

Keysight E6640A

EXM Wireless Test Set





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Solve Today, Evolve Tomorrow with the EXM

In the wireless industry, an incredible amount of technology is packed into every smartphone and tablet. The multi-antenna, multi-radio devices with both cellular and wireless connectivity are evolving quickly to meet end users demands for fast data throughput, universal access, and instantaneous sharing. This presents challenges to those developing and manufacturing the latest chipsets and user equipment (UE).

Successful manufacturing organizations need tools that help them meet ever-tougher goals and tighter schedules. Access to the best resources will help them deal with the technical, business, and operational risks that, when managed carefully, ensure success. When these factors are under control, the organization is able to achieve several key goals:

- Ramping up new production quickly
- Achieving and optimizing volume production
- Minimizing the total cost of test
- Meeting budget
- Reducing wastage

The measurement challenges generated by today's multi-format, multi-band devices are difficult – and the key to success is finding test methods that are more efficient and more effective. Within this context, the Keysight Technologies, Inc. E6640A EXM wireless test set builds on the non-signaling and sequencing capabilities of Keysight's previous test sets.

Designed to Grow with You

EXM is a PXI standard-based platform with an architecture that expands parallel testing and provides the ultimate in scalability. Key to the flexibility of the EXM test set is the feature-rich transmit/receive module (TRX). With the freedom to start with one TRX and add up to three additional TRXs, or upgrade the TRXs' frequency coverage or analysis bandwidth, you can cost-effectively meet today's requirements while preserving your investment in the future when your production needs expand.

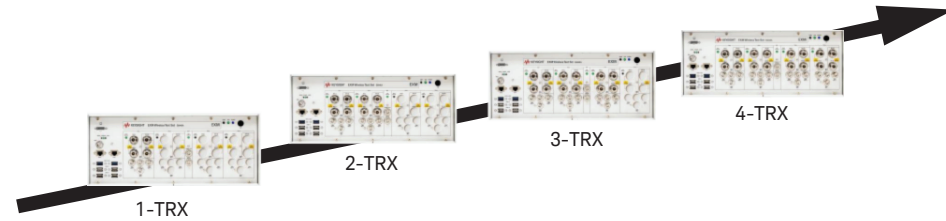


Figure 1. The EXM platform lets you incrementally expand your production capability

Advanced isolation for TRX-to-TRX and across RFIOs addresses the need for test stations to support the increasing density of antennas and devices. The field programmable gate arrays (FPGA) and Keysight-designed, application-specific integrated circuits (ASICs) used in each TRX also helps improve the data processing speed to allow the fastest execution of test plans.



Figure 2. EXM's system hardware architecture (4 TRX configuration)

Platform key features

Optimize multi-device testing

- Up to four TRXs per EXM
- Each TRX is a complete vector signal analyzer/vector signal generator (VSA/VSG) and RFIO in one unit
- Up to 6 GHz with 160 MHz bandwidth on each TRX
- Two full-duplex and two half-duplex ports, or four full duplex ports with rugged type-N connectors
- Software applications apply to the platform; buy one copy of software and use it on up to four TRXs in a single EXM
- Smart scheduling, advanced sequence analyzer to speed up cellular and wireless connectivity test plans
- Independent source and analyzer on each TRX for parallel transmitter and receiver testing

Accelerate from NPI to Full-volume Production

In addition to its integrated and versatile hardware architecture, EXM's broadest format coverage in cellular and wireless connectivity technologies helps you accelerate automated design validation, NPI, and volume production.

Use EXM to test a certain set of technologies today, and when your devices change in the future, support other technologies via a simple software upgrade. You can even test different formats on different TRXs in parallel, without using separate instruments.

Each measurement and waveform application license applies to all TRXs in a given instrument, so when it's time to add more TRXs to your EXM, all existing licenses extend to them too. Buy the software you need today and easily add new application licenses in the future to match your production line needs.

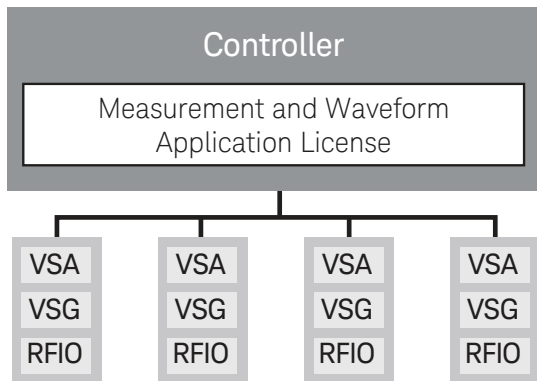


Figure 3. Measurement and waveform applications operate across all TRXs in a mainframe

Broadest multi-format coverage

EXM is ready to test 2G, 3G, and 4G cellular including the latest LTE-Advanced Carrier Aggregation, as well as various wireless connectivity standards such as *Bluetooth*, WLAN 802.11a/b/g/n/j/p/ac/ah/af, WLAN MIMO, and Zigbee.

