Voice over LTE (VoLTE) Wireless Core Networks Test Solution

QUALITYASSURER SERIES – QA-805/QA-813

Lab-testing tool for comprehensive performance and functionality-validation of VoLTE under live network conditions.

SPEC SHEET

KEY FEATURES AND BENEFITS

Purpose-built for VoLTE testing

Accurately replicates live network conditions in the lab

Simulates the behavior and traffic of millions of subscribers with a single module

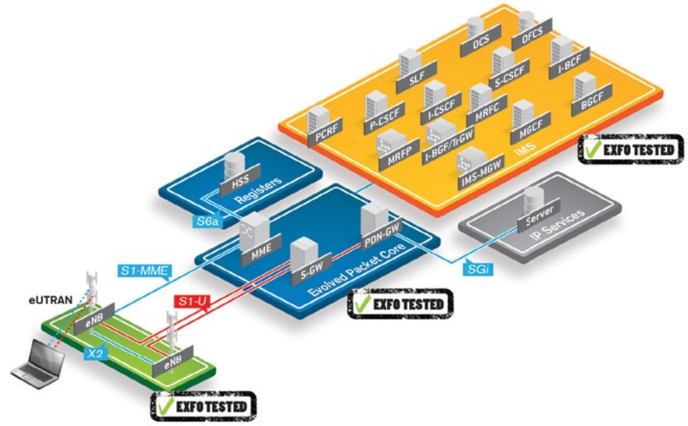
Generates and analyzes a mixture of VoLTE and data traffic at line rates

Real-time voice quality analysis of every VoLTE call

Flexible test solution that can be easily customized to simulate any network scenario

EXFO

PURPOSE-BUILT FOR VoLTE TESTING



VoLTE requires seamless end-to-end interworking between multiple domains: radio access networks (RAN), evolved packet cores (EPC) and IP multimedia subsystems (IMS). But the challenges do not stop there. Mobility with legacy 2G/3G networks through single radio voice call continuity (SRVCC) adds another layer of complexity. On top of that, a typical deployment involves equipment from multiple vendors each with their own interpretation of network standards leading to almost certain interoperability issues. Last but not least, mobile data continues to grow at an astounding rate, putting tremendous strain on networks. Under these challenging conditions, VoLTE introduces an extremely demanding and sensitive type of data to the network. Delivering high quality and reliable VoLTE services within this framework requires a new way of thinking about preparing for deployments. To ensure successful deployments, it's imperative to recreate live network conditions and complexity in the lab first, before going live.

The EXFO QualityAssurer Simulation solution provides:

- Industry leading performance and capacity to match live networks
  - 40 Gbit/s (line rate) per blade of real application data generation
  - 2 million subscribers, 4 million total bearers and 2 million active bearers emulated per blade
  - 512 000 RTP sessions per blade with real-time analysis of every session
  - 21 000 eNBs per blade
- Powerful Traffic modeling Ccapabilities
  - Shape simulated user and control plane traffic to match live network based on:
    - Busy hour call attempts (BHCA)
    - Individual or subscriber group behavior
    - Different types of data with varying quality of service (QoS) requirements
- Comprehensive analysis and measurements
  - Real-time analysis of every single data session at line rate – VoLTE and other data
  - Voice quality, GBR/MBR enforcement and other measurements on every flow
  - 10 nanosecond timer resolution for accurate measurements of sensitive data
  - System and service responsiveness measurements
- Unmatched flexibility to conquer complexity
  - Stateful implementation with ability to customize
  - Quickly incorporate vendor variations, new scenarios and types of data
  - Only test tool flexible enough to test network failure scenarios

TESTING APPLICATION EXAMPLES

End-To-End EPC and IMS Testing

EXFO's QualityAssurer Simulation solution tests at the edge of the radio interface by simulating thousands of eNB's and millions of subscribers, recreating live network volume and scale toward the core network. Traffic generated by simulated subscribers can reflect various parameters as time-of day and emergency situations to name a few. The combined behavior of all subscribers results in predictable traffic patterns in a network, both on the control and user planes. Every single VoLTE call and data session of this generated data can also be analyzed in real time to verify network performance and user quality of experience (QoE). The end user QoE is quantified as close to a real-world scenario as possible in a practical, cost-effective lab testing environment.

