

# AR2300 BLACK-BOX

PC Control All-Mode  
High-Performance Communications Receiver  
40kHz to 3.15GHz



# The future of radio monitoring.

The AR2300 is a Black-Box version of the AR5001D, a high-performance communications receiver from AOR. The AR2300 is ideally suited for radio and spectrum monitoring in various commercial and government applications, as well as for use in radio investigation services.



AR5001D Receiver

## Typical application of AR2300 includes:

- 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 an optional I/Q board with supplied AR-IQ software.



## Detailed applications:

- Monitoring of given frequencies, e.g. storage of 1 to 2000 frequencies, receiving modes, antenna port, attenuator settings, constant monitoring of one frequency or scanning of selected frequencies.
- Searching in a frequency range with freely selectable start and stop frequency and step widths of 0.001 kHz (1Hz) to 999.99 kHz.
- Detection of undesired emissions including pulsed emissions.
- Detection of unlicensed transmitters communicating illegally or interfering with licensed transmission.
- Protection against tapping by detecting miniature transmitters (bugs)
- Monitoring of one's own radio exercises in a service band and monitoring of selected transmissions.
- Remote-controlled operation via an optional LAN controller in coverage check and monitoring systems.

## Technical Features:

- Computer controlled Black-Box  
All functions of the AR2300 can be used with lap-top or desk-top PC that runs under Windows XP, Vista and 7. The AR2300 can be controlled remotely through an optional LAN controller.



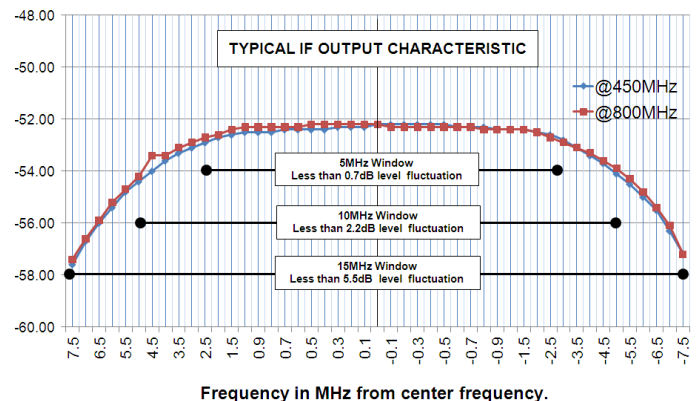
Lightweight net-book PC can be used as control head for the AR2300. (PC not included.)

- Super Wide Range  
Continuous frequency coverage: 40 kHz to 3.15 GHz in 1 Hz step with 1ppm frequency accuracy. (Frequency accuracy can be optimized to 0.01ppm with an optional GPS receiver.)
- Multi-Mode reception  
High performance digital signal processing circuitry offers variety of reception modes as well as decoding options. Receiving mode includes USB/LSB, CW, AM, SAM, FM, Wide FM and FM stereo. The decoding modes include CTCSS, DCS, DTMF and APCO P-25 by an optional P-25 decoder.
- High-Performance analog front-end  
The RF front-end is carefully designed by CAD to obtain optimum performance across the entire frequency range of 40kHz to 3.15GHz.
- Digital Signal Processing  
The 45.05MHz IF signal is processed by the independent signal processor for signal demodulation and recovery. No AGC circuitry is used in the analog stage to ensure accurate level reading as well as to offer IF output signal level linearity against RF input signal.
- Direct Sampling Architecture (40 kHz to 25 MHz)  
The AR2300 employs 14bit/65Ms/s direct sampling receiver architecture for VLF, LF and HF band. The direct sampling architecture assures high IMD and IP3 characteristics.
- 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.
- Simulations reception and monitoring  
Simultaneous reception on HF (below 25MHz) and VHF-UHF (above 25MHz) frequencies are possible. For the frequencies above 25MHz, absolute dual-channel reception within an IF bandwidth is possible. Thus, triple channels can be monitored simultaneously.
- Analogue VIDEO demodulation  
Composite video output is provided to monitor FM modulated analogue type wireless security camera or frequency search operation for bug transmitters.
- SD Audio recorder  
AR2300 is capable of recording demodulated audio directly to the built-in SD media recorder. Compact and readily available, SD memory card 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 1GB SD card is about 8 hours. The recording time can be extended when squelch operation is employed.

- Wideband and high-performance IF output  
45.05MHz of intermediate frequency (IF) analogue output with 15MHz bandwidth is provided for the external peripherals when use AR2300 as receiver front-end. Between 25MHz to 3GHz, the analog IF output is correlated within  $\pm 1.5\text{dB}$  to the antenna input by accurate signal source with traceability, thus accurate signal monitoring or measurement is possible with appropriate measurement antennas.

The graph shows typical IF output characteristics. (Absolute level difference between Input level versus IF output level.)



- AF-IQ Output  
12kHz IF output is provided for the 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.



