

# TS-900e-5G SERIES



## 5G MMWAVE SEMICONDUCTOR PRODUCTION TEST SYSTEMS

- 53 GHz VNA RF test performance
- 5G mmWave production test and characterization
- Up to 20 independent RF VNA ports for parallel, multi-site test
- Compatible receiver interface for wafer probes and device handlers
- DC, Parametric and RF test capabilities
- ATEasy® Integrated Test Executive / Development Environment
- ICEasy Semiconductor Test Suite



## DESCRIPTION

GENASYS Semiconductor 5G mmWave test systems deliver 53 GHz VNA RF test capabilities to the device under test (DUT). Capable of supporting up to 20 independent VNA ports, these systems are ideal for applications requiring parallel, multi-site test capabilities.

Keysight Technologies modular vector network analyzers (VNAs) are at the heart of the TS-900e-5G, delivering exceptional RF measurement performance and repeatability. They deliver unmatched phase and amplitude measurement accuracy across the entire band of interest, eliminating test band gaps found with some instruments, a critical requirement for comprehensive testing of mmWave semiconductor devices.

The Keysight M9807A (44 GHz) and M9808A (53 GHz) PXIe VNA instruments are the ideal VNA solution delivering modularity, speed and accuracy in a true multi-port instrument, sharing the same measurement science as PNA-X instrumentation. Instrumentation based on a common measurement science simplifies the transition from the laboratory to the production floor, and the modular architecture provides a clearly defined path to upgrade both channel count and frequency.

Complete system-level calibration is implemented to remove signal path errors, including interconnect points such as cables, connectors, blind mate interfaces, and load board error sources such as board traces and sockets, from the test results. A multi-step process to isolate the device under test (DUT) utilizes the industry standard practice of fixture de-embedding with verification coupons. Fixture de-embedding is the most accurate calibration approach, but other methods such as Automatic Fixture Removal (AFR) are also available to extract S-parameters from an open fixture.

Ideally suited for any production environment, the high performance receiver interface supports both packaged or wafer test and characterization of mmWave semiconductor devices. The receiver interface is compatible with the Opus 3 and TEL probe stations, as well as the Seiko Epson E8040 and E8080 device handlers. Reid-Ashman OM-1069 and inTest manipulators are also supported.



TS-900e-5G Test System with manipulator

MANUFACTURING



# TS-900e-5G SERIES



Compact footprint, reduced power consumption and standard air cooling further contribute to the overall lower cost of ownership and reduced carbon footprint of these test systems.

Test system startup and commissioning is significantly reduced, a critical concern when transitioning to outsourced semiconductor assembly and test (OSAT) facilities. Typical installation and start-up time, including execution of complete system level self-test, is typically accomplished in less than one hour.

## FEATURES

The base system includes Keysight VNA instrumentation, dynamic and static digital I/O, multi-channel SMU power supply, and system self-test with fixture. Additional expansion slots are also available.

The core system components include the following test resources and functionality:

- VNA Instrumentation (Keysight M9807A / M9808A)
- [GX3104](#) 4-Channel SMU
- [GX5295](#) 64-Channel Dynamic Digital I/O with per pin PMU
- [GX5733](#) 64-Channel Static Digital I/O
- [GX7200](#) 21-Slot, high-power PXI Express chassis
- RF pogo-pin blind-mate receiver interface
- Embedded i7, quad core controller with Windows®10 OS
- ATEasy test executive and programming environment
- DIOEasy digital waveform editing and display tools
- ICEasy test software development tools

## CHASSIS CONTROLLER

The TS-900e-5G Series features the new GX7950 mini-Computer / Thunderbolt Controller Series (also available on GX7201 and GX7206). This state-of-the-art mini-PC delivers exceptional performance and flexibility with rear panel access to all peripheral interface connections, as well as access for maintenance and upgrades.

## SOFTWARE

The test system is supplied with ATEasy and all instrument drivers, virtual instrument panels, and a system self-test. optional in system calibration, as well as ICEasy test software tools which facilitates device test development and characterization such as I-V curve and Shmoo plot tools for analyzing device DC and AC characteristics..

SemiEasy - a production user interface is also provided supporting interface to Handlers, Binning, STDF file generation, Multi-Sockets/DUTs Parallel testing, and more.

