PrecisionWave AG
Swiss RF Solutions

Product Brief

Broadcast Receiver (BR-VBI)

BR-VBI is a digital broadcast receiver allowing measurements and supervision for your broadcast networks from 400 kHz up to 950 MHz. BR-VBI is natively supported by the PrecisionWave Signal Analyzer (PWA) software which is an ideal combination for spectrum and channel impulse response analysis, stationary and mobile service performance estimation, and many more use-cases.

Product Description

Based on the field-proven VBI family, our BR-VBI in combination with the PrecisionWave Signal Analyzer (PWA) is a highly integrated and cost-effective solution for supervision and analysis of almost all common sub-GHz broadcast standards.

BR-VBI contains two selectable RF input paths, each optimized for two different frequency ranges.

The best dynamic range for a wide range of input signal levels is achieved by switchable input attenuators and low-noise amplifiers. Multi-stage input signal filtering guarantees optimal channel selectivity for a convincing measurement experience.

A fast-attack overdrive prevention circuit attenuates the input level to adequate signal levels. This enables accurate drive tests in which signal levels fluctuate strongly.

Stand-alone System

Our device works as a stand-alone receiver. A 1-Gbit Ethernet interface is used for I/Q data streaming and remote control. We selected a well-established and open-source driven API called “libIIO” for data streaming and device configuration. libIIO is widely used and natively supported out-of-the-box by the most popular signal processing software (PWA, Matlab, GNU Radio, and many others).

Supported Broadcast Technologies

In combination with the PrecisionWave Signal Analyzer (PWA) software, the following broadcast technologies are supported as ITU compliant measurements:

ATSC	DVB-T
AM/SW	DVB-T2
DRM/DRM+	FeMBMS (5G Broadcast)
DAB/DAB+	FM
DMB	LTE



Our compact receiver module with an active ventilation system, N-connector and status LEDs. This lightweight housing is optimized for laboratory and vehicular use.

Benefits & Highlights of our Solution

- Two selectable RF inputs optimized for 0.4-108 MHz and 0.4-950 MHz respectively
- Optimized low-noise design to achieve best dynamic range for a wide signal power range
- Automatic gain control and fast-attack overdrive prevention circuit
- Ultra low phase noise clocking (130 fs typical)
- High channel selectivity thanks to multi-stage analog bandpass filtering
- Low power consumption (24 W max.)
- Compact, rugged module ideally fitting for vehicular and remote applications where space matters
- Actively cooled housing optimized for vehicular applications available as option
- On-board GPS receiver for exact LO frequency disciplining and geopositioning in drive tests
- Gbit-Ethernet for direct I/Q sample streaming and configuration

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Functional Description

BR-VBI consists of two selectable analog RF inputs: a broadband input with configurable preselector filters and mixer stage and a second input with a fixed preselector.

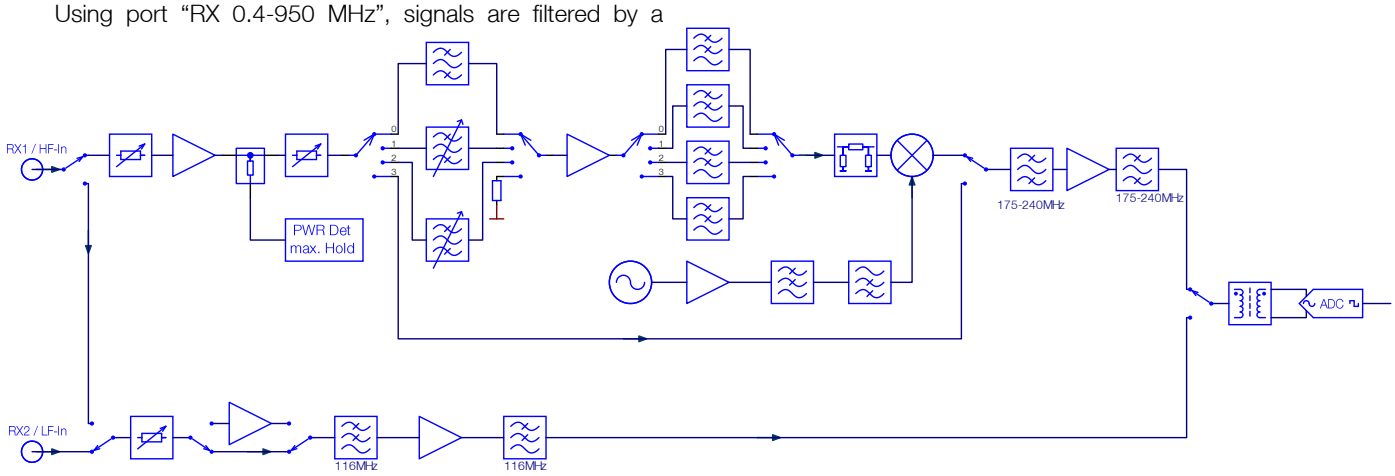
A fast-attack overdrive prevention circuit at the input of the receiver ports attenuates the input level to adequate signal levels. This enables accurate drive tests in which signal levels fluctuate strongly.

