TECHNICAL UNIVERSITY
OF CLUJ-NAPOCA

**2021 Research Conference of Technical University of Cluj-Napoca
October 20-22, 2021**
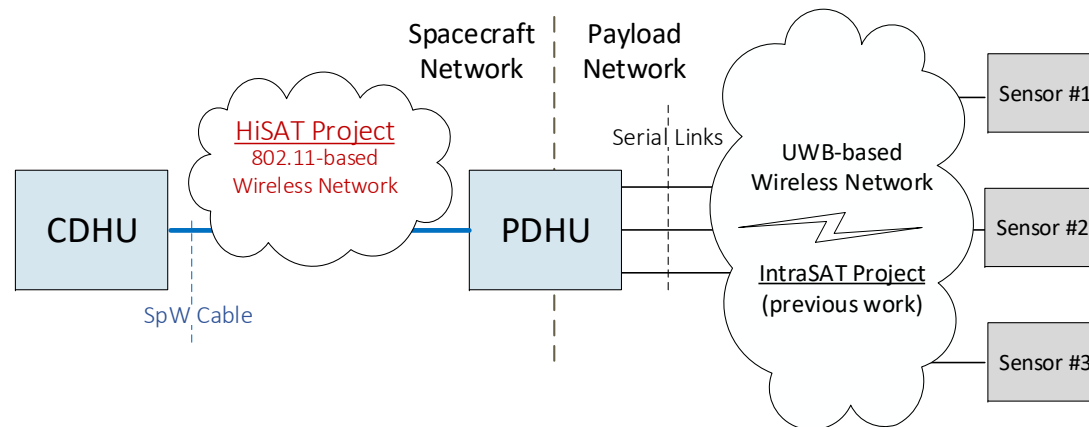
Track 1 - Spatial Applications

Implementation of Wireless Communications Solutions for Intra-Satellite Environments

Centre of Competence for Wireless Intra-SATellite Technologies
Professor, Dr.-Ing. Habil. Emanuel PUȘCHIȚĂ

IntraSAT-Tech
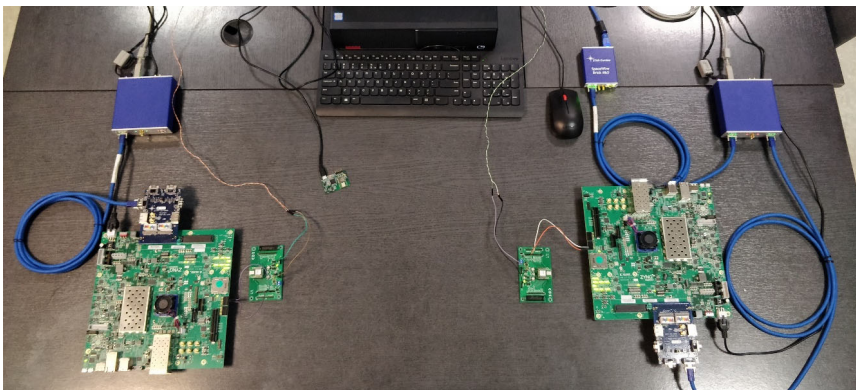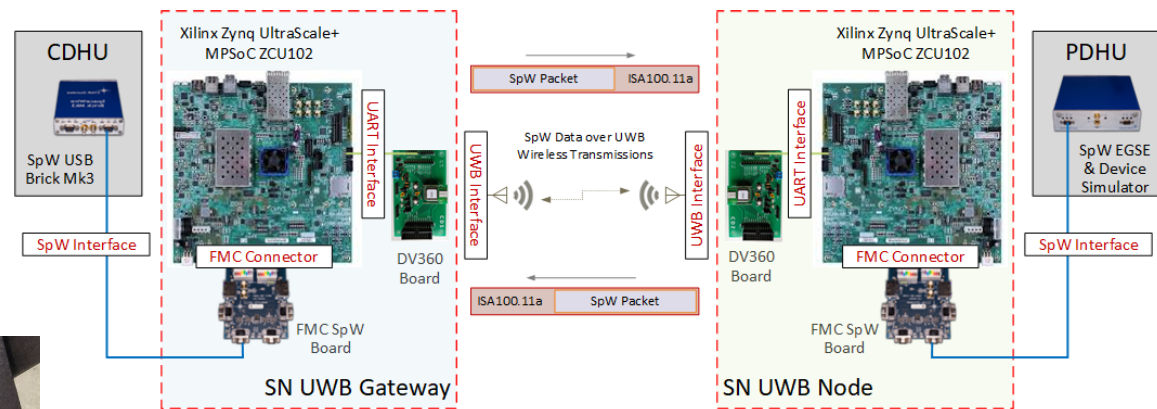
Intra-satellite transmissions

