# IZT R3200
## Wideband Receiver Family

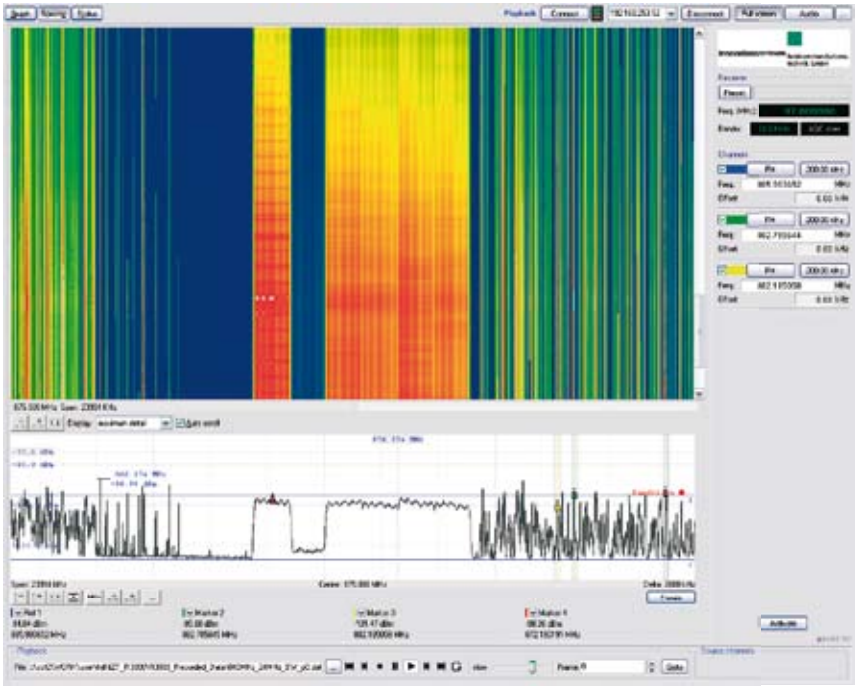
Innovationszentrum Telekommunikations-technik GmbH

- HF-VHF-UHF Receiver
- Excellent RF Performance
- Powerful Signal Processing
- Multichannel Operation
- High Linearity
- Low Noise
- Gigabit LAN Interface
- up to 24 MHz Real-Time Bandwidth

# IZT R3200
## Wideband Receiver Family

### Digital Receiver Family for HF - VHF - UHF

- Frequency range:
  IZT R3220: 100 kHz - 30 MHz
  IZT R3230: 20 MHz - 3 GHz
  IZT R3240: 100 kHz - 3 GHz
- Real-time bandwidth up to 24 MHz
- Multichannel Operation: up to 4 independent channels within 24 MHz bandwidth
- Filter bandwidth: 6.25 kHz - 24 MHz
- 1 Hz tuning resolution
- Digital IF output to Gigabit LAN
- LAN data rate up to 80 MByte/sec
- 128 MByte on-board snapshot memory for I/Q data
- Output data format: complex baseband (I/Q), complex FFT and PSD (variable averaging)
- Optional analog IF output
- Fully remote controlled using TCP/IP software interface
- External synchronisation enables direction-finder systems
- Smart processing algorithms on external PC Hardware
- Optional digital demodulation of AM, FM, SSB, CW
- Embedded ADC and high speed signal processing core
- Robust, low-power design
- Compact 19“ / 2 RU size
- Optional 24 VDC power supply



Today's demanding surveillance technology requires powerful solutions for efficient monitoring of frequency bands.

The IZT R3200 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.

The implementation concept focuses on the combination of an analog tuner designed for maximum linearity, high speed signal processing cores within the receiver and a Gigabit LAN interface for additional external smart processing algorithms.

The exceptional performance allows for handling wideband signals while matching the performance of traditional narrowband receivers. This implementation allows to analyze and demodulate modern digital wideband signals as well as to track or even jam frequency agile systems over a wide range of bandwidths. This is accomplished by using frequency and time slot analysis.

