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IZT
Innovationszentrum
Telekommunikationstechnik

IZT R3000 Family
Wideband Monitoring Receiver

- IZT R3000, IZT R3200, IZT R3301, IZT R3410
- HF-VHF-UHF receiver
- Excellent RF performance
- Powerful signal processing
- Multichannel operation
- High linearity
- Gigabit LAN interface
- Up to 24 MHz real-time bandwidth

IZT R3000 Family
Wideband Monitoring Receiver

Digital Receiver Family for HF – VHF – UHF

The IZT R3000 receiver family is a versatile high performance wideband receiver system and combines state-of-the-art high frequency technologies with the latest developments in digital signal processing thus providing one of the most comprehensive receiver platforms available today.

Four model variants offer maximum flexibility for every application:
The IZT R3000 and IZT R3200 are 19 inch models with 1 U respectively 2 U height. Both models are to be used in conjunction with a controlling PC.
The IZT R3301 is a stand-alone system with front control panel.
The IZT R3410 combines a reduced weight of under 7 kg with a fanless design.

- Frequency range: 9 kHz to 3 GHz, 6 GHz or 18 GHz
- Real-time bandwidth up to 24 MHz
- Multi-channel operation: up to four independent channels within 24 MHz bandwidth
- IF filter bandwidth: 6.25 kHz to 24 MHz
- 1 Hz tuning resolution
- Digital IF output to Gbit LAN
- LAN data rate up to 115 MB/s
- Output data format: I/Q complex baseband, complex FFT and PSD
- Optional analog IF output
- Fully remote controllable
- External synchronization enables direction finding (DF) systems
- TDOA location finding platform
- ITU compliant measurements
- Fast scanning modes
- Analog demodulation
- Available in different form factors
- Front control panel model available (IZT R3301)

IZT R3000 Family Overview

HIGH PERFORMANCE MONITORING

The IZT R3000 family is particularly suitable for signal search and analysis, spectrum monitoring in line with ITU recommendations and communication intelligence.
It allows to analyze and demodulate modern digital wideband signals as well as to track or intercept frequency agile systems over a wide range of bandwidths.
The exceptional performance with outstanding receive characteristics and a 24 MHz real-time bandwidth allow for handling of wideband signals while exceeding the performance of traditional narrowband receivers.

The IZT R3000 family is the ideal solution for a multitude of both civilian and military applications:

- Radio monitoring of broadcast stations
- ITU-R spectrum monitoring measurements
- Real-time signal analysis
- Spectrum allocation analysis
- Automatic signal detection
- Search, intercept and emitter location
- Direction finding (DF) systems
- TDOA location finding systems
- Strategic and tactical reconnaissance systems
- Data acquisition, classification and preprocessing
- Threat recognition
- Signal recording
- Offline processing and technical analysis
- Emission compliancy testing

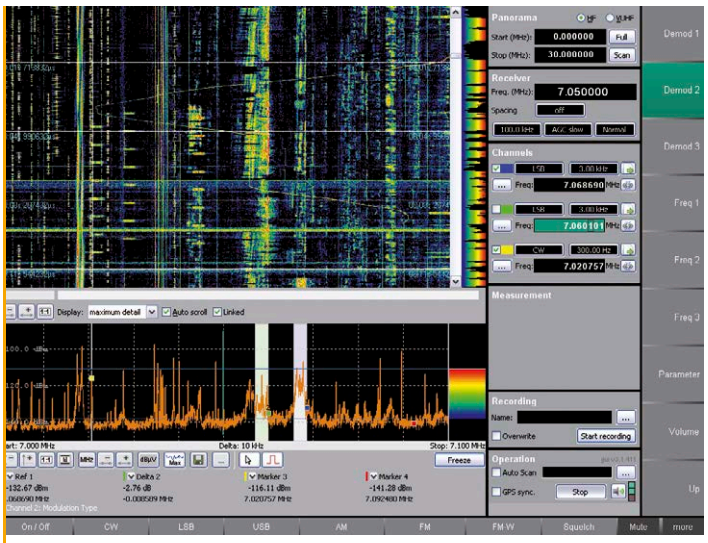


FIGURE 1: COMBINED SPECTRUM AND WATERFALL DISPLAY

VERSATILE AND EFFICIENT

The R3000 family covers the frequency range from 9 kHz to 18 GHz.

Overview of available models:

Frequency range	IZT R3000 series	IZT R3200 series	IZT R3410 series
9 kHz – 30 MHz	IZT R3020	IZT R3220	IZT R3411, Option HF
20 MHz – 3 GHz	IZT R3030	IZT R3230	IZT R3411, Option RF3
9 kHz – 3 GHz	IZT R3040	IZT R3240	IZT R3410

The receiver family stands out for its world-class radio frequency performance and digital signal processing. The integrated high speed processing core with its 4096-point FFT processor offers a real-time bandwidth of up to 24 MHz for both time and frequency domain. Powerful multi-channel signal extraction can be provided by the receiver which enables for example multi-channel demodulation or other advanced features.
Scan speeds of up to 4 GHz/s at a frequency resolution of less than 7.5 kHz can be achieved independent of any channel allocation. The result is a panorama frequency scan capable of detecting LPI signals (Low Probability of Intercept) as well as weak signals in the presence of strong neighboring signals.

The windows based user software is well known for its simplicity, its reliability and its ease of use. Various display types like frequency, waterfall and panorama are available.
When selecting a frequency of interest in the panorama scan, the receiver will immediately tune to this frequency and will display the spectrum in the main display area.
Multiple channels can be demodulated simultaneously in addition to the wideband spectrum display. Simply assign a marker to the desired frequency in the spectrum and select the demodulation mode. Use the peak search functionality to assign the demodulators automatically to emissions. Horizontal lines can be used to limit the search functionality to a specific power range. The continuous peak search function uses algorithms to automatically allocate active channels to the demodulators. This is especially useful when monitoring duplex or multi-user communication on different frequencies.

Spectrum data can be recorded continuously limited only by the size and speed of the controlling PC's hard disk. When playing back these recorded files measurement and monitoring functionality such as marker and bandwidth measurements, zoom and waterfall displays are available in the same detail as if live signals were received.

All of the receiver's functions can be remote controlled via the LAN interface. All receiver data streams (spectrum, I/Q, demodulated audio) are available via LAN as well.
The receiver can be integrated into existing user environments or system solutions by either remote controlling the windows software or by low-level integration based on the LAN interface of the receiver. Further documentation is available on request.

