Automate Wi-Fi Regulatory Test for Smart Devices

KEYSIGHT

Organization

- leading global mobile device maker

Challenges

- failed ETSI test
- complicated and time-consuming adaptivity test
- difficult CAM (channel access management) and minimum idle period tests

Solutions

- Keysight IOT0047A IoT regulatory compliance test solution
  - X8749A signal conditioning test set
  - XA5005A ETSI regulatory test software

Results

- reduced CAM test time
- improved repeatability

Smart mobile devices have transformed the world in the past decade. Wi-Fi technology helped enable this transformation. It allows smart gadgets such as mobile phones, computers, and Internet of Things (IoT) devices to connect to the internet wirelessly. Household Wi-Fi routers can easily support dozens of smart devices, but Wi-Fi 6 / 6E ushers in a new era by carrying two or three times the traffic of its predecessor at a much faster speed.

New performance levels bring more complex standards, though. Device manufacturers must pass all regulatory tests before they can sell their products.

At the same time, the smartphone market has become increasingly competitive. Performing pre-compliance testing before taking a device to the accreditation lab, and accelerating this process, can give device makers a significant competitive advantage by reducing the time to market for their latest, most advanced products.

A leading global manufacturer of consumer products faced this challenge. The company had difficulty passing a series of mandatory adaptivity tests established by the European Telecommunications Standards Institute (ETSI), preventing it from launching its products in European countries. With the Keysight IOT0047A regulatory test system, this company not only passed these complex tests but reduced test time dramatically and improved repeatability.

Challenges: Complex and Time-Consuming Adaptivity Tests

ETSI requires an adaptivity interference test to ensure that mobile devices support the latest Wi-Fi standards. This test confirms that the device can hold off transmission when there is an interfering signal and ensures that the device can safely share the spectrum. The test procedure is complicated, and performing it manually takes a long time, even for expert engineers.

ETSI adaptivity test procedures require conducting separate tests for initiating and responding devices, each with drastically different requirements and benchmarks. The tests must consider priority classes, energy detection threshold levels, and short control signaling transmission.

ETSI also includes a channel access management (CAM) test as part of the adaptivity test. This test ensures that wireless devices can safely and effectively share spectrum. The smartphone or device under test should pause the transmission and leave pseudorandom time between transmissions before trying again. CAM is the most time-consuming part of the adaptivity test because of tedious and long detection intervals at a resolution of 1 μs.

This test also generates a considerable amount of data. Test engineers need to collect as much data as possible on every sweep to properly conduct the ETSI CAM test. One sweep can generate more than 1 million data points, depending on the test scenario.

This measurement takes nearly three hours to complete if an experienced engineer triggers it manually. Processing up to 60 million data points can take at least another 30 minutes with some sort of automated analysis. For example, for a 2x2 device, engineers must repeat this process 12 times to cover six modulation formats and two-channel scenarios, leading many companies to dedicate at least one week to conducting CAM measurements.

CAM and minimum idle period tests presented significant challenges for this smartphone maker whose device failed ETSI's regulatory tests at an authorized test house.

Solution: Automate to Save Time and Improve Repeatability

The Keysight IOT0047A accelerates the certification of wireless devices operating in unlicensed 2.4 GHz, 5 GHz, and 6 GHz bands. It makes Wi-Fi 6 / 6E regulatory tests fast and efficient.

