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Alinco DX-R8E

US$500 £550 €699

OVERVIEW

Although perhaps not a familiar name to the HF listener, the Alinco company has been established for many years and is well known to the radio amateur and scanning-receiver enthusiast. The company's DX-R8E is a desktop receiver covering 150kHz-35MHz, and as we shall see it has some very interesting features. We may as well deal with our only major reservation straight away, which is that the unit does not contain an internal mains PSU and requires an external 13.8V 3A power supply. At this price point we would have expected something suitable to be provided with the receiver as a matter of course. Alinco offers several suitable supplies under its own brand name but these are all rather over-specified and (in the UK at least) decidedly expensive. Care always needs to be taken with the choice of PSU for use with a wideband HF receiver and for preference we would always opt for a linear rather than a switched-mode supply. It is also important that any associated mains power unit incorporates proper fusing and over-voltage protection since the consequences of failure are liable to be very expensive.

FEATURES

Finished in a rather lustrous charcoal-grey, the DX-R8E (of which our review sample was kindly loaned to us by Nevada Radio) measures 280 x 240 x 90mm and weighs a little over 2.5kg. In general terms the quality of construction is high. The main chassis appears to be a substantial die-casting and the sheet metalwork is well pressed and finished. From what could be seen of them, the internal printed-circuit boards looked to be high-quality items fabricated in silk-screened FR4 or equivalent and with very accurate placement of the components. A tiltable bail stand allows the receiver to be angled upwards from the desktop if required although we found it slightly more comfortable to use when set 'flat' on the desktop. The front panel is dominated by the large white-backlit LCD and the tuning knob at lower right, around which the keypad buttons are arranged in what is visually a rather cramped arrangement. Unusually the panel is removable and allows remote mounting of the radio proper if required via an optional 5m connecting cable. This could be useful in some mobile applications or where space is restricted.

The tuning knob is about 20mm deep and 45mm in diameter and in our view it is unnecessarily large in both dimensions. Because of its excessive depth, access to the lower two rows of the numeric keypad buttons requires the forefinger to be bent over the top of the knob in a rather unnatural manner. Its excessive diameter means that the rotary RIT control to its left can only be operated by the finger-tips and over a small range of angular motion. Both characteristics become thoroughly irritating over time. The buttons themselves have long travel, low breakout force and moderate tactile feedback. The other rotary controls below the LCD are volume, squelch and IF shift. The speaker is at upper left and 3.5mm jacks for headphone and speaker output are situated beneath. A rather large blanking plug at lower left hints at the origin of the DX-R8E's casework in the DX-SR8 amateur HF transceiver, the plug being a substitute for the latter's microphone input connector. On the rear drop is an SO-239 antenna input socket. In our view the PL-259 plug which mates with this particular variety of connector is a mechanical and electrical monstrosity best consigned to history and forgotten. This being so we would have preferred to have seen almost any other type of coaxial antenna connec-

tor instead of an SO-239 but we suspect this particular battle is long lost, simply because poorly made SO-239s of Chinese origin cost next to nothing. At lower left is a standard 13.8V coaxial DC input for which a fused cable is provided. The plug was rather a loose fit in the socket and we would have greatly preferred a captive connector in this position. We also thought that the thickness of the supplied cable was marginal for a radio capable of drawing 2A or so and would have felt more comfortable with something more substantial. Next to the power input is a 12kHz I/Q output. This is a very useful feature in that if it is connected to the sound-card input of a PC running appropriate software such as Dream, the DX-R8E can provide DRM reception. An adjacent socket marked 'Clone' can be used for software control of the receiver although we did not assess this function. Two RCA sockets provide another AF output and a mute facility, relevant if the receiver is used with an associated transmitter.

The available modes are AM, USB, LSB, CW, FM and IQ and there is a dual VFO facility operating in switchable increments between 10Hz and 1kHz. Incidentally the lower limit of the quoted frequency range is 150kHz but our sample tuned down to 30kHz and provided good copy of both the UK MSF 60kHz time-signal transmission and DCF77. The available bandwidths are 9 and 2.4kHz on AM, 2.4 and 1kHz on SSB (the latter being arguably a little pointless), 1 and 0.5kHz on CW and a fixed 9kHz on FM, the latter being a rather unusual bandwidth for the mode. There is no synchronous detector. There is a total of 600 memory channels arranged as three banks together with quite comprehensive scan and store functions. A four-level preamp and 10/ 20dB attenuator is provided, as is a noise blanker.

PERFORMANCE

The DX-R8E proved to be quite a good performer. Sensitivity was very good overall and on a par with other receivers of this type and price point. At 29MHz the MDS was about -128dBm in the 500Hz CW bandwidth, which is a respectable performance. Selectivity was generally acceptable although the ceramic filters in the Alinco receiver are noticeably 'wider' than the equivalent mechanical filters used in other receivers would be. Nevertheless it was not usually difficult to pick out weak wanted signals next to strong unwanted ones, aided by the unit's generally good strong-signal performance. The DX-R8E coped easily with the assortment of antennas used at the test location and seemed particularly at ease with full-size dipoles and the Wellbrook loop. Using the latter and listening around the amateur 28MHz band during the day brought in some truly 'rock-crushing' signals from Europe and the Middle East but there was also no difficulty in hearing weak beacons in the same band from several parts of the world with marginal propagation. Under these circumstances the DX-8E gave very solid and convincing results. It also worked very well on other modes and gave eminently usable copy of utility USB stations. The narrow CW filter was not quite sharp enough for busy amateur bands such as 7MHz at night but for general listening it was perfectly adequate. The AM filter bandwidths are perhaps not ideal; the nominal 9kHz filter exhibited a width of about 15kHz to its -6dB points and as such was too wide for a busy HF broadcast band although it gave very pleasant-sounding results on local LW and MW broadcast stations. The nominal 2.4kHz filter was better but here again its -6dB points were at about 6kHz and in some circumstances a more narrow filter (or a filter with better-defined passband and stopband) would have been helpful.