Benefits and Key Features

FFT SPECTRUM ANALYZER

The IZT R3000 family offers advanced spectrum analyzer functionality based on internal FFT processing algorithms. Variable bandwidths from 6.25 kHz up to 24 MHz with frequency resolutions from less than 2 Hz up to 30 kHz can be selected.

Emissions can be measured using individual markers or bandwidth and power measurement guides.

The marker functionality covers not only standard tasks such as normal marker, delta marker and peak search marker but also phase noise and intermodulation measurements.

The zoom functions enable a detailed view of signals without changing acquisition time or bandwidth. When using the combined spectrum and waterfall display, both screens can be linked. Zooming in the waterfall screen will then simultaneously display the respective area of the frequency screen.

Real-time bandwidth	Frequency resolution (approx.)	Time resolution (approx.)
24 MHz	7.25 kHz	150 µs
16 MHz	4.8 kHz	200 µs
8 MHz	2.4 kHz	400 µs
4 MHz	1.2 kHz	800 µs
3.2 MHz	1.0 kHz	1 ms
1.6 MHz	500 Hz	2 ms
800 kHz	250 Hz	4 ms
400 kHz	125 Hz	8 ms
200 kHz	60 Hz	16 ms
100 kHz	30 Hz	32 ms
50 kHz	15 Hz	65 ms
25 kHz	7.5 Hz	130 ms
12.5 kHz	4 Hz	260 ms
6.25 kHz	2 Hz	520 ms

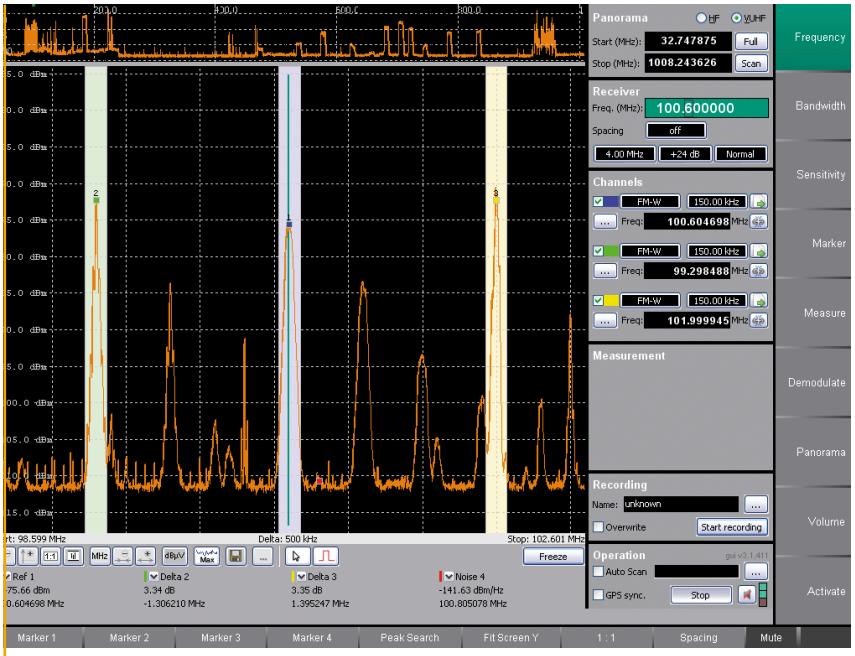


FIGURE 2: PANORAMA SCAN AND 4 MHZ SPECTRUM DISPLAY WITH THREE ACTIVE DEMODULATION CHANNELS

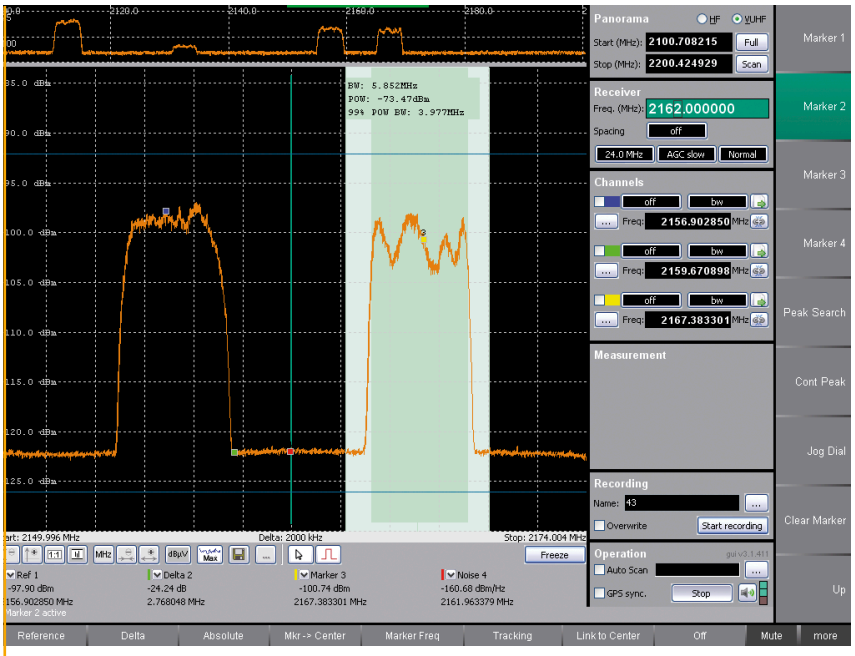


FIGURE 3: PANORAMA SCAN AND BANDWIDTH MEASUREMENT OF OFDM SIGNAL

ONLINE – OFFLINE PROCESSING

All received data can be recorded for detailed analysis or for further post-processing. This includes not only the digital baseband data but also the spectrum information. Complete scenarios can be recorded continuously limited only by the size and speed of the internal hard disk. When playing back these recorded files, all measurement and monitoring functionality is available in the same detail as if receiving live antenna signals. It is possible to analyze the stored data on a frame by frame basis, using playback at different speeds or looping specific areas of interest.

Signal behavior in time and frequency can be measured in order to identify interferences or hopping signals by using the spectrogram functionality.

ITU COMPLIANT MONITORING

The IZT R3000 family can be used for civil monitoring in line with ITU recommendations. As a FFT based measuring system the IZT R3000 family is superior to other systems using standard swept spectrum analyzer techniques.