VoLTE can impact the performance of other types of applications (e.g. web browsing, video streaming, file downloads, etc.). While measuring the responsiveness of the network to VoLTE, the QualityAssurer solution also quantifies the responsiveness of the network to other applications. Testing need not be limited to intra-LTE scenarios and can also include iRAT mobility scenarios to 2G/3G networks with simulation of the applicable elements. Thus the QualityAssurer solution can be used to completely surround the EPC & IMS networks for testing VoLTE under real world conditions within a single system.

End-to-End Wireless Core and IMS Testing-Including iRAT to 2G/3G

An extension to the EPC and IMS test setup described above is to include the 2G/3G core networks as well as part of the system under test. All the intra-LTE and iRAT scenarios described in the previous section are still applicable here. However, this setup provides more coverage in terms of the network tested, providing an accurate measure of end user experience including iRAT scenarios.

Gateway Testing

One of the keys to delivering high quality VoLTE service is the ability of the network to prioritize critical and sensitive data like VoLTE over other types of data such as web browsing or file transfers. Policy & Charging Control (PCC) is the framework specified by 3GPP responsible for setting and enforcing policies related to the handling of user data. Enforcement of PCC policies is handled by the gateway elements in the EPC. The QualityAssurer facilitates an important test setup including isolating the gateway (typically the PDN-GW) to analyze its success rate at enforcing those PCC policies.

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Failover Testing

Networks must be built to handle failure events with minimal impact on end-user experience. It is therefore crucial to test for the resiliency of VoLTE services to such failures and the resulting impact on end users when ongoing VoLTE calls are impacted. The QualityAssurer provides the necessary flexibility to be able to perform testing of network traffic resulting from such events, including instances such as when a primary P-CSCF goes down and a secondary one takes over.

TECHNICAL SPECIFICATIONS

QualityAssurer Simulation Solution

- ATCA-based chassis
- System controller, shelf manager and 500 GB HDD included
- Daisy-chained to scale as required

Two models available:

QA-805

- 6-slot platform that holds up to five processor blades
- 19 inch rack-mount 7U system
- Weight: 25.50 kg
- AC power: 90 V to 250 V

QA-813

- 14-slot chassis that holds up to 13 processor modules
- 19 inch rack-mount 13U system
- Weight: 29 kg
- DC power: 48V

Three models available:

PEv2

- Processor module dedicated to control plane
- Single-slot ATCA module
- Dual Intel Xeon-based 8-core processor
- 64 GB RAM or 128 GB RAM
- One AMC slot
- Up to 2.6 million simulated UEs per blade
- 20 000 simulated eNBs per blade
- 160 000 messages per second on S1-MME
- 160 000 messages per second on GTP-C-based interfaces like S10, S11, S3
- 60 000 messages per second on an S6a with 8 million subscribers

W^{2}CM

- User-plane module based on FPGA technology
- Two 10 Gigabit Ethernet (GigE) ports and eight 1 GigE ports
- Line rate, layer-7 application data generation and analysis on all eight 1 GigE ports or one 10 GigE port, or line rate on both 10 GigE ports
- 2 million total bearers per 10 GigE port
- 1 million active bearers per 10 GigE port
- 256 000 RTP streams (VoLTE) per 10 GigE port
- 1 million SIP endpoints (VoLTE) per 10 GigE port (512 000 with IPsec enabled)

W^{2}CM Lite

- User-plane module based on FPGA technology
- Two 10 GigE ports and eight 1 GigE ports
- Line rate, layer-7 application data generation and analysis on all eight 1 GigE ports or on one 10 GigE port
- 2 million total bearers per 10 GigE port
- 1 million active bearers per 10 GigE port
- 128 000 RTP streams (VoLTE) per 10 GigE port OR 256 000 RTP streams from one 10 GigE port
- 1M SIP endpoints (VoLTE) per 10 GigE port (512 000 with IPsec enabled)

