Labkit v3

OPEN SOURCE CELLULAR NETWORK

FOR INDOOR DEVELOPMENT AND TESTS

Ref : 2023_09_04_PMM_PS_LK_EU_v4.2

Firecell Labkit v3

Firecell Labkit is a lightweight indoor open source cellular network, packaged in a compact kit with a smartphone and SIM card, for development and tests

Fit for all use cases

Firecell Labkit is a perfect fit for enterprises, R&D labs and universities who want to demonstrate innovative use-cases with a real indoor private cellular network in their premises.

Firecell Labkit can be used to :

- Build and run demonstrations and proof of concepts using an indoor cellular network
- Wirelessly connect your smartphones, tablets, industrial routers, cameras and other devices within your lab
- Kick start your research on the cellular network protocols thanks to an all-in one setup
- Develop your own extensions or integrate third party software
- Inspect the security of the 5G protocols and develop your own enhancements
- Train your team or your students hands-on on an actual cellular network

Open source

Firecell Labkit is the only commercial cellular network solution provided as open source, with a version also supporting Open RAN.

O-RAN ALLIANCE

OPEN AIR INTERFACE

It is based on the **OpenAirInterface (OAI)** Core network and Radio Access Network (RAN), which embeds its own proprietary gNodeB - software, backed by over 200 industry and academic members, including Qualcomm, Fujitsu, Orange and Meta. With **Firecell Labkit**, you can extend the OAI code with your own development, and, should you wish to contribute back to the OAI community, we will gladly accompany you.

Support from experts

Firecell Labkit comes with online access to Firecell's source code and documentation. You also get access to a support page dedicated to you, where you can raise all your questions and issues.

With Firecell's **Gold** Support, our experts will provide you guidance for the configuration and operation of your Labkit with the provided smartphone and SIM card.

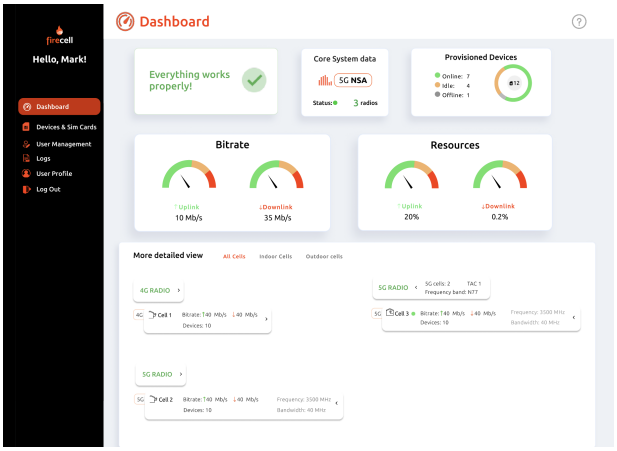
If your objective is to integrate Labkit with third party software, use devices not validated by Firecell, or develop your own code, then Firecell's **Platinum** Support is what you need to help you reach your goal.

Quarterly releases

Firecell publishes software releases 4 times a year, with new features, enhancements and bug corrections. You can upgrade your software version from Firecell's online repository using a single command.

As long as you subscribe to Firecell's Gold or Platinum Support & Maintenance, you will get access to Firecell's latest software releases.

What you get



Firecell Labkit is composed of :

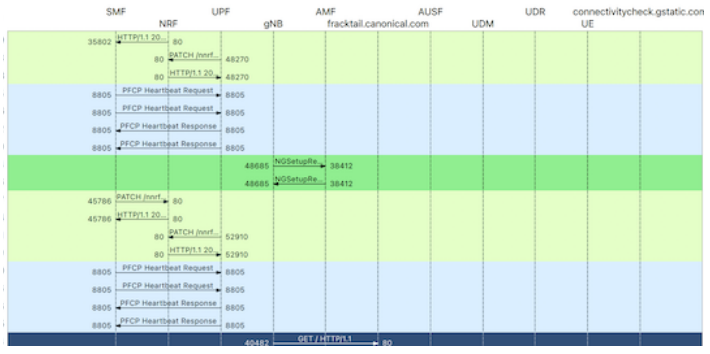
- 1 PC containing :
  - 4G Core software (except Labkit O-RAN)
  - eNodeB software (except Labkit O-RAN)
  - 5G Core software
  - gNodeB software
  - Wireshark software
  - configuration files
  - Firecell's 5G Standalone Network Management System (NMS)
  - scripts for starting, stopping and checking the status of the cellular network
- 1 rugged 4G / 5G smartphone
- 1 pre-configured SIM card
- 1 software defined radio (SDR) - 2 for Labkit 40 NSA - or an Open RAN Radio Unit (O-RU)

What you can do with Labkit

Firecell Labkit is pre-installed, pre-tested, pre-configured and ready to use. You can get your own end-to-end 4G or 5G cellular network on air in less than 15 mn.

