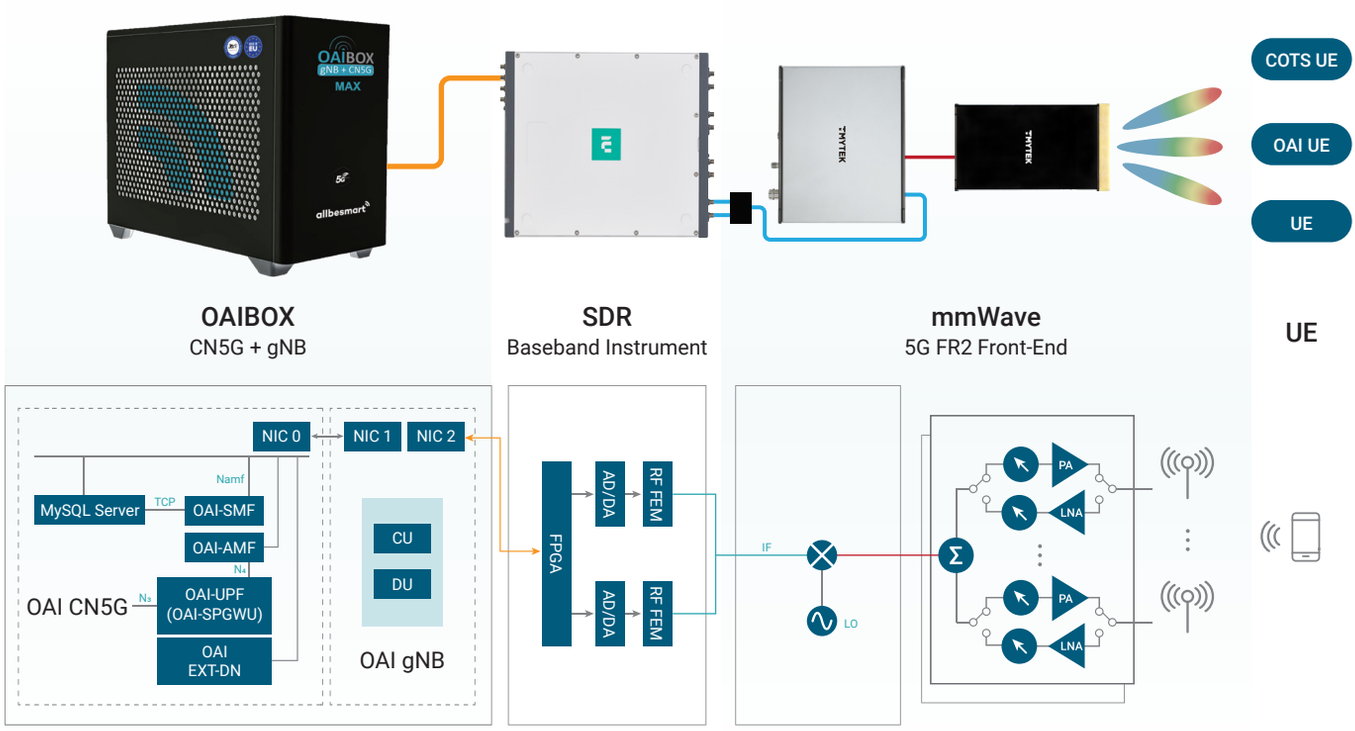
mmW-OAI Solution

Open-Source 5G FR2 Test Network

OpenAirInterface (OAI) is an open-source implementation of 3GPP standards for mobile systems. It is a customizable platform for developing and testing mobile network components, including gNB and UE.

mmW-OAI = mmWave + SDR + OAIBOX



The mmW-OAI testbed combines millimeter-wave (mmWave) and OpenAirInterface (OAI) to create a comprehensive test environment for 5G FR2 networks. TMYTEK offers the mmW-OAI, which includes various components such as mmWave beamformers, frequency converters, and a powerful PC installed with the latest OAI stack.

The software stack comprises several components, including OAI gNB, OAI CN5G, the beamformer UHD driver, an easy-to-use dashboard, and more. This makes the testbed suitable for testing, simulating, and debugging layer-to-layer and end-to-end connections from UE to gNB, as well as to the core network. Additionally, the testbed supports the gNB and UE mmWave array antennas, enabling advanced features such as FR2 beamforming and beam tracking.

The mmW-OAI provides a versatile and customizable test environment that combines the benefits of mmWave technology with the flexibility of the OAI platform. This enables the emulation of gNB and UE, supports mmWave beamforming, facilitates frequency conversion, and provides powerful software tools for network monitoring and analysis.

Following are the FR2 features that we have supported or plan to support in the future.

FR2 Features and Roadmap

Time Division Duplex

TDD is supported in mmW-OAI already. 5G FR2 requires the Time Division Duplex (TDD) scheme to benefit from improved spectrum efficiency. TDD is also a solution for addressing the asymmetrical nature of UL and DL in 5G scenarios. FDD, on the other hand, has to stick to set amounts of uplink and downlink network resources, which makes network slicing or something similar hard to do. mmWave communication also needs to use channel reciprocity, which means that the UL and DL propagation channel characteristics are very similar.

Beam Management

The beam management procedure includes several different states to select the best-performing beam, which interacts with many submodules below.

- Beam-sweeping
- Beam measurements
- Beam determination
- Beam reporting
- Beam failure recovery

In 2024, we plan to support full beam management features, according to our production roadmap. Beam sweeping is scheduled for Q1, while beam reporting is scheduled for Q2. To develop the user plane and control plane, all modules will be based on the P19 architecture. The NI UHD driver will be integrated into the control method.

Beam Tracking

The beam management deliverables include software modules that can be used to develop the beam tracking algorithm. The customer can use those modules to control the beam or to determine the beam quality.

UE Configuration

OAI gNB

Base Station

User Equipment

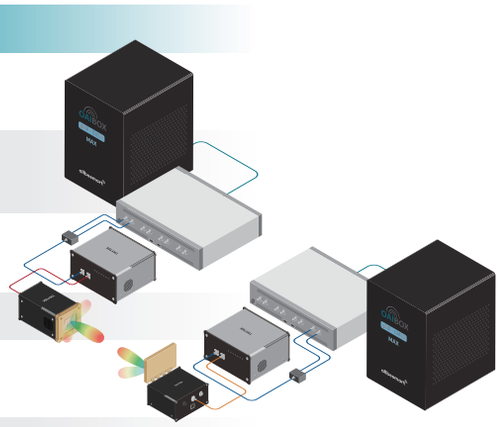
Smartphone
iPhone 14 Pro, iPhone 14 Pro Max, or later

OAI UE
OAI UE stack runs on a PC with NI USRP X410

COTS UE
Quectel modules. E.g., RM530NGL

Features and Benefits

Features	Benefits
Open source	Modifying the 3GPP compliant FR2 stack to test your idea
Highly integration	Verifying your idea in an controlled testing environment
Time Division Duplex (TDD)	A true TDD wireless testbed for high-band
USRP X410[1]	400 MHz channel bandwidth USRP
Dashboard	Cloud-based web app to control and visualization of cellular network KPIs
mmWave RF frontend	28/39 GHz beamformer and broadband frequency conversation



[1]Old USRP models such as X310, B210 and N300 should also work with mmW-OAI with smaller channel bandwidth

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Subject to change without notice. V2.0.1 Released in 2024