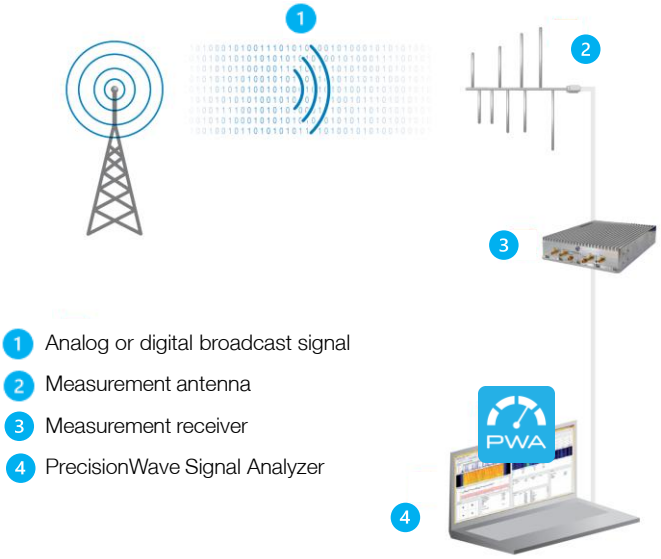
Automatic gain control maximizes the dynamic range for any signal power level.

Using port “RX 0.4-950 MHz”, signals are filtered by a configurable dual-stage filter bank to achieve the best frequency selectivity. After the filtering, signals are mixed to a fixed intermediate frequency and then converted by an ADC. Digital pre-processing and I/Q sample streaming over Gbit-ETH is then performed by the SoC/FPGA.

Port “RX 0.4-950 MHz” can be routed to both input paths.

Input signals on port Port “RX 0.4-108 MHz” are filtered by two lowpasses with fixed cut-off frequency.





1. Analog or digital broadcast signal
2. Measurement antenna
3. Measurement receiver
4. PrecisionWave Signal Analyzer

PWA measurement system overview

PrecisionWave Signal Analyzer (PWA) is a high-performance solution to analyze your broadcasting networks. The measurement and investigation tool for analog and digital broadcasting is a powerful and complete system to assist you through any phase of radio network planning, realization, and maintenance, as well as in the quality assurance of your broadcasting network.

PWA is hardware-independent and supports several measurement receivers.

We have seamlessly integrated our system to PWA and are thus able to provide the entire measurement system.

Further information about PWA can be found on our product page. See www.precisionwave.com.

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All-in one hardware: modularity, improved reliability and low power

To guarantee high reliability, long-term operation, compact size, and low power consumption, our system follows a simple and powerful approach where the complete hardware is downsized to just a few, but of the highest quality components. We're not ready to make compromises when it comes to quality.

All analog RF processing is done on dedicated, RF frontends that are plugged onto the baseboard.

Digital signal processing is completely hardware-based, thanks to DSP IP-cores, running on the FPGA. This leaves plenty of room for data interpretation and other signal processing on the CPUs.

