

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 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 testing 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 with dedicated test software for the following standards:
 - ETSI EN 300 328, EN 301 893, EN 303 687
 - FCC Part 15.247 and FCC 15.407 (inclusive KDB987594 for U-NII 6 GHz)
 - KC KS-X-3123 2024 Conformity Assessment Test Methods for Radio Equipment
 - 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
 - Dynamic Frequency Selection (DFS)
- Is a scalable test system covering a wide array of IoT device types, and supports frequency hopping, adaptivity, MIMO up to eight channels, and common radio formats (such as WLAN, Bluetooth®, ZigBee®).
- Simplifies test automation and improves speed with signaling test method via a companion device.
- Expands 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 that automates the regulatory testing and report generation, as shown in Figures 1 – 5 below.

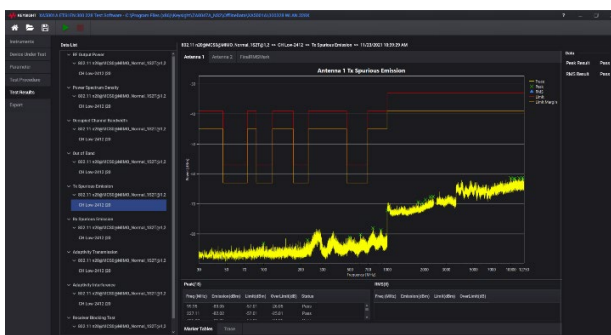


Figure 1. Spurious emission

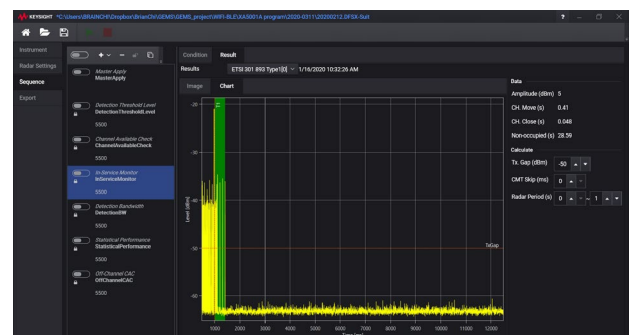


Figure 2. In-service monitor

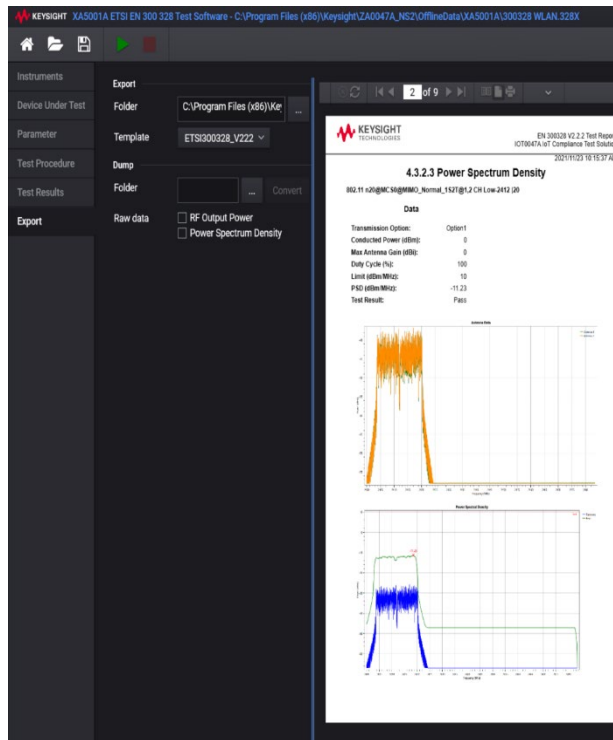


Figure 3. Test Report Generation

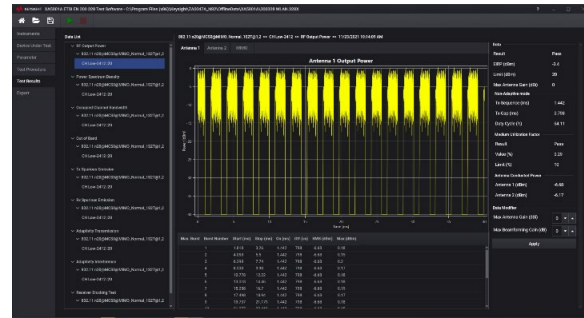


Figure 4. MIMO Power Measurement

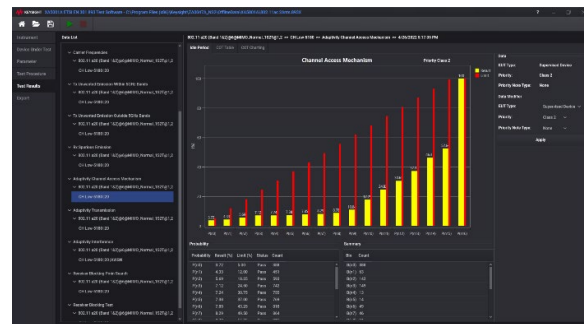


Figure 5. Channel Access Mechanism (CAM)

Wi-Fi 7 (802.11be) support

The IOT0047A now includes support for Wi-Fi 7, also known as 802.11be. Wi-Fi 7 represents the next leap in wireless technology, promising unprecedented performance enhancements. With multi-gigabit speeds, improved efficiency, and advanced features like Basic Service Set (BSS) Coloring, Wi-Fi 7 is poised to revolutionize connectivity.

The IOT0047A's Wi-Fi 7 testing capabilities empower manufacturers to validate their devices against the latest regulatory standards, ensuring seamless interoperability and compliance.

The XA5001A ETSI regulatory test software added:

- 802.11be new modulation to support Wi-Fi 7 EUT testing
- New support for the N5186A MXG Vector Signal Generator
- Updated center frequency list covering 5955 MHz to 6415 MHz, including 320 MHz channel

The XA5002A FCC regulatory test software added:

- 20 MHz B/W channels (Channel 31/63/95/127/169/191)
- New support for the N5186A MXG Vector Signal Generator
