

IOT0047A Regulatory Test Solution

Conduct ETSI, FCC, KC, MIC and SRRC regulatory tests for wireless devices operating in 2.4 GHz, 5 GHz, and 6 GHz unlicensed bands

Deliver the Win-Win in IoT

The race to launch IoT chipsets, modules and devices is pushing test labs to the limit. That is why Keysight created the IOT0047A regulatory test solution as to accelerate the certification of unlicensed wireless devices in a flexible and efficient way.

Before, during and after compliance testing—full or partial—the IOT0047A gives you multiple ways to cover more tests for more standards in less time. With faster throughput for you and quicker time-to-market for your clients, Keysight helps you deliver the win-win in IoT.



Flexible and Scalable Platform For 2.4 GHz, 5 GHz, and 6 GHz Regulatory Testing

Regulatory test is complex, time consuming and costly. It directly impacts project schedule and time to market for new products. Hence, regulatory testing needs to be carefully planned into the project schedule.

The Keysight IOT0047A wireless IoT device regulatory test solution makes 2.4 GHz,

5 GHz, and 6 GHz unlicensed bands wireless device testing easy and efficient. Be confident with Keysight's laboratory grade RF instruments. The solution:

- Covers the latest test cases of ETSI EN 300 328, EN 301 893, EN 303 687, FCC Part 15.247, and FCC 15.407 (inclusive KDB987594 for U-NII 6GHz), KC KS-X-3123 2022, MIC 特定無線設備の技術基準適合証明等に関する規則_第2条第1項第 19/19-3/79/80, SRRC 工信部无〔2021〕129号《工业和信息化部关于加强和规范2400 MHz、5100 MHz和5800 MHz频段无线电管理有关事宜的通知 and DFS with dedicated test software.
- Scalable test system to cover wide arrays of IoT device types: Frequency hopping, adaptivity, MIMO up to eight channels and supports common radio formats (WLAN, Bluetooth®, ZigBee® etc.).
- Simplifies test automation and improves speed with signaling test method using companion device.
- Expand your test system - purchase what you need now and add more capabilities later for better capital planning with its flexible platform.
- Reduces test complexity with readily available software which automates the regulatory testing and report generation (Figures 1-5).



