WiNRADiO®

AVENTAS INC

Embedded Computing, Timing and Telemetry Products

WR-G315i Receiver with Options

Overview

The WiNRADiO WR-G315i is a software-defined high-performance VHF/UHF receiver (9 kHz to 1800 MHz, extendable to 3500 MHz using an optional Antenna Multiplexer and Frequency Extender) on a PCI card.

This receiver is intended for government, military, security, surveillance, broadcast monitoring, industrial and demanding consumer applications.

The receiver offers an unparalleled flexibility given its SDR architecture, respectable dynamic range, and high sensitivity. Many useful features complement the receiver, making it capable of filling not only the role of a monitoring receiver but also that of a measuring receiver, such as the calibrated S-meter showing the received signal levels in dBm, µV or S-units, down to the -140 dBm noise floor, several spectrum analyzers, and many other features not usually found on receivers of this price.

The hardware and software package consists of the receiver card, Windows-based software, a start-up antenna and a user's manual.

Hardware

The PCI card plugs into an available slot of an IBM-compatible PC. Several receivers (as many as there are free PCI slots available) can be controlled by a single PC - an ideal solution for high-performance multi-channel automatic monitoring systems.

There is a single SMA antenna connector and an output line audio jack which can be used to connect the receiver output directly to a sound card line-input or an amplified speaker.

The receiver has its own on-board DSP, and does not rely on the PC sound card for its performance. As the DSP performs the final stage IF filtering and all demodulation, this receiver is entirely software-defined, which means that additional demodulation or decoding modes can be easily added by a mere software change. (For example, an optional DRM decoder/demodulator is also available.)

Software

The WR-G315i software contains numerous advanced features such as three types of scanning, five types of squelch, many tuning options, virtually unlimited memories and a rich on-line help facility.

There are numerous demodulation modes, continuously variable IF bandwidth 1 Hz to 15 kHz (in 1 Hz increments), a 20 kHz wide real-time spectrum analyzer with 16 Hz resolution, noise blanker and notch filter. There is also an integrated recorder, making it possible to instantly record and playback the received signal.

Apart from audio recording and playback, the receiver can also record an entire 20 kHz wide IF spectrum, making it possible to thoroughly analyze the received signal, and "re-receive" the same signal again and again with different IF filter bandwidths, notch filter, noise blanking or demodulator settings, to arrive at the best possible reception of weak or interference-prone transmissions.

In addition to the real-time narrow-band spectrum analyzer, there is also a wide-band spectrum analyzer which contains additional professional instrumentation facilities: the ability to display minimum and maximum spectrum sweeps, search for peaks, average spectra, save and print spectra, marker mode, etc.

Another useful feature, previously unavailable with receivers of this price class, is a test and measurement facility, performing measurements on the received signal including frequency accuracy, amplitude modulation depth, frequency deviation, THD (total harmonic distortion) and SINAD. An audio spectrum analyzer is also included, making it possible to observe the demodulated spectrum in real-time with a resolution of 5 Hz.

The unique research and education function makes it possible to explore interactive block diagrams of the software-defined demodulator, for each demodulation mode, and observe demodulation taking place on real-time signals using two spectrum analyzers and a vector voltmeter.

Options

Wide-FM Demodulator Option (/WFM)

With the standard WR-G315i receiver, the FMW mode button is disabled and the wide FM demodulation mode is not available. This is because wide FM demodulation cannot be provided within the signal-processing constraints of the WR-G315i software-defined narrow-band receiver architecture.

However, wide-band FM demodulation capability is available as a factory-installed option. The wide-band FM demodulator option is in fact a self-contained "hardware-defined" receiver which shares only the main receiver's front-end and first mixer, but has an independent wide-band analog processing circuit with a conventional "hardwired" demodulator.

If the *Wide FM Option* is installed, the FMW button becomes active. The demodulator spectrum display shows real-time spectrum of the demodulated audio. There is also a user-definable audio filter, displayed superimposed over the audio spectrum and graphically adjustable. The order code for a receiver with the Wide-FM Option installed is WR-G315i/WFM.

External Reference Oscillator Input Option (/XR)

The G315i/XR receiver includes an additional external SMA connector, which can be used to connect an external reference oscillator for the highest possible frequency accuracy. This external oscillator can be any frequency from 8 to 20 MHz (the user specifies this frequency via software). The input is available at an additional SMA connector, it is AC coupled and has an internal impedance of 150 ohm. The reference oscillator signal can be either sine or square wave between 100 mV to 5 V peak-to-peak.