- New support for VLP new device type CBP testing

Case	Description	Device type
Case 1	With CBP Operating frequency: Band5 to Band8	6ID, 6PP, 6XD, 6CD (indoor AP)
Case 2	With CBP Operating frequency: Band5 and Band7	6VL, 6FX, 6CD (standard power AP)
Case 3	Without CBP, Operating frequency: Band5 and Band7	6SD, 6FC

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 test cases.

The table below 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 (V2.2.1)	ETSI EN 303 687 (V1.1.5)
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	✓	✓	✓
8	Transmitter: unwanted emission in the spurious domain	✓	✓	✓
9	Transmitter: unwanted emission in within the 5 and 6 GHz 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)	

Test Cases: Keysight XA5002A FCC Regulatory Test Software

This version of the test software addresses the most recent versions of the following:

- KDB 558074 D01 v05r02 for 15.247
- KDB 789033 D02 v02r01 for 15.407 5 & 6 GHz
- KDB 662911 D01 v02r01 for MIMO Power Measurements
- KDB 987594 D01 v03 for 15.407 6 GHz
- KDB 905462 D02 v02 DFS Compliance Procedures

The table below 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 U-NII
		DSS/FHSS ¹	DTS ²	
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 cases and radar profiles, which include detection threshold 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 the CAC 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

The 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 (V2.2.1), and EN 303 687 (V1.1.5) harmonized standards. 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

The XA5005A test software addresses the signaling test requirements of most recent versions of the ETSI EN 300 328 (V2.2.2), EN 301 893 (V2.2.1), and EN 303 687 (V1.1.5). This test software is a subset of the XA5001A test software and covers test requirements such as adaptivity and receiver blocking.

Test Cases: Keysight XA5006A KCC Regulatory Test Software

The XA5006A test software addresses the test requirements of Korea KS-X-3123 2024.

The table below summarizes the test coverage of the XA5006A test software.

No	Test items	2.4 GHz		5 GHz	6 GHz
		BT/BLE	WLAN	WLAN	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

The 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 the test coverage of the XA5007A test software.

