

# Powerline Communication for Spacecraft and Instruments

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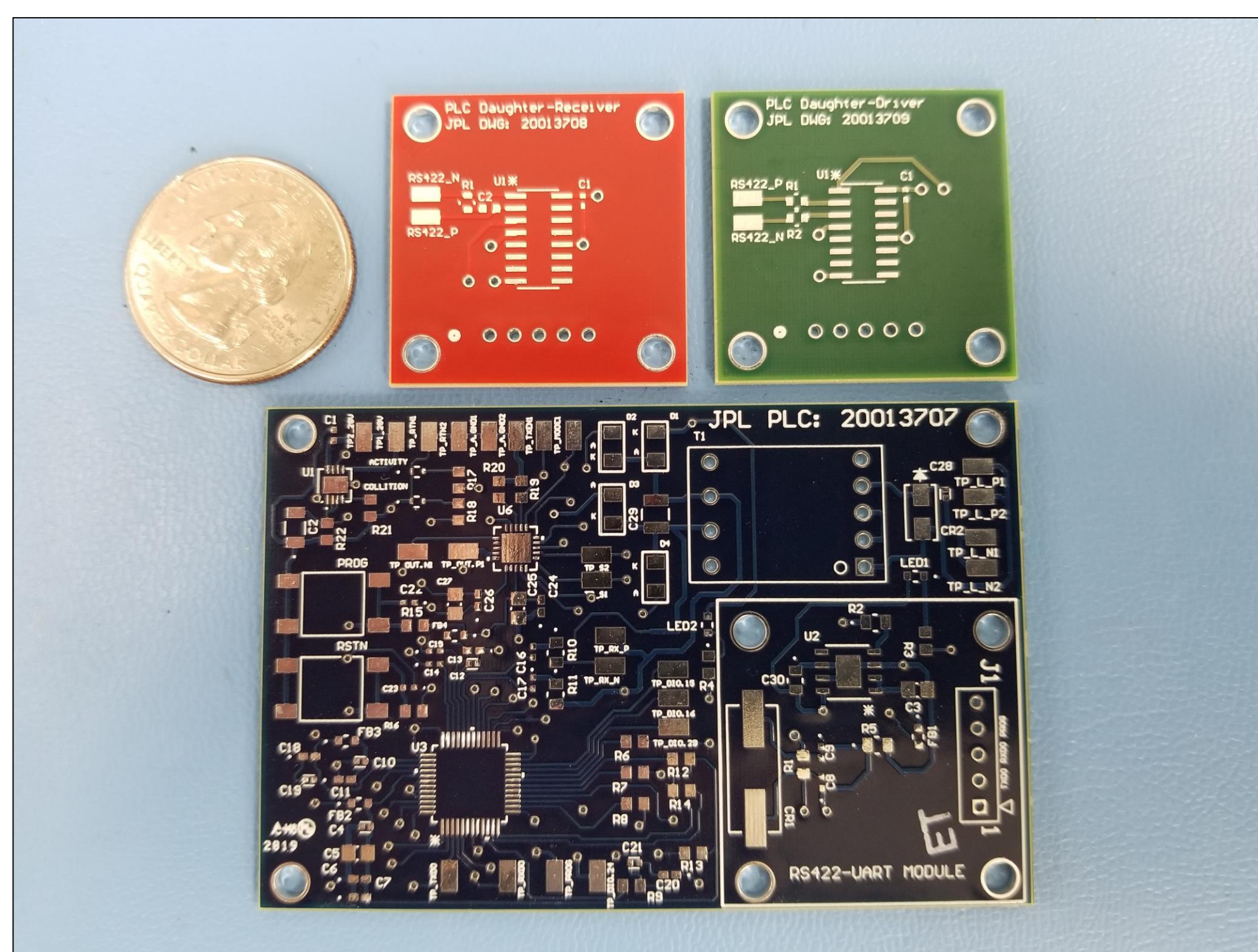
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Program: Strategic Initiative