## Options:

- Accurate reference frequency

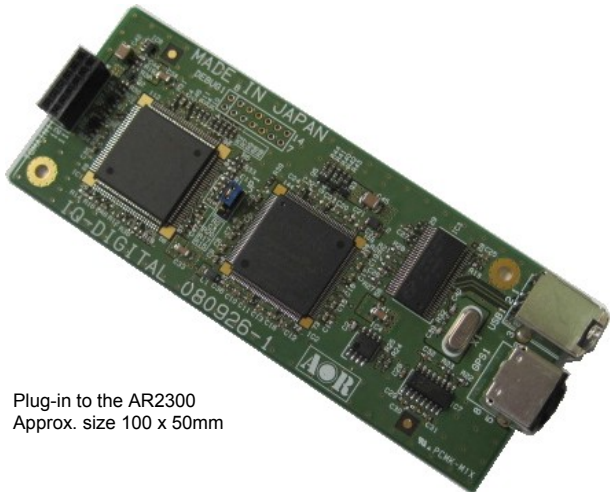
The AR2300 is capable of using GPS pulse signal for the accurate time base for the local oscillator circuit. 0.01ppm frequency accuracy for the 10MHz internal master oscillator is obtained when synchronized to the GPS signal source. The optional digital I/Q output board is capable of acquiring GPS data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



Optional GPS Receiver.  
Third party product. (Connect to accessory jack.)

- Digital I/Q board and PC software

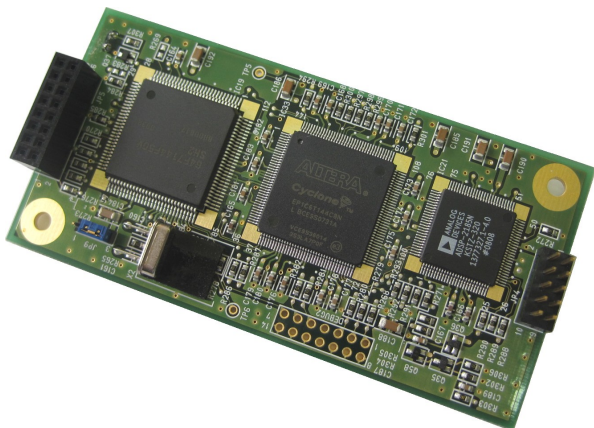
When an optional I/Q interface board is installed, up to 1MHz of digital I/Q output can be recorded to the hard drive of computers operating under Windows environment for later playback and analysis without any loss of quality. This feature allows for unattended logging, signal classification and signal analysis. PC Control software for Windows XP, Vista and 7 is supplied with the board.



Plug-in to the AR2300  
Approx. size 100 x 50mm

- APCO P-25 Digital Voice Decoder

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

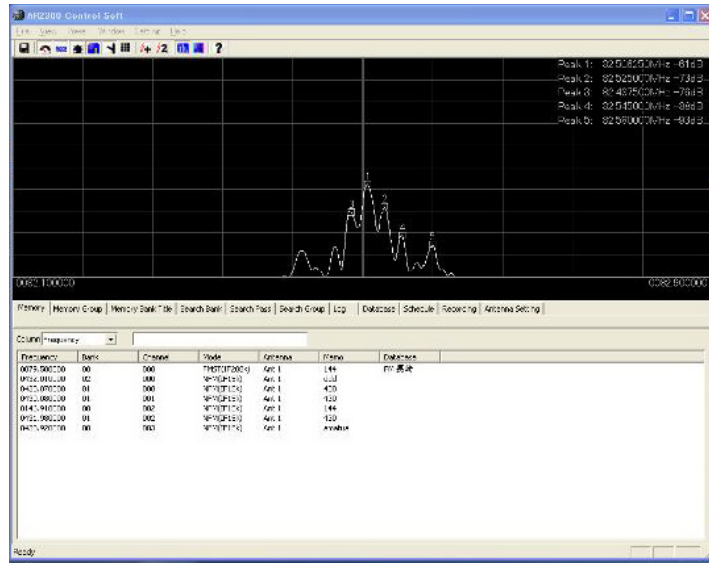


Plug-in to the AR2300  
Approx. size 125 x 50mm

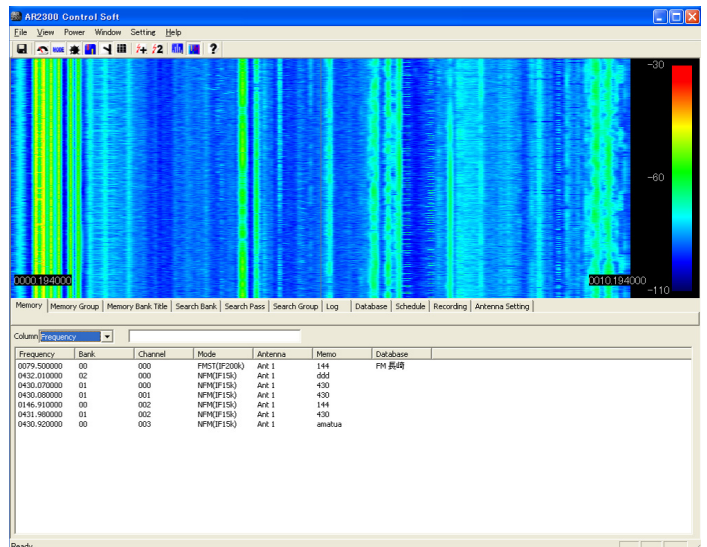
## Software:

- Control Software (Standard Accessory)

The AR2300 control software is a strong companion of the AR2300 black-box receiver. The software provides powerful control function 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.

