MATeF-2 EM Test Report

Qualification Testing

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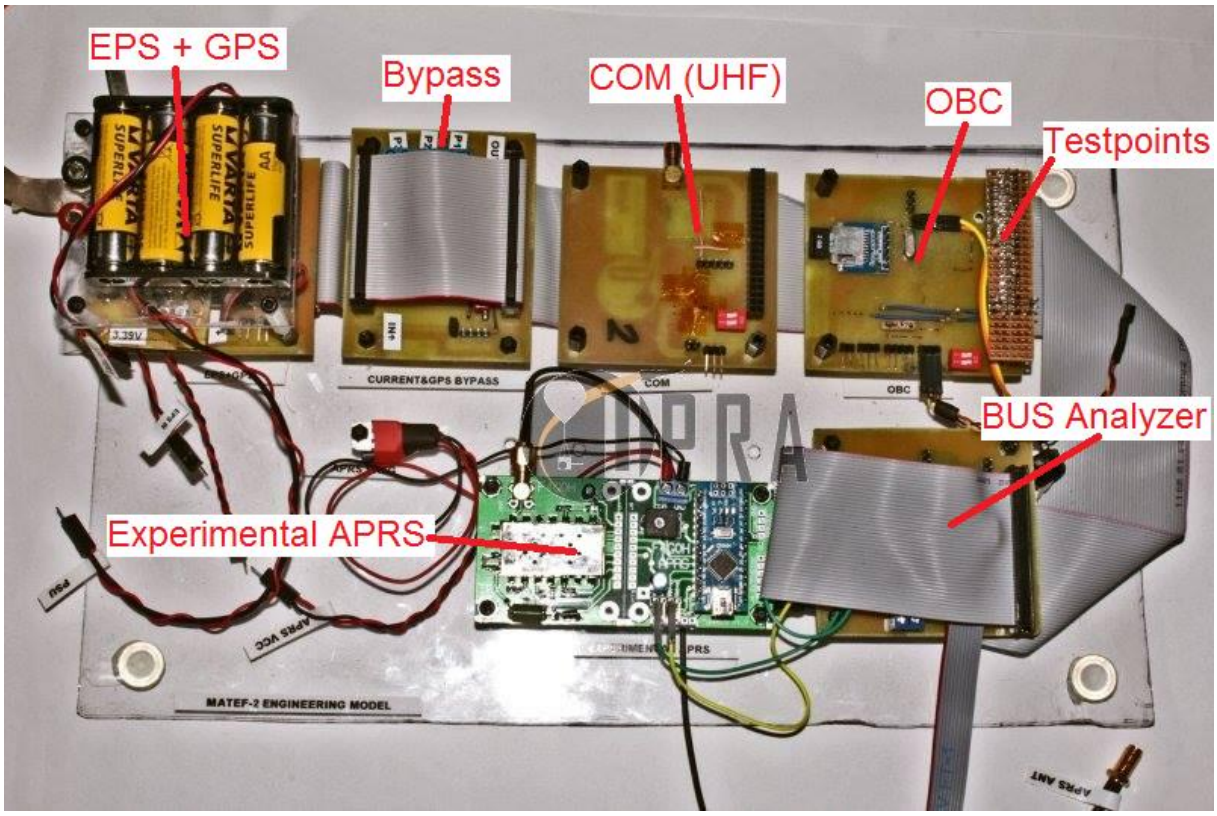
1 Engineering Model

For the qualification testing the MATeF-2 Engineering Model (EM) was used. For Integration Tests the EM was assembled in breadboard/test board configuration:

- Sub-modules were connected by ribbon cable
- Bus analyzer was added
- Bypass module was added for current measurement

EM components have the same HW configuration as in the planned Flight Model (FM), but have lower requirements on manufacturing.



Engineering Mode in Breadboard/Test board configuration

2 Integration Test

Integration Test was run at room temperature, the EM was powered by bench PSU. Operational tests and parameter measurements were conducted during the test.

