AMANTYA

5G Lab

The Versatile Playground for 5G Use Cases

A brief understanding of the 5G Labs, prominent use cases, and a glimpse of some industry 5G use cases

Table Of Contents

5G Lab

The global 5G services market size is set to grow from USD 53 billion in 2020 to USD 249. 2 billion by 2026, at a CAGR of 29.4% during the forecast period. The 5G ecosystem will transform at a 3-4 times faster growth rate than other connectivity transformations. [1]

5G, the fifth generation of mobile communications, is a game-changing innovation unlocking unprecedented opportunities across industries. Sure, the complex nature of this next-gen technology promises a ginormous opportunity for growth. But only for those who can accelerate their go-to-market with safe, reliable, and high-performing products and solutions. As a result, the pressure to be the first to market with affordable 5G products and solutions that deliver the highest level of Quality of Service (QoS) is tremendous. Verifying and validating your 5G proposition is now the priority for assessing 5G readiness.

5G testing allow telecom players to test and prove their solutions before going to market, reducing costs by up to 60% and increasing development speeds three times. These benefits apply across every facet of the 5G development, from the base station and antenna to the analysis of systems and electrical environments.[2]

Therefore, testing the reliability and effectiveness of the new 5G use cases, features, and solutions before their commercial rollout is crucial. As small-scale testing and/or POC (Proof of Concept) preceding the launch of new 5G use cases and applications identify and resolve potential bottlenecks, and facilitate innovation.

This need has led to the rise of 5G Labs.

This whitepaper entails a brief understanding of the 5G Labs, prominent use cases, and a glimpse of some industry 5G use cases supported by them

Overview

The Versatile Playground for 5G Use Cases

Testing 5G use cases, products, and solutions in a controlled environment, or 5G Labs [3], is vital for facilitating large-scale rollout and mass adoption. And the need is growing exponentially as testing its reliability and effectiveness is crucial for an innovation to be impactful. 5G labs offer organizations across industries the opportunity to explore, design, develop, test, optimize, integrate, deploy and put 5G at the core of their business. They provide a dynamic testing and optimization environment that simulates the real-time field deployment scenarios for testing next-gen products/ solutions before they hit the market.

How 5G Labs Add Value to the Telecom Ecosystem

A purpose-built, open platform for exploration around 5G with minimal investment

Enable early prototyping and experimentation of new 5G features and use cases

Ability to scale as per demands of an evolving 5G landscape

Platform to collaborate to test, optimize and validate multi-vendor technologies

Enable telcos and partners to pre-integrate their solutions and accelerate the drive to mass-scale deployments and monetization of 5G networks

Help telecom players speed up 5G adoption and generate new revenue streams faster by getting hands-on experience with the latest 5G innovations in a live test environment

Accelerate go-to-market. Helps secure early mover advantage as future 5G solutions and applications evolve

Minimizes user churn, increases the rate of adoption and enhances the end-user experience

Drives efficiencies and reduces Total Cost of Ownership (TCO)

Allows various stakeholders to integrate features, functionalities, and capabilities of 5G to unlock new use cases and spawn new products and solutions

Supports unparalleled digital learning, research, and development opportunities for students, educators, institutions, and other R&D bodies

Global 5G Testing Market

The global 5G testing equipment market is expected to grow from USD 1,666.9 million in 2019 to USD 3,227.9 million by 2027, at a CAGR of 8.8% from 2020 to 2027.[4]

The primary drivers are the growing R&D, deployment of 5G network, increasing telecom subscriber base, and growing urban population

