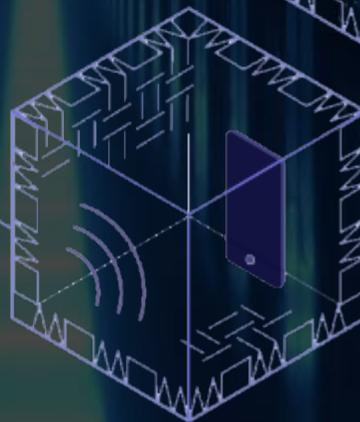
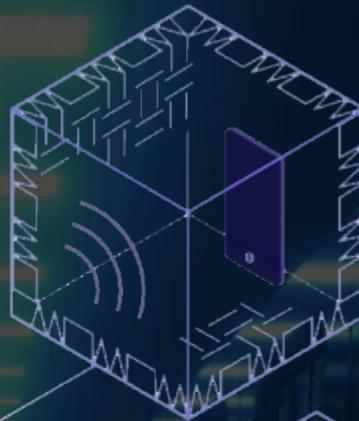


Solutions for Wireless Labs



 **ACENTURE**
LAMTA

Dear valued customer,

Acentury has had over a decade of experience working in the test and measurement industry. We've seen firsthand the struggles and pains large wireless labs go through. I knew that there was a better solution that could be engineered. With the support of Acentury's innovative environment, Acentury LAMTA was created, a turnkey solution for managing and automating wireless 3G/4G/5G lab operations.

Our mission statement is to "Accelerate wireless communications innovation globally" and my vision for Acentury LAMTA is creating a new standard for every wireless lab in the world. I truly believe that Acentury LAMTA can revolutionize wireless testing in a meaningful way.

I appreciate you taking the time to learn more about Acentury LAMTA. We would love to hear from you if you have any questions.

Yours truly,

Adam Xie

Product Manager

Acentury LAMTA

A handwritten signature in black ink, appearing to read 'Adam Xie', with a stylized, cursive script.



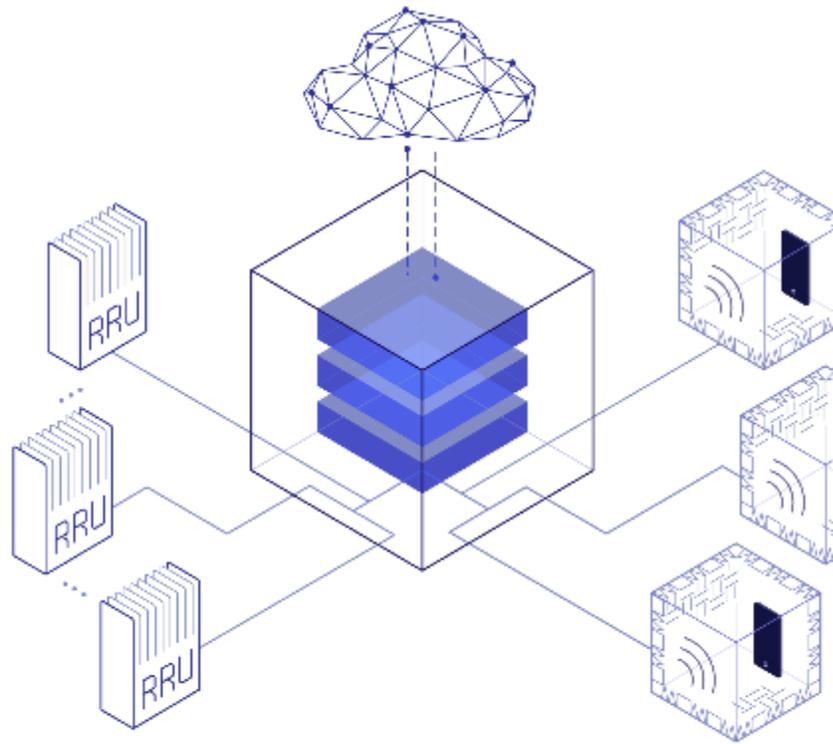
Accelerating wireless communications innovation globally

Acentury Inc. was founded in 2011 and began by selling test and measurement solutions across North America. Since 2013, Acentury has innovated new products and that journey began with Radiocomm, a line of passive network components that have met the requirements and scale of several carrier-grade networks. Acentury continues to innovate with software products designed for RF engineers, including OMERA, a 5G deployment automation software platform, and Acentury's subsidiary company, SynMatrix, a RF design and test measurement platform for passive components.

System Overview

Manage your wireless lab remotely with end-to-end test automation.

Acentury LAMTA is a turnkey solution for managing and automating wireless 3G/4G/5G lab operations. LAMTA consists of three modules designed to change the way you operate your wireless lab: Radio Management, Test Automation, and Resource Management.



