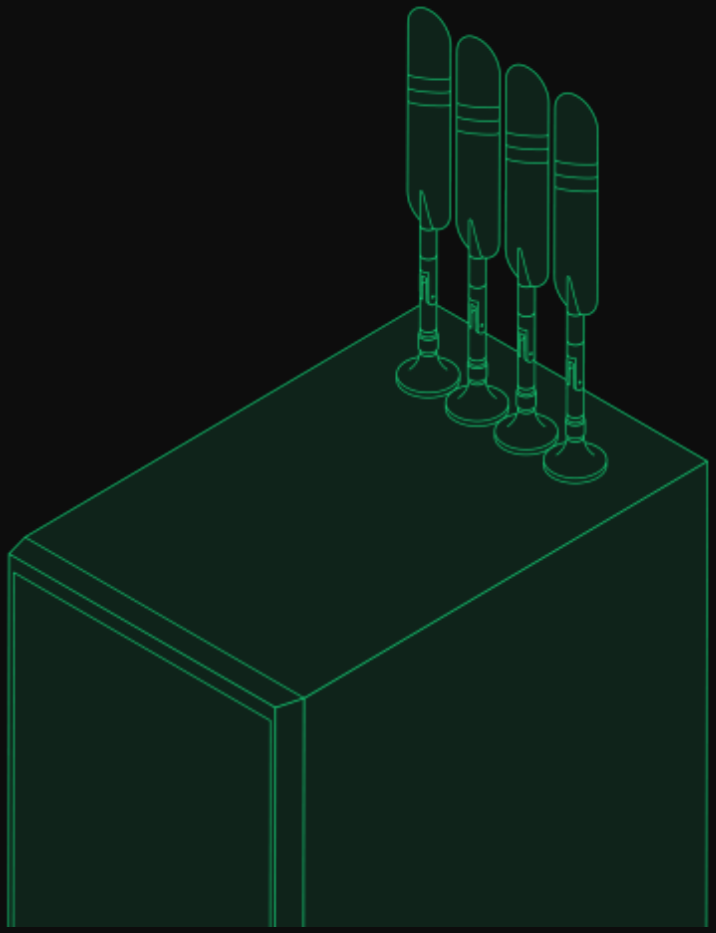
AMARI Callbox Classic

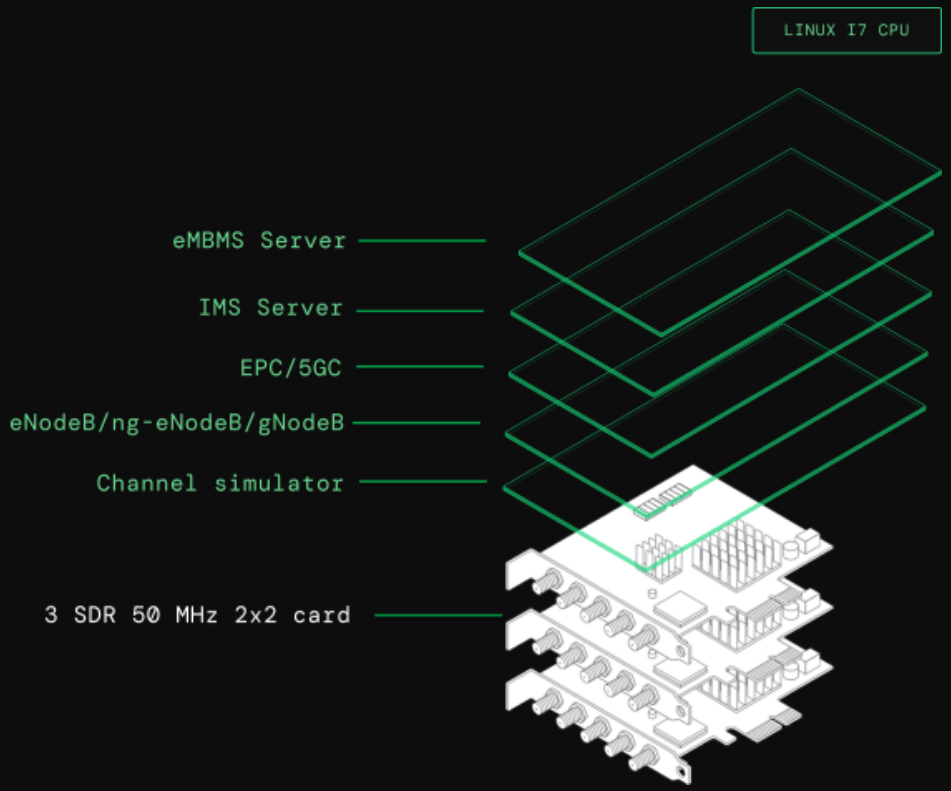
amarisoft



Overview

The AMARI Callbox stands as the ideal solution for testing devices across 5G NSA and SA, LTE, LTE-M, and NB-IoT. It functions as a 3GPP compliant eNB/gNB and EPC/5GC, facilitating functional and performance testing and is driven by a carrier-grade software suite.

The AMARI Callbox Classic, the smallest callbox, supports multiple cells, enabling NSA and intra eNB/gNB handover. Initially designed to support three LTE sectors with a 20MHz 2x2 configuration, it has been subsequently upgraded to accommodate low-bandwidth SA and NSA configurations.



Capabilities

5G

The callbox can act as a 5G standalone mode (SA) or 5G non-standalone mode (NSA) network. 5G Non Terrestrial Network (NTN) and 5G Reduced Capacity (RedCap) are also supported.

LTE

Even if it is designed for 5G, this callbox provides with the best of Amarisoft LTE technology.

LTE-M

The callbox supports LTE-M in both FDD and TDD to connect CAT-M1 devices.

NB-IOT

The callbox supports standalone, in-band and guard-band NB-IOT to connect NB1 and NB2 devices. It also supports Non Terrestrial Network (NTN) NB-IOT.

Up to 1000 UEs

Powered by a macro base station software, depending on the callbox model and configuration, it can handle up to 1000 concurrent active UEs.

600 Mbps - 210 Mbps

Depending on the callbox configuration and the UE capabilities, the callbox can deliver up 600 Mbps in downlink and 210 Mbps in uplink.

