YOUR ESSENTIAL GUIDE TO THE WORLD OF SCANNING

Scan'98

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Discone & Log Periodic Construction Details

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A SHORT WAVE MAGAZINE PUBLICATION

Introduction

Hello and welcome to the world of scanners and scanning. We, here at *Short Wave Magazine*, have produced this booklet for both newcomers and old hands alike. Hopefully there is something within its pages for all of you. Unfortunately it is beyond the scope of such a small booklet to explain all the 'ins and outs' of a subject so vast as scanning. This short introduction, however makes an attempt to answer some of the most fundamental questions.

There are books dedicated to the subject and these include frequency guides, explanations of radio communication systems in general, and specifics related to monitoring specific services. What I intend to do here is to provide a starting point. By using the increasingly popular format of the FAQ (frequently asked questions), I hope to enable you to quickly get an idea as to what the hobby of scanning is all about.

Also included in this guide is a digest of past reviews of current scanners, both hand-held and base station.

For those of you who like to experiment there are two classical scanning antennas. The ubiquitous discone for non-directional listening and a log periodic beam for directional use. Both of these antennas are much cheaper than their commercial alternatives and should give the brave amongst you hours of 'playing' and learning.

Scan 98 FAQ
Is Scanning Legal?

You can legally buy and own a scanner. You can use it to listen to broadcasts from the world's many broadcasters, both radio and TV - though you won't see a picture. You may legally listen to radio amateurs in conversation with each other around the world on a variety of bands ranging from long waves to microwaves.For most of the population - that's it! Generally speaking everything else is illegal including listening to CBers doing their thing, too.

The actual position in law is something like this. You may not listen to any service or part of the spectrum unless you possess a licence to do so. The DTI have a leaflet, *RA169*, which explains. This document in turn refers you to the *Wireless Telegraphy Act* section 5(b). It is this somewhat aged act that governs the monitoring and interception of radio signal and traffic in the UK. The is another act of Parliament the *Interception of Telecommunications Act*, that also governs radio interception and this relates specifically to Cellular Telephones.

So, it all looks pretty grim for *SWM* readers and scanner owners. This need not be the case. The key to this hobby is discretion. If you don't tell anyone what you've picked-up, then no-one will know! So using your scanner discretely and wisely allows you to gain maximum enjoyment and return on your investment in the latest radio.

It is also worth noting that, technically speaking, sharing information

In basic terms a (radio) scanner is a self-contained, computer controlled radio. They come in two basic types, hand-held and base station.

Technically speaking, sharing information with others can be considered as incitement to commit an offence. So the utmost care is required with this hobby.

with others can be considered as incitement to commit an offence. So the utmost care is required with this particular hobby.

I will observe however that those who would bring a prosecution about have far better things to do than hunting down casual users of scanners and other monitoring equipment.

If, on the other hand, your interest in interception is somewhat more sinister and you wish to turn anything you may hear into personal gain, then watch out!

So, everybody with an interest in radio monitoring, please take this advice - be careful.

What Is A Scanner?

In basic terms a (radio) scanner is a self-contained, computer controlled radio. They come in two basic types, hand-held and base station.

What Frequency Coverage Do I Need?

Well that depends on what you want to listen to. If, say, you know for sure that you only ever want listen to civil airlines in the UK and an airport just down the road from your home, then you will only need a receiver that covers a limited chunk of the whole spectrum. Specifically 108 - 137MHz. You will only need a receiver with an a.m. detector as this is the mode used by aircraft and ground stations.

All well and good then! Just so long as you **know** that you won't ever get tempted or interested by anything else - can you be sure?

My own opinion is that, if you are a raw beginner, then acquire, as cheap, as possible, a set that will cover your primary and initial area of interest. Use this set to develop you knowledge and skill. You will then be in a position to make a much more informed judgement as to what parts of the spectrum hold your interest. Don't forget to keep your eye on the 'Trading Post' in *SWM* and 'Bargain Basement' in *Practical Wireless* for those cheap starter scanners. You'll be amazed at how cheaply you can get going.

What Does Search Mode Do?

On most recent scanners, the user is provided with the ability to manually tune the radio to a directly entered (via the keyboard) frequency. This is useful if you want only to monitor one frequency. Most of these sets also allow you to tune up and down in frequency by a selectable step size. Such as 5, 10, 12.5, 25kHz and so on.

The Search facility provided by these radios is an extension of this feature, which allows you to define a lower and upper frequency limit and set the scanner automatically stepping between these boundaries. Usually you are able to set the scanner running up or down (incrementing or decrementing the current frequency value by the step size) once the other limit is reached the whole process starts again.

If a signal is received (or rather present on one of the stepped frequencies when that frequency is selected) during the Search sequence and it is strong enough to 'break' the squelch then the scanner will stop its sequencing. This may be momentarily or until the user instigates the search to be continued or until the signal disappears - this is radio and setting dependant.

It is common to use search mode to identify frequencies of interest for subsequent programming of the receiver's Scan memories.

Isn't That Scan Mode?

Scan mode differs some what from Search mode.

Originally, in the dim and distant past, scanners were rather more simple that the radios that they have now evolved into. Early scanners consisted of a few, ten or so, memory

locations into which frequencies could be programmed. There was no direct entry without actually programming a memory location. These scanners would only, in fact, cycle around their bank of memories. This is just what scan mode on the latest types does too. These days, the user is able to select one or more of the many banks of memories provided by the latest radios, 1000 memories is nominal, and set the scanner running through. With each step the content of each memory is loaded into the synthesiser (the part of the scanner used to control the frequency being monitored) and for a preset time the scanner stays on that channel then moving on to the next and the next and so on. If a signal is present then it will be heard, just so long as it can 'break' the squelch.

Unlike older radios, today's sets allow a whole host of parameters other than frequency to be programmed into the memory locations, this such as bandwidth, mode, descriptive text on more expensive (£1000+) sets a.f.c., to name but a few.

Since modern scanners have many - typically ten - banks it is possible on some models to enable two, all or somewhere in between, of the banks for a scan session. This is a useful feature as it allows you to plan groups of frequencies around certain banks. For instance, you might have all the local ground-to-air frequencies in one bank and the coast guard frequencies in another. If you happened to want to listen exclusively to these two types of transmission, then you could select the two specific banks only.

What Can I Listen To?

In theory, if a service is using radio communication within the spectrum covered by your receiver, then you will be able to **detect** it. Just so long as you are 'in range'. Quite a sweeping statement, and there are a lot of qualifiers and exceptions - as you might expect. Once you've excluded all the special cases, which takes us back to the scope of this booklet and not having the room for all the details, then that still leaves a very large array of transmission that you can both detect and resolve - actually listen to.

A quick look though the *UK Scanning Directory* - see the rear of this guide for details - will show you the full extent of what's out there. But to summarise the types of transmission that don't need more than just a scanner and some (lots) patience.

It is worth pointing out at this stage, that signals that are generally of interest to scanner users are both v.h.f./u.h.f. that is above 30MHz in frequency and are relatively low powered. They also tend to utilise omnidirectional antenna systems, (not beams). These factors conspire, especially when the listener uses a set-top antenna, like the one supplied with your scanner, to limit the range of usable signals to about 12-16km.

This is a rule of thumb, but to better it requires work on your antenna system. Both v.h.f. and u.h.f. signals can be considered as 'line-of-sight' only. This is not strictly true, and there are various modes of propagation that increase range, but for now we will consider it to be the case.

Okay, ground rules set, what traffic is it **possible** to listen to? Aircraft, civil and military, airports tower, radar, ground crews, taxies, outside broadcasts, radio microphones, security guards, emergency services, breakdown services, delivery services, satellite up/down links, military exercises, air cadets, Search And Rescue operations, motor sport events, large industrial site communications to name but a small selection. The fun is finding things in your area.

Please don't forget to enjoy this hobby to the full discretion is the key.

Now read on and enjoy. 73 (best wishes)

Kevin Nice G7TZC BRS95787
Editor *Short Wave Magazine*

Search And Rescue operations, motor sport events, large industrial site communications to name but a small selection. The fun is finding things in your area.

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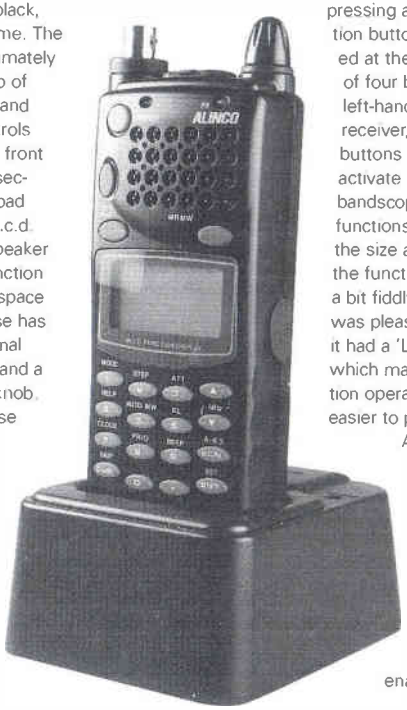
Alinco DJ-X10 Wide Band Communications Receiver

Alan Gardener has been putting the new Alinco DJ-X10 Wide Band Communications Receiver through its paces.

Alinco is not usually one of the first names to spring to mind when enthusiasts discuss scanning receivers. However, they have been around for some time now, and although their previous offerings have not sold in particularly large volumes, things may change with the introduction of the DJ-X10.

It's Got The Looks

The styling of the unit is different from the usual offerings, with its black, orange and gold colour scheme. The outer case measures approximately 60 x 150 x 30mm with a strip of four rubber function buttons and the volume and squelch controls down the left hand side. The front facia is split into three main sections with the numerical keypad occupying the bottom third, l.c.d. display the middle and the speaker grill, power and additional function buttons filling the remaining space at the top. The top of the case has a BNC antenna socket, external speaker and 'Clone' sockets and a multi-function rotary control knob. The right hand side of the case has a socket for external power, whilst the rear of the case features a battery pack release catch and belt clip fixings. The supplied NiCad battery pack forms part of the case and is very securely held in place by a latching mechanism. It has external charging connections and fits very neatly into a special desk mounting charger unit, which is supplied with the receiver. I liked this idea, but I would have preferred it if the scanner had been positioned at a slight angle to make the display more readable and the bottom row of keypad buttons more accessible.



Second Functions

As with all hand-held scanners most buttons have second or third uses, which are enabled by pressing a separate function button. This is located at the top of the strip of four buttons on the left-hand edge of the receiver, the other three buttons being used to activate the monitor, bandscope and backlight functions. In use I found the size and location of the function button to be a bit fiddly, although I was pleased to find that it had a 'Latching' action which made second function operations that bit easier to perform.

Another slight criticism was the liberal distribution of controls around the edge of the loudspeaker grill. These are used to enable the scan

"I would have preferred the greater level of prominence to have been reserved for other controls such as the function button."

programming, v.f.o., and memory modes. I found the location of these buttons a bit confusing and would have preferred the greater level of prominence to have been reserved for other controls such as the function button. I also found cancelling some of the modes of operation a bit confusing. For example, one type of search could be cancelled by pressing the same button, whilst another required the v.f.o. button to be pressed. I guess that, in some respects, this criticism is just down to personal taste.

Main Features

The DJ-X10 has all the features you would expect from a radio in this price range, including frequency coverage from 100kHz to 2GHz, reception of a.m, n.b.f.m, w.b.f.m, u.s.b, l.s.b. and c.w., Preset tuning step sizes of 50Hz, 100Hz, 1, 2, 5, 6.25, 9, 10, 12.5, 15, 20, 25, 30, 50, 100, 125, 150, 200, 250 & 500kHz, Beginner mode, Help menu, Auto Bandplan mode and step size adjustment, On/Off Auto Timer, Clock, Key Lock, Priority Watch and Attenuator. A couple of points to note are that the 8.33kHz step size recently proposed for aircraft communications is not included and my attempts to offset 25kHz channel spacings by 12.5kHz were strongly resisted.

A nice touch is the inclusion of a 'help' menu. This is intended to give a useful reminder of how to enable certain functions, which should be of particular interest to new owners.

Memories

The DJ-X10 has 1200 memory channels arranged in three sets of ten banks with 40 channels in each bank - additionally each memory is capable of being alphanumerically tagged with a description of up to eight characters. Scanning modes include: 'Memory Scan', 'Programmed Memory Scan', 'Selected Mode Scan' and 'VFO Scan' as well as the more usual search facility for locating new frequencies complete with auto-memory write function. The auto-memory write function worked well with lots of local signals being automatically stored in one of the memory banks. All the usual memory functions are present, with the ability to 'link' or 'lock-out' various permutations. A number of special 'set' menus are used to enter, edit and copy memory contents. I found it took a bit of time to initially get used to some of these menus. However, after a while it became almost second nature and I soon found that I could quickly manipulate memory contents. The number of memory locations available to the user can make the maintenance of contents difficult, especially if you need to reload all of them from scratch, perhaps after pressing the reset button. This is where a computer interface can come in handy, and although the user guide makes reference to a 'clone' function, I was not able to obtain any further information about its facilities or any ability to interface the radio to a PC. (*Nevada have informed us that Alinco are currently working on a PC program for this scanner and expect to have it ready in the near future.* ***Ed.***)

Display

The liquid crystal display shows a lot of information, including frequency, channel number, mode, volume and squelch levels as well as providing a bandscope facility which allows you to 'see' activity upto 40 channels away from the received frequency. Unfortunately the amount of space available to each of these functions is a little bit limited and when added to the rather restricted viewing angle of the display it does make reading some of the information difficult. This is made worse by the fact that Alinco have only chosen to make the display contrast adjustment operate only in the 'Demo Mode'. This can be very frustrating. (*Nevada have pointed out that the contrast can be set and stored to the operator's personal preference. Although the display is typical of an l.c.d., they have noticed that artificial lighting can cause glare due to reflection from the display front. Rotating the set slightly so that the light doesn't hit the display at right angles can help.* ***Ed.***)

Unlike some other hand-

helds the bandscope cannot operate continuously whilst you are listening to a signal. The best compromise I found was to use the interval mode where the bandscope is updated about once every 10 seconds during which time the receive audio is muted. By fiddling with the bandscope set-up it is also possible to improve the horizontal scale resolution, which can make a big improvement to the usefulness of the display. The range of the bandscope can be toggled between a narrow range of seven channels or a wider range of 40 channels. Watching signals appear and scroll across the screen when the bandscope was used in conjunction with the search function was very entertaining, and by using the combinations of functions it was possible to jump quickly to active frequencies on channels adjacent to the current receive frequency.

