



TECHNICAL OVERVIEW

Nemo 5G RAN Analytics

Centralized, web-based automated RAN data analytics and reporting

Accelerating 5G deployments globally are having a ripple effect throughout the mobile ecosystem. 5G networks deliver faster and more reliable communications and open doors to exciting new business opportunities. Network rollout acceptance, optimization, benchmarking, and remote monitoring are essential for reducing customer churn, deploying 5G services, and ensuring go-to-market targets are met.

Nemo 5G RAN Analytics provides MNOs, equipment vendors, regulators, and service contractors with a centralized, web-based scalable platform to load, process, and analyze field test data for enterprise-level analytics and reporting accessible anytime, anywhere using an internet browser.



Benefits

- Access data anytime anywhere
- Improve operational efficiency
- Enhance customer experience by quickly identifying and resolving system-impacting issues
- Maximize quality-of-service
- Speed up time-to-revenue of 5G
- Gain deep insight into your network quality and enhance QoE

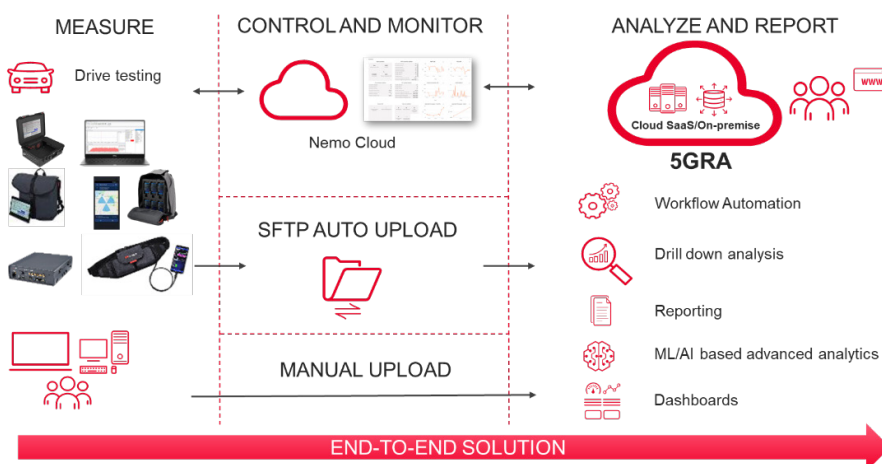


Figure 1. Nemo 5G RAN Analytics, a web-based end-to-end RAN data management solution



Key Features

- Fully automated end-to-end workflow for data processing and management
 - Multiple automation workflows
 - Nemo Cloud integration to provide a single tool for managing fleet and analytics
- ML/AI driven advanced analytics
 - Guided optimization to automatically detect anomalies, discover competitor site location, and perform proactive root cause analysis
- Intuitive, friendly, and data-rich graphical user interface (GUI)
 - Clean, easy-to-use interface for enhanced user experience
 - Multiple engineering oriented advanced analytics views available for effective and efficient troubleshooting
 - All views are synced with each other for effective troubleshooting and analysis
 - Templates for one-click drilldown analysis
 - Detailed drilldown analysis with an extensive list of KPIs/events and L1/L2/L3 messages
 - Automated problem and anomaly detection and diagnosis across all layers of the protocol stack
- Enhanced data management
 - Central repository for all log files and processed data
 - Enhanced search functionality. Files can be filtered and merged based on selected attributes
- Centralized web-based access
 - Web-based interface accessible using internet browser (no client required)
 - Process and analyze data anytime and from anywhere
 - Multiple users across the organization can log in to single platform
 - Self-service system administration for user permissions and roles management
- Powerful reporting and customization capabilities: Create - Manage - Distribute
 - Report Designer module for creating custom Excel-based report templates
 - On-demand and automated report generation with flexible report scheduler
 - User configurable custom events and KPIs using Analytics Builder module

End-to-End Automation Solution

Together with Nemo Cloud and Nemo data collection tools, Nemo 5G RAN Analytics offers an automated end-to-end solution from the collection of RAN data and project monitoring to data processing and reporting.

