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Solution Brochure

Ultra-Wideband Test Solution

Enabling Faster Ultra-Wideband Signal Generation

Streamline Test of Ultra-Wideband Wireless Devices

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Trends in UWB Development

Ultra-Wideband (UWB) is useful for devices requiring low-power operating over a short range, that can coexist with other RF signals for the purpose of providing real-time location information.

A robust UWB test solution needs to:

- Account for wideband capabilities greater than 500 MHz
- Ensure full frequency coverage from 3 GHz to 10 GHz
- Allow for coexistence of UWB, WLAN, and Bluetooth standards on a single test bench
- Incorporate precision ranging measurements with time-of-flight (ToF) and angle-of-arrival (AoA) calculations
- Include deterministic HRP frame generation for thorough characterization

THE NI ADVANTAGE

01

High reusability of hardware for additional RF test applications

02

Shortened time to market with automation APIs

03

FiRa Consortium PHY conformance certification

04

Full support of complex UWB test cases and measurements

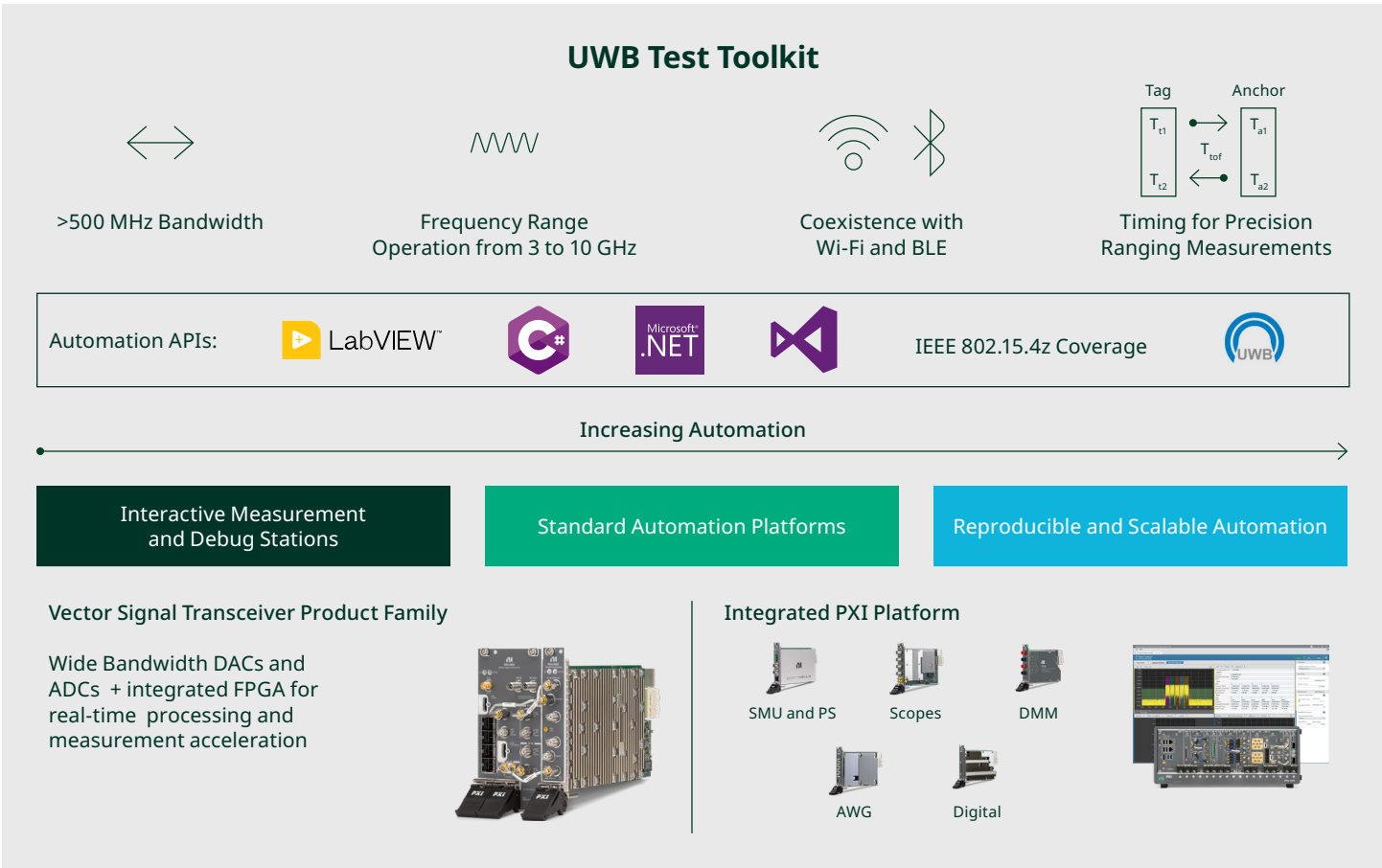


FIGURE 1
UWB Test Solution Diagram

BENEFITS OF NI WIRELESS CONNECTIVITY TEST SOLUTIONS

01
Enables higher reusability of hardware through a consolidated test bench with RFmx for WLAN, Bluetooth, cellular, and MaxEye UWB Test Toolkit for ultra-wideband test.

02
Shorten time to market with intuitive APIs that incorporate robust automation from interactive bring-up to characterization.

03
Ensures test quality and completeness with the implementation of FiRa Consortium PHY test cases and FiRa PHY certification.