When some minor PC-related issues were resolved the DX-8E proved to be capable of delivering good results with DRM. Dream is very capable open-source software but no-one would claim that it is well documented. For those wishing to experiment along these lines the most current version of the source code is at http://sourceforge.net/projects/drm/

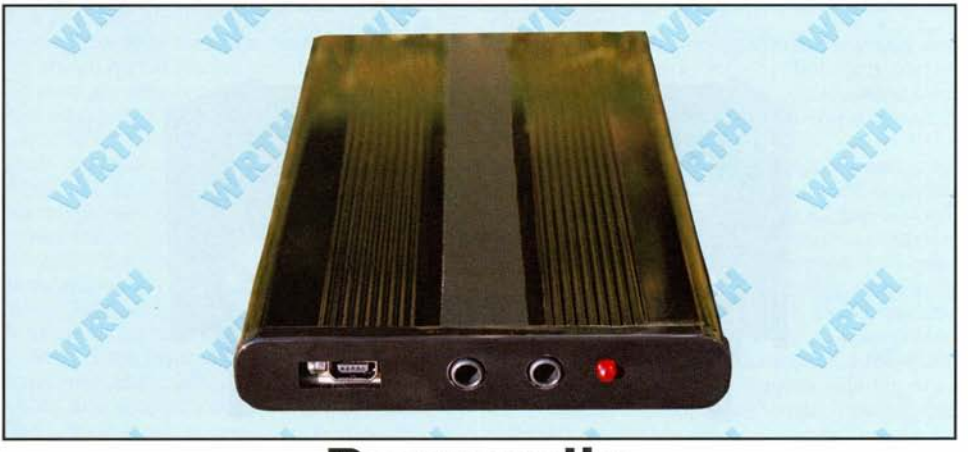
CONCLUSION

In an age when several of the erstwhile major players appear to have dropped out of the desktop HF receiver market, the emergence of Alinco as a contender must be welcomed. In general terms the DX-R8E is a good performer offering plenty of features and functionality together with ease of use. Some aspects of its ergonomics leave something to be desired – the tuning knob in particular looks like a refugee from a receiver twice its size and its relationship with the other controls is not ideal – but it would be easy enough to fit a smaller knob. And while the omission of a synchronous detector is perhaps a little regrettable, the provision of a 12kHz I/Q output is a very useful feature indeed. It would be nice to see a Mk II version with better filters and some other minor improvements but for now the DX-R8E is well worth investigating.

Rating table for Alinco DX-R8E

Constructional quality	★★★★★
Sensitivity	★★★★★
Dynamic range	★★★★
RF intermodulation	★★★★
Audio quality	★★★★
Versatility	★★★
VFM	★★★
Overall rating	**★★★★**

Key:
★ = Poor ★★ = Fair ★★★ = Average
★★★★ = Good ★★★★★ = Excellent
VFM = Value for money



Pappradio

US$100 £65 €80

The Pappradio is the brainchild of Stephen Schaa, who is a talented engineer and a long-time listener to HCJB who became interested in DRM a few years ago. Stephen's brother was working at HCJB at the time and was able to arrange some DRM tests to Europe, which worked remarkably well. He wished to listen to the DRM transmissions locally and Stephen built a simple direct-conversion receiver for him to use. This was sent in the centre of a cardboard tube and the HCJB staff dubbed it a "paper radio" – or in German *Pappradio*. He then decided to make a developed version available to a wider audience and the current receiver is the result.

A slender box measuring 130 x 80 x 12mm and weighing almost nothing, the Pappradio is a software-defined radio reduced to its lowest terms. Largely based around the functionality of the Atmel AT 90USB 8-bit microcontroller, the formal architecture is that of an I/Q direct-down-conversion front-end receiver with four fifth-order bandpass filters for HF operating in conjunction with a three-step attenuator. From this simple description it will be evident that the Pappradio relies on the processing power of the PC to which it is connected. The latter's soundcard, which handles the I and Q inputs, also needs to be fairly capable. Depending on the sample-rate of the PC's audio sub-system, the Pappradio can cope with a maximum bandwidth of 192kHz, which should be perfectly acceptable for most listeners.

The connection to the PC is via a mini-USB port and other connections are via 3.5mm jacks. The software is supplied on a CD-ROM; installation was simple and quick and the presentation is that of a waterfall at the top and mode/frequency selection below. The available modes are AM, ECSS, USB, LSB, FM, CW and DRM and it was the latter which proved most interesting. We have complained many times about the dearth of usable DRM receivers at a reasonable price and the Pappradio addresses this issue remarkably well. Using an active Wellbrook loop and dipole antennas we were able to copy a variety of DRM transmissions for lengthy periods, with good audio and remarkably few dropouts or other misbehaviour. Reasonably strong signals were required and the Pappradio is in no sense a weak-signal DRM receiver, but the point is that it works. And at the quoted price of about $100 plus shipping, it is arguable that it represents the first true low-cost DRM-capable receiver; that it copes very well with other modes is a bonus.

