5G Core (5GC) Network Test Solutions

- 5G Core Network Simulation -
  - MAPS™ 5G N1 N2 Interface Emulator
  - MAPS™ 5G N4 Interface Emulator
- Monitoring 5G Core Network
- End-to-End Voice, and Data QoS Testing

Visit [https://www.gl.com/5G-NR-Core-network-test-measurement-solution.html](https://www.gl.com/5G-NR-Core-network-test-measurement-solution.html) for more details.
GL's Message Automation & Protocol Simulation (MAPS™) is designed for testing 5G N1 N2 interfaces can simulate gNodeB (gNB), and AMF (Access and Mobility Management Function) according to 3GPP Release 15 standards.

The above diagram depicts N1N2 interface in the 5G network. NGAP is found on the N1N2 reference point between the gNB (gNodeB) and the AMF (Core Access and Mobility and Management Function) in order to support UE and non-UE related services. This includes operations such as configuration updates, UE context transfer, PDU Session resource management and support for mobility procedures. The user (UE) has very high-speed RF connection to the nearest local tower. This high-speed connection is always ON, as long as the mobile is powered up. 5G is designed for compatibility with older 2G, 3G and 4G (LTE) mobile systems.

**5G Core Network Simulation**

**MAPS™ 5G N1N2 Interface Emulator**

- Setup a virtual real-time scenario simulating 5G interoperability with 4G-LTE network elements
- Simulates UE+gNodeB and AMF nodes.
- Supports Control plane signaling and User plane traffic
- Supported Procedures in N1 and N2 interfaces includes:
  - NG Reset
  - NG Setup
  - Initial Context Setup
  - UE Context Release
  - Registration
  - De-registration
  - Primary authentication
  - key agreement procedure
  - Security mode control
  - Identification
- Generate hundreds of UE Signaling (Load Testing).
- Generate and process NGAP/NAS (valid and invalid) messages.

5G N1N2 Interface Call Control Procedure at gNodeB Node (Call Generation)
GL’s Message Automation & Protocol Simulation (MAPS™) 5G-N4 Interface Emulator is an advanced protocol simulator/tester for 5G simulation over N4 interface that can simulate PFCP messages and signaling specification as defined by 3GPP standards. As seen in the network diagram, N4 is the reference point in the control and user plane separation (CUPS) architecture.

MAPS™ 5G-N4 can simulate and test Session Management Function (SMF) and User Plane Function (UPF) elements. SMF in the 5G N4 interface is primarily concerned with managing the UE’s PDU sessions. Its responsibilities include the establishment, modification, and release of the PDU sessions. UPF in the CUPS architecture is responsible for handling user data and reporting the traffic usage data to the SMF.

- Simulates Session Management Function (SMF) and User Plane Function (UPF) elements
- Supports 5G Control plane and User plane
- Supported procedures include - establishment, modification, and release of the PDU sessions
- Supported Traffic types include Mobile Traffic, Packet Traffic, and VoLTE
- Generates and process PFCP (valid and invalid) messages
- Supports GTP Traffic (GTP User Plane Data), HTTP traffic generation capability
- Supports customization of call flow and message templates using Script and Message Editor
- Provides Call Statistics and Events Status
- Automation, Remote access, and Schedulers to run tests 24/7
GL's PacketScan™ - an All-IP Network Monitoring software offers powerful features to capture and monitor live signaling and traffic over IP. PacketScan™ with Voice, Data, and Video QoS capability addresses customers long felt need of call quality analysis in IP networks.

- Capable of capture, decode and perform various test measurements between any two nodes across various interfaces of the 5G network
- Support for wide-range of codec, including AMR and AMR WB – visit Voice Codec webpage for more details.
- Supports QoS parameters such as E-model (G.107) based MOS/R-Factor scores, Media Delivery Index (Delay Factor: Media Loss Rate) for video calls, Jitter, Delay, and Gap for Audio and Video traffic
- Segregates, captures, and collects statistics on VoIP and Wireless calls
- Live monitoring of traffic statistics - digits, tones, voice, video, and T.38 fax over IPv4 and IPv6 (version 4 and version 6) networks
- Monitors QoS (quality of service) on voice and video calls
- Supports both real-time and offline analysis
- Trace files for analysis can be loaded through simple command-line arguments.
- Decode and analyze full 5G N1N2 protocol stack.
- Test gNodeB or UE over N1, N2, N3, N4, N6, N8, N9, N10, N11, N12, N13, N14, N22 interfaces of 5G network.
- The protocols supported for decoding across all these interfaces are NAS, NGAP, GTP-U, SCTP, UDP, TCP, and IP.

