

Thorium Ka-Band Terminal Demo with Telesat - Test report abstract



During the test campaign, involving communication via the LEO3 satellite with Telesat APK Gateway, **positive test results were obtained for the Thorium Space Terminal**, confirming its functionality and usability in data communication with satellites in LEO orbits.

Thanks to the ability to conduct multiple tests runs for selected passes, during test campaign, multiple test variants could be applied, and it was possible to react actively and fast by improving the Terminal, test setup, or test preparation process in the event of a test failure. Thanks to the multiple passes, tests that failed for various reasons did not compromise the verification of the primary test objectives.

Finally, as a result of test campaign the following were confirmed:

- The satellite tracking functionality, in which the radio beam is formed, directed and tracked LEO satellite via an electronically steered flat array antenna
- The EIRP level transmitted from the Thorium Space Terminal was sufficient and with adequate margin within the link budget. The EIRP level Uplinked from the Terminal allowed for sufficient signal-to-noise margin to enable the RTN Uplink modem to set even APSK32 digital modulations in ACM mode.

- For RX part, the Terminal operated correctly, achieving throughputs of ~13 megabits for the FWD Downlink, even though the RX antenna array design was not a full 32x32 array because it lacked four edge 8x8 modules.
- Usable data link throughputs of approximately 13 Mbps upload and approximately 8 Mbps download were achieved for the maximum elevation points in a given pass.
- Several video calls were made, confirming the real and practical usability of the Terminal and the proper technologies developed by Thorium Space
- The operation of the entire conversion chain (two frequency conversions) and RF signal conditioning in both the TX and RX paths was confirmed.
- It was confirmed that the demonstration platform tested in this test campaign is justified in its form, and thanks to its modular design, various modules and subsystems can be tested in the future without building new platforms.
- Thanks to Telesat's generosity and the workshop and laboratory resources they provided, it was possible to quickly modify and improve the Terminal if any shortcomings were identified.

Tests also revealed room for further improvements and enhancements to the Thorium Space Terminal. These include:

- Improving stability during startup
- Implementing additional self-diagnostics for the Terminal modules
- Adding more parameters to be logged to the log list
- Balancing the RF path to a wider dynamic range, allowing for a wider signal range from the modem without introducing additional nonlinear distortion caused by overdriving the RF amplifier stages.
- Increasing the G/T value by reducing the NF and increasing the gain in the RX input section, i.e. the number of the antenna modules.

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