The search functions available were well thought out and I particularly like the ability to quickly set-up a search within a pre-set range by setting the upper and lower limits on the twin v.f.o.

Where Are The Knobs?

One of the features I liked the most was the lack of the rotary volume and squelch controls. Alinco have chosen to replace these with two electronic 'Rocker' switches located on, but inset from, the left hand side panel. The volume and squelch settings are changed by pressing the appropriate edge of the 'Rocker' switches which vary the levels as indicated on the l.c.d. display.

The volume control worked very well but I would have preferred to have been able to make a slightly finer adjustment to the squelch settings. This was not quite as big a problem as it could have been due to another nice feature. As with most hand-held scanning receivers the DJ-X10 has a monitor button. When this is pressed the squelch is disabled so that weak signals can be monitored more easily. Now anyone who has used a scanner for short wave reception will know that you have to disable the squelch when listening to weak s.s.b. transmissions, normally by turning the squelch control fully off. With the DJ-X10 you can press the function key and then the monitor button to disable the squelch. Pressing the monitor button again restores normal operation. This is a great time saver and I just wish that my current hand-held had this facility.

How Well Does It Work?

In practice the receive sensitivity with the supplied antenna was adequate, with all the usual airband and amateur signals being audible. I did notice a slight problem with the coarseness of the squelch setting, but this could be improved by using the monitor function when listening to weak signals that would otherwise have caused the squelch to 'chop'. Performance on the short wave bands was good with several broadcast stations being clearly audible using just the supplied antenna. Connecting a few metres of wire to the antenna socket made a big improvement, with many amateur s.s.b. stations being received. The 50Hz tuning step size made the fine resolution of speech reasonably easy, but may still be too coarse for the reception of certain types of data signals.

Summary

I was presently surprised by the DJ-X10. Its styling is good, it feels nice to handle and the performance is comparable to that of similar models in the price range. I felt that the only real problem was associated with the small size of l.c.d. display and its limited viewing angle. This factor aside the DJ-X10 is worth taking a look at if you are considering buying a new hand-held scanner.

Nevada Communications, 189 London Road, North End, Portsmouth PO2 9AE. Tel: (01705) 662145. FAX: (01705) 690626 provided the review model. The DJ-X10E costs £295.

Original review published in SWM September 1996

"Connecting a few metres of wire to the antenna socket made a big improvement, with many amateur s.s.b. stations being received."

AOR AR500
All Mode

Alan Gardener reflects that it seems that new receivers are a bit like buses, you wait a long time for a manufacturer to produce a new design, and when they do, two or three tend to come along at once. AOR are proving the theory - first there was the AR7030 h.f. receiver, now it's the turn of their flagship, the AR5000.

It was about a month after I had bought my original AR3000 that I first heard whispers about a new higher specification model being developed. But it is only now, several years later, that the AR5000 has appeared - with very wide frequency coverage, all mode reception, extensive Search and Scan facilities, 1000 memory channels, RS-232 computer control port, and - yes, you've guessed it - I was very keen to try one.

First Impressions

The first thing that struck me was the size and weight of the unit. The basic cabinet measures approximately 217 x 260 x 85mm with the feet and loudspeaker port extending the height by a further 40mm. The weight is in the region of 3.5kg, which combined with the metal case gives the unit a professional 'feel' and stops it sliding across the table as soon as you touch the tuning dial.

The front panel has all the usual controls you would expect but is dominated by the large liquid crystal main display, mechanical 'S-meter' and tuning knob. The display is illuminated with a soft green back light which makes the l.c.d. look very attractive, but unfortunately it doesn't do much for the red portion of the 'S-meter' scale and pointer.

The rear panel has two antenna ports, a 10.7MHz i.f. output, 10MHz external frequency reference input, remote RS-232 connector, mute control socket, external speaker jack, accessory connector and a d.c. input socket used to power the unit from the external 12V power unit provided or from a 13.5V car supply.

Wide Coverage

The frequency range of the receiver is specified as being from 5kHz (yes five kilohertz) to 2.6GHz. This is an amazing span and unlike most other wide band receivers it uses separate Varicap tuned r.f. stages to provide vital front end pre-selection for a large part of this range. This is particularly important in conjunction with a good dynamic range and a low noise synthesised local oscillator in order to minimise unwanted intermodulation products.

RF Performance

In practice, the AR5000 does seem to be fairly resistant to intermodulation problems. The third order intercept point at 100kHz signal spacing was found to be good for a v.h.f./u.h.f. receiver. I achieved significantly better figures at around 6-10MHz with the pre-amp switched off. This gave good performance during the evening on the 40m amateur band where other receivers I have used in the past have suffered from the very strong broadcast band signals on adjacent frequencies. Receive sensitivity was very good and remained fairly constant throughout.

Listening on short wave was a pleasure and the smooth tuning offered by the 1Hz step size and the Numerically Controlled Oscillator made it seem as if a conventional analogue v.f.o. was being used (without the frequency drift normally associated with such designs). As an indication of the receiver's frequency stability I tuned to BBC Radio 4 on 198kHz and by selecting u.s.b. produced a very slow beat signal that remained constant over several hours. Tuning around the 5-100kHz frequency range I was surprised at just how many signals were audible. In fact this proved to be more of an eye opener than the v.h.f./u.h.f. range. The only features I missed compared to my dedicated h.f. receiver were the pass-band tuning, i.f. notch filter and noise blanker. The latter would have been particularly useful for mobile operation.

(The later AR5000+3 features a noise blanker in addition on synchronous a.m. and a.f.c.)

o Wideband Receiver

Manual Operation

The main tuning dial step size is selectable from 1Hz to 999.999999kHz, which makes it very easy to set a suitable tuning rate for the current mode of operation. Five different v.f.o.s are available, all of which can be personalised, making it easy to swap between h.f. and v.h.f./u.h.f. operation. The small rotary sub-dial, which has 'click' positions, can also be used in conjunction with the main tuning dial. I found it particularly useful to set this to tune at normal channel spacing on v.h.f./u.h.f. and the main dial to tune in-between. I would like to have been able to programme the sub-dial step size directly but it is currently only possible to use either pre-defined step sizes or 10 times the main dial rate. To prevent the receiver being inadvertently knocked off frequency during operation a small lever is provided to increase the amount of friction on the main tuning dial.

Six different i.f. filter bandwidths of 220, 110, 30, 15, 6 & 3kHz are provided as standard (500Hz for c.w. is an extra option). These can be either manually or automatically selected depending on the mode in use. I found this very useful, especially on the v.h.f./u.h.f. ranges where the 6 or 15kHz filters accommodated 12.5 or 25kHz channel spacing, the 110kHz filter allowed me to listen to f.m. broadcast stations tucked between stronger local ones and the 30kHz filter was almost ideal for weather satellites, although some form of a.f.c. would have put 'icing on the cake' as far as orbiting satellites were concerned.

(The later AR5000+3 features a.f.c. in addition on synchronous a.m. and a noise blanker)

Too Many Second Functions?

Unfortunately one of the main problems associated with complex equipment and small control panels is the need for second function keys and sub-menus. It would be ideal if every function had a separate control knob or key, but in the case of the AR5000 this would quite easily run into more than a hundred or so. Obviously the manufacturer has to compromise somewhere along the line but it is nice from an operational point of view if all the main functions are immediately accessible rather than via a series of different button presses.

The most serious gripe about the operating system on the review AR5000 was the method of manual mode selection. A separate mode button is provided and one quick press puts the receiver into automatic mode selection. When this is in operation the exact mode is determined by an internally stored bandplan which resets the mode, tuning step size and i.f. filter bandwidth as the dial frequency changes. In order to manually change just the mode you have to press the mode button and hold it in for longer than a second. This brings up a sub-menu on the l.c.d. display which you scroll though by means of the rotary dial or Up/Down keys. The correct mode is then con-

Continued on page 13...

Comment

(A few of Alan's 'niggles' have been addressed in production units and a new version, the AR5000+3 is now available in addition to the standard unit. The '+3' version features a.f.c., synchronous a.m. and a noise blanker. The price is marginally higher than the standard unit.

All sets now feature EEPROM Bank switching, which effectively provides two data maps in one set, resulting in 20000 memory channels, 20 scan banks, 10 v.f.o.s and 40 search banks!

an optional 4-way automatic antenna switch is also available. ***RH AOR****).*

The Skeleton D

Ray Fautley G3ASG 'comes clean' and describes the skeleton that he's been hiding away for a long time. Here he shows you how to calculate the dimensions involved.

The Skeleton Antenna gets its name because it's just the 'bare bones' of a complete discone antenna. A discone antenna is essentially a horizontal disc mounted vertically above the apex of a cone as in Fig. 1. This vertically polarised antenna has proved to be very effective for use with v.h.f. and u.h.f. scanning receivers due to its broadband and omnidirectional characteristics, together with peak performance at a very low angle to the horizontal.

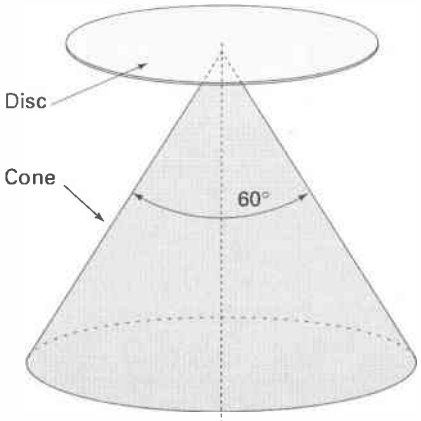


Fig. 1: The 'standard' discone antenna is, as its name suggests, made up from a disc element and a cone element.

To what extent could the antenna be 'skeletonised' whilst still retaining its desirable characteristics? What compromises would be acceptable? My own experience of the discone type of antenna was to design a suitable u.h.f. antenna for military use. The minimum number of elements that could be used to represent the disc and the cone, whilst retaining the required specification bandwidth, was found to be four for each part.

The 'disc' elements are essentially just two strips (or wires for the lower frequency versions) of twice the design dimension D, soldered together at their centres at right angles to each other. Further, it was found that each disc element D should be mounted vertically above each sloping cone element L, spaced by dimension S (at the apex). The last dimension necessary for the design of the antenna was the angle between the legs. This was found to be 40° to give near horizontal radiation and provide a feed-point of 50Ω.

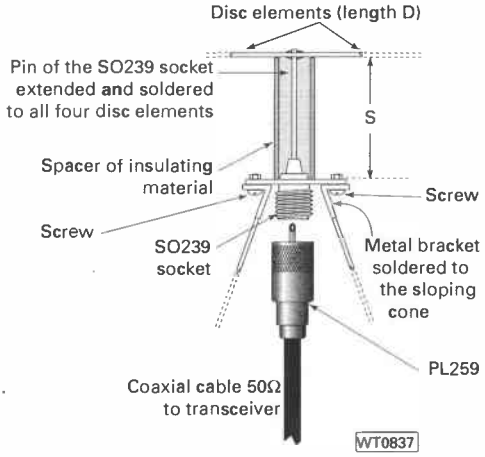


Fig. 2: A more detailed view of the feedpoint of the skeleton discone antenna.

Resulting Design

The resulting design gave a useful bandwidth of up to 25% above the lowest useful frequency. More simply, if the lowest usable frequency was f(MHz) then the antenna could be used successfully up to 1.25 x f. It had to be fairly rugged but light in weight and very easy to transport. My first thought had been to use metal rods or tubes, but these would necessarily have to be made into a suitable flat pack for carrying about. This requirement would mean that the elements would have to be screwed together to assemble and

iscone Antenna

then unscrewed each time to repack - a bit time consuming.

Further thoughts lead me to utilise the type of metal strip used in manufacturing flexible steel rules. By using several strips riveted together for the first part of the sloping sides at the top of the cone, one less for the next part and so on, more strength was added to the weakest part at the top of the cone. This is where high winds would produce most leverage and consequently, metal fatigue.

The skeleton disc mounted above the cone consisted of strips of the same material, riveted together in a similar way. A conical plastics moulding contained the ends of the sloping sides and the disc parts, separated by the necessary spacing. Due to the flexibility of the strips, all the elements could be folded downwards from the moulded cone and inserted into a soft plastics pocket for transport.

As this antenna is a reciprocal device (useful for both receiving and transmitting) it should be very attractive to amateurs with an interest in h.f. DX because of its low radiation angle. Of course, a full discone at these frequencies would be ridiculously large and very heavy, but a skeleton version becomes much more of a possibility as wires could be used instead of solid metal sheets!

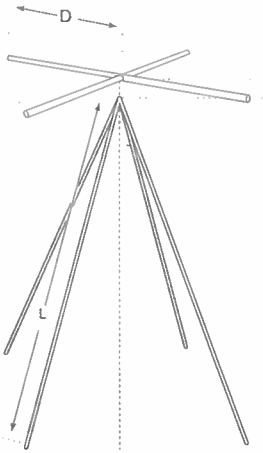


Fig. 3: The skeleton discone antenna is slightly different, in that the apex angle is less, and the top elements are larger than the equivalent discone elements.

Desirable Feature

Solid versions of discone antennas have the very desirable feature of operating over several octaves above a lowest frequency, which depends upon the dimensions of the disc and the cone sides. If we restrict operation to a single amateur band, the skeletonised version becomes practical because, although its bandwidth is no longer several octaves, it is still 25% of the design frequency.

For example an antenna designed for the 14MHz band would have a bandwidth of some 3.5MHz with a standing wave ratio (s.w.r.) not exceeding about 1.5:1 for an optimum terminal resistance of 50Ω . This means that it would be usable from 14MHz to about 17.5MHz. As the antenna is unbalanced with regard to earth it is suitable for direct connection of 50Ω coaxial cable. The coaxial cable inner wire is connected to the four skeleton disc elements and the cable outer screen to the four skeleton cone elements as shown in **Fig. 2**.

How do we go about designing these skeleton antennas? Well, the only thing to think about is 'what is the lowest frequency that I want the antenna to work at?' This lowest frequency will determine the dimensions of the antenna elements.The dimen-

"As this antenna is a reciprocal device, it should be very attractive to amateurs with an interest in h.f. DX because of its low radiation angle."

