Low EMI Power Supply Design for Nanosatellites

Craig Clark | CEO | 27th April 2017
Why a low noise EPS?

- Increasing range of CubeSat communications and RF sensing applications.
  - AIS
  - ADS-B
  - M2M
  - IoT
- These applications in turn are driving the next generation CubeSats in order to meet operational requirements.
Development based on heritage designs

The world’s most flown NanoSatellite Power System based on decades of experience aggregated across multiple missions.

- Encompassing 3.3V (4.5A), 5V (4.5A), and 12V (1.5A) regulated buses and an unregulated battery voltage bus (4.5A)
- Designed for high-power missions – our EPS is designed to deliver power across its four buses, at their maximum currents, simultaneously providing up to 90W
- 10x Latching Current Limit (LCL) switch-controlled power buses
- Maximum Power Point Tracking (MPPT) of solar arrays
- Protections include over-current, battery over-voltage and under-voltage, and a watchdog timer
Modular approach

Flight Switches

13W BUCK BCRs x8

3.3V and 5V Regulators
<table>
<thead>
<tr>
<th>Output Current (A)</th>
<th>Efficiency (%)</th>
<th>Switching Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUCK BCR</td>
<td>N/A</td>
<td>87</td>
</tr>
<tr>
<td>3V3 Bus</td>
<td>4.5</td>
<td>Testing ongoing</td>
</tr>
<tr>
<td>5V Bus</td>
<td>4.5</td>
<td>Testing ongoing</td>
</tr>
<tr>
<td>BATV Bus</td>
<td>4.5</td>
<td>N/A</td>
</tr>
<tr>
<td>I2C Node</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

- BUCK BCR: N/A
- 3V3 Bus: 4.5, Testing ongoing
- 5V Bus: 4.5, Testing ongoing
- BATV Bus: 4.5, N/A
- I2C Node: N/A, N/A

- Switching Frequency:
  - BUCK BCR: 592.8kHz
  - 3V3 Bus: 881kHz
  - 5V Bus: 881kHz
  - BATV Bus: N/A
  - I2C Node: 20MHz
Preliminary testing results: 162MHz

3rd Generation EPS

Low-noise Prototype EPS
Preliminary testing results: 865MHz

3rd Generation EPS

Low-noise Prototype EPS
Clyde Space IoT Bus

OBC w/ GPS

EPS

>80Whr

100Mbps

<0.05° ADCS

>50W per 3U
Thanks for listening....