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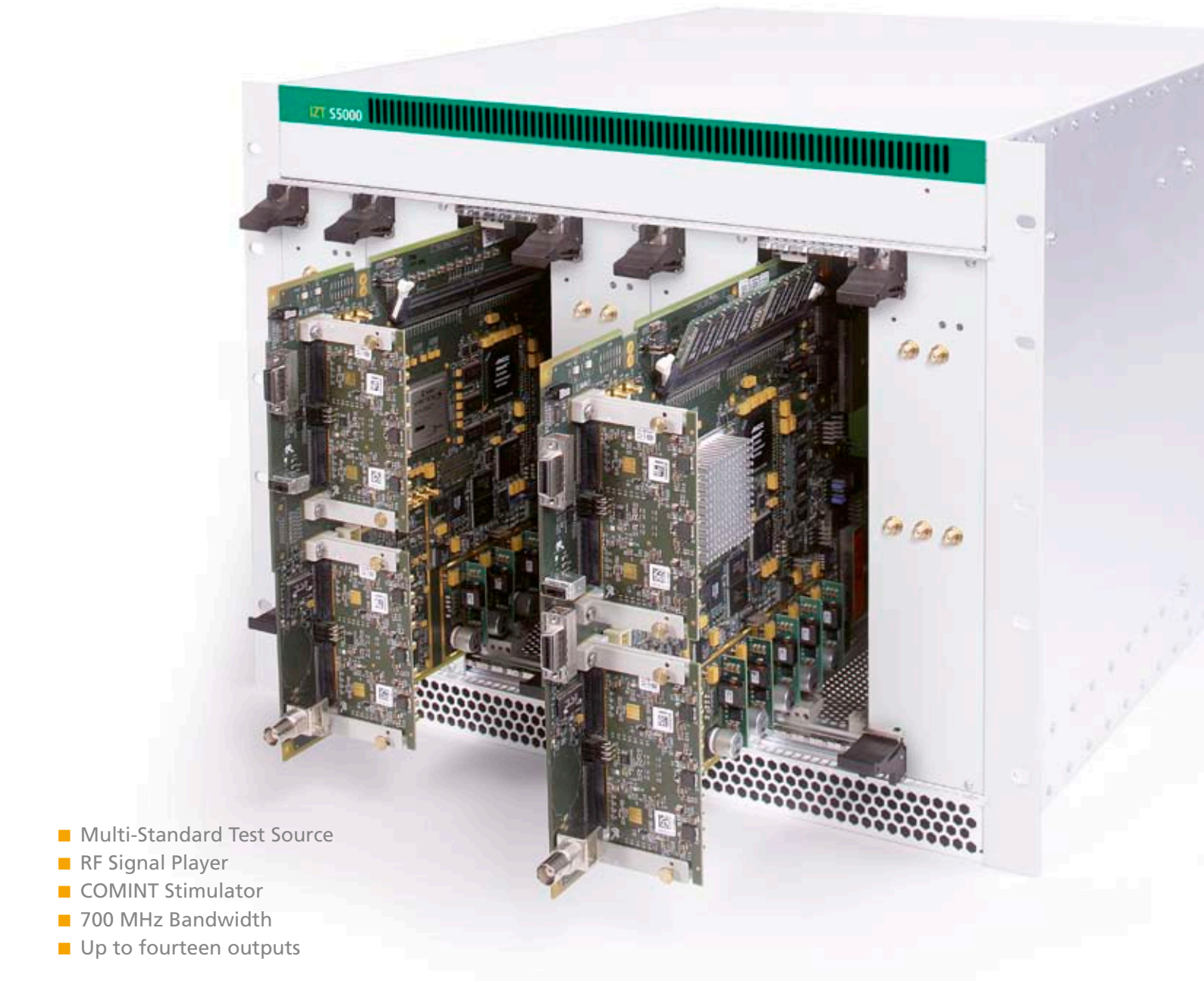
IZT
Innovationszentrum
Telekommunikationstechnik

IZT S5000

Multichannel Signal Source for Real-Time RF Environment Simulation



- Multi-Standard Test Source
- RF Signal Player
- COMINT Stimulator
- 700 MHz Bandwidth
- Up to fourteen outputs

IZT S5000
Multichannel Signal Source

The IZT S5000 is a unique and novel concept for a digital signal source to simulate time variant, complex and realistic RF signals.

