic elements are ones which are not directly connected to the your transmitter, but are in the "near field" of the "driven element" (i.e., the wire which is connected to your transmitter) and therefore affect its directionality and performance. Of course here I am talking about intentional parasitic elements such as the reflector and directors you will find on most VHF beam aerials, not the nearby satellite TV dishes or telephone wires which will affect your aerial in rather less predictable ways!

Some Theory

Let's start by looking at a half-wave long piece of wire or tubing (Fig. 1). If we can somehow get radio frequency energy into it at the frequency at which it is a half wave, the current distribution will be as per the solid line. This is not

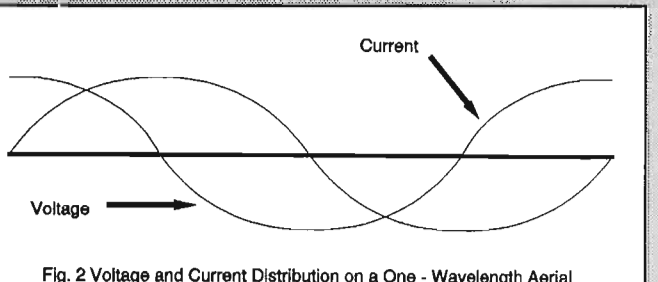


Fig. 2 Voltage and Current Distribution on a One - Wavelength Aerial

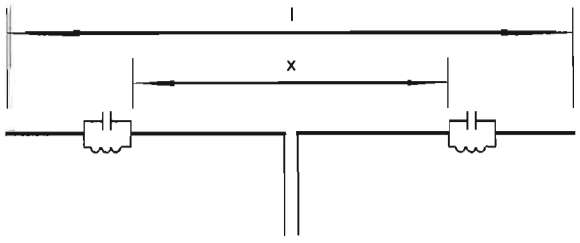


Fig. 3 Trapped Half Wave Aerial

surprising. The ends are open circuit, so no current will flow. The voltage distribution will be as per the dotted line, with the highest voltage at the ends. Remembering Ohm's Law, you will see immediately that our piece of wire looks like a high impedance at the ends (high voltage, low current) and as a low impedance at the centre (low voltage, high current). In the days of valve transmitters, it was common practice to connect such an aerial directly onto the output of the transmitter, as valves inherently have a high output impedance, and so would be quite happy feeding directly into a high impedance load. Nowadays most radios have a low impedance output and it is more common to feed the aerial at its centre point. Of course, the centre point will usually be well away from the shack, so a feedline is required to carry the signal from transmitter to aerial. Ideally this will have the same characteristic impedance as the transmitter output and the aerial. The impedance at the centre of a half-wave dipole is about 75 ohms, and 75 or 50 ohm coaxial cable will be suitable as a feedline.

So we now have a simple, convenient aerial. On the 40 metre band, for example, a half-wave dipole (which is what this aerial is called) would be about 20m long, short enough to fit into most gardens, perhaps suspended between two trees, or a tree and the chimney. On the 20 metre band our 40 metre dipole will be a full wavelength long and the current distribution will be as shown in Fig. 2. Oh dear! The centre point is now high impedance, and we cannot achieve a suitable match to our transmitter. Again, in days gone by it was very convenient that all the short wave amateur bands were harmonically related. If you had an aerial that was a wavelength long at the lowest frequency, it would be a number of complete wavelengths on all the higher bands, so that on every band it would be high impedance at the centre. Feed it from your valve transmitter via an open wire feeder and, hey presto. A simple multiband aerial. No longer! If you want an aerial which covers several HF bands nowadays you need to resort to other techniques.

One method is to use traps. These are parallel tuned circuits which offer a high impedance at their resonant frequency (remember what you learned for the RAE?). It is then possible to make an aerial such as that shown in Fig.3. Let's suppose in this case that length *l* is 10m, a half wavelength on the 20 metre band. And let's also suppose that the traps are resonant at 14.2MHz. A 20 metre (14MHz) signal would see only the middle 10m of the aerial. The rest would appear as an open circuit, and the current distribution would be as per Fig. 1 again. A good match for our modern transmitter. However, on the 40 metre band the traps will look like a low impedance and our signal will 'see' the whole of the aerial. In this case the overall length *x* will be slightly less than 20m for the aerial to look like a half-wave, as the traps have some residual effect in electrically lengthening the aerial. But, again, on 40 metres the aerial will look like a good match to our transmitter. So we have a two band aerial. Ready made traps are available from a number of suppliers. Most triband HF beam aerials (usually for 10, 15 and 20 metres) use the same principle, with two sets of resonant traps to allow the aerial to work on three wavebands. Similarly, many multiband trapped vertical aerials use exactly the same idea.

The well-known G5RV dipole uses a slightly different principle. This aerial, as shown in Fig. 4, uses no traps and, as you will see from the dimensions, is not a half-wave or a multiple of a half-wave on any of the HF amateur bands. Instead the length is chosen to be a compromise. The impedance at point *F* will vary from band to band, but on no band will it be very high or very low. The matching section *y* then transforms the impedance at point *F*. The amount of impedance transformation will vary from band to band because the change depends on the length of the matching section in electrical terms (i.e., once again, relative to the wavelength). If you are interested in the theory look it up in a book about transmission lines. Otherwise take my word for it that the end result is that the impedance at point *G* is amazingly close to 50 ohms on each of the bands 80 through 10 metres.

Talking about the G5RV aerial takes us nicely into the concept that an aerial doesn't have to be a resonant (e.g., half-wave) length. A so-called doublet is any piece of wire, fed in the centre. However, if it is not a resonant length the impedance at the centre will be complex, meaning that it will have both a resistive and a reactive (capacitive or inductive) part. You can still match this to your transmitter by using an aerial tuner back in the shack. However, there will be standing waves on the feedline which can result in power being lost and can also mean sufficiently high voltages on the feedline to cause electrical breakdown. Coaxial cable is unsuited to this situation; most people who use doublet aerials feed them with open-wire line.

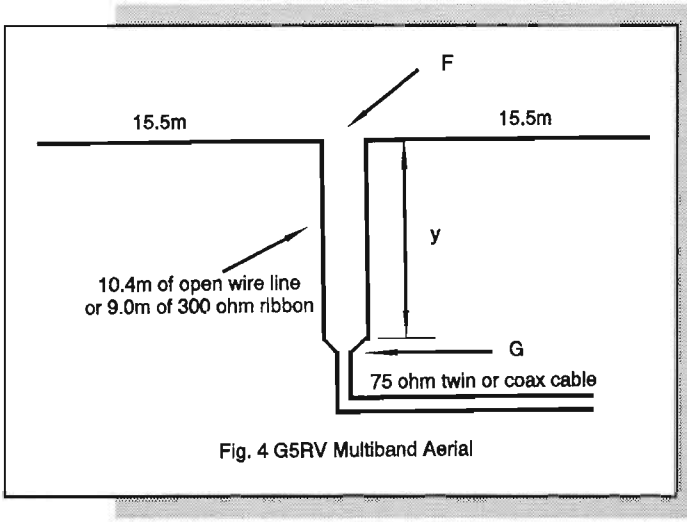


Fig. 4 G5RV Multiband Aerial

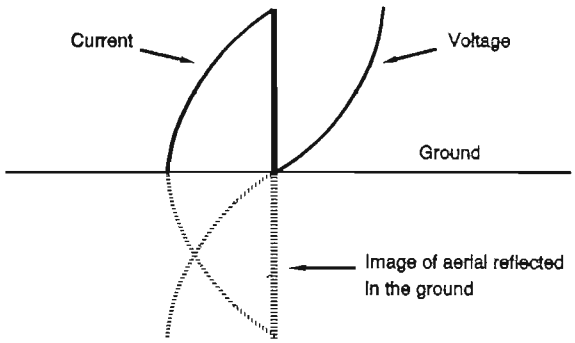


Fig. 5 A Quarter Wave Vertical Aerial is essentially a vertical half - wave with the lower half produced by ground reflection

A quarter-wave vertical aerial is really just another version of a half-wave dipole (Fig. 5). You can imagine the bottom half as being under the ground! However, a vertical aerial does need a good earth connection or system of ground radials (rods or wires radiating from its base). On the HF bands a vertical aerial will usually be ground-mounted, and the earth wires will be on, or probably under, the ground. If you can't manage the full height (a quarter-wave vertical on 160m would be about 40m high), then the trick is to

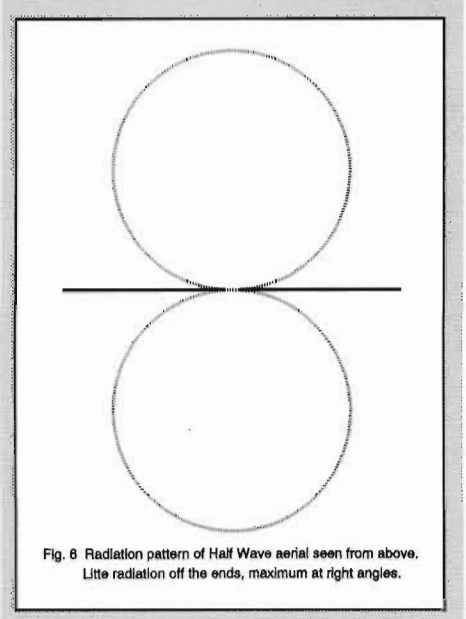


Fig. 6 Radiation pattern of Half Wave aerial seen from above. Little radiation off the ends, maximum at right angles.

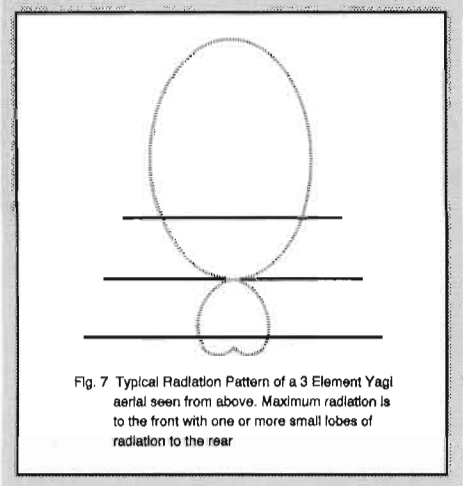


Fig. 7 Typical Radiation Pattern of a 3 Element Yagi aerial seen from above. Maximum radiation is to the front with one or more small lobes of radiation to the rear

make the vertical part as high as you can manage, and then go horizontally with the rest, resulting in the so-called 'inverted-L' configuration. On VHF the aerial will probably be mounted high up and will have short rods to produce an artificial 'earth' beneath the aerial. Where a VHF aerial is mounted on a car, the metal of the car body has the same effect.

Finally, loop aerials are an enclosed loop, usually one whole wavelength in circumference. The loop can be square, rectangular or triangular. The idea is to maximise the area within the loop, which a mathematician would tell you means the loop should be circular. But other than on the UHF bands this is mechanically very difficult to achieve, so reality has to intrude again. The popular 'cubical quad' aerial consists of a full-wave loop as the driven element, plus a further loop acting as a parasitic reflector. At VHF where the sizes are more manageable, one or more director loops may be added as well. In terms of performance, a full-wave loop can be thought of as two (bent) half-wave dipoles, stacked one above the other.

This is all very well, but which aerial should you choose for a particular job?

A dipole has maximum radiation off its sides and very little off its ends (Fig. 6). When a reflector and directors are added the directional effect is even more marked (Fig. 7). This is the popular Yagi aerial (named after its Japanese inventor) and is ideal for the higher HF bands and for VHF/UHF, where it can be mounted on a rotator and will give maximum gain in the direction you want while rejecting unwanted signals from other directions. As I said earlier, to achieve a low angle of radiation from a dipole or Yagi (needed for long-distance working), it needs to be at least a half-wavelength above ground. This is often impractical on the LF bands (40, 80, 160 metres) so the solution here is to use some sort of vertical aerial, as vertical aerials inherently produce low-angle radiation (providing they are used with a good earth system). A quarter-wave vertical aerial for 40m would only be 10m high, a very reasonable proposition for most people. The other advantage of vertical aerials is that they are omnidirectional, so require no aerial rotator. This makes them very suitable for VHF mobile working. You hardly want to have an aerial rotator on your car roof! So VHF repeaters use vertical polarisation for convenience, as they are intended primarily for use by mobile operators. As it happens, one of the most popular vertical aerials on the VHF and UHF bands is not a quarter-wave vertical at all, but one which is five eighths of a wavelength long. This is because a five eighths wavelength aerial gives a low angle of radiation, sending as much of your signal as possible off towards the horizon rather than up in the air. You will realise from what I have said already that a five eighths wavelength long aerial will not be an ideal match for coaxial cable. Fortunately the manufacturers of such aerials take care of this for us by building a suitable matching unit into the aerial itself.

Although I always encourage people to experiment with aerials and build their own, I realise this is easier to do with wire aerials for the LF bands than with tubular aerials for the higher bands, especially as high grade aluminium is often difficult to buy in small quantities. Nowadays there are many commercially available aerials for all the amateur bands, though the prices of imported ones can be ridiculously high. In the coming months I hope to be able to review some of the more popular HF models, and no doubt the HRT Editor will be finding someone to do the same with VHF aerials. Your choice will depend largely on what your interests are. For example, if you wanted to keep up a regular schedule with a friend in Canada, then you might feel that you only needed an aerial for the 20 metre band, and may not even want to be able to rotate it. A dipole, or a Yagi if you had space, as high as possible, would be a good solution. If you are a 'Worked All Britain' chaser then you want an aerial that lays down a good signal around the British Isles, primarily on 40, 80 and possibly 160 metres. A multiband dipole (using traps) would be appropriate and need not be very high, as you are not trying to achieve low angle radiation for long distance working. For mobile use on two metres, as I have already discussed, some sort of vertical aerial is appropriate. To access your local packet mailbox or DX Cluster, again a vertically polarised aerial is the order of the day. The packet mailbox itself will probably have an omnidirectional vertical aerial so that users can access it from all around. However, your best bet will be some sort of directional aerial, perhaps a vertically mounted Yagi, to achieve directionality and avoid causing interference to other users of the packet channels. Again, it need not be steerable; the mailbox isn't going to move!

Table 1 tries to summarise some of what I have said, though inevitably this leads to considerable simplification. Again, in one short article it is impossible to cover all the options, but I hope I have given you some ideas to get you started. Often it is the space you have available which will play a large part in your choice. Drawing a plan or your house and garden on a piece of squared paper, cutting out some typical aerials to scale and trying them in different configurations can help a lot. And, yes, in the case of HF wire aerials you can bend them round corners and generally distort them with remarkably little impact on their overall performance. This doesn't work with aerials that have parasitic elements – the spacing of these from the driven element is crucial.

If there are particular aspects of aerials you would like covered in more detail, and aerials are one of the most written about aspects of our hobby, I suggest a note to the Editor might not go amiss!

