

Top 5 Things You Need to Know About 5G Testing

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Overview

This guide was created to help users testing 5G applications better understand the top challenges and considerations involved in 5G testing and how to address them.

The improved connectivity, speed, and latency of 5G will give rise to applications that were previously considered impossible, such as autonomous vehicles, remote medical monitoring and treatment, and factory automation. Theoretical maximum speeds of 10Gbps and an expected 10-year battery life for low-power, machine-type devices mean that a massive wealth of data can be collected, processed, and acted upon.

With 5G supporting the Internet of Things (IoT), the proliferation of connected devices looks certain to accelerate.

- In 2017, there were an estimated 8.4 billion connected devices – 5.2 billion of which were consumer devices.
- By 2020, Gartner predicts that there will be more than 20 billion connected devices.

This explosion of IoT devices means that the 5G infrastructure needs to be installed quickly and efficiently, and a virtual flood of consumer and IoT devices need to be validated to ensure market growth and adoption.

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Top 5 Testing Considerations

1. Validation of Over-the-Air Performance

With the number of devices increasing, and the frequency bands becoming more cluttered, verifying that users are getting the performance they expect from the network will be a top priority. Testing devices will be needed to search for interference in the area, and to verify that the units comply with all relevant standards.



2. Maintaining Ultra-Low Latency

With the potential speed increases offered by 5G, devices will need to respond faster to maintain a connection. Making sure that devices and broadcast systems respond within the 1 to 2 milliseconds required to keep this new technology running smoothly will be imperative.

Ensuring a network has the capacity to deal with peak demand will be essential.

3. Ensuring Low Packet Loss

Along with the latency concern, with higher speeds comes the need for a low-packet-loss system. With the requirement to be around one packet lost in 100 Million, testing to make sure all generators and receivers in a network meet this standard will be crucial to smooth network operation.

4. Antenna Testing

Considering the complexity of new signals being broadcast, ensuring that antennas perform to specification will be crucial. This will include testing Direction of Arrival (DoA), Direction of Departure (DoD), Polarization, and testing them in challenging conditions, such as under interference and when being used for multipath applications.

5. Capacity Testing

With the large number of devices expected to be added, and to deliver the performance that will be required by users and critical safety systems, ensuring a network has the capacity to deal with peak demand will be essential. Load testing, including problem users and faulty devices, before ramping up new networks will ensure the smoothest go live for new deployments.



Testing Phases and Challenges

Concept Proving, Technology R&D

This is where standards are written, so it is imperative that the accuracy of the equipment and the stability of the testing environment is at the top of the possible range. This will mean testing new components, from their frequency and voltage response to their reactions to RF interference.

Product Development and Prototyping

Once the concept has been proven as a viable use of technology, the next step will be turning it into a usable device. It will need to be tested against existing standards to make sure it is compatible with the current infrastructure, and to ensure that any backwards compatibility requirements are met.

In turn, at the prototyping stage, so called “real world” tests will be needed to make sure that it can survive the theoretical best, as well as the actual reality of the current network environment.

Continuous testing will be even more important in 5G, as the standards and compliance criteria are bound to be much tighter – the penalty for non-compliance much greater.

Design Acceptance Testing and System Test

This is where the new prototype is tested in an actual live system for longer periods and undergoes compliance tests to ensure that it meets existing standards in a commercial environment.

Depending on the complexity of the device, these may include, HDMI, USB, Ethernet, WiFi and many other standards, in addition to the 5G standards. This means that any new device will have to be put through a full suite of test equipment to ensure that all features can be used in the current market.



Today, a variety of sourcing methods are available to acquire test equipment that can protect against changing industry standards and protocols, or evolving test requirements.

Production Test

Once standards have been met, it is time to build the device on a larger scale. This is where automation starts to come into its own. With modern test equipment, full scripts can be written to test all the critical parts on most new devices, providing confidence that every device leaving the production line meets the full standards set by the market.

This continuous testing will be even more important in 5G, as the standards and compliance criteria are bound to be much tighter, meaning that the penalty for non-compliance will also be greater. 5G technology is moving at a fast pace, so flexibility will be key.

Today, a variety of sourcing methods are available to acquire test equipment that can protect against changing industry standards and protocols, or evolving test requirements. Smart sourcing can increase testing flexibility with the ability to return, exchange, or upgrade technology at any time should needs change.

