

Architecture and Design of the McMaster NEUDOSE Communication Radio Subsystem

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I. Objective/Motivation

The communication subsystem is responsible for ensuring robust communication between the McMaster NEUDOSE CubeSat and the Ground Station located at McMaster University. This subsystem sends the collected scientific data, system telemetry (health), and telecommand from the onboard instruments using two different communication radio frequencies.

II. Communications Module

Key Objectives:

- I. Obtain scientific data
- II. Obtain telemetry regarding full system and sub-system health
- III. Send telecommands to update satellite operations in orbit

Modes of Operation (Full-Duplex):

- 1) Receive Mode (Always On)
- 2) Beacons Mode (Satellite ID, Latest Telemetry)
- 3) Downlink Mode (Full Telemetry, Science Data, Update Operational Commands)

Hardware Characteristics:

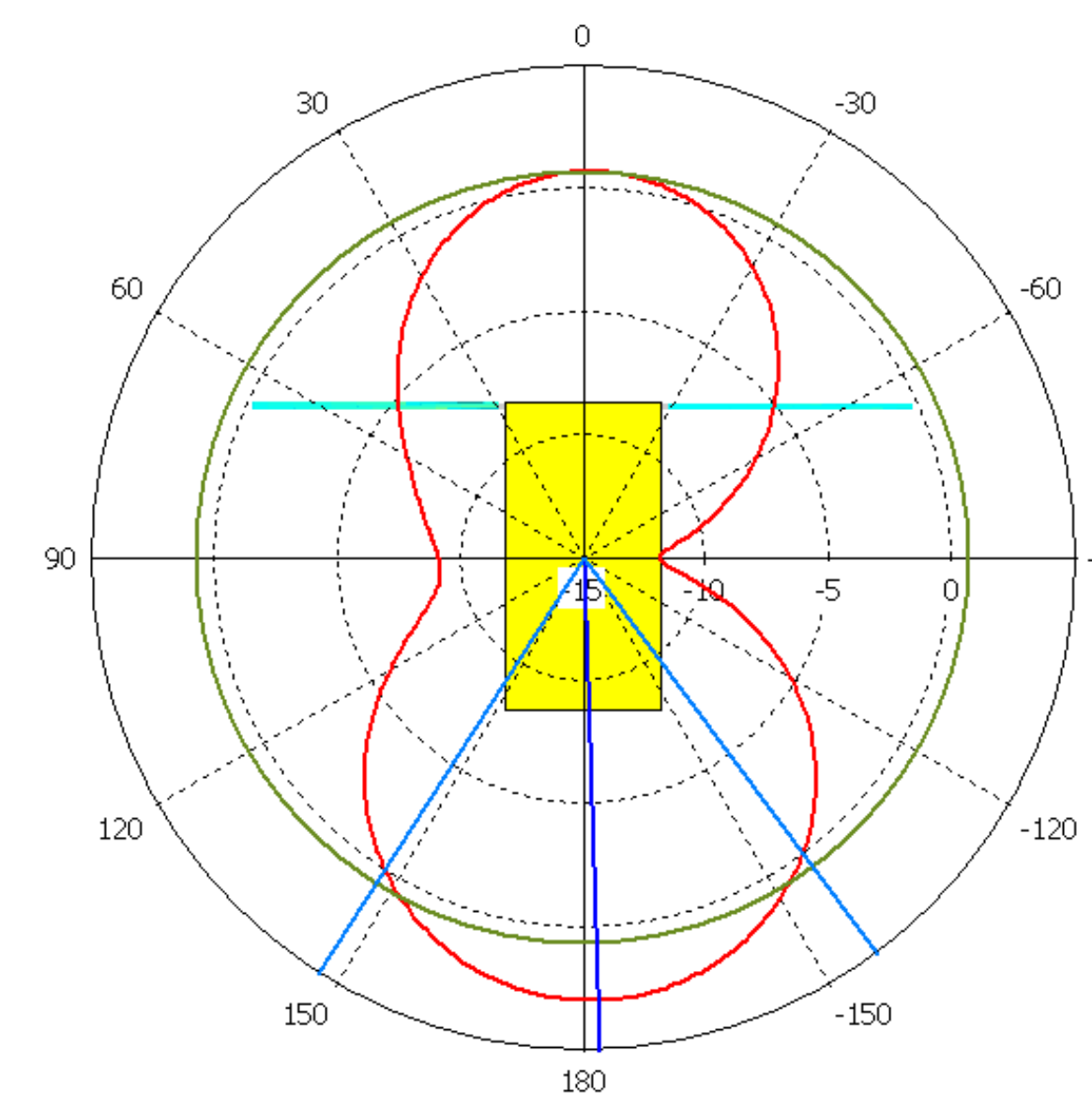
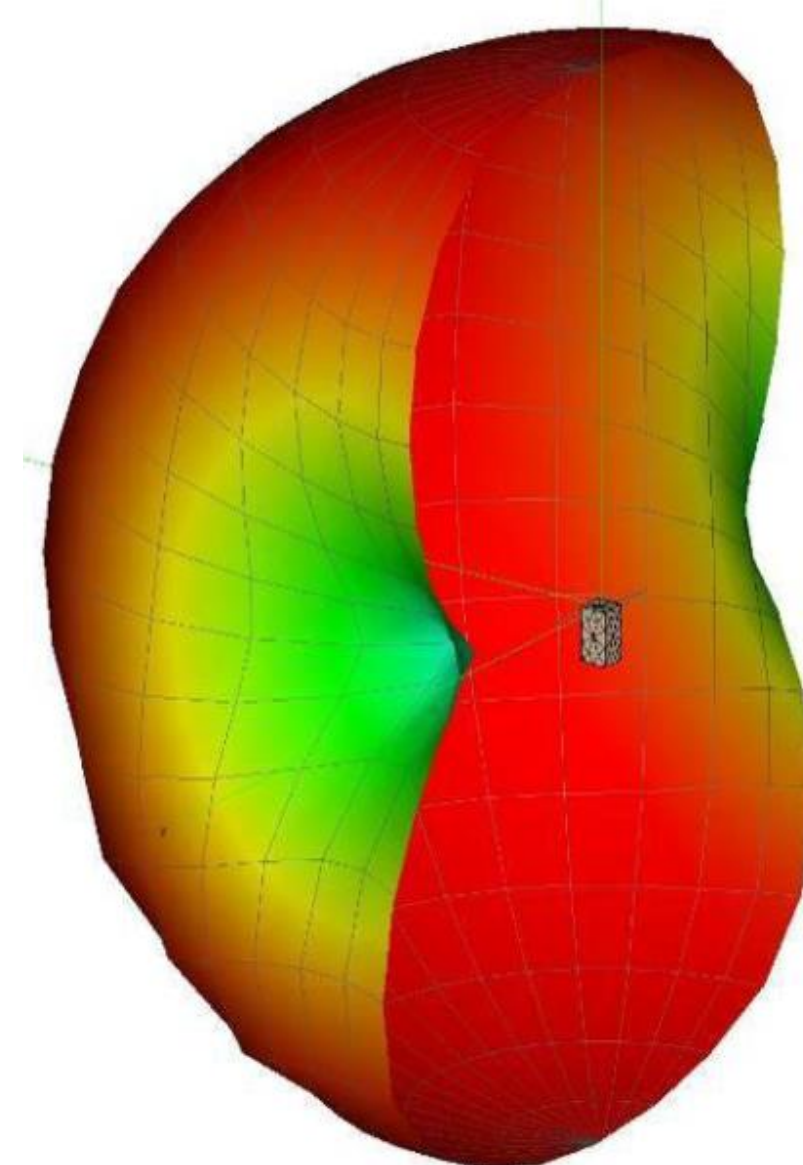
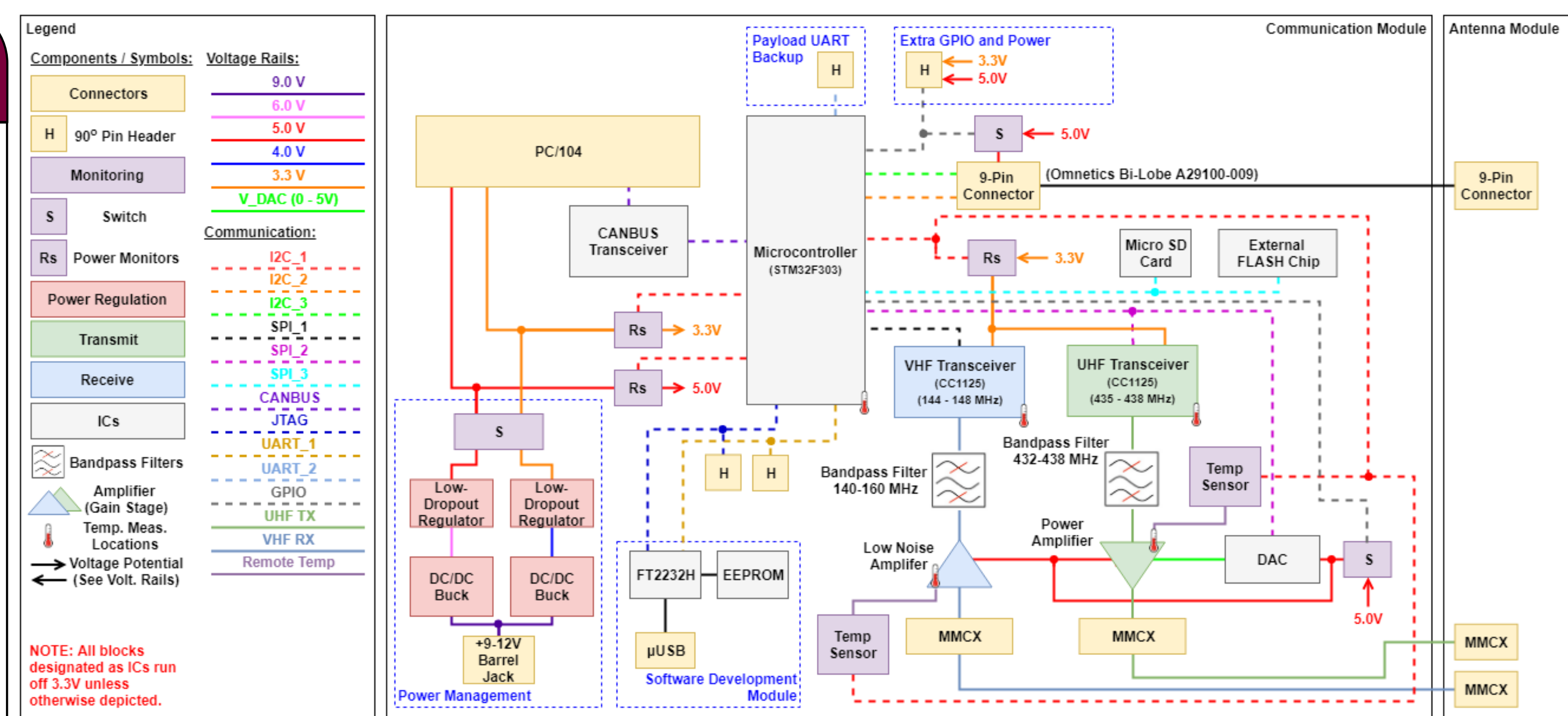
- 2 W (33 dBm) RF Output
- Designed on the Pumpkin CubeSat Kit PCB PC/104 specification