04
Incorporates complex UWB test cases such as angle-of-arrival and time-of-flight measurements.

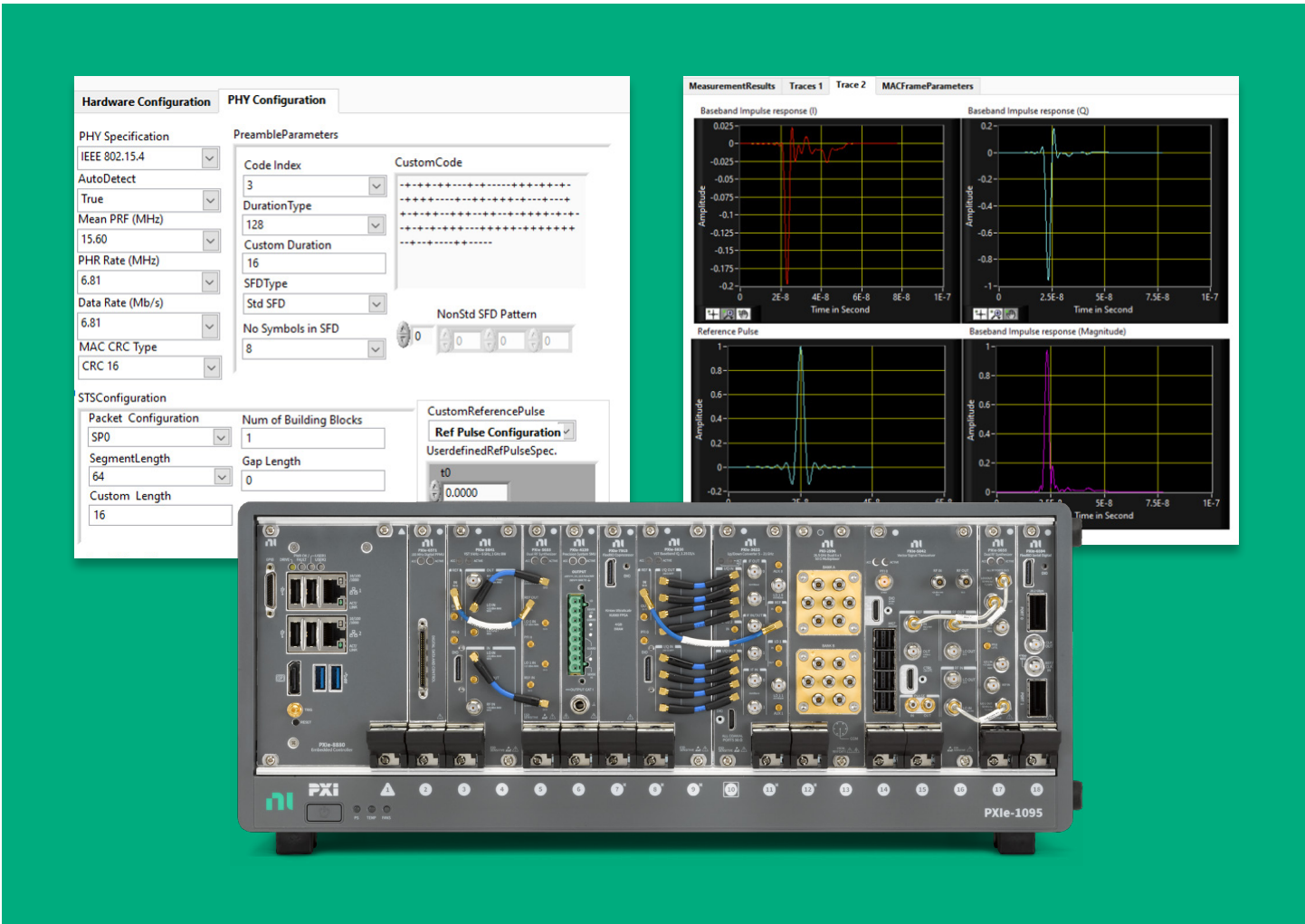


FIGURE 2
 UWB Test Solution: Reusable Test Bench for WLAN, Bluetooth, and Cellular Applications

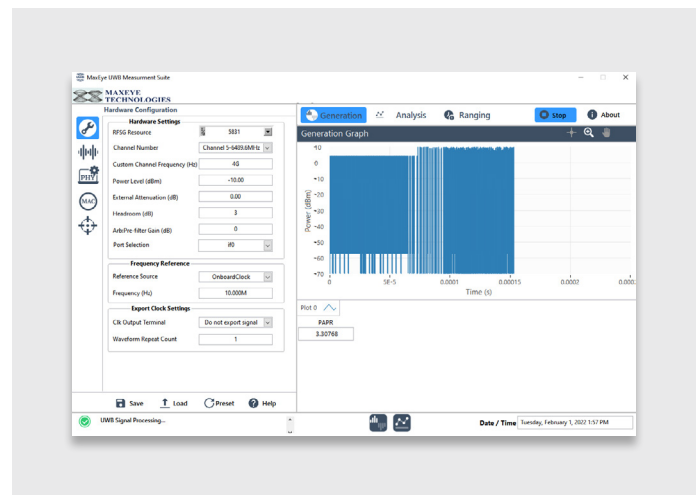
UWB Test Toolkit from MaxEye Technologies

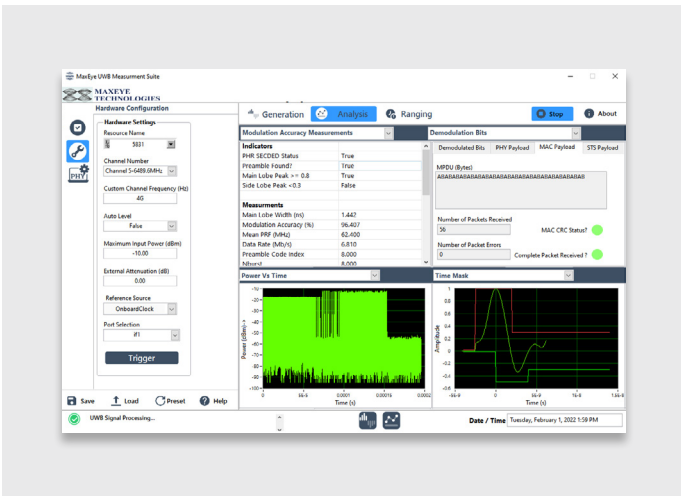
The NI UWB Validation Solution, comprised of PXI instrumentation and the Ultra-Wideband (UWB) Test Toolkit, is the only test solution on the market to comprehensively test UWB front-end devices, transceivers, and electronic devices with superior frequency coverage as well as baseband signal generation and analysis capabilities. The UWB Test Toolkit is developed in conjunction with MaxEye Technologies, leveraging their expertise in wireless communications for a one-to-one, tailored test solution for UWB test cases enabling fast, accurate, and easily configurable test of UWB front ends and transceivers.

