



Inter-Satellite Link Experiment on PEARL-1A/1B CubeSats

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PEARL-1A and PEARL-1B (Propagation Experiment using kurz-Above-band radio in Low earth orbit) are two 6U XL CubeSats, integrated by National Central University (NCU) in Taiwan. The two CubeSats will be launched into a sun-synchronous orbit at 520 km altitude around 1030 local time sector by SpaceX rideshare mission in February 2026.

To meet the broadband communication requirements (Downlink ≥ 25 Mbps and Uplink ≥ 3 Mbps), each of CubeSats is equipped with K/Ka-band communication payload, Inter-Satellite Link (ISL), and four sets of patch antennas, which are Down-Link Antenna, Up-Link Antenna, Rear-Side RX Antenna, Rear-Side TX Antenna. ISL is designed to support both ground-to-satellite communication and inter-satellite communication, with both operating full-duplex mode. For the ground communication, the downlink operates at 19.6 GHz, the uplink at 29.6 GHz, with a maximum bandwidth of 100 MHz for both. For the inter-satellite communication, Rear-Side RX operates at 19.6 GHz, Rear-Side TX at 29.6 GHz, with a maximum bandwidth of 100 MHz for both.

The transmission path of communication link is designed to using a one-way, from one ground station, PEARL-1B, PEARL-1A, to the other ground station. In an orbital configuration where PEARL-1A follows PEARL-1B, PEARL-1A adjusts its attitude to align with the rear-facing antenna of PEARL-1B, enabling efficient inter-satellite data transmission. ISL will transmit TLE packets, as well as monitoring and scientific data, back to the K/Ka band ground station in NCU via the Down-Link antenna. As a proof-of-concept demonstration, the mission will establish an over-the-horizon indirect communication link between ground stations, utilizing K/Ka-band inter-satellite connectivity rather than traditional skywave or groundwave propagation.