



Case Study

# Open RAN

African mobile network operator

As a leading African mobile network operator continued its innovative drive for cost-effective coverage, it decided to trial and test Open RAN technology to determine whether open, disaggregated technology could play a part in its plans to take mobile broadband connectivity to populations scattered throughout the continent.

To do this, the operator tested an Open RAN ecosystem in a lab environment and conducted field testing in key areas. The activities focused on validating standards-based open, interoperable and disaggregating network technologies, accelerating deployment of commercially viable solutions, expanding the local talent pool of experts, and nurturing a diverse and robust ecosystem of innovative companies. The field trial's main focus, however, was on deploying Open RAN lab use cases, with Amdocs helping implement the operator's decision-making strategy of rolling out Open RAN on a commercial basis.

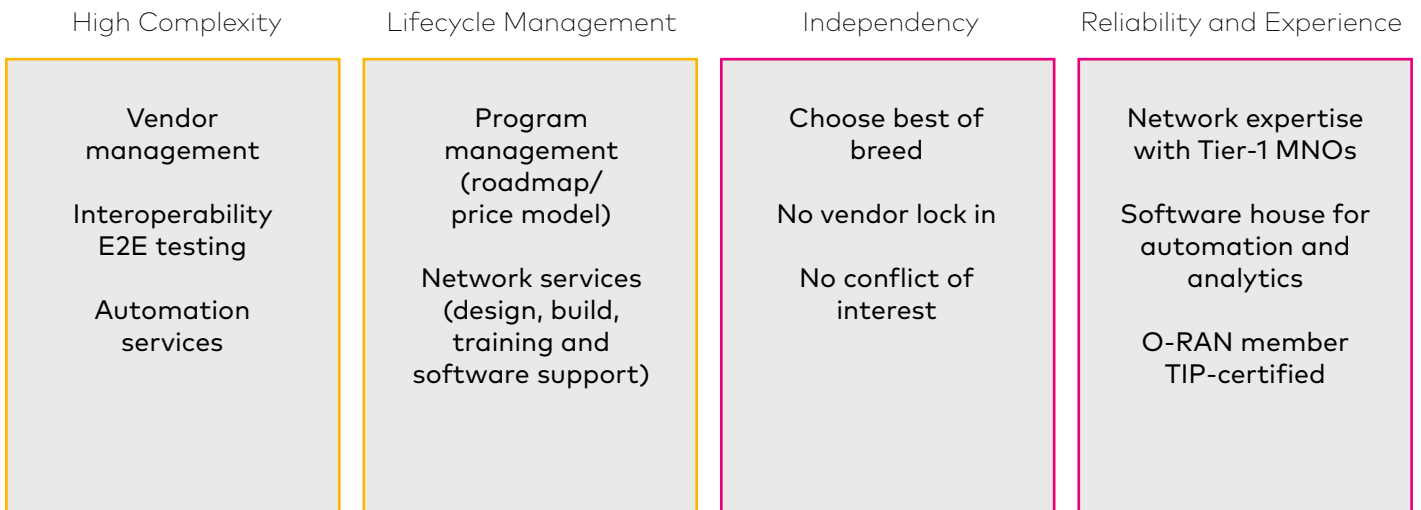
## Amdocs' role

Amdocs' Open RAN solution transforms monolithic networks into cloud-based, disaggregated, intelligent, open powerhouses. Its deployment enabled the operator to experience the freedom of flexible network architectures, automating operations and streamlining innovation, without being held back by monolithic network systems.

As part of managing the project lifecycle and accelerating the adoption of Open RAN, Amdocs minimized the complexity of the new multi-vendor, disaggregated mobile access network open ecosystem by leveraging its vendor-agnostic network expertise to manage them accordingly to ensure interoperability and on-time delivery.

### Importance of network integration

### Partner of Choice



Furthermore, as in other deployments where customers partnered with Amdocs for its robust Open RAN deployment services, systems integration services, service management & orchestration (SMO) and Open RAN automation, here too Amdocs played a pivotal role in the customer's deployments in both South Africa and a country in West Africa, Guinea Conakry.