Figure 1. Spurious Emission

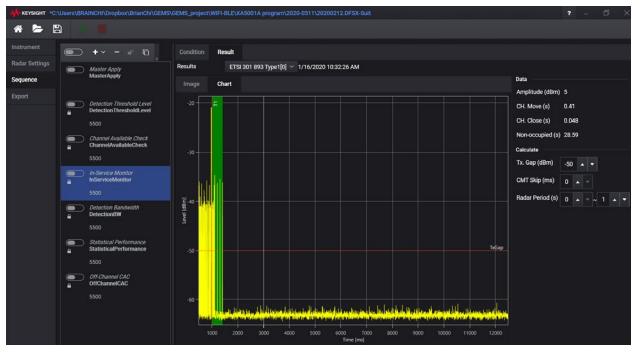


Figure 2. In-Service Monitor

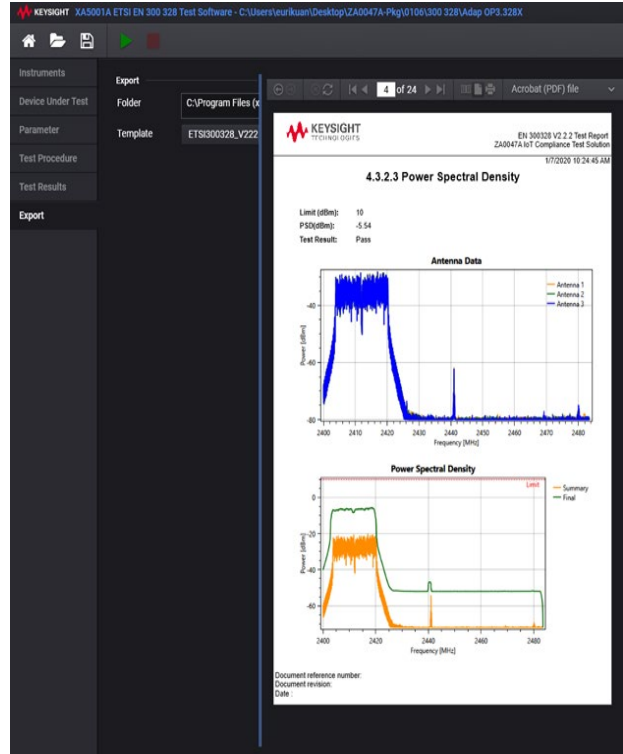


Figure 3. Test Report Generation

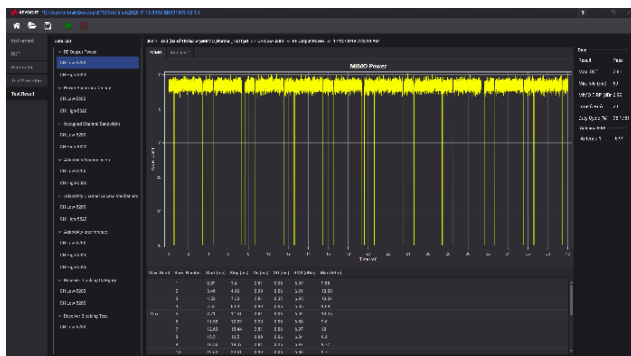


Figure 4. MIMO Power Measurement

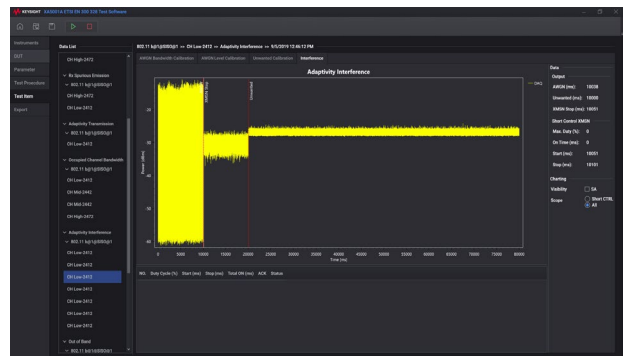


Figure 5. Adaptivity Waveform Analysis

Test Cases: Keysight XA5001A ETSI Regulatory Test Software

This version of the system software addresses the latest versions of the ETSI EN 300 328, EN 301 893 and EN 303 687 (V1.0.0) test cases:

XA5001A test software supports ETSI EN 300 328 V2.2.2, EN 301 893 V2.1.1 and EN 303 687 (V1.0.0)

The table summarizes the test items covered for each set of test cases.

No	Test items	ETSI EN 300 328 (V2.2.2)	ETSI EN 301 893 (V2.1.1)	ETSI EN 303 687 (V1.0.0)
1	RF output power	✓		✓
2	Duty cycle, transmitter sequence, transmitter gap	✓		
3	Medium utilization	✓		
4	Power spectral density (PSD)	✓		✓
5	RF output power, transmit control power (TCP) and power density		✓	
6	Occupied channel bandwidth	✓	✓	✓
7	Transmitter: unwanted emission in the out-of-band domain	✓	✓ ¹	✓
8	Transmitter: unwanted emission in the spurious domain	✓	✓	✓
9	Transmitter: unwanted emission in within the 5 and 6GHz RLAN bands		✓	
10	Accumulated transmit time, frequency occupation and hopping sequence	✓		
11	Hopping frequency separation	✓		
12	Carrier frequencies	✓	✓	✓
13	Receiver: spurious emissions	✓	✓	✓
14	Adaptivity	✓	✓	✓
15	Receiver blocking	✓	✓	✓
16	Adjacent Channel Selectivity			✓
17	Dynamic frequency selection (DFS)		✓ (XA5003A)	

1. Available for EN 301 893 (draft version V2.1.5 (Contact Keysight for the new update)

Test Cases: Keysight XA5002A FCC Regulatory Test Software

This version of the test software addresses the most recent versions of the FCC Part 15.247, Part 15.407, RSS-247 and RS-248 test cases. The table summarizes the test items covered for each set of test cases.

