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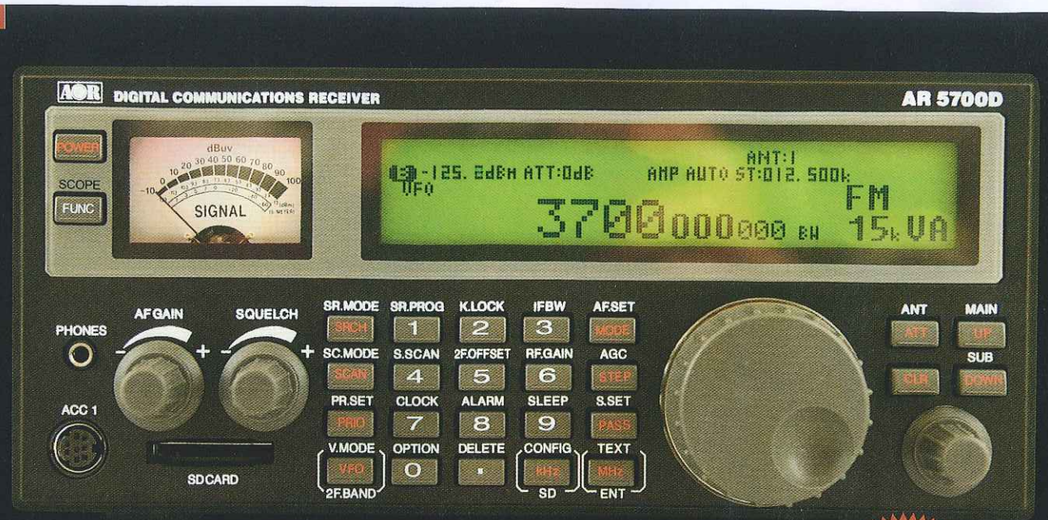

GEORG WIESSALA

Review: AOR AR5700D Digital Wideband Receiver

Radio User REVIEW Radio User

This month **Tim Kirby** is lucky enough to try the new wideband receiver from AOR, the AR5700D. Here, he offers his in-depth review of this radio.

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This month, I am taking an in-depth look at the new AOR AR5700D receiver (Figs. 1 and 2). When I was sent the review unit, and upon unboxing it, it was quickly very apparent that this was a serious bit of kit.

The build quality, finish and general presence of the unit suggested something to be reckoned with, without even switching it on and hearing signals.

It was at this stage that I thought I'd better do a quick bit of research and find out some basics, including the price. At a price tag of £4595, this is not your average scanner/receiver. I poured myself a coffee (well away from the receiver, I might add) – before beginning the review.

So, what makes the AOR5700D so special?

First of all, Table 1 shows the main points and specifications, according to the manufacturer.

Not Batting an Eyelid

Two features caught my eye immediately – the first one was the very wide range of the receiver – from VLF going well up into the microwave region at 3.7GHz. The second was the wide range of modes that can be demodulated, including pretty much all the digital voice modes (Mototrbo, DMR, D-STAR, C4FM etc) that you can shake a stick at.

My first (local) test was to unbox the receiver, hook-up the supplied 12V power supply and switch on – you have an option to set the date and time. I tuned the receiver to the output of my amateur radio digital hotspot, which can transmit in a variety of digital modes. I set the mode on the AR5700D to DALL.

DALL means 'Digital All' – the receiver will look at the content of the data stream and work out what type of transmission it is receiving. It will then change to the appropriate mode and decode it.

I set my digital hotspot to DMR, and sure enough, the AR5700D quite happily received that, as well as showing data about the transmission, such as the timeslot and colour code of what was being received.

C4FM (Yaesu's digital voice offering, sometimes known as 'Fusion' was no problem either.

How about D-STAR? That was fine too, and the display showed the callsign of the station transmitting, as well as the reflector in use. The data displayed when a digital transmission is being received varies from mode to mode. It was great to find that the receiver did all these modes without batting an eyelid, as it were.