# Creating an Open RAN lab environment

Amdocs helped the operator create the best Open RAN solution for its South African-located lab. As systems integrator, Amdocs **provided end-to-end project management, solution assessment, network design, bill of material, Open RAN deployment services, integration and ongoing testing and validation** of solutions across all areas of the network stack, including access, transport, core and services. This solution stitching included Parallel Wireless vBBU, HNG & EMS with Comba RRH for GSM, UMTS and LTE technologies connected with its existing Ericsson core.

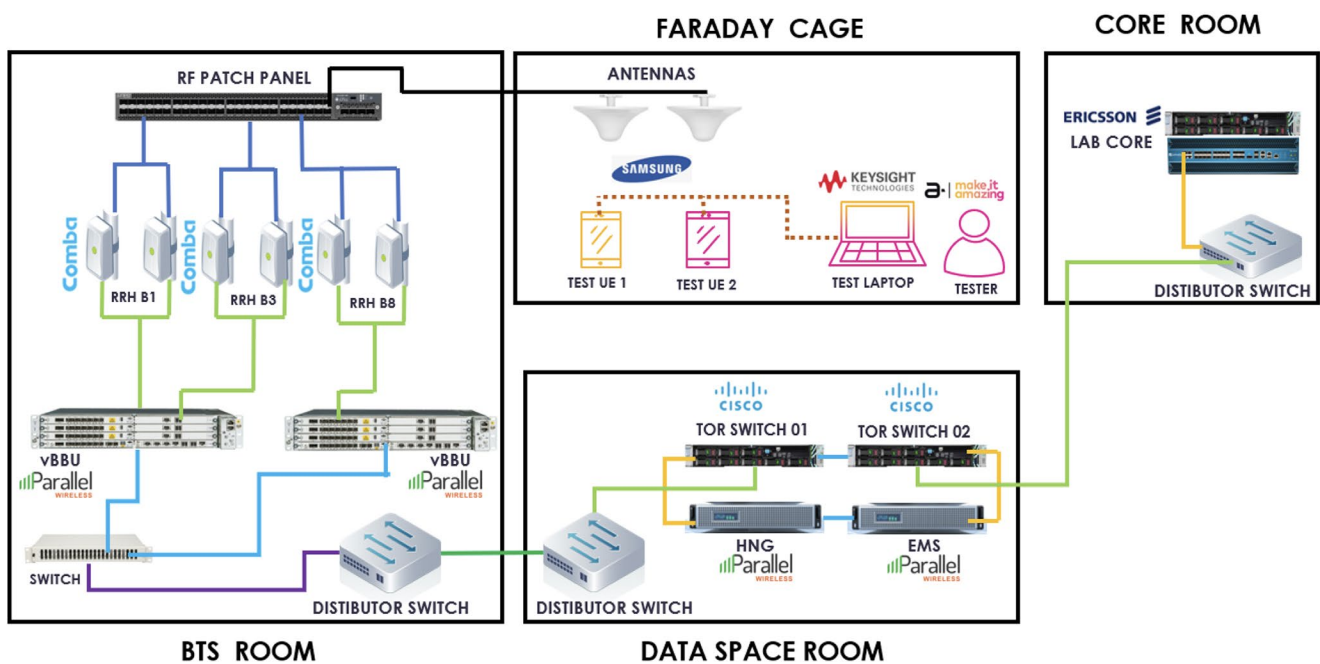


Figure 1: Open RAN lab environment architecture design

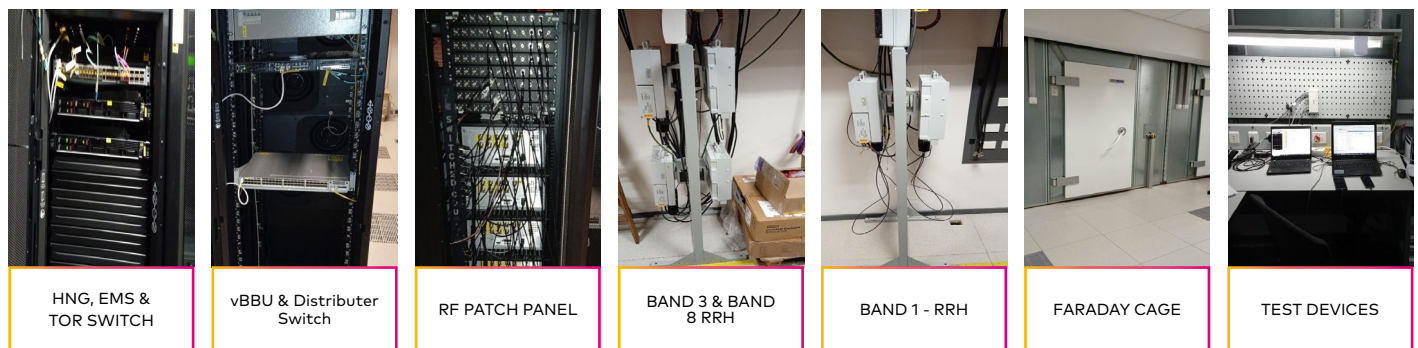


Figure 2: Lab setup view of network elements and devices



# Guinea Conakry field trials

In a field trial conducted in Guinea Conakry, Amdocs tested the open RAN ecosystem both in a lab environment, as well as in a field trial for 3G and 4G. As systems integrator, Amdocs provided **end-to-end project management, assessment, network design, deployment (including logistic movement, field work etc.), integration and field testing** of solutions across all areas of the network stack, including access, transport, core and services. This solution stitching included Parallel Wireless vBBU, HNG & EMS with Comba RRH for UMTS technology connected with its existing Ericsson core, while LTE technology was connected with Athonet open core.