Modules



Radio Management

Manage 5G/LTE/UMTS/Wi-Fi connections on a dashboard, not on patch panels



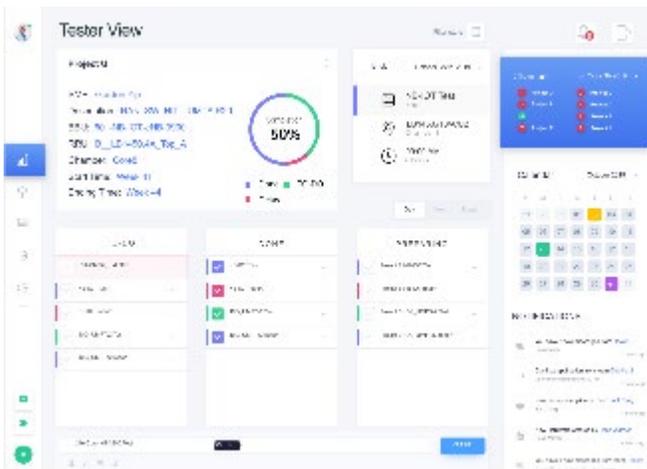
Test Automation

Enable end-to-end automation by controlling DUT, switch and network elements

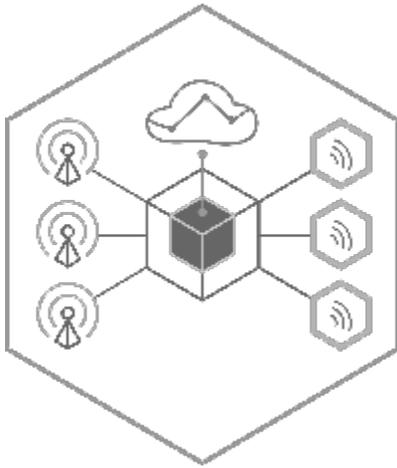


Resource Management

Track & manage lab resources to improve resource utilization, boost productivity and increase ROI



The Acentury LAMTA platform operates on the cloud or on-premise and is tailored to your organization's requirements. Set up repeatable tests, automate mobility scenarios, and efficiently share lab resources from anywhere, all on your web-based LAMTA dashboard.



Radio Management Module

There are several challenges wireless labs face today that can impact engineers, technicians, and lab admins:

- Messy patch panels & broken cables
- Too many radios & RF cables
- Too much leakage & interference
- Too many test configuration changes

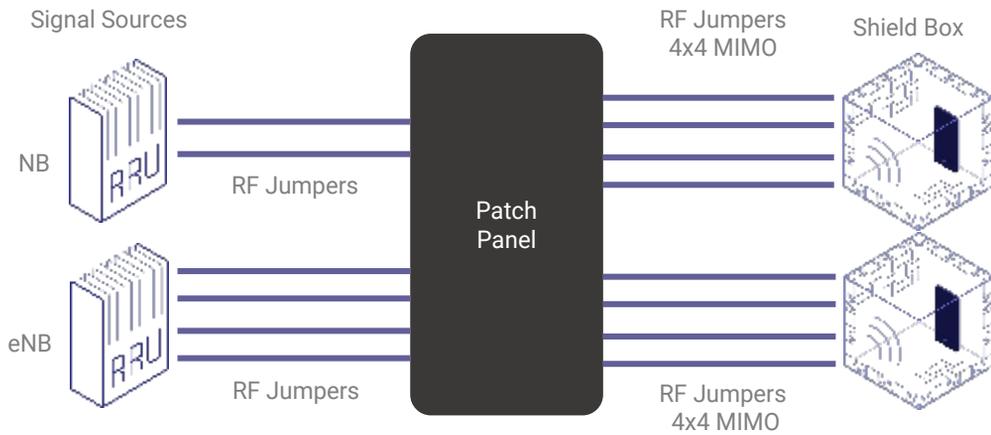
LAMTA's radio management module allow admins to use our GUI interface to make test re-configuration changes in seconds. By abstracting cabling complexity with software, admins don't need to be physically in the lab for cable changes. The platform is also scalable, allowing users to manage a few switch connections to several thousands.

Radio Management Features

Name	Description
UMTS/CDMA/EVDO/LTE/5G/Wi-Fi full range Spectrum support	Wide range radio frequency supported from 500 MHz to 7.5 GHz
Scalable radio connection management	Support several connections to several thousand connections from radio to test chamber
Customizable port labelling	Identify thousands of radios with name, PCI, channel, and all necessary labels
Radio status monitoring	Monitor radio signal levels in real-time