Stephen Schaa has floated some very interesting ideas in the context of the Pappradio and it will be fascinating to see what develops from them. He has talked in terms of a "creative commons" hardware platform and open-source software such as Android to produce low-cost SDRs capable of DRM reception. Android is capable of handling multimedia content and already includes AAC+, which implies that tablets and handsets running Android could in principle be fitted with a "radio dongle" to upgrade them to DRM-ready radios. We rather think that our reservations in respect of the widespread adoption of DRM would evaporate overnight if the mode ever became a simple Android 'app'!

All in all we liked the Pappradio very much and feel that the overall approach has considerable promise. It is not yet ready for a mainstream market; a certain amount of technical and PC awareness is currently required to get the best out of it, not to mention a certain amount of persistence. But as matters stand it strikes us as a remarkable creative achievement which may point the way ahead to the convergence of the software-defined radio with the mobile handset-cum-tablet. We look forward to reviewing the first Android DRM application.

Reuter Elektronic RDR54C

€2950

OVERVIEW

As with the Medav SDR reviewed last year, the firm of Reuter may not be well known to *WRTH* readers but the company is well established in its native Germany as a manufacturer of high-grade electronic systems for professional and military markets. The RDR54C is one of a family of high-end software-defined communications receivers offering very wide coverage. Burkhard Reuter was kind enough to loan the current top-of-the range model, the RDR54C1, for a short-period review. This receiver offers coverage of 1kHz-30MHz, 50-54MHz, 87.5-108MHz and 144-148MHz. As we will see, it offers exceedingly good performance over all these ranges.

One caveat which should be stated straight away is that the radio's display legends and all the associated literature are in German and there is currently no option for any other language. Our command of German could hardly be described as fluent and it may well be that we have inadvertently omitted or erroneously described some of the unit's features and functionality, for which we apologise in advance.

The RDR54C is described as a "digital measurement and communication receiver" and apparently uses 17-bit analogue-digital conversion and direct spectrum-based signal processing. It is a standalone unit which does not require a PC or other external connection. Physically the unit takes the form of the proverbial black box measuring 290 x 240 x 110mm and weighing a hefty 3.3kg. The latter is one clue to the quality of manufacture, which is best described as exemplary. The cabinet is finished in a high-quality epoxy enamel redolent of the 'black crackle' finishes of yore and the separate modules for HF, 50 and 144MHz are mounted in the rear of the mainframe together with a PSU module and another one carrying USB and S/PDIF connectors. The overall mechanical arrangement is rather reminiscent of a miniaturised version of one of the illustrious Plessey PRS series of HF receivers. The integral PSU uses an IEC mains socket and appears to be multi-voltage-capable.

FEATURES

The front of the unit is dominated by a high-contrast WVGA (800 x 480) TFT display. This measures 110 x 70mm and has what appears to be a high-grade anti-reflective coating. It is a fine example of the current state of the art in TFT manufacture although users over the age of 40 or so may need their glasses when using the receiver since some of the display icons and legends are decidedly small. The available viewing angles are very wide in both lateral and vertical orientations and the backlighting is commendably even. To the left of the display is a loudspeaker and rotary volume control together with a microphone connector used when the RDR54C is combined with an optional separate unit (RPA5C) to form a nine-band transceiver for the amateur HF allocations. The volume control doubles as a push-switch to select headphone on or off, which is a neat touch. A row of five function buttons lies to the right of the display and these act as soft keys invoking various modes as required. One of them is a comprehensive 'setup' menu which as far as we could see allowed almost every feature of the receiver to be customised to individual tastes. There is a numeric keypad and an on-off button. Below the keypad is a rotary VFO-type control which has a rather unusual 'feel' rather like that of a ferrous reluctor wheel sitting in the field of quite a powerful magnet. In use the effect is of a variable rotary breakout force which at low speed feels rather notchy and imprecise. However, there

is more to this control than a VFO. Depressing the knob sequentially selects various functions which are shown on the display and these can then be adjusted as required by rotating the knob. We noticed a slight but perceptible pause between selecting the function and being able to control it, which is presumably a function of the firmware. Whilst on this subject, we also occasionally noticed a few squeaks, plops and extraneous noises from the speaker when the RDR54C was in use. However, it is understood that the firmware version in the receiver was not completely finalised and no doubt this kind of trivial problem will be resolved in future releases.

Most of the display is given over to a conventional 'waterfall' display of the selected band. Above this is a split-level sub-display indicating frequency and signal strength (the latter calibrated in both S-units and dBm) in two windows along the top. Several smaller windows indicate the selectable functions. The leftmost of these is the mode and the receiver supports demodulation of DSB, LSB, USB, CW, narrow and wide FM, 2FIQ, BalQ and AM. The default filter bandwidth values associated with each mode are shown in an adjacent window and can be changed as required; two vertical lines on the waterfall show the currently selected value. There is a clever RIT function, selectable notch filtering and an extremely effective noise blanker. This latter passed a very severe test involving the removal of interference from a local farmer's electric fence with flying colours, and indeed we suspect that the noise blanker in the RDR54C may be the most effective we have ever used.

The VFO step size is more or less infinitely variable, with a basic resolution of 1Hz. As far as we were able to establish, the DSP filter bandwidth is selectable between 10Hz and 9.84kHz in SSB and CW modes and 5, 7, 10 and 14kHz in AM. There appear to be extremely comprehensive memory facilities but regrettably we were unable to master them in the rather limited period available for the review.