Table 1

Typical aerials for local and long-distance working

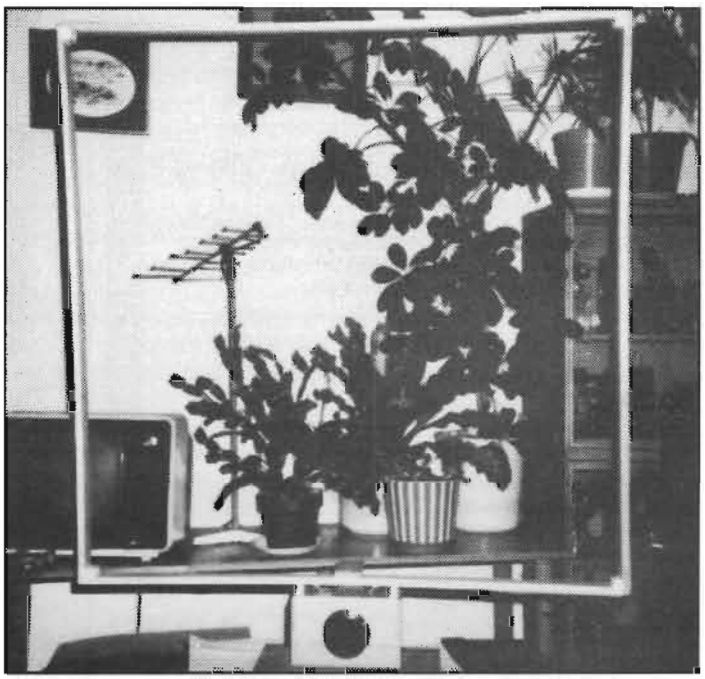
Waveband	*Local working*	*Long-distance (DX)*
160/80/40/30	Dipole	Vertical or inverted-L
20/17/15/12/10	Low dipole	High dipole, full-wave loop, Yagi or quad
6/2/70cm	Vertical	Yagi

Project – An 80m Loop Aerial

Richard Marris G2BZQ constructs a simple to make 80m loop aerial

The transmitting loop aerial I describe here is simple to make, low in cost, easy to use and gives excellent performance. I use mine on a table alongside the operating position, but as it has only one control, it may alternatively be installed in the loft, using a simple remote control device.

Though no doubt capable of handling higher power, my loop has only been operated with around 10W CW following an initial reliability test with 25W. I consider though, in the interests of safety, that indoor transmitting aerials should only be used with comparatively low power!



The Circuit

Fig. 1 shows a two turn 910mm x 910mm loop (L1) resonated to frequency with a 100pF variable capacitor (C). A type of helical hairpin (L2) gives 50 ohm impedance matching to the transmitter. Using a transmitter with a Pi-output, I have detected no TVI with my system. No doubt the loop acts as a band pass filter, as on my prototype I measured the usable bandwidth, without retuning C, as 18kHz. Variable capacitor C tunes the loop over the whole of the 80m amateur band, covering 3.5-3.8MHz (3.5-4.0MHz in some countries). As the loop has non-amateur applications, I should mention that the total frequency range is 3.45MHz to 6.00MHz. The loop dimensions I determined by available space, plus the essential necessity of using complete, and not part, loop turns.

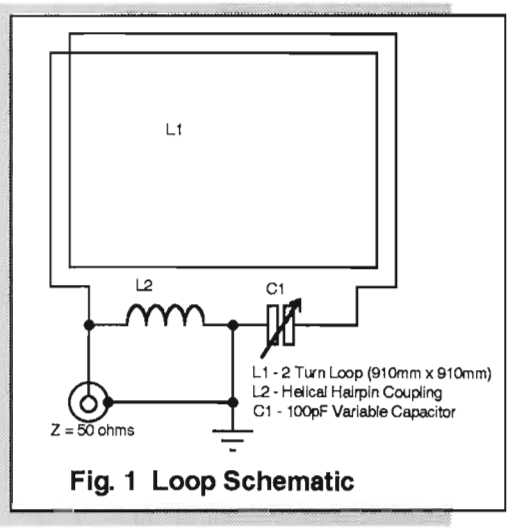


Fig. 1 Loop Schematic

Loop Profile

Fig. 2 shows a square loop frame mounted on a plastic box, which is bolted to a wooden baseboard. The box is stood on its edge so that its lid now becomes a removable back plate.

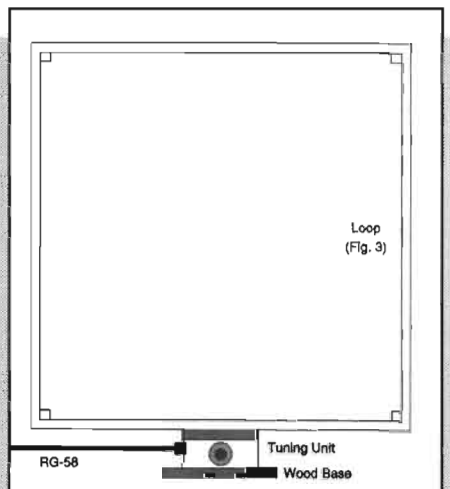


Fig. 2 Loop Profile

The plastic box contains the tuning/matching unit, consisting of variable capacitor (C) and helical hairpin (L2) plus a socket in the side. A large diameter instrument knob on the variable capacitor gives adequate control without a slow motion drive.

Construction

The loop frame shown in Fig. 3 is made of dry seasoned wood. Two lengths of 910mm x 32mm, and two lengths 888mm x 32mm, x 12.5mm, are required. These are glued to form a 910mm x 910mm frame with 32mm x 12.5mm x 12.5mm corner blocks. The simplest method of assembly is to use thin panel pins plus glue to hold the pieces together. The pins should not be driven right in, so that they can be extracted when the glue has hardened. I finished my frame with teak colour wood stain.

The loop winding (L1) consists of two turns of 32/0.2mm PVC covered power connection wire rated at 10A. The turns are wound counter clockwise, spaced 5mm between the insulated PVC

wire covering – this means that the wire conductors are at 6.3mm centres. The wire tails are then temporarily held in position with masking tape.

The tuning unit (Figs. 2 and 4) is assembled into a plastic box 177mm x 114mm x 70mm, which is bolted upright to a wood baseboard with the box lid now forming a removable back plate. The wood base is 305mm x 203mm x 12.5mm. The variable capacitor (C) is mounted in the centre of the box front, and fitted with a 75mm diameter instrument knob. C should be a good quality ceramic 100pF variable capacitor. The coaxial socket is fitted to the left hand side of the box.

The helical hairpin impedance matching device (L2) is hung from the upper lid of the box, soldered to the ends of two thin brass bolts (Fig. 4). L2 consists of 9 turns of 16 gauge tinned copper wire spaced one turn.

The loop frame/winding is mounted on the top of the tuning unit, with two 60mm x 12.5mm x 12.5mm blocks of wood or plastic, and the whole held together with four bolts. The two loop wire turns are thus trapped between the frame and the blocks, the masking tape can now be removed. The loop wire ends, or tails, pass through holes drilled in the box (Fig. 4). The tuning wiring is completed with the same 32/0.2mm wire used for the loop and can be seen in Fig. 4.

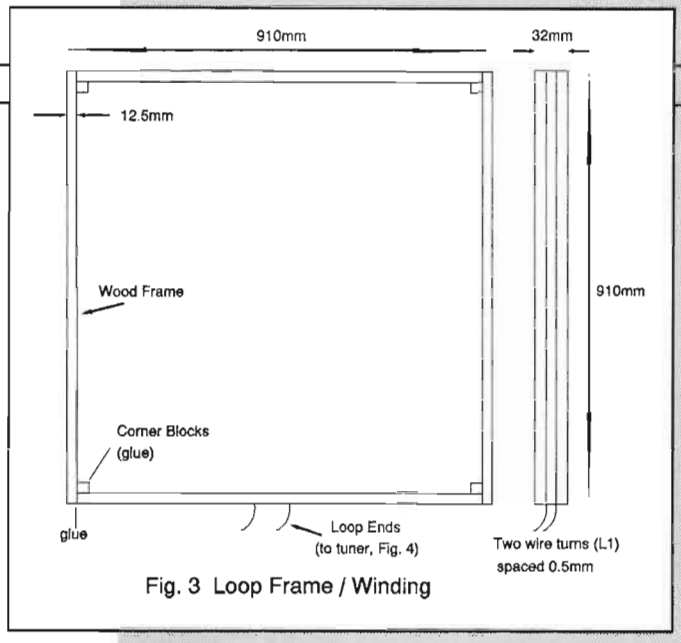


Fig. 3 Loop Frame / Winding

Operation

Connect the loop to your transceiver with RG58 coaxial feeder 1.2m long. If a much longer length is used (e.g., if remote controlled) it might be advisable to 'ground' the loop (Fig. 1).

Glossy white card is fitted to the front panel of the plastic box with double sided sticky tape. As the variable capacitor (C) rotates through 360 degrees, a heavy black line is drawn to indicate the low (LO) and high (HI) frequency ends of the tuning range. Calibrations to your individual requirements can be marked on the card. I marked my prototype at 3.5, 3.6, 3.7 and 3.8MHz, and at 3.568MHz for convenience for my regular early morning contact with a friend in Germany.

My prototype gave lively reception with a low noise level. To test on 'transmit' first resonate the loop to frequency on your receiver, then feed low transmit RF power into the loop and load in the usual way. Maximum radiation can be peaked using a simple nearby field strength meter, by a small adjustment of C if needed. Using a transmitter with a Pi-network output circuit, no difficulty has arisen in my case and I've detected no TVI or harmonics. The loop works equally well with, or without, my regular ATU.

The usable bandwidth, on my prototype, was 18kHz, without retuning the variable capacitor (C). 'Usable bandwidth' I define as the amount my transmit VFO can be moved without any detectable reduction in the loop radiation, measured by using my field strength meter, without retuning variable capacitor C.

In operation the loop has been used with 7 to 10W CW, which power is quite adequate. *In the interests of safety, I would recommend that high transmit power should not be used with an indoor aerial.*

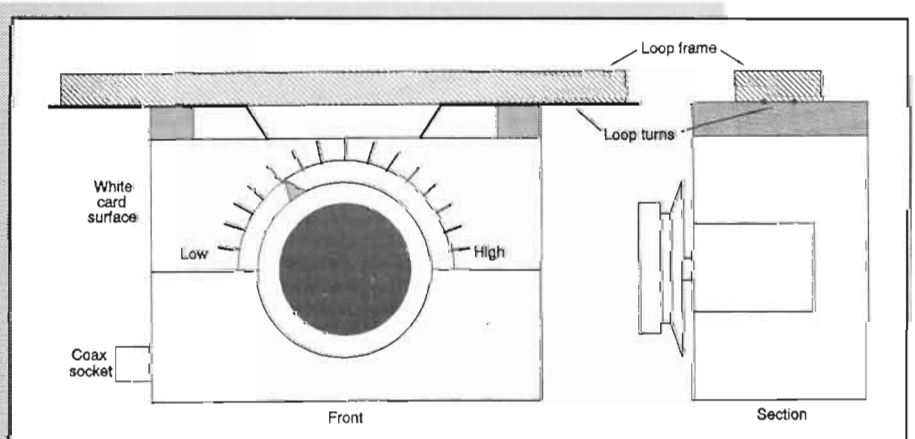


Fig. 4(a) Tuning Unit

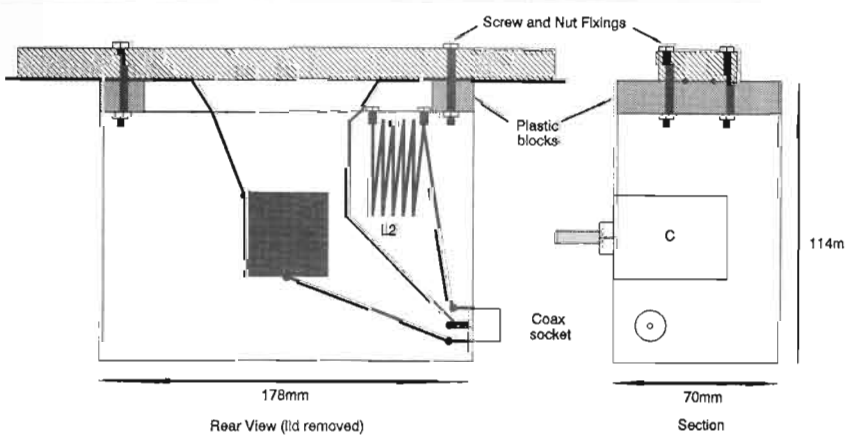


Fig. 4(b) Internal Arrangement

Parts list;

2 pieces timber 914mm x 32mm x 12.5mm
2 pieces timber 888mm x 38mm x 12.5mm
4 corner blocks 32mm x 12.5mm x 12.5mm
Plastic box 178mm x 114mm x 70mm
Wood baseboard 305mm x 203mm x 12.5mm
2 plastic or hardwood spacer blocks 60mm x 12.5mm x 12.5mm
Ceramic variable capacitor, 100pF
75mm instrument knob
Coaxial socket
L1 PVC covered power connection wire, 32/0.2mm 10A rating, o/d = 2.5mm
L2 16 gauge tinned copper wire
Connecting cable; RG58 (with suitable plugs) coaxial feeder approx 1.2m long.
Sundries; wood stain, screws, nuts and washers, wood glue.

Trio TK801S Ex-PMR Radio Conversion

Dave Coomber G8UYZ, Kev Graham G8ZWU and Brian Gallear G8VPR get some Trio-Kenwood ex-PMR radios onto 70cm

The Trio TK801S is a synthesized 40W UHF FM transceiver, and this article describes how the set can be converted for use on 70cm with the use of EPROMs to derive the output frequency. (The VHF TK-701S conversion to 2m is planned for a future issue of HRT – Ed).

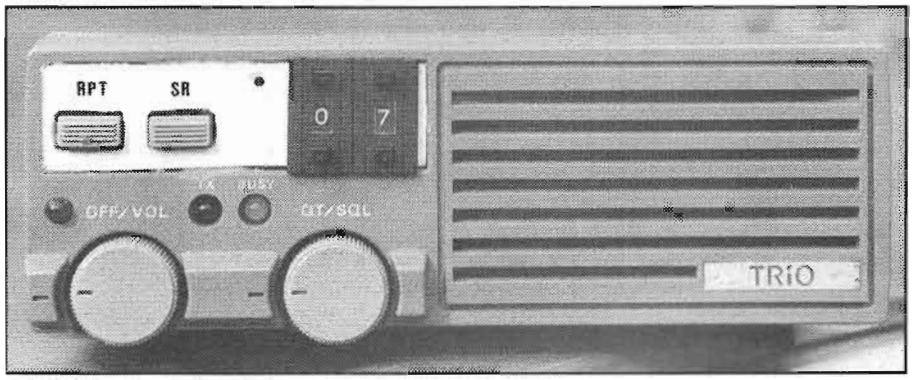
Programming

The EPROM-based conversion offers 240 channels in the band 432.0 to 435.0MHz including the repeaters, simplex and the packet channels in the hexadecimal range 00 – F1 in 12.5kHz steps. It is alternatively possible to arrange a set of 16 small switches or links and have a 'look-up' table to set the simplex frequency of operation. There are two sections to the whole conversion; making sure it works on UHF (it's important that the set is working correctly on the band before starting), and modification of the ROM data source by fitting a pair of EPROMs. The conversion described, whilst straightforward, *can* get a bit difficult especially for those unused to digital work. We cannot stress enough the need for a good standard of work and careful attention to normal safety procedures, including the safe handling of CMOS devices. If you make up a Veroboard, it is absolutely vital that great care is taken with the wiring. All three of us suffered problems which were attributable to wiring problems.

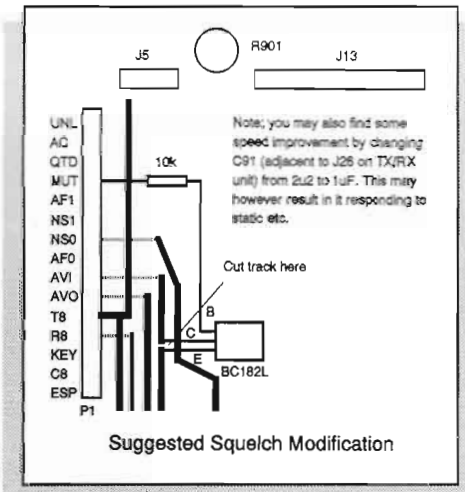
EPROMs

It would be pointless to waste a lot of space with a load of meaningless printed jumble of little use to the average ham who lacks an EPROM programmer, so the authors offer a programming service on your own EPROMs, or can supply suitably programmed EPROMs.

Since a 16-bit pattern is required, two EPROMs are used, 27C64 types are described here. Thumb-wheel BCD switches select a programmed address in the EPROM and the memory constants are put onto the input lines of U18, the first Phase-Locked Loop (PLL), via header cables to U22 & U23.