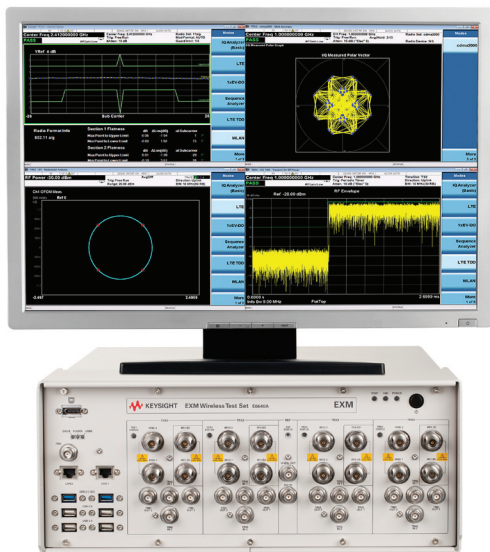


Figure 4. EXM tests 2G, 3G, LTE, and WLAN in parallel on four TRXs

Formats supported by EXM include:

Cellular

- LTE-Advanced
- LTE FDD/TDD
- W-CDMA/ HSPA+
- 1xEV-DO
- cdma2000®
- GSM/EDGE-Evo
- TD-SCDMA/TD-HSPA
- PHS/DECT

Connectivity

- WLAN 802.11a/b/g/n/j/p/ac/ah/af
- WLAN up to 4x4 MIMO
- WLAN 80 + 80 MHz & 2x2 MIMO
- *Bluetooth*® 1.0 to 4.2
- Zigbee
- WiSUN (MR-FSK)
- GNSS (GPS, GLONASS, Galileo, BeiDou, QZSS)
- Mobile WiMAX™
- Digital video (DVB-T, DVB-H, DVB-C, ISDB-T, ATSC, DTMB, CMMB)
- FM

Roll Out Production Lines with Greater Speed and Confidence

With our validated turnkey chipset solutions, you can roll out new production lines, or upgrade them, with greater speed and confidence – and be up and running in a matter of hours.

Save time with validated chipset solutions

Through chipset-specific calibration and verification routines, EXM helps you reduce the time and cost of test development. By leveraging proven solutions for every manufacturing line producing devices with a supported chipset, you gain certainty about chipset compatibility and validated EXM test capabilities that directly control the chipset. It's also easy to access the fastest, most reliable calibration and verification functions offered in each vendor's chipset, and implement chipset improvements in the future. You simply load the latest test packages into the EXM test set.

Keysight's ongoing collaboration with chipset vendors ensures the readiness of EXM to work with wireless chipsets now and in the future. Wireless chipset vendors benefit from Keysight's industry-proven measurement expertise to achieve the highest test speed possible for specific chipsets in manufacturing lines.

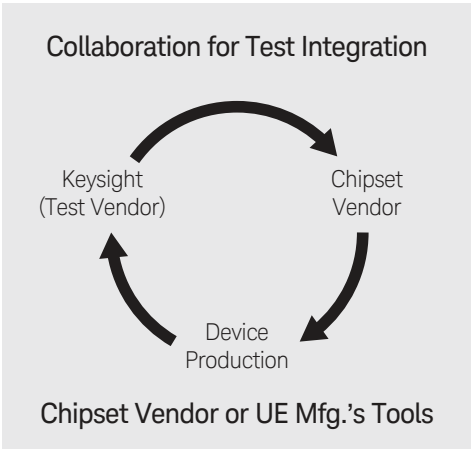


Figure 5. Test integration collaboration

Develop custom test executives

Alternatively, Keysight Test Automation Platform (TAP) allows the optimization of calibration and verification procedures for leading wireless chipsets. This software platform has a user-friendly graphical user interface (GUI), making it easy for NPI engineers to use it on lab benches. Plus, you can reference the highly-flexible COM application programming interface (COM API) while you develop your own test executives.

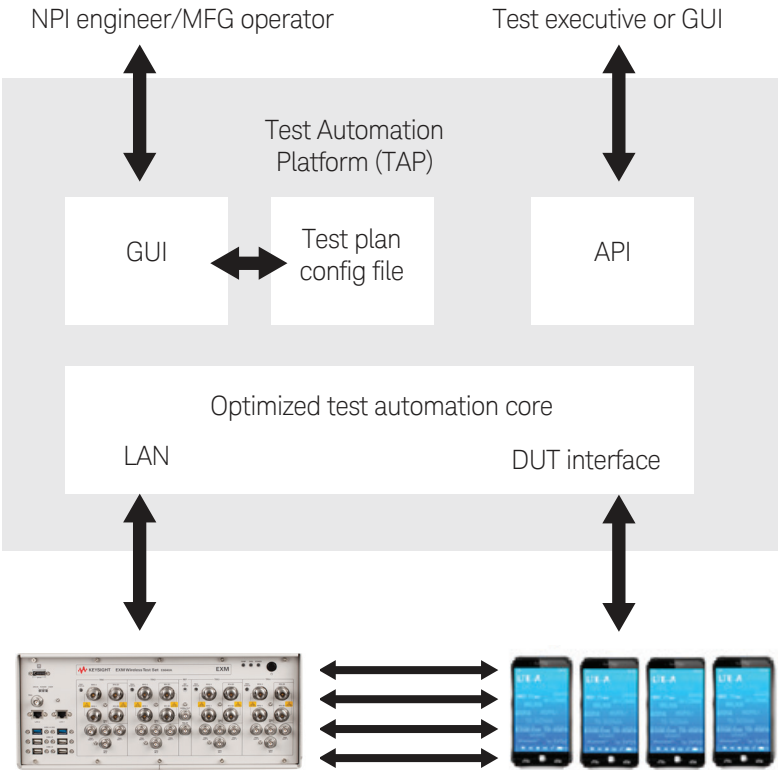


Figure 6. Keysight TAP architecture for multi-DUT test

Gain System Flexibility for High-volume Manufacturing

Easily keep pace with your production needs with EXM. It's designed to help you achieve the highest throughput possible, increase first-pass yield, maximize production line uptime, and reduce capital investment. That's a lot of capability from a test solution that puts up to four TRXs in just 4U of rack space.

