FLORIS Calibration Unit

Equipment qualification status list (EQSL)

Doc :	FLX-LI-ALM-CU-0005
Issue:	4:0
Date :	01.02.2019
DRD Code :	PA-08

Almatech SA
EPFL – Innovation Park D
1015 Lausanne
Suisse

Tel : +41 21 555 30 00
Tel : +41 21 555 30 01
www.almatech.ch info@almatech.ch

Approval Sheet

	Name	Date	Signature
Prepared by:	T. Gandy	Digitally signed by Thomas Antoine David Gandy (Authentication) Date: 2019.02.01 18:23:39 +01'00'	
Approved by:	M. Lai	Digitally signed by Marco Lai (Qualified Signature) Date: 2019.02.01 18:25:32 +01'00'	
Approved by:	G. Capo	Digitally signed by Gianluigi Capo (Authentication) Date: 2019.02.01 20:29:31 +01'00'	

Distribution List

Internal reference: ALM-PRO-3385

Person	Organization	Distribution
L. Blecha	Almatech	C
G. Capo	Almatech	O
T. Gandy	Almatech	C
M. Lai	Almatech	C
M. Lichtenberger	Almatech	C
M. François	ESA	C
A. Capanni	Leonardo	A

A = Approval
C = Copy
I = Information
O = Original
R = Review

Change Record

Modification	Page	Iss.	Rev.	Date
First Issue	all	1	0	13.06.2017
Update for URR		2	0	25.01.2018
Resolver removed from design	11			
Updated for PDR according to URR actions	11	3	0	18.07.2018
Updated for MRR EQM	11	4	0	01.02.2019

Contents

1 Introduction

1.1 Project Overview

The Earth Explorer - Fluorescence Explorer (FLEX) mission will map vegetation fluorescence to quantify photosynthetic activity.

The conversion of atmospheric carbon dioxide and sunlight into energy-rich carbohydrates through photosynthesis is one of the most fundamental processes on Earth – and one on which we all depend.

Information from FLEX will improve our understanding of the way carbon moves between plants and the atmosphere and how photosynthesis affects the carbon and water cycles.

In addition, information from FLEX will lead to better insight into plant health and stress. This is of particular relevance since the growing global population is placing increasing demands on the production of food and animal feed. At the moment, photosynthetic activity cannot be measured from space, but FLEX's novel sensor will observe this faint glow.

The FLEX satellite will orbit in tandem with one of the Copernicus Sentinel-3 satellites, taking advantage of its optical and thermal sensors to provide an integrated package of measurements.

Mission objectives can therefore summarized as follows:

- To assess the quality of fluorescence-derived photosynthesis data against classical optically-based methods (i.e. from fraction of absorbed photosynthetically active radiation times Light Use Efficiency).
- To address in more detail temporal and spatial scaling issues (from towers to satellite footprints).
- To identify and characterize the effects of different types of stress on fluorescence and photosynthesis (especially drought and freezing air temperatures).
- To indicate potential applications of the novel fluorescence observations.

Mission orbit:

- Orbit: Sun-synchronous
- Measurement altitude: 815 km

The FLEX Space Segment consists of a single satellite carrying the FLuORescence Imaging Spectrometer (FLORIS) push-broom instrument. This high-resolution imaging spectrometer will acquire data in the 500– 780 nm spectral range, with a sampling of 0.1 nm in the oxygen bands (759–769 nm and 686–697 nm) and 0.5–2.0 nm in the red edge, chlorophyll absorption and Photochemical Reflectance Index bands.

The monthly global maps will have an on-ground spatial resolution of 300 × 300 m2 with a swath width of 150 km.

1.2 Scope of the Document

This document is the Equipment qualification status list (EQSL).