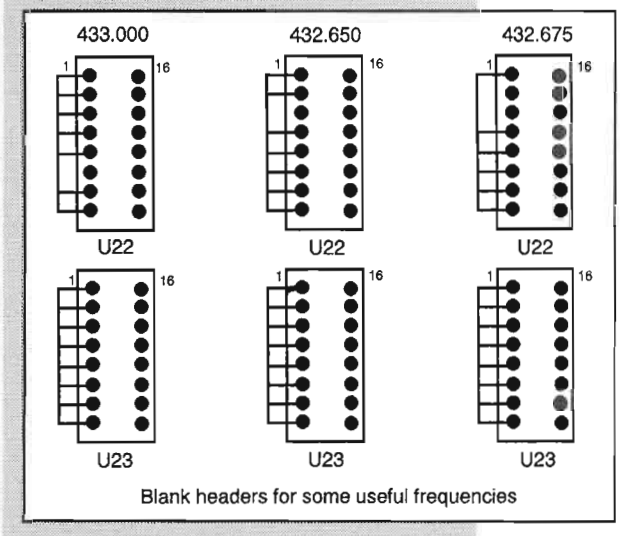


The TK-801S



Suggested Squelch Modification

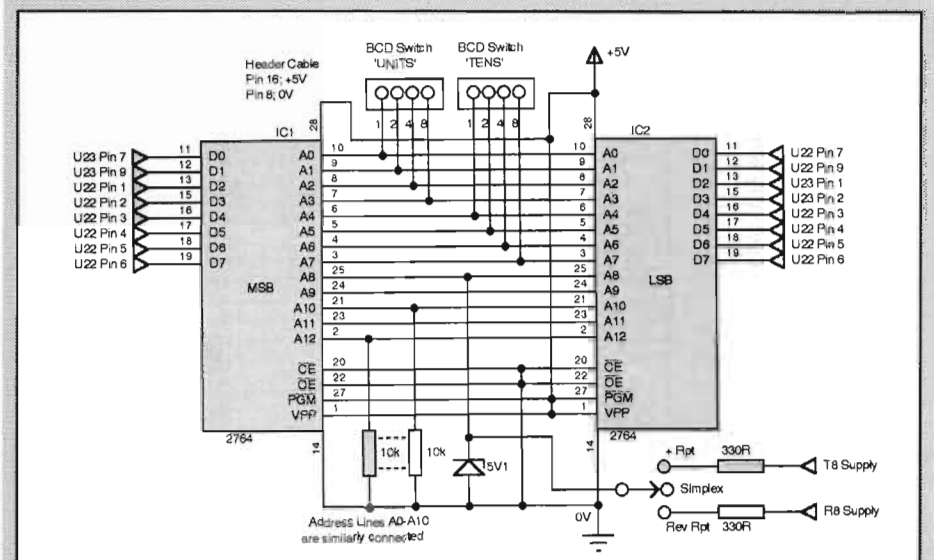
The data on the EPROM address lines A0-A7 is selected by the BCD switches which address data held in the ROMs. The resultant 8+8 data (8 bits from each of the two EPROMs) is sent via the header cables to the PLL in the radio as a 10 bit plus 6 bit. All address lines are held *low* by the 10k pull-down resistors (this is opposite to the PLL U18, which keeps its lines high unless otherwise pulled low). Address line A8 is used to select an offset to store the repeater shifts. This selection is made by using the T8 (+8V Transmit line) via S3a (S3b is used to select the appropriate LED). Reverse repeater is accomplished by selection of R8 (+8v Rx line). The centre-off position ensures that simplex mode is selected. EPROM address line A8 is clamped to +5V by a zener diode.



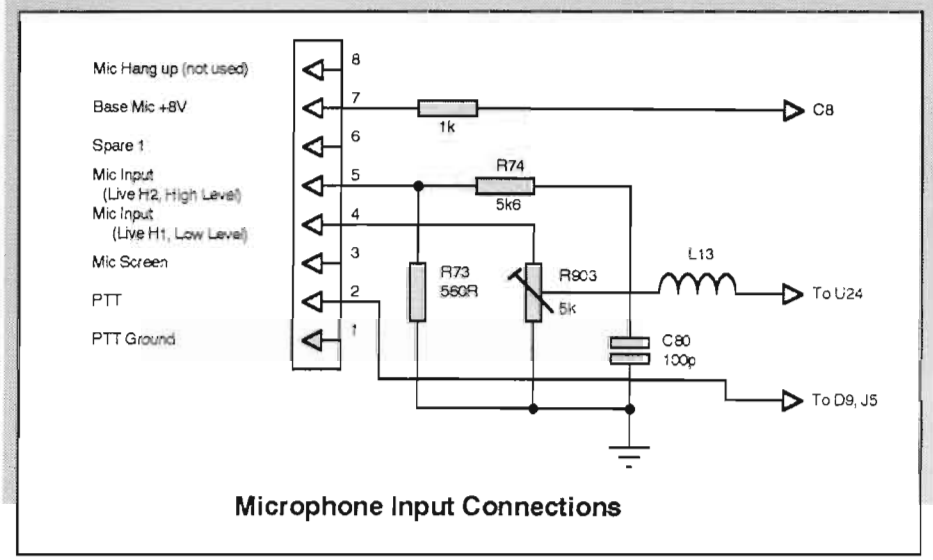
Blank headers for some useful frequencies

No ROM?

If your set does not have any ROM data you will need something to replace them, such as a binary switch assembly which can be used to select frequencies of use (simplex transmission only). The accompanying listing shows typical binary codes to be used on the switch, and a PC



PLL EPROM Driver Unit for the TK-801S



Microphone Input Connections

program is available (see later) to enable you to calculate the codes required for any required frequency range. We used both GWBasic and QBasic for the PC, and the program is simple enough to be easily converted to other BASICs. Alternatively, you will need to make up a pair of header blanks (using a wired pair of headers or IC sockets (turned pins), with some coding on to drive the PLL. In the listing shown here, the binary numbers are in switch order, i.e., lowest value on the left.

Preliminaries

You'll need a 13.8V DC supply, a 15A Ammeter to measure the DC consumption (unless fitted to the supply), an RF Power meter, an AVO or good DVM (10V DC full scale), a 50W UHF dummy load, and normal tuning tools. You will find a simple logic probe of considerable help in diagnosing any problems. (You can also use a multimeter set to the 5V range). Connect a microphone for the PTT, a dummy load to the aerial socket and the 13.8V supply to the set.

If there is a CTCSS tone board fitted in your set, remove it. If there is no CTCSS tone board fitted, check that a plug is fitted to J6 (near the microphone input connector). If this plug is not fitted, solder a lead between pins 3 & 5 (AF1 & AF0) or make sure that link H4-H3 (adjacent to pin 5) is fitted with a jumper connection. (This point is also noteworthy for being an ideal place from which to take AF output (500mV) to a TNC). Solder a second lead between pins 4 & 1 (AC and GND).

PLL Adjustment

Switch on, set the repeater switch to centre (off), the BCD switches to 50 (corresponding to 433.000MHz), or use a programmed blank header. Squelch fully open, volume to a comfortable level. Connect an AVO earth lead to earth, select 10V DC range, apply the positive lead to the 1st RX test point (TP1). Tune capacitor C901 for about +5V. It should not move by more than about 0.5V at the top and bottom edges of the chosen band. Re-adjust for a compromise if necessary. Connect the UHF Frequency Counter to TP6 on J11 pin 3 and tune C902 for (Rx frequency – 21.4MHz)/3. This works out to 137.1MHz for channel 38 (432.700MHz).

For the TX PLL, place the AVO positive lead (10V DC range) on TP4. Press the PTT button. Tune C903 for 2.5V on TX (it should not vary by more than about 0.5V from the bottom to the top of the band).

Receiver Alignment

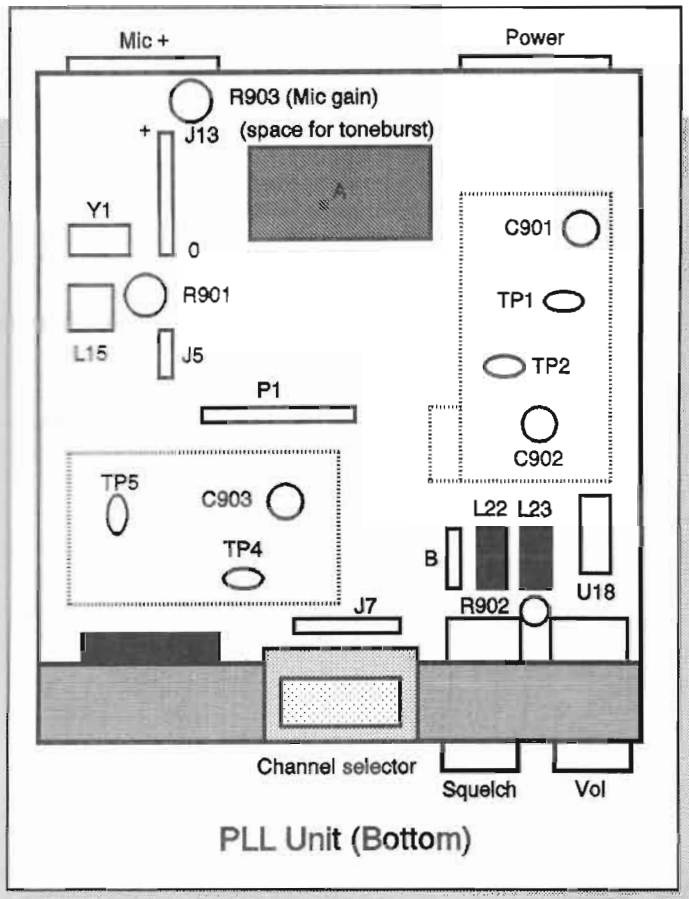
The TK801 uses helical resonators which have brass core slugs. If you lose the core retaining springs, you are in deep trouble as they not only secure the core slugs, but also form an earth connection from the slug to the outer case. They are not easily replaced. You might get away with soldering a piece of wire across the can and in line with the core slot or even solder the slug to the can – but only *after* you have tuned the set up.

If you have been fortunate enough to obtain a 420-440 MHz set, (T band), you will probably not have to do much! If you have a U band set (440-470 MHz), the cores of Z17, 18, 19 & 20 will be about three turns out. It's about the only way of telling the difference! Connect the AVO (or a 'scope) to the loudspeaker connections (set to 2.5V AC range). Inject fundamental RF, modulated 1kHz tone, at a high enough level into the Ae socket to hear *something*. Tune Z17, Z18, Z19 & Z20 for maximum audio output (as read on the 'scope or the AVO connected across the loudspeaker connections), reducing the input signal level as the noise decreases and the signal rises. Repeat until there is no further improvement. The brass cores will be almost fully in on Z17, 18, 19, & 20. Tune L27 to obtain maximum sensitivity (best SINAD). Tune L29 for maximum AF output. Tune L26 & L23 for minimum audio distortion (best SINAD).

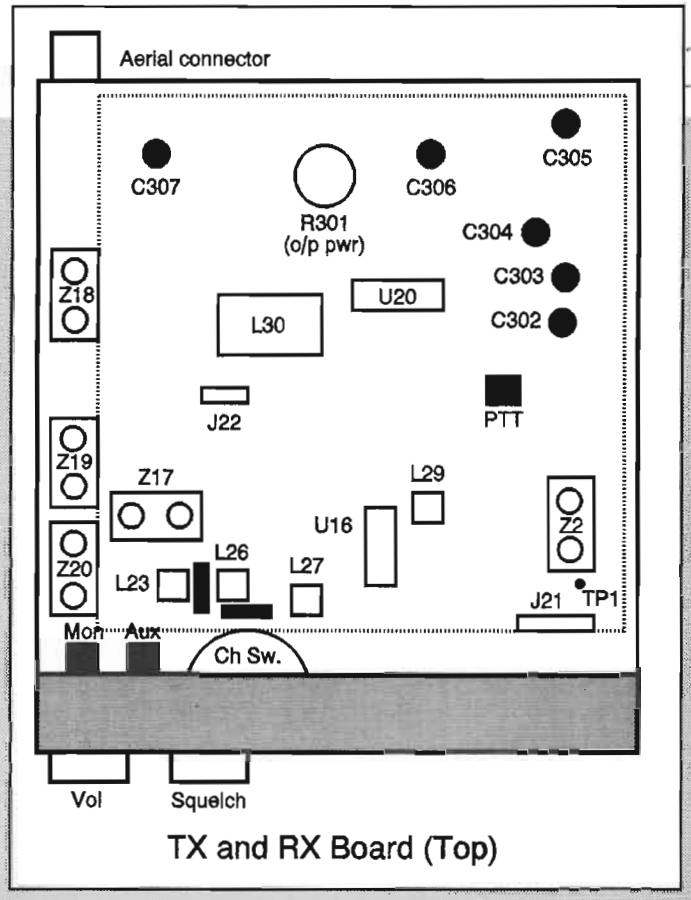
To preset the squelch, turn the front panel squelch control fully anti-clockwise until the switch operates. Set R902 clockwise until the squelch opens (and the green LED light illuminates), then back off R902 until the light just extinguishes. Some users have reported problems with the squelch. A simple modification is possible which requires only a small transistor and a 10k resistor.

TX Alignment

Connect your dummy load and select a channel in the middle of the



PLL Unit (Bottom)



TX and RX Board (Top)

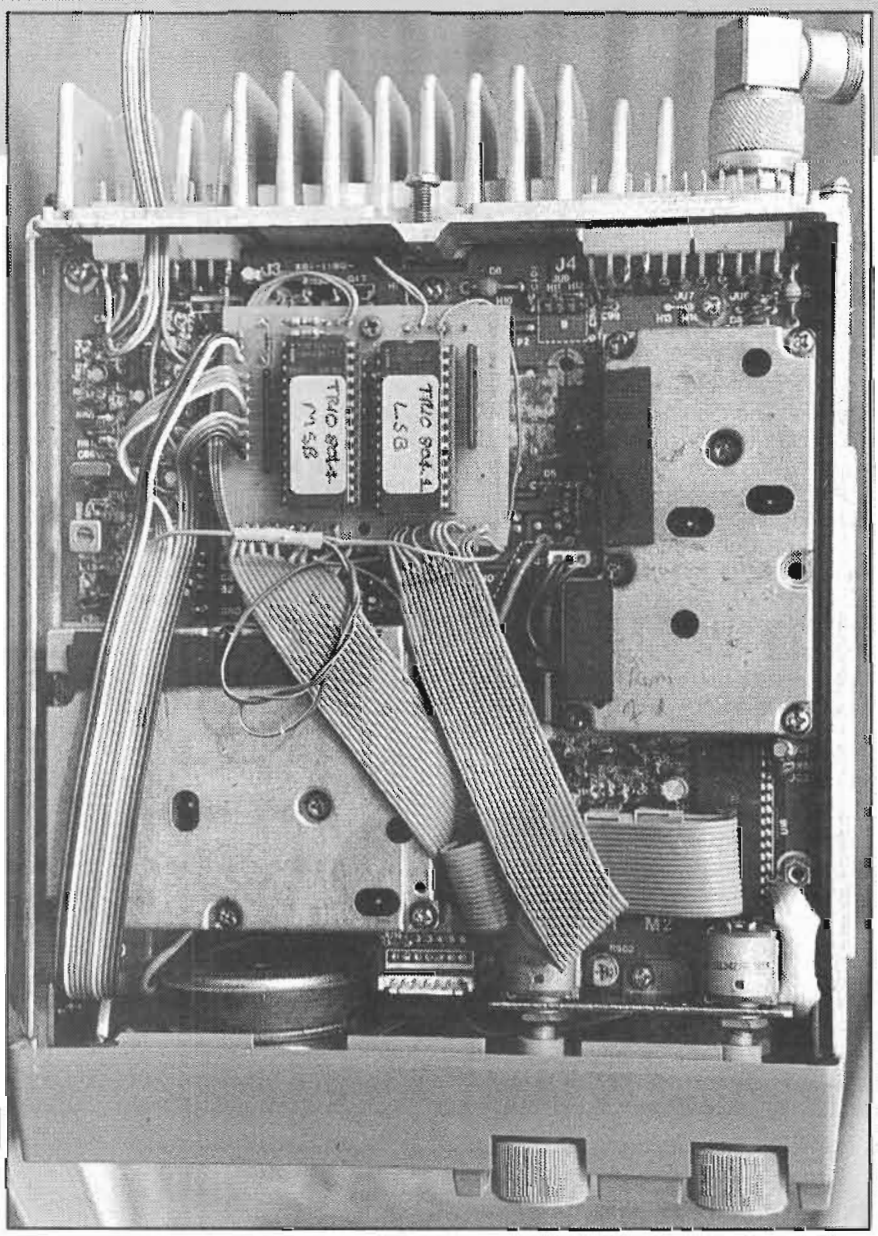
band. Squelch closed, volume to a comfortable level. Put the frequency counter leads to J21. It should read (Tx freq./3) when the PTT line is pressed. Disconnect the counter from J21 and put it near C302. Tune Z2 coils for an RF output at TX final frequency. Tune C302, C303 & C304 for increasing RF output (measured at the aerial socket). If you get none, rotate R301 fully clockwise. Re-tune C302, 303, 304, 305, 306 and 307 for maximum RF output (should be well in excess of 25W – usually 40W). Observe the ammeter for a slight 'dip' as you come up to maximum output power. The core of Z2 should be about one turn out after tuning. Rotate R301 anti clockwise to set desired RF output level (ours all seem to work very well at about 20W (4 – 5A consumption).

