

# Ham Radio TODAY

## OPTOELECTRONICS XPLOER REVIEWED

Project;  
Legal-limit  
6m amp by  
GJ4ICD

G3LLL says  
"It's all in a  
day's work"

Hundreds of  
bargains in  
our free  
reader's ads



# Ham Radio T O D A Y

HAM RADIO TODAY VOLUME 14 NO.12 DECEMBER 1996

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Left: Optoelectronics Xplorer reviewed

Right: Construct a legal limit 50MHz amplifier



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# CQ

## From G8IYA Editorial



Radio amateurs and the equipment we use are viewed by the public in many different lights. To those of mature years, the early TV 'Hancock' image can spring to mind, that of a bumbling chap surrounded by early equipment, much if not all of it home made or wartime surplus. This may certainly be the case with some amateur's shacks nowadays, but we're more likely to see an array of Japanese-made equipment, probably with a computer alongside running some sort of amateur radio software.

Often, the amateur radio equipment used by beginners in our hobby is simply a 2m or 70cm handheld FM transceiver. If they're a listener, it's quite likely to be a portable wideband scanner receiver, maybe even a multimode type with HF coverage as well, rather than a large amateur bands table-top receiver. It was different many years ago, but I'm talking of the typical scenario today.

### Starting out

My first 'shack' was in my parent's house, in a corner of the bedroom I shared with my sister. My secondhand Trio TR-2200GX transportable 2m FM transceiver sat on a small table with a logbook alongside it, the rig coupled to a Jaybeam 2m ground plane mounted on the chimney of our terraced house

in a small Lancashire village. The same transceiver followed me when I married and moved away to East Anglia. Through using it I had the pleasure of chatting with plenty of locals, in what would otherwise have been to me a strange new area, that was to become my home for many years.

At that time, someone walking around talking into an 'electronic handbag', as the TR-2200 series was fondly known by many amateurs at the time, was something different. I know of one amateur, back in Lancashire, who got 'pulled' by the police one morning on his walk into work, for acting in a suspicious manner. Yes, he was chatting away on his TR-2200 rig. He was detained for several hours by the police, his set taken away from him and examined, before he was released without charge. I'm quite glad I never suffered the same experience, although my boyfriend at the time, who's now my husband, did get 'pulled' three times. In each case he was using his 2m handheld FM rig (a Standard C-146A), in a public place, he was obviously suspected of doing something illegal each time simply because he was using it.

### Changes?

This was all about twenty years ago, but has anything now changed? What's our current 'image' to the public? With the

## What image do the public have of the way we communicate?

increasing use of portable gear, this is often the image we're seen in, rather than the smaller number of people who may be invited to our 'shack' to see what goes on. We read, in a number of misguided publications, that 'Radio Hamis' listen into private cellphone conversations using their scanner. We also see on various TV 'police' type drama programs that, apparently, the only use for a scanner is for criminals to go 'equipped' with when they're intent on breaking the law. Is this the image that amateurs and SWLs are getting?

The last time I appeared on BBC TV, representing Ham Radio Today magazine, was in promoting the pioneering work done by radio amateurs in space-age communication, in this case linking up with the Mir space station and letting three children have a short chat with one of the cosmonauts on board using a club station callsign. It seemed to create a very good impression to the public at the time, showing that we amateurs were different, but in a technically advanced way, doing something very different than just talking about the weather over our radios.

There's nothing new any more in communicating around the world via radio. Anyone with a cellular phone, which is usually a lot smaller than a typical amateur rig, can do this with crystal-clear clarity. Struggling through QRM with a large and possibly untidy-looking transmitter/receiver arrangement coupled to an outdoor aerial system really must seem like 'backwards technology' to many members

of the public. We do it for the fun of it, for the challenge, for our hobby. It may not be efficient, but we like it. Just like mountaineering in the traditional way isn't efficient compared with getting a helicopter to the summit of the place we're aiming to get to.

### Future modes of contact

There's a growing 'threat' to many traditional methods of communication with the ever-growing use of the Internet. It's a vast, anarchic and unregulated system (at the moment!), which is probably just what the short wave spectrum was in the very early days of wireless. Using the Internet you can talk to people around the world, including radio amateurs via 2m repeaters in distant countries (see this month's 'Data Connection'). You can call 'CQ', have DX contacts around the globe, using the microphone and speaker connected to your PC's sound card rather than to your amateur transceiver.

Some US telephone companies are already 'up in arms' about this because of the threat of revenue loss, and are talking of legal injunctions to stop the use of it. But then, at least one US telegraph company in the very early days of wireless also instigated a legal injunction to prevent the use of wireless telegraphy in competition to their land-based lines. It's funny how things have gone 'full circle'.

Now, who's going to be first with multimedia amateur radio communication over our worldwide amateur packet radio network?

# On Test - Optoelectronics Xplorer

Chris Lorek G4HCL reviews a unit that tunes 30MHz to 2000MHz in less than a second

How should I describe the Xplorer? Is it a wideband scanning receiver? Is it a deviation test meter, a CTCSS decoder, or an automatic logging system? The answer is that it's all of these, and a lot more besides.

I'd guess the 'main' function of the Xplorer could be described as being a wideband automatic searching receiver, designed for 'near field' use (i.e. reasonably near to the transmitting source), which can automatically receive and store what it finds. Besides storing the received frequency, it can also log the deviation, any DTMF, CTCSS and DCS (digital coded squelch) tones on the signal, as well as taking a note of the time the signal was logged, and for repeated instances of finding the same signal, the total number of 'hits' on that frequency. If you connect a GPS receiver with a remote data connection facility up to the Xplorer, you can also log the latitude and longitude of the Xplorer when it received the signal.

## Near Field

The Xplorer isn't a 'scanner' in the usual sense, it's actually a frequency-swept 'near field' receiver. It uses multiple swept local oscillator injection, which allow the unit to 'lock onto' a VHF/UHF signal in less than a second. As a guide to receive distance capability, with an appropriate set-top aerial used on

the Xplorer the user instructions give a detection range of around 200/300m from a VHF/UHF radio. With a well-sited aerial connected, it will of course receive far greater distances, especially from base-station transmitters.

I can already think of quite a few interesting possibilities for this.

Being involved with a number of packet and repeater groups, local breakthrough and mixing due to other transmitters on a shared radio site can sometimes be a problem. I well remember, several years ago, trying for several days before eventually working out what the 'draining sink' noise was that appeared, very weakly at the site itself, on the input to a 2m hilltop-sited repeater. I suspected that it was a multiple-order mix between other transmitters on the site together with the repeater's output signal, but which frequencies? There were many other transmitters in different site buildings, as well as a further aerial-loaded mast a few hundred metres away. If I had something like the Xplorer I'd have been able to very quickly get a log of the active transmitters at the site, matching the times and frequencies received to the time of the intermodulation mix appearing.

Other more 'interesting' uses do of course spring to mind. Like, subject to licensing restrictions, instantly detecting whatever's happening and on what frequency etc. at an outdoor

A telescopic aerial, terminated in a BNC connector to mate with the set-top aerial socket, is supplied for portable use.

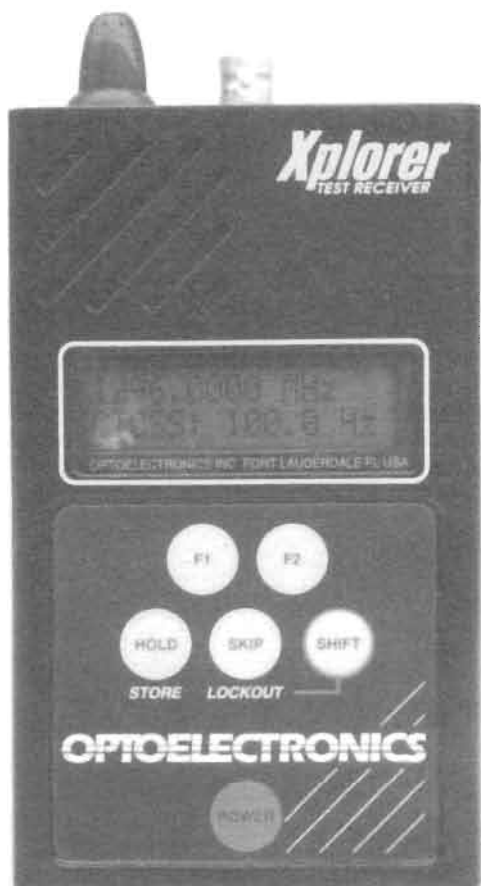


event such as a motor racing meet, or at a county show, typically where radio amateurs offer communications services to various groups, or even in emergency exercises.

## Features

The Xplorer is a self-contained portable unit. It doesn't need to be connected to anything, or used with a separate scanner

receiver, to perform its monitoring and logging. It's powered by an internal nicad pack, it has its own volume and squelch controls, a built-in speaker, and set-top aerial. The set uses a two-line 16 character dot-matrix alphanumeric display, together with a single click-step rotary knob and push buttons to give varying information displays and 'menu' functions.



The two-line LCD gives a visual display of various operation modes



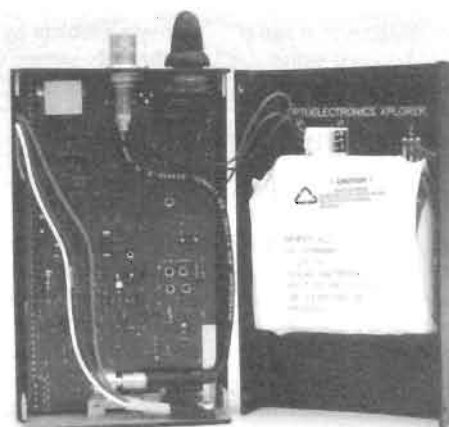
The Xplorer has an audio output / headphone jack plus a 'tape control' jack to allow for automatic recording.

It has a frequency range of 30-2000MHz, with an automatic sweep time of less than one second across this very wide range.

The audio frequency response is 50-3000Hz, and there's an audio output / headphone jack plus a 'tape control' jack to allow for automatic recording. A telescopic aerial, terminated in a BNC connector to mate with the set-top aerial socket, is supplied

for portable use.

The Xplorer measures 77mm x 127mm x 40mm, and comes in a sturdy black finished metal outer case. It has an internal nicad pack with a capacity of 900mAh, which gives you around 5-6 hours of use when fully charged. You can also plug in an external 12V DC power source via a set-top socket, this also acting as a 'nicad charge' connector. A mains power supply/charger is supplied,



High-capacity nicads inside the unit allow portable operation for 5-6 hours

this 'trickle charges' the batteries when plugged in and a switchable fast-charge mode on the set lets you fully charge the nicads in around one to one and a half hours. In the 'fast charge' mode the Xplorer has its own built-in protection against incorrect input voltage and excess temperature to protect the cells. If it senses any such 'out of tolerance' condition it tells you on the alphanumeric display what the problem is.

The Xplorer also has a built-in CI-V interface port, and a suitable lead, terminated in a 9-pin RS232 plug for your PC, and is supplied together with software to allow you to download the memory frequency information from the set to a PC file (more of this later).

Demonstration versions of two scanner control programs, Scan-Star for Windows, and Radio Manager for Windows, are also supplied. However these are not 'free' programs with the set, you need to pay extra to use them, thus I won't be testing them here. But it's just worth noting that you can use additional, optional, programs. A text file on the disk also gives details on the data strings used, so if you wish you can write your own software. The file also gives details on blocking and unblocking the US cellular radio frequency ranges in the Xplorer.

## On the air

After an initial nicad charge, I plugged the Xplorer into my rooftop VHF/UHF aerial system with great expectations. It

instantly found its first strong signal - one of my local FM Band II broadcast stations. A press of the 'skip' button then quickly found the next, then the next. This is because the unit receives signals in the 'near field', in other words only strong signals such as either strong broadcast stations. However, a 'double press' of the shift / lockout buttons quickly stopped the unit locking onto the unwanted broadcast signals on subsequent passes. It would then have the possibility of locking onto other, non-constant, signals, like amateur radio operators, other two-way radio users, cordless phones, and so on.

I very quickly found that the unit would halt on a lot of unwanted signals, especially strong paging data transmissions on VHF and UHF, so I initially had to use the 'lockout' facility a lot as well. This manually stores the currently received frequency into a 'skip' bank, which the set then ignores on subsequent passes. After a while of this, repeatedly pressing the 'Shift' and 'Skip' buttons, I managed to reasonably effectively prevent the unit halting on the many unwanted signals around my location - including broadcast radio and UHF TV signals. However I also found it tended to receive a few signals on apparently 'spurious' frequencies, for example I'm sure UHF TV signals aren't on around 1.6GHz. This I'd presume was due to the oscillator harmonic of mode of searching used in the Xplorer.

Being an FM receiver, it can't detect AM, although it would log the frequency of received AM signals. Naturally, it also wouldn't demodulate the various digitally coded speech modulation methods. For example, I tried to check the Xplorer with my CT2 (800MHz) and DECT (1.8GHz) digital cordless phones, it did find them but naturally it didn't demodulate them.

## Recording

Placing the Xplorer into 'Automatic Data Recording' mode, and leaving it searching away for a few hours, rapidly filled a hundred or so of its memory channels with active local frequencies. I could then review these, together with the number of 'hits' on each channel, plus time/date, by switching to 'memory' mode and scrolling through the auto-stored channels with the rotary encoder knob. If I'd had a GPS receiver plugged in, it would also have stored the location - which has interesting possibilities for 'roaming' use!

Besides recording the frequency, the unit can measure and display the signal strength (on a relative bargraph display), deviation (digitally, in kHz), any CTCSS tone in Hz, the DCS code if used, and received DTMF ('touch tone' digits received on the received signal, any of these readouts being displayed on the LCD depending upon the mode the unit's been manually set to. If that's not enough, this information can also be stored into the memory, with a manual push of the 'Shift' and 'Hold' to give a 'Store' function. These can't unfortunately be automatically stored, but then you can't have everything I suppose!

In use, with the unit set to display decoded CTCSS tones, I found the review sample wouldn't measure tone frequencies below 100Hz. For example, it didn't detect that my local 70cm repeater, under test, was transmitting a 71.9Hz CTCSS tone. A check with my FT-811R with its fitted CTCSS unit confirmed this. A quick call to the supplier showed this was

a known problem by the factory on the early sample unit I had, and that subsequent Xplorers are due to operate correctly on CTCSS decode.

## PC Interface

The supplied PC DOS-based software allowed me download all the memory frequency information, i.e., frequency, hits etc. that it had found in 'auto store' mode. This was a fairly simple, one-way, program, with the memory data transferred from the Xplorer to an entered file name, in ASCII format in memory number order. The frequencies and hits were 'comma separated' and the frequency itself was given between quotation marks, so that the data could be input to a spreadsheet or database on a PC, for subsequent processing. No doubt this could be very useful for analysing band occupancy in a given area or areas.

As well as automatic sweeping, the Xplorer can also be used as a manually-tuned receiver, either in 'memory' mode (receiving on the selected memory channels it had found in sweep mode) or in 'VFO' mode. Here you can tune the Xplorer up and down in frequency, in your selected 'fast' and 'slow' step sizes, just like a normal receiver. I found the receiver to be essentially quite wide-band, as it would have to

be for such a fast sweep rate with wide FM as well as narrow FM reception. So, if an adjacent signal came up it would also try to receive it as well, with resultant poor results. However in this mode it was also a very useful test device, for example it would quickly display DTMF strings, peak transmitter deviation, and the like.

