DATA SHEET

IOT8700 Series
IoT Wireless Test Solution

Deliver Reliable IoT Devices, Every Time

What are we seeing in today's IoT world?

Driven by the need for convenience and portability in Internet of Things (IoT) devices, device manufacturers now face new challenges in testing the increasingly smaller devices when wired connections are not possible. IoT technologies is widely used in many areas include mission critical applications such the smart city, industrial automation and digital health. IoT devices cannot afford to fail, over-the-air measurements are critical to thoroughly test IoT devices at every stage of the design cycle. The Keysight IO8700 series IoT wireless test solution can help you ensure that your products are robust, reliable, and safe under any real-world condition.

Purpose-build test solution for IoT application

The flexibility of the IOT8700 series allows you to easily integrate this solution into your existing R&D bench or manufacturing test setup – the solution covers the most commonly used radio formats such as *Bluetooth*® Low Energy and more, offers multi-device parallel test configurations to maximize throughput. And with software based on Keysight's TAP platform, the IOT8700 series is easy to configure and helps you save time through test automation, without needing to write your own programming codes.

Main features and benefits

Key features	Your benefits?
Over-the-air or conducted signaling test	Perform RF test wired or wirelessly without the need of control driver of device under test.
Parallel testing up to 16 devices (with interleave multi-DUT testing capability)	Scale test configuration to meet the demand of high throughput in manufacturing environment.
Great measurement coverage (e.g. Channel-based Tx Power, Rx PER, Tx Power Envelope, Advertising Interval etc.)	Comprehensive end-device performance characterization include antenna. Objectively measure key transmitter and receiver parameters with quantitative measurements, ensuring device quality and performance
Software GUI and Software Commands for Programmable Instruments (SCPI) ready	Simplify test setup with ready-to-use software GUI and automate your test sequence without time-consuming programming.

Deliver Reliable IoT Devices, Every Time

IOT8700 Series enables simplified over-the-air or conducted signaling testing of IoT devices in their actual operation mode and final form. The solution covers the commonly used radio formats and performs comprehensive transmitter and receiver RF measurements to help engineers ensure the quality and performance of their IoT devices.

KEYSIGHT TECHNOLOGIES

Connection diagram samples of IOT8700 Series

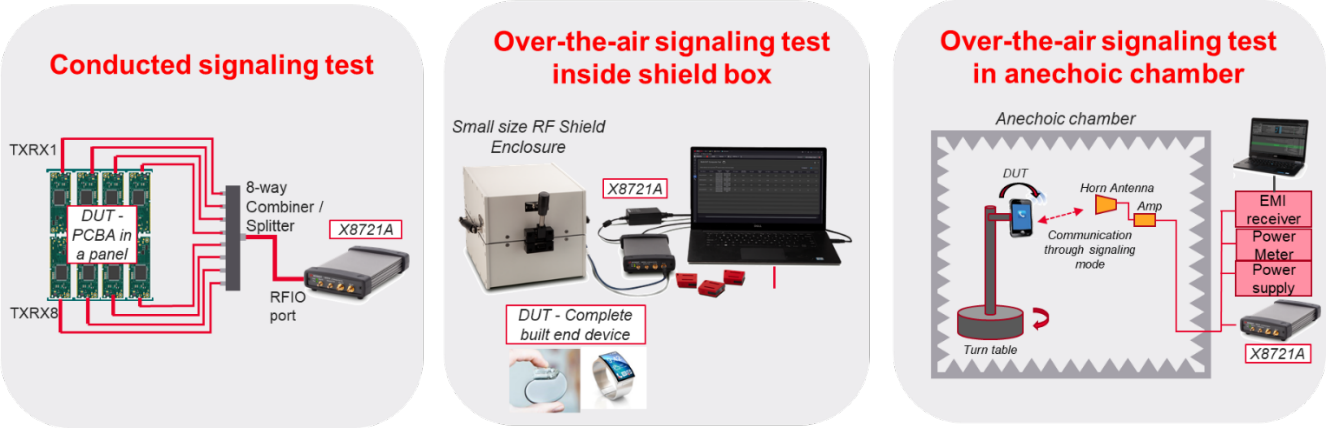


Figure 1. Various test configuration of IOT8700 Series

Whether you are characterizing your IoT device over many different scenarios during the design process, filtering manufacturing defects, or testing your IoT device for regulatory compliance, the Keysight IOT8700 series IoT wireless test solution gives you the confidence and reliability you need to ensure that your IoT products can withstand the mission-critical rigors of the real world.