PLC technology presents an opportunity to decrease mass and complexity of spacecraft and GSE harnessing

## Project Objective: Enable simpler and more capable spacecraft through elimination of data harnessing with powerline communication (PLC)

- Survey, evaluate, and document power bus noise and the frequency spectrum of PLC technologies
- Demonstrate PLC functionality through a spacecraft to instrument like interface
- Characterize the robustness of the PLC interface through EMI/EMC and environmental testing



PLC Prototype/Daughter Card PWB



PLC Prototype Thermal Ambient Test Setup

## FY18/19 Results:

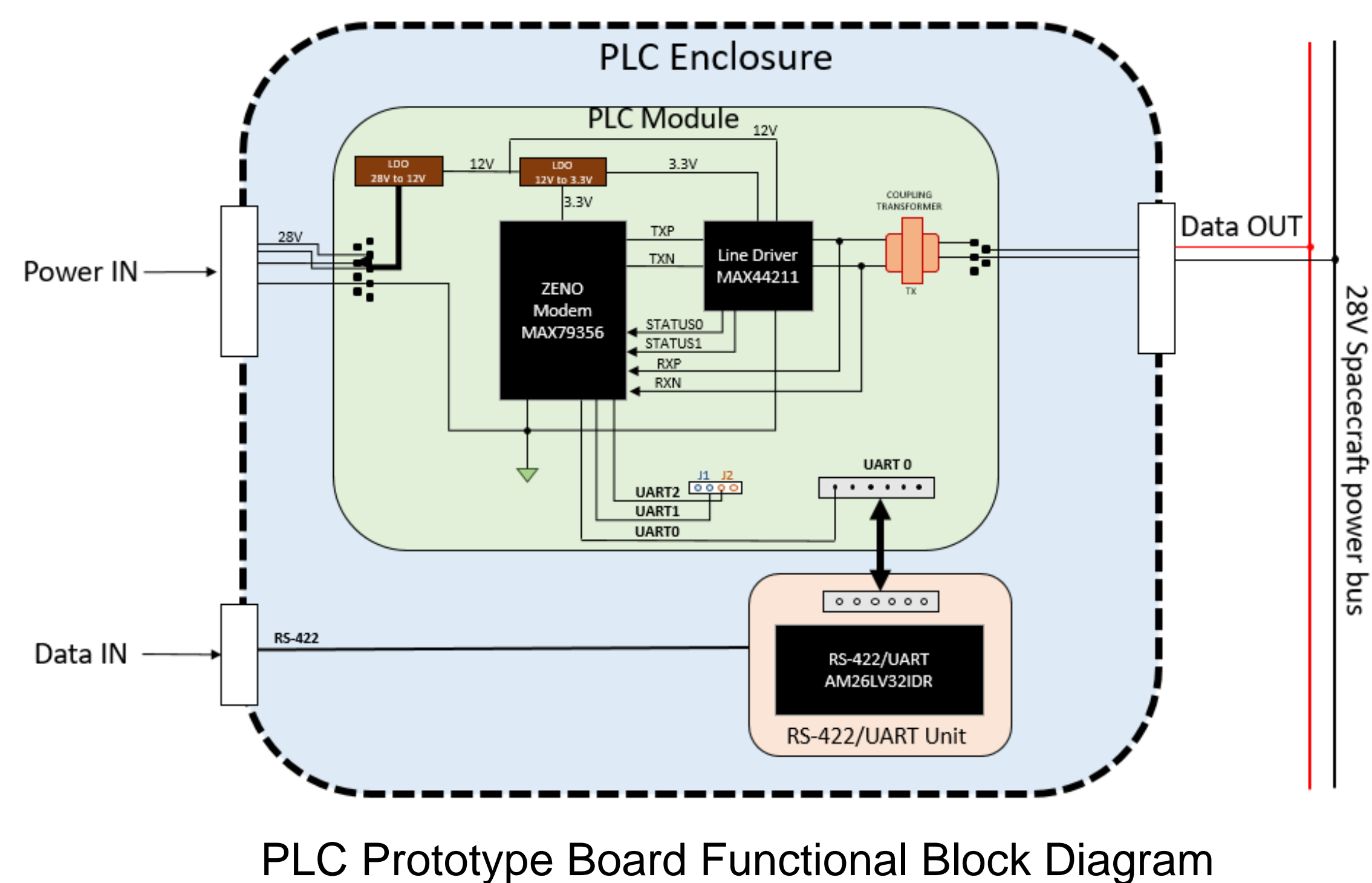
Primary objectives of FY19 were the design, fabrication, and test of a custom JPL PLC Prototype module using a radiation tolerant commercial off the shelf (COTS) PLC modem. Basing the design around the MAX79356 PLC modem, a set of PLC Prototype boards was created and both functional and environmental testing carried out. Full-duplex (bidirectional) communication across a standard 28V spacecraft bus was achieved with a maximum data rate of 180kbps. No loss of data rate was observed during thermal ambient testing between -35C and 55C, closely matching typical allowable flight temperatures (AFT) for JPL missions.