Advantages can be seen in acquisition times or in using advanced methods to measure ITU monitoring data. For bandwidth measurements the IZT R3000 family uses for example the FFT results which allow to measure the occupied bandwidth of an emission in the sense of the formal definition (RR No. 1.153).

The following measurements can be performed:

- Spectrum occupancy in line with ITU-R SM 182/SM 328
- Modulation in line with ITU-R SM328
- Frequency and frequency offset in line with ITU-R SM377
- Field strength in line with ITU-R SM378
- Bandwidth in line with ITU-R SM443

Most measurements can be performed on up to three active emissions at the same time by simply assigning a demodulator to each emission.

SPECTRUM OCCUPANCY MEASUREMENTS

The IZT R3000 family can be used for spectrum occupancy measurements compliant to ITU recommendations. The spectrum occupancy measurements are based on the FFT data generated by the receiver. The task is to explore, as a function of time, frequency bands of various widths in the spectrum between 9 kHz up to 3 GHz for the purpose of detecting signals above the noise level (noise-riding-threshold) or a pre-set threshold (fixed-threshold).

The user can specify the duration of the spectrum occupancy measurement ranging from minutes to days and the storage interval within which measurement results are grouped into intermediate statistical results. The final measurement result accumulates all intermediate statistical results.

It is possible to scan frequency bands defining only start- and stop-frequency as well as measurement bandwidth, to scan single channels with predefined, variable bandwidths or to mix both methods within the same measurement.

The result of the final measurement assigns to the observed channel the measured occupancy, the maximum and average power-level and the relative accuracy of the measurement. The measurement results and the corresponding side information are written to a database. Based on the database the user can perform further post-processing, e.g. combine user-defined coherent intermediate statistical results into more complex statistical analysis.

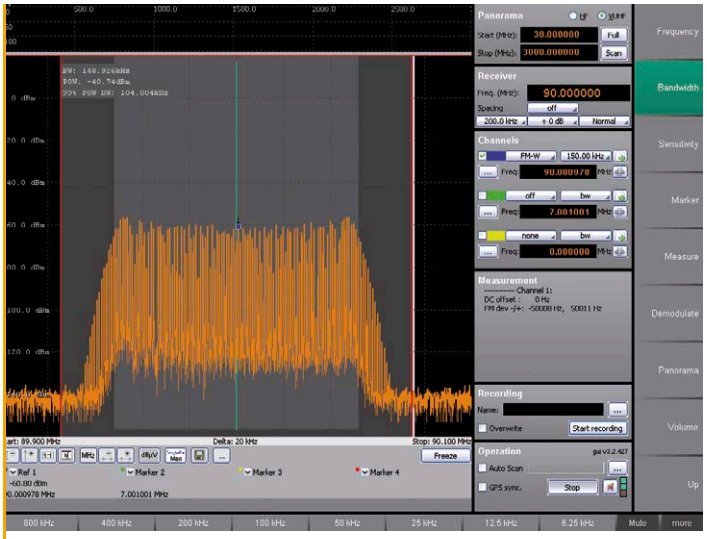


FIGURE 4: FM MODULATION AND OCCUPANCY MEASUREMENT

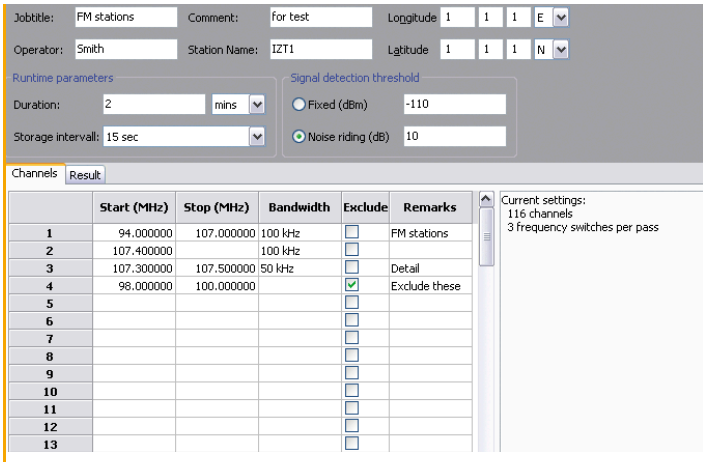


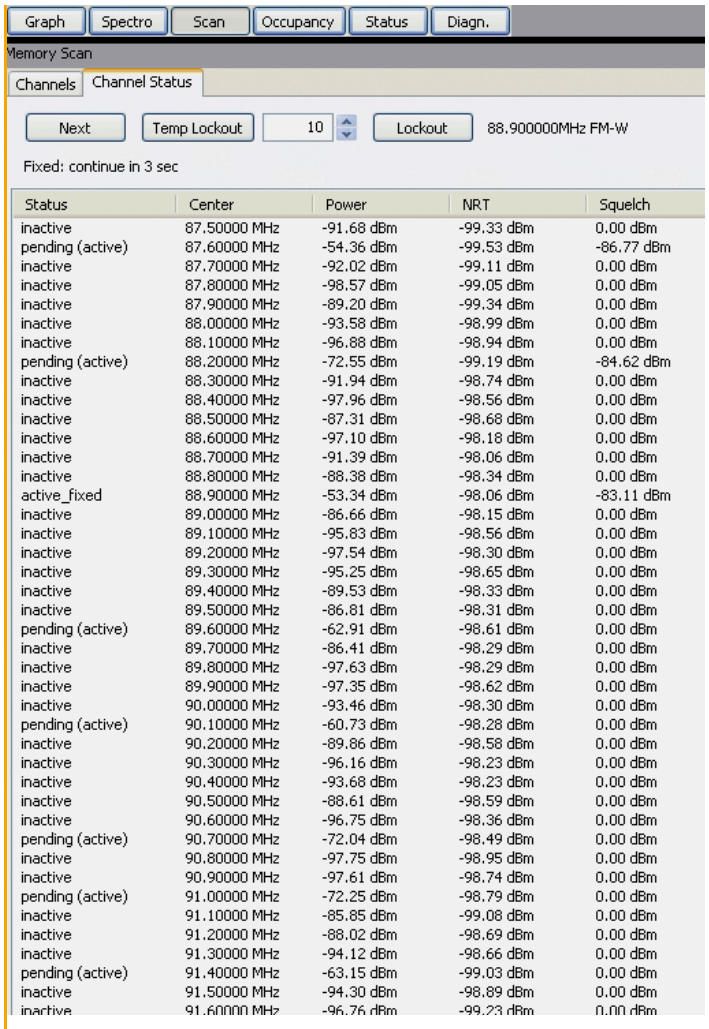
FIGURE 5: CONFIGURATION OF SPECTRUM OCCUPANCY MEASUREMENTS (DETAIL)

CHANNEL SCANNING CAPABILITIES

Comprehensive scans are easily performed by the IZT R3000 family. A frequency scan is defined by start frequency, stop frequency, dwell time, demodulation mode, bandwidth, etc. Arbitrary frequency areas can be excluded from the scan. A memory scan can be performed by predefining over up to 20.000 individual channels. For maximum flexibility, frequency and memory scans can be combined.