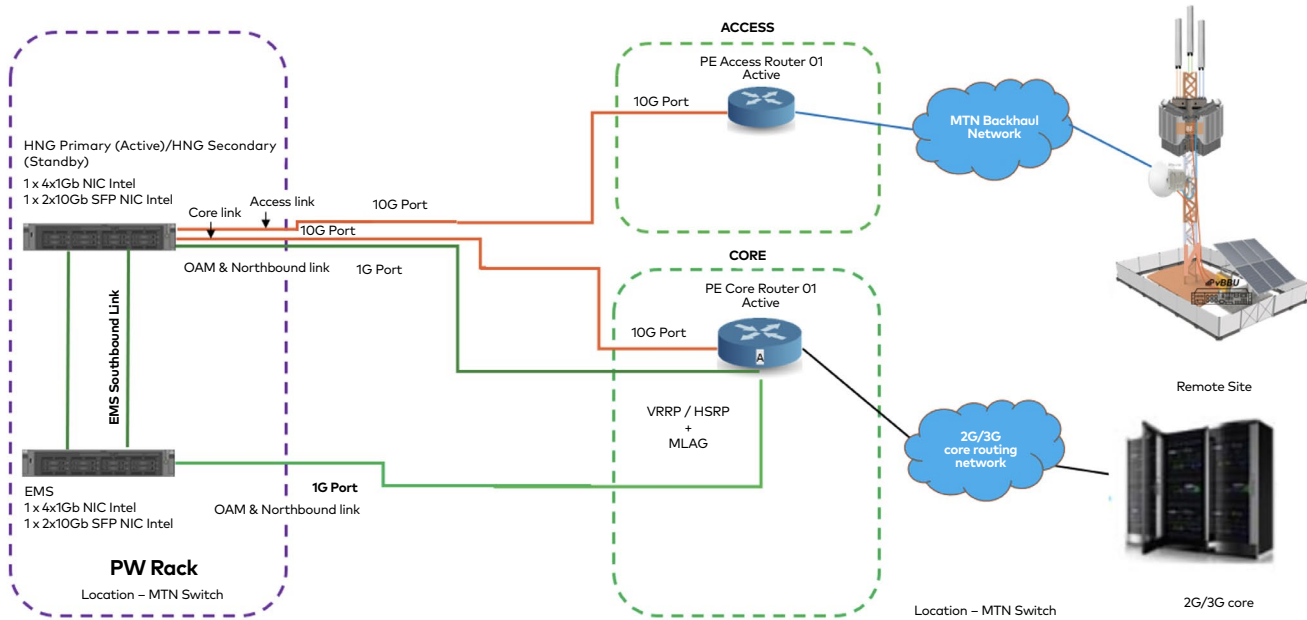


Figure 3: High-level solution architecture designed for field testing – 3G

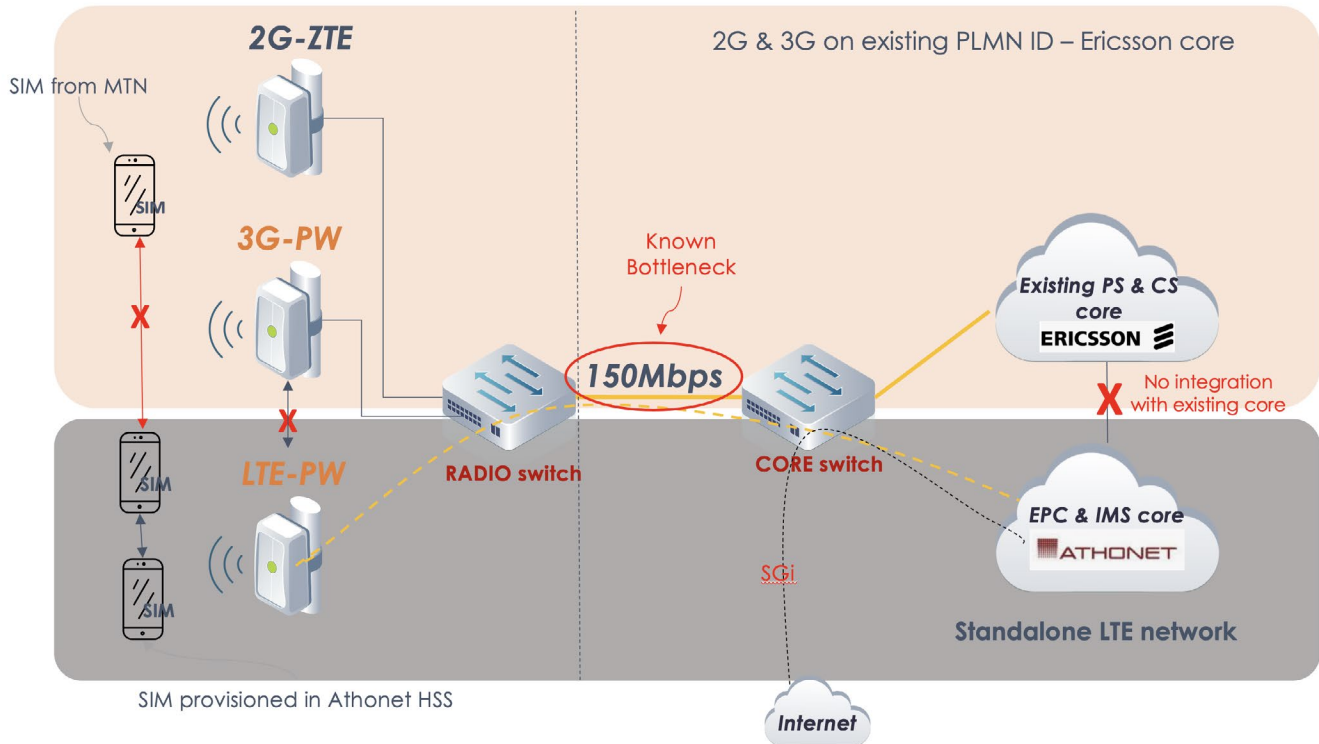


Figure 4: High-level solution architecture designed for field testing – 4G

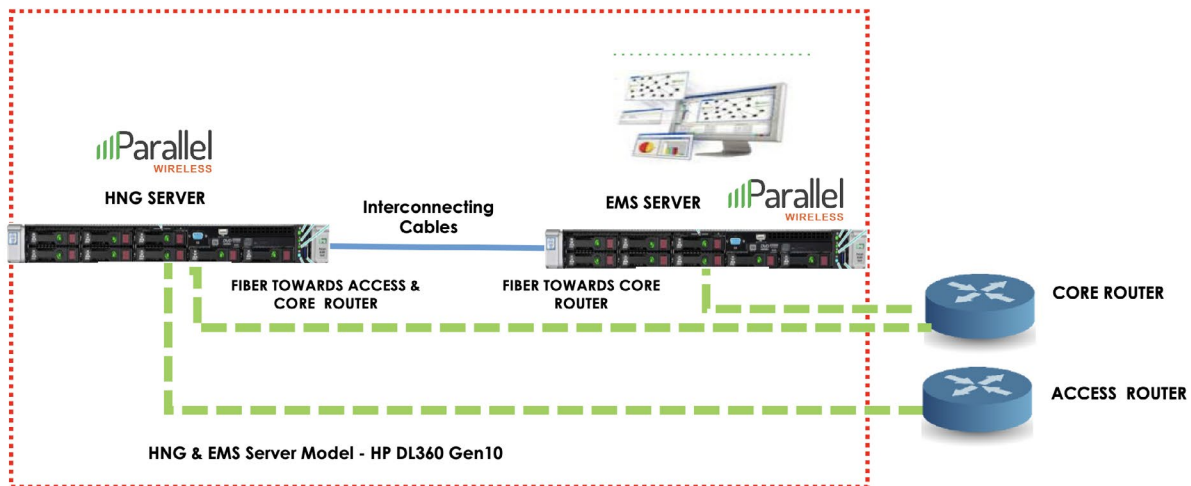


Figure 5: Guinea Conakry Open RAN POC data center implementation

## Network design and integration

In both locations – South Africa and Guinea Conakry – Amdocs completed the network design for RAN, transport and core. Amdocs was also responsible for testing the interoperability between the vast ecosystem of Open RAN vendors – Parallel Wireless, Comba, and RRH – to ensure Open RAN compliance and facilitate its fulfillment of requirements in the lab environment before beginning the field deployment.

Network Element & Devices in Test				
S.No	Vendor	Device Name	Model	Software Version