Handover

On a single callbox, intra eNB/gNB handover is supported. Inter eNB/gNB handover is supported using two callboxes.

Carrier aggregation

The callbox can aggregate multiple TDD and FDD LTE, NR FR1 and NR FR2 cells for high throughput testing.

VoLTE VoNR VoWiFi

The embedded IMS Server allows VoLTE, VioLTE, VoNR, VioNR, SMS and emergency call testing. The embedded N3IWF allows VoWiFi by connecting an external WiFi access point.

Highlighted features

Logging and Measurements

Selective logging and display of all layers of 3GPP LTE and NR stacks as well as useful graphs and analytic tools.

LOG EXAMPLE

Automatic Test Setup and Scripting

Extensive WebSocket API allowing to send remote commands to eNodeB, ng-eNodeB, gNodeB, EPC and 5GC to ease test automation.

TUTORIAL

Easy Configuration

Easy configuration thanks to JSON files with example configurations already included in each software release for eNodeB, ng-eNodeB, gNodeB, EPC and 5GC.

End to End Data Testing

Running on top of standard Linux in user space mode allowing easy integration with IP services.

Channel Simulation

Simulation of different DL channel types as per 3GPP models specified in 36.101 and 38.141 specifications.

TUTORIAL

Feature testing

Test features to override the nominal protocol behavior in order to simulate error cases.

High Performance

Highly optimized software supporting multiple UEs and cells and high data rates in LTE and NR.