Maximize test throughput

EXM's hardware speed, advanced sequence analyzer, and an independent source and analyzer help you maximize throughput during production test. A quad-core controller and high-bandwidth PXIe backplane ensure ultra-fast data processing and transfers. To further accelerate test execution, EXM provides a smart sequencer with single-acquisition multiple measurements (SAMM).

Advanced EXM sequencing capabilities

- Cover both cellular and WLAN formats
- Change the same parameter over all acquisition steps
- Change format, power, and frequency within each acquisition
- Single acquisition with multiple measurements

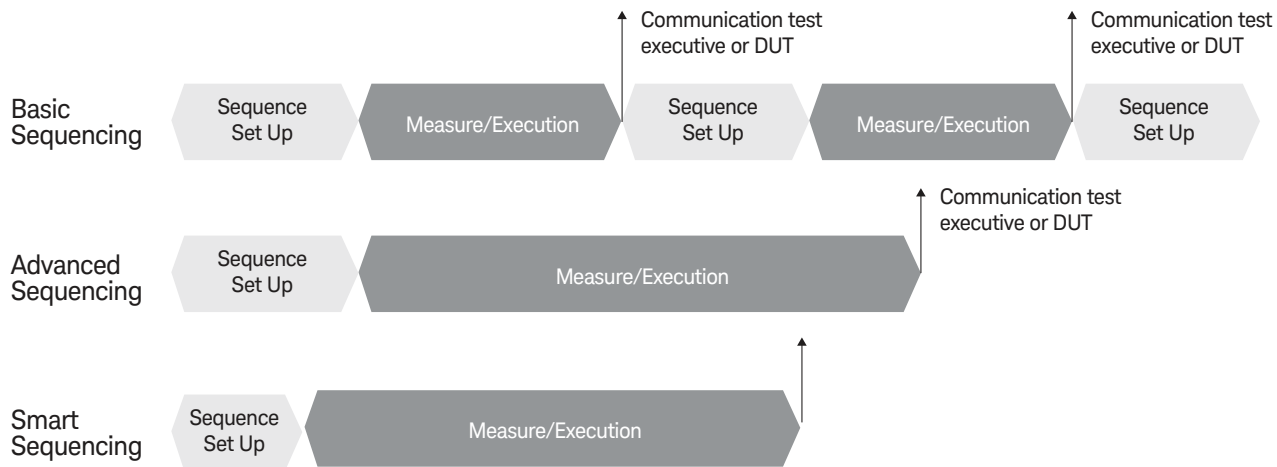


Figure 7. Sequencing evolution

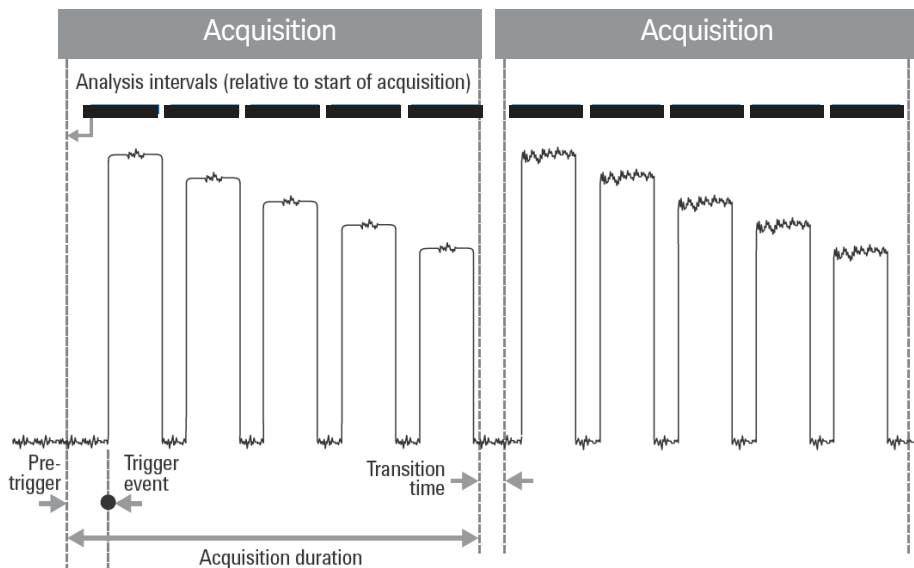


Figure 8. EXM's sequence capability with SAMM for DUT transmitter test

Fast set up and measurement of multi-format devices greatly reduces calibration and verification times. With EXM’s powerful sequence analyzer, you’ll test faster across different power and frequency ranges. When you move to fast-sequenced verification test with full control of the chipset, EXM is ready to exploit this capability with fast, sequenced measurements of multiple formats, frequencies, and power levels. The smart sequencer allows the flexibility to change the same parameter over all acquisition steps of the whole sequence – shrinking the sequence set-up time and enabling further speed enhancement.

Pipeline testing efficiency

Among the many test efficiency features of EXM is the ability to use the source and analyzer of a single TRX independently. This allows the use of a “pipeline” test architecture approach (see Figure 9), providing the benefit of decreased device test times and greater use of the capital asset test equipment.