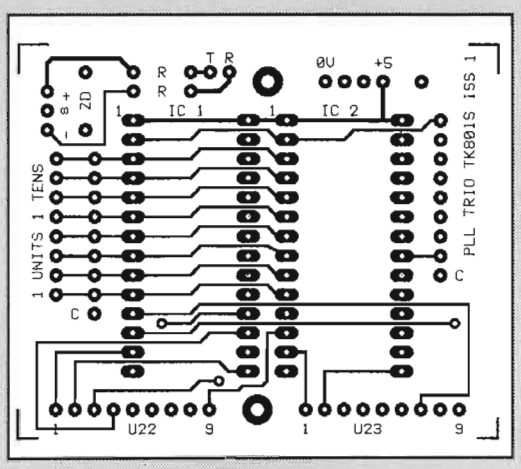
Place the counter lead near the aerial socket (or on the dummy load). Tune L15 for *exact* TX frequency. Re-tune C305, 306 & 307 for maximum RF output commensurate with minimum DC supply current, this ensures that the set will run a bit cooler. This manoeuvre can take a little practice.

For deviation adjustment, set R903 fully clockwise, then set R901 clockwise for your desired deviation, the local repeater signal is usually a good comparison.

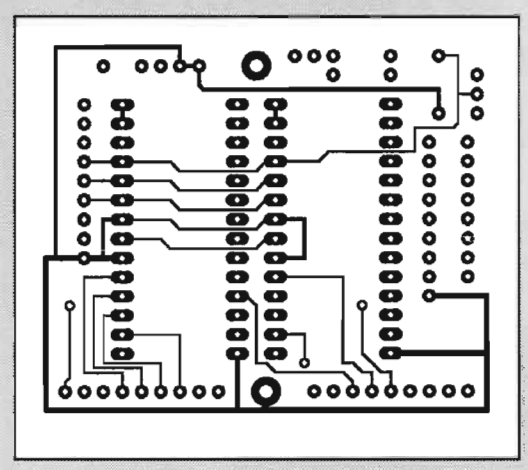
Diagnostics

If you're having problems and you're using the EPROMs, check that the supplies are good to both ICs (on pins 28, 27 & 1) and that the earth is





PCB, component side, full size



PCB, solder side, full size

properly made (pins 14, 20 & 22), and that you have the correct bit patterns on the ICs (details available from HRT for an SAE).

If you fail to get the correct frequency of output (or none at all if the PLL is out of lock), double check the header blanks (if used), or that the switch bank (if used) is correctly set. The switches are used with the binary count reversed to the normal method (0 to the left). You might find it easier to wire up the 'cross-overs' of pins 7 & 9 for U22/U23 on the board as it will make for easier construction of the headers. Remember that the switch order is N0 – N9 , A0 – A5, left to right. Check also the setting of the repeater switch (if used).

The lowest simplex channel is 00 (432.000 MHz), highest channel is F0 (435.000 MHz). These simplex channels are in 12.5kHz steps. Using the ready-programmed EPROMs, the repeater channels start at 50, running every other one to 6E (viz., 50, 52, 54, etc..). Note: These transmit *only* in 25kHz steps, although you should be able to receive a station that is 12.5kHz away (51, 53, etc..). The repeater switch should be set to '+' for normal repeater operation, '-' for reverse. The centre position should be *off* for simplex operation.

General Notes & Applications

As noted earlier, there is a 500mV source of audio, which is suitable for feeding a TNC, available at AF0/AF1. Note that the audio output on the rear apron is at 130mV and it is passed via a high-pass filter (Q24, 2SC1815C), which does not seem to be too friendly to packet/data signals.

The PTT line is 'live' and pulled to earth to make the set transmit. Consumption has not been measured, but it work well on our TNCs. The Loudspeaker output is rated at 4 watts into 4 ohms.

PCBs, EPROMs, and More Information

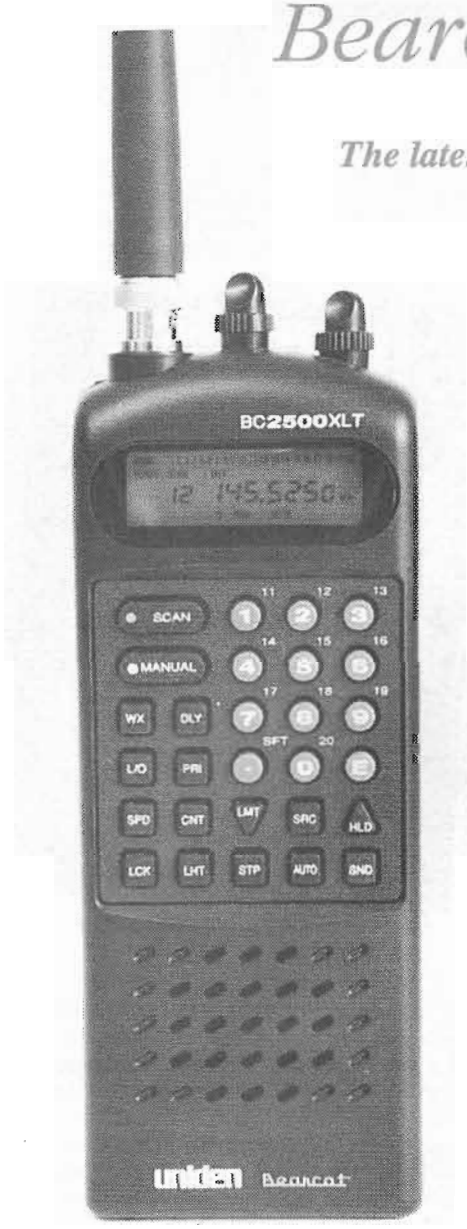
For a programming service on your own EPROMs, or a supply of suitably programmed EPROMs, contact Kev Graham G8ZWU, 670 Stafford Rd, Fordhouses, Wolverhampton WV10 6NW, for full details and please do not forget to enclose an SAE. Thanks to the efforts of G4YTK who designed it, there is a double-sided PCB layout illustrated, there may even be one or two in stock for those who do not want to design their own. A transceiver circuit diagram, 'add-on' details, operational and faultfinding notes, drawings etc. (unfortunately far too many to publish in this magazine article – Ed) are available by sending a large SAE marked "TK801 Information" to the HRT Editor at the usual HRT Head Office address (rear pages). If you'd like a copy of the BASIC program to calculate the channel codes for any 70cm frequency, send a blank, formatted 3.5in PC disk along with your SAE. For any other queries relating to this conversion, please contact the author, Dave Coomber G8UYZ, 14 Francis Green Ln, Penkridge, Staffs ST19 5HF.

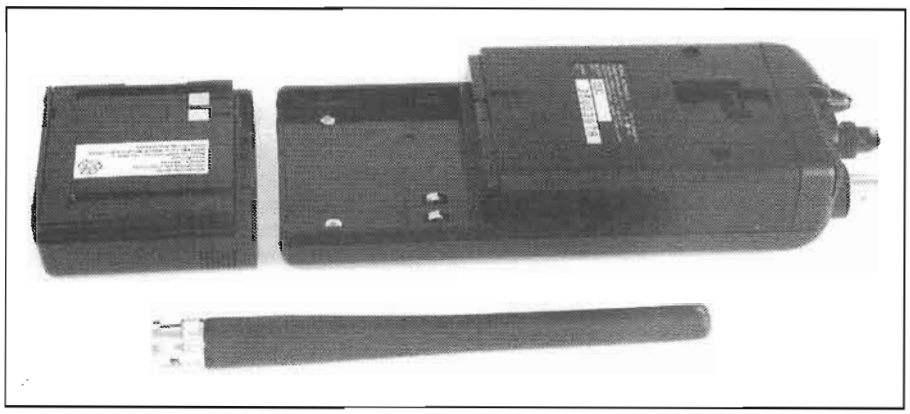
Typical EPROM codes

Freq	Dec.	N Binary N0123456789	Dec.	A Binary A012345
			2	010000
432.625	514	0100000001	4	001000
432.650	514	0100000001	6	011000
432.675	514	0100000001	32	000001
433.000	514	0100000001	34	010001
433.025	514	0100000001	36	001001
433.050	514	0100000001	38	011001
433.075	514	0100000001	40	000101
433.100	514	0100000001	42	010101
433.125	514	0100000001	44	001101
433.150	514	0100000001	46	011101
433.175	514	0100000001	48	000011
433.200	514	0100000001	50	010011
433.225	514	0100000001	52	001011
433.250	514	0100000001	54	011011
433.275	514	0100000001	56	000111
433.300	514	0100000001	58	010111
433.325	514	0100000001	60	001111
433.350	514	0100000001	62	011111
433.375	514	0100000001	0	000000
433.400	515	1100000001	2	010000
433.425	515	1100000001	4	001000
433.450	515	1100000001	6	011000
433.475	515	1100000001	8	000100
433.500	515	1100000001	10	010100
433.525	515	1100000001	12	001100
433.550	515	1100000001	14	011100
433.575	515	1100000001	16	000010
433.600	515	1100000001	18	010010
433.625	515	1100000001	20	001010
433.650	515	1100000001	22	011010
433.675				

Bearcat BC-2500 Review

The latest fully featured Handheld from Bearcat put under close scrutiny





The Bearcat BC 2500XLT was featured in a 'new products' feature in *Scanners* a couple of months ago, and I was very pleased indeed to be able to 'get my hands on one' as soon as they became available in the UK.

Design Features

It's been a while since we've seen a new handheld scanner on the market under the 'Bearcat' name. It looks like their design department have been saving up their ideas for the 'big one', as the BC 2500XLT must now be the 'top of the range' set in Bearcat's handheld scanner offerings. Let's take a look at what it offers.

You get no less than 400 memory channels, in 20 banks of 20 channels each, which Bearcat's patented 'Turbo Scan' can step through at a very fast rate of nearly 100 channels per second. This really *does* put most other scanners to shame! The secret to this incredible speed is the way the channels are scanned within the memory banks. These are cycled through in 'frequency order' within each bank in 'Turbo Mode', rather than in actual programmed order, and knowledgeable 'synthesizer boffins' will I'm sure confirm that *this* is currently one of the best ways to get the very fastest scanning rate with 'mixed' frequencies.

Frequency Range

The scanner covers the frequency range of 25-550MHz, and 760-1300MHz, in the reception modes (which you can't change) as shown in the accompanying table. Various 'default' channel steps are programmed in as shown, however these steps can be changed as you wish once you're 'in' that frequency range, to either 5kHz, 12.5kHz, 25kHz or 50kHz, which shows that Bearcat have been listening to the wants and needs of scanner users in this respect.

As well as direct keypad entry of the frequency you want to listen to, a small click-step rotary knob, next to the concentric volume and squelch controls, can also be used to tune around your entered frequency or to step between channels. This can often be easier than pressing 'up' or 'down' buttons, as you would with many other handheld scanners.

Auto Store

As well as the usual 'search' mode, where the set searches for activity between any two pre-set frequencies you enter, an 'Auto Store' facility is also available. Here, whilst in 'Auto Store' search mode the set automatically programs all the active frequencies it finds into the memory bank, or banks, you tell it to, rather than simply halting on active frequencies. This mode is, in my opinion, one of the nicest features to be offered on the BC-2500XLT, and can be a great 'boon' when you're searching out new activity to listen to.

After your scanner is suitably 'filled' with channels, either by manual or automatic means, you can even then get it to do an automatic 'count' of the number of times the scanner has stopped on each of the channels you've left it scanning across – a novel touch! Another 'user-friendly' feature is the facility to reassign a stored frequency into another memory bank's open channel, the set automatically selecting that bank's lowest unprogrammed channel for you.

The scanner comes with a clip-on 600mAh nicad battery pack which forms the lower rear section of the set, together with a plug-in AC mains wall charger. For use out and about, as well as a belt clip a soft plastic carrying case is supplied, and spare nicad packs are available if you're on an 'all day' scanning excursion. The set measures 67mm (W) x 170mm (H) x 34mm (D), and weighs around 380g.

In Use

Right, that's enough of the 'woffle', let's see how it performed on the air. I've used several Bearcat scanners in the past (indeed my 'usual' personal handheld scanner is a Bearcat model) so I had little difficulty in getting to grips with using the BC 2500. Whenever I *did* have problems (in using the many new features) the handy sized user manual gave me clear guidance with step-by-step instructions. No worries in this respect.

Within literally a few seconds on switching on and doing a 'search' across 145.600-145.775MHz, the set had found one of my semi-local 2m repeaters, and I was happily listening away to the mobile rush-hour 'local

gossip' on the state of the various snow-bound roads at the time of the review. Unfortunately, I also noticed quite a bit of 'blocking' from other, much stronger, signals on the same band, which caused frequent disruptions to the signal I was trying to listen to. Ah well.... This I also found on several other bands when I connected my rooftop wideband unamplified aerial system, the scanner often just couldn't cope with the large amount of signals coming in on some of the more 'crowded' bands.

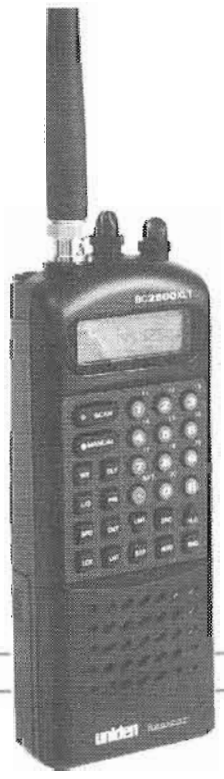
I used the set for many hours when walking out and about with the supplied set-top helical, together with several hundred miles of travelling in the car with the scanner connected to my wideband glassmounted mobile aerial. Here, it worked quite well, especially on VHF airband where my aerial was 'peaked' on, and there was enough audio from the internal speaker without speaker rattles or distortion, to allow reasonably comfortable listening on the move.

I found the 'Auto-store' mode extremely useful when travelling to a new area. Here, as I could leave the set scanning across a given range for a while, letting it store what it found, then simply scan across the 'action' at my leisure, very handy! I found the batteries gave me around four or five hours' worth of listening before going flat, but I often wished I'd had a spare battery pack. Unlike some other scanners I couldn't just pop a charged set of AA cells in when needed.

