2010 Innovation Partnership Program Innovation Fund

Demonstration of Gbps Data Rates through a Ka-Band Space TWTA

NASA Glenn and L-3 Communication Systems-West

Goal:

- Meet Agency future high data rate requirements by enhancing Ka-band space communications data link throughput by 20X or higher

State-of-Practice for High Data Rate:

- Data transmission rate from space-to-Earth is 100 Mbps QPSK at K-band for the Lunar Reconnaissance Orbiter (LRO)

Objective:

- Using a software-defined modem with bandwidth efficient modulation capability and a high-power high-efficiency space traveling-wave tube amplifier to demonstrate
  - >1 Gbps data throughput in a 500 MHz wide channel &
  - >4.5 Gbps data throughput in a 3 GHz wide channel at Ka-Band

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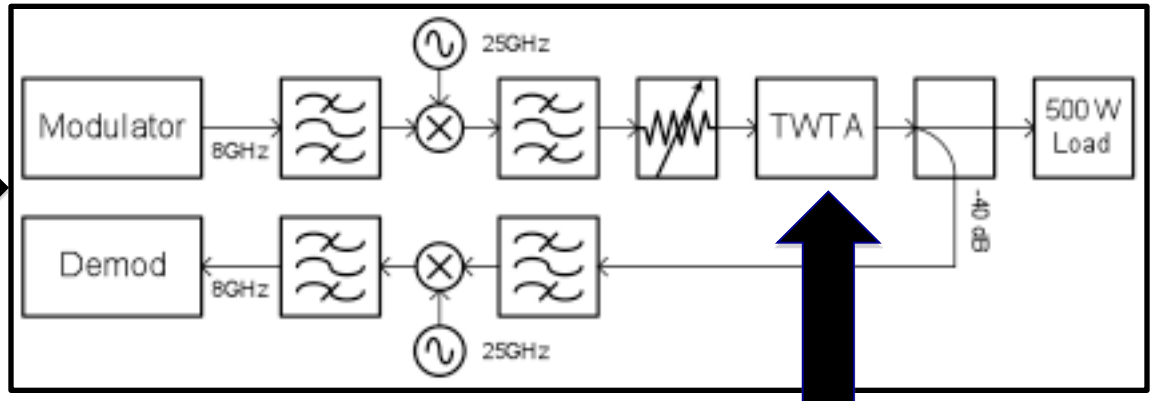
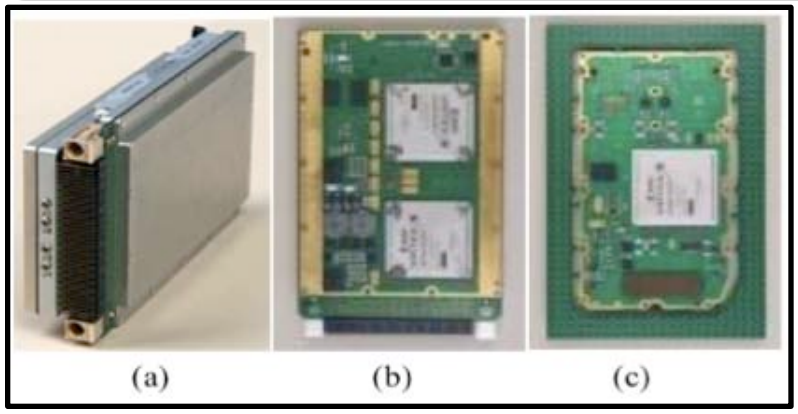
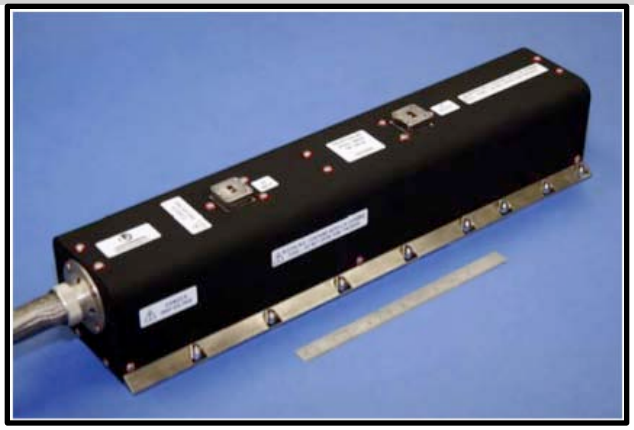
System Level Block Diagram of the Experimental Set Up