With the auto data streams feature in Nemo 5G RAN Analytics, you can enable automation workflows in data processing and reporting. The framework is highly adaptable to your needs and specifications, and enables faster data processing and reporting, and efficient troubleshooting as a consequence.

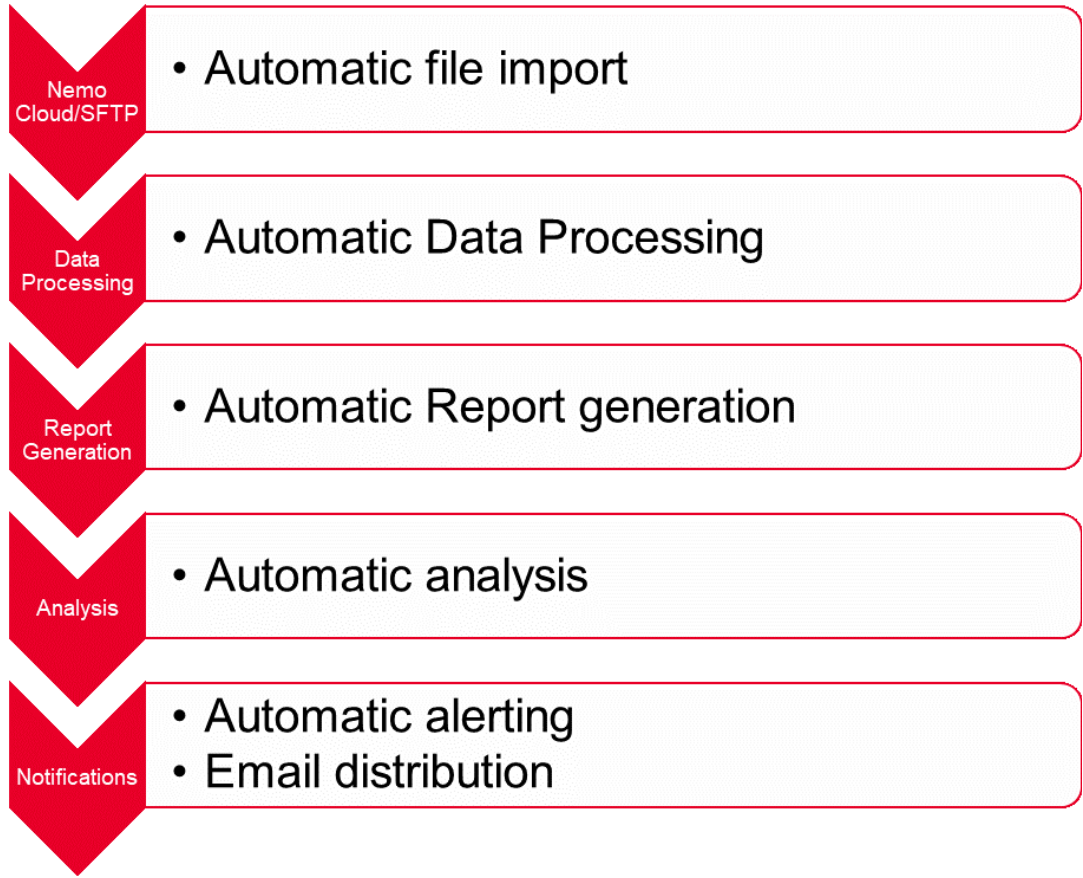


Figure 2. Automation workflows in Nemo 5G RAN Analytics

ML/AI Driven Advanced Analytics

The automated, machine learning-based anomaly and problem detection and monitoring capabilities of Nemo 5G RAN Analytics assist operators and service providers throughout the entire 5G life cycle.

Nemo 5G RAN Analytics speeds up network rollout, optimization, and verification with automated anomaly and problem detection and diagnosis. It provides a consistent troubleshooting and an automated analytics environment for all users. Automated anomaly and problem detection reduces the chances of missing important problems. With the troubleshooting capabilities offered by Nemo 5G RAN Analytics, you will gain deep insight into your network quality and enhance QoE.