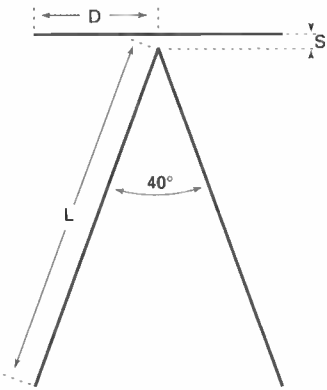
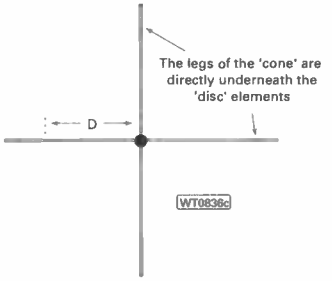


Fig. 4: The skeleton discone antenna viewed in the side (a), and from above (b), for clarity.

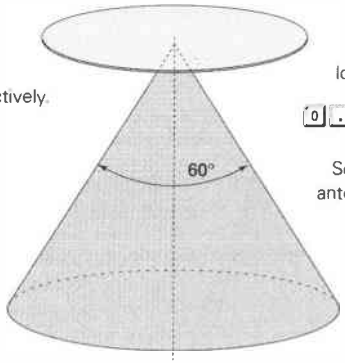


The Skeleton Discone Antenna

"The useful bandwidth of the antenna will be from 144 to 180 MHz."

***This article was originally published in the March 1998* Antennas in Action *section of* Practical Wireless.**

sions are shown in side and top views of **Fig. 3** and **Fig. 4** respectively.



Design Procedure

Now let's have a look at the design procedure. First you must decide the lowest frequency of operation (f_{min}).for the antenna. From which, the design frequency, f_D is obtained via the formula:

$f_D = 0.8 \times f_{min}$

where both f_{min} and f_D are both measured in MHz.

Next, calculate the length of the sloping sides (of the cone) L measured in metres via the equation:

$L\ (m) = 75 \div f_D$.

$$S = \frac{L^{0.75}}{27}$$

The length of the horizontal elements D, also measured in metres, may be calculated now (this is also the diameter of a full disc) using the formula:

$D(m) = 0.85 \times L$.

The last dimension we need to calculate is the spacing between the horizontal elements and the apex of the sloping sides, S, again measured in metres from the equation:

When constructing the antenna, the angle between the sloping sides and a vertical from the centre of the horizontal elements should be 20°. So the angle between any two sloping sides (the cone angle - *Ed.*) will be 40°. The effective upper frequency f_{max}, of the antenna will be:

$f_{max}=1.25 \times f_{min}$

So, the effective bandwidth is from f_{min} to f_{max}.

Worked Example

Let's look at a design for use in the 144MHz (2m) amateur band which is 144 to 146MHz. The design frequency f_D for an f_{min} of 144MHz is:

$f_D = 0.8 \times f_{min} = 0.8 \times 144$ (MHz)

On the calculator this would look like:

0 . 8 × 1 4 4 - *115.2*

So the design frequency of the antenna is 115.2MHz

Next find the length of the sloping legs L:

where

$L(m) = 75 \div f_D$.

On the calculator we have

7 5 ÷ 1 1 5 . 2 - *0.6510416*

The legs will each be 0.651m (651mm) long. Now calculate the length of each horizontal element D:

$D = 0.85 \times 0.651$

On the calculator

0 . 8 5 × 0 . 6 5 1 - *0.55335*

So each horizontal will be 0.553m (533mm) long.

The final calculation will be to find the spacing S in metres.

$$S = \frac{(0.651)^{0.75}}{27} = \frac{0.724745857}{27}$$

On the calculator the keystrokes are:

0 . 6 5 1 x^y 0 . 7 5 - ÷ 2 7 -

0.026842439

The spacing S will be 0.0268 metres (27mm) The maximum useable frequency will be:

$f_{max} = 1.25 \times F_{min}$

On the calculator we have:

1 . 2 5 × 1 4 4 - *180*

The useful bandwidth of the antenna will be from 144 to 180MHz. If this antenna is made from 6mm diameter rod or tube, preferably copper which has been painted to prevent oxidation, it should be a self-supporting structure.

AOR AR5000 Wideband All Mode Receiver

FROM PAGE 9

firmed by pressing the Enter key.

I would have preferred to be able to quickly press the mode button and toggle through to the next mode on each press rather than having to mess about with three separate buttons. A long press on the mode button would select the automatic mode.

The current method of operation is particularly frustrating because if you accidentally select the automatic mode it also resets the i.f. bandwidth and Step size, each of which takes two or three button presses to restore to the previous value.

(The later production units from about 1996/97 featured this change and select auto mode by pressing and holding the key, a quick press allowing manual selection.)

Special Facilities

Okay, that's the moan over - now on to some of the better bits hidden amongst the sub-menus. One unusual feature is the DTMF display function, this allows the receiver to decode DTMF tone signals and display them as a series of digits. A CTCSS decode function is also available as an option. *(So is the voice inverter).*

Another unusual facility is the 'Tone' eliminator. This allows the squelch circuit to ignore signals with constant frequency tones on them. The frequency range is tuneable from 400Hz to 4.4kHz and rumour has it that it was included to prevent the search or scan functions stopping on trunk signalling channels used on Japanese railway systems. One use I found for it was to mute the audio on certain v.h.f. transmissions which carry supervisory signalling tones. It would have been nice if it could also have been used as an audio notch filter on the h.f. bands.

The audio bandwidth, pre-emphasis time constants and a.g.c. rate is also adjustable and I found that this made a big difference to the intelligibility of weak signals especially when using s.s.b. or c.w. In addition the squelch control can be set to operate as an r.f. gain control which also makes h.f. reception that bit more enjoyable.

The front-end r.f. pre-selector stages can be manually tuned using a sub-menu. I found that this didn't make much improvement to weak signals, as the automatic tuning always seemed to be spot on. However I did find a use for it on the 2m amateur band, where I could off-tune it in order make use of the r.f. band-pass characteristic to stop a very strong local packet station from blocking the receiver whilst listening to the output of a repeater. This proved to be much more effective than turning off the pre-amp or switching the attenuator on.

I was not able to try the RS-232 remote control option, but it does support 19200 baud rate, which should speed up any external computer controlled scanning functions.

(Various software packages are now available including Spectrum-Master from AOR, the RS-232 Protocol Book is provided as standard with the receiver.)

Search and Scan

Turning to some of the search and scan features I was interested to find that it was possible to link various search ranges by means of a separate sub-menu. This gave the option of setting up and storing up to 20 different sets of linked search bands and ten sets of memory scan banks, along with characteristics such as delay times, level and voice sensitive squelch operation and the automatic storage of active frequencies found during a search. This effectively allows the operator to set up different 'personalities' for the search and scan function - the only problem is remembering which one is in operation, as the display won't tell you. *(A group number is displayed on later production units).*

Contents of memories and search bands can be identified with short alpha-numeric titles of up to eight characters and this is a great memory jogger if you have a lot of channels programmed in. The search and scan speeds can be increased up to 45 channels per second by selecting the 'Cyber-Scan' option. This replaces the frequency display with the word 'Cyber Scan' whilst the search is running, and only displays the frequency or alpha-numeric title once an active frequency has been found. This can be a bit inconvenient if the search doesn't stop, as you are not really too sure what is happening. It would be nice to have the moving frequency display for reassurance that a search is running correctly.

Original Review published in SWM June 1996

Summary

I found the r.f. performance of the receiver to be very good, making it suitable for professional as well as top of the range hobbyist use. Any criticisms should be judged against the large number of facilities on offer, as I believe most people could think of at least one feature on their favourite piece of equipment that they would change given the opportunity.

I thought the way some of the controls and sub-menus operated were a bit inconsistent, and it took some time to get used to them. However I'm sure that if I could afford to buy an AR5000, I would be able to adjust my operating habits to suit.

The review model and additional technical support during the review period was provided by **AOR (UK) Ltd., 4E East Mill, Bridgefoot, Belper, Derbyshire DE56 2UA. Tel: (01773) 880788.**

Icom IC-R10

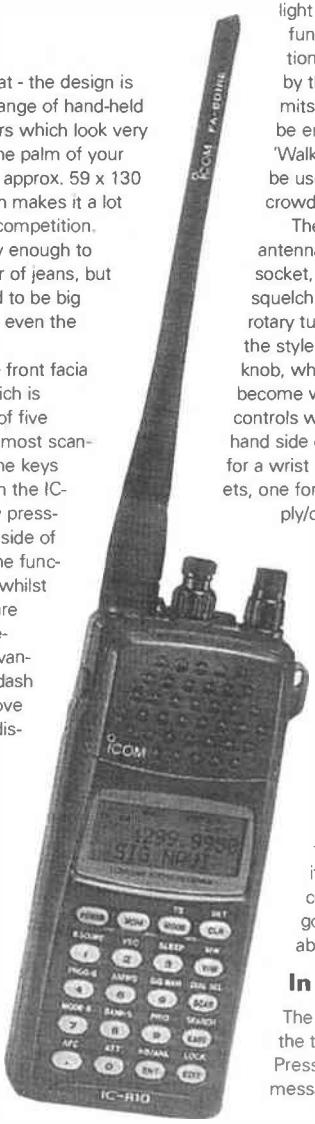
Alan Gardener just couldn't wait to get his paws on the potential replacement for his trusty IC-R1, did the new IC-R10 fit the bill? Read on to see how it faired.

I had been looking forward to reviewing the new Icom IC-R10 since it was first advertised, so when I received the 'phone call from SWM to tell me that they had been able to get hold of one, I was delighted.

Good Looking

Well the IC-R10 looks great - the design is based on Icom's current range of hand-held Amateur Radio transceivers which look very sturdy and fit nicely into the palm of your hand. The case measures approx. 59 x 130 x 32mm (w x h x d), which makes it a lot smaller than most of the competition. However it's not quite tiny enough to lose in the pocket of a pair of jeans, but it does allow the keyboard to be big enough to be operated by even the largest of fingers.

The bottom half of the front facia contains the keyboard which is arranged in four columns of five rows. As is the case with most scanning receivers, nearly all the keys have second functions. On the IC-R10 these are selected by pressing a key on the left hand side of the case. Unfortunately, the function key has to be held in whilst buttons on the keyboard are pressed, preventing single-handed operation, a disadvantage if you wish to use it dash mounted in a car. Just above the keyboard is the l.c.d. display, which has provision for up to two lines of alpha-numeric text as well as various symbols representing different operating modes and user options. An automatic backlight mode allows the display and keyboard to light for approximately two seconds each time a button is depressed or a signal received. This is a very handy facility, but it would have been even better if a photocell had been built in so that the light only operated when it was required. If you wish to preserve battery life I would recommend turning the backlight off using the 'Set' menu function. The remaining top section of the front panel is occupied by the loudspeaker, which permits a reasonable level of audio to be emitted, but a cheap pair of 'Walkman' style earphones would be useful during operation in crowded places.



The top of the case has a BNC antenna socket, 3.5mm earphone socket, concentric volume and squelch controls and a separate rotary tuning knob. I particularly liked the style and position of the tuning knob, which didn't cause my fingers to become wedged between the adjacent controls when I turned it. On the right hand side of the case there is provision for a wrist lanyard, and two further sockets, one for an external 12V power supply/charger and the other for a computer interface - thank goodness Icom have fitted one! Actually there are two (Clone and CI-V port) but more of that later.

At the rear of the case the battery compartment can be accessed by lifting off a panel which reveals four AA-sized NiCad cells. A small switch hidden between the cells allows you to turn off the charger circuit if you wish to substitute dry cells. Very handy if the NiCads go flat whilst you are out and about.

In Use

The power button is located in the top left of the keyboard. Pressing it brings up a 'welcome' message on the l.c.d. display.

The main features of the receiver are: All mode reception over the frequency range 500kHz to 1.300GHz; 1000 memories which can be individually alpha-numerically tagged; variable tuning step size; etc. So what's it like to use?

Search or Scan

Rather than differentiating between 'Search' (where the receiver automatically tunes between pre-defined frequency limits with a given step size) and 'Scan' (where the receiver tunes to specific pre-defined frequencies and modes stored in pre-set memory locations). Icom have chosen to call everything 'Scan'. The only difference being the way in which the various scan modes are initiated. The more observant will, by now, have spotted a button on the front panel marked 'Search' - so what is going on?

The 'Search' function allows the operator to perform an alpha-numeric text search of memory titles and contents - all very handy if you can't remember which one of the 1000 memories contains your local airport tower frequency. Memories and search bands can be edited and copied by use of a special 'Edit' button. To speed up the process you should consider the special cloning software and cable that Icom can supply. This plugs into the earphone socket and permits the contents of the memories to be edited and downloaded from a PC. You can also use the cloning facility to copy the entire receiver set-up to another IC-R10 if you wish, another nice touch.

Easy Operation

The IC-R10 also has an 'Easy' program button which I found confusing, as it appeared to operate in a similar manner to normal method of operation - but perhaps I'm just being a bit too critical. Memory banks are labelled A-Q, with bank R being used to store frequencies which are to be excluded from searches and Bank Q being used to store the contents of the 'Auto Memory Write' search function. This works really well, especially when used in conjunction with the 'VSC' or audio scan function which only stops a search or scan on signals with audio present. The 'Auto Memory Write' finds busy frequencies by searching through pre-defined frequency ranges and automatically writes active frequencies into memory.

Unlike some receivers which have similar facilities, Icom have made sure that frequencies only get written once into memory - so you don't end up with a local paging frequency in all of the 100 memory locations set aside for the function. A great time saver if you can't continuously monitor the airwaves. Even better if you own an Optoelectronics 'Scout' as you can plug it directly into the CI-V computer port. The CI-V interface is good news if you are interested in external control of the receiver, although it does require a simple interface unit if you want to connect it to a computer's RS-232 port.

Tuning Around

All of these facilities nearly compensate for the moderately slow search rate of approximately 17 channels per second, and the painfully slow scan rate of approximately 7 channels per second. A good range of tuning step sizes can be selected and in addition a user defined step size can also be programmed in increments of 100Hz up to a maximum of 999.99kHz. Unfortunately this does not permit the 8.33kHz step size being considered as the future standard for v.h.f. aircraft communications, although 6.25kHz steps are provided and frequencies offset by half channels can be entered. In some instances this can improve the tuning rate during frequency searches.

Noise And The Lack Of It

Another nice touch is that Icom have provided an Automatic Noise Blanker for use on a.m. signals and a Noise Blanker for use when u.s.b., l.s.b. or c.w. is selected. The ANL function worked very well and removed nearly all of the ignition interference on a.m. short wave broadcast signals when I tried using the receiver in my car. The NB function was much less successful and in some cases actually made the reception of s.s.b. signals worse. A lot seemed to depend on the type and level of interference present.