Three distinct scan types can be applied whenever a channel is detected as active:

- Manual: the scan stops and the current channel is demodulated until a "continue" command is received
- Fixed: the scan stops and the current channel is demodulated for a fixed time
- Automatic: the scan stops and the current channel is demodulated based on channel activity. The scan continues after the channel becomes inactive



Status	Center	Power	NRT	Squelch
inactive	87.50000 MHz	-91.68 dBm	-99.33 dBm	0.00 dBm
pending (active)	87.60000 MHz	-54.36 dBm	-99.53 dBm	-86.77 dBm
inactive	87.70000 MHz	-92.02 dBm	-99.11 dBm	0.00 dBm
inactive	87.80000 MHz	-98.57 dBm	-99.05 dBm	0.00 dBm
inactive	87.90000 MHz	-89.20 dBm	-99.34 dBm	0.00 dBm
inactive	88.00000 MHz	-93.58 dBm	-98.99 dBm	0.00 dBm
inactive	88.10000 MHz	-96.88 dBm	-98.94 dBm	0.00 dBm
pending (active)	88.20000 MHz	-72.55 dBm	-99.19 dBm	-84.62 dBm
inactive	88.30000 MHz	-91.94 dBm	-98.74 dBm	0.00 dBm
inactive	88.40000 MHz	-97.96 dBm	-98.56 dBm	0.00 dBm
inactive	88.50000 MHz	-87.31 dBm	-98.68 dBm	0.00 dBm
inactive	88.60000 MHz	-97.10 dBm	-98.18 dBm	0.00 dBm
inactive	88.70000 MHz	-91.39 dBm	-98.06 dBm	0.00 dBm
inactive	88.80000 MHz	-88.38 dBm	-98.34 dBm	0.00 dBm
active_fixed	88.90000 MHz	-53.34 dBm	-98.06 dBm	-83.11 dBm
inactive	89.00000 MHz	-86.66 dBm	-98.15 dBm	0.00 dBm
inactive	89.10000 MHz	-95.83 dBm	-98.56 dBm	0.00 dBm
inactive	89.20000 MHz	-97.54 dBm	-98.30 dBm	0.00 dBm
inactive	89.30000 MHz	-95.25 dBm	-98.65 dBm	0.00 dBm
inactive	89.40000 MHz	-89.53 dBm	-98.33 dBm	0.00 dBm
inactive	89.50000 MHz	-86.81 dBm	-98.31 dBm	0.00 dBm
pending (active)	89.60000 MHz	-62.91 dBm	-98.61 dBm	0.00 dBm
inactive	89.70000 MHz	-86.41 dBm	-98.29 dBm	0.00 dBm
inactive	89.80000 MHz	-97.63 dBm	-98.29 dBm	0.00 dBm
inactive	89.90000 MHz	-97.35 dBm	-98.62 dBm	0.00 dBm
inactive	90.00000 MHz	-93.46 dBm	-98.30 dBm	0.00 dBm
pending (active)	90.10000 MHz	-60.73 dBm	-98.28 dBm	0.00 dBm
inactive	90.20000 MHz	-89.86 dBm	-98.58 dBm	0.00 dBm
inactive	90.30000 MHz	-96.16 dBm	-98.23 dBm	0.00 dBm
inactive	90.40000 MHz	-93.68 dBm	-98.23 dBm	0.00 dBm
inactive	90.50000 MHz	-88.61 dBm	-98.59 dBm	0.00 dBm
inactive	90.60000 MHz	-96.75 dBm	-98.36 dBm	0.00 dBm
pending (active)	90.70000 MHz	-72.04 dBm	-98.49 dBm	0.00 dBm
inactive	90.80000 MHz	-97.75 dBm	-98.95 dBm	0.00 dBm
inactive	90.90000 MHz	-97.61 dBm	-98.74 dBm	0.00 dBm
pending (active)	91.00000 MHz	-72.25 dBm	-98.79 dBm	0.00 dBm
inactive	91.10000 MHz	-85.85 dBm	-99.08 dBm	0.00 dBm
inactive	91.20000 MHz	-88.02 dBm	-98.69 dBm	0.00 dBm
inactive	91.30000 MHz	-94.12 dBm	-98.66 dBm	0.00 dBm
pending (active)	91.40000 MHz	-63.15 dBm	-99.03 dBm	0.00 dBm
inactive	91.50000 MHz	-94.30 dBm	-98.89 dBm	0.00 dBm
inactive	91.60000 MHz	-96.76 dBm	-99.23 dBm	0.00 dBm

FIGURE 6: CHANNEL STATUS INFORMATION DURING A SCAN

TIME AND FREQUENCY DOMAIN

With powerful FPGA based processing the IZT R3000 generates multiple data streams simultaneously in time and frequency domain.

Time domain

I/Q complex baseband signals are the basis for various applications. The IZT R3000 family digitizes the wideband analog signals. The following downconversion stage generates an I/Q complex baseband signal. High performance digital filters with stop band attenuation beyond 100 dB narrow the effective signal bandwidth to user selectable bandwidths in the range of several kHz up to 24 MHz.
The I/Q complex baseband signal is delivered in 16-bit signed integer format, which can be changed to 32-bit signed integer for maximum dynamic range when operating in very narrow band modes.

Frequency domain

Many applications require frequency domain signals. In order to reduce the processing effort of subsequent enduser equipment, a high performance 4096-point FFT has been incorporated into the IZT R3000 family. The integrated polyphase windowing offers much better adjacent channel rejection compared to simple window functions.
The resulting complex FFT data is delivered in 24-bit resolution. Power Spectral Density (PSD) data – the magnitude representation of the complex FFT – is known from typical spectrum analyzers.

