VIAVI Solutions

Executive Guide to 5G Radio Access Network Rollout (RAN)

Methods and Operational Procedures

3 Simple Steps
A Giant Leap for 5G

5G

A Giant Leap for 5G

De-Risk Your Deployments

If you asked five people what they thought the promise of 5G was going to deliver, you'd hear at least as many answers. As someone working in mobile telecoms, you'd do better than most. It's not a new symbol in the top corner of a shiny new handset representing Enhanced Mobile Broadband (eMBB), which most of us understand and expect. It's actually all about:

- **The Internet of Things**
- **Massive Machine Type Communications (mMTC)**
- **Ultra-Reliable Low Latency Communications (URLLC)**

All this new complexity comes with risk, not just benefit. It is not only about opportunity and new ways to monetize your networks. Operators have been focused on speed of rollout – i.e., densification, trying to win the coverage competition but not considering optimization and troubleshooting. After some years of pushing ahead with the network expansion now is the time to de-risk the deployments and concentrate on better verification.

Don't Delay Test Today

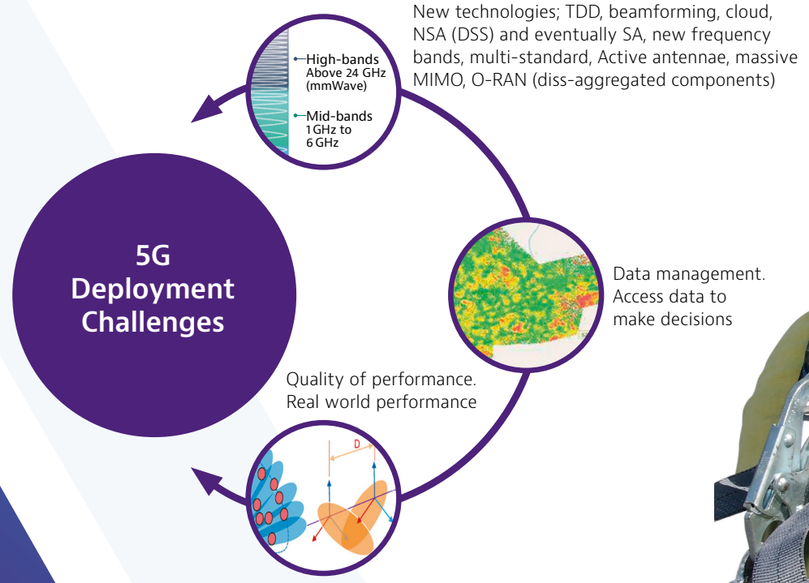
5G deployment is not a simple radio upgrade, but a complete change of topology. It demands major changes across the network to support 5G Standalone (SA) and cloud networks, to enable myriad new 5G services, many of them yet to be imagined. Take as examples, mission-critical applications such as remote surgery, or fully self-driving cars, these

"verticals" will place an ever-increasing load on underlying networks and will be more demanding than mobile video streaming and mobile data from the 4G and 3G eras.

If you're a mobile network operator in an excruciatingly competitive environment, and you're bidding to build a large private network for a gigafactory or a vast container-port, you wouldn't want to deploy an underpinning network that had not been adequately stress-tested. You would be very keen to understand the new methods of operating procedures (MOPs) to confirm that your colleagues were assuring all aspects of the network build-out and turn-up were being done correctly.

Test 5G Smarter

Complexity Abounds! For example, 5G relies on higher spectrum frequencies, mid-band: 1-6 GHz (CBRS and C-Band) and high-bands: > 24GHz (mm-wave) for its greater speed and capacity, but that increases cell density. New massive MIMO antenna beam forming enables that extra capacity, sending multiple data streams, one per UE, using the same time-frequency resources. Open RAN, with its multiple vendor approach, requires seamless interoperability. This complexity brings major challenges in the radio frequency (RF) domain. Furthermore, the fundamental shift from the frequency domain to Time Division Duplexing (TDD) causes all manner of synchronization problems. 5G is much more complex than the previous Gs, but by adopting smarter testing methodologies, you can avoid catastrophic and costly consequences downstream.