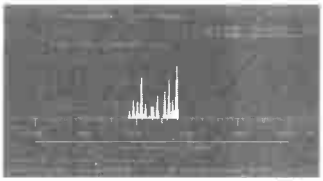
One other interesting feature was that the squelch control doubled up as an r.f. gain control when s.s.b. or c.w. was selected. I always found that I needed maximum r.f. gain, so the control knob had to be reset every time a.m., w.b.f.m. or n.b.f.m. signals were being received. I think in practice the attenuator function is more likely to be used than the variable gain control, especially if an external antenna is in use.

A Bit Wide

Listening to stations in busy segments of the radio spectrum presented a problem. The i.f. filter bandwidths of 15kHz (a.m. and n.b.f.m.)

"The ANL function worked very well and removed nearly all of the ignition interference on a.m. short wave broadcast signals when I tried using the receiver in my car."

At last, you can SEE what you are hearing!



Press F5 and walk into a new world

Decoding what you hear on your radio receiver has been a difficult - and expensive task. You could have chosen black boxes which work - but are limited in their coverage and can soon become near obsolete. You could go the software route, using excellent, but limited shareware programs. Which sometimes need a degree in computer science and the patience of Job to set up and keep in tune. Doesn't it make sense to use the power you already have in your PC? To harness that power and, with Hoka Code3 GOLD's superfast software, plug in to professional style monitoring?

Press F5 and walk into a new world

At Hoka, we have been working for a year on our new Code3 GOLD program. We wanted to make it decode more easily and quickly. So we borrowed the advanced software Digital Signal Processing from our professional Code30 software (don't even ask the cost!) and we matched this with the latest surface mount miniaturised electronics for the hardware interface. We made it possible to plug in to the serial port of your PC without an adaptor. We supported all four COM ports. We even tapped the PC for a power supply!

Press F5 and walk into a new world

What happens when you tune in is simply magic. Pressing F5 brings up your own spectrum analyser to show shift and baud speeds. Press enter and Code3 GOLD jumps into decoding mode and begins to decode. Even if your signal is one of the very few not available via Hoka, you are told what it is. Now, a new world of information opens up to you. Pilots sending flight data on ACARS, the fascinating world of pagers, packet systems, ship's messages and slow scan TV. Met station weather maps - even the special 2400Hz modulated tone system from geostationary satellites. Did we mention that with Code3 GOLD you'll be able to decode nearly every decodable system on short wave?

Hoka Sales UK, PO Box 2630, Eastbourne, East Sussex BN20 9RU
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E-mail: hokasales@pavilion.co.uk See our web page: http://www.hoka.com

Icom IC-R10

and 4kHz (s.s.b./c.w.) are just a bit too wide for average use. This makes it difficult to listen to signals without adjacent channel interference from strong signals, particularly if 12.5kHz spacing is in use on the v.h.f. and u.h.f. bands, or you are trying to monitor s.s.b. transmissions on a typical short wave amateur band.

Interesting enough the IC-R1 exhibits the same sort of problem - it's a pity that Icom didn't quite manage to fix it this time around.

The wide i.f. filter also makes the Automatic Frequency Control function less effective than it might otherwise have been. The a.f.c. only works during n.b.f.m. operation and seems to have a range of approx. ±5kHz. The idea being that if a signal is received slightly off frequency the a.f.c. function retunes the radio to ensure perfect reception. Now this would be great if the receiver had a really narrow i.f. filter as it would prevent off-tune signals from sounding distorted, but the existing i.f. filter is so wide that signals 5kHz off-tune easily fall within the i.f. passband. I would have preferred the a.f.c. function to have a wider lock range and work on a.m. as well as n.b.f.m. which would have made it possible to use a much narrower i.f. filter, especially for v.h.f. airband reception, where most receiver designs use a wider than normal i.f. bandwidth in order to permit the reception of offset transmissions which are used in this band. The real icing on the cake would have been w.b.f.m. operation with a.f.c., as this would appeal to satellite enthusiasts who have to contend with doppler shift on orbiting satellites and counter-surveillance operatives trying to locate simple bugging devices, which have a tendency to drift in frequency.

Looking Either Side

The 'Bandscope' function allows you to 'see' activity up to ±100kHz either side of the frequency the receiver is tuned to. This equates to approximately five channels ether side of the centre frequency, however the i.f. filter bandwidth is so great that half the screen is filled when a strong local signal is being received. The Bandscope circuit is also used to provide a fast search facility which Icom call 'Signal Navigation'.

Measured Performance

The measured receive sensitivity was average. The performance fell off fairly dramatically below 1MHz and above 1GHz but was reasonably consistent across the remaining frequency range. I found that most signals I could hear with other modern hand-held scanners could also be heard on the IC-R10, although short wave performance with the supplied antenna was really only suitable for a.m. broadcast station reception. I had to connect a few metres of wire to the antenna socket before I could really start to hear the weaker amateur and utility stations below 30MHz.

The intermodulation performance was not quite as good as I would have hoped for and I had difficulty obtaining consistent intermodulation measurements at close frequency spacings. This was partially due to v.c.o. phase noise which tended to be particularly noticeable on s.s.b. signals above a few hundred MHz and the i.f. filter performance. However at larger frequency spacings the results seemed to be much better and I can only assume that this was due to the r.f. and i.f. roofing filters making an improvement. With an external roof mounted antenna connected, intermodulation products from v.h.f. paging systems could be heard at various points in the v.h.f. aircraft and 2m amateur bands. Very few problems were experienced with the supplied flexible rubber antenna, which the IC-R10 was designed to work with.

Summary

My impressions of this receiver are a bit mixed. I really liked the feel of the radio and the performance is OK for its size and selling price - £379. I am sure that it will sell like hotcakes, but I just wish that Icom had worked a bit harder on some aspects of the design. **Nevada Communications, 189 London Road, North End, Portsmouth PO2 9AE, Tel: (01705) 662145**, supplied the review model. (Current price is around £260.)

Original review published in SWM May 1997

"I found that most signals I could hear with other modern hand-held scanners could also be heard on the IC-R10."

Icom IC-R8500 Receiver

Having said in the past that he preferred equipment which stopped at 30MHz, John Wilson was placed in a difficult position when asked to review the new IC-R8500 receiver - with a frequency range extending from 100kHz to 2GHz! Could he refuse? Of course he couldn't!

The R8500 is a receiver which looks like a receiver in the classic style, with the major operating functions laid out conventionally and conveniently on a panel measuring 287 by 112mm. It weighs in at 7kg, which gives some idea of its solidity, because that weight does not include a mains power supply, the receiver being powered from an external 12V d.c. source. Taking off the covers reveals that the whole receiver is built on and inside a complex die casting that not only includes individually shaped compartments for each section but also continues right around the receiver. What a perfect way to construct high performance r.f. equipment!

Very Attractive

The overall styling is new to ICOM, with the previous sharp edged look being replaced by a softer, more rounded appearance very suggestive of the JRC NRD-535 but retaining the familiar ICOM excellent build quality and finish.

The control layout is very logical and each control is clearly labelled with its function. The tuning knob is a delight to use, being just the right size and weight to spin easily and whiz through the frequencies. When tuning slowly, the soft rubber outer grip feels perfect, but what a nice touch to find that the recessed finger hole rotates on its own shaft, so you don't wear out your fingertip when using it. Small details like this make a big impact on the 'feel' of a receiver. So you don't like freely spinning controls - ICOM have provided a variable drag brake adjusted by a little screw adjacent to the tuning knob - another small but significant design detail.

I'm a man who likes his modes well defined, and I was pleased to see a row of individually labelled mode selector buttons for 'WFM', 'FM', 'AM' and 'SSB/CW'. Selection between modes is by pushing the appropriate button, but three of the modes have further selections made by repeated presses of the same button. 'FM' toggles between wide and narrow selectivity bandwidths of 12kHz and 5.5kHz thereby accommodating most used communications f.m. deviation standards. 'AM' has three steps: Narrow (2.2kHz), normal (5.5kHz) and wide (12kHz), whilst the s.s.b. button has four steps cycling u.s.b., l.s.b., c.w., c.w.(narrow) and back to u.s.b. again.

I am of course considering the R8500 so far as an h.f. receiver because I found it so good on these frequencies, but I haven't forgotten the stretch from 30MHz to 2.000GHz which, combined with the memory and scan facilities, makes the receiver so different and powerful. I will go into this further, but for now, back to the controls.

Below the mode select buttons is another row selecting 'NB/AFC', 'AGC' and two attenuator settings. When in f.m. modes the 'NB/AFC' button activates an automatic frequency control system which tracks an incoming signal and keeps it in the middle of the f.m. discriminator passband. Two left/right arrows are provided in the main display to show if the signal has drifted, but in practice the R8500 tracks so well that the arrows only appear if you deliberately off-tune the receiver. For a signal which is steadily drifting, the a.f.c. tracking is remarkable, but of course if a signal suddenly pops up 10 or 20kHz away from the receiver frequency, the a.f.c. ignores it - as it should. The only observation I would make is that in wide f.m. with a large frequency drift, the a.f.c. sometimes stops retuning a few kilohertz short of the original frequency. In practice this does not matter at all since a wide f.m. signal has by its nature some latitude in the need for exact tuning, provided that the discriminator response is linear - and in the R8500 it certainly is linear.

In all other modes the 'NB/AFC' button brings in an impulse type noise blanker which again worked well on 'clicky' noises such as my son's unsuppressed 25 year old Land Rover.

Attention To Detail

The a.g.c. button switches between 'fast' and 'slow' settings, with the appropriate legend on the main display. Both decay time constants are correctly chosen and work well for s.s.b., c.w. and a.m. signals. Although the exact time constants are not quoted in the handbook it is clear that there is more to the a.g.c. system than one is told, because when a signal stops, the a.g.c. decays slowly to about S3 on the signal strength meter and then accelerates quite quickly to restore full receiver gain. In use, this means that s.s.b. speech keeps the gain constant at levels over S3 but on cessation of speech the gain is restored quickly, which helps greatly when listening to, say, a strong aircraft signal followed by a weaker ground station response. I don't have a circuit for the R8500 so I don't know how this has been achieved, but it shows careful design on someone's part - more attention to detail.

Two r.f. attenuator buttons select 10 and 20dB steps, and if both buttons are depressed the attenuation is 30dB. With my antennas here I didn't need the 30dB attenuation at all, but then again I'm out in the country and not sitting underneath the towers at Droitwich or Rugby, so the 30dB may be of use in certain locations. The attenuation in use is shown on the main display panel

Underneath again are three rotary controls for 'AF Gain', 'Squelch', and a dual control for 'IF Shift' and 'APF'. 'AF Gain' is obvious, but the squelch control is in fact operating in two different ways. In the f.m. modes the squelch is a classic noise operated system, but for all other modes the squelch control sets a level on the a.g.c. 'pedestal' below which signals are suppressed. The actual level is shown on the signal strength meter and this is a very accurate method of determining which signals will be heard. Setting the level to, say, S-3 on the meter ensures that any noisy signals will be rejected, leaving only those strong enough to provide easy listening when using the scanning facilities.

Audio Peak Filter

The 'APF' (Audio Peak Filter) control proves to be very useful in real listening conditions and consists of a bandpass filter which can be tuned across the audio spectrum of an incoming signal. Two bandwidths are provided, the wider one being available on all modes including wide f.m., whilst the narrow filter can only be engaged in s.s.b., c.w. and a.m. modes - quite a reasonable choice since one is hardly likely to need narrow filtering on f.m. signals. The filter tuning range is from approximately 500Hz to 5kHz and its effect is remarkable on the h.f. bands. Selection of the APF function is by a push button adjacent to the main tuning knob and if the button is held for a second the filter toggles between 'wide' and 'narrow'. The setting you choose is retained in memory when you switch off the receiver.

For an h.f. receiver the provision of 'IF Shift' is almost essential, and the R8500 provides the facility on s.s.b. and c.w. modes. The shift range is quoted as more than ±1.2kHz and on the review receiver it actually measured at +1.5 and -2kHz. The slight unbalance was of no practical consequence, but for those who want perfect u.s.b./l.s.b. tonal balance (and it's remarkably difficult to achieve), the demodulating carrier oscillator frequency (b.f.o.) can be adjusted individually in u.s.b., l.s.b. and c.w. modes by simply holding down the s.s.b./c.w. mode button for one second which activates a sub display showing the actual b.f.o. offset. The amount of offset can then be adjusted by use of the (M-CH) knob to suit your own preference and the settings are then retained by the receiver. This kind of provision allows a user to tailor the receiver to their own particular requirements - for example a keen RTTY or data enthusiast can arrange to have a unique b.f.o. offset for the tone spacings they wish to use.

That more or less covers the left hand section of the front panel except to observe that in adition to the headphone jack, ICOM have provided a fixed level audio output for tape recorder use, together with a socket for remote switching a tape recorder when the squelch control opens. The thing I'm so pleased about is that these are on the front, rather than the rear panel, and thus become very convenient to use. How many times have I fiddled around the back of a receiver trying to find the remote control connector?

Tuning Rates Are Crucial

Now - how does one tune the R8500? With a tuning knob - but there is more to it than that. In a receiver covering such a wide frequency range as the R8500, the tuning rates are crucial to being able to use it to its fullest. The R8500 has a built-in selection of tuning rates ranging from 10Hz to 1MHz in no less than 13 steps, including the all important 9kHz spacing for European medium wave listening. These are selected by two easy to reach buttons alongside the main tuning knob. As the buttons are pressed the tuning step chosen is shown in the display where it remains until changed and it's completely independent of mode - what a flexible feature this is in real use.

There are frequency bands where the channels are at 12.5 kHz spacing but at a 6.25kHz offset from a whole frequency unit; for example instead of starting the band at 850MHz the authorities decide to start at 850.00625MHz. With the R8500 you can

"ICOM have provided a fixed level audio output for tape recorder use, together with a socket for remote switching a tape recorder when the squelch control opens."

Icom IC-R8500 Receiver

enter 850.00625MHz using the keypad, select a 12.5kHz tuning step, and then happily tune the band knowing that the 6.25kHz offset has been included and shown on the frequency display for confirmation.

But that's not all: in addition to the built in selection of tuning steps, the user can enter any unique tuning step from 0.5kHz (500Hz) to 199.5kHz in 0.5kHz increments by using the keypad followed by a prod at either TS button to store the new step. Most comprehensive and thoughtfully executed.