National Aeronautics and Space Administration

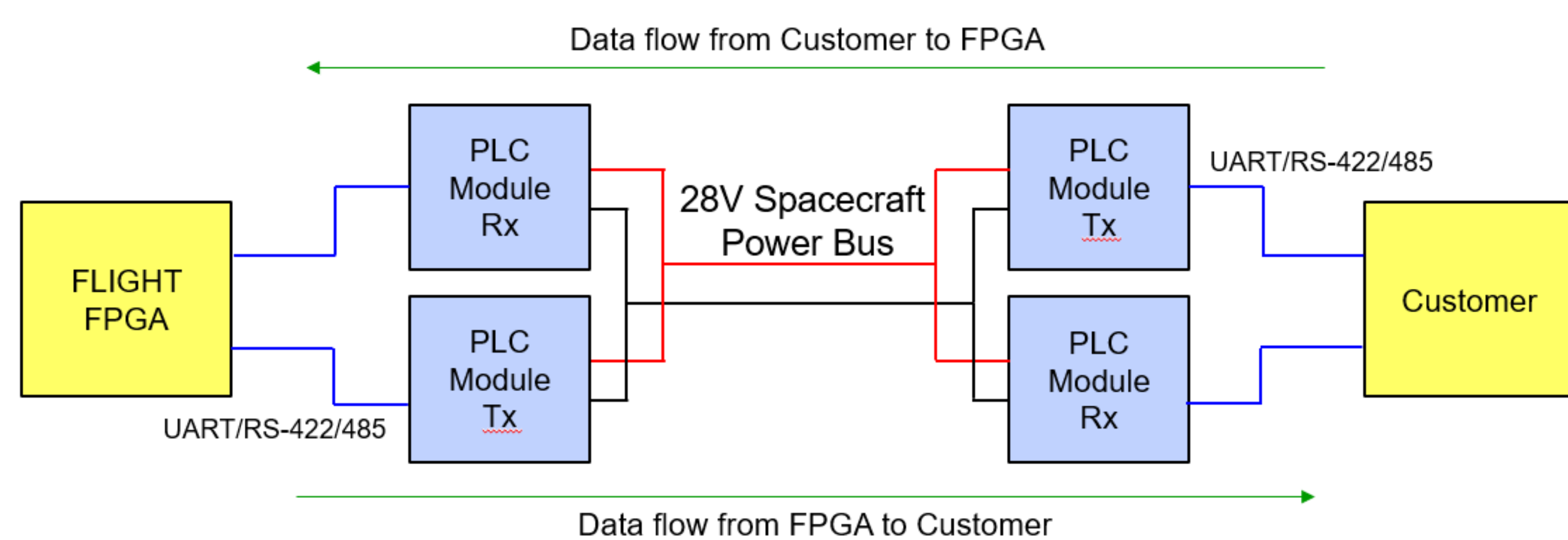
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