

DRS's WJ-8611 DIGITAL HF/VHF/UHF RECEIVER

Features

- Frequency range: 2 to 1000 MHz in 10-Hz steps
- Compact 5.25-inch (13.34 cm) high (3U) half-rack package
- Digital IF section providing 17 IF filters from 200 Hz to 200 kHz with exceptional shape factors
- AM, FM, CW, SSB and ISB detection modes
- Low phase noise and highly linear RF performance
- Built-in tracking preselection
- Large front-panel displays and user-friendly controls
- 200-channel memory scan and F1-F2 scanning
- RS-232C and IEEE-488.2 remote control
- Built-in self test
- High MTBF
- Optional integral digital signal monitor IF Pan data output
- European CE approved for EMC and low voltage directives compliance
- 5.25 H x 8.25 W x 18.0 D inches (13.34 x 20.96 x 13.34 cm)
- Weight: 15 lbs. (6.8 kg)



Description

The WJ-8611 is a half-rack, fully synthesized general-purpose HF/VHF/UHF surveillance receiver that covers the 2 to 1000 MHz frequency range with 10-Hz tuning resolution. The unit combines a high quality RF front end with digital signal processing (DSP) to achieve high performance at a low cost.

The WJ-8611 accomplishes functions such as IF filtering, demodulation, fine tuning, automatic gain control (AGC), and beat frequency oscillator (BFO) through DSP techniques. Filters with superior amplitude and group delay characteristics are achieved with digital stability and repeatability, and are not subject to variations with operating temperature. Available detection modes include AM, FM, CW, SSB, and ISB. An operator can select

17 standard IF bandwidths (IFBW) in the 200-Hz to 200-kHz range from the front panel or remotely. An operator can adjust the tunable BFO in 10-Hz steps over the ± 8 kHz range during CW reception. Over 90 dB of automatic or manual gain control range is available along with a selectable automatic frequency control (AFC) function.

The squelch threshold is adjustable over a 100-dB range.

In addition to fixed-frequency tuning, the WJ-8611 provides fast, flexible scanning. Scan modes include 200-memory-channel scan with channel lockout and dwell capabilities, and F1-F2 (search) scan with band lockout capabilities. In addition, an operator can recall the

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200 memory channels individually for fixed-frequency use. An operator can also use all scan and memory functions from the front panel and over the remote control bus of the receiver.

The WJ-8611 front panel uses large, bright, LED displays and individual function keys to achieve user-friendly operation in a half-rack size. The two display sections give an immediate indication of receiver status. Separate function and numeric keys provide straightforward control of basic receiver functions. In addition, cumbersome multi-key operations are minimized. Front panel displays include a direct readout of signal strength and a bar graph indication of center tuning. Front-panel controls include a lockable weighted tuning knob, a headphone output, a headphone volume control and an ac power on/off switch.

The WJ-8611 is packaged in a standard 5.25-inch (13.34-cm) high half-rack enclosure with an overall depth of 18 inches (45.72 cm) excluding connectors and knobs and a width of 8.25 inches (20.96 cm). Panel ears, slide attachment holes, and special hardware allow rack mounting in a side-by-side configuration. The overall unit weight is less than 15 pounds (6.8 kg). Ac power consumption is less than 50 watts using an internal switching supply that operates from 90 to 264 Vac at 48 to 440 Hz.

Control

The WJ-8611 Receiver is controlled via either an asynchronous serial or IEEE-488 interface. The receiver supports one of the following interface standards, which are changeable by setting an internal DIP switch:

- Single-drop full-duplex RS-232C
- IEEE-488 (GPIB)

The RS-232 interface allows an operator to connect a single receiver to a single controlling device with standard baud rates between 1200 and 38.4 K baud. The RS-232 interface also supports the **XON-XOFF**, and **ENQ-ACK/NAK** software interface protocols. The receiver may generate a service request by sending an **ESC** character followed by a status byte. The service request capability may also be disabled.

The IEEE-488 interface supports basic talker and listener capabilities with service request and serial poll. The RS-232 and IEEE-488 interfaces both support high-level ASCII IEEE-488.2 command mnemonics. The receiver implements a **speaks when spoken to** protocol. Data is accepted in a format that is forgiving, while responses are always precise.

Functional Description

The WJ-8611 main chassis functional block diagram shows the receiver circuitry is divided between two major modules. The RF tuner module contains the circuitry required to downconvert the RF signal to the final IF of 250 kHz. The unit routes the final IF signal to the digital control/DSP module where it is converted to digital form, filtered and demodulated.

