AOR, LTD.

HIGH PERFORMANCE BLACK-BOX RECEIVER
Radio monitoring from 40kHz to 3150MHz

AR2300
Black-Box Receiver
The AR2300 communications receiver from AOR is ideally suited for radio and spectrum monitoring in various commercial and government applications, as well as for use in radio investigation services.

The AR2300 offers:

- Signal detection
- Signal search in frequency and memory scan mode
- Spectrum occupancy and on-the-air monitoring
- Coverage and field-strength check
- Signal and spectrum analysis through optional I/Q software

Applications may include:

- Monitoring and storage of up to 2000 frequencies, receiving modes, antenna port, attenuator settings, constant monitoring of one frequency or scanning of selected frequencies.
- Searching a frequency range with freely selectable start and stop frequencies and step widths of 0.01 kHz (10Hz) to 999.99 kHz.
- Detection of undesired emissions including pulsed emissions.
- Detection of unlicensed transmitters communicating illegally or interfering with licensed transmission.
- Protection against eavesdropping by detecting miniature transmitters (bugs)
- Monitoring of one's own radio transmissions in a service band and monitoring of selected transmissions.
- Remote-controlled operation via an optional LAN controller.

Technical Features:

- Computer controlled Black-Box
  All functions of the AR2300 can be used with a lap-top or desk-top PC that runs under Windows XP or higher OS. The AR2300 can be controlled remotely through an optional LAN controller.

- Digital signal processing
  45MHz of the 3rd intermediate frequency is directly digitized for digital signal processing for demodulation and spectrum display by a PC. No automatic gain control (AGC) is employed in the analog circuitry to allow accurate level monitoring across the IF bandwidth.

- High performance analog front-end
  The analog RF front-end is carefully designed and by CAD to gain optimum performance across the entire receiving frequency range of 40KHz to 3150MHz.

- Direct digital sampling
  The HF stage (40kHz to 25MHz) employs direct digital sampling architecture that offers exceptional linearity across the band.

- Direct digital synthesizer (DDS) local oscillator
  Direct digital synthesizer is employed for the 1st local oscillator that ensures fast frequency switching for memory channel scanning and frequency band search operation.

- Accurate reference frequency
  The AR2300 is capable of using a GPS pulse signal for an accurate time base for the local oscillator circuit. 0.01ppm frequency accuracy for the 10MHz internal master oscillator is obtained when synchronized to a GPS signal source. The optional digital I/Q output board is capable of acquiring GPS data for time-stamping digital I/Q data.
Technical Features:

- **Wideband IF output**
  45MHz of intermediate frequency (IF) analog output with 15MHz bandwidth is provided for external peripherals when using the AR2300 receiver front-end. The optional digital I/Q output board with USB2.0 interface is available to access AR2300’s I/Q data for spectrum/playback/analysis by a PC.

- **Simulations reception and monitoring**
  Simultaneous reception on HF (below 25MHz) and VHF-UHF (above 25MHz) frequencies is possible. For frequencies above 25MHz, absolute dual-channel reception within an IF bandwidth is possible. Thus, up to three channels can be monitored simultaneously.

- **Analog VIDEO demodulation**
  Composite video output is provided to monitor FM modulated analog type wireless security camera or frequency search operation for bug transmitters.

- **SD Audio recorder**
  The AR2300 is capable of recording demodulated audio directly to a built-in SD media recorder. Compact and readily available, SD memory cards are immune to vibrations and produce no mechanical noise, unlike motor-driven media such as tape or discs.

  The AR2300 can accommodate up to 32GB SDHC card, allowing up to 240 hours of total recording time using PC compatible WAV format. Typical continuous recording time with a 1GB SD card is about 8 hours. The recording time can be extended when squelch operation is employed while recording two-way voice communication.

- **AF-IQ Output**
  12kHz IF output is provided for a PC sound card based SDR (software defined radio) for signal demodulation by the PC. Typical application include the reception of DRM (Digital Radio Mondiale) broadcasts on HF frequencies.

- **Optional APCO P-25 Digital Voice Decoder**
  APCO P-25 Digital Voice Decoder option is available for the demodulation of project 25 (P25) digital voice communications which are quite popular in North America for the government and public safety communications.

- **Direct sampling architecture**
  The AR2300 utilizes outstanding direct sampling digital architecture for reception below 25MHz. It features a 14 bit 65MS/s analog-to-digital converter, a high-performance FPGA-based digital-down-converter and DSP-based demodulation circuitry. The direct sampling architecture offers exceptionally high linearity against input signals.

AR2300 Control Software

The AR2300 control software is a strong companion to the AR2300 black-box receiver. The software provides powerful control functions running on an MS Windows PC connected to the AR2300 via USB or an optional LAN. The software provides a signal overview using a high-speed spectrum or waterfall display.

Powerful memory channel management features are available to manage and control up to 2,000 channels allowing direct entry of alphanumeric channel information. The channel hit-counter and last event (time and signal level) on each memory channel is available to monitor the activity and channel coordination.