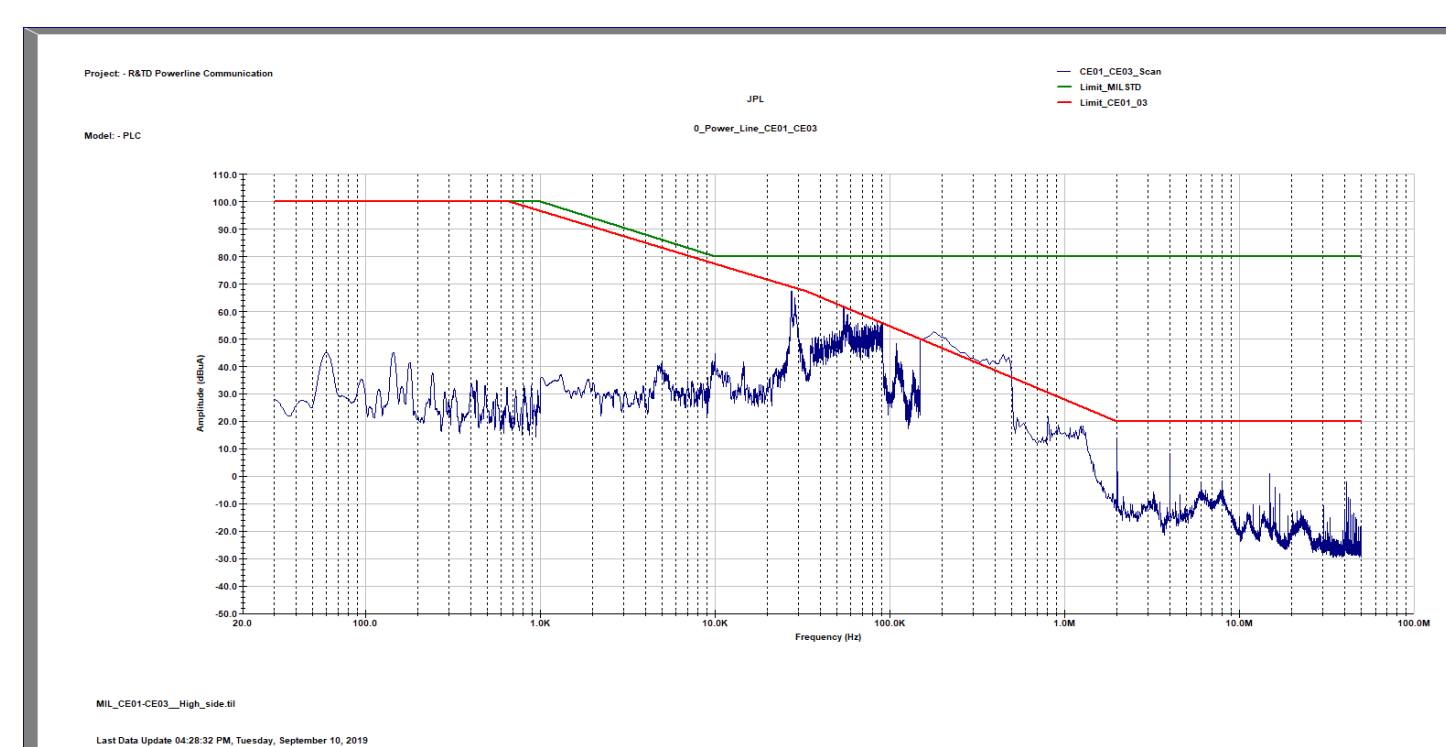
PLC Prototype Board Functional Block Diagram