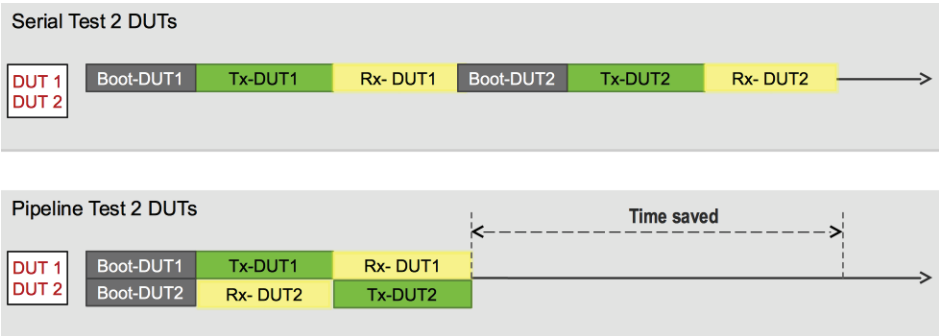


Figure 9. Test configuration example illustrating the use of a single TRX to test two DUTs in a pipeline approach

Pipeline operation describes a configuration in which the transmitter of the first device is being tested with the tester’s analyzer, while the tester’s source is testing the receiver of the second device, and then the two are flip-flopped. This approach is particularly well suited to Wireless LAN testing, which is a TDD system, and is tested using control modes where only the transmitter or only the receiver is being tested.

Smart Scheduling Instrument

Another test technique supported by EXM is the Smart Scheduling Instrument (SSI) where a test scheduling executive helps to manage the instrument to minimize the instrument's idle time.

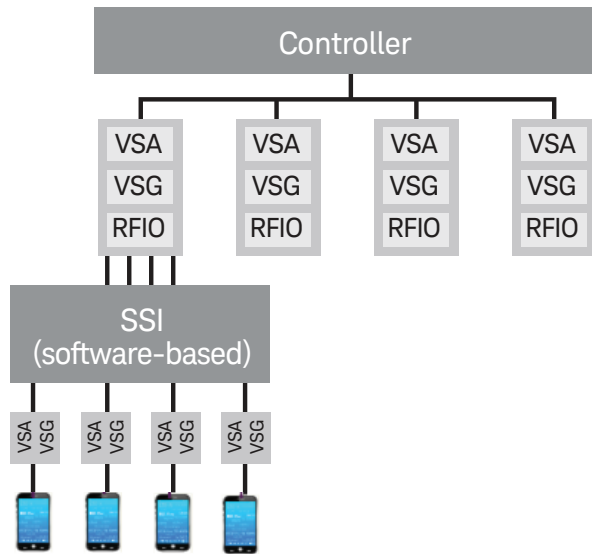


Figure 10. Test four DUTs with one TRX using SSI (software-based)

In SSI, DUT control and initialization, and instrument control and execution, are managed dynamically across multiple DUTs. Use of the smart scheduling software approach can be considered as providing more virtual VSA/VSGs. Based on the cellular test case, SSI increased test speed by 30%.

Increase first-pass yield

The superior signal purity and excellent measurement accuracy of EXM are the foundation to better first-pass yields. For example, EXM delivers a high-margin error vector magnitude (EVM) floor of less than -43 dB with 256QAM modulation. Power level measurements have best-in-class accuracy of less than ± 0.2 dB at 3.8 GHz. To save space and reduce the need for external equipment, EXM offers an output power range that extends from -130 to $+5$ dBm.

Test Scenarios

This section provides examples of configurations for testing various devices.

Cellular

This configuration illustrates the flexibility that EXM brings to testing devices that are multi-radio, multi-format, and multi-antenna. In this test setup, four phones are being tested in parallel. The test plan sequences thru cellular calibration and verification, and includes transmitter test, receiver test, and receiver diversity test.