Optional AR-IQ Software

When an optional I/Q interface is installed (factory option), up to 1 MHz of digital I/Q output can be recorded to the hard drive of almost any computer operating Windows environment for later playback and analysis without the loss of quality. This feature allows for unattended logging, signal classification and signal analysis.
AR2300 SPECIFICATIONS

GENERAL

Frequency range 40kHz to 3.15GHz
Frequency resolution 1Hz
Tuning steps - program 1Hz to 999.999kHz in 0.001Hz increments
Receiving mode USB/LSB (J3E), CW/A1A, AM/A3E, APCO P-25 (D3E) Optional, FM (F3E), WFM(F3E), FM-Stereo (F8E)
Memory channel 2,000 channels (50 channels x 40 banks)
Memory channel Bank 40 banks (each bank can be customized between 5 to 95 channels.)
Pass frequencies 1,200 frequencies or 1,200 frequency ranges (30 frequencies (ranges) x 40 banks)
Priority channel 1 (one)
Selected memory channel 100 channels through memory banks
Typical scanning speed Approx. 100 channels/steps per second.
Antenna impedance 50Ω
Operating temperature range 0°C to +50°C / 32°F to 122°F
Frequency stability Less than ± 1ppm after warm-up (5 minutes).
Power supply requirement DC 12 to 13.8V, Minimum 1.5A
Frequency stability Less than ± 0.01ppm with an optional GPS unit.
Power consumption* Stand-by : 200mA
Ground system Negative ground
Dimensions* 285mm(D) x 220mm(W) x 70mm(H) 11½”(D) x 8½”(W) x 2½”(H)
Weight* 3kg. (6.6 lb.)
Audio output > 2W at 8Ω load

RECEIVER

Receiver system 40kHz - 25MHz Direct conversion
25MHz - 200MHz Double super-heterodyne
200MHz - 420MHz Triple super-heterodyne
420MHz - 3.15GHz Double super-heterodyne
Intermediate frequencies 1st - 294.5MHz / 1.7045GHz
2nd - 45.0MHz / 294.5MHz
3rd - 45.0MHz
Third-order IMD > +20dBm at 14.1MHz
> +12dBm at 50.0MHz
> +7dBm at 620.0MHz
Spurious and image rejection > 70dB : 40kHz - 25MHz
> 50dB : 25MHz - 2.0GHz
> 40dB : 2.0GHz - 3.15GHz
Digital IF Filter bandwidth 200Hz, 500Hz, 1kHz, 3kHz, 6kHz, 15kHz, 30kHz
Selectivity CW - 500Hz -3dB: > 380Hz -80dB: > 500Hz
AM - 6kHz -3dB: > 5.5kHz -80dB: > 6.9kHz
SSB - 3kHz -3dB: > 2.7kHz -80dB: > 3.1kHz
NFM - 15kHz -3dB: >14.2kHz -80dB: > 15.6kHz
WFM-200kHz -3dB: > 200kHz -80dB: > 250kHz
Sensitivity

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<tr>
<th>MODE</th>
<th>SSB, CW</th>
<th>AM</th>
<th>FM 12dB SINAD</th>
<th>WFM 12dB SINAD</th>
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<td>10dB S/N</td>
<td>10dB S/N</td>
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<tr>
<td>Filter B/W</td>
<td>3kHz</td>
<td>6kHz</td>
<td>15kHz</td>
<td>200kHz</td>
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<td>40kHz to 100kHz</td>
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<td>8.0uV</td>
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<tr>
<td>100kHz to 1.8MHz</td>
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<td>4.0uV</td>
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<tr>
<td>25MHz to 1GHz</td>
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<td>2.0uV</td>
<td>0.7uV</td>
<td>1.8uV</td>
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<tr>
<td>1GHz to 2.4GHz</td>
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<td>2.5uV</td>
<td>0.7uV</td>
<td>1.8uV</td>
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AUXILIARY FUNCTIONS

Simultaneous reception Two types of simultaneous reception (dual-watch) are possible.
- 2 Band reception - One HF (40kHz - 25MHz) frequency + One VHF/UHF (25MHz and above) frequency.
- Offset reception - Main frequency + sub-frequency (within 45MHz from main frequency.) Offset reception is possible only for VHF/UHF (25MHz and above) band.

Triple reception Triple (trio) reception is possible by combining simultaneous reception mode. i.e. One HF (40kHz - 25MHz) + Offset reception.

Squelch system CTCSS, DCS
Demodulation Aid APCO P-25 Digital voice demodulator (option) Auto Notch Filter (NOTCH) De-Noiser (NR)

AUDIO RECORDING

Type of recording Record/Playback function through SD or SDHC card.
SD Card type SD or SDHC card per SD Card Association. More than 256MB is required. Use card adapter for miniSD and microSD cards. FAT16 and 32 only.
File Format Windows compatible WAV file format. RIFF (little-endian) data, WAVE audio, Microsoft PCM, 16bit, mono 17.576kHz.
Recording Time Approximately 8 hours of continuous recording by 1GB SD Card. Squelch synchronization is possible to eliminate inactive time.

INPUT & OUTPUT

Antenna Input ANT 1: 25MHz - 3.15GHz, N-J connector
ANT 2: 40kHz - 25MHz, N-J connector
10MHz reference input SMA-J connector, Typical input: -2dBm to -2dBm for 50Ω
45MHz Analog IF output BNC-J connector, 45MHz±7.5MHz
Typical output: Antenna input +10dBm for 50Ω
Frequency range 25MHz - 3.15GHz only.
Digital I/Q output (Option) USB2.0 compatible isochronous transfer Digital I/Q output through USB Type-A Jack. Frequency range 25MHz - 3.15GHz only.
12kHz offset output 12kHz offset analog I/Q through 3.5mm φ stereo phone jack.
Line output 3.5mmφ stereo phone jack. (3-wire)
External speaker 3.5mmφ miniature phone jack (2-wire)
Accessory 8-pin miniature DIN
DC Power Input EIAJ MP-121C (5.5 x 2.1mm) plug. Positive
Interface 9-pin D-subminiature type (Male) - Firmware update and remote control by PC.
USB USB Type-A, USB 1.1/2.0 Jack for PC control.
VIDEO output (Front Panel) RCA Jack, 75Ω stereo-phone jack. (2-wire)

Specifications subject to change without prior notice for product improvement or modification. Power consumptions, Size and Dimensions are only approximate value. Dimensions does not include projections. E & O. E.