Requirements

In this rection requierements for the ᵖᵒCat spacecrafts (system) and corresponding mission are presented. These are to be defined by the team developing each mission and PocketQube.

- Mission Requirements
- System Requirements

Mission Requirements

Index	Domain	Description
M-0010	General	The satellite will be launched in a LEO orbit corresponding to both its purpose and the international regulations.
M-0020	General	The satellite must not contain entry resistant materials or completely detachable sections or appendages.
M-0030	General	To comply with ESA's zero debris approach the satellite must reenter in less than 5 years.
M-0040	General	The satellite must be able to control its attitude in case of payload acquisition requirements as well as high temperatures.
M-0100	Structural	The satellite must abide to both its class' available standard, as well as the regulations imposed by the deployer entity.
M-0110	Structural	The satellite must have all its deployable elements safely stowed during transport, storage and launch.
M-0120	Structural	The satellite must be capable of of starting and using all its systems and appendices in a controlled manner.
M-0210	Electronic	The satellite must keep its power source disconnected from all its subsystems during transport, storage and launch.
M-0220	Electronic	The satellite must be capable of satisfactory harvesting all the necessary power during its entire lifespan.
M-0230	Electronic	The satellite must regulate all its power and data lines, providing protection against potential electrical hazards.
M-0300	Computational	The satellite must maintain complete control of its circuitry, data processes, communications, payloads and physical interfaces at all times.

Index	Domain	Description
M-0310	Computational	The satellite must be able to store both the information obtained from payloads as well as telemetry: location, date, battery level, temperature, current and voltage in key nodes.
M-0400	Communications	The satellite must be able to communicate and receive telecommands from both the ground station and other satellites.
M-0410	Communications	The satellite must be able to maintain a satisfactory link budget and to allow control of the satellite by way of telecommands.
M-0420	Communications	The satellite must be able to transmit and receive without an attitude requirement.

System Requirements

Owner	Req ID	Requirement Text	Requirement Note
OBC	OBC-0010	The OBC shall monitor all spacecraft subsystems.	
OBC	OBC-0020	The OBC shall have an Scheduler which determines the execution of different tasks through time.	
OBC	OBC-0030	The OBC shall provide and store the following housekeeping data: Satellite mode, Boot count, OBC error events, Internal satellite communication error events, RAM memory usage.	
OBC	OBC-0040	The OBC shall retrieve and store housekeeping data for all spacecraft subsystems.	
OBC	OBC-0050	The OBC shall monitor all satellite subsystems in order to verify their nominal behavior.	
OBC	OBC-0060	The OBC shall execute TC received from the GSeg.	
OBC	OBC-0070	The OBC shall be able to control and command all subsystems via its interfaces.	
OBC	OBC-0080	The OBC shall retrieve and store scientific data from the Payload.	
OBC	OBC-0090	The OBC shall have data interfaces with all subsystems.	
OBC	OBC-0100	The OBC power supply voltage shall be 3.3 V.	With 4% margin from datasheet
OBC	OBC-0110	The OBC shall enable the manual transition between satellite modes if a TC from the ground is received.	

OBC	0BC-0120	The OBC shall automatically transition between satellite modes based on battery levels.	
OBC	OBC-0130	The OBC should allow in-orbit changes of its configuration.	
OBC	OBC-0140	The OBC shall implement a command-less timer that triggers a recovery routine if a telecommand from the GS is not received after a certain period.	
OBC	OBC-0150	The spacecraft should allow modifications to the OBC Software after the satellite assembly is complete and while on ground.	
OBC	OBC-0160	The spacecraft shall have a timer, set to a minimum of 30 minutes, before operations or deployment of the antennas.	
OBC	OBC-0170	No radio emission shall be allowed after the spacecraft has been integrated within the PocketQube deployer until 45 minutes after deployment.	
COMMS	COMMS - 0000	The Communications Subsystem (COMMS) shall work in the ISM band via radio links.	The Ground Station is set to 868 MHz (amateur). The S/C is able to receive and transmit in this band.
COMMS	COMMS - 0010	The COMMS subsystem must transmit at a maximum power of 20 dBm.	This power values takes into account the internal losses.
COMMS	COMMS - 0020	The COMMS subsystem must support half-duplex communication, enabling both transmission and reception of data.	The S/C can receive telecommands and transmit data via the RF link of the COMMS subsystem.
COMMS	COMMS - 0030	Be able to deploy the omnidirectional quarter wavelength antenna once the satellite is deployed in space.	The deployment will be conducted using a thermal knife.