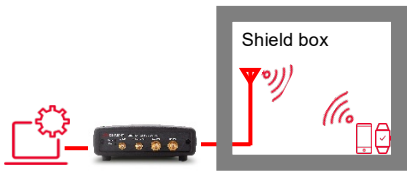
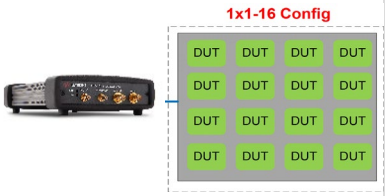
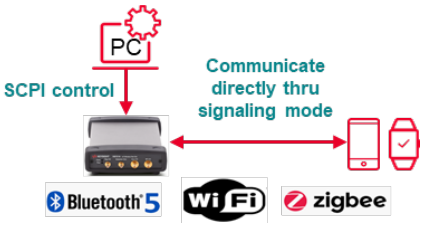
Design validation	Manufacturing	Regulatory compliance
		
• Perform over-the-air signaling test of end-device, including the antenna • Characterize device performance under various actual operation modes • Save time and simplify test development with optional Soft Front Panel Pro software (XA8722A) or Keysight Test Automation on Pathwave (TAP) - based automation software (XA8723A)	• Perform parallel testing of up to 16-DUT to reduce cost of test • Maximize throughput on the manufacturing line and accelerate time-to-market • Assure end device meeting quality levels and reduce the risk of manufacturing defects or field failures • Increase efficiency and reduce test development time with XA8723A Keysight TAP based automation software	• Ideal companion device for regulatory compliance testing • Simplify receiver blocking test without needing to develop the DUT's control driver • Cover the commonly used radio formats at an affordable cost • Assure your measurement results are accurate and traceable • Easy integration to existing test system through SCPI

Figure 2. IOT8700 Series uses in different applications

Features to Optimize Your Test Capability

Signaling test capability to streamline test flow

The IOT8700 series enables users to perform signaling test without the need to develop chipset specific driver to control or programming the device into test mode. Manufacturers can easily execute the transmitter and receiver tests by flashing the current firmware on the device under test. This helps manufacturer eliminate the process of switching device under test into test mode for testing and reflash with final firmware once testing is passed. With the streamlined test flow, manufacturers save time and effort on testing as they perform measurements under actual operation mode to ensure device quality.

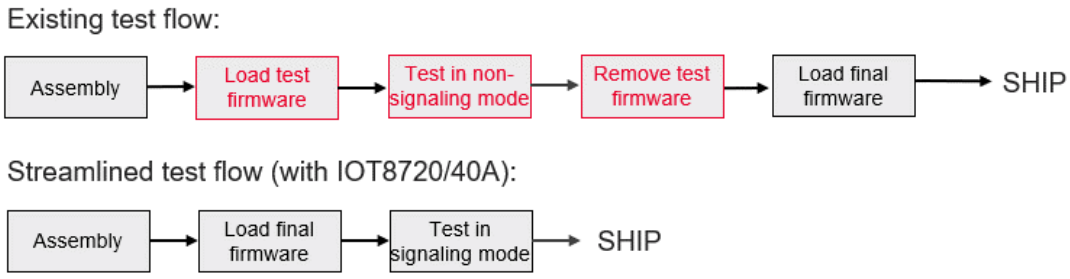


Figure 3. Streamlined test flow by testing in signaling mode with IOT8720/40A

Channel-based transmitter power and receiver PER measurements

The IOT8700 series can display transmitter power and receiver PER results based on individual BLE channels.

	Transmitter power	Receiver PER
Channel 37	-8.98 dBm	10.37%
Channel 38	-9.10 dBm	11.29%
Channel 39	-9.45 dBm	8.71%

Under Active Scan mode, the instrument can provide the transmitter power and receiver PER results for the three advertising channels which corresponding to low, mid and high frequency channels. This help to ensure the transmitter and receiver performance of the entire Bluetooth frequency bands.

If the BLE device supports Connected Mode, it is possible to perform transmitter and receiver measurements of all data channels, or selected data channels, to have very comprehensive performance characterization of the device.

Advertising interval and throughput measurements

Some devices may have variable advertising interval. The IOT8700 series will enable user to measure the advertising interval during the advertising events (active or passive scanning) and monitor the trend in a graph view to have better understanding of the advertising events. It is also possible to perform data throughput measurement of the advertising data or the scan response data.

Deep radio control capability

With deep radio control capability, it is possible to use IOT8700 series as a companion device to control the DUT to transmit and receive in various operation modes, and perform a comprehensive transmitter, receiver and throughput analysis. This is especially useful for designer or test engineers to fully characterize the device performance under various modulations, bandwidth and channel settings. Test lab or compliance testing engineers able to use IOT8700 series as a signaling unit during regulatory compliance testing to simplify PER tests at various blocking conditions. This would save you a significant amount of time since there is no need to develop the individual chipset specific driver.

Transmitter power envelope display capability

The turn-on behaviors of IoT devices may vary. Some IoT devices will not advertise immediately upon turned on. Some devices will advertise at high power level for a short duration before reducing the transmit power to the minimum to save battery life. While other devices may have variable advertising intervals. The transmitter power envelope display capability will come in handy to have better understanding of the device transmitting behavior to order to improve the measurement accuracy or repeatability and troubleshoot any connection issues with the instrument.

Connection, pairing and bonding check

The *Bluetooth* standard offers security check at different levels.

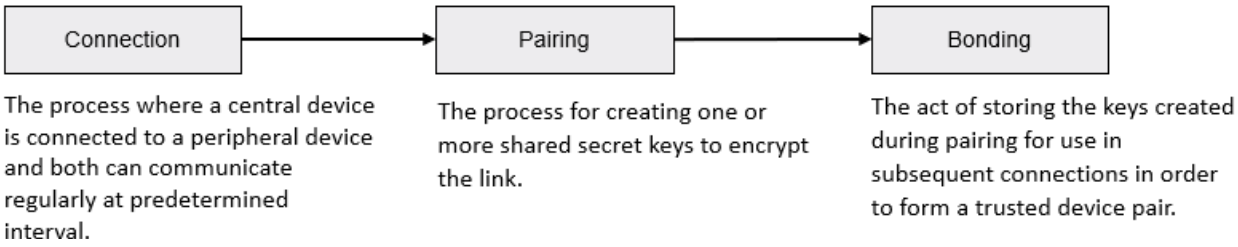


Figure 4. Security feature of *Bluetooth*

IOT8700 series will enable designers to verify the ability of the device to connect, pair and bond, to ensure that these security features are being implemented properly in the device.