The IZT R3200 – a versatile and highly sophisticated receiver platform – is the ideal solution for a multitude of both civilian and military applications:

- radio monitoring of broadcast stations
- ITU-R spectrum monitoring measurements
- jammer location finding by public authorities
- emission compliancy testing
- spectrum allocation analysis
- automatic signal detection
- search, intercept and emitter location
- direction finding (DF) systems
- strategic and tactical reconnaissance systems
- data acquisition, classification and pre-processing
- threat recognition
- offline processing and technical analysis

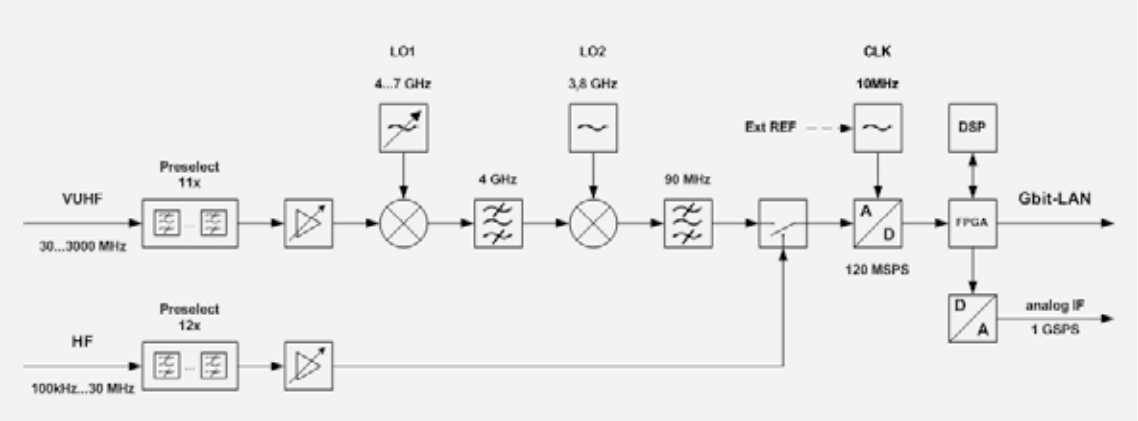



**figure 1:**

By using powerful FPGA based signal processing, the IZT R3200 is able to generate multiple data streams simultaneously, both in frequency and time domain.

**Time Domain**

I/Q complex baseband signals are the basis for various applications. The IZT R3200 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 widths 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 R3200. 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 R3200 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.

The spectrum domain FFT and PSD signal data are available as options.

**Gigabit LAN**

The key interface to the IZT R3200 is Gigabit Ethernet LAN. All data is being sent and received using this interface. This allows fast, simple and cost efficient integration of the IZT R3200 into an existing IT environment.

The Gigabit LAN offers data rates of up to 80 MBytes/sec, provided that the host PC is capable of receiving continuous data at this data rate.

Instantaneous Bandwidth (single channel)

| | |
|---|---|
| CBB Baseband (I/Q): | 16 MHz |
| FFT (complex): | 16 MHz |
| PSD (power density spectrum): | 24 MHz |

When multiple data types or multichannel operation is used the maximum Gigabit LAN data rate has to be taken into account. Please refer to chapter multichannel operation for application examples.

**RF**

The antenna signals are input using separate N-type connectors for HF and VUHF.
Two N-connectors for each of the HF and VUHF antenna frequency ranges are optionally available. Switching between the two inputs is controlled by software.

**Synchronization**

The receiver can be synchronized to an external 10MHz reference source. An additional trigger or 1PPS signal can be used to start automatic modes at precisely given times.
Optional SMD-type connectors allow the phase-coherent synchronization of multiple receivers by providing respectively receiving the local oscillator signals.

Using the multichannel option up to four independent channels – each capable of providing CBB, 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 complex baseband (I/Q) signal with a bandwidth of 10 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 signal into four single channels, even with overlapping bandwidths, for example 3 MHz for each channel.
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 maximum bandwidth (24 MHz). The remaining three channels could then be set up to produce medium- or narrow-band complex baseband IQ signals for demodulation at the same time.

Three distinct operation modes allow maximum flexibility:

**Manual Mode**

All configuration parameters can be changed on the fly. Change frequency, bandwidth and other parameters without noticeable interruption.