Below the two 'TS' buttons, but intended to be associated with them is a dual function Speech/Lock button. If the optional UT-20 speech synthesiser is fitted, a prod at this button will cause the displayed frequency to be announced, and if my reading of the handbook is correct, the frequency will be announced during scanning when the squelch opens which is very handy for anyone who wants to leave a tape recorder running on voice control when checking a range of frequencies for activity. Not only can you then review the voices recorded but you have a speech identification of the frequency on which the receiver stopped - magic.

The second function of the button is as a dial lock to prevent accidental frequency shifts should the tuning knob get disturbed. ICOM have gone one step further and given you the option of 'Dial Lock' or 'Panel Lock' in which all the front panel controls are disabled; useful if you have inquisitive offspring around.

Having mentioned keypad entry it must be obvious that the user can enter any operating frequency within the tuning range of the receiver by using the alpha-numeric keys in the top right hand corner of the panel. Frequencies are entered in MHz format.

Smooth

Tuning the R8500 is smooth and largely free from tuning 'glitches', no doubt due to the use of a DDS (direct digital synthesis) approach to synthesiser design, and there are no loud rasping noises when tuning through strong signals. You can barely hear the 10Hz tuning steps when slowly tuning a steady carrier in the s.s.b. or c.w. modes, and for all practical purposes the tuning is perfect. As with most synthesised receivers or transceivers these days, there is an automatic tuning rate 'speed-up' when you spin the tuning knob rapidly. In normal tuning there are 400 increments per knob revolution, e.g. using 10Hz steps one knob rotation tunes 4kHz, but the number of steps at larger increments must somehow be reduced since 1MHz steps result in 14MHz per revolution, not the expected 400MHz. The tuning rate changes are not detailed in the operator's manual, so it's a matter of try it and see what happens. When the auto speed-up comes into action, the number of tuning steps increases to 2000 per knob revolution. Now having experienced many receivers using this variable tuning rate system, I've decided that in some cases I don't actually like it. However, ICOM have resolved my dilemma by allowing the user to disable the auto speed-up if required. I have a feeling that this feature is unique to ICOM.

The R8500 does many things, and it's essential for the user to know what's going on inside. All the essential information is presented on a large backfit liquid crystal display utilising a mixture of seven segment sections for numeric information, dedicated legends for functions such as a.g.c. speeds and so on, and matrix displays for text which may change, such as memory bank titles and station names. I must say that I like the curent trend towards orange back lighting with clear black legends, and the R8500 information is extremely clear and unambiguous, with a wide viewing angle from side to side as well as up and down. Alongside the display is a traditional moving coil analogue meter showing signal strength, backlit to match the frequency display.

The entire right hand side of the front panel is taken up by the alpha numeric keypad and controls associated with the memory functions, and this is a section of the review which is really separate from the R8500 as a receiver. I found the memory and scanning facilities extremely comprehensive, and in an area where it is easy for a manufacturer to get completely confused, ICOM have thought things through very well indeed. The R8500 provides 1000 memory channels, 20 programmable band edge channels and 1 priority channel. Every one of the frequency memories will store frequency, mode, tuning step, attenuator settings and an 8-character name. In addition to this, although not mentioned in the manual, the memory also stores the filter settings in each mode.

"I found the memory and scanning facilities extremely comprehensive"

Memories

The memories are initially arranged in 20 banks of 40 channels, and each bank can also be allocated a name; for example 'Airband' or '2 metres' or 'Med. Wave', and so on. The names are entered using the

Continued on page 26...

ICOM

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How small can you go?

ICOM's very latest scanning receiver, the IC-R2 is the most fantastic piece of kit we've seen! Features include wide-band Rx between 500kHz and 1310MHz boasting high-quality Rx sensitivity, easy operation, drip-resistance and low voltage operation to save battery power. The IC-R2 may be small, but then again, size isn't everything is it?

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try the IC-R10, covering 0.5MHz to 1300MHz in all-modes (including CW capability) the R10 was the first handheld in the world with a real-time bandscope function! This makes it easy to find busy frequencies and observe the receiving frequency band conditions.

ICOM's IC-R2 and R10... what a lovely pair of handhelds!

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The IC-R8500 receiver covers 100kHz~2GHz in all modes giving you the chance to hear everything! The R8500 includes IF shift, APF, direct RS-232C computer compatibility and appeals to both professionals and serious listeners alike, who demand top performance... but at sensible prices.

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Count on us!

Billboard - A W Antenna For Y

The project described in this article was designed by the late Bill Wilson as a quick and easy 400 - 1000MHz wide band antenna for use with his scanner.

The logarithmic-periodic array antenna is extremely useful, being inherently wide band over a large span of frequencies, and you'll often see rotatable h.f. versions on embassy roof tops and in military and commercial communications centres.

At v.h.f. and u.h.f. they are, like the discone, capable of wide band coverage, only the discone is omni-directional, while the log periodic is highly directional like a Yagi, particularly if it is split and the halves angled about 30° apart.

Outdoor log periodics are quite a problem to construct and mount. However, for an indoor version, using foam-core display board and self-adhesive copper tape, the concept becomes ridiculously easy to translate into hardware.

The other way is to etch the antenna onto a couple of slabs of p.c.b., but this takes time and effort - anathema to the author!

The Materials Required

The board (Cappa-board or Fome COR are two makes that spring to mind) consists of two sheets of thin card bonded to a foamed polystyrene core, making a very light, rigid board, either 5 or 10mm thick, which can be cut easily with a sharp blade or craft knife. Sadly, it is only sold in vast sheets measuring approximately 1.5 x 1m. Rather too much for our needs, but probably your friendly local design studio or framers will be happy to supply a couple of offcuts about 350mm square.

The self-adhesive copper tape is available in various widths (you'll need 5 - 10mm wide) from any craft shop that supplies materials for the amateur terrarium maker. I seem also to remember that a similar tape was available from electronics suppliers at one time (possibly still is) to make your own circuit board tracks.

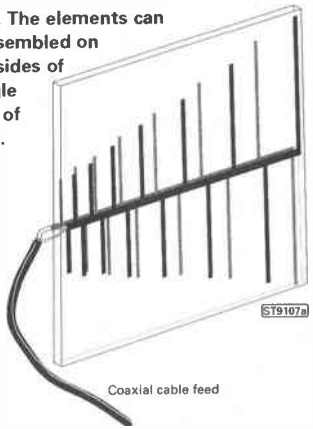


Fig. 1: The elements can be assembled on both sides of a single sheet of board.

Construction

Armed with the board and tape, a snap-off type craft knife and some self-adhesive fabric tape from your local upholstery or d.i.y. store, we're all set to begin!

The antenna can be assembled with each element on either side of a single piece of board, **Fig. 1** or two pieces of board can be

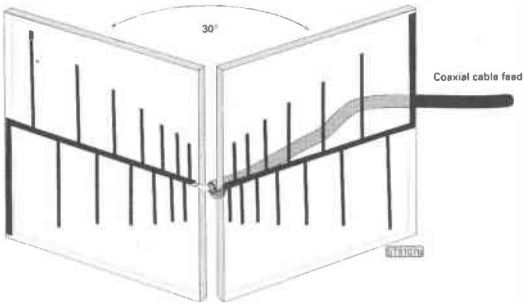


Fig. 2: Two separate single-sided boards can be opened out at 30°.

Vide Band UHF our Scanner

used to give a 30° angle of separation between the two, **Fig. 2**. The latter is preferable. On each board (or each side of one board) mark off with a pencil the measurements in **Fig. 3**, remembering that the two elements are not identical, but are **vertically** displaced mirror images of each other. Over these marks, lay down the adhesive copper tape, making sure that there is some overlap at the joins. Because the adhesive acts as an insulator, it is now necessary to lightly solder each overlap to make an electrically continuous structure.

The two antenna sections can now be taped together at the 'short' end to make a hinge. The ends of the coaxial feeder cable are then soldered to each element and the cable then terminated with coaxial connector to suit your receiver. Ideally the cable should be run back along the length of the 'earthy' element. The cable can be tapped down firmly to the board or holes made for cable ties to keep the cable in place. 'V' channels can be cut in the reverse sides of the board to accommodate the cable, allowing the two boards to lie flat together for storage.

The antenna can, of course, be extended to cover higher and/or lower frequencies by adding more strips (logarithmically) at the ends, depending on the size of board you can tolerate.

This method of using copper tape is an excellent way of quickly experimenting with v.h.f./u.h.f. antennas. For example, if you are a lazy amateur, a very efficient 433 or 1296MHz umpteen element beam can be assembled on a length of board in a few minutes. In the past the author has used this method to make the following items:

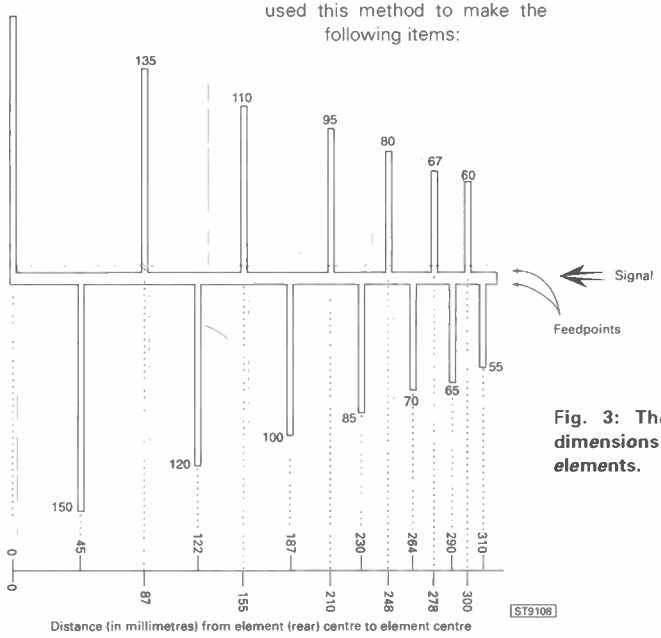


Fig. 3: The basic dimensions of the elements.

- A five element Yagi for 144MHz, folding up zig-zag fashion in four sections to make a neat compact package 1m x 3m for transportation and storage.
- A helically wound length of taper on a suitable grade of ferrite rod resulting in a Hi-*Q* h.f./d.f. antenna.
- Wound on a pvc/abs former to make an a.t.u. coil that allows very accessible tapping.
- A 'nest of dipoles' using a length of pvc drainpipe as the substrate.

You can use your own ingenuity for other uses! ***SWM***

This project was originally published in SWM June 1996

Icom IC-R8500 Receiver

numeric keypad, but each key also has three letters of the alphabet on it, used in constructing the names. If a particular bank needs more than 40 channels, the bank can be extended, which, of course, means that another bank must be reduced. But if you wish you could have a single bank containing 800 channels, it's all very flexible. Putting information into memory couldn't be easier, simply select a channel number using the rotary 'M-CH' control and press 'MW'; that's it. Similarly, to clear any channel just select it and press 'M-CL'.

"What about the other 200 memories?" I hear you cry. 100 of these are allocated to a bank called 'AUTO', and how I enjoyed using this one. You can set the R8500 to scan any band of frequencies you wish, such as 118 to 137MHz for the airband, and by selecting the 'AUTO' mode let the receiver scan continuously whilst you go off and have a coffee. When you return the receiver will have been stopping on any occupied channel and popping the frequency into the 'AUTO' memory bank. You now have a bank of active frequencies in store which you can scan as memory channels - so simple, and saves hours of sitting doing it yourself. So, now what do you do with all these active frequencies? Easy, simply select one of the active channels in the 'AUTO' bank, press 'M-SET' to temporarily store it, select a free channel in the memory bank you wish to use, press 'M-SET' again and the entire contents of the stored channel are written into the new memory location. What impressed me about all of these functions is that they are so easy to use, and so logical.

Still missing 100 channels? They are allocated to the 'SKIP' bank in which is stored those annoying frequencies that are always occupied by continuous transmissions which stop the scanning process but you don't actually want. During the scan of any frequency band of interest, if the scan stops on a steady but unwanted signal, you simply press the 'SKIP' button and that frequency is then memorised and will be skipped over not only in any future band scan, but in any other scan mode including auto scanning. Even the speed of scanning and length of delay on resuming the scan are adjustable by the operator.

The whole memory arrangement is rather like having a series of written logbooks to which you can refer by looking up a title 'AIRBAND', 'SHORT WAVE' and so on, and in these books you can select a frequency of interest which can also be named 'LONDON', 'RADAR', and so on. It's well thought out and easy to use even for someone as dim as me. For any user wishing to assemble a comprehensive collection of frequencies of interest, the R8500 is just ideal.

Conclusions

It's hard to know where to stop with such a comprehensive unit as the R8500, because the manufacturers seem to have thought of everything. As far as r.f. performance is concerned, their stated aim was to produce a receiver which incorporated all the advances made in the ICOM h.f. transceivers, and in this they have succeeded. Performance at v.h.f. and u.h.f. is also excellent, although a small *caveat* must be made in that the receiver, in common with other ICOM receivers, is designed to meet full specification up to 1.000GHz. Above that frequency a converter is used, which guarantees spec. between 1.240 to 1.300GHz but not at higher frequencies, although the receiver does in fact work to 2.000GHz.

The operating manual is well written and easy to understand, a particular feature being the detailed information on all the connectors and ports which specifies exactly the impedances, connection details and signal levels at each connector. The section on memory management is straightforward and logical, with clear examples of each step to be taken in what is actually a complex procedure, and no one should have any difficulty in making this receiver dance to his own tune.

Frankly I loved having the R8500 in my hands, even for such a short time and I was impressed by everything about it. It looks like, and handles like a classic h.f. receiver, but has this capability of receiving everything from 100kHz to 2.000GHz. Above all, it was easy to use and get to know, and for the real listening enthusiast, or indeed the listening professional, the R8500 allows you to dispose of every other receiver and simply have it all in one stylish box. It's a great product.

ICOM (UK) Ltd., Sea Street, Herne Bay, Kent CT6 8LD. Tel: (01227) 74300. Internet: http://www.icomuk.co.uk/ supplied the review **IC-R8500** which costs around £1550.

Original review published in SWM September '96.

Computer Control

The rear panel of the R8500 carries the RS-232 connector for external computer control, and comprehensive details are included in the operating manual of all the commands available. It seems that everything on the front panel is controllable via the computer port. There are three antenna inputs; an 'N' type connector for use from 30MHz to 2GHz; an SO-239 for 50Ω input from 100kHz to 30MHz and a phono socket providing a 500Ω input for the same frequency range. Selection of the 50 or 500Ω h.f. input is controlled from the front panel.