## Conclusion

Every day it seems that we're living more and more in a wireless world, with the airwaves becoming filled more and more

with a wide variety of radio users. Thinking of the adage 'knowledge is power', the Xplorer can help that knowledge in a rather significant way.

For the serious scanner user, or the communications professional, the Xplorer is a very powerful, and portable tool. At several hundred pounds it isn't cheap, but it's cheaper than a wide range scanner, automatic logger, deviation meter, digital decoder and the like all rolled into one, and a lot smaller to boot!

*My thanks go to Waters and Stanton Electronics for the loan of the Xplorer for review.*



The Xplorer also has a built-in CI-V interface port, and a suitable lead, terminated in a 9-pin RS232 plug for your PC

## Brief Laboratory Results:

Measured at 145MHz;

*Sensitivity;* 30.5µV pd for 12dB SINAD

*Squelch Threshold;* 15.3µV pd (0dB SINAD)

*Squelch Max.;* >1V pd

*Blocking/Adjacent Channel Selectivity;*

Measured as relative increase of unwanted signal level over 12dB SINAD level to cause 6dB SINAD degradation of 12dB SINAD on-channel signal;

+12.5kHz;	<1dB
-12.5kHz;	<1dB
+25kHz;	<1dB
-25kHz;	<1dB
+100kHz;	4.1dB
+1MHz;	47.5dB
+10MHz;	48.7dB

# SCANNERS

Bill Robertson shows how you can join in scanning activity without having a scanner or even being anywhere near one!

If you're reading this as the magazine comes out, then the Leicester Show will have been and gone, although as I write this it hasn't yet happened - the joys of publishing lead times. I'm hoping to go along, and maybe spend a little time in chatting to readers at the Ham Radio Today stand at the show, so if you did come and have a chat with me there, all I can say is thanks (in advance?).

Winter is approaching, and it's the traditional time to sit in front of a nice warm fire, possibly being entertained by the local activity on your scanner. I remember my fiancée telling me that, one winter morning after a heavy snowfall, her father switched off his broadcast 'wireless' and asked her if he could listen to the fun happening in the bad weather with motorists on her scanner receiver, rather than listening to the broadcast news!

## Remote scanning

If you fancy listening to scanning activity, 'live' and under your control but from a different location, then the age of 'remote scanning' is now a reality! I recently came across the Scanmaster TeleScan Service, from Scanmaster Products in Dorset. This is a professional firm, who supply monitoring equipment and services to governmental and commercial users. They're bringing out a new product in early 1997,



You can listen on this IC-R7000 receiver, right now

Scanmaster SM3, and one of the features of this is that it will allow the user to have remote control a receiver over a telephone line, by using the keys on a DTMF (tone) telephone to enter frequencies and modes. Any resulting audio from the receiver is sent down the phone line for the caller to hear. Better still, you can try it out yourself!

At their location in Portland, Dorset, the firm has installed an Icom IC-R7000 base scanner, which has a frequency range of 25.000 to 999.999 MHz (any frequency entered which is outside this range will be rejected). The aerial in use is a 'Skyscan' disccone which gives good results as it has extra tuned elements for certain frequencies. Reception from the South and East is poor, but there is a line-of-sight path from the East

across Lyme Bay allowing excellent reception from all over Devon and west Dorset, Exeter is line-of-sight.

Here's what you need to do to use the system; Call 01305 861305 using a tone phone (a speaker-phone is best). After about four or five rings, TeleScan will answer the phone and will send 861305 in DTMF. This is your cue to key in \*12345# as a password. Any error here will result in TeleScan sending Error Tone twice (DTMF #1 #1) and hanging up, otherwise TeleScan will connect you to the scanning receiver which will be set to its default frequency and mode (Wessex FM on 97.2 WFM) and you will hear music/speech, etc. You now have control of the receiver.

Here's a typical example; Entering 433\*35# and then \*3#

will place the system on the local amateur UHF repeater (433.350 MHz, NFM) which is normally quite active. Should this frequency not be active, the receiver's squelch will be shut and no audio will be heard. After about two or three seconds TeleScan will send a bleep and this indicates a no signal condition. This will continue every two or three seconds until you enter another frequency. The first key of a sequence received correctly will blank the audio from the receiver. Remember to enter the first key and the second key quickly because of the single-key timeout. Correct commands will be indicated by TeleScan sending a DTMF \*. Invalid commands will receive Error Tone, which is DTMF #1. If you lose track of where you are while entering a command, or

you make a mistake, key \*\* to clear the TeleScan input buffer.

#### Main Commands;

#### Set Frequency:

nnn\*nn# enters a frequency, so 145\*65# sets the receiver to 145.650 MHz.

103\*# sets the receiver to 103.000 MHz.

145\*00625# sets the receiver to 145.00625 MHz, and so on.

TeleScan is quite flexible with the format of frequencies entered, and is only limited by the frequency range of the attached receiver.

#### Set Modulation Mode:

\*1# sets the receiver to WFM (Wide-FM)

\*3# sets the receiver to NFM (Narrow-FM) and

\*5# sets the receiver to AM (Narrow AM)

TeleScan is usually available on a 24-hour basis, but it is inevitable that it will be down for short periods of time as and when needed for make engineering changes, etc. It will be a priority to have the service available during evenings/weekends to take advantage of lower call costs for callers.

## Frequencies

Here's some frequencies to try. The TeleScan system defaults to 97.2 MHz WFM which is a local radio station. ## will return you to the default frequency & mode if you get lost (or \*\*## if you are really lost!)

Try the following 'local' frequencies; 145\*65# (145.650 NFM, Torbay repeater). 145\*7# (145.700 NFM, Dartmoor repeater). 433\*# (433.000 NFM, Exeter repeater). 433\*275# (433.275 NFM, Stockland Hill repeater). 433\*35# (433.350 NFM, Weymouth repeater). Other broadcast band WFM stations are on 103\*# (103.0 WFM, Gemini FM), 102\*3# (102.3 WFM, 2CR FM), 102\*6# (102.6 WFM, Orchard FM), 92\*5# (92.5 WFM, BBC Radio 4), and 97\*7# (97.7 WFM, 1FM)

Another remote scanning mode If you've an Internet browser

with 'real audio' installed, then you can listen to live audio from Chicago Airport approach on 133.500MHz. The URL to point your browser to is <http://www.cyberair.com/audio/chiapp/>

## From the mailbag and the 'net

Toby 2E1ELC sent me an Email to say he enjoyed reading my piece in the October HRT *Scanners* column, where I gave a mention to the 'hidden signals' on satellite TV transponders. This is certainly a growing interest amongst scanner listeners, and with today's multimode wideband handheld do-everything scanner, coupled to the output of a normal satellite TV receiver, it certainly doesn't need specialist equipment!

If any other readers are interested in this subject, please do drop me a line, you can also Email me with a message to [hrt@netlink.co.uk](mailto:hrt@netlink.co.uk) Toby is an avid scanner enthusiast and is a well-known face and voice at the SMC emporium in Chandler's Ford. He'd be pleased to meet other scanner enthusiasts in the area, there's even a coffee, tea, and soft drinks machine at hand for visitors (Tech Ed's note - the frothy cappuccino is superb!) if you feel like dropping in for your scanner needs.

## Military Airband Squawks

A message on the UK scanner 'Listserver' recently asked about the strange periodic tones and squawks heard on the UHF airband frequency of 338.025MHz, which promoted much discussion. The most probable answer, from the research I've made, is that these are timing tones for the frequency-hopping 'Have Quick' radios used by NATO. These sets change frequency quickly, and are time-synchronized with each other, hence the need for the brief synchronization tones. Originally developed by Magnavox, the first ones (Have Quick 1) used 5 hopping channels, subsequent sets which became available later used 16 hopping channels, and I'm told that NATO use two different 'hop sets' at the moment.

The radios in use can be set up to operate on a wide range of frequencies, and no doubt in the case of conflict they could, and would, operate across a very wide spectrum. In peacetime however they operate on a given number of pre-defined channels, although naturally such information is of a rather 'sensitive' nature, however 800 channels have been reported as being available. A selectable 'hop rate' of two, four, or eight channels a second can be used. In practice, anyone listening on just one frequency on their scanner would pick up just the odd 'snippet' of the transmission. But I wonder if any reader has tried using a number of receivers, all tuned to different frequencies used by a given air base or possibly scanning just two or three channels each for a fast lockup time?

## AR-2000

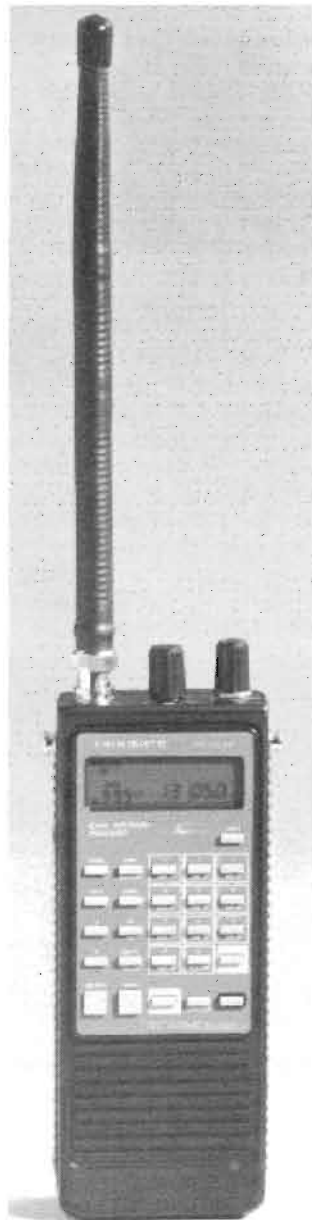
Vic Klein says he's recently bought a second hand AOR AR-2000 handheld scanner, and asks for a source of information on getting the 'best' out of it. Vic lives in a rural area with poor reception at best of times, and is looking for information on the best type of outdoor aerial.

The AR-2000 is already reasonably sensitive, it's virtually identical to the Fairmate HP-1000E, on which HRT published a full technical review in the April 1990 issue. It's not superb on strong signal handling, but if these aren't going to be a problem in the rural location, then I'd suggest some form of amplified aerial sited well in the clear, maybe on the chimney breast. This would have the effect of overcoming any feeder loss, and thus giving the receiver the effective sensitivity limited only by the aerial preamplifier's noise figure. If loft-mounting is the only option, then try one of the Garex 'Nomad' aerials, using the discount card on the October issue's cover of HRT you'll be able to get 20% discount! If a new active aerial is out of the question, then Maplin Electronics have a do-it-yourself kit available for one, take a look at their latest catalogue or pop into a Maplin store for more details.

Bill Robertson is pleased to hear from readers and will answer queries through this column - address your letters to; Bill Robertson, c/o HRT Editor, Nexus, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, or by fax or Email to the Ham Radio Today direct Editorial contact points.

Please remember that reception of some services may not be permitted without appropriate authority. The RA's information sheet on 'Scanners' has full information for the UK.

The HP-1000E good sensitivity





# A High Power Amplifier For 50MHz

Geoff Brown GJ4ICD continues with the construction of the power supply and RF deck

*Part 1 of this project appeared in the November 1996 issue of Ham Radio Today, back issues are normally held for 12 months, available from Nexus Subscription Services, Ham Radio Today, Tower House, Sovereign Park, Latikill Street, Market Harborough, Leicestershire LE16 9EF, Tel. 01858 435344 - Ed.*

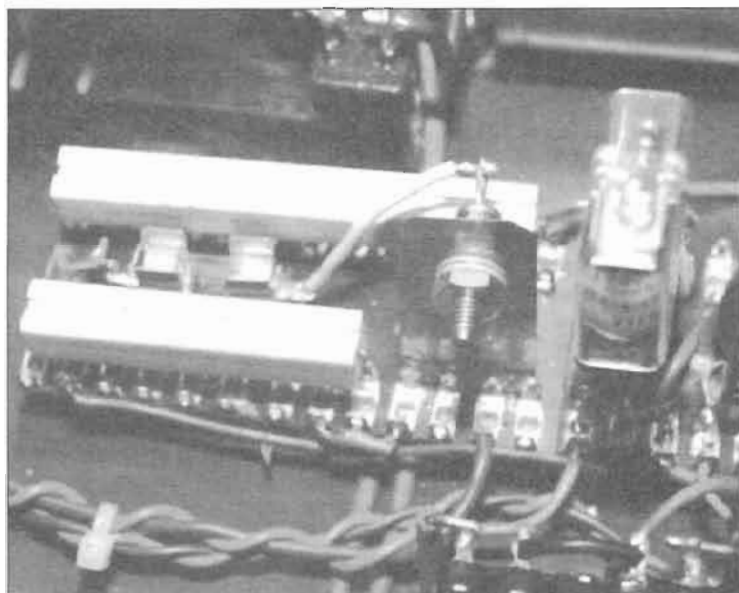
## Power supply construction

A case is required for the power supply. I had one fabricated for £15, as cases in Jersey are impossible to find. It was custom made so that the RF deck would sit on the top, and the grid section of the RF deck would fit inside the power supply. Also a 144MHz RF unit could just be 'dropped into place', so the unit could

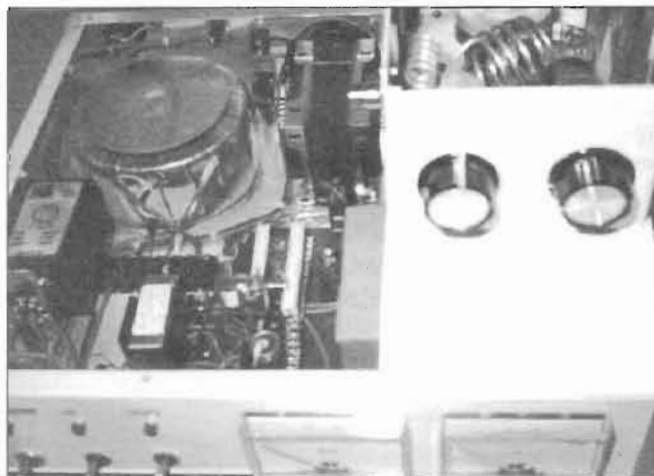
be used for two bands if required.

The laying out of components is not at all critical. You could use my layout as a guide, depending upon whether you opt for a toroidal transformer (costly), or just a standard linear 'door stop' type. Should you use a large ex-military transformer then you would have to use a more substantial cabinet. This could then be placed under the shack table, with leads running to the amplifier on the bench.