3GPP Features

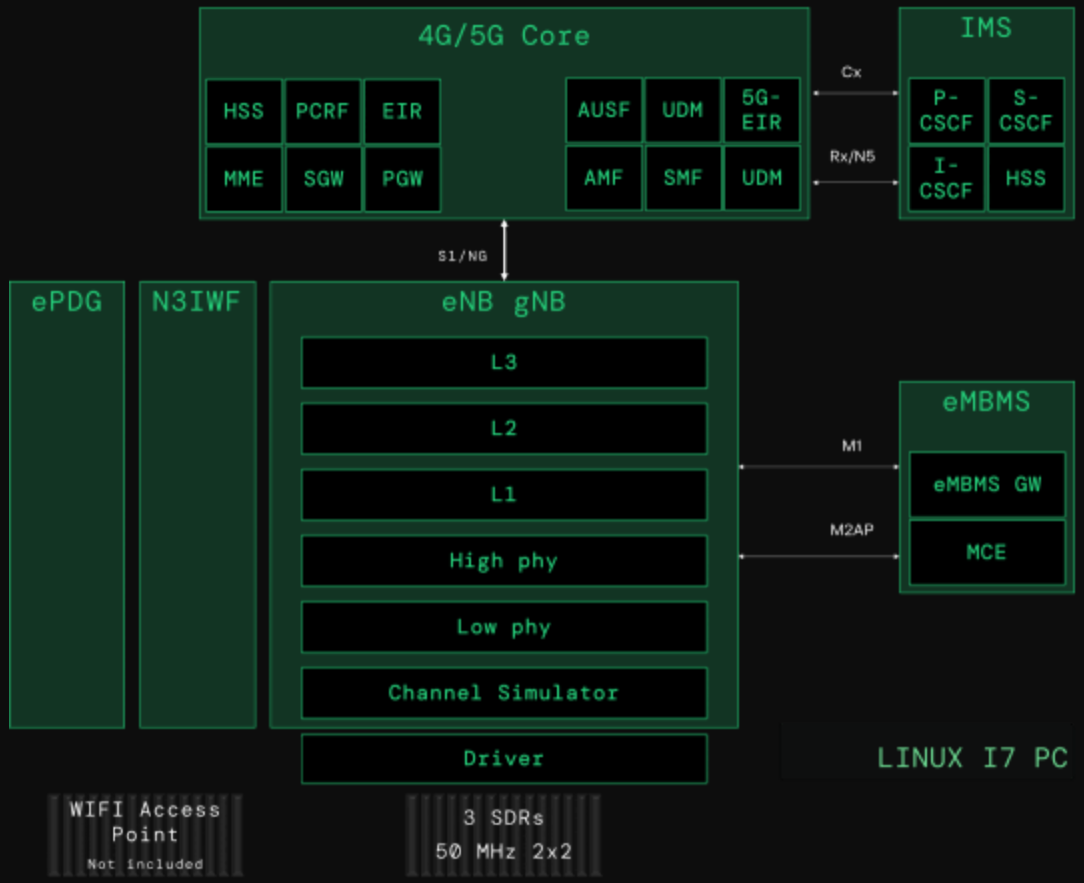
Early access to 3GPP features for rapid validation of features under development.

Frequency Agnostic

Support of a wide range of FDD and TDD frequency bands even nonstandard ones allowing to test in Sub-6GHz and mmWave. mmWave available on the AMARI Callbox Advanced, Ultimate and Extreme as an option.

TUTORIAL

Architecture



Possible RAN Configurations

RAN Configuration constraints

The AMARI Callbox Classic RAN configuration is subject to constraints stemming from:
1- The characteristics and the number of Software Defined Radios (SDRs) it incorporates.
2- The CPU power, thereby ultimately being restricted by the terms of the software license.

1- Constraints Arising from SDRs:
The Callbox integrates three SDRs, with each SDR capable of supporting Single-Input Single-Output (SISO) or 2x2 Multiple-Input Multiple-Output (MIMO) configurations with a maximum bandwidth of 56 MHz. Users have the flexibility to assign each SDR to a specific frequency, thereby configuring either a SISO or 2x2 channel. Additionally, two SDRs can be aggregated to enable 4x4 MIMO functionality. It's worth noting that as an experimental feature, albeit with a performance trade-off, two SDRs can be combined to provide a 100MHz channel. However, for optimal performance in a 100MHz channel, it's recommended to opt for the AMARI Callbox Advanced, Ultimate, or Extreme, which are equipped with 100MHz SDRs. This provides users with the follwing combinations:
Three 56 MHz 2x2 channels
One 100 MHz 2x2 channel combined with one 56 MHz 2x2 channel
One 56 MHz 4x4 channel combined with one 56 MHz 2x2 channel
Each channel can support multiple contiguous cells, provided that the total bandwidth and MIMO layers of the channel are not exceeded.

2- Constraints Arising from CPU and Software License:
The limitations imposed by the software license restricts the total bandwidth of cells multiplied by the number of MIMO layers to 120MHz.