1	Parallel Wireless	vBBU	Super Micro 515-R6DX11	6.2.1
2	Hewlett-Packard	HNG	HP Proliant DL360 Gen 10	6.2.1
3	Hewlett-Packard	EMS	HP Proliant DL360 Gen 10	6.2.1
4	Comba	RRH	RRH-440-01-10	2.0.13C
5	Comba	RRH	RRH-440-03-10	2.0.13C
6	Comba	RRH	RRH-440-08-10	CT.A01.00.010.01.05
7	Cisco	TOR SWITCH	Nexus N9K-C93180YC-EX	9.3.1
8	Samsung	Test UE	Galaxy Note 20	Android 11
9	Samsung	Test UE	Galaxy S 20	Android 10
10	Keysight	Test Tool	Nemo Outdoor	9.1.0.19

Figure 6: Open RAN architecture solution components

# Testing and verification

O-RAN & 3GPP standards testing guidelines were strictly followed for all test cases, which were planned and drafted to ensure all areas of the O-RAN architecture were tested and verified.

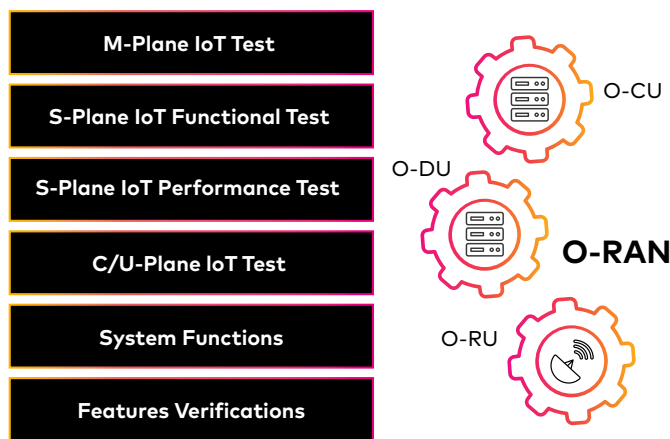


Figure 7: O-RAN tests and verifications standards

The major Open RAN tests performed for 2G (GSM), 3G (UMTS) and 4G (LTE) were as follows:

Technology	Test	Test Cases
LTE	4.1.32	Successful establishment of S1 connection with MME – LTE
LTE	4.1.33	Verify S1 recovery after Enodeb restart – LTE
LTE	4.1.34	Cell Selection – LTE
LTE	4.1.35	Attach/detach Test – LTE
LTE	4.1.36	IMS Registration – LTE
LTE	4.1.37	IMS De-registration – LTE
LTE	4.1.38	Voice Call Test – VoLTE to VoLTE – LTE
LTE	4.1.39	Verify CSFB call from 4G to 3G (Vice Versa) – LTE
LTE	4.1.40	Verify CSFB call from 4G to 2G (Vice Versa) – LTE
LTE	4.1.41	Verify CSFB call from 4G to 4G (Same cell) – LTE
LTE	4.1.42	CSFB Setup Time – LTE
LTE	4.1.43	Fast return – when call is terminated – LTE
LTE	4.1.44	SRVCC to 3G – LTE
LTE	4.1.45	SRVCC to 2G – LTE
LTE	4.1.46	SMS Test – LTE
LTE	4.1.47	PS Accessibility Tests – LTE
LTE	4.1.48	FTP Download – LTE
LTE	4.1.49	FTP Upload – LTE
LTE	4.1.50	Verify Latency – LTE
LTE	4.1.51	Intra-site Handover Tests – LTE
LTE	4.1.52	Inter-site Handover – LTE