No	Test items	FCC part 15.247 / RSS247		FCC part 15.407 / RSS-247 / RS-248
		DSS/FHSS ¹	DTS ²	U-NII
1	Peak output power	✓	✓	
2	Maximum conducted output power		✓	✓
3	Power spectral density (PSD)		✓	
4	Emission bandwidth (6 dB)		✓	✓
5	Emission bandwidth (20 dB)	✓		
6	Emission bandwidth (26 dB)		✓	✓
7	99% occupied bandwidth	✓		✓
8	Channel separation	✓		
9	Channel number	✓		
10	Dwell time	✓		
11	Band edge	✓	✓	✓
12	Spurious emission		✓	✓
13	Dynamic frequency selection (DFS)	✓		✓ (XA5003A)
14	Frequency stability			✓
15	Contention-based Protocol (CBP)			✓ ³

1. Digital spread spectrum (DSS) and frequency-hopping spread-spectrum (FHSS) systems

2. Digital transmission system (DTS)

3. According to FCC KDB987594 D02 test requirement

Test Cases: Keysight XA5003A DFS Test Software

The dedicated Dynamic Frequency Selection (DFS) test software supports test cases for ETSI EN 301 893 V2.1.1, EN 302 502 V1.2.1, FCC-06-96, FCC-13-22 (KDB905462), Japan MIC 2019-W53 and W56, Korea, and China DFS standard. It significantly reduces time by simplifying and automating DFS test profile, which includes detection level calibration, CAC (Channel Available Check), detection bandwidth and in-service monitoring. It also enables interactive control with Master / AP and AC outlet as part of the requirements to complete whole test process. Post data analysis and report generation functions are included in the software.

Test Cases: Keysight XA5004A ETSI Regulatory Test Software for Non-Signaling Tests

XA5004A test software addresses the non-signaling test requirements of most recent versions of the ETSI EN 300 328 (V2.2.2), EN 301 893 (V2.1.1), and EN 303 687 (V1.0.0). This test software is a subset of XA5001A test software and covers test requirements such as RF output power, occupied channel bandwidth, power spectral density, spurious emissions, and hopping frequency separation.

Test Cases: Keysight XA5005A ETSI Regulatory Test Software for Signaling Tests

XA5005A test software addresses the signaling test requirements of most recent versions of the ETSI EN 300 328 (V2.2.2), EN 301 893 (V2.1.1), and EN 303 687 (draft 0.0.13). This test software is a subset of XA5001A test software and covers test requirements such as adaptivity and receiver blocking.

Test Cases: Keysight XA5006A KCC Regulatory Test Software

XA5006A test software addresses the test requirements of Korea KS-X-3123 2022. The table below summarizes test coverage of XA5006A test software.

No	Test items	2.4GHz		5GHZ WLAN	6GHZ WLAN
		BT/BLE	WLAN		
1	Output Power	✓	✓	✓	✓
2	Radiation Power				✓
3	Frequency Stability	✓	✓	✓	✓
4	Power Spectral Density	✓	✓	✓	✓
5	Occupied Channel Bandwidth	✓	✓	✓	✓
6	TX Spurious Emission (Spurious and OOB Domain)	✓	✓	✓	✓
7	Dwell Time	✓			
8	Number of Hopping	✓			
9	RX Spurious Emission	✓	✓	✓	✓
10	Listen Before Talk				✓
11	Dynamic Frequency Selection (DFS)			✓	

Test Cases: Keysight XA5007A MIC Regulatory Test Software

XA5007A test software addresses the test requirements of Japan regulation law 特定無線設備の技術基準適合証明等に関する規則_第2条第1項第 19/19-3/79/80. The table below summarizes test coverage of XA5007A test software.