The internal architecture of the RDR54C is unclear but from the strong-signal performance test results we would be surprised if the antenna inputs were not routed to switched narrowband (possibly half-octave) filters. The IPI_3 performance is not specified but it appears to be somewhere around +35dBm, which gave our test equipment a very hard time. The measured noise figure at 29MHz is 11dB, which is excellent and almost certainly better than necessary; in conjunction with the excellent strong-signal handling, it should allow the receiver to give optimum performance with virtually any antenna to which it is connected. The measured RF sensitivity is about -116dBm for a 10dB s/n in a 5kHz bandwidth for 50% AM modulation at 1kHz, which implies that the RDR54C is not quite as sensitive as the very best modern SDRs but comes very close.

PERFORMANCE

Comparing the Reuter receiver directly with the Excalibur Pro (see p 16) over a lengthy period including a major amateur contest weekend was very interesting and enlightening. Using a variety of antennas ranging from a seven-element triband Yagi to sundry full-size dipoles and long wires, the performance of the two receivers was very similar. Nothing which was audible on one was inaudible on the other although sometimes there was a sense – more instinctual than anything else – that the Excalibur somehow had a little more in hand with weak and fading signals. We subsequently spent some time making comparisons with high-grade conventional receivers using the same antennas together with the resident Wellbrook loop. For some reason the RDR54C seemed to get on particularly well with the latter antenna and using this combination we were very surprised to be able to hear several NDBs in the medium-wave region which had seldom been encountered before. These included beacons on a couple of North Sea oil production platforms which are very rarely heard at the test location. The receiver was not remotely troubled by extremely strong 6/7MHz signals heard on a full-size dipole and there was no trace of second-order intermodulation under any circumstances. At the other end of the coverage, very weak and fading 28MHz amateur-band beacons were perhaps slightly better and more consistently received by the Excalibur but – as with SDRs tested in previous years – neither was quite as good in this respect as a high-grade conventional receiver. It is not quite clear to us why this should be since there is very little difference in the measured performance.

CONCLUSION

All in all, the RDR54C is a fine receiver although its high price will probably put it out of reach of the average listener. Overall, however, Reuter Elektronik should be congratulated for an excellent product, and the company is clearly one to watch for the future.

Rating table for RDR 54C

Constructional quality	★★★★★
Software	★★★★
Sensitivity	★★★★★
Dynamic range	★★★★★
RF intermodulation	★★★★★
Audio quality	★★★★
Versatility	★★★★★
VFM	★★★★
Overall rating	★★★★★

Key:
★ = Poor ★★ = Fair ★★★ = Average
★★★★ = Good ★★★★★ = Excellent
VFM = Value for money

WinRadio Excalibur Pro

US$1800 £1600 €1900

OVERVIEW

Last year we reviewed the WinRadio WR-G31DDC 'Excalibur' SDR and thought it the best SDR we had encountered so far. At the current price of around £700 it is also remarkably good value for money. This year we have been looking at what might be called an enhanced version, namely the WR-G33DDC 'Excalibur Pro'. Although this carries a significant price premium over the Excalibur, it offers some significant improvements over the latter and represents a new benchmark in the development of the SDR.

Both receivers are fully software-defined, implying that the RF and mixer stages of a conventional superheterodyne give way to what is referred to as *direct down-conversion* (DDC). Here the fixed IF generated by the RF and mixer stage is replaced by a technique in which the entire spectrum of interest is digitised as a whole. Since it would require a vast amount of computing power to process all possible signals simultaneously, a smaller portion is selected by a process known as *decimation* and down-converted for the PC to perform the filtering and demodulation functions using digital processing techniques implemented in software.

One consequence of this approach is that it becomes possible to record and replay the decimated part of the spectrum and subject it to whatever analysis and processing is required. The massive advantages to the listener (and presumably to the professional and military monitor) is that the process need no longer take place in real time. Early software-defined receivers could record and replay segments a few hundred kilohertz wide; later iterations of receivers such as the Perseus offered 400, then 800 and 1600kHz which was enough to cater for the MF and several HF broadcast and amateur bands. Last years' Excalibur had a 2MHz bandwidth but the Excalibur Pro neatly doubles this to 4MHz. As far as we are aware this is the largest of any current consumer SDR. To put this capability into perspective, the entire content of the MW broadcast band and any of the HF broadcast bands can be recorded and replayed at leisure. The only constraint is the size of the associated hard drive.

FEATURES

The Excalibur Pro has some other enhancements and in particular the front-end arrangement is different from that of its cousin. Immediately following the antenna and matching circuitry is an attenuator adjustable between zero and 21dB in 3dB increments. This can be operated manually or left under automatic control to allow the receiver to optimise its dynamic range. The attenuator is followed by a bank of band-pass preselector filters whose cut-off frequencies are user-adjustable.

The preselection makes use of 15 high-pass and 15 low-pass filters (fifth-order Chebyshev and Butterworth) which are individually switched and bypassed as required by miniature relays rather than IMD-prone semiconductor switching arrangements. These are combined to create the desired band-pass filters. The filter bandwidths are arranged to be narrower at lower frequencies, reflecting typical power distribution on the HF bands and hence minimizing interference more efficiently. In conjunction with the preselector is an 'MW filter', the selection of which reduces the receiver's sensitivity below 1.8MHz.