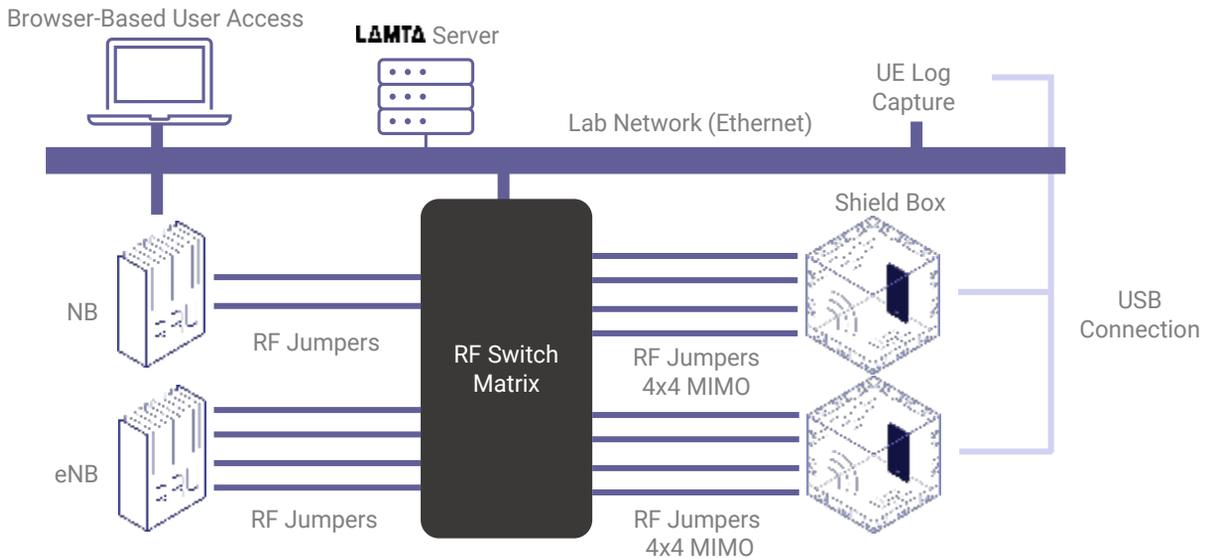
Input	Radio Port	Description	Output	Chamber Port	Description
1	LTE101-1	PCI 101	1	CHAMBER1-1	1st port at chamber 1
2	LTE101-2	PCI 101	2	CHAMBER1-2	2nd port at chamber 1
3	LTE101-3	PCI 101	3	CHAMBER1-3	3rd port at chamber 1
4	LTE101-4	PCI 101	4	CHAMBER1-4	4th port at chamber 1
5	LTE102-1	band 2	5	CHAMBER2-1	1st port at chamber 2
6	LTE102-2	band 2	6	CHAMBER2-2	2nd port at chamber 2
7	LTE102-3	band 2	7	CHAMBER2-3	3rd port at chamber 2
8	LTE102-4	band 2	8	CHAMBER2-4	4th port at chamber 2

Traditional Wireless Labs

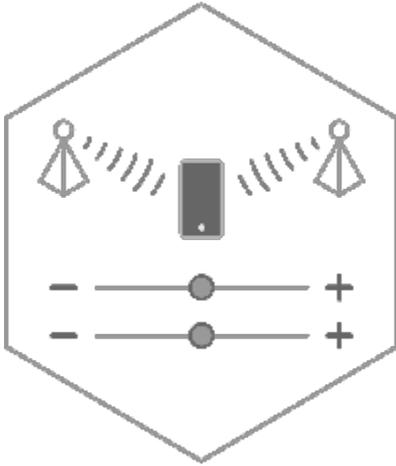


In traditional wireless lab setups, the signal sources (NodeB or eNodeB), are connected to the patch panel using RF jumpers. Lab administrators need to manually switch connections to set up test scenarios, which can lead to expensive cable wear and tear. The patch panel is connected by RF jumpers to the shield box test chambers.

Sample LAMTA Starter System



With the LAMTA server setup, the user can make test scenario changes entirely through their web browser. Once the physical connections are set up, LAMTA software can reconfigure changes in seconds, saving hours of manual work, reduces process delays, and preserves the longevity of expensive cables. This set up also enables remote access to the lab and eliminates the need for personnel to be physically present in the lab to make changes.

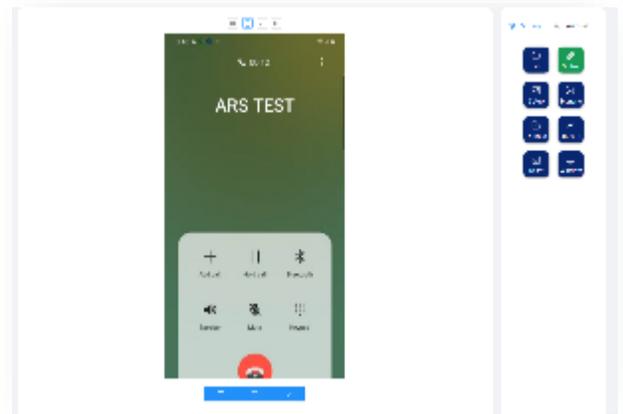


Test Automation Module

Wireless testing complexity introduces several challenges:

- Test scenarios are becoming increasingly complicated
- Complex test scenarios cannot be simulated manually
- Variability in setup reduces confidence in test results

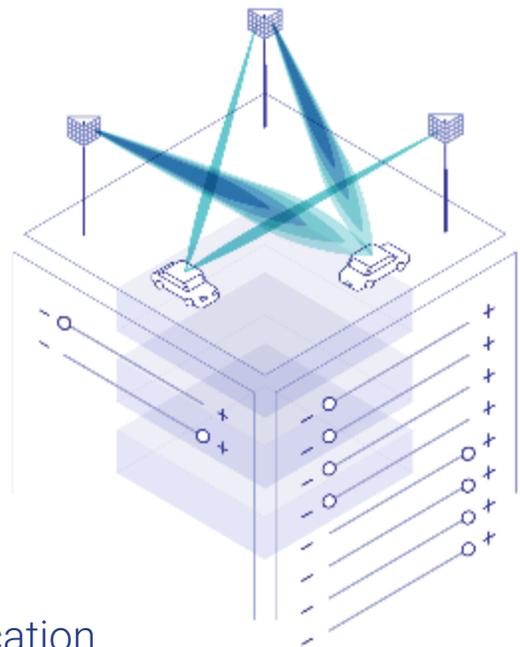
Acentury LAMTA's Test Automation module expands your testing capabilities and enables test lab teams to simulate complex test scenarios.



Advanced Mobility

With LAMTA's advanced mobility capabilities, Acentury LAMTA can simulate complicated RF scenarios for lab testing. These include:

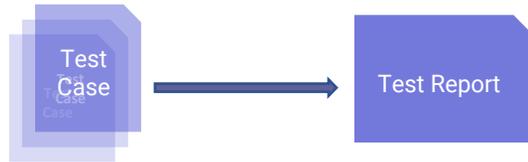
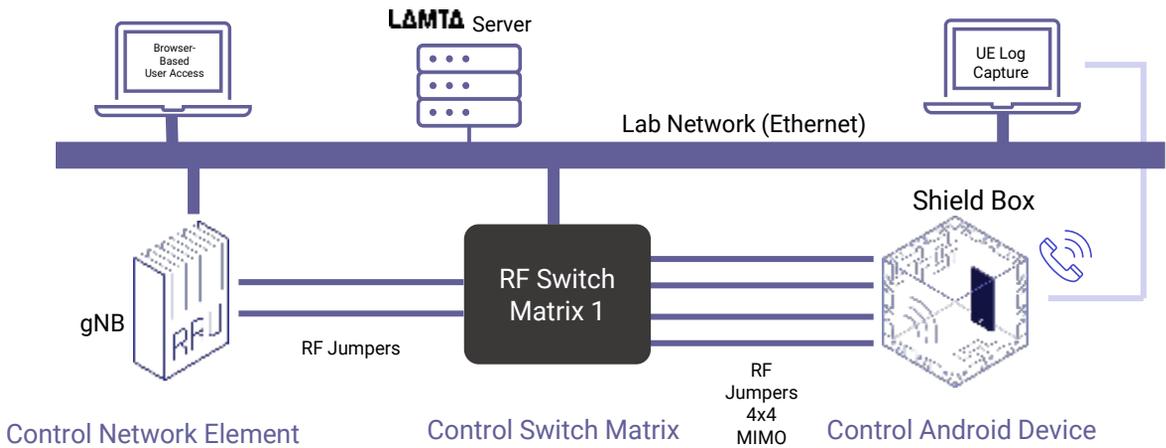
- One-click setup for repeatable MIMO handover testing
- Up to 4x4 MIMO
- Tier roaming
- Carrier aggregation
- Intra-RAT / inter-RAT mobility