The IZT R3000 family supports adjustable averaging factors for PSD data up to a factor of 128. The PSD data is delivered in 16-bit integer format covering a logarithmic range of 255 dB with a resolution of less than 0.01 dB.

MULTI-CHANNEL OPERATION

Using the multi-channel feature up to four independent channels – each capable of providing I/Q, FFT and PSD data – can be extracted from the wideband input signal. All channels can be set to independent center frequencies, bandwidths and averaging factors, but must be placed within the maximum real-time bandwidth of up to 24 MHz.

Application example 1: Distribution of processing load

A part of the spectrum with a bandwidth of 24 MHz shall be further processed by external PCs. Due to processing requirements this might not be possible by using only a single PC. The multichannel option can be used to split the spectrum into four single segments, even with overlapping bandwidths, for example 6 MHz for each segment. Now the load can be distributed to four independent PCs as each single data stream can be sent to individual IP-addresses.

Application example 2: Monitoring the spectrum

One channel can be set to continuously monitor wideband spectrum (PSD) at the maximum bandwidth of 24 MHz. The remaining three channels can then be configuired to receive medium- or narrow-band complex baseband I/Q signals for demodulation at the same time.

Hardware and Interfaces

R3000 FAMILY MODEL VARIANTS

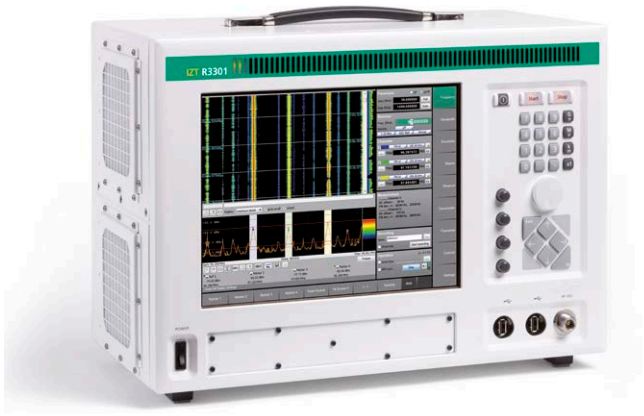
IZT R3000

The "original" IZT R3000 receiver. It is mainly designed for installations where the system's components are installed in a 19 inch rack environment. With only 1 U height multiple receivers can be stacked.

IZT R3200

The IZT R3200 has a convenient form factor for most single user applications. It features a significantly reduced depth compared to the IZT R3000 in a 19 inch 2 U form factor. The support brackets and the feet can be removed if desired.

IZT R3301



With its front panel control, touch screen and integrated processing hardware the IZT R3301 is the perfect portable monitoring system. While is has a compact and rugged design, it also meets CISPR 25 for extremely low RF emissions. The AC and DC power supply is completed by an uninterrupted power supply (UPS) for changeover periods and for the accommodation of load surges. An internal GPS module adds location information to the received signals.

IZT R3410

The compact variant of the sucessfull R3000 series combines a limited weight of under 7 kg with a fanless design suited for harsh environments while maintaining the excellent HF performance and a real-time bandwidth of 24 MHz.

While the IZT R3410 can provide frequency coverage from 9 kHz up to 18 GHz, the IZT R3411 is further reduced in size and weight covering either HF or VUHF frequency ranges.

Customer-specific variants

The modular design of the IZT R3000 offers the possibility to customer-specific mechanical modifications. This ranges from simple additional antenna inputs over multiple receivers in one housing to complex modifications like water-cooling. Please contact IZT for further information.

RECEIVER INTERFACES

Gigabit LAN

All digital signal and control data is transmitted and received via Gigabit Ethernet LAN. This allows fast, simple and cost efficient integration of the IZT R3000 family into an existing IT environment.
Gigabit LAN offers data rates of up to 115 MB/s provided that the host PC is capable of receiving continuous data at this rate.

Instantaneous bandwidth (single channel):

- I/Q baseband: . . . . . 24.0 MHz
- FFT (complex): . . . . . 24.0 MHz
- PSD (power spectral density): . . . . . 24.0 MHz

An I/Q bandwidth of up to 20.5 MHz can be achieved when reducing the stopband attenuation requirements. The receiver has the capability to discard FFT frames in order to reduce data throughput. Using this feature the maximum FFT bandwidth can be extended to 24 MHz.
When multiple data types or multichannel operation are used the maximum Gigabit LAN data rate has to be taken into account. Please refer to chapter multi-channel operation for application examples.

Antenna

Separate N-type connectors for HF and VUHF are available for the antenna signals as standard configuration. Various options can be selected in order to match the receiver to the conditions of the installation site:

- IZT R3000-AAI-HF: a second N-type antenna input for the HF frequency range
- IZT R3000-AAI-VUHF: a second N-type antenna input for the VUHF frequency range
- IZT R3000-AAI-RF1: a single N-type antenna input for the HF and VUHF frequency range
- IZT R3000-AAI-RF2: one of the two default antenna inputs serves as an single antenna input for the HF and VUHF frequency range

Synchronization

The IZT R3000 family features a high stability internal reference clock. The receiver can be synchronized to an external 10 MHz reference source.
With option IZT R3000-TRIG an additional trigger pulse or 1PPS signal can be used to synchronize multiple receivers with sample accuracy. This is required for direction finder applications and is usually sufficient for goniometric or Watson-Watt DF applications.
In order to realize DF systems based on a single-receiver architecture the option IZT R3000-FTRIG can be used to accept antenna synchronization pulses at intervals of 100 µs and less.
For the phase coherent synchronization of multiple receivers the option IZT R3000-EXT_SYNC provides external synchronization interfaces for the clock and the local oscillator signals.

REMOTE CONTROL

Windows software

The IZT R3000 Windows software can be remote controlled. The demodulated audio is available in addition to the I/Q and spectrum data of the receiver on individual UDP ports. Remote controlling the IZT R3000 Windows software offers a quick and convenient way to embed the IZT R3000 family into an existing user environment.

LAN interface

For integration into customer-specific systems the receiver can be interfaced on Ethernet LAN level.

Multiple sockets are available: One for each signal data stream (I/Q, FFT, PSD) and multiple sockets for the monitoring and control port. The signal data streams consist of raw data preceded by meta data specifying the signal, such as center frequency, bandwidth, attenuation, time-of-arrival, clipping indicator, gaps, etc. The monitoring and control port employs a user-friendly ASCII format to command and configure the receiver.

