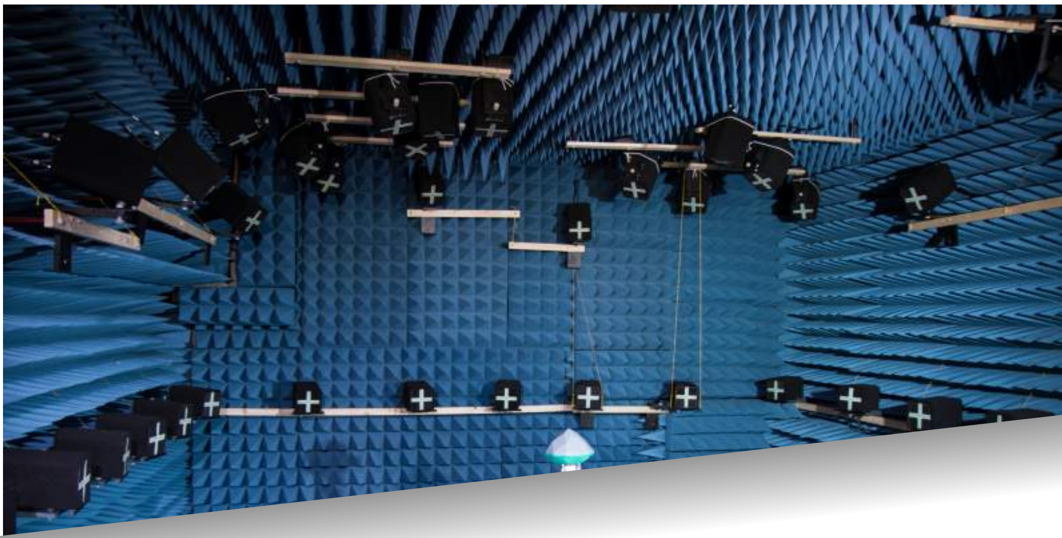
RF MIMO Emulator
IZT C7000

Product Information



- 4G and 5G user equipment testing
- MANET testing
- GNSS testing
- Wireless cable testing in non-anechoic and anechoic environments
- Real-time streaming of channel parameters
- Multi-frequency operation
- Up to 80 MHz instantaneous bandwidth
- Extreme low RF to RF latency
- Fully coherent and phase-stable
- Highest signal quality in the frequency range up to 6 GHz
- Signal distribution via IP and optical LAN
- Scalable number of channels

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The IZT C7000 is a high-performance MIMO Simulator for the frequency range of 30 MHz to 6000 MHz with 80 MHz instantaneous bandwidth. The very low and adjustable input to output latency enables efficient testing of modern communciation systems. The digitized signals are sent to the FPGA processor via optical cables to avoid loss of performance due to coaxial cables.
The successful development of applications in communication applications requires the simultaneous simulation of multiple transmission standards and very agile motion parameters. Devices under test can be tested witout error-prone mechanical equipment such as turn tables. The IZT C7000 system has been developed for sophisticated customers such as research labs, universities and industries working with state-of-the-art technology.

MIMO Overview

A Multiple Input Multiple Output (MIMO) system uses multiple antennas at transmitter and receiver side for wireless communication. The transmission path can be described by a matrix channel consiting of all Nt and Nr paths between the Nt transmit antennas at the transmitter and Nr receive antennas at the receiver. The receiver decodes the received signal vectors into the original information.

The IZT OTA system is a real-time Over-the-Air MIMO system. With its scalable up to 12 x 64 MIMO channels, no physical movement of the DUT or the antennas is necessary. The instantaneous bandwidth of up to 80 MHz and the advanced signal processing capabilities cover all reasonable test scenarios for sophisticated signal simulation. Each single test can be repeated as often as required.

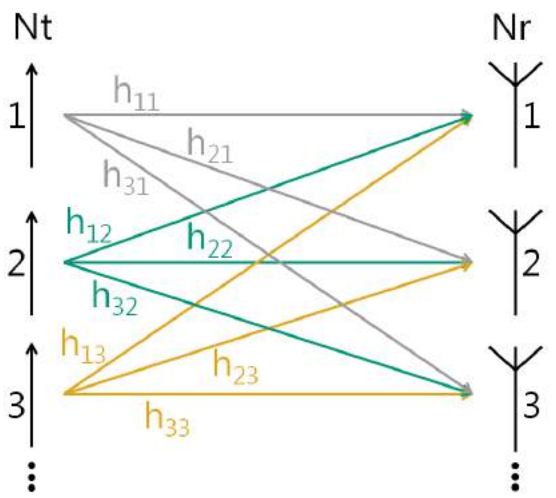

FIGURE 1: MIMO CHANNEL MODEL

FIGURE 2: MIMO 2 X 2 LABORATORY SYSTEM

Key Features

HIGHEST SIGNAL QUALITY UP TO 6 GHZ

The IZT C7000 system uses generic and flexible high-quality hardware. It is based on the proven IZT S1000 Signal Generator, the IZT R4000 Receiver family and IZT FDSP, a high-performance FPGA-based digital signal processor.

An internal calibration source ensures optimum phase and amplitude matching between the channels. The IZT OTA system has a perfect phase stability among the RF outputs. It also has an excellent long term stability. Figure 3 and 4 show the phase drift characteristics of the RF outputs.

Figure 5 shows the RF output quality at the RF output with a spurious free dynamic range of a CW signal. The signal is generated with -8 dBfs at 642.5 MHz(*CF*640 MHz). Figure 6 shows input to output delay measurements.