Built-in pass-fail limit check and result log for manufacturing test

The built-in pass-fail limit check enables faster test time with the ability to catch up with the transmission rate of the DUT. The theoretical tester speed can be estimated as the number of packets multiplies with the advertising interval plus some overhead time to process the data. Production throughput and manufacturing test time can be optimized by the capability of parallel testing and faster test speed. Sample test plans are provided in the XA8723A signaling measurement suite for single and multi-DUT configurations, along with pass-fail limit check and results logging capability. Manufacturing engineers can save test development and testing time by leveraging and modifying the test plans and test sequence provided.

Service discovery and UUID read-write

UUID (Universally Unique Identifier), it identifies a service provided by a Bluetooth device. The IOT8700 series can perform UUID service discovery to identify all the supported UUIDs, the handlers, values and permissions. If the permission is set as write-able, user can overwrite a specific UUID and its values. This feature is very useful for manufacturer to retrieve certain data from the device (example: battery level) or program specific data to the device (example: manufacturing data, serial number) over-the-air without hardwire connection. This feature only works on BLE devices supporting Connected Mode.

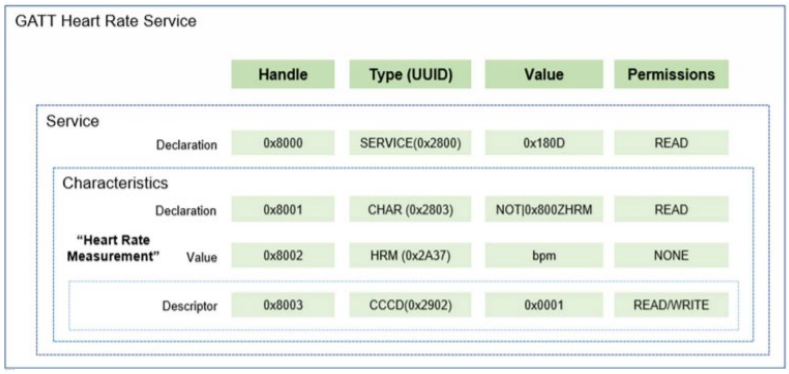


Figure 5. GATT profile example of a heart rate service

True Multi-devices parallel test configuration

The IOT8740A IoT wireless multi-device test solution is the industry's first solution to enable full parallel testing for both transmitter and receiver tests in signaling mode. It is possible to test up to 16 devices in parallel with all of them transmitting and receiving concurrently and being placed in the same shielding box. With tight timing alignment between the radio subsystem and RF power detection subsystem in the tester, it is possible to monitor all the incoming RF packets using the RF detection subsystem, and correlate each of the packets with the DUT MAC address decoded from the radio subsystem to provide TX and RX measurements for all the DUT in parallel. Through this innovative measurement algorithm, manufacturers can now save test time up to 16 times.

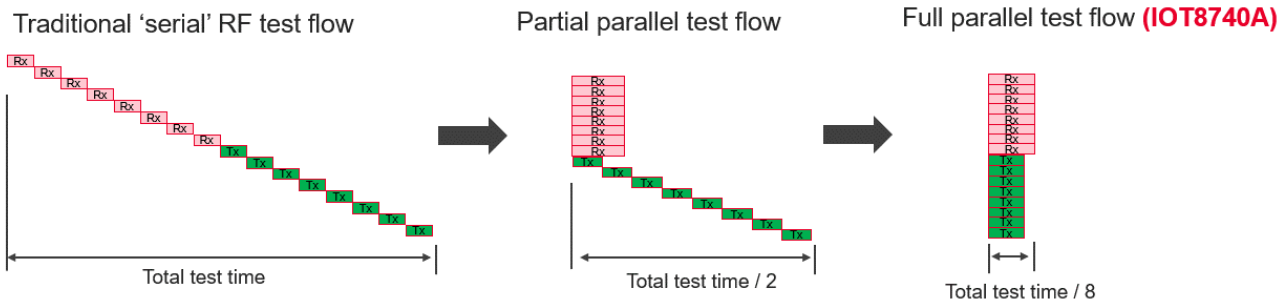


Figure 6. Significant improvement in test time is achievable using full parallel test flow

Single and Multi-DUT Configurations

The IOT8700 Series is available in two configurations:

Figure 7. Diagrams showing the single vs multi-device configurations

The IOT8720A is suitable use in design validation application whereas IOT8740A is ideal for high volume manufacturing applications.

The IOT8740A is the industry's first solution to offer interleaved multi-DUT feature where it concurrently tests multiple DUTs inside a single shield box. The testing is interleaved to maximize the utilization of the tester and thus reduce the overall test time.

