5G-Advanced for Digitalization of Maritime Operations (ADMO)

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Publications

Task 3.1 Theoretical study of on-ship communication

Task 3.2 Lab evaluation of URLLC communication for on-ship automation

- ***Standards for enabling On-Ship URLLC**, IEEE Conference on Standards for Communications and Networking,* 25–27 November 2024 // Belgrade, Serbia

- ***Spectrum Analysis of Signal Transmission: From Laboratory Environment to Off-Shore Electric Vessel**, IEEE International Conference on Industrial Cyber-Physical Systems, (submitted)* 12-15 May 2025 // Emden, Germany

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Standards for enabling On-Ship URLLC

- URLLC onboard ships requires a 1 ms latency, relying on the PHY and MAC layers of the ship's network.

- ZigBee standard enhances security and networking, while NMEA 2000 and OneNet standards improve ship communication with 1 ms latency and IPv6 support.

- IEEE 802.11n/ac/ax supports speeds up to 9.6 Gbps at short distance and meets the 1 ms URLLC standard, but maritime use is rare.

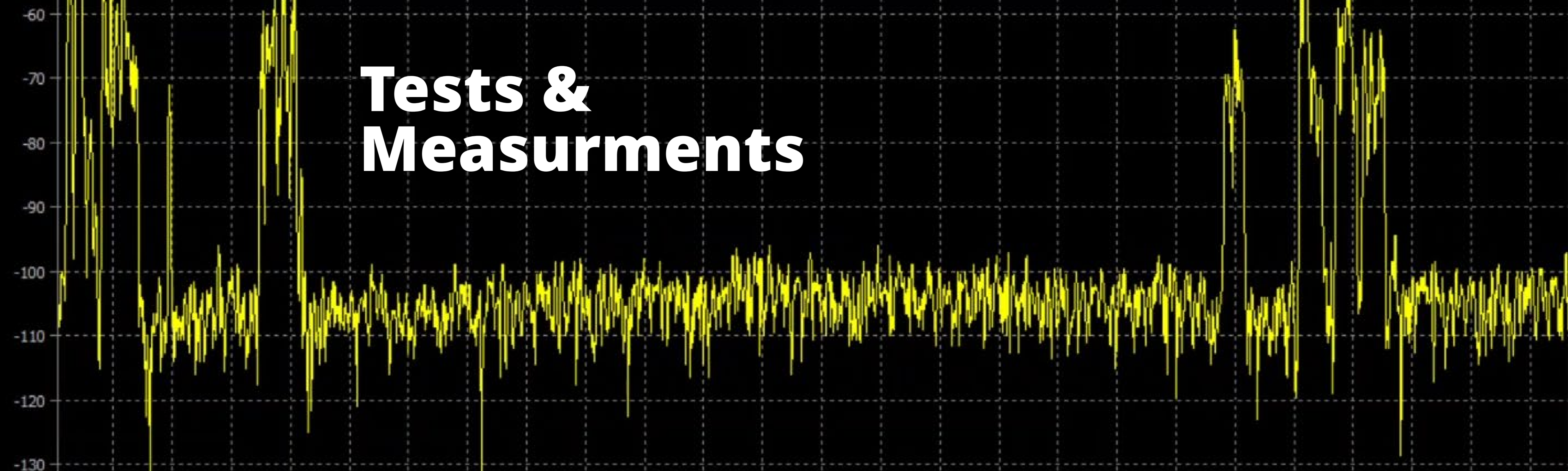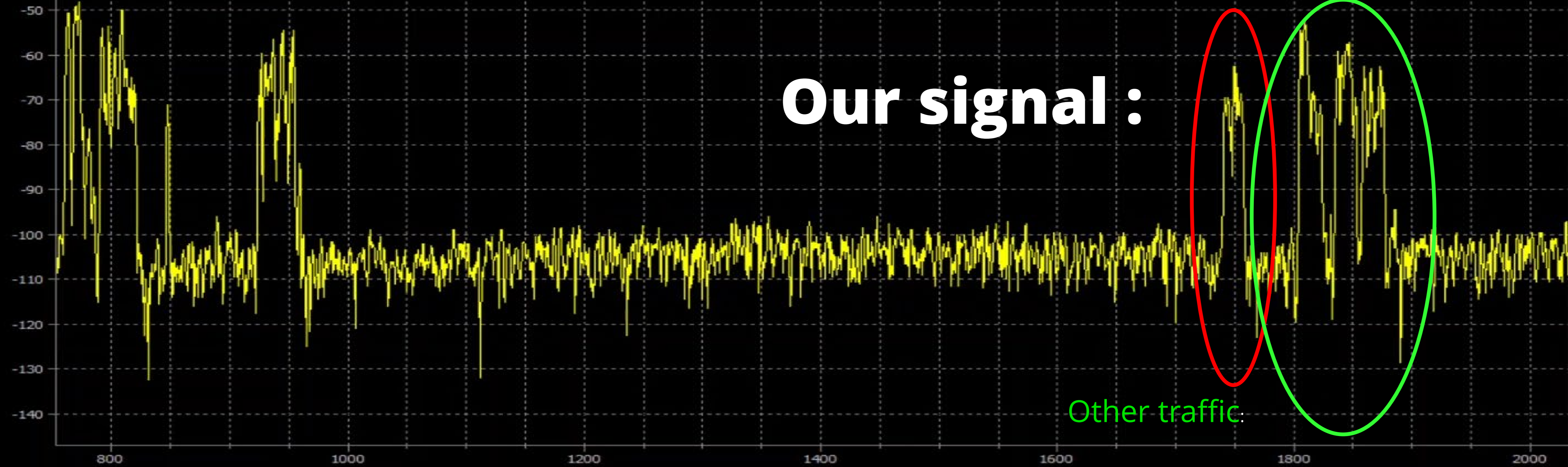# Spectrum Analysis of Signal Transmission: From Laboratory Environment to Off-Shore Electric Vessel