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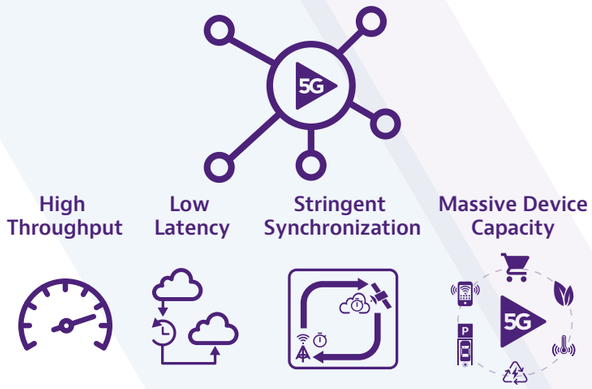
The benefit of this Giant Leap for 5G

Is that your network will support new verticals.

A flexible network that can support the following characteristics



PLANNING

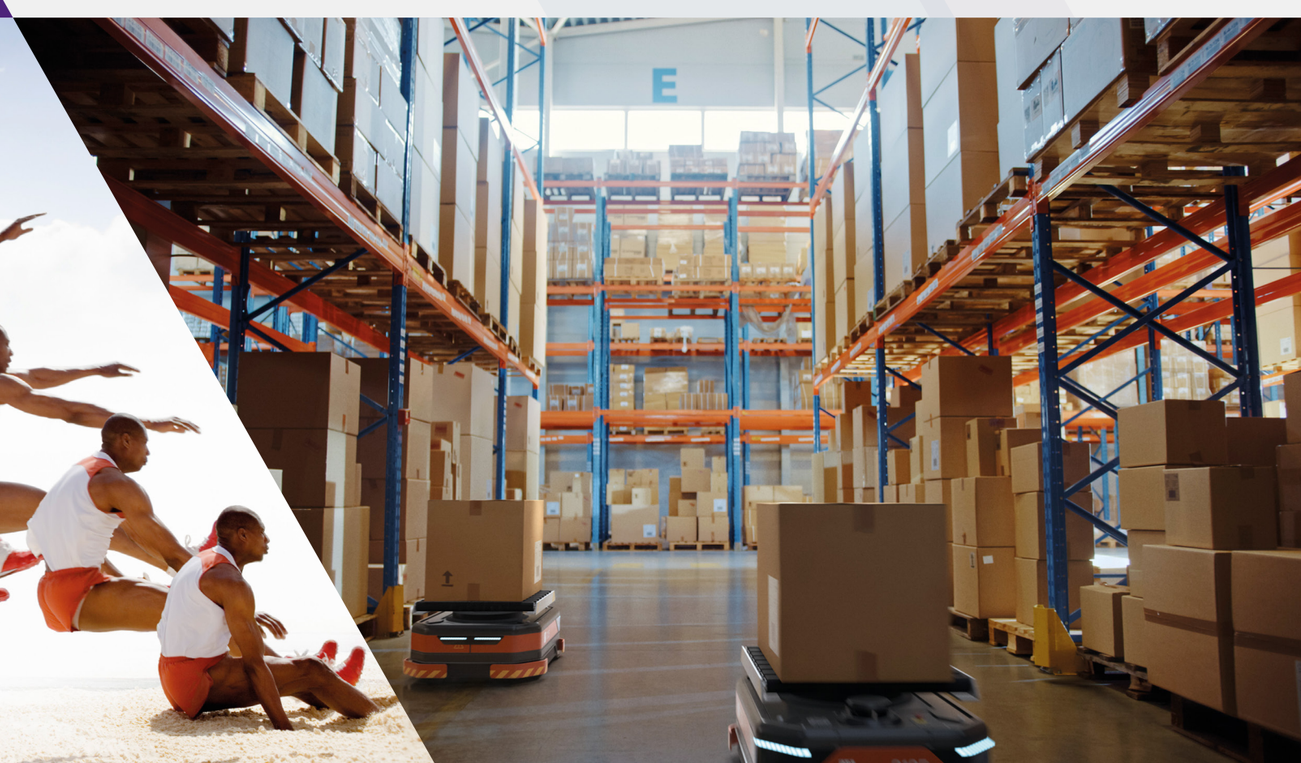
INSTALLATION

MAINTENANCE

Consistent Test Procedures

Enabling the 5G Verticals

- Automotive
- Industry
- Public Safety
- Healthcare
- Energy & Utilities
- Public Transport
- Retail
- Media
- Agricultural
- Financial



If your colleagues follow these prescribed steps, shown here and in more detail on the chart overleaf –

from a Mobile Network Operator (MNO) perspective, this will help you reduce Capex and Opex.