The next stage is a two-stage amplifier whose first stage is switchable. When engaged it adds about 10dB of wideband amplification. Following this is an anti-aliasing filter and then into a 16-bit analogue-to-digital converter which samples the

input signal at 100 megasamples/sec to produce the data for the DDC. The demodulator filter is variable between 1Hz and 24kHz, which should cover almost every user requirement.

We have noted hitherto that larger the DDC bandwidth, the more processing power is required in the connected PC. The Excalibur Pro manual states that the minimum requirement is a 2GHz dual-core Pentium and we used a 2.4GHz Core2 Pentium 6600 with 4GB of RAM running fully patched WinXP SP3 for our testing. This was clearly inadequate and we suspect that a fast quad-core Pentium is more or less essential. In any SDR the maximum achievable selectivity is a simple function of the available processing power, other things being equal. The filter-length function in Excalibur allows this to be modified to some degree but our PC could not cope with anything beyond the default.

PERFORMANCE

Mechanically the Excalibur Pro is identical with its sibling but as always the real interest in any SDR lies in the software, which is functionally almost identical with that in the Excalibur. We used version 1.58 for most of our testing with a change to version 1.61 when it appeared in September 2011. In performance terms the Excalibur set new standards in several areas but the Excalibur Pro excels it in several. It is the most sensitive SDR we have yet measured, with MDS figures of between -127 and -132dBm in a 2.8kHz SSB bandwidth depending on the tuned frequency and whether or not the 10dB preamp was switched into circuit. This is entirely on a par with what would be expected with a high-grade conventional receiver. Selectivity is superb and strong-signal handling is generally speaking about 3-5dB better than even that of the Excalibur, which was extremely good. Software-defined receivers are not generally amenable to the classical form of strong-signal testing outlined in our article on page 24 and rather different techniques have to be used to gauge their performance. There is as yet no standardised test methodology and we are still feeling our way towards settled measurement protocols but it is abundantly clear that the Excalibur Pro is better than anything we have hitherto encountered. To be able to connect a full-size 6/7MHz dipole to a receiver on an autumn evening and be able to observe the sideband sets of individual broadcasters down to virtually the receiver's noise floor is – to put it mildly – an unusual position for a reviewer to find himself in! Certainly the Excalibur Pro was not remotely troubled at any time by anything our various antennas could throw at it.

CONCLUSION

The Excalibur Pro is the best SDR we have used – in some ways it is the best receiver we have used regardless of the underlying architecture – and undoubtedly represents a considerable advance in the state of the art. Unfortunately the price of such advancement is high and at £1,600 it is over twice that of the Excalibur. For the professional user and those who must have the best at any price – and the ability to deploy what amounts to three separate high-grade receivers within an overall 4MHz slice of spectrum is exceedingly impressive – there will be no argument.

WinRadio Excalibur Pro
BEST SDR

The advent of such capable receivers also raises two questions. One is that if an SDR with this level of performance is available at a discretionary consumer price-point, what are the capabilities of current military and professional receivers at many times the price? We simply do not know and details are not available but some rumours suggest that there are phenomenally capable SDRs in use in various interesting applications. The other question is whether at some stage in the foreseeable future the technical parameters of a radio will no longer be the limiting factors in the performance of the link between transmitter and receiver. In other words, what we hear at a given time will be simply determined by whether or not there is a propagation path to whichever transmitter we wish to listen. As we have outlined elsewhere in this edition, achieving sensitivity appropriate to the frequency in use is now merely a matter of design. It could conceivably be the case that at some stage this will apply to all other receiver parameters as well. Imagine a world where filter passbands and stopbands were archaisms and mentioning them brought forth a look of puzzlement, much as mentioning the audion does today!

Rating table for Excalibur Pro

Constructional quality	★★★★★
Software	★★★★
Sensitivity	★★★★★
Dynamic range	★★★★★
RF intermodulation	★★★★★
Audio quality	★★★★
Versatility	★★★★★
VFM	★★★★
Overall rating	**★★★★★**

Key:
★ = Poor ★★ = Fair ★★★ = Average
★★★★ = Good ★★★★★ = Excellent
VFM = Value for money

Sangean ATS-909X

US$260 £180 €225

OVERVIEW

We reviewed the Sangean ATS-909 (also badged as the Roberts R861) in 1997 and 2002 and liked it on both occasions. This portable receiver had a remarkably long production life, having been first manufactured in 1995 and only discontinued earlier this year; in fact 'new-old stock' examples could still be found at various internet sites at the time of writing. We now have the ATS-909X which Sangean calls its 'flagship' model. Given its designation and the fact that its feature set is generally very similar to that of the ATS-909, it would seem that the manufacturer intends the ATS-909X to be seen as an updated version of its predecessor rather than an entirely new model. We encountered some problems in obtaining a sample for review in time to meet our production deadlines and in the end had to settle for a variant purchased from Taiwan and with all its associated literature in Japanese. Readers are asked to forgive any inadvertent errors or omissions in what follows.

