Low cost, scalable and integrable QKD using continuous variables

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Optical & Quantum Communications Group
Munich Research Center

The company's operations in 2022 aligned with expectations

US$92.4 Bn

2022 sales revenue

ICT infrastructure
Consolidating digital infrastructure

Consumer business
Tech leadership in "1 + 8" domains

Huawei Cloud
Industry customers' preferred partner in cloud migration

Digital Power
Helping customers go low-carbon

IAS
Improving competitiveness and user experience

We maintained heavy R&D investment to drive future development through innovation

- **>10%** Annual revenue re-invested into R&D
- **No. 4** 2022 EU Industrial R&D Investment Scoreboard
- **120,000+** Active patents held by Huawei globally
- **90%+** Percentage of patents that are utility patents

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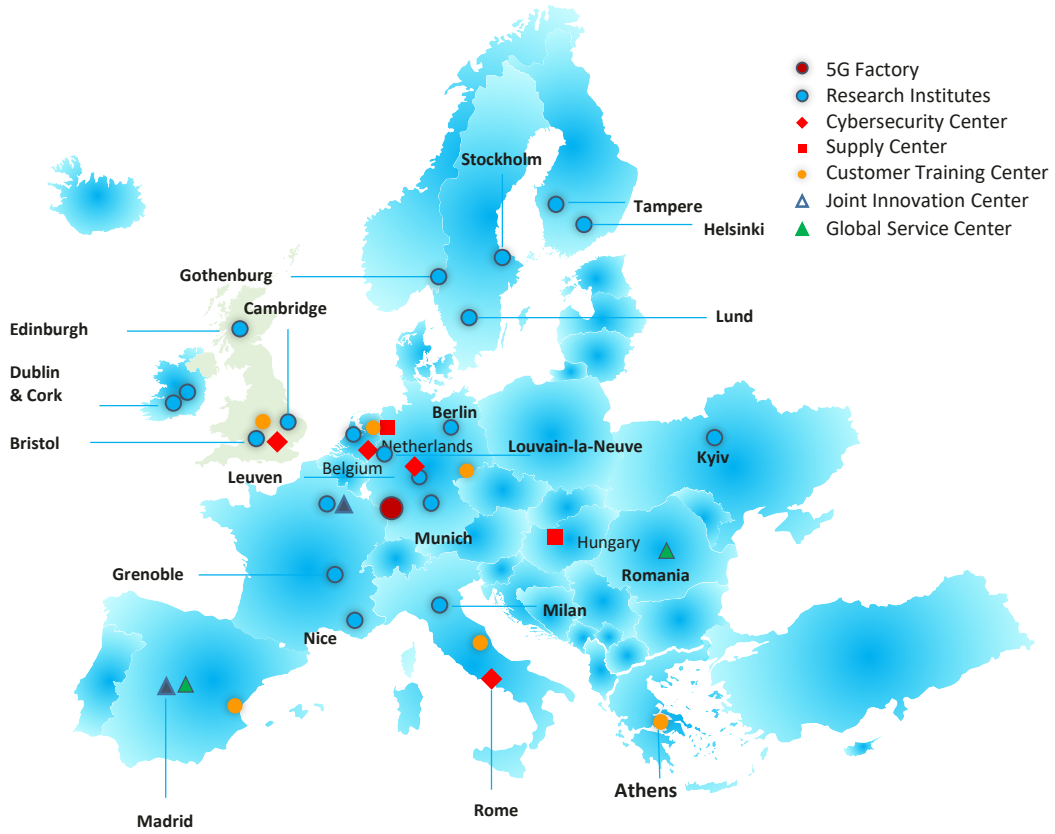
In Europe for Europe, Huawei Continuously Serves Partners and Society



Total contribution to European value added	Tax revenues for European Gov.	Total number of European jobs created*	0 accident, best security operation records.
€12.3Bn	**€5.2Bn**	**143,800**	**100%**

Source: The economic contribution of Huawei in Europe in the year 2021

** Including direct, indirect and induced*

12,000+ employees

3,400+ researchers **27** sites in **13** countries

230+ tech. partnership agreements with 150+ universities and institutes

140+ universities collaboration across Europe

10,000+ patents at the European Patents Office (EPO)