If you complete these simple verification steps, you can utilize network elements more efficiently, for example you might not need to install so many macrocells in detriment of compact small cells.

Furthermore, getting it right first time, doing ALL the measurements, whilst at site during the installation phase will reduce the number of site revisits, saving more operational costs, improving customer service, and reducing network churn.

Correct Methods and Procedures
Organized by Lifecycle

To achieve this Giant Leap for 5G, you need to ensure all these steps are completed and that the data is safely stored in the cloud to speed up future troubleshooting. These steps have been developed from sharing best practices from leading mobile network operators around the world.

A Giant Leap for 5G

Get it Right First Time.

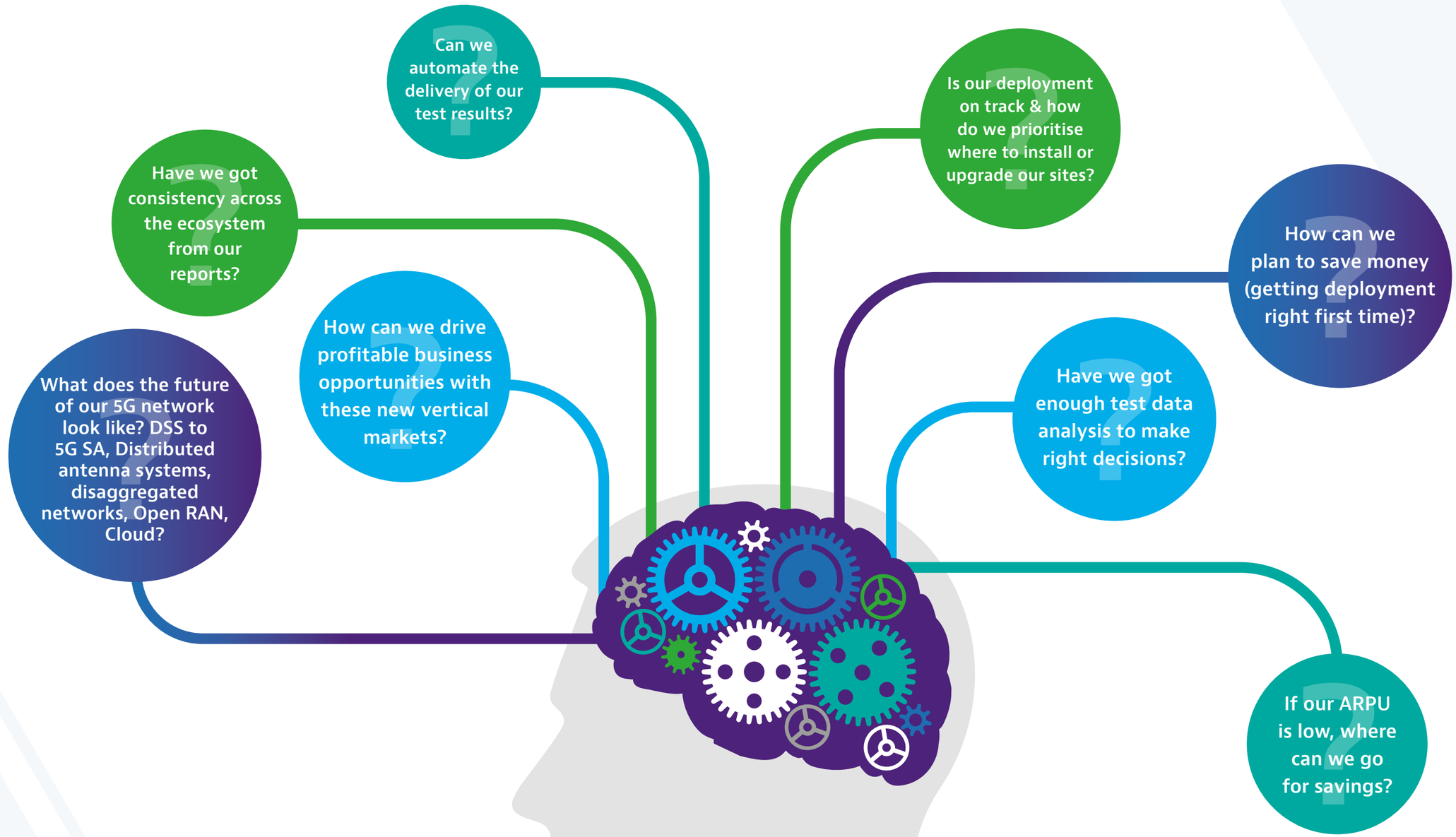
Reduce OPEX (no second troubleshooting site visits) while increasing QoS, QoE. Increase service up-time and reduce churn.

