

# IZT R3301

## Portable Monitoring Receiver and RF Recorder

- Portable design with touch display
- Excellent RF performance
- 9 kHz to 18 GHz frequency range
- 25 MHz real-time bandwidth
- Many hours of continuous RF recording
- Swappable data storage
- Wide range power supply with built-in UPS
- Built-in GPS reference time source



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## Portable Monitoring Receiver and RF Recorder

The IZT R3301 RF sensor is a portable receiver with built-in sensor controller for running software applications and storing signal data. It is optimized for recording RF signals in mobile and portable applications. The outstanding RF performance and signal processing matches the professional IZT R3000 receiver series.

The IZT R3301 has an integrated sensor controller, data storage, a wide range DC supply with UPS and a built-in GPS module.

The frequency range is scalable from 9 kHz to 18 GHz and its real-time bandwidth is supporting continuous I/Q recording of up to 25 MHz.

The system is designed to produce good signal quality under challenging dynamic range conditions and has successfully passed many rigorous technical evaluations.

## Overview

The IZT R3301 is suitable both for mobile operation and in the lab. The device operates with both 11 VDC to 30 VDC and AC power supply. The power consumption in standard I/Q recording operation at full bandwidth is approximately 125 watts. An integrated uninterruptible power supply supports continuous operation for up to one hour. With its weight and compact size the IZT R3301 is the preferred means for recording RF signals in mobile applications.

Four terabytes of storage space can record up to 25 MHz bandwidth over eight hours with 16 bit resolution on four 2.5" HDDs or SSDs. Multiple narrow band channels can be recorded as well. The equipment is shielded for minimum RF emissions and optimized for operation onboard a vehicle.

The IZT R3301 RF sensor integrates one 1 Gbit Ethernet interface, one 10 Gbit optical Ethernet interface and a SSD system drive with additional four 2.5" storage media slots for signal recordings. It can be fully synchronized and provides an integrated GPS receiver.

Multiple units can be interconnected for synchronous multi-channel recording or reception with the Synchronization Kit R3301-SNC. In this case multi-channel signals could be either coming from different antennas at the same phase coherent center frequency and bandwidth or coming from different frequency bands.

## Key Features

### SENSOR HARDWARE

With its very high dynamic range and excellent phase noise this RF sensor platform is the ideal solution for the needs of modern digital modulation standards.

The IZT R3301 is characterized as follows:

- Portable design
- Continuous I/Q data recording
- Swappable RAID system (Figure 5)
- Built-in GPS for embedded location information
- 10 V DC to 30 V DC power supply
- 100 V AC to 240 V AC supply with built-in UPS
- Touch screen control
- Synchronization interface (Figure 6)
- Low RF emissions
- Built-in high-end IZT R3000 Receiver technology)

Monitoring and configuration of the unit can be carried out remotely with Windows Remote Desktop (RDP) via 1 Gbit Ethernet interface from an externally connected PC or Notebook.



FIGURE 1: IZT R3301 RF SENSOR

# Your Benefits

## HIGH QUALITY RECEIVER TECHNOLOGY

The outstanding RF performance of the integrated IZT R3000 receiver technology is based on a very modern and market proven receive system with excellent reception at very good signal quality.

The integrated IZT R3000 receiver is characterized as follows:

- 9 kHz to 3 GHz frequency range
- Frequency range upgradeable up to 18 GHz
- Real-time bandwidth up to 25 MHz
- Very low phase noise
- High linear RF frontend for excellent IP3 performance
- Pre-selector filter bank guarantees best IP2 performance
- Additional digital filtering
- IF Filter bandwidth: 6.25 kHz to 25 MHz
- 1 Hz tuning resolution
- Multi-channel recording of up to 4 different sub-bands



FIGURE 2: EASY RAID STORAGE SWAPPING

## MOBILE

The portable design of the R3301 enables usage in different environments and an easy transportation to various applications in open fields. If there are use cases which require high mobility and easy carrying, the compact IZT R3301 will be the perfect choice.

