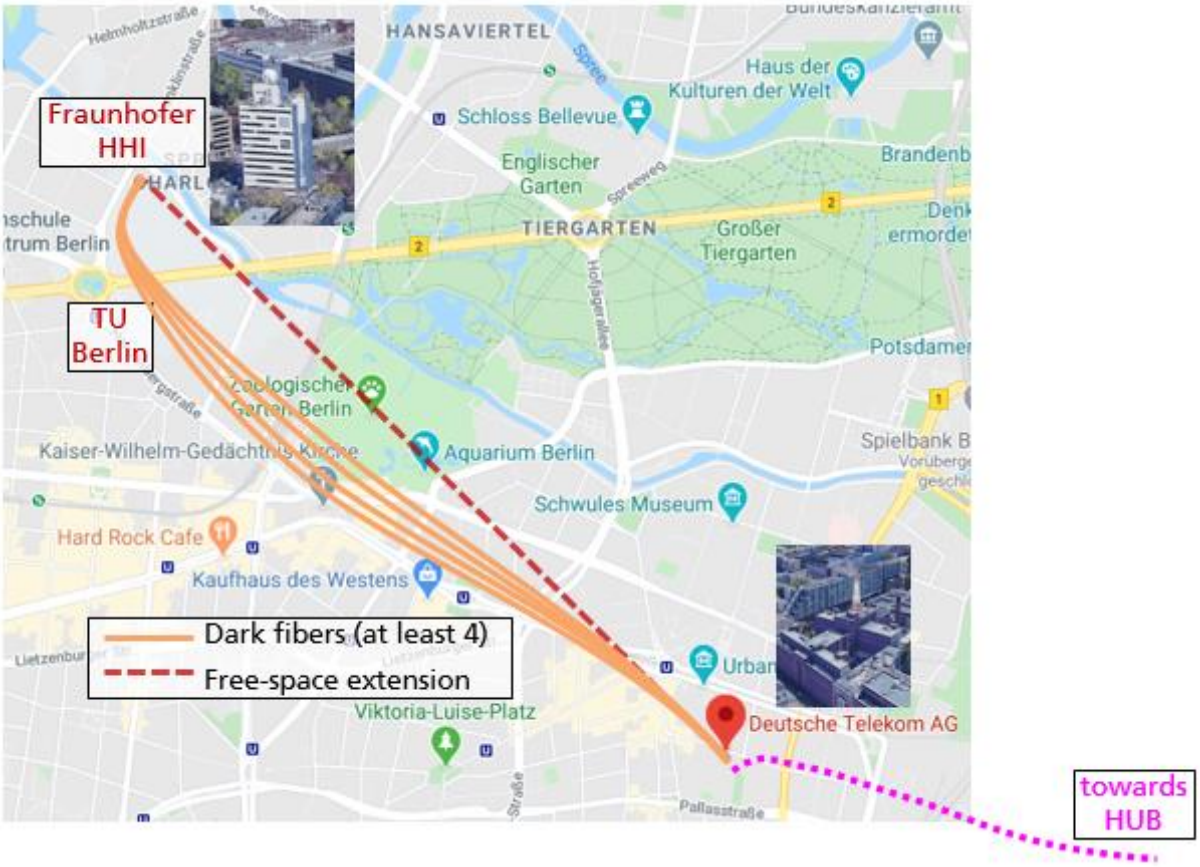
Berlin Quantum Communication Testbed

The Berlin Quantum Communication testbed allows experimental quantum communication between different nodes/buildings over fiber and free space using telecom wavelengths (optical O and C bands).



A: Brief Information

Testbed Title	Berlin Quantum Communication Testbed
Institution/Organization	Humboldt University (HU) of Berlin T-Labs (Deutsche Telekom AG) Fraunhofer Heinrich Hertz Institute (HHI)
Contact	Dr. Marc Geitz, marc.geitz@telekom.de
	Dr. Nicolas Perlot, nicolas.perlot@hhi.fraunhofer.de
Status	active

B: Technical Information

Start Point	End Point	Length [km]	Losses [dB]	Type of Transmission
Fraunhofer-Institut für Nachrichtentechnik, Heinrich-Hertz-Institut (HHI) Einsteinufer 37	Fraunhofer-Institut für Nachrichtentechnik, Heinrich-Hertz-Institut (HHI) Salzufer 15/16	0.3	20	free space link
Fraunhofer-Institut für Nachrichtentechnik, Heinrich-Hertz-Institut (HHI)	Telekom Innovation Laboratories	3.1	30	free space link
Fraunhofer-Institut für Nachrichtentechnik, Heinrich-Hertz-Institut (HHI)	Telekom Innovation Laboratories	7	7	fiber
Telekom Innovation Laboratories	Humboldt-Universität	25	8	fiber
Telekom Innovation Laboratorie	Strausberg	47.3	14.5	fiber
Supported Wavelengths [nm]	C-Band, O-Band			
Type of Fiber	single mode			
Type of Deployment	aerial for free space link and underground for fiber			
Polarization Stabilization	No			
Free Aperture	2 cm			
Adaptive Optics	No			
Quantum Communication Infrastructure	entangled photon pair source at 1550 nm; div. single photon detectors for C- and O-band (SNSPDs array, InGaAs SPADs); DWDM Mux/Demux C-Band DWDM Telecom laser rack; DV-QKD platform incl. Encryptors; RF-Communication link system			
Available Infrastructure for external Parties	access upon request and agreement; available infrastructure: access to entangled photon source, single photon detectors, internet			

C: Additional Information

Linked Projects	• QR.X: https://www.forschung-it-sicherheit-kommunikationssysteme.de/projekte/qr.x • QR.N: https://quantenrepeater.net/

Press Release and Publications	• High-Fidelity Quantum Entanglement Distribution in Metropolitan Fiber Networks with Co-propagating Classical Traffic, 04.2025 • Secure fiber-based quantum communication, • A Flexible Real-Time Quantum Key Distribution System for Fiber and Free-Space Links, 09.2024 • Linking QKD testbeds across Europe, 01.2024 • Experimental validation of DV-QKD-based Qline architecture for metropolitan network on Berlin OpenQKD testbed, 11.2023 • A quantum key distribution testbed using a plug&play telecom-wavelength single-photon source, 03.2022 • Projekt-Kick-off: QR.X treibt Forschung zum Quantenrepeater voran, 10.2021
Demonstrated Milestone	• Massively parallelized DWDM-QKD with more than 1Mbit/s secret key rate over HHI-TLabs-Loop of deployed fiber; • photonic entanglement distribution over HHI-TLabs-Loop of deployed fiber; • continuous FSO QKD over 300m, classical FSO communication over 3km
Outlook	• demonstration of free-space QKD over 5km FSO link between HHI and TLabs; • Entanglement transfer over the direct open-air optical link between HHI & DT (LoS) and fiber optical network; • demonstration of entanglement based QKD; • demonstration of entanglement swapping and quantum teleportation between remote, fiber-coupled nodes
Suggested Use Cases	
Other Comments/ Information	