Front and Rear Panels

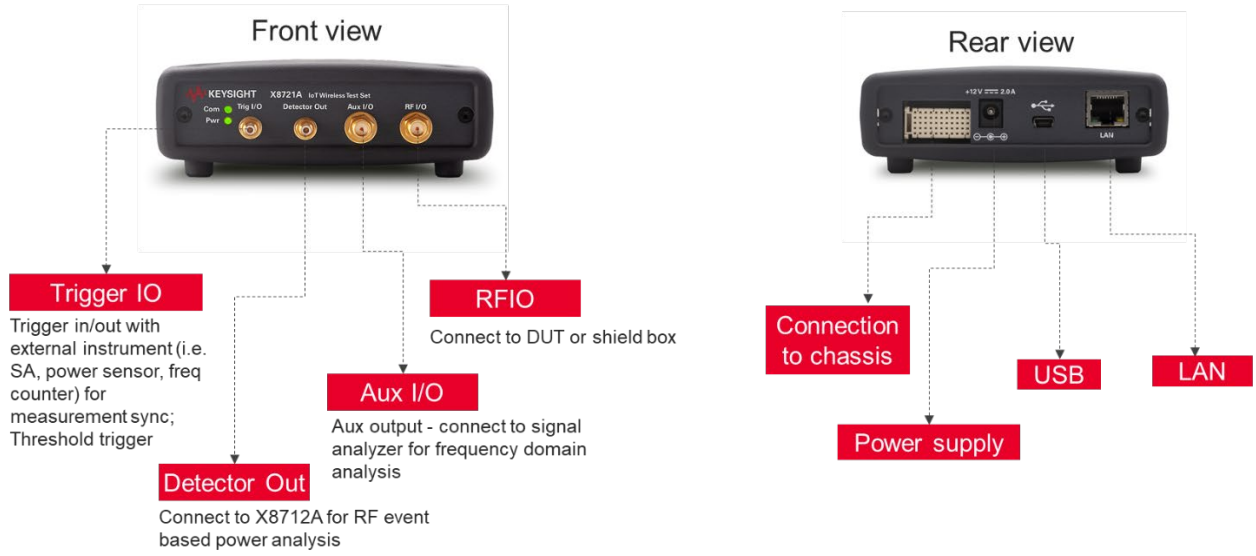


Figure 8. Front and rear panels of X8721A IoT wireless test set

Hardware Performance

Radio	*Bluetooth*
Radio format	*Bluetooth* Low Energy 5.0 & 4.2
Frequency Range	2.4 to 2.48 GHz
Frequency Accuracy	50 ppm (Nominal)
Input Power Measurement (DUT Transmit Power)	Range: +17 to -50 dBm Accuracy: ± 0.7 dB (Typical) ± 1.0 dB (Spec)
Output Power Range / Downlink Power Adjustment (Receiver Sensitivity)	Range: -25 to -100 dBm Resolution: 0.25 dB Accuracy: ± 0.7 dB (Typical) ± 1.0 dB (Spec)
Maximum Input Level at RF I/O or Aux I/O	≤ +27 dBm
Input VSWR at RF I/O or Aux I/O	≤ 2:1 (Nominal)
Isolation/Shielding Effectiveness [2]	> 100 dB
Residual Packet Error Rate [1]	< 1%

Notes

1. Tester will not generate any false good or false bad packets above this level. False good packet is counting a good packet as a bad packet. False bad packet is counting a bad packet as a good packet.
2. Isolation at the Radio with RF I/O and Aux I/O terminated.
3. All specifications are specified at operating temperature of 23 °C ± 5 °C, with relative humidity less than 80%.
4. All specifications are referenced to RFIO port.

General Characteristics

Remote interfaces	USB 2.0
Remote programming language	SCPI
Physical dimensions	25 mm (H) x 175 mm (L) x 105 mm (W)
Weight	0.7 kg
Power requirement	100/120 V, 50/60 Hz 220/240 V, 50/60 Hz

Bluetooth Low Energy Specification

The IOT8700 series can support BLE testing in Active Scan or Connect Mode. Table below shows the supported BLE device roles and test parameters.

Device role	Description	Active Scan Mode			Connected Mode		
		TX power	PER	Throughput	TX power	PER	Throughput
Peripheral	Slave device that can send and receive info	Yes	Yes	Yes	Yes	Yes	Yes
Beacon	Transmit only device	Yes	No	No	No	No	No
Observer	Receive only device	No	No	No	No	No	No

1. Active Scan:
    - Parameters: TX power, RX PER, RX sensitivity for all advertising channels, advertising data and scan response data throughput, advertising interval time during advertising events (active or passive scanning)

2. Connected Mode:
    - Parameters: TX power, RX PER, RX sensitivity for all data channels, throughput, advertising interval time during advertising events (active or passive scanning)

3. Others:
    - Services discovery and UUID read/write
    - Connection, pairing, and bonding check
    - Power envelope display for TX signals

Software Applications

The IOT8700 Series wireless test solution offers 2 optional software packages to help you to easily configure the test setup, and help to save time through test automation, without needing to write your own programming codes.

1. XA8722A soft front panel

The **X8722A soft front panel** provides simple interface that allow you to quickly conduct tests without needing to spend a lot of time writing test software. It provides simple operation with powerful visualization, allowing you to easily evaluate and control your hardware, as well as automate and speed up testing.