Installation and Commissioning

At the current time, there is debate in the marketplace about how new networks will be deployed, with some advocating core computing, and others favoring the edge computing method for the distribution of equipment in the new infrastructure. This may change the types of tests that will be required in any new 5G system.

Once installed, there will be tests of any broadcast signal against known standards, and tests to ensure that other devices can pick up any new information they need from these broadcasts.

In addition, pre- and post-installation spectral surveys, in the case of RF installations, are bound to be required, as the potential number of devices in the new networks will inevitably lead to frequency cluttering and interference.

Network Performance Testing

As new networks go live, constant performance testing will be key to ensuring that all users see the benefits of the new infrastructure. These could be in the form of load testing of the network before it goes live or inserting rogue elements to stress test the network and ensure it is robust and capable.

Where these tests take place and what they entail will depend on the type of deployment installed, but the use of constant network testing and remote probing points is likely to become the norm.

To reduce expenses and uncertainty, many companies rent the latest 5G test equipment. This provides a flexible, pay-per-use approach and helps avoid the long-term commitment and cost of purchasing equipment that may not fit future testing needs.

Maintenance

As well as constant performance testing and monitoring, the vast increase in devices, broadcasts, and traffic will necessitate vast amounts of maintenance.

Monitoring should allow infrastructure operators to be aware of failures quickly and react to them, as well as picking up information to institute proactive maintenance programs, removing issues from the system before they occur.

The use of constant network testing and remote probing points is likely to become the norm.

In addition, constant frequency monitoring on the RF side will be essential to removing interferences before they can impact a network, whether they are pirate broadcasts, or a WiFi router in the wrong location.

How to Manage These Challenges

Deploying Smart Equipment Strategies

Keeping up with the latest technology, meeting deadlines, and getting to market quickly are key priorities in any industry, and they are especially important with 5G. Having the right equipment—in the right place at the right time—means projects get done quickly, on-time and under budget.

Smart sourcing strategies, including mixing rental, leasing, and purchase programs, provide quick and easy access to the latest 5G test technology at the lowest cost. Consider a flexible “pay as you go” approach that allows you to work with the equipment without making long-term financial commitments. Also, return, exchange, or upgrade equipment whenever you want or need. Examining your options in advance can reduce up-front costs and avoid recurring costs for calibration, maintenance, and repair.

Electro Rent’s portfolio of electronic test equipment and financing options ensure that you can find what you need, including accessories, to fulfill almost any 5G requirement. With one of the largest inventories available, a wide range of equipment is available now, for immediate delivery.

Consider a flexible “pay as you go” approach that allows you to work with the equipment without making long-term financial commitments.

The Next Step

Let Us Help You on Your Journey to a 5G Future.

Please contact us at **1.800.553.2255** or email **5G@electrorent.com**. Our 5G experts are available to assist with your needs.

Examples of Leading Edge 5G Testing Products

5G Signal Creation - Keysight

Keysight M9383A PXIe Microwave Signal Generator
1 MHz to 44 GHz



Electro Rent Part No. KT-M9383A-F44

The M9383A is a modular microwave signal generator test solution for design validation. It can be efficiently leveraged into a manufacturing environment with the flexibility to solve today's pre-5G LTE Advanced requirements and can be upgraded to your future test needs.

Applications

- Modular test solution for design validation that can be efficiently leveraged into manufacturing
- Flexibility to solve your immediate test needs, but upgradable for what comes next – whether that's more frequency coverage or a rapid shift to high volume production.
- Pre-5G signal confidence you need with 1% EVM @ 28 GHz, 800 MHz bandwidth

Features

- Single side band phase noise typ. -137dBc @1GHz, 20kHz carrier offset
- High output power @1GHz, -90 to +19dBm
- Analog and digital modulation
- Cellular modulation formats from 2G to Pre-5G LTE Advanced

Keysight E8267D PSG Vector Signal Generator
100kHz to 44GHz



Electro Rent Part No. KT-E8267D-544

The E8267D vector signal generator is used to test advanced receivers, with realistic wideband radar, EV, Satcom, and 5G applications. It offers up to 2GHz of bandwidth (with external AWG), allowing you to simulate complex electromagnetic environments and reduce complex signal creation times.