Software-Defined Modem



Ka-Band Traveling-Wave Tube Amplifier



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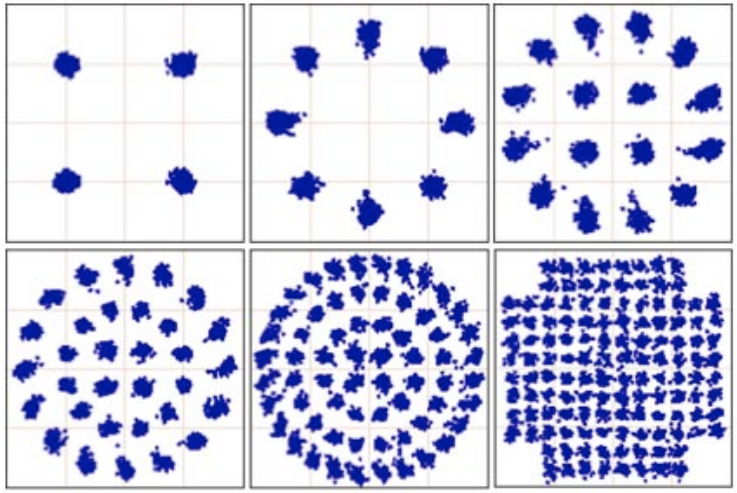
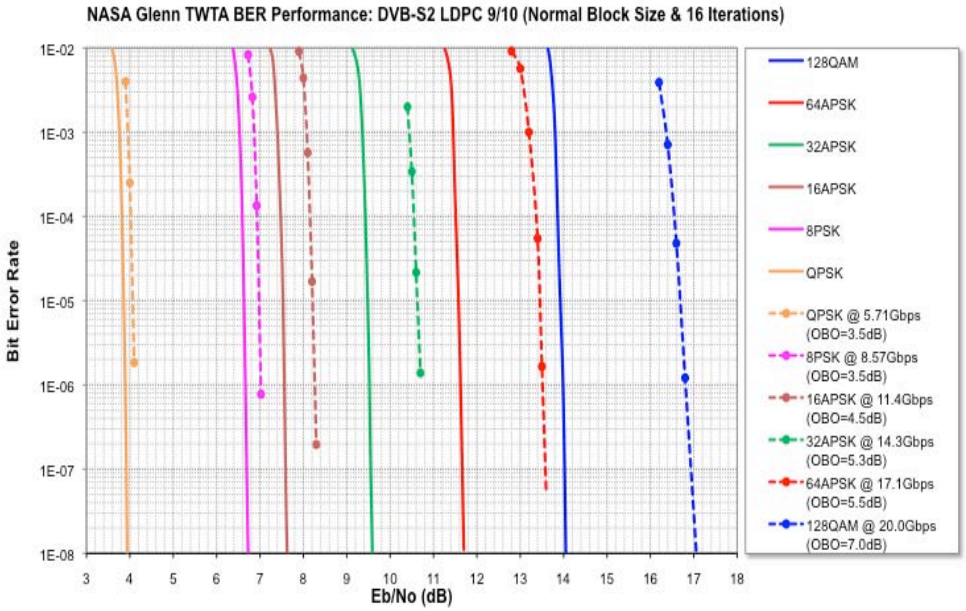
Hardware-True Emulations of a Space-to-Ground Link with NASA's Space-Qualified, High-Efficiency 200 W Ka-Band TWTA, Digital Pre-Compensation, and the Industry Standard DVB-S2 Waveforms



Received Constellations: QPSK, 8PSK, 16APSK, 32APSK, 64APSK & 128QAM



Test Demonstration Conclusions

RF links offering >20 Gbps (data rates >20 X) are realistic with today's technology—subject to mission-specific link budgets