General Hardware Specification	
Typical power consumption	24 W max
Module supply voltage	8-15 V DC
Mains power supply	100-240 V AC, 50/60 Hz to 12 V DC
GPS antenna	3.3 V LNA bias, 1.5 m cable
Operating temperature	0-50 °C
MTBF	260'000 h
Long-term availability	At least until 2030
Module size	210x155x40 mm
RF connectors	SMA female
RF ports impedance	50 Ω
RF port input reflection (S11)	< -10 dB
ADC sampling rate	276.48 MHz
ADC resolution	12 Bit
IQ Stream configurable sampling rates	69.12, 30.72, 15.36, 10.24, 7.68, 6.144, 5.12, 4.3886, 3.84, 3.4133, 3.072, 2.56, 2.3631, 2.1943, 2.048, 1.92 MSPS

Minimum System Requirements

To ensure the functionality for BR-VBI, minimum system requirements for the PC hosting PWA (PWA PC) must be met.

Please also note the minimum system requirements of the PWA software, which are defined in the respective product description.

System	Description
PWA	PrecisionWave Signal Analyzer (PWA) Software Version 6.0.5 or higher
PC Ethernet Interface	1000BASE-T Ethernet with Jumbo-Frame Support (MTU = 9000, for max streaming bandwidths)

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Typical RF Performance

RX input 0.4-950 MHz	
Frequency range	0.4-950 MHz
Fixed preselector filter bands	Band 1: 0.4-108 MHz Band 2: 100-180 MHz Band 3: 174-240 MHz
Tunable preselector filter bands	Band 4: 210-440 MHz Band 5: 420-950 MHz
Tunable preselector filter fractional bandwidth	Band 4: 8.4-14 % Band 5: 13.1-16.8 %
RF input power	< 15 dBm nominal 20 dBm max
Fast attack overdrive threshold	15.5 – 20 dBm
Fast attack overdrive input attenuation	0, 6, 12, 18 dB
Second stage AGC attenuation	0-31.75 dB
SFDR (60 MHz Rx BW)	150 MHz 80 dBFS 205 MHz 88 dBFS 370 MHz 85 dBFS 480 MHz 85 dBFS 650 MHz 85 dBFS 890 MHz 85 dBFS
Input intercept point (attenuators 0 dB)	150 MHz -1.8 dBm (LNA always active) 205 MHz 10.4 dBm (LNA always active) 370 MHz 8.4 dBm (LNA always active) 480 MHz 11.7 dBm (LNA always active) 650 MHz 1.5 dBm (LNA always active) 890 MHz 3.5 dBm (LNA always active)
Noise figure (attenuators 0 dB)	150 MHz 2.8 dB 205 MHz 4.9 dB 370 MHz 3.9 dB 480 MHz 3.2 dB 650 MHz 3.2 dB 890 MHz 4.5 dB
Full scale input (0 dBFS, attenuators 0 dB)	150 MHz -34 dBm 205 MHz -25 dBm 370 MHz -29 dBm 480 MHz -32 dBm 650 MHz -30 dBm 890 MHz -25 dBm
LO RMS Jitter	< 135 fs
LO frequency precision (GPS disciplined)	2.5 Hz

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RX input 0.4-108 MHz	
Fixed frequency range	0.4-108 MHz
RF input power	< 15 dBm nominal 20 dBm max
Input LNA gain	15 dB or bypass
Input attenuator	0-32 dB, 0.25 dB steps
SFDR (60 MHz Rx BW)	15 MHz 91 dBFS 86 MHz 91 dBFS 100 MHz 91 dBFS
Input intercept point (attenuators 0 dB)	15 MHz 28.5 dBm (LNA deactivated) 15 MHz 7.8 dBm (LNA activated) 86 MHz 28.5 dBm (LNA deactivated) 86 MHz 15.5 dBm (LNA active) 100 MHz 28.3 dBm (LNA deactivated) 100 MHz 13.2 dBm (LNA active)
Noise figure (LNA enabled, attenuators 0 dB)	15 MHz 6.4 dB 86 MHz 5.3 dB 100 MHz 6.1 dB
Full scale input (0 dBFS, attenuators 0 dB)	15 MHz -9.8 dBm (LNA deactivated) 15 MHz -25 dBm (LNA active) 86 MHz -9.5 dBm (LNA deactivated) 86 MHz -24 dBm (LNA active) 100 MHz -11 dBm (LNA deactivated) 100 MHz -26 dBm (LNA active)