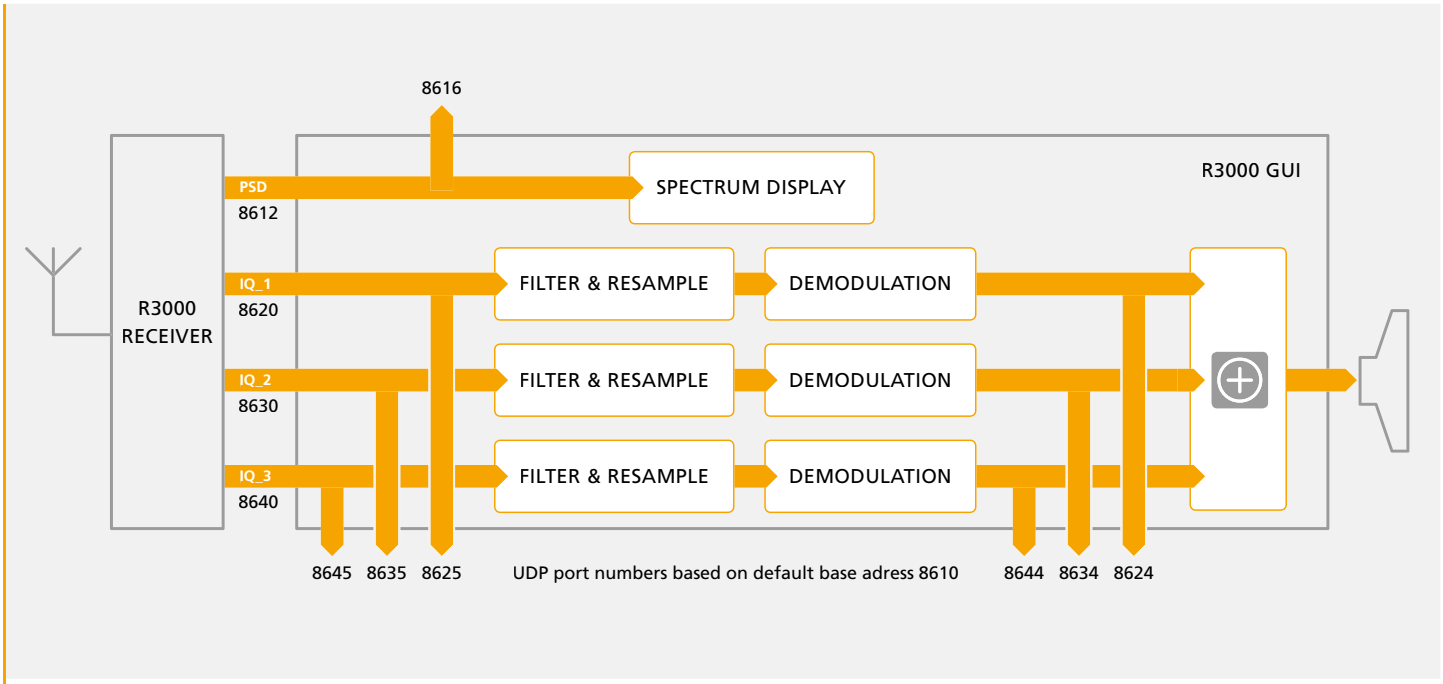


FIGURE 7: UDP PORTS OF R3000 GUI AVAILABLE FOR REMOTE APPLICATIONS

Specifications IZT R3000 Family

Technical specifications		
Frequency range	HF	9 kHz – 30 MHz [1)]
	VUHF	20 MHz – 3 GHz [2)]
RF input	Impedance	50 Ω
Maximum input power	HF	+20 dBm, +30 dBm with input attenuator active
	VUHF	+15 dBm
Tuning resolution	HF, VUHF	1 Hz
VSWR	HF, VUHF	< 2.1
Tuning accuracy	HF, VUHF	< 0.2 Hz
Reference frequency	HF, VUHF	10 MHz internal/external
Internal reference stability	HF, VUHF	< 1 x 10^{-7}
Input sensitivity	HF: 100 kHz – 30 MHz @ S/N = 10 dB	-120 dBm @ 3 kHz BW -111 dBm @ 25 kHz BW
	VUHF: 20 MHz – 3 GHz @ S/N = 10 dB	-114 dBm @ 3 kHz BW -105 dBm @ 25 kHz BW -92 dBm @ 500 kHz BW
Oscillator phase noise	HF	-130 dBc/Hz typical @ 1 kHz offset -140 dBc/Hz typical @ 10 kHz offset
	VUHF	-120 dBc/Hz typical @ 10 kHz offset
Sweep time	HF, VUHF	< 3 ms, typical
Scanning speed	HF, VUHF	4 GHz/s, linear
		175 GHz/s, within 24 MHz bandwidth
Input IP3	HF	+40 dBm, typical
	VUHF	+24 dBm, typical (low distortion mode) +13 dBm, typical (normal mode)
Noise figure	HF	9 dB, typical
	VUHF	10 dB, typical (low noise mode) 15 dB, typical (normal mode)
IF rejection	HF	not applicable
	VUHF	> 120 dB, typical
Image rejection	HF	not applicable
	VUHF	> 110 dB, typical
Oscillator reradiation at antenna output	HF	not applicable
	VUHF	< -110 dBm
Preselector	HF	12-Band
	VUHF	11-Band
IF bandwidth	HF, VUHF	6.25 kHz to 24 MHz

