MT REVIEW

# AOR SR2000 FFT Frequency Monitor

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Is it a scanner? Is it a spectrum analyzer? For untold decades of radio manufacturing, the industry still awaits the first wide-frequency-coverage communications receiver with a wide-span spectrum display. There are spectrum analyzers with audio recovery, and service monitors with spectrum displays, but nothing that combines a high-quality receiver with a spectrum display that spans more than 10 megahertz, all in one box.

Several manufacturers have made noteworthy attempts: ICOM's R9000 was a high-performance, wide coverage receiver, but only had a 2 MHz spectral span; Standard's AX-700 VHF/UHF scanner had only a 1 MHz span; Grove Enterprises tried to produce their cutting-edge SR1000, but cancelled it after a six-year, half-million-dollar development effort.

Several high-end scanners now include "spectrum scopes" which show a narrow band of signals above and below the tuned frequency, but these are relatively crude devices, and none spans more than 10 MHz. A few manufacturers like WiNRADiO offer computer-hosted "black boxes" with wide frequency coverage and a broad spectrum display observable on the computer monitor (up to 100 MHz for the WiNRADiO). But no one has it all in one box…yet.

## Enter the AOR SR2000

This newest entry, named the "FFT (Fast Fourier Transform) Frequency Monitor," boasts a 25-3000 MHz (3 GHz) frequency range for reception, and a 10 MHz-span spectrum display. While it doesn't cover shortwave, nor does it offer SSB reception, it is a powerful scanning receiver for AM and FM signals in the VHF/UHF spectrum.

A stand-alone receiver, the SR2000 can alternatively be computer-hosted by a PC, either through its serial (RS232C) port or an optional USB interface. Serial port speeds may be selected as 9600, 19.2k, 38.4k, 57.6 k or 115k bps (default). A full command set is printed in the manual for all computer functions.

## Scan and search

The 1000-channel memory is divided into ten 100-channel banks. Up to 12 alpha characters can be inserted to identify each channel. Any one channel may be chosen as a priority channel, and sampling intervals for that channel to check for activity can be chosen anywhere from 1 to 99 seconds.

For the memory-channel scanning function, scan delay may be selected for any period from 0.1 to 9.9 seconds after signal dropout. If desired, a hold option may be selected so that scanning won't resume after the sequence stops on an active channel even after the signal drops out.

A search feature allows any swath of spectrum to be automatically swept for active frequencies which will then be displayed on the screen as hits are found. For faster search, an FFT function may be elected to sample a 10 MHz span six times per second. To avoid unwanted or previously-identified frequencies, up to 1600 of them may be entered as "pass" frequencies so that the search sequence won't look for them during the search routine. All this activity as well as command functions are displayed on a five-inch, full-color, TFT LCD display.

## A first look

The SR2000 is compact (8-3/4"W x 4-3/4"H x 7-3/4"D) and lightweight (7.4 lbs.), making it pre-eminently portable. It is powered by 12 VDC at 1.4 amps. A tilt bail lifts the front of the receiver so that the control panel can be comfortably viewed from a desktop, and threaded holes (two on each side) invite mobile mounting.

Curiously, although the SR2000 is entirely self-contained for portable convenience, there is no internal speaker; attachment of an external speaker or headset is required for signals to be audibly monitored.

## Specifications

A tuning knob allows rapid frequency slewing (there are nine independently-selectable VFOs), and doubles as an option selector in the menu mode. Tuning steps may be selected as 0.1, 0.5, 1, 2, 5, 6.25, 8.33, 9, 12.5, 25, 50 and 100 kHz; a non-standard step may be entered anywhere between 0.1-100 kHz via the keypad. Any keypad press is confirmed by a soft beep which can be muted in the software command set, but the amplitude can't be changed.

The SR2000's high-stability receiver employs triple conversion (255.3/744.3 MHz, 10.7 MHz, 455 kHz) to reduce image response and, for single-signal selectivity, wide (300 kHz), narrow (15 kHz) and sharp (6 kHz) FM modes as well as conventional 6 kHz AM may be selected.

Sensitivity is an impressive 0.35 uV, but this ability to detect weak signals comes with a price: dynamic range. The third-order intermod (IP3) of the SR2000 is only +1dBm, making the receiver vulnerable to strong-signal overload unless the attenuator (10 or 20 dB) is used – which reduces the sensitivity. Still, in remote monitoring areas where all signals are weak, the sensitivity is important and, in dense signal environments, it makes sense to invoke the attenuator.