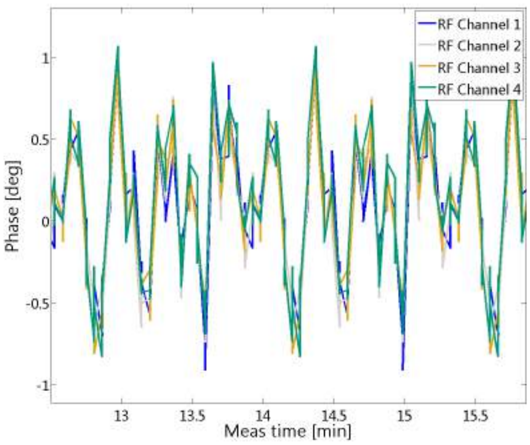

FIGURE 3: PHASE DRIFT OVER MULTIPLE RF OUTPUTS

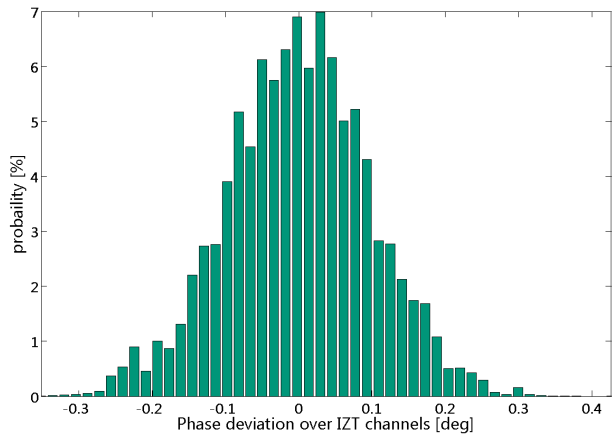

FIGURE 4: PHASE DRIFT HISTOGRAM

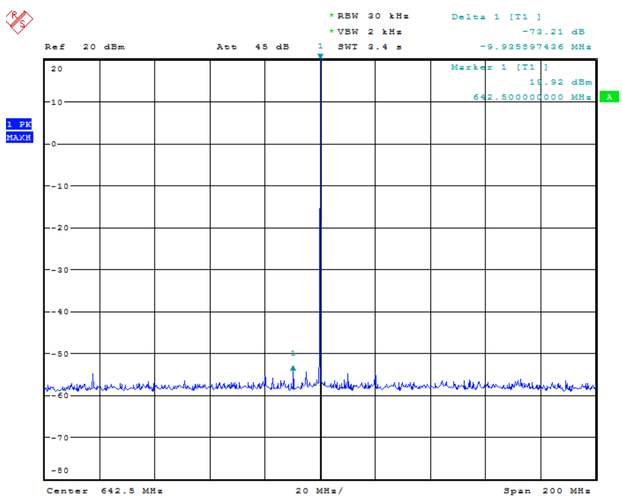

FIGURE 5: RF QUALITY SFDR

FIGURE 6: VERY LOW INPUT TO OUTPUT DELAY

SCALABLE NUMBER OF CHANNELS

The system is scalable in terms of the number of channels. Starting from a 2 x 2 MIMO configuration, the system can be expanded to a 12 x 32 MIMO configuration or even an unlimited number of output channels. All RF input channels are fully synchronous. All signals and the switching matrix are operated via optical 10G Ethernet. The 10G optical distribution ensures a minimum signal latency and lossless transmission of the digital signals.

FIGURE 7: SIGNAL ROUTING VIA 10 GBIT ETHERNET

FIGURE 8: REFERENCE CUSTOMER INSTALLATION 12 X 32

CHANNEL MODELS

The IZT C7000 supports arbitrary channel models that can ge generated with simple Matlab or Python routines. Standard channel models are Winner, 3GPP, COST and Quadriga. Other channel models can be provided on request. Channel parameters can be streamed in real-time for realistic simulations. A suitable streaming software is available and IZT will help to integrate in customer environments.

TEST SETUPS

Depending on the use-case, the IZT C7000 supports different test setups. The IZT OTA System supports three different test setups.

Conducted Testing

If the antenna can be disconnected, the IZT C7000 can stimulate non-integrated radios via an RF cable connection. Typical test cases include the testing of demodulators under multipath conditions or meshed communication network testing, for example vehicle-to-vehicle or vehicle-to-infrastructure.

Over-the-Air Wavefield Synthesis in Anechoic Environments

Wave-Field Synthesis (WFS) is a special device test method as it emulates physical wave-fields for small to mid-size test devices. It:

- can reproduce wave-fields realistically
- does not need radiation pattern measurements before the test
- drives all hardware channels towards the emulation antennas fully phase coherent

Wireless Cable (radiated two stage method RTS)

Large test objects (for example vehicles) require a lower number of input and output channels due to the Wireless Cable approach. The IZT C7000 system provides the necessary resources for wide-band compensation of the chamber characteristics and an arbitrary channel model. The “inverse calibration” of the non-anechoic chamber allows to achieve a very good channel separation between the receive and transmit path, because all artificial interferences and reflections are eliminated during the wide-band calibration.

Time-variant effects can effectivly be streamed in realtime with the 10G optical interface. This allows to generate nearly infinite simulation lengths and a very fast start of the simulation.

Operation in two stages:

- Measurement of the OTA antenna to DUT antenna port propagation channel (transfer matrix)
- Obtain wireless cables by transfer matrix inversion; embed DUT antenna pattern, apply desired propagation channel