No	Test items	Sub test item	2.4 GHz		5 GHz	6 GHz
			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

The 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 2400 MHz、5100 MHz 和 5800 MHz 频段无线电管理有关事宜的通知》。

The table below summarizes the test coverage of the XA5008A test software.

No	Test items	MIIT (2021) 129		
		2.4 GHz (WLAN, BTC, BLE)	5100 MHz	5800 MHz
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 with the Keysight Unique IPA Function

Looking to perform complete device characterization of a new product across many different DUT setups and test conditions, such as different temperatures, humidity levels, supply voltages, and traffic profiles?

If you are like many of the other chipset or device manufacturers we have worked with, the Inter-Process Automation (IPA) is just the feature you need that will help save you a lot of time.

The Inter-Process Automation (IPA) function allows you to perform fully automated device characterization by remotely controlling the DUT and the IOT0047A using your existing preferred software platform. You will be able to execute or loop specific or all test cases, configure test parameters, setup, and retrieve measurement results. This will save you a lot of time as it converts your current manual process to full software automation.

IPA is a custom feature of the IOT0047A, please contact Keysight to discuss your needs and requirements.

System Configuration

ETSI EN 300 328 (V2.2.2), EN 301 893 (V2.2.1), EN 303 687 (V1.1.5), and FCC 15.247, and 15.407, KCC, MIC, and SRRC require multiple instruments to work together and complex calculations to complete the tests.

The following is a list of instruments that supports this solution:

- Keysight N90xxB X-Series Signal Analyzer
- Keysight N518xB and N5186A 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 X8749B Signal Conditioning Test Set
- Keysight X8750A 4-Channels MIMO Power Test Set, which is built upon the U2063XA Power Sensor
- Keysight XA5001A ETSI Regulatory Test Software
- Keysight XA5002A FCC Regulatory Test Software
- Keysight XA5003A DFS Test Software
- Keysight XA5006A KCC Test Software⁴
- Keysight XA5007A MIC Test Software⁴
- Keysight XA5008A SRRC Test Software⁴

Additional automation, racking, and RF accessories are available. Contact your Keysight representatives to find out more.