The functional block diagram of the WJ-8611 RF subsystem is provided. A rear-panel type-**N** connector couples RF signals from the antenna to the input of the receiver. The RF bandwidth is limited by a two-pole tracking preselector. The filtered RF signal is passed to a low-noise RF amplifier that provides excellent receiver sensitivity. After the signal is amplified, it passes through a lowpass filter that provides image rejection for the first mixer. The first local oscillator (LO) tunes from 1370 to 2350 MHz in 2.5-MHz steps and provides conversion of the signal to the first IF, which is centered at 1350 MHz. A low-noise amplifier follows the first mixer, providing sufficient gain to overcome the losses of the first mixer and first IF filter. The output of the first IF amplifier passes through the first IF filter, which provides image rejection for the second mixer. The second mixer combines the first IF signal with the second LO, which tunes from 1327.75 to 1330.25 in 1-kHz steps. The second LO is a three-loop design providing fine frequency resolution, as well as low phase noise and fast tuning.

The output of the second mixer is centered at 21.4 MHz. A 10-MHz roofing filter follows the mixer, which provides LO rejection and limits the bandwidth of the signal passed to the second IF amplifier. The output of the second IF amplifier is split before it is routed to the final IF filter. A sample of the 21.4-MHz IF signal is routed to the receiver's rear panel for use with an external signal monitor.

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The 21.4-MHz IF signal is routed to a 200-kHz-wide bandpass filter that sets the final analog bandwidth of the receiver. After passing through the filter, the signal is converted to 250 kHz in the third conversion mixer. The third IF is amplified and routed to the analog-to-digital converter.

The analog-to-digital converter digitizes the 250-kHz final IF frequency to 12 bits of resolution at a 1-MHz sample rate. This digitized IF signal is applied to a series of programmable DSP chips that perform the following functions:

- Fine tuning to 10-Hz resolution
- IF filtering
- Gain control
- Signal strength and squelch functions
- Signal demodulation and BFO
- Generation of digital IF outputs

After digital processing, the filtered and demodulated signal is routed to the analog reconstruction circuitry, which generates the video and audio outputs. A digital I and Q IF output provides digitized IF in a high-speed serial format.

8611/SM

This option adds a WJ-9168 Signal Monitor Module inside the WJ-8611 connected to the 21.4 MHz signal monitor output of the receiver. With this option digital signal monitor IF pan data is available over the active IO interface of the WJ-8611. This data may be used to generate an IF pan spectral presentation on a controlling device. The WJ-RCS32 receiver control application supports an IF pan presentation from the WJ-9168. See WJ-9168 data sheet for details. This option eliminates customer access to the 21.4 MHz signal monitor output.

Connectors (Inputs/Outputs)

I/O	Function	Type
Input	• Antenna (2 to 1000 MHz range)	N
	• 1, 2, 5 or 10 MHz auto-selectable external reference	BNC
Output	• AC power (90 to 264 Vac; 48 to 440 Hz; 50 watts, maximum)	3-pin IEC
	• 21.4-MHz signal monitor (10-MHz BW; 12 dB above RF input, nominal)	BNC
	• Selected video (AM, FM, SSB, 1.0 Vp-p, nominal into 50 ohms)	BNC
	• Line audio (200 Hz to 16 kHz; 0 dBm, nominal into 600 ohms)	6-pin terminal block
	• Digital IF output	15-pin D
	• COR (squelch), TTL output	BNC
	• RS-232 remote control	25-pin D
	• IEEE-488	IEEE-488 standard
	• Headphone audio (adjustable up to 10 mW, minimum into 600 ohms; 200 Hz to 16 kHz)	1/4 in (0.64 cm) Stereo phone jack