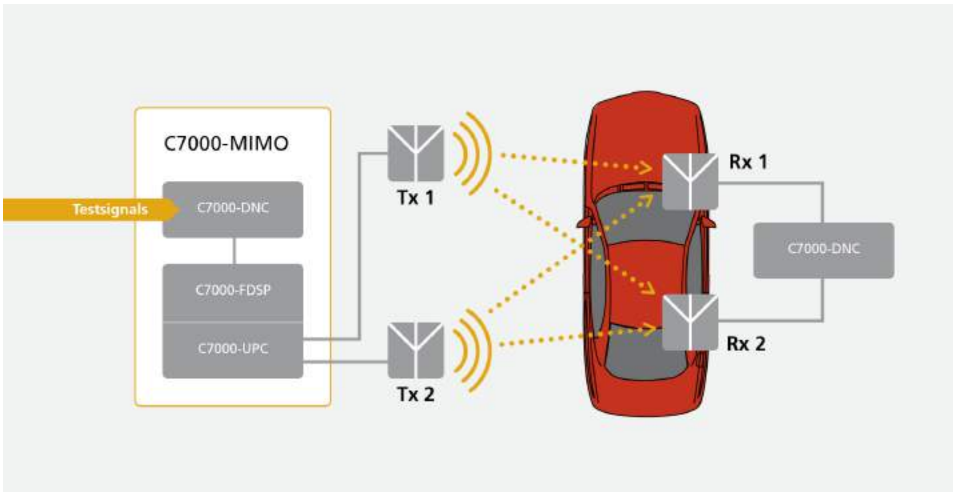

FIGURE 9: WIRELESS CABLE BLOCKDIAGRAM

FIGURE 10: WIRELESS CABLE LABORATORY SETUP

```
  % plot impulse responses
  subplot(5,2,5);
  plot(db(ifft(FreqResponse1(1).fd)),'b'); axis([1 2048 -90 30 ]);
  hold on;
  plot(db(ifft(FreqResponse2(1).fd)),'r'); axis([1 2048 -90 30 ]); hl1=legend('RF1','RF2'); set(hl1,'FontSize',6); xlabel('Bins'); ylabel('dB
  grid on;
  subplot(5,2,6);
  plot(db(ifft(FreqResponse1(2).fd)),'b'); axis([1 2048 -90 30 ]);
  hold on;
  plot(db(ifft(FreqResponse2(2).fd)),'r'); axis([1 2048 -90 30 ]); hl2=legend('RF1','RF2'); set(hl2,'FontSize',6); xlabel('Bins'); ylabel('dB
  grid on;

  % initialize H_target matrix
  H_target = [1 0; 0 1]; % TX1 => RX1
                         % TX2 => RX2

% H_target = [0 1; 1 0]; % TX1 => RX2
%                        % TX2 => RX1

  % initialize S1 and SS2
  S1=zeros(numel(WFS.settings.TxChannels),WFS.settings.Nf);
  S2=zeros(numel(WFS.settings.TxChannels),WFS.settings.Nf);

  % calc steering-vectors
  for freqidx=1:WFS.settings.Nf
    % steering-vector for InputSingal (1 an Rx ant 1, 0 an rx ant 2)
    S1(:,freqidx)=pinv(squeeze(H_chamber(:,:,freqidx)))* H_target(:,1);

    % steering-vector for InputSingal 2 (0 an Rx ant 1, 1 an rx ant 2)
    S2(:,freqidx)=pinv(squeeze(H_chamber(:,:,freqidx)))* H_target(:,2);
  end

  % normalize S parameter because of fdsp_ota irp upload
  maxValue = max(abs([S1(:); S2(:)]));

  S1 = S1./maxValue;
  S2 = S2./maxValue;

  % split to irp profiles
  Rf1Irp0 = S1(1,:);
  Rf1Irp1 = S2(1,:);
  Rf2Irp0 = S1(2,:);
  Rf2Irp1 = S2(2,:);

  % plot steeringvectors
  subplot(5,2,7);  plot(db(Rf1Irp0)); grid on; axis([1 WFS.settings.Nf -40 10]); title('S1 : RF1 (IRP0)'); xlabel('Bins'); ylabel('dB');
  subplot(5,2,8);  plot(db(Rf2Irp0)); grid on; axis([1 WFS.settings.Nf -40 10]); title('S1 : RF2 (IRP0)'); xlabel('Bins'); ylabel('dB');
  subplot(5,2,9);  plot(db(Rf1Irp1)); grid on; axis([1 WFS.settings.Nf -40 10]); title('S2 : RF1 (IRP1)'); xlabel('Bins'); ylabel('dB');
  subplot(5,2,10); plot(db(Rf2Irp1)); grid on; axis([1 WFS.settings.Nf -40 10]); title('S2 : RF2 (IRP1)'); xlabel('Bins'); ylabel('dB');
```

FIGURE 11: RADIATED “TWO STAGE METHOD” SCRIPT

APPLICATIONS

4G and 5G User Equipment Testing

The IZT C7000 enables manufacturers of devices and network equipment to perform RF performance testing of 4G and 5G base stations and multi-mode devices up to 6 GHz under phase coherent real-world complex 3D propagation channels. Due to the very low latency, realistic 4G and 5G bidirectional tests can be performed.

MANET Testing

The IZT C7000 can be configured to be used for Mobile ad-hoc network (MANET) and Mesh Radio Testing in communication network applications.

Defense organizations transit from operating traditional stationary forces to rapidly deploying forces with increasing mobility requirements. Mission-critical application fields for manufacturers and military forces include avionics, surveillance, radar or satellite systems. In consequence, the need for robust wireless communication systems for critical operations has enormously increased and powerful test solutions are required to test according equipment and systems.

GNSS Testing

In the last 15 years, GNSS evolved to an essential part in many applications of daily life. Typical applications are:

- Car navigation
- Smartphones for navigation
- Location based services
- Tracking applications
- Safety-critical applications

Nevertheless, GNSS systems are vulnerable to interferences and disturbances because of inherent low power. Examples include:

- Unintentional interferences (e.g. oscillator harmonics): CW, Multitone
- Other services within the GNSS bands: DME, TACAN in L5/E5a
- Intentional interferences such as jammers

Spoofing is an even bigger threat and it is essential to develop robust reveivers and test against:

- Robustness against spoofing
- Robustness against jamming
- In repeatable and shielded laboratory conditions
- Taking into account propagation of GNSS signals and jammers

The IZT C7000 facilitates the development of mobile end user devices, e.g. for GPS or the European Galileo system. The development and testing time can significantly be reduced.

The system can simulate a satellite flyover of one or more satellites with all realistic impairments. This includes parameters such as rain fading, Doppler shift, variable signal delay. The test parameters can be stored and the test can be reproduced as often as necessary under identical conditions. Developers are independent of actual real-world conditions such as varying weather. They can succesively improve the product and obtain immediate results from their work.

- Up to 6/12 (dual/single frequency) GNSS time variant satellites (3D emulation)
- Interferer and satellites signals subject to multipath propagation
- Applicable for any Multi Satellite System
- Useful for systems not yet in orbit

One of our customers uses the C7000 for a wave field synthesis (WFS) in an over-the-air (OTA) testbed for global navigation satellite systems (GNSS) emulation[1][2]. A specially adapted GNSS simulator from Spirent was used to provide the signals of each satellite independently and digital. The results of a measurement campaign have been descibed in a paper. [3]

[1] https://www.iis.fraunhofer.de/en/profil/standorte/forte.html
[2] https://www.iis.fraunhofer.de/en/ff/kom/automotive/forte_otainvee.html
[3] https://www.iis.fraunhofer.de/content/dam/iis/de/doc/lv/los/lokalisierung/SatNAV/PLANS2016_OTAWFS.pdf

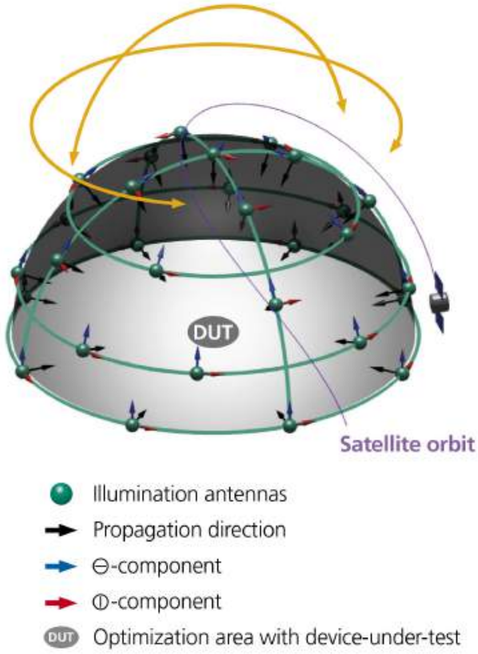

FIGURE 12: GNSS ORBIT OF SINGLE GNSS SYSTEM

Directional sensitive GNSS receiver testing for L1 / E1

A basic system can solve the task of stimulating a 4+1 antenna system for directional sensitive testing of zeropoint-controlled GNSS receivers.

