

# Real-Time, Multi-Channel Testing with LIBERTY

Redefining Precision and Performance

## **Keysight Technologies and TEVET**

# **Real-Time, Multi-Channel Testing with LIBERTY**

As modern radar and communication systems evolve to meet the demands of broader frequency ranges, dynamic signal environments, and rapid technological advancement, traditional test solutions struggle to keep up. The LIBERTY platform, a collaboration between TEVET and Keysight Technologies, addresses these challenges with a revolutionary real-time, multi-channel, wideband testing solution. By delivering gapless signal processing, wideband capabilities, and unmatched reconfigurability, LIBERTY enables precise, real-time validation of advanced systems under the most complex conditions. This real-time capability is the cornerstone of LIBERTY, empowering customers to achieve unparalleled gapless performance and precision.

## **Modern Radar Designs Driving Change**

Modern radar systems demand real-time, multi-channel, wideband, phase-coherent testing to ensure resilience against interference and jamming. The need for real-time capability extends to phased-array antennas, which feature hundreds or thousands of antenna elements requiring precise synchronization and analysis. Additionally, industries face shrinking product development cycles, making faster, real-time testing solutions critical to meeting time-to-market pressures. Furthermore, with increasing spectrum congestion, robust, real-time validation in realistic interference scenarios is essential for maintaining performance and reliability. LIBERTY meets these demands with its real-time multi-channel capabilities, ensuring systems are tested with speed, accuracy, and adaptability.

## **Customers Need Real-Time Signal Capabilities**

Customers frequently struggle with testing delays, insufficient data precision, and limited reconfigurability in legacy systems. LIBERTY addresses these issues by offering real-time data acquisition, analysis, and signal generation. Its FPGA-driven architecture ensures immediate processing of multi-channel signals, eliminating delays and delivering actionable insights. Additionally, LIBERTY's scalable and modular design allows customers to adapt quickly to changing requirements, reducing total cost of ownership while extending the platform's longevity.

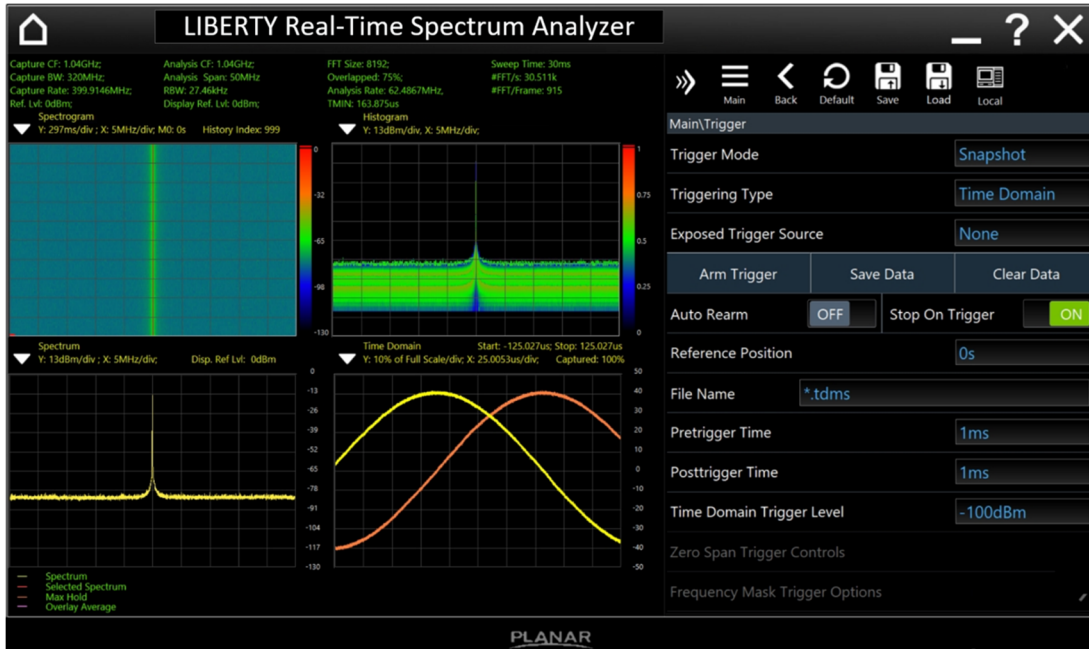


Figure 1: LIBERTY RTSA Front Panel

Managing interference and co-channel testing in crowded frequency bands is another critical challenge. LIBERTY's gapless real-time signal analysis ensures no data is lost, even in the most dynamic environments. By providing wideband, multi-channel capability, the system delivers precise, real-time validation across diverse use cases, from phased-array radars to 5G communications. With femtosecond-level channel-to-channel precision, customers can detect and analyze ultrafast phenomena that were previously undetectable, further enhancing the platform's value.

