HRT
HAM RADIO TODAY

Incorporating SCANNER INTERNATIONAL

JUNE 1991 £1.60

CONTACTING THE MIR SPACE STATION

Linking up with Cosmonauts using Amateur Radio

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DXCC on 6m – G5KW reports

EUROPEAN EXCLUSIVE

Icom IC-W2 Reviewed

Novice – HRT meets City and Guilds and the RA

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AN ARGUS SPECIALIST PUBLICATION

NOVICE • PACKET • REVIEWS • PROJECTS • SATELLITES

HRT
HAM RADIO TODAY
VOLUME 9 NO 6 JUNE 1991

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REVIEWS

FEATURES

PROJECT

NEWS AND VIEWS

CQ de G8IYA

So who's been reading the G8IYA editorials and taking note then? Remember when I said that schoolchildren would love to be able to communicate via. amateur radio with a Cosmonaut on board a space station, *and* get a QSL card posted from space to prove it? No sooner said than done — this month the UK 'Woman in Space' on board the Mir space station will be contacting arranged schools throughout Britain on 2m FM — and what a great boost this could give amateur radio. I can see it now, in the papers, on the news, in programmes such as 'John Craven's Newsround' and even 'Blue Peter'! The cry comes; "Dad, can I go in for one of these amateur radio licences so I can contact the Cosmonaut amateurs who are up there all the time? I hear they've even got a permanent 2m FM packet radio station up there which I can link my computer up to." Remember where you read it first (CQ de G8IYA, HRT January 1991).

An International Hobby

When you read this, we'll just about be recovering from our weekend at the RSGB's National Amateur Radio Convention at the NEC, near Birmingham. We extend a big 'thank you' to all our readers who came and said 'hello' to the HRT team, as you know we *do* take note of what you tell us, and we try to publish what *you* want us to. So why not tell us what you'd like, also if you're active on HF, VHF, Satellites, Packet or whatever, drop a line to the appropriate regular HRT columnist, either direct or via,. the Editorial address. We know they'd like to hear from you, and you could also get a mention in the mag! I know for example Ken G5KW would like to hear what you've been working on 2m and 70cm, and how about some photos of your recent VHF/UHF contest station? Feedback from you is essential, and we're only too pleased to read or forward the many letters that arrive with us each day.

Our mail-order subscription department has an even busier time, did you know for example that right now they're processing another Australian subscription request every day on average! We also extend a warm welcome to amateurs in the USA who may be reading this for the first time, we know that in common with our readers throughout the world you'll like the exclusive equipment reviews we feature in HRT each month. We have a 'knack' of getting hold of the very latest amateur radio gear, often before it's generally released, to give it a thorough and unbiased 'going-over' for you to read. And not once has our resident equipment reviewer even had as much as a free beefburger from any HRT review equipment supplier in the past years (in fact he often takes *them* out to lunch!) in connection with reviews — just to show we try to be fair and unbiased! (hang on, what's this, an SAE with the review equipment manual on loan, could this be a bribe?). Remember, by listening to what *you* say, we try to bring you the information *you* want. Which other magazine keeps their editorial office phone line open until 8.30 pm each day, Mon-Sat? (yes, we'll even talk to you on a Saturday night!). That's in addition to the dozen or so HRT staff based at the production/readers services head office in Hemel Hempstead who work more 'sociable' hours, even though we often drag them out to exhibitions and rallies!

Amateur Radio in the Space Age

Incentive Licensing

An interesting point came up at the recently held meeting HRT attended at the Radiocommunications Agency's HQ in London. Not just a mention, but a well discussed statement was made of 'additional' privileges being offered in future for UK amateurs who could show they had appropriate credentials/experience, i.e knowledge of EMC matters and so on. The RA told us they already have items such as high power experimental licences in hand, and the future could see a wider range of opportunities. This of course would enable amateurs to expand the range of their current pioneering work. In the UK we've already had many licence relaxations, together with extra facilities like unattended packet stations and radio controlled remote operation of our station now being allowed, so what of the future? The RA are of course currently very busy getting the Novice licence going so all this is, and must be, for the years to come. This period should of course allow amateurs to think up some constructive ideas!

A mention at the meeting of 'mandatory Morse' as the qualification for HF operation not lasting for ever was also made. The RA later confirmed to HRT that although this is the current regulation, indeed nothing lasts for ever and that it is the RA's intention to keep things under constant review. Looks very much like some people are keeping their eyes firmly on the future rather than reminiscing in the past! So let's go full steam with the Novice and get this well and truly on the road, in the meantime make sure you let HRT know what you'd like us to bring up for the future. Through constructive discussion, things get done as we've shown, just leaving it up to 'someone else' pleases few people!

LETTERS

Letter of the Month

Dear HRT,
In the April issue of HRT, there is a letter from David Webb who wants to be allowed to operate on the amateur bands without sitting the RAE, which he refers to as 'stupid'.

David Webb does not realise the privileged position of the radio amateur. The radio amateur is the only person who is allowed to transmit, who does not have to use type-approved equipment. Everybody else, such as CB, PMR (private mobile radio), yachtsmen etc, must use type-approved equipment. The radio amateur has to pass a technical exam, so that he has some knowledge of what goes on inside his equipment. This enables him, hopefully, to be able to build, modify or repair his equipment as required.

I see that David Webb has spent much time in building TX and RX. Good for him, since this experience gained, would have stood him in good stead for the RAE. One point puzzles me though. If he only wants to operate, why has he spent his time building equipment?

So David, pass the RAE, pass the Morse, it's not much to ask for and then enjoy yourself operating.
J.P. Olway G3RMA

Editorial Comment
We have a various types of radio licences to allow people to talk freely on the air, one step beyond those requiring type-approved equipment is the Novice licence, where the accent is on 'learning by doing' to introduce newcomers to our hobby, the more competent amateur (demonstrated through passing a stiffer examination) being allowed to use higher power and a greater range of frequencies. The 'Black Box' operator is certainly here, but thankfully, radio amateurs in many countries are allowed to use homebrew equipment. Let's trust this continues.

Dear HRT,
If I want to speak to someone by radio you would assume that a similar test to the current UK driving test on the correct usage and official regulations would be sufficient, especially with all the modern communication equipment available for amateur radio on which one can get such excellent service from good retailers.

But No! Out comes the red flag and the 'get out and get under' attitude prevails. The theory needed is totally unnecessary, and where does Morse fit in with satellites? Bring the RAE exam up to date and let a few older members of the community on the air. If the road driving test was similar to the RAE, the roads would be half empty. There is abuse of the roads, but even the RAE ticket doesn't stop abuse on the airwaves.

David Webb's letter in your April 91 issue, hits the nail on the head completely. Let those who want to get out their soldering irons and pieces, but let us who want to chat, do so also.
Yours faithfully
Peter Kendall

Editorial comment
So who's going to set up the first amateur radio type- approval (i.e. MOT test) service then?

Dear HRT,
For a man who has been building TX and RX for 20 years, David Webb has a very unusual outlook on ham radio (letters page April issue). People from all walks of life sit and pass the RAE and take Morse tests, for the joy of speaking and communicating with like minded folk all over the world, not just teachers and BT staff.

Is ham radio dying? I think not. David must be living in a part of UK many feet below sea level, and the call book gets fatter. I hope to see his callsign soon. Hi!
Bill Hubbard, G0HUB

Editorial comment
Some people take the RAE and Morse test, then use black boxes and never again touch a key or a soldering iron. They also just want to communicate.

Dear HRT,
I see the whingers, whiners, I want everything without having to work for it brigade are out again. Drop the RAE, drop CW, perhaps they should get the licence on buying a transceiver or one years subscription to HRT or even two coupons from chocolate bar wrappers they think. Stop moaning, a RAE pass will not make one into a radio engineer, but will help one operate with the minimum of interference to other users. Regard it as a challenge, get on with it, get it done and stop whining. Perhaps those who cannot find CW on the bands should buy new equipment or a good reference book. Perhaps David Webb should read the WT acts.
M. Charlton G0MDF

Editorial comment
Constructive 'whingeing' may not be a bad thing, as times change and practices must also lest we cease progressing (constructive 'whingeing' stopped us being forced to have the man carrying his red flag walk in front of every car). But no, you don't get something for nothing, the question is *what* is needed in today's age. There's always the telephone for world wide communication of course.

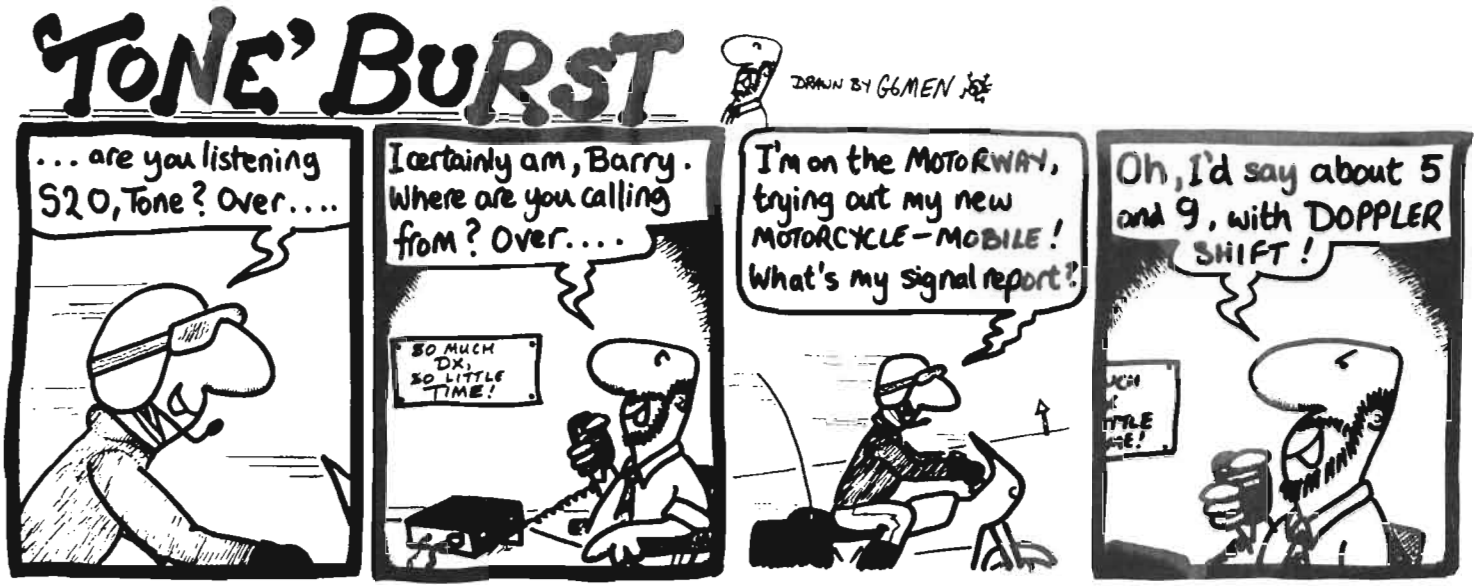
Dear HRT,
With reference to the author of the 'letter of the month' in the November 1990 issue, Mr. R. Gouldstone G3TAG. In terms of my commitment in obtaining a licence, my night school course was two hours per night, one night per week. I also put in at least another 2-4 hours per week on my own at home by working through the RAE manual and reading various other books. I joined my local amateur radio society and attended the meetings and talks and received help from the others there.

No-one can accuse me of not being interested in the hobby, and that, Mr. Gouldstone, is the key word 'hobby'. It is a spare time interest. I realise that I *will* have to learn Morse and take the test, but what really and truthfully is the point of it all?

If we must have a two tier system then the class A should be decided by some other means rather than a mandatory Morse test. I can already hear the howls and screams of the old timers but let me finish by saying this; I served my time as an electrician and most of the men who taught me my trade had to do a seven year apprenticeship. When I started work this had been cut down to four years, but none of the men said "Huh — I had to do a seven year apprenticeship so you should too". I think there are a number of amateurs out there who would do well to take a leaf out of their books.
John Hewitt, G7IFM

£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 HRT, P.O. Box 73, Eastleigh, SO5 5WG.



Editorial comment
Right now, our VHF/UHF bands are envied by commercial users around the world, even more so than some of our HF allocations. Has anyone (else) wondered why 50% of UK amateurs don't go in for a Class 'A'? Maybe we amateurs should be glad of the privileges bestowed upon us by passing a relatively simple test such as the RAE or the not-too-distant-future Novice exam.

Dear HRT
As you can see, I am newly licensed, but I have been a SWL since 1983. If we scrap the use of the Morse code, we would loose a very valuable form of communication. I am certainly looking forward to studying for the Morse test. I acknowledge that I have a long and hard battle on my hands, but, in the end, I hope, with a little patience, I will become a class A.

As for David Webb in April HRT, complaining about having to learn about how a radio works just so he can talk on 2m, I say this. I started studying for the RAE without a single knowledge of radio practice and theory, eventually passing this. My knowledge on radio theory is still limited but has vastly improved on what I knew before. If you think that the exam was hard and should be made easier then it would be the biggest mistake anyone could do.

Making the exam easier would invite appliance operators onto the amateur bands with a free ticket and could cause the end of amateur radio in this country. If anything the exam should be made harder. We don't want it to end up like CB or do we?

For anyone interested, I am only 24 years old and am an ex- CBer and thankfully not a dirty mouthed music playing lout.
Thanks for a super mag
Andrew Nevill G7JDM

Editorial comment
Everybody has their own interests in radio, that why there are different classes of hobby licences in the UK as well as in many countries around the world. We already have 'incentive' hobby radio licensing here, as a gradual extension in operating privileges such as permissible equipment, frequencies, power etc. Each to his own, I'll stick to preferring modern communication practices as a proposed way of incentive licensing practices.

Dear HRT
I see that you have published a dealer's reply to my letter about excessive postage charges on mail order items. The reply suggested that some businesses are either one-man operations or employ few extra staff, I would have expected this to reduce overheads and keep costs down.

Also it mentioned the 15 minutes that it would take to process an order and the need to charge for working out paperwork. I would think that the only extra cost incurred on a mail order is posting the item. If I had bought it personally in the shop over the counter then I might have taken up more of the shop assistant's time, there would still be paperwork to process. The only extra cost is packing and posting. I refuse to accept that this takes much more time and certainly not two or three pounds worth of time.

I wonder what the reaction would be of the average customer in a shop if he agrees to buy an item then is told that as he has taken up ten minutes of the shop assistant's time and they will have to spend more time afterwards in the office working out VAT etc., and so there is an extra £3 on the cost of the item. I am sure I know what I would tell them. The 50% mark up that there seems to be on amateur radio goods sold in this country should be able to cover any administrative costs.
Yours faithfully
J.M. Briscoe

Editorial comment
I wish there was a 50% mark up — if there was I wouldn't be doing this, instead I'd be selling rigs! If dealers could offer you no extra charge for carriage and handling, and still stay in business, I'm sure they would. Remember that long-established businesses don't stay that way by charging excessive prices coupled with poor service.

Dear HRT,
I have been buying HRT for five issues now. You keep stressing in your editorial that new blood must be encouraged (I enjoy the editorials very much) but quite honestly some of us do not know about anything you are mentioning, packet, DX transceivers, what is G8IYA and so on? It's gradually clicking together and I enjoy your magazine very much even though almost all of it goes over my head. I couldn't even buy a scanner from your advertisements because I really didn't know what I was buying.

I am intending to visit our local radio club tomorrow evening so I will let you know whether it is successful or not. I am 42 years old and still willing to learn.
Yours faithfully,
Howard Turner.

Editorial comment;
There's a wealth of information out there, but knowing how to find it is another thing. Through HRT, we're progressing this to show the many facets of amateur radio, from low power beginners' gear right through to pioneering propagation work on VHF (the professionals even read HRT to find out about this!). I'm glad you're going along to your local club, one-to-one contact with enthusiastic club members can often be a great help, and I hope you make many new friends. If you found their details through HRT it's a sure sign that the club regularly write to us to enthusiastically promote newcomers. Welcome to your new hobby, I trust you'll enjoy it's many facets immensely!

Icom IC-W2E Review

European Exclusive — G4HCL tests the new Icom IC-W2E 2m/70cm portable

Icom's new IC-W2E goes one further than it's predecessor the IC- 24E by allowing simultaneous reception of two bands, in a similar manner to current dual-banders from other manufacturers, coupled with a variety of other extra features. This means that while having a QSO on one band, you can listen out on the other for calls, even in a 'silent' mode waiting for the correct tone sequence, handy if you're listening out for a given station you don't want to miss while still having a QSO on the other band.

Twin frequency displays together with separate volume and squelch controls for receivers on both bands are provided, and in keeping with 'intelligent' control, even power on/off switching is performed under microprocessor control. Together with this, the set even has a built-in digital clock so you can control it to automatically switch itself on and/or off at pre-set times, no excuses for flat batteries on the way home because you forgot to switch it off when getting to the office!