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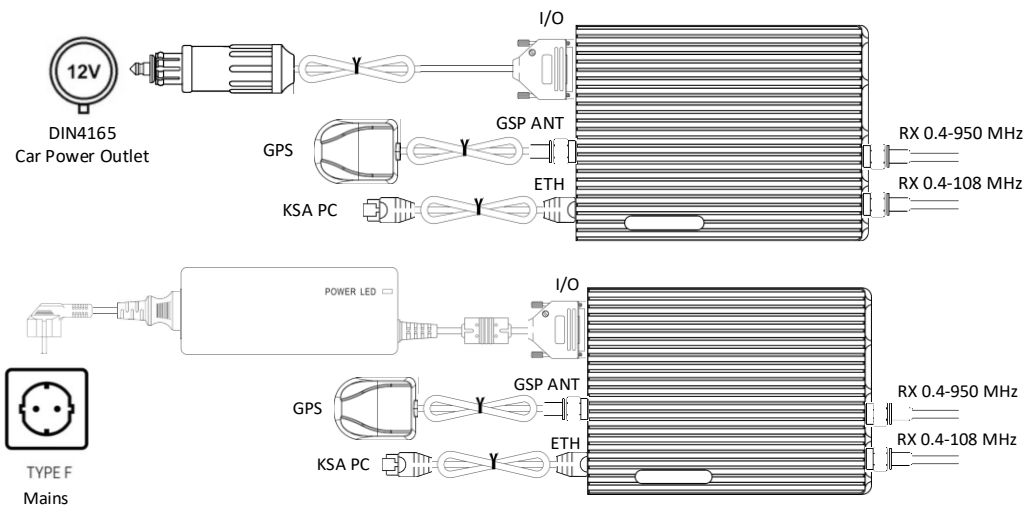
BR-VBI module version (BR-VBI)

The kit version (BR-VBI) is a stand-alone product. It complies with the safety and EMC guidelines. If other components are used, the end-user must take care for appropriate protective measures to comply all required safety and EMC guidelines.

The receiver module itself is to be regarded as a pure system component and it's not intended to be operated "stand-alone".

The kit includes the following components to be used:

Art. No.	Description
810024	Broadcast receiver module (BR-VBI)
710007	Power cable; 12 VDC; car auxiliary power outlet connector to D-SUB-40; 2.5 m
710006	Power cable; 230 AC; type F (CEE 7/4) to 3 pole AC inlet (IEC320-C14); 0.5 m
810023	AC-DC Industrial desktop adaptor; Mean Well GST40A12-P1J; 110/230 VAC; 12 VDC at 3.34 A; 3 pole AC inlet IEC320-C14
810022	GPS antenna; Taoglas AA.108.30111
610001	VBI mounting brackets
620003	Countersunk screw cross recess form H M4 6mm



Kit version comes with a mains power supply for stationary scenarios and a 12V car auxiliary power adaptor for mobile scenarios

