PRODUCT DATASHEET

RADLite – Miniaturised Space Weather Monitor for CubeSat/ SmallSat Missions

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CHANGE RECORD

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N/A (initial release).			

TABLE OF CONTENTS

1 Purpose and Scope

The present document provides detailed technical information about the RADLite Miniaturised Space Weather Monitor for CubeSat/SmallSat Missions.
The definitions and glossary of terms from ECSS-S-ST-00-01C [AD 1] apply to this document.

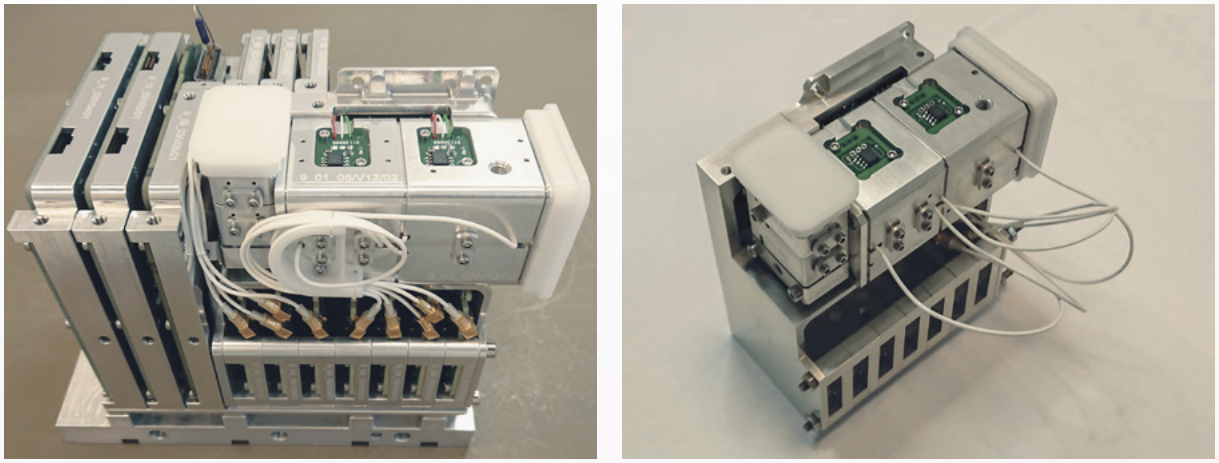

Figure 1 – RADLite System

2 Application and Key Features

2.1 APPLICATION

- ✓ **Cosmic Ray and Space Weather Research & Forecast using CubeSats**
  - Space Weather instrument fitting into the CubeSat standard (~1U)
  - Measuring space weather related space radiation data products as defined by the European Space Agency (ESA)
    - Protons
    - Electrons
    - Heavy Ions
  - To measure long-term cosmic ray flux profiles
  - Optional extension possibility with a low resource magnetometer
    - Measuring magnetic field strength in 3 directions
    - Optional external boom system operation capability
- ✓ **Radiation Hardness Assurance**
  - To determine the LET-spectra of the incoming space radiation
  - To determine the total ionising dose in different points in real time
  - To study the shielding effects of the surrounding environment

2.2 KEY FEATURES

- ✓ **Space radiation and space weather research and forecast for CubeSat/SmallSat missions**
  - Cost and time effective monitoring solution for constellations
  - Extremely low budgets with relatively high performance
  - Real-time space weather alarm function
- ✓ **Radiation Hardness Assurance capability**
  - Total Ionising Dose measurements at different locations
  - Real-time TID alerts for the platform operators
- ✓ **Configurable system**
  - 1 or 2 orthogonal telescope directions
  - Total Ionising Dose measurements
  - Optional low resource magnetometer (procured from ICL)
  - Optional built-in boom system operation capability (procured from Astronika)
- ✓ **Fully autonomous operation**
- ✓ **Controlled via TM/TC**
- ✓ **Available interfaces: CAN, M-LVDS, RS-422**