Figure 3. ML use case - site discovery

The KPI anomaly detection algorithms in Nemo 5G RAN Analytics use the trained ML algorithms to detect and flag KPI problems. KPI anomaly detection provides a confidence measure, which indicates the ML algorithm’s confidence in detecting the selected KPI anomaly.

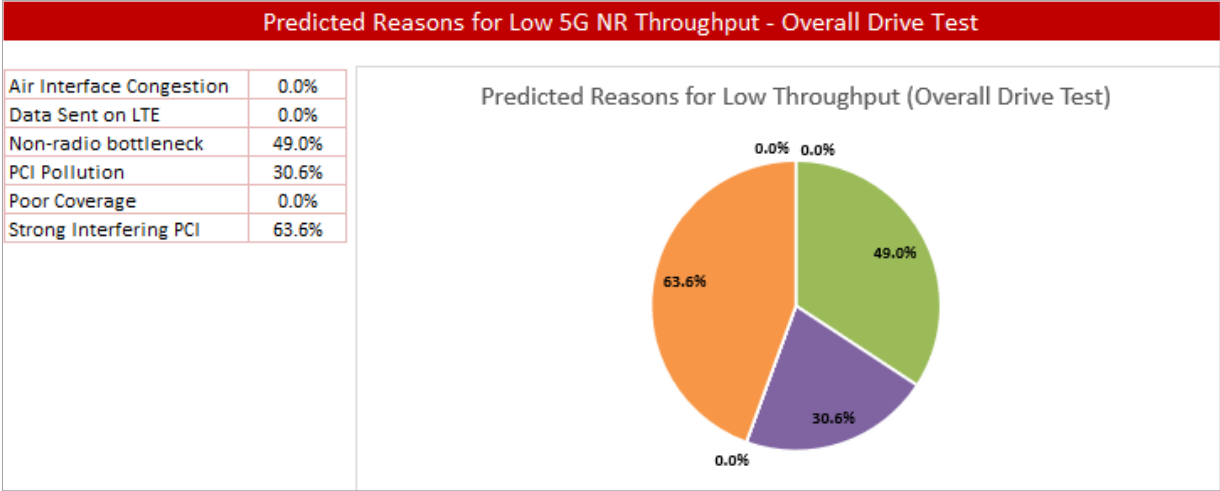


Figure 4. ML use case - 5G NR low throughput analysis

Intuitive User Interface

The intuitive user interface with synchronized and interactive views provides a consistent troubleshooting and analytics environment for all users, which reduces the chances of missing important problems.

Nemo 5G RAN Analytics offers a comprehensive suite of metrics and system generated events from the processed data to enable extensive troubleshooting of the RAN data. System generated events are triggered to give you more information about the events and procedures during testing, such as RACH Msg3 failure and SN addition failure.