Originally driven by the application of testing COMINT systems, it can be efficiently applied when ever multiple and accurately synchronized RF test signals are required.

The IZT S5000 is capable of generating up to 128 independent RF signals with excellent dynamic range from a streaming server, internal RAM or any combination thereof.

Applications

MULTI-CHANNEL RF SOURCE

With antenna diversity becoming more and more common for mobile receivers, accurate replication of a receive scenario in the lab requires a phase-synchronous player. The IZT S5000 can replay up to fourteen recorded channels. Multiple IZT R3000 receivers can be used as a phase synchronous multi-channel recording system.

If multi-standard receivers are to be tested, the IZT S5000 is a very cost efficient way to generate all required test signals from a single source.

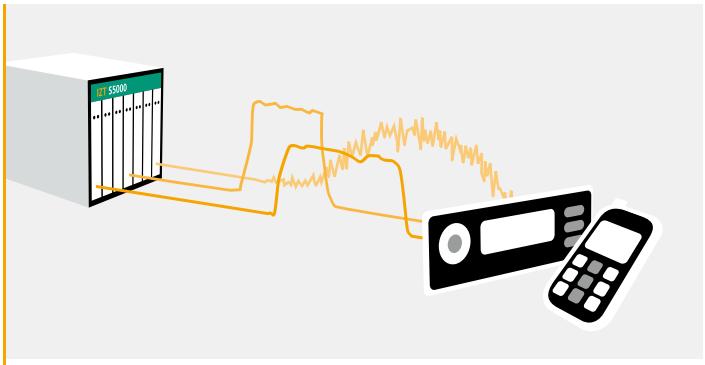


FIGURE 1: MULTIPLE STANDARDS FROM ONE S5000

WIDEBAND SIGNAL GENERATOR

With a special LO configuration and its associated calibration hardware the IZT S5000 can generate signals with an instantaneous bandwidth up to 700 MHz. The signals are pre-processed in software and then played from the memory on the S5000-DSV2 cards.

Possible applications are the test of UWB waveforms, radar signals, Electronic Counter Measures (ECM) or satellite signals with a very large bandwidth.

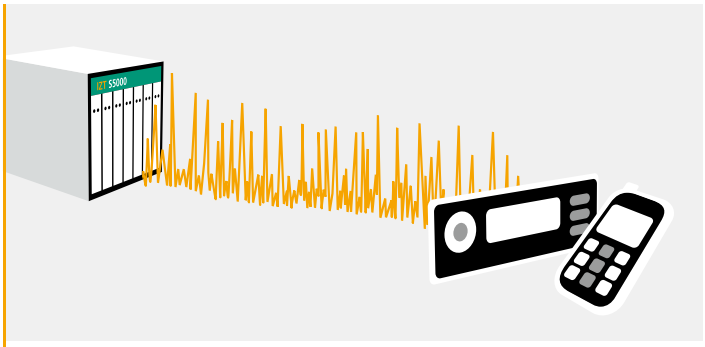


FIGURE 2: UP TO 700MHZ CONTINUOUS SPECTRUM FROM ONE S5000

FIGURE 3: STAND-ALONE S5000 WITH SERVER

COMINT STIMULATOR

Development and test of COMINT receive systems together with subsequent operator training require a repeatable and well controlled representation of the realistic RF environment the system will have to operate in. If the COMINT system has a DF component, multiple receive inputs have to be fed. For this application the IZT S5000 provides

- a very large number of emissions at an excellent signal quality
- stationary and moving emitters in different positions relative to the COMINT system under test
- emissions with realistic content
- simulation of receive antenna patterns

The IZT S5000's assumes the place of the receive antenna and its output signals are directly fed into the receive inputs of the COMINT system.