Conclusions

The Bearcat BC 2500XLT is a 'full-featured' offering, although it's unfortunate the bands offered are 'hard programmed' with various modes which don't match with European usage of the bands. The set's American 'main market' is undoubtedly the reason for this, however a useful point is that you can change the default channel steps, for example to 12.5kHz instead of 5kHz, which you can't do with many other 'designed for the US' scanners. I found the 'Auto Store' function extremely useful, and the 'count' facility is a very nice 'bonus', allowing the user to get a good idea of how active each channel is. As with some other handheld scanners, the strong signal handling performance could prove limiting in busy areas, especially if you connect an outdoor aerial. The BC 2500XLT has a list price of £299, with additional nicad packs available at £32.95 each.

My thanks go to Nevada Communications Ltd. in Portsmouth for the loan of the review scanner.



LABORATORY RESULTS:

All measurements performed on 145.0MHz FM unless otherwise stated.

Sensitivity;

Input signal level in µV pd required to give 12dB SINAD;

Freq.	*Sensitivity*
25MHz	0.57 (AM)
68MHz	1.45 (WFM)
78MHz	1.24 (WFM)
88MHz	1.23 (WFM)
118MHz	0.58 (AM)
130MHz	0.58 (AM)
145MHz	0.40 (FM)
160MHz	0.41 (FM)
174MHz	0.39 (FM)
220MHz	1.37 (WFM)
250MHz	0.65 (AM)
300MHz	0.60 (AM)
350MHz	0.69 (AM)
400MHz	0.51 (FM)
435MHz	0.47 (FM)
450MHz	0.48 (FM)
500MHz	0.63 (FM)
520MHz	1.60 (WFM)
800MHz	0.60 (FM)
850MHz	0.53 (FM)
900MHz	0.57 (FM)
935MHz	0.63 (FM)
950MHz	0.63 (FM)
1000MHz	0.68 (FM)
1300MHz	0.99 (FM)

Frequency Bands and Associated Modes

Freq.	Mode	Default Chan step
25-29MHz	AM	5kHz
29-54MHz	FM	5kHz
54-72MHz	WFM	50kHz
72-76MHz	FM	5kHz
76-108MHz	WFM	50kHz
108-137MHz	AM	12.5kHz
137-174MHz	WFM	5kHz
174-216MHz	WFM	50kHz
216-225MHz	FM	5kHz
225-400MHz	AM	12.5kHz
400-512MHz	FM	12.5kHz
512-550MHz	WFM	50kHz
760-1300MHz	FM	12.5kHz

Squelch Sensitivity;

Level of signal required to raise receiver squelch

Threshold; 0.11µV pd (<2dB SINAD)
Maximum; 0.47µV pd (14dB SINAD)

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;	10.3dB
-12.5kHz;	15.0dB
+25kHz:	50.9dB
-25kHz;	56.6dB

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;	59.0dB
+1MHz;	67.4dB
+10MHz;	88.7dB

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;	Blocking limited
50/100kHz spacing;	Blocking limited

Image Rejection

Difference in level between unwanted and wanted signal levels, each giving 12dB SINAD on-channel 145MHz FM signals;

1st Image;	Blocking limited
2nd Image;	27.5dB (-910kHz)

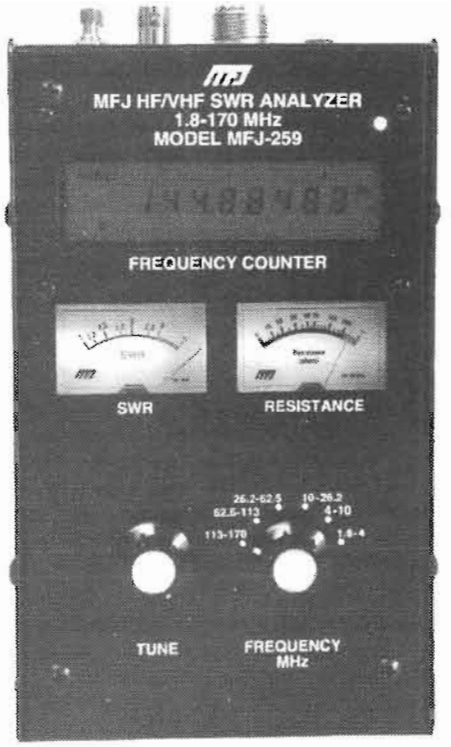
Maximum Audio Output

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

624mW RMS

Current Consumption

Scanning, no signal;	91mA
Receive, mid volume;	130mA
Receive, max volume;	176mA



The MFJ-259

MFJ-259 Aerial Analyzer Review

Chris Lorek G4HCL tests a very useful shack accessory which can also help SWLs as well as licensed amateurs

In our hobby, we all use aerials. If we didn't, we wouldn't be able to communicate very well, would we? It may not be surprising that adjusting aerials to resonance after they've been installed is one of the most common problems faced by amateurs. I very well remember being woken at around 11.30pm one night by a phone call, just as I'd got to sleep. It was a local chap with his cordless phone, up on the roof next to his chimney (yes, at *that* time!), trying to find out why he couldn't adjust his 10m aerial for a low SWR, he'd been trying everything all day he said. After a few expletives on my part, we eventually sorted his problem out (an inner/outer coax short), his aerial worked, and we both got some sleep. This admittedly 'extreme' example just shows the antics some amateurs go through with their aerial SWR!

I wish he'd have been able to have something like the MFJ-259 SWR Analyzer with him, we'd both have been able to get a much better night's rest.

Tuning Up

What's inside this little 'black box of tricks' then? Well, it's a tiny wideband 'transmitter substitute', covering the frequency range of 1.8-170MHz, complete with its own built-in digital frequency counter and SWR meter. You connect your aerial or feeder to the PL-259 connector on top of the unit, set to the appropriate frequency range, and use the 'tune' knob to see where the minimum SWR of your aerial system lies. Once you have an SWR minimum on the 'SWR' meter, the adjacent 'Resistance' meter shows you the resistive value of the aerial impedance at that point. If it's a 1:1 SWR, it'll be 50ohms for example, whereas either a 100 ohm or 25 ohm resistance would yield a 2:1 SWR. The unit operates either from an external plug-in 12V DC supply, and you can install eight AA cells inside the unit if you wish for portable use (e.g., up the tower!).

As well as for occasional use in setting up aerials once installed, a common day-to-day 'shack use' would be for owners of aerial tuning units, to save transmitter or PA finals when tuning-up. First, switch in the MFJ Analyzer, set it to your required operating frequency, and simply adjust the ATU for minimum SWR. All without radiating a 'whopping carrier' right on top of the net or DX frequency!

Mobile whip adjustment (i.e., when you change operating frequency or band) is of course another use, and as the analyzer covers up to 175MHz, it'll even be useful for setting up your 2m mobile whip after installation, today's latest glassmount aerials often need a 'fine tune' before use for the best results. A handy use of the 'Resistance' meter also with the SWR meter would be for setting up gamma matches on HF and VHF yagis – adjusting the match on my tower mounted 4 element 50MHz yagi once took me hours using just a 'normal' SWR meter.

Versatile

As the unit has a built-in frequency counter, MFJ have usefully provided a separate 'input' BNC socket so you can use this as a normal counter in your station – a very useful accessory at any time. But as well as this, it only takes a little imagination to think of a whole host of other uses for such a device. Like tuning up coax 'stubs', just add a 50 ohm resistor in series with the coax and cut to length for minimum SWR for a quarter wave 'stub', or with the far end shorted just cut for minimum SWR for a half wave. You can work this idea 'backwards' to find the velocity factor of that length of coax you have lying around, just measure the frequency across the unit's range which corresponds with the lowest SWR and do a quick calculation based on the 'physical' and measured 'electrical' lengths of the coax. You can also find the loss of it at any frequency by measuring the resultant SWR with the far end open circuited, 3:1 giving 3dB loss, 2:1 giving 4.7dB loss, 1.5 giving 6.9dB loss for example. You can test your home made aerial 'traps' for correct resonance, check baluns, even adjust amplifier matching networks before applying HT and risking those expensive valves in your latest linear project. The list goes on. It can, of course, be *extremely* to non-licensed enthusiasts in getting their aerials and other gear 'spot on' with the need for a transmitter.

In Use

I was pleased to be able to use the MFJ Analyzer 'in anger' on several occasions over the review period. I love 'messing about' with aerials, realizing, as many amateurs do, that this part of the station is often the most important. For example, I found the analyzer an extremely handy tool once when out in the garden, adjusting the wire 'drop' ends from my 80m traps on my 40/80/160m trap dipole. As well as giving me 'spot on' performance from my aerial, it also kept my XYL happy as I didn't need to keep walking mud all over the house for the otherwise necessary trips between the back-garden aerial and shack! Likewise when up the tower – it's a bit difficult to hoist a HF transmitter and SWR meter up there. 'Remote TX keying' *can* have its dangers with RF burns (yes, I know – I now wait a second after keying my handheld PTT before saying "don't transmit" to make sure the "don't" gets through!).

Yes, I found the MFJ-259 a very handy tool indeed, and although it isn't cheap, I'd certainly recommend one to anyone interested or involved in aerial work if you can afford one.

The MFJ-259 currently retails at £249.95, and my thanks go to Waters and Stanton Electronics in Hockley for the loan of the review sample.

From My Notebook

Geoff Arnold G3GSR takes a steady look at oscilloscope waveforms

'Looking at' Signals

Although the multimeter is the most widely used test electronic instrument, it has its limitations – it can tell you nothing at all about the waveform of an alternating or pulsating voltage or current. An instrument which can do that job, and many others, too, including that of a multimeter, is the oscilloscope, sometimes called a cathode-ray oscillograph, or 'CRO' (either spelt out or pronounced like the word 'crow'). Whatever it is called, it is surely the most versatile single piece of test equipment for work in radio and electronic circuits, whether they are digital or analogue.

In the normal mode of operation of an oscilloscope, an internal oscillator sweeps the spot repeatedly across the screen horizontally from side to side. In mathematics, the horizontal axis of a graph is called the 'X' axis, and in an oscilloscope the horizontal movement of the spot, and the oscillator which produces it, are sometimes called the 'X' sweep.

The oscillator and amplifier which provide the 'X' sweep are called the timebase generator. Its output is shaped like a sawtooth (Fig. 1), with a steadily rising voltage which moves the spot across the screen from left to right. That 'steadily rising voltage' is the clue to the name 'timebase', for any steadily changing quantity provides the means to measure something against. Even a ruler fits that definition, although there the 'changing quantity' is the increasing distance from the '0' mark on the scale. It is up to you to judge which scale mark the end of the object you are measuring lies opposite, having first lined up its opposite end with the '0' mark. With a ruler or scale, the quantity you measure is length, but with an oscilloscope timebase, it is time.

When the spot on our oscilloscope has reached the right-hand side of the screen, the timebase generator output voltage falls rapidly, returning the spot swiftly to the left-hand side of the screen ready to begin the next sweep. This swift return is called, appropriately, the 'flyback'.

The signal to be observed on the oscilloscope screen is amplified and applied to the display tube so that the spot is deflected up and down (called the 'Y' deflection, following mathematical tradition of the vertical axis of a graph being the 'Y' axis), tracing out the 'shape' of the variations of the signal with time.

Although in Fig. 1 I've shown a new ramp starting immediately after the completion of the flyback, oscilloscopes don't actually work quite like that. The fact that the timebase repetition frequency is not directly related to the speed of the ramp is something that seems to baffle many newcomers to oscilloscopes, basically I think because textbooks tend to show the timebase looking just like Fig. 1, whereas in real life it looks more like Fig. 2, with the waiting time between ramps being adjusted so that the timebase and the signal to be displayed can be kept in synchronism.

Triggering

In the very simplest types of oscilloscope, the timebase oscillator is 'free-running', in other words it oscillates at a rate set only by internal circuit time-constants, although these are adjustable by means of front-panel controls. If the timebase is not running at a frequency which is exactly harmonically related to the signal to be displayed, then the waveform appearing on the screen will at best be drifting slowly to left or right; more likely it will be moving so fast that it becomes a faint blur.

Any oscilloscope worthy of the name incorporates at the very least a synchronising circuit, rather like that which holds the picture steady in a TV, 'pulling' the timebase into step with the incoming signal over a limited range of frequency difference.

In modern oscilloscopes, a far more efficient system called timebase triggering is incorporated. When triggering is in operation, the starting point of each horizontal sweep (the beginning of the ramp) is totally controlled by the incoming signal, although the operator can decide the signal voltage level at which the timebase will actually fire off.

The level on the incoming signal waveform at which the trigger circuit operates is adjustable, and is also switchable between the 'positive' and 'negative' excursions of the signal (Fig. 3). This variable setting can be useful where the waveform has 'kinks' on it, so that there is more than one point in each cycle where the waveform passes through a given level. If adjusted as in Fig. 4, there are three points per cycle at which the trigger point is reached.

Telling the Difference

I don't think there are any oscilloscopes produced today which don't incorporate full triggering facilities, often with built-in TV sync separators for work on television equipment, low-pass filters to aid reliable triggering in the presence of high-frequency noise, etc., and other clever features.

If your budget doesn't stretch to a new instrument, there are plenty of second-user ones available at radio rallies. 'Professional' types are almost certain to incorporate full triggering facilities unless you go back to pre-1950s models, such as might appear on the 'bring-and-buy' from time to time. Early 'hobbyist' models, such as Heathkit, may have only 'sync' circuits, and are more fiddly to use.

If in doubt, study the markings around the controls – in a well-designed instrument those for the timebase and triggering will be gathered together in one area of the front panel. If only the label 'sync' appears, it is probably from the pre-triggering era. If both 'sync' and

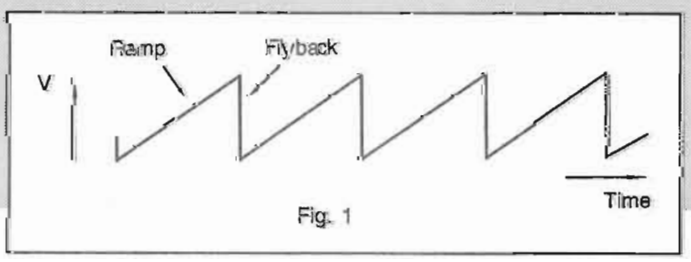


Fig. 1

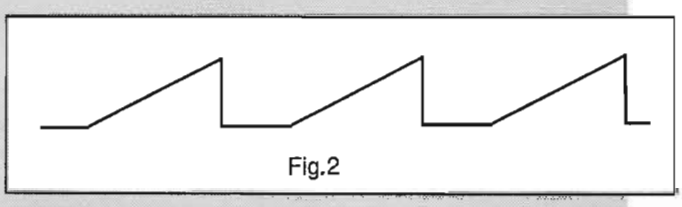


Fig.2

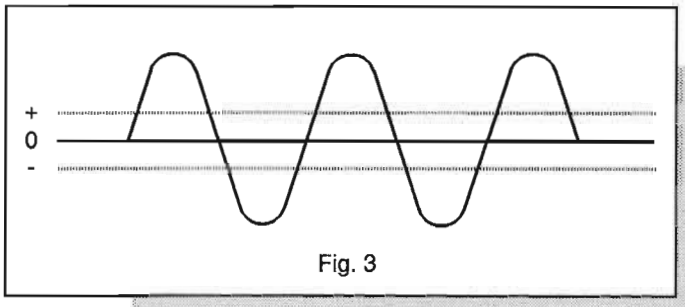


Fig. 3

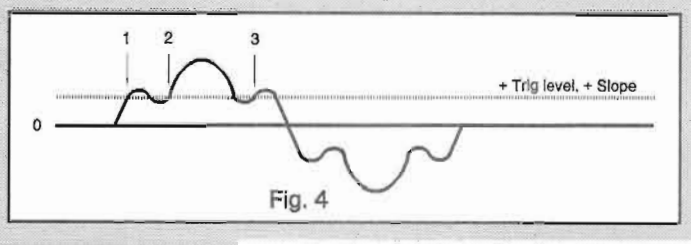


Fig. 4

'trigger' appear, it may well be that the normal mode is synchronised sweep, with trigger available only for single-sweep operation – used for viewing transients in a darkened room! The early Cossor double-beam 'scopes fall into this category.