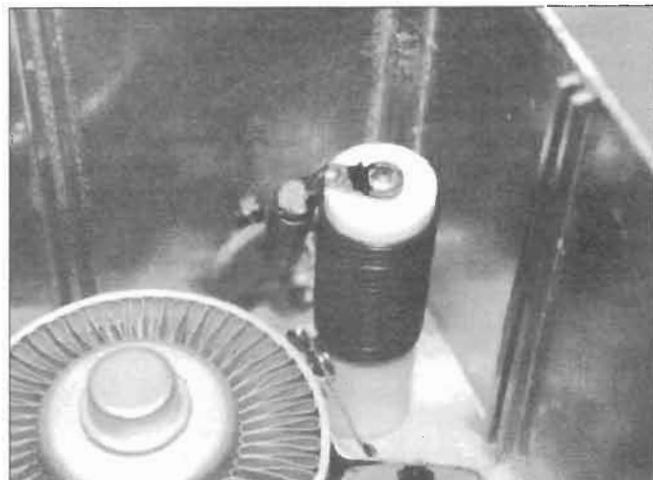
The 3CX800 ceramic valve is a triode. This means it only requires a few simple voltages for it to function, a filament voltage, 13.4V at 1.5A AC,



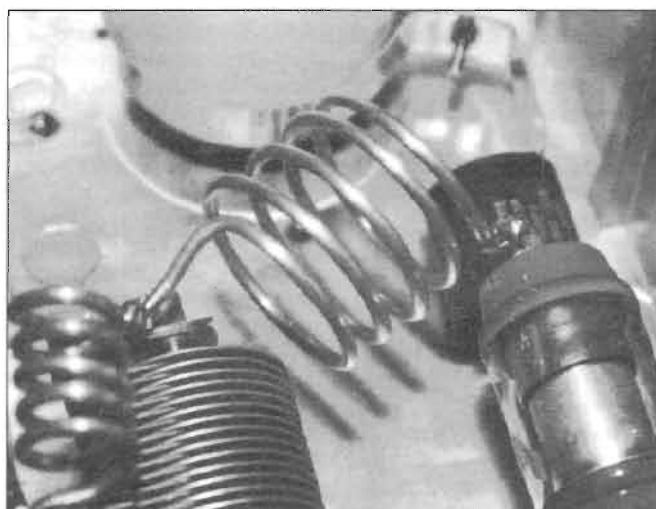
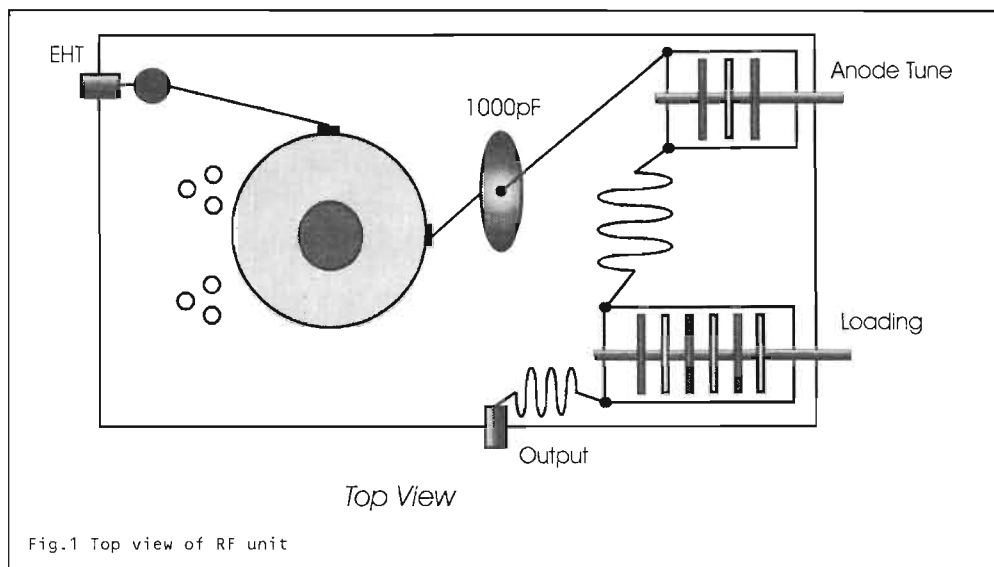
Zener supply, note that the Zener is mounted on a small heatsink and left 'floating' above ground. The bias relay is mounted to the right of the Zener. In the background can be seen one of the EHT stick rectifier diodes.



PSU internal view, toroidal is on the back left, RS timer in front. EHT capacitors are hidden from view to the right below the RF deck. A small stripboard is mounted in the middle to support the Zener and 12V relay circuitry.

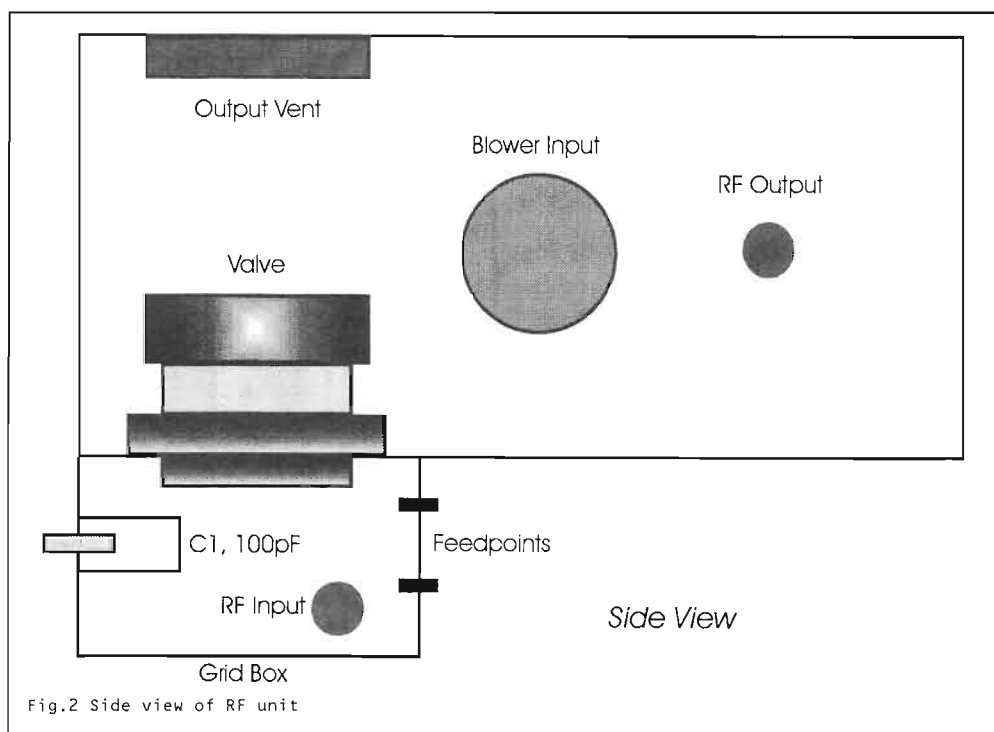


RF deck internal anode view. Note the two RFCs (chokes) mounted outside the RF field. The chokes are connected in series and then connected to the TNC EHT socket on the back wall and decoupled to earth via a 1000pf 5kV capacitor.



Anode tuned circuit, the anode collar/clamp fits around the valve then continues to the isolating capacitor C8, C8 then connects to the tuning capacitor via a brass strap.

1.5 to 2.2 kV DC, and a bias voltage which is derived from the B-high voltage supply, plus a fan voltage, usually 230V AC. It also requires a 12V DC supply for the bias relay and coaxial aerial relays to function. This valve doesn't require regulated screen supplies like the tetrode range of valves such as the 4CX250B.



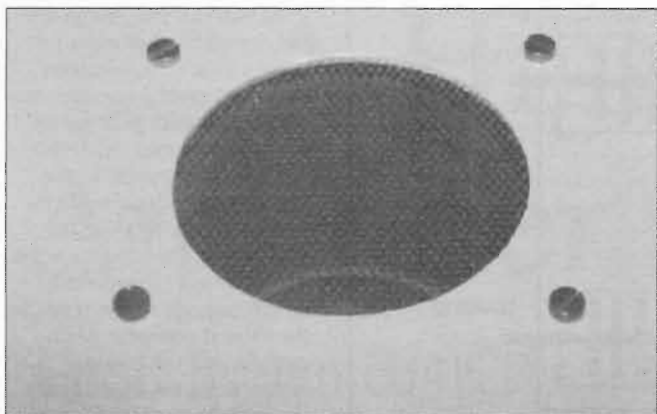
As you can see, things are not complicated at all, it just takes a little time, common sense and careful consideration before you 'stick your hands' in places you may regret later..

The power switch on the left operates a timer/relay for three minutes, to allow the filaments of the valve to warm to the correct temperature. Severe damage would result to the valve if you were to go straight into the transmit mode. There are three neons on the PSU to give indication that supplies are working. The first meter is for *grid* current, this is rated at 100mA, the second meter is for *anode* current and is rated at 1A.

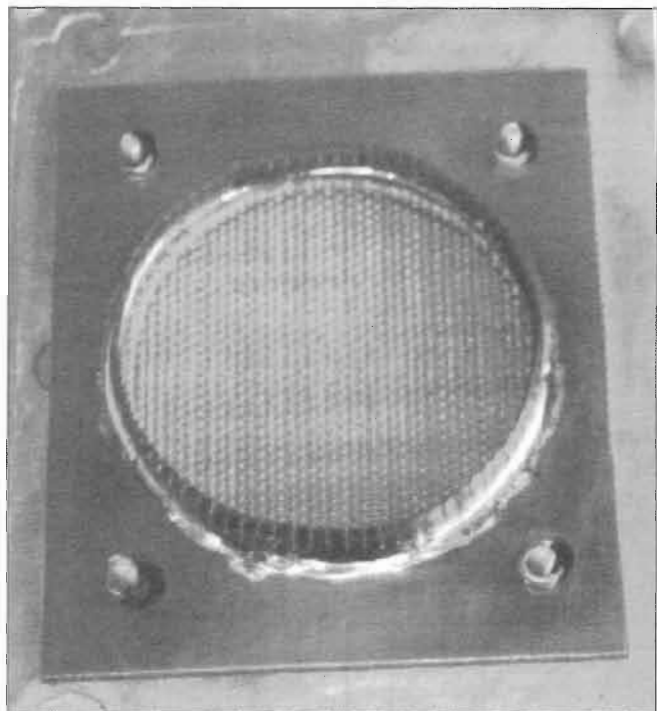
## RF deck construction

The RF deck can be any airtight box, I chose to use a diecast box, approximately 230 x 130 x 100mm which is adequate for the job. The 3CX800 valve has rather an unusual cooling method. Usually ceramic valves are cooled by blowing air into the grid compartment, the air then makes it's way through the 'airflow' valve socket and out via the anode exhaust vent. The 3CX800 does not use an 'airflow' socket. Instead the anode compartment is blown rather than the grid box, the air then escapes via the cooling fins (part of the anode of the valve), and out of the RF deck via a home-made PTFE sheet chimney. This is placed on the valve and is supported in the RF deck lid, by a small sheet of printed circuit board fitted with brass shim or fingerstock.

Several small holes are drilled alongside the 3CX800 socket, to let air circulate around the filament / grid / cathode seals. Air then enters the anode compartment and 2/3rds escapes via the anode fins, up through the newly-built PTFE sheet chimney, and out of the meshed exhaust in the lid. The rest of the air (1/3rd) escapes via the grid compartment. RF output is situated on the left of the upper box, the tuning and loading capacitors are on the front. The 'hot air' vent is located at the rear of the top



RF unit lid with the PCB secured underneath.



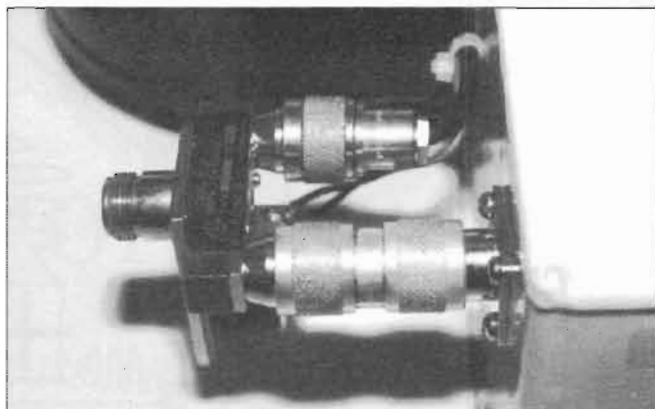
Underside view of RF unit lid, showing PCB with soldered fingerstock to support the PTFE chimney.

box, this has a PCB fabricated panel to support the PTFE sheet built chimney. Gauze is fitted to prevent electric shock as otherwise the 2.2kV HT is accessible.

Now here's a word of warning! Do *not* use non-solvent glues when fabricating the PTFE chimney, this is due to their conductivity, and believe me, sparks fly! Use silicon rubber, available from most component dealers. The chimney is easily made by cutting a piece of PTFE sheet, 75mm wide by several centimetres long, and applying silicon rubber to the joints. Fit

the chimney onto the valve and then carefully remove it, using electrical tape to hold the joint in place until dry. Finally, measure accurately the height of the chimney (about 70mm) and cut to size, so that the chimney fits into the fabricated support in the lid.

The two RF chokes are fitted away from the RF field at the back of the valve, they are in turn connected to the TNC EHT receptacle, a 1000pF 5kV capacitor decouples any stray RF to earth. 12.5mm strip brass, available from model shops, is used to fabricate a collar for the valve. This collar



RF output, use coaxial relays.

fits all the way around the valve and then is bolted together, it then continues on to connect to the DC isolating 1000pF 20kV 'doorknob' capacitor. The other side of the capacitor is connected to the tuning capacitor, the rotor of this capacitor is earthed.

L6, the anode tuning coil, fits between both variable capacitors. Wrap wire around the connections and solder them well. L6 is 4 1/2 turns of 14 SWG 38mm in diameter and about 50mm long. The loading capacitor (C7) must have its rotor earthed. L7 is connected between C7 and the 'N' type output socket. Do not use PL259 type connectors at these power levels.

Finally, I painted all the screws in the anode compartment with a car touch-up paint/brush, to stop any nuts or bolts coming loose due to vibration from the blower. This completes the anode circuitry.

The grid circuit is very simple to build. A second small diecast box was purchased, the lid was discarded and the base of the box removed but leaving 12.5mm all the way round. This then bolts onto the main anode RF deck with four nuts/bolts. The grid tuning capacitor is fitted to the rear wall, as is the RF BNC input socket. C2, the silver mica 3600pF capacitor, is soldered to the BNC socket, the other end being connected to L1, which is 10 turns of 18 SWG and 16mm in diameter. L2 is also the same size. L2 fits between C1 and the cathode

connection on the valve socket.

The valve socket is wired as follows. Using short pieces of tinned copper wire, connect across the socket pins 3 and 10, 2 and 9, and finally 1 and 8. Where these all meet in the middle, solder them all together, this forms the cathode connection for the choke and L2. Pins 4, 7, and 11 are the grid pins, these must be earthed directly to the socket mounting bolts (3) using solder tags. Pins 5 and 6 are the filament connections, the bifilar choke (which is described in the component listing) is fitted between two small PTFE bushes or feedthroughs on the grid box, the cathode RFC (choke) is also fitted in a similar manner. If you are going to build a 144MHz version then it might be a good idea to replace the PTFE feedthrough bushes on the grid box, with a screw-up type 4 pin microphone plug and socket.