1	2				3			
PLANNING	INSTALLATION	MAINTENANCE AND TROUBLESHOOTING						
Sweep spectrum (site audit) – must use real-time spectrum analysis for looking on site – band clearance	**Antenna Alignment**	**Cable Sweeping**	**Fiber Connector Inspection**	**Fiber Measurements (Insertion Loss or OTDR)**	**Spectrum Measurement – must use real-time spectrum analysis for looking on site – band clearance**	**Timing and Synchronization**	**4G/5G RF Analysis**	**CPRI (Common Public Radio Interface)**
ADDRESSING THE RISKS								
What other signals already exist at the chosen site? Will they interfere with or degrade the planned and expected radio performance at this location? Will your site cause interference to other networks or your own signal?	The coverage might not be optimised (e.g. antennae elements pointing in the wrong direction – not as in the RF plan). The slightest error here will cause dropped calls or poor throughput, especially as the site's traffic ramps up. Leading to very unhappy customers!	If there is a mismatch in impedance with the transmission lines at this site it will become inefficient, drawing more power, which costs money and may ultimately cause damage. This can affect network geographic coverage and also cause dropouts and poor throughput.	Fiber is everywhere these days, even replacing most of the transmission lines. 90% of the faults in fiber networks are caused by dirty connectors affecting the throughput and can be a point of total network failure, perhaps causing a burnout in the remote radio head optics, which would be a costly and timely problem to fix. Inspect Before You Connect (IBYC) is the industry standard practice to optimise FTTA installs.	Fiber installation can be very sensitive. Macro/micro bends cause attenuation, which mean the link performance could be dramatically reduced as the laser power is not all transmitted to its destination. This could also be caused by poor splices in the fibers done at installation. Again this could cause drops in throughput to all out failure. Testing is critical to qualify or troubleshoot a link or ensure link loss is within permitted optical budgets.	After radio equipment and antennas are installed at site, RF validation of the installation or upgrade should happen to ensure they are transmitting as expected. If testing wasn't conducted previously and those test results are not accessible it is very hard for a tech to be certain that their upgrade or repair hasn't made a problem worse. What is the overall RF Envelope?	The 5G Time Division Duplex (TDD) signals are much more susceptible to interference. As a result there are much more stringent requirements for timing and synchronization. If sync has been lost a tech could spend ages looking for external Interference without realising the fault was from his own network. Verify it's not an external interferer at site (saving time and money) Potential first problems would be interference, low throughput due to excess latency. Difficulty for 5G devices to attach to radios, frequent call drops, etc.	It is important to verify that the over-air RF performance is as expected. This is where there have been significant hardware changes from 4G, so there are certain expectations with this, so more measurements are absolutely needed to offer the next level of detail, for example service testing. Also many regulatory bodies are requiring EMF testing to ensure 5G transmitted power remains within safe limits.	You can avoid unnecessary climbs by checking the health of the CPRI link to the RRU (Remote Radio Unit) from the bottom of the tower, as well as saving a fortune from SFPs (Small Form-Factor Pluggable transceivers) not being mistakenly destroyed. It is also possible to investigate interference and PIM (Passive Intermodulation) problems, without climbs and while the BTS (Base Transceiver Station (tower)) remains in service.