A 'remote' jack allows connection to the standard ICOM control system so that the R8500 can be linked to compatible transceivers or receivers from the ICOM range, whilst an 'IF' output connects to the optional TV-R7100 receive adapter to provide stereo sound and TV facilities. The 'AGC' jack can either feed a.g.c. to the TV-R7100 or, with a connector change over inside the R8500 provides an audio feed without de-emphasis for 9600 Baud data use in the f.m. mode. There are two power input connectors, one being for a feed from a regulated 13.8V d.c. supply and a second for use with an ICOM AC-55 a.c. mains adaptor which needs further regulation built in to the R8500.

Welz WS1000E Wide Band Receiver

A few years ago if someone had shown me a pocket sized receiver which covered the frequency range 500kHz to 1.3GHz, resolved a.m., n.b.f.m. and w.b.f.m. signals, with a good r.f. performance and operated from a couple of 1.5V pencell batteries, I would have been amazed. However, I got quite a shock when I first saw the review model - it is tiny! Measuring only 58 (w) x 97 (h) x 24mm, it easily slips into a shirt pocket.

Styling

The unit has very distinctive styling with a slightly curved shape making it a snug fit in the palm of the hand. The top panel carries a BNC antenna connector, 3.5mm earphone socket and concentric tuning and volume control knobs. The left hand side features a convenient second function key and squelch override button whilst the right hand side sports a safety lanyard loop and a knurled, edge mounted, squelch adjustment knob. Most of the front panel is occupied with the speaker grill, but the top quarter includes a liquid crystal display and the left hand side has two strips of buttons providing a means of entering frequencies and controlling the main receiver functions. A small flap at the rear provides access to the battery compartment, which accommodates two AA sized cells, whilst two recessed studs on the bottom of the case provide a means of externally powering the unit.

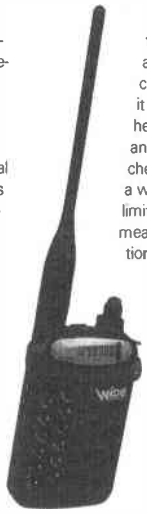
One of the buttons on the front panel is marked 'Power' and on switching it on I was greeted with a cheery "HELLO" message on the l.c.d. screen. Rotating the tuning knob allowed me to step between nine pre-programmed memory channels, but almost any attempt at more sophisticated operation was repelled with a warning beep from the speaker - indicating that it was time to read the operator's handbook! This proved to be very enlightening as the receiver has a normal and expanded mode of operation. The unit is shipped in the normal mode. This gives a very limited set of commands, which permit you to become used to operating the basic functions before progressing on to programming your own search and scan memories.

RF Performance

In terms of r.f. performance the model worked remarkably well considering the very compact design and low power consumption. The measured sensitivity on n.b.f.m. averaged -120dBm for 12dB SINAD over most of the range 30-1000MHz. Below 30MHz the performance tailed off with a worst case of -110dBm at 500kHz which was in line with the manufacturer's figures. Intermodulation measurements gave a 3rd order intercept point averaging around -40dBm at 100kHz spacing. Both the sensitivity and intermodulation performance are adequate in comparison to other current wideband hand-held scanners, but would lag some way behind models specifically designed for mobile or base station use.

Antenna

The antenna supplied with the receiver is a short flexible wideband design which gave reasonable performance above 100MHz, but substituting it for a slightly longer type gave improved results, especially on the medium and short wave broadcast bands. Connecting an external base station antenna produced good results on v.h.f. and u.h.f. but the attenuator had to be switched in before acceptable performance could be obtained on the short wave bands. Using the WS1000 in a car with an external mobile antenna worked well, with very few unwanted signals being observed, the only exception being when I was less than a couple of miles away from a very active p.m.r. site.



The only major problem I noticed during mobile operation was the maximum level of audio the internal speaker could produce, which barely overcame the engine and road noise. The 60mW audio output stage is just about sufficient to drive an external loudspeaker, if it is not mounted too far away from your head. When I used the review model at an outside event, I found that a pair of cheap personal hi-fi headphones became a worthwhile accessory. However, the limited power of the audio stage does mean that you get a long period of operation from a set of batteries. The dry cells supplied with the WS1000 almost survived the three week review period, but eventually a large 'Batt' message appeared on the l.c.d. display warning me that they needed replacing.

Summary

The WS1000E is a tiny hand-held scanner with a very wide frequency coverage, which makes it convenient enough to carry around with you at all times. This should make it very appealing for example to air and motor sports enthusiasts who wish to monitor the action as it happens.

The r.f. performance is adequate for its intended style of operation and is comparable to other hand-held scanners. Unless you connect a large external antenna to it or live in a very active urban area you are unlikely to encounter too many problems with unwanted spurious signals.

I enjoyed using the review model but found some of the functions restrictive, mainly due to the inappropriate use of factory programmed bandplans to permit automatic step size and mode selection during searches. This would be less troublesome if the search memories were capable of storing the necessary information. However, if you mainly intend to use the scan mode to monitor individual frequencies stored in memory it shouldn't be a significant problem.

Waters & Stanton Electronics, 22 Main Road, Hockley, Essex SS5 4QS. Tel: (01702) 206835. FAX: (01702) 205843 provided the review model.

The **Standard AX400mkII** is available from **Martin Lynch & Sons, 140 - 142 Northfield Avenue, Ealing, London W13 9SB. Tel: 0181-566 1120.FAX: 0181-566 1207.**

Original review published in SWM July '96.

Hand-held scanners have been getting smaller by the year, but the latest to arrive from the far east is so tiny that it amazed even Alan Gardener. Since this review was written a new model - the WS2000E - has been produced - the main differences are double the number of memories and a higher audio output. This is also marketed as the Standard AX400mkII.

Scouting Around

The Optoelectronics Scout

Kevin Nice looks at an intriguing counter-come-data-logger from the company that, for the past twenty years has been producing innovative products such as the Interceptor, their latest offering is the Scout, a small pocket-sized unit.

The ability to monitor a wide range of frequencies and record them for later is invaluable for the scanning enthusiast. The manual supplied with the Scout tells us that the unit is not a frequency counter in the traditional sense, because it is not intended as a measurement tool, instead, the device is designed to be used with an antenna - the one supplied is a highly flexible, helical affair - to receive radio transmissions, and record their frequencies. So it's a frequency recorder. The memory configuration is such that 250 captures can be stored in each of the 50 locations.

Use of signal processing techniques provided by the embedded microprocessor allows the unit to evaluate the incoming signal and statistically to determine when a specific frequency is dominant, i.e. when a signal is 10-20dB stronger than any other signal or the r.f. noise floor. The counter circuitry then produces a stable count

Computer Control

Those of you with an Icom IC-R7100 receiver will probably be familiar with the CI-V interface. This interface is a serial bi-directional system using a two wire connection and t.t.l. signal levels. There is a 2.5mm jack socket on the top panel to facilitate interconnection to other equipment, Optoelectronics have provided four possible address combinations, selected by two internal jumpers, so that the user can connect up to **four** separate Scouts to one receiver or host computer! When the Scout is operating in FILTER, CAPTURE or RECALL mode it automatically transmits tuning commands to the CI-V interface equipped receiver, as the incoming signals are captured or as memories on the Scout are recalled.

In order to connect the Scout to a PC an external interface is required to convert the t.t.l. levels to RS-232C. Once connected, the Scout responds to a variety of interrogation commands. Optoelectronics produce the CX12 interface, which is supplied with logging software.

Specifications:

Frequency Range:
1MHz-2.8GHz
Antenna/Input Impedance:
50Ω BNC
Power Supply:
Internal NiCads or 9-12Vdc 1.2A max. (Supplied)
Display:
10 digit l.c.d. backlit
Warning Device
Audiable beep or vibrator
Dimensions:
67 x 45 x 97 (w x d x h) including pocket clip and input socket.
Weight:
250g

Power Supply

The Scout contains a high capacity NiCad pack, and comes complete with an external charger/p.s.u. The unit has a rapid charge facility which allows full power in two hours, this facility is intelligent as the cell voltage is monitored, if the NiCad pack is totally exhausted it is first trickled charged until the battery voltage is up to the minimum, then the charge rate is increased, when fully charged, the rate resumes to trickle, where it remains until the charge voltage is removed and re-applied.

In Use

There are four modes of operation, NORMAL, FILTER, CAPTURE and RECALL. In NORMAL

Continued on page 30

Standard AX-700 Base Scanner Receiver

Chris Lorek takes a close look at the newly updated base scanner from Standard, the AX-700.

The Standard AX-700 made its first appearance in late 1990, and caused quite an enthusiastic 'stir' with its unique spectrum scope display. Good things keep on going, and over the years the AX-700 has been giving sterling service to many satisfied users. It has recently been relaunched as a new MkII version, which also conforms to the very stringent CE immunity and emission requirements.

With its smart metal case, base-mounted feet for desk-top placement and a chromed tilt-up stand, it's essentially a base station scanner. As it operates from a 13.8V d.c. supply, mobile or portable operation certainly isn't also out of the question, there's even a plug-in telescopic whip supplied for temporary use. For home use, an a.c. adapter is supplied, fitted with a European two-pin mains plug together with a suitable adapter for UK use. The d.c. output lead from this supply plugs directly into the 2.1mm d.c. input socket on the rear of the case, and an optional d.c. lead is available.

Coverage

The AX-700 covers the frequency range of 50 to 905MHz continuously, with reception modes of f.m., a.m. and wideband f.m. The numeric keypad lets you enter frequencies directly, and the front-panel up/down buttons, together with a click-step tuning knob, can be used to manually tune. The tuning step sizes available are 10, 12.5, 20 and 25kHz, plus two further steps sizes in the curiously-named 'AJ' (fine-tuning) mode, these being 5kHz with the rotary channel selector and 1kHz with the up/down buttons. The usual rotary volume and squelch controls are fitted, added to these is a variable tone control so that you can adjust the sound of your local airport control tower operator to

Continued from page 29

mode, frequency measurements are made continuously. Captured frequencies are displayed on the l.c.d. display. On capture of a new frequency either the beeper, or for a more discrete warning the vibrator, are activated. If the beep is selected then the display backlight is also illuminated for ten seconds.

Selecting FILTER mode reduces random counting, noise and false signal detection. A digital filtering algorithm is applied to incoming signals and only those signals which pass the algorithm are stored and displayed. Gate settings are selected as in the NORMAL mode of operation.

CAPTURE automatically selects the 1kHz gate setting, incoming signals are displayed and stored in up to 50 unique memories. Up to 255 occurrences of each are also recorded by the Scout, the count being incremented each time the unit registers a transition of a carrier. When capture mode is selected and a receiver is connected via the CI-V interface the Scout will tune the receiver to the captured frequency.

RECALL disables the frequency measurements but does not prevent the signal strength meter from operating. Memories are integrated by depressing the Gate button. The frequency captured is displayed, as is the number of captures, a zero displayed for the number of captures indicates that a memory location is unused.

The overall performance of the Scout is dependant on the front-end tuning, due to its wideband input, so the addition of some preselector circuitry will be beneficial when using the unit for specific bands.

Waters and Stanton, 22 Main Road, Hockley, Essex SS5 4QS. Tel: (01702) 206835, Fax: (01702) 205843 supplied the review unit. When originally reviewed, the Scout costs **£349.95** inc. VAT.

Originally reviewed in SWM March '95

your exact preference! A front-panel earphone/headphone jack is fitted for private listening.

Searching

One hundred memory channels are provided to store your favourite frequencies, and the AX-700 usefully lets you manually tune away from any of these at the push of a button. You can of course scan through the memory channels, either all the channels or just those you've programmed with a 'MSM ('Memory Scan Memory') marker. To find new active channels the set has ten search ranges, each of which can be programmed with individual lower and upper frequency limits to suit your listening interests. In scan and search modes, the set halts as usual when it finds an active channel, i.e. when the receiver squelch raises. It can be programmed to resume either a couple of seconds after the signal level disappears, or an 'audio scan' which resumes a couple of seconds after any audio ceases on the signal, or after five seconds regardless of whether or not the signal's still there, or to halt on the first channel that's had a signal present for at least two seconds.

Panoramic Display

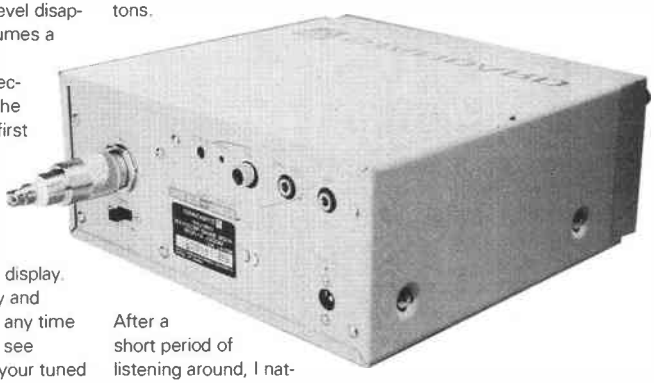
A primary feature of the set is, of course, the large, bright, panoramic display. Besides showing you the frequency and memory channel you're tuned to at any time in text form, it also lets you visually see what's happening on either side of your tuned frequency. For this, the display provides a real-time bargraph of activity in the band, with vertical bars representing the relative strength of signals. The spectrum display can be toggled to show either a 1MHz, 250, or 100kHz bandwidth at any time, the signal 'bars' automatically changing in width to reflect the channel spacing and display widths selected.

Round The Back

The rear panel has a number of connectors and further controls. Besides the d.c. power input and SO-239 antenna sockets, an attenuator switch is fitted which places a 20dB attenuator in line with the r.f. signal input for when strong signals start to get the better of the scanner. Complementing the front panel squelch control, which operates only in narrowband f.m. and a.m. modes, a small 'W-Mute' preset potentiometer is fitted for the wideband f.m. squelch adjustment. A 'recorder output' 3.5mm jack socket gives a 30mV audio level to your tape recorder or PC sound-card for audio recording, and there's a similar 3.5mm extension speaker output jack, which disconnects the internal speaker when used. An 8V d.c. output is available via a phono socket for powering accessories, and a small reset hole lets you reset all the set's memories and frequencies to their default conditions.

On The Air

With the intuitively easy-to-use front panel controls, it didn't take me long to start successfully receiving off-air signals with the set, indeed within a few seconds of switching on I was listening to a two-way conversation on my local 433MHz amateur repeater. Changing frequency was very easy with the keypad, tuning around likewise with the front-panel knob and up/down buttons.



