IZT R5040
Rugged Wideband Receiver

- Highest signal quality in the frequency range up to 18 GHz
- Up to 120 MHz instantaneous bandwidth
- Up to 64 narrow-band DDCs
- Real-time spectrum calculation
- Suitable for outdoor installation

The IZT R5040 is a wideband receiver with a frequency range up to 18 GHz, up to 120 MHz instantaneous bandwidth and powerful internal signal processing. Typical applications are COMINT Systems, satellite monitoring, broadband RF recorders or quality measurements in mobile communication networks.

The IZT R5040 has a rugged, water-proof enclosure suitable for outdoor installation and harsh environments. Its enclosure can be adapted for free convection, forced air cooling or mounting on a cold plate, for example a liquid cooler.

Figure 1: IZT R5040 Receiver

Key Features

Highest Reception Quality

The IZT R5040 uses IZT's latest generation of tuners with sub-octave preselectors, dual conversion and a variable 1st IF for maximum robustness against false reception and two high-power mixers for maximum linearity. A low-noise preamplifier can be activated for maximum sensitivity. A built-in test source allows for end-to-end verification and alignment of the receiver. The receiver can be operated in manual or automatic gain control mode. All internal clocks can be sychronized to an external source or the built-in GNSS receiver. The available frequency range is determined by the installed tuner modules:

- Configurable preselector with 16 high-/lowpass filters for direct sampling from 9 kHz to 140 MHz for highest performance up to the lower VHF range or
- alternatively a configurable preselector with 16 high-/lowpass filters for direct sampling from 9 kHz to 40 MHz for highest flexibility and performance in the HF range
- Superhet tuner for 20 MHz to 6000 MHz
- Microwave frontend for 6 GHz to 18 GHz

Large Instantaneous Bandwidth and Six DDCs

The IZT R5040 uses latest FPGA technology for signal processing.

In its baseline configuration the IZT R5040 offers an instantaneous bandwidth of 60 MHz. Software option IZT R5040-BW1 increases the available bandwidth to 80 MHz. With option IZT R5040-BW2 the maximum bandwidth of 120 MHz will be activated.

Up to six DDC channels can be set up within the instantaneous bandwidth of the receiver. Each DDC can handle the full bandwidth, so the only limitation is the maximum output streaming capacity of 20 Gb per second. The decimation is continuously variable and can be choosen independently for all six DDCs. With maximum decimation, the sample rate can be set as low as 10 kHz at the output of a DDC. The IZT R5040's flexible job control allows the user to define complex scan scenarios that will be executed by the receiver. The output data is provided via UDP as complex I/Q data (Vita.49 on demand) with embedded meta data, very similar to the proven IZT R3000 data format. Accurate time stamps allow for calculating the reception time for each sample down to sub-nanosecond accuracy.
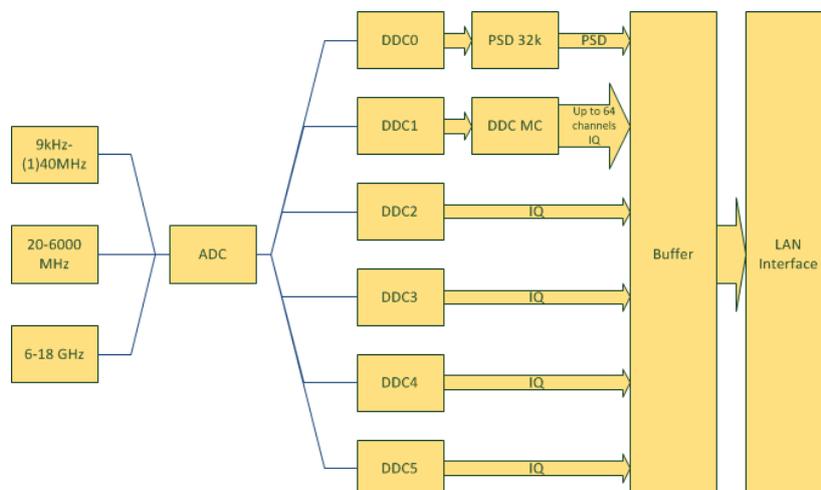

Figure 2: IZT R5040 Receiver Block Diagram

Broadband PSD

With option IZT R5040-PSD, the receiver calculates a PSD with 32678 points in FPGA with very high frequency selectivity. The PSD is always connected to DDC0. By adjusting the variable decimation rate of the DDC, the bin spacing of the PSD can be set to an arbitrary value in the range of 1 kHz to 5 kHz. The bandwidth covered by the PSD will change accordingly from 29 MHz to up the full instantaneous bandwidth. To reduce the data rate, a RMS detector can accumulate frames before the result is sent to the host computer via the digital interface. The number of averages can be set between 1 and 4096.