- Easy-to-use graphical user interface (GUI) through intuitive and interactive Soft Front Panels and a wide range of APIs enabling automation of UWB test cases
- Full coverage of IEEE 802.15.4z specifications including spectrum mask transmit, symbol modulation accuracy, carrier frequency offset, and many others
- All-in-one tester that combines WLAN, Bluetooth, cellular, and UWB validation
- Scalable test bench with RF, DC, digital, and analog measurements
- Flexible choice of frequency coverage and bandwidth as well as baseband signal generation and analysis capabilities with NI's versatile PXI Vector Signal Transceivers (VSTs)
- Scalable and synchronized RF channels for MIMO applications

UWB Signal Generation and Analysis

- Generate highly customized UWB signals supporting various frame formats including data frame, beacon frame, and multi-frame generation with user-defined interframe spacing.
- Configure payloads with PN sequence, user-defined bits, test pattern, or import payload from a file and develop custom sequences that deviate from standard UWB test cases.
- Introduce impairments such as AWGN, IQ gain, phase imbalance, and frequency skew for thorough test and characterization.





- Choose from a variety of measurement types including ModAcc, power measurements, carrier frequency offset, UWB pulse time, and many others.
- Leverage built-in automation APIs with UWB test cases for an easy transition from interactive to automated measurements and industry leading test speed.
- Supports IEEE 802.15.4/15.4z HRP standards and FiRa PHY and MAC specifications v1.1.

Measurement Capabilities

- Power measurements
- Modulation accuracy
- Frequency and clock offset measurements
- Spectral emission mask (SEM)
- Pulse main lobe width
- MAC CRC, packet error rate, and payload bits
- Baseband impulse response
- UWB pulse time domain mask
- Time-of-flight (ToF, ranging test)
- Angle-of-arrival (AoA)

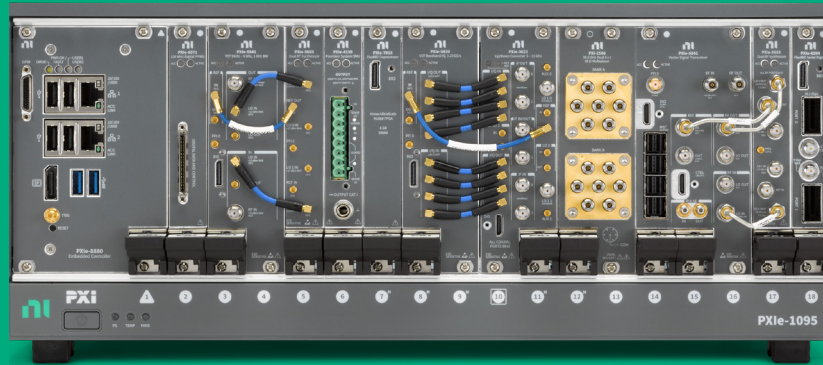


The NI UWB Test Solution is **FiRa certified** and is up to date with the latest IEEE 802.15.4z specifications.

System Hardware and Software Components

The UWB Test Solution consists of several hardware and software components working together seamlessly in a cohesive and integrated system. Scalable to meet your needs, you can choose from a range of RF Vector Signal Transceivers for different frequency and bandwidth options along with DC, analog, and digital instrumentation for a tailored test solution that meets exactly the needs of your application.