## 25 MHZ REAL-TIME BANDWIDTH

The innovative IZT Signal Suite software for the IZT R3000 receiver family allows continuous I/Q recording of up to 25 MHz real-time bandwidth, including smooth spectrum/spectrogram display and storage of the PSD spectrum and the CBB I/Q data stream to files. The 25 MHz real-time bandwidth is fully supported by IZT signal analysis modules and post-processing applications such as IZT Viewer and IZT Data Processor.

## BUILT-IN UPS AND GPS

The wide range DC power supply provides easy connection to electrical systems in the field or in mobile applications. With its built-in uninterruptable power supply (UPS) it is robust against undervoltage and surge problems caused by the power source, for example from the electrical system of a vehicle.

Depending on options a built-in GPS receiver can be used for location tracking and as a reference time source.



FIGURE 3: EXTERNAL INTERFACES FOR POWER SUPPLY, LAN, GPS ANTENNA AND SYNCHRONIZATION

# Applications

## COMPATIBLE WITH IZT SIGNAL SUITE APPLICATIONS

The IZT R3301 perfectly works together with IZT Signal Suite software solutions. Various plug-in modules such as Panorama Scan, Persistence Display, Mask Triggered Recording, Long-term Spectrogram Recording, Time Scheduled Recording, signal analysis and decoding or Modulation Recognition of various modulation schemes can be added to the I/Q wideband recorder application 'RF Recorder R3000'.

## UNATTENDED MONITORING AND RECORDING

Typical applications for the IZT R3301 are continuous RF recording to storage with FIFO buffer, spectrum monitoring for broadcast stations and mobile communication measurements (e.g. DAB or Cellular standards).

## GNSS MONITORING AND INTERFERER CAPTURE

The system is a perfect platform for long-term GNSS (Global Navigation Satellite System) spectrum band monitoring and automated selective high-dynamic range I/Q data capture: trigger events caused by interferers defined by spectrum mask criteria are automatically starting the wideband I/Q recording process of both the interferer itself and the GNSS services.

## MODULATION RECOGNITION

IZT Modulation recognition (ModRec) is an innovative software feature of IZT Signal Suite for signal analysis. Segmentation, which means dividing the broadband spectrum up into individual signals, can be done either manually by the user or automatically by the software.

In radio monitoring and intelligence there is a demand for sophisticated signal analysis techniques in order to detect, classify or demodulate radio signals. For the purpose of achieving this goal, IZT ModRec provides powerful signal analysis techniques for detecting and classifying known and unknown signals.

## TRIGGER-CONTROLLED SIGNAL CAPTURE

Triggered recording allows capturing signals with adjustable pre-recording and adjustable follow-up time. The trigger event can be defined by power limits exceeding spectrum masks, captured reference traces with adjustable offset, manually by pressing the recording button or by an external trigger pulse.

## GPS AND VIDEO CAMERA INTERFACE

A GPS Interface gives access to NMEA location information which is part of the embedded metadata inside the recorded I/Q data streams. This allows visualization of the sensor setup in a map while post-processing the recording with 'Viewer' or 'Data Processor' application.

A Video Camera Interface supports synchronous recording and replay of IP based video camera data. This allows capturing additional terrain information like traffic situation, building density, and weather conditions in addition to the GPS location information.

## MULTI-SENSOR SETUPS

Multiple IZT R3301 sensors can be synchronized for handling phase coherent and frame synchronous recordings from multiple antenna channels at the same center frequency or synchronous recording from multiple antenna inputs at different center frequencies. A synchronized setup can also be arranged with a combination of different RF sensors based on the IZT R3000 receiver family or the IZT R4010.