Reference Oscillator Output Option (/RO)

The G315i/RO receiver includes an additional external SMA connector, which can be used to output the internal reference frequency. This is useful for situations when the receiver's own internal oscillator is to be used as a reference for other equipment, or, if an external reference is used, to provide this external reference to other receivers in a daisy-chain arrangement. If the receiver relies on its internal reference oscillator, this option will provide 16.384 MHz reference output. If an external oscillator is used, then the external oscillator frequency will be provided at this output. The output is at an additional SMA connector, DC coupled, sine-wave at HCMOS levels (i.e. approx 0.6 to 4 V peak-to-peak) with an internal impedance of 150 ohm. It can be directly connected to an external reference oscillator input of another WR-G315i receiver.

Intermediate Frequency 109.65 MHz Output Option (/IF0)

The G315i/IF0 receiver includes an external SMA connector, which provides a wide-band IF output (prior to the roofing filters) at the first intermediate frequency of 109.65 MHz.

Intermediate Frequency 10.7 MHz Output Option (/IF1)

As an alternative to the previous option, the G315i/IF1 receiver provides a wide-band IF output. The difference is that this option involves an additional internal down-converter which converts the 109.65 MHz IF down to 10.7 MHz.

Intermediate Frequency 16 kHz Output Option (/IF2)

This G315i/IF2 receiver provides a narrow-band IF output at 16 kHz, its bandwidth limited by the receiver's 20 kHz roofing filter. This is a useful option for low-cost experiments with Software Defined Radio concepts, because the frequency is low enough to be digitized by a standard PC sound card.

Receiver type	DSP-based SDR with DDS-based dual-conversion superheterodyne front end
Frequency range	9 kHz - 1800 MHz (3500 or 8599 MHz with optional ***AMFE*** unit) *(except cellular radiotelephone frequencies where required by law)*
Tuning resolution	1 Hz
Mode	AM, AMS, LSB, USB, DSB, ISB, CW, FM (wide-FM with optional WFM demodulator)
Image Rejection	1.8-150 MHz: 60 dB typ. 150-1800 MHz: 50 dB typ.
IP3	0 dBm @ 20kHz
Spurious-free dynamic range	90 dB
MDS	-135 dBm
Phase noise	-148 dBc/Hz @ 100 kHz
Internal spurious	Typically less than equivalent antenna input of -105 dBm
RSSI accuracy	2 dB
RSSI sensitivity	-137 dBm
Bandwidth	1 - 15000 Hz (adjustable in 1 Hz steps)
Scanning speed	50 channels/s
Sensitivity (AM/SSB/CW 10dB S/N) (FM 12dB SINAD)	<table><tr><th>Mode</th><th>0.15-500 MHz</th><th>500-1800 MHz</th></tr><tr><td>AM, AMS (30% modulation)</td><td>-108dBm (0.89µV)</td><td>-104dBm (1.4µV)</td></tr><tr><td>AM, AMS (80% modulation)</td><td>-116dBm (0.35µV)</td><td>-112dBm (0.56µV)</td></tr><tr><td>LSB, USB, ISB, DSB</td><td>-119dBm (0.25µV)</td><td>-115dBm (0.40µV)</td></tr><tr><td>CW</td><td>-126dBm (0.11µV)</td><td>-122dBm (0.18µV)</td></tr><tr><td>FM</td><td>-113dBm (0.50µV)</td><td>-109dBm (0.80µV)</td></tr></table>
Intermediate frequencies	IF1: 109.65 MHz IF2: 16 kHz
Roofing filter	2 x 4-pole 20 kHz crystal filter
Tuning accuracy	1 ppm (25°C ±2°C)
Frequency stability	0.5 ppm (0 to 60° C)
Antenna input	50 ohm (SMA connector)
Output	600 ohm line audio
Form factor	2/3 length PCI card
Interface	PCI 2.2 compliant
Dimensions	Length: 195 mm (7.68") *(excluding mounting bracket)* Height: 99 mm (3.90") *(excluding edge connector)* Thickness: 19 mm (0.75") *(incl. components on either side)*
Weight	330 g (11.6 oz)

Specifications are subject to change without notice due to continuous product development and improvement.

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