It'll do much more as well, although those will be the main digital voice modes you'll find in use on the amateur bands (mostly, though not exclusively, in the 430MHz band). TETRA (both Direct and Traffic Channels) will get the attention of many listeners, but of course, although the receiver is capable of receiving the mode, you won't be able to listen to encrypted transmissions, of which there are of course some here in the UK.

You'll find Mototrbo in use in various parts of the spectrum – often between 450 and 460MHz.

On the Bands

Audio quality from the receiver was pleasant to listen to – the inbuilt speaker sounded decent enough. There's an extension speaker socket if you want to feed the audio into an external audio system.

With a VHF/UHF antenna available – I thought I'd take a listen on the Marine and Air bands, as these tend to be the busiest in this part of the world. This gave me a chance to get used to entering frequencies and selecting the appropriate bandwidth for the various modes – of which there is a comprehensive selection.

If you wish to look at this in detail, grab yourself a copy of the instruction manual at this URL:

https://tinyurl.com/s5xha8a

I also had to play with the step function to be able to get to all the frequencies I wanted to try. Step frequencies available are 0.001, 0.010, 0.050, 0.100, 0.500, 1.000, 5.000, 6.250, 9.000, 10.000, 12.500, 20.000, 25.000, 30.000, 50.000, 100.000, and 500.000 kHz. You can also enter your own values for the step frequency – so you could create an 8.33khz step to be used in the airband, for example.

I quickly dialled up the local VOR beacon 'STU'. This, as you would expect, came in nicely; it is not much more than a mile away. A feature of the receiver I noted and enjoyed at this stage was the analogue signal strength meter and movement, which worked beautifully. Other civil aviation traffic was noted in the airband, as well as signals while listening to Channel 16 on the Marine band.

The sensitivity of the receiver seemed in line with what I would expect in the VHF/UHF ranges. I also tried out the AR5700D in FM Stereo mode (FMST) with 100 and 200khz bandwidths available – which sounded good. You'll only get the benefit of stereo if you plug headphones in though.

Onto HF

Of course, I wanted to try the receiver on HF as well. My first stop was some of the Shanwick HF channels, which came in nicely.

Later, I tuned to the 14MHz amateur band to try some CW (Morse code), and I was very pleased to find that the narrow filter worked very well indeed, with no ringing.

After that, I had a quick tune around the broadcast bands – where the receiver was a delight to use.

Much as I love the SDR receivers I use on a regular basis, the AR5700D did have an 'old school' feel to it, but with SDR performance.

I wish I'd had the opportunity to try the receiver with a very low noise antenna such as a loop – I bet the results would have been stunning.

There are five separate VFOs, so you can leave a VFO 'parked' in different parts of the spectrum and switch between them as needed.

The receiver has two antenna inputs, both N-sockets. An N connector is a good choice especially as the receiver is specified to perform well into the microwave region. I was going to say that not all hobby radio enthusiasts will have N connectors or adapters in their shack, but I suspect that the serious enthusiasts or professional users that the AR5700D will attract will be well equipped with the appropriate connectors and adapters.

Parallel Listening and Recording

The AR5700D has the ability to listen to two different frequencies at the same time (in some cases three!). You can use Dual-band reception (one frequency below 25MHz and one above) – you'll need to use a separate antenna socket for each of these, although I guess there is nothing to stop you splitting the antenna feed to the two different sockets if you wanted to.

There's Offset reception, with a main and sub frequency within 5MHz of the main frequency (Offset reception is only available above 25MHz). Finally, there's Triple Reception which allows a combination of the two – in other words, one HF frequency and two VHF/UHF frequencies set up in Offset mode.

With headphones or line out – you'll find the Main frequency on the left-hand stereo channel and the Sub frequency on the right-hand stereo channel. For FM modes with 100/200khz bandwidth, they are audible as a mono source.