After a short period of listening around, I naturally decided to start programming the memory channels with my favourite frequencies and scanning around these. Here, the large l.c.d. came in very useful, with a large text-based display showing what was happening at each stage, e.g. 'Memory Change', 'Memory Scan', 'MS.M Scan', etc. Programming the search ranges was also helped by this display, which read 'Start Freq', 'End Freq', etc. at the appropriate moments - who needs the instruction book? Having said that, the 30-page operating manual was certainly useful, with clear step-by-step instructions on changing the search range, memory channels, etc. After just an hour or so of use, I believe I'd learned how to use virtually all of the set's functions, no problems at all here.

I found the set a pleasure to use, operation-wise. The bright yellow-backlit l.c.d. was very easy to read, a front panel button switching in a two-level dimmer for night-time use. I

"I found the set a pleasure to use, operation-wise."

Standard AX-700 Base Scanner Receiver

"I was very pleased to find that the panoramic display updated itself continuously as I was listening to a given frequency, without any breaks in reception"

was very pleased to find that the panoramic display updated itself continuously as I was listening to a given frequency, without any breaks in reception as some other 'spectrum display' scanners do due to their single receiver circuits. The audio quality from the internal speaker, which was fitted at the bottom of the case, was excellent, especially when I used the small bracket to slightly tilt the front of the set upwards towards me. The variable tone control was useful also, enhancing the already-superb audio response from the set, plugging in an external hi-fi quality speaker gave even better performance on the broadcast bands using wideband f.m.

But how about the 'radio' performance? When I first used a sample of the original version of the AX-700 around seven years ago in my radio shack, I found it performed quite well using a variety of indoor and outdoor antennas. Time goes on, and the airwaves become increasingly more crowded, especially with the advent of powerful nationwide v.h.f. pager transmitters and a digital cellphone base station site around almost every corner. In my location in the south of England, which certainly is an 'r.f.-congested' town, the AX-700 coped well on u.h.f. and the lower v.h.f. section of its coverage, including civil airband. But it did tend to suffer badly from wide-coverage (i.e., high power) v.h.f. pager transmitter breakthrough around the 145MHz amateur and 156MHz marine bands. So much so, that with my short (just 1m long) rooftop v.h.f./u.h.f. vertical connected, I had to constantly keep the attenuator switched in to prevent rather loud, and quite annoying, intermodulation breakthrough halting the scan, this wiping out even an 'S9' strength amateur repeater located about 20 miles away. I've often found this problem on small hand-helds which are primarily designed to be used with an equally small set-top antenna, but I was a little surprised to find it on a purpose-made late-1990s base station receiver.

Having said that, I found the receiver picked up weak signals reasonably well, although occasionally not to the extent of a 'purpose-designed' set for some ranges. For example, a 51MHz amateur f.m. signal, which I could clearly receive on an f.m. handheld connected to my loft-mounted antenna, I could only receive rather weakly on the AX-700, similarly on 433MHz. However, 145MHz weak-signal reception was excellent, as long as there weren't other strong signals around!

Laboratory Tests

My measured results showed that the AX-700 gave a reasonable sensitivity, i.e. the capability of receiving weak signals, across its coverage range, although this tailed off right at its lowest frequency of 50MHz, as I'd found on air. The strong signal handling was typical of that I've come to find on many other scanning receivers, nothing new here, all good 'solid stuff'. The measured intermodulation rejection, where two stronger off-channel signals mix within the receiver to create a third, unwanted, on-channel interfering signal, I feel could have been better for it's primary use as a base station receiver.

Conclusions

The AX-700 was very easy to use, and I found the bright and easily-read panoramic display was extremely handy in keeping me informed if I was possibly 'missing' something else whilst monitoring a given channel. The receiver is very smart and professional looking, and the r.f. performance was typical of many wide-band scanners currently on the market. However, in my opinion it wasn't up to the performance standard of some other dedicated base station receivers, although many of these are, of course, rather more expensive! The **AX-700** costs £449.95. **Martin Lynch & Son, 140-142 Northfield Avenue, Ealing, London W13 9SB, Tel: 0181-566 1120** provided the set for review.

Original review published in SWM Jan '98

Yupiteru MVT-3300EU Hand-held Scanner

Yupiteru's latest hand-held scanner, the MVT-3300EU has been given the once-over by Chris Lorek.

Yupiteru have a well-deserved reputation for their high-performance and fully-featured portable communications receivers. As well as their all-mode wide-coverage hand-helds, they've also released hand-held scanners for defined band ranges, e.g. for the civil airband and the marine v.h.f. f.m. ranges. Retailing at £180, the MVT-3300EU is a multi-band scanner rather than a continuous coverage all-mode receiver. The 'EU' suffix identifies the European version, which has passed the stringent requirements for emission and immunity performance.

The MVT-3300EU covers of 68-88, 108-170, 300-470 and 806-1000MHz, which includes all of the v.h.f. (civil) airband, plus a section of the military airband, as well as most v.h.f. and u.h.f. land mobile communication bands. It can tune, and store, frequencies in steps of 5, 6.25k, 10, 12.5 or 25kHz, either a.m. or narrowband f.m. reception in any band within its coverage.

Channels

There are 200 memory channels, arranged in ten banks of twenty channels each for easy scanning, a scan speed of 16 channels per second being specified. To help you find new active frequencies there are ten user-programmable search bands, as well as an 'auto-write' scan facility which can store active channels into a memory bank automatically. To save the receiver continually halting on given frequencies such as constant carriers, you can program up to 100 'pass' channels into the set's memory, which it will subsequently ignore in search mode. A two-second delay after the squelch closes, before the set resumes scanning, helps in receiving replies on simplex channels in scan mode. A switchable attenuator is fitted to help with signal overload, this can be switched in or out, but not on a channel-by-channel basis into the memories.

Besides searching and scanning, the rotary click-step knob on the top panel lets you manually tune around in either your own selected tuning step and reception mode, or with the 'default' parameters for the frequency range you've chosen. For this, there are ten programmable 'band memories' in the set, into which you can store upper and lower frequency limits together with an accompanying step size and receive mode for each range.

Descrambler

Speech scrambling has recently been introduced into the UK, for on-site p.m.r. users,. This can range from simple 'inversion' scrambling to more secure types such as rolling code, and these are already being used by on-site security services as well as Formula One racing teams and the like. The MVT-3300EU has an 'SCR' button, which switches in an internal descrambler for decoding simple inversion systems. This will not cope with higher-security forms of scrambling such as rolling code or split-band types, nor will it descramble any digital forms of coding such as the 'MASC' systems used by UK government services (including the police), or GSM or PCN cellular 'phones systems and such - the suppliers were very keen to point this out!

Power

The MVT-3300EU uses four internally-fitted AA cells which you'll need to supply, a d.c. connector is also fitted so that you can plug in an external 12V d.c. supply for home or mobile use. The rear of the set's case has a pull-out wire stand, which you can use for desktop operation at home and which tilts the set at a comfortable angle for easier viewing of the display. The receiver comes with a set-top helical antenna, a hand strap for portable

AR5000 = Performance receive + flexible microprocessor

AOR®

Usually the question of "which is the best" is met with a multitude of further questions, however the AR5000 is clearly seen by many as the most feature packed high performance wide band performance receiver available today. This is backed by the German 'funk' magazine readers award 1997 for ***best receiver*** and by government procurement departments on both sides of the Atlantic. True base receivers are few and far between, some have simply evolved from the hand held equivalents with little tangible improvement in performance or facilities over their smaller counterparts. The AR5000 is not like this! Drawing from its earlier success, AOR has designed the AR5000 to be a true base station receiver - from the drawing board, this is very apparent when plugging in an external aerial, the result is unsurpassed performance instead of a clutter of music and pager breakthrough over many of the desired frequency bands. The AR5000 strong signal handling is very good, over the range of 500 kHz to 999 MHz this is further assisted by an automatic preselector which peaks the receiver's front end circuits for the best 'on channel' sensitivity and ultimate rejection of out of band interference. There are several IF filter bandwidths provided as standard including 3, 6, 15, 30, 110 & 220 kHz with an optional slot for 500 Hz. The ***WEFAX picture*** shown here was e-mailed to us by a happy customer in Derby within the first few days after purchasing his AR5000 (using the standard 30 kHz IF filter). Microprocessor facilities are unrivalled (1000 memory channels x 2 and more).

PLUS PERFORMANCE Capabilities have been further increased with the arrival of the ***AR5000+3*** providing three enhanced facilities: **A.F.C.** switchable automatic frequency control for accurate tracking of unusual bandplans, **noise blanker**, switchable to help reduce the effects of ignition noise especially while mobile, **synchronous AM**, featuring double and selectable sideband with an easy to use wide lock range.

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E&OE

Yupiteru MVT-3300EU

use, a plug-in earphone, and an instruction manual. It measures 152 (H) x 59 (W) x 32mm (D) and weighs 310g with batteries.

In Use

Most receiver manufacturers have their own defined idea on user operation methods and control, and the MVT-3300EU follows the normal Yupiteru type of operation as used in their many other hand-held scanners. So I found no surprises here, the manual also giving clear instructions with plenty of worked step-by-step examples for the 'raw beginner'. Within minutes I was happily monitoring signals in my locality, the set-top antenna pulling in signals, particularly on v.h.f., surprisingly well. Entering frequencies into the memory channels was very easy, the receiver automatically selecting the 'next vacant' channel for me in each case, although I could easily change these as needed.

Over the dark winter evenings during my review period, I found the backlighting facility on the set to be superb. As well as this lighting up the l.c.d. panel, to let me see what was happening frequency-wise, it also illuminated the translucent keypad buttons so that I could also operate the scanner at night without too many incorrect button pushes! For weak signal-reception, a 'monitor' button next to the side-mounted backlight button acted as a momentary squelch defeat, which I found very handy with fading signals to prevent the scanner whizzing off to the next channel when I'd found something interesting.

Out And About

Although the supplied carry-strap was handy for portable use, I felt it was a pity that a belt clip wasn't also supplied, nor was there any facility for one to be fitted. I often use a car-mounted ventilator grille clip with my hand-held scanner for use on the move, but here I had to either just place it on the seat, or use one of the 'gripper' type of 'cellphone' holders instead.

I took the scanner with me on holiday to a favourite 'haunt' of mine, a small fishing village in south-east Cornwall. But this was the first time I'd ever thought of taking a scanner. Together with my growing family, we took in a couple of sessions of sea-fishing, and the MVT-3300EU provided me with yet another 'chatty' companion! Although I had to take care that it didn't drop into the 'briny', it certainly gave us all a surprising amount of extra entertainment, particularly from the comical banter between other fishermen out on the water. There was ample volume from the small speaker, even in windy outdoor conditions, and the fast search rate made sure that I didn't miss a thing when several channels were alternately busy. The auto-write scan was also handy in finding active new frequencies, and I quickly filled a number of memory channels using this mode.

I used both NiCads and nickel-hydride cells to power the set, finding each gave me at least a day's worth of listening, with the 1.3Ah nickel types naturally lasting rather longer - often for an entire weekend. However, I did need to take the batteries out of the set in order to charge them, which meant that I couldn't use the set on air in 'float charge' mode because the side-mounted d.c. connector couldn't also be used to charge the batteries. I eventually settled on using two sets of batteries, one in use in the scanner and the other set on charge.

Strong Signals

The receiver usually worked fine when I was out and about, but in some locations I did get the occasional problem from strong signals such as paging transmitters. I found that, when tuning around even in 12.5kHz steps, that signals came and went cleanly, without the adjacent channel 'splitching' I've often found on less-selective scanners. However, using the set from home with my rooftop 144/430MHz vertical collinear antenna plugged in, gave me almost constant overload problems on the 144MHz amateur band from out-of band signals, and I had to keep the set's internal attenuator switched in at all times here. I also found an effect of weakly receiving otherwise strong signals which were exactly 225 and 900kHz above my tuned frequency, these being caused by second image and 'half 2nd i.f.' effects within the scanner.

Lab Tests

A measurement period in my lab showed the set to be reasonably sensitive across its range, with excellent adjacent-channel selectivity, as I'd found on air. The 3rd order intermodulation results also replicated what I'd found on air, which wasn't all that good, but it would normally be adequate for the set's primary intended use as a hand-held, and not a base station, receiver.

Original review published in SWM Feb '98

Conclusions

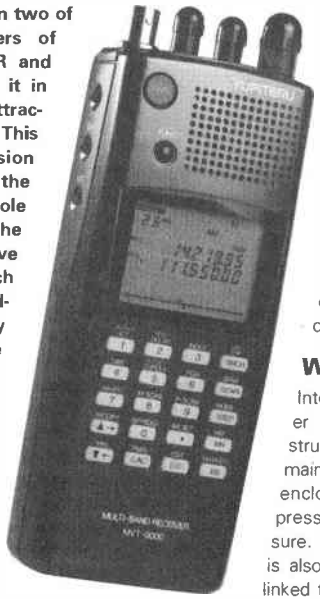
Although the Yupiteru MVT-3300EU isn't a wideband, continuous-coverage receiver, it usefully gives coverage of many of the popular v.h.f. and u.h.f. communication bands used in and around Europe. I found it was easy to operate, with plenty of handy features such as the 'auto-write' scan and the extremely useful frequency 'pass' function for searching around. It gave a good level of performance when used out and about, pulling in signals well, although it did tend to suffer from signal overload when used in some r.f.-congested locations with an external and well-sited antenna connected.

Nevada Communications, 189 London Road, North End, Portsmouth PO2 9AE. Tel: (01705) 662145 provided the review set.

Yupiteru MVT-9000

Alan Gardener recently fought his way through the crowd and got his hands on the very latest offering from Yupiteru. Here he reveals his findings.

The past few years have produced a distinct rivalry between two of the main manufacturers of scanning receivers, AOR and Yupiteru, as each takes it in turn to try and produce a more attractive product than its competitor. This has generated a lot of discussion between enthusiasts as they extol the virtues of each new model. AOR stole the show for some time with the AR8000, but now Yupiteru have launched the MVT-9000, which many are expecting to be the hand-held scanner of 1997. I was lucky enough to be able to put one of the first in the UK through its paces.



External Appearance

I think the first thing that struck me was the styling of the MVT-9000 which reminded me of a hand-held cellular 'phone. This is due to the slightly indented keyboard which curves in towards the centre in order to present a fairly constant key depression range across the face of the front panel. This makes the keyboard pleasant to operate and naturally guides the operators fingers towards the main keys. Above the keyboard is a custom l.c.d. display which consists of a dot matrix area used to display graphical and alpha-numeric data and above it a predefined text area used to display the main operational information. This gives much greater visibility of the display than would be possible with just a dot matrix type l.c.d. panel.