For further information on the methods and procedures cited here, there is a more detailed document that we can provide as well as datasheets for suitable products to carry out the testing.

Call to Action

Let us help you define your methods and operational procedures to ensure an effective and cost efficient 5G network rollout.



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A Giant Leap for 5G

3 Simple Steps
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Delivering on the promise of 5G involves fundamental changes across the entire network, meaning operators and their contractors have to change the way they turn-up and test.

1 PLANNING

2 INSTALLATION

3 MAINTENANCE

For more information visit:
viavisolutions.com/5gbootcamp

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Test 5G Smarter

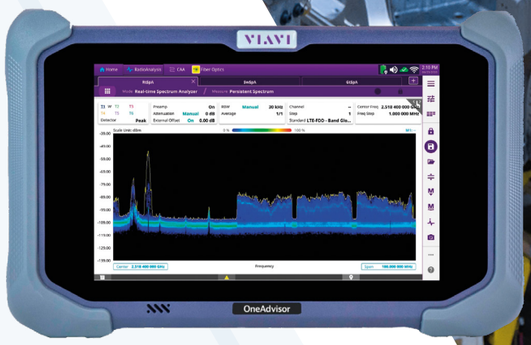
New tool sets offer modern connectivity and performance that take advantage of technology advancements over the last ten years.

Workflows can be defined and deployed across all your field technicians to ensure consistency of setups and processes. It also minimises the time to make ready the equipment and perform the tests, allowing your technicians to focus on the installation.

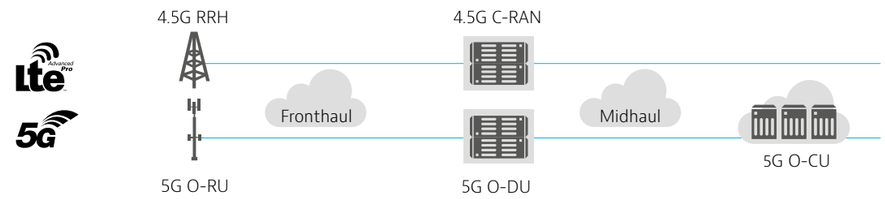
New technicians can be coached remotely and securely. Experienced techs can log in, view their configuration setup, results and even drive their instruments by remote control.

Once testing is complete, the data can immediately be uploaded before the technician leaves the site. This can be verified and reduces costly revisits.

Many of the tests outlined here can be performed on just one test set, the modular OneAdvisor 800, this reduces the amount of equipment that needs to be taken to site and reduces overall cost of ownership.



FUNCTIONAL / PERFORMANCE / CAPACITY TESTING / TROUBLE SHOOTING



Evolution to Beam Centric / Non StandAlone / DSS

3Z RF Vision

OneAdvisor 800

M-MIMO Beam Coverage
5GNR FR1 and FR2 Support
Interference Hunting
Realtime Spectrum
OTDR Measurments

Fiber Microscope

Test Consisitency

VIAVI StrataSync enabled

Asset Management
Test Results and Reports
Tool Configuration
License Management

A Giant Leap for 5G

Put an Experienced Partner on Your Strategy Team

VIAVI has supported operators globally for 100 years and we see that as new 5G networks are being deployed, many of these essential steps are being ignored. A simple check with a 5G enabled handset to 'prove' it is working is simply not enough.

It's not just at the cell sites where new advanced testing is required. The 5G lifecycle means efficient lab verification of network equipment, capacity, and throughput, through to monitoring and service assurance are needed to ensure a smooth deployment and timely launch of any new 5G network or service. Built-in network equipment alarms are helpful, but knowing fault cause, precise location and who or what services are affected make a real difference in the proper uptake of a newly launched service, in other words, **delivering on the promise of 5G**.

For further information on the methods and procedures cited here, there is a more detailed document that we can provide, as well as datasheets for suitable products to carry out the testing.

Please get in touch using the contact details below.

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