[ATEasy®](#) Test Executive and Software Development Studio is a comprehensive software development environment featuring a customizable test executive for execution, sequencing, fault analysis and debugging. It is pre-configured with all required instrument drivers, virtual instrument panels, and system selftest to simply startup and software development activities.

## APPLICATIONS

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

# TS-900e-5G SERIES



## SPECIFICATIONS

MMWAVE TESTS	
Tx / Rx Tests	S-Parameter Measurement (Insertion / Return Loss) S12, S21, S11, S22
TS-900E-5G SERIES 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: $\pm 2^{\circ}\text{C}$ Default warning and shutdown limits: $+50^{\circ}\text{C}$ & $+70^{\circ}\text{C}$ 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 Synch 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

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
DYNAMIC DIGITAL I/O SUBSYSTEM	
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 commutate 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

# TS-900e-5G SERIES



Parametric Measurement (PMU)	
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	±20 mV
Force Voltage Resolution	16 bits
Force Current Ranges	±32 mA, ±8 mA, ±2 mA, ±512 uA, ±128 uA, ±32 uA, ±8 uA, ±2 uA FS
Force Current Accuracy: Compliance Range: +1.75 V to +7 V @ 32 mA -1.5 V to +7 V @ no load	±120 uA, 32 mA range ±40 uA, 8 mA range ±5 uA, 2 mA range ±1.2 uA, 512 uA range ±600 nA, 128 uA range ±160 nA, 32 uA range ±80 nA, 8 uA range ±20 nA, 2 uA range
Current Measurement Accuracy (60 Measurements / Sec) Compliance Range: +1.75 V to +7 V @ 32 mA -1.5 V to +7 V @ no load	±120 uA, 32 mA range ±40 uA, 8 mA range ±5 uA, 2 mA range ±1.2 uA, 512 uA range ±600 nA, 128 uA range ±160 nA, 32 uA range ±80 nA, 8 uA range ±20 nA, 2 uA range
Measure Voltage Range	-2 V to +7 V
Measure Voltage Accuracy	±1 mV (measurement rate < 200 measurements / sec)
STATIC DIGITAL INSTRUMENT	
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	LVTTL compatible
Source / Sink Current	24 mA (max)

USER POWER	
Source / Measure Unit (SMU)	4-channel, 4 quadrant operation, isolated outputs, common ground, with remote sense
Programmable Voltage Range	0 to ±20 V
Output Voltage Accuracy	±0.05% of programmed value + 2 mV
Output Noise	<20 mV p-p, 20 MHz BW, full load
Output Current	±2.5 uA to ±250 mA in decade ranges, any one channel can supply up to 1A
Output Current Accuracy	±0.05% of programmed value + 0.05% of FS
Voltage Measurement Accuracy	±0.03% of programmed value + 2 mV
Current Measurement Accuracy	Ranges: 2.5 uA to 250 mA in decades Accuracy: ±0.05% of reading + 0.05% of FS range
Measurement Resolution	Programmable, 18 to 24 bits
TS-900E-5G RF VECTOR NETWORK ANALYZER OPTIONS	
Keysight Technologies	M9807, 2 port VNA, 40 GHz, PXIe M9808A, 2 port VNA, 53 GHz, PXIe
TS-900EX-5G 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-900EX-5G SERIES 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>• 20 blind mate RF ports (TS-960e-5G)</li> <li>• 24 blind mate RF ports (TS-960eX-5G) (Weinschel Planar Blind-Mate, 2.92mm (SMK))</li> </ul>

# TS-900e-5G SERIES



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
TS-900e-5G Weight	125 lbs, core system
TS-900eX-5G Weight	250 lbs, core system
TS-900e-5G Overall Size	24" D x 22" W x 17" H
TS-900eX-5G Overall Size	24" D x 39" W x 35" H
Manipulator Options	TS-900e-5G: Reid-Ashman OM-1069 TS-900eX-5G: inTest 930591 FTM-MVT5900E-5G

Note: Specifications are subject to change without notice

## ORDERING INFORMATION

TS-900e-5G	mmWave / 5G PXle Production Test System
TS-900eX-5G	mmWave / 5G PXle / LXI Production Test System
OPTION	
TS-900-OPT64	64 Additional Dynamic Channels for use in TS-900



# TS-900e-5G SERIES



THIS PAGE INTENTIONALLY LEFT BLANK

MANUFACTURING