The upper part of the front panel is occupied by the loudspeaker grill, main power switch and 2nd function button. The left hand edge of the receiver has three small buttons to select the display and keyboard illumination, operate the monitor function and lock the keyboard and controls to prevent accidental operation. The right hand side of the case has sockets for an earphone and external 12V d.c. power supply whilst the top edge of the receiver has a BNC socket to connect an external antenna, volume, squelch and rotary tuning dial. The tuning dial is situated towards the extreme right-hand front edge of the panel and as such is fairly easy to operate, but I did find my finger catching the volume control on one or two occasions. The overall size of the unit is 66(w) x 175(h) x 40mm(d) including knobs. This makes it a comfortable fit in the palm of your hand. My own preference would have been for it to be slightly smaller, but that would almost certainly have been at the expense of build quality.

Well Built

Internally the receiver is very well constructed with all the main receiver boards enclosed within a pressed metal enclosure. The control board is also screened and is linked to the receiver by means of a short flexible printed circuit board cable. Judging by the amount of internal electrical screening, Yupiteru have taken no chances with the design to ensure that it would pass the EEC EMC regulations, which are now mandatory before items can be CE marked and sold within the European Community.

Main Features

The receiver is capable of tuning from 530kHz to 2.039GHz in step sizes of 50, 100, 200, 500Hz, 1, 5, 6.25, 8, 9, 10, 12.5, 15, 20, 25, 30, 50, 100 and 125kHz. It can receive n.b.f.m., w.b.f.m., a.m., narrow a.m., l.s.b., u.s.b. and c.w. The narrow a.m. mode being particularly useful for the reception of short wave stations in crowded broadcast bands. The unit has twin v.f.o.s, 1000 memory channels in 20 banks of 50, 20 search banks which are labelled A-J and a-j, all of which can be given up to a nine character long alpha-numeric name. The memory and configuration settings are stored in EEP-

ROM, so no worries about losing data when the batteries go flat. Like the AOR AR8000 the receiver has a bandscope.

Operation

In operation the MVT-9000 has a keyboard layout and style of data entry which should be familiar to existing Yupiteru owners. As is the case with most designs of this type, a second function key is required to provide control of all the functions with only a limited number of buttons available. Fortunately Yupiteru have chosen to site this in a convenient spot next to the power switch, which makes it very easy to find, and the electronic latching means that you don't have to use both hands to drive the keyboard.

You can link search banks and memory banks, set the mode and tuning step size independently from the internal factory set band plan, set search pass frequencies and edit the titles of search and memory banks and individual memories.

Bandscope

One of the more interesting aspects of the receiver is the Bandscope display, which allows you to see activity on adjacent frequencies providing the receiver has stopped searching or scanning. In theory this is a great idea as it allows you view signals up to ±800kHz either side of the frequency tuned. A marker can be moved by means of the tuning knob to determine the frequency of any signal displayed on the screen and a quick press of the monitor button temporarily tunes the receiver to the marker frequency. Pressing Monitor and Enter sets the marker frequency as the new v.f.o. frequency - a nice touch.

Receive Performance

I was pleasantly surprised by its performance on the short wave bands. Reception of a.m. broadcast stations and s.s.b. amateur and commercial signals with the supplied flexible antenna was very good, although replacing it with a 2-3m length of wire made a significant improvement. Connecting an external short wave long wire antenna was not quite so successful, as the large number of extremely strong broadcast signals present resulted in a cacophony of intermodulation distortion. Switching the internal attenuator on made a dramatic improvement.

I compared the MVT-9000 with my dedicated short wave receiver, feeding both from an active antenna. For the most part this produced identical results, it was only under extremely crowded band conditions or in the presence of strong broadcast signals on adjacent frequencies that the dedicated short wave receiver showed its true worth. Performance on the medium wave broadcast band was very good for a receiver of this type, and the ability to switch off the internal ferrite rod antenna must make it attractive to listeners preferring to use a loop antenna.

The v.h.f. and u.h.f. performance was also good with a measured receive sensitivity in line with previous Yupiteru models. Although the figures are not sparkling, the actual performance seemed to be better than that indicated by the measured results. I can only assume that this is due to the characteristics of the recovered audio, which had a small amount of residual background noise present, even on very strong signals.

Intermodulation performance was adequate and typical for a modern design of this type.

Summary

The MVT-9000 is a very attractive, wide frequency coverage scanning receiver offering good performance, particularly on the short wave bands. It is relatively easy to operate and provides a large number of features which most owners will find a use for. The Bandscope function is extremely interesting to watch, particularly when monitoring h.f. broadcast stations and propagation conditions change, although its usefulness as an aid to monitoring is somewhat limited.

The lack of a computer or RS-232 port will be seen as a major limitation. This facility is especially useful when trying to maintain the contents of 1000 alpha-numerically tagged memories. It would be nice for experienced users to be able to modify the internal band plan and configuration details - the values programmed into the review model were not ideally suited to the UK.

The MVT-9000 is worthy of being called Yupiteru's flagship hand-held receiver, although its price and competition from other manufacturers may influence many people's decision to buy one - only time will tell if this model is destined to become a Classic.

Waters and Stanton Electronics, 22 Main Road, Hockley, Essex SS5 4QS. Tel: (01702) 206835, Fax: (01702) 205843, provided the review model. The **MVT-9000** has an RRP of £489.

Original review published in SWM February'97

"Although the figures are not sparkling, the actual performance seemed to be better than that indicated by the measured results."

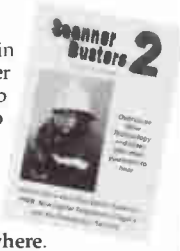
Books for Scanning

The UK Scanning Directory

This new 6th edition covers 26MHz to 1.8 GHz and continues to amaze everybody. The tens of thousands of frequencies include Civil and Military, Aviation, Army, Navy, the largest Police list ever published, DSS Snoopers, GCHQ, Eye-in-the-Sky Links, Bailiffs, Prisons, Motor Racing, Universities, Railways, Telephones, Couriers and many more we dare not mention. Separate parts cover the Civil Aviation Band and European frequencies for Dxers. This book remains Britain's largest and best-selling scanning directory, the undisputed leader in the field. No other book dares to list so many frequencies and in such great detail.

Price: £18.50 +£1 UK Post. For Europe add £3.25, elsewhere £7.50

Scanner Busters 2 by D. C. Poole



How to Tune into More Frequencies and Beat New Technology! The rate of change in radio technology is incredible. The Police continue to scramble an increasing number of their frequencies, trunked radio systems are making it more difficult to eavesdrop on conversations, and there are more and more strange noises heard on the bands. To overcome this *Scanner Busters 2* guides you through the maze, explaining in simple terms the working of PMR, new digital telephone systems, spread spectrum, new pager systems, frequency hopping, encryption such as MASC used by the Police and the latest communications methods of the emergency services.

Price: £5.00 incl UK Post. Overseas post add £1.25 for Europe (airmail) or £2 elsewhere.

Scanning the Maritime Bands by F. F. O'Brian

Hear ports controlling ships and ferries, weather and navigation broadcasts, the supplies and spare parts required, problems they are having with the crew, search and rescue and lots more. It gives the Channel Number for each port, harbour and coast radio station in the UK, Ireland, Western Europe and right up to Iceland; all you have to do is to key into your scanner the corresponding frequency from the foldout frequency list.

Price: £9.50 incl UK postage. Overseas post add £1 for Europe (airmail) or £2.50 elsewhere.

UK Scanning Frequency Chart

Stunning full colour A3 wall chart covering 25Mhz to 1.8 GHz showing in graphic detail all major users of the VHF/UHF spectrum. It will show you quickly where to scan to pick up your favourite transmissions.

Price: £3 incl UK postage. Overseas post add £1 for Europe/sea mail or £2 for other countries.

VHF/UHF Airband Frequency & Callsign Guide

This new edition lists every UK airport and airfield in alphabetical order with their corresponding frequencies in an easy-to-read format, and gives the frequencies for military ranges, low flying, refuelling, aerobatic displays, UK air defence and AWACS. It also covers air traffic control, Squark codes, Volmet, emergency frequencies and lists other frequencies. There are over 8,500 military callsigns listed and a vast number of civil ones. It will be indispensable for any aircraft enthusiast.

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Which Scanner?

Your scanner selection guide

For your convenience we have compiled the following buying guide listing out the important criteria to consider before committing your hard earned cash.

Covered in the table are the hand-held and base station models currently available in the UK.

If you need more comprehensive information as to how any particular model has faired in the hands of our reviewers then check-out the review that's indicated in the appropriate column. You will notice that a good proportion of the list are actually covered in a summarised form within the pages of this very guide. If you should wish to obtain a copy of a full review, then these are available from the *SWM* Book Store - details given on page 44 of this guide.

Key to Which Scanner table

✔ Included

❍ Optional extra

Abbreviations used in this guide

a.c.	alternating current
a.f.	audio frequency
a.f.c.	automatic frequency control
a.g.c.	automatic gain control
a.m.	amplitude modulation
d.c.	direct current
dB	decibel
dBm	decibel referenced to 1mW into a 50Ω load
Hz	Hertz (cycles per second)
i.f.	intermediate frequency
kHz	kilohertz - 1000Hz
kΩ	kilohm
l.s.b.	lower sideband
MHz	Megahertz - 1000000Hz
mV	millivolt
mW	milliwatt
n.b.f.m.	narrow band frequency modulation
r.f.	radio frequency
s.s.b.	single sideband
u.s.b.	upper sideband
V	Volt
W	Watt
w.b.f.m.	wide band frequency modulation
Ω	ohm

	Coverage			Modes					Memories			
Hand-held	Min. Frequency	Max. Frequency	Continuous Coverage	a.m.	w.b.f.m.	n.b.f.m.	s.s.b.	c.w.	Sets	Banks	Channels	Lock-out
Alinco												
DJ-X1D	100kHz	1.3GHz	Y	✔	✔	✔			2	10	40	20
DJ-X10E	100kHz	2.0GHz	Y	✔	✔	✔	✔	✔	3	10	40	
AOR												
AR8000	500kHz	1.9GHz	Y	✔	✔	✔	✔	✔				
AR8200	530kHz	204GHz	Y	✔	✔	✔	✔	✔			20	
Bearcat												
UBC 120XLT	66MHz	512MHz	N									
UBC 220XLT	66MHz	956MHz	N									
Commtel												
COM-102	66MHz	512MHz	N									
COM-510	500kHz	1.3GHz	Y	✔	✔	✔						
GRE												
PSR239	66MHz	960MHz	N	✔		✔						
PSR244	66MHz	512MHz	N	✔		✔						
PSR250	66MHz	512MHz	N			✔						
Icom												
IC-R10E	500kHz	1.3GHz	Y	✔	✔	✔	✔	✔				
Standard												
AX400mkII	500kHz	1.3GHz	Y	✔		✔	✔					
Yupiteru												
MVT-3300 EU	66MHz	1.0GHz	N	✔			✔					
MVT -7100 EU	530kHz	1.65GHz	Y	✔	✔	✔	✔	✔				
MVT- 9000 EU	530kHz	2.00GHz	Y	✔	✔	✔	✔	✔			20	50
Welz												
WS-2000E	500kHz	1.3GHz	Y	✔		✔	✔					
Base Station												
AOR												
AR3000A	100kHz	2.03GHz	Y	✔	✔	✔	✔	✔				
AR5000	10kHz	2.0GHz	Y	✔	✔	✔	✔	✔				
AR5000+3	10kHz	2.0GHz	Y	✔	✔	✔	✔	✔				
Bearcat												
UBC-9000XLT	23MHz	1.3GHz	N	✔			✔					
Fairhaven												
RD500	20kHz	1.75GHz	Y	✔	✔	✔	✔	✔				
Icom												
IC-R8500	100kHz	2.0GHz	Y	✔	✔	✔	✔	✔				
Realistic												
PRO-2042	25MHz	1.3GHz	N	✔			✔					
Standard												
AX-700	50MHz	905MHz	Y	✔		✔	✔					

Features

Total	NiCads	Charger	Rotary Tuning	Case	Battery Saver	Computer Control	Data Cloning	Bandscope	a.f.c.	Noise Blanker	Review	Current Model	Typical Price
100	✔	✔	✔	✔	✔			✔			Oct '92	N	
1200	✔	✔	✔	○	✔			✔			Page 5	Y	£295
1000	✔	✔				✔	✔				Sept '94	Y	£299
1000	✔	✔	✔			✔	✔	✔			Jun '98	Y	£399
100	✔	✔										Y	£130
200	✔	✔										Y	£150
												Y	£60
800												Y	£190
200												Y	£160
50												Y	£130
20												Y	£80
1000						✔		✔			Page 14	Y	£259
	○	○										Y	£200
200											Page 33	Y	£180
1000	✔	✔									April '93	Y	£269
1000			○				✔				Page 36	Y	£395
	○	○									Page 27	Y	£200
400						✔					Jan '90	Y	£699
1000											Page 13	Y	£1349
20000						✔		✔	✔			Y	£1595
500												Y	£325
											Aug '98		£799
1000						✔					Page 18	Y	£1549
1000												Y	£430
100											Page 30	Y	£450

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Further Reading

There are numerous books available covering all aspects of scanning.

Frequency Listings

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VHF-UHF Scanning Frequency Guide Bill Laver
£12.95

General Scanning Books

An Introduction To Scanners and Scanning BP311 I.D. Poole
£4.99

Scanner Busters 2 D.C. Poole
£6.00

Scanners 2 International Peter Rouse GU1DKD
£10.95

Scanners 3 Putting Scanners Into Practice 4th Revision Peter rouse GU1DKD
£10.95

Scanning Secrets Mark Francis
£16.95

Airband

Air Band Radio Handbook 6th Edition David J. Smith
£9.99

Airband Radio Guide 3rd Edition Graham Duke
£6.99

Airband Radio Frequencies & Guide Book 2nd Edition
£5.99

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VHF/UHF Airband Frequency & Callsign Guide
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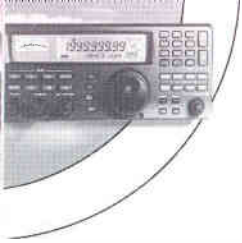

Worldwide Aeronautical Communications Frequency Directory 2nd Edition Robert E. Evans
£19.95

Airwaves 98 The Complete HF/VHF/UHF Aviation Frequency Directory
£8.95

Maritime

Scanning The Maritime Bands
F.F. O'Brian
£9.50

Ship To Shore Radio Frequencies Ken Davies
£5.99

Military

Eavesdropping On The British Military Michael Cannon
£17.50

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