The solution's software supports the latest Wi-Fi standards test cases, including ETSI EN 300 328, EN 301 893, EN 303 687 (Draft), FCC Part 15.247, and FCC 15.407. IoT device makers can test their wireless devices against all regulatory standards and simplify and accelerate the testing process with purpose-built test automation regulatory compliance software.
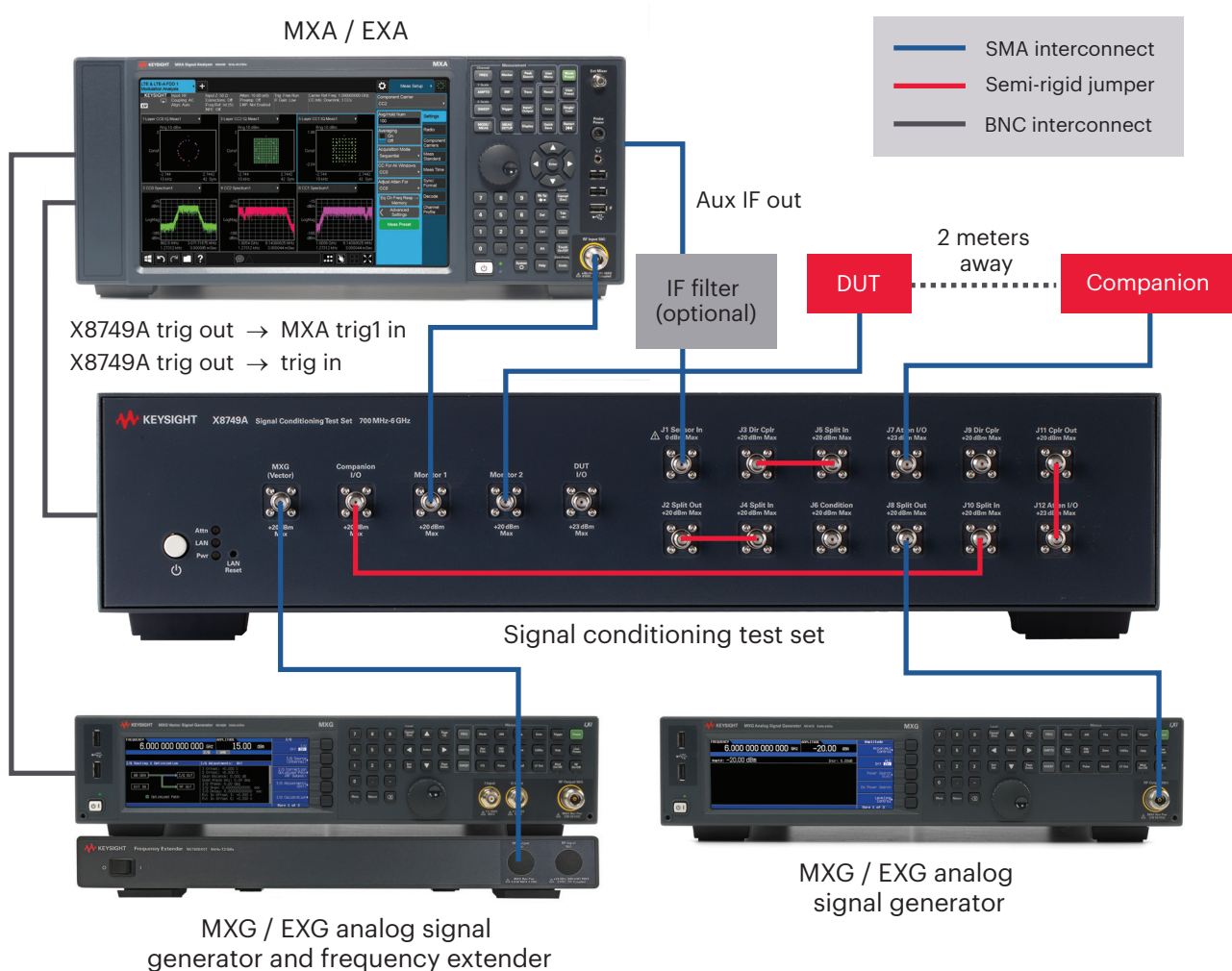

Figure 1. Keysight IOT0047A adaptivity test connection diagram

The Keysight XA5001A ETSI regulatory test software covers the latest ETSI test requirements and a wide range of test cases, such as adaptivity and receiver blocking. The Keysight X8749A signal conditioning test set has a built-in data package counter, providing level control and signal conditioning capabilities. It enables measurements for receiver blocking tests, dynamic frequency selection, adaptivity, and CAM tests.

Figure 1 illustrates the Wi-Fi 6E test configuration for ETSI adaptivity tests using the IOT0047A IoT regulatory compliance test solution. The solution uses an MXA signal analyzer, an RF vector signal generator, an RF analog signal generator, a frequency extender, and a signal conditioning test set. Adaptivity and receiver blocking tests (signaling) are included with the Keysight XA5005A test software, and are also included with non-signaling tests in Keysight's XA5001A.