A frequency offset function allows the operator to choose any second frequency that he can immediately select to check repeater input/output pairs, two-frequency simplex, or other requirements for rapid dual-frequency switching.

## That big LCD

The bright, busy, backlit, color LCD is very informative, reporting the frequency currently selected, the VFO in use, upper and lower span limits, demodulation mode, resolution bandwidth (RBW), operational function, step increment, attenuation, volume and squelch (noise or level) settings, signal strength, and more.

A waterfall mode allows a dynamic representation of signals in the spectrum over time; their relative signal strengths are color coded for identification.

Spectrum-display resolution bandwidth (RBW) may be selected as 4, 32, 64 or 125 kHz, accompanied by a sweep rate as fast as 10 MHz in only 0.2 second to assure real-time signal capture. But this digitally-triggered sweep shows signal spikes as vertical lines, not the sloped envelope familiar to veteran CRT users unless the span is narrower than about 500 kHz.

Marker functions can be chosen to report instantaneous values of signal readings as well as peak readings. The display can calculate maximum, average and medium levels for signals over time. As informative as the display is, there may be times when the operator doesn't want the information to be visible; the display may be switched off for "black" operations.

## ❖ IF output options

An IF output port (10.7 MHz center frequency, 10 MHz wide) from a BNC connector on the rear panel of the receiver provides a source of raw data for custom demodulation or, as we did here, to drive an auxiliary spectrum display unit, the popular AVCOM SDM42B. With this accessory, the active spectrum under surveillance can be watched remotely or collocated with the receiver.

Since the receiver's IF output port is normally coupled to its own SDU by a short BNC/BNC coax jumper, the disconnection removes the sweep from the SR2000 LCD, leaving only the alphanumeric information on the receiver's integral display. But both SDU applications can be used simultaneously by simply placing a "T" adaptor on the receiver's IF output connector, attaching the original jumper to it and the extension cable to the auxiliary SDU.

## ❖ Lots of buttons and connectors

The front panel is busy with its 26 multifunction keys, and they aren't all intuitive. The combinations are daunting, demanding the 60-page manual to be kept at hand to master the many functional requirements.

The rear panel sports no less than 12 jacks and connectors, with DB connectors for external computer control, BNC connectors for RF and IF ports, and two mini jacks for audio (speaker and headphones). Jumper cables for the rear panel are provided to interconnect the receiver section with the control section for stand-alone operation. Although the initial impression may be daunting, experience with the receiver eventually begins to make sense.

## ❖ General impressions

The dominant display is contrasty and crisp, making viewing easy. The multi-color presentation helps separate the large selection of textual and graphic elements. The waterfall display is addictive – hypnotic and informative as the modulation slowly paints its record in time while the spikes gradually drift down the screen.

When the receiver is first switched on, a loading message scrolls up, then down, followed by an alert message "Initialize……" which continues to flash rapidly for a full eight seconds before the receiver finally activates. This long interval is confusing at first, since it seems to be instructing the operator to do something when it's not.

The presence of a tuning knob invites manual frequency tuning. While the dimple allows rapid spinning with the fingertip, the sharp edge of the knob is irritating to a finger rotating the knob by its circumference.

While appearance of signal spikes on the trace is in real time, the time lag (backlash) of tracking them by turning the tuning knob results in overshoot by the operator; thus, brief transmissions may not be quickly caught in the manual tuning mode. This sluggishness is visible both on the integrated LCD as well as an auxiliary SDU.

The suppression of "grass" (the noise pulses on the baseline of a spectrum display) is a welcome relief to traditional spectrum-analyzer users, but, as a result, weak but readable signals are not visible on the display.

Some spurious signal spikes were visible in the 155-156 MHz range, but they are quickly identified by their movement in the opposite direction from the legitimate spikes as the tuning knob is turned.

## ❖ The Bottom Line

All in all, this is nice receiver with a very informative graphic display. The frequency coverage extends clear through the busy 2.4 GHz wireless band, making it a natural for locating and identifying sources of interference as well as intrusive wireless cameras, microphones and other clandestine devices in that band.

Its small size and independence from external control devices invites its use in mobile applications, while its ability to be computer controlled suggests a host of custom applications.

At present, the AOR SR2000 is a continuous-coverage version (including cellular frequencies), so its availability is limited to government and military agencies, laboratories, radio and cellular service shops, and foreign export.

The AOR SR2000 is around $3000 in the US; check **http://www.aorusa.com** for contact information for AOR dealers in the U.S.

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*The AOR SR2000 (RCV-20G) is $2995 plus shipping from Grove Enterprises (1-800-438-8155).*