5G Testing Equipment Market - Market Outlook

CAGR of 8.8%

2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027
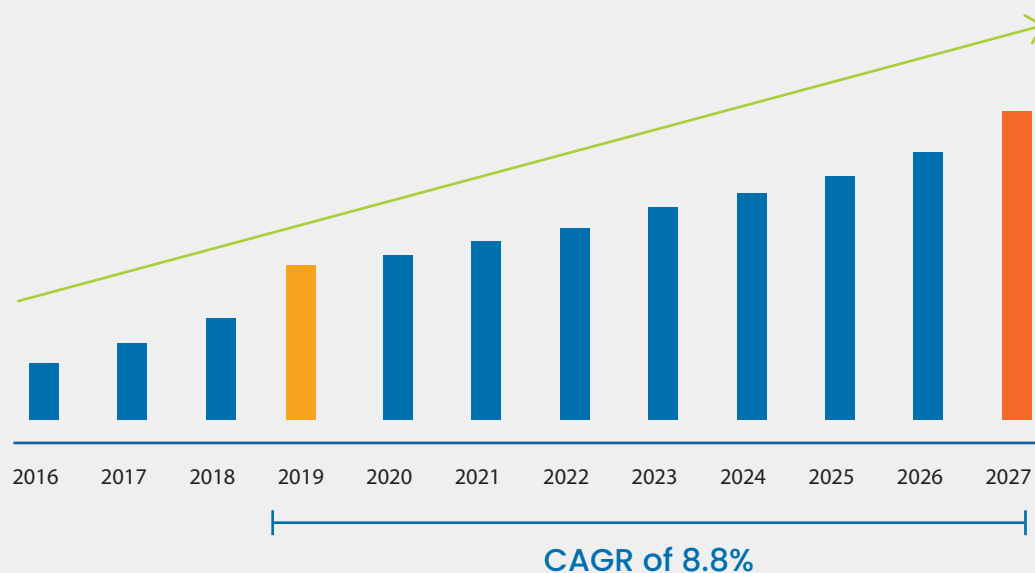
5G Testing Equipment Market size (Revenue in USD Million) 2016 - 2027

> 5G standards are designed to help telcos build scalable 5G networks using open and cloud-native platforms that utilize modular components, software, and hardware, from different vendors. It enables them to deploy new 5G products/ solutions faster, more securely, and with greater flexibility. This represents a paradigm shift from the hitherto vertically integrated legacy systems. To embrace this shift, the telcos must align with partners that demonstrate performance and interoperability in a live, real-time test environment. 5G labs are innovation hubs that foster such partnerships by creating a dynamic testing environment where telecom players and their collaborators can come together to test, validate and integrate 5G network solutions.
>
> We at Amantya have the technological and the people expertise and provide end-to-end solutions to help our clients build state-of-the-art 5G labs and ride the wave of this disruptive technology.
>
> **Sanjay Bisen,**
> **Chief Technology Officer**

Gaurav Saini,
AVP - Presales

Key Use Cases

5G labs provide tangible benefits to its customers by helping identify gaps, if any, in 5G products and solutions' quality. Thereby ensuring more predictable and faster development timelines and reducing overall developmental costs. Listed below are the primary use cases enabled by these innovation hubs:

Portable Labs

Portable 5G [5] labs simulate an integrated 5G radio and core network to measure multiple levels of end-to-end application performance before its field deployment. They enable end-to-end 5G testing on a single unified platform and help OEMs, telecom operators, silicon players and other telco players validate their current solutions, minimize field defects, establish vendor interoperability and improve the customer experience cycle. Also, plan future scaling and innovations to stay at the forefront of emerging 5G-enabled technologies.

New Technology Introduction (NTI) or PoC ■

Acceptance Testing ■

■ First Office Application (FoA) Testing

■ E2E Solution Testing

Interoperability Testing

For 5G to deliver on its promise of low latency, high Quality of Service (QoS), and more, it requires all its moving parts to come together seamlessly. It requires interoperability. Interoperability testing [6] is critical for every 5G solution targeted for commercial deployment and is a vital step for achieving vendor agnosticism. It ensures all standards-based solutions work together seamlessly, irrespective of the vendor.

RAN/ Core Testing

As 5G standards evolve, it is crucial to continuously perform standards testing to accelerate innovation, ensuring scalable and high-performing 5G architectures. 5G Core (5GC) introduces innovations like virtualization, Service Based Architecture (SBA), and network slicing. However, the elastic nature of the 5GC also poses new challenges for testing the core network elements. From the 5G Core to the 5G Radio Access Network (RAN), a 5G network demands a close link between all network resources. A 5G network simulator [7] is the perfect solution as it emulates all the elements of a 5G network - 5G devices (UE), 5G base stations (gNB), and 5G Core (AMF, AUSF, NSSF, UDM, UDR, SMF, UPF, and PCF). A 5G Lab is the perfect solution as it creates a live 5G environment to test all components of a 5G network.