Uplink:

Amateur VHF Band
(144 – 148 MHz)
BW = 20 kHz (1 Channel)

Downlink:

Amateur UHF Band
(435 – 438 MHz)
BW = 25 kHz (1 Channel)



III. Software

Application Firmware: Programming written to the communication board's memory to control various hardware devices and systems

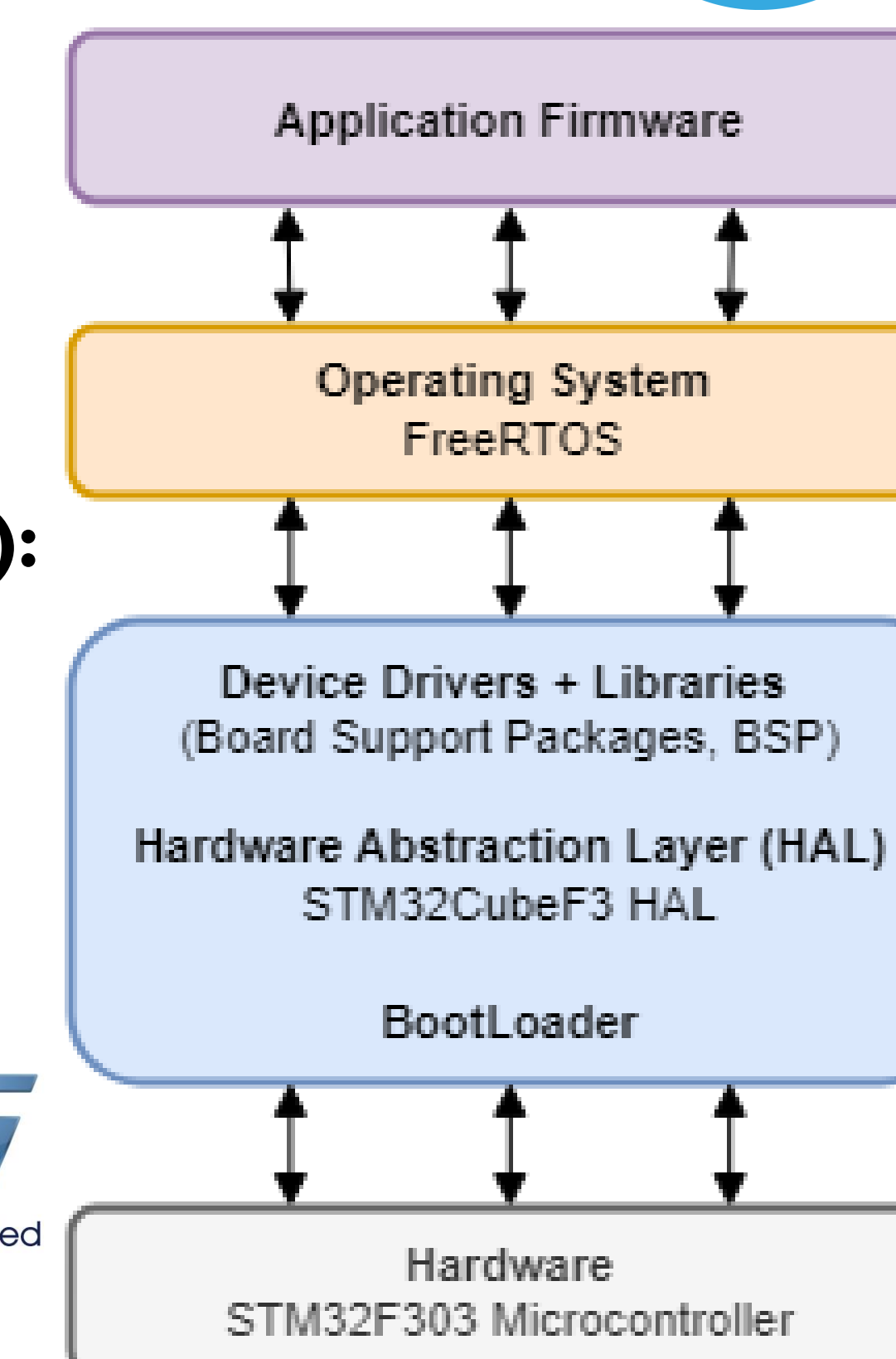
Operating System: FreeRTOS

Device Drivers + Libraries: Communication Module board support packages (BSPs)