Finally, when the RF unit is completed, a cut-out will have to be made in the power supply lid as follows. The lid has to be cut into two parts, one for access into the power supply and the other to mount the RF deck on. A width of around 150mm is needed for the RF deck to fit onto, and a hole slightly bigger than the grid box must be cut out, so that the RF deck sits comfortably on the plate.

*Next month, Geoff completes the project with the tuning up procedure.*



John G8\*\*\* says; "My FRG-7700 receiver ran without a problem for 10 years, but now all of a sudden it's gone deaf!"

# All In A Day's Work

Harry Leeming G3LLL gives some valuable 'insider's tips' from his extensive experience in repairing amateur radio equipment

John, G8\*\*\*, had waited for many years for the Morse requirements to be dropped. At last he decided to take the plunge, passed his Morse test, and was soon on the air with an FT-200, which he had for many years.

A few days later he was in with his FRG-7700 receiver. "It's run without a problem for 10 years, but now all of a sudden it's gone very deaf".

It's surprising how many HF receivers are returned to me by licensed hams, with a complaint of lack of sensitivity. Sometimes the first FET is found to be blown. At other times, either the diodes in the bandpass filter are faulty, or some of the chokes and transformers in the aerial circuit show signs of having been burnt. In John's case a new FET was needed to get some life back into the

receiver, but then it seemed rather noisier than usual. A check with an ohmmeter showed that the switching diodes in the aerial input filters were leaky, and replacing these made the set as good as new.

The cause of the trouble? John had become accustomed to leaving his receiver permanently connected to an aerial. Even though he was now transmitting on a separate G5RV, he had left in place his old long wire. This had been putting volts, into the front end of the receiver, not the microvolts it was designed to take, hence the damage. If you want to avoid this kind of trouble, don't leave a receiver connected to one aerial system while you transmit on an other. Also be very careful when using multi-way switches to exchange aeriels between your receiver and transceiver. It

only needs a bad shield connection on a PL259, to give an enormous signal at the receiver's input, even with the switch in the 'out' position. Play safe by disconnecting all leads from your receiver aerial socket when transmitting.

## Smoking

To be honest, I am somewhat biased. I don't like the smell of cigarette smoke, and make a dive for the non-smoking section, of bus, cafe or whatever. Having said this however, I must admit that around 1/3rd of my income from repairs, comes from undoing the effect of nicotine on the inside of ham radio equipment. Fortunately for us retailers, the effect on equipment is not usually apparent until after the guarantee period has run out.

One wonders what the reaction will be, of those few retailers who are offering extended guarantees, when equipment comes in 'under guarantee' tarred up solid, after 4 or 5 years of being smoked at. Many hams seem to go into a cold shack, switch on the rig, and light up a 'fag' as a kind of reflex action. The rig is cold, the cigarette smoke is warm, and the fan draws the air into the innards of the rig where it condenses on the surfaces. One could scarcely think of a better way to clog relays, controls and switches.

One piece of equipment that has proved particularly sensitive to a smoky environment, is the FT-102. This unit has rather a lot of relays in sensitive RF switching circuits, and a fan that draws air across all of them. One of the first sales I ever made of





One piece of equipment which has proved particularly sensitive to a smoky environment is the FT-102

this rig resulted in a load of complaints of intermittent operation, and things got so bad that the distributors agreed to replace the unit. It wasn't until the replacement started giving trouble, that I realised that there were extenuating circumstances, and that the owner made a very good imitation of a factory chimney. Personal health warnings are not the prerogative of this magazine, but if you can't kick the habit why not invest in an extractor fan? At least hold off, until the rig and the room become warm? (or even when you feel the urge coming on, drop the value of a cigarette in to a box marked 'new ham equipment', and suck a mint!).

### Another RX fault

George turned up with a faulty FT-757. "Will you have a look at this for me Harry, the receiver has gone suddenly deaf". On the workbench I found it indeed very deaf, and I could only just hear stations that should have been '40 over 9'.

Investigation showed that the small protection lamp in the aerial input circuit was blown. I replaced the lamp and the receiver became better. I could

hear stations that should have been 'S9', but they were still not moving the meter. Perhaps whatever blew the lamp has damaged the front end? I took the whole circuit panel out, checked the protection diodes, and the RX/TX switching diodes, but no fault was found.

Enough prodding in the dark I thought, and so I set up the signal generator, and started measuring stage gain. This is not that easy, as one does not always know just how much gain each stage should have, but no stage seemed exceptionally low, and yet things were certainly far from

right. Fortunately I had an identical rig in secondhand, and so I opened it up and started to make some comparisons.

Every stage seemed down in gain by amounts varying between 3 and 10 dB. I wonder? I carefully tried a trimming tool on a few tuned circuits, and up the gain came. The set was suffering from what is known as 'The little boy with a screwdriver syndrome'. I therefore went through the whole alignment procedure, and after another hour the set was good as new. By this time, what should have been a half hour job had taken

nearer four hours. Half of the time was spent going around in circles looking for a fault that I was told had 'happened' where, the truth was, the fault had been caused.

George came in to collect his repair in a few day's time, and took the fact that the bill was over a hundred pounds rather calmly. It was only a few weeks later that he admitted the truth. When the FT-757 had at first taken a deep dive in receive sensitivity, a 'friend' had had a look at it for him, and only later had he brought it to me. I tried to politely point out that if *he had told me this*, I would have suspected an alignment fault and would have wasted less time, and that it would also have cost him a lot less.

By all means have a go at sorting out your troubles yourself, but when taking equipment to any professional for repair, tell "The truth, the whole truth and.....!".

### When the light was seen

A little knowledge can be a very dangerous thing. The above reminds me of my early days in the radio and TV trade. As a 15 year old apprentice, I was sent out with a van driver to help with the collection of outside repairs. On one call we were due to pick up a 'dead' mains operated radio. Being rather keen, but lacking even the most basic test equipment, I suggested that before taking in the radio, we ought to test that the socket into which it was plugged was live. "Have you anything we can plug in to test the socket" the customer was asked, whereupon a vacuum cleaner was produced. We plugged in the upright cleaner, and operated the switch on the handle. The result was that the room lights came on, and just a slight hum came from the motor on the vac! We stood there, mouths wide open, switching on and off the room lights, with the switch on the handle of the vac, before asking the



George turned up with a faulty FT-757. "Will you have a look at this for me Harry, the receiver has suddenly gone deaf".

lady a few questions about the history of the three-pin wall socket.

Apparently it had been wired by a friend who 'knew all about electricity' who, looking around for a source of supply, had tapped across the leads going to the room light switch. Stranger still, it turned out that the radio actually was faulty, as with the room lights switched off, it had been able to draw its 20W or so through the electric lamp bulb, without making it glow. The 500W of the cleaner being another story. The lady was told that she would probably live longer if she employed an electrician to check her house wiring over.

### The burnt out input coil

Ken was a radio and TV engineer, and did his own repairs. One day he called in to tell me about an unusual fault with his FT-480 mobile transceiver.

The receiver had become almost dead, and upon investigation he had found the primary of the receiver aerial input coil to be open circuit. He had carefully stripped the coil down, and rewound it, "strange though" he said, "The primary looked just like it had fused".

Not long after, a customer's FT-480 turned up on my bench, with the primary of the aerial coil open circuit. Strange, and then another, what is going on here?

Only after much head scratching (and splinter removal) did I realise the cause of the trouble. If you have a mobile rig switched on, isolated from the body of the car, with the negative lead having a poor connection, or open circuit, it will not be able to draw current. Start to connect the PL259 plug however, and the first point of contact is the centre pin. The pin is connected to the chassis of the car via the matching coil of the mobile aerial, resulting in power to the rig flowing through the primary of the aerial coil. The aerial input coil is wound with very thin wire, and the current burns it out.

The clear way out of this problem is to break the lead at

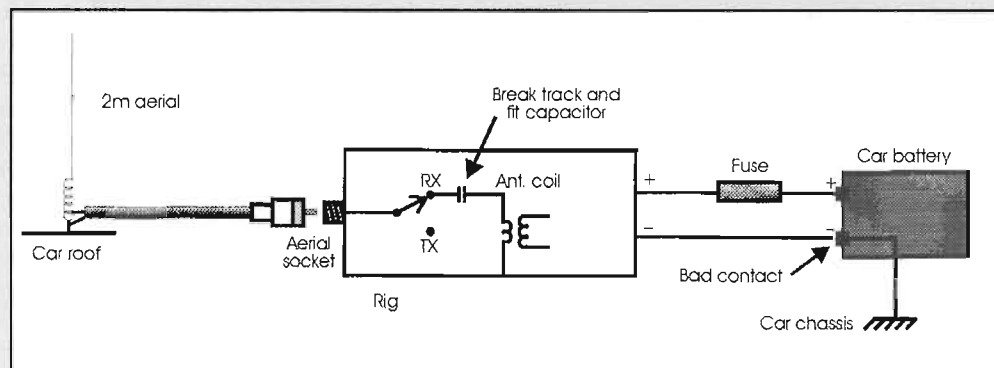


Fig.1. The correct way to wire a mobile rig into your car, so as not to burn out the input coil.

point 'Y' (Fig.1) and fit a DC blocking capacitor. I always do this modification now to any FT-480 that passes through my hands, and have never had trouble with a modified unit. (When this modification has not been carried out, ensure that your rig is drawing power and functioning, *before* touching the centre pin of the plug on the ant. socket.)

### A simple job, says he

Peter turned up with his FT-77. "The mode switch has been a bit loose lately. Now it has moved round and the set has gone off. Only a few leads have fallen off, it can't be much of a job".

I had to point out to him, that if he had taken the trouble to remove the mode knob, and tighten up the nut, it *would* have been a very simple job, but now it would be anything but. How did he expect me to

know which lead went on which tag? Sorting out the wiring to a multi-way multi-bank switch, can be a nightmare. Either he could find a friend with an identical rig, and bring both rigs to me so that I could copy the switch wiring, or he could pay me for three or four hours time to sort out the connections. He went away rather dejected. Failing to find a rig for me to copy from, and reluctant to pay a substantial sum of money, for a few soldered joints, he left his phone number. When

eventually someone else turned up with an identical rig, I was able to copy the switch wiring. "A stitch in time.... can save an awful lot of trouble!"

### All for the lack of a fuse

John arrived with his FT-101ZD. "It's started smoking" he said, "Will it be expensive?" Without speaking, I unscrewed the fuse holder on the rear, and removed what should have been a 3A quick blow fuse, it was a 13A mains fuse! "Do you really want to know" I said, and



Customer's FT-480s kept turning up with the primary of the aerial coil open circuit, what is going on here?

Peter turned up with his FT-77. "The mode switch has been a bit loose lately. Now it has moved round and the set has gone off. Only a few leads have fallen off, it can't be much of a job".



John arrived with his FT-101ZD. "It's started smoking" he said, "Will it be expensive?"

then gently broke the news to him.

There are quite a few simple faults on the FT-101ZD, which with luck result in a blown fuse, if the correct fuse is fitted. Fit a 5A or larger fuse and it's quite a different story. If for instance the PA valves decide to develop a short circuit, all that *should* be required is a new pair of valves and a new fuse. If however you have fitted a larger fuse, you will also be looking for a new anode choke, and a new mains transformer, which with labour costs and the new valves will tot up probably to more than the set is worth. I have seen quite a number of perfectly good rigs that have had to be scrapped just for the lack of the correct value of fuse.

In John's case he was offered £50, for spares, for a rig that a couple of days earlier had been worth over £300.

It's a fact of life that many of us listen to good advice, but in the end only really learn things when circumstances teach us the hard way. I now *always* check that the fuses are of the correct value, before selling secondhand rigs. I learnt to do this after selling one, only to have it returned a few days later completely burnt out. Some minor fault had developed, which should have blown the fuse, but a previous

owner, had left a 20A fuse in place of the 3A one! I had slipped up, and had to refund the customer, a rather expensive mistake. The moral is don't trust other people, if you didn't fit your rig's fuse, break off reading now, and go and check it is of the correct type and value. Do drop a line to the Editor, and let Sheila know

what you find, I am certain there will be some surprises.

### A not so handy socket

Joe came in with his FT-757 and explained that, after hearing me recommend the Datong RF speech processor to a friend, he had bought a secondhand unit at a rally. "I

just wired it up, plugged the 13.5V lead into the back of the processor, and there was a cloud of smoke from my rig, can you sort out what has happened?"

Not having taken any advice before he wired the unit, Joe had committed several errors. Look at Fig.2 and see how many you can spot.

First he had taken his DC supply for the processor from the 13.5V socket on the back of his FT-757, without fitting a low value fuse. Secondly, he had created an earth loop, by connecting a negative return from the power supply to the processor, when the processor was already connected to the negative terminal via the rig and the microphone lead. Thirdly, he had omitted to limit the maximum current that could flow, and prevent RF feedback by fitting a series resistor. Lastly, but worst of all, he plugged in the jack to the back of the processor, while the power supply was switched on. With the jack plug halfway inserted, a dead short was created, passing the full current of the PSU through the rig's internal wiring harness and PCB. To say the rig was 'in a mess', would be an understatement. The main wiring had to be replaced, and large chunks of burnt-out printed circuit bridged across. If he had only asked first.

I tend to recommend the use of a separate PSU when operating accessories with 13.5V equipment. If you must use the main PSU with a Datong processor, the circuit in Fig.3 will be found not to give trouble.

Regarding the 'handy little 13.5V. sockets' on the back of many Yaesu rigs. My advice is to **never** use them for anything (or if you must live dangerously, at least fit a 500mA fuse in the lead, and be absolutely certain that there is not a short on the plug.

To be continued...

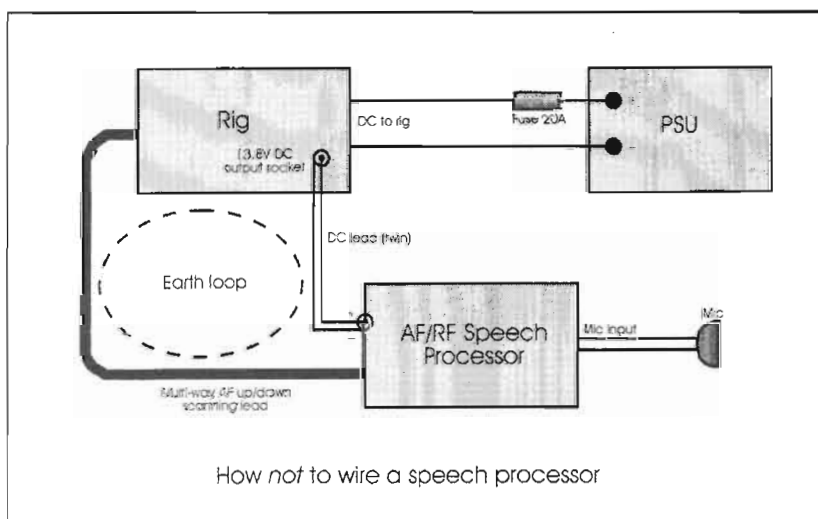


Fig.2. How not to wire a speech processor. See how many errors you can spot.

