

PocketQube Class Satellite Developments at BME

SMOG-1 & SMOG-P: 1 PQ - 5x5x5 cm

To follow the educational path in satellite development, during the lifetime of MASAT-1, in 2014 a new group of university students carried on with satellite development at Budapest University of Technology and Economics (BME). To reduce the costs and development time, the team had decided to work with the PocketQube standard. Thus the development of 1 PQ (5x5x5 cm) SMOG-1, SMOG-P and 2 PQ (5x5x10 cm) ATL-1 size satellites begun. - Fig. 1

The primary payload of SMOG-1 and SMOG-P satellites is the spectrum monitoring system in the digital video broadcasting television (DVB-T) frequency band on the Low Earth Orbit (LEO). This man-made RF radiation, known as electromagnetic smog (hence the name) can cause interference in LEO satellite communication.

The secondary mission of the SMOG satellites is the measurement of total ionizing dose with suitable field effect transistors (FETs) on-board. This makes it possible to estimate the operational lifetime of the satellites.

As an additional payload, SMOG-1 features a special magnetic hysteresis material mounted on the side panels below the solar cells to decrease the life span of the orbit to minimize the time during which the satellite acts as space debris.

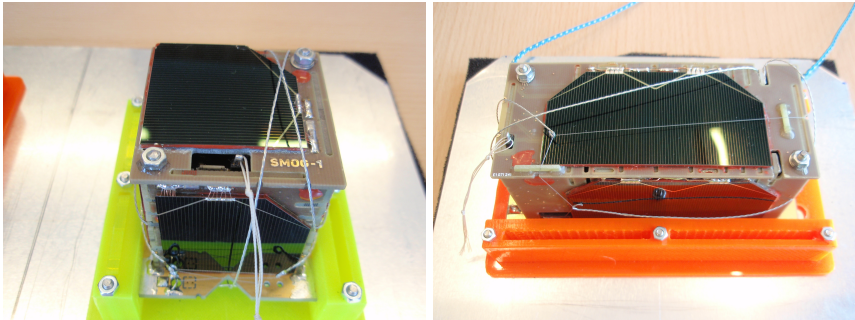


Figure 1: SMOG-1 & SMOG-P (left) and ATL-1 (right) Satellites

ATL-1: 2PQ - 5x5x10 cm

The primary mission of ATL-1 satellite is the on-board thermal isolation demonstration of three different and special thermal insulator materials in vacuum and micro-gravity to regulate the temperature of the batteries.

ATL-1 also features the DVB-T based spectrum monitoring system as SMOG-1 & SMOG-P.

Satellite Tracking and Control Station

On the top of building E at BME, the automated and remote controlled satellite tracking and control station called BME GND can be found. It has autonomous energy source based on 4x240W solar panels and 100 Ah batteries - Fig. 2. This control station has 4.5 m diameter parabolic type aperture antenna and a high precision azimuth-elevation antenna rotator. This enables us to track satellites with the main beam of the antenna with circular primary radiator (21 dBlin, 24dBcirc gain, 8 deg. main beam width).

The PocketQube class satellites are operating on the 70 cm radio amateur frequency band: SMOG-1 at 437.345 MHz, SMOG-P at 437.150 MHz and ATL-1 at 437.175 MHz - coordinated by the National Infocommunication Authority (NMHH), International Amateur Radio Union (IARU) and International Telecommunication Union (ITU). The bandwidth of the downlink (satellite GND) is limited to 20 kHz using a maximum of 12.5 kbit/s datarate with GMSK modulation and Forward Error Correction coding scheme. The nominal RF output power of the PQ class satellites is 100 mW (20dBm) with only 300-500 mW DC input power from the solar panels.



Figure 2: Primary Satellite Tracking and Control Station at BME

Our satellite control station is available here: <http://gnd.bme.hu/>

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