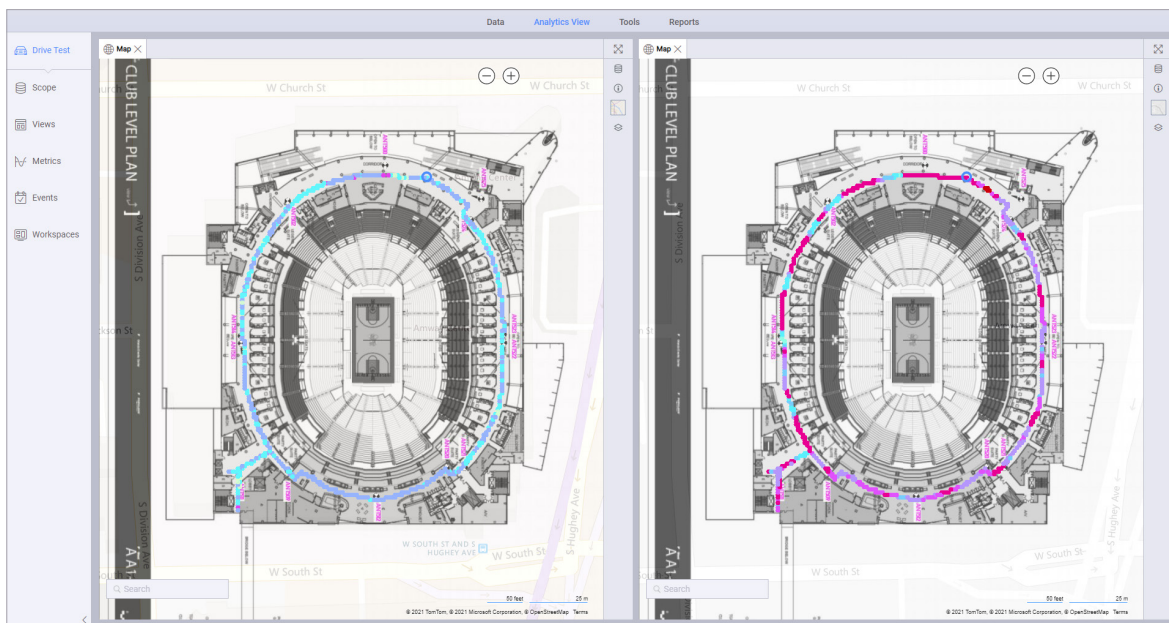
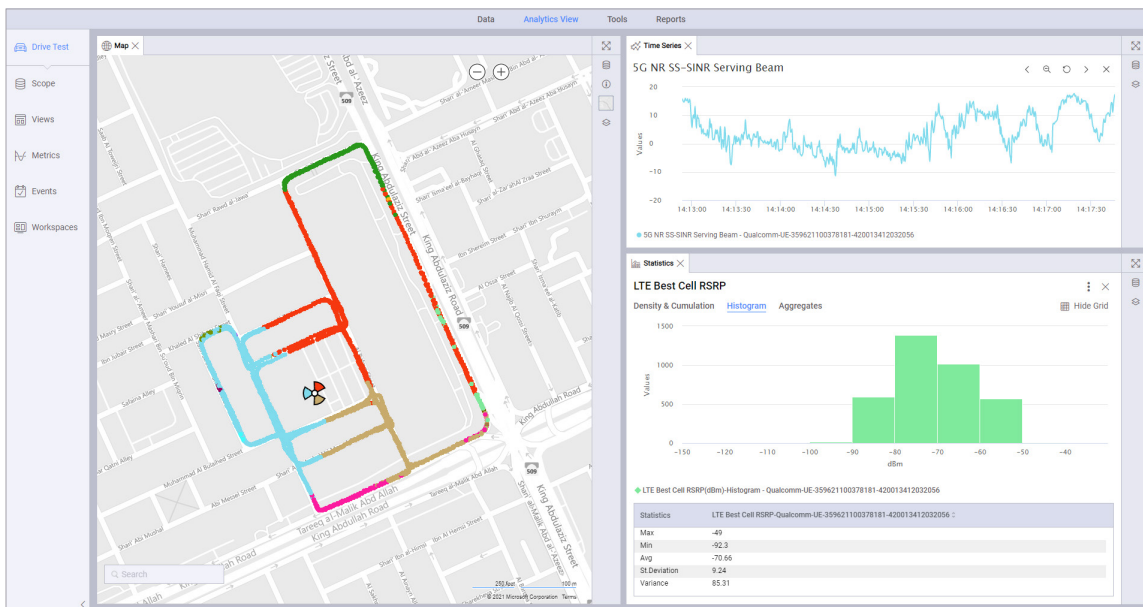


Figure 5. Analytics views in Nemo 5G RAN Analytics

Analytics views are designed as templates to offer you effective means for troubleshooting problems detected in the processed data. These templates enable a combination of different features, KPIs, and events that facilitate faster troubleshooting.