You'll see a standard-sized SD card slot on the AR5700D. You can use this for re-

The build quality, finish and general presence of the unit suggested something to be reckoned with

The AR5700D is a high-end table-top receiver with wideband coverage between 9kHz and 3.7GHz. It supports a variety of digital, as well as analogue modes. Some of its outstanding features are as follows:

Digital Signal Processing (DSP): Input signals after the 45.05MHz IF are converted from analogue to digital by a DSP processor. There is no AGC in the analogue processing unit, as all processing, including AGC, is done by DSP.
High-Performance Analogue Front-End: Analog signal processing is performed by a computer-simulated, high-performance distribution constant filter.
DDS Local Oscillator: Instead of the conventional PLL method, the first local frequency is produced by direct digital synthesis. That method allows frequency-switching at high speed.
IF Output: An analogue IF of 15MHz (+/-7.5MHz) bandwidth is output.
Digital I/Q Output: Digital I/Q signal of 0.9MHz is output via a USB 2.0 interface.
High-Precision Frequency Reference: 0.01ppm frequency stability of the 10MHz internal master oscillator is achieved when using the optional GPS receiver unit.
FFT Analyser: Thanks to the onboard FFT processor, 10MHz wide spectrum data can be output at high speed via serial.
Multi-mode Digital Voice (DV) Demodulation: D-STAR, YAESU, ALINCO, D-CR, NXDN, P25, dPMR, DMR, Mototrbo, TETRA. (Mode dependent restrictions apply).
Video Demodulation: By connecting and external TV monitor, it is possible to demodulate the signal of FM modulation security cameras and analogue TV broadcasts. When you connect the TV monitor, you can check the demodulated video. Not compatible with digital terrestrial television.
Simultaneous Monitoring: 2-band reception, offset reception, triple reception (restrictions apply).
SD Card Slot: You can record the received audio, analogue and decoded digital, as well as logs.
12kHz Analog I/Q Output: Allows DRM broadcasts decoding via a PC and dedicated 3rd party software.
HF Direct Sampling: When receiving HF signals, the signals are converted directly to digital without entering the mixer. This allows very good linearity characteristics.

Table 1: The AOR AR5700D: The Specifications.

	AR-DV1	AR5700D	COMMENTS
Frequency Range	100kHz-1.3GHz	9kHz-3.7GHz	
Fpga Signal Processing	1 CORE	3 CORES	Parallel processing of digital demodulation.
DSP	1 CORE	4 CORES	More cores allow faster digital signal detection.
Frequency Accuracy	2.5ppm	0.1/0.01ppm	0.01ppm with optional GPS unit.
I/Q Output	✗	✓	AR-IQ-III software made by Microtelecom s.r.l. supplied as standard.
Analog If	✗	15MHz wide	To connect to external IF recorders, signal and spectrum analysers.
10mhz Reference Input	✗	✓	
Simultaneous Reception	✗	3	Dual-band, offset and triple reception modes (limitations apply).
Rec To Sd	Audio only	Audio + logs	Access logs and playback related audio files with the special PC utility
Agc (Hardware)	Automatic	✗	Not needed as excellent IIP3 figures provide very high linearity.
Signal Strength Reading	Only relative values due to AGC	Direct antenna reading	
Local Oscillator	VCO+PLL	DDS	High-speed frequency switching, thanks to excellent C/N characteristics.

Table 2 The AOR AT-DV1 and AR5700D In Comparison (AOR Japan).

cording audio from the receiver, as well as backing up and restoring configuration data. The SD Card slot will take up to a 32GB card, formatted as either FAT or FAT32 and records in WAV format, 16bit mono at a sample rate of 17578khz. Recordings are saved with file names such as *00000001.wav*, *00000002.wav*, which increment by one for each recording. The manual also states that: "*Logs of audio recordings are also written into the wav file; however, those logs cannot be accessed via the receiver. You need to use a dedicated LOGEXTRACT PC utility to access the logs, playback related audio files on your PC and save export the logs in CSV format. Details at: www.aor.co.jp/receiver/product/ar5700d.*

You can record about 8 hours' worth of audio per Gb – so a 32GB card will record 256 hours of audio (it equates to about 2Mb a minute). You can play the audio files back through the receiver, rather than having to do it through a computer with an SD card slot/adapter.

