USER MANUAL

UHF Antenna II

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This user manual is specially designed to describe the EnduroSat UHF Antenna II module, its functions and features.

Please read carefully the manual before unpacking the antenna in order to ensure safe and proper use.

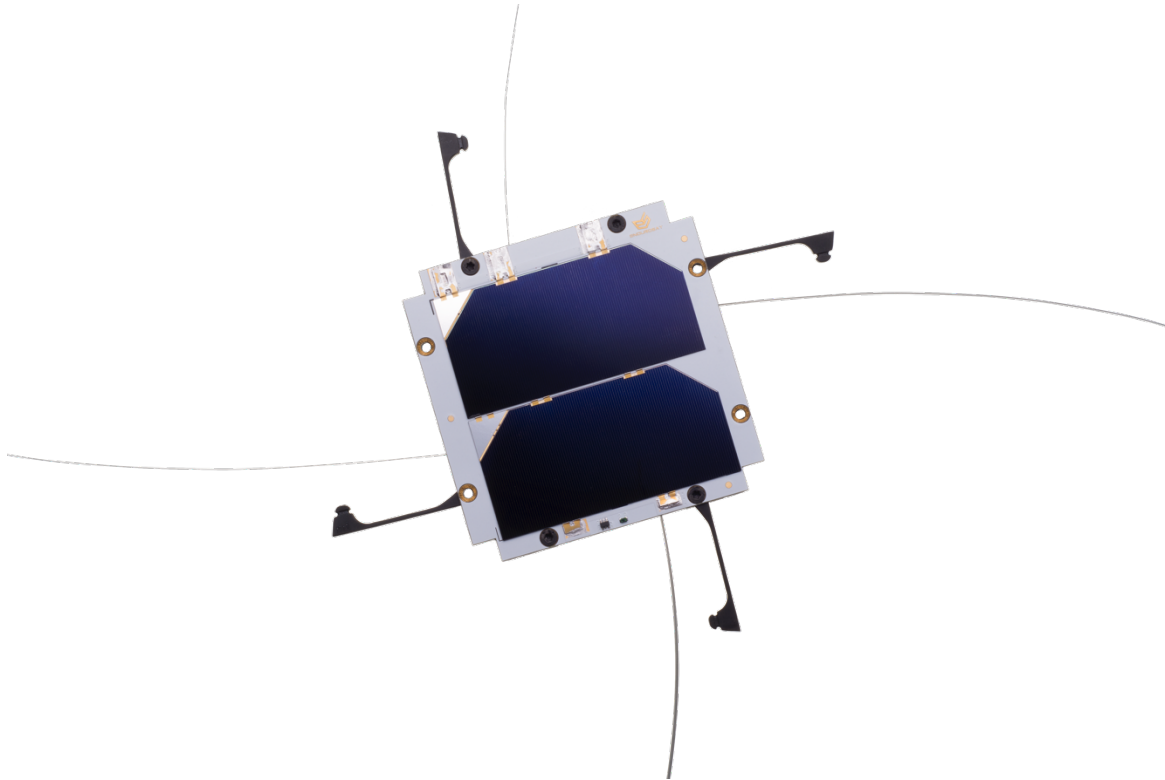Figure 1 – EnduroSat UHF Antenna II (**Solar panel is a separate product**)

1 CHANGE LOG

Date	Version	Note
22/Nov/2017	Rev 1	
01/Feb/2018	Rev 1.2	Radiation testing details added, Minor text enhancements

2   ACRONYMS LIST

LHCP   Left Hand Circular Polarization

RHCP   Right Hand Circular Polarization

RF   Radio Frequency

UHF   Ultra-High Frequency

PCB   Printed Circuit Board

3   OVERVIEW

The antenna is designed to cover the amateur satellite band 435-438 MHz. It has a circular polarization and uses a dual redundant burn wire mechanism with feedback for the deployment of the antenna rods. The antenna is controlled and monitored via I^2C interface. It has an additional redundancy feature for direct control of the burning resistor chains by general purpose outputs.

4   HIGHLIGHTED FEATURES

- UHF band for amateur satellite communications 435 – 438MHz
- Compatible with EnduroSat Solar panels
- Circularly polarized
- Weight: 85 g
- Gain > 0dBi*
- Max RF output power 3.5W
- Burn wire mechanism with feedback for deployment
- Supply voltage for deployment: 5V
- Interface: I^2C
- Redundant direct control of the burning resistor chains through the connector

*from simulation

5   FUNCTIONAL DESCRIPTION

The feed network for the RF part of the antenna is realized using strip lines. Each rod is fed with 90 degrees phase shift so that the antenna has a circular polarization. The antenna has a through hole for connecting it to EnduroSat'solar panel Z.