Applications

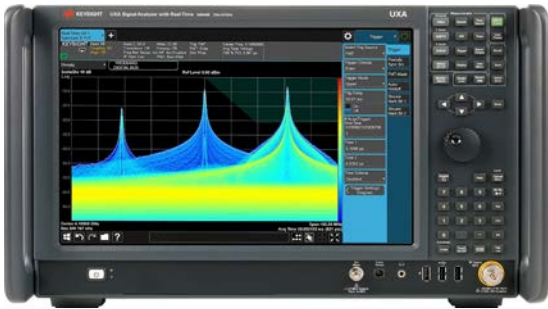
- Waveform playback and real-time
- Antenna Array Testing - Conducted and Over-the-Air
- 5G Waveform Creation with signal studio application
- Signal optimizer with K3101A

Features

- Single-side-band phase noise typ. -143dBc @1GHz, 20kHz carrier offset
- High output power @1GHz, -130 to +21dBm
- Analog and digital modulation
- Cellular modulation formats from 2G to Pre-5G LTE Advanced

5G Signal Analysis - Keysight

Keysight N9040B UXA Signal Analyzer, Multi-touch
2 Hz to 50 GHz



Electro Rent Part No. KT-N9040B-550

The N9040B signal analyzer offers real-time spectrum performance analysis up to 1GHz for deeper views of complex and challenging 5G signals. Clean spectral purity with leading phase noise measurements. Extendable frequency range to 110GHz with external smart mixers.

Applications

- Utilize application measurements that range from parametric to wireless measurements including 5G LTE Advanced, WCDMA, phase noise, noise figure, analog demodulations
- 5G Waveform analysis and vector analysis with VSA software 89601B
- Satellite, radar, EW, fast-hopping signal analysis

Features

- Analysis bandwidth – 25MHz standard, upgradable to 1GHz
- Real-time bandwidth optional to 510MHz
- Displayed average noise level (DANL) +174dBm at 1GHz (1Hz resolution)
- SSB phase noise at 10kHz offset -136dBc
- Cellular modulation analysis from 2G to Pre-5G LTE Advanced
- 5G NR (new radio) with N9085EMOE application software

5G Signal Creation - Rohde & Schwarz

Rohde & Schwarz SMW200A Vector Signal Generator
100kHz to 40GHz



Electro Rent Part No. RS-SMW200A-40

The SMW200A is a vector signal generator for 5G applications. It offers flexibility for generating complex, digitally-modulated signals of high quality for 5G LTE Advanced to 2G applications.

Applications

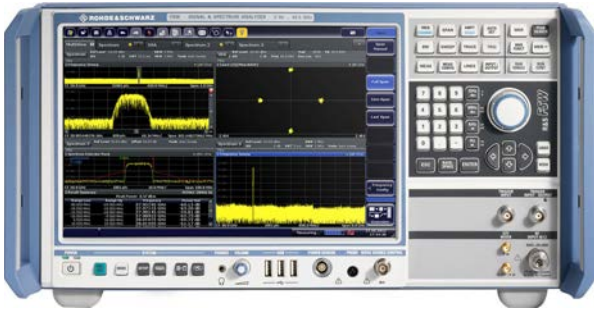
- Pre-5G NR Signal Generation
- Antenna Array Testing - Conducted and Over-the-Air
- 5G Waveform Candidates

Features

- Single side band phase noise typ. -135dBc @1GHz, 20kHz carrier offset
- High output power up to +18dBm (PEP)
- Analog and digital modulation
- Cellular modulations

5G Signal Analysis - Rohde & Schwarz

Rohde & Schwarz FSW43 Signal and Spectrum Analyzer 2Hz to 43.5GHz



Electro Rent Part No. RS-FSW43

The FSW43 signal and spectrum analyzer is designed with 5G measurement analysis in mind. It offers low phase noise, wide analysis bandwidth (2GHz) for complex LTE Advanced applications, with an easy to use GUI.

Applications

- Used in aerospace and defense applications (ASD)
- Wideband communication systems for military and commercial use
- 5G Waveform analysis
- Development of oscillators for radar systems and complex LTE Advanced applications

Features

- Analysis bandwidth – 10MHz standard, upgradable to 2GHz
- Displayed average noise level (DANL) +154dBm at 2GHz (1Hz resolution)
- SSB phase noise at 10kHz offset -134dBc
- Cellular modulation analysis from 2G to Pre-5G LTE Advanced

Contact Us Today

Contact us today to learn more about our complete portfolio of cross-industry 5G testing products.

You can reach us by phone at **1.800.553.2255** or email **5G@electrorent.com**. Our 5G experts are available to assist with your product testing and financing needs.



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