**Automatic Mode**

Use advanced job lists for sophisticated operation of the R3200 family. Generate frequency sweeps (start frequency / stop frequency / frequency step) and frequency scans to monitor channels. Job lists can include up to 20.000 entries and can be synchronized to an internal or external time basis.

**Snapshot Mode**

The digitized IF can be recorded using the internal snapshot memory. 128 MByte of on-board RAM allows data capturing at up to 120 MByte/sec equivalent to an instantaneous bandwidth of 24 MHz.
The recorded data can then be transferred using TCP/IP LAN for later external postprocessing.

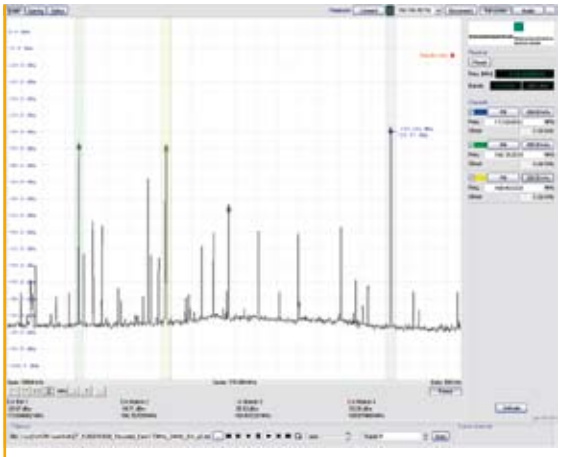


**figure 2:**

The IZT R3200 receiver features a high stability internal reference clock. It can also be synchronized to an external 10 MHz signal source.