Huawei Quantum Key Distribution Research

Location: Munich

Started: September 2015

No technology transfer to China

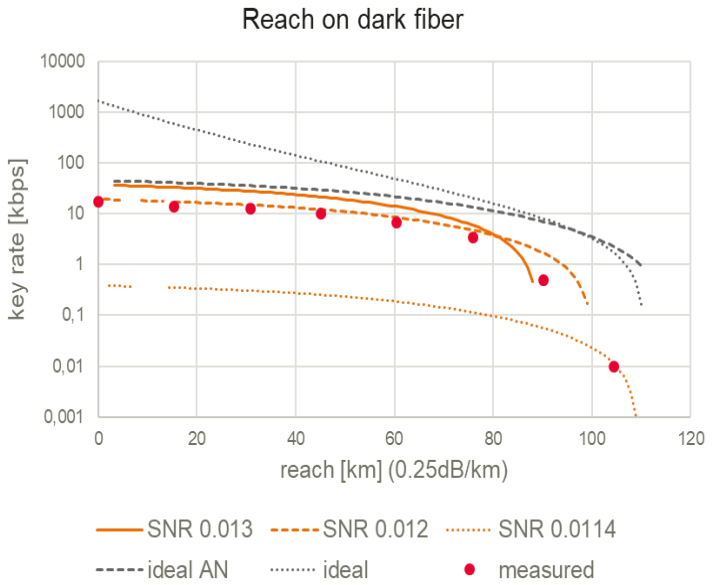
Main achievements

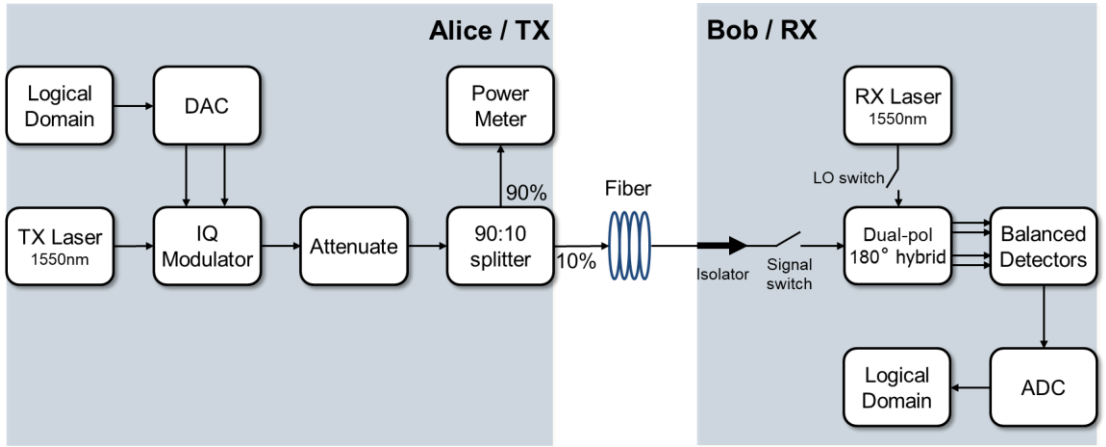
- State-of-the-art CV-QKD prototypes
- System-level field trials with customers in operational environment
- >30 patents or patent applications

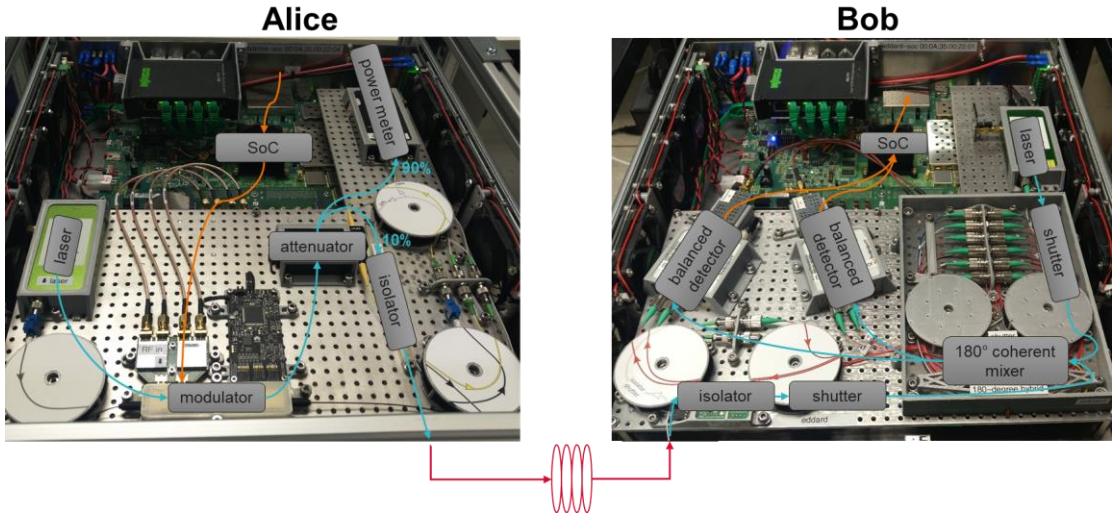
Low-complexity software-defined setup

Software defined with **low optical / analog complexity**
- Simplifies in-depth security analysis, increases trust
- Highly flexible, rapid prototyping, easy to control

R**eadily available components** for coherent communication
- Low cost implementation
- Allows photonic integration