6   HARDWARE LAYOUT

Figure 2 depicts the bottom side of the antenna. All dimensions are in mm. It uses up to 8 bolts for mounting to the satellite body (minimum 4 required: in this configuration, the bolts shall be installed in the proper locations as shown in figure 4). There is an opening in the PCB, through which an EnduroSat solar panel can be connected. The right angle MCX connector, used for connecting the antenna to the communication module, is located next to the opening.

The thickness of the antenna and the height of the connector are shown on Figure 3. The overall thickness (and weight) of the antenna depends on the top cover. It can be a solar panel, a top cover or another module. On figure 3 is shown the thickness of the whole antenna with a cover of 1.6 mm.
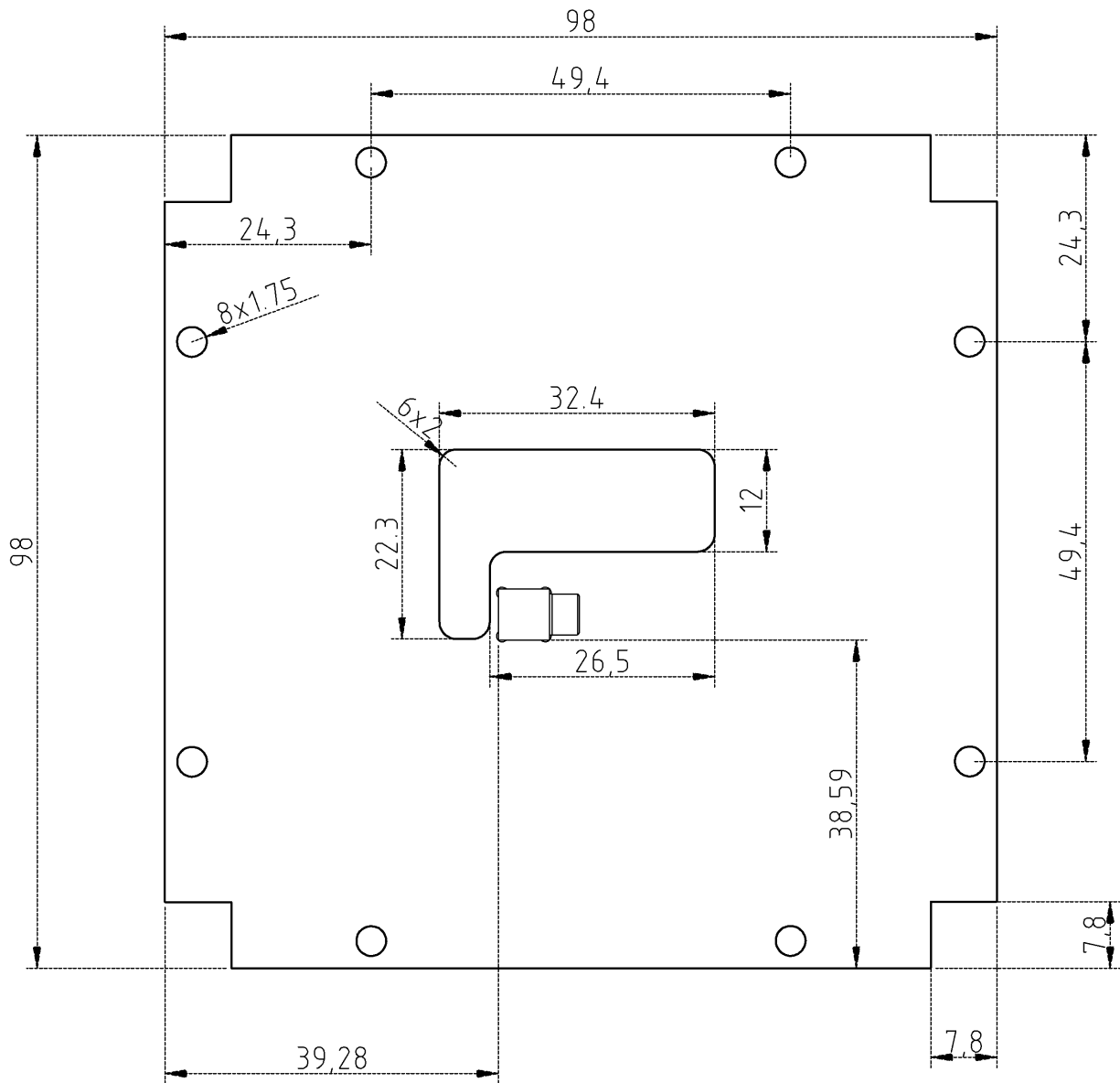
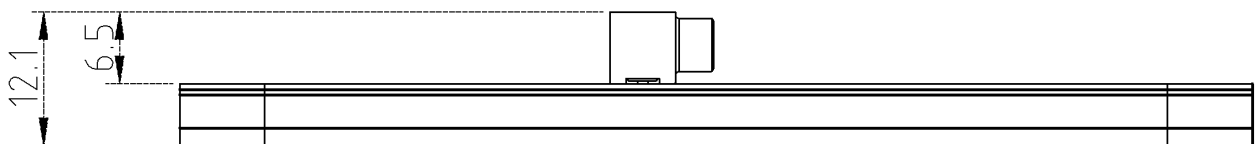Figure 2 - Physical layout bottom side - Dimensions in mm.