Memories, Searching and Scanning

Of course, you can save frequencies into memories for *scanning*. The AR5700D can store 2000 memories in 40 memory banks of 50 channels. This is probably sufficient. However, given the wide range of the receiver, have a think about how you plan to use the memories and check that the capacity is sufficient for your needs. As you'd probably expect, you can scan multiple memory banks at a time. There's also a 'Select Scan' operation, which allows you to tag up to 100 channels across different memory banks to provide a 'super list'. You can link memory banks together for scanning if you wish.

The AR5700D provides different methods of *searching* for signals. For example, searching between two frequency limits as defined by 'VFO-A' and 'VFO-B'. You can have the search pause for up to 9.9 seconds, as well as make it stop only on frequencies on which a voice is detected.

You can also create up to 40 'Search Banks', with upper and lower frequency limits, a defined step and IF bandwidth. You can group 'Search Banks' together into 'Search Groups' (up to 20).

This will be most effective on the VHF/UHF/SHF bands. Although it works on lower frequencies too, as the manual notes, this is less likely to be successful, owing to the relatively high noise floor. There's an Auto-Store feature available, which stores the first 50 active frequencies found into Bank 39 for further analysis.

There's an RCA socket on the back panel, which allows you to take the output of a demodulated analogue video signal and put it into a video monitor. You won't be able to use this for digital terrestrial TV, of course. There's an IF output (BNC socket) which allows you to take the 45.05MHz IF (a bandwidth of +/- 7.5MHz) – you could use that as input to a panadapter, for example.

Computer Control: AOR-IQ-III

All this and we haven't even covered the computer control aspects. Because the receiver is an SDR design, you can do a huge amount if you connect the AR5700D to your computer and use the AOR-IQ-III software suite (Figs. 3 to 5). You'll need a reasonably capable machine – the suggestion is for an i7 CPU, 16GHz RAM an HDMI monitor, plenty of hard disk for recordings and three USB ports (one for the IQ stream, one for receiver control and one for the licence dongle). Windows 7, 8.1 and 10 are supported.

The manual helpfully notes that – if you notice any 'audio stuttering', due to insufficient PC resources, you can adjust the software's *Buffer Reads/Interval*.

There are more details on this in the *Advanced Parameters* chapter of the manual.

On first reading, I was a bit disappointed to see that a USB dongle was required to run the software.

However, on the positive side, all the licencing, drivers and software you need to run AOR-IQ-III are included on the dongle. Recording onto it is not advisable, for two reasons (1) because the I/Q data size would very quickly fill the USB memory, and (2) because the USB memory speed would probably be a 'bottleneck' for larger files and create 'stuttering'.

In line with much modern equipment software, upgrades will be available from the factory as downloads.

For the moment, you will need to install the IQ drivers and the receiver control drivers (the receiver control drivers should install automatically) before you try and start to run the *AOR-IQ-III* software.

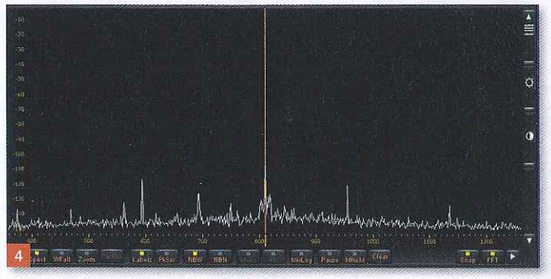
On its first run, *AOR-IQ-III* will ask you for the USB Serial Port number of the receiver. If you're not sure which port number it is, use *Device Manager* in *Windows Control Panel*.