High-Density Packet Monitoring Tool (PacketScan™ HD): PacketScan™ HD is an high density multi-protocol VoIP monitoring, reporting and diagnostic network monitoring appliance. It can capture and process high volumes of communication protocols over IP and Wireless at 1GigE (PKV120) and 10GigE (PKV122) data rates. Visit PacketScan™ for Wireless Networks webpage for more details.
5G Core Network Monitoring & Diagnosis

**NetSurveyorWeb™ - Centralized System**

GL's NetSurveyorWeb™ (PKV170) is a centralized web-based client that facilitates display of call data records and call summary using a web interface based on a scalable and flexible architecture. It is used in conjunction with GL's LTE Protocol Analyzer and IMS Protocol Analyzer probes to non-intrusively monitor the entire network from a central remote testing location.

GL's 5G Protocol Analyzers have unlimited ability to capture, decode, and measure KPIs. The analyzers support decoding of all 5G protocols. GL's 5G protocol analysis probes feed data to centralized database (Oracle) in real-time for further analysis. The probes provide instant visibility into the performance with extensive KPIs, and also the operation of nodes in 5G networks.

For more information, refer to NetSurveyorWeb™ - Centralized System webpage.

**NetSurveyorWeb™ Lite - Distributed Probe Level System**

NetSurveyorWeb™ Lite (PKV169) is an integrated and a cost-effective monitoring system that works at the probe-level as an addon tool with all real-time Protocol Analyzers. It is a web-based client that allows to view historical and real-time call data records. It enhances the capabilities of protocol analyzer to process large volumes of calls, filter for specific calls, build custom statistics and KPIs, automation and graphical features to analyze the call detail records (CDRs).

For more information on Lite version, refer to NetSurveyorWeb™ Lite System webpage.
Using GL’s VQuad™ with the Dual UTA HD, or all-in-one VQuad™ Probe HD, along with centralized analytical tools, voice as well as data quality can be tested simultaneously on a wireless or wired network.

Since the GL’s VQuad™ solution is network independent, all Voice and Data networks are supported including 3G, WiMax, 4G LTE, Advanced LTE and the 5G.

GL’s VQuad™ NetTest solution provides automated data testing on Mobile Devices (Android and Apple) as well as PC based internet connections. The Data Testing includes TCP, UDP, HTTP, FTP, DNS, VoIP, SMS, and Email tests. GL’s Voice Quality Testing (VQT) supports automated voice quality between any two nodes within the network using latest ITU based algorithms including Perceptual Objective Listening Quality - POLQA (ITU-P.863) and PESQ (ITU-P.862). The POLQA algorithm is specifically used for testing Wideband voice networks.

Visit Complete Voice and Data Quality webpage for more details.

5G Network Voice, & Data Quality Testing

VQuad™ Probe HD is a self-contained unit used to objectively evaluate Signal Strength, Voice, & Data Quality on Cellular networks (5G, 4G VoLTE, 3G, 2G), Land Mobile Radios, and Wired networks.

It includes VQuad™ software, Dual Universal Telephone Adapter (Dual UTA HD), and NUC in a portable platform. VQuad™ Probe HD can connect to practically any end-point, wired or wireless devices, independent of underlying network type.

Various associated analytical applications (Voice Quality, Data tests, Echo and Delay tests, Fax tests, Voice Band Analysis) work with the base VQuad™ software to provide "end-to-end assessment" of the network performance.

GL’s Voice Quality Testing (VQT) supports automated voice quality between using - POLQA (ITU-P.863) and PESQ (ITU-P.862). The POLQA algorithm is specifically used for testing Wideband 5G networks.

GL’s VQuad™ NetTest solution supports egress/ingress Data analysis along with Voice Quality Testing and GPS.