Integrated PXI System



HARDWARE

01

PXI chassis and controller

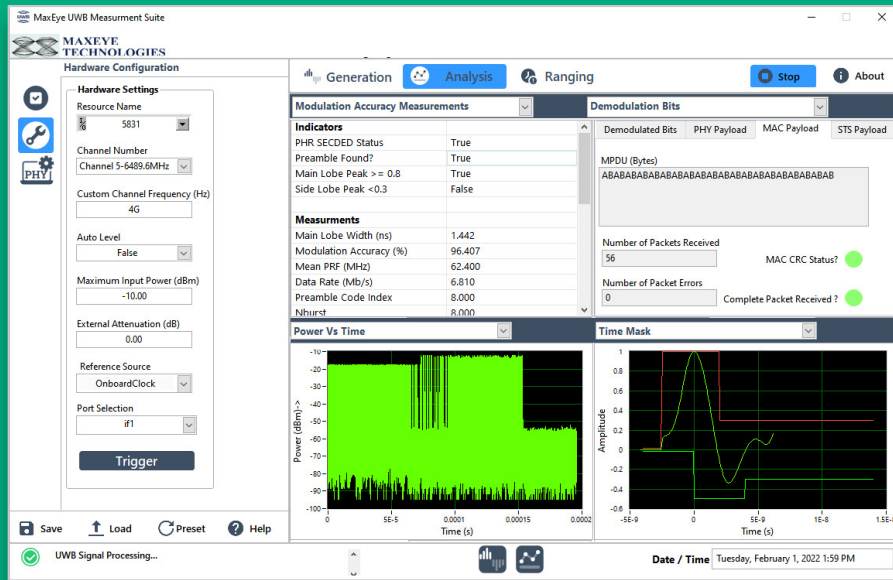
02

PXI VST

03

Optional: DC, analog, digital instruments, AWG, and more

Application-Specific Software



SOFTWARE

01

UWB Test Toolkit including Soft Front Panels and automation APIs

02

FiRa PHY Conformance Test Tool

03

Optional: RFmx WLAN, NR, Bluetooth

Key Solution Technology

NI **Vector Signal Transceivers** combine an RF vector signal analyzer and generator with a powerful FPGA and high-speed serial and parallel digital interfaces for real-time signal processing and control from baseband to mmWave.

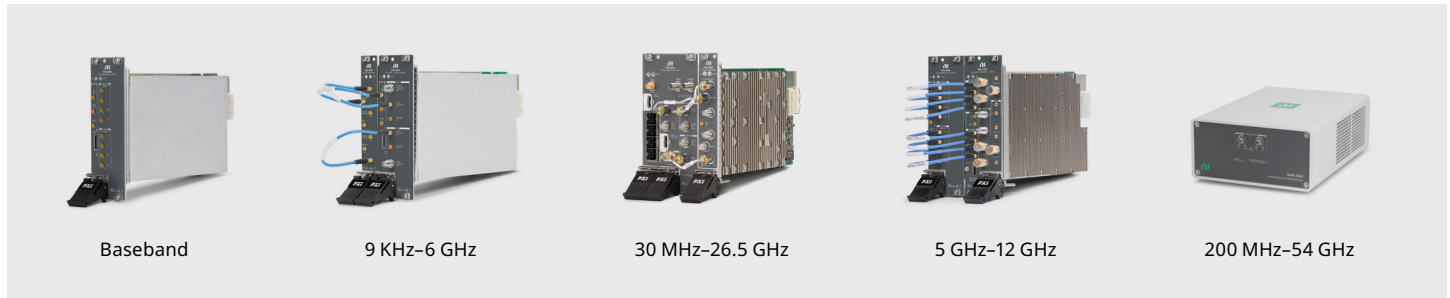


FIGURE 3

Left to Right: PXIe-5820, PXIe-5841, PXIe-5842, PXIe-5830, PXIe-5842 with 54 GHz Frequency Extension