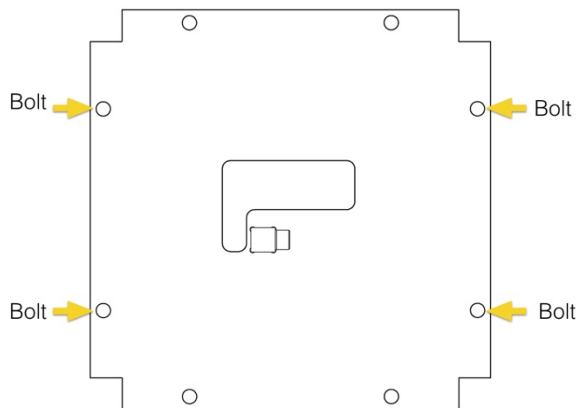Figure 3 - Side view - Dimensions in mm.

Figure 4 – Proper installation of the 4 bolts configuration.

7 CHARACTERISTICS

7.1 Frequency

Figure 5 shows the measured return loss of the UHF antenna

Figure 5 - measured return loss of the UHF antenna

7.2   Polarization

LHCP or RHCP with regards to antenna orientation.

7.3   Connectors

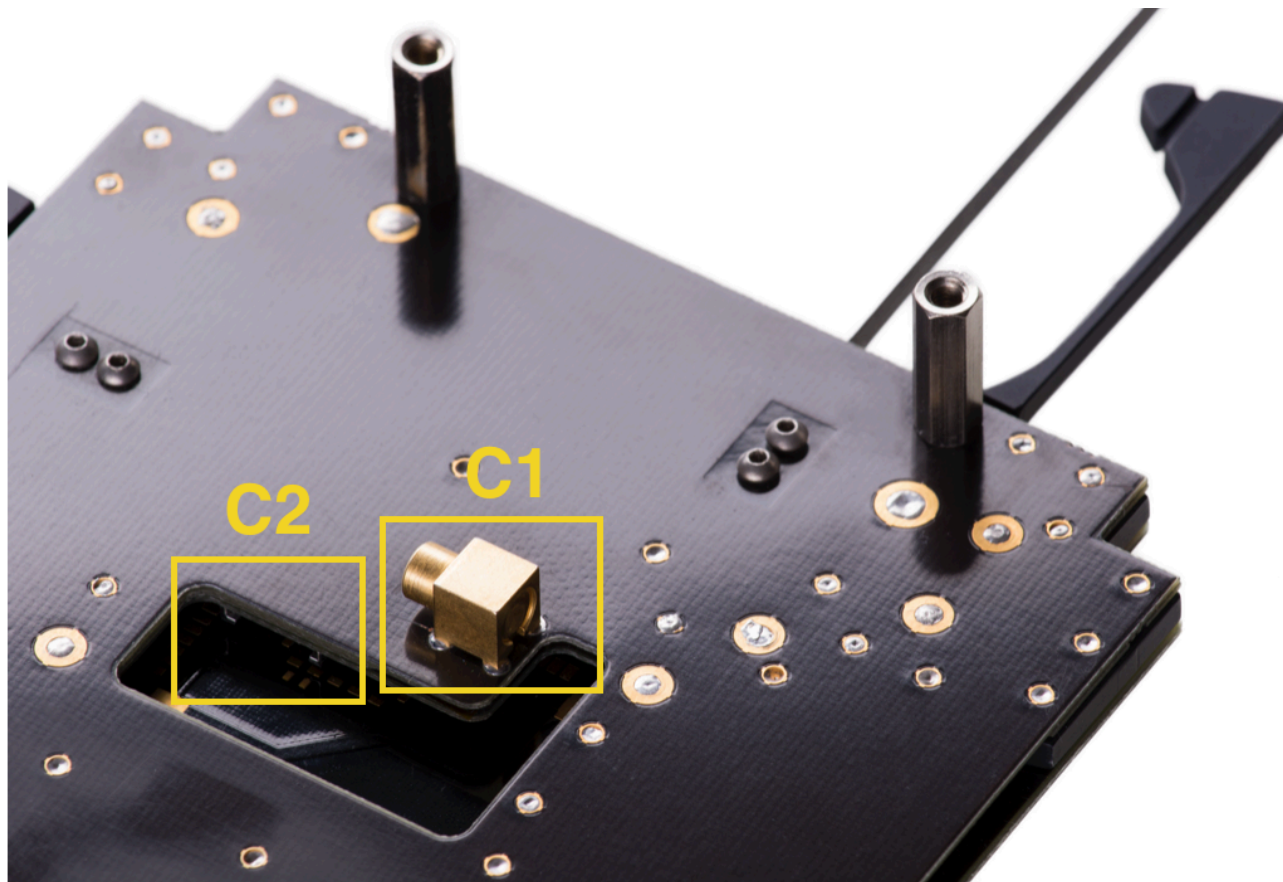|	
C1	MCX right angle (straight MCX or SMA upon request)
C2	Six pin Molex Pico-Lock™