- Software GIPSIE (TM) for generating GNSS signals L1 / E1.
- two exactly time synchronized IZT S1000 signal generators, each with two RF outputs and supplied with data via a common server

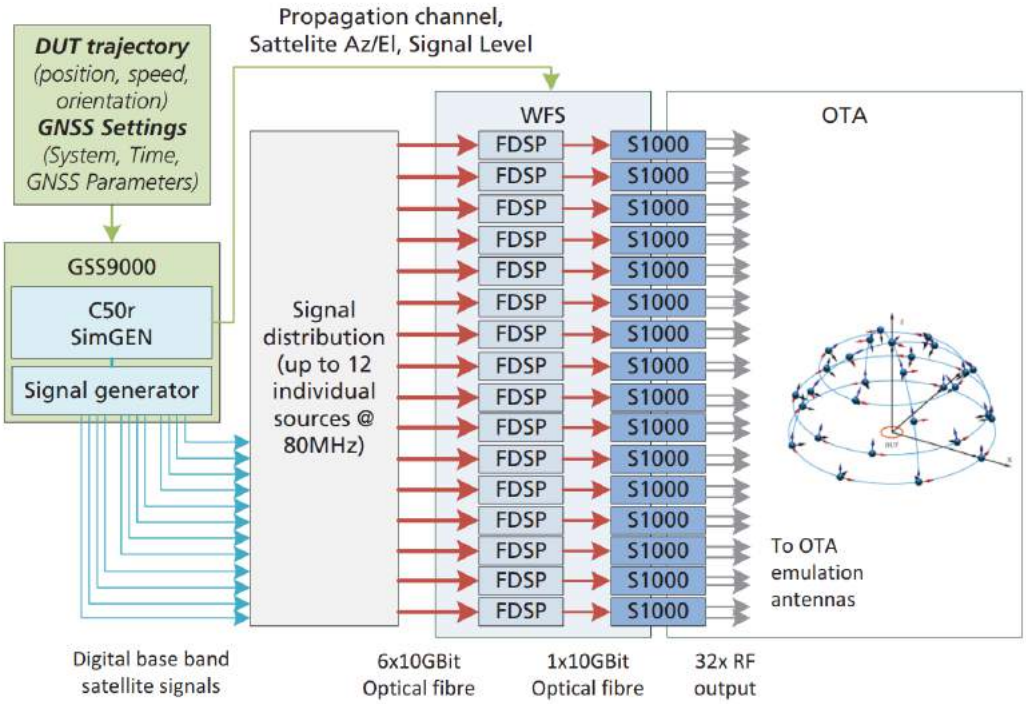

FIGURE 13: CUSTOMER INSTALLATION OF GNSS OVER WFS

Figure 14 shows the basic configuration for stimulating the antennas (4 + 1) of an exemplary "Measurement Chamber" for GNSS receiver tests. The GNSS Simulator software generates the individual satellite signals and sums them up according to the relative orientation of the Device Under Test (DUT) to the transmit antennas. The satellite signals whose direction of incidence on the DUT corresponds to the quadrant covered by the respective transmitting antenna, are already summed in the software and stored as an IQ file on the central server. From there, the two S1000 signal generators are supplied with the data and generate one RF signal per transmit antenna. This is routed to the respective antenna and emitted. An additional signal generator may be used as a non-synchronized jammer on the fifth antenna.