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Technical Specifications

<i>Parameter</i>	<i>Specification</i>
Frequency range	2 to 1000 MHz (specifications apply 20 to 1000 MHz)
Tuning resolution	10 Hz
RF input impedance	50 ohms, nominal
Input VSWR	2:1, typical; 3:1 maximum
Noise figure	12 dB, maximum
Preselection	Tracking filter, bandwidth typically 20% of the tuned frequency
Intermodulation performance:	
Second-order input intercept point	+40 dBm, typical
Third-order input intercept point	+4 dBm, minimum
Image rejection	80 dB, minimum
IF rejection	80 dB, minimum
Maximum input signal (without damage)	+20 dBm
Internally generated spurious	<-110 dBm equivalent input
LO level at RF input	-90 dBm, maximum
LO phase noise	<-95 dBc/Hz @ 10-kHz offset
Receiver tuning	20 ms, maximum to within 1 kHz - measures from the last byte of a tuning command to the FM video output
Internal frequency accuracy	$\pm 5 \times 10^{-6}$ (5 to 40°C)
IFBW (6-dB BW)	200 kHz, 150 kHz, 100 kHz, 60 kHz, 50 kHz, 35 kHz, 30 kHz, 20 kHz, 15 kHz, 10 kHz, 8 kHz, 6.4 kHz, 5 kHz, 3.2 kHz, 1 kHz, 500 Hz, 200 Hz,
IF shape factor	<1.5:1, 60 dB: 6 dB, typical
Gain control modes	Manual, AGC
Gain control range	90 dB, minimum
Manual gain resolution	1 dB, nominal
COR/squelch range	Adjustable from -130 to -30 dBm
COR/squelch resolution	1 dB, nominal
Detection modes	AM, FM and CW, all BWs USB and LSB for 3.2 kHz BW ISB for 6.4 kHz BW
Variable BFO range	± 8 kHz
Variable BFO resolution	10-Hz steps
Signal monitor output	Nominally 12 dB above the RF input, 10-MHz BW
Switched video output level	1.0 V peak-to-peak into 50 ohms (30% deviation in FM or 50% AM modulation)
Video frequency response	dc to 1/2 the IFBW
Line audio output level	0 dBm into 600 ohms, nominal
Control interface	RS-232 and IEEE-488
Power requirements	90 to 264 Vac, 48 to 440 Hz
Power consumption	50 watts, maximum (90 VA maximum)

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Technical Specifications

Parameter

Specification

Blocking Attenuation of a desired -90 dBm RF signal by a -5 dBm interfering signal offset by 20 MHz is <3 dB.
Reciprocal mixing With an input signal at rated sensitivity level in the 50-kHz bandwidth, an out-of-band signal removed by 350 kHz, and 70 dB higher in level will not degrade the S-N/N ratio of the desired signal by more than 3 dB.

Environmental

Operating temperature 0° to 50°C
Storage temperature -40° to 80°C
Full specification compliance +5° to 40°C
Vibration MIL-STD-810E method 514.4 categories 1, 8, and 9
(Basic transportation, ground mobile and Shipboard)
Shock MIL-STD-810E method 516.4, procedure VI, bench handling
High and low operating temperature MIL-STD-810E methods 501.3 and 502.3
Humidity MIL-STD-810E method 507.3, procedure III
Altitude MIL-STD-810E method 500.3
MTBF In excess of 10,000 hrs per MIL-HDBK-217E, ground-fixed environment
MTTR <30 minutes
CE approvals Low-voltage directive 72/23/EEC
EMC directive 89/336/EEC

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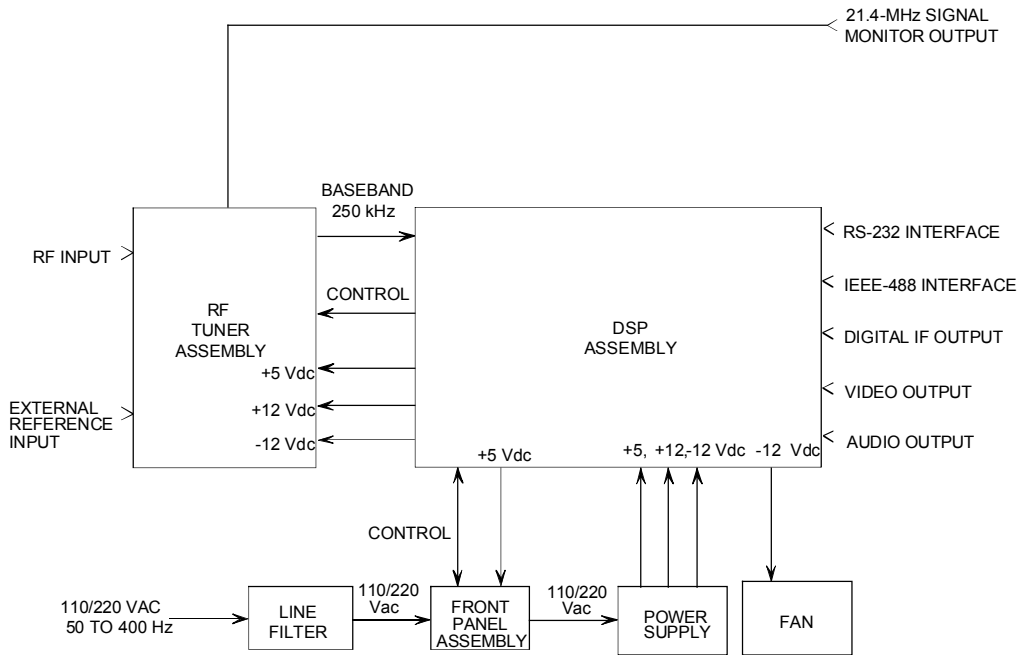


