

# AR2300

Black-Box Receiver



**HIGH PERFORMANCE BLACK-BOX RECEIVER**

Radio monitoring from 40kHz to 3150MHz



AOR, LTD.

# The future of radio monitoring.

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



## Technical Features:

- Computer controlled Black-Box

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



Lightweight net-book PC can be used as control head for the AR2300. (PC not included.)

- 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.



## 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.

- 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. The 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

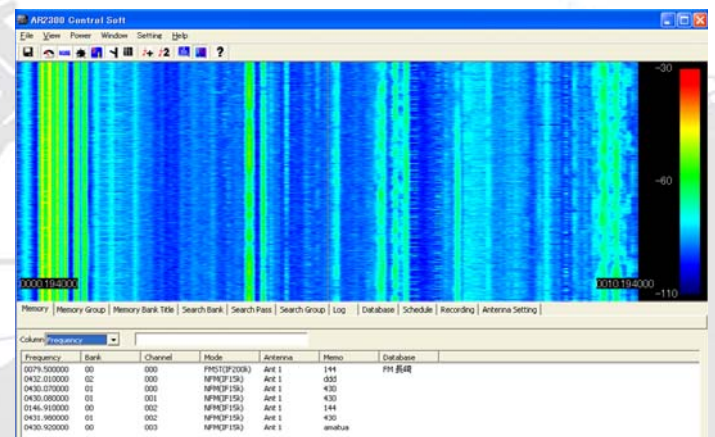
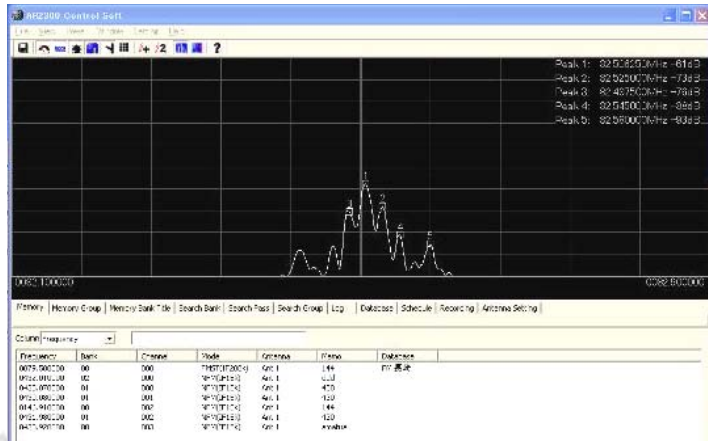
APCO P-25 Digital Voice Decoder option is available for the demodulation of project 25 (P25) digital voice communications which are quite popular in North America for the government and public safety communications.

### ■ 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 0.001kHz 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). Less than ± 0.01ppm with an optional GPS unit.
Power supply requirement	DC 12 to 13.8V, Minimum 1.5A
Power consumption*	Stand-by : 200mA Max. Audio; 1.2A
Ground system	Negative ground
Dimensions*	285mm(D) x 220mm(W) x 70mm(H) 11¼"(D) x 8½"(W) x 2¾"(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 100kHz, 300kHz - Receiving mode dependent
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	

MODE	SSB, CW	AM	FM	WFM
Test Method	10dB S/N	10dB S/N	12dB SINAD	12dB SINAD
Filter B/W	3kHz	6kHz	15kHz	200kHz
40kHz to 100kHz	2.0uV	8.0uV		
100kHz to 1.8MHz	1.2uV	4.0uV		
1.8MHz to 25MHz	1.2uV	4.0uV		
25MHz to 1GHz	0.3uV	2.0uV	0.7uV	1.8uV
1GHz to 2.4GHz	0.3uV	2.5uV	0.7uV	1.8uV

## 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 ±5MHz from main frequency.) Offset reception is possible only for VHF/UHF (25MHz and above) band.
Triplet reception	Triplet (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 17.578kHz.
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 - 3.15GHz, N-J connector
10MHz reference input	SMA-J connector, Typical input: -2dBm±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 3.5mmΦ 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 center.
RS-232C	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 1Vp-p

*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.*



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