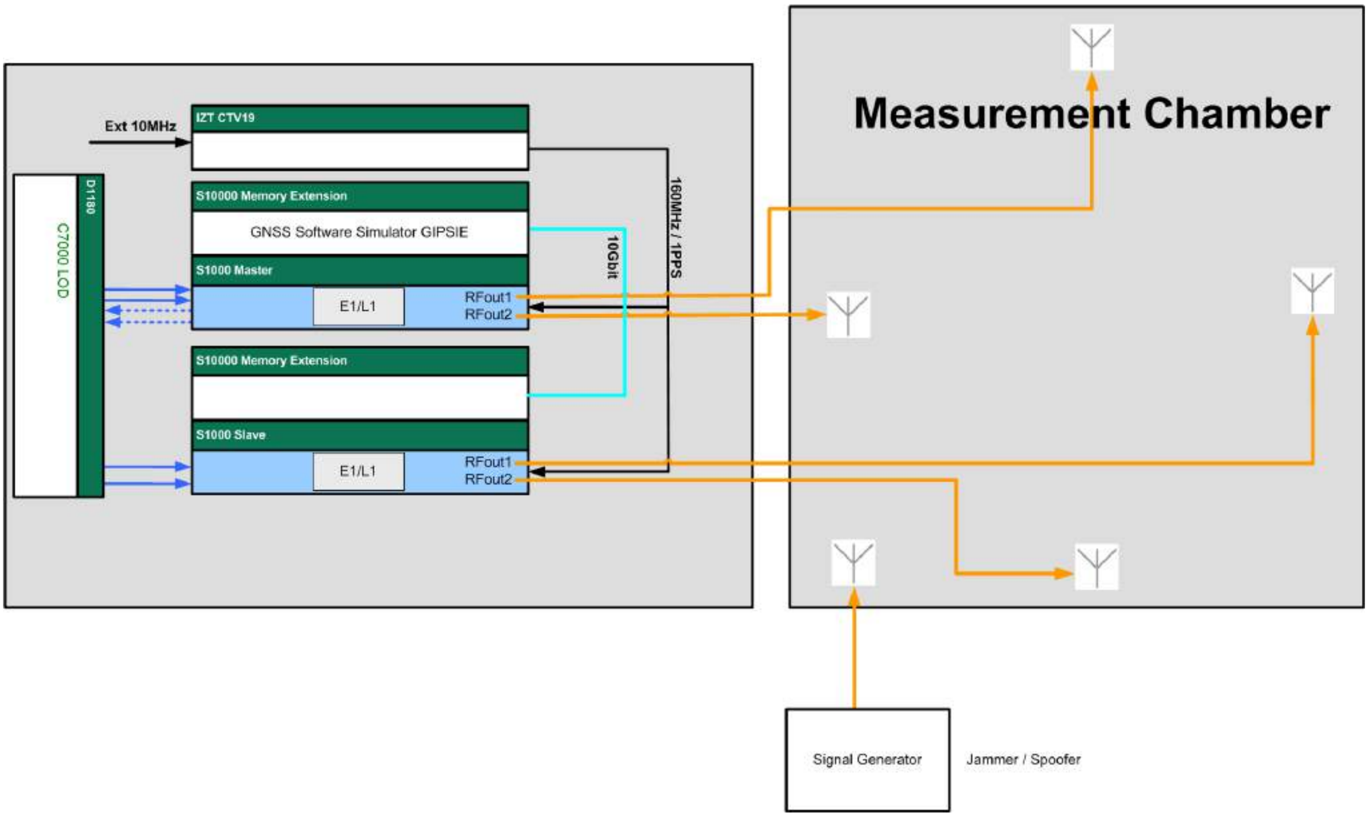

FIGURE 14: BLOCKDIAGRAM 4+1 L1/E1 ANTENNA SYSTEM

Future-proof concept for GNSS receiver testing

By additional IZT S1000 signal generators, the system can easily be upgraded to more than four transmit antennas as shown in the 14. Additional synchronization signals are already provided by the basic system and the system parameters can be easily adjusted so that it takes into account the reduced solid angles.

- Software GIPSIE (TM) for generating GNSS signals L1 / E1 and L5 / E5.
- four exactly time synchronized IZT S1000 signal generators, each with two RF outputs and supplied with data via a common server
- synchronous and asynchronous Jamming and Spoofing signal from 5th antenna

The basic configuration can be supplemented by two further synchronous signal generators. In the same way, four RF signals with content L5 / E5 are provided, which are exactly synchronous with the L1 / E1 signals. Passive combiners join the two frequency bands per antenna at the output of the IZT S1000. All signal generators start exactly synchronous in time. If required, a time offset can be set for each sum signal and each antenna.

If an asynchronous jamming / spoofing signal is required for the fifth antenna, which also contains L5 / E5 in addition to L1 / E1, IZT offers an additional signal generator S1000 for this purpose. This allows both synchronous and asynchronous GNSS spoofing signals to be generated. Due to the enormous flexibility of the IZT S1000, it is possible to import other interference signals, which could also have been recorded in the real environment by means of an IZT R3000.

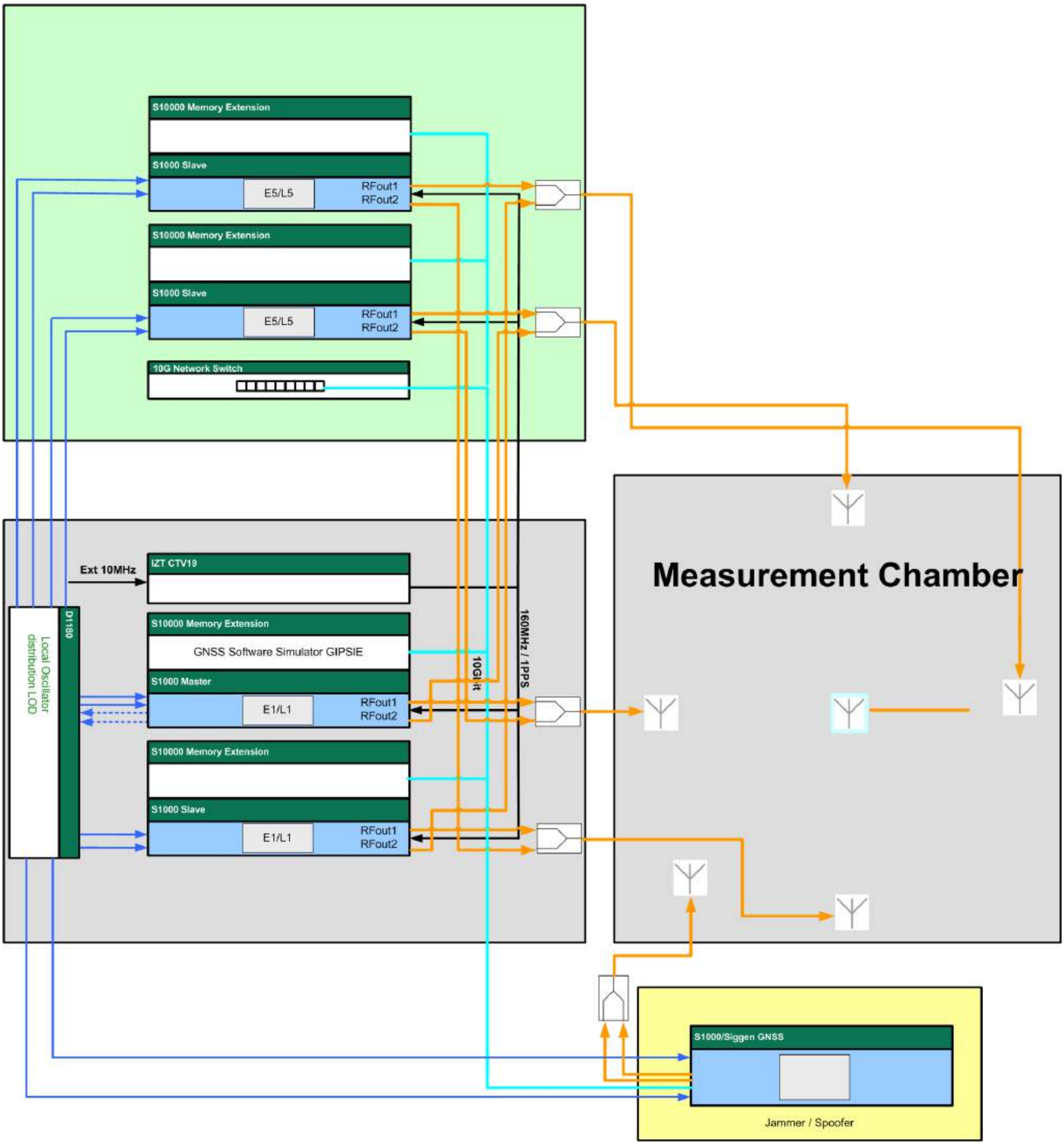

FIGURE 15: BLOCKDIAGRAM 4+1 L1/E1 L5/E5 ANTENNA SYSTEM

OPERATION

Matlab Interface

IZT provides a Matlab interface to control the BPM and HPM Modes of the IZT C7000. All available RF inputs and RF outputs can easily be routed and superimposed to the available RF outputs.

BPM is the Base Performance Mode of the C7000 and works as a MIMO multipath fading simulator with adjustable routing resource among input and output channels. The BPM Fading Simulator allows modeling reflections of the signal for terrain, fixed and moving objects. It supports up to 144 propagation paths (taps) with a variable delay between 0 and 100 µs on top of the set link delay. Each propagation path can be processed with an individual Doppler with a maximum Doppler frequency of ±150 kHz. There are 144 delay paths per antenna output. Each delay path has a delay change profile and a fading profile.