There are two versions of XA8722A:

Descriptions	XA8722A soft front panel utility	XA8722A soft front panel pro
Version	Free version Available for download from www.keysight.com/find/XA8722A (coming soon)	Licensed version Download trial version from www.keysight.com/find/XA8722A (coming soon)
Feature	Provides basic view • Basic composite TX power and RX PER readings • Basic TX power envelope display Provides basic functionalities • License enablement • Firmware upgrade • Run self-test • Display SCPI logs	Provides various views • Quick view • TX power envelope display • PER trend chart • Advertising interval trend chart • Throughput trend chart • TX power trend chart • UUID Read/Write • DUT info • Multi-DUT view • Utility Provides advance measurement capabilities • Display channel-based TX power and RX PER measurements • Provide min/max and average readings for all measurement parameters • Ability to configure upper and lower limits and perform limit check with pass-fail indicators • Export test results to csv format • Display SCPI logs
PC requirements	Windows 10 Build 1809 onwards, 8GB RAM.	

Software Applications (continued)

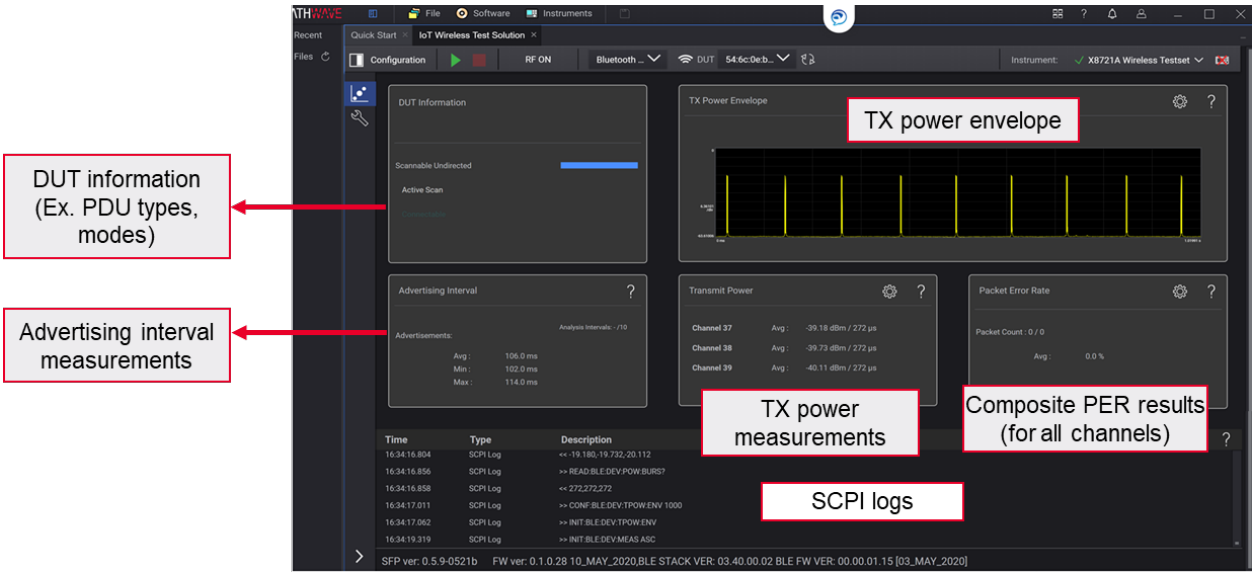


Figure 9. X8722A soft front panel utility (free version)