- Intra-satellite communications (EuCROPIS Mission Network Architecture)

Puschita, E., Ratiu, O., Drobczyk, M., Panagiotopoulos, N., Kirei, B., Vos, S., Ratiu, V., Gärtner, T., Pastrav, A., Palade, T., *A UWB Solution for Wireless Intra-Spacecraft Transmissions of Sensor and SpaceWire Data*, **International Journal of Satellite Communications and Networking**, vol. 38, no. 1, Jan./Feb. 2020, p. 41-61, doi: 10.1002/sat.1307. (IF=1.633, Q2).

Intra-satellite Ultra-Wideband (UWB) transmissions

- UWB wireless communications in highly reflective environments (intra-satellite)

- Validation tests on dedicated laboratory testbed (TRL3/TRL4) @ IntraSAT-Tech.

- Sentinel-3 mockup @ IntraSAT-Tech

WiSAT - Wireless Communication Bus for Satellite Applications (2014-2015)

IntraSAT-Tech - Centre of competence for wireless Intra-SATellite Technologies (2016-2019)

Intra-satellite IEEE 802.11ac (MIMO) transmissions

- Implement a High-Throughput Wireless SpaceWire Bridge (up to 200Mbps) for intra-spacecraft communications in order to replace on-board SpW connections

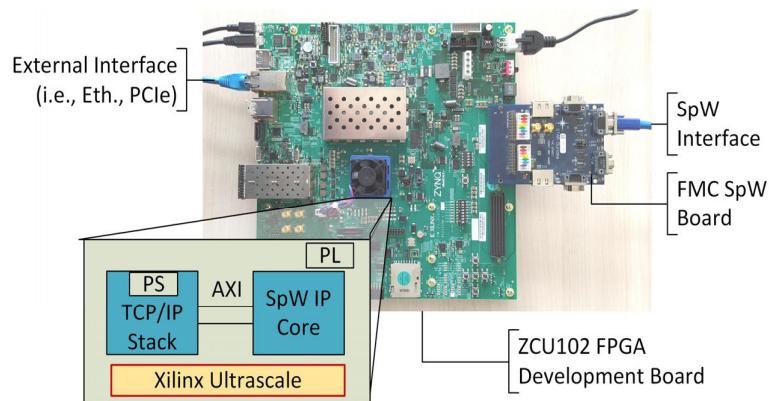- Validation tests on dedicated laboratory testbed (TRL3) @ IntraSAT-Tech.
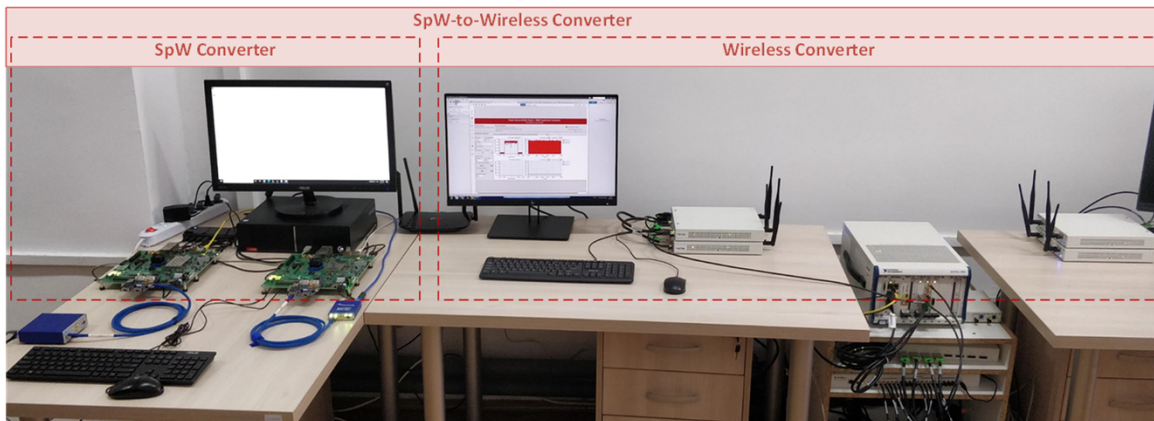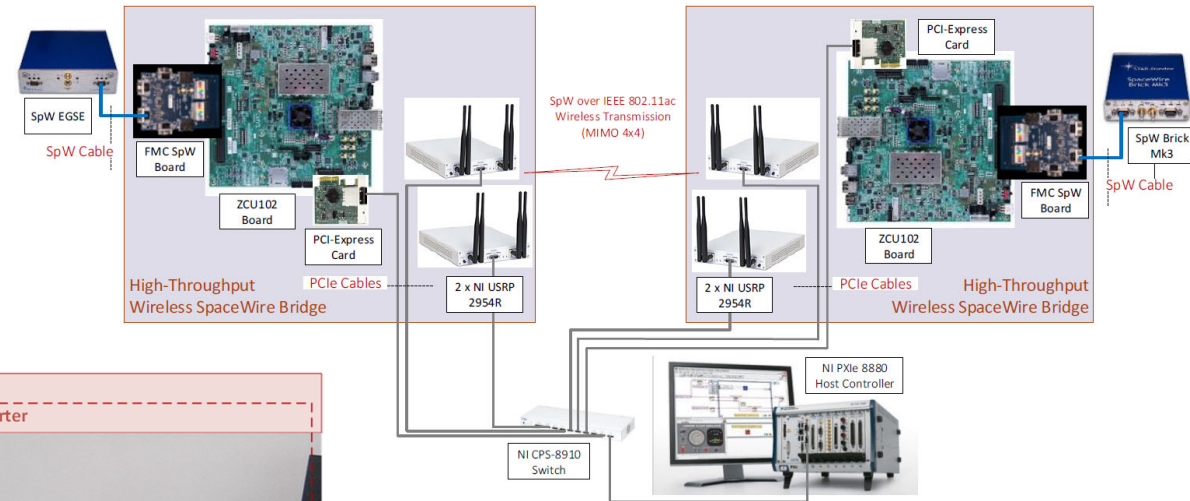
HiSAT - High-Throughput Wireless-SpaceWire Bridge for Intra-Satellite Transmissions (2020-2022)

Intra-satellite IEEE 802.11ac (MIMO) transmissions

- ## SpW Converter

- STAR-Dundee SpaceWire Instrumentation

- Multiple data packets are transmitted repeatedly with a resend delay of 0.1 seconds.

- By increasing the packet payload, the data rate computed by the SpW data reception application increases.

R. Buta, B. Kirei, C. Codau, A. Pastrav, C. Farcas, R. Simedroni, P. DoleaT. Palade, E. Puschita, *Design and Validation of a SpW Converter for Intra-Spacecraft Communications*, 44th International Conference on Telecommunications and Signal Processing (TSP), 2021, pp. 381-385, doi: 10.1109/TSP52935.2021.9522627.
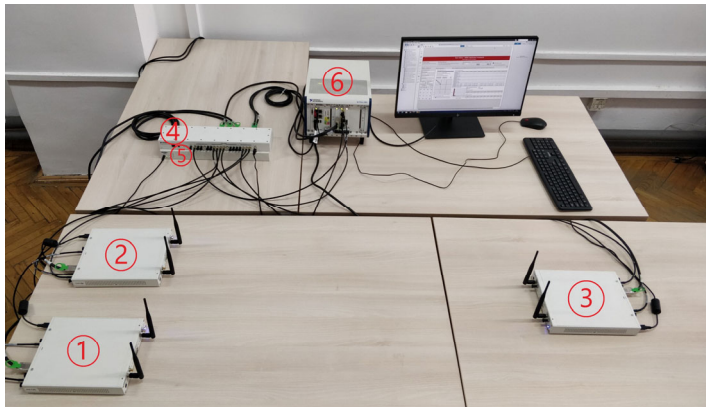
HiSAT - High-Throughput Wireless-SpaceWire Bridge for Intra-Satellite Transmissions (2020-2022)