No	Test items	Sub Test Item	2.4GHz		5GHz	6GHz
			BT/BLE	WLAN	WLAN	WLAN
1	Frequency Tolerance		✓	✓	✓	✓
2	OBW	OBW	✓	✓	✓	✓
		Spread Bandwidth	✓	✓		
3	Antenna Power	Antenna Power	✓	✓	✓	✓
		Power Tolerance	✓	✓	✓	✓
4	Burst Time			✓	✓	
5	ACPL			✓	✓	
6	Spurious Emission Intensity		✓	✓	✓	✓
7	Secondary Radiated Emission		✓	✓	✓	✓
8	Dwell Time		✓			
9	Carrier Sense			✓	✓	✓
10	DFS				✓	
11	EIRP	EIRP			✓	✓
		Antenna Gain	✓	✓		
		Antenna Beamwidth	✓	✓		

Test Cases: Keysight XA5008A SRRC Regulatory Test Software

XA5008A test software addresses the test requirements of China regulation law 工信部无〔2021〕129号《工业和信息化部关于加强和规范2400MHz、5100MHz和5800MHz频段无线电管理有关事宜的通知》. The table below summarizes test coverage of XA5008A test software.

No	Test items	MIIT (2021) 129		
		2.4GHz (WLAN, BTC, BLE)	5100MHz	5800MHz
1	EIRP with / without TPC	✓	✓	✓
2	Power Spectral Density (Hopping / Non-Hopping) PSD with / without TPC	✓	✓	✓
3	Carrier Frequency Error	✓	✓	✓
4	Operation Frequency Range	✓	✓	✓
5	Spurious Emission	✓	✓	✓
6	Spurious Emission in Particular Band	✓	✓	✓
7	Adaptivity (CAM / Interference)	✓	✓	✓
8	Dynamic Frequency Selection (DFS)		✓	

Enable Full Automation using Keysight Unique IPA Function

Do you need to perform complete device characterization of your new product over many different DUT settings and test conditions, such as different temperatures, humidity levels, supply voltages and traffic profiles?

If you are the same as many other chipset or device manufacturers that we have been working with, this IPA (Inter-Process Automation) function will be a great time-saving feature for you.

IPA allows you to perform fully automated device characterization by enabling you to remote control both your DUT and the IOT0047A using your existing preferred software platform. You will be able to execute or loop through specific or all test cases, configure the test parameters, settings, and retrieve measurement results using this IPA function. Significant time saving is possible by converting your current manual process into full software automation.

IPA is a customized function of IOT0047A, please contact Keysight to discuss your needs.

System Configuration

ETSI EN 300 328 (V2.2.2), EN 301 893 (V2.1.1), EN 303 687 (V1.0.0) and FCC 15.247, and 15.407, KCC, MIC and SRRC requires multiple instruments to work together and complex calculation to complete the tests.

- Keysight N90xxB X-Series Signal Analyzer
- Keysight N518xB Vector Signal Generator
- Keysight M9384B VXG series Vector Signal Generator
- Keysight N517xB Analog Signal Generator
- Keysight N5182BX07 Frequency Extender for EXG/MXG, 9 kHz to 7.2 GHz (For Wi-Fi 6E test)
- Keysight X8749A Signal Conditioning Test Set
- Keysight X8750A 4-Channels MIMO Power Test Set, which are built upon U2063XA Power Sensor.
- Keysight XA5001A ETSI Regulatory Test Software
- Keysight XA5002A FCC Regulatory Test Software
- Keysight XA5003A DFS Test Software
- Keysight XA5006A KCC Test Software¹
- Keysight XA5007A MIC Test Software¹
- Keysight XA5008A SRRC Test Software¹
- Keysight IOT8720A IoT Wireless Test Set (Support WLAN and Bluetooth® signal profiles)²