[1)] DEGRADED PERFORMANCE: 9 KHZ TO 500 KHZ
[2)] DEGRADED PERFORMANCE: 20 MHZ TO 30 MHZ

Analog to digital converter	SFDR, HF	90 dB typical (referenced to full scale of A/D converter)
	SFDR, VUHF	75 dB typical (referenced to full scale of A/D converter)
Digital post-processing	Digital downconverter	Variable decimation
	Complex baseband	Variable bandwidth: 6.25 kHz to 24 MHz
	Complex FFT	32-bit complex, 1024- or 4096-point FFT, polyphase filter Variable bandwidth: 6.25 kHz to 24 MHz
	Power density spectrum	Magnitude and logarithm of complex FFT
	Averaging	Variable averaging of PSD by 1, 2, 4, 8, 16, 32, 64 or 128
Digital data format	Complex baseband	16-bit or 32-bit signed integer, I/Q samples
	Complex FFT	16-bit floating point, complex 1024- or 4096-point FFT
	Power density spectrum	16-bit unsigned integer, 1024- or 4096-point FFT, logarithmic scaling, range 256 dB
	Maximum data rate	115 MB/s
Demodulation	Channels	Up to three, demodulated simultaneously
	All following demodulation parameters can be set for each channel individually	
	Demodulation modes	AM, FM, FM-W, PM, Pulse, USB, LSB, ISB, CW, I/Q
	IF filter	Additional bandpass filtering 0% to 100% of IF bandwidth
	IF notch	Unlimited notches within IF bandwidth
	Squelch	-140 dBm to -40 dBm, resolution 1 dB
	Audio filter	Bandpass 300 Hz to 3300 Hz, low-pass 15 kHz
	Audio notch	Two notch filters, center frequency 0 Hz to 22 kHz
Measurement	Signal level	-160 dBm to +20 dBm, resolution 0.1 dB
	Frequency offset	Up to ½ IF bandwidth, resolution 1 Hz
	AM modulation depth	AM, AM+, AM-; m = 0% to 99.9%; resolution ≤ 0.1%
		Indication error ≤ 5% (S/N = 40 dB, AF = 1 kHz, tmeas < 1s)
	FM deviation	FM, FM+, FM-; Δf = 0 Hz to 10 MHz; resolution 1 Hz
		Indication error ≤ 2% of occupied IF bandwith (S/N = 40 dB, AF = 1 kHz, tmeas < 1s)
	PM	Δ = 0 rad to 12.5 rad; resolution = 0.01 rad
		Indication error < 0.1 rad (S/N=40 dB, AF = 1 kHz, tmeas < 1s)
	Bandwidth measurement	Automatic, up to 24 MHz bandwidth
Interfaces	Antenna input, HF, VUHF	N, female, 50 Ω
	External reference input	SMA, female, 50 Ω
	External trigger pulse	SMA, female, CMOS 3.3 V (5 V tolerant input)
	External synchronization	6 x SMA, female, 50 Ω
	Service interface	RS232, D-SUB 9, male
	LAN	1 Gbit LAN, CAT6, legacy support for 100 MBit

Frequency range extension for IZT R3000 Series: 3 GHz to 6 GHz	
Frequency range	3 GHz to 6 GHz
RF input	50 Ω [3)]
Maximum input power	+15 dBm
VSWR	< 2.1
Oscillator phase noise	-120 dBc/Hz typical @ 10 kHz offset
Sweep time	< 3 ms typical
Input IP3	+18 dBm (normal mode)
	+2 dBm (low noise mode)
Noise figure	7 dB (low noise mode, LNA on, maximum gain)
	17 dB (normal mode, LNA off, maximum gain)
IF rejection	> 120 dB, typical
Image rejection	> 110 dB, typical
Oscillator reradiation at antenna output	< -110 dBm
Preselector filter	8-Band
	2800 MHz to 3320 MHZ
	3200 MHz to 3720 MHz
	3600 MHz to 4120 MHz
	4000 MHz to 4520 MHz
	4400 MHz to 4920 MHz
	4800 MHz to 5320 MHz
	5200 MHz to 5720 MHz
	5600 MHz to 6120 MHz

Frequency range extension for IZT R3000 Series: 3 GHz to 18 GHz	
Frequency range	3 GHz to 18 GHz
RF input	50 Ω
Maximum input power	+10 dBm
VSWR	< 2.1
Oscillator phase noise	-114 dBc/Hz typical @ 10 kHz offset
Sweep time	10 ms
Input IP3	+25 dBm (low distortion mode)
Noise figure	15 dB (low noise mode)
IF rejection	> 120 dB, typical
Image rejection	> 110 dB, typical
Oscillator reradiation at antenna output	< -110 dBm
Preselector filter	Tracking bandpass filter

[3)] THE RECEIVER'S VUHF ANTENNA INPUT IS USED, ELECTRONIC RF INPUT SWITCH
SPECIFICATION SUBJECT TO CHANGE WITHOUT FURTHER NOTICE.

General data	IZT R3000	IZT R3200	IZT R3301
Operating temperature	0°C to +50°C	0°C to +50°C	0°C to +45°C
Storage temperature	-40°C to +70°C	-40°C to +70°C	-20°C to +60°C
Humidity	max. 85%, non-condensing	max. 85%, non-condensing	max. 85%, non-condensing
EMI / EMC	EN 61010-1:2002	EN 61010-1:2002	EN 55022
	EN 61000-6-2:2002	EN 61000-6-2:2002	EN 55025
	EN 61000-6-3:2002	EN 61000-6-3:2002	
MTBF	> 70 000 h	> 70 000 h	> 70 000 h
Power supply	90 V to 264 V, 50 Hz to 60 Hz, 50 VA to 80 VA depending on configuration	AC: 90 V to 264 V, 50 Hz to 60 Hz, 50 VA to 80 VA depending on configuration	AC: 100 V to 240 V, 47 Hz to 63 Hz, 240 VA
		DC: 10 V to 30 V, 50 to 80 W depending on configuration [4]	DC: 10 V to 30 V, 150 W
			UPS: 21.6 V, 2.4 Ah, 56.4 Wh, Li-Ion
Dimensions (WxHxD)	19″ x 1 U x 560 mm	19″ x 2 U x 320 mm [5]	450 x 347 x 239 mm
Weight	IZT R3020: 10 kg	IZT R3220: 10 kg	approx. 17 kg
	IZT R3030: 11 kg	IZT R3230: 11 kg	
	IZT R3040: 12 kg	IZT R3240: 12 kg	

General data	IZT R3411 Option HF	IZT R3411 Option VUHF	IZT R3410
Operating temperature	0°C to +55°C	0°C to +55°C	0°C to +55°C
Storage temperature	-40°C to +70°C	-40°C to +70°C	-40°C to +70°C
Humidity	max. 85%, non-condensing	max. 85%, non-condensing	max. 85%, non-condensing
EMI / EMC	EN 61010-1:2002	EN 61010-1:2002	EN 61010-1:2002
	EN 61000-6-2:2002	EN 61000-6-2:2002	EN 61000-6-2:2002
	EN 61000-6-3:2002	EN 61000-6-3:2002	EN 61000-6-3:2002
Power supply	24 VDC, 1 A External AC/DC adapter included	24 VDC, 1.8 A External AC/DC adapter included	24 VDC, 2–3 A (depending on frequency range and current frequency) External AC/DC adapter included
Dimensions (WxHxD)	300 x 233 x 79 mm	300 x 233 x 79 mm	423.5 x 233 x 79 mm
Weight	4.5 kg	4.9 kg	6.8 kg (depending on RF frontend configuration)

[4] WITH OPTION R3000-DCW
[5] WITH OPTION RF6 OR RF18: 19″ X 2 U X 370 MM
SPECIFICATION SUBJECT TO CHANGE WITHOUT FURTHER NOTICE.