Figure 1. WJ-8611 Functional Block Diagram

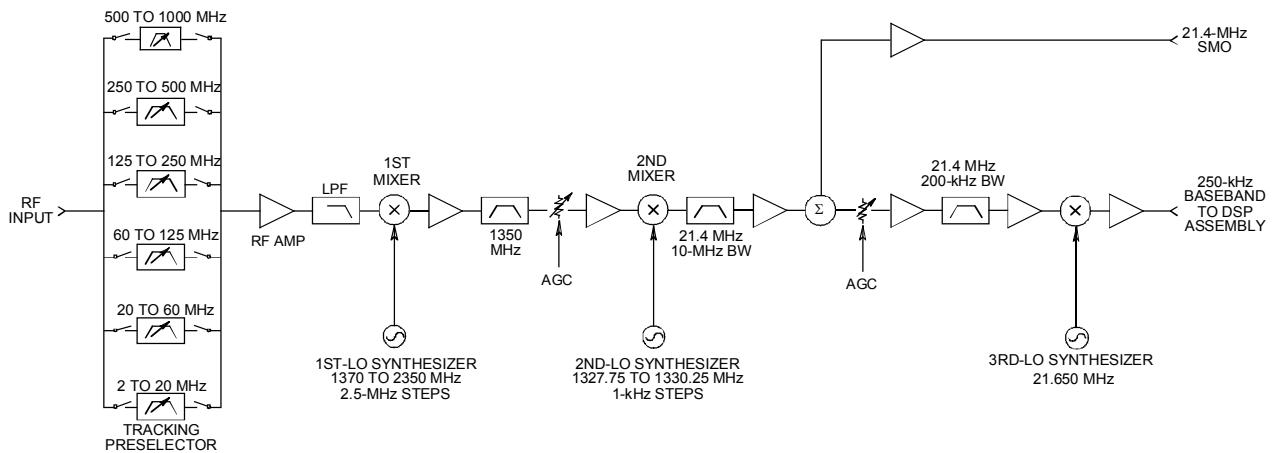


Figure 2. WJ-8611 RF Subsystem Functional Block Diagram

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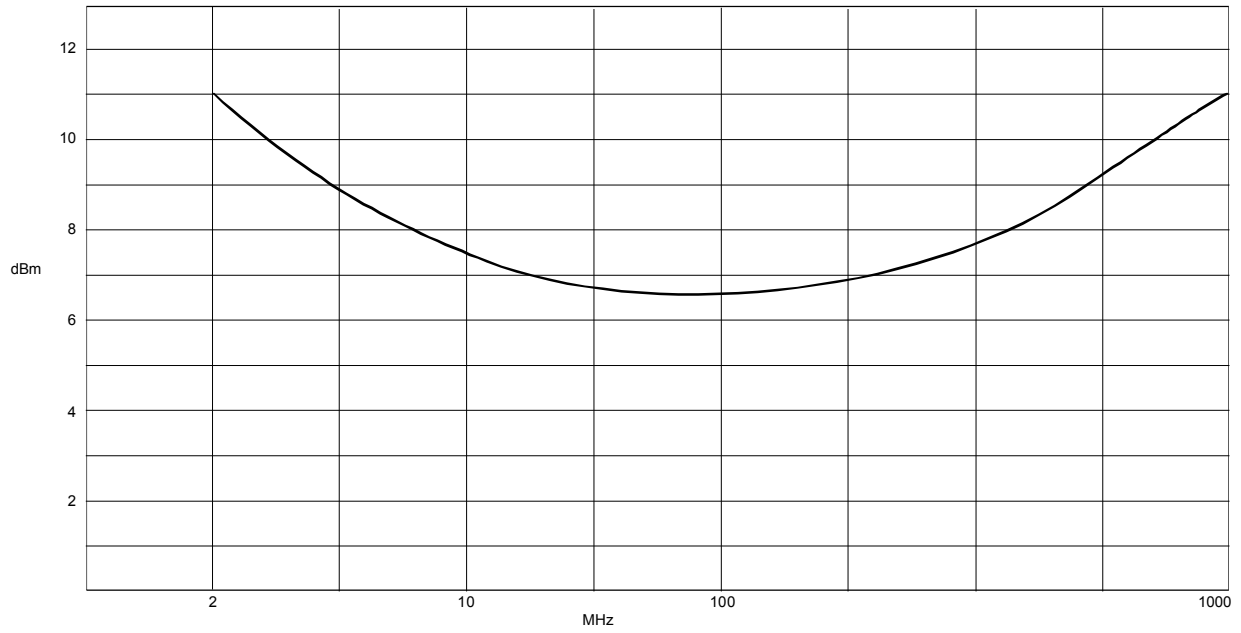