Figure 6 - Bottom Side - Connectors location

In the case of collision between the MCX connector and the structure of the satellite, U.FL connector on the internal side can be accessed by disassembling the top cover of the antenna.

C2 pinout:

Pin	Mnemonic	Description
1	+5V	Positive
2	I2C SCL	I^2C Clock
3	I2C SDA	I^2C Data
4	Ground	Ground
5	Release All A	Activate all four primary burning resistors
6	Release All B	Activate all four back-up burning resistors

7.4   Gain

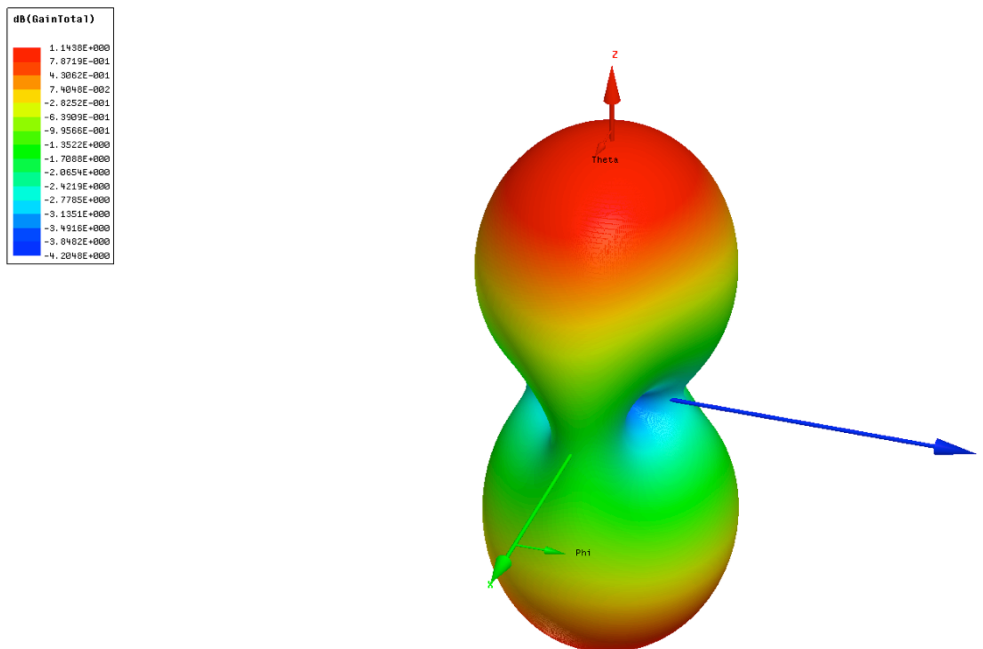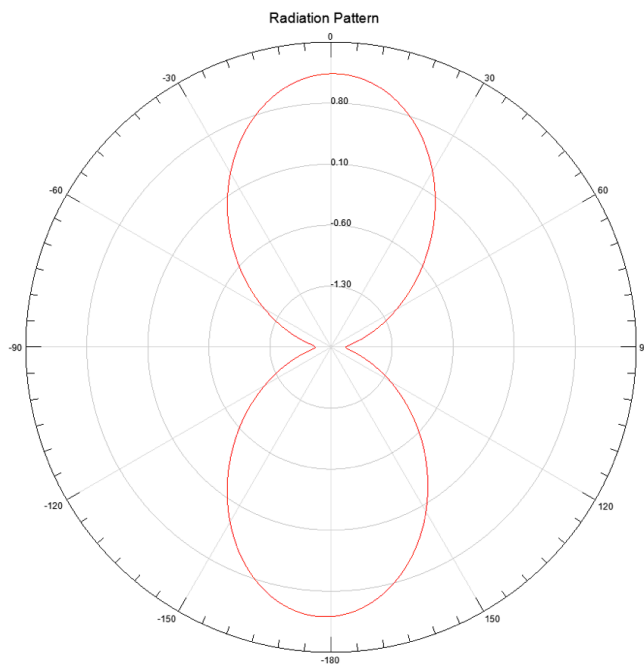Figures 7 and 8 show the radiation pattern of the antenna