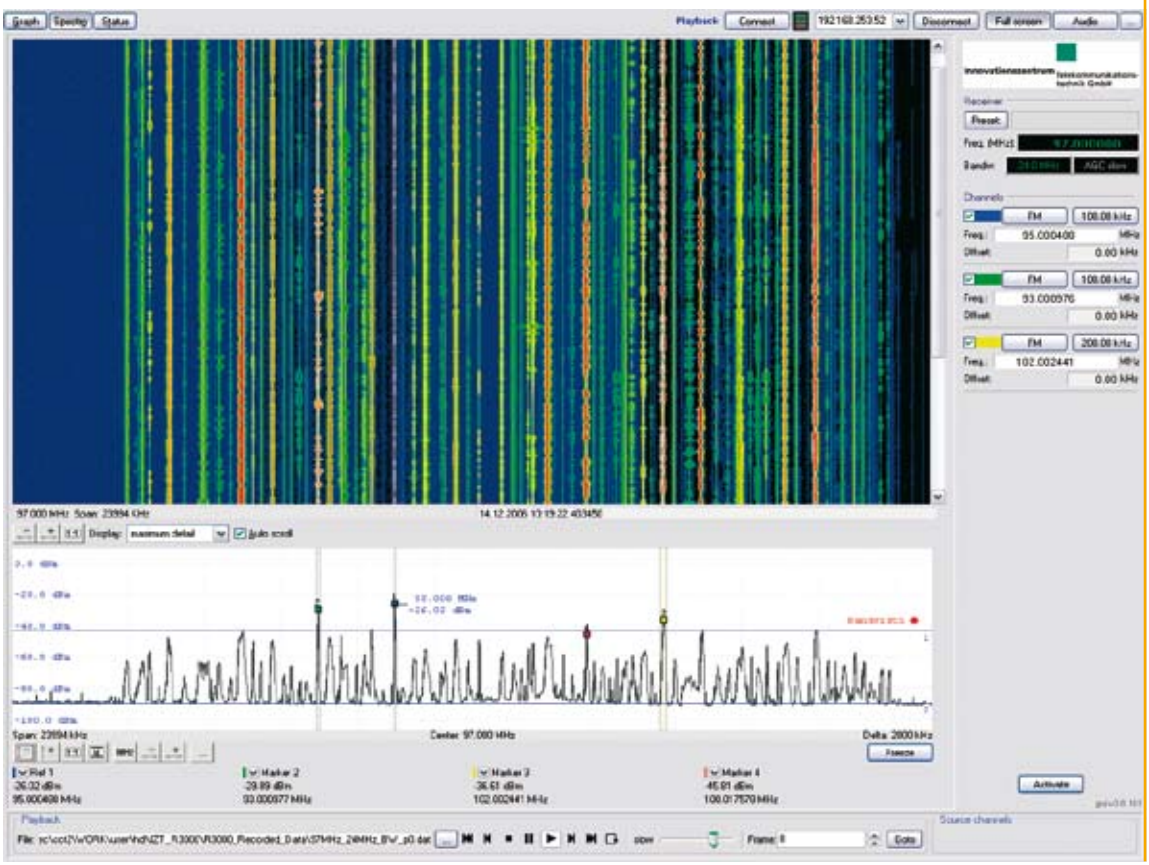
### Direction Finding

DF Systems require the synchronized start of multiple receivers on a sample accurate basis. This requires all receivers to be synchronized to the same external reference clock. Sample accuracy is reached by additionally synchronizing the receivers' time basis using an external 1PPS input (option). Once in sync, the receivers can be started precisely at given times using the LAN interface. Optional SMD-type connectors allow the phase-coherent synchronization of multiple receivers by providing respectively receiving the local oscillator signals.

Whether as a desktop model for the lab, in a 19" rack, or as a portable unit with 24 VDC power supply – the IZT R3200 is always convenient to use.

- 19 inch, 2RU form factor with removable support brackets
- Desktop design with removable feet
- Mobile use through optional 24 VDC power supply

**figure 3:**
Wideband RF Broadcast. Spectrogram with three simultaneously demodulated channels.



## Smart Processing Algorithms on

The IZT R3200 can be ordered with a powerful Windows-based graphical user interface (GUI) to enable immediate operation of the receiver. The GUI supports basic functions such as frequency and bandwidth setting of the receiver with real-time display of time and frequency domain signals. Advanced functions such as multimarker, reference marker, delta marker, peak search and tracking peak search modes provide necessary features required for precise and effective measurements. Averaging, zoom and detailed stream information round out the picture of a comprehensive tool.

### Demodulation, Spectrogram and Data Storage

Optional software packages include, for example, analog demodulators (AM, FM, SSB, CW), data storage and playback of received signals and spectrogram functionality. The spectrogram features a real-time, wideband, panoramic display of signal amplitude and frequency variations over time. This allows the measurement of signal and propagation characteristics just as the detection of frequency hoppers or frequency sweepers. The spectrogram features zoom functionality and markers for precise measurements. Data storage and playback allows recording of all data streams for subsequent detailed measurements. This feature is compatible with the spectrogram and the analog demodulator option. Hence wideband signals can be recorded and all narrowband transmissions within this band can be scrutinized afterwards.

### ITU Compliant Monitoring

The R3200 receiver family fulfills all requirements for ITU compliant measurements with respect to spectrum monitoring:

- ITU-R SM 182 (Spectrum Occupancy)
- ITU-R SM 328 (Modulation)
- ITU-R SM 377 (Frequency and Frequency Offset)
- ITU-R SM 378 (Field Strength)
- ITU-R SM 443 (Bandwidth)

### Additional APIs

For integration in customer-specific systems the receiver can be interfaced on Ethernet LAN level. This allows customers to integrate the IZT R3200 in their specific system environment. Multiple sockets are available: One for each signal data stream (I/Q baseband, 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, scaling, time-of-arrival, clipping indicator, gaps, etc. The monitoring and control port employs a user-friendly ASCII format to command and configure the receiver.

### Customer Specific Implementations

Special modifications and additions, both in hardware and in firmware, can be implemented on customer's request.