Power

The transmitter provides 1.5W output on high power and 0.5W on low power on both 2m and 70cm when using the supplied battery, plugging in an external power supply or adding a higher voltage battery pack increases the transmitter output accordingly. The set is nicely hand-sized without being over-small, a large LCD panel also gives a decent-sized readout of what frequency

you're tuned to on both bands. Individual S-Meter bar-graphs show you which bands are active, a green 'busy' LED lighting when a signal appears on either band. A tiny multi-function key array using rubberised buttons controls most of the set's parameters including frequency entry, memory channel recall, up/down tuning and the like, with a rotary click-step knob on the top panel also acting as a 'tuning' control for those of us who like things a little simpler! Below the LCD, the two larger-sized buttons switch control of the 'Main' band (i.e. the band controlled by the keypad/rotary knob) between 2m and 70cm, a large 'Main' icon adjacent to the controlled frequency being shown on LCD panel. A pair of external speaker sockets are provided on the top panel, one combined with an external mic socket, and by plugging separate speakers (or indeed stereo headphones with re-wired twin sockets) this allows 2m and 70cm received signals to be separated, very nice!

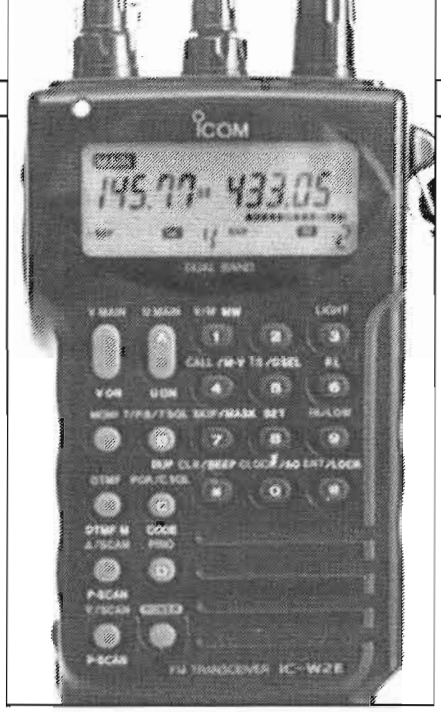
If simultaneous twin-band reception gets a bit too much, you can of course use the set as a simple single-bander, switching between 2m and 70cm, by using the small side-mounted 'Function' button together with the 'Band' button. This 'Function' button also doubles-up many of the keypad functions, allowing you to do all sorts of clever things such as hide and recall memory channels, preset the on/off ratio of the receiver economiser and the like.

Selective Calling

In common with many other sets appearing on the market today, the IC-W2E has facilities for DTMF selective calling as well as DTMF encoding using either the front panel keypad or by transmitting pre-stored digit sequences from memory. By suitable pre-programming, this allows your receiver to remain silent until the correct DTMF 'code' is received, the sequence of 3-digit and 7-digit codes being common to that used by some other amateur equipment manufacturers to ensure compatibility between sets — a welcome sign. For use with the increasing number of UK repeaters employing CTCSS, an optional CTCSS module is available for internal fitment, an encoder isn't fitted in European models although a 1750Hz toneburst is provided instead. This latter function uses the 'Main' band button when used on transmit, the set generating a 1750Hz tone when this is pressed.

On The Air

The shape of the set made it quite nice to hold in both my left and right



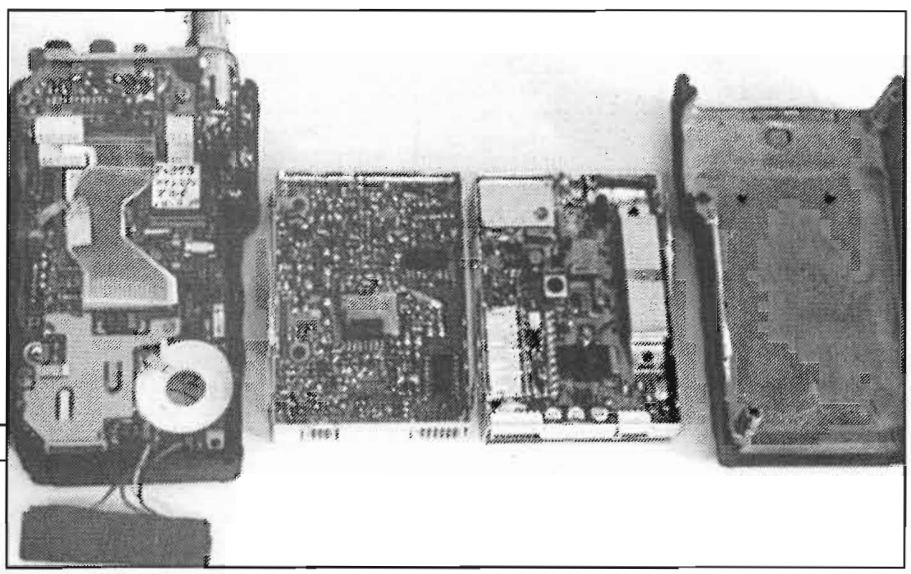
hands, in each case either my forefinger or thumb being in a naturally correct position for the PTT — some ergonomic design must have been used here! Operating many of the front panel buttons was a two-handed affair though using the edge of my finger, many of the buttons being very tiny! The volume knobs were also tiny — I had difficulty with the 2m volume due to the close proximity of the BNC aerial connection.

30 memory channels on each band are available together with the usual scanning and 'priority' channel check modes, so as usual I went about programming these with my commonly-used frequencies. This of course allowed me to store repeater shifts in memory channels where needed, to allow 'simple' operation using just the rotary channel knob. This I often found essential, especially at night due to the total absence of any key lighting - the backlight only operating on the LCD. However the commonly- used buttons, i.e. up/down scan initiation and 'monitor' (squelch defeat together with listen-on-input in the case of a repeater- programmed channel) were sensibly placed along the left edge of the keypad, the 'Light' button being at the top right of the keypad, all of which I became familiar with after a while.

I normally had the set operating on both bands while listening around, when I received a signal I had to be quick to check which band it was received on, and then to push the appropriate 'band' button if necessary before transmitting a reply! Apart from that minor limitation, in general I found the set quite reasonable to operate once I had set the volume/squelch levels. Exploring the user manual in greater depth, I found that as with other Icom handhelds I could enter a 'Set' mode to tailor some of the set's features to my preferences, for example the scan resume condition to either 'pause' or 'timed', and the CTCSS frequency if this option was fitted.

On receive, for such a tiny speaker on the front panel I was amazed at the good audio quality, even at high volumes when I used the handheld in my car, likewise on transmit my audio was described as very good indeed, no need for external speaker-mics here to get a message across. I found the 2m sensitivity quite good using the set-top aerial although the 70cm side was noticeably 'down' on my usual 70cm handheld, however replacing the supplied dual-band whip with a 70cm helical improved matters slightly. The 1.5W level of transmit power I found a bit on the 'low' side, not surprisingly in use I could normally receive stations far better than I could be heard by them. I think I would be tempted to fit a higher voltage battery to get a few more watts if I were to use the set regularly, using the low- power mode (which may be set to 0.5W, 1.5W or 3.5W with a higher voltage supply) for local nattering.

At home, I found the rejection of other strong on-air signals naturally not up to that I'd expect from a mobile or base station, the odd packet signal from my nearby 2m node/BBS sometimes de-sensitising the receiver, however one must bear in mind it's intended use as a handportable here. The DTMF facilities were quite useful for when I was listening out for a specific station, the set 'waking up' as soon as I was called with the appropriate sequence.



I found the battery consumption was quite reasonable with the usual battery 'economiser' operating in the absence of received signals, a full charge normally lasting me a day's worth of operation. With the supplied BP-83 600mAh battery, the manual tells me I should expect just over 5 hours worth of operation at 10% RX, 10% TX and 80% standby, which seemed to be borne out in practice.

Insides

The set is built from a plastic moulded front, with a die- cast metal rear panel acting as a heatsink for the transmitter power amplifier modules. After battling for a while to open the set up (lots of tiny screws everywhere!), I found it was made up of a pair of screened plug-in RF units, one each for 2m and 70cm, both controlled from the set's main PCB mounted immediately behind the front panel keypad. Very tiny construction techniques are used, although some adjustments are accessible from the side of the modules I believe fault-finding and repair really is a job for the skilled engineer armed with a good magnifying glass, associated vacuum pickup surface-mount tools and soldering equipment together with the correct types of servicing extender lead matrices. Either that or it's a module-by-module throwaway job, no wonder user-servicing information doesn't come with the set!

On receive, the usual tuned front end is followed by down- conversion to the first IF (30.85MHz on 2m and 35.8MHz on 70cm) where a pair of tiny monolithic dual crystal filters are used, then down to 455kHz and a small ceramic filter, and demodulation to audio using an MC3372 IF subsystem IC. Individual synthesisers are used in each module, the VCO being modulated, amplified, and passed to the usual block PA module for amplification to the final transmit power level, a low pass filter using discrete coils on each band being used to reduce the level of transmitted harmonics.

LABORATORY RESULTS:

RECEIVER;

Sensitivity;

Input level required to give 12dB SINAD;

144MHz;	0.135uV pd
145MHz;	0.140uV pd
146MHz;	0.140uV pd
430MHz;	0.195uV pd
435MHz;	0.195uV pd
440MHz;	0.195uV pd

Squelch Sensitivity;

	145MHz	435MHz
Threshold;	0.070uV pd (3dB SINAD)	0.100uV pd (4dB SINAD)
Maximum;	0.170uV pd (18dB SINAD)	0.180uV pd (15dB SINAD)

Adjacent Channel Selectivity;

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

	145MHz	435MHz
+12.5kHz;	29.0dB	12.5dB
-12.5kHz;	36.0dB	49.5dB
+25kHz;	66.5dB	63.0dB
-25kHz;	69.0dB	63.0dB

Blocking;

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

	145MHz	435MHz
+100kHz;	79.5dB	71.0dB
+1MHz;	85.5dB	76.0dB
+10MHz;	95.5dB	84.5dB

Intermodulation Rejection;

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

	145MHz	435MHz
25/50kHz spacing;	61.0dB	53.0dB
50/100kHz spacing;	61.0dB	53.5dB

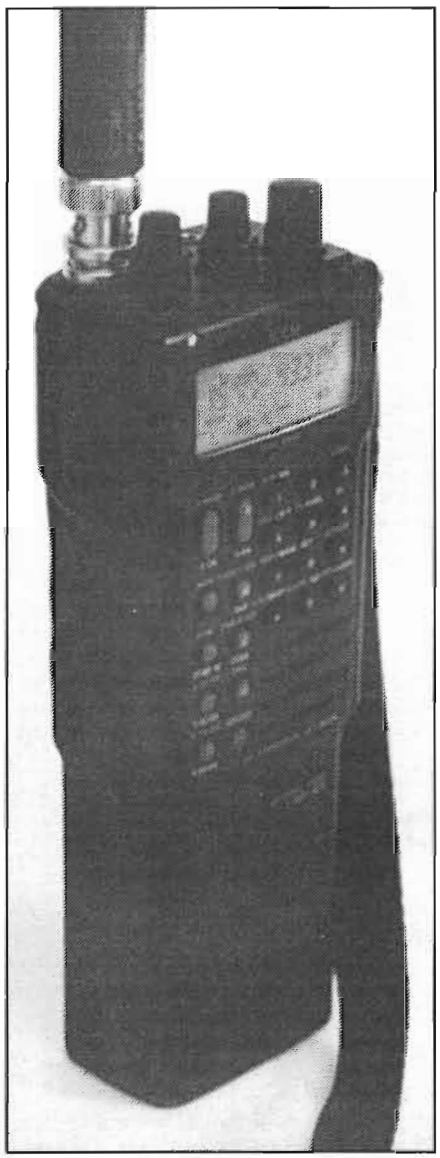
Maximum Audio Output;

Measured at 1kHz on the onset of clipping;

3 ohm load;	175mW RMS
8 ohm load;	158mW RMS
15ohm load;	115mW RMS

Laboratory Tests

The laboratory results again generally confirmed my on-air findings, these results are tabulated here in the usual HRT fashion to allow reader comparison as required. The significant point on transmit was that the harmonics were exceptionally well suppressed, very good for a handheld. The 2m deviation was over the top, however to be fair this could have been a result of the 'early sample' supplied, likewise with the frequency accuracy.



Conclusions

A new step for Icom, a dual band portable with true twin- receive operation. It's fitted with a number of operating features to put it up with the latest on-air practices used, CTCSS being available as an option. Although I found it an easy- to-hold size, some of the operating controls such as the volume knobs, were rather fiddly to use and the lack of back-lighting of the keys made it difficult to fully operate at night. The audio quality I found very good on both transmit and receive, and the usual range of optional accessories could make it a reasonably versatile rig to have around.

Our thanks go to Icom-UK for the timely loan of the review sample.

Image Rejection;

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

145MHz	435MHz
75.0dB	72.0dB

S-Meter Linearity;

	145MHz		435MHz	
Indication	**Sig.Level**	**Rel.Level**	**Sig.Level**	**Rel.Level**
S1	Sq. open	—	Sq. open	—
S3	0.35uV pd	-7.0dB	0.29uV pd	-8.2dB
S5	0.45uV pd	-4.7dB	0.37uV pd	-6.0dB
S7	0.57uV pd	-2.7dB	0.50uV pd	-3.3dB
S9	0.78uV pd	0dB ref	0.77uV pd	0dB ref
S9+	0.96uV pd	+1.9dB	0.97uV pd	+2.5dB
S9++	1.39uV pd	+5.1dB	1.52uV pd	+6.4dB

Current Consumption

Standby, (economiser off);	135mA
RX, Mid Volume;	182mA
RX, Max Volume;	226mA

TRANSMITTER;

TX Power and Current Consumption;

Freq MHz	Power	7.2V Supply	12.0V Supply
44MHz	*High*	1.83W/890mA	5.15W/1.47A
	Low	340mW/415mA	340mW/430mA
145MHz	*High*	1.84W/885mA	5.20W/1.48A
	Low	340mW/420mA	340mW/400mA
146MHz	*High*	1.88W/890mA	5.20W/1.47A
	Low	330mW/415mA	340mW/420mA
430MHz	*High*	1.65W/1.31A	4.46W/1.91A
	Low	1.19W/1.06A	1.20W/1.03A
435MHz	*High*	1.61W/1.26A	4.45W/1.87A
	Low	1.20W/1.02A	1.20W/950mA
440MHz	*High*	1.57W/1.24A	4.46W/1.84A
	Low	1.20W/1.03A	1.20W/950mA

Harmonics;

	145MHz	435MHz
2nd Harmonic;	<-90dBc	-65dBc
3rd Harmonic;	<-90dBc	<-90dBc
4th Harmonic;	<-90dBc	<-90dBc
5th Harmonic;	<-90dBc	—
6th Harmonic;	<-90dBc	—
7th Harmonic;	<-90dBc	—

Peak Deviation;

145MHz	435MHz
6.49kHz	4.96kHz

Frequency Accuracy

145MHz	435MHz
+710Hz	+1.68kHz

A typical Radio Communications Test Set

Typical Receiver Sensitivity: What are the Numbers?

Phil Anderson W0XI makes sensitivity figures make sense

What's the sensitivity of your 2m rig? How would you measure it if you had the available test equipment? What is a reasonably good value for sensitivity? Chances are that you are like me, since you do not own the necessary test equipment you can only guess how sensitive your rig is.

I recently purchased a service manual for my Kenwood TM-221A 144MHz FM transceiver, and the specification sheet on the back page answered some of my questions. First of all, the sensitivity is listed as less than 0.2 microvolts pd for 12dB SINAD. More about SINAD later. Second, squelch sensitivity is listed as less than 0.1 microvolts. There was no mention of blocking level or dynamic range on the specification sheet.

Now suppose you got lucky and Santa dropped off a new commercial test set, called a 'Service Monitor' in the land mobile industry, for your shack for Christmas. With this $8,000 (£4,000) piece of equipment you'd be able to measure nearly all the parameters of your 2m rig: sensitivity, squelch sensitivity, transmit frequency, receive frequency, transmit deviation, and sensitivity at 12dB SINAD. A typical service monitor is an RF signal generator, a step attenuator, an audio signal generator, a deviation meter, an RMS voltmeter and an additional FM receiver all rolled into one unit, as sometimes 'acquired' by radio clubs for 'rig test' nights and the like.

Some units have the signal generator calibrated in microvolts while others list dBm output. So, before describing how to measure the sensitivity of your rig, let's review microvolt levels and how they compare with dBm levels.

First of all, nearly all voltage and power measurements made on VHF communications gear assume a 50ohm impedance system. The generators have an output impedance of 50ohms, your rigs assume a 50ohm load, and most aerials are made to be tuned to 50 ohms. Secondly, whilst power measurements for transmitters and amplifiers are made in Watts, most receiver and signal measurements are made in milliwatts. In fact, a typical signal arriving at your VHF aerial would be measured in tens of microvolts, equivalent to several picowatts!

Since received signals are so small, it's become standard and convenient to make measurements relative to a signal of one milliwatt. Hence, most measurements are listed as so many decibels (dBm) relative to the milliwatt power signal. For example, a 0.22V pd signal is equivalent to a one milliwatt power signal with a 50ohm load. Checking Power = Vrms x Vrms / 50ohms = 0.22 x 0.22 / 50 = 0.001 Watts = a milliwatt.