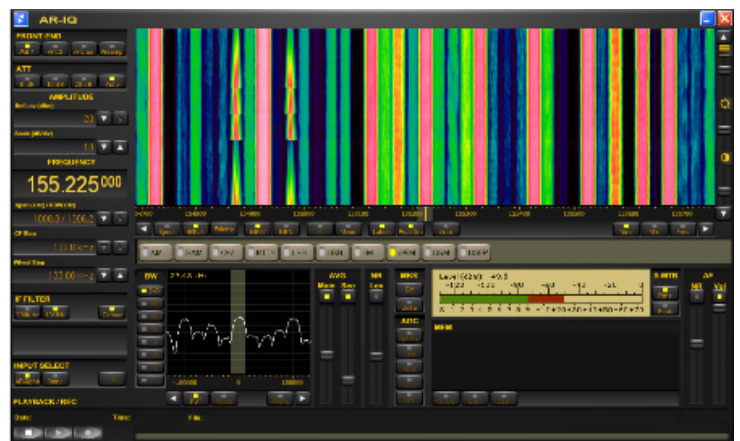


Powerful memory channel management features are available to manage and control 2,000 channels allowing to enter alphanumeric channel information. The channel hit-counter and last event (time and signal level) on each memory channel is available to monitor the activity and channel coordination.



- AR-IQ Software (Supplied with digital I/Q board)

When an optional digital I/Q board is installed, the I/Q output can be recorded to the hard drive of almost any computers operating under Windows environment for later playback and analysis without any loss of quality. This feature allows for unattended logging, signal classification and signal analysis. The AR-IQ software has been developed exclusively for AR2300 by Microtelecom of Udine, ITALY.



# 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), FM(F3E), WFM(F3E), FM-Stereo(F8E), APCO P-25(D3E) Optional
Number of VFO	5 (A through E)
Memory channel	2,000 channels (50 channels x 40 Memory banks)
Memory 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	50W
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 optional GPS unit.
Power supply requirement	DC 10.7V to 16V, 2.0A @ 12V
Audio output	> 2W into 8W load
Power consumption*	Stand-by : 200mA, Max. Audio : 1.5A
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.)

## RECEIVER

Receiver system	40kHz - 25MHz	Direct conversion
	25MHz - 220MHz	Double super-heterodyne
	220MHz - 360MHz	Triple super-heterodyne
	360MHz - 3.15GHz	Double super-heterodyne
Intermediate frequencies	1st -	294.5MHz / 1.7045GHz
	2nd -	45.05MHz / 294.5MHz
	3rd -	45.05MHz
Third-order IMD	> +20 dBm	at 14.1MHz
	> +9 dBm	at 50MHz
	> +5 dBm	at 620MHz
Spurious and image rejection	> 70dB :	40kHz - 25MHz
	> 50dB :	25MHz - 2GHz
	> 40dB :	2.0GHz - 3.15GHz
Digital IF filter bandwidth	200Hz, 500Hz, 1kHz, 3kHz, 6kHz, 15kHz, 30kHz, 100kHz, 200kHz - Receiving mode depended	
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	2.0µV	4.0µV	/	/
100kHz to 1.8MHz	1.2µV	2.0µV		
1.8MHz to 25MHz	1.0µV	2.0µV		
25MHz to 1GHz	0.25µV	1.0µV	0.5µV	1.5µV
1GHz to 2.4GHz	0.3µV	1.0µV	0.5µV	1.5µV
2.4GHz to 3GHz	0.5µV	1.7µV	0.5µV	2.5µV
3GHz to 3.15GHz	1.0µV	2.0µV	0.8µV	3.5µV

## AUXILIARY FUNCTIONS

Simultaneous reception	Two types of simultaneous reception (dual-watch) are possible.
2 band reception	One HF (40kHz-25MHz) frequency plus one VHF/UHF(25MHz and above) frequency.
Offset reception	Main frequency plus sub-frequency (within ±5MHz from the center frequency) Offset reception is possible only for VHF/UHF.
Triple reception	Triple receptions are possible by combining simultaneous reception mode. I.E. One HF frequency plus offset reception.
Squelch system	CTCSS, DCS
Demodulation Aid	Auto Notch Filter(NOTCH), De-Noiser(NR), Noise Blanker, IF Shift, CW Pitch, AGC, AFC, DTMF APCO P-25 Digital voice decoder (option)

## AUDIO RECORDING

Type of recording	Record/Playback function through SD or SDHC
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, 16-bit 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
45.05MHz Analog IF output	BNC-J connector, 45.05MHz±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)
Accessory	8-pin miniature DIN
DC Power Input	EIAJ MP-121C (5.5 x 2.1mm) plug. Positive center.
External speaker	3.5mmΦ miniature phone jack (2-wire)
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 1V p-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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