RAN Configuration examples

4G LTE	3 cells 20MHz 2x2
	1 cell 20 MHz 4x4 + 1 cell 20MHz 2x2
5G NR SA Mode	1 5G cell 50MHz 2x2
	3 cells 20MHz 2x2
	3 cells 40 MHz SISO
5G NR NSA Mode	1 5G NR 50MHz 2x2 + 1 LTE 10MHz 2x2
	1 cell 5G NR 40 MHz 2x2 + 1 cell LTE 20 MHz 2x2
	1 cell 5G NR 40 MHz SISO + 2 cells LTE 20 MHz 2x2
NB-IOT	3 NB-IoT standalone cells
	3 LTE cells with an in-band or guard-band NB-IoT cell each
LTE-M	3 LTE cells with CAT M1 support

Hardware components

Callbox and accesories

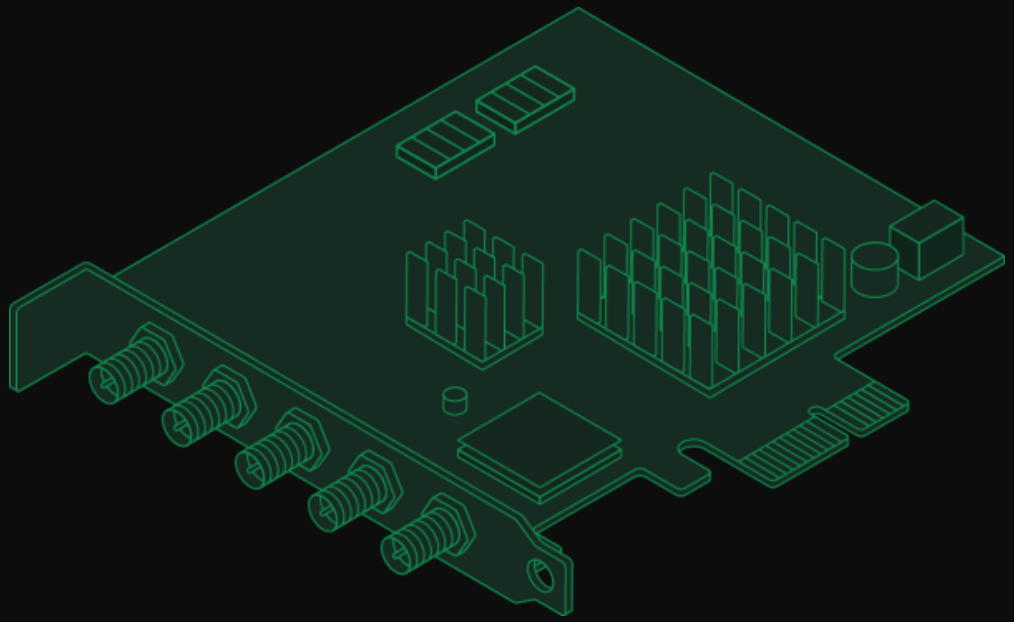
Callbox Specification	
Dimensions H × W × D	30 cm × 27 cm × 35 cm
Weight	11 kg
# AMARI PCIe SDR 2x2 Cards	3
Power supply voltage	230 V AC input
CPU	Intel i7

Accesories	
	12 antennas are included and connect to callbox SDRs throught standard SMA port for over the air testing.
	5 programmable SIM Cards are included and already registred in the Callbox core user database.

AMARI PCIe SDR 2x2 Card

AMARI PCIe SDR 2x2 is a software defined radio (SDR) card using AD9361 2x2 RF transceiver. It supports MIMO 2x2, FDD and TDD operations in any frequency between 500 MHz and 6GHz. It has an integrated GPS for precise time and frequency synchronization. The cards can be easily chained thanks to a provided cable allowing clock and PPS propagation in between the cards. This will facilitate testing of higher MIMO layers and carrier aggregation. The total bandwidth of the card is 56 MHz, and its output power is around 0 dBm depending on the used frequency. The card requires at least gen 2 PCIe slot. This RF is used in AMARI Callbox Mini, AMARI Callbox Classic and AMARI UE Simbox LTE Series products.