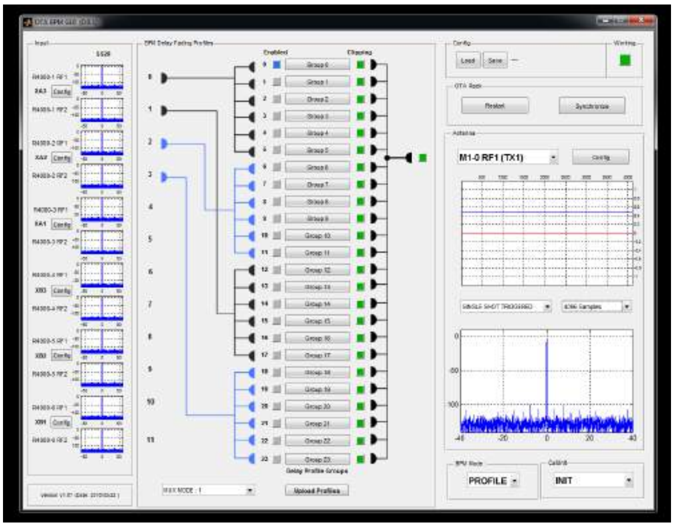

FIGURE 16: BPM GUI FOR CONFIGURING SWITCH MATRIX

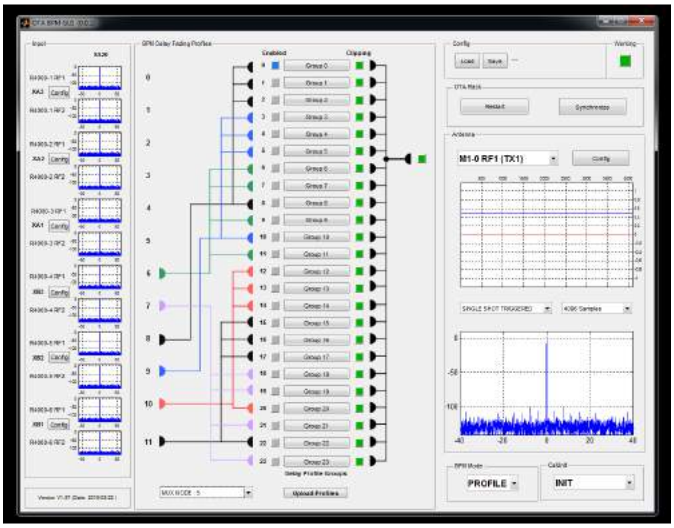

FIGURE 17: BPM GUI FOR EASY RECONFIGURING SWITCH MATRIX

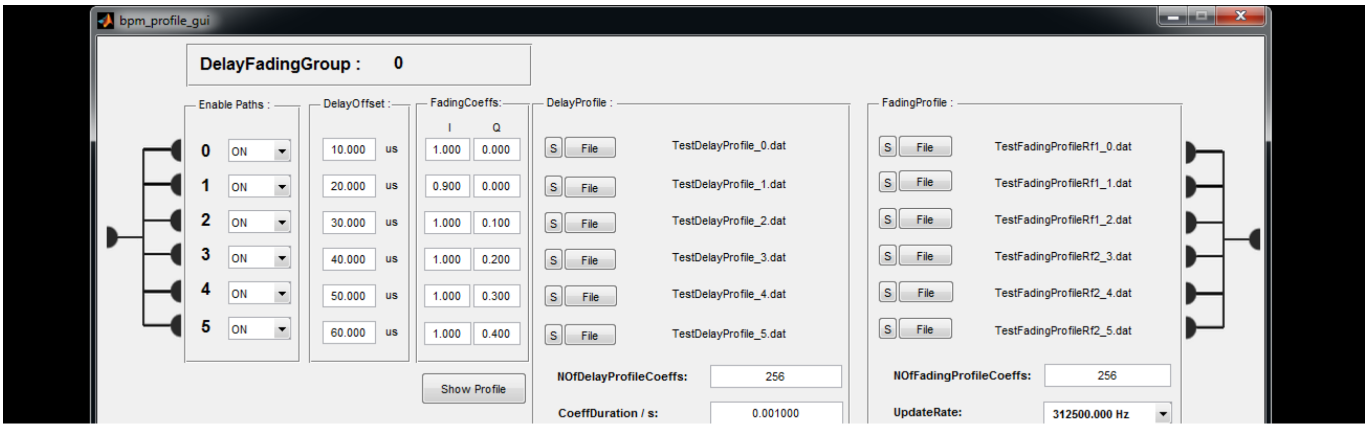

FIGURE 18: BPM GUI FOR CONFIGURING DELAY AND FADING

HPM is the High Performance Mode of the C7000 and allows to load and stream complex impulse response profiles (CIR). These CIR profiles can be superimposed on all channels. A wide range of parameters for the fully synchronous channels can be controlled.

The HPM mode can be controlled from a matlab GUI. It also allows to configure the CIR Profiles and check the input and output spectrum.

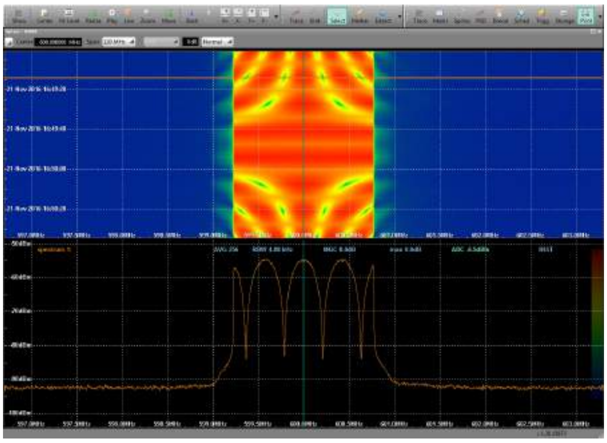

FIGURE 19: MOVING DELAY SUPERIMPOSED ON TWO CHANNELS

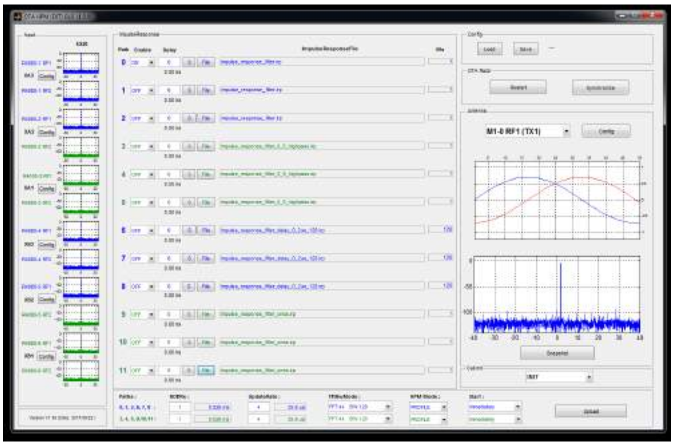

FIGURE 20: HPM GUI 1

HPM Features	IZT C7000
Phase	all time-variant impulse responses are fully synchronous and configurable in starttime
Simulation start/stop	the time variant profiles can be paused and continued
CIR Speed	impulse response speed can be configured
CIR Updaterate	update rate for impuls responses can be configured in a resolution of 25.6 µs