The easy-to-use UI in Nemo 5G RAN Analytics offers a wide range of troubleshooting features to gain intelligence-driven diagnostics and deep insight. The Messages view displays all the messages logged in the data file. The view can be filtered, message content is decoded, and you can search for a specific string within the message content.

Time	Message type	Protocol	Message	Summary	Direction
10/25/2016 13:56:35.819	UE Log	App	GAA		
10/25/2016 13:56:35.819	UE Log	App	GAC		
10/25/2016 13:56:35.819	UE Log	App	PAA		
10/25/2016 13:56:35.819	UE Log	App	PAC		
10/25/2016 13:56:35.819	UE Log	App	PAC		
10/25/2016 13:56:35.819	UE Log		LTE_PBA		
10/25/2016 13:56:35.819	UE Log		LTE_PBC		
10/25/2016 13:56:35.971	UE Log	RRC	paging		Downlink
10/25/2016 13:56:35.971	UE Log	App	DEVI		
10/25/2016 13:56:35.971	UE Log	PHY	SEI		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_CHI		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_CELLMEAS		
10/25/2016 13:56:35.971	UE Log		ROAM		
10/25/2016 13:56:35.971	UE Log	RRC	LRRC NB Message info Message		
10/25/2016 13:56:35.971	UE Log		LTE_PCHI		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_TXPC		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_PHRATE_PBCH		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_PHRATE_PDSCH		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_TAD		
10/25/2016 13:56:35.971	UE Log		LTE_PLAID		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_PLAID_MCS		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_PLAID_PRB		
10/25/2016 13:56:35.971	UE Log		LTE_PLAID		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_CQI		
10/25/2016 13:56:35.971	UE Log		LTE_PLAIU		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_PLAIU_MCS		
10/25/2016 13:56:35.971	UE Log	PHY	LTE_PLAIU_PRB		
10/25/2016 13:56:35.971	UE Log		LTE_PLAIU		
10/25/2016 13:56:35.971	UE Log	MAC	LTE_MACRATE		
10/25/2016 13:56:35.971	UE Log	MAC	LTE_MACRATEU		
10/25/2016 13:56:36.611	UE Log	RRC	paging		Downlink

```

Decoded Message
Add for Comparison
channel_number:1300
direction:"EDownlink"
lte_physical_layer_cell_id:125
rrc_message:"Paging"
lte_rrc_subchannel:"PCCCH"
▼ paging:
  ▼ PCCCH-Message:
    ▼ message:
      ▼ c1:
        ▼ paging:
          ▼ pagingRecordList:
            ▼ 0:
              ▼ ue-Identity:
                ▼ s-TMSI:
                  mmecc:"00010010(18)"
                  m-TMSI:"11010000
                  01111001 10000011
                  11100000(3497624544)"
              cn-Domain:"ps"
            ▼ 1:
              ▼ ue-Identity:
                ▼ s-TMSI:
                  mmecc:"00010010(18)"
                  m-TMSI:"11100000
                  00110011 10110000
                  11101000(3761484008)"
              cn-Domain:"ps"
  
```

Figure 6. Messages view in Nemo 5G RAN Analytics

The Parameter Comparison view helps you determine what sites from the drive test deviate from the parameters set in the lab and investigate those differences to see if the lab parameters need to be updated or the site parameters need to change.

Furthermore, with the powerful Analytics Builder module, you can create and configure customized events and KPIs and view them in the analytics views and reports.

Enhanced Data Management

Nemo 5G RAN Analytics with its central repository for all log files and post-processed data provides an ideal solution for network operators handling large amounts of data. All measurement data is stored in a single blazing fast database management system.

With its enhanced search and data management functionalities, files can be filtered and merged based, for example, on file name, geographical area, time, and datasets.