**FIGURE 4:** IZT R3302 SENSORS AND IZT R4010 ARE COMPATIBLE WITH R3301 SENSORS

# Specifications IZT R3301 RF Recorder

Technical Specifications		
<b>Frequency range</b>	HF	9 kHz – 30 MHz <sup>1)</sup>
	VUHF	20 MHz – 3 GHz <sup>2)</sup>
<b>Conversion concept</b>	9 kHz – 30 MHz <sup>1)</sup> (HF)	Direct sampling
	20 MHz – 3 GHz <sup>2)</sup> (VUHF)	Double superheterodyne conversion
<b>RF input</b>	Impedance	50 Ohm
<b>Maximum input power</b>	HF	+20 dBm, +30 dBm with input attenuator active
	VUHF	+15 dBm
<b>Tuning resolution</b>	HF, VUHF	1Hz
<b>VSWR</b>	HF, VUHF	< 2.1
<b>Tuning accuracy</b>	HF, VUHF	< 0.2 Hz
<b>Reference frequency</b>	HF, VUHF	10 MHz internal/external
<b>Internal reference frequency</b>	HF, VUHF	< 1 · 10 <sup>-7</sup>
<b>Input sensitivity</b>	HF: 100 kHz – 30 MHz	-120 dBm @ 3 kHz BW
	@ S/N = 10 dB	-111 dBm @ 25 kHz BW
	VUHF: 20 MHz – 3 GHz	-114 dBm @ 3 kHz BW
	@ S/N = 10 dB	-105 dBm @ 25 kHz BW
<b>Oscillator phase noise</b>	HF	-130 dBc/Hz typical @ 1 kHz offset
		-140 dBc/Hz typical @ 10 kHz offset
	VUHF	-120 dBc/Hz typical @ 10 kHz offset
<b>Sweep time</b>	HF, VUHF	< 3 ms typical
<b>Scanning speed</b>	HF, VUHF	> 4 GHz/s, linear
		> 175 GHz/s, within 25 MHz bandwidth
<b>Input IP3</b>	HF	+40 dBm, typical
	VUHF	+24 dBm, typical (low distortion mode)
		+13 dBm, typical (normal mode)
<b>Noise figure</b>	HF	9 dB typical
	VUHF	10 dB, typical (low noise mode)
		15 dB, typical (normal mode)
<b>IF rejection</b>	HF	not applicable
	VUHF	> 120 dB typical
<b>Image rejection</b>	HF	not applicable
	VUHF	> 110 dB typical
<b>Oscillator reradiation at antenna input</b>	HF	not applicable
	VUHF	< -110 dBm
<b>Preselector</b>	HF	12-band
	VUHF	11-band
<b>IF bandwidth</b>	HF, VUHF	6.25 kHz – 24 MHz

<sup>1)</sup> DEGRADED PERFORMANCE: 9 KHZ – 500 KHZ

<sup>2)</sup> DEGRADED PERFORMANCE: 20 MHZ – 30 MHZ

Signal processing		
<b>Data representation</b>	Data format: 16/32 bit I/Q with embedded IZT CBB metadata information	
<b>Output sample rate</b>	variable up to 30 MS/s	
<b>Data storage</b>	4 x 2.5" SATA HDD or SSD, removable tray; 4 TB RAID system by default	
<b>Recording modes</b>	Stand-alone / diversity and multi-frequency (with second unit and Synchronisation Kit)	
<b>Gain control</b>	AGC fast/slow with adjustable ADC backoff and deadband, MGC	
Interfaces		
<b>Antenna input</b>	HF, VUHF	N, female, 50 $\Omega$
<b>Data storage system</b>	SATA tray	4 x 2.5" HDD or SSD, 9.5 mm height, removable
<b>Ethernet</b>	1 Gbit Ethernet	RJ45, CAT 6
	10 Gbit Ethernet, optical	LC-Duplex , 10 Gbit fiber optical
<b>USB</b>	2 x USB 3.0	
<b>GPS antenna</b>	Input	SMA, female, 50 Ohm
	Active biasing	< 60 mA @ 3 V DC
<b>Synchronization</b>	Input	3 x SMA, female, 50 $\Omega$ (DCLK, 2 VUHF LO)
	Output	3 x SMA, female, 50 $\Omega$ (DCLK, 2 VUHF LO)
<b>Trigger pulse</b>	Input	SMA, female, CMOS 3.3 V (5 V tolerant input)
	Output	SMA, female, CMOS 3.3 V
<b>Reference input</b>	10 MHz	SMA, female, 50 $\Omega$
<b>Remote control</b>	Proprietary Connector	D-SUB 9, female
General data		
<b>Operating temperature</b>	5°C to +40°C	
<b>Storage temperature</b>	-20°C to +60°C	
<b>Humidity</b>	Max. 85%, non-condensing	
<b>EMI / EMC</b>	CISPR 22 / CISPR 25 (EN 55022 / EN 55025)	
<b>MTBF</b>	> 70.000 hrs	
<b>Power supply</b>	AC: 100 V – 240 V, 47 Hz – 63 Hz, 240 VA, DC: 10 V – 30 V, approx. 125 W	
	UPS: Li-Ion, 99,9 Wh; approx. 25 min. recording, 40 min. measurement	
<b>Dimensions (WxHxD)</b>	450 mm x 347 mm x 234 mm	
<b>Weight</b>	Approx. 17 kg	
<b>Operating system</b>	Windows 10 (64 bit)	
<b>Integrated hard disk</b>	System disk SSD 250 GB	
<b>Internal memory</b>	16 GB	