In general, levels relative to the milliwatt can be calculated by the following

formula, dBm level = log (20 (Vrms x Vrms)). Saying it another way, the power level of a received signal relative to a one milliwatt signal would be dBm level = 10 log (power of that signal / one milliwatt).

Table 1 shows the range of dBm values that correspond to Vrms values. For example, a fully readable but weak FM signal might be about 2 microvolts in value. According to the table, or by using the above formula, this corresponds to a -100dBm level. As another example, a very strong signal of about 66 microvolts would correspond to a -70dBm level.

With that in mind, let's unpack that service monitor Santa supposedly brought you and measure the sensitivity of your 2m rig. Following Fig.1, our first step is to connect the rig to the monitor. The output of the monitor, its RF signal generator, is attached to the aerial input of your rig. Then the speaker output of your rig is attached to the 'input' of the monitor.

We're going to use the service monitor to provide a weak signal to your rig, and increase that signal until your rig responds with a strong enough audio signal as shown on the monitor. First however, set your rig to, say, 145.01MHz. Then set the signal generator of the service monitor also for an output of 145.01, now set the switch to the SINAD position, or audio monitor position. Then increase the RF output of the generator until the audio level on the monitor reads 12dB SINAD on the meter. Once it does, note the level of the RF output, that's your receiver sensitivity. For my rig, the output measured -120dBm (or 0.2 microvolts pd) when the audio reached 12dB on the audio side. I also noticed that the squelch broke at about 0.1 microvolt, as it should.

You might be saying to yourself at this point, "Gee, that's a lot of bucks, $8,000, to do that straightforward sensitivity measurement!" Agreed. But keep in mind, the service monitor is used for many other uses, and can be a handy device if your club can 'borrow' one!

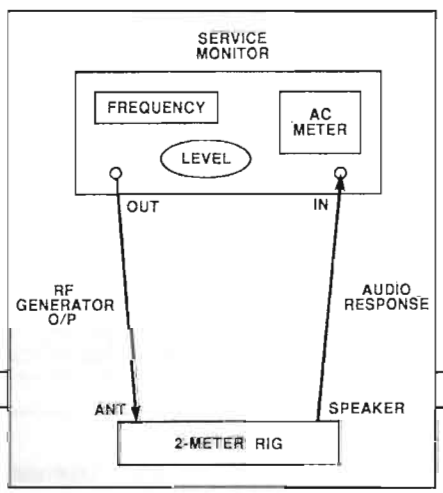
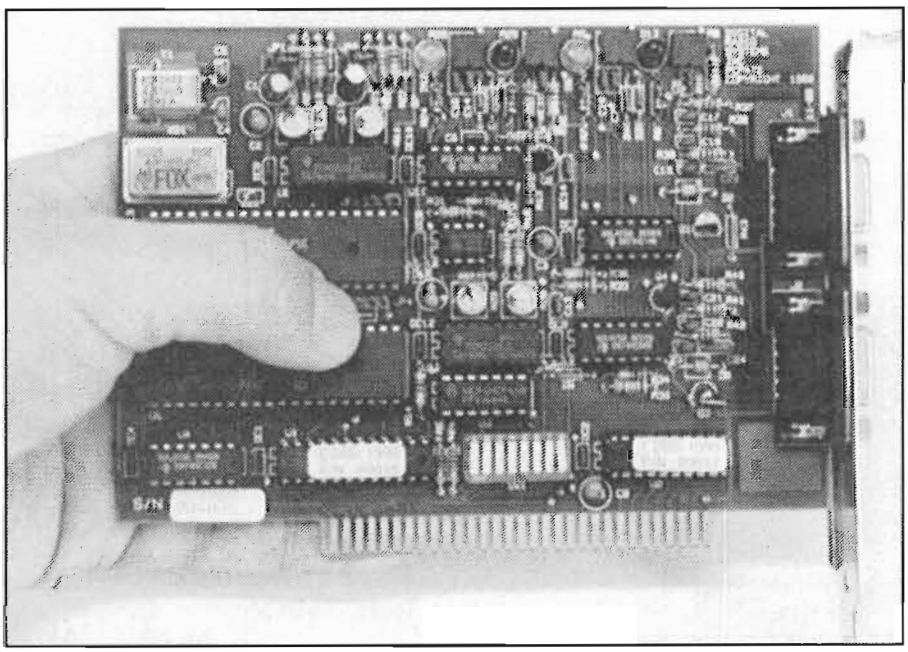


Table 1 V pd versus dBm, 50ohm system

V pd	uV pd	dBm	Input signal comment
7.07E-01	707200	10.00	
2.22E-01	222060.8	-0.06	0.22V pd, 1mW
6.97E-02	69727.09	-10.12	
2.19E-02	21894.30	-20.18	extremely strong
6.87E-03	6874.812	-30.24	near blocking range
2.16E-03	2158.691	-40.31	
6.78E-04	677.8289	-50.37	
2.13E-04	212.8383	-60.43	
6.68E-05	66.83122	-70.49	
2.10E-05	20.98500	-80.55	
6.59E-06	6.589291	-90.61	
2.07E-06	2.069037	-100.67	
6.50E-07	0.649677	-110.74	0.6uV pd
2.04E-07	0.203998	-120.80	0.2uV pd
6.41E-08	0.064055	-130.86	near noise floor

dBm = 10*log (20*(Vrms)exp2), for 50ohm system
0.15 to 0.50 uV pd for 12dB SINAD typical sensitivity
0.05 to 0.25 uV pd for squelch sensitivity

DRSI Packet TNC Review



Packet sysops will love this one, tested here by our resident packet freak Chris G4HCL

Many packet radio operators use a stand-alone Terminal Node Controller (TNC) plugged between their computer's RS-232 communications port and a transceiver. However, once someone becomes 'hooked' and decides to expand their horizons somewhat, a system more integrated with the host computer can often bring benefits. Ask many packet BBS and node system operators what TNC they use, very often they'll say 'a DRSI card'. So what is one of these strange-sounding things?

DRSI stands for Digital Radio Systems Incorporated, their PC- Packet adaptor system being commonly called a 'DRSI card' amongst the packet fraternity. It's built on a half-length PC card, as such it simply plugs into one of the expansion slots on an IBM PC or compatible. Without using any of the computer communications ports, it acts as a TNC in itself, used in conjunction with a Terminate-and-Stay-Resident (TSR) program that comes with the unit.

Three types of adaptors are currently available;

Type 1 — This has one 1200 baud VHF/UHF radio port and one RS232/TTL serial port (to allow connection of an external modem if required).

Type 2 — Two 1200 baud VHF/UHF radio ports on this one, the favourite for BBS and Node sysops and the one tested in this review.

Type 3 — This comes with two external RS232/TTL modem ports for add-on modem connection.

An externally mounted HF modem is available from DRSI, and homebrew and commercial 9600 baud and PSK modems are of course also available.

Software

With many computer systems accessories, associated 'bundled- in' software often forms a major selling feature even when this can also be obtained elsewhere. With the DRSI card, no less than *four* disks worth of software come supplied, enough to keep anyone busy for a while. The software is logically selected to benefit the probable users of the card, that of packet sysops, and comprises;

1) Memory-resident software for the card, allowing you to run packet in 'background' without such programs as Desqview. Providing up to four simultaneous 'connect' screens with a 'monitor' screen available in connect mode, the usual features such as digipeating and gateway operation are available, with full duplex use for satellite operation.

2) 'BB', the multi-connect Bulletin Board system by AA4RE, to provide a mailbox system from your station.

3) G8BPQ Node software, the famous network node as often seen on packet as well as described in HRT's 'Packet Radio

Roundup'.
4) TCP/IP by Phil Karn KA9Q, the packet networking system that several groups are using around the country.

Hardware

Packet technical boffins may like to know that the card is powered from the PC bus, no external power supply is used. The 1200 baud modems have an adjustable audio output of between 5mV and 100mV RMS, the modem sensitivity on receive being adjustable between 50mV and 750mV RMS, i.e. it should match most rigs! A 9 pin DB-9 connector on the rear of the card is used for the radio interface, so you can plug your transceivers in and out without unplugging the card. If you want to plug an external modem into the appropriate card, you can vary the card's output baud rate between 300 and 38,4000 baud, quite a range!

In Use

The card comes with a user manual with several pages detailing interrupt settings, chip register addresses and the like together with DIP-switch settings and software tests for available computer interrupts. However a 'quick start' section details how to get going in most cases by simply plugging in, installing the software, and connecting the radio up. The system needs as a minimum an IBM PC, XT, AT or compatible with DOS version 3.1, 3.2 or 3.3, together with twin floppy disc drives (or one floppy and a hard drive) together with at least 384k of usable RAM. For most packet 'system' users this won't be a problem, however users of single-drive computers take note!

The supplied TSR 'driver' software provides a number of useful pop-up menu features, the computer 'Alt' key combined with a keyboard letter allowing a number of options such as a connect menu, printer on/off control, function key list, ASCII and YAPP file exchange, received text review, and a 'DOS gateway' function to let you out of the packet program to do other things with your computer.

For myself, I used the card mainly in combination with BPQ node software to provide a dual port network node on 4m and 70cm together with a direct link with DX PacketCluster BBS software also resident in the computer. The use of these software packages are of course a feature in their own right, having of course been detailed in HRT in the past from a packet user's point of view. Briefly however the supplied system allowed me to run the dual band network node as well as allowing 'personal' connects, and also to connect another TheNet node operating with an external 'stand alone' TNC into one of the computer's RS-232 ports. While all this was going on, I could use the computer for word processing or even the other RS-232 port to link into my local amateur's 'landline' BBS for file exchanges at a rather faster rate than on-air packet!

Conclusions

The DRSI PC-Packet Adapter will appeal to the packet 'system' operator requiring possibly greater flexibility than attained with external TNCs, for example using the computer's built-in memory rather than on-board TNC memory and the like, together with 'freeing' one or more RS-232 ports on the computer for other uses. As the TNC will not function without the PC being switched on, it may not appeal to the 'occasional' packet user, also remember it needs an IBM PC or compatible rather than any type of computer used simply as terminal emulator. However for it's intended use in a 'system' application, it provides a cost- effective and flexible answer for the existing or budding BBS/Node sysop.

Our thanks go to Amdat for the loan of the review unit.

Hooking Up To Packet

Trip Neisler KC4KLS tells us of his first steps in the future of Amateur Radio

Like many radio amateurs, I wanted to try the increasingly popular mode of VHF packet. It's certainly a much discussed mode, both on the air and in print. I figured that since I'd been using, upgrading, and generally keeping up my own XT-turbo clone computer for more than three years, the hook-up of a TNC between the PC and my Icom IC-28H mobile 2m FM rig should be a breeze. After all, isn't familiarity with the computer supposed to be the hardest part? (I heard that chuckle!). Well, that's what I thought before I got into the project. I guess I might as well admit up front that I found hook-up of the TNC to be anything but a breeze! This article's purpose is to keep that from happening to you. But I'm getting ahead of myself. First you need a TNC.

A casual glance at the totals column of my bank account quickly pointed me in the direction of something besides the fancy multi-mode TNCs, each of which, to be sure, I wanted. Using the time-honoured method of endlessly checking every ad and article in amateur radio publications, I finally settled on an AEA PK-88, this looked like it had everything needed for getting on VHF/UHF packet, and it was widely available at a modest cost. Best of all it had a Maildrop, a way for others to read messages from me or leave messages for me while the PC was doing something else or even switched off. There are, as I've already mentioned, other TNCs available with comparable features and more. Take your pick.

Before we get any deeper into the subject I'd better mention that this article isn't a testimonial for the PK-88, XT clone, or IC-28H. It's about hooking up the TNC of your choice between your computer and your VHF rig, about getting started on packet from the ground up. Not very long ago I was a beginner too, thus the PK-88 is the single TNC I'm familiar with, the XT clone my computer of choice, and the IC-28H my lone 2m rig.

For VHF/UHF packet you'll need a computer with an RS-232C serial data port, a properly terminated shielded serial cable, a communications software program, a TNC and power supply, and your 2m or 70cm FM rig and its power supply. Plus naturally, a few other odds and ends I'll get to as we go along.

Many, perhaps most, computers will work fine with available TNCs, but your computer must either have an RS-232C serial port or be adaptable to RS-232C specifications. No RS-232C port or adapter, no packet *(although some TNCs provide TTL level interfacing as well — Tech Ed)*. It's not really as necessary to understand what an RS-232C port actually is, you just need to be sure your computer either has one or is adaptable. Check your computer's manual first if you're not certain.

An RS-232C serial port was standard equipment on my XT clone, included on an internal expansion card. It's accessible at the rear of the computer, using a DB25M connector. A DB25M connector is a 25 pin male connector, as opposed to a DB25F, which is a 25 pin female connector. That is, the male connector has exposed pins, the female connector has holes arranged in a compatible configuration. You'll need a suitable cable, wired up as shown in your TNC manual. A local computer retailer or your TNC dealer should be able to provide whatever cabling you require, also many mail-order firms stock cables. Any cables should be of the shielded variety to minimise the very real possibility of RFI problems.

Next on my list of essentials is a communications software program. If you have a telephone modem installed in your computer system and use it with a communications program to log on to telephone bulletin boards, or whatever, then you already have all the software needed for packet. On the other hand, if that last sentence lost you, then you're going to need to locate a communications software package. All the major TNC manufacturers offer software packages for various computers. The only one I've looked at is AEA's for the IBM/compatible, and it's a menu driven program that greatly simplifies packet operation, there are of course many others. Whichever program you eventually have, it wouldn't hurt to read the documentation before diving in head first!

At this point, if you've obtained a TNC plus its power supply, and your 2m/70cm FM rig is ready to operate from your computer's location with a suitable aerial, feeder and power supply, then that takes care of the main components. Now comes the part I dreaded the most, hooking all this stuff together to form a working packet station without accidentally destroying anything during the initial power up, also known as the 'smoke test'. I'm referring to installing the small, multi-conductor shielded cable that goes between the rig and the TNC, you know, the one included with the TNC, the one needing a mic plug correctly attached at each end.

My PK-88 came with an 8 pin plug for the TNC's end of the cable. Radio Shack stores here in the States *(Tandy in the UK)* stock one just like it, so I bought one there for the rig's end of the cable. You'll need to locate a suitable mic plug or connector for your FM rig. I've heard that many amateurs can precisely solder conductors to a mic plug in the dark with one hand tied behind their back, but for those of us without the magic touch I'm going to explain the way I do it. We'll start with the TNC's end. First, determine which pins to use, your TNC manual will have this information. Lightly tin only the lugs your manual specifies, using a low wattage soldering iron. By the way, tiny, hard to see, numerals on the insulator section of the mic plug provide a way to identify the pins. Now gingerly trim about 25mm of the outer insulation from one end of the cable. If you nick any of the conductors, start over. Separate the newly exposed colour coded wires, strip about a 5mm of insulation from each, then lightly tin the conductors. Right now, before doing anything else, slip the metal section of the plug, clamp first, over the cable, followed by the soft insulating sleeve you should have found on taking the plug apart. There is no worse feeling than finishing up a super neat solder job on a mic plug only to discover the plug body resting comfortably on the work bench! Don't ask how I know this. Since it's unlikely colour coding is standardised among the different manufacturers, follow your manual's instructions. After all the wires are accurately connected and everything cooled down, slide the soft insulator over the lugs, followed by the plug's body.