Hardware Abstraction Layer (HAL): Hardware drivers provided by STMicroelectronics STM32CubeMX software

Bootloader: Software redundancy for multiple firmware images (i.e. Working Version and Golden Image)

Hardware: STM32F303
STMicroelectronics Microcontroller (ARM Cortex-M4 from ST)



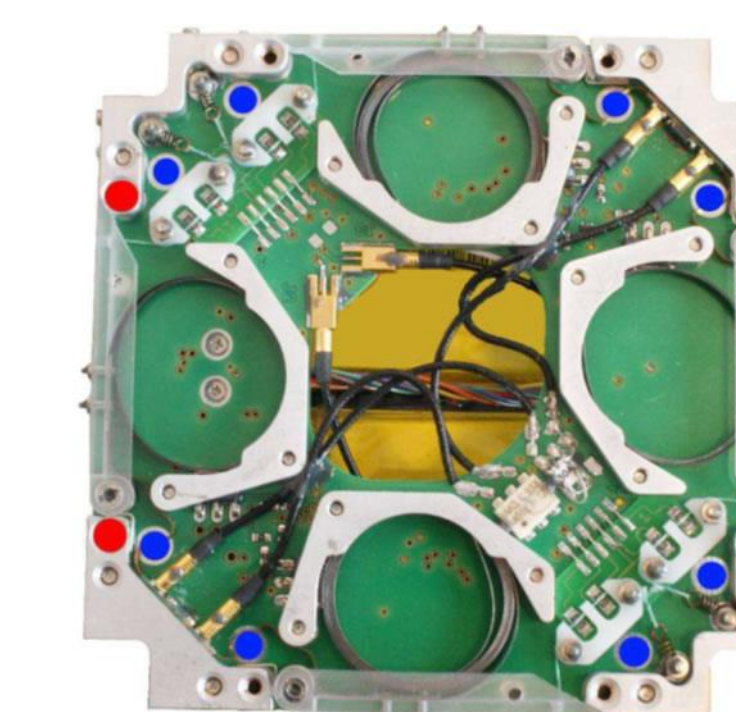
IV. Antenna Module

Commercial-off-the-shelf (COTS) module developed by *Innovative Solutions in Space*