Frequency Range Extension	IZT R3301-RF6	IZT R3301-RF18
<b>Frequency range</b>	3 GHz – 6 GHz	3 GHz – 18 GHz
<b>RF input</b>	50 Ohm <sup>3)</sup>	50 Ohm
<b>Maximum input power</b>	+15 dBm	+10 dBm
<b>VSWR</b>	< 2.1	< 2.1
<b>Oscillator phase noise</b>	-120 dBc/Hz typical @ 10 kHz offset	-114 dBc/Hz typical @ 10 kHz offset
<b>Sweep time</b>	< 3 ms typical	10 ms
<b>Scanning speed</b>	> 4 GHz/s, linear	> 1.5 GHz/s, linear
	> 175 GHz/s, within 25 MHz bandwidth	> 175 GHz/s, within 25 MHz bandwidth
<b>Input IP3</b>	+18 dBm (normal mode)	+25 dBm (low distortion mode)
	+2 dBm (low noise mode)	+15 dBm typical (low noise mode)
<b>Noise figure</b>	7 dB, typical (low noise mode, LNA on, maximum gain)	15 dB typical (low noise mode)
	17 dB, typical (normal mode, LNA off, maximum gain)	23 dB, typical (normal mode, LNA off, maximum gain)
<b>IF rejection</b>	> 120 dB typical	> 120 dB typical
<b>Image rejection</b>	> 110 dB typical	> 110 dB typical
<b>Oscillator reradiation</b>	< -110 dBm	< -110 dBm
<b>Preselector filter</b>	8-band	Tracking bandpass filter

<sup>3)</sup> THE RECEIVER'S VUHF ANTENNA INPUT IS USED, ELECTRONIC RF INPUT SWITCH. SPECIFICATION SUBJECT TO CHANGE WITHOUT FURTHER NOTICE.



# Ordering Guide

Hardware options		
<b>IZT R3301</b>	<b>IZT R3301-CHS</b>	Receiver Chassis with built-in Sensor Controller
	<b>IZT R3301-SNC</b>	Synchronization Kit for synchronizing two IZT R3301 recording units
	<b>IZT R3301-TCS</b>	Transport Case for shipping with trolley function
	<b>IZT R3300-SDD</b>	Solid State Data Disk 1 TB SSD, up to 4x for IZT R3301/R3302
	<b>IZT R3300-GSR</b>	GPS Synchronous Reference Clock
	<b>IZT R3000-HF</b>	HF Frontend frequency range 9 kHz – 30 MHz
	<b>IZT R3000-RF3</b>	VUHF Frontend frequency range 20 MHz – 3 GHz
	<b>IZT R3000-RF6</b>	Frequency Range Extension 3 GHz – 6 GHz for VUHF Frontend
	<b>IZT R3000-RF18</b>	Frequency Range Extension 3 GHz – 18 GHz for VUHF Frontend
	<b>IZT R3000-OCX</b>	Oven Stabilized Reference Oscillator
	<b>IZT R3000-BST</b>	Bias-T <sup>1)</sup>
	<b>IZT R3000-AAI-RF5</b>	3x3 Antenna Switch (one of up to three RF inputs is switched electronically to one of the built-in RF front-ends by software)
<b>IZT A1000</b> External accessories	<b>IZT A1000-CAM</b>	IP Camera Kit (requires IZT SignalSuite-274)