TECHNICAL DOC



AMARI PCIe SDR 2x2 Card technical specification

Dimensions H × W × D	2 cm × 11.5 cm × 12.8 cm
Weight	0.1 kg
Frequency range	500 MHz to 6.0 GHz
RF bandwidth	200 KHz to 56 MHz
Power supply voltage	12 V DC input
Operation mode	FDD and TDD
MIMO	2x2
ADC/DAC sample rate	61.44 MS/s
ADC/DAC resolution	12 bits
Frequency accuracy	2 ppm
PCIe minimum requirements	1x / Gen 2
LTE 20MHz 64QAM EVM	<4% RMS (f<3.5 GHz) <2% RMS (f<2.6 GHz)
Synchronization	Internal clock , PPS signal, GPS , Reference external clock (LVDS)

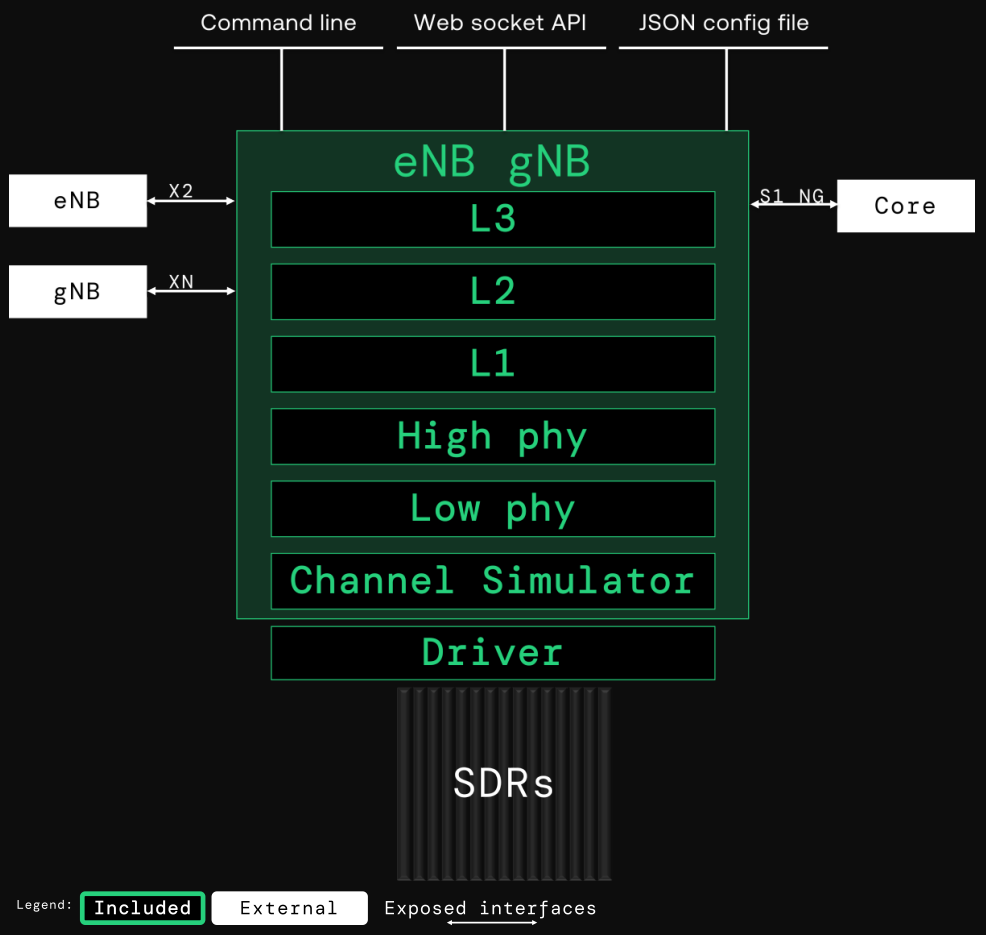
Software components

vRAN eNodeB gNodeB

A release 17 full software eNodeB gNodeB including layer3, layer 2, layer1 and physical layer. It also includes a channel simulator. It connects to a split 8 or split 7.2 radio front end through an open API via a driver. It supports a standard S1/NG interface to connect a 4G or 5G core network. The eNodeB gNodeB is configurable through hundreds of parameters in a text file in JSON format. It has a WebSocket API for automation, and a command line interface.

DETAILED SPEC

TECHNICAL DOC



4G 5G CORE

A compact release 17 core network with built-in MME, SGW, PGW, PCRF, HSS, EIR, ePDG, AMF, AUSF, SMF, UPF, UDM and 5G-EIR.

