Embedded Vector Network Analyzer

ZA0169A Microwave Sensing, 4 port Solution Set

Introduction

Advancements in microwave sensing and imaging are unlocking transformative applications across medical diagnostics, food safety, environmental monitoring, and industrial process control. By providing a safe, non-ionizing, and low-cost alternative, microwave sensing solutions create new sensing modalities that powerfully complement traditional techniques like X-ray or CT.

Bringing these innovations to market requires a multidisciplinary design approach to bridge technical complexity with precise performance and usability requirements. Beyond engineering, optimizing manufacturing costs is critical to ensuring your product remains competitive and commercially viable.

The Keysight ZA0169A Embedded Vector Network Analyzer is designed specifically to integrate high-performance microwave sensing directly into your diagnostic and research tools. Combined with our deep network analysis expertise, this embedded VNA provides the acceleration you need for your entire concept-to-market process.

Figure 1. ZA0169A Embedded Vector Network Analyzer

KEYSIGHT

ZA0169A Embedded Vector Network Analyzer

Scalable Precision for Integrated RF Systems

The ZA0169A Embedded Vector Network Analyzer provides R&D-grade precision in a compact, low-power footprint designed for seamless RF system integration.

Optimized for Embedded and Portable Environments

Engineered for the demands of modern test beds and field applications, the ZA0169A is small, lightweight, and operates on a low power 12V supply. This efficient design supports portable use cases where space and power are at a premium. To ensure long-term reliability once integrated, the unit features built-in health monitoring. This allows engineers to verify the instrument's status and performance while it is embedded deep within device, eliminating the need for costly and time-consuming teardowns.

Advanced swept analysis for total Device Under Test (DUT) insight

ZA0169A utilizes a sophisticated swept analyzer architecture to provide a comprehensive picture of DUT behavior across its 100 MHz to 4 GHz range. To optimize your workflow, it offers specialized sweeping modes:

- **Segmented sweep**: Define custom frequency regions with independent settings (points, IFBW, power). This allows you to skip unimportant frequencies while applying a narrow IFBW for maximum dynamic range in critical regions.
- **Parallel sweep**: Maximizes throughput by enabling continuous sweeping and optimized data handling, effectively reducing total test time

Superior signal integrity and sensitivity

With a variable IFBW (1.5 kHz to 6 MHz), the ZA0169A gives you granular control over your measurement environment. Utilizing a lower IFBW provides:

- **Enhanced dynamic range**: See through the noise to characterize high-rejection components clearly.
- **Reduced trace noise**: Achieve cleaner S-parameter traces and a lower noise floor
- **High sensitivity**: Detect and analyze weak signals that traditional embedded solutions might miss

Scalable architecture: 4 to 16 ports

The ZA0169A is designed to scale with your project's complexity. While a single module provides a 4-port configuration, its unique multi-module support allows you to link up to four units for a 16-port (N-port) solution. This true multiport capability is essential for high-speed microwave sensing and imaging, as it eliminates the need for external switches that would otherwise degrade signal integrity and increase measurement time.

Seamless integration and maintenance-free operation

Built on industry-standard measurement science and a robust API interface, the ZA0169A ensures total consistency as you move from initial R&D to full-scale manufacturing. With native Linux support, the system is protected from the frequent OS upgrade cycles and maintenance overhead associated with other platforms, providing a stable environment for automated testing.

General Information

Embedded System

Table 1. Physical Specifications for Single Unit (With Enclosure)

Description	Specifications
Dimension (width x height x depth)	105 mm x 50 mm x 221 mm
Weight	1 kg
Power consumption (max)	36 W
Power consumption (typical)	33 W
Power consumption standby (typical)	10 W
Number of RX ports	4
Number of TX ports	4
RF connectors	SMA
Computer connectivity for data transfer	LAN or USB

Table 2. Electrical Specifications for Single Unit (Standalone)

Description	Specifications
Input power	10.8 to 13.2 V (typical 12 V ± 10%)
Frequency minimum	100 MHz
Frequency maximum	4 GHz
Frequency resolution	6 Hz
Number of frequency points	1000 points
Number of sweeps in a block	100 sweeps
Trace noise threshold	0.0015 dB rms @ 12 kHz IFBW
Trace noise average	0.001 dB rms @ 12 kHz IFBW
LO Delay Difference	100ps after LO cable calibration
Source return loss	15 dB
Load return loss	20 dB
Isolation max hard	-70 dB @ 12 kHz IFBW
Isolation max	-88 dB @12 kHz IFBW
Isolation average	-100 dB @12 kHz IFBW
Reciprocity max	-70dB @12 kHz IFBW
Reciprocity average	-80 dB @12 kHz IFBW

Description	Specifications
Max power out	10 dBm
Dynamic range	-112 dB @ 12 kHz IFBW
Concurrent transmitters	1
Concurrent receivers	4
Adjustable IFBW	6 MHz to 1.5 kHz
Thermal warmup time	30 mins

Literature Information

Unveil the Invisible with On-the-Go Imaging – Solution Brief

Enabling the Next-Generation Patient Point of Care through Microwave Sensing Technology – White Paper

RF Components Characterization Improves MRI Image Quality – Case Study

Web Resources

Keysight Vector Network Analyzer Page: www.keysight.com/find/na