Verify the port number by unplugging and then reinserting the receiver control connection – you'll see the port 'vanish' and 'reappear', which should confirm the one to choose in the setup dialogue box.

I thought the interface quite well designed and attractive, but your opinion may be different! The interface is well described in the manual – at least enough to get you started with confidence.

What did become apparent (thanks to

PICTURES: AOR, JAPAN



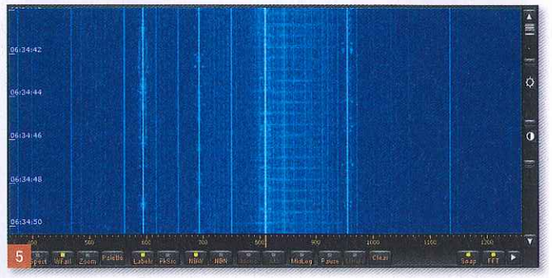


Fig.1: The front of the AOR AR5700D.
Fig. 2: The back of the AOR AR5700D.
Fig. 3: The AOR-IQ-III Interface.
Fig. 4: AOR-IQ-III Main Spectrum.
Fig. 5: AOR-IQ-III Waterfall Display.

Peter Hegan, for pointing this out) is that the software does *not* provide any method of entering memories or search bank limits. The key purpose of AR-IQ III, according to AOR Japan, is basic control, I/Q recording and playback.

At a later time, a free AOR utility will be available for memory management. A few commercial, third-party software (control and database) solutions will also be available in the future.

Whether you choose to use the control software, of course, is up to you – I think it's fair to say that you can do everything you are likely to want to do from the control panel of the receiver. If you like SDR programs as I do, you'll probably find it easier to do it all from the software, but it's a very personal choice.

If you decide to record the spectrum, the IQ data is recorded as WAV files, but you'll only be able to play the data back using the *AOR-IQ-III* software (Figs. 3 to 5). No other SDR programs will be able to read the data.

Concluding Remarks

I have reached the end of my allotted space, but I feel I've barely scratched the surface of the AOR5700D. I would have liked to spend more time looking at HF and SHF capabilities, but I decided it was better to give a general overview of the receiver. It really is a fascinating piece of kit.

The price reflects the performance and capability of this receiver, which is likely to be targeted at – and will find wide appeal in – the professional and governmental market.

Nevertheless, I am sure that a few hobbyists will be attracted to this receiver too.

Overall, the receiver performance is good, highly flexible and configurable.

Having a receiver that can be entirely controlled from the front panel rather than a computer is unusual these days, but the AR5700D scores highly here.

The AR5700D really does well if you are interested in seamless decoding of digital modes and/or in a receiver which can be used in the microwave region. The AR5700D goes much higher in frequency than the majority of SDR receivers.

In addition to this, it provides demodulation of the majority of modes without the need for additional software or licence keys.

Computer interfacing is proprietary (Microtelecom in Italy) – as it stands now, you can't use any other SDR software with

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the AOR5700D. However, the interfacing of all AOR receivers has always been open, and the complete PC command lists are available for download on the AOR website. According to AOR, the command list for the AR5700D is in preparation now and will be on the AOR website soon.

Table 2 shows the main differences between the smaller (and cheaper) AOR-DV1 receiver and the more expensive AR5700D.

If you're tempted by the AOR5700D, I suggest a trip to your friendly dealer, get them to put it on some aerials, HF and VHF/UHF and SHF if they can! Spend an hour or two playing and see how you get on.

If you're going to spend on the receiver, any dealer will be happy to spend time with you.

The AOR AR 5700D retails at £45995.

Very many thanks to Waters and Stanton for the loan of the AOR5700D – I really enjoyed having the opportunity to try it out.

See you next month when it'll be the next in the series of *Signals from Space*.