The new receiver is certainly smaller than its predecessor, measuring 210 x 132 x 38mm and weighing about 2kg. It is slightly more rounded in appearance than its severely rectilinear predecessor but shares the latter's large and clear LCD. This now has a very bright white LED backlight and the upper vertical viewing angle of the display is surprisingly restricted when it is switched on. A fairly large loudspeaker is to the left of the display and a conventional alphanumeric keypad is sited below. This latter uses sensibly sized buttons with short travel, low breakout force and nicely weighted tactile feedback. The main tuning control at lower right is a recessed thumbwheel type with slightly excessive breakout force for its size and a degree of backlash. It is well placed for operation with the right thumb, as are the up/down keys to its left and the centrally located step-size button. This is intelligently arranged to give either 1kHz or 9/10kHz steps in the AM bands and either 50 or 100kHz steps on FM. In addition to these modes the ATS-909X offers USB and LSB reception facilities. Unfortunately it perpetuates the 40Hz tuning step used in the ATS-909 which makes the function rather less useful for ECSS reception of broadcast stations than it might otherwise have been and introduces just enough error to be audibly irritating on some SSB transmissions.

On the left-hand side are sockets for an external AM antenna, headphones, auxiliary audio input, record standby and line-level outputs. There is an edgewise rotary control billed as 'RF gain' (although it is in effect an RF attenuator) operating on the AM bands and a DC input socket for an external 9V supply. The right-hand side carries the rotary audio volume control and slide switches for manual or RDS-derived time setting; a three-position tone switch marked 'narrow', 'news' and 'music' and a two way switch selecting narrow and wide filters on AM and mono or stereo operation on FM, the latter being available via the headphone output. The rear drop carries a telescopic antenna. Sangean states that this is 2in longer than that fitted to the original ATS-909 to "...improve SW and FM reception". In practice we cannot imagine two inches making the slightest difference to reception performance.

FEATURES

Much of the functionality of the ATS-909X is identical to that of its predecessor. Coverage is 153-519kHz on LW and 520 or 522-1710kHz on MW. The HF coverage is 171-30MHz and the 88-108MHz FM band is also available; in fact our sample embodied the Japanese 76MHz extension

to Band II. An RDS facility is available in conjunction with the FM band and provides for the PS (Programme Service) name and CT (Clock Time) elements of the system, with some other functionality available via a sub-menu. A carrying case and a neatly spooled 7m roll-out wire antenna are supplied with the receiver.

As with its predecessor, the memory facilities in the ATS909 are very comprehensive and a total of 406 stations can be stored. The nine numeric presets are configured into 'pages' and there is one available for LW (hence nine stored stations), two for MW, three for FM and a massive 39 for SW, implying a total of 351. These latter are all factory-programmed with the frequencies of major international broadcasters, the names of which appear in the display as each page is selected. As if this was not enough, there is also a 'priority preset'. One new feature is a squelch button. Pressing this and rotating the tuning control gives a 12-step muting threshold, particularly useful when scanning the HF bands.

PERFORMANCE

The ATS-909X appears to be a dual-conversion design with a DSP IF sub-system. Given the latter it is perhaps a little unfortunate that the receiver apparently does not incorporate synchronous AM detection. Side-by-side comparison with an original ATS-909 suggested that FM selectivity was slightly better although sensitivity was if anything slightly worse, and this trait was maintained on the MW and SW bands when using the receiver's own antennas. We also noticed an assortment of low-level noise and digital artefacts on the MW band, presumably originating somewhere in the DSP circuitry, and weaker daytime signals seemed subjectively to be 'noisier' than on the ATS-909. Results with the roll-out wire antenna and also a selection of external antennas were rather better and it may be that Sangean has optimised the front-end circuitry on the basis that external antennas will be used with the receiver. The best results were obtained using a Wellbrook ALA1530 loop although curiously some extraneous noises were occasionally audible even with this antenna in use. We were also rather surprised to note a few MW broadcast station images or spurious responses appearing at low level in the LW band. For example, tuning the receiver to 234kHz produced a signal from a local station (Radio Hafren) on 756kHz, and on 261kHz we noted a weak and distorted version of Absolute Radio on 1215kHz. Neither of these is particularly strong at the test location – measured with a correctly calibrated S-meter, one is about -60dBm and the other about -66dBm on the Wellbrook loop – and it did not prove possible to identify the mechanism responsible. No such problems were noted in the HF bands although here again the impression was received that the ATS-909X was a little short of sensitivity below about 15MHz and this became more marked as the frequency was reduced. External antennas again helped on some occasions although not all; on the 6/7MHz band it was particularly evident that almost any antenna more than a few feet long added nothing to signal strength whilst increasing the noise.

Apart from these issues the ATS-909X performed well and was also very easy to use. We found an English-language manual on the internet which although evidently rather badly translated from Chinese gave a valuable degree of help, and it became evident that operation of the receiver was exceedingly simple. If the frequency of the wanted station was known, it could simply be entered directly; tuning and memory storage were simple and quick and for the most part the internal station database was up-to-date. One definite point in the ATS-909X's favour is the audio quality. We always liked that of the ATS-909 but the later receiver is even better in this respect despite its smaller speaker and some very pleasing results were obtained on FM broadcasts. The use of a separate headphone amplifier seems to have reduced the hiss associated with the headphone output in the ATS-909 and we much enjoyed some concerts on a good-quality headset connected to the ATS-909X.

CONCLUSION

In summary, the ATS-909X largely seems to be a worthy successor to the original ATS-909 if perhaps not quite displaying the same build quality and lacking a little of its polished performance. In an ideal world Sangean would address some of the ATS-909X's minor shortcomings by running changes in production and this would leave them with a very fine receiver. For the moment, the very extensive memory facilities, the provision of RDS and the extreme ease of use make the ATS-909X worthy of consideration by those looking for a wide-range portable radio, and the ability to recharge batteries without having to mount them in a separate charger will be very useful.

