

# Amdocs Massive MIMO & Beamforming



The growing demands on wireless networks to support 5G services are causing mounting pressure on service providers to boost bandwidth, densify cells – or both. Yet such solutions have serious limitations. One is high cost and latency. More pressing is that they utilize scarce resources that are within years of reaching saturation.

Massive multiple-input multiple-output (mMIMO) is an efficient wireless access technology that increases wireless area throughput without the need to increase bandwidth or densify cells. It brings together antennas, radios and spectrum to enable higher capacity and speed for 5G.

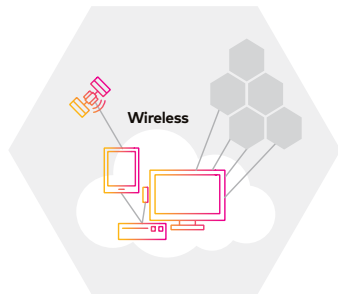
With its strong multiplexing gain and beamforming capabilities, mMIMO can sense data from concurrent sensor transmissions with very low latency, and provide sensors with high data rates and reliable connectivity. The technology's capabilities are fully maximized when combined with beamforming and multiuser MIMO.

mMIMO systems fulfil a crucial role in enabling information gathered through smart sensors to be transmitted in real time to central monitoring locations for the operation of smart sensor applications such as autonomous vehicles, remote healthcare, smart grids, smart antennas, smart highways, smart building, and smart environmental monitoring. For 5G, coverage is beam-based rather than cell-based.

Beamforming complements mMIMO to improve coverage, and is a necessary feature in TDD and mmWave deployment in environments where spectrum is relatively abundant but coverage is limited due to the propagation characteristics of mmWave.

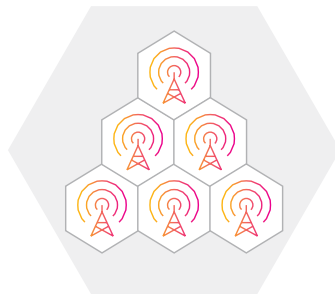
## Amdocs massive MIMO and beamforming offerings

Amdocs mMIMO and Beamforming service provides a variety of activities to accommodate the various stages of the network deployment lifecycle. These are described below.



### Field test sector beam tuning

- Sector beam calibration on planning tool
- Perform field drive test
  - Coverage/capacity antenna beam test



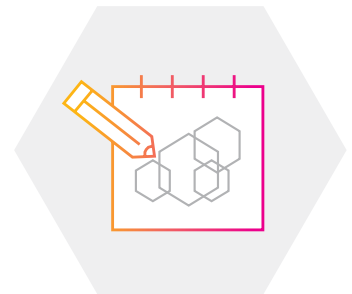
### Massive MIMO RF design

- System module
  - CPRI links
  - Baseband
- 16TRx/32TRx/64TRx
- Antenna array mode



### Capacity planning

- Single user mMIMO
- Multi-user mMIMO
- High-rise building

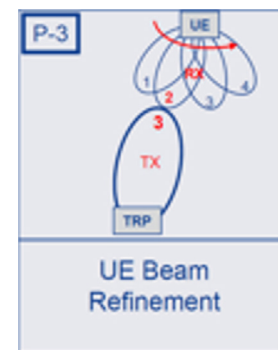
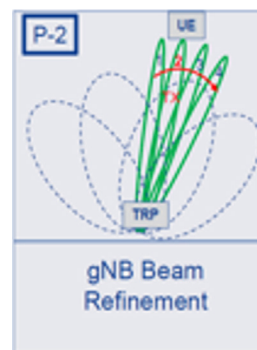
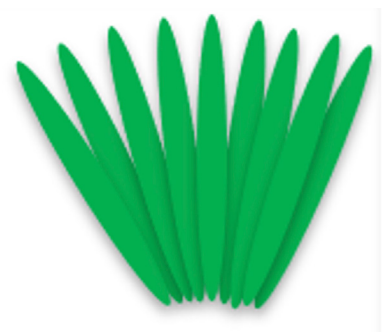
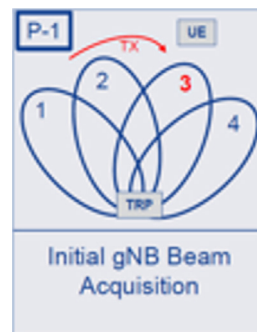