2 Applicable and Reference Documents

2.1 Applicable Documents

Ref.	Title	Reference	Iss.
AD 105	Cover Letter	FLX-LET-FNM-INS-0003	3
AD 106	Special Condition of Tender	FLX-OF-FNM-INS-0001	4
AD 100	Contract for FLEX Unit/sub-system	Draft Contract	
AD 101	Generic Statement of Work for FLEX Unit/sub-system	FLX-SOW-FNM-INS-0001	2
AD 102	Specific Statement of Work	FLX-SOW-FNM-INS-0005	2
AD 103	Floris Calibration Unit User Requirement Specification	FLX-RS-FNM-INS-0006	5
AD 201	FLORIS Radiation Environment RS	FLX-RS-FNM-INS-0016	4
AD 202	FLEX FEMM Requirements Specification	FLX-RS-FNM-INS-0023	1
AD 203	FLEX GMM &TMM Requirements Specification	FLX-RS-FNM-INS-0024	1
AD 204	FLEX CAD Model Requirements Specification	FLX-RS-FNM-INS-0025	1
AD 205	FLEX Cleanliness Requirements for Sub-contractors	FLX-RS-FNM-INS-0028	3
AD 206	FLEX Instrument General Design Interface Requirements	FLX-RS-FNM-INS-0029	3
AD 208	FLEX PA Requirements for Subcontractors	FLX-RS-FNM-INS-0021	2
AD 209	FLEX PA SW Requirements for Subcontractors	FLX-RS-FNM-INS-0022	1
AD 210	FLEX Configuration Control and Documentation Management Plan	FLX-PL-FNM-INS-0001	3
AD 211	FLEX List of Acronyms and Abbreviations	FLX-LI-FNM-INS-0003	2

2.2 Reference Documents

Ref.	Title	Reference	Iss.	Date
[RD01]	FLORIS Calibration Unit Almatech Proposal	17-10S-225	1.0	15.06.2017
[RD02]	Leonardo Clarification Letter	FLX-LET-FNM-INS-0009	--	18.10.2017
[RD03]	Floris CU Negotiation Meeting #1 between Leonardo and Almatech	FLX-MIN-FNM-INS-0041		15.11.2017

2.3 Acronyms and Abbreviations

The abbreviations and acronyms used in this document are in accordance with [AD 211].

Appendix A
EQSL

Floris Calibration Unit EQSL
[PA-08]