Rating table for ATS-909X

Constructional quality	★★★★
Sensitivity	★★★
Dynamic range	★★★★
RF intermodulation	★★
Audio quality	★★★★★
Versatility	★★★★
VFM	★★★
Overall rating	**★★★★**

Key:
★ = Poor ★★ = Fair ★★★ = Average
★★★★ = Good ★★★★★ = Excellent
VFM = Value for money

Tecsun PL-660

US$120 £85 €100

OVERVIEW

Last year we reviewed two Tecsun receivers in the context of an examination of 'ultralight' portables. Given their very low cost of around £35-40 we were pleasantly surprised by their very good performance. This year we examined the Tecsun PL-660, which could be regarded as a mainstream portable in the same bracket as, for example, the Grundig G3 or one or two of the lower-cost Sony and Sangean receivers. It is currently the top model in the company's range. As with last year's Tecsun receivers, our sample was obtained directly from Hong Kong via an internet auction site although just as we went to press it was noted that Amazon USA had begun to carry the PL-660. Amongst other things this would mean that a conventional warranty would be available, as would an English-language manual.

The PL-660 measures 185 x 115 x 35mm and weighs just under 1kg. Our example had an overall matt black finish although we have seen silver-coloured examples for sale on the internet. The slightly curvilinear front is dominated by a large LCD with switchable amber backlight. Below the display is a numeric keypad with memory and delete/enter buttons, and to its left are the power switch and timer-setting push-buttons. To its right are two rows of buttons which select various modes and functions. All are in our view rather too small for comfort and have breakout forces which are out of all proportion to their size; the combination of this with excessively long travel and weak tactile feedback does not give much pleasure to the user. On the right-hand side are rotary controls for tuning, the SSB BFO and volume. The left-hand side carries sockets for an external antenna, headphones and an external 9V input. There is also a three-position antenna gain switch for DX, normal and local reception and a treble/bass tone switch. On the rear is a fold-out flap which gave a rather alarming-sounding "crack" when opened out but positioned the receiver at a pleasant angle for desktop use. The battery compartment below the flap gives access to the four AA cells required to power the radio.

FEATURES

The PL-660 covers 100-519kHz on LW and 520-1710kHz or 522-1620kHz on MW depending on the selected step size, together with 1711-29999kHz and the 87-108MHz FM band; fourteen HF broadcast bands are directly available via up/down keys. The receiver also offers coverage of the 118-137MHz VHF air band but this was remarkably poor in our sample at least; the sensitivity was dire and the lack of a squelch function made for very fatiguing listening. The air-band coverage has the feeling of something added very late in the design stage and not properly developed. It should not be treated as a relevant factor in a buying decision. Quite why the PL-660's designers included such a poorly implemented function instead of some other useful feature such as RDS on FM is difficult to understand. On the bright side, the AM functionality includes switchable synchronous detection. In effect there are three separate tuning modes. One allows the radio to be tuned in the conventional way and an automatic speed-up changes the tuning-step size according to the rotation rate of the tuning knob. On FM this gives 100kHz and 10kHz steps, the latter being really rather pointless. On LW and MW the major step sizes are selectable between 9 or 10kHz to suit the local ITU region and the minor step is 1kHz. On HF the steps are 10 and 1kHz. The tuning control can also be used in a different mode in which rotation scrolls through stations stored in memory. There appear to be

100 user-programmable locations per band making a total of 2,000 storable locations although the store-and-recall function appeared to be slightly erratic in our sample. Direct entry of a frequency can be carried out via the keypad in the usual way. There is a scan mode, which when invoked causes the radio to pause for about six seconds on each stored station, and an auto-store mode in which the strongest stations within a band are automatically saved to memory. In practice this feature did not work very well because the lack of a proper squelch function caused the radio to store almost any frequency where there was a construable signal.

PERFORMANCE

Arguably the best feature of the PL-660 is its very good synchronous detector. In extensive tests with a variety of antennas the detector never failed to lock on to the tuned station, even if it was weak and subject to fading. Under these conditions many synchronous detectors either lose lock and fail to regain it, sometimes making peculiar noises in the process, but that in the PL-660 proved consistently reliable. Quite often it made the difference between very difficult reception of weak signals and almost perfect copy, and surprisingly the detector remained in lock even if the receiver was tuned 1kHz either side of the nominal frequency. The switchable wide and narrow filters worked quite well in this mode and it was noted on several occasions that using the wide filter with synchronous detection switched in gave very good results despite the presence of a strong adjacent channel. Re-tuning the receiver to a different frequency with the synchronous detector switched in also caused no problems, with an immediate lock happening automatically. We noticed a considerable difference in audio quality between upper and lower sidebands, probably because of the use of relatively low-cost filters, but this is of little consequence. In fact the receiver's SSB performance overall was quite reasonable and the centre-detented BFO control was very easy to use. As supplied, incidentally, our sample exhibited a frequency error of about 45Hz and this drifted slightly upwards with time but the BFO coped easily enough. Some strong utility stations such as RAF Volmet on 5450kHz sounded better if the RF attenuator was used in its normal or local positions.

The PL-660 is presumably a dual-conversion design although no information seems to be available. In overall performance terms the receiver acquitted itself quite well. FM reception was generally very good with adequate sensitivity and selectivity and the recovered audio was of good quality although better (and of course stereophonic) on a high-grade headset; the small speaker in the PL-660 is not the best we have ever heard. In a direct comparison with the ATS-909X (see page 18) the Tecsun product was slightly better than the Sangean in that it often managed to produce usable audio from weak stations adjacent to strong ones.