Remember that oscilloscopes using valves in the amplifiers and timebase are (very) heavy, and you will need a good strong bench, or a trolley, to support them. Watch out, too, for burns on the tube screen, usually a horizontal line across the middle. A new tube for these old types can cost more than you paid for the instrument itself, always assuming you can even locate one.

How Many Beams?

You can make a lot of useful observations and measurements on an oscilloscope with just one trace, but one capable of displaying two traces simultaneously, one above the other, is more than twice as useful!

Early multi-trace 'scopes had tubes in which the electron beam was actually split in two, both sections being scanned with the same timebase, but with separate 'Y' deflection plates fed by separate amplifiers, called 'Y1' and 'Y2'. The tubes were expensive, however, and with advances in pulse and switching technology a different technique was adopted, with a single electron beam, switched between the two different 'Y' amplifiers.

The switching is done in one of two ways. To display signals which have a high repetition rate, the Y1 and Y2 traces are displayed on alternate sweeps of the timebase, with a vertical 'shift' voltage mixed with the signal, so that the two traces are displayed one above the other, rather than in a superimposed muddle. The persistence of the phosphor screen coating on the inside of the tube face (the fact that it continues to glow for a short period after the beam has passed) means that the display does not flicker.

For signals at lower repetition rates, the flicker would become obvious and annoying if this method were used, so instead, vertical control of the beam is switched continuously back and forth between the two Y amplifiers, typically at a frequency in the region of 100 to 200kHz. The vertical 'shift' voltage which separates the two traces on the screen is also switched at the same rate.

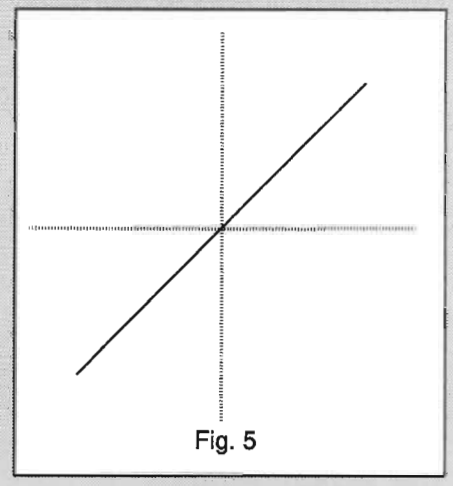


Fig. 5

Selection of the two modes, which are known as alternate or 'alt' and 'chopped' respectively, is usually done automatically by the setting of the timebase rate switch, though some instruments have a manual over-ride facility.

You might think that the 'chopped' display mode would leave visible gaps in each trace during the brief time that the beam was switched to the other one. In fact, because the 'chopping' oscillator is not synchronised with the timebase oscillator, the gaps appear at different places on succeeding sweeps, and the tube persistence fills in the holes. Obviously there are settings of the timebase sweep rate at which the chopping may become stationary and visible on the screen, but it is not a problem in practice.

Oscilloscopes having tubes which produced two separate beams were generally known as 'dual-beam' instruments, while those that produced multiple displays by switching the beam between two signals were called 'dual-trace'. You cannot rely on this neat division, however, as advertisers and others do not always follow this convention in their descriptions.

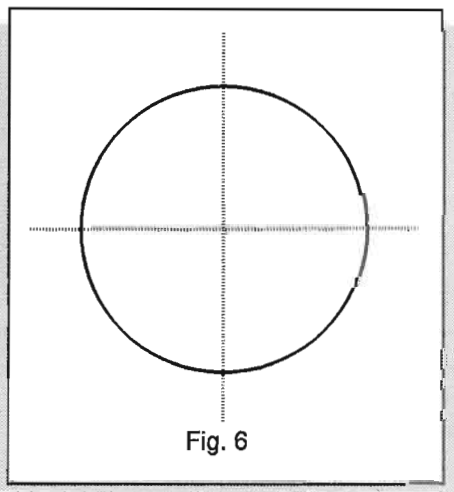


Fig. 6

Using Two Traces

Within the capabilities of the oscilloscope vertical (Y) amplifiers to cope with small or large voltages, you can use the two traces to display simultaneously any two signals that may be of interest. Checking at the input and output of an amplifier for distortion, phase-shift or delay is one use that springs to mind.

There are circumstances in which indications of phase-shift or signal delay as displayed on dual-trace (alternate switched beam) oscilloscopes can be misleading, because of the fact that the two traces are not drawn out simultaneously in real time. It's not something I've experienced myself, basically because I've only fairly recently replaced my old true dual-beam 'scope with a more modern dual-trace one. It is, though, obviously something to be aware of.

Lissajous

If you read up the oscilloscope textbooks, you'll find another way of displaying phase differences which requires only a single trace display. It is based on something called 'Lissajous figures'. With this method, the timebase oscillator, which normally sweeps the spot from side to side across the screen, is switched off, and the input to the amplifying stages feeding the tube's X-plates is made available at a front-panel socket or terminals. The two signals whose phase is to be compared are fed to the 'X' inputs and 'Y' inputs.

If the signals are identical in phase and shape, the display will change from a spot in the centre of the screen to a single straight line at an angle which will be determined by the relative amplitudes of the two signals, and the gains of the 'X' and 'Y' amplifiers. The gain controls are usually adjusted to tilt the trace to and angle of 45 degrees (Fig. 5).

If there is a phase difference between the two signals, the line will open out into an ellipse, becoming a circle when the phase difference is 90 degrees (Fig. 6).

QRP Corner

Dick Pascoe G0BPS gets in contact with QRP clubs around the world

The G-QRP Club's 'Winter Sports' finished off as a week of varied activity. For the uninitiated these Winter Sports are the annual gathering of QRP operators, taking place between Boxing day and New Year's day, a complete change from the Christmas Pud and the alcohol normally seen during this period. Some of the Morse heard though may have been the result of just a smidgen too much!

I found band conditions varied enormously, with the numbers of operators varying to match. My own excursions onto the bands was terrific fun as usual, especially as I sadly missed last year's sports because of my house move. The aerial used at G0BPS was a simple doublet thrown up rapidly just to get on the air. When asked "What length?" I couldn't answer, I just didn't know.

An odd occurrence with one station I worked was his insistence on adding the */QRP* to his callsign. Readers may remember comments made in HRT last year about such deviations from our licence conditions. I must stress though that in this case the operator was not a "G". I was working ON5**/QRP. I would guess that many other UK operators would have also worked him. I mentioned that I often add "QRP" to my callsign when calling CQ on the QRP frequencies. I do not send G0BPS/QRP but rather G0BPS (space) QRP, the former is not within the scope of our licence but the latter is.

Like many others I tried milliwatting also during the course of the week, with success into Finland, Italy and Germany. Reports from others also indicate some success into the near continent with the odd contact across the pond. For the unitiated, 'milliwatting' is transmitting a signal with a power output from the transmitter of less than one watt, usually known by the abbreviation of QRPp.

SSB and RTTY?

One of my greatest disappointments was the heavy QRM from the SSB signals of the fishing fleet chat. No callsigns were given and with my limited German I gathered it was just chatter. A shame that these signals should be right on the 80m QRP center of activity. Forty metres (7MHz) also had its problems, with RTTY signals being heard bang on 7.030MHz. Live and let live I say, but 100W (or more) of carrier kills our chances with power levels of under one watt.

QRM from RTTY is nothing new, in the USA the centre of activity for QRP operators is on 7.040MHz as many readers will be aware. What they may not be aware of is the latest listing of the USA band plans that show this frequency as the RTTY DX centre frequency too. This is not new, it has been in the listing for some years and only recently has there been some effort to get the RTTY operators to use this frequency.

8000 Members

I was pleased to get a letter from Walt HB9AQT, who gave his G-QRP club membership number as 8002. This means that the club has gathered almost 1000 members in just eighteen months since Terry Barnes GI3USS joined at Dayton in 1992. This must be indicative of the huge interest being shown in the hobby in recent years.

E-Mail

I have recently joined the increasing numbers of UK amateurs on E-Mail. Electronic mail has been around for several years, and is the land-line equivalent of packet. Here's a brief introduction for those who are not aware of how it works (those who do may skip this section..). My computer has a board fitted for use as a fax and as a high speed modem. My fax operates at 2400 baud and the modem operates at 14,400 baud. This high speed is required when down loading files from the BBS. Using the phone line I 'connect' my computer to one in London and download any messages addressed to me and any other information from user groups requested by me.

There are many various groups, one of these user groups is a Amateur Radio group, there is also a QRP group and many more with other interests. Many well known callsigns appear on the QRP (QRP@Think.com) group and lots of information passes back and forth. Of course as it is over a phone line there is no restriction, as in radio, on what may be sent. 'For Sale' notices often appear (rec.radio.swap)! The list of UK subscribers is not high, but I found many American friends on board including Randy Rand AA2U, who is one of the world's best QRP DXers. Membership of this Electronic mail service is £10 per month, plus the cost of the calls of course (send me an SAE if you'd like details).

One of the messages sent to all members of the QRP group came from Chuck Adams K5FO, giving a list of all known QRP clubs. The list is shown here, in alphabetical order. It will be seen that several clubs have only been formed recently, which is an instant indication of how interest is increasing in the hobby. I am a member of those marked with a star. There must be a lot more that I don't have on the list, if you know of one let me know please. (N.B. The Dragonslayers group membership is by invitation only)

If any reader would like more details, addresses membership fees etc, they are available on receipt of a stamped addressed envelope to me at the address below.

Luke Dodds W5HKA

Readers who attended the gathering at Rochdale will remember Luke Dodds W5HKA, the elderly American who delighted everyone with his slow Texas drawl and a humour to match. Unfortunately we've just heard that Luke passed away on January 16th, at the age of 72 years. I first met Luke on my initial visit to the Dayton Hamfest in 1990, and after chatting about various things as one does, we discovered that apart from our interest in radio we shared a love of cameras and photography. It appeared that we both were collectors and so managed to swap various models, books and ideas.

Luke had been the Secretary / Treasurer of the ARCI (the American QRP club) for many years, only giving it up in December of last year. Luke was also the US representative of the G-QRP Club and the OK-QRP Club, collecting membership subscriptions and looking after our US members in general. He was my contact with the ARCI for those DX members who rejoin / renew through me. Luke will be sadly missed, but not forgotten by his many UK and DX friends from all over the world.

QRP Master

News has just arrived that the G-QRP Master Roll of Honour has gained

another member, Peter PE1MHO is member number 74. Even though we now have over 8000 members there are only 74 on this roll of honour. This gives an indication of how difficult it is to achieve.

Peter has been working at this for some time, of course but not many members will realize from his callsign that Peter only holds a 'B' Class Dutch licence and his award was the first ever for VHF contacts only. Peter is an avid six metre operator, and whenever the band is open he will be there. Almost all contacts were on 'phone but a couple of CW contacts were made as well. Easier for someone who works from home of course. Peter is also one of the founder members of the Dragonslayers QRP group in Holland. As an 'Ex-Pat' Brit he often pops over and visits his family, usually via my own home.

10 years On

It seems very strange to think that the forthcoming Yeovil QRP convention is to be the tenth. 'Time flies' when you are having fun, they say. It just proves that this one is just that, fun. Held at the Preston Centre, Monks Dale, Yeovil, on the 8th May. It is not a rally but a gathering. Highly recommended for QRP enthusiasts in the south of England.

I'm told that the changes made last year were very well received and these will occur again. There will be four talks by well known speakers, on such varied subjects as propagation, and of course construction. More details of the construction contest taking place and also the convention may be obtained from Peter Burridge G3CQR 9, Quarr Drive. Sherbourne. Dorset DT9 4HZ.

That's it for this month. News and views to me please via HRT Editorial, via GB7RMS or direct to Seaview House, Crete Road East. Folkestone CT18 7EG. 72 de Dick G0BPS

QRP Clubs Around The World

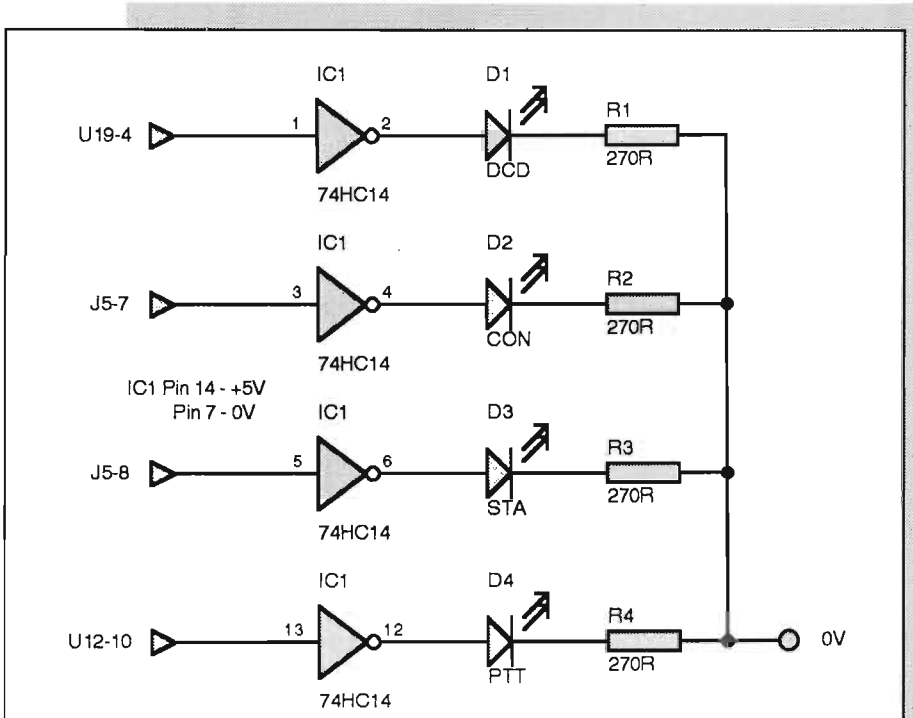
Club	*Founded*	*Country*
Cleveland QRP club	1993	USA
EA QRP Club	1993 *	SPAIN
Dragonslayer QRP Group	1992 *	HOLLAND
G-QRP club	1974 *	UK
Illinois QRP Group	1992	USA
Maryland Milliwatt Club	1992	USA
MFJ 90's Radio Club	1993	USA
Michigan QRP Club	1978 *	USA
Northwest QRP Club	1992	USA
NE Illinois QRP Society	1991	USA
NorCal QRP Club (California)	1993 *	USA
Oklahoma QRP Group	1988	USA
OK QRP Club	1992 *	CZECH REP
QRP ARCI	1961 *	USA
QRP Club of New England	1991	USA
St Louis QRP Society	1987	USA
VK QRP Club	1987*	AUSTRALIA

Packet Radio —Roundup—

Our resident packet SysOp gets to grips with an LED modification for the PacComm PC320 TNC card

By now, (especially if you read last month's *Packet Radio Roundup)* you'll be aware of the extra channels allocated in the UK bandplan for 2m packet usage, making the digital allocation now between the frequency limits of 144.5-144.7MHz (or packet/RTTY 'channels' of 144.5125-144.6875, or 144.525-144.675MHz, depending on what your interpretation of 'channels' is). +/-144.600MHz remains allocated to RTTY (and is often used for such in my area), which leaves six 25kHz spaced packet channels, or a few more if you consider 12.5kHz channel spacing. As I type this (with this being a 'packet' column, I've *got* to say "type", rather than "write", haven't I?), many users are discussing the 'pros' and 'cons' of 25kHz vs. 12.5kHz channel spacing. The wanted result (and greatly needed in many areas), is higher throughput, as packet on 2m sometimes 'grinds to a halt' due to the sheer congestion of 1200 baud packet users in busy areas. 12.5kHz operation can double the number of channels available, but will normally mean that every user has to 'delve inside' his 'black box', which can then make the transceiver incompatible with 'normal' FM speech operation on repeater and simplex channels. Also, 9600 baud packet won't fit into a 12.5kHz radio channel spacing. 25kHz channel spacing will allow 9600 baud operation, for far higher throughput, but this means that users have to delve even deeper into the technicalities of modifying their sets, feeding TNC modem audio direct into the TX modulator and taking the RX audio direct from the discriminator. One suggested plan is a compromise, with the use of two frequencies as 12.5kHz 'offset' packet channels.

