

5G



WHITE PAPER

Using Test Asset Optimization Services to Enable 4G to 5G Migration

For Network Equipment Manufacturers (NEMs)—those companies providing infrastructure solutions to wireless operators—the migration from 4G to 5G technology brings with it some new realities. For one, test requirements for 5G will not be the same as those for 4G and that means NEMs will have very different test needs and likely require new test equipment. Due to the higher frequency, wider bandwidths, and number of channels they must support for 5G, those test assets will undoubtedly be more expensive, posing a problem for NEMs under constant pressure to reduce costs.

To deal with these challenges throughout the migration process and stay within project budget, NEMs need to make informed, cost-effective program decisions (e.g., buy versus lease, technology refresh, upgrade sustainment, or disposition). To accomplish this, they require real-time understanding of what test assets they have, where they are located, what capabilities they offer and if they are being used. This information will allow them to have access to the right test asset, when and where it's needed.

This white paper examines challenges NEMs face as they migrate to 5G and how better management of test assets via Test Asset Optimization Services from Keysight Technologies, Inc., can play a pivotal role in overcoming those challenges. Using real-time asset data, NEMs can successfully navigate the migration path to 5G in the fastest time possible, while optimizing both their Capital Expenditure (CapEx) and Operating Expenditure (OpEx).



5G Migration Challenges

With the 5G revolution now firmly underway, the promise of ultra-fast data delivery, a real-time, reliable experience for users wherever they are, and support for communication between Internet of Things (IoT) devices is now closer than ever to becoming reality. But that revolution won't happen overnight. A number of emerging challenges promise to complicate the migration path for NEMs.

From a technical perspective, NEMs have to contend with 5G's use of higher microwave and millimeter-wave frequency bands. The first wave of 5G New Radio (NR) and pre-5G fixed wireless deployments, will operate at 28 GHz, with 39-GHz deployments also being trialed. There is also significant 5G work being done with sub-6GHz base station deployments. With these higher frequencies comes the requirement for wider bandwidths, up to 2 GHz.

NEMs also have to deal with the complex technologies that will be utilized for 5G, such as beamforming and massive MIMO. Additionally, increased levels of integration and the use of higher frequencies are driving the need for testing to take place Over-the-Air (OTA). This OTA testing will more accurately emulate the conditions experienced in the real world and improve reliability.

From a business perspective, the challenges NEMs face are multi-faceted. With the first 5G NR standard recently completed, NEMs can now move forward with their 5G products, but there is a requirement to co-exist with current 4G technology. Development will need to continue in the manufacturing and development of 4G. For base station manufacturers, much of the 4G infrastructure is already in place and sales are slowing. 5G infrastructure is not yet ramping up. As a result, the number of base stations sold overall is down and revenue is decreasing. The other issue is the dramatic decline in Average Selling Price (ASP) of wireless infrastructure, which is putting renewed pressure on the NEM's CapEx and OpEx budgets (Figure 1).