Intra-satellite IEEE 802.11ac (MIMO) transmissions

• Wireless Bridge

- NI (National Instruments) solutions
- Uplink transmission with two STAs, and an AP with 4 antennas.
- The pseudo-random data is sent using 4 types of modulations: QPSK, 16QAM, 64QAM and 256QAM;
- The SNR is around 25-30dB, and the operating frequency 2.4GHz.
- The performance is evaluated in terms of transmission rate, received throughput, and BLER

C. Codau, R. Buta, B. Kirei, A. Pastrav, R. Simedroni, P. Dolea, T. Palade, H. Hedesiu, E. Puschita, *Design and Validation of a Wireless Bridge for Intra-Spacecraft Communications*, 44th International Conference on Telecommunications and Signal Processing (TSP), 2021, pp. 386-389, doi: 10.1109/TSP52935.2021.9522609.
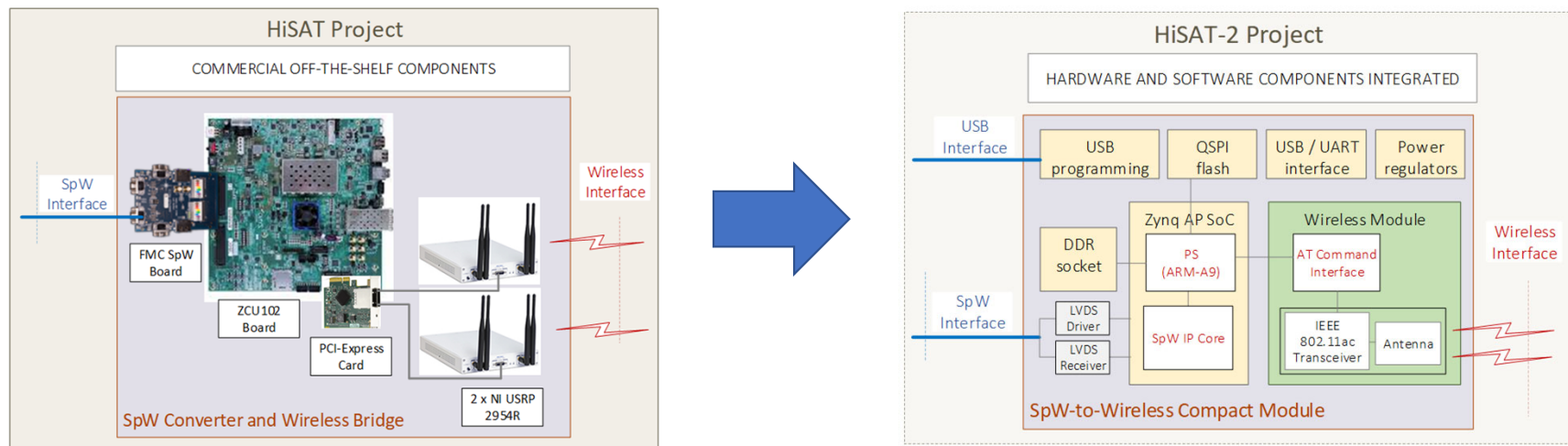
HiSAT - High-Throughput Wireless-SpaceWire Bridge for Intra-Satellite Transmissions (2020-2022)

Intra-satellite IEEE 802.11ac transmissions - Compact Module

- Design and implement a SpW-to-Wireless compact module implementation based on electronic components integrated on a breadboard
- Validation tests on dedicated laboratory testbed (TRL4) @ IntraSAT-Tech.

HiSAT-2 - High-Throughput Wireless-SpaceWire Module for Intra-Satellite Transmissions

Implementation Team | IntraSAT-Tech Members

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Thank You!

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