Multichannel DDC

The option IZT R5040-DDC allows to further break down the output of DDC1 into up to 64 DDCs. The sum of the output sample rates of these 64 DDCs can be as high as the output sample rate of DDC1. The decimation factor in the Multichannel DDC can be set in powers of two between 2 and 64 and their center frequency can be arbitrarily set within the available bandwidth at the output of DDC1. In the examples below, DDC1 is set to an output sample rate of 128 megasamples per second. If the relative center frequency of DDC1 is set to 0, it will cover the full receiver instantaneous bandwidth. Possible configurations of the Multichannel DDC are:

- 2 DDCs with an output sample rate of 64 MSps or
- 4 DDCs with an output sample rate of 32 MSps or
- 8 DDCs with an output sample rate of 16 MSps or
- 16 DDCs with an output sample rate of 8 MSps or
- 32 DDCs with an output sample rate of 4 MSps or
- 64 DDCs with an output sample rate of 2 MSps

Combinations of the aforementioned sample rates will be possible as well, as long as the total sample rate is not exceeded, for example:

- 1 DDC with 64 MSps and one DDCs with 32 MSps or
- 1 DDC with 64 MSps, 1 DDCs with 32 MSps and two DDCs with 16 MSps or
- 2 DDCs with 32 MSps, one DDC with 16 MSps and eight DDCs with 2 MSps

The center frequencies of the DDCs are always independent and only constrained by the output bandwidth of DDC1. If the Multichannel DDC is deactivated, the output stream of DDC1 can be routed directly to the buffer and LAN interface.

Internal Memory Buffer

Not all use cases require or even support the continuous streaming of the large bandwidth. Therefore the IZT R5040 can be equipped with an optional internal RAM buffer. With this option, the user can configure, which of the DDC channels will be routed to the buffer instead of the data output. Once the buffer is full, the respective stream will stop. Commanded by the user, the content of the buffer will be streamed to the client at a data rate set by the user. With option IZT R5040-BUF1 a maximum number of 256 megasamples can be stored. The maximum available memory depth is close to 1000[1] megasamples with option IZT R5040-BUF2. Operation through the buffer and continuous streaming may happen in parallel, as long as the maximum capacity of the output interface is not exceeded.

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[1] about 1.5% overhead is caused by the metadata information

Connection via Hybrid Cable

The IZT R5040 connects to its power supply and servers for data post-processing via a single hybrid cable. In case the full maximum data throughput of 20 Gbit/s is required in the desired operation, a second cable can be added. The cable can be several hundred meters long and is well suited for reeling, making the IZT R5040 the ideal choice for installation close to the antenna in fixed or temporary installations avoiding the need for high-gain preamplifiers and their associated loss in RF signal quality.

Robust and Flexible Enclosure

The IZT R5040 receiver has a robust, waterproof housing with flat base and top. This give the user the choice for different cooling methods, for example:

- short cooling fins for forced air cooling
- longer cooling fins for free convection cooling
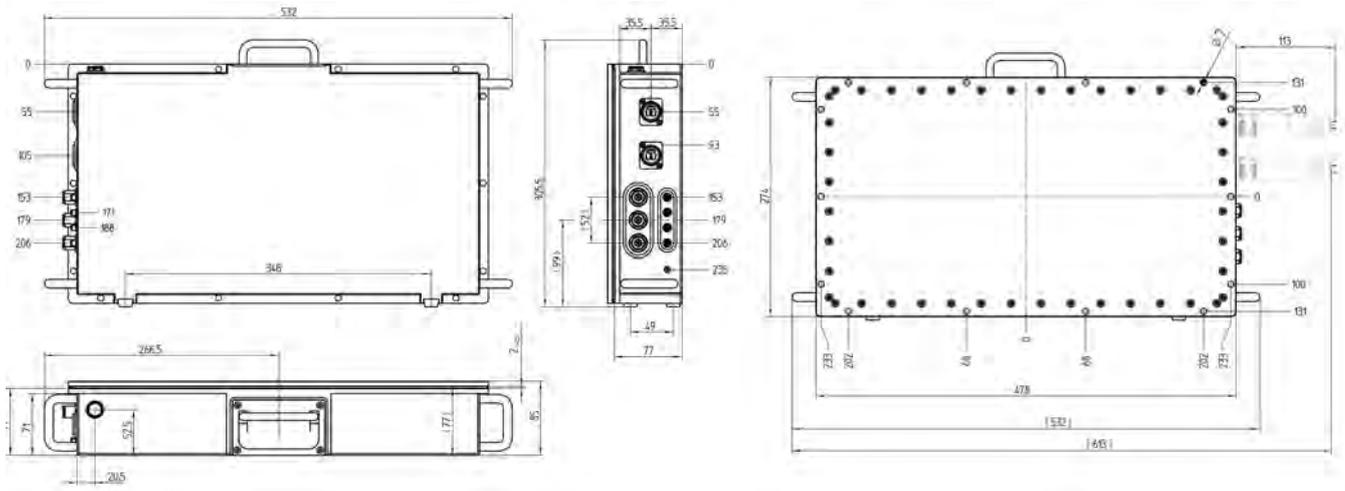- conduction cooling for example via a liquid cooler

Figure 3: IZT R5040 Receiver Mechanical Dimensions

Specifications

RF Performance	
Frequency range	20 MHz to 6000 MHz
Noise figure	preamp off: 14dB
	preamp on: 7dB
Third order intercept point	preamp off: +14dBm
	preamp on: +2dBm
Oscillator phase noise	-120dBc/Hz@10kHz
Frequency range	6000 MHz to 18000 MHz
Noise figure	low noise mode: 15dB typ.
	normal mode: 23dB typ.
Third order intercept point	low distortion mode: +25dBm
	Low noise mode: +15dBm
Preselector	14 bands, electronic switching
Conversion scheme	dual conversion with variable 1st IF

DSP Section	
Instantaneous bandwidth	up to 120 MHz
Number of DDCs	up to six and up to 64 [1]
Data output	UDP via two 10 Gbps optical LAN outputs
PSD	32768 points

Enviromental Parameters	
Mechancial size	532 mm x 306 mm x 85 mm [2]
	478 mm x 274 mm x 85 mm [3]
Weight	approx. 12kg depending on cooling method
Protection	IP65
Temperature range	-30 to +65°C flange temperature
Power consumption	approx. 70 W to 150 W [4]

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[1]depending on options
[2]including handles but without coolers
[3]without handles and without coolers
[4]depending on options

Ordering Guide

Option	Description
IZT R5040-CHS	Base Unit, 60 MHz bandwidth, 1 channel (DDC)
IZT R5040-HF	HF Frontend frequency range 9 kHz – 40 MHz
IZT R5040-HVHF	HVHF Frontend frequency range 9 kHz – 140 MHz
IZT R5040-RF6	Frontend frequency range 20 MHz – 6 GHz
IZT R5040-RF18	Frequency Range Extension 6 GHz – 18 GHz [1]
IZT R5040-REF	Internal GNSS Receiver for synchronization
IZT R5040-BUF1	256 MS Internal Snapshot Memory
IZT R5040-BUF2	1000 MS Internal Snapshot Memory [2]
IZT R5040-BW1	80 MHz receiver bandwidth
IZT R5040-BW2	120 MHz receiver bandwidth [3]
IZT R5040-MC	Six Independent Channels (DDC) within receiver bandwidth
IZT R5040-DDC	Up to 64 DDCs within receiver bandwidth
IZT R5040-PSD	32768-point PSD Spectrum
IZT R5040-AAI-RF5	3x3 Antenna Switch (one of up to three RF inputs is switched electronically to one of the built-in RF front-ends by software [4]

[1]Requires R5010-RF6
[2]Option BUF2 includes BUF1
[3]Option BW2 includes BW1
[4]increases noise figure by approx. 2...6dB depending on frequency

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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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