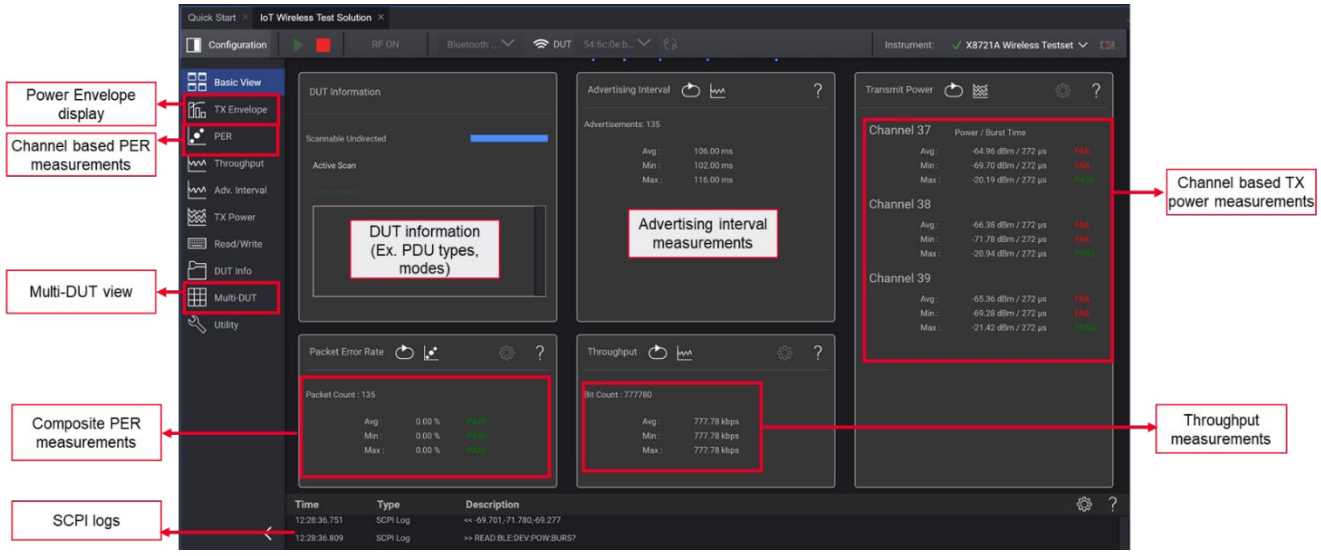
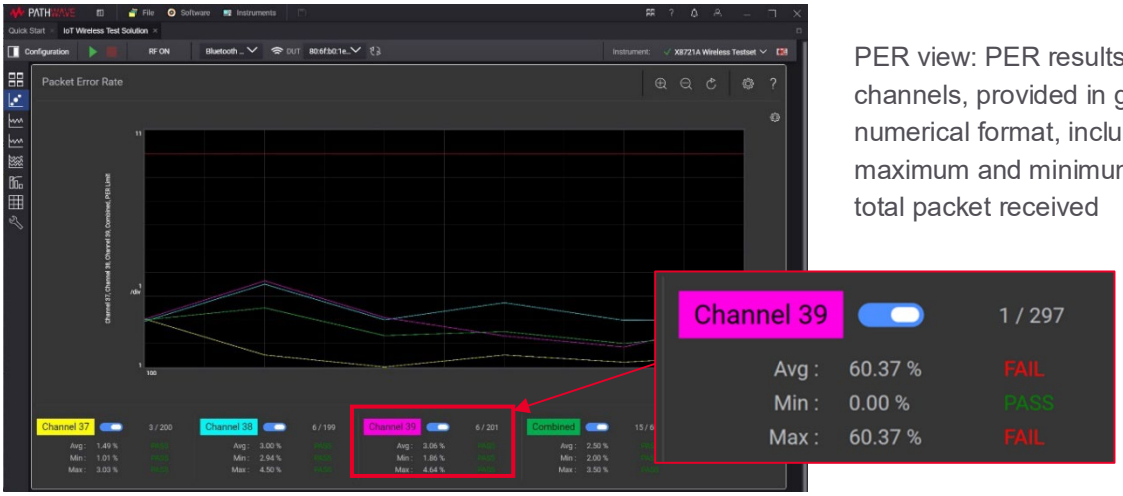


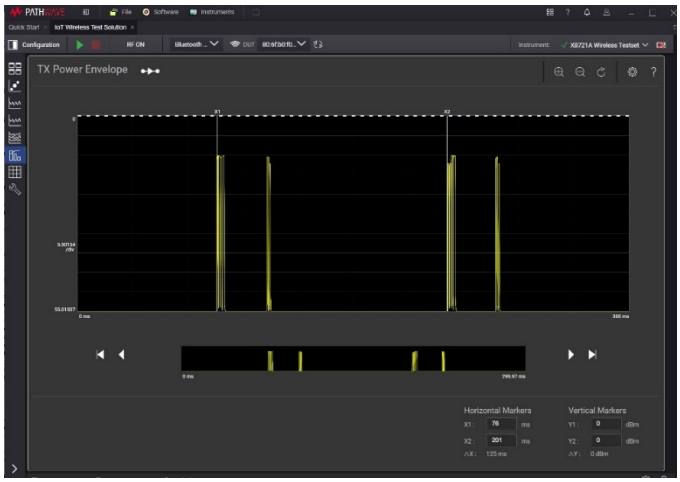
Figure 10. XA8722A soft front panel pro (license required: IOT8700AU-XA8722A)

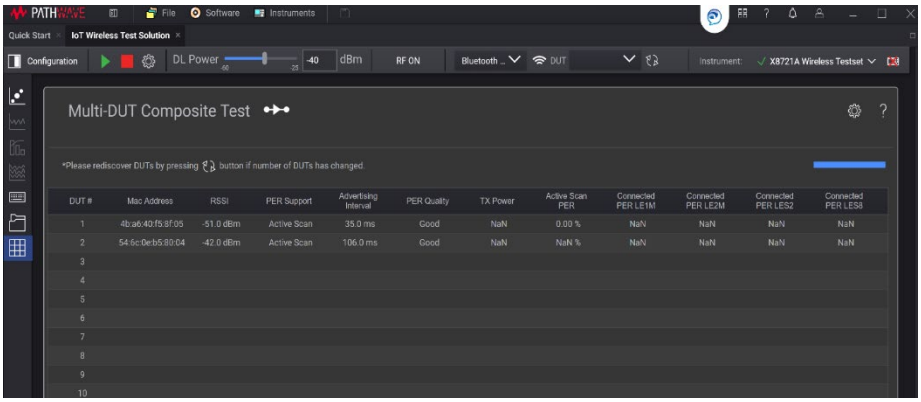
Software Applications (continued)



PER view: PER results by individual channels, provided in graph and numerical format, including average, maximum and minimum readings and total packet received

TX power view: Display TX power envelope with marker functions and zoom capability





Multi-DUT view: All DUTs results display in tabular format, with ability to configure display parameters. Support up to maximum 16-DUT (required Multi-DUT option).