Technology	Test	Test Cases
GSM	4.1.6	Successful establishment of ABIS link – GSM
GSM	4.1.7	Verify ABIS recovery after Link break – GSM
GSM	4.1.8	Cell Selection – GSM
GSM	4.1.9	Attach/detach Test – GSM
GSM	4.1.10	IMSI Attach – GSM
GSM	4.1.11	IMSI Detach – GSM
GSM	4.1.12	Voice Call Test – GSM
GSM	4.1.13	SMS Test – GSM
GSM	4.1.14	PS Accessibility Tests – GSM
GSM	4.1.15	FTP Download (Static Test) – GSM
GSM	4.1.16	FTP Upload (Static Test) – GSM
GSM	4.1.17	Intra-site Handover Tests – GSM
GSM	4.1.18	Inter-site Handover – GSM
GSM	4.1.19	2G-3G Rerelection – GSM

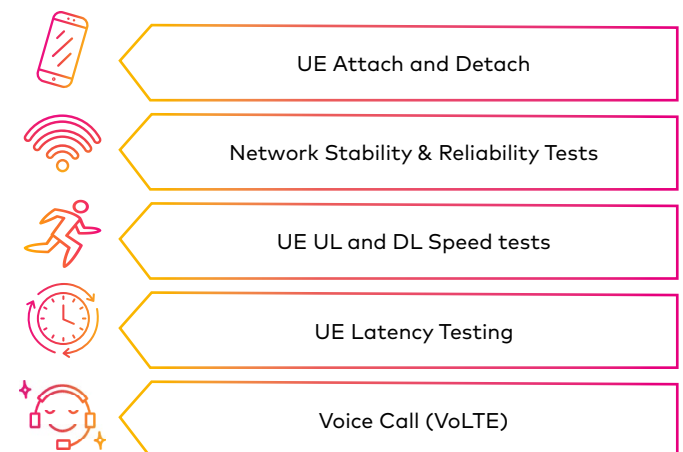
Technology	Test	Test Cases
UMTS	4.1.20	Verify UE can perform successful Location Update with MSC – UMTS
UMTS	4.1.21	Cell Selection – UMTS
UMTS	4.1.22	Attach/detach Test – UMTS
UMTS	4.1.23	Voice Call Test – Both devices in the same 3G network – UMTS
UMTS	4.1.24	SMS Test – UMTS
UMTS	4.1.25	FTP Download (Static Test) – UMTS
UMTS	4.1.26	FTP Upload (Static Test) – UMTS
UMTS	4.1.27	Latency – UMTS
UMTS	4.1.28	Intra-site Handover Tests – UMTS
UMTS	4.1.29	Inter-site Handover – UMTS
UMTS	4.1.30	Inter-RAT Handover – UMTS
UMTS	4.1.31	3G-2G Rerelection – UMTS

Figure 8: Major Open RAN tests performed for 2G, 3G & 4G

## Successful test execution

During the proof of concept (POC) trial, Amdocs' Open RAN systems integration team successfully executed 47 acceptance test protocols (ATPs) spanning 2G, 3G and 4G, resulting in several major achievements, including voice and video calls using the Open RAN equipment, while connecting to the existing Ericsson core network in the South African lab.

After completing the ATPs in South Africa, a similar set was tested in a field environment in Guinea Conakry.



## Results

As system integrator, Amdocs successfully tested all use cases associated with 2G, 3G and LTE/4G in the lab environment, with the results enabling the operator to conduct Open RAN field testing in Guinea Conakry. This successful trial may open the door for Open RAN to be deployed throughout Africa in the coming years.





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