5G Labs - Transforming Industries

5G Labs are the one-stop solution to test, validate and accelerate use cases across industries. Here's how they add immense value to some industries:
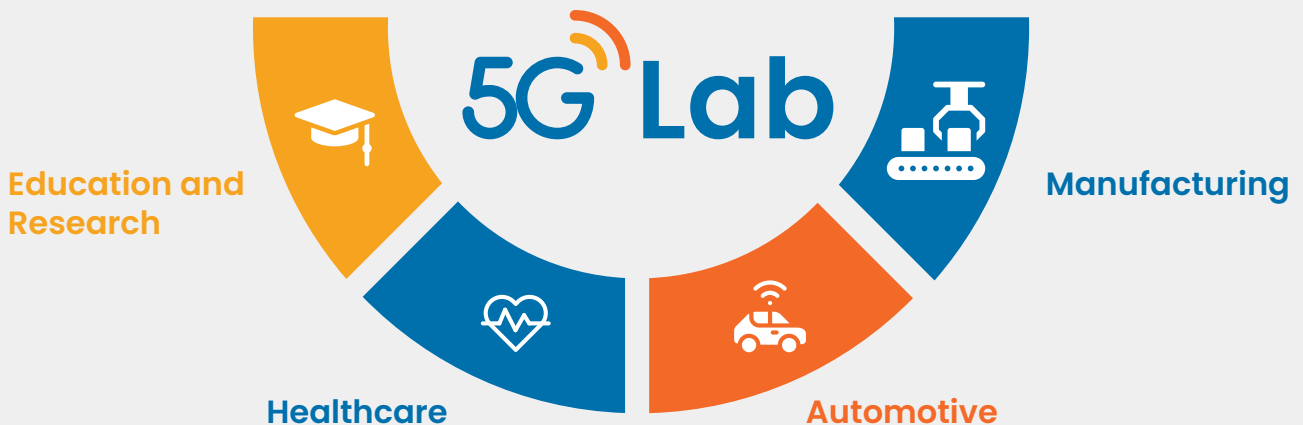
Education and Research

- Help students test new age applications and products on 5G networks and craft the future of 5G-enabled devices and applications

- Allow students, faculty, and corporates to collaborate in the R&D of 5G-powered educational experiences that are more immersive and accessible

- Create new 5G-enabled inclusive experiences that improve remote learning

- Help generate new revenue streams for the institutes, e.g., attracting grants from the government and industry for innovative projects

Healthcare

- Testbed to develop future-ready healthcare products and solutions

- A conduit for interplay of next-gen technologies like IoT, big data, edge computing, AI-ML and cybersecurity

- Help bring cutting-edge healthcare technology in rural and suburban areas

- Expert and collaborative environment for the healthcare industry and academia to R&D breakthrough healthcare solutions

- Proving ground to test and push boundaries of telehealth, remote health monitoring/diagnosis, real-time remote image processing, data analytics etc.

Automotive

- A unified platform for end-to-end testing and validation of 5G-powered automotive applications, including creating field-to-lab scenarios to ensure optimization of all aspects of automotive 5G connectivity

- Help evaluate 5GC-V2X operational capabilities in multiple test environments to verify performance

- Create a simulated exposure for the automotive parts to test the quality of the products and the effect of different weather conditions on the products

- Foster cross-industry collaboration between automotive, technology, and telecommunications industries to develop end-to-end solutions for future mobility services

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Manufacturing

- An agile platform for manufacturers to test and verify use cases supported by new age technologies like AI/ML, IIoT, AR/VR, Digital Twin, etc., and accelerate rollouts

- A holistic one-stop shop to test and verify 5G solutions and applications cohesively and raise the bar for end user 5G experiences

- Enables collaboration between the industry, academia and government to foster future advances in 5G and accelerate Industry 4.0

- A sandbox for rapid prototyping of 5G use cases and creating pre-integrated and pre-validated 5G solutions to address the needs of the manufacturing industry

Amantya's 5G Lab Solution

Amantya's state-of-the-art 5G Lab [8] is a one-stop solution to test and optimize 5G products in a live test environment. The lab is a proving ground where technology providers can pre-validate their solutions to current 3GPP standards and test them for interoperability with third-party integrations, helping speed up the innovation cycle and reducing time-to-market.