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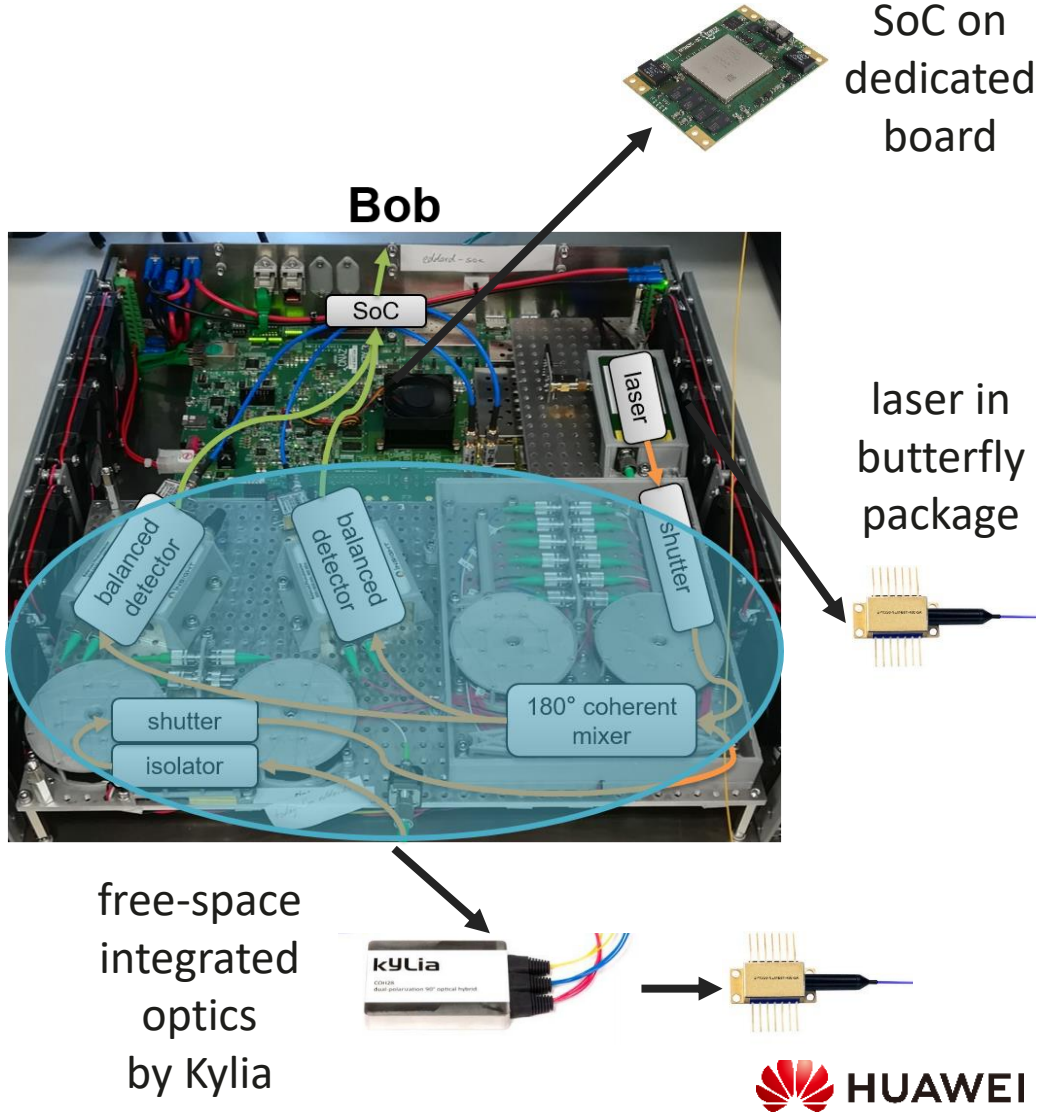
Next steps – the path to integration (photonic and electronic)

- “Bulky” general-purpose devices can be replaced by dedicated hardware
- Cost of material (TX-RX pair) will be reduced
- Size (TX/RX) – 19” x 2HU x ~20cm depth – will be reduced
- External computer needed for processing can be replaced by an ASIC dispensed in following generations
- MOST IMPORTANT: stability can be increased (even by a partial integration) and performance improved