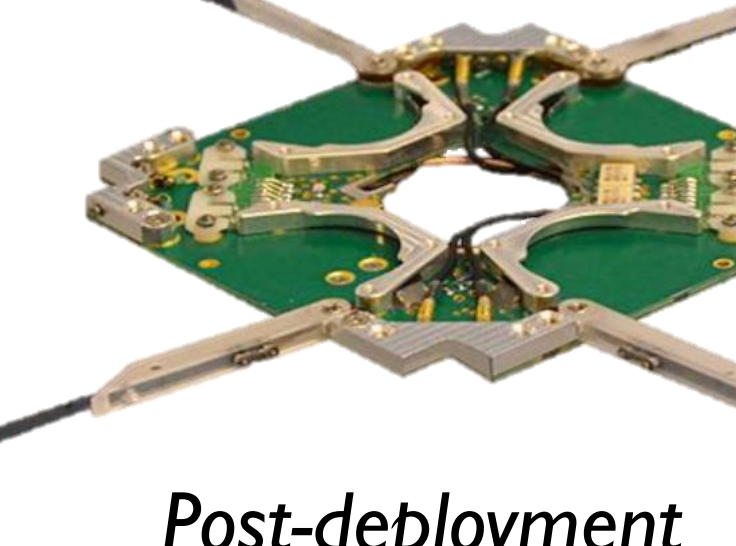
TRL: 9

Flight Heritage: Since July 2010, 50 successful deployments in space

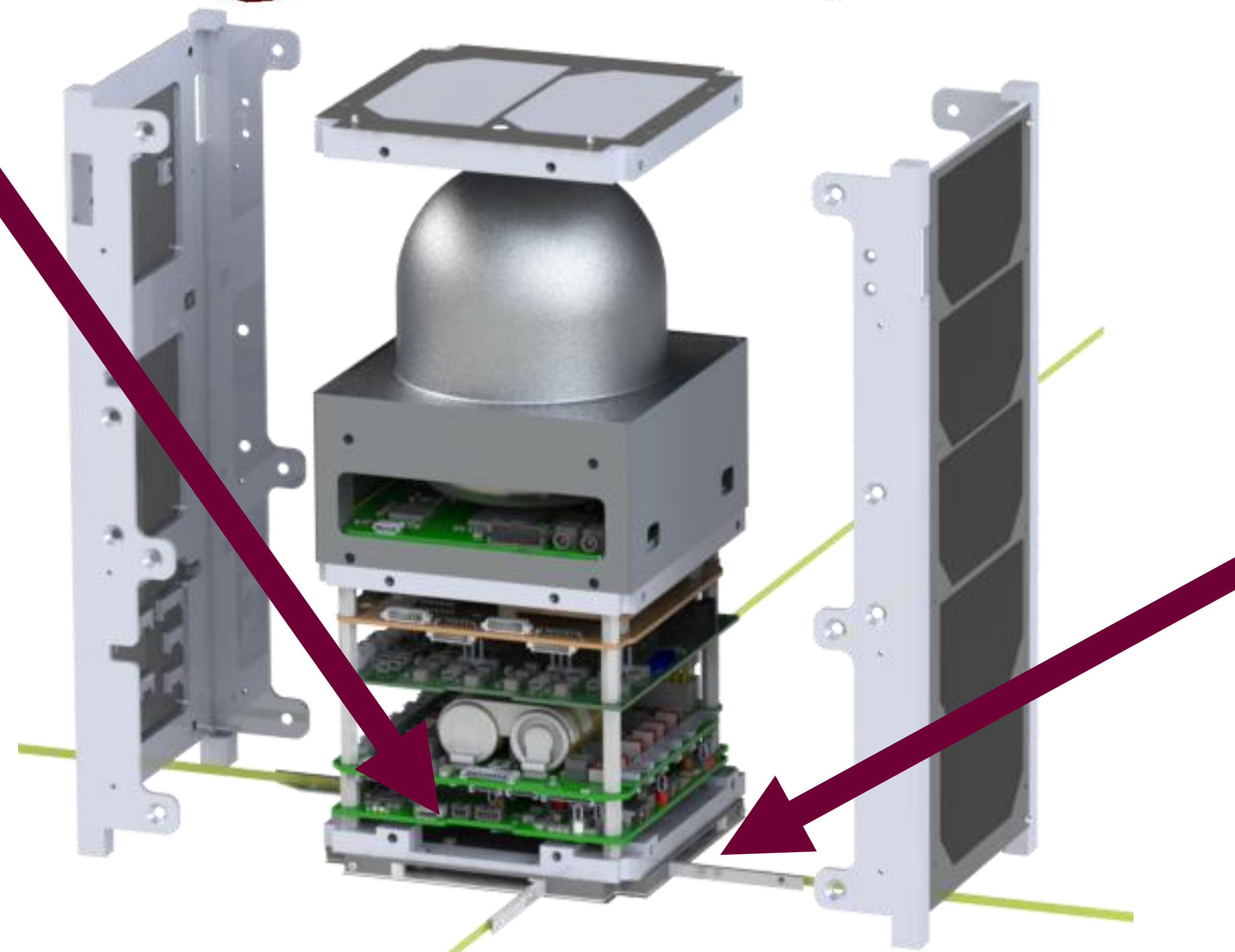
Deployment Time: 3 seconds per arm (30 second safety limit) @ 2 W Power