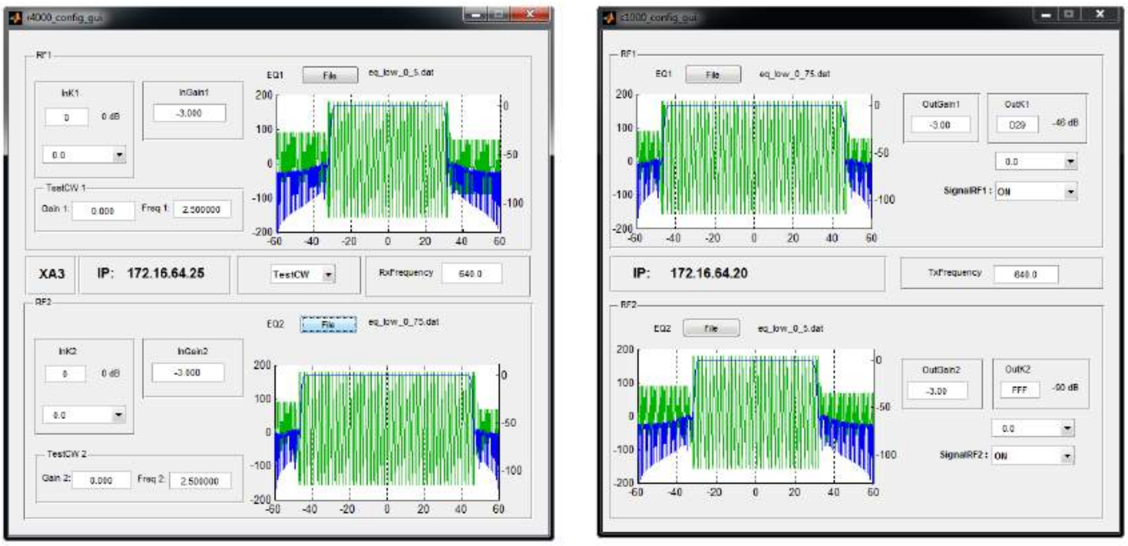

FIGURE 21: EQUALIZER CONFIGURATION

Remote Interface

The IZT C7000 can be integrated in automated test setups. All parameters can be accessed via a SCPI like interface language. The remote interface is well documented and easy to implement in Matlab^{TM}, Octave or Phyton.

```
  % turn off r4000_ota test signal path
  McpCommandHdlr(hR4k, 'SET Ss10Mux12=0'); 
  
   % generate test arb signal
  fprintf('Generate test arb signal \n');
  MakeArbSignal(szArbFile, 0, 0.0, 0);

  % set mux to arb
  fprintf('Set mux to arb \n');
  SetMuxMode(szS1000Ip, 'ss90_1', 'ARB');
  SetMuxMode(szS1000Ip, 'ss90_2', 'ARB');

  % upload to snapshot arb
  fprintf('Upload ss90_1/2 arb to s1000 (%s) \n', szS1000Ip);
  UploadArb(szS1000Ip, 'ss90_1', szArbFile);
  UploadArb(szS1000Ip, 'ss90_2', szArbFile);

  % configure s1000 hf output
  fprintf('Configure S1000 HF \n');
  McpCommand(szS1000Ip, 'SET OutGain1=-3.00');
  McpCommand(szS1000Ip, 'SET OutGain2=-3.00');

  McpCommand(szS1000Ip, 'SET OutK1=0xc000');
  McpCommand(szS1000Ip, 'SET OutK2=0xc000');

  McpCommand(szS1000Ip, 'SET SignalRF1="on"');
  McpCommand(szS1000Ip, 'SET SignalRF2="on"'); 
    
  fprintf('Configure R4000 \n');
  UploadEQFilter(szR4000Ip, 'RF1', sprintf('%seq_bypass_filter.dat', szEqPath));
  UploadEQFilter(szR4000Ip, 'RF2', sprintf('%seq_bypass_filter.dat', szEqPath));
  
  McpCommand(szR4000Ip, 'SET InGain1=-3.00');
  McpCommand(szR4000Ip, 'SET InGain2=-3.00');
```

FIGURE 22: REMOTE OPERATION FROM SCRIPTS

Specifications

Performance Specification	IZT C7000
RF input frequency	300 MHz to 3000 MHz, 30 MHz to 6000 MHz (optional)
RF output frequency	300 MHz to 3000 MHz, 30 MHz to 6000 MHz (optional)
Number of RF inputs	2 to 12 (fully phase synchronous)
Number of RF outputs	2 to 64 (fully phase synchronous)
RF output Amplitude Imbalance	±0.5 dB
RF output Phase Imbalance	30 ps
Amplitude response	±0.5 dB m (typical)
Bandwidth	max 80 MHz
RF input level	10 dB m (max)
RF output level	10 dB m (max)
Carrier-Supression in-band	>70 dB
Carrier-Supression out-of-band	>60 dB
Dynamic Range, two subcarriers	>60 dB
Min. phase step and accuracy	0.1° @3 GHz
Min. step and accuracy in spatial channel simulation at 3 GHz	30 ps
Update data rate of C and T	312.5 kHz
Input VSWR	< 2 : 1
Output VSWR	< 2 : 1
Impedance	50 Ω
Fading paths	288 (each 80 MHz Bandwidth)
Delay paths	288 (each 80 MHz Bandwidth)
Delay range	0 μs to 100 μs
Delay resolution	3.15 ps
Delay change rate	±15 ps/s .. ±1/32 s/s
Delay profile resolution	100 ns
HPM profile length	5 μs - 26.8 s
HPM Impulse response length - 4096 FFT	19.2 μs
HPM Impulse response length - 512 FFT	2.4 μs
Min. input-to-output latency - BPM	9 μs
Min. input-to-output latency - HPM 4096 FFT	26 μs
Min. input-to-output latency - HPM 512 FFT	12 μs