Figure 11. Various views provided in XA8722A soft front panel pro

Software Applications (continued)

1. XA8723A signaling measurement suite

The XA8723A Signaling Measurement Suite is a plugin that run under Keysight KS8400A Test Automation Platform (TAP). It contains test steps that enable BLE signaling connection, TX power measurements, RX packet-error-rate, sensitivity and many other measurements, for both single DUT and multi-DUT parallel testing configurations.

The software provides powerful, flexible and extensible test sequence and test plan creation with additional capabilities that optimize your test software development and overall performance. TAP provides a graphical user interface (GUI) so that both beginning and experienced programmers can quickly construct test plans consisting of multiple test steps. Flow operations are supported, along with parallel testing.

XA8723A software trial license will be available for download from www.keysight.com/find/XA8723A (coming soon)

(PC requirement: Windows 10 Build 1809 onwards, 8GB RAM)

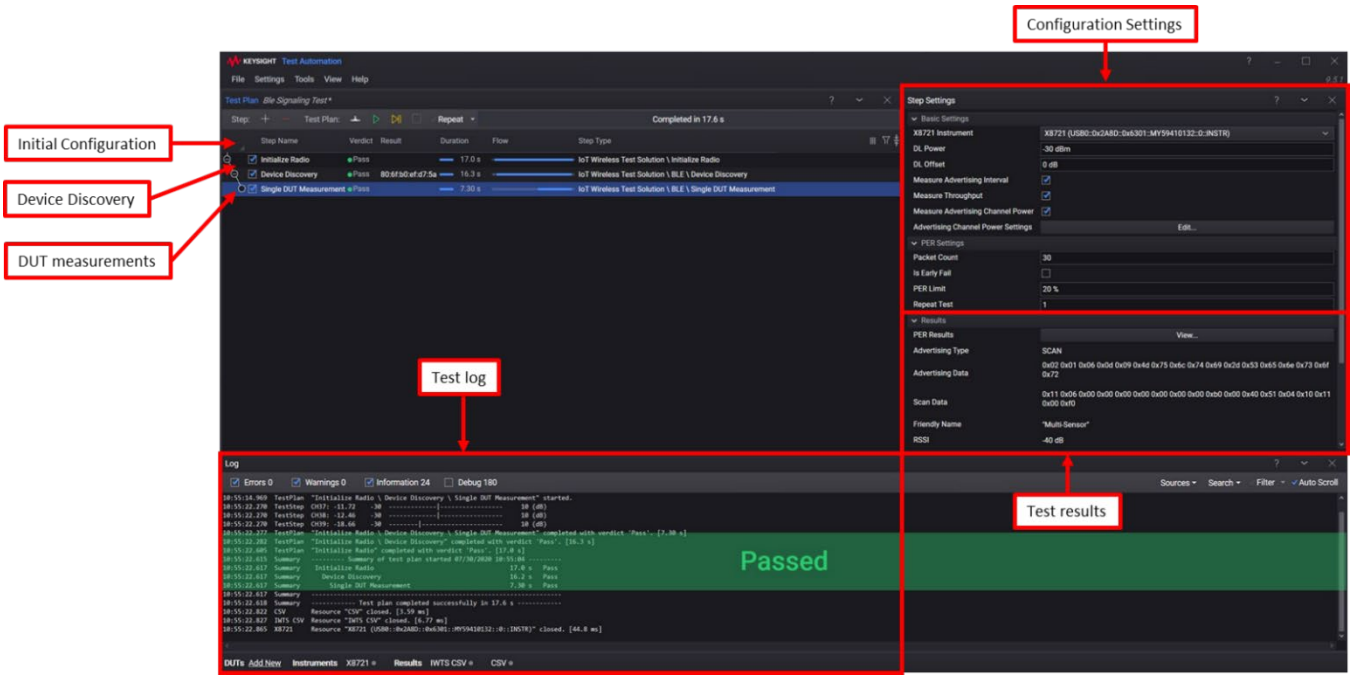


Figure 12. Test Plan consists of multiple test steps, setting for each test step

Optional Accessories

RF shielded enclosures

Three different sizes of RF shied enclosures are available for purchase together with the IOT8700 series. These enclosures are RoHS compliant and is shippable to most countries globally. To complement the IoT8720A and IoT8740A solutions, Keysight offers the ordering convenience to add RF shielded enclosure manufactured by and including 1-year warranty from BIP Roottek. The purchase of any of these enclosures will come with the following accessories to enable RF connection from X8721A module to the enclosure:

- 1x RF N-Terminator Plug Straight
- 1x 36in RF SMA-Male to N-Male cable

1. X8763A small-size RF shielded enclosure

- High performance RF absorber
- High shielding effectiveness using double layer gasket structure
- Fixture mounting holes in the bottom plate

Parameters		Characteristics
Inner Size		173 mm (W) x 248 mm (D) x 134 mm (H)
Weight		Approx. 7.6 Kgf
Interface		1x DB25, 1x USB 2.0 2x N-SMA
Antenna Coupler		Wide band with VSWR < 2.2 at 0.8~6 GHz
Shielding Effectiveness (Measured when the blank I/O panel is attached)	100-3000 MHz	> 70 dB
	3000-6000 MHz	> 60 dB