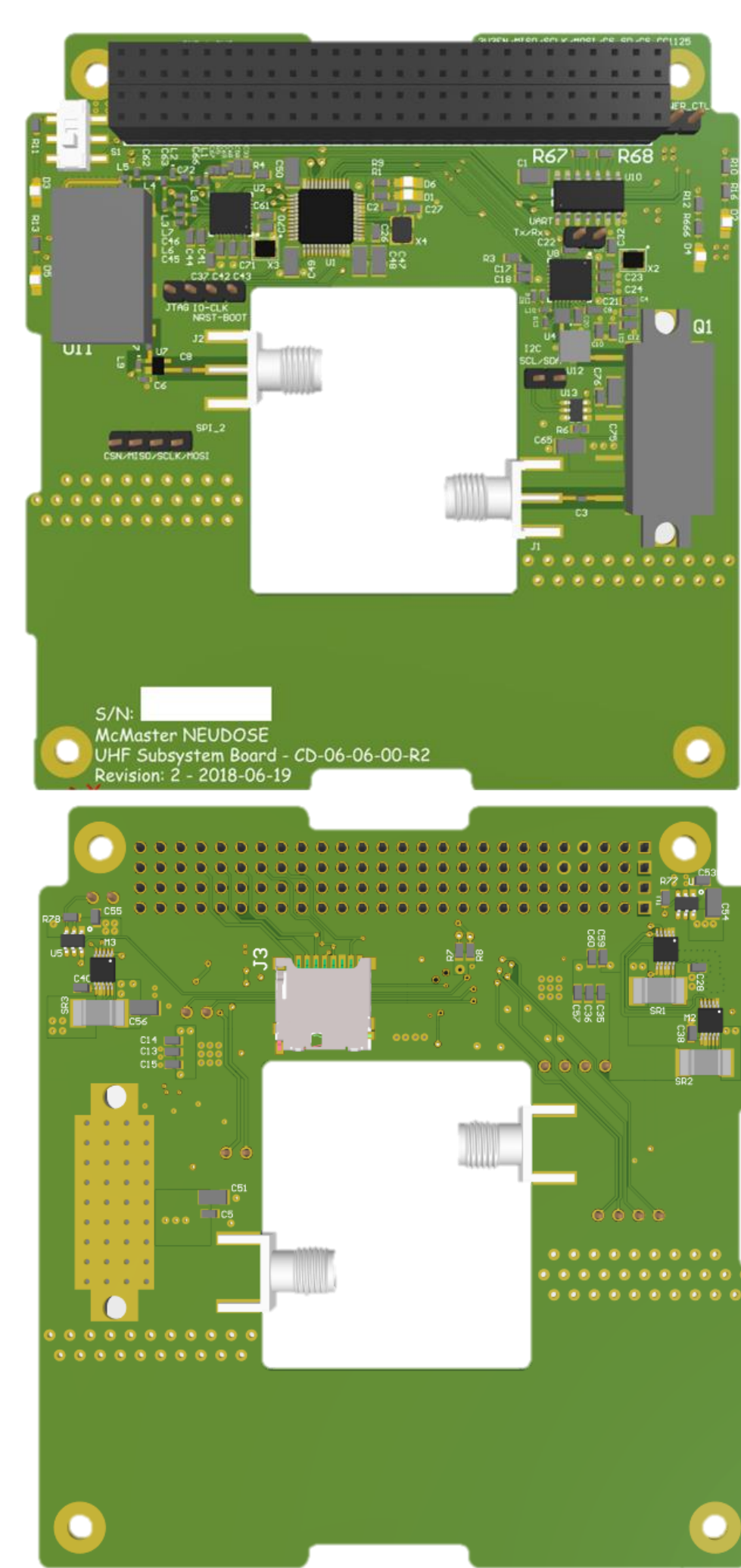
Pre-deployment



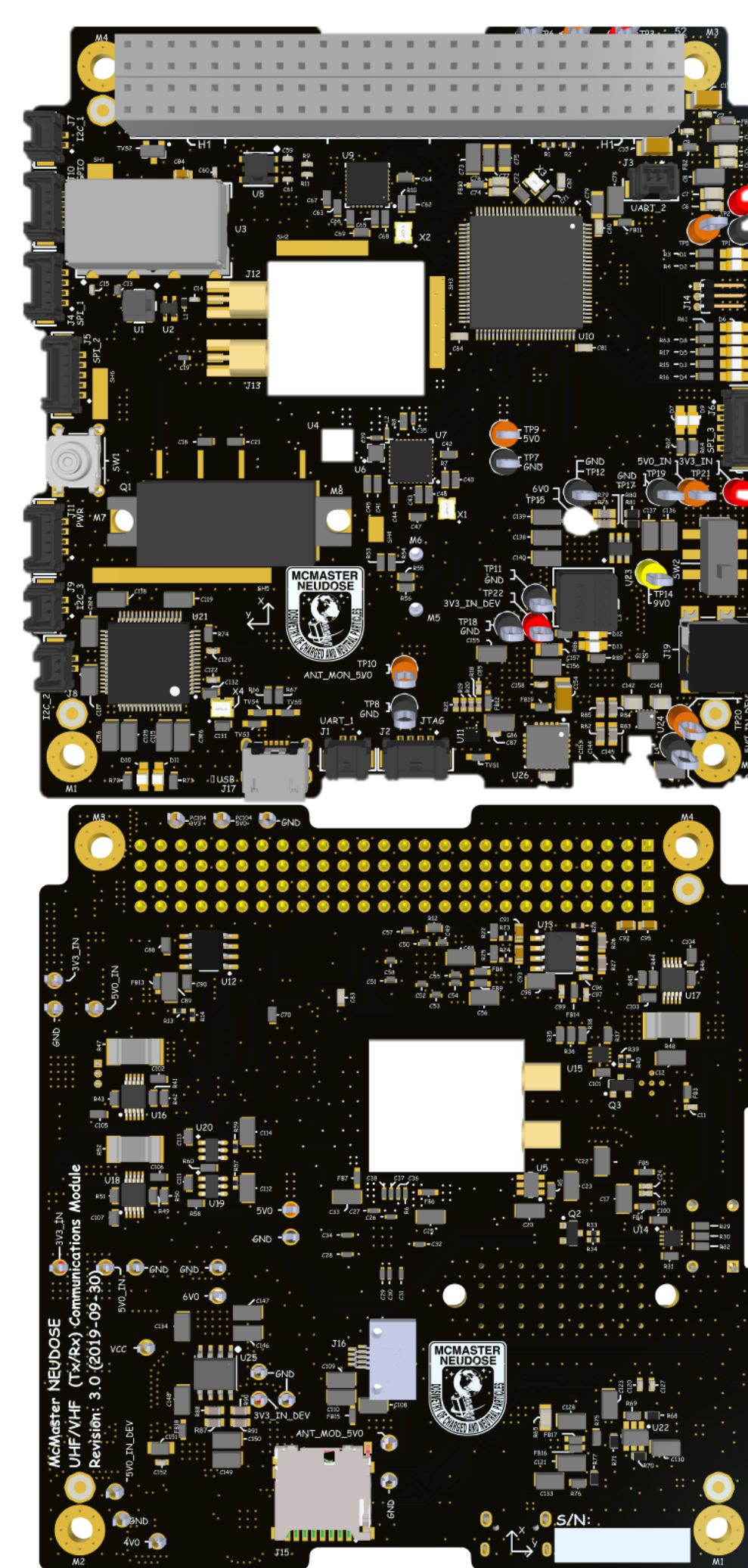
Post-deployment



Revision 2



Revision 3



Additional Information

Check Out: www.mcmasterneudose.ca

Point of Contact: Dr.A. Hanu (hanua@mcmaster.ca)

Check out posters: SSC20-WP1-07, SSC20-WP2-20, SSC20-WP2-24