

# TS-960EX-5G

## MMWAVE / 5G PRODUCTION TEST SYSTEM

- mmWave Production Test and Characterization
- DC, Parametric and RF Test Capabilities
- PXIe and LXI RF Instrument Options
- Supports Up to 24 Ports for Multi-site Testing
- 50 GHz Signal Delivery to the Device Under Test
- Comprehensive ICEasy Semiconductor Test Suite
- Intuitive ATEasy® - Integrated Test Executive / Development Environment



## DESCRIPTION

The TS-960EX-5G mmWave test system delivers proven performance up to 50 GHz. The system incorporates laboratory grade RF instrumentation with a high performance receiver interface for multi-site production test or device characterization of mmWave devices. In addition, MTS offers a full suite of digital and parametric test capabilities as well as SPI/I2C interface support for controlling / monitoring the device under test (DUT).

The base system includes a PXIe chassis with 64 dynamic digital I/O channels, 64 static digital I/O channels, a user programmable power supply, a system self-test and fixture. Additional PXIe slots are available for adding RF instrumentation, more digital or analog test resources as needed. Optionally, the system can be configured with LXI RF instrumentation for supporting a range of mmWave test needs.

System software includes DIOEasy for digital waveform editing / display, ICEasy for device test development, and Marvin Test Solutions' ATEasy which provides an integrated and complete test executive and test development environment, allowing users to quickly develop and easily maintain test applications.

For production test applications requiring integration with an automated handler, the TS-960EX-5G is available with an inTEST manipulator which provides precise positioning of the test head and the flexibility to interface to automated probers and device handlers.

The TS-960EX-5G's device interface board (DIB) / receiver interface is designed to be compatible with virtually any device handler.

## FEATURES

The TS-96EX-5G can be configured with up to 256 dynamic digital channels. The base TS-960EX-5G platform uses the [GX5295](#) - a 3U PXI, 32 channel, 100 MHz digital I/O card with per channel parametric measurement units (PMUs).

A wide range of digital and analog instrument options can easily be incorporated into the TS-960EX-5G for supporting both functional and DC parametric test capabilities. RF instrumentation options include the Keysight M9807 / M9808 PXIe VNA or the Rohde and Schwarz ZNBT40 LXI instruments. The system is also available with digital vector conversion tools that support ASCII, WGL, STIL, VCD, eVCD and ATP vector formats.

## TS-960EX-5G CORE SYSTEM CONFIGURATION

The TS-960EX-5G core system includes the following test resources and capabilities:

- ICEasy test software development tools
- ATEasy test executive and programming environment
- [GX3104](#) SMU with 4 channels each (expandable to 16)
- GtDIO6xEasy digital waveform editing and display tools
- Embedded i7, quad core controller with Windows®10 OS
- (64) 100 MHz digital channels with per pin PMU (expandable to 256)
- (64) static digital channels (expandable to 128), which can be used for fixture ID, UUT static control or DUT board relay control
- 21-slot, high-power PXI Express chassis
- Pogo pin, blind-mate receiver interface with 24, 50 GHz RF ports



# TS-960EX-5G

## SOFTWARE

The test system is supplied with ATEasy and all instrument drivers, virtual instrument panels, and a system self-test as well as ICEasy test software tools which facilitates device test development and characterization.

ATEasy supports a wide variety of Windows based APIs including, LabVIEW, CVI, Microsoft® and Borland® C/C++, Microsoft Visual Basic®, and Borland Delphi.