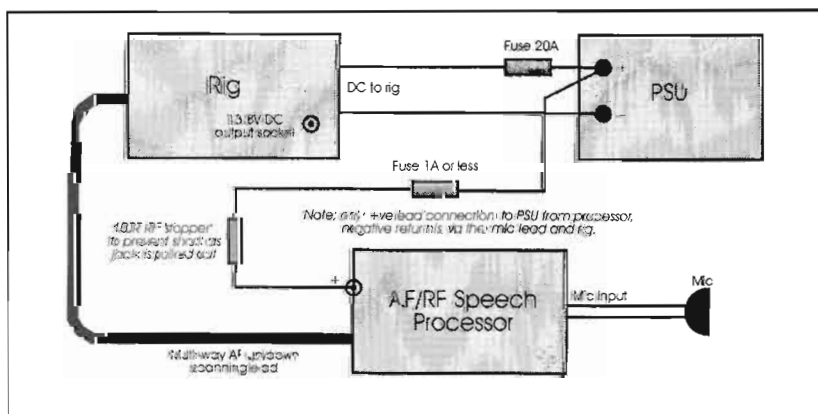


Fig.3. I recommend the use of a separate PSU when operating accessories with 13.5V equipment. If you must use the main PSU with a Datong processor, this circuit will be found not to give trouble.



# QRP

## corner

Dick Pascoe G0BPS gives a few hints on getting the size of your PCB right

I recently received a long letter from one reader, but who shall remain nameless just to protect his identity from some embarrassment. He has done what many others have in the past, but in this case owned up to it to me.

On occasions we all see circuit diagrams in magazines that we take a liking too, in some cases there will be a PCB layout to go with it, but often what is not realised is that the PCB layout is not on a 1:1 scale. My writer, I shall call him Bill, saw a 30m rig from Byron Weaver, an American who also spends a lot of time in France. His callsign escapes me but we have met several times at Dayton. He loves to use his little Mizuho 30m rig on SSB and works wonders with it. The keying on these rigs is done by a very small button on the side and after a couple of minutes your finger goes dead. Hence the penchant for SSB with this rig.

Back to Bill, he had seen a circuit from Byron for a small 30 metre transceiver, next to it was the PCB layout. It was not until he had completed the PCB as per the diagram and tried to fit some components, that he realised the IC holes were wrong. He is not the first to do this, nor the last I would bet. I also remember an amateur copying the 'Oner' transmitter and offering it as a kit of parts. Several bought it and very soon sent it back. The article showed the PCB double size. i.e. 50mm by 50mm. Guess what our friend had done? (no, it wasn't me either). I wonder if John remembers this?

The answer to all those who like to build from these sources

is to check the size. Any decent constructor giving a PCB will show a size next to it, usually a line measuring 1cm or whatever when the scale is correct.

If you are unsure whether a PCB is the correct size there are several ways to check this out. If any IC's are used check the pin spacing, there should be a space of about 2.5mm per pin (or for those unmetrified try 1/10th of an inch). Other clues are capacitor spacing of 5mm between pins for modern capacitors. Modern transistors usually have 5mm between emitter and collector with the base being 2.5mm between and 2.5mm back. Yes I do know other transistors may be configured differently, this is a spacing guide!

With this information you should in theory be able to check out most layouts given, experience helps a lot too. If all else fails, ask the Editor of the magazine, they should know if the layout was squeezed or enlarged because of page space availability. (Ed's note - all current Ham Radio Today projects show the PCB full size, the accompanying caption always stating this). If they can't help, check with the author who will usually be delighted that someone is interested in building his pet project.

We cannot let a piece about PCBs pass without a mention of making your own. This is not difficult and I have covered it several times in the past. What I will remind you all of is the hazards of using Ferric Chloride. Frank G3YCC Emailed me recently about a new shirt he was wearing when making up some solution. He said it looked quite trendy with the new

colouring of brown blotches, although his wife who had bought him the shirt had a different opinion! I'm not sure yet whether they are speaking again.

### Rochdale

By the time you read this, the annual convention in Rochdale will be over. If I saw you there I hope you enjoyed it as much as I did, yes I know it's not on yet but I know I will have fun. I always do, so many old friends to renew acquaintances with. So many new friends to make and enjoy their company. If you didn't make it there, tough. You missed one of the most enjoyable QRP weekends there is.

During other Email conversations, well swapping messages, I had a mailing from Dr. Ian White G3SEK, he who compiled the VHF/UHF DX book. Yes I know this is a QRP column but what Ian and his gang of authors have to say about working DX on these bands is very applicable to us QRP types, even more so when he discusses feeders and aerials. OK, it is VHF and UHF, but just transpose it all to HF. For those on the higher bands, if you have not yet seen this book grab one, it has become the VHF/UHF DXer's bible. Ian will be at Rochdale and I plan on bending his ear quite a bit. You only get these chances once.

I well remember staying at the home of the renowned Doug DeMaw W1FB for a couple of days. We were made so welcome, and after the initial 'shock' wore off I spent a couple of days just learning what construction and building

techniques were all about, from the man who is accepted throughout the world as the very best. When it comes to VHF/UHF Ian's team are in there with the best.

Whilst I mention these bands, the ancient VHF/UHF manual from the RSGB is currently being rewritten, it should appear at the RSGB's VHF convention in 1997. Look out for some new authors and some new chapters!

### QRP ARCI

I was very disappointed to see in the latest edition of the Amateur Radio Club International's (ARCI) Quarterly magazine, (that's it's name!) that the Board of Directors of the QRP ARCI had decided that the subscription of the non-USA membership had to be increased heavily. From the existing £12 per year they have raised subs to: renewal £25, and new member £27, an increase of over 100%. (they also very substantially increased the price of their advertising space). Many readers will remember that I was their DX subscription manager, and have been since 1990. I argued that this increase was too much, but was overruled. So I've resigned as the DX membership representative. For all those who wish to rejoin, please contact Mike Bryce at the address on the QQ magazine.

### WWW Pages

Frank G3YCC, he of the Ferric Chloride stains, has been very busy again writing up his World Wide Web (WWW) pages. He has huge amounts of news, ideas, rigs, bits to build and QRP rig reviews to look at. Frank also



runs the GQRP league on the internet. He runs a list of points scoring contacts, the winner is the one who gains the most contacts. This is open to all GQRP club members who are active on the qrp1 group.

For those who are not aware of this group, it is part of the Blacksheep.org network and is the meeting place of many QRP enthusiasts from all over the world on the Internet. If you would like to join us then send a message to majordomo@blacksheep.org with the following in the body of the text 'subscribe gqrpl' (that is a lower case 'L' not a figure one). Remember that it must all be in lower case to work.

Your's truly has been active on VHF with just 700mW of SSB, and getting contacts into Germany, Holland, France and Belgium. 8 watts of SSB on 70cm gained a Spanish station one evening too. A couple of directional beams help of course. These contacts helped me gain a 'well above bottom' place on Frank's list, he can be contacted at G3YCC@enterprise.net.

The GQRP club home pages are also available on the

internet, with lots of details of the club, who does what, where and what with. Club news and lots more. Check it out on <http://www.kanga.demon.co.uk/gqrp.htm>

You will also find access via this, or Frank's page to many other sites throughout the world. It never ceases to amaze me that I can access a computer in either Australia or the USA in just a few seconds via the internet and in this current weather (very wet), surfing the net is a very apt title.

If you are active on the internet and with QRP you can Email me with all your fun and games, circuits are a little difficult to transpose but it can be done. Please let me have all your activity information on the bands with low power. My URL is at the bottom of the column.

For those not on the Internet it must be disconcerting to read so much about it, the mystique has gone now. I well remember in the early days, about 1991 or so when Demon first started, it was very unusual to find any friends on the net. Now it is unusual to find any not on. All you need is a computer and a

modem. A telephone line of course and you also could be on for as little as £10 per month plus call charges which are local ones only. The amount of information available about our side of the hobby is immense, you can access all sorts of information even if you don't know its source with some search facilities such as Alta Vista. Geoff GJ4ICD has a huge web page full of wonderful information dedicated to the amateur. Not only the 6m enthusiast but all of us. Even the Radiocommunications Agency is on with their own pages.

It may seem that with the advent of the Internet that the need for amateur radio will die, I think not. Yes, it may be very easy to send a message to the far reaches of the world, but there will always be those of us who want to do it using radio. Those of us who want to do it with low power.

Having spent so much space on the Internet lets get back to packet. Steph F5NZY had a complete list of GQRP members that were available on packet. His computer crashed and he

lost the list. (another one who forgot the backup). If you have this listing available could you please send it to Steph at F5NZY@F6BVP.FRPA.FRA.EU he will be very appreciative of your help.

#### Winter Sports approach

The GQRP Club's 'Winter Sports' are fast approaching. This is the annual operating extravaganza where we try to get all members onto the amateur bands with low power. It's not a contest, just an 'on air' gathering of friends who try to work as many others as possible. This should not be another "UR 599, 73, QRZ" type of meeting, have a chat. It all takes place between Boxing Day and New Year's Day. Operate as much, or as little as you want. It's all up to you. It's the chance to run across old friends and meet many more.

That's it for now; TTFN. News and views to me via, GB7RMS, Email; Dick@kanga.demon.co.uk, or snail mail to Seaview House, Crete Road East Folkestone CT18 7EG.

# Scanners

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Peter Rouse

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# From my notebook

This month, Geoff Arnold G3GSR discusses percentages, crystal mixing, and frequency accuracy

In my last 'Notebook', I was talking about transmitter power measurement and the various ways of calculating it and of expressing it – either in watts or in decibels relative to a reference level of one watt (dBW).

Decibels are simply a specialised way of expressing percentage differences between two quantities. The logarithmic nature of decibels is a great advantage when the two quantities concerned are vastly different in magnitude. It's far easier to say that the IF rejection ratio of a communications receiver is, say, 90dB than that it is 31,600 to 1.

We also use percentages themselves in radio and electrical engineering. For example, when talking about modulation levels, time's constants in CR or LR circuits, percentage ripple on DC power supplies, reflected power in feeder and aerial systems, and of course, in the tolerance of resistors and capacitors or of frequencies.

Outside of the engineering aspects, there's one percentage which hits you in your pocket – the government's cut of every piece of equipment you buy, in the form of VAT.

With all the ways in which percentages feature in our everyday lives, in discounts and other ways in which prices may change up or down, it's surprising that their application and understanding seem to cause so much agony and confusion to people. I've known salesmen who were still not entirely convinced whether calculating the result of giving

two discounts on a deal, of say 10 per cent and then 25 per cent, would produce the same answer as offering 25 per cent and then 10 per cent! There is often confusion, too, about the subtle differences in calculating percentage 'up' and percentage 'down'.

I think it's best to go back to basics. What is a percentage? As already mentioned, it's a particular way of expressing a ratio between two quantities, but with the resulting figure multiplied by one hundred. In fact the way I was taught to apply percentage calculations was exactly that – simply to say to myself 'percentage is part over the whole, times a hundred', meaning the part divided by the whole, with the answer multiplied by one hundred. But what is the part and what is the whole? To explain that, I think it's easier to look at an example unconnected with radio engineering, that of the VAT element in the price of a new rig you've set your heart on.

To keep it simple, I'll choose a round figure for the price; let's make it £500 including VAT at 17.5 percent (I'll call that the gross figure). What was the price before VAT was added (the net figure)? People often fall into the trap of saying that the answer is £500, minus 17.5 percent of £500, which comes out at £412.50 (17.5 percent of £500 being £87.50). But that's not the correct amount – you'd be crediting the government with even more than the pound of flesh they normally purloin! The VAT element is 17.5 percent of the net price of the rig, in other words the amount

that would have been quoted as a 'plus-VAT' figure, not 17.5 percent of the gross figure, which is obviously more.

## How on Earth?

The usual reaction to this is 'How on earth do I work that out, when I don't know what the original figure was?'. In fact it's very simple, always providing that you have access to a calculator – 17.5 percent is not a figure which lends itself to mental arithmetic, I'm afraid. The reasoning goes like this. The net price is what we take as our 100 percent baseline. The gross price of £500 is the net price plus 17.5 percent, in other words it's 117.5 percent of the net price. If you divide £500 by 117.5 you will get 1 percent of the net price, which works out at £4.2553, and all you need to do then is to multiply that by 100 to reveal that the net price was £425.53. As a cross check, multiply £4.2553 by 17.5 and it will give you the VAT, which is £74.47. To double-check that, add £425.53 and £74.47, which gives £500 – the correct answer.

Applying my memory-aid for calculating a percentage by saying 'part over the whole, times a hundred', the gross price represents the 'part', and the net price the 'whole'. The 'whole' is always the figure existing before the percentage change was made, and on which the percentage is based. In this particular case we already knew the percentage (117.5) and the 'part', but wanted to calculate the 'whole', so we need to transpose the equation contained in my memory-aid so that it says: the

'whole' equals the 'part' divided by the percentage, times a hundred. If you look back at the last paragraph, you'll see that's exactly the calculation I carried out. The same procedure applies if you are calculating a discount rather than a mark-up, but in that case the 'part' (the amount after discount) will be smaller than the 'whole'.

Depending on what you are trying to calculate, the 'part' can be just the change itself – the discount or mark-up – rather than the figure obtained after the change has been applied.

## Combining Percentages

Going back to my example of a confused salesman, let's work out an example to test what happens. He's selling something at £100, so 10 percent off will give £90, and a further 25 percent will bring the end price down to £67.50. Doing it the other way round, 25 percent off £100 will give £75, and a further 10 percent off makes the end price £67.50, exactly the same! If you're not convinced, choose another starting price, or another pair of percentage discounts, and rework the sums. It's usually wise to do this when checking any calculations by example, as you can sometimes put in figures which combine to confirm as correct what is actually a spurious result. One other thing; successive discounts of 10 and 25 percent do not add up to 35 percent, because the second discount is given off a smaller figure. As the example shows, the final discount is only 32.5 percent.

## It's Divisive

Moving on to a simple example of the use of percentages in radio engineering, let's look at a classic example of a DC potential divider made up of two resistors with a tap at their junction (Fig. 1). We want a potential which is half the supply voltage. To keep it simple, we'll assume that the current drawn from the tap will be negligible, so we don't need to allow for any extra current flowing through the top resistor and out to the load  $R_L$ . We shall use two 1000 ohm resistors, which means that the voltage at the tap will be 4.5 volts, and the current drawn by the divider will be 4.5 milliamps (2000 ohms across 9 volts). We're not looking for particularly great accuracy so we shall use resistors having a tolerance of plus-or-minus 5 percent.

A question that sometimes causes some head-scratching is 'What happens if the two resistors selected happen to be at the limits of their tolerance, but in opposite directions, say with  $R_1$  at 5 percent high (1050 ohms) and  $R_2$  at 5 percent low (950 ohms), surely the errors will add, and the output voltage will be 10 percent below its design value!'. At first glance, I admit that it looks as if this might be so, but if you work out the figures you will find that it's not. With two resistors of the same value (and this is the

worst case of all), the greatest voltage error you can get at the tapping is in fact 5 percent.

Choose some resistor values for yourself and work them out, the general formula for the output from a voltage divider is:  $V_o = R_2 / (R_1 + R_2) \times V_{in}$ , as shown in Fig. 1.