Environmental Specification	IZT C7000
Nominal operating temperature	18° to 25°
Max operating temperature	0° to 40°
Storage temperature	−10° to 60°
Humidity	10 % to 90 % non condensing
Altitude	1000 m, AMSL
Power supply	100 V to 240 V (AC)
Power supply frequency	50 Hz to 60 Hz

Ordering Guide

Hardware Options	Description
IZT C7000-MIMO	2 x 2 MIMO Matrix. This is the basis configuration for a two by two MIMO System which can be scaled in the steps of 2 x 2. Consists of - IZT C7000-DNC - IZT C7000-FDSP - IZT C7000-UPC When using a MIMO configuration larger than 2 x 2 additional options C7000-LSW, C7000-LSW-ADD, C7000-LOD-ADD, C7000-CSO are needed. The maximum input channels are 12. The number of output channels can be scaled up to 64.
IZT C7000-DNC	Downconverter unit and preprocessing unit for 2 independent RF inputs - 2 independent - phase coherent high performance RF downconversion stages - A/D conversion - Equalization and propagation to fiber optical outputs
IZT C7000-DNC-6G	6 GHz upgrade for IZT C7000-DNC Upgrade of the 2 independent - phase coherent RF inputs from 3GHz to 6GHz
IZT C7000-FDSP	High Speed FPGA Based Digital Signal Processor - Up to 12 Channel input on 6 * 10G optical port - Up to 2 Channel output on 1 * 10G optical port - One 10G optical port for streaming 12 HPM profiles
IZT C7000-LSW	Extreme Low Latency 10 G Lan Switch - A high performance low latency (<250ns) switch with 24 (48) optical 10 G interfaces - The multichannel "RF switching" and distribution is done with 10G optical interfaces - 1RU and dual redundant color-coded power supplies
IZT C7000-LSW-ADD	10G Periphery 2 x 2 MIMO Consists of 10 G SFP+ modules and 10 G fiber glas cable set for a 2 x 2 MIMO system
IZT C7000-UPC	Upconverter unit and preprocessing unit for 2 independent RF outputs - 2 independent - phase coherent high performance RF upconversion stages - D/A conversion - propagation from fiber optical inputs including equalization
IZT C7000-UPC-6G	6 GHz Upgrade for IZT C7000-UPC - Upgrade of the 2 independent - phase coherent RF outputs from 3GHz to 6GHz
IZT C7000-LOD	Central Local Oscillator Distribution - A central local oscillator distribution for up to 8 units of C7000-UPC, C7000-DNC - They can be cascaded to increase the number of channels.
IZT C7000-LOD-ADD	LOD Periphery 2 x 2 MIMO - RF cableset to connect IZT C7000-DNC, -FDSP and -UPC with IZT C7000-LOD - All RF cables are measured and qualified to work with the IZT MIMO setup
IZT C7000-CSO	Central Synchronization Unit A central synchronization unit that provides trigger and clock signals to all hardware units. This ensures sample synchronized data processing and coherent operation of all inputs and outputs

Hardware Options	Description
IZT C7000-SVR	Server - The control server hosts the tools to synchronize the complete hardware - It allows remote access to all units in the system and it can host Matlab(tm) [4]
IZT C7000-SVR-10G	Upgrade Server 10G addon for the IZT C7000-SRV. It includes SFP+ Module and Dual 10G Ethernet interfaces
IZT C7000-DSPL	Rack Mount Display An integrated high performance, 19 inch rackmount display and keyboard unit. The 17" TFT Wide LCD display provides a resolution of 1920 x 1200 pixels
IZT C7000-RCK	Rack IZT offers all kinds of rack configurations for a 2x2 MIMO System up to a 12x32 MIMO System. A cooling system can be integrated on request as well

[4] Matlab(tm)which is used as the control interface

Software Options	Description
IZT C7000-101	BPM software and firmware for spacial channel mode Up to 144 discrete paths at 80MHz bandwidth per channel can be simulated and configured individually [5]
IZT C7000-201	HPM software and firmware for measured and precalculated time variant channel The configurable FFT modes are 4096 and 512 Block size (Option IZT C7000-215) [6]
IZT C7000-210	HPM Streaming Functionality for C7000-201 The time variant Complex Impulse Profiles - Can be streamed via two 10 G optical LAN Port for all available paths - Can loaded to the profile memory via two 10G optical LAN ports
IZT C7000-215	Enhanced HPM FFT modes for C7000-201 HPM Simulation Mode - The configurable FFT Modes are enhanced by 1024 and 2048 block size - The additional FFT sizes allow a reduced processing delay in fine granularity
IZT C7000-216	Reduced Bandwidth profiles for C7000-201 HPM Simulation Mode - The streaming bandwidth for the Complex Impulse Profiles is 120 MHz or 30 MHz - The simulation length of the Complex Impulse Profiles is enhanced by factor 4
IZT C7000-220	Matlab Functions BPM - Matlab Functions to control the MIMO setup - Documentation and interface description for BPM functionality
IZT C7000-221	Matlab Functions HPM - Matlab Functions to control the complete setup - Documentation and interface description for HPM functionality

[5] The spacial channel mode is focused on realisation of spacial models developed by standardisation groups or networks such as COST 273 and WINNER (SCME)

[6] In contrast to the BPM Mode where the signal processing is done in the time domain the HPM mode can be used where the signal processing is performed in the frequency domain. This allows to use "complex frequency responses" with an almost infinite number of discrete paths at 80MHz bandwidth per channel.

Wireless Cable Config	Description
IZT C7000-MIMO	2 x 2 MIMO Matrix This is the basis configuration to use a 2 x 2 MIMO Matrix and can be scaled.
IZT C7000-LSW	Extreme Low Latency 10G Lan Switch
IZT C7000-LSW-ADD	10 G Periphery 2 x 2 MIMO
IZT C7000-CSO	Central Synchronization Unit
IZT C7000-LOD	Central Local Oscillator Distribution
IZT C7000-LOD-ADD	LOD Periphery 2 x 2 MIMO
IZT C7000-RCK	Rack IZT offers all kinds of Rack configurations for a 2 x 2 MIMO System up to a 12 x 32 MIMO System. A cooling system can be integrated on request as well.
IZT C7000-201	HPM software and firmware for measured and precalculated time variant channel
IZT C7000-210	HPM Streaming Functionality for C7000-201
IZT C7000-221	Matlab Functions HPM

Other configurations on request.

RF MIMO Emulator
IZT C7000

Product Information

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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