Generally speaking, performance on the HF bands was also good and the receiver is clearly well optimised for use with its telescopic antenna. External antennas were also quite usable with both the Wellbrook loop and random wire antennas giving good reception on more or less any HF band that was open. A full-size 6/7MHz dipole proved a little too much for the PL-660 on occasions and caused a dramatic increase in noise which demolished all but the strongest stations. This kind of behaviour is not at all surprising with a low-cost receiver. Performance on the LW and MW broadcast bands was generally acceptable but subjectively perhaps a little noisier than would have been expected on all but the strongest stations. The measured sensitivity reflected this; at our standard 20dB signal-to-noise ratio the PL-660 was about 12-15dB less sensitive than we would normally expect a low-cost portable to be. For an admittedly outrageous comparison, at 1MHz it is 11dB less sensitive than the Excalibur Pro (see page 16). We also found that the AGC action was rather peculiar, with a decidedly sigmoid characteristic and a degree of hysteresis which was not present on the HF bands. No audible images or spurious responses were found.

CONCLUSION

It would not be reasonable to expect immaculate performance at this price point and neither should one expect impeccable build quality. In fact the PL-660 is fairly well made and ergonomically quite pleasant apart from the rather fatiguing design of the keypad and buttons. In terms of pure radio performance, and neglecting the dreadful air-band implementation, the results could be summarised as fine FM and HF and rather indifferent LW and MW. But even so, our view is that the PL-660 offers good value for money – and how nice it would be if only all synchronous detectors were as good as this one!

Rating table for Tecsun PL-660

Constructional quality	★★★
Sensitivity	★★★
Dynamic range	★★★★
RF intermodulation	★★★★
Audio quality	★★★★
Versatility	★★★★
VFM	★★★★
Overall rating	**★★★★**

Key:
★ = Poor ★★ = Fair ★★★ = Average
★★★★ = Good ★★★★★ = Excellent
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WRTH HF Receiver Guide 2012

Budget, Hand-held & Travel Portables

Maker	Model	Size	SEL	DR	OV	US$	£	€
AOR	AR8200 MkIII	H	****	***	***	600	440	480
Degen	DE-1103	S	***	***	**	80	50	60
Kchibo	KK-D6110	S	***	***	***	45	30	35
Roberts	R861	M	****	***	****	280	185	210
Roberts	R9914	S	****	***	****	160	100	110
Sangean	ATS-404	S	***	***	***	80	55	60
Sangean	ATS-909	S	****	***	****	220	150	165
Sangean	ATS-909X	S	****	****	****	260	180	225
Sony	ICF-SW11	S	***	***	***	100	60	70
Sony	ICF-SW12	S	***	**	*	130	80	95
Sony	ICF-SW35	S	***	***	****	180	135	160
Sony	ICF-SW7600GR	S	****	****	****	240	170	190
Tecsun	PL-310	S	****	****	*****	55	30	40
Tecsun	PL-380	S	****	****	*****	60	40	45
Tecsun	PL-660	S	***	****	****	120	85	100

PC Radios, SDRs, Serious Shortwave & Semi-pro Receivers

Maker	Model	Size	SEL	DR	OV	US$	£	€
Alinco	DX-R8E	M	****	****	****	500	550	700
AOR	AR5001D	M	*****	****	****	3995	3395	4000
AOR	AR8600	L	**	***	***	900	670	800
Elad	FDM77	C	****	****	****	640	400	450
Etón	Satellit 750	L	***	***	***	299	299	485
FlexRadio	FLEX-1500	C	****	****	***	650	550	650
FlexRadio	FLEX-5000A	C	*****	*****	*****	2800	2495	2720
Icom	IC-718	L	***	****	****	800	520	620
Icom	IC-7000	M	*****	****	*****	1300	1100	1375
Icom	IC-7600	L	*****	****	****	3800	3150	3800
Icom	IC-R9500	L	*****	*****	*****	13450	10000	12000
Medav	LR2	C	*****	*****	***	4800	3100	3600
Microtelecom	Perseus	C	*****	*****	*****	1000	700	820
Palstar	R30	M	*****	*****	****	750	600	660
Pappradio		C	****	***	*****	100	65	80
Reuter Elektronic	RDR54C	M	*****	*****	*****	-	-	2950
RFSpace	SDR-IQ	C	****	****	****	520	490	590
Ten-Tec	RX320	C	***	***	***	370	200	240
Ten-Tec	RX340	L	*****	*****	*****	4250	3600	3925
WinRadio	G31 Excalibur	C	*****	****	*****	900	700	840
WinRadio	G33 Excalibur Pro	C	*****	*****	*****	1800	1600	1900
WinRadio	G303i	C	****	****	*****	360	590	700
WinRadio	G313i	C	*****	****	*****	1150	1100	1000
WinRadio	G313e	C	*****	*****	*****	1150	1090	1200
WinRadio	G305e	C	****	****	****	1100	670	750

KEY: SEL = Selectivity, DR = Dynamic Range, OV = Overall Value. H = Hand-held, C = PC radio/SDR, S = Small, easily portable. M = Medium, suitcase size. L = Large, table top use. * = Avoid ** = Poor *** = Fair **** = Good ***** = Outstanding.
NOTE: Prices vary due to exchange rate fluctuations. Some models may be unavailable in certain markets.