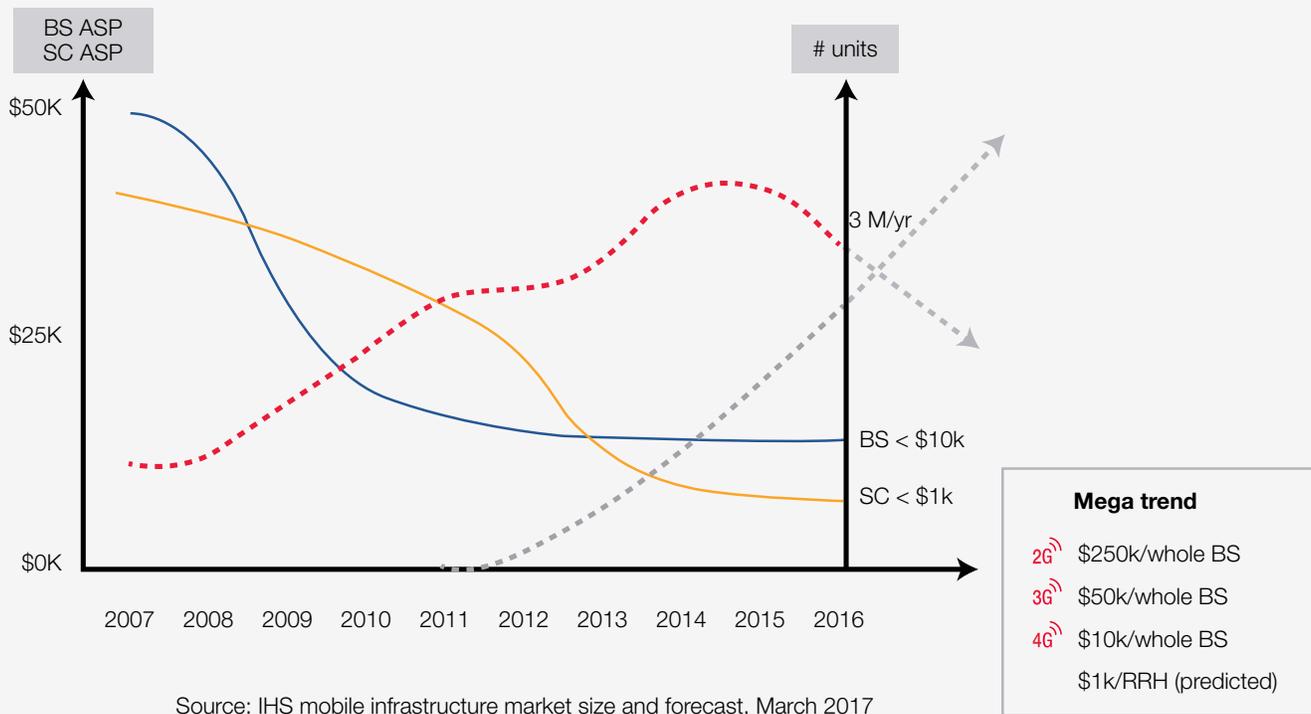


Figure 1: From 2007 to 2016, there has been a dramatic decline in ASP for both Base Stations (BS) and Small Cells (SC). For example, the average price to deploy a base station went from \$250K for 2G to \$10K for a 4G deployment. With 5G deployments, it may drop as low as \$1K

Test Asset Considerations

To deal with the technical and business challenges during the migration to 5G, NEMs will need to procure equipment to meet the new 5G test requirements. At the same time, their existing 4G assets will become underutilized as the migration advances. This increasing asset base, coupled with the high cost of newer, high frequency, wide bandwidth, multi-channel test instruments, will further strain their tight CapEx and OpEx budgets, making better test asset utilization management all the more critical. Three key test asset considerations for NEMS migrating to 5G include:

Capital expenditure

CapEx, the cost to acquire and install an asset, is a primary consideration for any NEM migrating to 5G. It is a significant contributor to an asset's Total Cost of Ownership (TCO) and given the expected higher price tag of 5G test equipment, will likely be at odds with the shrinking selling price of wireless infrastructure, which is declining between 20 to 30% a year on average. As the cost of wireless infrastructure decreases, so too must the cost of test.

The challenge for NEMs is how to secure the right test equipment at a lower cost of test, while ensuring CapEx stays within budget. Better asset management offers NEMs one way to address this challenge. It not only helps reduce the cost of ownership across all assets by tracking and managing purchases, warranties, contracts, rentals, and maintenance, but also ensures quality standards compliance of all test assets. Test asset management programs tracking real-time asset utilization also allow NEMs to identify underutilized assets and avoid unnecessary capital expenses. However, not all such test asset management programs can increase utilization, even though they may claim they can.



Technology refresh

Current test equipment will likely be unable to provide the increased levels of measurement capability required for 5G standards. 5G, for example, utilizes MIMO technologies and that means multiple channels may be required; something that may not be supported in today's 4G test process. The challenge for NEMs is how to secure the right technology to ensure they get their products to market ahead of the competition, while maximizing the use of their existing test assets.