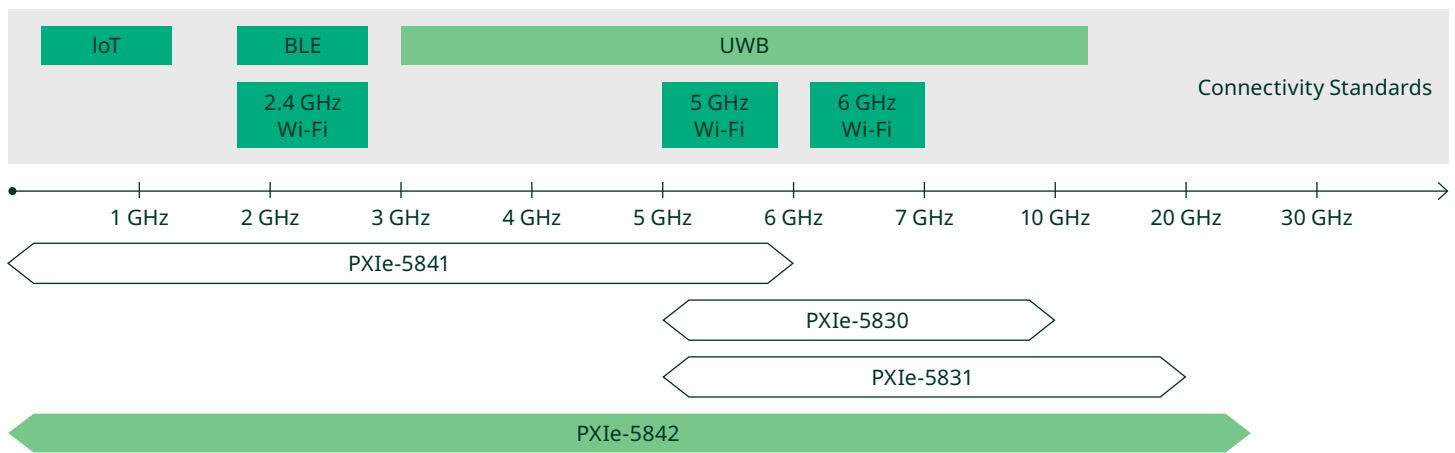


FIGURE 4

Frequency Coverage for Different PXI VSTs

UWB frequencies range from 3 GHz to 10 GHz, a much wider range than traditional wireless standards like Wi-Fi or Bluetooth. Additionally, UWB channel bandwidths can span up to 1.2 GHz. Specifications such as these require high-performance and capable RF instrumentation. With frequency coverage from 30 MHz to 26.5 GHz, the PXIe-5842 can ensure full coverage of UWB frequencies and wide-channel bandwidths. Additionally, all wireless connectivity standards like Bluetooth and Wi-Fi can be covered all on one instrument.



FIGURE 5
PXIe-5842 Vector Signal Transceiver

OPTIONAL HARDWARE

The UWB Test Solution is scalable to meet exactly the needs of your application. Add multiple RF Vector Signal Transceivers to cover a wide frequency range and multi-port DUTs, or add DC, analog, or digital instruments for more thorough test and full device characterization.



Add PXI Source Measure Units for DUT power/ stimulus and analog measurement capabilities (PXIe-4138 pictured).