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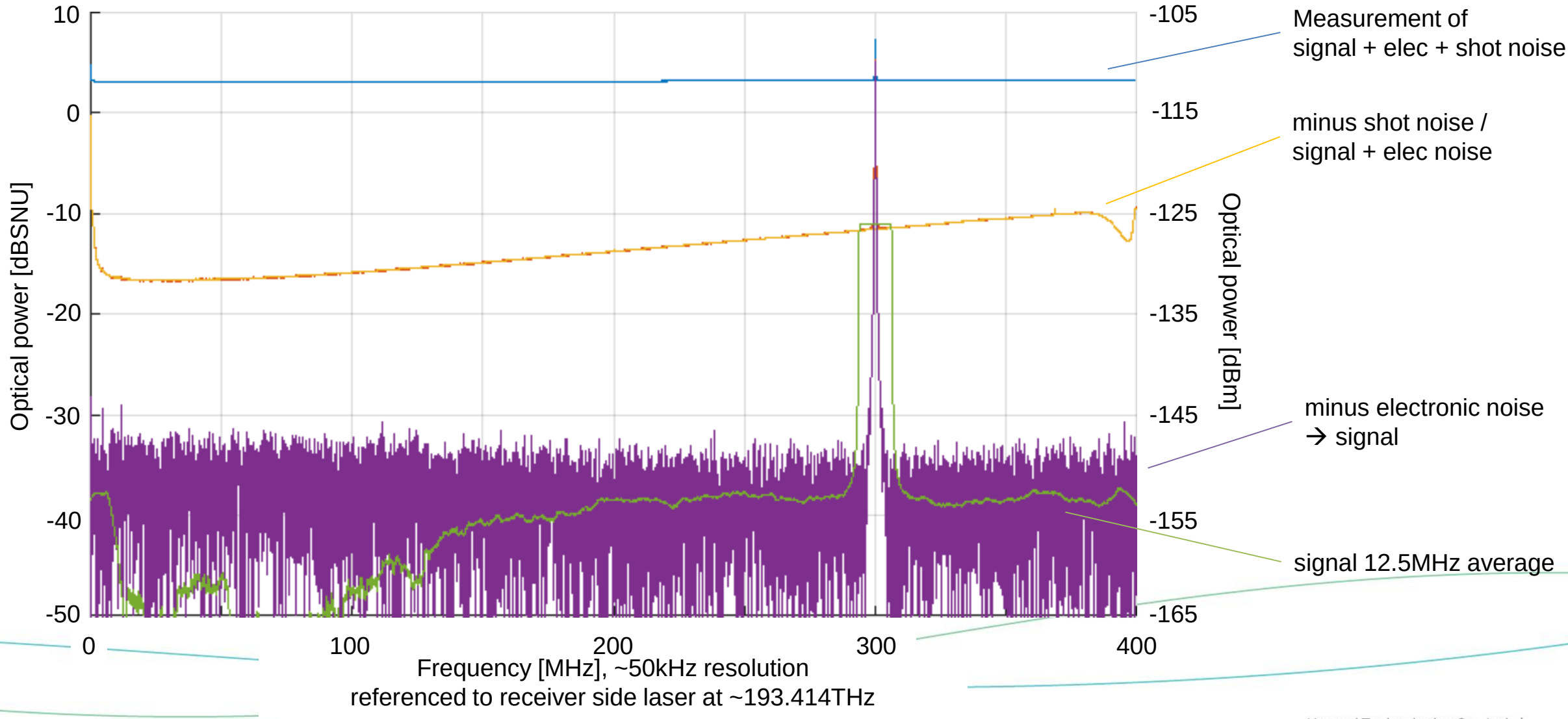
Noise-spectrum analysis with very weak pilot tone for verification