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INTERFACES AND STANDARDS

- S1-AP: 3GPP TS 36.413 v8.2.0 (R8-Jun08), v8.3.0 (R8-Sept08), v8.4.0 (R8-Dec08), v8.5.1 (R8-Mar09), v8.6.0 (R8-Jun09), v8.7.0 (R8-Sep09), v8.8.0 (R8-Dec09), v8.10.0 (R8-Jun10), v9.2.0 (R9-Mar10), v9.4.0 (R9-Sep10), v9.5.1 (R9-Jan11), v9.6.0 (R9-Apr11), v10.4.0 (R10-Dec11), v11.6.0, v12.0.0
- S1 Signaling Transport: 3GPP TS 36.412 v8.0.0 (R8-Dec07)
- S1 Data Transport: 3GPP TS 36.414 v8.0.0 (R8-Dec07), v8.1.0 (R8-Mar08)
- NAS: 3GPP TS 24.301 v0.3.0 (Jun08), v1.0.0 (R1-Sep08), v8.0.0 (R8-Dec08), v8.1.0 (R8-Mar09), v8.2.1 (R8-Jun09), v8.3.0 (R8-Sep09), v8.4.0 (R8-Dec09), v8.7.0 (R8-Sep10), v9.2.0 (R9-Mar10), v9.4.0 (R9-Sep10), v9.5.0 (R9-Dec10), v9.6.0 (R9-Mar11), v10.5.0 (R10-Dec11), v11.9.0,12.3.0
- E-UTRAN Architecture 3GPP TS 23.401 v8.2.0 (R8-Jun08), v8.4.0 (R8-Dec08), v8.5.0 (R8-Mar09)
- EPS Architecture 3GPP TS 29.803 v0.6.2 (R0-Mar08)
- S6a: 3GPP TS 29.272 v1.1.0 (Jul08) with IETF RFC3588, v8.2.0 (R8-Mar09), v8.3.0 (R8-Jun09), v8.4.0 (R8-Sep09), v8.5.0 (R8-Dec09), v8.8.0 (R8-Sep10), v9.2.0 (R9-Mar10), v9.4.0 (R9-Sep10), v9.5.0 (R9-Dec10), v9.6.0 (R9-Apr11), v10.5.0 (R10-Dec11), v11.8.0, v12.3.0
- S10/S11: GTP TS 29.803 v0.6.2 (Mar 08), v0.9.0 (Jul08), v9.5.0 (R9 Dec10), v10.5.0 (R10-Dec11)
- S5: GTP-C 3GPP TS 29.274 v9.3.0 (R9-Jun10), v10.5.0 (R10-Dec11)
- GTP-C: 3GPP TS 29.274 v8.0.0 (R8-Dec08), v8.1.0 (R8-Mar09), v8.2.0 (R8-Jun09), v8.3.0 (R8-Sept09), v8.4.0 (R8-Dec09), v9.2.0 (R9-Mar10), v9.3.0 (R9-Jun10), v9.4.0 (R9-Sept10), v9.5.0 (R9-Dec10), v9.6.0 (R9-Apr11), v10.5.0 (R10-Dec11), v11.8.0, v12.3.0
- GTP-C 3GPP TS 29.060 v7.15.0 (R7-Dec09), v8.13.0 (R8-Dec10), v11.8.0, v12.3.0
- SMS: 3GPP TS 24.011 v9.0.1 (R9-Mar10), v10.0.0 (R10-Dec11), v11.1.0
- SMS GSM: 3GPP TS 23.040 v8.6.0 (R8-Mar09), v9.2.0 (R9-Mar10), v9.3.0 (R9-Sept10), v10.0.0 (R10-Apr11), v11.5.0, 12.2.0
- S3: 3GPP TS 23.401 v8.8.0 (R8-Dec09), v9.2.0 (R9-Mar10), v9.4.0 (R9-Sept10), v9.5.0 (R9- Dec10), v9.6.0 (R9-Mar11), v10.6.0 (R10-Dec11)
- S4: 3GPP TS 29.274 v8.8.0 (R8-Dec09), v9.3.0 (R9-Jun10), v9.7.0 (R9-Dec10), v10.5.0 (R10-Dec11)