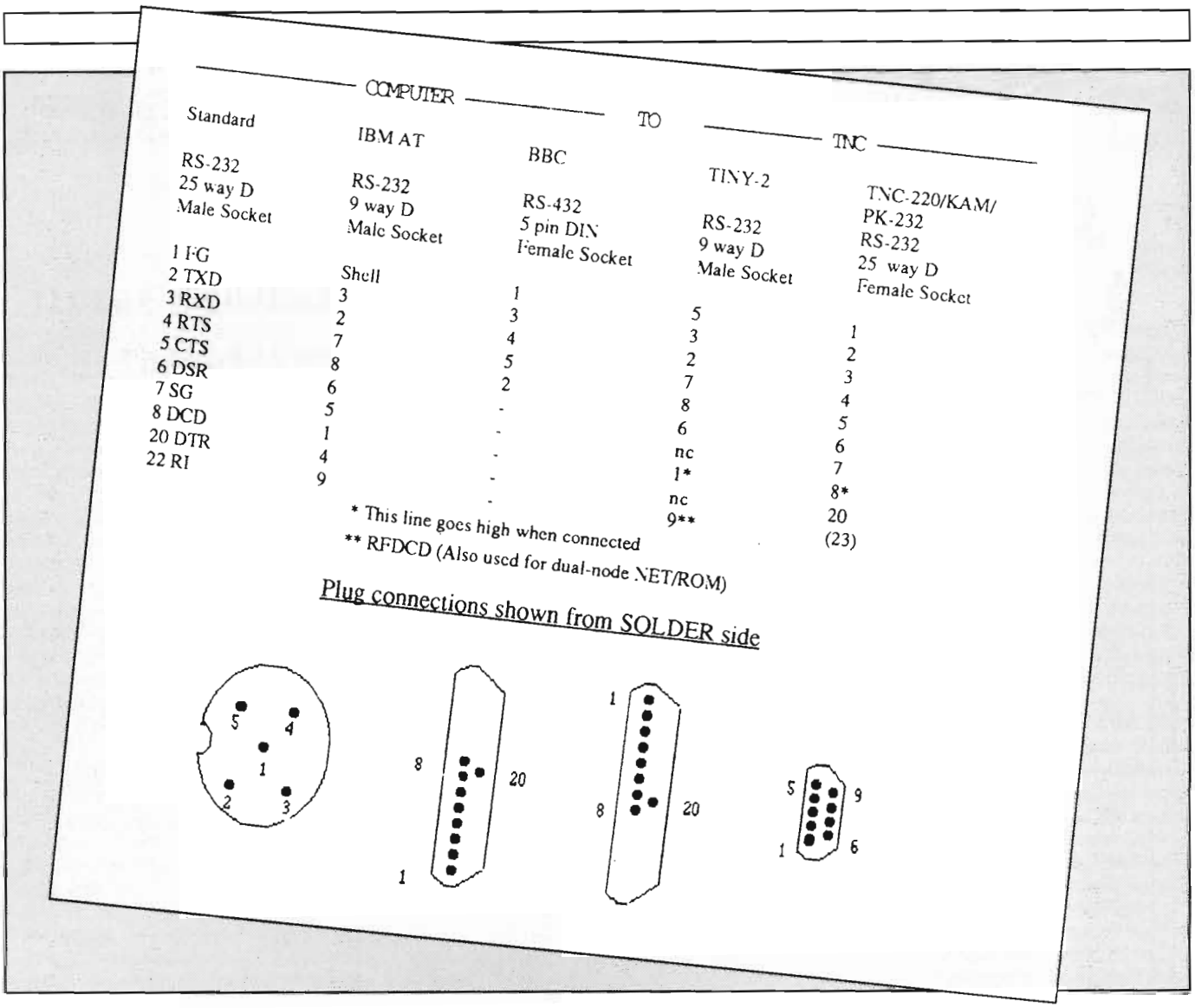


Fig 1. Typical RS-232C to TNC connections

Screw in the set screw and tighten the clamp. *Be sure to identify this plug as the TNC end by marking it with a felt-tip marker, a piece of tape or something.* Easy enough, right?

Attaching the mic plug at the rig end is just another application of the procedure described above. *Don't forget to slide the plug body and soft insulator on first!* Once again, be sure to read and understand your manual's instructions before you start making connections. One other note; receive audio is available at the mic plug's socket on some rigs, including my IC- 28H, and can be connected using one of the conductors in this cable. If your rig doesn't have this feature (and apparently many don't, judging from the wiring diagrams I've seen), then connect to the external speaker socket on your rig.

Before setting your completed cable aside and moving onto the next task, take a moment to test your fresh connections. Get your multimeter (you do have one of these don't you?) and check and double check each connection. Don't forget to look for the possibility of shorts between the pins.

Okay. With the hard part behind us at last, the final bit of preparation is connecting your adequately rated power supply, as determined by your manual, to the TNC. For my TNC this takes a coaxial power plug, which, along with five or six feet of two conductor cable, was also supplied with my PK-88. My operating manual stresses that the *positive* voltage from the power supply must go to the plug's *centre* pin, others use the reverse. Determine the required polarity for your TNC from your manual and wire up this final connector.

The moment we've been working towards is here. With everything powered *off* attach your shielded RS-232C cable to the RS-232C ports at both the computer and the TNC, and connect the multi-conductor cable between the rig and the TNC, making sure the TNC's end is at the TNC if these use similar connectors. If needed, attach the receive audio cable between the TNC and rig. Plug in the TNC power cable, leaving the power *off*. Check your FM rig's hookup to it's antenna and power supply.

Now boot up your computer, then load and run your communications program. Use the communications program to properly configure the RS-232C serial data port, this step is important because it ensures that the TNC and PC understand each other. For my setup it's 1200,7,E,1, but some software needs 1200,8,N,1 and other software may require yet another set of parameters. Turn on your rig and adjust it for simplex operation on an active packet frequency. Around here, 145.010MHz, the almost always busy national packet frequency, is a good place to start, in the UK 144.650MHz, 144.675MHz and 432.675MHz are the places to be. Check one last time that everything's as it should be. Power up the TNC and smile while it writes its opening message to your monitor. When 'cmd:' appears type MYCALL KC4KLS (enter your call here instead of mine, of course), then hit the carriage return.

Now you're hooked up to VHF/UHF packet! An adjustment or two to the TNC might be necessary and there are a jillion commands to decipher .....but that's another story.

NOVICE NOTES
Check that Earth

Brian Kendal G3GDU checks HF earth resistance

For a station earth, many amateurs use a single earth stake and leave it at that, then realise they aren't getting out on the LF bands as well as G3 down the road who has even less wire in the sky. With any end-fed aerial, the power output from your transmitter divides itself between the aerial and the earth in the ratio of their relative impedances. As short aerials have a low impedance, the resistance of the earth can have a significant effect on the performance of the overall system.

Improvements

Improving your station earthing system normally boils down to burying as much metal as possible, but there seems to be a dearth of information on how to make any quantitative assessment of the earth which has been so laboriously obtained. I was recently faced with this problem when I experienced poor results on 160m, burying 15m of wire under the lawn showed an immediate benefit as did two further wires buried in succeeding weeks. The problem then was to determine how many more buried wires would be necessary, the answer being to measure the earth resistance.

For this, disconnect the earth wires from your rig and separate them. The resistance between any two wires can then be measured, each figure obtained being the sum of the earth resistances of the two wires being measured. As I had three separate earths, let's call them A, B, and C, then three different readings were obtained. From these, three equations were written, i.e. A + B = X ohms, B + C = Y ohms, and A + C = Z ohms. By simple algebra, the values for each earth resistance could be calculated.

If you're not able to separate your earth cables, a couple of temporary earth wires can be used, or indeed a single metal stake driven about 1m into the ground should be adequate. Any normal meter should be suitable, provided that it's capable of reading resistance values below 100 ohms with reasonable accuracy.

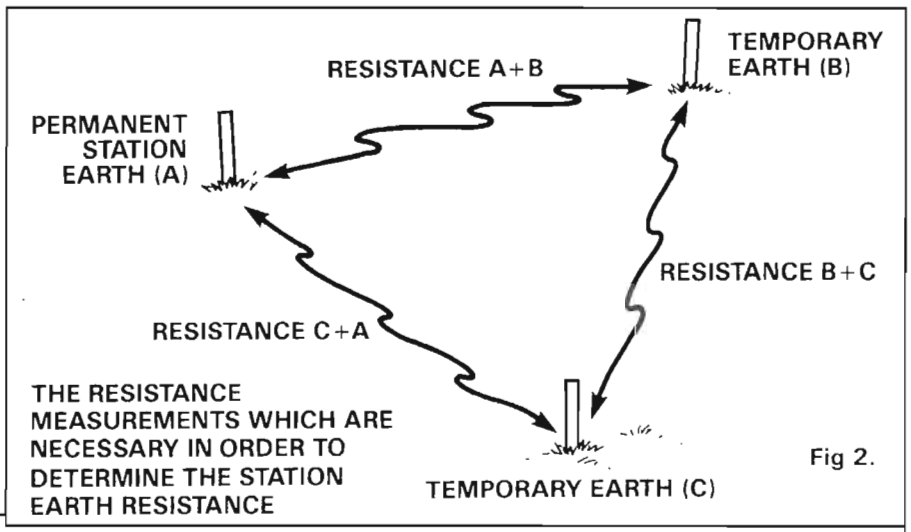
As the earths are parallelled in use, the overall earth resistance can then easily be calculated. In my case, A + B = 50 ohms, B + C = 45 ohms, and C + A = 60 ohms giving approximate values for A, B and C of 33, 18 and 28 ohms respectively. When in parallel these gave an overall earth resistance of about 8 ohms.

It's now possible to go a stage further. My transmitter has a measured output of 10W and the aerial current was measured at 0.6A. As P = I x I x R, 10 = 0.6 x 0.6 x R, therefore R = 10/0.36, i.e. 28 ohms. With the earth resistance calculated as 8 ohms and the total as 28ohms, the impedance of the aerial must be 20 ohms. As transmitted power distributes between aerial and earth in proportion to their relative impedances, then 20/28ths of the transmitter output was being radiated, i.e. about 70%.

More Earth Wire?

At this point we could come back to the original question as to whether more buried earth wires would be advantageous and, if so, how many. It would seem that a likely resistance for each of my earth wires would be in the region of 30 ohms, hence two additional wires would reduce the overall earth resistance to just over 5 ohms, four would bring it down to 4 ohms, giving efficiencies of 80% and 83% respectively. The law of diminishing returns becomes evident. Had the aerial been a short loaded whip, with an impedance of say 5 ohms, the addition of more earth wires would have been well worthwhile.

By measuring the resistance of the station earth, as well as assessing the overall efficiency of your aerial system, it's also possible to determine when further effort will bring little benefit. Remember the moisture content of the ground will vary through the year possibly causing a considerable fluctuation in the earth resistance, hence only by taking measurements over an extended period will a final decision be possible as to the ultimate form to which your earth system will take.



THE RESISTANCE MEASUREMENTS WHICH ARE NECESSARY IN ORDER TO DETERMINE THE STATION EARTH RESISTANCE

Fig 2.

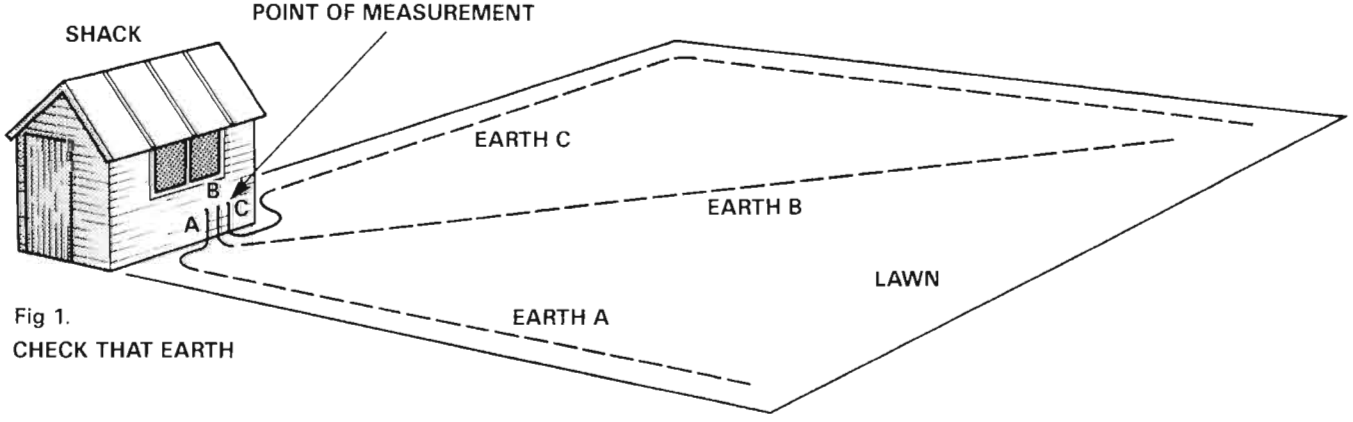


Fig 1.
CHECK THAT EARTH

LAYOUT OF EARTH WIRES AT G3GDU'S QTH

SCANNERS INTERNATIONAL

Radio Criminals no Longer? - Coming Soon!

In past months, we've been showing that the UK law on scanners could be described as a mockery. Handheld receivers listening to airband communications for example are blatantly advertised and sold in the high street, newspaper ads, and even in mail order catalogues, the accompanying descriptions encouraging the potential purchaser to become a criminal by using them to - gasp - listen to aircraft communications! So little Johnny who goes up to the local airport observation platform to see the planes, and takes with him his £9.99 receiver and listens to the goings-on, instantly becomes a criminal. This is because it's currently against the law in the UK to do this, and it's no wonder that readers in certain other countries fall over laughing at the current UK position on this.

Are aircraft listeners breaking the law?

Now we at Scanners don't just sit around and make noises, we get out and do something about it. At a recent meeting with the UK Radio communications Agency (the UK radio licensing authority), the Consultant Editor brought up this subject, and guess what? The RA agreed that it was daft to stop *"Little Johnny listening to aircraft on his scanner"* and that right now there's *"something going through the Home Office"* to clear up the situation. The RA added that this was mainly as a result of the editorial coverage on this matter being published in magazines such as ours. So then, it looks like the law may soon allow us to do what we've been doing for years, without fear of getting our sets confiscated. Unlike one poor chap in Hampshire who had his set seized and was charged with *"obtaining information he was not authorised to receive"*.

Cellular Reception on your TV

In the USA, activities such as listening into cellular telephone conversations are regarded by some as the *seedy end* of scanning, with people purposely going out and buying specialised equipment to listen in to these conversations. It's also attracted the attention of the UK press with some scanner users being likened to *electronic snoopers*, however the main result of this has just been to show previously ignorant cellular phone users that their conversations are indeed being transmitted over the airwaves, and can easily be overheard on a simple receiver.

In a recent interview with Bob Kay of *Monitoring Times*, a USA publication, NBC news asked him; *"Do you listen to cellular phones?"*, Bob replied *"Sure, but not very often"*. They asked him what equipment he used to listen to cellular phones, his reply being *"I use a 27inch Panasonic TV set, model number CTL 2781S"*, adding that listeners could also monitor cellular phones on a Sony, General Electric, Zenith...they interrupted; *"Don't you use a scanner radio?"*, the reply being *"You don't need to buy a scanner radio to monitor cellular phones. Simply connect a standard UHF bow-tie antenna to your television and tune across TV channels 80-90"*. When NBC asked *"What kind of people listen to cellular phone calls?"* Bob answered *"Common, everyday people who own television sets"*! Does this mockery sound familiar?

Remember, there's no law, here at least, to prevent you owning a receiver to tune into anything you want to (although the UK TV licensing people want you to buy a licence from them to install equipment to receive certain TV broadcasts). It's just currently against the law to deliberately listen into some things, and if you accidentally overhear anything you're not allowed to receive, like when you're tuning around for legitimate signals and someone's two-way radio conversation breaks through, you simply shouldn't tell anyone except the people stated in the current UK Wireless Telegraphy Act.

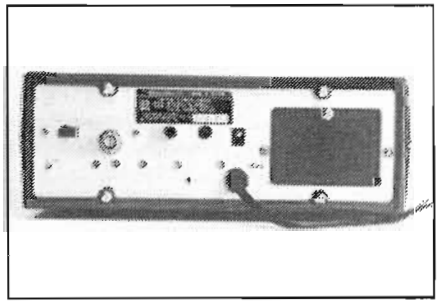
But should we be allowed to listen to what are, to all intents and purposes, private cellular or other cordless telephone conversions? Or should every user be made aware their conversations aren't private? An interesting fact came out from our last reader's survey, not one Scanners reader gave cellular listening as something they wished to see covered in great detail, but rather other forms such as aircraft and marine communication, which we're pleased to do through our pages. Reviews came *top of the list*, and you'll see we constantly respond to this with the very latest sets to hit the streets. It looks like our readers seem to think cellular conversation is boring listening. Instead they tune to more interesting signals from orbiting space stations, the local coastguard and air traffic controllers.

Realistic PRO-2006 Scanner

The PRO-2006

Smart table-top appearance suitable for lounge or 'shack'.

Rear panel connections together with the battery holder for memory backup.