**figure 4:**

| Technical Specifications | | |
|---|---|---|
| **Frequency Range** | HF | 0.1 MHz to 30 MHz<br>degraded performance: 0.1 MHz to 0.5 MHz |
| | VUHF | 20 MHz to 3 GHz |
| **RF Input** | Impedance | 50 Ohm |
| **Maximum Input Power** | HF | +20 dBm<br>+30 dBm with input attenuator active |
| | VUHF | +15 dBm |
| **Tuning Resolution** | HF, VUHF | 1 Hz |
| **Tuning Accuracy** | HF, VUHF | < 0.2 Hz |
| **Reference Frequency** | HF, VUHF | 10 MHz internal/external |
| **Internal Reference Stability** | HF, VUHF | +/- 1ppm |
| **RF Gain** | Flatness HF | ± 1 dB |
| | Flatness VUHF | ± 3 dB |
| | Attenuator stepsize | 2 dB / 6 dB |
| | Gain control | MGC, AGC (slow, medium, fast) |
| **Input Sensitivity** | HF: 100 kHz - 30 MHz<br>@ S/N = 10 dB | -120 dBm @ 3kHz BW<br>-111 dBm @ 25kHz BW |
| | VUHF: 20 MHz - 3 GHz<br>@ S/N = 10 dB | -114 dBm @ 3kHz BW<br>-105 dBm @ 25kHz BW<br>-92 dBm @ 500kHz BW |
| **Oscillator Phase Noise** | HF | -130 dBc/Hz typical @ 1 kHz offset<br>-140 dBc/Hz typical @ 10 kHz offset |
| | VUHF | -120 dBc/Hz typical @ 10 kHz offset |
| **Sweep Time** | HF | <3ms |
| | VUHF | <5ms |
| **Scanning Speed** | HF, VUHF | 4 GHz/s |
| **Input IP3** | HF | +40 dBm typical |
| | VUHF | +24 dBm, typical (Low Distortion Mode)<br>+13 dBm, typical (Normal Mode) |
| **Noise Figure** | HF | 9 dB typical |
| | VUHF | 10 dB (f<2GHz) - 12 dB (f > 2 GHz), typical<br>(Low Noise Mode)<br>13 dB (f<2GHz) - 15 dB (f > 2 GHz), typical<br>(Normal Mode) |
| **IF Rejection** | HF | not applicable |
| | VUHF | >120 dB typical |
| **Image Rejection** | HF | not applicable |
| | VUHF | >110 dB typical |

| | | |
|---|---|---|
| **Preselector** | HF | 12-Band |
| | VUHF | 11-Band |
| **IF Bandwidth** | HF | 6.25 kHz to 24 MHz |
| | VUHF | 6.25 kHz to 24 MHz |
| **Analog to Digital Converter** | SFDR, HF | 90 dB typical<br>(referenced to full scale of A/D converter) |
| | SFDR, VUHF | 75 dB typical<br>(referenced to full scale of A/D converter) |
| **Digital Postprocessing** | Digital downconverter | Variable decimation |
| | Complex baseband | Variable bandwidth: 6.25 kHz to 24 MHz |
| | Complex FFT | 32 bit complex, 1024 and 4096-point-FFT,<br>polyphase filter<br>Variable bandwidth: 6.25 kHz to 24 MHz |
| | Power density spectrum | Magnitude and logarithm of complex FFT |
| | Averaging | Variable averaging of PSD<br>by 1, 2, 4, 8, 16, 32, 64 or 128 |
| **Digital Output via LAN** | Complex baseband | 16 bit or 32 bit signed integer,<br>I and Q samples |
| | Complex FFT | 16 bit floating point, complex 1024 or 4096 FFT |
| | Power density spectrum | 16 bit unsigned integer, 1024 or 4096 FFT,<br>logarithmic scaling, range 256 dB |
| | Maximum data rate | 80 MByte/sec |
| **External References** | 10 MHz | 50 Ohm, 0 dBm ... +10 dBm |
| | SYNC | CMOS 3.3 V (5 V tolerant input) |
| **Operating Temperature** | | 0° C ... 50° C |
| **Storage Temperature** | | -40° C ... 70° C |
| **Humidity** | | max. 85%, non-condensing |
| **Power Consumption** | | 85-264 VAC, 50-60 Hz, 70 VA<br>24 VDC, 50 VA |
| **MTBF** | | > 10 000 hrs (MIL-HDBK) |
| **EMI / EMC** | | EN 61010-1:2002, EN 61000-6-2:2002,<br>EN 61000-6-3:2002 |
| **Mechanical** | Width | 19“ |
| | Height | 2 RU |
| | Depth | 320 mm |
| | Weight | 10 kg |