<sup>1)</sup> CAN NOT BE COMBINED WITH OPTION R3000 AAI-RF5

IZT RF Recorder Software options		
<b>Applications</b>	<b>IZT SignalSuite-800</b>	GUI Base R3000
	<b>IZT SignalSuite-810</b>	RF Recorder R3000 – 25 MHz
	<b>IZT SignalSuite-820</b>	Viewer
	<b>IZT SignalSuite-830</b>	Data Processor
<b>Enhanced software options</b>	<b>IZT SignalSuite-130</b>	Panorama Scan
	<b>IZT SignalSuite-190</b>	COM-SDK
	<b>IZT SignalSuite-220</b>	Time Scheduled Recording
	<b>IZT SignalSuite-230</b>	Long-term Spectrogram Recording
	<b>IZT SignalSuite-240</b>	Mask Triggered Recording
	<b>IZT SignalSuite-242</b>	Pre-recording
	<b>IZT SignalSuite 250</b>	Persistence Display
	<b>IZT SignalSuite-260</b>	Signal Import/Export
	<b>IZT SignalSuite-262</b>	Signal Extraction
	<b>IZT SignalSuite-270</b>	GPS Interface
	<b>IZT SignalSuite-274</b>	Video Camera Interface
	<b>IZT SignalSuite-310</b>	Time Shift Signal Access
	<b>IZT SignalSuite-510</b>	Sensor Synchronization
	<b>IZT SignalSuite-520</b>	Communication Interface
<b>Analysis &amp; demodulator plug-ins</b>	<b>IZT SignalSuite-600</b>	RDS Demodulator
	<b>IZT SignalSuite-610</b>	DAB/DAB+ Demodulator
	<b>IZT SignalSuite-630</b>	CellularBase Analysis – bundle (GSM/UMTS/LTE)
	<b>IZT SignalSuite-650</b>	Signal Segmentation
	<b>IZT SignalSuite-660</b>	Modulation Analyzer
<b>License Management</b>	<b>IZT A1000-CMB</b>	Metal Case USB Dongle for using IZT Signal Suite options on Win7 or Win10 based systems
	<b>IZT A1000-CMC</b>	Compact Robust USB Dongle for using IZT Signal Suite options on Win7 or Win10 based systems

IZT Service	
<b>IZT WE2</b>	Warranty Extension to 2 years
<b>IZT WE3</b>	Warranty Extension to 3 years
<b>IZT Software Support Contract</b>	Support for IZT software options
<b>IZT Training</b>	IZT Training Course
<b>IZT R3000-CLC</b>	Factory Calibration
<b>IZT R3000-CAL</b>	Accredited ISO Calibration

# IZT R3301

## Portable Monitoring Receiver and RF Recorder

**About IZT** The Innovationszentrum fuer Telekommunikationstechnik GmbH IZT specializes in the most advanced digital signal processing and field programmable gate array (FPGA) designs in combination with high frequency and microwave technology.

The product portfolio includes equipment for signal generation, receivers for signal monitoring and recording, transmitters for digital broadcast, digital radio systems, and channel simulators. IZT offers powerful platforms and customized solutions for high signal bandwidth and real-time signal processing applications. The product and project business is managed from the principal office located in Erlangen/Germany. IZT distributes its products worldwide together with its international strategic partners. The IZT quality management system is ISO 9001:2015 certified.

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