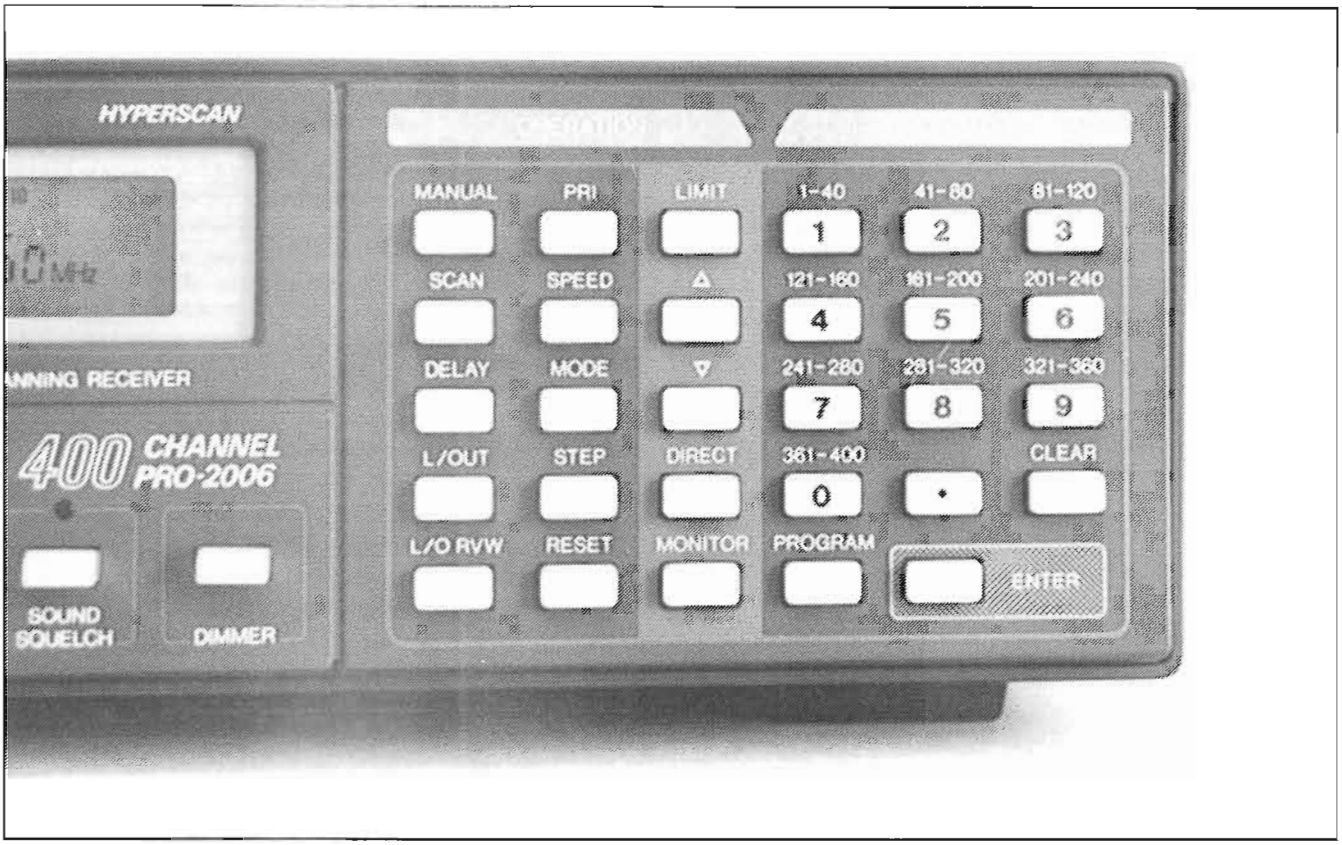


Realistic's PRO-2006 'Top-of-the-range' scanner looks virtually identical to its predecessor the PRO-2005 (reviewed in the Nov 89 issue of Scanners). The PRO-2006 model adds Realistic's appropriately named 'Hyper Scan' to the features provided, in this case a maximum channel scan rate of 26 chan/sec is offered to allow you to search somewhat more quickly through the 400 memory channels offered, thus reducing the possibility of missing a signal while the set is busy checking other frequencies.

The scanner covers the frequency range of 25-520MHz and 760-1300MHz, with reception modes of AM, FM, and WFM, and is primarily designed for desktop use at home, the set measuring 76(H) x 220(W) x 205mm(D).

Searching

The memory channels are organised in 10 banks of 40 channels each, as with other scanners this allows you to organise your monitoring depending upon your individual preferences. Likewise,



Well laid-out user push-buttons

10 frequency search ranges may also be programmed with your required lower and upper frequencies, reception mode, with frequency step increments of either 5kHz, 12.5kHz or 50kHz. A useful operating feature is that of 10 'monitor' memory channels in addition to the normal memories. Using this facility in search mode, when receiving a frequency you can just manually push a couple of buttons to store the displayed frequency into a 'monitor' memory, either for quick recall later or to subsequently store this into one of the 'normal' memory channels.

A 'sound search' button is fitted to the front panel, this may be used in addition to the normal 'stop on busy' search function to check if the received signal has audio present, if no audio is received within half a second the search then continues - useful to prevent 'birdies', i.e. internally generated signals, locking up the set's frequency search.

Connections

The set comes with a screw-in telescopic aerial for local signals, for more serious listening this may easily be removed and an external aerial connected to the BNC connector on the rear panel of the set. A switch for a built-in aerial attenuator is fitted adjacent to the BNC connector, this guards against exces-

LABORATORY RESULTS

Sensitivity

Input level in uV pd required to give 12dB SINAD;

Freq MHz	Sig. Level
29	0.22 (FM)
51	0.26 (FM)
80	0.42 (FM)
100	1.11 (WFM)
120	1.47 (AM)
145	1.08 (FM)
170	0.92 (FM)
250	1.69 (AM)
435	0.39 (FM)
934	0.48 (FM)
1296	1.28 (FM)

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;
28.0dB
-12.5kHz;
26.5dB
+25kHz;
50.5dB
-25kHz;
50.0dB

Image/IF Rejection

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

145MHz;	>80dB
934MHz;	>80dB

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;	69dB
+1MHz;	88dB
+10MHz;	94dB

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, 50/100kHz spacing;

66.5dB

sively strong signals disrupting reception when using amplified external aerials and the like. As well as front panel headphone and rear panel earphone connections, a 'line output' is fitted at the rear for tape recording purposes, this lets you manually record received audio rather than automatically switching on a tape recorder when the squelch raises. The front panel backlit LCD shows the usual indications of frequency, memory channel and suchlike, a 'dimmer' switch controlling the brightness of the backlight. A wired-in two core mains lead is fitted for use at home, and a rear panel DC socket allows you to connect an external 13.8V DC supply using an optional cable.

In Use

Memory backup in the absence of a power supply requires a 9V PP3 size battery to be fitted into a compartment at the rear, this was evident as soon as I switched the set on with the LCD 'Batt' indicator flashing away and the set persistently bleeping at me, the bleep period also muting all received audio. Eventually I found a suitable battery, fitted it, and thus retained my sanity.

The supplied instruction book I found gave extremely well-written details on operating the scanner together with worked examples for guidance, very useful with so many operating modes which could easily confuse the beginner. Within a few minutes I'd programmed in my required search ranges and a few memory channels, connected up my external 25-1300MHz discone, and started listening around. The audio quality from the internal speaker was quite good, and I found the set nicely sensitive on UHF although surprisingly a little 'deaf' on the mid-VHF range, especially the 2m (145MHz) amateur band. Likewise, attempting to hear my local 1297MHz amateur repeater gave zero results whilst it was a weak but perfectly readable signal on my purpose-designed amateur receiver.

Living close to both an international airport and a major shipping port gave me plenty to listen to besides radio amateurs, and throughout the review period the set performed faultlessly, although I sometimes had to switch in the rear panel attenuator to prevent powerful signals from my local fire brigade station transmitter causing me problems in receiving weak signals around 145MHz. I found the set easy to use, it's smart appearance not looking out of place in my lounge as well as in the radio 'shack'.

Conclusions

The set's availability from the many high-street Tandy (UK)/Radio Shack (USA) outlets must go a long way to making it a popular model. I found the set very easy to use, the high scanning speed helping me to search through channels faster than I'd normally expect and thus miss less of the beginning of briefly transmitted signals, although I found the set a little insensitive on some frequency ranges.

At a current catalogue price of just under £350 (at 15% VAT) it isn't one of the cheapest of course (if you're after a budget model look for the £99 Realistic 'Patrolman' scanner review coming up in Scanners shortly) and I'd suggest you ensure the store you purchase it from can offer good advice and after-sales service. Having known the suppliers of the review set for many years with the store manager's good knowledge of scanners, I often find it infuriating to go into some high street shops to be greeted with a blank look when asking for more details than how much a receiver costs!

My thanks go to Link Electronics for the loan of the review scanner.

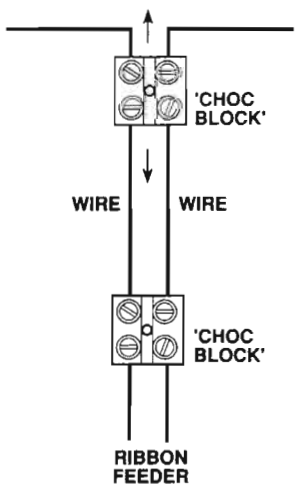
QRP CORNER

Dick Pascoe G0BPS of the G-QRP Club says you need an efficient aerial for QRP

I sit and write this having spent an exhausting weekend at the Pickets Lock Rally.

It all started when George G3RJV asked if anyone was interested in manning a stand at the show to help publicise the G- QRP club. The stand was thus booked and helpers in the shape of George G3RJV, Ian G3ROO, Paul G1PJJ and Roy (call unknown) as well as your scribe spent their time extolling the virtues of the G-QRP club and the benefits of QRP in general.

Several new members enrolled, and a few even paid their subs! Sales of club regalia and wares helped to generate a lot of interest, and both Ian and George were booked to give talks at the rally. I understand these were both received very well, the crowd around the stand



'Choc Block' connectors used for feeder separation

following the talks said it all. Walking around the halls during the brief breaks in the crowds also enabled me to pay a visit to the HRT stand and meet some of the other staff that we don't normally see. Our editor even found time to part with a few glasses of bubbly too, HRT contributors **do** get treated well!

Aerials

To most people's minds, the thoughts of QRP are solely on the rigs and the low power levels involved. We have looked at the relation of power levels in the past, but how does the good QRP operator get such a good signal out into the ether? The answer lies, not in the soil only, but also in the air. Nearly *all* successful QRP operators use *very good* aerial systems. I use both a Windom and a loop aerial, the Windom is full size, i.e. suitable for all HF bands 10m to 160m, whereas the loop is mainly for 40m.

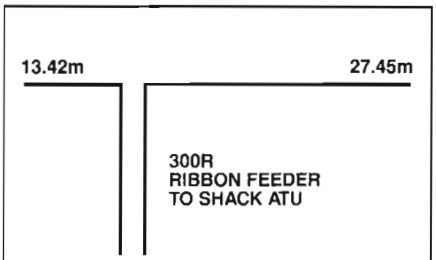
The Windom is a very dated aerial, but it still has its uses. Some may decry it in favour of the G5RV, but how many versions of that famous aerial are there now? The Windom is still basically the same as it was when General 'windy' Windom first put his up, which must say something about it. It works!

The loop aerial is totally different. Mine is a full size loop on 40m mounted in the vertical plane, and following help from Chris G4BUE it's fed about half way up one side.

One problem associated with all wire aerials is the tuning, but with the loop this is made very easy by using the wire connectors known as 'choc blocks' (electrical connecting blocks). Use one pair to join the loop wire to the feeder, the other pair to slide up and down the wire, pulling the loop tighter to shorten it and playing out to lengthen it. The length of wire between the 'choc blocks' will not need to be cut, it will only act as part of the feeder as the currents in this part will be self cancelling.

Last October I had a visit from the President of the ARCI, the American equivalent of the G-QRP club. She runs a 40m loop but horizontal, only about 3m above ground level too, and she swears by it! Height and space are not always required.

Back to the soil. John Heys, G3BDQ in his book 'Practical Wire Antennas' gives excellent reasons for getting the best ground plane possible for aerials, especially verticals. Most earths in the UK are not very good electrically, in the south of England the beautiful chalk downs are nice to see but not good as at all for long distance working. So don't forget the earth when improving your aerial system!

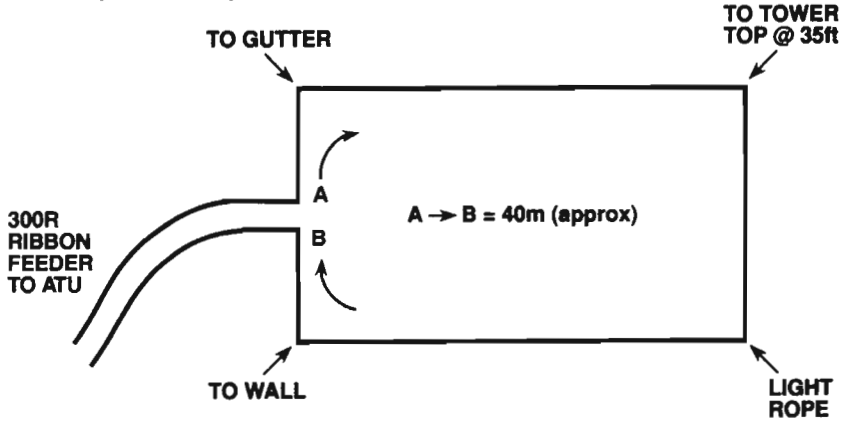


The 'Carolina' Windom Aerial

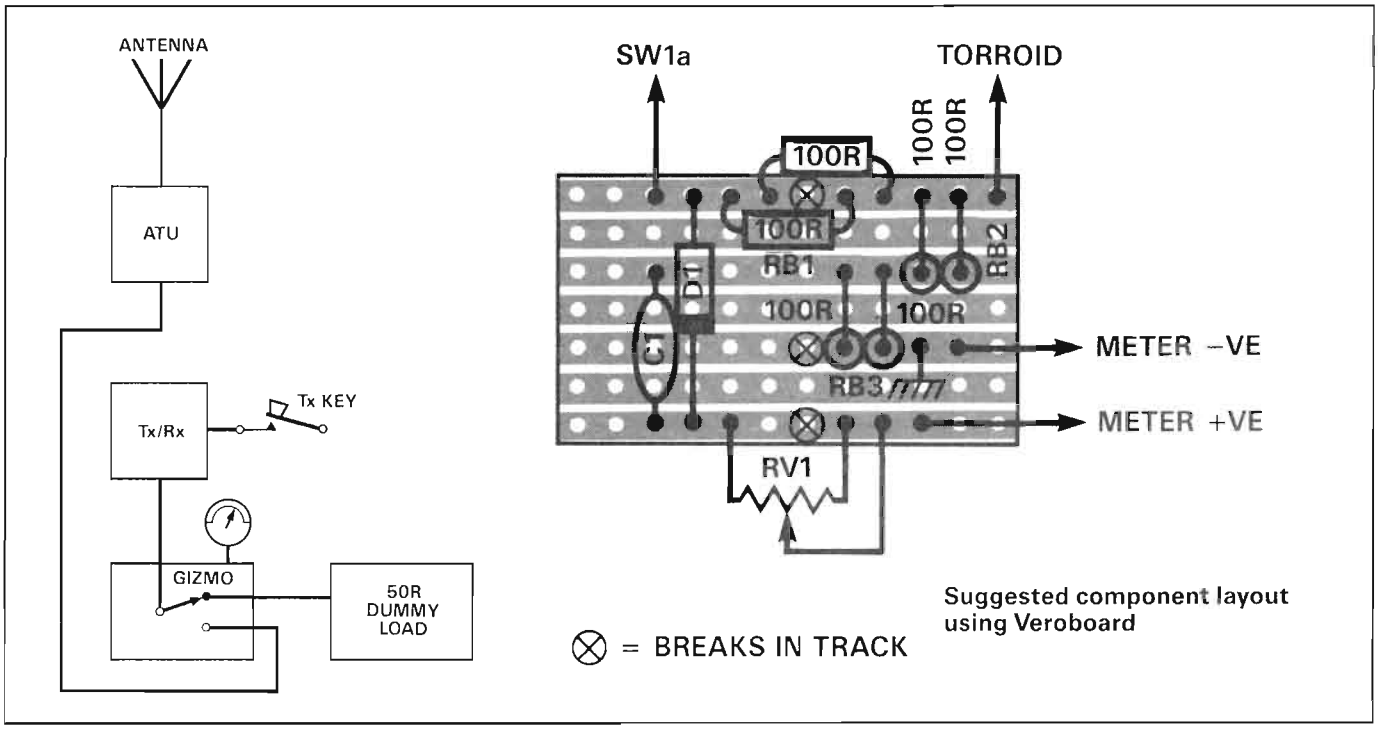
When you next visit the shack of any good QRP operator, look at their bookshelf. The amount of technical information available on that shelf may well give a very good idea of what I'm talking about, I would warrant that a lot of that shelf will be filled with books on aerials and aerial design.

That's it for this month, comments and information to me at *3, Limes Road, Folkestone* or via HRT editorial. 73s es gd QRP.

40m Loop at used by G0BPS



Project — A Silent Tune 'Gizmo'



Suggested component layout using Veroboard

Fig.1. Basic block diagram

Tony Skaife G4XIV, shows you how to remove those tune-up whistles.

An operator of the HF bands will be all too familiar with the 'tune-up' heterodynes mid-way through an over, caused by the 'tuner-upper' not knowing a better way to tune up their aerial to the transmitter. I hope this description of my *Gizmo* will encourage more amateurs to have ago at building it, then *using* it to tune the ATU with no power on the aerial. The *Gizmo* enables you to do all your tuning into a dummy load, even using solid state equipment, which keeps those annoying carriers off the bands.

A useful point worth noting on this little device is that it may be left in permanently without the hassle of undoing plugs etc. Also the aerial system is isolated from the transceiver by simply switching to the dummy load position.

