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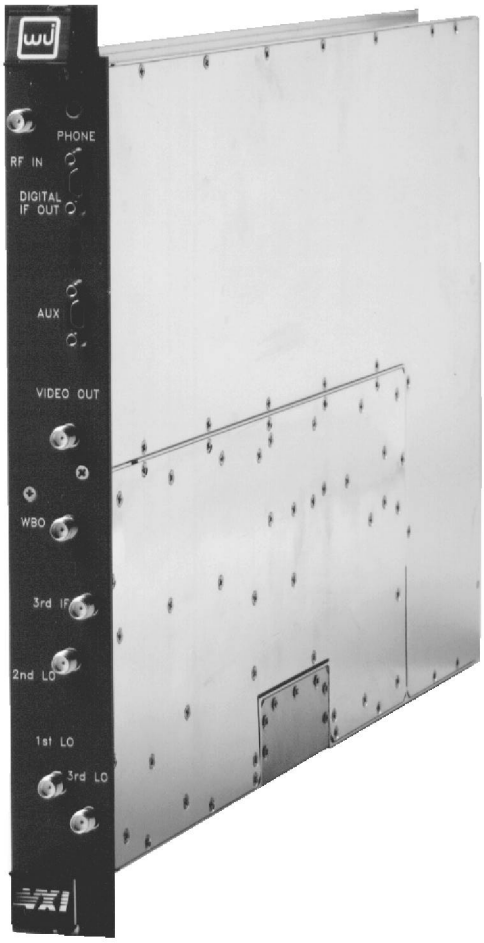
Find the *Watkins-Johnson WJ-8621* at our website: ***Click HERE***

Developmental Specification

WATKINS-JOHNSON

May 1997

VHF/UHF Wideband ViXIceptor
WJ-8621



The WJ-8621 is a general-purpose VHF/UHF receiver covering a 20 to 2700 MHz frequency range. WJ packages the unit in a single-slot C-size VMEbus extensions for Instrumentation (VXI) module. The WJ-8621 is ideal for applications requiring broad-frequency coverage in a highly integrated package. Combining receiver control directly onto a standard instrumentation and computing bus adds significant system capabilities, yet reduces the complexity of system integration.

The WJ-8621 Receiver features low-phase-noise frequency synthesizers, a preselector equipped front end, 100-Hz tuning resolution, and high dynamic range. The WJ-8621

Features

- ❏ *Frequency coverage from 20 to 2700 MHz with 100-Hz resolution*
- ❏ *+10 dBm 3rd-order intercept point, typical*
- ❏ *12-dB noise figure, typical*
- ❏ *Suboctave preselection*
- ❏ *Switchable RF preamplifier*
- ❏ *AM, FM, CW, LSB, & USB detection modes*
  - *Up to 8 IF bandwidths from 3.2 kHz to 12 MHz*
  - *Audio, video, or tunable baseband output available on front panel*
- ❏ *Configurable for multichannel phase-coherent operation*
  - *LO inputs/outputs*
  - *2 WJ-8621s can form a 2-channel coherent system*
- ❏ *Powerful built-in search capabilities*
- ❏ *VXI message-based control*
- ❏ *Built-in reference oscillator*
- ❏ *12.5-MHz wideband IF output*
- ❏ *Front-panel-mounted RS-232 auxilary control port*

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utilizes traditional analog circuitry to achieve wideband signal processing capability. The high-performance suboctave preselector filters incoming RF signals, and rejects undesired out-of-band signals, improving the usability of the receiver in dense signal environments.

WJ uses surface-mount technology in the printed-circuit board design of the WJ-8621 Receiver. A milled-aluminum chassis provides RF isolation between multilayer PC boards. The front panel of the unit provides RF/analog interconnections. SMA-type connectors pass the RF/Analog signals in and out of the unit. Microminiature D-type connectors provide analog audio outputs.

A high-speed message-based VXI interface provides remote control. This interface provides accessibility to all functions except power. An operator may also control the WJ-8621 from its auxiliary RS-232 port on the receiver front panel.

Internal switching allows the WJ-8621 to route a sample of the Local Oscillators (LOs) to another receiver, or to apply external LOs to the unit. An operator can cable together a pair of WJ-8621 Receivers to form a two-channel phase-coherent system. Systems needing more than two channels require an external LO divider/buffer module.