### OSS Configuration data fill & analytics

- All OEM OSS data fill
- Perform data analysis & utilization study

## Field test sector beam tuning

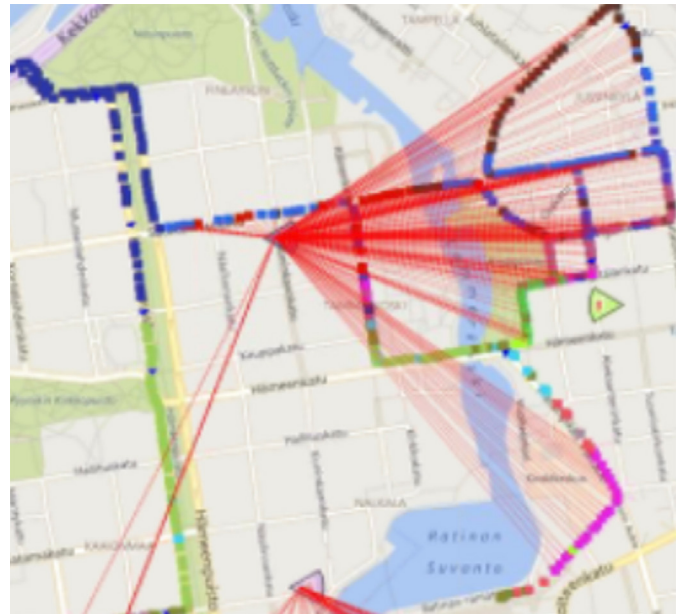
Massive MIMO sector beam profile collaboration and selection simulates the propagation of the RF signal on the air to obtain accurate radio coverage and interference predictions in the service area. Amdocs RF engineers perform field testing for each MIMO antenna type and sector beam profile at various locations with different types of clutter (e.g. rural, dense, high dense) throughout the network. This provides better insights into the radio signal's propagation characteristics at these locations, as well as for the site deployment type (e.g. 3 sector or 6 sector). The purpose of the testing is to measure the propagation of defined radio signals (at known transmission power levels, locations and frequency), which allows a baseline model to be developed for different morphologies and traffic profiles, as well as UE speeds (highway vs shopping center). The process incorporates several steps, which together, result in a tuned massive MIMO profile and antenna array selection. At the end of the process, we provide the tuned model and its accuracy for acceptance.



## Massive MIMO RF design

Based on coverage, capacity and throughput requirements, we generate types antenna required to achieve coverage/capacity targets, together with an evaluation of current deployed network assets. Based on the technology (e.g. mmWave, mMIMO), the following plots and KPIs are provided:

- Best server plots of PCI-beam index, number of beams
- Coverage (NR-best SS reference signal receive power – RSRP)
- Interference (NR best SS SINR( $E_c/I_0$ ); reference signal receive quality (RSRQ)
- Best server plots
- Design throughputs NR PDSCH/PUSCH
- Maximum user capacity
- Antenna type
- Antenna parameters, etc.



## Capacity planning

The combination of increasing data and voice usage, together with forecasted RAN and backhaul demand, are forcing network operators to continually plan for capacity upgrades, expansions and better utilization of new antenna features to improve spectrum efficiency and meet throughput demand (e.g. mMIMO beamforming on FDD/TDD bands). Issues for consideration include traffic profile (e.g. urban, high dense) and mMIMO configuration selection for massive events (e.g. single user-MIMO – SU-mMIMO; multi-user MIMO – MU-mMIMO).

The following factors are evaluated during capacity planning:

- Antenna array (Right array, left array and full array)
- Analog, digital, hybrid MIMO
- High-rise building profile
- Fast-moving vs slow-moving user profile
- SU-mMIMO, MU-mMIMO

## OSS configuration data fill and analytics

Leveraging the RF design configuration from the final design tool, we generate an OSS configuration fill, which includes:

- Bulk plan generation
- Beam profile object creation
- Validation error and rectification
- Sector beam (like electrical tilt)
- Automate deployment dashboard and tracking
- eNodeB/NodeB/base transceiver station (BTS) model
- KPI data analytics

We can also provide RF configuration data to enable the operational support systems (OSS) team to create the scripts necessary for integrating and commissioning the site. In addition, we generate scripting for the field teams using our own proprietary tools.

## Why Amdocs

Amdocs has a proven track record supporting projects throughout all phases of network rollout and acceptance – including but not limited to RAN, transport and core design, provisioning and troubleshooting services, pre/post launch optimization, provisioning, triage and so on – for multi-vendor, multi-technology heterogeneous networks.

With an experienced network provisioning team staffed by professionals in the area of transport and core, as well as RF engineers, our strength lies in adapting to our customers' needs and requirements, while orchestrating various support teams/vendors to ensure timely delivery.

As a preferred vendor for Tier-1 and Tier-2 service providers across the globe, our vast complex configurations integration experience and holistic approach to network management ensures you can deliver faster, within budget and with the highest levels of quality.

Partner with us to benefit from our proven tools, processes and time-tested methods, as well as customized services for all major network equipment providers and technologies, so you can be confident in your ability to meet your customer experience goals.

For more information on our network management services, visit [Amdocs Mobile Network Services](#).