## Solving Today's Challenges – The LIBERTY solution

LIBERTY sets itself apart with its comprehensive real-time capabilities, enabling immediate insights and adjustments during testing. Its wideband, multi-channel functionality supports synchronized, phase-coherent testing across multiple channels, making it ideal for advanced systems like 5G Massive MIMO and Active Electronically Scanned Array (AESA) radars. The system's gapless signal analysis ensures no data is missed, while its femtosecond channel-to-channel alignment precision enables ultra-accurate timing and frequency tracking, critical for modern applications.

The platform's modular and scalable design allows customers to configure solutions tailored to their needs, ensuring longevity and adaptability as requirements evolve. LIBERTY also features high-speed scalable data storage, with up to 32 TB of SSD RAID per single PXIe module, eliminating the need for external recorders and streamlining operations.



By incorporating advanced automation capabilities, LIBERTY minimizes manual intervention and accelerates testing cycles. This high degree of automation, coupled with real-time processing, enhances efficiency, reduces test times, and accelerates product development. Customers benefit from improved accuracy, reduced costs, and faster time-to-market, positioning them as leaders in their respective fields.

## Key Features of the LIBERTY Solution

Product features	Description
<b>Real-Time Signal Analysis</b>	<p>Gapless and concurrent real-time signal analysis for each channel</p> <p>Assurance that no data is lost during testing, even in highly dynamic and complex environments</p>
<b>Multi-Channel Support</b>	<p>Real-time concurrent analysis across up multiple phase-coherent, time-aligned and synchronized channels.</p> <p>Ensures accurate multi-channel testing, enhanced signal integrity, and robust system validation</p>
<b>Frequency Range</b>	<p>Frequency range up to 40 GHz</p> <p>Ensures compatibility with advanced technologies like 5G, SATCOM, and RADAR</p>

## LIBERTY Solution Applications

LIBERTY's real-time testing capabilities make it indispensable across a range of industries. In multi-channel radar systems, it provides the capability to perform real-time analysis for each channel concurrently to validate system performance against interference and countermeasures. For 5G and SATCOM applications, the platform ensures precise characterization of signal integrity and interference across wide bandwidths. Space exploration and medical imaging benefit from LIBERTY's ability to detect faint, transient signals with unmatched clarity. Additionally, the platform is perfectly suited for testing IoT RF and low-power edge devices in noisy environments.



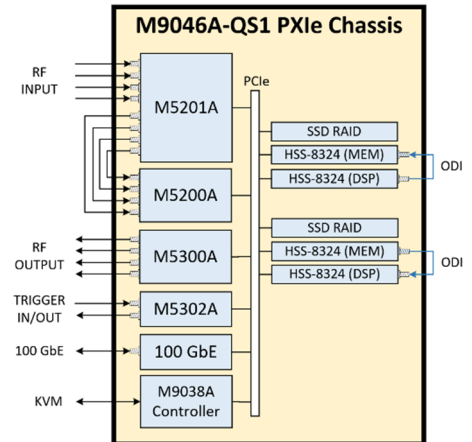
LIBERTY Software Pallet

## LIBERTY Solution Components

Keysight Technologies	
Model/Series Number	Description
M5201A	QUADS PXIe 4-Channel RF Down Converter
M5200A	QUADS PXIe 4-Channel Digitizer
M5300A	QUADS PXIe 4-Channel Arbitrary Waveform Generator
M5302A	QUADS PXIe Digital IO Module
M9032A	PXIe System Timing Module
M9038A	PXIe Embedded Controller
M8131A	AXIe 4-Channel Digitizer
M8121A	AXIe 2-Channel Arbitrary Waveform Generator
M9505A	AXIe 5-Slot Chassis
M9537A	AXIe Embedded Controller

TEVET	
Model/Series Number	Description
Liberty-AXIe-SDI	Liberty AXIe Real-Time Multi-Channel Software-Defined Instrument
Liberty-PXIe-SDI	Liberty PXIe Real-Time Multi-Channel Software-Defined Instrument

LIBERTY Block Diagram



## Conclusion

LIBERTY redefines precision and performance in testing with its real-time, multi-channel capabilities, enabling customers to overcome the challenges of modern system validation. Its wideband analysis, gapless signal processing, and scalable design provide unmatched flexibility and reliability, ensuring success in the most demanding applications. By choosing LIBERTY, customers gain a competitive edge, accelerating development and maintaining leadership in their industries.

For more information, visit TEVET's LIBERTY page or contact us at [info@tevet.com](mailto:info@tevet.com).

## About TEVET

TEVET, a leading SDVOSB and HUBZone small business, delivers innovative solutions like the LIBERTY Platform for advanced testing. Recognized with 50+ awards, TEVET excels in service, transparency, and innovation.