almatech

Qualification Status List

1. Item Designation	2. Next Higher Assembly	3. Manufacturer name	4. Requirement Specifications	5. Design Heritage	Qualification					
				Summary data	6. Category	7. Plans/Procedures	Development Model	8. Reports	9. Status	10. Open actions / Due dates
motor physpace 42-2	CU	Phytron	a) FLO-CU-URD-REQ-0510/ CU-URD-REQ-1290 CU-URD-REQ-1300 CU-URD-REQ-1330 CU-URD-REQ-1340 CU-URD-REQ-1360 CU-URD-REQ-1420 CU-URD-REQ-1430 CU-URD-REQ-0140 CE-URD-REQ-1350 ICU-URD-REQ-2330 CU-URD-REQ-1270	a) The motor is based on the phytron VSS 42 which was used in previous missions b) 2002, Astrium, "Gravity Recovery and Climate Experiment (GRACE)" 2016,Max Planck Institut für extraterestrische Physik (MPE), "Spectrum-X-Gamma" 2016, Surrey Satellite Technology LTD, "EarthCARE" 2016, Surrey Satellite Technology LTD, "EarthCARE" 2016, Airbus Dutch Space (TNO),"EarthCARE" 2018, EADS Astrium, "James Webb Space Telescope" Maven, BepiColombo MERTIS, Mars Rover Curosity, Juno, MIRIS, EnMAP, SOLACES, Rosetta Cosima, STEREO, XMM, Cassini-Huygens, MOS-IRS-P2	A	a) N/A b) N/A	c)	a) Heritage only b) -	qualified	a) - b) -
Harmonic Drive gear CPL-17-2A	CU	Harmonic drive	a) FLO-CU-URD-REQ-0510/ CU-URD-REQ-1290 CU-URD-REQ-1300 CU-URD-REQ-1330 CU-URD-REQ-1340 CU-URD-REQ-1360 CU-URD-REQ-1420 CU-URD-REQ-1430 CU-URD-REQ-0140 CE-URD-REQ-1350 ICU-URD-REQ-2330 CU-URD-REQ-1270	a) The gear was used in previous missions adaptation are foreseen only to connect the motor shaft. b) GAIA, deployable sunshield SENTINEL-2, Multi-Spectral Instrument Calibration and Shutter Mechanism BepiColombo, Electric Propulsion Pointing Mechanism	A	a) N/A b) N/A	c)	a) Heritage only b) -	qualified	a) - b) -
Super duplex Ball bearing WKSP20664TA4DOK7 216	CU	ADR	a) FLO-CU-URD-REQ-0510/ CU-URD-REQ-1290 CU-URD-REQ-1300 CU-URD-REQ-1330 CU-URD-REQ-1340 CU-URD-REQ-1360 CU-URD-REQ-1420 CU-URD-REQ-1430 CU-URD-REQ-0140 CE-URD-REQ-1350 ICU-URD-REQ-2330 CU-URD-REQ-1270	a) Super duplex ball bearing were used in previous missions. Only envelop dimensions are taylored to the current mission needs b) -	A	a) N/A b) N/A	c)	a) Heritage only b) -	qualified	a) - b) -
Spectralon diffuser	CU	Labsphere	a) FLO-CU-URD-REQ-0510/ CU-URD-REQ-1290 CU-URD-REQ-1300 CU-URD-REQ-1330 CU-URD-REQ-1340 CU-URD-REQ-1360 CU-URD-REQ-1420 CU-URD-REQ-1430 CU-URD-REQ-0140 CE-URD-REQ-1350 ICU-URD-REQ-2330 CU-URD-REQ-1270 FLO-CU-URD-REQ-0590 FLO-CU-URD-REQ-0600 FLO-CU-URD-REQ-0620 FLO-CU-URD-REQ-0625 FLO-CU-URD-REQ-0630 FLO-CU-URD-REQ-0640 FLO-CU-URD-REQ-0645	a) Standard flight material used for diffuser b) -	A	a) optical tests will be performed at higher resolution w.r.t. manufacturer data FLX-PL-ALM-CU-0007 - DDVP b)	c)	a) Heritage only b) -	qualified	a) - b) -

Floris Calibration Unit EQSL
[PA-08]

1. Item Designation	2. Next Higher Assembly	3. Manufacturer name	4. Requirement Specifications	5. Design Heritage	Qualification					
				Summary data	6. Category	7. Plans/Procedures	Development Model	8. Reports	9. Status	10. Open actions / Due dates
Baumer Switch B75/80 / RUAG Microswitch SG	CU	Baumer, Ruag	a) FLO-CU-URD-REQ-0510/ CU-URD-REQ-1290 CU-URD-REQ-1300 CU-URD-REQ-1330 CU-URD-REQ-1340 CU-URD-REQ-1360 CU-URD-REQ-1420 CU-URD-REQ-1430 CU-URD-REQ-0140 CE-URD-REQ-1350 ICU-URD-REQ-2330 CU-URD-REQ-1270	a) SPICE b) -	A	a) N/A b) N/A	c)	a) Not deliverable. B) Qualified by Almatech on SPICE SCM porject between -60 & +75°C. SPICE-ALM-TR-4319 report refers	qualified	a) - b) -
Calibration Unit	CU	Almatech	a) FLO-CU-URD-REQ-0510/ CU-URD-REQ-1290 CU-URD-REQ-1300 CU-URD-REQ-1330 CU-URD-REQ-1340 CU-URD-REQ-1360 CU-URD-REQ-1420 CU-URD-REQ-1430 CU-URD-REQ-0140 CE-URD-REQ-1350 ICU-URD-REQ-2330 CU-URD-REQ-1270	a) None b) -	D	a) FLX-PL-ALM-CU-0007 - DDVP b) TBD	c) EQM	a)- b) -	Not qualified	a) - b) -