Functional Description

A front-panel SMA connector couples the RF signals from the antenna to the input of the receiver and routes the signals to a multiband, suboctave preselector. The filtered RF signal is then applied to a low-noise RF amplifier that provides excellent receiver sensitivity. The WJ-8621 amplifies the signal and passes it through a lowpass filter that provides IF rejection. The control microprocessor sets the step attenuator, preceding the first mixer, to optimize the dynamic range of the receiver based on the incoming signal strength.

The first LO tunes from 3755 to 6435 MHz in 2.5-MHz steps and upconverts the RF signal to the first IF. The first LO synthesizer uses a YIG oscillator to provide excellent phase noise. A low-noise amplifier follows the first mixer, and provides 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, centered at 3735 MHz, and rejects the second mixer-image frequency at a 42.8-MHz offset. A low-noise amplifier following the first IF filter provides additional signal gain. A step attenuator follows the second mixer and is set by the microprocessor, based on the incoming signal strength.

The second mixer combines the first IF signal with the second LO, which tunes from 3711.101 to 3713.6 MHz in 100-Hz steps. The second LO is a three-loop design providing 100-Hz frequency resolution, low phase noise, and fast tuning.

The second LO centers the output of the second mixer at 21.4 MHz. A 12.5-MHz-wide bandpass filter follows the mixer, providing rejection of the LO, and sets the bandwidth of the wideband analog IF output.

The IF/Demodulator section bandpass filters the 21.4-MHz IF signal to the final selected bandwidth. Seven optional bandwidths are available, with four included in the standard receiver plus the 12 MHz bypass mode. The WJ-8621 supports IF bandwidths from 3.2 kHz to 12 MHz, with video response equal to one-half the selected IF bandwidth. The video filters are also selectable independently from the IF bandwidth selection when less video bandwidth is desired. The sensitivity table on page three indicates the IF filter choices. WJ can provide other bandwidths for special requirements.

The filtered IF signal is gain/bandwidth normalized and applied to the log amplifier and the variable-gain IF amplifier. The log amplifier provides up to 80 dB of accurate log range, and has video bandwidth up to 2 MHz for faithful reproduction of pulse signals. The variable-gain amplifier provides manual or automatic gain control. It applies the optimum signal level to the demodulator section. The demodulator provides AM/FM/CW and SSB detection.

The AM demodulator is a quasi-synchronous detector. A limiting amplifier recovers the carrier from the signal. The carrier mixes with the IF signal, and the modulation product results from this mixing action. This provides AM detection that is linear for about 40 dB of signal range.

The FM demodulator consists of a crystal discriminator for bandwidths of 300 kHz and lower. A quadrature discriminator demodulates bandwidths between 300 kHz and 1 MHz. A delay-line discriminator demodulates bandwidths greater than 1 MHz for excellent wideband linearity.

The WJ-8621 demodulates CW inputs by mixing the IF signal with the synthesized Beat Frequency

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Oscillator (BFO) in the product detector. The BFO is tunable from -0.5 MHz to +4 MHz, in 250-Hz steps. This detector also provides the tunable baseband output.

During USB or LSB detection modes, the CW detector mixes the IF signal down to 455 kHz, where a bandpass filter improves selectivity needed for this mode. The filtered output of the 455-kHz IF applies to another product detector for sideband detection. Upper or lower sideband demodulation results from programming the third LO for either high-side or low-side injection into the CW detector.

The product of the selected detection mode is automatically routed to the video-output connector, the line audio, and the headphones jack. A separate connector provides DC-coupled and bandlimited FM at all times. The selected detector output is also connected to an optional Analog to Digital (A/D) converter (consult factory) that digitizes the video or translated IF to parallel data format. An operator can connect the parallel data to a VXI DSP card for further signal processing. Since the receiver includes IF translation, an operator can also use it as a baseband tuner.

The WJ-8621 Receiver supports the comprehensive WJ *Miniceptor/Microceptor* search and command structures, and is compatible with WJ-8634 and WJ-8629 applications. The receiver provides three operating modes:

- Manual (fixed-frequency operations)
- SWEEP (contiguous coverage of up to 10 start/stop frequency sectors)
- STEP (preprogrammed discrete frequencies).

The WJ-8621 is interactive in all three modes and alerts the host computer of signal activity. While in either the SWEEP or STEP mode, the receiver logs individual signals in the coverage area and reports only changes in signal presence to the VXI controller. This greatly reduces overhead time required by the controller in multi-receiver systems, since it eliminates the need to communicate and sort data from each sweep, and to differentiate between new and repeat signals. In SWEEP mode, the receiver locks out portions of the RF spectrum and excludes previously identified portions of the spectrum from the coverage area. In the SWEEP or STEP modes, the receiver maintains a frequency versus amplitude data block available to the controller for RF pan display generation. Receiver memory provides storage for up to 200 SWEEP or STEP setups, and 200 lockout bands.