COMMS	COMMS - 0040	The COMMS shall periodically transmit the telemetry of the spacecraft	The period of the beacon shall be configurable using telecommands and dependant of the battery state.
COMMS	COMMS - 0050	All packets shall be tagged with a timestamp.	
COMMS	COMMS - 0060	The COMMS must be able to receive Telecommands from the ground segment and send a reception acknowledgement.	RF packets are received by the satellite. If they are correctly parsed and with the expected command counter, the S/C will transmit an acknowledgement.
COMMS	COMMS - 0070	The COMMS shall have the capability to provide past telemetry housekeeping.	Housekeeping data is present in the telemetry.
COMMS	COMMS - 0080	The transmitted beacon shall contain a subset of information from the whole satellite housekeeping.	Housekeeping data is present in the telemetry.
COMMS	COMMS - 0090	OBC and COMMS subsystems must communicate through SPI.	
COMMS	COMMS - 0100	The S/C shall be capable of changing the operating frequency using a telecommand.	
COMMS	COMMS - 0110	The satellite must comply with european regulations.	
COMMS	COMMS - 0120	Be able to distinguish between wanted packets and unwanted packets.	This will be done making use of the packet ID.
EPS	EPS - 0000	The EPS is capable of providing the requisite current for the other subsystems to function correctly.	The current must not exceed 800mA
EPS	EPS - 0010	The battery shall remain within safe temperature ranges.	
EPS	EPS - 0020	The EPS shall provide an output of 3.3V ±5% at its output to power the other subsystems	

EPS	EPS - 0030	The battery shall be able to charge via the umbilical port.	
EPS	EPS - 0040	The satellite's battery shall be decoupled from the rest of the system during launch using mechanically controlled kill switches.	
EPS	EPS - 0050	The EPS shall charge the battery automatically using the solar cells.	
EPS	EPS - 0060	The EPS shall include protections to prevent battery damage	
EPS	EPS - 0070	The MPPTs shall produce sufficient power to charge the battery	
ADCS	ADCS - 0000	The communication between the chips of the ADCS and the OBC must be conducted via I2C.	
ADCS	ADCS - 0010	The PQ must be able to detumble using the BDOT algorithm.	
ADCS	ADCS - 0020	The satellite must be able to point the Payload at the nadir angle using the magnetic control law.	
ADCS	ADCS - 0030	The ADCS must be able to estimate the satellite's position in an inertial reference frame.	
ADCS	ADCS - 0040	The ADCS must be able to obtain the magnetic field in an inertial reference frame.	
ADCS	ADCS - 0050	All sensors used in the ADCS must be calibrated and characterized by temperature.	
ADCS	ADCS - 0060	The magnetorquers must be able to be fed with current.	
ADCS	ADCS - 0070	The ADCS must use an active actuator.	

ADCS	ADCS - 0080	The ADCS must have a fail-safe mechanism to enter a safe mode in case of anomalies.	
ADCS	ADCS - 0090	The ADCS sensor's calibration parameters must be able to be modified via telecommand.	
P/L-1	PRFL - 0000	The payload shall have a sensitivity of -110 dBm	
P/L-1	PRFL - 0010	Frequency resolution has to be smaller or equal than 10 MHz	
P/L-1	PRFL - 0020	Output has to be an analogue voltage between 0 and 3.3 V	
P/L-1	PRFL - 0030	Maximum peak power consumption has to be smaller than 1.5 W	
P/L-1	PRFL - 0040	Average power consumption has to be smaller than 0.5 W	
P/L-1	PRFL - 0050	The L-band antenna has to be stowed inside the satellite	
P/L-1	PRFL - 0060	No debris in the payload antenna deployment	
P/L-1	PRFL - 0070	Non-operational temperature has to range from -40 to 80 ºC.	
P/L-1	PRFL - 0080	Operational temperature has to range from 0 to 45 ºC.	
P/L-1	PRFL - 0090	Antenna return losses must be lower than -6 dB in the L-Band	
P/L-2	RFI5G_010	The payload shall have a sensitivity of -110 dBm	
P/L-2	RFI5G_020	The payload frequency resolution must be smaller or equal than 10 MHz.	
P/L-2	RFI5G_030	The payload output must be an analogue voltage between 0 and 3.3 V.	