But how about another way to double the amount of packet 'airtime' available, one that means just a 'plug-in' modification to your TNC? No rig modifications needed at all, you still feed your audio into your rig's mic connector, and take receive audio from the speaker connections. You'll have read about it here in *Packet Radio Roundup,* in the Feb 94 issue of HRT. G0BSX's 2400 baud packet modem will do just that. Maybe this is the way we as 'users' should be going? Well, *I'm* planning to put up a 2400 baud 'user access port' to my CFORD node system (which provides a 'trunk route' via 23cm to various other systems including my local BBS, as well as 1200 baud 'user ports') to get the ball rolling. Any other offers?



LED Connections for PC-320 PC TNC Card

HRT May 94 - Packet Radio Roundup

PacComm PC320 LED Modification

Andy G7LOL has been in touch to say "I have a PacComm PC320 TNC card, which I use on 2m and it serves me very well indeed. However being an internal card it does not have any LEDs. Now I'm not really a flashing lights bells and buzzers man but I would like to know when someone is connected, or if there's a message waiting, even if the PC is switched off. The PK88 which I use on 70cm is great for this. I have the circuit diagrams for the PC320 but rather than guess where to connect the DCD, STA, CON and PTT LEDs, I thought why not ask you guys for some *HELP!!* My intention is to build the LEDs into the computer body shell so any extra circuitry can be hidden inside. So can you help with this mod?"

No sooner said than done, Andy! As readers may have gathered, the PC-320 has the capability of being left in operation via a rear panel plug-in 13.8V DC connector, even when the PC is switched off. So an 'LED modification' could also be of interest to other readers, even if the LEDs are just fitted into a small panel or box next to the PC or keyboard.

There are internal logic levels within the PC-320 to indicate these states, which go active 'Low' for DCD, STA, CON and PTT. To drive a set of LEDs, about the easiest way is to is add a 74HC14 IC which contains logic inverter gates with enough output current capability to drive LEDs, via the usual series resistor in line with each. The

In HRT Next Month

Amateur Licencing – SSL Reply!

Icom IC-T21E handheld reviewed

Construction feature – Audible VSWR Meter

The VK9MM 1993 Mellish Reef DXpedition

Who Sells What In The UK

Using The Ten-Tec 'Scout' on QRP

Plus all our regular features –

From My Notebook, HF Happenings,

Packet Radio Roundup, QRP Corner,

Satellite Rendezvous

and much more besides!

(Planned articles subject to editorial space being available.)

accompanying diagram shows to the connections needed to the relevant PC-320 board points. You'll find a 7805 voltage regulator on the PC-320, and you'll find the +5V and 0V lines on that to power the added IC.

Packet Group News

The CIPAC group, who look after the packet side of the things in the Channel Islands, are again active in getting a dedicated link to the mainland, with plans to link on 23cm to the GB7IW:IOW node at Chillerton Down on the Isle of Wight (which links to GB7IOW, GB7XJZ and GB7HJP). Maybe GB7GUR won't need a 'modem' link for BBS traffic any more by the time you read this?

The Feb/Mar 1994 issue of 'Digicom', the newsletter of the Midlands AX25 Packet Group *Maxpak*, is another bumper information-filled journal. As well as all the usual 'news', this issue provides a guide on using packet 'White Pages', together with an information listing on every BBS and DX Cluster in the UK including those with HF Packet, PacTOR and AMTOR gateway facilities. You can get membership information on this active group from Richard G1NZZ @ GB7MAX or by post with an SAE to 37 Thicknall Dr., Stourbridge, West Midlands DY9 0YH.

The Winter newsletter from the Kent IP Group tells of the 'fun' (i.e., frustration!) they've had in getting their GB7CRE 'hub' 70cm equipment running reliably. Other information includes Part 1 of the series "Know Your Hubs", "How to get a quart into a pint pot", and an article on the Kent IP Network. Membership details from Stuart G4IYK, either via packet or by post with an SAE to 33 Medhurst Cres, Gravesend, Kent DA12 1HJ.

Mail forwarding and DX Cluster linking in the SUNPAC (Southern Users Packet Network) area has been helped along recently by generous equipment donations and a lot of work on the part of Phil G6DLJ, better known as the proprietor of Siskin Electronics. As well as erecting beams and installing large numbers of ex-PMR radios and TNCs for a new 'trunk node' at his workplace, he also did the same at several other local node and BBS sites for the benefit of the network – nice one Phil.

CTRL-Z, End of Message

A news release I recently received about the new 1200/9600 PK96 TNC describes it as a "PK-88 on Steroids". Very fitting, as many users who've tried 9600 baud will tell you.

That's it for this month, please do keep me in touch with your packet activities, you can contact me either on packet by a message to G4HCL @ GB7XJZ, or by post c/o the HRT Editor at the HRT Head office address. Until next month, 73 from G4HCL.

VHF/UHF Message

Geoff Brown GJ4ICD gets ready for his Jordanian DXpedition

Bill G6XM's portable microwave station operating from Dartmoor

Steve, G4JCC, on Hayling Island reports that reflections were poor both on 6m and 2m during the quadrantids. I was active during the 3rd, but didn't find too much activity on 50MHz, between 1100z and 1300z contacts were made with SM7AED, SM7CMV, DL6NCI, PB0ALN, OZ3ZW, G0JHC, DJ3TF, and DL8HCZ, all around the 37 report mark. So there were *some* good bursts, especially from the SM guys, but there again you would expect it as they are running much more power than UK amateurs!

Other News

Costas, SV1DH, reported that on the 31st December SV1AB had a T.E.P. opening to 7Q7 (Malawi). Costas also reports that V51VHF is off the air, it is not known if the 144MHz beacon is still active. Other stations reported to be active on six from Africa are V51KC with 100W, and V50CO, both were worked by 9H5EE in Malta. Mal Z23JO reports that Z21SIX/KH52MK is now running with 4 W into a three element beam from Harare in Zimbabwe until the correct licence has been issued, then it will be moved and the power increased.

In Eric VK5LP's notes to me dated February the 'ES' season in Australia is well under way, Trevor VK5NC worked ZL1IU on 144MHz, Trevor said "He had been attempting to work New Zealand for 29 years, and finally his dedication had paid off".

Trevor had done the usual UK 'ES' type watch, keep an eye on the 90MHz FM Radio from ZL, and then the aircraft VORs from ZL. Other News from VK was that 50MHz 'ES' produced the following: FK8DH, P29CW, ZL4AAA, JA's, VK9NS was heard working into ZL and VK2, and VK6 to ZL3. VK4DO heard the FO5DR beacon (Tahiti) on 50.049MHz for over two hours at a distance of over 7500km (multi 'ES'?).

Two metres livened up at the end of January. On the 29th, reports of strong signals from Spain were into the southern UK, but this only lasted a couple of hours as the warm front approached. Ela G6HKM reports that the VHF/UHF bands "are at an all time low" and so she has been applying for various awards to keep her busy.

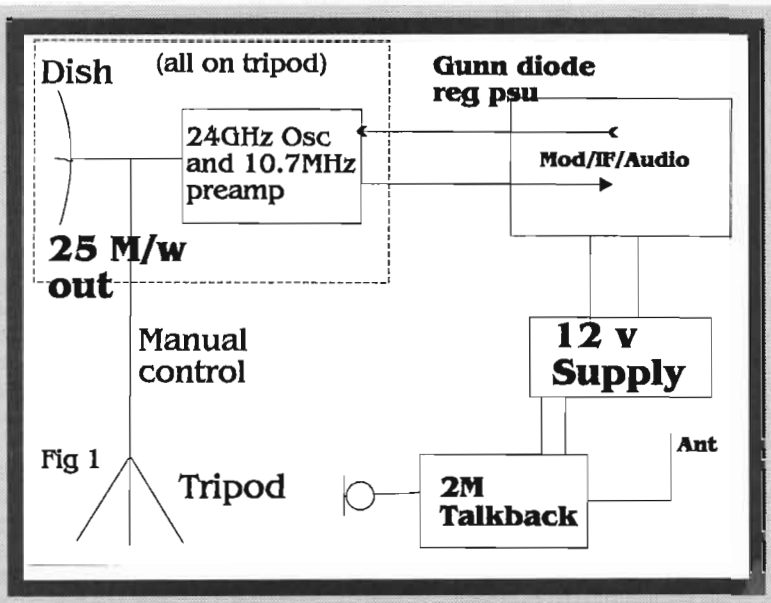
Early February saw a little action on the bands with several good auroras taking place. On the 5th, auroral 'ES' was reported by Neil G0JHC with the OH9 and ES0 beacons being heard on 50MHz. Mid-afternoon on the 6th saw very strong GM's, LA's and OZ's into the UK, certainly very disturbed conditions on the Sun.

Beacon News

P29BPL is operational from New Guinea on 50.019MHz and has been reported being heard in VK4 land. JY6SIX is being currently built in Jersey for the Jordanian expedition, it should be sited at the Royal Jordanian Amateur Radio Club's HQ on 50.075MHz and the

UKSMG Jordan Dx-pedition 1994

The UK 6m Group will be in Jordan 28th May-27th June this year



A basic 24GHz TX/RX

locator should be KM71wx.

More on Jordan

Things are still progressing on the Jordanian Expedition. Mike, G3SED has joined the gang and will be travelling out with Paul G4CCZ in late June. It really is amazing just how much planning and work has to go into an expedition, the equipment list continues to grow with now the possible inclusion of taking 144MHz equipment (this is a 50/50 chance at the moment as excess baggage charges are around £11 per kilo and a radio plus amplifier would add over £100 to the excess baggage costs). Steve G4JCC has kindly offered to loan us a 144MHz transceiver plus a 100W amplifier, if the list grows any larger then we will need a container to transport all the equipment! The Marriot Hotel have been very helpful in giving us permission to take over the roof space for the aerial farm.

It's not just radios that must be taken out to Jordan, but also items like TVI filters (Jordan has 55MHz TV), masts, rotators, tools, drills, wall fixings, plus all the aerials. When you think that only two of us will take out all these bits and bobs it becomes quite a feat.

In 1991 JE3TXU was stationed in Amman Jordan during the summer months. He apparently had good results listening on 50MHz, and so I have written to him for a copy of his log. Interestingly enough, just check out the March edition of HRT and you will see that 5B4/DK9IP (QSL card) operated from Cyprus during 1993. He was only using an FT726 with 10W and a six element yagi, so this looks very promising from Jordan.

Ken G4IGO sent along his findings and records of Middle East openings on the 50MHz band for the past few years, these are shown in this month's column. This should give you some idea what time to book your holidays so you can work us!! Ken seems to favour early morning openings or late afternoon openings, like we had to Kuwait, Lebanon, Cyprus and Israel in 1992/3.

10 and 24 'Giggles'!

Many years ago, I often went to watch a friend of mine, Phil GJ8KNV, operate on the north coast of Jersey on 10GHz. Phil had some success in that he completed the first GJ to France contact on this band. Sometimes it was nice sunny weather, at other times it just tipped down with rain, but Phil being very patient would stay active in all weathers. From that day on I called 10GHz "10 Giggles", a bit of a laugh really standing out in the rain for hours on end trying to align a dish!

However things have changed over those 10/15 years. Now you can buy very professional kits, and no longer have to be a plumber to get on the band. Vast distances using tropospheric ducts have been achieved, Sweden has been worked from the UK as well as record breaking contacts off the moon. Higher power has become more available with the use of TWTs (Travelling Wave Tubes) that can produce 100W of 10GHz power (enough to fry a passing seagull with the dish gain!)

Bill James G6XM, well known for his VHF/UHF operations over the years, is one such amateur who has really gone to town on 10GHz and above. Over the next few months I'll be looking into some of Bill's handiwork.

Fig. 1 shows the basics of a 25 milliwatt 24GHz station, and Bill's photo shows both his 10GHz and 24GHz stations operational from Dartmoor last summer. The 10GHz system can be completely controlled from inside the car, more from Bill next month.

Deadline News on Jordan

A few weeks ago I had contacted Royal Jordanian Airlines about return trip to Amman. The basic flight was £742 return, however, after a little arm twisting they very kindly faxed me back a special concessionary price of £370 return and a 50% reduction in excess baggage, what great people!

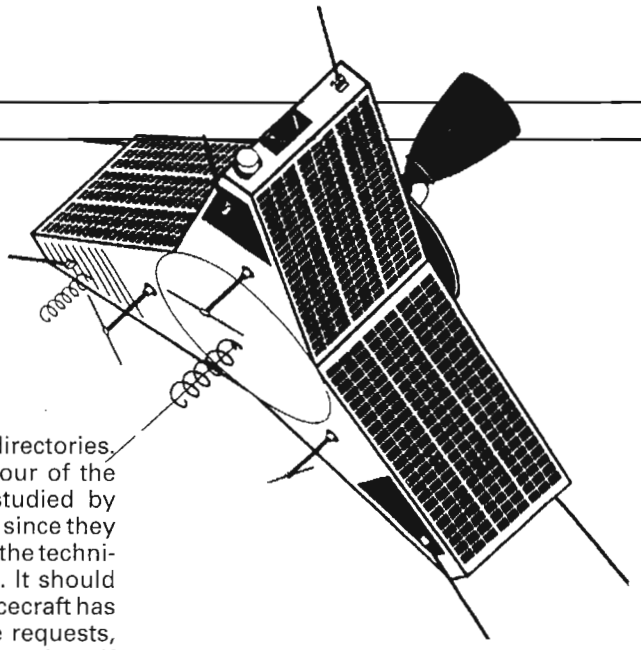
So, the flights are now booked and the final dates are as follows: Neil, G0JHC and myself fly out on Saturday 28th May (not the 26th as previously stated) to install the equipment, from then on the operation will continue until the 27th June when Paul G4CCZ and Mike G3SED return with the equipment.

Well, again another month gone by, the 'ES' season should be along very shortly so keep an eye out! News, views, photos please to Geoff Brown, GJ4ICD, TV Shop, Belmont Rd, St Helier, Jersey. C.I. or phone/fax anytime 0534 77067.

G4IGO's records of Middle East openings on 6m for past years

8/6/86 0700z Jordanian TV
7/6/87 1554-1628z 5B4
30/5/88 1724-1747z 5B4
10/6/89 1925-1933z 5B4
11/6/90 1653-1742z 5B4
1/6/91 2006-2142z 5B4
29/5/92 late pm to 4X4
3/6/92 1654-2000z 5B4/TA/9K2/4X1

Satellite Rendezvous



Richard Limebear with this month's AMSAT-UK news on POSAT-1, now on air

As many readers may know, PoSAT-1 was built at University of Surrey and is owned by a Portuguese Industrial Consortium. It carries a commercial as well as an Amateur Radio payload.

A protocol was finally established between the PoSAT Industrial Consortium and AMSAT-PO in December; the main concern of AMSAT-PO being to protect the amateur bands and the amateur codes of practice.