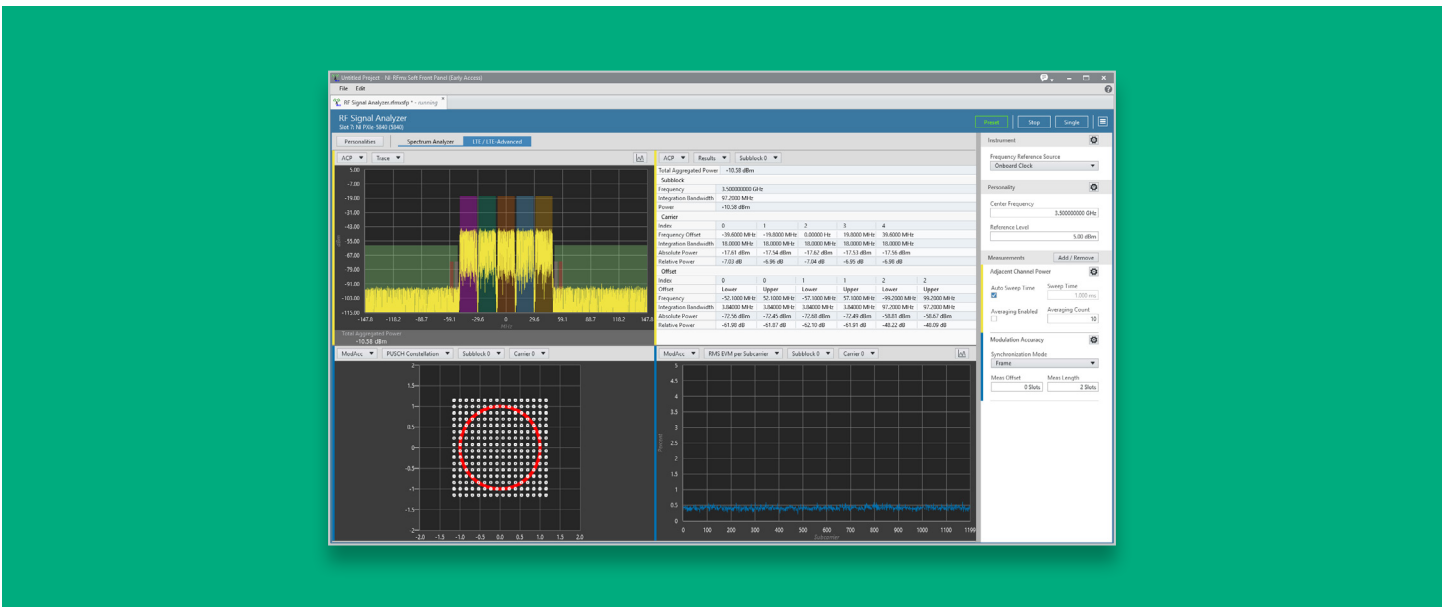


Include digital instruments, such as the PXIe-6571, alongside other instruments for configurable and synchronized DUT control.



Choose from many other DC, analog, and digital instrumentation for additional measurement capabilities (PXIe oscilloscopes pictured).

OPTIONAL SOFTWARE



RFmx is a set of interoperable software applications that optimize NI RF instrumentation for general-purpose, cellular, connectivity, and aerospace/defense test applications.

Include RFmx NR, WLAN, and Bluetooth for a test bench capable of handling multiple cellular and connectivity standards.

UWB Configuration Options

Solution Name	Part Number	Description
Wi-Fi and Bluetooth Test Reference Solution ¹	866573-01B	Wi-Fi and Bluetooth, 30 MHz to 8 GHz, 1 GHz BW, 9-slot chassis, controller, 4 additional PXI slots
	866573-02B	Wi-Fi and Bluetooth, 30 MHz to 26.5 GHz, 2 GHz BW, 9-slot chassis, controller, 4 additional PXI slots
	866573-10B	Wi-Fi and Bluetooth, 30 MHz to 8 GHz, 1 GHz BW, 18-slot chassis, controller, 13 additional PXI slots
Wi-Fi, Bluetooth, and UWB Test Reference Solution ¹	866573-03B	UWB, 5 to 12 GHz, 1 GHz BW, 9-slot chassis, controller, 4 additional PXI slots ²
	866573-04B	Wi-Fi, Bluetooth, and UWB, 9 KHz to 12 GHz, 1 GHz BW, 9-slot chassis, controller ²
	866573-17B	WLAN, Bluetooth, and UWB, 30 MHz to 12 GHz VST, 2 GHz BW, 18-slot chassis, controller ²
	866573-19B	WLAN, Bluetooth, and UWB, 30 MHz to 26.5 GHz VST, 2 GHz BW, 18-slot chassis, controller ²
	866573-20B	UWB, 5 to 12 GHz, 1 GHz BW, 18-slot chassis, controller, 13 additional PXI slots ²
	866573-21B	Wi-Fi, Bluetooth, and UWB, 9 KHz to 12 GHz, 1 GHz BW, 18-slot chassis, controller, 9 additional PXI slots ²

TABLE 1
Reference Solution Base Configurations

Notes:

1. For Wi-Fi/Bluetooth/UWB reference solutions, use the PXIe-5841, PXIe-5842, and PXIe-583x VSTs. Refer to [specifications](#) for more information.
2. Ultra-wideband (UWB) test applications require separate software independent from RFIC Test Software. Include the [UWB Test Toolkit](#) for UWB test applications.

Base configurations will offer everything you need to build a test system from scratch for a given wireless standard. Whether for Wi-Fi, Bluetooth, or UWB, or a combination of all three, all options listed will include the PXI instrumentation needed to set up a fully functioning test bench.

The PXI chassis included in bundles are the PXIe-1095 (timing and synch option, 18-slot) or PXIe-1092 (timing and synch option, 9-slot) and controllers included are the PXIe-8881 (8-core, Windows 10). Bundles with the PXIe-8398 MXI controller (remote controller) are also available.

For further assistance choosing configurations, please reach out to your Account Manager, Distributor, or contact NI.

