# Acceptance Tests

## Qualification tests

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Model: PLD PFM 2.02 / **Flight Hardware**
Test equipment / conditions: all components and sockets soldered.
Tested with OBC EM 2.02 via OBC terminal.

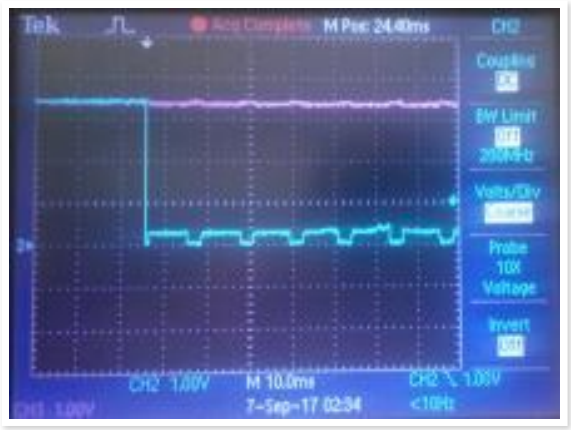
1. Power

| | Current (raw) | Current (mA) | result |
|---|---|---|---|
| before PLD turned on | 13 | 30 | passed |
| after PLD turned on - idle mode | 23 - 32 | 54 - 75 | passed |
| current consumption - idle mode | | 24 - 45 | passed |

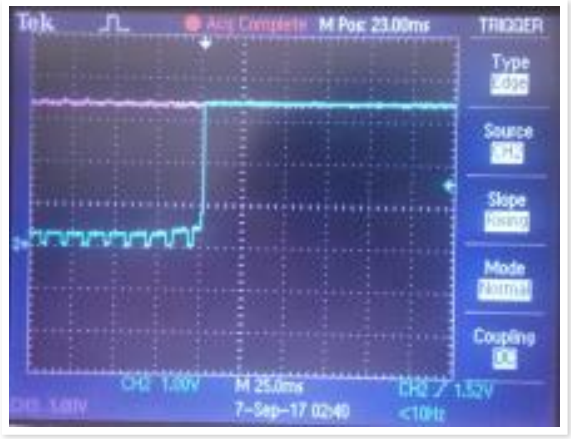
**LCL tests**

`OBC_PLD_3V3` and `OBC_BUS_3V3` were tested against overcurrent/short-circuit. Overcurrent condition was caused by a 5 Ohm resistor.

in pink: input voltage to LCL, in blue: output voltage from LCL. Both LCLs were behaving exactly the same, so only one oscillogram is shown.




Normal operation (LCL powered up) and then short by a 5 Ohm resistor.




A moment of load (5 Ohm) disconnection.

**2. AVR**

Uploaded software: commit 29d1b9d8dc5e0fe59c7b0065ac84c183bede075d

- **WHO_AM_I test**

simply passed

```
OBC> obc.payload_whoami()
Out[10]: {'Who Am I': 83}
```

- **house keeping**

| field | raw value | computed voltage (V) | result |
|---|---|---|---|
| INT 3V3D | 1633 | 3.27 | passed |
| OBC 3V3D | 1669 | 3.34 | passed |

- **payload temperatures**

| Thermometer | raw | Centigrades (°C) or Resistance (Ω) | result | additional info |
|---|---|---|---|---|
| CAM nadir | 2155 | 28.33°C | passed | |
| CAM wing | 2153 | 27.77°C | passed | |
| SADS | 2157 | 28.89°C | passed | |
| Sail | 1238 / 3472 / 3376 | 433.17Ω/5564.1Ω/4688.89Ω | passed | references: 430Ω/5.6kΩ/4.7kΩ |
| Supply | 2261 | 27.48°C | passed | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| Xn | 1238 / 3475 / 3379 | 433.17Ω/5595.8Ω/4712.7Ω | passed | references: 430Ω/5.6kΩ/4.7kΩ |
| Xp | 1239 / 3475 / 3379 | 433.67Ω/5595.8Ω/4712.7Ω | passed | references: 430Ω/5.6kΩ/4.7kΩ |
| Yn | 1239 / 3475 / 3379 | 433.67Ω/5595.8Ω/4712.7Ω | passed | references: 430Ω/5.6kΩ/4.7kΩ |
| Yp | 1238 / 3475 / 3379 | 433.17Ω/5595.8Ω/4712.7Ω | passed | references: 430Ω/5.6kΩ/4.7kΩ |

All channels were validated for correctness in PLD/OBC code.

- **reference sun sensor**

| **channel no.** | **test voltage 1 (V)** | **raw for test voltage 1** | **calculated value for test voltage 1** | **test voltage 2 (V)** | **raw for test voltage 2** | **calculated value for test voltage 2 (V)** | **result** |
|---|---|---|---|---|---|---|---|
| V1 | 1.0 | 801 | 1.018 | 2.0 | 1579 | 2.007 | passed |
| V2 | 2.0 | 1583 | 2.012 | 3.0 | 2369 | 3.011 | passed |
| V3 | 1.0 | 793 | 1.008 | 2.0 | 1578 | 2.006 | passed |
| V4 | 2.0 | 1581 | 2.009 | 3.0 | 2368 | 3.010 | passed |
| V5 | 1.0 | 794 | 1.009 | 2.0 | 1579 | 2.007 | passed |

Channels naming in PLD/OBC software is correct.