It has been built using our latest offering, 5G Network in a Box [9], which comprises a homegrown 5G SA Core Network [10] and RAN (Radio Access Network). The solution comes with an interactive GUI-based interface and is ideal for testing and optimizing 5G products in a live test environment.

Amantya's 5G Network in a Box

Amantya's 5G Network-in-a-Box (NIAB) is a revolutionary all-in-one solution dedicated to testing, experimentation, and discovery around 5G. An end-to-end homegrown solution, the NIAB combines the key technologies, standalone 5G core and RAN, required to test and validate 5G solutions for market readiness in a compact, ready-to-use box. Complying with 3GPP's standards, Amantya's 5G NIAB is ideal for setting up fully functional 5G Labs to test and optimize 5G products in a live test environment before field deployment. It adds immense value to government bodies, small and mid-sized companies, telecom operators, device manufacturers, network equipment providers, and independent software vendors looking for an advanced, integrated, convenient and cost-effective solution to test and accelerate the time to market of their 5G offerings.

Amantya's Robust Partner Ecosystem

Amantya, in collaboration with our robust partner ecosystem, also supports various peripheral accessories, including AR/VR sensors & cameras, IoT sensors like soil, crop, weather sensors, etc., and 5G-enabled drones to enhance our 5G NIAB's functionalities further.

Conclusion

In the current dynamic era of complex ecosystems and high consumer expectations, delivering immersive and flawless digital experiences is increasingly challenging and crucial. The slightest aberration can risk losing the competitive edge, innovation, market opportunity, customers, and revenue. Therefore, the pivotal role of comprehensive and intelligent testing in ensuring Quality of Experience (QoE) and Quality of Service (QoS) at every stage of 5G, from development to deployment, cannot be stressed enough. 5G Labs are innovation hubs that create a dynamic testing environment where telecom players and their collaborators can come together to test, validate and integrate 5G network solutions.

Glossary

3GPP: Third Generation Partnership Project

5G: Fifth Generation of Mobile Communications

5GC: 5G Core

AI: Artificial Intelligence

AMF: Access & Mobility Management Function

NSA: Non-Standalone

NSSF: Network Slicing Selection Function

NTI: New Technology Introduction

OEM: Original Equipment

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AUSF: Authentication Server Function

E2E: End-to-End

FoA: First Office Application

FCC: Federal Communications Commission

FR: Frequency Range

FR1: Frequency Range 1 − 5G Sub 6 GHz

Gbps: Gigabytes Per Second

GTM: Go to Market

IoT: Internet of Things

Mbps: Megabits Per Second

MEC: Multi-access Edge Computing

MHz: Mega HertZ

ML: Machine Learning

Next-gen: Next Generation

NIAB: Network-in-a-Box

NR: New Radio

RF: Radio FrequencyR&D: Research and Development

Manufacturer

PoC: Proof of Concept

PCF: Policy Control Function

QoE: Quality of Experience

QoS: Quality of Service

RAN: Radio Access Network

SA: Standalone

SBA: Service Based Architecture

SMF: Session Management Function

Telco: Telecom Company

TCO: Total Cost of Ownership

TTM: Time-to-Market

UE: User Equipment

UDM: Unified Data Management

UL: Underwriters Laboratories

UPF: User Plane Function

VNF: Virtual Network Function

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CONTACT US

www.amantyatech.com

connect@amantyatech.com

+91 825 029 6037
+91 798 257 3857

USA: 122 South Michigan Avenue, Suite 1390-E37, Chicago, IL 60603

Canada: 567 Roehampton Ave, Unit #63, Toronto, ON M4P 1S5

India:
Head Office: 12th Floor, Tower B, Unitech Cyber Park, Sector 39, Gurugram - 122003

Bangalore: 4th Floor, Karle, The Cube, No 61/1, 61/2, 94/1, Kempapura Main Road, Nagavara, Bangalore, Karnataka, 560045

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