1. Orderable under ZA0047A
2. Contact Keysight for more details

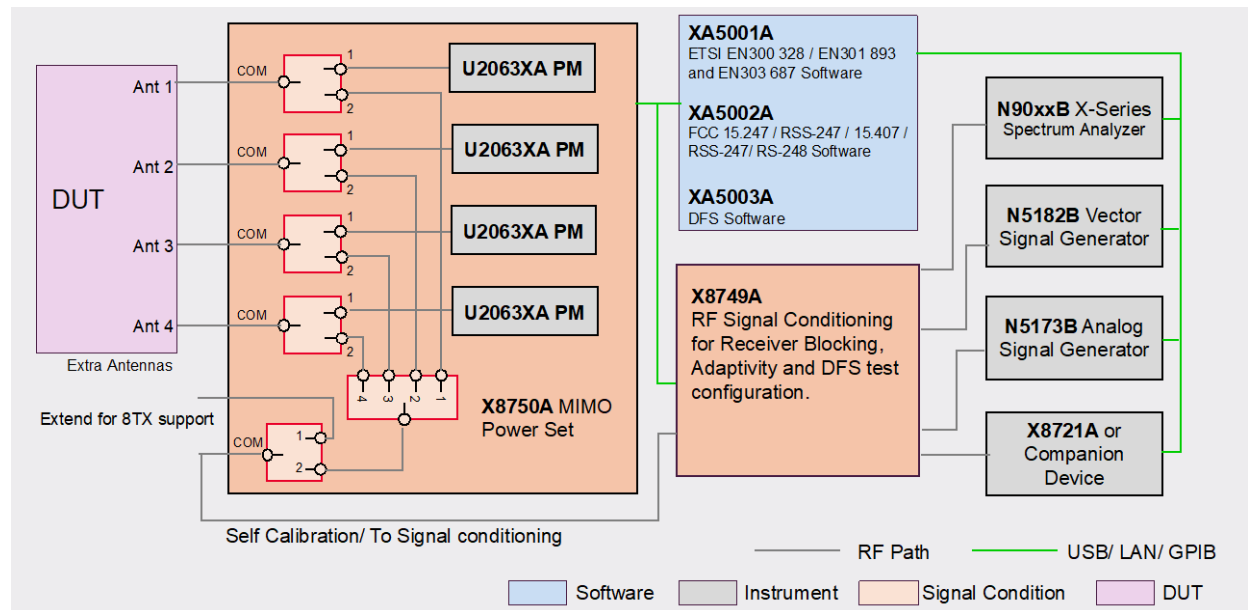


Figure 6. Keysight IOT0047A Regulatory Test System Block Diagram

Keysight X8749A Signal Conditioning Test Set Characteristics

The X8749A set has a built-in data package counter and provides level control and signal conditioning capabilities. It enables PER measurement for Receiver Blocking test using a WLAN companion device, as well as Adaptivity, Channel Access Mechanism, CBP, Carrier Sensing, Listen Before Talk (LBT) and DFS tests.

Parameters	Characteristics
RF frequency range	700 MHz to 7.2 GHz
RF attenuation range	0 to 60 dB with 1 dB steps
Max. power input	+20 dBm typical
Input Power	-40 to +20 dBm power acquisition range Sampling rate up to 1MSa/sec
Connector Type	SMA Female
Input Voltage and Frequency	100 to 240V, 50 to 60 Hz,
Input Power Consumption	50 W max
Operating temperature	0 to 40 °C

Keysight X8750A 4-Channels MIMO Power Test Set Characteristics

X8750A consists of U2063XA USB Wide Dynamic Range Average & Peak Power Sensors to enable simultaneous 4-Channels MIMO power measurements. It supports variable sampling rate of over 1MSa/sec to meet or exceed regulatory requirements. On high-speed wireless radio format such as IEEE 802.11ax with 160MHz bandwidth, the X8750A's broadband average power measurement capabilities enable accurate RMS power measurement and calculation.