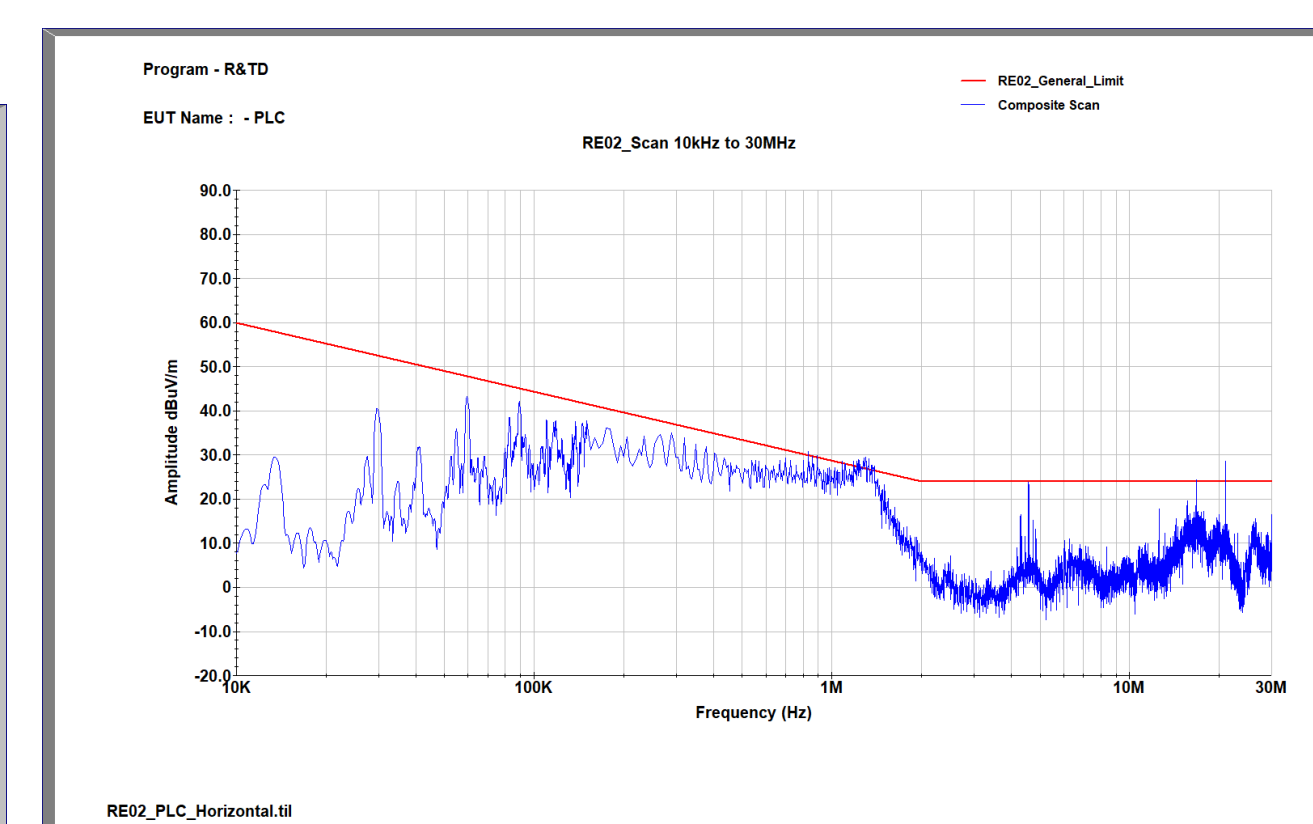
PLC Prototype System Block Diagram

## Benefits to NASA and JPL:

- Reduction in spacecraft harnessing mass and telemetry/command interface complexity
- Creates simpler instrument/spacecraft interfaces, more straightforward instrument packaging, and the capability for more deployable instruments
- With PLC the NuSTAR mission conductor count between spacecraft and instrument could have been reduced by 32.6%, resulting in a mass reduction of 1.36kg
- This reduction in mass provides the capability to add additional instruments or fuel to the spacecraft, enabling greater science and mission possibilities.



CE01/03 28V High Side Power Line



RE02, Vert. Pol. 14kHz - 30MHz

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