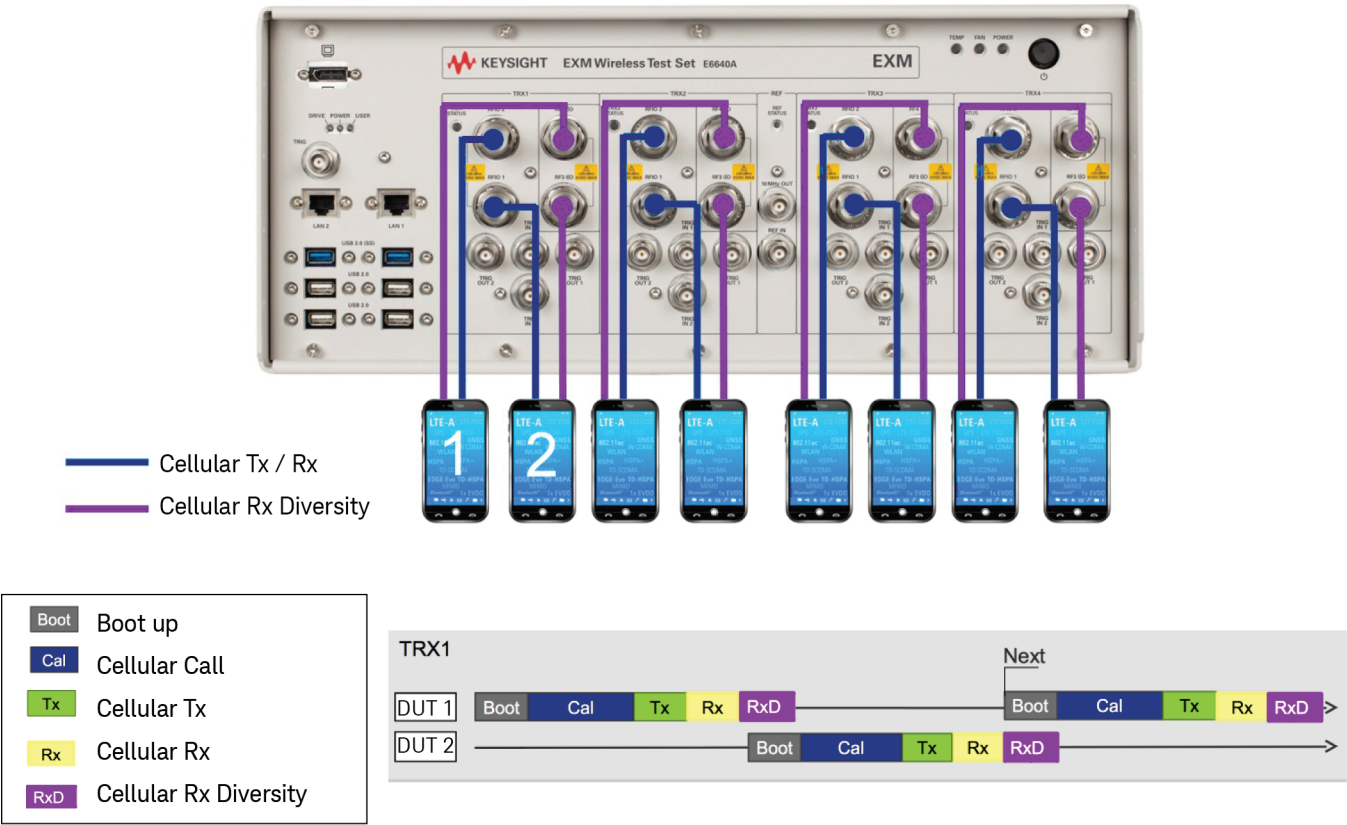


Figure 11. Ping pong test for 8 two-antenna cellular DUTs (one Tx/Rx, one Rx diversity)

Test Scenarios (continued)

WLAN

In this setup 16 WLAN devices are connected to EXM. On each TRX, both ping pong and pipeline testing can be implemented to increase the test efficiency because the source and analyzer on each TRX are independent. The TX and RX can be tested in overlap for DUT1 and DUT2; the same applies to DUT3 and DUT4. As WLAN is a TDD system, this approach is easily implemented in WLAN test.

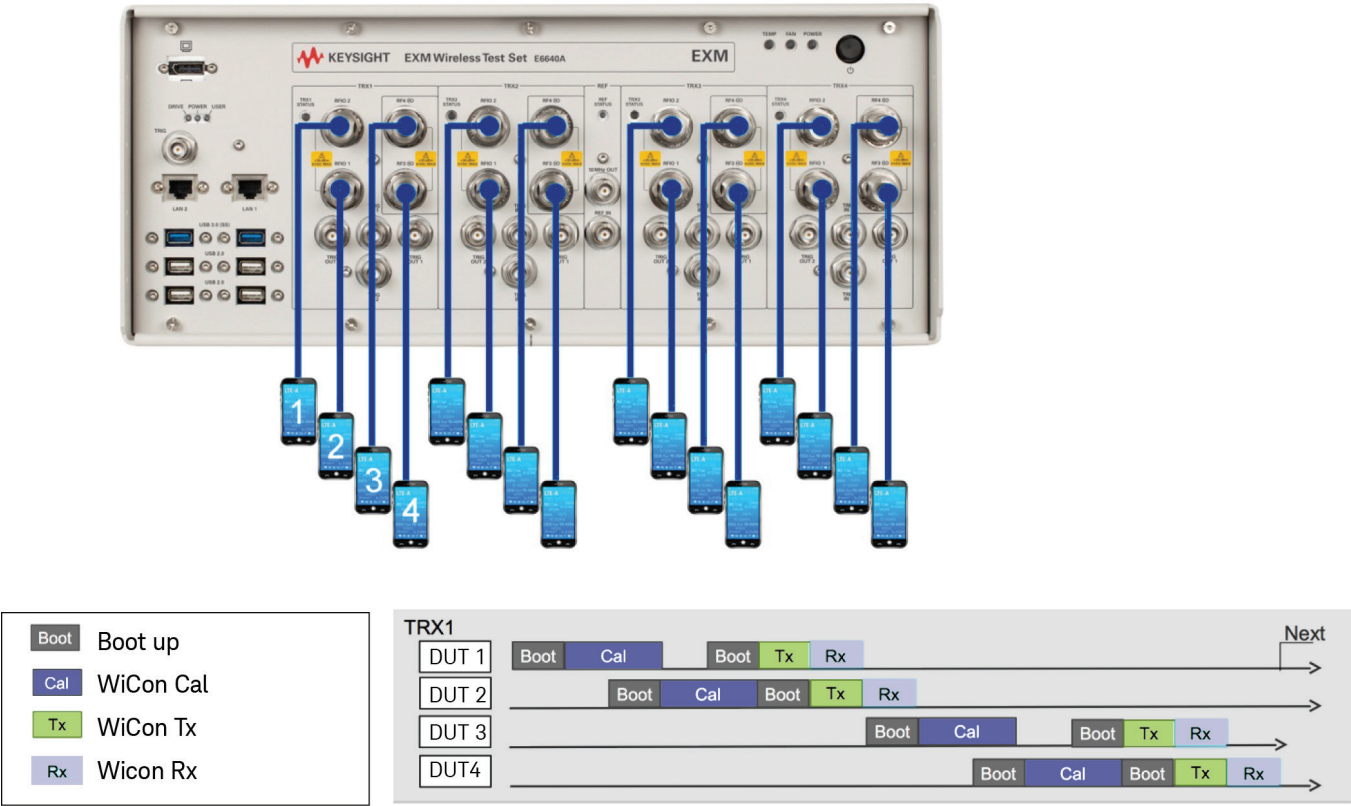


Figure 12. Ping pong and pipeline test for 16 single-antenna WiCon DUTs

Test Scenarios (continued)