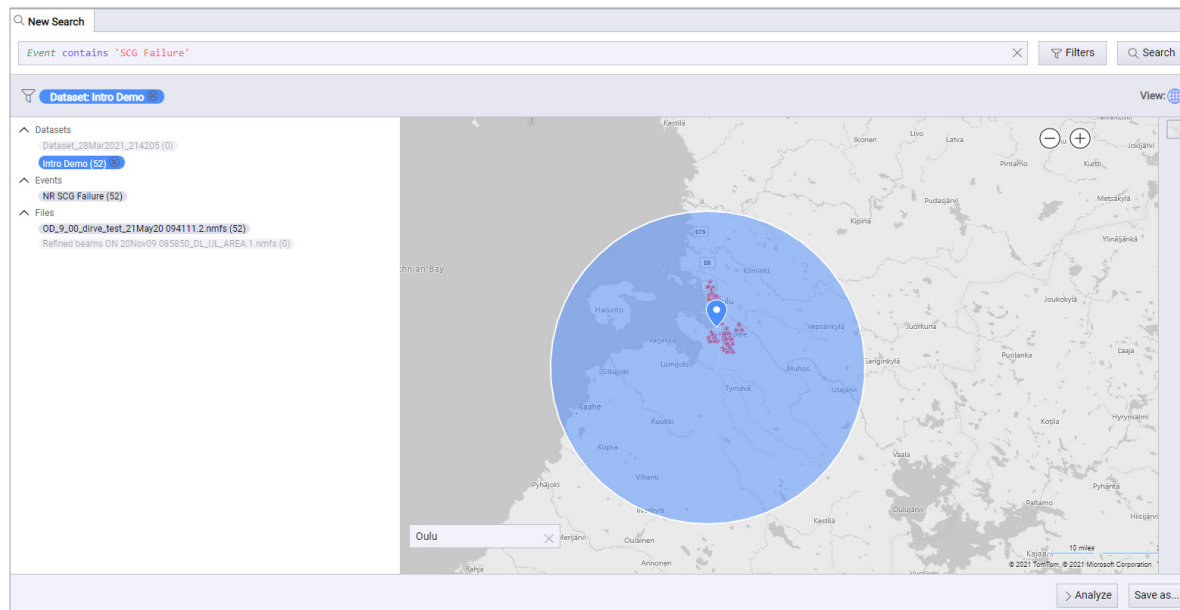


Figure 7. Enhanced search tools in Nemo 5G RAN Analytics

Centralized Web-Based Access

The centralized, web-based data management platform of Nemo 5G RAN Analytics allows you to access and process your data anytime and from anywhere using an internet browser. Multiple users across the organization can log in to the platform simultaneously and access relevant analytics views and reports.

Nemo 5G RAN Analytics also offers self-service system administration tools for user permission and role management.

Powerful Reporting Capabilities

With the advanced reporting module, you can easily create, manage, and distribute custom Excel-based reports across the organization in addition to having access to a full suite of off-the-shelf analytics reports.