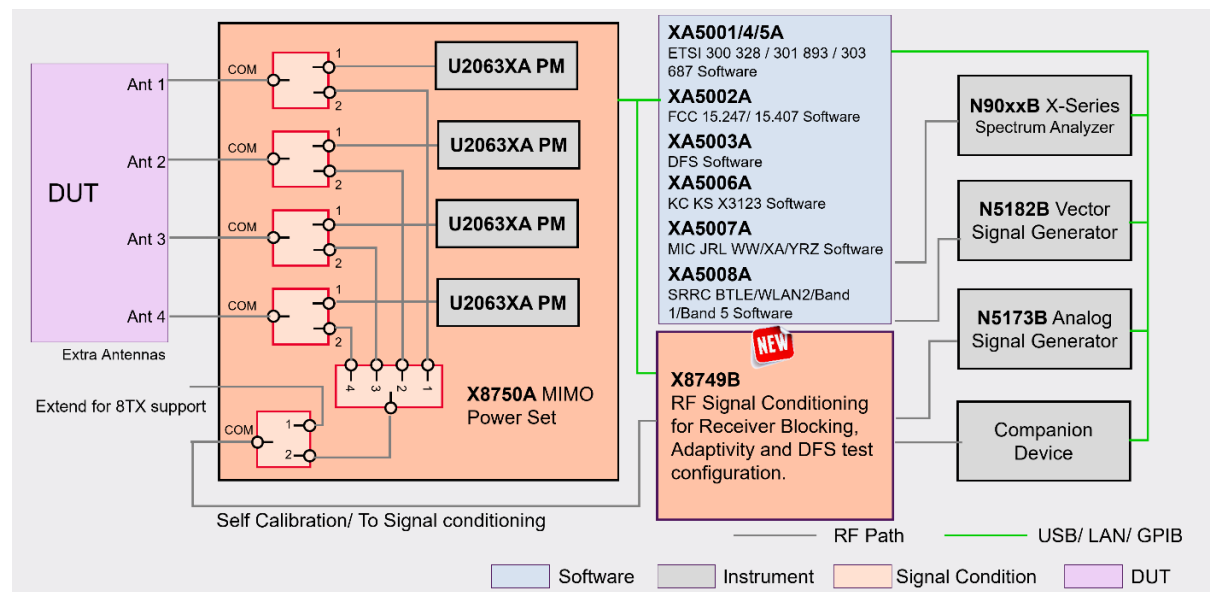


Figure 6. Keysight IOT0047A regulatory test system block diagram

⁴ Orderable under ZA0047A

Keysight X8749B Signal Conditioning Test Set Characteristics

The X8749B 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 8 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 1 MSa/sec
Connector type	SMA Female
Input voltage and frequency	100 to 240 V, 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

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

Parameters	Characteristics
RF frequency	10 MHz to 26 GHz simultaneous power measurement (Optional: 40 GHz version available, contact Keysight for more details)
Power measurement	Wideband dynamic range: • -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	2.92 mm (K-Type), Female
Input voltage and frequency	100 to 240 V, 50 to 60 Hz,
Input power consumption	50 W max
Operating temperature	0 to 40 °C
Average power accuracy	10 MHz to 8 GHz, ± 0.5 dB

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KEYSIGHT "C:\Users\chris\Desktop\ETS1 Test Files\2020-0113-R93X EN301893 V2.1.1"

Instrument

DATA LIST

- RF Output Power
 - Ch Low S280
 - Ch High S320
- Power Spectrum Density
 - Ch Low S280
 - Ch High S320
- Occupied Channel Bandwidth
 - Ch Low S280
 - Ch High S320
- Adaptivity Transmission
 - Ch Low S280
 - Ch High S320
- Adaptivity Channel Access Mechanism
 - Ch Low S280
 - Ch High S320**
- Adaptivity Interference
 - Ch Low S280
 - Ch High S320
- Receiver Blocking Category
 - Ch Low S280
 - Ch Low S320
- Receiver Blocking Test
 - Ch Low S280

802.11 a29 (Band 182)@54@MIMO_normal_1537@1 >> CH Low-S280 >> Adaptivity Channel Access Mechanism >> 11/26/2019 9:08:45 AM

File Period: 001

Channel Access Mechanism

Probability	Result (N)	Limit (N)
0	0	0
1	0	0
2	1.72	0
3	3.45	0
4	3.45	0
5	3.45	0
6	3.45	0
7	12.07	0
8	15.52	0
9	24.74	0
10	27.86	0
11	34.48	0
12	48.1	0
13	48.1	0
14	48.55	0
15	48.55	0
16	100	0

Legend: Result (Yellow), Limit (Red)

Summary

Class	Number
B(n=0)	0
B(n=1)	0
B(n=2)	1
B(n=3)	1
B(n=4)	0
B(n=5)	0
B(n=6)	0
B(n=7)	5

Probability

PN	Result (%)	Limit (%)	Status
0	0.00	5.00	Pass
1	6.00	12.00	Pass
2	1.72	18.25	Pass
3	3.45	24.50	Pass
4	3.45	30.75	Pass
5	3.45	37.00	Pass
6	3.45	43.25	Pass
7	12.07	49.50	Pass

Ordering Information

Configuration example: 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, 10 Hz to 44 GHz, wideband IF output, calibration + uncertainties + Guard-banding (accredited)
N5172B with options 506, 653, 655, 657, AMG, N7607EMBC	EXG RF Vector Signal Generator, 9 kHz to 6 GHz, with 160 MHz RF bandwidth, calibration + uncertainties + Guard-banding (accredited), Signal Studio for DFS Radar Profiles
N5173B with options 540, AMG	EXG RF Analog Signal Generator, 9 kHz to 40 GHz, calibration + uncertainties + Guard-banding (accredited)
N5182BX07	Frequency Extender for EXG/MXG, 9 kHz – 7.2 GHz
IOT0047A-151	X8749B 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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