With **Firecell Labkit**, you can :

- Deploy and update a cellular network easily using Firecell's command line scripts
- Configure your network's central frequency band, bandwidth, modulation and coding scheme, attenuation
- View the protocol messages between network elements using Wireshark
- Inspect extensive log files and view the detailed list of network events
- Modify and recompile the source code



Labkit models

Labkit is available in the following flavours :

- **Labkit 40** : supports 4G up to 20 MHz and 5G Standalone (SA) up to 40 MHz in SISO or up to 20 MHz in 2x2 MIMO. Supports all frequency bands under 6 GHz.

- **Labkit 40 NSA** : supports 4G up to 20 MHz, 5G Standalone (SA) and 5G Non-Standalone (NSA) up to 40 MHz in SISO or up to 20 MHz in 2x2 MIMO. Supports all frequency bands under 6 GHz.

- **Labkit 100** : supports 4G up to 20 MHz and 5G Standalone (SA) up to 100 MHz in 2x2 MIMO. Supports all frequency bands under 6 GHz.

- **Labkit O-RAN** supports 5G SA up to 100 MHz in 2x2 MIMO[1]. It comes with a GPS antenna, a 10 Gb network interface card and a 4 x 250 mW Open-RAN radio unit (O-RU). It uses the split 7.2 eCPRI interface with PTP synchronisation. It is available for the following frequency bands : **n48**, **n77** and **n78**.

Frequency bands

Labkit 40, **Labkit 40 NSA** and **Labkit 100** support all frequency bands under 6 GHz. **Labkit O-RAN** supports the most common 5G private network frequency bands.

Simply choose the frequency band according to your country's private 5G network regulations.

Performance of the SDR-based Labkit models

The performance of the SDR-based Labkit models are summarised in the following table:

Labkit model	Capability	Max Throughput UL / DL	Frequency Band	Coverage
Labkit 40	4G, 5G SA	131 Mbps / 21 Mbps	70 MHz - 6 GHz	3-5 metres
Labkit 40 NSA	4G, 5G SA, 5G NSA			
Labkit 100	4G, 5G SA	800 Mbps / 100 Mbps	10 MHz - 6 GHz	5-10 metres

[1] 4x4 MIMO planned in 2024

Performance of Labkit O-RAN

The performance of the Labkit O-RAN models are summarised in the following table:

Labkit model	Capability	Max Throughput UL / DL	Frequency Band	Coverage
Labkit O-RAN n48	5G SA	600 Mbps / 100 Mbps[2]	USA	30-100 metres
Labkit O-RAN n77			France, UK, Belgium, Norway, Canada	
Labkit O-RAN n78 low			Netherlands, Croatia, Poland	
Labkit O-RAN n78 high			Germany, Sweden, Netherlands	

Pricing

Labkit price is composed of a one-shot fee, plus yearly support & maintenance (minimum 1 year).

Labkit model	Price, including worldwide delivery
Labkit 40	€ 11,900
Labkit 40 NSA	€ 14,900
Labkit 100	€ 24,900
Labkit O-RAN n48 / n77 / n78 low / n78 high	€ 22,900

Support & Maintenance	Gold	Platinum
1 year	€ 5,580 / year	€ 9,840 / year
2 years	€ 9,486/ year	€ 16,728 / year
3 years	€ 12,555/ year	€ 22,140 / year
Access to Firecell Open Source code	✔	✔
Access to quarterly Firecell software releases	✔	✔
Support for Labkit configuration and operation	✔	✔
Support for integration with 3rd party software or device		✔
Support for source code modification & extension		✔

[2] In TDD Config DDSUUUUUUU. Other TDD configs are available, with higher UL performance

Invoicing and Payment Terms

Invoicing Terms

- 100% invoice at order

Payment Terms

- 30 days net from date of invoice

Delivery and Warranty

Delivery Duty Paid (DDP)

- 4-8 weeks (Labkit 40, Labkit 40 NSA)
- 8-12 weeks (Labkit 100, Labkit O-RAN)

Warranty

- 1 year warranty

Technical Specifications

Hardware

PC for Labkit 40 / Labkit 40 NSA	
Dimensions H × W × D / weight	430 mm × 200 mm × 377 mm / 6.8 kg
CPU	Intel Core i9-12900K (3.2 GHz / 5.2 GHz)
RAM	32 GB
Storage	SSD 500 GB
Network connectivity	1 x 2.5 GbE, Wifi 6
USB	2 x USB 2.0 ports (Type-A), 1 x USB 3.2 Gen 2 port (Type-A), 1 x USB 3.2 Gen 2x2 (Type-C), 2 x USB 3.2 Gen 1 (Type-A)
Power supply voltage input	100 - 240V AC
Operating system	Linux Ubuntu 20.04 LTS with 5.4.0-126-lowlatency kernel

Server for Labkit 100	
Dimensions H × W × D / weight	430 mm × 200 mm × 377 mm / 6.8 kg
CPU	Intel Core i9-12900K (3.2 GHz / 5.2 GHz)
RAM	32 GB
Storage	SSD 500 GB
Network connectivity	1 x 2.5 GbE, Wifi 6 Intel-based NIC 710 with 2x 10GbE SFP+
USB	2 x USB 2.0 ports (Type-A), 1 x USB 3.2 Gen 2 port (Type-A), 1 x USB 3.2 Gen 2x2 (Type-C), 2 x USB 3.2 Gen 1 (Type-A)
Power supply voltage input	100 - 240V AC
Operating system	Linux Ubuntu 20.04 LTS with 5.4.0-126-lowlatency kernel