FIGURE 4: IZT S5000 IN A LARGE INSTALLATION FOR COMINT STIMULATION

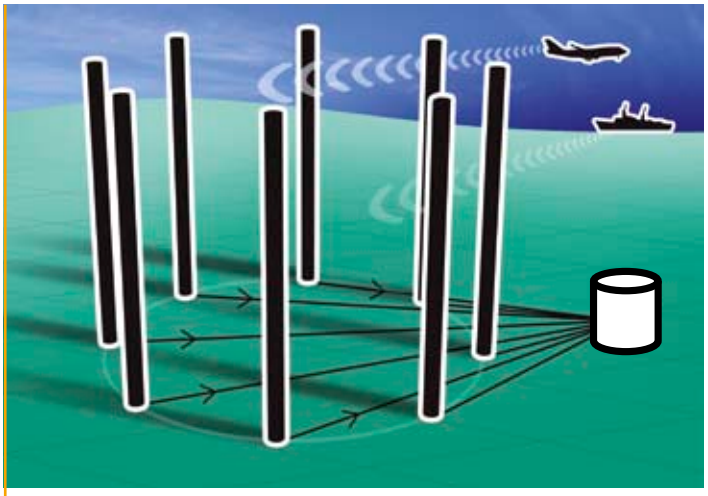


FIGURE 5: RECORDING OF SIGNALS

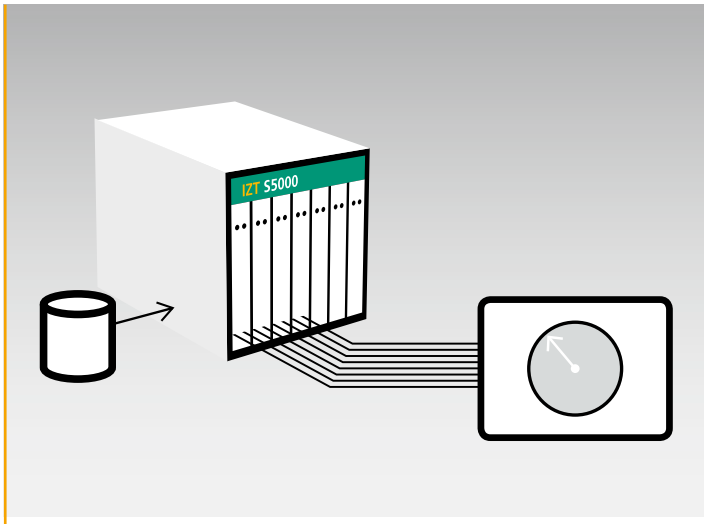


FIGURE 6: IZT S5000 REPLAYING SIGNALS

In the control software of the S5000 the user defines time variant "scenarios":

- type and content of the emissions
- power
- distance
- relative bearing between receive antenna and each emitter.

The emissions are simulated as if they were received from the actual antenna system of the COMINT receiver. Phase, amplitude and delay of each individual signal are time variant and matched to the current receive scenario.

Each element of the receive antenna is described by means of a complex gain function of azimuth, elevation and frequency.

In its full configuration, the IZT S5000 comprises 26 chassis to continuously cover the frequency range from 20 MHz to 3000 MHz and generates several thousand emissions.

Subsystems

The IZT S5000 is a set of hardware and software components that can be combined to support the different applications.

S5000-DSV2 CARD

The DSV2 card is the core of the IZT S5000. It contains powerful FPGA based signal processing, RF or IQ-output modules. Unlike standard arbitrary waveform generators, the IZT S5000 offers a proprietary and highly efficient signal processing. This patented technology allows interpolating a large number of independent channels ("emitters") in real time. Their relative delay, frequency and amplitude can be varied seamlessly in real-time. On a single card up to 128 individual signals can be processed with a cumulative bandwidth of up to 250 MHz.

Specifications and Functionality

The S5000-DSV2 has an instantaneous bandwidth of 120 MHz. This means, emitters can be placed arbitrarily within +/-60 MHz of the center frequency.
The frequency range of the RF output is 20 to 3000 MHz with 70 dBc SFDR (typ.) and +20 dBm peak power.
Emitters are stored as ideal signals and streamed with 12 bit resolution. For applications where recorded data with a larger dynamic range is used 16 bit or higher resolution can be traded against total cumulative emitter bandwidth.
The emitter data is streamed from servers via GBit LAN interfaces or stored in 4 GByte on-board memory. The streaming is primarily intended for long sequences.

Available data throughput for emissions streamed directly from the servers supports a total data rate up to 200 MByte/sec which is sufficient for a total signal bandwidth up to 50 MHz.
With a storage space of one terabyte signals would loop only once per hour on average. The remaining bandwidth can be filled with up to four gigabyte of emission data stored in the RAM.
The DSV2 accurately sets power, delay, phase and frequency of each emitter in real time based on external control data.
The S5000-DSV2 can be synchronized with respect to timing and phase from a central clock source. This includes all local oscillator signals allowing phase stable operation of several S5000-DSV2 in parallel.