Since PoSAT was launched last September, at least 5 different dates were given for the start of amateur operation, and, indeed, PO-28 has appeared at last. PO-28 will perform dual operation with the commercial bands (5 seconds each minute it changes to the commercial frequency). UO-14 and UO-22 used to operate in this manner.
Uplink: 145.975MHz (145.925MHz was also announced but does not appear to work).
Downlink: 435.275MHz (435.250 MHz Secondary)
Call: POSAT1

A major point of the protocol (a posh word for an agreement) is that amateurs are allowed to download all the files related to the technical and scientific experiments on board, but the *images taken by the onboard CCD cameras will not be made available to the amateur radio service!* Since we aren't allowed to use images there are the two experiments that will, however, be quite interesting:

1) The onboard GPS receiver: if everything goes as expected, the days of difficult tracking are over. Just wait till AOS and the satellite will tell you where it is and where to point your aerials, if you know your position.

2) There is a possibility of operation at 38.4kbps which will allow amateurs to develop the necessary RF and digital techniques to go beyond 9600 baud. Imagine receiving about 100 kbytes file in just 5 seconds!

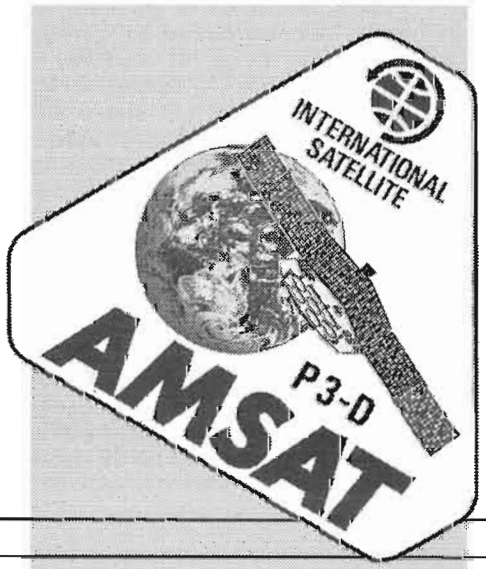
PoSAT-1 will benefit mostly the amateurs that have 9600 baud operational capability, and since there are only two 9600 baud stations at present in Portugal, your suggestions and comments would be most appreciated and might help AMSAT-PO in their contacts and negotiations with the PoSAT Consortium through AMSAT-PO.

It must be stressed that the image files should not be downloaded even if you see them listed in the directories. We believe that the behaviour of the amateurs will be closely studied by PoSAT Consortium officials, since they only have a small idea about the technical capabilities of amateurs. It should be remembered that the spacecraft has *LOG* files which note all file requests, and it's possible that the consortium, if they notice that images have been downloaded, may remove PO-28 from the amateur bands. Apparently the images aren't much different from those we can get on KO-23.

For more information on PoSAT-1 contact the PoSAT Technical Director Dr. Rebordao at: Comsorcio PoSAT, INETI-Instituto Nacional de Engenharia e Tecnologia Industrial, Director da Equipa Tecnica do Consorcio PoSAT, Doutor Jose Manuel N. V. Rebordao, Azinhaga dos Lameiros a Estrada do Paco do Lumiar, 1699 LISBOA Codex, Portugal, Tel. +351 1 716 5181 ext 2490, Fax. +351 1 716 3048, or AMSAT-PO, P.O. Box 227, 2003 SANTAREM Codex, Portugal, (an SAE + IRCs for this one would be appreciated).

Oscar 13 Perigee

James, G3RUH, has put out a bulletin about Oscar-13 Orbital Parameters until the end of 1996. The perigee height will reach its greatest value of 845 km between 1994 Feb 26 – Mar 11, and reduce steadily thereafter. Around the first quarter of 1996 perigee height will be such that atmospheric drag will start to cause apogee height to reduce, tending to circularise the orbit. This info can also be found in articles published in recent issues of Amsat-NA Journal, Satellite Operator, Oscar News, Amsat-DL Journal, Amsat-VK Newsletter etc., etc.



Oscar 10's Still There!

It's still operational in Mode-B. Despite good signals from the transponder, there are very few stations using it. Its currently available when in view but *please do not* attempt to use it if you hear the beacon or the transponder signals FMing. The downlink signals are quite strong from AO-10 but there are complaints that no users are taking advantage of it.

Russian Satellites

The RUDAK group of AMSAT-DL recently achieved another milestone with the development of more sophisticated software for the OSCAR-21/ RUDAK satellite. Beside the Voice Broadcast which was successfully used throughout the last year with several greeting messages in different languages, RUDAK is now capable of transmitting picture files in WEFAX compatible format. Unfortunately there is no camera on board AO-21, so the pictures have to be uploaded first by the command station.

RUDAK is also capable of holding several picture and voice broadcast files in the ramdisk at the same time. They can be transmitted on a schedule mixed with FM-Mode and 1200 baud AX.25 Telemetry. Stay tuned to AMSAT OSCAR-21 for some more surprises!

The RUDAK downlink mid-frequency is 145.987MHz, the uplink for FM-Mode is 435.014MHz. The WEFAX format is like Meteosat WEFAX Specification (MGCS): FM, 2400Hz subcarrier frequency with double sideband AM

modulation, 300Hz start signal for 3 seconds, 450Hz stop signal for 5 seconds, 800 x 800 pixel Image format with 256 grey levels, 4 Lines/sec.

New Amateur Crew on Mir

The crew on Mir has changed. The new cosmonauts are Victor Afanassiev (U9MIR), Yuri Usachov (R3MIR), and Valery Poliakov (U3MIR). The Personal Messaging System (PMS) on-board MIR continues working under the callsign R0MIR-1, operated by the actual crew that arrived in TM-18 Soyuz.

What is interesting to note about U3MIR is that he will attempt to break Musa Manarov's record for remaining in space. He is a medical doctor and will remain on-board for 429 days (until April 1995). On his previous flight he was relatively inactive due to limited English; his mission is to test the effects of long term weightlessness on the human body. The current record for a space mission is one year, set by Musa Manarov, U2MIR, in 1988.

Phase-3D Frequencies Agreed

During a Phase-3D Payload Engineering meeting in Germany the frequencies shown in the accompanying table were agreed for the spacecraft. Each passband is 500kHz wide on the uplink and 400kHz wide on the downlink, except that Mode V is divided into an analogue segment and a digital segment. The digital segment is in the lower part of the band, the analogue segment is in the upper part of the band. The uplink segments are of equal width for both analogue and digital modes. The downlink segment for digital modes is 150kHz wide and the analogue mode's downlink is 250kHz wide. The exact position of the beacons will be determined as soon as all relevant information is available. These frequencies are now *final* and can only be changed for *very* good reasons.

Note that with the P-3D, the mode designations are changed. For instance the Old Mode B is Mode UV and the old Mode J is Mode VU.

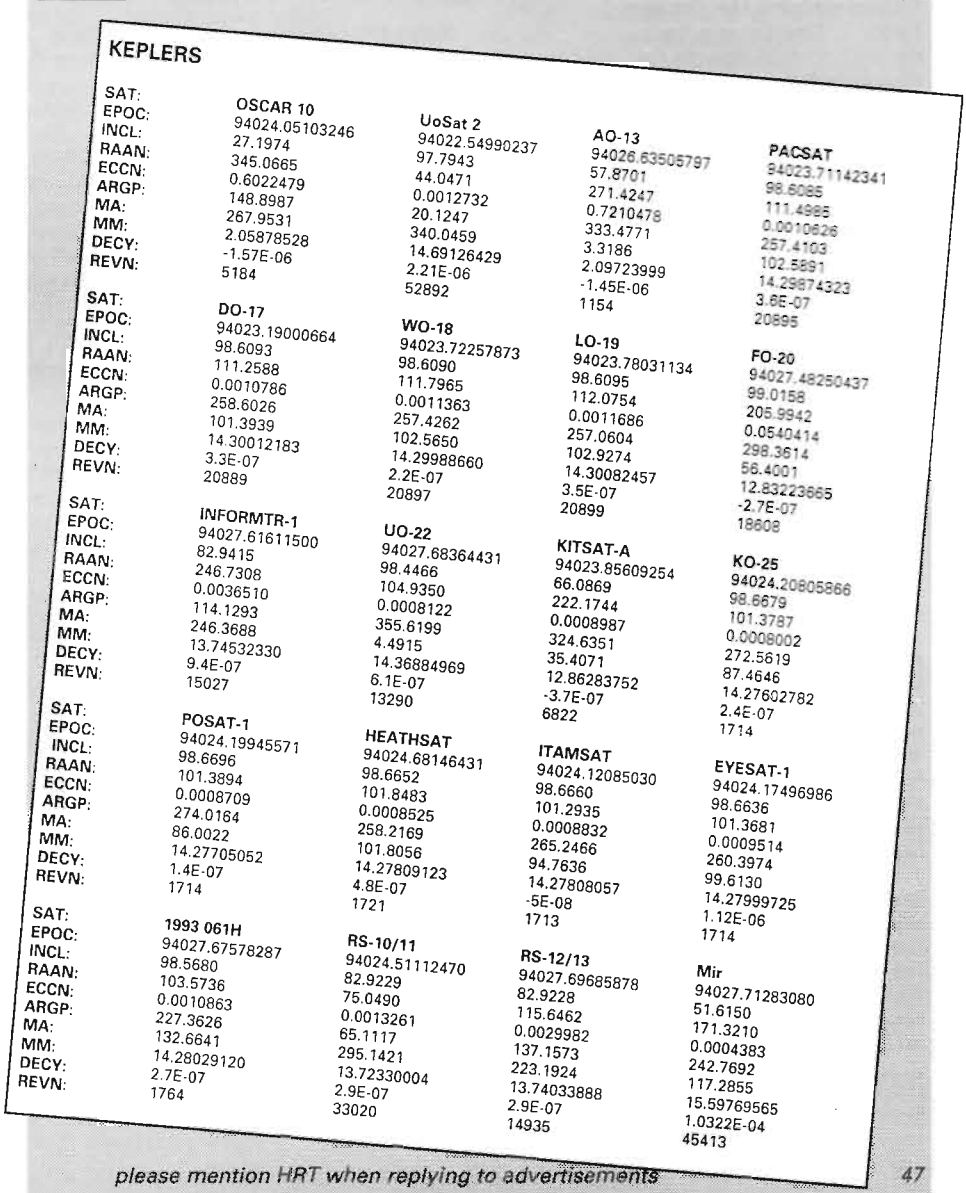
AMSAT-UK News

The Amsat-UK office has been a little busy of late so Ron is currently catching up on orders for goods; new applications will be dealt with once the backlog has been cleared. Remember that date for your diary: The 1994 AMSAT Colloquium will be held on the 28th to the 31st of July, 1994. Further details are available Amsat-UK.

For further information about Amsat-UK contact: AMSAT-UK, c/o Ron Broadbent, G3AAJ, 94 Herongate Rd, London, E12 5EQ. Big SAE gets membership info. SWL's are welcome. All new joiners get the USAT-P tracking program on 5¼in disk. A copy of the latest keplers (magazine production schedules always mean those shown here can never be the 'latest'), is available for an SAE, by modem or AX25 packet radio (HF/VHF) from me if anyone wants it; my packet mailbox is GB7HSN. When asking for keplers please say which satellites; *all* means about 150 satellites. ("all amateur sats" is adequate if that's what you want); requests on packet will get 2-line elements unless Amsat format is specified.

Phase-3D Frequencies

1. 21.210-21.250 MHz uplink only; Mode K
2. 29.330MHz CAM (Compatible Amplitude Modulation) Downlink only. (no transponder) Spare Frequencies: 29.310, 29.320, 29.340, and 29.350MHz Mode A
3. 145.805-145.995MHz Uplink and Downlink: Mode V
4. 435.200-435.700MHz Uplink 1 Mode U
   436.000-436.500MHz Uplink 2 Mode U
   435.300-435.700MHz Downlink Mode U
5. 1268.5-1269.0MHz Uplink 1 Mode L
   1269.0-1269.5MHz Uplink 2 Mode L
6. 2400.5-2400.9MHz Downlink Mode S
   2400.1-2400.5MHz Uplink Mode S
7. 5840MHz centre frequency channel 25kHz wide. Downlink only; Mode C
8. 10451.0-10451.5MHz Downlink; Mode X
9. 24048MHz downlink channel 25 kHz wide; Mode Ka



KEPLERS

	OSCAR 10	DO-17	INFORMTR-1	POSAT-1	1993 061H
SAT:	OSCAR 10	DO-17	INFORMTR-1	POSAT-1	1993 061H
EPOC:	94024.05103246	94023.19000664	94027.61611500	94024.19945571	94027.67578287
INCL:	27.1974	98.6093	82.9415	98.6696	98.5680
RAAN:	345.0665	111.2588	246.7308	101.3894	103.5736
ECCN:	0.6022479	0.0010786	0.0036510	0.0008709	0.0010863
ARGP:	148.8987	258.6026	114.1293	274.0164	227.3626
MA:	267.9531	101.3939	246.3688	86.0022	132.6641
MM:	2.05878528	14.30012183	13.74532330	14.27705052	14.28029120
DECY:	-1.57E-06	3.3E-07	9.4E-07	1.4E-07	2.7E-07
REVN:	5184	20889	15027	1714	1764

	UoSat 2	WO-18	UO-22	HEATHSAT	RS-10/11
SAT:	UoSat 2	WO-18	UO-22	HEATHSAT	RS-10/11
EPOC:	94022.54990237	94023.72257873	94027.68364431	94024.68146431	94024.51112470
INCL:	97.7943	98.6090	98.4466	98.6652	82.9229
RAAN:	44.0471	111.7965	104.9350	101.8483	75.0490
ECCN:	0.0012732	0.0011363	0.0008122	0.0008525	0.0013261
ARGP:	20.1247	257.4262	355.6199	258.2169	65.1117
MA:	340.0459	102.5650	4.4915	101.8056	295.1421
MM:	14.69126429	14.29988660	14.36884969	14.27809123	13.72330004
DECY:	2.21E-06	2.2E-07	6.1E-07	4.8E-07	2.9E-07
REVN:	52892	20897	13290	1721	33020

	AO-13	LO-19	KITSAT-A	ITAMSAT	RS-12/13
SAT:	AO-13	LO-19	KITSAT-A	ITAMSAT	RS-12/13
EPOC:	94026.63505797	94023.78031134	94023.85609254	94024.12085030	94027.69685878
INCL:	57.8701	98.6095	66.0869	98.6660	82.9228
RAAN:	271.4247	112.0754	222.1744	101.2935	115.6462
ECCN:	0.7210478	0.0011686	0.0008987	0.0008832	0.0029982
ARGP:	333.4771	257.0604	324.6351	265.2466	137.1573
MA:	3.3186	102.9274	35.4071	94.7636	223.1924
MM:	2.09723999	14.30082457	12.86283752	14.27808057	13.74033888
DECY:	-1.45E-06	3.5E-07	-3.7E-07	-5E-08	2.9E-07
REVN:	1154	20899	6822	1713	14935

	PACSAT	FO-20	KO-25	EYESAT-1	Mir
SAT:	PACSAT	FO-20	KO-25	EYESAT-1	Mir
EPOC:	94023.71142341	94027.48250437	94024.20805866	94024.17496986	94027.71283080
INCL:	98.6065	99.0158	98.6679	98.6636	51.6150
RAAN:	111.4985	205.9942	101.3787	101.3681	171.3210
ECCN:	0.0010626	0.0540414	0.0008002	0.0009514	0.0004383
ARGP:	257.4103	298.3614	272.5619	260.3974	242.7692
MA:	102.5891	56.4001	87.4646	99.6130	117.2855
MM:	14.29874323	12.83223665	14.27602782	14.27999725	15.59769565
DECY:	3.6E-07	-2.7E-07	2.4E-07	1.12E-06	1.0322E-04
REVN:	20895	18608	1714	1714	45413