2.1 Test results

Test Suite	Test Case	Result	Notes
Preconditions	matef-85:Inegrated Tests	Passed	
OBC.mega328	matef-1:Startup	Passed	
OBC.mega328	matef-3:Outgoing Telemetry	Passed	
OBC.mega328	matef-4:Outgoing COM-housekeeping request	Passed	
OBC.mega328	matef-5:Incoming COM-housekeeping	Passed	
OBC.mega328	matef-89:Current Consumption	Passed	SD CARD current consumption is ~30mA by datasheet
OBC.mega328	matef-90:Voltage Drop	Passed	
OBC.mega328	matef-6:Timing	Passed	
COM.RFxxx	matef-9:Startup	Passed	
COM.RFxxx	matef-10:Incoming Telemetry message	Passed	
COM.RFxxx	matef-88:Current Consumption	Passed	
COM.RFxxx	matef-15:Voltage Drop	Passed	
Integrated Flight System/Flight Operations	matef-30:Telemetry - Valid GPS	Passed	
Integrated Flight System/Flight Operations	matef-32:House keeping	Passed	
Integrated Flight System/Flight Operations	matef-33:Environmental Data	Passed	
Integrated Flight System/Flight Operations	matef-34:Radio Downlink	Passed	
Integrated Flight System/Flight Operations	matef-39:Complete Flight - over 18K - no limit	Passed	'quick log' was used
Integrated Flight System/Flight Operations	matef-82:Telemetry - No GPS Connection	Passed	
Integrated Flight System/Flight Operations	matef-91:Current Consumption After EPS	Passed	proper 500 ohm APRS antenna
Integrated Flight System/Flight Operations	matef-92:Current Consumption Before EPS	Passed	proper 50 ohm APRS antenna
Integrated Flight System/Flight Operations	matef-93:BEACON mode	Passed	

3 Thermal Chamber Test

Thermal tests were conducted at 28°C – (-16)°C temperature. The flight system were running on internal power, GPS signal was provided by GPS Signal-simulator.

3.1 Thermal tests:

COOL DOWN test

1. Start system at room temperature
2. Start thermal chamber (TC)
3. Decrease temperature to the designated value while the system is running

SYSTEM COLD OUT test

4. Stop the system
5. Leave at the designated tepmerature for at least 30mins while not running

COLD START test

6. Start the previously cooled down system
7. Decrease the temperature to the designated value
8. Leave the system running for at least 30mins

WARM UP test

9. Stop the TC and open the door
10. Increase the temperature to room temperature while the system is running

3.2 Test results

Test Suite	Test Case	Result	Notes
OBC.mega328	matef-1:Startup	Passed	
OBC.mega328	matef-3:Outgoing Telemetry	Passed	
OBC.mega328	matef-3:Outgoing Telemetry	Passed	Altitude Variable overflow over 33000m Not Thermal related!
OBC.mega328	matef-4:Outgoing COM-housekeeping request	Passed	
OBC.mega328	matef-5:Incoming COM-housekeeping	Passed	
OBC.mega328	matef-22:Internal Temperature	Passed	
OBC.mega328	matef-6:Timing	Passed	
COM.RFxxx	matef-9:Startup	Passed	
COM.RFxxx	matef-10:Incoming Telemetry message	Passed	
COM.RFxxx	matef-11:Incoming Housekeeping request	Passed	
COM.RFxxx	matef-23:Internal Temperature	Passed	
OBC.mega328	matef-24:External Temperature	Passed	
Main GPS	matef-26:Below 18K	Passed	
Main GPS	matef-27:Over 18K	Passed	
Integrated Flight System/Flight Operations	matef-30:Telemetry - Valid GPS	Passed	
Integrated Flight System/Flight Operations	matef-32:House keeping	Passed	
Integrated Flight System/Flight Operations	matef-33:Environmental Data	Passed	
Integrated Flight System/Flight Operations	matef-34:Radio Downlink	Passed	
Integrated Flight System/Flight Operations	matef-82:Telemetry - No GPS Connection	Passed	
Integrated Flight System/Flight Operations	matef-93:BEACON mode	Passed	
Preconditions	matef-85:Inegrated Tests	Passed	
Preconditions	matef-86:UPRA Thermal	Passed	
Thermal	matef-94:Low Temperature Operation	Passed	
Thermal	matef-95:COOL DOWN test	Passed	
Thermal	matef-96:SYSTEM COLD OUT test	Passed	
Thermal	matef-97:COLD START test	Passed	
Thermal	matef-98:WARM UP test	Passed	

4 Accepted System for Flight Model

4.1 OBC

- **HW:** OBC.mega328
- **Bootloader:** Arduino/Genuino uno18v (1.8V brownout)
- **Firmware:** 2018_01_10_2129

4.2 COM (UHF)

- **HW:** COM.rf69HCW
- **Bootloader:** ATmega328 on a breadboard (8 MHz internal clock, 1.8 V BrownOut)
- **Firmware:** 2017_11_28_2308
- **Callsign:** TBD

4.3 APRS

- **HW**: DARPS (Experimental APRS Module)
- **Bootloader:** Arduino nano
- **Firmware:** DARPS default
- **Callsign:** HA3PL

4.4 GPS

- **HW:** uBlox NEO 6M
- **Operation Mode:** Airborne 1

4.5 EPS

- **HW:** EPS Proto V2
- **Interface PCB:** PDU V3