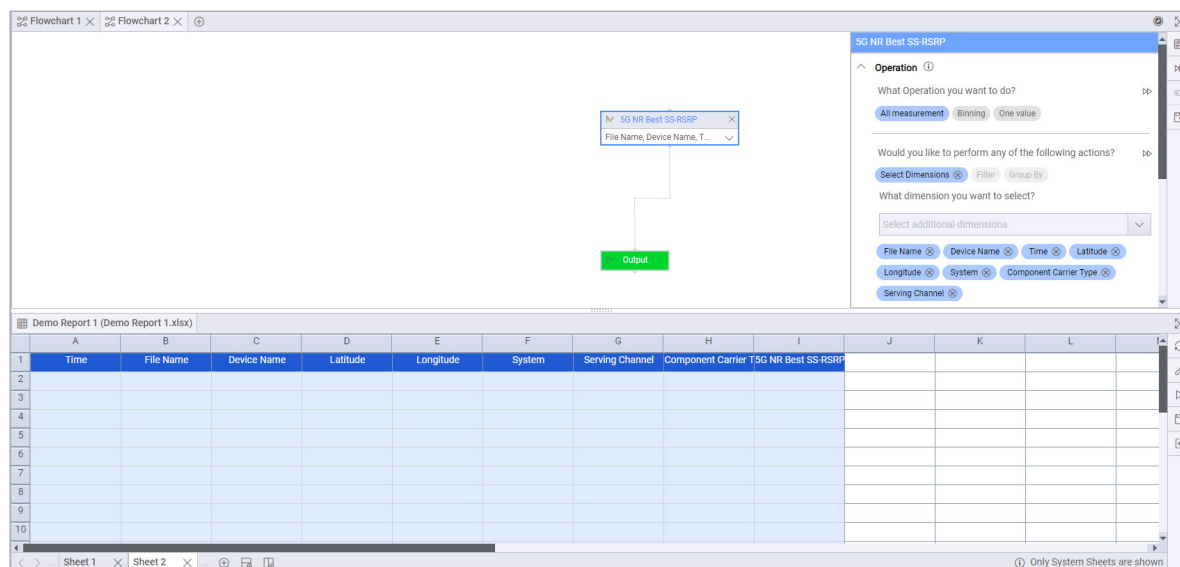


Figure 8. Report Designer module

Reports can be created on-demand or scheduled to be run and distributed automatically. Furthermore, the centralized platform enables access to report history.

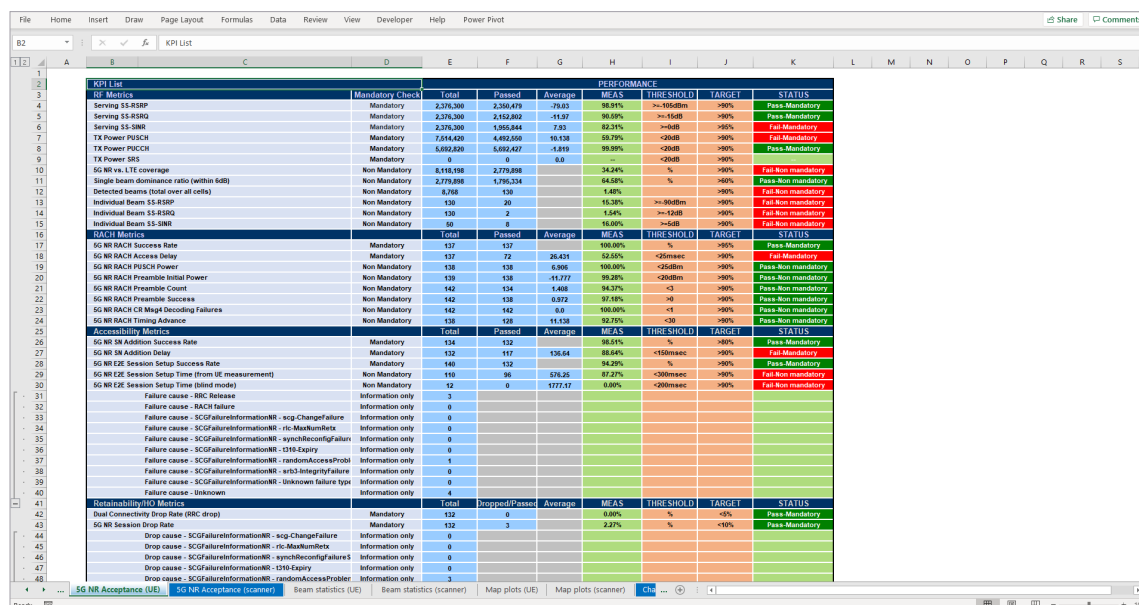


Figure 9. Example report in Nemo 5G RAN Analytics

Customer Benefits

- Better organization of all data in centralized location that can be easily accessed anytime and anywhere
- Save time and cost on network deployments, benchmarking campaigns and remote monitoring with fully managed E2E automated processing, reporting and data analytics solution
- Quickly identify, troubleshoot and perform root cause analysis on network issues to ensure high QoS and minimize subscriber churn
- Highly customizable platform that could cater to specific analytics and reporting requirements

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