Option Name	Part Number	Description
Additional RF Channels: General Purpose	866573-31P	30 MHz to 26.5 GHz, 2 GHz BW (PXIe-5842)
	866573-32P	30 MHz to 12 GHz, 2 GHz BW (PXIe-5842)
	866573-33P	30 MHz to 8 GHz, 1 GHz BW (PXIe-5842)
Additional RF Channels: UWB ¹	866573-10P	5 to 12 GHz VST (PXIe-5830)
	866573-12P	9 KHz to 21 GHz with switch (PXIe-5831, PXIe-5841, PXI-2599)
	866573-24P	9 KHz to 12 GHz, low phase noise with switch (PXIe-5831, PXIe-5841, PXIe-5655, PXI-2599)
Switching	866573-05P	Dual SPDT switch 26 GHz (PXI-2599)
Baseband	866573-06P	Baseband VST, 0 to 500 MHz, 1 GHz BW (PXIe-5820)
DC Power	866573-07P	8 V, 3 A precision SMU 4 CH (PXIe-4147)
Digital DUT Control	866573-08P	100 MHz pattern digital with PPMU 32 CH (PXIe-6571)
Accessories	Contact NI	Power cord (by region)
	786300-01	Upgrade/replacement power supply for PXIe-1092 or PXIe-1095
	Contact NI	Software: RFmx (various personalities), RFIC Test Software, UWB Test Toolkit
	960680-301	Standard service program for systems with traceable calibration

TABLE 2

Reference Solution Optional Add-Ons

Note:

1. For Wi-Fi/Bluetooth/UWB reference solutions, use the PXIe-5841, PXIe-5842, and PXIe-583x VSTs. Refer to [specifications](#) for more information.

To add multiple RF channels, or to include analog, digital, or DC instrumentation, select from the part numbers in Table 2 to fully customize test requirements to a given application.

For existing test benches, choose the options in Table 2 to add functionality to your test bench.

Part Number	Description
763830-01	Power Cord, AC, U.S., 125 VAC, 15 A
763068-01	Power Cord, 240 V, 10 A, North America
784686-01	Power Cord, 250 V, 10 A, China
763634-01	Power Cord, 125 V, 15 A, Japan
784685-01	Power Cord, 240 V, 10 A, Korea, Right Angle
763064-01	Power Cord, 240 V, 10 A, U.K.
763065-01	Power Cord, 220 V, 10 A, Switzerland
763066-01	Power Cord, 240 V, 10 A, Australia
763067-01	Power Cord, 240 V, 10 A, Euro, Right Angle
785626-01	Power Cord, 250 V, 10 A, Brazil
786300-01	1200 W upgrade/replacement power supply for PXIe-1092 or PXIe-1095 chassis
787659-01	Memory upgrade 16 GB DDR4 2666 SO-DIMM RAM, ECC for PXIe-8881
779660-01	USB English keyboard and optical USB mouse
786774-01	HD upgrade 1 TB NVMe solid state drive upgrade, M.2, 80 mm

TABLE 3
Hardware Accessories

Part Number	Description
784584-35	LabVIEW Professional
N/A	RFmx SpecAn
788024-35	RFmx Digital Modulation
788018-35	RFmx Analog Modulation
788033-35	RFmx Cellular Bundle
789804-35	RFmx Connectivity Bundle
788036-35	RFmx NR
788064-35	RFmx WLAN
788082-35	RFmx Bluetooth
N/A	Third-party licensing and activation toolkit
N/A	NI Modulation Toolkit
788372-35	NI TestStand
787917-35	RFIC Test Software Professional (includes RFmx PA)
788542-35	Ultra-Wideband (UWB) Test Toolkit
960680-301	Standard service program for systems with traceable calibration

TABLE 4
Software

Software is not included as part of bundles and must be purchased separately. Software with no part number is free to download and use.



System Integration on Your Terms

NI offers a variety of solution integration options customized to your application-specific requirements. You can use your own internal integration teams for full system control or leverage the expertise of our worldwide network of NI Partners to obtain a turnkey system.

Contact your account manager or call or email us to learn more about how NI can help you increase UWB product quality and accelerate test timelines at (888) 280-7645 or info@ni.com.

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