Parameters	Characteristics
RF Frequency	10 MHz to 26 GHz simultaneous power measurement (Optional 40GHZ version available, contact Keysight for more details)
Power Measurement	Wideband dynamic range: <ul style="list-style-type: none"> -40 to +26 dBm (Peak RMS mode) -70 to +26 dBm (Average mode)
Sampling Rate	Variable, 1 MSa/sec to 20 MSa/sec
Connector Type	2.92mm (K-Type), Female
Input Voltage and Frequency	100 to 240V, 50 to 60 Hz,
Input Power Consumption	50 W max
Operating Temperature	0 to 40 °C
Average Power Accuracy	10MHz to 8GHz, ±0.5dB

Example ETSI EN 300 328, EN 301 893 and EN 303 687 Adaptivity Test (Supports 6GHz Test Configuration)

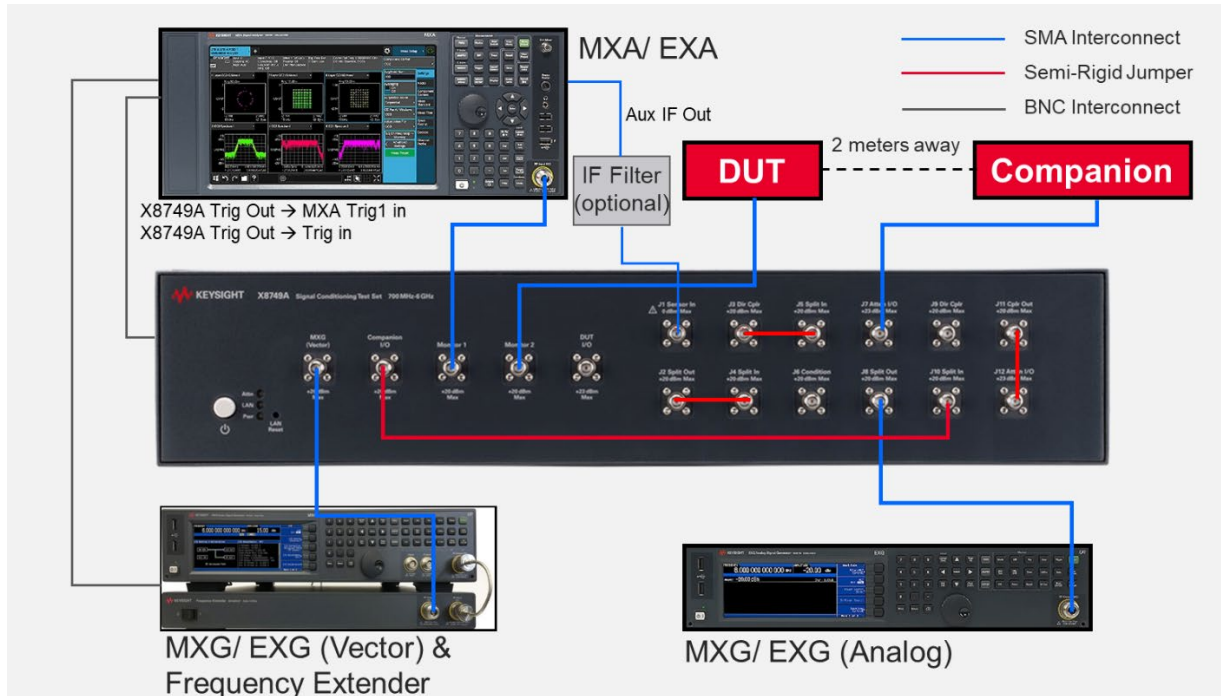


Figure 7. Keysight IOT0047A Adaptivity Test Connection Diagram

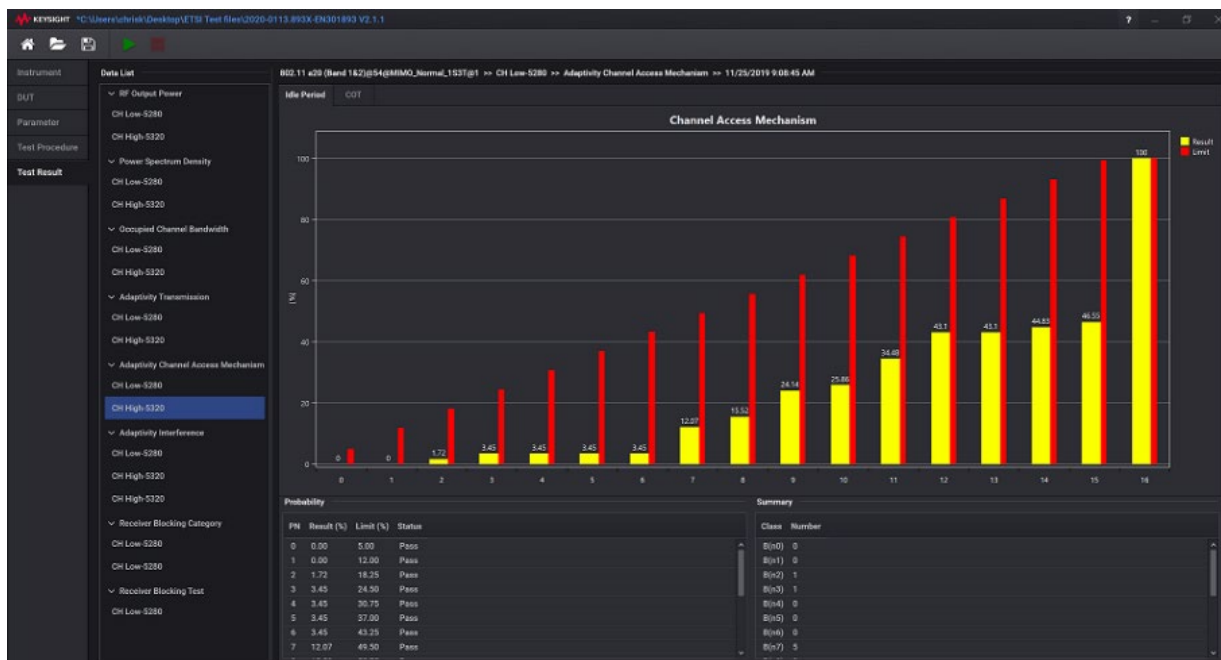


Figure 8. XA5001A ETSI EN 301 893 Adaptivity screen capture

Ordering Information for IOT0047A

Example Configuration: ETSI EN 300 328, EN 301 893 and EN 303 687, FCC Part 15.247 and Part 15.407 and DFS for 2.4, 5, and 6 GHz Wireless Devices up to 4-ports

I. Hardware

Model/Option number	Description
N9020B with options 544, CR3, AMG	MXA Signal Analyzer, 10Hz to 44GHz, wideband IF output, calibration + uncertainties + Guard-banding (accredited)