Sensitivity

Bandwidth (kHz)	60:3 dB Bandwidth Shape Factor	20 to 1200 MHz Sensitivity* (dBm)
3.2	3:1	-108
6.4	3:1	-105
10	3:1	-103
20	3:1	-100
30	3:1	-98
50	3:1	-96
100	3:1	-93
200	3:1	-90
300	5:1	-88
500	5:1	-86
1000	4:1	-83
2000	4:1	-80
4000	4:1	-77
6000	4:1	-75
8000	4:1	-74
12000	4:1	-72

***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: IFBWs <10 kHz require a 400-Hz modulation rate.)

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

Add 1 dB for 1200 to 2400 MHz

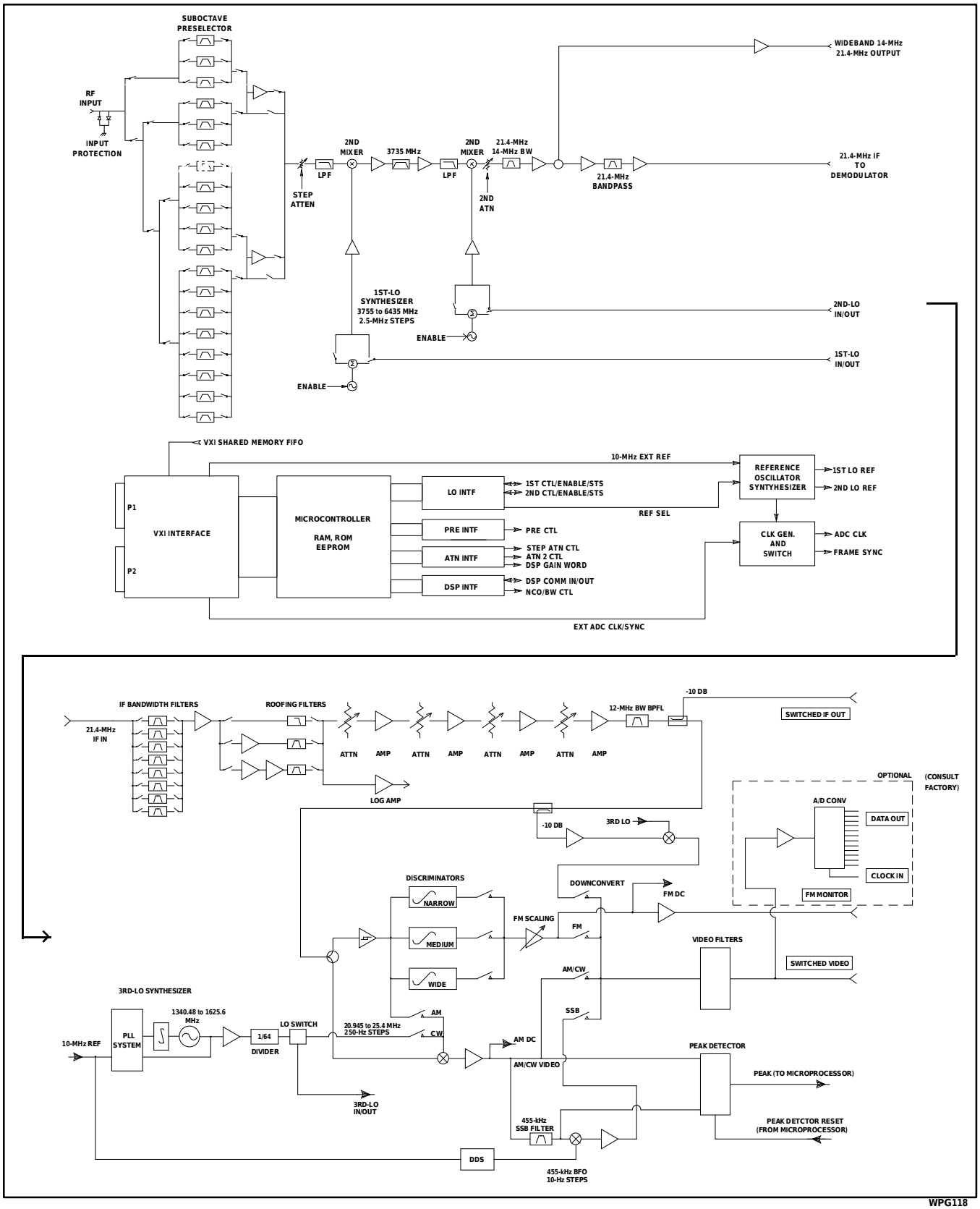
Add 2 dB for 2400 to 2700 MHz

Receiver Connectors

I/O	Function	Type
Input	Antenna	SMA
	10-MHz reference	SMA
Outputs	Wideband IF output, 21.4-MHz center, 12.5-MHz bandwidth	SMA
	Switched IF output	SMA
	Video	SMA
	Line Audio	Multipin D
	Phone Audio	Phone jack
Bi-directional*	1st-LO Input/Output	SMA
	2nd-LO Input/Output	SMA
	3rd-LO Input/Output	SMA
	RS-232 Control	Multipin D

***Operating more than one slave receiver requires an external LO divider/buffer module.**

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Specifications

Frequency Range	**20 to 2700 MHz**
Tuning Resolution	**100 Hz at demodulated output, 1 kHz at analog IF outputs**
Internal Reference Accuracy	**±1.0 ppm, max (0 to 40°C)**
External Reference Input	**10 MHz (across VXI backplane)**
RF Input	**50 ohm, 1.5:1 VSWR, typical** **3.0:1 VSWR, maximum at the tuned frequency**
Preselection	**Switched suboctave bandpass filters, 19 bands**
Noise Figure (Pre-amp on)	
20 to 1200 MHz	**12 dB, max** **11 dB, typical**
1200 to 2400 MHz	**13 dB, max** **12 dB, typical**
2400 to 2700 MHz	**14 dB, max** **12 dB, typical**
RF Input Protection	**1 W, max input without damage**
Input 3rd-order Intercept (Pre-amp on)	**+8 dBm min, +10 dBm typical, at wideband 21.4-MHz IF output with -20 dBm signals spaced 10-MHz apart**
Input 2nd-order Intercept	**+55 dBm, typical at 21.4-MHz IF output**
Wideband IF Output	**Centered at 21.4 MHz (inverted spectrum)** **12.5-MHz 3-dB bandwidth, min**
Gain-to-wideband IF Output	**17 dB, min**
