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Radio instrument of Radio and Plasma Wave Instruments (RPWI) aboard ESA JUICE: from Launch, via Lunar-Earth, toward Venus

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This paper provides initial status of Radio & Plasma Wave Investigation (RPWI) aboard Jupiter ICy moons Explorer (JUICE), from the view for its high frequency radio observation capability in 80k – 45MHz.

The high frequency part of this system, i.e., Preamp of RWI and its High Frequency Receiver (HF), is procured by the RPWI team in Austria, France, Japan, Poland, and Sweden. This part enables the characterization of Jovian radio emissions (including gonio-polarimetry), passive radio sounding of the ionospheric densities of icy moons, and passive sub-surface radar measurements. It has an enough capability to detect Jovian radio emissions from magnetosphere (aurora etc.), atmosphere (lightning), and icy moons. Direction and polarization capabilities are first enabled in the Jovian system, to identify their source locations and characteristics.

After the launch on April 14, 2023, the RPWI did the deployment of our antennas. Although it had to wait due to a problem happened with the RIME antenna, all deployments were successfully completed in May 2023. However, immediately after that, we started the life struggling with the spacecraft noise. As a result, new onboard software with the noise reduction function was uploaded in January 2024.

The spacecraft succeeded to do the Lunar-Earth Gravity Assist (LEGA) operation in August 2024. It was the unique opportunity to observe "an airless body" before real icy moons flybys in 2030s. Associated with this observation chance, we executed (1) AKR occultation test for sensing the moons' thin ionospheres, (2) AKR reflection test for sensing the moons' surface and subsurface, (3) AKR polarization measurement test for separating and investigating Jovian northern & southern radio sources, (4) flux calibration test with Solar radio burst comparing the Wind, Parker Solar Probe, Solar Orbiter etc.

Recently, JUICE was passed Venus in August 2025. Next flybys are Earth I (September 2026) and Earth II (January 2029). Arrival to Jupiter will be in July 2031.

This paper reviews those activities in 2023-2025. We also summarize the plans with the proved performances for Jupiter and icy moons in 2030s.