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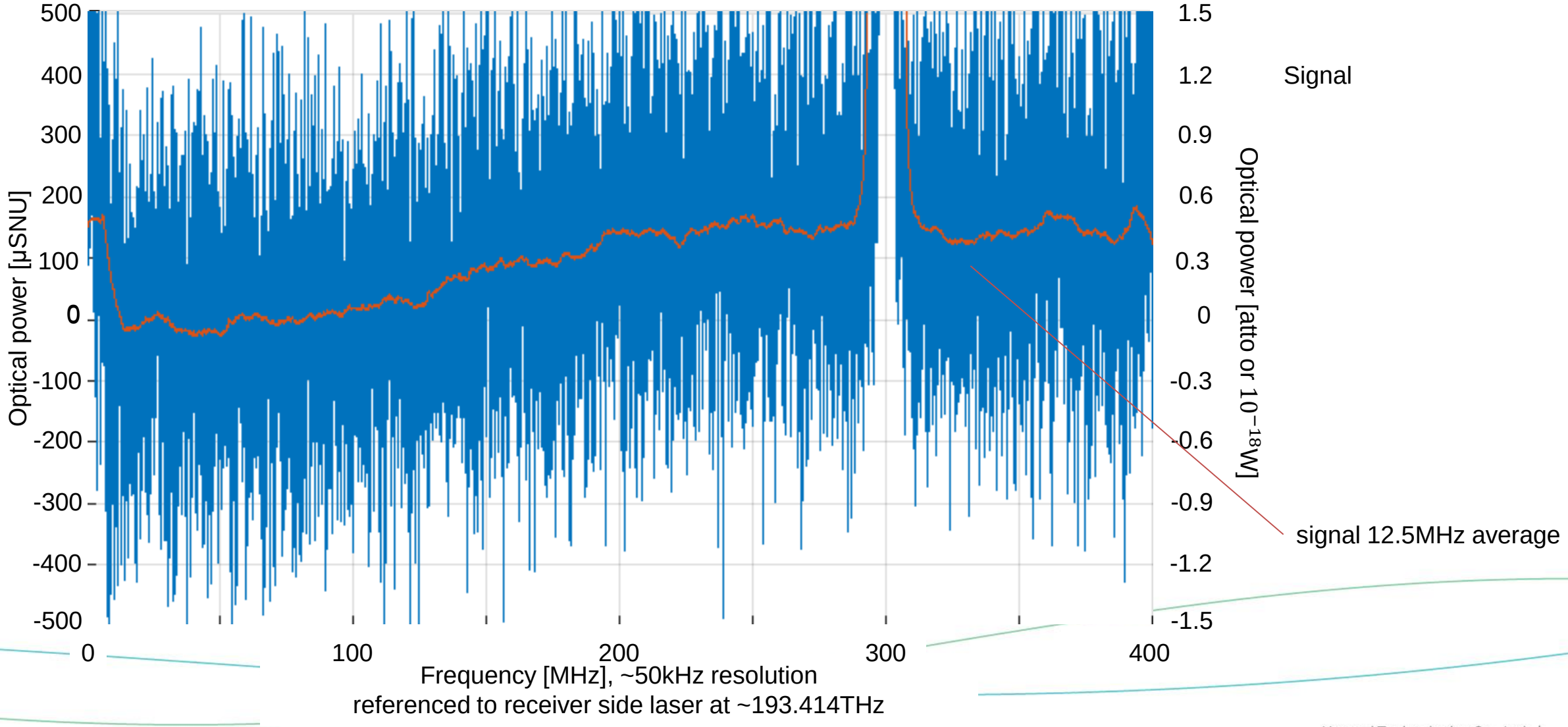
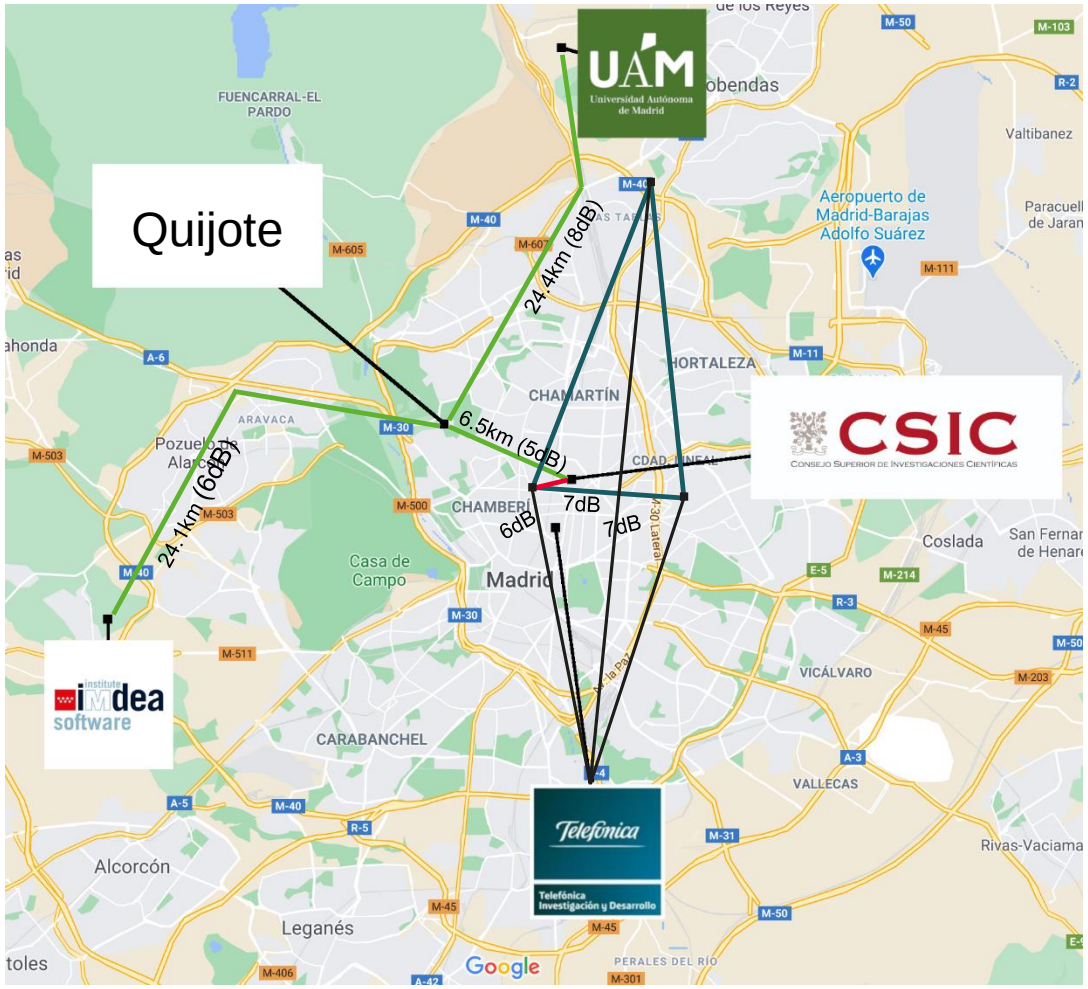