DETAILED SPEC

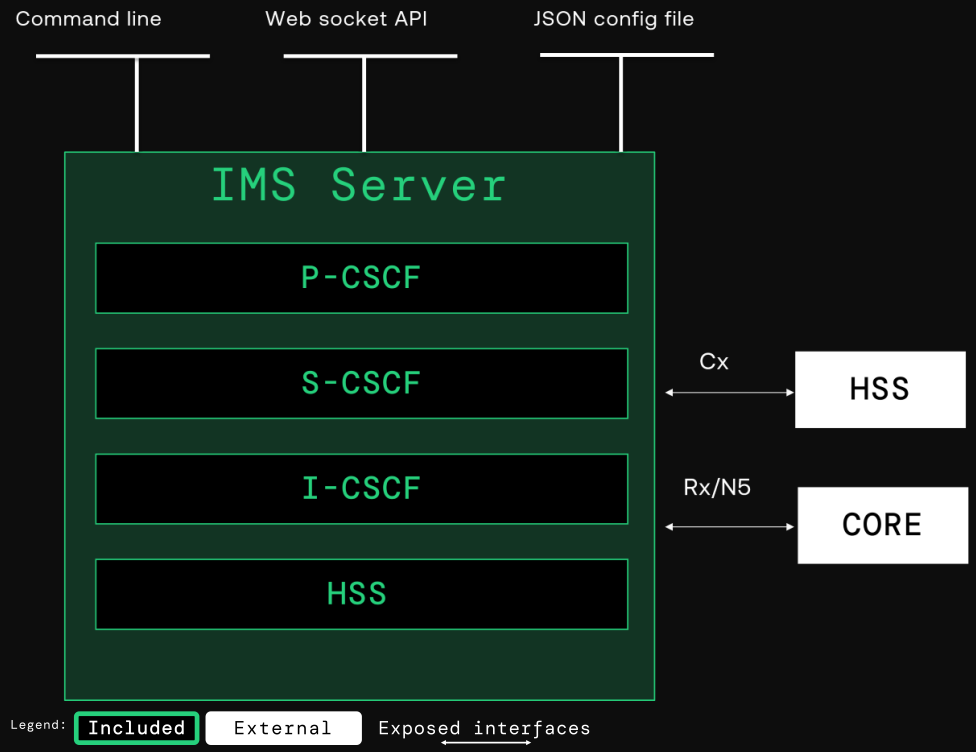
TECHNICAL DOC

IMS Server

An IMS standalone simple server. It has a built-in P-CSCF, I-CSCF, S-CSCF, HSS.

DETAILED SPEC

TECHNICAL DOC

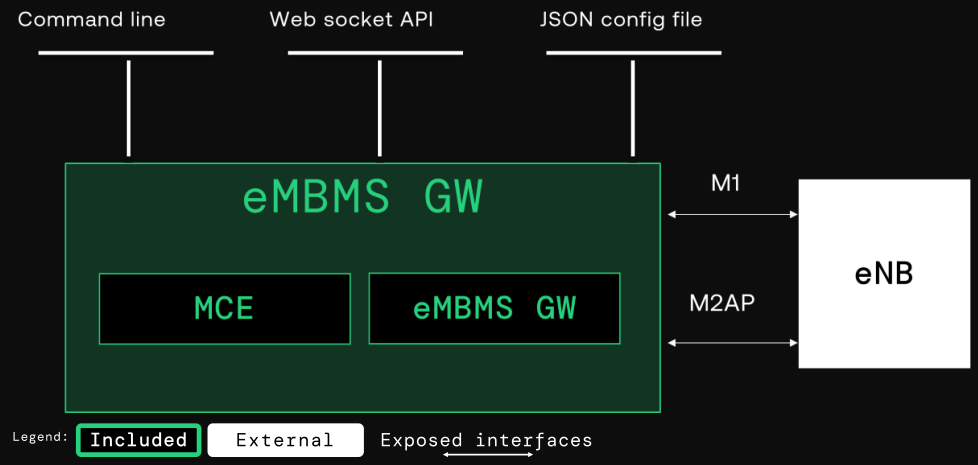


eMBMS Gateway

An LTE multimedia broadcast multicast services gateway with buit-in MCE.

DETAILED SPEC

TECHNICAL DOC



USE CASES VIEW ALL →

- End to end device testing →
- Specific feature device testing →
- 4G 5G network element testing →
- Private network →
- Operator conformance testing →
- FTW gateway testing →

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