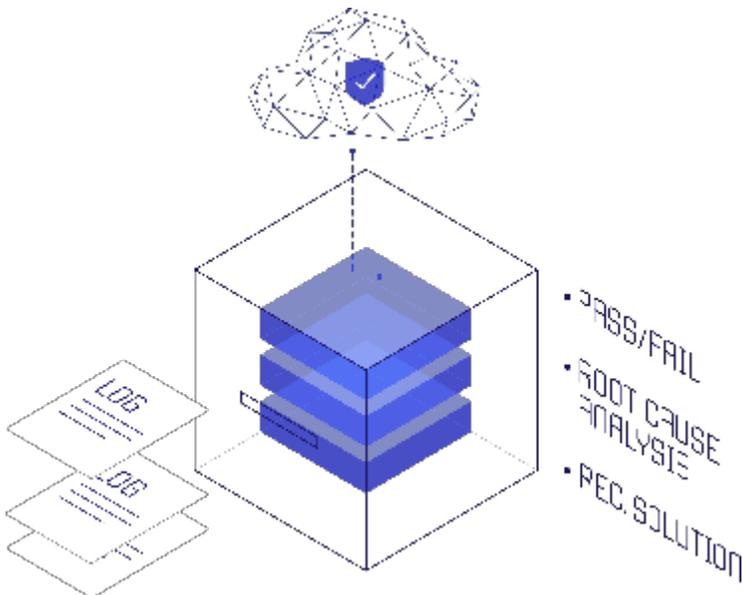
Massive MIMO Performance Verification

Acentury LAMTA can perform MIMO performance verification, including maximum throughput tests, beamforming performance verification, mobility tests, and release verification tests.

End-to-End Automation

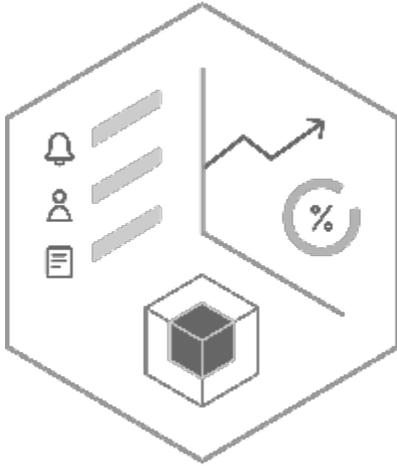


Test automation includes end-to-end automation. Our system consists of three parts from left to right: the network element control (including vRAN, O-RAN), the switch control, and the user equipment (UE) control. Connected to the UE control is the UE log capture as part of the LAMTA module. Layer 3 messages are collected, the call flow is analyzed, and the test result will be automatically generated.



Log Analysis (coming soon)

- Faster time-to-market by automating testing processes with open APIs
- Error-free log analysis by policy-based machine learning techniques



Resource Management Module

Operational inefficiencies can severely impact a lab organization:

- Limited test chamber and test equipment capacity
- Project and workflow scheduling challenges
- Lab resource utilization
- No remote access

Acentury LAMTA's Resource Management module helps manage your lab assets more effectively with workflow management and capacity optimization tools.

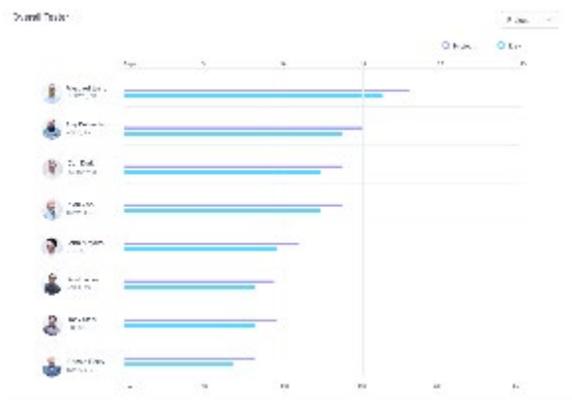
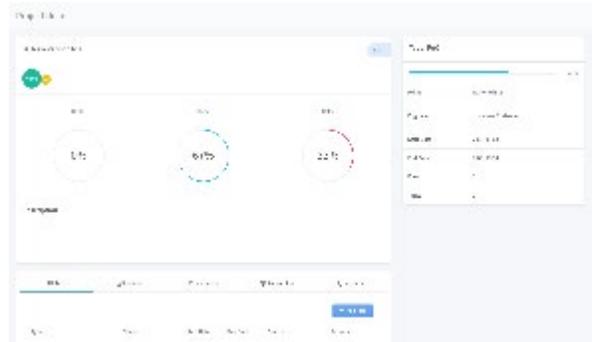
ID	Name	Location	Status	Actions
10001	TEST CHAMBER	LAB 1	Available	✓ [Red X]
10002	TEST CHAMBER	LAB 2	Available	✓ [Red X]
10003	TEST CHAMBER	LAB 3	Available	✓ [Red X]
10004	TEST CHAMBER	LAB 4	Available	✓ [Red X]
10005	TEST CHAMBER	LAB 5	Available	✓ [Red X]
10006	TEST CHAMBER	LAB 6	Available	✓ [Red X]
10007	TEST CHAMBER	LAB 7	Available	✓ [Red X]
10008	TEST CHAMBER	LAB 8	Available	✓ [Red X]
10009	TEST CHAMBER	LAB 9	Available	✓ [Red X]
10010	TEST CHAMBER	LAB 10	Available	✓ [Red X]

Lab resource monitoring

Make the availability transparent for all lab resources, including test chambers, radios, and network elements to name a few.

Streamline project workflow

Track project progress with scheduling tools and help uncover asset availability to help meet your deadlines.