P/L-2	RFI5G_040	The payload's maximum peak power consumption must be smaller than 1.5 W.	
P/L-2	RFI5G_050	The payload's average power consumption must be smaller than 0.5 W.	
P/L-2	RFI5G_060	The payload must interface with the "IEEE Open PocketQube".	
P/L-2	RFI5G_070	The full PocketQube weight with the payload must be smaller than 250 g.	
P/L-2	RFI5G_080	The payload's non-operational temperature must range from -40 to 80 ºC.	
P/L-2	RFI5G_090	The payload's operational temperature must range from 0 to 45 ºC.	
GSeg	GS - 010	At least one GS shall be available for bidirectional communication with the spacecraft.	
GSeg	GS - 020	The GS shall comply with ITU requirements [RD5].	
GSeg	GS - 030	The GS shall be able to receive signals from the PocketCube following an orbit consistent with the launch.	Test may be performed by tracking another spacecraft operating in a similar orbit.
GSeg	GS - 040	The GS shall be capable of receiving satellite messages.	
GSeg	GS - 050	The GS shall be able to predict and schedule a satellite pass and store the prediction in an SQL-based database.	
GSeg	GS - 060	The GS shall track the satellite during its passes over the station.	
GSeg	GS - 070	The GS shall provide mechanisms to control and manage the orientation of communication antennas.	

GSeg	GS - 080	The GS shall be connected to the internet via a wired interface.	
GSeg	GS - 090	The GS internet interface shall be accessible through a VPN.	
GSeg	GS - 100	The GSeg shall retrieve the satellite data during its passes over the station, following an operations plan.	
GSeg	GS - 110	The GSeg shall store the retrieved data (telemetry and scientific) from the satellite in the OpCen.	
GSeg	GS - 120	The OpCen shall structure the retrieved data from the satellite in order to provide a simple and fast access.	
GSeg	GS - 130	The OpCen shall send specific commands to the satellite, operator cannot create his own TC.	
GSeg	GS - 140	The administration of the GS software can be done remotely.	
GSeg	GS - 150	The GS shall forward the retrieved data to the OpCen.	
GSeg	GS - 160	The GS shall be operable both locally and remotely, and both manually and automatically.	
GSeg	GS - 170	The GS shall have antennas to operate at UHF band.	
GSeg	GS - 180	The GSeg shall be composed of a minimum of one tracking, commanding and receiving station and an unique OpCen.	
GSeg	GS - 190	The GS shall be placed in a limited access area with controlled environment.	
OPS	OPS - 010	The OpCen shall communicate with the GS using a VPN interface.	

OPS	OPS - 020	The OpCen shall be connected with a wired network to internet.	
OPS	OPS - 030	Only an administrator can modify OpCen configuration.	
OPS	OPS - 040	The OpCen shall be placed in a limited access area.	
OPS	OPS - 050	The OpCen shall provide a GUI interface to interact with the GS and the spacecraft.	
OPS	OPS - 060	The OpCen GUI shall provide mechanisms to control an manage the GS remotely.	
OPS	OPS - 070	The OpCen GUI shall provide mechanisms to operate the spacecraft.	
OPS	OPS - 080	The OpCen GUI shall provide mechanisms to upload satellite configurations.	
OPS	OPS - 090	The Opcen GUI shall provide a login mechanism before starting any activity.	
OPS	OPS - 100	The OpCen shall exploit the retrieved data from the GSeg stations.	
OPS	OPS - 110	The OpCen GUI shall list the different TC that can be sent to the spacecraft.	
OPS	OPS - 120	The OpCen GUI shall present the download data from the spacecraft.	
OPS	OPS - 130	The OpCen GUI shall plot stored data.	
OPS	OPS - 140	The OpCen shall provide mechanisms to stop and resume spacecraft communications.	
OPS	OPS - 150	The OpCen shall provide mechanisms to reboot the spacecraft.	

OPS	OPS - 160	The OpCen shall provide mechanisms to perform a health check of the satellite.	
OPS	OPS - 170	The OpCen shall provide mechanisms to request scientific and telemetry data from the satellite.	
OPS	OPS - 180	The OpCen shall provide mechanisms to manually transit through satellite modes.	
OPS	OPS - 190	The OpCen shall provide mechanisms to perform manual deployments on the satellite.	