S5000-DSV2 Configurations

In baseline configuration the S5000-DSV2 has one RF output and requires external LO and clock signals.
Adding a local oscillator module will make it independently tuneable. This is intended for applications which require a medium number of emissions over a wide frequency range accessible at a single antenna only.
If the S5000-DSV2 is equipped with a second RF upconverter, it can supply signals to two receive antennas. Both RF outputs share the same LO signal and therefore are phase-locked with respect to their center frequency. Emitters can be controlled independently while both outputs share the total cumulative bandwidth available in the DSP section and servers.
IQ-outputs may be used for signals exceeding 3 GHz in frequency.

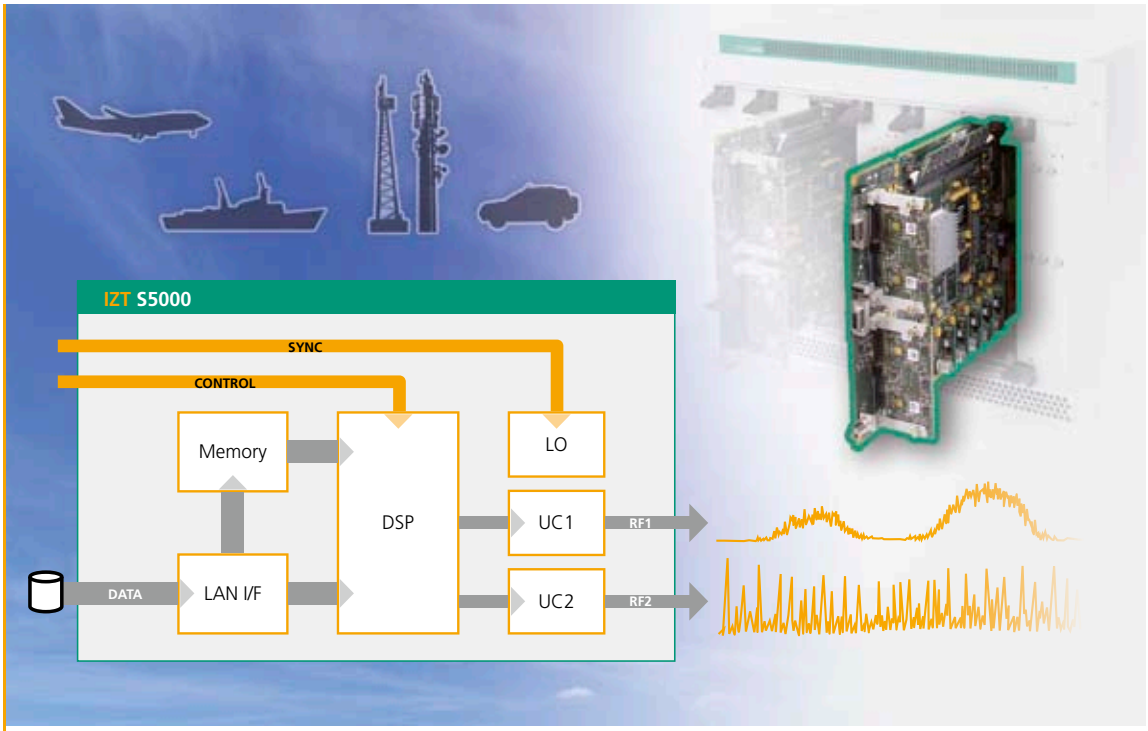


FIGURE 7: S5000 DSV2 CARD

S5000-CHS

Up to seven S5000-DSV2 can be placed in one 19" chassis S5000-CHS. The chassis supplies power, cooling and synchronization signals to the cards. When each S5000-DSV2 is equipped with dual RF upconverters, a maximum of fourteen antenna inputs of an interferometric receiver system can be supplied with signals.

COUPLERS & SYNCHRONIZATION UNITS

In order to support the different combinations of cards and chassis to larger systems, IZT is offering the necessary couplers, synchronization units and cabinets.

Accurate measurements on interferometric receivers require a calibration of each individual card. This is done by an automatic calibration which is based on the IZT R3000 receiver.