Technology refresh offers an answer to this dilemma, providing NEMs an easy and cost-effective way to upgrade or trade-in their existing assets to obtain the required test equipment performance. One example could be moving to newer modular instruments based on the PXI standard to meet current test needs, while also being flexible enough to support future changes as the 5G standard develops.

Upgrade

In the sub-6 GHz frequency range, current test equipment may have sufficient performance; but it likely won't meet exact 5G needs. A prime example is a signal analyzer that only covers the 3.6-GHz frequency range as required for 4G. Fortunately, some test and measurement vendors offer a hardware upgrade to increase the frequency range of a signal analyzer to meet new millimeter-wave frequency measurement needs.

The same is true of bandwidth. With a hardware upgrade, a signal generator could easily be upgraded from a bandwidth of 120 MHz to 160 MHz to support 5G requirements and enable measurement of individual component carriers. Often times, that upgrade is available through a software license key, providing a cost-effective way of ensuring NEMs can continue to utilize existing assets.

Trade-in/Trade-up

When an upgrade is not an option, it may be possible to trade-in underutilized assets for credit that can be applied to the purchase of new assets to meet 5G test needs. With this option, NEMs can get the required performance they need and the ability to get faster, more accurate measurements than were possible with previous generation instruments.

For many NEMs migrating to 5G, trade-in will likely be the best option since 5G will require new equipment that covers the microwave and millimeter-wave frequency ranges for both signal generation and analysis. For product development engineers, trading up is often the appropriate option, particularly when there is a need to generate 1-GHz bandwidth or higher.

Loan pool

As NEMs migrate to 5G, their test asset base has to increase to account for the addition of new 5G-specific test equipment. At the same time, their existing 4G assets will likely become more and more underutilized. The challenge for NEMs is to ensure their engineers have access to the equipment they need, while at the same time improving asset utilization and reducing their total CapEx requirements. To address these issues, use of a loan pool should be a major consideration.

A loan pool allows the NEM to more effectively share assets across groups of users during the migration when new test equipment may be limited or when older test equipment may be offline for upgrade or being traded in. It also provides relief in situations when making decisions about which instrument to buy is difficult, as is the case with 5G where requirements are in flux. NEMs can use it to access an instrument for pre-5G measurements in the short-term and then, with the 5G standard finalized and test requirements known, either purchase new equipment via a trade-in or simply trade-up to get the performance they need.

By sharing assets with assigned chargeback rates, the loan pool identifies under-utilized assets for trade-in or disposition, reducing CapEx and the ongoing operating expenses of maintaining those assets, while increasing utilization of the remaining assets. It can also significantly reduce the total inventory of test assets—meaning, less calibration, repair, and other costs—and concurrent capital outlay in measurement equipment when not in use. This assumes, of course, that the loan pool is properly managed and actively controlled.

Easing Migration To 5G With Test Asset Optimization Services

Throughout the migration period, test asset management decisions must be made based on real data to ensure that correct conclusions are reached. The foundation of these decisions is a good understanding of the instruments the NEM has today, where they are located, and what functionality is available. This information can then be used to plan for which capabilities will be required in the future and how equipment can be shared between users, laboratories, and locations during the migration to allow both early access to new 5G technology and support for ongoing 4G needs. The goal is to ensure the required equipment is available to the NEM when needed. Test Asset Optimization Services from Keysight offer NEMs the ideal way to obtain the required information and meet this goal. Such services include:

Asset tracking and control

Standard asset tracking tools provide the ability to know what equipment is available, where it is located, and under whose control it resides. This information makes it easier to locate equipment for calibration and identify the right contact when there is a need for a specific instrument. The result is a time saving during the audit process, a reduction in lost assets, and assurance that the assets in question are being put to productive use. When trying to identify equipment as you move to a new technology, asset tracking can be useful in identifying what equipment may already be available within the company.