Operation

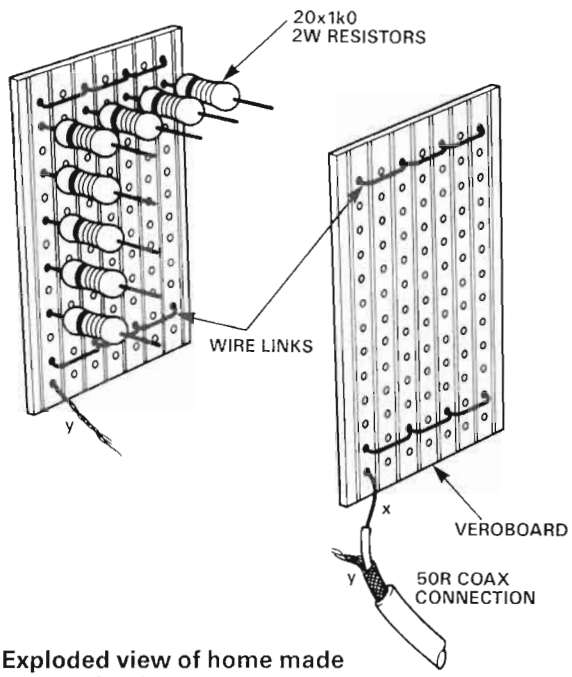
Fig 1 shows a basic block diagram of how *Gizmo* fits into the scheme of things. With the *Gizmo* switched as shown, the transmitter can be keyed with its power going into the dummy load and being safely absorbed. This power as it goes through *Gizmo* activates its built-in meter, with 30W being usually adequate to produce an FSD reading so that high power dummy loads are not required. The reading on the meter can now be monitored, and the ATU adjusted to null out (reduce to zero) that reading. If a zero reading can be achieved it means that the ATU has produced a 50 ohm match to the transmitter. The transmitter may now be unkeyed, the switch moved to the alternate position, and now the transmitter can be operated at its normal power level knowing the aerial system has been set up correctly.

Construction

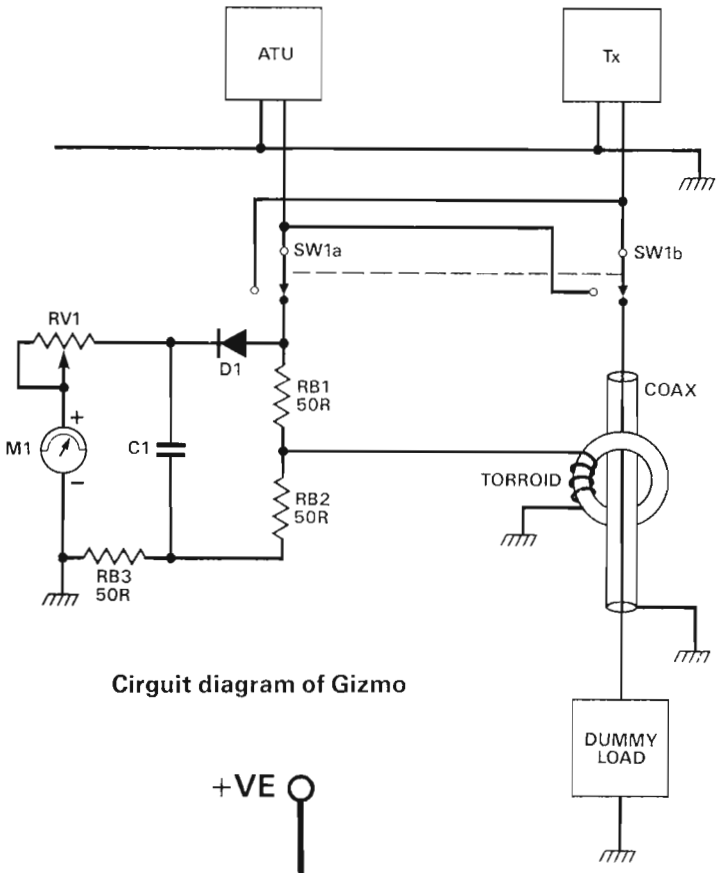
With the operating aspect of *Gizmo* having been covered, I shall explain the circuit and constructional details of this effective but very simple device.

The circuit (which has been around for a number of years) is based on the principle of the AC bridge, i.e. if all the sides of the bridge are the same (balanced) then no current will flow in the circuit. Resistors RB1, RB2 and RB3 form three sides of a bridge based on 50 ohms, with the aerial via the ATU forming the 4th side. Current is induced into the bridge by the windings on the toroid, this is rectified by D1 and smoothed by C1. The resultant DC is indicated on the meter, with variable resistor RV1 set so that the meter reads FSD (maximum) with typically no more than about 25W from the transmitter to the dummy load.

I had a small SWR/power meter which had suffered some internal overloading, but as its meter was OK I pressed it into service for this device if only for its case, each constructor will of course have their own preference. The



Exploded view of home made dummy load



Cirguit diagram of Gizmo

now redundant internal circuitry in my case was carefully removed, so as not to damage the meter or SO239 sockets as they comprise part of the new device. From the old SWR circuit board, I removed the low power signal diodes and tested each one before use as a precautionary measure. A simple test of the diode can be carried out with the aid of a resistance meter, connect the diode each way across the meter and note the reading in each case. With a typical meter, when forward biased it should be in the order of 1k, and greater than 25k when reverse biased.

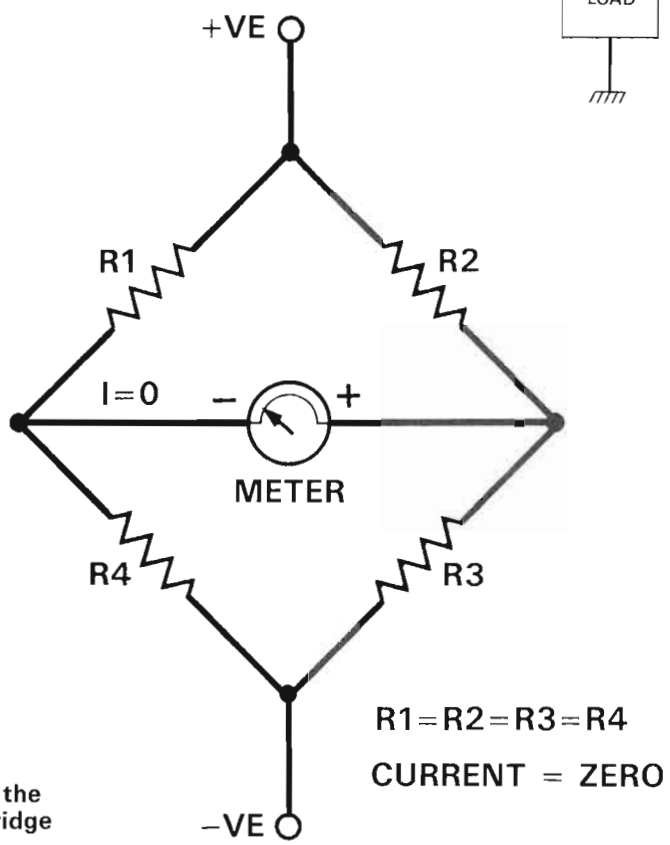
Components

The bridge I constructed on a small piece of Veroboard, but this is not critical and all the components may be hard wired to terminal posts, again dependent upon your preferences. 50 ohm resistors may not be too common, so two 100 ohm resistors in parallel make the ideal value. RV1, the variable resistor, is a 10k skeleton type and C1 is a 0.1uF disc ceramic capacitor.

The type of coax cable used between the switch and socket for the dummy load may be any that 50 ohm type that is at hand, but it is important that the braid is left unconnected at the switch end and connected to the case (earth) at the socket to the dummy load. The toroid consists of 10 turns wound on a ferrite ring of sufficient size to just slide over the coax.

Gizmo's final component is the switch, which is a rotary double throw double pole type, mine cost me 20p at a local rally. An extra socket I had to fit was the one used to connect to an external dummy load. and here a 3.5mm audio socket was chosen as it was small enough to fit anywhere convenient in the side of the case. Those who are more ambitious with access to metalworking facilities may like to construct a slightly larger case and build an internal dummy load to this, possibly using the well known combination of 20 1k resistors.

So here is the little device that **G**ives **I**ndicated **Z**ero **M**eter **O**utput.



Principle of the balanced bridge

From My Notebook

Geoff Arnold G3GSR shows the benefits, and pitfalls, of voltmeters used for electronic measurements

In my last 'Notebook', I talked about what happens when a current- consuming load of some sort is connected across a source of power. That source of power can take many different forms, it can be a battery, or a mains-driven power supply, or it can be a source of signal power, such as a microphone, a signal generator or even a receiving aerial.

One example which may not have occurred to you until you've actually experienced it — maybe even been totally misled by it! - is the load placed on an electronic circuit when you connect a voltmeter across some part of it. Apart from electrostatic voltmeters, where the deflection of the pointer is produced by the attraction between two oppositely-charged metal plates or sets of plates, and used for measurements in the kilo-volt-plus range, all voltmeters draw *some* power from the circuit to which they are connected. Just how much the act of connecting the meter will load the circuit being tested will depend on the resistance or impedance of the meter, compared with the resistance or impedance of the circuit at the point where you are applying the test-probes.

Before we can begin to consider the loading effect of the meter, it's essential to understand how its resistance or impedance may be specified by the manufacturer. As in many things in radio and electronics, there are several different ways of talking about it, *so* confusing for the beginner!

For simplicity, let's look first at the good old-fashioned moving-coil panel meter, sometimes termed an analogue meter, which has been around since long before there were meters with a digital read-out. The same sort of meter movement forms the heart of conventional multimeters, (even of what are called electronic multimeters, which incorporate a valved or solid-state amplifier to drive the meter so increasing its sensitivity, but we'll ignore those for the moment).

The coil in the meter is connected directly (more or less) to the circuit under test, and draws a current from it which produces a magnetic field. This field has a strength which is proportional to the current drawn, which in turn is proportional to the voltage across the points to which the meter probes are connected. It interacts with another field, produced by a permanent magnet in the meter movement, causing the coil to move, hence the name *moving-coil*. Attached to the coil is the pointer which travels across the scale to indicate the strength of the current and therefore the voltage difference which produced it. The angle through which the pointer turns is the analogue of (i.e., corresponds to) the strength of the current.

FSD and Sensitivity

If a current through the meter coil of, say, 1 milliamp causes the pointer to move right across to the end of the scale, the meter is said to have a full-scale-deflection (abbreviated FSD) of 1 milliamp. A couple of paragraphs back, I casually mentioned the word 'sensitivity', without explaining it. Sensitivity is not the same as FSD although they are closely related, and if you know one you can calculate the other. Sensitivity is expressed in ohms per volt, and very simply our 1mA movement has a sensitivity of 1000 ohms/volt. How should that be? Well, Ohm's law tells us that a load of 1000 ohms connected across a supply of 1 volt will draw a current of 1 milliamp. That fact should be engraved upon your mind, for it tells you all you need to know to work out in your head the current and voltage levels in simple circuits.

What neither the sensitivity nor the FSD figure can tell you is how much power the meter will take from the circuit under test, because they give you no idea of the actual resistance of the meter and therefore how much voltage difference must exist across the test probes before the meter will draw that 1mA. A typical cheap 1mA meter movement may have a resistance of only 75 ohms. Further application of Ohm's law will tell us that the voltage required to drive a current of 1mA through 75 ohms is 75 millivolts, or 0.075V. That's not very much use if we want to measure the voltage of, say, a 9 volt battery, because at the very least, the pointer will be hard up against the right end of the scale. We must find some way of absorbing the rest of the voltage.

That's done by connecting a resistor, known as a *multiplier resistor* or just a *multiplier*, in series with the meter coil. There are two ways of looking at the operation of the multiplier; one is to say that it is a current limiter, holding down the current to the value that the meter movement can safely handle. The current flow must cause a voltage drop across the multiplier, which is the voltage we need to get rid of. So the multiplier is a voltage dropper too. These are two aspects of the same action.

If we wanted to make our 75 ohm 1mA movement into a voltmeter reading 10V FSD (convenient for checking that 9 volt battery) we need the resistor to be the right value to drop the voltage difference, 10 — 0.075 = 9.925V, when carrying 1mA. The resistor required is of course 9,925 (or 9.925k) ohms, which is so close to the standard value of 10k ohms as not to make any odds in practical terms. It's important to realise that connecting the multiplier in series with the meter movement has not changed its sensitivity in any way. The load presented to the circuit under test is still 1000 ohms for every volt FSD; 1000 ohms/volt. Remember, too, that these calculations are based on the full-scale deflection of the meter, not on the value of the applied voltage, which can obviously vary widely.

If we wanted to make the meter read 100 volts full-scale, the series multiplier resistor required is 100,000 ohms. Well, actually it's 99,925 ohms, but even a 1% tolerance 100k resistor could have a value of anywhere between 99k and 101k, so you might as well accept the

figure of 100k. Whenever you get past the point of wanting to increase the FSD of the meter by a factor of about 100 (even less than that if you are not looking for great accuracy), you can ignore the resistance of the meter movement when calculating the multiplier.

In Practical Terms

A meter of 1mA FSD or 1000 ohms/volt sensitivity is not very good for use as a voltmeter, though there have been plenty of multimeters around in the past with that sort of specification, some even worse. The famous AVO Model 7, for example, was only 500 ohms/volt unless you pressed the 'divide-by-two' button, when it doubled to 1000 ohms/volt. The AVO Model 40 and 47, intended for use mainly in electrical work where the heavy loading didn't generally matter, went as low as 333 ohms/volt.

Better quality moving-coil voltmeters have offered sensitivities of 20,000 ohms/volt (FSD 50 microamps) or more for many years now, a few going as high as 100,000 ohms/volt (FSD 10 microamps). A good-quality panel meter intended for use as a voltmeter will have much the same sort of sensitivity, with an internal resistance of some 2,000 to 4,000 ohms.

Gaining an Advantage

We don't often use a voltmeter at full-scale deflection, of course, so the current drawn is almost always less than the FSD figure. A 1mA movement showing a half-scale reading will be drawing only half a milliamp (500 microamps, i.e. 500uA). So things are not usually as bad as they might first appear in terms of the load imposed on the circuit under test. The smaller the deflection of the pointer, the smaller the current being drawn. Looked at another way, the higher the range that you switch to, the lower the current drawn by the voltmeter.

Don't be tempted to take this too far though, as most moving coil meters become much less accurate when they are reading below about one-third FSD. It is for this reason that professional-grade multimeters have range switching in steps in a 1-3-10-30-100 sequence, which means that until you get to the bottom range, there's always a more sensitive one to switch to when the deflection falls into that bottom third of the scale.

Electronic Voltmeters

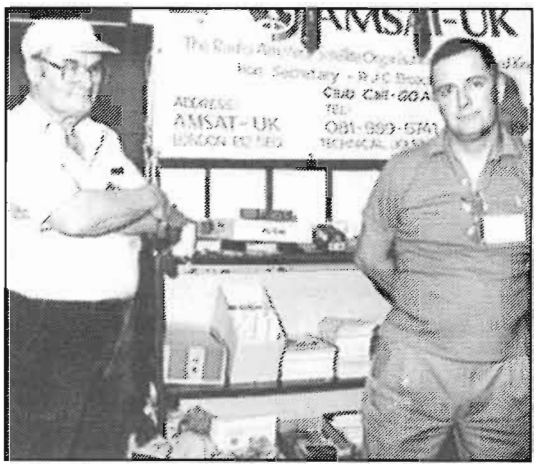
By electronic voltmeters I mean, as mentioned previously, those that have an amplifier between the test probes and the meter movement. On some of these, the rule that selecting a higher range will reduce the loading does not apply. The reason is that sometimes a fixed value resistor network is connected permanently across the input terminals, and all range switching is done after this network, where it does not affect the input resistance.

A typical figure for this fixed input resistance is 10 megohms, which sounds great. In fact, although it is very good for measuring low to medium voltages, it is not necessarily so good for high voltages. Consider, for example, a conventional multimeter with a sensitivity of 20,000 ohms per volt, set to the 1000 volt range. The resistance presented to the circuit under test will be 20,000 x 1000 ohms or 20 megohms, twice as good as the 10 megohm electronic multimeter.

In these days of solid-state circuits with low operating voltages, this may not be such an important factor as it used to be. If you are still involved with valved circuits, especially transmitter final stages with perhaps 600V or more on the HT rail, it's a point to bear in mind.

In my next *Notebook*, I plan to look at meters for current measurement and how to go about extending their ranges. See you next month.

Satellite Rendezvous



Ron G3AAJ (left) and Richard G3RWL (right) at the Amsat-UK stand

I've just come back from a busy weekend manning the Amsat-UK stand, together with Ron G3AAJ and several other helpers, at the London Show. It was nice to meet many readers there, and a pleasant surprise came when the HRT editorial staff arrived in force laden with pint-sized liquid refreshments for Ron and myself!

