OA-II Backplane Bus System Design

DR00001

Rev: A01

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1 Introduction

1.1 Scope

This document analyze the requirement for OA-II VEH system data transmission, and current bus technology in the field, come up with a system design to fullfill the need of OA-II VEH system.

1.2 Purpose

The goal for the OA-II backplane bus system is constructure a high speed, high compatibility, and high robustness backplane data transmission system.

2 Revision History

Rev#	Editor	Delta	Date
A01	Jinzhi Cai	Initialize	2019-7-15

Table 1: Summary of Revision History

3 BUS System Requirement

3.1 Hardware Requirement

Backplane Bus The bus need to suppport swappable module

Vribation-proof The bus need to have stronge support to the module on the frame.

Size The size need to fit into the rocket.

Topology The hardware structure need to support out-of-order locating.

3.2 Software Requirement

Max Speed The bus need to suppport swappable module

Vribation-proof The bus need to have stronge support to the module on the frame.

Size The size need to fit into the rocket.

Topology The hardware structure need to support out-of-order locating.

3.3 Bandwidth Calculation

Low Speed Payload Each low speed payload it sensing in 10kHz 16bit

- 4 high pressure sensors for propulsion system
- 2 low pressure sensors for pitot tube
- 4 high temp sensors for propulsion system
- 4 low temp sensors for electronics
- 4 low temp sensors for batteries
- 2 low temp sensor for ambient

$$4+2+4+4+4+2=20chennals$$
$$10kHz=10000Hz$$
$$16bit=2byte$$
$$10000Hz\times 2byte=20000byte/s=20Kbyte/s$$
$$20Kbyte/s\times 20=400Kbyte/s$$

High Speed Payload

- 9 axis IMU
- GNSS
- 4x cameras

9 axis IMU in 10kHz is
$$9 \times 10000Hz \times 2byte = 180000byte/s = 180Kbyte/s$$

GNSS module[1]
UTC launch time 4byte
Latitude 4byte
Longitude 4byte
Height 4byte
Direction+Ground speed 4byte
$$4byte \times 5 = 20byte$$
$$10Hz \times 20byte = 200byte/s$$

Camera, set the bitrate to 8Mbps[2]
$$8Mbps = 1Mbyte/s$$
$$1Mbyte/s \times 4 = 4Mbyte/s$$

Total bandwidth

$$(180Kbyte/s + 4Mbyte/s + 200byte/s + 400Kbyte/s) \times 2 \approx 10Mbyte/s$$

[1]Did not include any fixing factor
[2]High bitrate is nessary for high virbation environment

4 Current Bus Analyze

4.1 I2C

4.2 SPI

4.3 UART

4.4 CAN

4.5 PCIe

4.6 RapidIO

5 OA-II BUS Hardware Structure

6 OA-II BUS Software Structure