Utilization and health data

While it is important to know where a product is located and its readiness to make measurements, it can be just as important to know specific information on the equipment's actual usage. Utilization data provides that information. It enables the identification of assets that are not in use, and provides data to identify assets that have become excess and are no longer adding productive value to the organization. True utilization requires knowing not just whether an instrument is switched on, but also when it is actually being used, either manually or automatically, through detailed application logging in real time. As the migration to 5G heats up and the need for 4G equipment decreases, such utilization data will be critical to driving decisions on when equipment can be made available for trade-in, trade-up, or disposal to maximize asset efficiency based on utilization and market value (Figure 2).

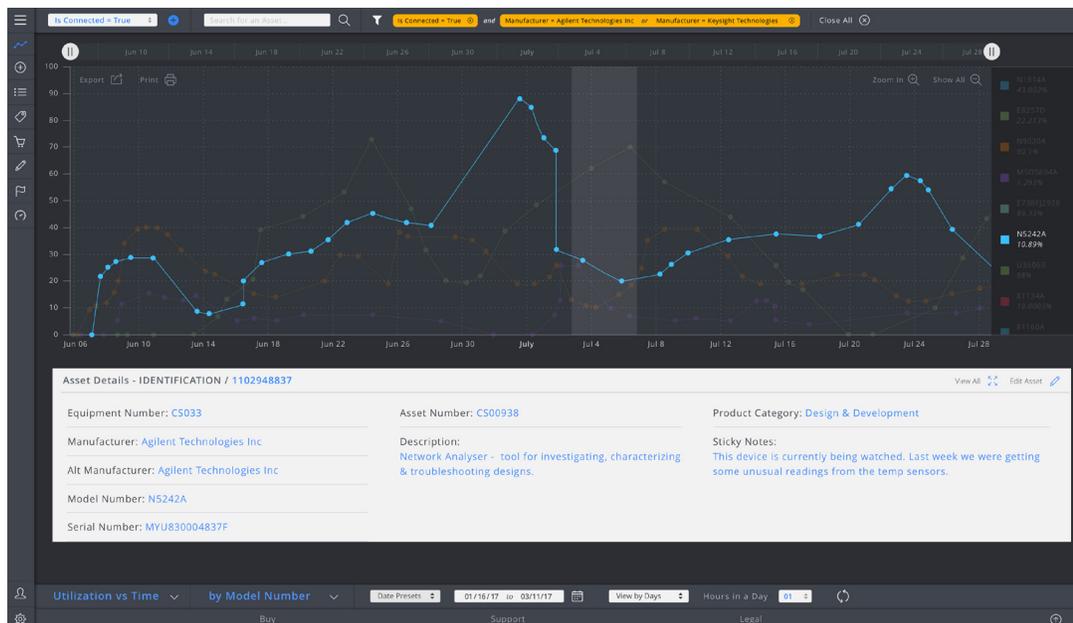


Figure 2: Real time Utilization data helps identify opportunities for improved equipment utilization

Loan pool management

As the need for the 4G test equipment decreases, it may mean that product development engineers no longer require dedicated instruments on their test bench. Loan pool management software provides visibility into the availability of assets and the current location of those assets, along with the ability to schedule instrument reservations. As 5G requirements increase, this loan pool management will be critical to helping identify underutilized assets (Figure 3). With this information in hand, NEMs can make better decisions on whether the purchase of a new asset is warranted or if a short-term rental will suffice.