OpenQKD – Madrid testbed

- Participation in industry advisory board
- We contribute 5 QKD TX-RX pairs
- Integration tests in collaboration with
  Telefonica, IMDEA SW, UPM,
  ID Quantique, Toshiba, Rohde & Schwarz



OPENQKD

Grant agreement ID: 857156

Status

Ongoing project

Start date	End date
2 September 2019	1 September 2022

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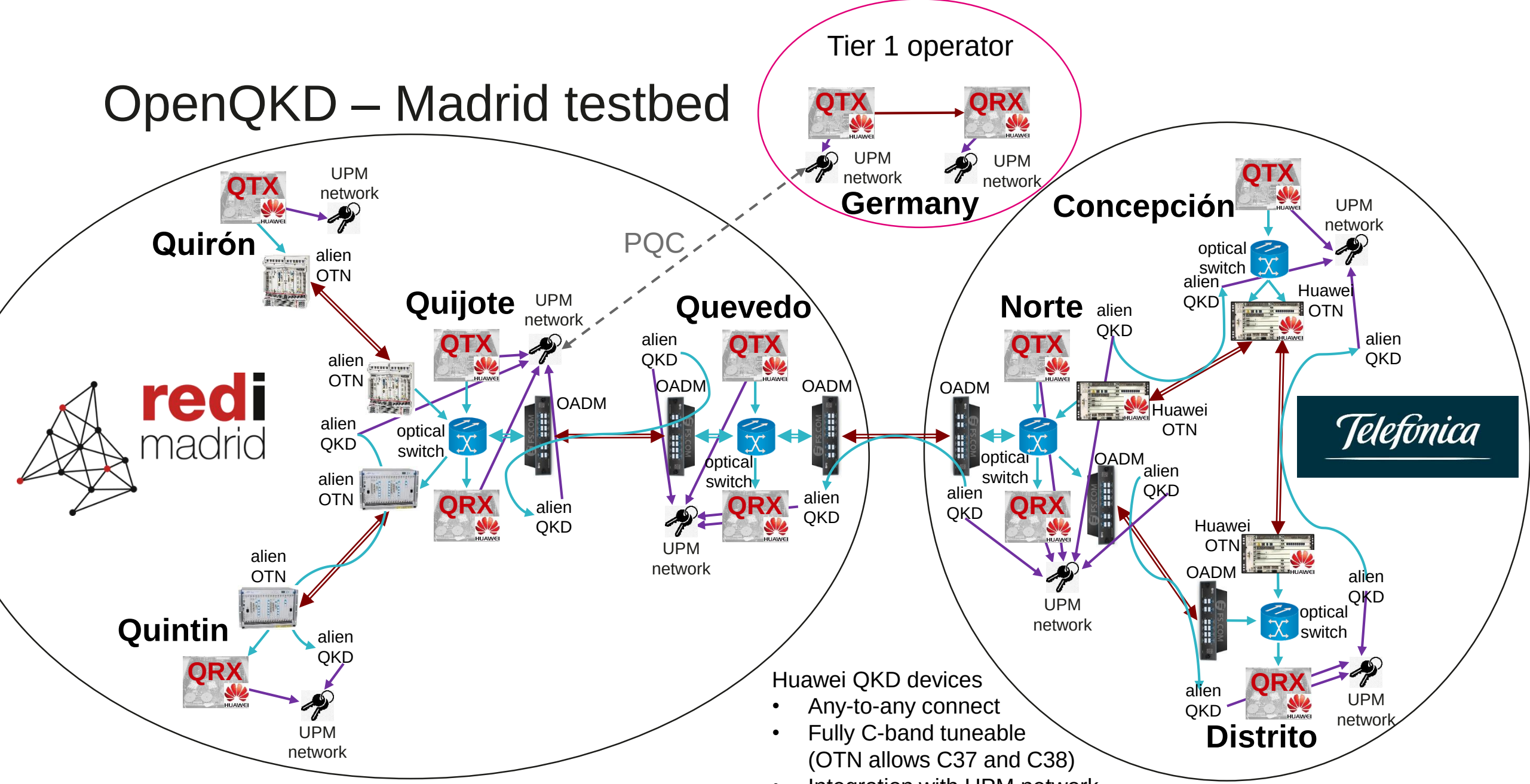
OpenQKD – Madrid testbed



Huawei QKD devices

- Any-to-any connect
- Fully C-band tuneable (OTN allows C37 and C38)
- Integration with UPM network control and configuration planes
- Zero-touch integration in deployed (alien) OTN