FIGURE 8: THE IZT S5000 CHASSIS

CONTROL SOFTWARE

For standard applications the IZT S5000 is controlled via an easy to use Graphical User Interface. For more complex applications it offers a remote control interface, which is especially suitable for complex, time variant scenarios.

FIGURE 9: CONFIGURING A LIST OF EMISSIONS

Combining Multiple Chassis

In order to best match the customer's application, multiple S5000-DSV2 can be combined in different ways. The sizing of the servers and switches depends on the specific configuration and will be done by IZT.

INDEPENDENT S5000-DSV2

In applications requiring a single antenna output and a maximum number of emissions, each S5000-DSV2 is equipped with a local oscillator, which makes the center frequency of each card independently tuneable. One chassis with seven cards in this configuration can generate about one thousand emissions and cover a bandwidth of up to 800MHz.
The up to fourteen RF outputs are then combined to a single antenna output.

COMBINING ACROSS CHASSIS

In an interferometric application, all DSV2 cards in one chassis are driven from a single local oscillator. The center frequency of the whole chassis can be set arbitrarily.
At a given point in time one 120MHz wide portion of the spectrum can be covered with signals.

For testing an automatic search receiver or DF system, continuous coverage of the full spectrum is important.
This is achieved by combining chassis "vertically", i.e. one chassis is assigned to a fixed portion of the frequency spectrum. For each antenna output up to twenty-six chassis can be combined to achieve full coverage of the frequency range up to 3 GHz.

Test setups requiring only a single antenna signal but a large number of emissions can be efficiently met by combining horizontally.

IZT offers the necessary coupler assemblies, filters and calibration equipment for both configurations.

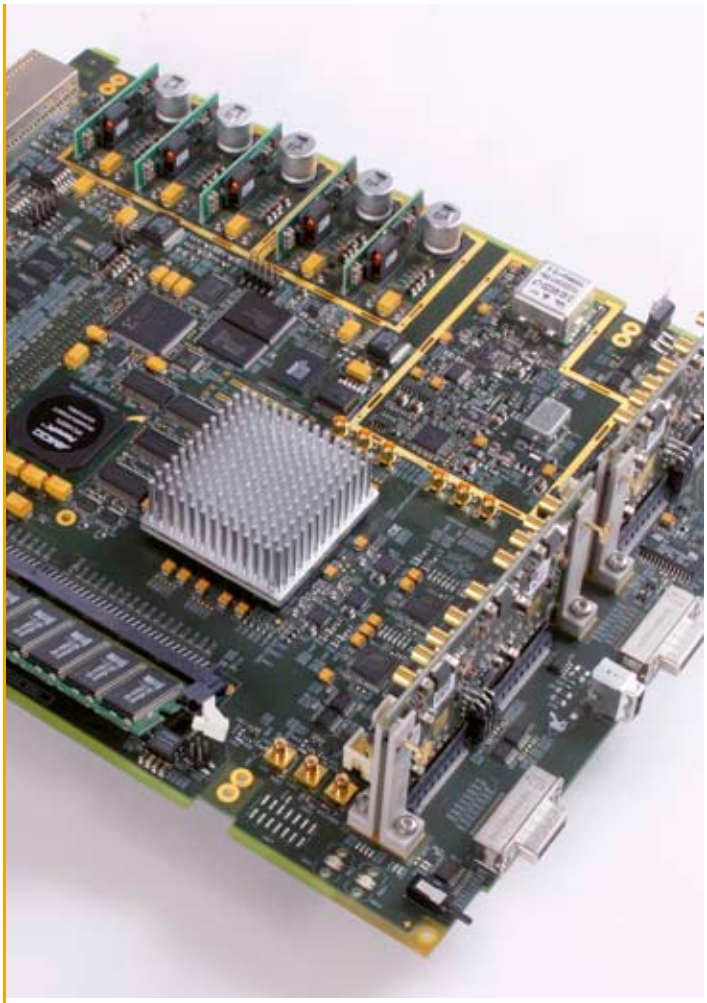


FIGURE 10: IZT S5000 DSV-2 CARD

FIGURE 11: COMBINING CHASSIS VERTICALLY

FIGURE 12: COMBINING CHASSIS HORIZONTALLY

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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 9001:2000 certified.

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