Visualize utilization for all lab resource with customized reports

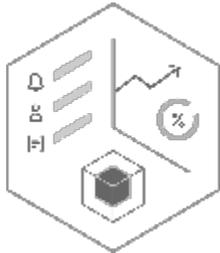
Utilization reporting for lab resources, including network elements, chambers, tools, etc. Automatic weekly report generation.

Benefits



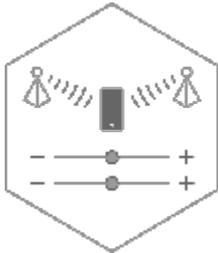
Increase Testing Flexibility

Enable remote testing. Test-from-home. No need to be physically co-located with lab equipment.



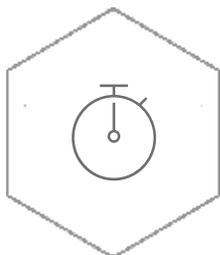
Improve Resource Utilization

Share equipment with multiple testers. Enable test bed access to global teams to get better asset ROI.



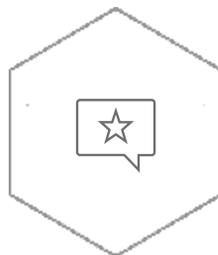
Expand Testing Capability

Easily create complex test scenarios. Create roaming, handoff, interference and other scenarios using multiple RF sources and variable attenuation.



Save Time & Cost

Simplify and reduce setup time from hours to minutes. Connect cables once and reconfigure in seconds through a web-based GUI.



Improve Quality

Consistent and repeatable testing. Minimal cable changes reduce leakage and interference. Balanced and stable power levels produce consistent test results.



Modernizing the RF lab with virtualization and test automation

Customer Whitepaper

Modernizing the RF lab with virtualization and test automation

There is a long-time customer of Acentury that is a Tier 1 wireless operator in a mature market. Their network environment includes many different technology vendors, multiple radio access technologies, and several frequency bands spanning 600 MHz to 3500 MHz. By any definition, it is a complex environment.

Subscriber growth is flat, and churn is a major driver of financial success. There is constant pressure to improve network performance, launch new technologies, and continuously deliver new and innovative services to attract and keep customers.

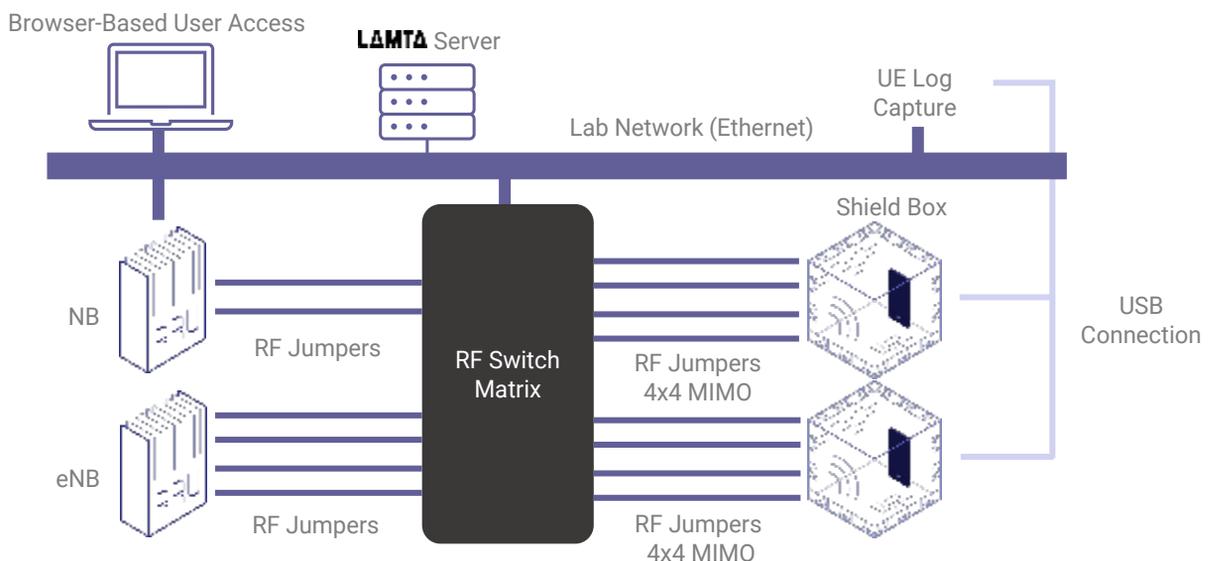
The typical wireless customer in this market is sophisticated. They understand quality of service, and how mobile phones are supposed to behave. They have high expectations of their service provider.