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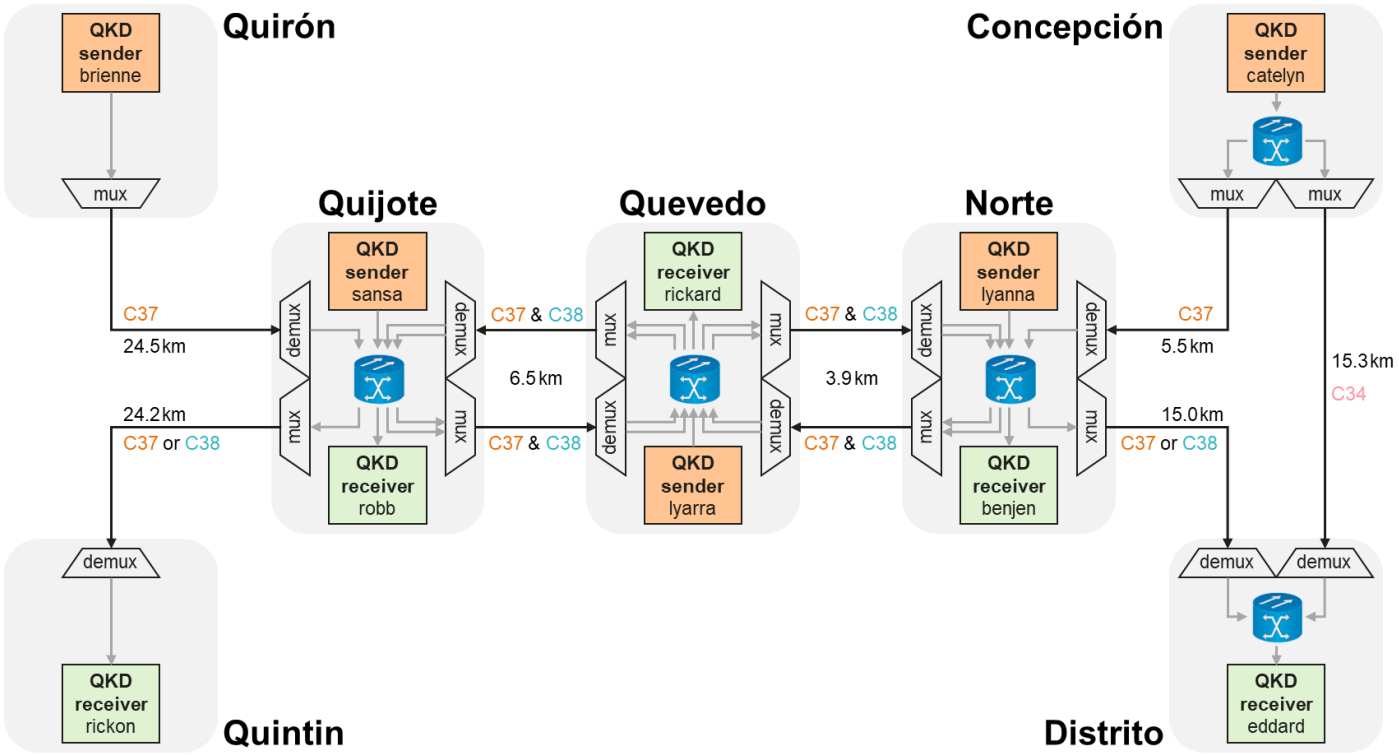
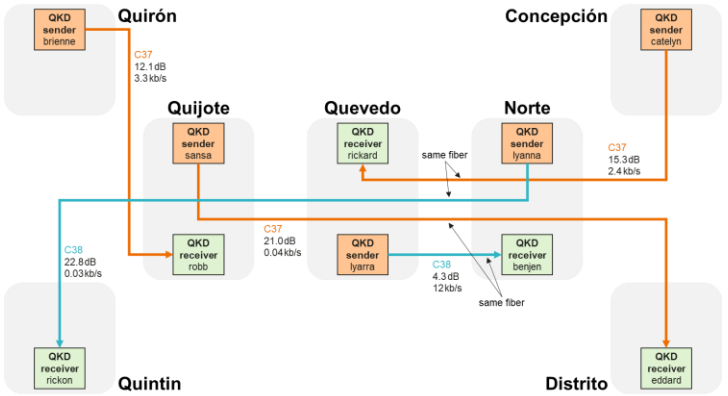
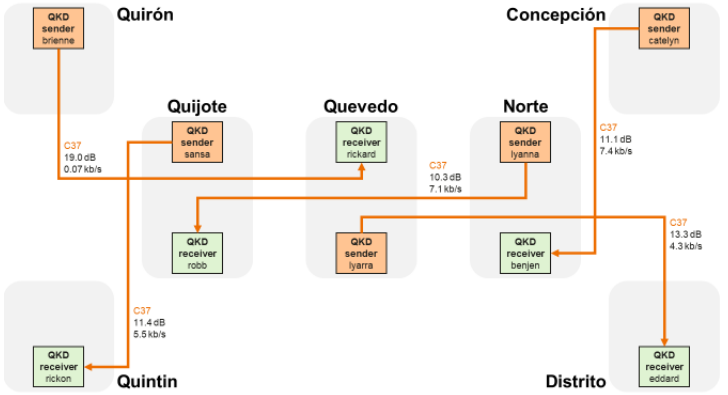
Any-to-any connectivity