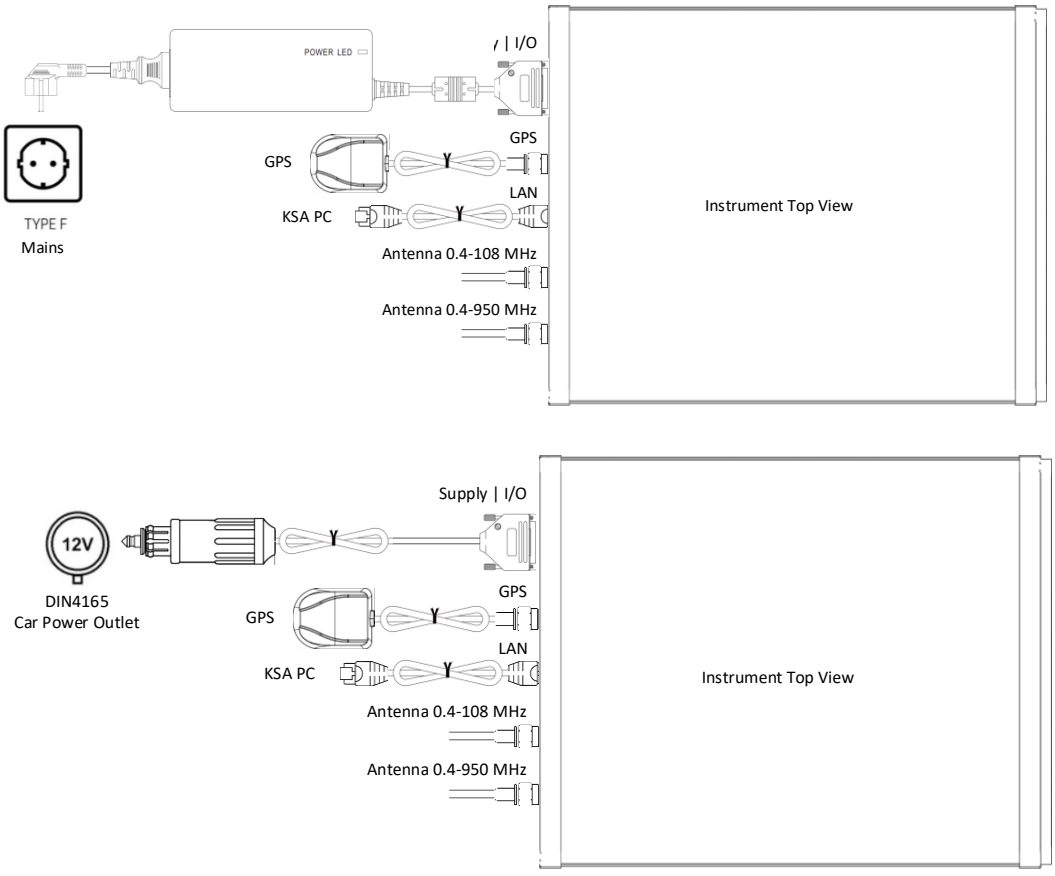
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BR-VBI halfrack version (BR-VBI-HALFRACK)

The halfrack option is a stand-alone product. It complies with the safety and EMC guidelines. If other components are used, the end-user must take care for appropriate protective measures to comply all required safety and EMC guidelines.

This option includes the following components to be used:

Art. No.	Description
810024	Broadcast receiver instrument (BR-VBI-HALFRACK)
710007	Power cable; 12 VDC; car auxiliary power outlet connector to D-SUB-40; 2.5 m
710006	Power cable; 230 AC; type F (CEE 7/4) to 3 pole AC inlet (IEC320-C14); 0.5 m
810023	AC-DC Industrial desktop adaptor; Mean Well GST40A12-P1J; 110/230 VAC; 12 VDC at 3.34 A; 3 pole AC inlet IEC320-C14
810022	GPS antenna; Taoglas AA.108.30111



Halfrack option comes with a mains power supply for stationary scenarios and a 12V car auxiliary power adaptor for mobile scenarios

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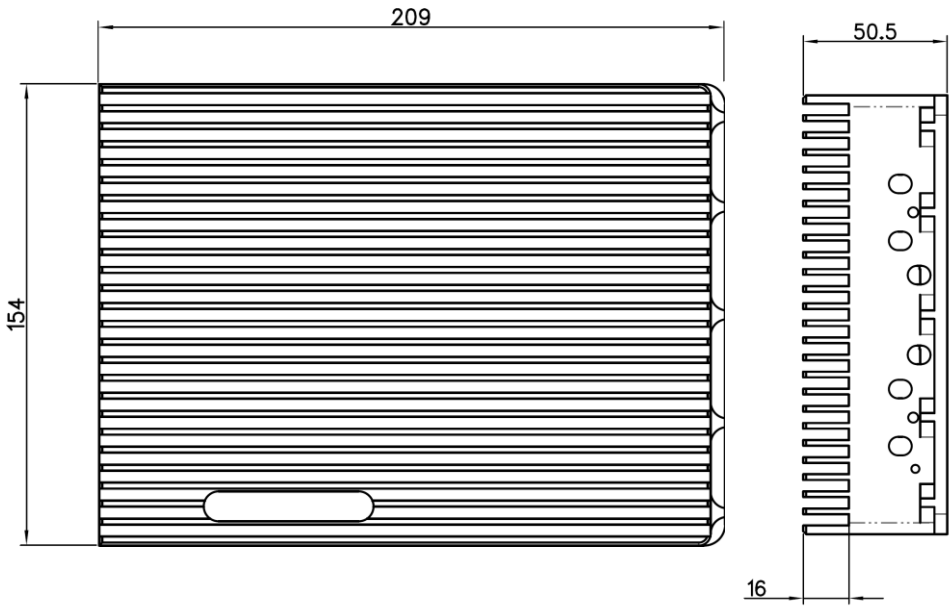
Mechanical Dimensions BR-VBI module (BR-VBI)

