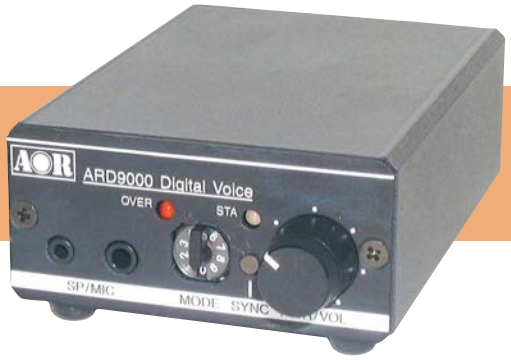


AOR ARD9000 digital

AOR's ARD9000 digital voice modem offers "astounding" sound quality at a modest price, writes Chris Lorek

We're increasingly living in a digital world, and this isn't just limited to commercial radio applications such as cellphones, digital TV and radio broadcasting. Amateur radio has been using digital communications from the very earliest days, when CW could be arguably termed as the first ever 'digital' mode. Eventually RTTY came along, then packet radio, followed by a plethora of advanced data modes for keyboard-based communication. Some of these do such a good job in weak signal and interference rejection that you'll achieve 100% copy when modes such as manual CW or analogue SSB wouldn't stand a chance of getting through. Some experimental modes, such as narrowband spread spectrum, are also suitable for digitising signals including speech for weak-signal and interference-laden work. Indeed any digital mode capable of data transfer at a reasonable bit-rate speed could be adapted for digital speech over an SSB bandwidth.

In 1999, Andy, G4JNT, and Charles, G4GUO, published their results with digital speech over HF in RadCom [1], followed by papers later in other publications [2, 3]. There's also an excellent description on G4GUO's website [4]. Last year, AOR took a brave marketing decision and launched a ready-made set-top version of a digital modem, the ARD9800, which was reviewed in the July 2004 issue of RadCom [5]. This offered not only digital speech over an SSB bandwidth, but also file transmission and optional TV-resolution picture transmission by adding a plug-in module. It's fair to say that many amateurs, me included, were greatly excited about this, although I am sure the price tag of just under £500 dissuaded a number of amateurs. However, AOR has now launched the ARD9000 at a typical retail price of around £169.

FEATURES

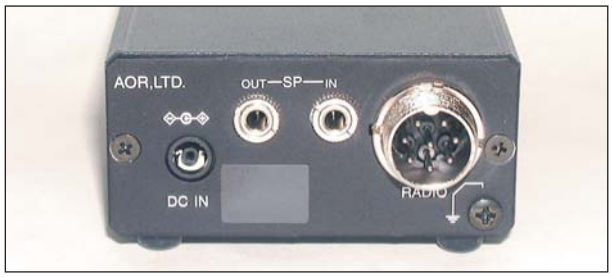
The ARD9000 is a voice-only modem, although it's fully backward compatible with digital speech with the ARD9800. Like its multimode predecessor, it acts just like a set-top box with no transceiver modifications needed. You just plug it in, possibly adjust a few audio levels using the controls on the unit, and off you go.

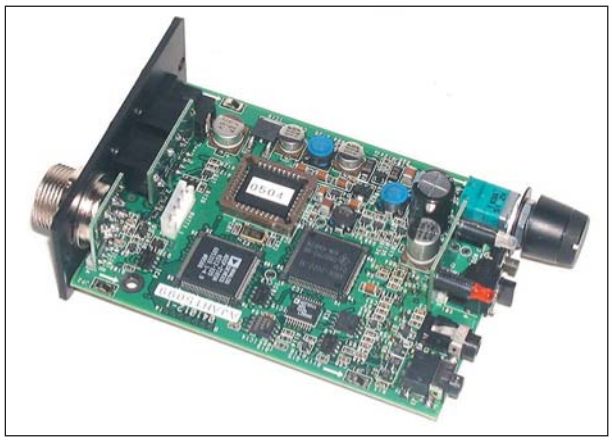
For the technically minded, a description of the data mode used is given in the references and the RadCom review detailed earlier. It uses OFDM with a digital vocoder and DQPSK modulation, employing 36 tone carriers spaced at 62.5Hz, giving an overall transmitted audio bandwidth of 312.5Hz to 2,500Hz.

The ARD9000 is quite compact, measuring just 70 x 33 x 98mm making it even smaller than most SWR meters. It operates from an external DC voltage of between 10-16V and draws a current of approximately 100mA at 12V, a plug-in DC cable being provided. AOR recommends this supply be separate from the DC feed to your transceiver, no doubt to prevent earth loops – a small AC wall adapter would be a typical choice here. 3.5mm jack sockets are fitted on the rear panel for receive audio in and out, together with an eight-pin microphone-style socket for connection to your transmitter. This is wired to be compatible with Adonis microphone wiring, and a range of optional ready-made leads are available to suit a variety of transceivers. A ready-made receive audio lead is provided with the unit, together with a matching 8-pin plug which you can wire up to suit your transceiver. But to get you started quickly, a handy speaker-mic, which plugs into the 2.5mm and 3.5mm jack sockets on the front panel, comes with the unit. Four rubber feet are fitted to the bottom panel, and a screw-on circular magnet is also supplied that can also be attached to the bottom panel, to keep the unit in place when it's positioned on top of your transceiver's metal case. This cleverly prevents the modem sliding around, especially if you're using the speaker microphone.