AO-21/RUDAK

This was successfully Launched on Jan 29, at 11:59:52 UTC. At the time of writing, only a brief test of operation of AO-21 has been done when AO-21 was turned on briefly by ground controllers to check the power consumption of the transponders. Since then we have seen much speculation about problems on board. Here's what the problem has been; on orbits #80 and #89 the payload was powered up for some short tests. Then the current protection automatically disconnected AO-21 from the main power supply, after the GEOS command station made a possible wrong command, by turning ON both transponder systems at the same time. Normally only transponder #1 will be used with transponder #2 used a spare unit, the resulting high power consumption during switch-on triggered the current protection. There was a need to switch off one of the transponders, but this needed some changes in the command procedures of the GEOS command station.

Unfortunately, they were doing extensive experiments and tests with their own payload and couldn't control AO-21 for several days, so they just turned everything off. However I've now heard the digital signals so it looks like the problem is over, and it has been

Richard G3RWL of AMSAT-UK with the latest Amateur Satellite Information

announced that its available for public use. Here's a reminder of transponders;

Linear Transponder Uplink: 435.030 — 435.120 MHz (90 kHz)
Linear Transponder Downlink: 145.880 — 145.970 MHz (inverted)
Output Power: 12 watts HF maximum.
Beacon: 145.880 MHz, CW telemetry.

RUDAK-II: Two on-board computers with IPS operating systems for packet radio (AX.25) (Mailbox, telecommunications experiment with Digital Signal Processing up to nearly 20 kHz, etc.) 1 MByte RAM disk. Four separate uplink channels.

Gain of satellite RX and TX aerials: 2.3 dBi each (dipoles)

SAT-RX-1: 435.016 MHz +-10 kHz 1200 bps, FSK, NRZIC/Biphase-M (JAS, PACSAT)
SAT-RX-2: 435.155 MHz +-10 kHz (AFC) 2400 bps, BPSK, Biphase-S
SAT-RX-3a: 435.193 MHz +-10 kHz (AFC) 4800 bps, RSM, NRZIC/Biphase-M
SAT-RX-3b: 435.193 MHz +-10 kHz (AFC) 9600 bps, RSM, NRZI (NRZ-S) +Scrambler
SAT-RX-4: 435.041 MHz +-10 kHz (digital AFC) RX for RTX-DSP experiments

The downlink can be switched to the following operating modes:Transmit frequency: 145.983 MHz
Mode 1: 1200 bps, BPSK, NRZI (NRZ-S) (like FO-20)
Mode 2: 400 bps, BPSK, Biphase-S (AMSAT mode for AO-13 beacon)
Mode 3: 2400 bps, BPSK, Biphase-S (planned for AO-13)
Mode 4: 4800 bps, RSM, NRZIC (Biphase-M) (like 4800 bps uplink)
Mode 5: 9600 bps, RSM, NRZI (NRZ-S) + Scrambler (like 9600 bps uplink)
Mode 6: CW keying (only for special events)
Mode 7: FSK (F1 or F2B), e.g. RTTY, SSTV, FAX, etc (only for special events)
Mode 8: FM modulated by D/A signals from DSP-RISC processor (e.g. speech)

The operating Instructions for the RUDAK-2 Mail Box BBS were published in last month's *Packet Radio Roundup.*

RS12/13

RS-12/13 was launched as a piggy-back on the COSMOS-2123 NAVSAT on Feb 5th at about 02:36:45 UTC, and the initial testing of RS-12 proved successful. The Command stations RK3KP and RS3A report that the transponder along with both 21 MHz and 145 MHz ROBOTs were commanded on, with checkout of RS13 planned to have been done by the time you read this. This bird was built to replace RS10/11 but I don't know if RS10/11 will be switched off or not. I've heard the RS-12 beacon operating on 29.408MHz with the Robot on 29.454MHz.

Oscar 13

AMSAT-NA operations nets occur regularly on Oscar-13, Mode B nets are conducted on an AO-13 downlink frequency of 145.950MHz and Mode J/L nets are held on an AO-13 downlink frequency of 435.970MHz. Nets are scheduled for North American geographic coverage and time zones, although other parts of the world are often within the footprint and check-ins from everywhere are welcome.

MicroSats

On 16th Feb, the LUSAT command stations completed the loading of the file system and BBS, with the entire load handled by LU stations, and the first uploaded message was from Carlos Menem, LU1SM, President of the Argentine Republic. This brings all three of the 'Pacsat Protocol' spacecraft on line, a total of 20 MB of 'rotating storage'. To access LUSAT with PG the PG.CFG file must have the following lines:
ao 16access 30660 (same as used for PACSAT)
bbscall lusat-12

bdcstcall lusat-11
The rest of the commands on PG.CFG are the same as used for PACSAT.

WO-18 reloaded, TNC Bug Discovered

The *Webersat* engineering team reports that WO-18 was blown back to MBL during recent commanding work. With the generous help of the Microsat command team, the reload is in progress. They expect to be shooting pictures again by early this week.

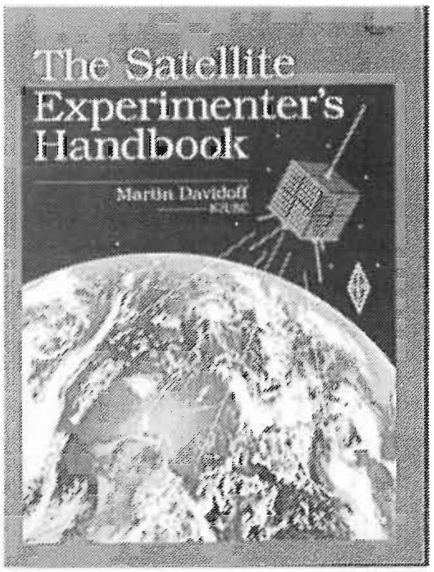
Dove

It is reported that, now AO-16 and LU-19 BBSs are up and running, they're hoping to start on Dove during the coming week.

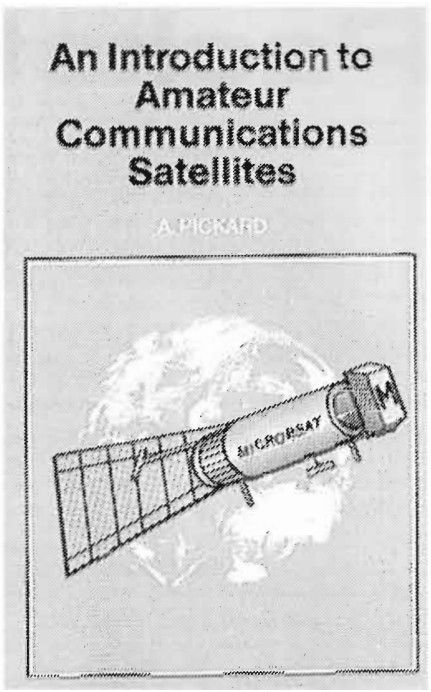
New Books

The latest version of that authoritative work, the 'Satellite Experimenter's Handbook' written by Martin Davidoff K2UBC and published by the ARRL is now available, Amsat-UK have these in stock *(I've just bought mine, I'm very pleased with it - Tech Ed)*. This is without doubt the amateur radio satellite experimenter's 'bible', and has the answer to 99% of all the questions that need to be asked on amateur and weather satellites.

Another book which recently came my way is 'An Introduction to Amateur Communication Satellites' written by A. Pickard and published by Bernard Babani (Publishing) Ltd. In my opinion this is a perfect example of how not to do a book, with a lot of misleading information and several items that are definitely wrong *(I never knew NOAA weather satellites transmitted on wideband AM on a 150MHz amateur band, as this book tells me - Tech Ed)*. With most of the book covering UoSats and weather satellites, even the title is misleading. My verdict — don't waste your money on this one, it's a pity as with a little more care it could have been good.



The Satellite Experimenter's Handbook



An Introduction to Amateur Communications Satellites

Short Bursts

There is a bug in several tracking programs which will prevent auto updating of Keplerian Elements from a NASA format input file when the day value is less than 100. This bug only showed up after the first of the year when the NASA EPOCH value began to have a blank in the hundreds position of the day number. Updates from an AMSAT format file are not affected, this is because the AMSAT EPOCH format has no blanks embedded in it. For example the AMSAT format would be 91012.345678 while the equivalent NASA format would be 91 23.45678.

Remember the Amsat-UK Colloquium is over the period 25th - 28th July, get in touch with Ron G3AAJ if you'd like to attend. The G8LWY telephone BBS has a section for Amsat-UK office stuff so, if you were going to phone Ron up at midnight, don't, leave a message there instead. The phone number is 081-547 1479; multi- speed, 8 bits, 1 stop, no parity.

For further information about Amsat-UK contact; AMSAT-UK, c/o Ron Broadbent, G3AAJ, 94 Herongate Rd, London, E12 5EQ. A large SAE gets membership info.

KEPLERS

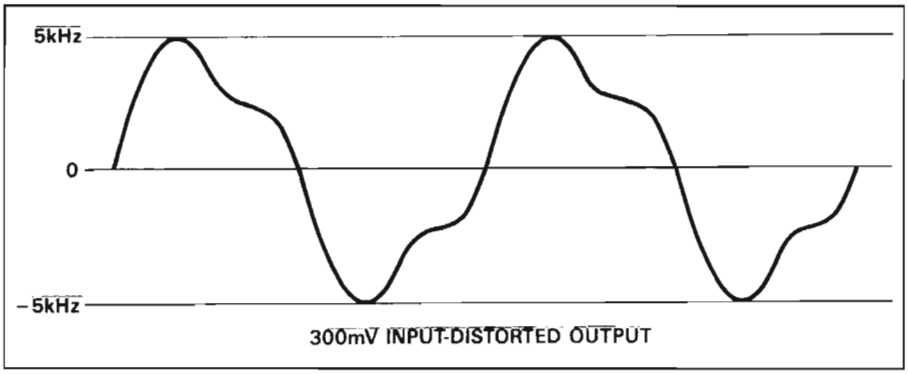
SAT:	OSCAR 10	UoSat 2	AO-13	UO-14	LO-19	FO-20	DEBUT	AO-21
EPOC:	91033.73676974	91052.11266993	91045.00765783	91050.73510885	91051.20937383	91048.93275734	91045.49710519	91053.22001973
INCL:	25.9197	97.9172	56.8263	98.6762	98.6806	99.0199	99.0200	82.9472
RAAN:	162.4090	101.1659	110.4896	130.8693	131.7184	53.7652	50.9871	318.7973
ECCN:	0.5980697	0.0011695	0.7123705	0.0011353	0.0012784	0.0540555	0.0540434	0.0034188
ARGP:	213.9903	175.0178	247.2287	147.9123	145.2042	211.7430	219.4488	218.7400
MA:	86.8948	185.1166	26.8939	212.2743	214.9984	144.9998	136.6064	141.1310
MM:	2.05880381	14.66236865	2.09695602	14.28899116	14.29204036	12.83171609	12.83170325	13.74342424
DECY:	5E-08	2.135E-05	1.95E-06	6.17E-06	5.92E-06	7.4E-07	4.6E-07	1.09E-06
REVN:	2948	37243	2047	5621	5629	4826	4782	323

SAT:	UO-15	PACSAT	DO-17	WO-18	RS-10/11	RS-12/13	Mir
EPOC:	91050.24997774	91052.17793466	91049.22387061	91048.21817658	91052.99455134	91049.93251436	91053.09907475
INCL:	98.6795	98.6805	98.6813	98.6820	82.9282	82.9239	51.6082
RAAN:	130.3119	132.5618	129.6542	128.6986	143.9786	191.7413	150.7084
ECCN:	0.0010256	0.0011835	0.0011753	0.0012321	0.0012820	0.0028095	0.0022793
ARGP:	148.4635	141.4124	150.3500	154.2795	141.0759	248.5878	271.5344
MA:	211.7158	218.7912	209.8349	205.8992	219.1296	111.2279	88.2864
MM:	14.28553711	14.28995971	14.29057612	14.29126292	13.72148328	13.73856783	15.65686044
DECY:	4.35E-06	6.09E-06	6.67E-06	6.29E-06	1.89E-06	1.12E-06	7.0549E-04
REVN:	5613	5642	5600	5586	18379	190	28714

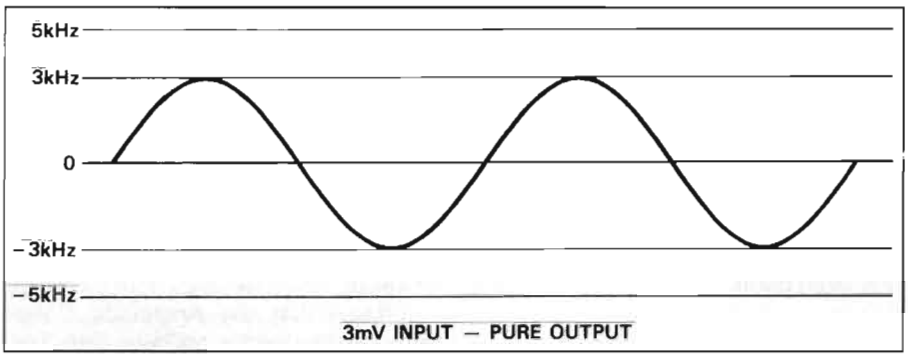
Packet Radio Roundup

Make sure your deviation is set correctly, says Chris G4HCL

When an operator first gets going on packet by hooking up their nice new TNC to their rig, they often manage to receive lots of off-air data, but sometimes become frustrated when they find it difficult, if not impossible, to achieve a packet 'connection'. There can be many reasons for this (like leaving the automatic toneburst, or even the repeater frequency shift, switched on by mistake), but the most common reason I've come across is that of running far too much audio level from the TNC into the rig.



300mV INPUT-DISTORTED OUTPUT



3mV INPUT – PURE OUTPUT

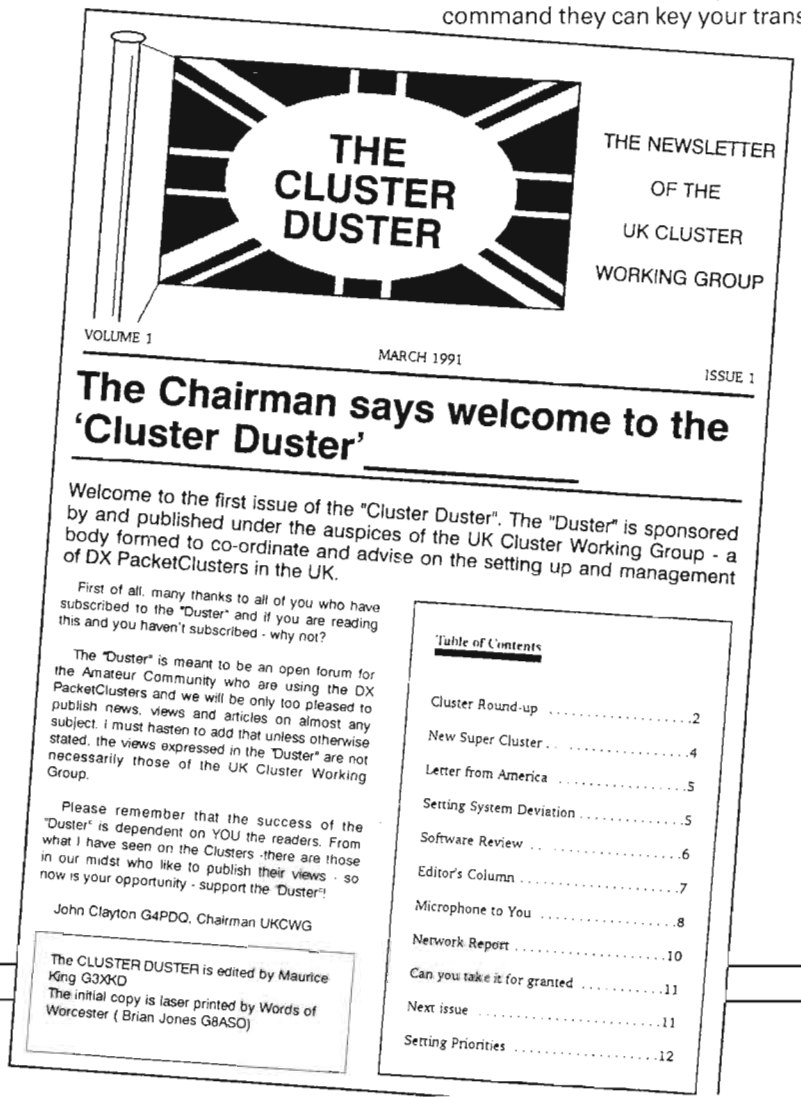
Deviation

But modern transceivers have deviation limiting don't they, so isn't it impossible to run too much deviation? Well yes, but the resultant deviation with an excessive amount of audio is rather distorted when a rig's audio stages are pushed into severe limiting/clipping, compared to that from a lower level of audio. Take a look at Fig. 1, and you'll see what typically happens with a) 3mV and b) 300mV RMS from the TNC output fed to a typical FM rig's microphone socket. As you can see, 3mV will give a reasonable sine-wave, whereas 300mV gives rather a distorted waveform! On FM phone, our speech peaks only occasionally hit this limit, and the odd distortion product accompanying our already distorted voice (in a manner of speaking — the human voice is full of harmonic and intermodulation products) can be tolerated in the interests of communications intelligibility rather than hi-fi speech quality. However for data it's rather different — a nice undistorted sine wave is often far easier for a distant TNC's modem to detect.