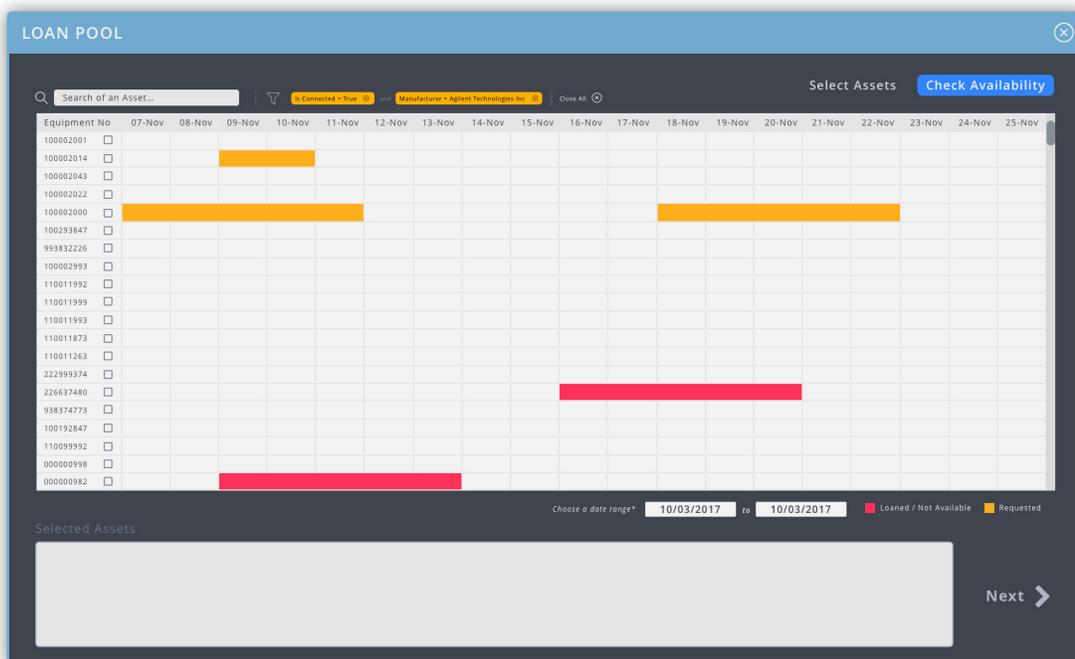


Figure 3: With loan pool management, NEMs can quickly check asset availability

The Keysight Value Proposition

Keysight provides the fastest path to 5G by helping companies solve design challenges ahead of each new technology wave. The Test Asset Optimization Services portfolio is ideal for helping NEMs deal with the challenges that come with the migration to 5G. The integrated program addresses NEMs needs throughout an instrument’s lifecycle with metrology-based asset calibration and instrument health services, as well as upgrades with technology refresh. Utilization and optimization secrets reveal themselves via real-time actionable data, giving NEMs the true picture of their inventory, not just whether an instrument is plugged in.

Keysight’s Test Asset Optimization Services includes unique asset management capability that can actually track “true” utilization in real-time. Using the portfolio’s offerings, NEMs can make smarter, more strategic decisions about how they acquire, maintain, and dispose of their test assets. These offerings include Pathwave Asset Advisor.

Pathwave Asset Advisor is at the core of an asset optimization program designed to significantly improve asset productivity. It features three applications. The Utilization and Health application delivers real-time data-driven utilization charts to help equipment owners visualize trends over time, and highlight opportunities for test-process optimization, standardization, and increased asset sharing. Its real-time health parameter monitoring identifies assets with abnormal maintenance requirements or those needing preventative maintenance, enabling equipment owners to avoid unscheduled downtime. The Track & Control application identifies an asset's "real" situation in terms of its location and user, while the Loan Pool application drives increased sharing of assets across organizations. Together, these applications provide a data-driven program for optimizing an organization's test assets productivity over their entire lifespan, in turn, allowing equipment owners to maximize their test assets return on investment.

Conclusion

Migrating to 5G is no easy task. Mitigating the challenges that arise during the tough transition and making the right equipment choices to support that transition requires access to real-time asset data and effective management of all assets. Test optimization services, such as those available through Keysight's Test Asset Optimization Services portfolio, offer an ideal solution to this dilemma, delivering the asset tracking & control, utilization & health data, and loan pool management that NEMs migrating to 5G require. The portfolio not only supports NEMs ongoing 4G needs, but provides them access to the right test asset, when and where it's needed, as the 5G standard continues to develop.

For more information on this topic, go to:

www.keysight.com/find/AssetOptimization.

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