If the resistors are of unequal values, so as to give an output of something other than half the input, with one 5 percent high and the other 5 percent low, the maximum possible error is even less. As an example, put  $R_1$  as 100 ohms and  $R_2$  as 1000 ohms across our 9-volt supply. With both resistors 'spot-on' for value,  $V_{out}$  will be 1000/1100 times 9V, or 8.182V. If  $R_1$  is in fact 5 percent high (105 ohms) and  $R_2$  is 5 percent low (950 ohms), then  $V_{out}$  will be 8.104V. That works out at marginally less than 1 percent low!

## Frequency Mixing

Multi-frequency radio communication equipment being designed for production now would almost certainly be based on full frequency synthesis, but 30 or so years ago synthesisers were rather nasty 'dirty' beasts. I recall an R&D engineer for one of the UK's largest radio manufacturers saying to me then "With a synthesiser we can generate any frequency you want. The problem is getting rid of all the frequencies you don't want!".

At that time, single sideband systems were replacing the old DSB, full-carrier radiotelephone equipment which we'd been using for marine HF long-distance telephony on passenger liners. Initially we were using Marconi NT-201 all-valve transmitters, designed originally for the military. This had a high-stability ovened crystal for the sideband generator, and a row of individual ovens, each holding up to ten crystals, one for each of the allocated channels on the bands at 4, 8, 12, 16 and 22MHz.

All these ovens naturally generated a considerable amount of heat, and were run continuously, which

the channel crystals did not like very much. They showed their disapproval by drifting steadily off-frequency as they aged with the passing months. I used to carry around a 'state-of-the-art' Hewlett-Packard frequency meter to do on-board checks prior to the annual official government radio surveys in those days, and as the transmitters got older, I found more and more channels approaching the limit of the official specification for marine SSB transmitters.

As this called for a frequency accuracy of better than plus or minus 100Hz under all conditions, the requirements were quite severe. When Marconi's designed a new SSB transmitter, called the 'Crusader', specifically for merchant marine use, they adopted a quite different approach. This allowed the multitude of individual channel crystals to be ovened, and just one crystal, operating at 5MHz, was installed in a proportionally-controlled oven, which gave it very high stability.

You will notice that each of the marine radiotelephone HF bands I listed above is within a couple of MHz of a harmonic of 5MHz, and this gives a clue to how the system worked. The output of the 5MHz oscillator was fed to a chain of regenerative frequency multipliers, based on ring mixers, which produced harmonics at 10, 15 and 20MHz, all very accurately controlled. The channel crystals operated in the range 1 to 2.5MHz, the output of their oscillators being mixed with the appropriate harmonic of 5MHz to produce a signal which was mixed with the 100kHz intelligence coming from the sideband generator, to produce the final radiated frequency.

The required accuracy for SSB (100Hz) is specified in frequency terms, rather than in percentage terms, because this is what is required for proper demodulation at the receiving end. The distant receiver is likely to be channelised also, and with only a limited range of fine tuning by means of a 'clarifier' control. However, that 100Hz can of course be expressed as a percentage error, but this will vary

according to the band of operation, being a smaller percentage as we go up in frequency. 100Hz at 22MHz is just under 0.0005 percent, whereas at 4MHz it represents some 0.0025 percent (five times less demanding).

The 5MHz and its harmonics are very accurate indeed; for the sake of simplicity I shall consider there to be zero error. That would mean that the channel crystals could be up to 100Hz off frequency and still give the required accuracy at the transmitter output. At 2.5MHz, which is the highest channel crystal frequency, 100Hz represents an error in the region of 0.005 percent, quite achievable in an ovened crystal oscillator with careful design.

The 'Crusader' was all transistorised (no ICs!) throughout the frequency and sideband generator stages, with valved driver and PA stages producing a kilowatt PEP output. The channel crystals were arranged radially in rings, one ring for each band, positioned around the wafers of a long, multi-banked selector switch. This meant that every crystal was connected to its switch-wafer by leads of identical length (and therefore inductance), which together with a cool, well-ventilated position at the bottom of the transmitter cabinet, helped to ensure reliable, stable operation. I don't recall finding any channel on a 'Crusader' being more than 20Hz off frequency, usually even less.

I imagine that the same principle was used in other equipment besides the 'Crusader', but I always thought that it was a very elegant technical solution to the problem of achieving long-term frequency accuracy on a large number of spot channels. The crystal costs were high, of course, but we had to wait for synthesiser design to overcome its problems before that snag could be overcome.

*(If you have any ideas for topics to cover in future 'Notebooks', please send them to Geoff Arnold G3GSR, 9 Weatherby Close, Broadstone, Dorset BH18 8JB, or have a chat with Geoff on the 'Radio Bygones' stand at a rally - Ed).*

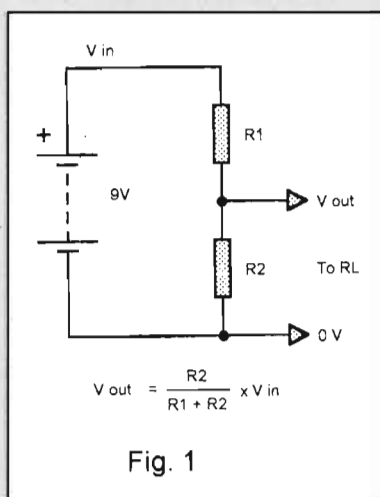


Fig. 1

Fig.1. DC potential divider made up of two resistors with a tap at their junction. Choose some resistor values for yourself and work them out, the general formula for the output from a voltage divider is:  $V_o = R_2 / (R_1 + R_2) \times V_{in}$ .

# Letters

## Letter of the Month

To; [hrt@netlink.co.uk](mailto:hrt@netlink.co.uk)

Dear HRT,

I am writing to express my dismay at a communication I received recently from the RSGB informing me that the society could no longer afford to provide free concessionary membership to the disabled. I was disappointed at this but more so as I read on.. The letter continued that Blind members will continue to receive free membership and taped RadCom.

I have been bed-bound due to a spinal injury since an accident whilst playing with

my children 12 years ago, with all respect, what makes my disability any less worthy of support from the RSGB. I cannot see what is to be gained by this announcement. I have never known a time when the RSGB has been so unpopular. As a charitable society acting for the furtherance of radio, I would have to say, that it is under the worst leadership ever at this point in time, they should be striving to improve their flagging support and this is not the way to do it.

I have made my feelings known on electronic media

and have received support from as far as America. All who have followed my comments have said how shocked they are to hear of this change and have commented they felt that the RSGB had let us down. It might interest people to know, that a lot of existing members are considering whether they can justify supporting an organisation whose first choice pick on the disabled. I would not be raising an argument if we disabled had all been treated equally, instead of segregating people like myself and blind operators.

Who is the RSGB trying to kid. I would love to know how they are going to save funds by taking membership away when it was free.. They could have at least offered continued support of the QSL bureau which in my opinion is the main reason for membership, or without RadCom if they are trying to reduce publishing costs.

How about Ham Radio Today voicing it's opinion to the RSGB on our behalf, they might then reconsider their membership losing decision.

Paul Simpson, GORUR

Dear HRT,

Having become interested in Ham Radio about a year ago, I am currently in the process of learning the 'in's and out's' of basic electrical and radio theory in order to pass the Class B amateur exam. Constantly I am perplexed as to why exactly this exam is so difficult, such a ludicrous amount of time must be spent on learning seemingly irrelevant information. Now assuming all good Amateurs out there have not just died of a heart attack at reading such a statement, I'm not finished by a long shot.

If one passes the full Class B licence exam, it will still take some considerable time and trouble to obtain the full Class A licence, at which point (saints be praised) the hallowed ground of HF transmission opens up. Why so much trouble I ask myself? It amazes me that anyone but the most technical of wizards obtains a Class A licence.

I'm sorry if this sounds like an attack on radio amateurs, it's not. The point I would dearly like to make however, is that unless there are some changes in the exam requirements, do not be surprised if the next generation of 'potential Hams' simply take the easy option, in this case the Internet.

This would be a great shame, the airwaves of Ham Radio could become a very dull place indeed. Picture the ultimate nightmare scenario. A wasteground of white noise punctuated only by occasional QSOs between sad ageing professors, consisting of reiteration of callsigns and the price of fish.

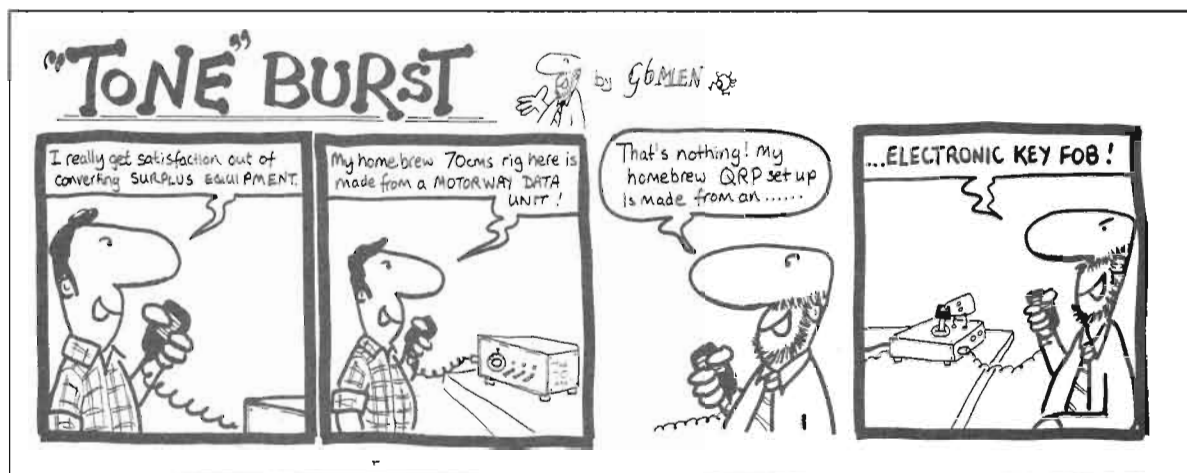
Surely it will never come to that though and that every year new and interesting people will take to the airwaves. Let's hope so. Indeed at this point, let us bow our heads over the microphone and pray that this will be the case. Oh by the way, have you seen the price of modems lately?

Mr D. Robertson

### £10 for 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 (normally paid during the month following publication). So write in with your views, to; Letters Column, Ham Radio Today, Nexus, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, or fax your letter direct to the Editor's desk on 01703 263429 (fax letters for publication only, for general readers queries please see the 'Readers Queries' section in the 'Who's Who and What's What in Ham Radio Today' section at the rear of this issue), or Email to [hrt@netlink.co.uk](mailto:hrt@netlink.co.uk). Please keep your letters short, we reserve the right to shorten them if needed for publication. Letters must be original and not have been sent to any other magazines, and must include name and address plus callsign if held. Reader's views published here may not necessarily be those of the magazine.





Dear HRT,

I decided to go to the CCBN (Central Council for British Naturism) AGM at the South Hants Sun Club in Fareham this year.

I have never been to any other club than my own, and having operated HF radio from the club site, I have made some new radio contacts with other naturists, some of whom arranged to meet at the AGM. It seemed a good idea to go, but wandering around a strange club with only a two metre handheld to hide behind, suddenly became quite daunting, but luck was on my side and I soon teamed up with the others. I am now glad that I did attend, otherwise I would have missed a super chance to see a commercial club at it's best. They had two swimming pools, one in and one outside, six miniten courts, a restaurant and pub, plus all the other activities that go on. You could rent a pitch for your own caravan or tent, or hire a caravan for the weekend. The caravans were the large 'mobile home' type fitted with all mod-cons and services, plus the minimum of QRN, as most clubs are in the country without any pylons in sight, and loads of tall trees to string the G5RV from. I will most certainly be going back for a weekend with my partner and taking the radio.

During the afternoon I presented Sue Piper, President of the CCBN, with a copy of the QSL card being used by GB2ASC, The Apollo Sun Club for all radio contacts made on Bank holidays and Naturist Day, picture taken etc., they have promised to put it up in the office in Northampton. The CCBN are very keen to promote amateur radio and would welcome a great influx of radio hams.

The whole day was great fun and I will be attending the next one at Telford next year. This time I hope to have a station running, as the BNARS (British Naturist Amateur Radio Society) have promised to help. So get booking now and you too can have a nice day, maybe you can help me operate the radio.

Chris Reynolds, GOUFP

*Editorial comment; If any club or individual is interested in attending next year and does not belong to a naturist club, you can write to the CCBN (Central Council for British Naturism), 30-32 Wycliffe Road, Northampton NN1 5JF, who will put you in touch with your local club. For further details on the special event station, contact Chris Reynolds GOUFP, Worthing & District ARS, P.O. Box 599, Worthing, West Sussex BN11 1AA, please enclose a stamped self-addressed envelope.*

To; [hrt@netlink.co.uk](mailto:hrt@netlink.co.uk)

Dear HRT,

There were comments made in last month's edition regarding the coach trip to the Friedrichshafen rally in Germany which may have given some the wrong idea totally.

As one of those who happily paid for the trip, it must be said in the organisers defence, Emie Bailey G4LUE, that the trip was most rewarding, well organised and even provided with free drinks all the way there and back. The rally itself was its usual delight, many bargains on the flea market, much new stuff and many old friends met along with new.

It goes to show that all these things are subjective, so at least two

views of an event are better than one, especially if that one contains untruths. For any one else interested in rallies, I am sure Emie would be only too pleased to send you details for next year trip there. I'm certainly booking up for it.

Ben Nock, G4BXD.

*Editorial comment; The comments made (not by the Editorial staff!) of course reflected a personal opinion, one man's meat is another man's poison. You'll have seen we've been very happy to promote this particular club's trip in HRT and will be happy to do in the future. We do however know of, other, professionally-run trips to overseas rally events, that were described as a total shambles, but the travelling group keeping in the 'spirit of things' is often needed!*

Dear HRT,

I was interested, at the recent McMichael Rally at Slough, to come across the WWW project being demonstrated by the Thames Valley IP User Group. They are running a WWW server, with lots of web pages accessible to users with Netscape software and an IP capability. Some of the users have built equipment for the microwave bands in order to improve download speeds. There are links to WWW servers elsewhere but, for licensing reasons, not to the traditional Internet World Wide Web (this could be done quickly and

easily if it were ever allowed).

I don't recall ever reading about these capabilities in the ham radio press, although I find it fascinating that at least some people are taking packet radio beyond EMail and BBS capabilities. As HRT is already an advocate of the (landlinebased) WWW, how about some coverage?

Don Field, G3XTT

*Editorial comment; We certainly will Don! Any other groups active with some high-speed TCP/IP links?*

# VHF/UHF Message

Geoff Brown GJ4ICD has a few things to say about 50.110MHz

By June 30th, over 69 countries had been worked in the UK on 50MHz. Not everybody had worked them all of course, but it shows what really can be done by perseverance!

I have now come to a point that needs to be explained. 50.110MHz is the calling frequency for DX outside of your own continent. This means please do not sit there, working fellow Europeans on this frequency. If you hear, for instance, a station in Spain or Portugal calling CQ, then ask him to QSY up the band somewhere, otherwise it causes chaos. If real DX outside Europe hears European stations working other European stations, and cannot break the QSO, he will more than likely go QRT.