In response to these demands, this operator is careful to evaluate and certify various technologies and configurations before they are deployed into the

production network. One of their main tools for this is a large RF lab, and they turned to Acentury to help them solve various operational challenges

Acentury LAMTA selected to automate the RF Lab

With so many radio sources, shield boxes and RF chambers to connect, using RF patch panels and separate variable attenuators became too cumbersome. The first step in modernizing the RF lab was to install RF switch matrices. These fully non-blocking RF switches allow any combination of RF signal inputs to be distributed to any combination of RF outputs, completely under software control. The Acentury LAMTA software platform was used to manage the configuration of the switch matrices and provides precise control over signal attenuation and routing.



Chamber					Test
Name	Description	Label	Status	Actions	
Chamber 1	6 GHz to 6 GHz	Hardware Log Analyzer, SA	Active	 	
Chamber 2	6 GHz to 6 GHz	SA	Active	 	
Chamber 3	6 GHz to 6 GHz	SA, IOT	Active	 	
Chamber 4	6 GHz to 6 GHz	IoT Analysis, LTE, 5G	Active	 	
Chamber 5	6 GHz to 6 GHz	4G LTE, 5G NR, 5G	Active	 	
Chamber 6	6 GHz to 6 GHz	5G, Carrier Aggregation, Hardware Log Analyzer	Active	 	
Chamber 7	6 GHz to 6 GHz	4G LTE, 5G NR	Active	 	
Chamber 8	6 GHz to 6 GHz	RF, IOT	Active	 	
Chamber 9	6 GHz to 6 GHz	Hardware Carrier Aggregation, IOT	Active	 	

Increase RF lab efficiency with Acentury LAMTA

The first benefit to replacing RF patch panels with software-controlled switch matrices was a massive reduction in test set-up and tear-down times. The manual work hours of disconnecting and reconnecting RF patch cables to create different test scenarios are replaced with a few minutes of switch reconfiguration through the LAMTA GUI. No more time is wasted tracing jumpers and signal paths, and the time savings can be reinvested in running better RF tests. Another side benefit was improving the usable life of expensive RF jumpers and connectors by significantly reducing the wear and tear of repeated connections and disconnections.

The mobile network operator (MNO) realized additional efficiency benefits now that RF sources can be used in

multiple tests simultaneously. Using the old setup with patch panels, the signal from an eNB, gNB or RRU can only be routed to one test chamber or shield box at a time. Using LAMTA, they can be fed to multiple chambers at once, and the signal entering each chamber can be controlled independently. This allows multiple testers to use the same RF source at the same time.

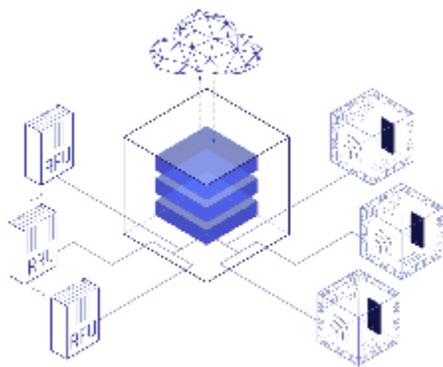
Further, LAMTA enabled this operator to configure test scripts and run them automatically without user involvement. This eliminated manual test runs managed by highly skilled lab technicians.

With Acentury LAMTA, their lab resources spend less time configuring, and more time testing. Highly skilled lab technicians also spent less time running manual-intensive tasks, and more time focused on higher-valued lab activities.

Improve RF test repeatability with Acentury LAMTA

One of the operator's biggest issues was test repeatability. Using RF patch panels and manually controlling signal attenuation made it impossible to maintain a repeatable process from test to test, and eroded confidence with test results. Acentury LAMTA helped address this in several ways.

With LAMTA, the test environment never changes. Test engineers connected RF cables once and they never have to touch them again. Since connections are never altered after initial setup, this MNO was assured that the test environment is the same test after test.



Test result variability was also previously caused by the overuse and wear and tear from RF jumpers and connectors. High-quality components will degrade after many connection and disconnection cycles, and the performance deterioration isn't obvious. Since LAMTA eliminates the need for manual reconfiguration, this was no longer a concern. The other side benefit is that they don't have to replace expensive RF cables when connectors wore out or shielding became damaged because of overuse.

The largest factor influencing test repeatability was the tester themselves. When the tester was responsible for manually controlling attenuation and rates of change, it was virtually impossible to effectively repeat a test. Imagine trying to manually control variable attenuation for multiple base stations when simulating handover in a carrier aggregation scenario. With LAMTA, all attenuation is software controlled, ensuring a repeatable process from test to test.

Another benefit of software control is that tests can be repeated with automation. Testers are assured that each test will run the same and software-controlled attenuation ensures exactly the same test each time.

With Acentury LAMTA, tester engineers have complete confidence in their test results.