Figure 7

Figure 8

8   ELECTRICAL CHARACTERISTIC

Parameter	Condition	Min	Typ	Max
Supply Voltage [V]			5	
Current Consumption [mA]	Idle mode		0.5	2*
	Primary burning resistor		250	
	Primary and Back-up burning resistor		500	
	All primary burning resistors (pin 5 activated)		1000	
	All back-up burning resistors (pin 6 activated)		1000	
Burning resistors voltage activation [V]	Logical level threshold for activation of all burning resistors (primary or back-up burning wire resistor chains – pin 5, 6)	1.5	3.3	

*Peak current consumption during I2C communication with 4.7 kOhm pull-up resistors

9   DEPLOYMENT MECHANISM

The deployment mechanism uses burning resistors to cut a wire and release the doors holding the antenna rods. Each antenna rod can be deployed by two independent resistors for redundancy controlled via I²C. The additional direct control feature enables activation of the entire burning wire resistor chains by general purpose outputs. Deployment status feedback information can be collected through the I²C interface pins on the connector.

In order to avoid significant voltage drop, the length of cables should be minimized. The recommended cable is AWG 24.

10   MATERIALS

The frame and doors used for holding the antenna rods rolled and encapsulated is made of aluminum with hard anodization, which prevents a short circuit between the frame and the antenna rods. Rods are made from SMA – Shape Memory Alloy with super elastic properties to ensure straight shape after release. All PCBs are made from FR-4.

11   MECHANICAL AND ENVIRONMENTAL TEST

A full campaign of tests at qualification level was performed on the qualification engineering model. Qualification tests level and duration follow the ESA standard ECSS-E-ST-10-03C and GEVS: GSFC-STD-7000A. Test performed:

- Thermal Cycling
- Thermal Vacuum
- Random Vibration
- Sinusoidal Vibration
- Pyroshock Test
- Total Ionizing Dose > 40 kRad

12 INCLUDED IN THE SHIPMENT

EnduroSat provides along with the UHF antenna:

- 2 Coaxial cables 50 Ohm with selectable lengths and connectors
- Power and command cable (PTFE Material Jacket, 24AWG), connector MOLEX 504051-0601
- USB stick with user manual

Customized cables and connectors can be provided upon request.

13   HANDLING AND STORAGE

Particular attention shall be paid to the avoidance of damage to the UHF antenna during handling, storage and preservation. The handling of the UHF antenna module should be performed in compliance with the following instructions:

- Handle using PVC, latex, cotton (lint free) or nylon gloves
- The environment where UHF antenna module will be handled shall meet the requirements for a class environment 100 000, free of contaminants such as dust, oil, grease, fumes and smoke from any source.
- Store in such a manner as to preclude stress and prevent damage
- To prevent the deterioration, the UHF antenna must be stored in a controlled environment, i.e. the temperature and humidity levels shall be maintained in the proper ranges:
    - Ideal storage temperature range: 15ºC to 27ºC
    - Ideal storage humidity range: 30% to 60% relative humidity (RH).

14   WARNINGS

This product uses very fragile components. Observe precautions for Handling.

This product uses semiconductors that can be damaged by electrostatic discharge (ESD). Observe precautions for Handling

Sensitive Electronic device. Do not ship or store near strong electrostatic, electromagnetic, magnetic or radioactive fields.