N5172B with options 506, 653, 655, 657, AMG, N7607EMBC	EXG RF Vector Signal Generator, 9kHz to 6GHz, with 160MHz RF bandwidth, calibration + uncertainties + Guard-banding (accredited), Signal Studio for DFS Radar Profiles
N5173B with options 540, AMG	EXG RF Analog Signal Generator, 9kHz to 40GHz, calibration + uncertainties + Guard-banding (accredited)
N5182BX07	Frequency Extender for EXG/MXG, 9 kHz – 7.2 GHz
IOT0047A-150	X8749A Signal Conditioning Test Set
IOT0047A-171	X8750A 4-Channels MIMO Power Test Set

II. Software

Model/Option number	Description
XA5001A	ETSI Regulatory Test Software
SW1000-LIC-01	Perpetual license
SW1000-SUP-01	Software Support Subscription
XA5002A	FCC Regulatory Test Software
SW1000-LIC-01	Perpetual license
SW1000-SUP-01	Software Support Subscription
XA5003A	DFS Test Software
SW1000-LIC-01	Perpetual license
SW1000-SUP-01	Software Support Subscription

Keysight and our partners provide system integration, startup assistant and training services. To place an order or for more information, please contact your local Keysight representative.

www.keysight.com/find/IOT0047A

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