Cellular and wireless connectivity

In this test setup, four phones are being tested in parallel and the test plan sequences thru cellular calibration and verification; including transmitter test, receiver test, and receiver diversity test, as well as WLAN test and GNSS receiver test.

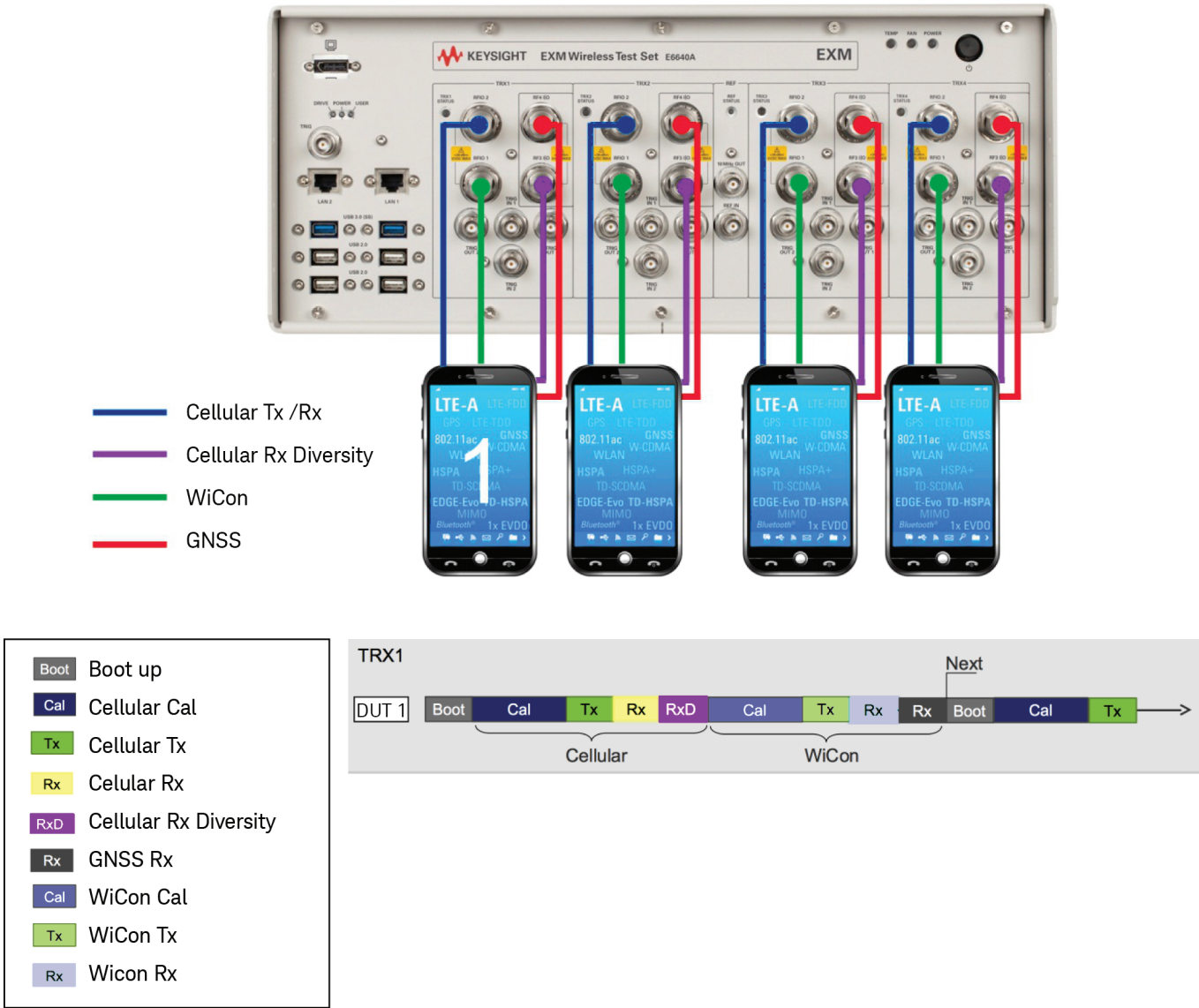


Figure 13. Connect one smart phone per TRX (one Tx/Rx and one Rx for cellular, one Tx/Rx for WiCON, one Rx for GNSS)

Drive Broader Acceptance of Your Chipsets

When it comes to creating the chipsets used in user devices, EXM helps you accelerate acceptance of your chipset designs by providing testing reliability for devices using your chipsets.

With up to four TRXs per EXM, you have the flexibility to perform parallel, sequential, or hybrid testing. In addition, EXM's advanced sequence analyzer, and optimized calibration and verification test techniques make it easy to maximize test throughput. It's designed to support what's coming next, so you can test your designs with 160 MHz bandwidth, up to 4x4 True MIMO, LTE-A CA, and more. And, as your chipset functionality evolves, EXM's flexible architecture will evolve too, minimizing the cost of capital equipment that will be needed to test your emerging designs.