Server for Labkit O-RAN n48 / n77 / n78	
Dimensions H × W × D / weight	430 mm × 200 mm × 377 mm / 6.8 kg
CPU	Intel Core i9-12900K (3.2 GHz / 5.2 GHz)
RAM	32 GB
Storage	SSD 500 GB
Network connectivity	1 x 2.5 GbE, Wifi 6 Intel NIC 810-XXVDA4 with 4 x 25GbE SFP28
USB	2 x USB 2.0 ports (Type-A), 1 x USB 3.2 Gen 2 port (Type-A), 1 x USB 3.2 Gen 2x2 (Type-C), 2 x USB 3.2 Gen 1 (Type-A)
Power supply voltage input	100 - 240V AC
Operating system	Linux Ubuntu 20.04 LTS with 5.4.0-126-lowlatency kernel
Synchronisation	PTP
Antennas	GPS antenna

Software Defined Radio for Labkit 40	
Dimensions H × W × D / weight	15 mm x 97 mm x 155 mm / 350 g
Frequency bands	70 MHz to 6.0 GHz
Bandwidth	Up to 56 MHz in 1x1 SISO, Up to 30.72 MHz 2x2 MIMO
Max output power	10 dBM (10 mW)
Antennas	2 x omnidirectional antennas : 617-960 MHz, 2496-2690 MHz, 3300-5000 MHz

Software Defined Radio for Labkit 100	
Dimensions H × W × D / weight	357.1 mm x 211.1 mm x 43.7 mm / 2,78 kg
Frequency bands	10 MHz to 6.0 GHz
Bandwidth	Up to 100 MHz per channel in 1x1 SISO and 2x2 MIMO
Max output power	18 dBM (63 mW)
Antennas	4 x omnidirectional antennas : 617-960 MHz, 2496-2690 MHz, 3300-5000 MHz

Open RAN Radio Unit for Labkit O-RAN n48 / n77 / n78	
Dimensions H × W × D / weight	209 mm x 186 mm x 62 mm / 2 kg
5G Frequency bands	Labkit O-RAN n48 : 3550-3700 MHz Labkit O-RAN n77 : 3800-4200 MHz Labkit O-RAN n78 low : 3400-3600 MHz Labkit O-RAN n78 high : 3600-3800 MHz
Bandwidth	up to 100 MHz in 1x1 SISO, 2x2 MIMO and 4x4 MIMO (available 2024)
Max transmitted power	24 dBM (250 mW)
Operating Temperature Range	-40 °C to +55 °C
IP Rating	IP 31
Regulatory	CE (Europe), RoHS, WEEE, REACH (UK)
Powering	PoE ++ Type 3 IEEE802.3bt
Antenna	4 integrated or external antennas
Synchronisation	PTP

Crosscall Core-Z5 smartphone	
Dimensions H × W × D / weight	175 x 81 x 14 mm / 281 g
5G Frequency bands	NR-FDD n1 (2100MHz)/ n3 (1800MHz) / n5 (850 MHz) / n7 (2600MHz) / n8 (900MHz) / n20 (800MHz) / n28 (700MHz) + NR-TDD n38 (2600MHz) / n40 (2300MHz) / n41 (2500MHz) / n77 (3700MHz) / n78 (3500MHz)
Operating System	Android 12
Processor	Qualcomm® QCM6490
Head/Body SAR	1,5 W/kg - 1,03 W/kg
SAR Limbs	2,63 W/kg
RAM	4 Go
Flash	64 Go
IP Rating	IP 68
Resistance	salt water (2 m / 30 min), dust (IP 68), falls (6 faces, 2m on concrete)

Software

Core Network software	4G	5G
3GPP release	Release 15	Release 16
Modules	HSS, MME, S/P-GW	SMF, AUSF, UDM, AMF, UPF
Container	Docker	

Radio Access Network software	4G	5G
3GPP release	Release 15	Release 16
Frequency bands	All FDD & TDD bands under 6 GHz	All FR1 (< 6 GHz) FDD & TDD bands
Bandwidth	5, 10, and 20 MHz	up to 100 MHz
Transmission Modes (downlink)	SISO 1x1 and MIMO 2x2	SISO 1x1 and MIMO 2x2 (MIMO 4x4 in 2024)
Modulation schemes	Up to 64QAM in DL and 16QAM in UL	Up to 64QAM in DL and 16QAM in UL
Subcarrier spacing	15 kHz	30 kHz

Network Management System software	
Capability	5G SA
Global network info	status, nb radios, total bit rate (UL/DL), % bandwidth used, nb of devices (online, offline, idle)
Radio info	location, bit rate (UL/DL), % bandwidth used, nb of devices (online, offline, idle)
SIM management	add, remove SIM, status (online, offline, idle)
NMS User management	add, remove, manage user profiles (Standard, Expert, Admin)
Logs	user logs, network logs