Switched IF Output	**-30 dBm, nominal**
Gain Control Modes	**Manual, AGC, 100-dB range**
Image Rejection	**90 dB**
IF Rejection	**90 dB**
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 20-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 to <7dB.**
Phase Noise	**Better than -97 dBc/Hz @ 20-kHz offset** **Typically -115 dBc/Hz @ 100-kHz offset**
Memory Channel Step Time	**100 channels per second, min**
F1 to F2 Sweep Time	**3 mSec, typical per sweep point (with 1-kHz resolution)**
LO Level at RF Input	**-90 dBm, max**
Internally Generated Spurious	**-110 dBm equivalent RF input, max**
Detection Modes	**AM, FM, CW, LSB, USB**
IF Bandwidths (kHz, -3 dB BWs)	**7 selectable bandwidths from 3.2 kHz to 8 MHz, plus 12 MHz bypass mode (see Table)**
IF Shape Factor	**60:3 dB (see Table)**
Variable BFO range	**-0.5 to + 8 MHz, 10-Hz steps**
AFC	**Frequency tracking within +/- 1/2 the IF bandwidth**
Switched Video Output level	**1-V p-p into 50 Ω** **(30% deviation in FM or 50% AM modulation)**
Video Frequency Response	**dc to 1/2 the IF bandwidth**

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Line Audio Output Level ..... **0 dBm into 600 Ω, nominal**

Headphone Output ..... **10 mW into 32 Ω**

VXI Interface

- **Device Type** ..... **Message-based device, VXI servant**
- **Module Size** ..... **VXIbus C-size module, 1-slot wide**
- **Data Transfer Handshake** ..... **Normal transfer mode**
- **Data Transfer Capability** **A24, D16**
- **EMI Shielding** ..... **Completely enclosed module**

Power Consumption ..... **<40 watts**

Typical Current .....

Vdc	mA
+24	250
+12	950
-12	250
+ 5	2500
- 5	500

Weight ..... **<7 lbs (3.2 kg)**

Environmental Specifications

Temperature

- **Operating Temperature Range** ..... **0 to +50°C Case**
- **Non-operating Temperature Range** ..... **-40 to +70°C Case**

Full Specification Compliance ..... **20 to 30°C Case**

Altitude ..... **0 to 12,000 feet (3658 meters) above MSL**

Humidity ..... **10 to 90% non-condensing**

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