Do you want to install the instrument in an existing measuring system with limited space?

No problem, the BR-VBI is available as a compact, ruggedized module, directly milled from a bare aluminum block.

We do not make any compromises in terms of stability or shielding against electromagnetic interference.

The directly milled heat sink is sufficient to cool the module passively for normal ambient temperatures up to 50 °C.



In the modular version, the device can be installed directly in an existing system, thus saving costly space, especially in mobile setups.



A housing in its most beautiful form, milled directly from the solid. Passivated for long use, so that the conductivity of the housing is guaranteed even after years.

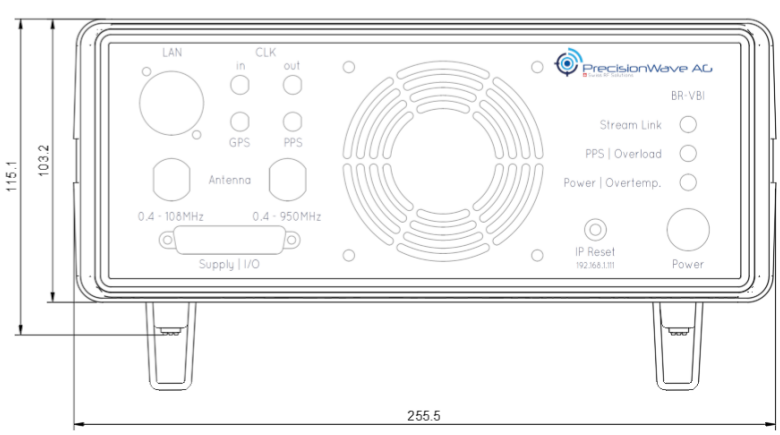
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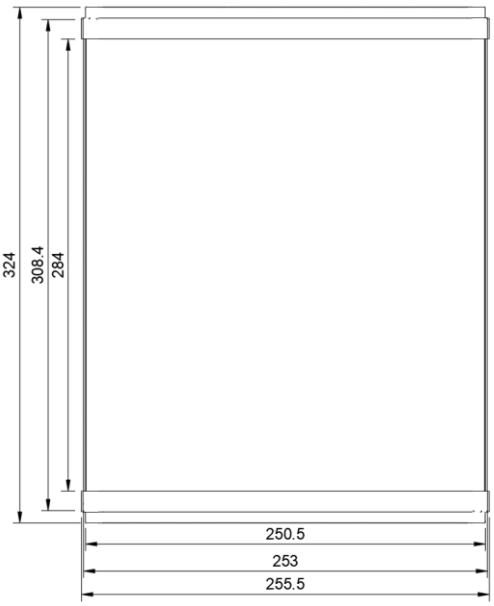
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Mechanical Dimensions: BR-VBI-HALFRACK option

Do you prefer to use the BR-VBI as a tabletop unit or do you often carry it to other locations with increased temperature requirements?

We have developed the Halfrack option especially for vehicular use-cases. Solid N-connectors offer a reasonable connection to vehicle antennas. The fan cools the device quietly and efficiently, even with increased temperature requirements.





A handy system, which hosts all interfaces on the front due to limited space for cabling in vehicles.



Two N connectors provide stable interconnection to the vehicular antenna system.

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