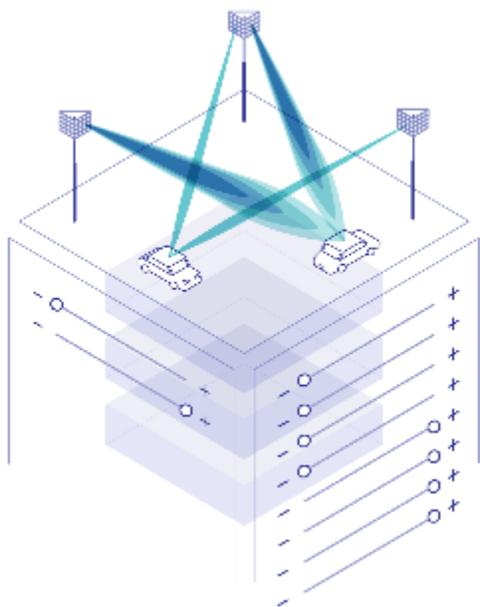
Simulate complex RF scenarios using Acentury LAMTA

Wireless subscribers are becoming more demanding, so it is more important than ever to ensure robust network performance. As such, there is an ever-increasing need for testing sophisticated features in the lab before they are released in the production network.

Acentury's LAMTA solution addressed this challenge by enabling simulation of "real-world" situations in the lab. Software control over RF switch matrices allows the precise combination of many RF signals in controlled ways. In this way, network features and capabilities like handovers, roaming, carrier aggregation and MIMO can be thoroughly tested. They rely on LAMTA to evaluate new infrastructure software loads and configuration details before they are released into the live network.

This has some important benefits. The impact of new infrastructure software releases on overall network performance can be evaluated prior to field deployment. The behaviour of subscriber devices can also be measured, and comparisons can be made between various firmware releases. Since the testing is automated and repeatable, tests can be run the same way identically hundreds of times so the results will be statistically significant.

With Acentury LAMTA, they can perform more tests – more quickly – ensuring greater confidence in the performance of their network.



Manage RF test resources using Acentury LAMTA

As RF labs get larger, it becomes even harder to manage all the resources efficiently and effectively. Lab managers need to co-ordinate the needs and objectives of many different testers with the availability of radio and chamber resources. This MNO found this challenge to be time-consuming and often frustrating work.



LAMTA offers a resource management solution. Using this module, lab managers can make certain resources available to different users. Individual users can see what resources are available and when, and book time on them directly.

LAMTA also provides a testing progress view. Lab managers can see which testing projects are on schedule, and which ones are ahead or behind. With this information, they can allocate resources more effectively across the organization.

With Acentury LAMTA, lab managers have a complete picture of how the RF lab is being used.

Operate an RF Lab remotely with Acentury LAMTA

Perhaps the biggest benefit that this LAMTA customer experienced was the ability to operate the RF lab remotely. This became critically important during the COVID-19 pandemic. When their office spaces were closed for health and safety reasons, it was difficult or even impossible to conduct testing that required many people on-site in the RF lab.

LAMTA easily solved that problem. During COVID, this operator was able to have testers complete their work from home, with only a small number of people physically at the RF lab.

A lab equipped with LAMTA does not require any manual labour to reconfigure RF cabling between tests. All RF path switching and attenuation is automated through the software-controlled RF switch matrices and operated via the LAMTA user interface. Devices under test are monitored remotely. Testers can be anywhere with an Internet connection.

LAMTA can control equipment across multiple RF lab sites as well. In this way, testers in one city can use test resources (RF sources, chambers, etc.) located in another city, town or country. A single RF lab location could be used by testers around the globe, 24 hours a day.

End-to-End Testing with Acentury LAMTA

In addition to controlling the RF path switching and attenuation, LAMTA can also control the rest of the test environment. It supports the option to control network elements such as NodeB radio units from several different equipment vendors. User equipment such as Android Smartphones can also be controlled through LAMTA. This allows test engineers to operate the RF test environment through a single interface.

An RF Lab Automation Platform for Labs of All Sizes

Because of its modular nature, LAMTA is suitable for wireless operators of all sizes and levels of sophistication.

LAMTA supports RF switch matrices and variable attenuators of various sizes from different manufacturers. It can connect to any RF chamber type, from small desktop shielded enclosures to full-size walk-in Faraday cages and anechoic chambers. The LAMTA software itself is modular and operators

can simply select the modules they need. It is also available as a perpetual license or SaaS model which allows budget flexibility.

Acentury LAMTA: the right tool for the job

When it came to automate their RF lab, this Tier 1 operator turned to Acentury. Since that decision, they have continued to expand their LAMTA deployment to control over a dozen RF switches, more than 10 RF chambers, three different RF infrastructure vendors and at least seven frequency bands with more on the horizon.

They count on LAMTA every day to help validate network configuration changes and handset software versions, ensuring that they perform up to their customer's expectations.

Acentury LAMTA is the end-to-end lab management solution for any RF lab. Contact info@acentury.ca to learn how LAMTA can work for you.



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