Another point that was raised by one reader was "why spot fellow Europeans on 50.110MHz on the cluster?" Well yes, why spot them, this also causes chaos in itself. The more you spot a European on 50.110MHz, the more other Europeans will dash to the frequency to work him! Totally pointless. Please bear these points in mind for the future, it may just help you to make that exclusive DX contact, or, somebody may be hearing something you can't!

## Sporadic E

Right, back to Sporadic 'E' condition. July 8th saw a few short openings via single hop, EA to G, I to CT, I to G etc.

The 9th saw Dave OZ3SDL operating as EH4BG/6 from locator JN10, and other European single hop stuff. On the 10th HB0/PI4TUE was very loud around the UK, and so was EU1AA in KO33. At 1130z VO1ZA was in at S9+, bringing the total of USA openings this year to a total of 17! Later that day Cedric CT3FT worked W3.

Dave EH4BG/6 moved squares to JM29, which was a new one for many. At 1800z Emil W3EP reported that he was receiving video signals from Spain.

The 10th at 2130z produced a 'G' first with JW7SIX (Svalbard!). Those who worked the short opening were G3WOS and G3FPQ and G3IBI.

The 11th saw an opening from EA to the USA, later that day JW7SIX was heard in Jersey at 1945z, but no station was active. Alan GW3LDH managed a contact with JX7DFA and then it all went mad to the USA.

Here in Jersey, W1/2/3/4/8/9 were worked along with FP5EK and several VE1/3's. 54 stations were worked on CW and SSB, the

best being KB9IEC on SSB in EM69 at a distance of 6400km, VP9MZ was also heard. Emil W3EP heard HB0/PI4TUE but then somebody in the USA started using the frequency and all was lost. However, KM1H did make it with HB0/PI4TUE for an all time new country. This was a real shock to HB0/PI4TUE, they couldn't believe that they had just worked the USA!

Bob WA1OUB and Dave N5JHV copied TV carriers from Moscow and Norway on the afternoon of the 12th, but sadly no QSO's took place. Later that day Roger G4HBA reported ES0SIX, and so it was all eyes on the band again. Could there be a repeat of the previous day? No!

Onto the 13th, and just after lunch time the band opened from EA to W1/3 and WP4. This was the 20th transatlantic 50MHz opening in 1996, and was by far the highest number of openings ever recorded.

W1/3 also worked EH8BPX and CT3FT at 1600z. Later in the day W1/2/3/4/7 were worked in the UK.

Sunday the 14th saw another nice opening to SM3FSK in JP64, a new square for many. Nick G3KOX worked WA1OUB at 1100z for the 21st

USA to Europe opening. Costa SV1DH also reported that he had notched up his 151st country with 4L6PA, he also reported that on July 1st he heard KP4 at 8900km. Later in the day W1/2/3/4/0 and VE1/3 were worked in central and northern UK, together with SM7 and ON4. Down here in Jersey, things were much poorer with only VE9AA making the trip. On the same day came a report from JA1VOK that three JA's made it into KL7 at about 5700km. Next day (the 15th) things had burnt themselves out, until around 1600z when VE1ZZ worked CT3FT.

Mike CY0AA sent his full report of European stations worked on 50MHz from Sable Island which are as follows; EH1YV, EH7KW, F5JKK, GJ4ICD (CW/SSB), GW4LXO, G4IGO, G4BWP, G3WOS, ON4GG and finally ON4ANT, ON4KST was heard. That's it, a total of ten European stations, two of which put personal substantial donations into the cost of the expedition.

## Short Skip

Continuing onto the 16th, short skip 'ES' was prevalent for most of the morning. Later after lunch, Bob WA1OUB started to report video from

1996 144MHz real DX, 1993km

**FLORIDA**  
**KJ4E**  
**DAMON MORRISON**  
 4855 Nolan Road • Sanford, Florida 32773  
 Grid Sq # EL98 • SMIRK # 2617 • 10-X # 10816

TO RADIO		CONFIRMING QSO						
GJ4ICD	DAY	MONTH	YEAR	UTC	RST	2-WAY	MHz	
	9	6	96	1355	59	CW	50.079	

RIG: TS60  
 ANT: 8x8  
 73 Damon  
☒ PSE QSL ☐ TNX

**REPUBLIC OF MACEDONIA**  
**Z32ZP**  
 WAZ 15  
 ITU 28

QSO WITH	DAY	MONTH	YEAR	UTC	MHz	RST	2-WAY
GJ4ICD	23	May	1996	15:50	144.3	59	SSB

ORA loc. KN 01 RX  
 PSE QSL TNX  
 73, [Signature]  
 MILCHINOSKI MIRCHE  
 Franklin Ruzvch 42-12  
 91000 SKOPIE

1996 50MHz real DX, 6860km

Portugal and Spain. At 1500z I copied the VO1ZA beacon on 50.039MHz, and literally 30 minutes later I had a QSO with Bob, his only QSO in fact! The day continued and on checking my log later in the day, it was noticed that over 25 countries had been worked. Other DX included 4X1IF, EH8ACW, SV9, SV1, etc. An OH station also reported the JW6SIX beacon in at night.

It was my day off on the 17th and the end of the season was fast approaching! Alas, things were quiet during the day, but later in the evening 5A1A showed up on 28MHz. He was coached up to 50MHz and worked nine Italian stations and one HB9, another one missed! Steve G4JCC also reported the JW (Svalbard) beacon on 50.047MHz at around 1900z, but no contacts were made. The 19th saw opening

number 23 across the 'pond', again Bob WA1OUB heard the CTOWW beacon but no stations were worked. Cedric CT3FT was worked into Spain by EH7KW, KM1H was worked by EH8BPX, and EH9IB worked VE1PZ. Finally to round the day off, David G3FPQ worked CT3FT at 2038z, otherwise a quiet day within Europe. Over in the USA as the day progressed there were many reports of W5/6 working into Mexico.

Incidentally, 76 countries had been worked from Europe up to this date (74 from the UK). David G3FPQ, who only started on 50MHz in April, had notched up 58 countries, an incredible achievement for a 'newcomer' to 'Six', but an old hand on HF. Our hearty congratulations David, well done!

On the 20th reports came flooding in from Japan, the

best being HL (Korea) to JA and BV (Taiwan) to JA.

Following on in the afternoon, EH1TA/P worked KP4EIT for another transatlantic opening, number 24, meanwhile in the UK things were very quiet. In the USA, W5's were working XE (Mexico) and W3's were working C6AFP (Bahamas). Later at 2200z, WA1OUB worked into EH7 and heard the CTOWW beacon weakly.

### DX Cluster on-line

Readers who have access to the Internet may like to try this

unique telnet system. Telnet into 158.65.11.62, then once in, type c nhdx (connect New Hampshire DX), then type dx. You will now be into the K1XX DX cluster network, with hundreds of nodes connected. I was shocked to see, on logging in, that the maximum number of users was 29788! This is really great fun, as the 'Big Guns' like WA1OUB, VE1YX, WA1AYS, W3EP, W3IWU, K1TOL and K1GPJ are all logged on, and you can 'Talk' with

them at your leisure about various openings / propagation. Bob WA1OUB is always on the system and reporting what is happening on 50MHz in the USA. I've even seen all the UK spots come up on the network, which has somehow been Internet / Cluster linked. Try it next year during the 'ES' season.

On the 21st, JA's reported the BV beacon, UR4LL (KO70) was into OK and OE, and W4's reported the V44 beacon. Bob WA1OUB also copied weak 48.250MHz video from Spain, all this was in the morning. In the afternoon there was a little action in Europe, and again Bob WA1OUB copied video from Spain/Portugal, but no QSO's were reported.

Things were becoming sparse now as the end of the season approached. However,

saying that, there have been some excellent openings in August/September, even in October when 3V8BB was worked. Following onto the 22nd, in the morning G3NVO worked 9H, F worked ISO, HB9 worked CT and PA0 worked EH9IB, showing that single-hop signals were still around. Later in the day the band opened for G0HVQ to EH7KW and G3IBI worked ZB2IF. There were other openings within Europe, but all by single hop. At 2114z JX7DFA was reported calling CQ by OH9NYW, and at 2154z, VE1PZ worked EH1YV for the 25th transatlantic opening.

There was still time for everyone in Europe to increase their 1996 country scores, as news came in that three new expeditions were about to commence; one on Market Reef, one in Latvia, and the other in the Azores. The Azores expedition was to commence on July 24th and the station (CU7VHF) would be active on 50MHz, 144MHz and 432MHz. Conditions had been excellent on the two latter bands due to a massive high pressure system that had sat for several days over the Azores and covered most of Europe.

The 23rd produced single-hop in Europe with YL to G, DL to OH, and WA1OUB copied 48.250MHz video at lunchtime. Interestingly, VE1PZ copied 48.250MHz and 49.740MHz video. In the afternoon, conditions were good via double-hop, from OZ to 4X and 5B4. GW7SMV also worked 9H1PA, EH9IB, ISOQDV, and YU1EU, quite a selection and widespread too.

That's all I have room for this month, next month, part 4 and an overall global view of the Northern Hemisphere, people's opinions from around the World.....

News and views please to: Geoff Brown, TV Shop, Belmont Rd, St Helier, Jersey, Channel Islands, or via Email to equinox@itl.net, or even packet at GJ4ICD@WD5B or GJ4ICD@GB7GSY, or GJ4HXJ@GB7GUR - I even have a phone; Tel. 01534 877067

# DATA Connection

Chris Lorek G4HCL looks at speech using data links and remote repeater use

I've been quite busy this past month, meeting amateurs at clubs and conventions, and chatting about future amateur trends, particularly the use of DSP in our hobby. The feedback I received surprised me a little, in that I was not alone. You'll read about this a little later.

## New WA4DSY 56kb Modem

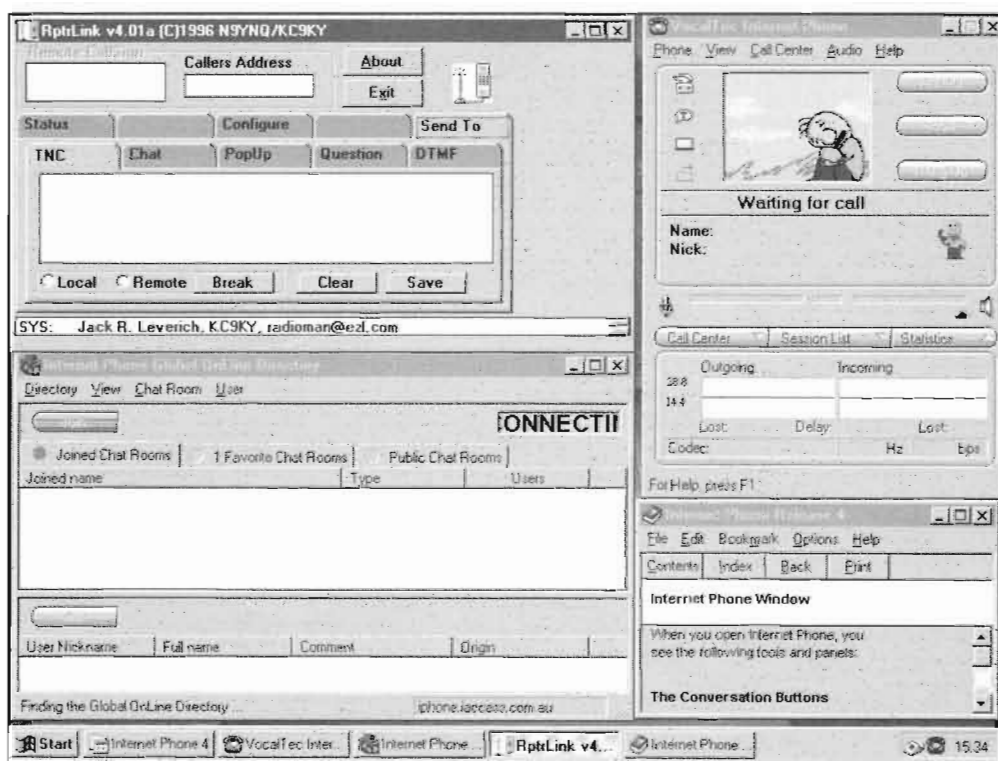
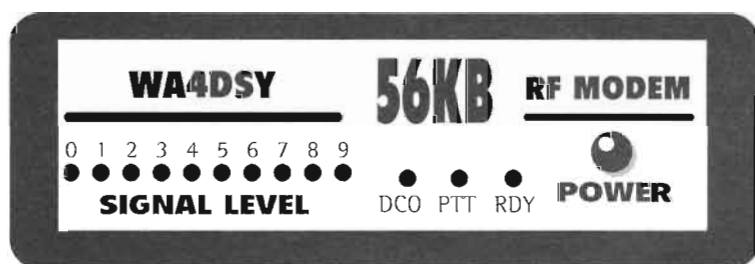
Just when you thought 9600 baud packet was 'state of the art' in an off-the-shelf system, PacComm have brought out a modernised version of the 56kb MSK modem designed by Dale

Heatherington WA4DSY and licensed by PacComm. It's a self-contained unit, with a built-in transmitter and receiver operating at an IF of 29-30MHz. It has an adjustable output power of 0.1-2mW which you'll typically use with a transceiver for operation on bands such as 2m and 70cm. A matching transverter is available from PacComm for 70cm, and a number of companies manufacture various amateur transverters -

Left: High speed packet with built-in modem and RF circuitry is available off the shelf

for example I use Microwave Modules transverters for 6m, 2m, 70cm and 23cm in my station. The new modem design uses a single PCB with 15 ICs, and around 200 components, and the only adjustments involve tuning the internal filters, a special 'tuning' mode being incorporated for this.

You can drive the modem with either a Gracilis PackeTwin HDLC card plugged into your PC, or for stand-alone operation using a PacComm SPIRIT-2 PAD packet TNC. The price in the US for the RF modem is \$349, if you're in the UK you can get further details from Siskin Electronics, Tel. 01703 254247.



## TSTHOST Version 1.43

TSTHost is packet radio software that operates in a similar way to TPK, as a complete personal message system in conjunction with FBB BBS systems. The latest version, 1.43, which has a number of additional facilities over the earlier V1.42b, is now available. If you're Internet FTP facilities, you can download a copy from: <ftp://members.aol.com/g3wcs/sth143>, the file name is TSTH143.ZIP.

## Digital speech

In past columns, I've described the work done by amateurs in high-speed packet radio links. At least

Is this the future of amateur radio communication using digital speech over data networks?



three years ago in Germany, the amateurs there had automatic speech mailboxes with forwarding facilities over their packet network.

If you've Internet facilities on a PC with a sound card, then you may have come across the various 'audio' modes available. For example, if you go to the Tucson Amateur Packet Radio (TAPR) site, at <http://www.tapr.com> you can click on links to listen to speeches on packet radio, which have been presented at various amateur radio conventions, using 'Real Audio' facilities over the data link.

All this uses various forms of speech compression, but it also uses a packet system, albeit landline based, complete with TCP/IP nodes, gateways, and the like.