2. X8764A medium-size RF shielded enclosure

- High performance RF absorber on inside walls
- High shielding effectiveness using double layer gasket structure

Parameters		Characteristics
Inner Size		457 mm (W) x 480 mm (D) x 358 mm (H)
Weight		Approx. 38 Kgf
Interface		1x DB25, 1x USB 2.0 2x N-SMA
Antenna Coupler		Wide band with VSWR < 2.3 at 0.5~6 GHz
Shielding Effectiveness (Measured when the blank I/O panel is attached)	100-3000	> 70 dB
	3000-6000 MHz	> 60 dB

Optional Accessories (continued)

3. X8765A large-size RF shielded enclosure

- High performance RF absorber on inside walls
- High shielding effectiveness using double layer gasket structure
- Reliable test result and repeatability
- Fixture mounting holes in the top, bottom and side walls

Parameters		Characteristics
Inner Size		842 mm (W) x 842 mm (D) x 842 mm (H)
Weight		Approx. 100 Kgf
Interface		1x DB25, 1x USB 2.0 2x N-SMA
Antenna Coupler		Wide band with VSWR < 2.3 at 0.5~6 GHz
Shielding Effectiveness (Measured when the blank I/O panel is attached)	100-3000 MHz	> 70 dB
	3000-6000 MHz	> 60 dB

X8761A rackmount kit

This rackmount kit supports up to 3 units of X8721A to an EIA 19-inch test rack cabinet. Fillers are provided to cover empty slots.

- Dimension: 483 mm(W) x 44 m(H) x 105 mm(D)

Ordering Information

Step 1: Choose single or multi-device test configuration (select one)	
IOT8720A	IoT wireless test solution
IOT8740A	IoT wireless test solution, multi-devices
Step 2: Choose radio option (select one or more)	
X8721A- BT5	*Bluetooth* low energy 5.0 & 4.2
Step 3: Choose multi-device option (select one); skip this step for IOT8720A	
X8721A-D04	Multi-devices, up to 4-DUT
X8721A-D08	Multi-devices, up to 8-DUT
X8721A-D16	Multi-devices, up to 16-DUT
Step 4: Choose software option (optional)	
XA8722A	Soft front panel (Pro)
XA8723A	Signaling measurement suite (require KS8400A Keysight PathWave test automation)
Step 5: Choose RF Shield Enclosure (optional)	
X8763A	Small-size RF shielded enclosure
X8764A	Medium-size RF shielded enclosure
X8765A	Large-size RF shielded enclosure
Step 6: Choose other accessories (optional)	
X8761A	Rackmount kit

Software – License Type and Terms

For XA8722A soft front panel pro and XA8723A signaling measurement suite

Perpetual license type and support subscription	
R-X5Y-001-A R-X6Y-001-L	Node-locked perpetual license KeysightCare software support subscription, node-locked – 12 months
R-X5Y-002-B R-X6Y-002-L	Floating (single site) perpetual license KeysightCare software support subscription, floating (single site) – 12 months
R-X5Y-004-D R-X6Y-004-L	Transportable perpetual license KeysightCare software support subscription, transportable – 12 months
R-X5Y-005-E R-X6Y-005-L	USB portable perpetual license KeysightCare software support subscription, USB portable – 12 months
Time-base license type and support subscription	
R-X4Y-001-L	12-months, node-locked license, KeysightCare software support subscription
R-X4Y-002-L	12-months, floating (single site) license, KeysightCare software support subscription
R-X4Y-004-L	12-months, transportable license, KeysightCare software support subscription
R-X4Y-005-L	12-months, USB portable license, KeysightCare software support subscription

For KS8400A TAP developer's system and KS8000A TAP deployment system

Perpetual license type and support subscription	
R-D5A-001-A R-D6A-001-L	Node-locked perpetual license KeysightCare software support subscription, node-locked – 12 months
R-D5A-002-B R-D6A-002-L	Floating (single site) perpetual license KeysightCare software support subscription, floating (single site) – 12 months
R-D5A-004-D R-D6A-004-L	Transportable perpetual license KeysightCare software support subscription, transportable – 12 months
R-D5A-005-E R-D6A-005-L	USB portable perpetual license KeysightCare software support subscription, USB portable – 12 months
Time-base license type and support subscription	
R-D4A-001-L	12-months, node-locked license, KeysightCare software support subscription
R-D4A-002-L	12-months, floating (single site) license, KeysightCare software support subscription
R-D4A-004-L	12-months, transportable license, KeysightCare software support subscription
R-D5A-005-L	12-months, USB portable license, KeysightCare software support subscription

Standard Shipping Items

- X8721A IoT wireless test set
- USB Type-A male to Mini-USB 2.0 Type-B cable
- External power adapter 85-264VAC, 12VDC, 2.09A, 25W and power cord
- Certificate of calibration
- Soft front panel utility software
  (available for download from www.keysight.com/find/XA8722A - coming soon)

Related Information

KS8400A and KS8000A test automation platform	www.keysight.com/find/TAP
X8711A IoT device functional test solution	www.keysight.com/find/X8711A
ZA0060A custom IoT device functional test solution	https://literature.cdn.keysight.com/litweb/pdf/5992-3871EN.pdf

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