Easy test code development helps maximize your NPI team's efficiency. Leverage existing test routines and automate code with standardized SCPI commands and reference drivers for higher-level automation abstraction. Save migration time through backward compatibility with EXT (E6607A/B/C) and E6630A. EXM's X-Series-based measurement applications provide consistent repeatability, ensuring seamless transitions from R&D to manufacturing.

EXM provides more than a future-ready test set. It gives you access to EXM-specific technical support from Keysight's Manufacturing Test Integration (MTI) team and the knowledge of Keysight domain specialists. Their expertise can help you optimize your existing test code, develop your own programs, or both. They can help you accelerate your chipset to manufacturing with greater readiness and faster ramp-up. That helps maximize your NPI team's efficiency to reach your goals quicker.

By partnering with Keysight, your chipsets are optimized for testing using EXM. As your chipsets are integrated into user devices, manufacturers testing devices with EXM will have the assurance that the chipsets are being properly verified. You get fewer calls from manufacturers needing information about your chipsets, allowing your resources to work on the next-generation chipsets.

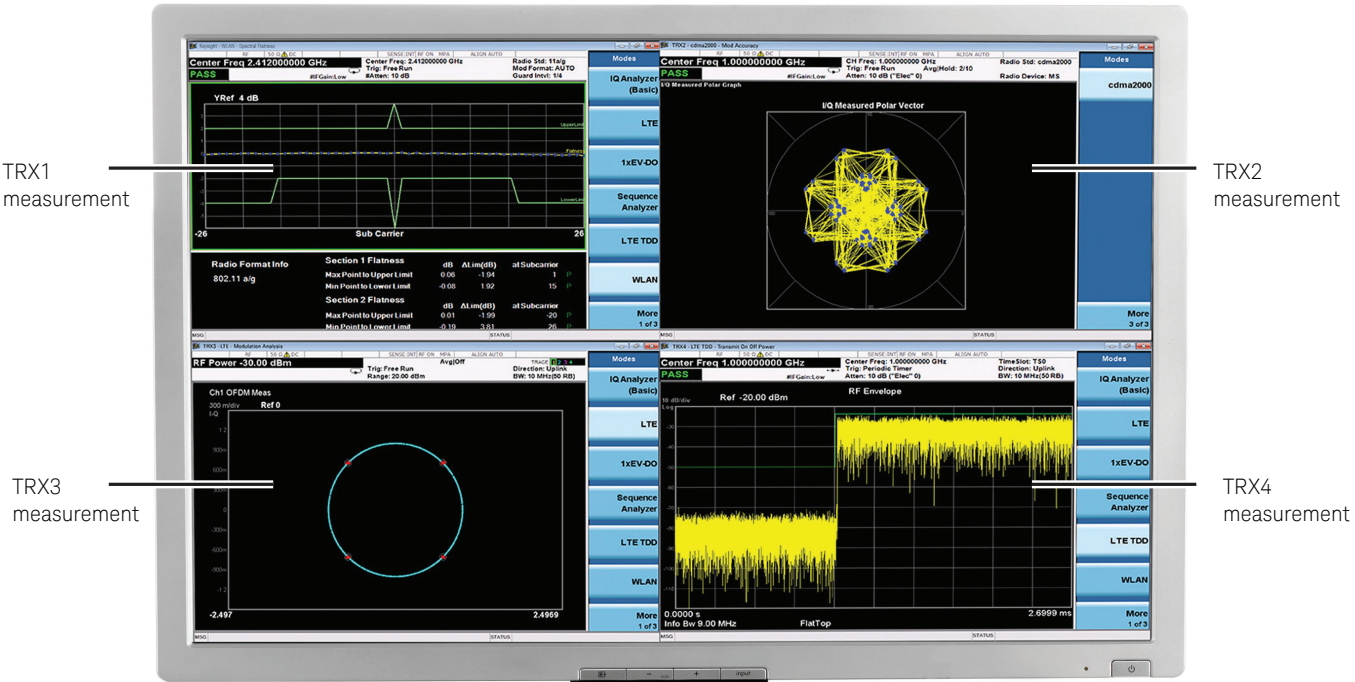
Experience Support

From initial planning meetings with chipset makers to peak production, count on our test expertise throughout the design and implementation of production lines. Whether you are using chipset vendors' test tools or Keysight TAP our technical experts can help. We can show you how to maximize production line uptime with robust, reliable equipment designed for the factory floor. Once you are up and running, the global presence of our calibration and repair services ensures quick turnaround to keep your manufacturing equipment running at peak performance. We will save you engineering test time and cost, allowing you to stay focused on your core business of device design, development, and manufacturing.