- Minimal signal interference was observed from obstacles like concrete pillars or hydrants in a lab setting

- IoT signal strength remained consistent across various locations on an electric boat.

- Signal power decreased as the boat moved 500 meters from shore, mainly due to distance.

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Finland spectrum tracker

	DNA	Elisa	Telia	Not allocated
	DNA	elisa	●	..l✗

n28, 700 MHz

FDD uplink (703 – 733 MHz)

10.0	10.0	10.0
703-713	713-723	723-733

FDD downlink (758 – 788 MHz)

10.0	10.0	10.0
758-768	768-778	778-788

n20, 800 MHz

FDD uplink (832 – 862 MHz)

10.0	10.0	10.0
832-842	842-852	852-862

FDD downlink (791 – 821 MHz)

10.0	10.0	10.0
791-801	801-811	811-821

n8, 900 MHz

FDD uplink (880 – 915 MHz)

11.6	11.4	11.4
880.1-891.7	891.9-903.3	903.5-914.9

FDD downlink (925 – 960 MHz)

11.6	11.4	11.4
925.1-936.7	936.9-948.3	948.5-959.9

n3, 1800 MHz

FDD uplink (1710 – 1785 MHz)

24.8	24.8	24.8
1710.1-1734.9	1735.1-1759.9	1760.1-1784.9

FDD downlink (1805 – 1880 MHz)

24.8	24.8	24.8
1805.1-1829.9	1830.1-1854.9	1855.1-1879.9

n1, 2100 MHz

FDD uplink (1920 – 1980 MHz)

19.8	19.8	19.8
1920.3-1940.1	1940.1-1959.9	1959.9-1979.7

FDD downlink (2110 – 2170 MHz)

19.8	19.8	19.8
2110.3-2130.1	2130.1-2149.9	2149.9-2169.7

n38, 2600 MHz

(2570 – 2620 MHz)

50.0
2570-2620

Tests &
Measurments

Our signal :

Other traffic

Thank you!