Ordering Guide

IZT R3000 / IZT R3200 Hardware		
HF receiver	**IZT R3020**	Frequency range 9 kHz to 30 MHz, 1 U
	IZT R3220	Frequency range 9 kHz to 30 MHz, 2 U
VUHF receiver	**IZT R3030**	Frequency range 20 MHz to 3 GHz, 1 U
	IZT R3230	Frequency range 20 MHz to 3 GHz, 2 U
HF-VUHF receiver	**IZT R3040**	Frequency range 9 kHz to 3 GHz, 1 U
	IZT R3240	Frequency range 9 kHz to 3 GHz, 2 U
Software	**IZT R3000-GUI**	Windows based user software
	IZT R3000-MONITORING	ITU compliant measurement module for IZT R3000-GUI
Receiver options	**IZT R3000-RF6**	Frequency range extension 3 GHz to 6 GHz
	IZT R3000-RF18	Frequency range extension 3 GHz to 18 GHz
	IZT R3000-AAI-HF	Additional antenna interface for HF
	IZT R3000-AAI-VUHF	Additional antenna interface for VUHF
	IZT R3000-AAI-RF1	Additional antenna interface type 1
	IZT R3000-AAI-RF2	Additional antenna interface type 2
	IZT R3000-AAI-RF6	Common antenna interface for VUHF and RF18
	IZT R3000-TRIG	External trigger interface
	IZT R3000-FTRIG	External fast trigger interface
	IZT R3000-EXT_SYNC	External synchronization interfaces [1]
	IZT R3000-IFOUT	Analog IF output
	IZT R3000-REFOUT	10 MHz reference output
	IZT R3000-DCW	Wide DC input, 10 V to 30 V [2]
	IZT R3000-OCX	Oven stabilized reference oscillator
	IZT R3000-BST	Bias-T, adjustable, 3 V to 12 Volt, 30 mA to 200 mA

IZT R3410 / IZT R3411 Hardware		
HF receiver	**IZT R3411-CHS**	IZT R3411 chassis
	IZT R3000-HF	HF frontend, frequency range 9 kHz to 30 MHz
VUHF receiver	**IZT R3411-CHS**	IZT R3411 chassis
	IZT R3000-RF3	VUHF frontend, frequency range 20 MHz to 3 GHz
HF-VUHF receiver	**IZT R3410-CHS**	IZT R3410 chassis
	IZT R3000-HF	HF frontend, frequency range 9 kHz to 30 MHz
	IZT R3000-RF3	VUHF frontend, frequency range 20 MHz to 3 GHz
Receiver options	**IZT R3000-RF6**	Frequency range extension 3 GHz to 6 GHz [3]
	IZT R3000-RF18	Frequency range extension 3 GHz to 18 GHz [3]
	IZT R3000-TRIG	External trigger interface
	IZT R3000-OCX	Oven stabilized reference oscillator
	IZT R3000-AAI-RF5	Three antenna inputs, electronically switchable [3]
	IZT R3000-BST	Bias-T [4]

[1] PHASE SYNCHRONIZED DATA ACQUISITION REQUIRES EXTERNAL CLOCK GENERATION. AVAILABLE ON REQUEST.
[2] ONLY AVAILABLE FOR MODEL IZT R3200, DEFAULT FOR MODEL IZT R3301
[3] ONLY AVAILABLE FOR MODEL IZT R3410-CHS
[4] CAN NOT BE COMBINED WITH IZT R3000-AAI-RF5

IZT R3301 Hardware		
IZT R3301 RF recorder	**IZT R3301-CHS**	IZT R3301 chassis
	IZT R3301-HF	HF frontend, frequency range 9 kHz to 30 MHz
	IZT R3301-RF3	VUHF frontend, frequency range 20 MHz to 3 GHz
	IZT R3301-RF6	Frequency range extension 3 GHz to 6 GHz
	IZT R3301-RF18	Frequency range extension 3 GHz to 18 GHz
	IZT R3301-BST	Bias-T
	IZT R3301-OCX	Oven stabilized reference oscillator
	IZT R3301-GSR	GPS synchronous reference (clock)
	IZT R3301-TCS	IZT R3301 transport case
	IZT R3301-CAR	IZT R3301 carrying case
	IZT R3301-TCA	IZT R3301 transport case for accessories
	IZT R3301-KBD	USB keyboard with touchpad
	IZT R3301-SNC	Synchronisation kit
	IZT R3301-SNC6	Synchronisation kit 6x
	IZT R3301-OLC	Ethernet converter kit
	IZT R3301-SSD	Solid state system disk
	IZT R3301-SDD	Solid state data disk 500 GB
	IZT R3301-CAM	IP camera kit – requires RecPlay-108
	IZT R3301-GPA	GPS amplifier
	IZT R3301-LFM	Low noise amplifier FM
	IZT R3301-LDV	Low noise amplifier DAB III
	IZT R3301-LDL	Low noise amplifier DAB L
	IZT R3301-CBL	Unit colour black, without product & maker labelling

IZT R3000 Family Software		
Software	**IZT R3000-GUI**	Windows based user software
	IZT R3000-MONITORING	ITU compliant measurement module for IZT R3000-GUI

IZT Service		
	IZT R3000-CLC	Factory calibration
	IZT R3000-CAL	Accredited ISO calibration
	IZT WE2	Warranty extension to 2 years
	IZT WE3	Warranty extension to 3 years

MORE INFORMATION ON THE IZT R3301 CAN BE FOUND AT WWW.IZT-LABS.DE.

IZT R3000 Family
Wideband Monitoring Receiver

STUMPF.POOL-X.DE REV.5.3 08/2016

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 9001:2000 certified.

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