Figure 3. Typical Noise Figure

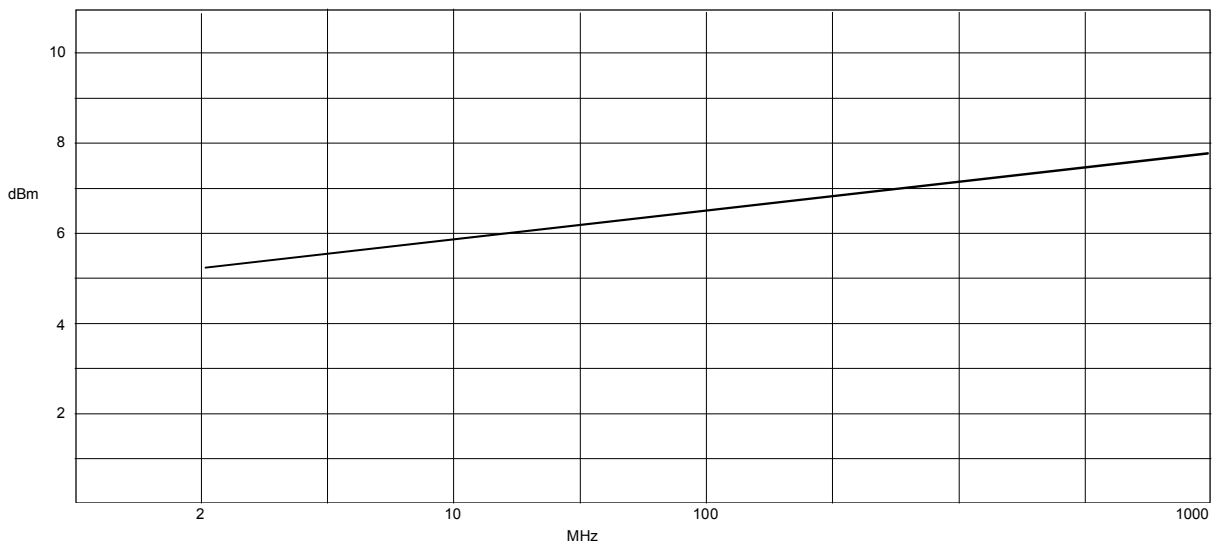


Figure 4. Typical Third-order Intercept

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Sensitivity

<i>Bandwidth (kHz) Modulation</i>	<i>60:6-dB IFBW Shape Factor (maximum)</i>	<i>Sensitivity (dBm)* 20 to 1000 MHz</i>
0.5 CW	1.5:1	-114
1.0 CW	1.5:1	-113
5.0 AM	1.5:1	-106
10 AM/FM	1.5:1	-103
20 AM/FM	1.5:1	-100
50 AM/FM	1.5:1	-96
100 AM/FM	1.5:1	-93
200 AM/FM	1.5:1	-90

*Sensitivity Conditions

AM - An input signal AM modulated 50% by a 1-kHz tone produces a minimum video output S+N/N ratio of 10 dB.

FM - An input signal FM modulated at a 1-kHz rate with a peak deviation equal to 30% of the selected IFBW produces a minimum video output S+N/N ratio of 17 dB. (Note: A 400-Hz modulation rate is required for IFBWs of 10 kHz or less.)

CW- A continuous RF input signal produces a minimum audio output S+N/N ratio of 16 dB.

Ordering Information

8611/SM

Adds WJ-9168 and internal cables to the WJ-8611.

DRS SIGNAL SOLUTIONS, INC.
700 Quince Orchard Road
Gaithersburg, MD 20878-1794

301.948.7550
Fax 301.921.9479
info@drs-ss.com
www.drs.com

PN: EXP904531-001, Rev E, June 2005

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