## APPLICATIONS

- mmWave device / module test and characterization
- Pilot production and focused production test
- Automated failure analysis and test

## SPECIFICATIONS

MMWAVE TESTS	
Tx / Rx Tests	S-Parameter Measurement (Insertion / Return Loss) S12, S21, S11, S22
TS-960E PXIE CHASSIS	
Number of Slots	1 controller, 8 PXI-1, 8 Hybrid, 4 PXIe
System CPU (Embedded)	Intel Core i7, 2.4 GHz, single slot controller 4x4 PCIe bus configuration 8 GB of RAM
System Hard Disk	320 GB (min)
Cooling	(4) 100 CFM fans for system cooling. Integrated temperature monitoring via an on-board microcontroller with audible and software notification when preset temperature limits are exceeded. Fan speed control and monitoring is automatic and can be controlled / monitored via the GxChassis software.
PXI Clock	Integrated 10 MHz PXI clock with auto-detect function. Presence of an external 10 MHz PXI clock will disable the internal clock. PXI clock is distributed to all peripheral slots. Optional external clock via slot 2
Temperature Monitoring	Per slot monitoring, 1 reading/sec/slot 4 second moving average value User selectable alarm criteria: <ul style="list-style-type: none"> <li>• Maximum slot temperature</li> <li>• Average slot temperature</li> </ul> Accuracy: $\pm 2$ °C Default warning and shutdown limits: +50 °C & +70 °C Warning and shutdown limits programmable via software driver Status: Query via software driver and audible alarm for a warning limit condition
Power Supply Monitoring	Monitored voltages: 3.3, 5, +12, -12, VIO value Accuracy: $\pm 2\%$ of reading
PXI Triggers	Slots: 2 – 21 Number: 8 per segment Software controlled segment mapping supports: <ul style="list-style-type: none"> <li>• Isolate a trigger line within a segment</li> <li>• Map a trigger line left to right</li> <li>• Map a trigger line right to left</li> </ul>
PXI Clock and Synchronization Resources	Integrated 10 and 100 MHz clock with an auto-detect function. Presence of an external 10 MHz PXI clock will synchronize the 100 MHz clock to the external 10 MHz source 100 MHz clock accuracy: $\pm 30$ ppm Synchronization signals: SYNC100 & SYNC_CTRL

# TS-960EX-5G

External 10 MHz Clock Input	An external 10 MHz clock source (TTL level) can be provided via a rear panel BNC or via a PXI Express System Timing Controller
10 MHz Clock Output	10 MHz output is available via a rear panel BNC connector, TTL compatible level
PXIe System Power	1600 W
PXIe Chassis Input AC Power	120 VAC, $\pm 15\%$ ; 20 A max (PFC) 240 VAC, $\pm 10\%$ ; 10 A max (PFC) 47 Hz to 440 Hz
<b>DYNAMIC DIGITAL I/O SUBSYSTEM</b>	
Number of Digital I/O and PMU Channels	64 (base configuration)
Maximum Channel Configuration	256 channels
Maximum Clock Rate	100 MHz
Digital Test Modes	Stimulus / response Real-time compare
Vector Memory	64 Mb / channel
Real Time Compare Record Memory	1,024 (records data and program steps)
Drive Voltage Range	-2 V to +7 V, Drive Hi & Drive Lo, maximum swing is 8 V
Sense Voltage Range	-2 V to +7 V, Sense Hi & Sense Lo
Programmable Pull-Up / Pull-Down Current Source / Sink	$\pm 24$ mA, programmable on a per channel basis, V commute range: -2 V to +7 V, programmable on a per channel basis
High and Low Commutation Voltage Range	VCLo: -2 V to +5 V VCHI: 0 V to +7 V
Voltage Clamp Accuracy	$\pm 100$ mV