3 Specification

3.1 GENERAL SPECIFICATION

Table 1 – General specification

Parameters	Values
Power	2.5-5.0 W (depending on the configuration)
Mass	0.6-1.0 kg (depending on the configuration)
Dimensions (H, W, L)	96 mm, 96 mm, 119 mm (for maximum configuration)
Operational temperature range	-40°C...+65°C
Non-operational temperature range	-40°C...+85°C
Operational pressure range	10^{5} Pa...10^{-4} Pa
Outgassing rate	<1% TML <0.1% CVCM
Data rate	<1.5 MB/day
Handling environment humidity	20...65% relH

3.2 ENVIRONMENTAL SPECIFICATION

Table 2 – Environmental specification

Parameters		Values
Thermal-vacuum	**Temperature environment**	-40°C...+85°C
	Vacuum environment	<10^{-3}Pa
	Max. depressurisation rate	5.0 kPa/s
Vibration	**Sine vibration environment for 3-axis**	20...100 Hz, 16.0 g
	Random vibration environment for 3-axis	5...2000 Hz, 17.0 g^{RMS}
	Shock pulse for 3-axis	100 g, 0.25 ms
EMC	**EMC environment**	Tailored ECSS-E-ST-20-07C Rev.1 [AD 2]
Radiation	**Used components**	COTS
	Proven lifetime	Demonstration is planned at LEO

3.3 INTERFACES

Table 3 – Interfaces

Parameters	Values
Input power bus	9.9 V...12.6 V (redundant)
TM/TC interface	CAN Bus / M-LVDS / RS-422 (redundant)

3.4 MEASUREMENT CAPABILITIES

Table 4 – Measurement capabilities

Radiation Monitor	
Particle types	electrons, protons, heavy ions
Count rate range (<10% dead time)	0-50,000 cps
Minimum electron energy	250 keV
Electron energy range	0.3...8.0 MeV (2-5 log channels)
Minimum proton energy	1 MeV
Proton energy range	4 MeV – 1 GeV (11-18 log channels)
Heavy ion energy range	100 MeV/n...1 GeV/n (2-5 log channels)
Spectra contamination	<10%
Field of view for electron and proton measurement (half-angle)	31°
Field of view for heavy ion measurement (half-angle)	46°
Orthogonal telescope directions	1-2
Magnetometer (procured from Imperial College London)	
Range	±[1 60,000] nT
Noise	<30 pTrms/sqrt(Hz) @1Hz @25C°
Absolute accuracy	<1-10 nT
Sampling rate	1Hz / 10Hz
Orthogonal directions	3
Orthogonality error	≤0.1°

4 Flight Heritage

Table 5 – Flight heritage

Mission name	Hosting platform	Orbit details	Duration	Remarks
RADCUBE	3U CubeSat	LEO 500-600 km	To be launched in 2020/2021	In maximum configuration

5 List of Abbreviations

AD	Applicable Documents
Astronika	Astronika Sp. z.o.o.
COTS	Commercial Off-The-Shelf
ECSS	European Cooperation for Space Standardization
ESA	European Space Agency
ICL	Imperial College London
LEO	Low Earth Orbit
LET	Linear Energy Transfer
RD	Reference Documents
TC	Telecommand
TID	Total Ionising Dose
TM	Telemetry

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8 References

8.1 APPLICABLE AND NORMATIVE DOCUMENTS

Table 6 – Applicable and Normative Documents

AD	Title	Reference	Version
[AD 1]	ECSS system - Glossary of terms	ECSS-S-ST-00-01C	1 Oct 2012
[AD 2]	Space engineering - Electromagnetic compatibility	ECSS-E-ST-20-07C Rev.1	7 Feb 2012

8.2 REFERENCE DOCUMENTS

Table 7 – Reference Documents

RD	Title	Reference	Version
[RD 1]	-	-	-