- Sv: 3GPP TS 29.280 v9.6.0 (R9-Apr11), v10.3.0 (R10-Dec11), v11.5.0, v12.1.0
- S13: 3GPP TS 29.272 v8.8.0 (R8-Sept10), v9.2.0 (R9-Mar10), v9.4.0 (R9-Sept10), v9.6.0 (R9-Apr11), v10.5.0 (R10-Dec11)
- Gx/Gxc: 3GPP TS 29.212 v8.3.0 (R8-Mar09), v8.4.0 (R8-Jun09), v8.6.0 (R8-Dec09), v9.3.0 (R9-Jun10)
- Gxa: 3GPP TS 29.212 v9.5.0 (R9-Jan11)
- 3GPP TS 29.213 v9.3.0 (R9-Jun10)
- Ga/Gz: 3GPP TS 32.295 v8.1.0 (R8-Sept09), v9.0.0 (R9-Jun10)
- Gy: 3GPP TS 32.299 v8.6.0 (R8-Mar09), v8.9.0 (R8-Dec09) v8.11.0 (R8-Jun10)
- Ge: 3GPP TS 29.078 v9.2.0 (R9-Dec10)
- Gd: 3GPP TS 29.002 v9.4.0 (R9-Dec10)
- IuPS: 3GPP TS 24.008 v3.14.0, v4.12.0, v5.11.0, v6.7.0, v7.13.0, v8.8.0, v9.5.0
- 3GPP TS 25.413 v3.12.0,v4.1.0, v6.4.0, v7.9.0, v8.4.0
- 3GPP TS 24.040 v4.11.0
- 3GPP TS 29.060 v3.7.0, v5.7.0
- GB: 3GPP TS 24.008 v3.14.0, v4.12.0, v5.11.0, v6.7.0, v8.8.0, v9.5.0
- 3GPP TS 24.040 v4.11.0
- 3GPP TS 44.065 v5.0.0, v6.3.0
- 3GPP TS 44.064 v5.1.0
- 3GPP TS 48.018 v5.5.0, v5.8.0, v6.5.0
- 3GPP TS 48.016 v5.1.0, v6.4.0
- RIM 3GPP TS 48.018 v9.4.0, v10.4.0
- Gn/Gi: 3GPP TS 29.060 v3.9.0, v5.9.0, v6.7.0, v7.9.0, v8.10.0, v9.5.0
- Gr: 3GPP TS 29.002 v9.4.0
- 3GPP TS 24.008 v4.15.0, v4.3.0, v4.12.0, v5.16.0, v6.7.0, v7.13.0, v9.5.0
- LPP: 3GPP TS 36. 355 v11.5.0, v12.0.0
- LPPa: 3GPP TS 36. 455 v9.1.0, v9.3.0, v9.4.1, v10.2.0 v11.3.0
- M3AP: 3GPP TS 36.444 v920, v10.3.0, v11.6.0
- GTP: 3GPP TS 29.060 v8.3.0, v9.5.0
- GTP: 3GPP TS 29.274 v8.7.0, v9.2.0, v9.4.0
- GTPv1: 3GPP TS 29.060 v8.2.0
- GTPv2: 3GPP TS 23.401 v8.0.0
- GTPv2: 3GPP TS 29.274 v10.0.0, v11.0.0
- 3GPP TS 23.401 v8.2.0 (2008-06), v8.3.0, v8.4.0, v8.5.0, v8.6.0
- 3GPP TS 23.402 v9.5.0, v9.6.0, v9.7.0, v9.8.0
- SCTP IETF RFC 2960, 3309, 3257, 3286, 3758, 4460
- DIAMETER Rx 3GPP TS 29.214 v8.7.0
- RADIUS SGI RFC 2865 and 2866
- RADIUS 3GPP TS 29.061 v8.4.0
- ASN.1 encoding rules: ITU-T X.691
- IPv4 IETF RFC791
- IPv6 IETF RFC 3513
- TCP IETF RFC 739, Len 16
- UDP IETF RFC768 (3309)
- RANAP: 3GPP TS 25.413 v9.5.0
- GMM: 3GPP TS 24.008 v9.5.0

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