<b>Parametric Measurement (PMU)</b>	
Number of Parametric Measurement Units	32, one per channel 4, one per auxiliary channel (for timing /control & static I/O functions)
Configurations	Force Voltage/Measure Current (FVMI) Force Current/Measure Voltage (FIMV) Force Voltage/Measure Voltage (FVMV) Force Current/Measure Current (FIMI)
Force Voltage Range	-1.5 V to +7 V
Force Voltage Accuracy	$\pm 20$ mV
Force Voltage Resolution	16 bits
Force Current Ranges	$\pm 32$ mA, $\pm 8$ mA, $\pm 2$ mA, $\pm 512$ uA, $\pm 128$ uA, $\pm 32$ uA, $\pm 8$ uA, $\pm 2$ uA FS
Force Current Accuracy: Compliance Range:	$\pm 120$ uA, 32 mA range $\pm 40$ uA, 8 mA range $\pm 5$ uA, 2 mA range $\pm 1.2$ uA, 512 uA range
+1.75 V to +7 V @ 32 mA -1.5 V to +7 V @ no load	$\pm 600$ nA, 128 uA range $\pm 160$ nA, 32 uA range $\pm 80$ nA, 8 uA range $\pm 20$ nA, 2 uA range
Current Measurement Accuracy (60 Measurements / Sec) Compliance Range:	$\pm 120$ uA, 32 mA range $\pm 40$ uA, 8 mA range $\pm 5$ uA, 2 mA range $\pm 1.2$ uA, 512 uA range $\pm 600$ nA, 128 uA range $\pm 160$ nA, 32 uA range $\pm 80$ nA, 8 uA range $\pm 20$ nA, 2 uA range
+1.75 V to +7 V @ 32 mA -1.5 V to +7 V @ no load	
Measure Voltage Range	-2 V to +7 V
Measure Voltage Accuracy	$\pm 1$ mV (measurement rate < 200 measurements / sec)
<b>STATIC DIGITAL INSTRUMENT</b>	
Number of Static Digital I/O Channels	64, expandable to 128 48 Input / Output (programmable I/O in groups of eight) 16 inputs for fixture ID
Logic Levels	LVTTTL compatible
Source / Sink Current	24 mA (max)

# TS-960EX-5G

USER POWER	
Source / Measure Unit (SMU)	4-channel, 4 quadrant operation, isolated outputs, common ground, with remote sense
Programmable Voltage Range	0 to $\pm 20$ V
Output Voltage Accuracy	$\pm 0.05\%$ of programmed value + 2 mV
Output Noise	<20 mV p-p, 20 MHz BW, full load
Output Current	$\pm 2.5$ $\mu$ A to $\pm 250$ mA in decade ranges, any one channel can supply up to 1A
Output Current Accuracy	$\pm 0.05\%$ of programmed value + 0.05% of FS
Voltage Measurement Accuracy	$\pm 0.03\%$ of programmed value + 2 mV
Current Measurement Accuracy	Ranges: 2.5 $\mu$ A to 250 mA in decades Accuracy: $\pm 0.05\%$ of reading + 0.05% of FS range
Measurement Resolution	Programmable, 18 to 24 bits
RF VECTOR NETWORK ANALYZER OPTIONS	
Rohde and Schwarz	ZNBT40, 24 port, 40 GHz, LXI
Keysight Technologies	M9807, 2 port, 40 GHz, PXIe M9808A, 2 port, 53 GHz, PXIe
TS-960EX-5G RECEIVER INTERFACE	
Type	Modular, pogo-pin and blind-mate RF interface
Interfaces	<ul style="list-style-type: none"> <li>• (4) 128 pin digital blocks</li> <li>• (2) power blocks (8 DPS)</li> <li>• 24 blind mate RF ports (Weinschel Planar Blind-Mate, 2.92mm (SMK))</li> </ul>

ENVIRONMENTAL / PHYSICAL	
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +60 °C
Relative Humidity (Non-Condensing)	90%
Altitude	30,000 ft
Weight	250 lbs, core system
Overall Size	24" D x 39" W x 35" H
Manipulator Option	inTEST 930591 FTM-MVTS900E-5G

Note: Specifications are subject to change without notice

## ORDERING INFORMATION

<b>TS-960EX-5G</b>	mmWave / 5G Semiconductor Test System, 64 Dynamic Digital I/O Channels with per Pin PMU
OPTION	
<b>TS-900-OPT64</b>	64 Additional Dynamic Channels for use in TS-900