INSTALLATION

Connecting up was very simple, and as I already had an Adonis desk mic I didn't need to make up or obtain a suitable lead from the ARD9000 to my transmitter, although this would have been a simple job taking just a few minutes, providing of course I had a suitable multi-way lead and transceiver mic plug handy. The first thing to do was to set up the receive audio level into the unit for digital reception, which I did by simply





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speech over SSB modem

Left
The ARD9000 is a compact unit

Rear panel connections

Inside the unit

A handy speaker-mic is supplied

adjusting the receiver's volume control until the front panel 'Over' LED remained off; if it's flashing, the level is too low and if it's always on, it means it's too high. It's also possible to adjust the level if needed using a small preset on the underside of the ARD9000's case. The front panel 'PWR/VOL' control is then used to vary the receive audio level in digital reception. The unit doesn't provide sound amplification for ordinary analogue voice - you'll need to use your main receiver's volume control. Next comes the transmit level - the remaining small presets can be used for this although I simply altered my transceiver's mic gain to suit. On transmit, again the front panel 'Over' LED gives you an indication of the correct level of mic audio going into the unit.

IN USE

On the air, the ARD9000 can remain completely 'transparent', automatically switching to digital mode on receive when it detects a digital signal, otherwise passing analogue receive audio straight through. The front panel dual-colour 'STA' (Status) LED let's you know which mode the unit is in at any time. On transmit, you can simply toggle between digital and analogue SSB transmission by quickly pressing and releasing the PTT switch, the second push then opening the microphone and allowing you to transmit. The small front panel 10-position 'Mode' switch lets you choose between various switching options, SSB or FM modes, and the length of the short 'header' which is automatically transmitted before the digital speech on each 'over'.

I've already used the ARD9800 digital speech modem on air, and I must say that the ARD9000 was just as impressive. On HF SSB when receiving a digital voice signal, the background noise you normally associate with high frequency long-distance communication instantly disappears, and perfect telephone-quality speech with absolutely no background noise comes through on your speaker. In fact, during one contact on 20m, my QSO partner commented on one of my cats who was meowing in the background – the cat was in another room and I could only just hear her myself! It really does sound like your QSO partners are sitting in the same room as you, rather than on the other side of the Atlantic.

On SSB, the system operated perfectly as long as signal levels remained reasonably strong, at a level that would normally give at least Q4 copy (readable with practically no difficulty). Once moderate interference was present, communication usually failed, although if this came up mid-way through a digital 'over' and the modem lost synchronisation, I could easily force it to re-sync with a press of the small front-panel 'Sync' button. However, it doesn't have an automatic re-sync facility built in.

To initiate a contact, the usual method is for someone to initially call 'CQ Digital' on analogue SSB, then both parties would switch to digital for the contact. Of course, calling 'CQ Digital' randomly on whichever frequency in the SSB portion of the band is clear will currently usually result in few, if any, digital contacts. Suggested calling frequencies for this mode currently are 14.236MHz, 18.1625MHz and 21.370MHz, all USB. 14.236MHz can sometimes be a noisy frequency over here, and UK and European amateurs also use 14.255MHz USB. There's also a weekly net every Saturday and Sunday at 20.00GMT on 14.236MHz USB plus or minus 3kHz depending upon QRM. As well as on-air contacts, if you'd like to pre-arrange a 'sked' then an independent web site has been set up for amateurs to compare results and arrange schedules (www.rfelectronics.com). On this site, you'll also find a sample of the audio quality you'll typically get on HF with one of these units, taken from a real on-air contact on 18.1625MHz.

As AOR lent me two units, I passed the other onto my colleague Andy, G4MYS. This allowed us to test the modems on VHF FM. Although local FM communication is already high-quality with low background noise, results were equally as impressive as HF SSB. The receive audio sounded far more natural in digital mode due to the wider audio bandwidth being transmitted. This is because narrow-band FM is filtered and clipped to prevent excessive spreading. 12.5kHz channel spacing FM typically starts 'rolling down' at 2.55kHz audio frequency, giving it a nasal effect, whereas the recovered digital audio went well above 3kHz. AOR however doesn't recommend the system to be used for FM mobile work because, in cases of mobile flutter, the digital signal could repeatedly lose synchronisation. But in fixed station use, once again it almost sounds like they're in the same room as you.

On a final note, although I experienced no problems, some amateurs have found that with the ARD9000 in circuit in analogue mode, there has been a slight 50Hz buzz in the background of analogue transmissions. A solution has already been found by AOR, and this involves the removal of an internal surface-mount resistor on the modem's PCB. The only disadvantage here is that the ARD9000 will no longer pass receive audio through when it's switched off. AOR (UK) offers a free, well-documented service bulletin if you wish to do the modification.

CONCLUSIONS

I was very impressed indeed with the quality of audio using the ARD9000 for contacts. It's a major improvement over analogue SSB and the results astonished fellow amateur visitors to my shack when I switched between digital and analogue. The system doesn't offer a 'weak signal' mode. For this you'll typically need to use computer-based digital text modes, but when signals are at a reasonable level, the results are astounding. AOR has launched the unit at an affordable price, and with the open communication protocol it uses (which means it's not just tied in to one manufacturer) the future looks promising. In my opinion, the ARD9000 is an ideal starter product and, as with the ARD9800, AOR is to be commended in leading the way.

The ARD9000 is available either direct from AOR (UK) in Matlock, Tel. 01629 581222, or from a selection of AOR dealers. ♦

REFERENCES

[1] 'Digital Voice Communications' by Andy Talbot, RadCom October and November 1999
[2] 18th ARRL/TAPR Digital Communications Conference proceedings
[3] QEX the Amateur Radio Experimenters Journal, May and June 2000 (ARRL)
[4] www.chbrain.dircon.co.uk/dvhf.html
[5] Digital voice transmission; the ARD9800, RadCom July 2004