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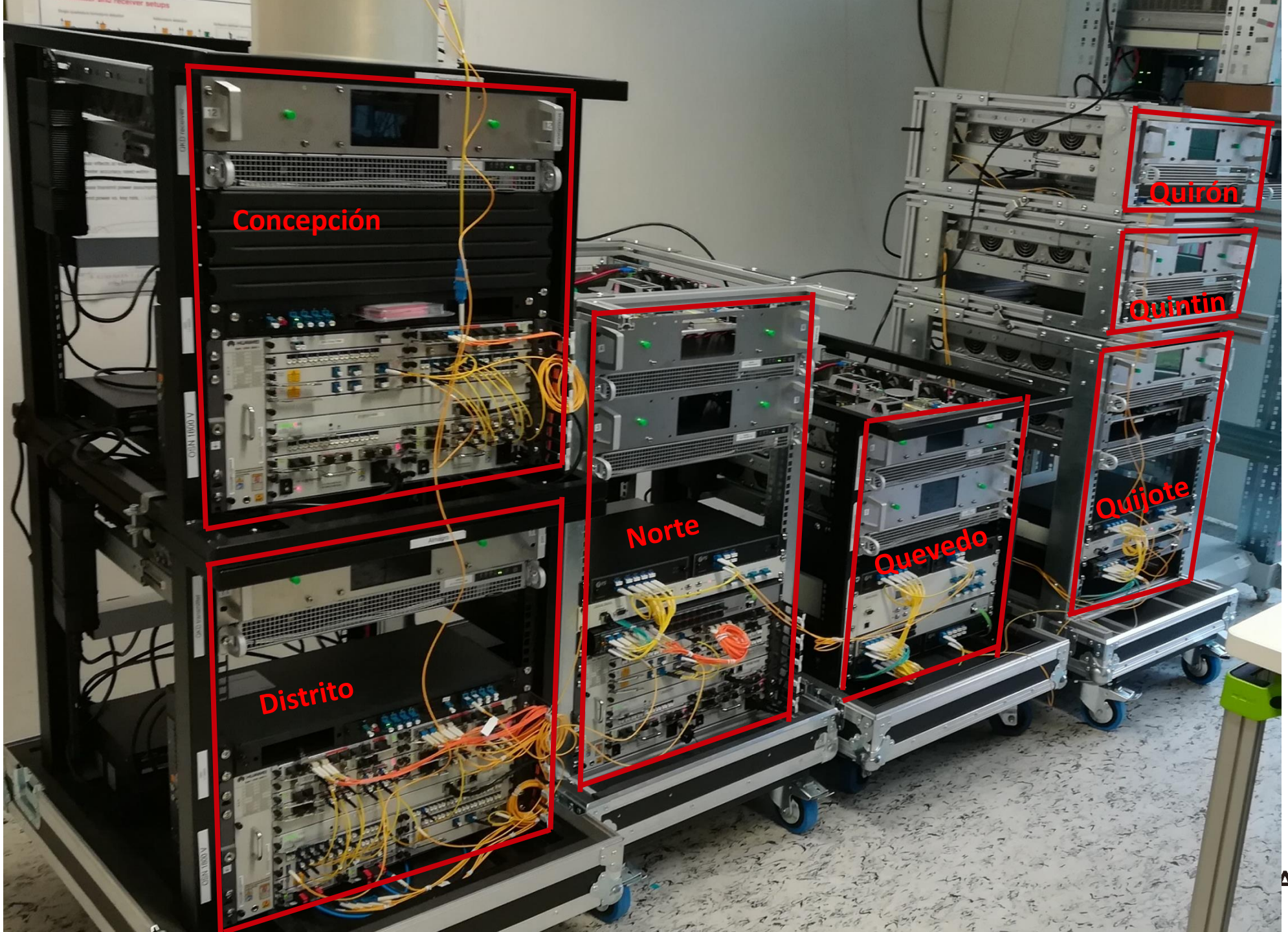
Concepción
Distrito
Norte
Quevedo
Quijote
Quintin
Quirón

Huawei CV-QKD Prototypes

- Thoroughly investigated and robust QKD implementation
- Software-defined for maximal flexibility and central configuration
- Low-cost implementation with a clear road for full integration (and high volume)
- Reach and key rate optimal for metro environment
- High tolerance to co-propagation of classical channels
- Possibility of zero-touch integration (plug into existing OTN without modification)
- Field deployment and integration with existing hardware has been demonstrated
- Any-to-any connectivity with ~N devices in N-node networks

➔ **Scalable towards simpler, cheaper, smaller and more robust implementation**

Thank you.

Bring digital to every person, home and organization for a fully connected, intelligent world.

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