- **photodiodes**

Test carried out with photodiode simulator (VCCS) and real photodiode. Chanel naming in OBC/PLD software was validated also.

| photodiode | phd test current (mA) | measured raw | computed measured current (mA) | result |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Xn | 1.373 / 0.520 / 0.109 | 1457 / 606 / 195 | 1.37 / 0.52 / 0.11 | passed |
| Xp | 1.368 / 0.516 / 0.108 | 1453 / 602 / 194 | 1.37 / 0.52 / 0.11 | passed |
| Yn | 1.371 / 0.520 / 0.109 | 1457 / 605 / 195 | 1.38 / 0.52 / 0.11 | passed |
| Yp | 1.375 / 0.518 / 0.110 | 1461 / 604 / 195 | 1.38 / 0.52 / 0.11 | passed |

- **RadFET**

Power consumption:

| | Current (raw) | Current (mA) | result |
|---|---|---|---|
| before RadFET turned on | 21 - 31 | 49 - 73 | passed |
| after RadFET turned on - idle mode | 24 - 36 | 56 - 84 | passed |
| current consumption - idle mode | 3 - 5 | 7 - 12 | passed |

Operation:

`radfet_read` after power cycle when radfet is off:
`{'Status': 225, 'Temperature': 0, 'Vth0': 0, 'Vth1': 0, 'Vth2': 0}`

`radfet_on`:
`{'Status': 225, 'Temperature': 0, 'Vth0': 0, 'Vth1': 0, 'Vth2': 0}`

`radfet_read` (when radfet is on):
`{'Status': 33, 'Temperature': 8237364, 'Vth0': 13729448, 'Vth1': 13680988, 'Vth2': 13748803}`

`radfet_off` (when radfet is on):
`{'Status': 32, 'Temperature': 8237364, 'Vth0': 13729448, 'Vth1': 13680988, 'Vth2': 13748803}`

3. **Sail indicator**

Tested on values indicated in telemetry. OBC correctly recognizes state of the sail indicator.
Tested values: jumper (0 Ohm), 430Ω, 4.7kΩ - all passed.

4. **Cameras**

Power consumption:

| camera | before turn on raw / mA | after turn on raw / mA | consumption raw / mA | test result | comment |
|---|---|---|---|---|---|
| nadir | 20 / 42.2 | 58 / 126.6 | 38 / 84.4 | passed | |
| wing | 18 / 39.8 | 55 / 121.9 | 37 / 82.1 | passed | |

Statistics of taken photos:

| Camera | Qty of photos taken | Fails | % of fails | Result |
|---|---|---|---|---|
| Nadir | 351 | 3 | 0.85% | passed |
| Wing | 351 | 0 | 0% | passed |

5. **SunS**

Power consumption:

- current EPS before SunS turning on: 18 raw / 0.042 A

- current EPS after: 28 raw / 0.066 A
- current consumption by the SunS: 10 raw / 0.024 A

Test passed.

Communication via I2C + INT with the SunS was successfully tested for 1000 times.

6. **Gyroscope**

`gyro init` - passed
`gyro read` - passed - 1000 samples taken.
The samples were logged into csv file and can be taken as calibration data for gyro (null offset).

**flight_gyroscope_calibration.csv** 19 KB
Download

7. **RTC**
    - **time counting test** - OBC range test: passed | 2-second test: passed | 5-minute test:

1st run:

```
>rtc test
Start: 0-1-1 18:4:0 (946749840 sec since epoch)
Seconds range: ok
Minutes range: ok
Hours range: ok
+2s: 0-1-1 18:4:2 (946749842 sec since epoch)
Time after 2 seconds: ok
```

```
Waiting 5 minutes...
+5min: 0-1-1 18:9:3 (946750143 sec since epoch)
System reported 301000 milliseconds
   RTC reported 301000 seconds
ok
```

2nd run:

```
>rtc test
Start: 0-1-1 18:15:10 (946750510 sec since epoch)
Seconds range: ok
Minutes range: ok
Hours range: ok
+2s: 0-1-1 18:15:12 (946750512 sec since epoch)
Time after 2 seconds: ok
Waiting 5 minutes...
+5min: 0-1-1 18:20:13 (946750813 sec since epoch)
System reported 300050 milliseconds
   RTC reported 301000 seconds
ok
```

- **backup power test for at least 1 hour** - passed

before power down

```
>rtc get
0-1-3 11:16:42 (946898202 sec since epoch)
```

after 1 hour lack of power:

```
>rtc get
0-1-3 12:20:29 (946902029 sec since epoch)
```

- **backup power test for 2 hour** - test passed
- **backup power test for 3 hour** - not carried out

8. **FRAM**

- run OBC diagnostics:

```
>fram testall f
Fram 1 read write ok: 1
Fram 2 read write ok: 1
Fram 3 read write ok: 1
```

Test was repeated for 200 times. All passed.

9. **FLASH**

- run OBC diagnostics

```
>Flash 1 id valid: 1
Flash 2 id valid: 1
Flash 3 id valid: 1
```

Test repeated for 1000 times.

```
>erase all
Erasing all flashes ...
Erase result: 0
```

Tests passed.

10. **LED**

OK

11. **Access port**

| # | Function | Status |
|---|---|---|
| 1 | Kill switch | OK |
| 2 | I2C BUS | OK |
| 3 | I2C PLD | OK |
| 4 | OBC UART | OK |
| 5 | MPPT X Input | OK |
| 6 | MPPT Y- Input | OK |
| 7 | MPPT Y+ Input | OK |