For one-to-one communication, using speech over the TCP/IP system, a number of software programs are available. One of these I've recently been using is Internet Phone, or iPhone as it's commonly known, produced by Vocaltec. Version 4 is the latest release at present, you can find out more or download a trial copy from <http://www.vocaltec.co/iphone4>

A minimum of a 14,400 bps modem is needed to use this, which takes many existing packet radio 'end user' TNCs with a maximum speed of 9600 baud operation out of the equation. However, off-the-shelf 56 kilobaud modems are now available, and you don't even need to modify a radio, like the 'old days' of modifying radios for 9600 baud. I've personally used 56kb packet radio on 23cm in the past, setting up and testing a link in the New Forest near to my home, and offering to set up a high-speed packet node using this for 'backbone' operation. The only problem was that, at that time, no-one else in my area could link in at that speed. Things are a little different now. With higher speeds, real-time voice over 'digital' radio links is a

reality, just like on the Internet. But it doesn't stop there.

## Repeater Link

Last week, I presented a lecture at my local radio club on Trends and Developments in Amateur Radio, and finished off by giving a mention to 'Repeater Link' software that works with iPhone for use on the Internet. It allows you to link into a distant voice repeater in the same way as a 'telephone patch', and have live QSOs with other stations around the world. I was extremely surprised to hear, as I think some of the other club members were, that during the ensuing 'question time' one of the club members said he'd been using Repeater Link the night before and gave a short list of the station callsigns he'd contacted! This I thought calls for a little further explanation and revelation!

Repeater Link is PC based shareware software, which has been developed by Mark Brown N9YNQ. A number of 2m and 70cm amateur repeater operators have been hardware interfacing their computer's sound cards to and from their repeater for use with the software. Controlling the link, i.e. "who gets to talk" on the repeater, is usually manually activated by the repeater operator (i.e., the 'repeater keeper'), or at a minimum it's manually monitored in the same way as phone patch connection as is commonly used in the US. On 'logging in', you enter your callsign details, which the remote system looks up to check your call is valid. You're then 'through', and you can listen in, and join in, conversations on the distant repeater using just your shack PC.

The basis of the hardware at the 'remote repeater' end is a simple Tandy voice activated recording system, which sells for around \$34 in the US, where the vast majority of the Repeater Link system repeater operators,

and indeed users, are located. To use Repeater Link, you start iPhone on your PC (it won't work without it), then start Repeater Link, then select the Repeater Link 'user' mode. The program automatically creates an iPhone public topic "HAM\_RADIO\_Rptlink", and after checking your callsign is displayed correctly you simply carry on using iPhone for the speech connection and link.

You can download a copy of the latest version of Repeater Link from <http://www.onramp.net/swta/rptlink> From that site you can also get an up-to-date list of Repeater Link users around the world, there are several 'G' and 'M' calls listed there, including my callsign. To download the software you'll need to provide your details, such as name, address, callsign, email and so on, which will then automatically update the callsign user base.

Right now, UK regulations don't allow Internet/Packet Radio gateways, nor telephone patch access to amateur radio equipment. But technology is changing, and I'm told that the

Radiocommunications Agency are 'looking at' the possibility of allowing various links in the future. Repeater linking in the UK by RF means is already with us, but will we be seeing packet radio to voice repeater links in the future? There will come a day, and my guess that it won't be that far in the future, when we'll be using small add-on DSP boxes between our microphone and SSB HF or VHF/UHF rig, just like add-on speech processors in the early days, to give us narrowband packetised speech-using-data on the bands.

## CTRL-Z, End of Message

If you've any comments on the column, or you'd like me to cover a specific topic you're interested in, then please do drop me a message. You can send me a letter, fax, email, or a phone message c/o the Ham Radio Today Editorial contact lines, or via packet to G4HCL@GB7XJZ.#48.GBR.E U. See you next month.

## Download Repeater Link Software

Please complete all entries.

Repeater Link Software V4.23 (Expires 9/30/96)

- Allows callsign screening by repeater owners who want to make their repeater links accessible from iPhone by licensed radio operators only.
- Allows licensed radio operators to make iPhone calls to a callsign screening repeater link.
- Select Callsign Search Engine.
- URL for Search Engine variable.
- Fixed Disconnections (Better).
- FIXED for iPhone 4.0 USAGE.
- Changed screen layout (reduces memory).
- \*\* PLEASE USE YOUR CALLSIGN IN THE SPACE PROVIDED. \*\*

Please submit the following information. Then you will be able to download.

Name:   
 Callsign:   
 Email address:   
 Address:   
 City:  State:  Zip:   
 Country:

Usage: ☒ Repeater User  
☐ Repeater Operator

Suggestions:

You can freely download the shareware software

# Satellite Rendezvous

Richard Limebear G3RWL gives a run-down to Oscar 13's last few weeks of operation and introduces a new satellite from Japan

*Oscar 13:* Drag has not been quite as severe as initially estimated, allowing AO-13 to be moved for a final session at a favourable attitude. The duration of this orientation is unknown, but on or before November 1st, reorientation will be necessary. Re-entry is expected for the second week of December.

In order to determine and adjust the attitude of AO-13, there will be occasional command station switch-overs to the Mode-S beacon during times of favourable squint angle. The mode-B transponder will be off for a few minutes at these times. Service will be restored as quickly as possible. The higher powered engineering beacon (145.985MHz) is currently on from MA 140 to MA 60. Eventually, this will be turned on full time for the duration of AO-13's functional existence. Please try to limit uplink power to avoid activating the AGC, with this configuration, modest uplink power gives an excellent downlink.

The drag effects at perigee cause the ALAT to rise slightly each orbit. The initial orientation for this period will be approximately ALON/ALAT 170/-10 with ALAT progressively rising during this time period. The nominal ALON/ALAT for this orientation allows for much more favourable squint angles early in the orbit when AO-13 is relatively high in the northern hemisphere, without greatly affecting the currently excellent conditions for users in the southern hemisphere. This should be a very good orientation. Use and enjoy AO-13 during this final favourable attitude.

When this orientation becomes impossible to maintain, or by November 1st, AO-13 will be turned to its final attitude of ALON/ALAT

90/0. This will provide protection of the solar panels and omni-directional aerial from perigee heating and will reduce the drag associated deflection of the ALAT. From this point until the demise of the electronics, AO-13 will be Mode-B only, full-time omni aerial, much as with AO-10. Internet users who want the latest AO-13 information should always check;

<ftp://ftp.amsat.org/amsat/satinfo/ao13/>

<http://www.amsat.org/amsat/>

Telemetry is archived at:  
<ftp://ftp.amsat.org/amsat/satinfo/ao13/telemetry/>

## Oscar 13 'Farewell' Operating Event

Instead of passively watching AO-13's demise and waiting for the launch of Phase 3D, a 'Farewell to AO-13' operating event has been proposed for the last months of AO-13's operational life. The intent is to get as much activity as is possible in a concentrated period of time as a way of saying farewell to this satellite.

The operating event would work like this: From now onwards everyone interested in operating on amateur satellites is encouraged to make as many valid QSO's with as many different stations/callsigns on AO-13 as possible. The hope is that new and/or dormant stations and countries will be activated, and that you'll be having enjoyable contacts with people you've never contacted before.

The re-entry of the satellite would (surprise!) end the event. At that point, you would compile your logs (unique callsigns, countries, stations, etc). But logs will probably be looked at to extract all of the unique callsigns/stations active during the event. As there are no prizes, there is no particular interest in validating your logs.

We trust you! There are no winners, except those who actually make an effort to get on AO-13. After a reasonable period of time, a listing of everyone who was active will be submitted to the appropriate publications.

Also, DB20S wants those who now collect telemetry, or hope to add that capability to their stations, to have a means of participating in this farewell. To that end, he has suggested a prize for the last Q-frame collected from AO-13.

## JAS-2

A Japanese H-II rocket carrying the Japanese amateur satellite JAS-2, and the ADEOS spacecraft, was launched by the Japanese Space Agency from the Tanegashima Space Centre at 01:54 UTC on August 17th. The satellite now takes the name Fuji-Oscar-29.

Operation of both the analogue and digital parts of this new amateur satellite appear normal. The spacecraft's communication system may be used if found to be switched on, but initial experiments are in progress at the time of writing so don't be surprised if it is off sometimes. All the frequencies and modes are identical to those of FO-20. In addition to the 1200bps digital mode FO-29 can run at 9600bps, using FSK (using the "normal" method for 9600bps operations) The callsign for all digital operations is 8J1JCS.

To summarise FO-29's equipment; Unlike most digital satellites which function as file servers and require specialized ground station software, JAS-2 provides a BBS that operates much like a terrestrial system except that a different modem is required. The only software required is a terminal program to 'talk' to your TNC.

Connecting to the BBS is as simple as sending a connect

request to 8J1JCS.

Amateurs who have PSK TNCs can connect at 1200 baud, but unlike FO-20, JAS-2 can handle 9600-baud FM FSK as well.

There is also a digital voice-storage unit called the Digitaltalker which will be used to transmit announcements, bulletins on the condition of the satellite and so on. It's similar to the unit presently being heard from the Mir space station and can be heard on the digital downlink frequency of 435.910MHz.

JAS-2 also features a linear transponder for SSB and CW communication; the uplink passband is 145.900 to 146 MHz with an inverting downlink between 435.800 and 435.900MHz. The beacon for this transponder is on 435.795MHz (CW telemetry at 12 WPM).

Since both FO-20 and FO-29 use the same frequencies, you can tell the difference between CW telemetry because the formats are different; JAS-2 has more channels (6x4) instead of 5x4 used for the JAS-1 series, and JAS-2 uses hexadecimal numbers whereas JAS-1 just uses numerics. Here is the format for JAS-2;

HI 1A 1B 1C 1D  
2A 2B 2C 2D  
3A 3B 3C 3D  
4A 4B 4C 4D  
5A 5B 5C 5D  
6A 6B 6C 6D HI

AMSAT-UK send congratulations to our Japanese colleagues.

## Oscar 10

As usual, it's currently available in mode-B when in view but *please do not* attempt to use it if you hear the beacon or the transponder signals FMing. Generally it seems to close down whenever it goes out of sunlight. Since AO-10's battery is totally non-functional, eclipses are associated with instant loss of power. If you hear AO-10's

beacon tone, it's not in the dark (eclipsed). The high solar angle power loss apparently happening now, comes and goes much more gradually.

The rotation rate of AO-10 is currently a guess but it has been suggested that it's very slow, on the order of 1-2 RPM. If anyone can gather good RPM estimates when the signal returns, based on the spin fade, please let either myself or any other AMSAT-UK official know. At these slow RPM's the gyroscopic stability is quite weak, making AO-10 more susceptible to minute attitude altering forces so the sleep periods, currently in Feb-March and Aug-Sept, may vary with time as the attitude slowly varies.

## Russian Satellites

The 70cm FM voice repeater operating on the Russian space station Mir is now open for general use. The repeater operates with an input frequency of 435.750MHz and requires a CTCSS tone of 141.3Hz for access. The repeater output is on a frequency of 437.950MHz, and the callsign is RR0DL.

The SAFEX voice recorder beacon may be in operation from time to time using a downlink frequency of 437.925MHz.

Doppler compensation is said to be required on both the uplink and downlink. (+/- 10kHz). The uplink Doppler is opposite from the downlink Doppler. You simply see what you're adjusting on the receive side, and correct the transmit side in the opposite direction.

Finally, contacts with the Mir crew themselves appear to be still happening on 145.550MHz.

## Micro/Digital Satellites

The upload problems that were experienced on UO-22 over the past few months have now been resolved. The reason for this problem was in fact a 'bug' in the spacecraft software, that didn't actually cause any problem until the type 18 files started to be used by the majority of SatGates.

Hopefully UO-22 operations are now back to normal. It seems that the gateway type 18 files are reducing the number of directory entries, which means that stations spend less time updating the directory and also files will last longer on the

spacecraft. This may allow a few more images to be targeted from this spacecraft.

## Phase 3D Flight

The big news at the Colloquium was the fact that P3D is almost certain to fly on Ariane-502 unless we get bounced by a commercial customer; this is thought unlikely. The flight could happen as early as mid-February 1997 but the official time-line says "in the first half of the year."

## Digital links

Recently U5MIR (currently the Deputy Chief of Russian space flights) and RV3DR (Manager of the Russian space amateur radio program) were able to have a long talk about future amateur experiments in space, particularly relating to digital radio networking; UA3CR and RA3APW also sat in on the discussion.

The possibility of marrying the existing PACSAT protocols and hardware with amateur TCP/IP networking protocols was brought up. It was suggested that if this combination were put into place on the orbiter and also at amateur Internet/satellite gateways around the world, perhaps one in each time zone, it could be possible to maintain full-time IP connectivity with the orbiting Mir. In addition to offering continuous IP access to Mir from anywhere in the amateur world, such an experiment might be useful for discovering and developing necessary protocols for mobile IP operation; an area where amateurs might have considerable interest and one where we may be able to contribute significantly to the state of the art.

## Satellite software

WA2N has changed SatSked's 2-line checksum calculations to handle "+" signs. The new algorithm essentially ignores them.

Later, the new software should also be available via the [amsat.org](http://amsat.org) Internet server; alternately go to WA2N's home page ([www.applink.net/wroth](http://www.applink.net/wroth)) and get 1.966.

An updated version of the Windows 3.1 MSGMAKER has

also been made available on the AMSAT ftp site as file

MSGMKR12.ZIP. You can find it at [ftp.amsat.org](http://ftp.amsat.org) in the [amsat/software/windows/wisp](http://amsat/software/windows/wisp) directory. This file is version 1.20 and it was issued to correct a problem that was found associated with all previous Windows 3.1 versions of WISP in which it could be possible (in some cases) to overwrite memory in the WISP directory. Again, this exists in previous Windows 3.1 versions of MSGMAKER. All users are encouraged to upgrade to this version as soon as possible. Note this information is just for the Windows 3.1 version of MSGMAKER, not the Windows 95 version!

## AMSAT-UK news

This year's AMSAT-UK Colloquium at the University of Surrey was attended by 92 people; 18 countries from five continents were represented. During the meeting, the RSGB presented a further donation (about £11,000) to AMSAT-UK's Phase-3D funds. We hope to see you at next year's event which will (very likely) be 24th to 27th July.

For further information about AMSAT-UK contact: AMSAT-UK, c/o Ron Broadbent MBE,

G3AAJ, 94 Herongate Rd, London, E12 5EQ. A large SAE gets you membership info. SWL's are welcome. All new joiners get the USAT-P tracking program on 5-1/4in disk.

## Latest Keplers

AMSAT-UK Keplers are put out on packet weekly. The latest satellite Keplers as supplied by



AMSAT-UK are also available by automatic fax retrieval from the 24hr Ham Radio Today fax-back line, 01703 263429 (use with a personal DTMF, i.e. 'touch-tone', phone/fax keypad - follow the voice menu), request fax document 90 from the satellite voice menu for this month's.



For further information about AMSAT-UK, go and have a chat with them, they have stands at many rallies

## JAS-2 Digital frequencies:

Uplink (MHz)	Downlink (MHz)	Mode
145.850 )		
145.890 )	435.910	1200 baud PSK
145.910 )		
145.870	435.910	9600 baud FMFSK