Results: Reduced Test Times and Repeatability Gains

Using the test setup from Figure 1, the engineering team at the mobile device manufacturer quickly received the test results (Figure 2). The engineers running the test could quickly compare the device's performance against the ETSI regulatory limitations. The red bars represent the CAM limits set by ETSI for each idle time probability distribution bin (dependent on priority class settings), while the yellow bars show the test results.
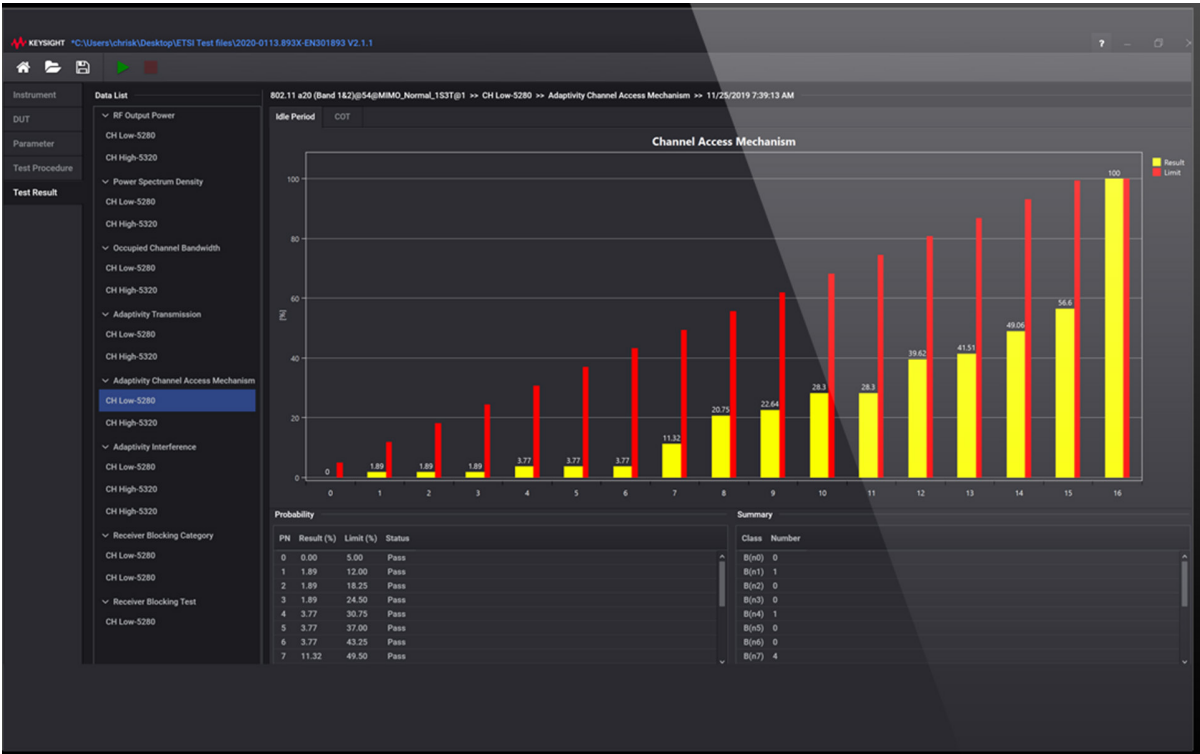

Figure 2. Screen capture of XA5001A ETSI regulatory test software for ETSI EN 301 893 adaptivity test

As mentioned, a manual CAM test can take at least a week to complete. The Keysight automated solution performs the ETSI CAM test in less than an hour, including the time engineers need to set up the channel and bandwidth information of their device.

Using Keysight's automated test cases, this smartphone maker reduced test time by 97.5% and improved repeatability. This solution uses automation to reduce test complexity and provides a comprehensive test report.

Related Information

- IOT0047A IoT regulatory compliance test solutions

- IoT Regulatory Compliance eBook

- IOT0047A IoT regulatory test solution technical overview

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