Specification subject to change without further notice.

| Ordering Guide | | |
|---|---|---|
| **HF Receiver** | **IZT R3220** | HF Receiver |
| | | frequency range 100 kHz ... 30 MHz,<br>maximum bandwidth limited to 20 kHz |
| **VUHF Receiver** | **IZT R3230** | VUHF Receiver |
| | | frequency range 20 MHz ... 3 GHz,<br>maximum bandwidth limited to 200 kHz |
| **HF-VUHF Receiver** | **IZT R3240** | HF-VUHF Receiver |
| | | frequency range 100 kHz ... 3 GHz,<br>maximum bandwidth limited to 20 kHz HF / 200 kHz VUHF |
| **Hardware/Firmware Options** | **IZT R3000 - WB** | Wideband Extension |
| | | extends real-time bandwidth up to 24 MHz *1 |
| | | includes 128 MByte snapshot memory module |
| | | Gigabit LAN for transfer rates of up to 640 Mbit/sec |
| | **IZT R3000 - FFT** | FFT Output |
| | | complex spectrum, 1024 or 4096 point variable bandwidth up to 24 MHz |
| | **IZT R3000 - PSD** | PSD Output |
| | | power density spectrum, 1024 or 4096 point,<br>variable bandwidth up to 24 MHz |
| | | variable averaging 1, 2, 4, 8, 16, 32, 64 or 128 |
| | **IZT R3000 - MC** | Multichannel |
| | | Extraction of up to four independent channels, each with independent bandwidth and data types. |
| | **IZT R3000 - AAI** | Additional Antenna Interface |
| | | second antenna input |
| | | relay based antenna switch, input selectable by software |
| | **IZT R3000 - TRIG** | Trigger |
| | | synchronization to external Trigger pulse for synchronized data acquisition of multiple receivers *2 |
| | **IZT R3000 - HFCAL** | Calibration of HF receiver |
| | | amplitude and phase calibration to FFT output of HF receiver (WatsonWatt) |
| | **IZT R3000 - DC** | 24 Volt DC Power Supply Input |

*1 Preselector bandwidth has to be considered for maximum usable bandwidth
*2 Phase synchronized data acquisition requires external clock generation. Available on request.

| | | |
|---|---|---|
| **Software** | **IZT R3000 - GUI** | Windows-based User Interface for the IZT R3200 Receiver Family |
| | | time display, spectrum display |
| | | multimarker, reference marker, delta marker, peak search, tracking peak search |
| | | agc / mgc support |
| | | variable bandwidth, variable psd average |
| | | max hold |
| | | zoom functionality |
| | | graphical average |
| | | stream information: frequency, bandwidth, TOA |
| | | upload function |
| **Software Options** | **IZT R3000 - DATA** | Data Storage and Playback |
| | | real time data storage to harddisk |
| | | data playback at various speeds, forward, backward, single step mode |
| | | support of comprehensive job lists |
| | | job list editor |
| | | compatible with IZT R3200-SPECTROGRAM, -ANALOGDEM |
| | **IZT R3000 - SPECTROGRAM** | Spectrogram Functionality |
| | | frequency, amplitude and time display of signals (frequency over time, amplitude colour coded) |
| | | various scroll speeds |
| | | zoom functionality |
| | | various multimarker modes |
| | **IZT R3000 - ANALOGDEM** | AM/FM/SSB/CW Analog Demodulator |
| | **IZT R3000 - MONITORING** | ITU Compliant Measurement Software |

Software options licenses are single unit licenses associated with one IZT R3200 receiver.

QUALITY MANAGEMENT
Certificate
Voluntary participation in regular monitoring according to ISO 9001:2000

**About IZT**

The Innovationszentrum fuer Telekommunikationstechnik GmbH IZT was founded in 1997.

IZT's major business fields are digital broadcast transmitters and repeaters, custom test equipment, special communication systems and spectrum monitoring receivers. The company is active in civilian and military markets.

IZT has a long history in customer specific test equipment, especially for modern hybrid satellite and terrestrial digital audio broadcast systems.

The company's products are marketed worldwide.

IZT's divisions are certified according to ISO 9001:2000.

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