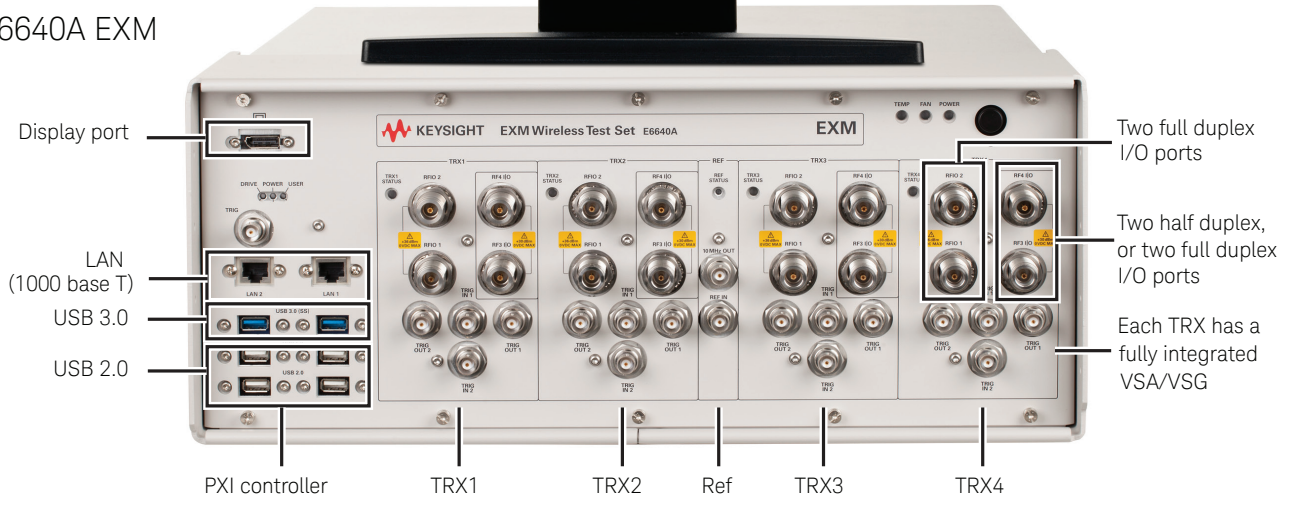
Product Tour

EXM Front View

X-Series user interface



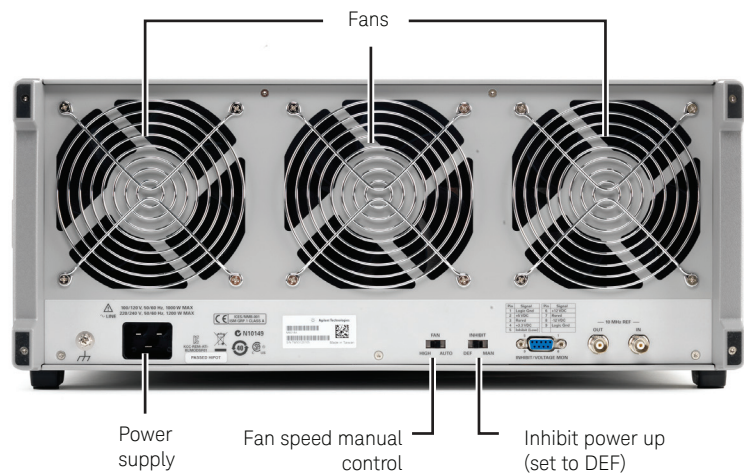
E6640A EXM



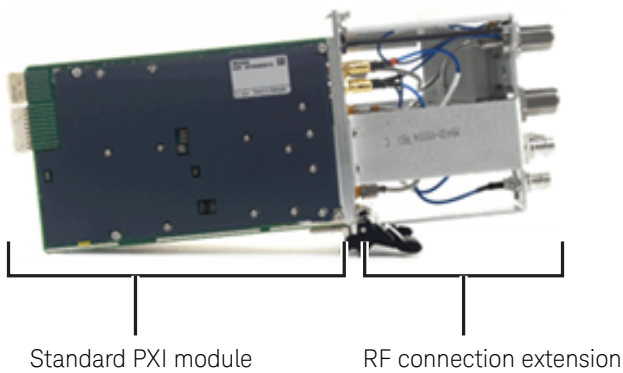
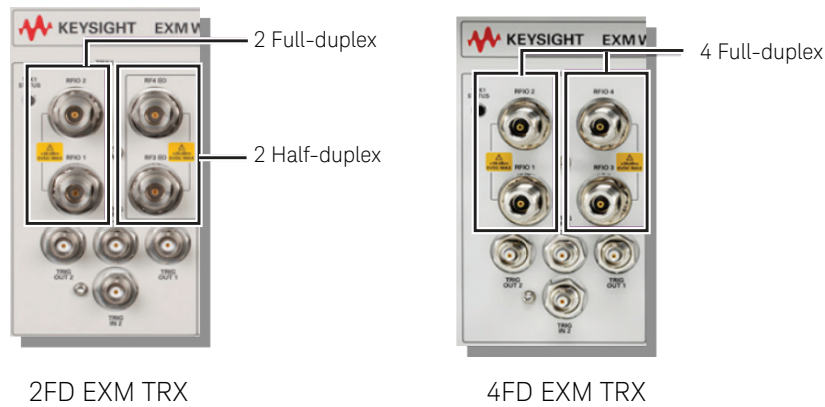
Note: Monitor is not part of the standard EXM configuration.

Product Tour

EXM Rear View



TRX View



Related Literature

- *E6640A EXM Wireless Test Set, Flyer*, literature number 5991-3532EN
- *E6640A EXM Wireless Test Set, Configuration Guide*, literature number 5991-3533EN
- *E6640A EXM Wireless Test Set, Data Sheet*, literature number 5991-4287EN
- *Solutions for LTE-Advanced Manufacturing Test*, Application Note, literature number 5991-3762EN
- *Solutions for WLAN 802.11ac Manufacturing Test*, Application Note, literature number 5991-4113EN

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