Another reason for setting your TNC level correctly comes into play with the increasing number of ex-PMR rigs in use on VHF/UHF packet with their high quality, but narrow, IF filters. In the UK, 12.5kHz PMR channel spacing means receivers that come our way with crystal filters fitted of around +/-3.75kHz bandwidth. With a received signal from a typical amateur transmitter, of 5kHz absolute maximum deviation and hence around 3.0kHz of packet deviation, there's no problem. But start transmitting 5kHz deviation, with gross distortion to boot, can you guess why some packet stations don't receive your signals?

Setting your TNC Level

So how do we fix this? Many TNCs have a 'CAL' command, where upon command they can key your transmitter



THE CLUSTER DUSTER

THE NEWSLETTER OF THE UK CLUSTER WORKING GROUP

VOLUME 1 MARCH 1991 ISSUE 1

The Chairman says welcome to the 'Cluster Duster'

Welcome to the first issue of the "Cluster Duster". The "Duster" is sponsored by and published under the auspices of the UK Cluster Working Group - a body formed to co-ordinate and advise on the setting up and management of DX PacketClusters in the UK.

First of all, many thanks to all of you who have subscribed to the "Duster" and if you are reading this and you haven't subscribed - why not?

The "Duster" is meant to be an open forum for the Amateur Community who are using the DX PacketClusters and we will be only too pleased to publish news, views and articles on almost any subject. I must hasten to add that unless otherwise stated, the views expressed in the "Duster" are not necessarily those of the UK Cluster Working Group.

Please remember that the success of the "Duster" is dependent on YOU the readers. From what I have seen on the Clusters -there are those in our midst who like to publish their views - so now is your opportunity - support the "Duster"!

John Clayton G4PDO, Chairman UKCWG

The CLUSTER DUSTER is edited by Maurice King G3XKD
The initial copy is laser printed by Words of Worcester (Brian Jones G8ASO)

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and modulate it with a 1200 and/or 2200Hz tone co-inciding with the Bell 202 tones used for normal AFSK packet. So with your transmitter operating into a dummy load or a vacant channel, place it in 'CAL' mode and listen on an adjacent receiver, for example a scanner or your main station rig. Initially turn the TX output tone level from the TNC to a high level, then reduce this slowly until you hear the audio level on your monitor receiver start to decrease. Now keep reducing it until it's around 60% of the volume you first had, hopefully now you should be hearing a pure sounding tone rather than a distorted, clipped noise. This is where you should leave it! If you have access to a deviation meter and/or an oscilloscope then even better, like connecting the oscilloscope to your receiver's audio output to display the received audio waveform.

You may find with some TNCs, the Tiny-2 for example, that you need to set the output level potentiometer almost at zero to achieve a correct level. A handy hint here is to use a resistor of around 270k in series with the TX audio line at the microphone connection to your rig — I've used this simple method on many occasions although admittedly a potential divider or a 'pi' attenuator would provide a better solution. Let's trust we'll all soon get more reliable connections!

Space Station Packet

Many HRT readers have contacted me to say they've been receiving good signals from the packet station on board the Mir Space Station, and when the AREM packet radio system gets added to the network things are going to get even more interesting - Worldwide packet communication with a handheld on the bus journey to work — even communicating with a space station, the bus conductor would never believe me! Even this month's front cover shows a packet operator taking a look at a downloaded list of U2MIR personal mailbox messages — the word's spreading. Next thing we know, they'll be getting UK Cosmonaut visitors up there with dual band handhelds.

Cluster News

There's now 8 operational DX PacketClusters in the UK, with proposed additions in London and Cambridge to expand the system. A brief test with European linking was recently carried out as an experiment, this is currently under review to be possibly implemented when inter-node links improve (although DX Cluster traffic has been reported to account for only 3% of total packet traffic in the UK). I detailed in previous articles the usefulness to the VHF/UHF operator of these clusters in allowing rapid warnings of sporadic E/Aurora/Tropospheric propagation to be passed between operators interested in continuing the pioneering experimental aspects of amateur radio, as our regular contributors have shown in recent HRTs.

If you've connected to the DX Cluster system, no doubt you'll have found it a different 'use' for the packet mode, and for those interested further there's now a quarterly newsletter, the 'Cluster Duster' available from Maurice G3XKD. It plans to feature items such as network news, technical and general interest articles, a 'for sale/wanted' section, and software reviews. A year's subscription will cost you £3.00 (payable to the 'UK Cluster Working Group') with any proceeds going towards financing improvements to the network, sent to Maurice G3XKD at 15 Glebe Road, Prestbury, Cheltenham, Glos. GL52 3DG.

CTRL-Z, End of Message

Please keep me informed of what you're up to, as always I can be reached (Worldwide) by a message addressed to G4HCL @ GB7XJZ, or 'live' on the editorial phone number most evenings. Until next month, 73 de Chris G4HCL @ GB7XJZ.

VHF/UHF Message

Ken Ellis G5KW details an Historic Month on 50MHz, and asks for reports on all VHF/UHF bands

The good conditions reported in the last two issues on 50MHz continued with DX openings to the Americas and the Pacific area. Conditions on the other VHF bands were very disappointing, with very little of interest to report.

The big news item already briefly reported was the major achievement of our regular contributor Geoff Brown GJ4ICD in Jersey, who on 1st Feb at 1058z worked PT7NK for his 100th country on 50MHz (he's now had 102 countries, see his report). I've just received a newsflash from Ted Collins G4UPS that he's also made the golden 100, details to follow.

Mike Bird reports major solar flares disrupt communications

During his weekly Thursday radio broadcast, Mike Bird reported five solar flares of X magnitude since 7/3/91. The highest on 13/3/91 of X3.9 magnitude was the highest recorded this cycle. Another large flare took place on 14/3/91 at 1816z, giving polar cap absorption with a complete fade out on the North American — Europe path. This is a repeat of the 27 day cycle, Mike reported the sunspot count as 179. The spring Equinox TEP is open with many reports of Europe — South Africa beacons heard over long periods, and some 50MHz QSO's already taking place.

Worked and heard Feb/March by Geoff GJ4ICD

Early February started off really great with my 100th country being worked. Stratwarm was in operation all the month but yet we had some fantastic openings into VK, DU, VS6, V73 and JA all being heard or worked. Long gone are the days of a few years ago when G3CCH worked into LU and created a British Isles distance record, we all thought it was not possible, but it seems that even on the backside of cycle 22 the records keep being broken. If my computer program is correct, then VK3OT/QF12OG to GJ4ICD/IN89WF is a massive 16,974 km (ZL next?). The ZS TEP path looks like it will open up here anytime, as ZS6WB has already heard me on 6m this month and the ZS5SIX beacon on 50.321MHz has been heard a few times during February. I had reported that TL8MB (FD1JKK) was going to Chad, but as you can see by the callsign change he never got there, however he's doing a fantastic job with very big pile ups and a very consistant signal here in Jersey. The consistency of the DU stations were a little puzzling to say the least, and KG6UH/DU was very strong, in fact strong enough to break the S9+20 TV from the USSR.

The South East/South/South West path has also been very good with Arabic phones heard from time to time at around 1000z, just as the far east path dies out. The central African path is excellent at the moment, on 24/2/91 TL8MB was heard for three hours at up to S9+30dB (wish we had a few more countries down there!). Other stations from west Africa like 3X1SG (now OK for DXCC), 6W1QC, 6W1QF, many TUs and the good old faithful TR8CA put in a daily appearance at fantastic strengths. The south west path has also been very kind to me, with PT7NK heard a number of times along with PY0FF (the PT was another new country) and on the odd occasion the path has just managed the Caribbean with 9Y4VU, KP2A and PJ4E.

100th DXCC country on 6m from UK.

After sitting on 99 countries for some time, early February brought the success I had been awaiting. On 1/2/91 the band opened up early, at 1030z the 9L1 beacon was S9+40dB and at 1058z I had a QSO with PT7NK, country number 100 square 434. Later that day I worked KP2A, 9Y4VU, PZ1AP, and PJ4E to finish an historic day.

Worked all continents (WAC) on 50MHz, in 3 hrs 6 min.

Some of us have taken years to make WAC on 6m, Geoff did it in 3 hours 6 minutes on 3/3/91. He reports "switched on at 0920z *VK6PA* 59/57; 0924z *JA4MBM* 599/559; followed by over 70 other JAs worked. JAs faded at 1028am then KG6DX at S9+CW and SSB; KE0SC/DU3, KG6UH/DU, V73AT, KH4AF. Then from the south came TL8MB, *TR8CA,* G8MFE/5N2, 9L1US. Europeans on backscatter from 180 degrees *SV1OE* 569/559; PA, ON, F, I etc., 6W1QC, *PZ1AP, VE1YX,* KP2A. This was some opening offering the best DX ever heard/worked on 50MHz, with WAC completed in 3 hrs 6 mins. The italics show the WAC stations." 6/3/91 — switched on at 0845z, JAs were heard calling CQ, so here we go again, over 120 were worked until 1020am, JD1BBE was the best DX and a new country. VK6s were also on, along with KG6UH/DU1 at 1100z, KG6DX was worked at S9+ on SSB. After this, SM3BIU reported to me there was a strong Aurora in progress, now KG6DX was on the correct beam heading and at 30/40 degrees appeared to go straight through the 'auroral zone' VK6JQ and VK6PA were still there at 1115z as was Joe KG6DX, the FR5 beacon was heard at 1130z but then I had to go QRT.

6m Report by Ted Collins G4UPS

Azores; A 160W linear is on its way to CU1EZ in the Azores, donated by kind JA stations.

Morocco; Information from JA1VOK indicates that a 100-200W 6m amplifier will be sent to Tarik, CN8ST from Japan sometime in early February. Our JA friends are certainly helping in a big way to up grade some of the regular DX stations.

Zambia; I have been sent the QSL information for 9J2KF with the obvious indication that he is active on 6m. Mr Kiyoshi Tsukamoto, Yodogawa-Ku, Osaka City 532, Japan.

JA Beacons; JA1VOK has kindly sent me an up-to-date list of active JA beacons;

50.017MHz — JA6YBR — PM51 — 50W — Turnstile aerial

50.0265MHz — JA7ZMA — QM07 — 50W — 6 ele yagi beaming south

50.491MHz — JG1ZGW — PM95 — 10W — Dipole

Sweden; Swedish amateurs are obliged to submit biannual reports to their PTT. From the reports, Arne SM7AED informs me that between March and August 1990 the members of the SM7 group, SM7FJE, CMV, AED, SCJ, JUQ, LXV and FMX notched 47% of all SM QSOs in that period. Arne also indicates that there will be a MS contest sometime in August 1991 during the Perseids. A new beacon became operational in early February, the first in Sweden, the callsign is SK6SIX on 50.080MHz, 10W ERP, vertical aerial, JO57TQ located 35m ASL.

USSR; At long last we have a station in the USSR with facilities to work crossband. Mike UL7GCC located in Alma Ata, worked G4JCC for his first 6m crossband QSO on 22 January 1991 at 1028z. Mike

has a 5 ele yagi on 6m and has been listening only on 50.140MHz.

Israel; Ralph 4X1IF received permission to operate on the 6m band in early February. The band will be available only to the Extra Class, with 25W output from 50.100-50.150MHz. Within an hour of receiving his permission, Ralph had his first QSO on 6m with Jack ZS6LN. Ralph has persisted with his interest in 6m by working many of us crossband over the years, and we are all delighted that at long last he is now able to operate and work two way on the band. Ralph hopes to have a beacon running very soon on 50.145MHz. His first G opening was 0900z with GI8YDZ on 15th February 1991.

Jamaica; Don K8MFO was in Jamaica from 13 to 20th February working most bands, but especially 6m. If you were lucky enough to work him his QSL information is; Mr. Don Karvonen K8MFO, 6905 South Carr Rd, Apple Creek, Ohio 44606, USA.

PY0FF; An appeal from Andre PY0FF — Please do not send dollar bills with QSL cards for return postage, please send two IRCs instead.

Ascension Island; David ZD8DX will very soon be active on 6m and I understand that his QSL route is via his manager WB2K.

IM0; Enrico IK2GSO has informed me that he will be spending his summer holidays on Sant Antioco Island, (JM48 and JM49) using the callsign IK2GSO/IM0. Dates will be given later.

Zambia; Peter 9J2HN, who is presently very active on the HF bands, will be going home to Japan on holiday in April and will be returning to Zambia with a 6m rig and aerial. His home callsign is JK1UWY, and he will be QRV on 6m sometime in May using an IC515 to a 6 ele yagi.

Argentina; Eduardo, LU7DZ has recently moved to a new home, his present address being; Eduardo Van Ooteghem, L.M. Drago 2524, Villa Adelina, Buenos Aires 1607, Argentina.

Phillipines; Bearing in mind the recent opening from DU into Europe, the following QSL addresses may be of interest; KE9A/DU3, QSL via WB9YXY, Robert L. Johnson, Rt 1, Box 173, Endeavor, WI.53930, USA. KE0SC/DU3, direct to Mr Ken Keehner, NSD Box 33, Code 700, FPO San Francisco, CA.96651, USA. KJ6WO/DU3, direct to Mr. Graham Gardner, Box 42, FPO San Francisco, CA.96651, USA.

Central African Republic; Eric TL8MB surprised everyone with his sudden appearance on the 6m band in February. He will be in TL8 for the next 4 months and many may remember his activity from FY5/FD1JKK. He's mentioned that QSL cards will be answered after he has arrived back home and had the cards printed. Those requiring a QSL card direct are requested to send cards with sufficient funds for repayment of postage to his listed address.

Cyprus; 5B4 stations have been permitted on 6m from November 1990, I understand that permits are required but I have no details on restrictions, more information as it becomes available.

Gotland Expedition; The Grid Ghosts, in fine spirit, will be going to Gotland, JO96 from 7 to 10 June 1991. Their callsign will be SM7NM/1 and they'll use 50.165MHz with split working if necessary. QSL information is; Grid Ghosts, c/o Bo Nilsson, V. Grevie 22, S-23594 vellinge, Sweden.

4U1ITU If you were lucky enough to work Dave Court, G3SDL from 4U1ITU on the evenings of 8 and 9 March 1991 on 50.155MHz, you can QSL via. his home callsign Mr. D. Court, 98 Andover Rd, Orpington, Kent BR6 8BN

This concludes an historic, outstanding month on 50MHz. Please send me your reports and comments, particularly on the other bands such as 4m/2m/70cm/23cm, to Ken Ellis G5KW 18 Joyes Road, Folkestone, Kent CT19 6NX, thanks.

CN8ST;	Mr Tarik Skiredj, 81 Avenue Okbah, Apt 1, Rabat Agdal, Morocco
CT3DJ;	Via OH2BC
DU1/KG6UH;	Capt. Luis Anciaux, USNR, USCINC PACREP-LINO, US Embassy, Manila, APO San Francisco, CA.96528, USA.
DU3/KE9A;	via WB9YXY only.
DU3/KJ6WO;	Mr. Gordon Gardner, Box 42, FPO San Francisco, CA 96651, USA
DU3/KE0SC;	Mr. Ken Keehner, NSD Box 33 code 700, FPO San Francisco, CA 96651, USA.
JR6WPT;	Mr. Kazuo Myojin, 22 Miyagi Naha-City, Okinawa 901-01, Japan.
OA8ABT;	Mr. Darrol Lockhart, Po Box 52, Pucallpa, Peru, S. America.
PT7NK;	Mr. Etevaldo B. Fontenele, Rua Jose Fraga Neto 71, 60000 Fortaleza, CE, Brazil.
PY5CC;	Mr. P. Z. Sprengel, Box 141, 80001 Curitiba, PR, Brazil.
PY0FF;	Mr. A. C. Sampaio, Box 1, 533990 Fernando de Noronha, Brazil.
PZ1AP;	Mr. A. J. Polsbroek, Po Box 566, Paramaribo, Suriname.
TL8MB;	Via. his home callsign FD1JKK. Mr. E. Lauch, 6 Rue Joseph, Le Brix, F-56890 Saint Ave, France.
TU2EW;	Mr. D. Biau, PO Box 1890, Abidjan 11, Ivory Coast, Africa.
TU2MA;	Mr. T. Vacaba, Po Box 520, Abidjan 01, Ivory Coast, Africa.
TU2OJ;	Mr. G. Piejougeat, Po Box 634, Gagnoa, Ivory Coast, Africa.
TU4DH;	Either via. F3HT or direct to Mr. J. C. Richard, PO Box 584, Bouake, Ivory Coast, Africa.
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VK3OT;	Mr. S.R. Gregory, Box 622, Hamilton 3300, Victoria, Australia.
VK8GF;	Mr. J.M. Farmer, Box 113, Alice Springs 5750, NT, Australia.
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3X1SG;	Via. ON6BV only, Mr. V. Ravyts, Freest 4, 1547 Bievene, Belgium.
4X1IF;	Mr. Ralph Rosenbaum, 17 Shalom St, Ra'anana, 43561 Israel.
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