DATASHEET

UHF Antenna III

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

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

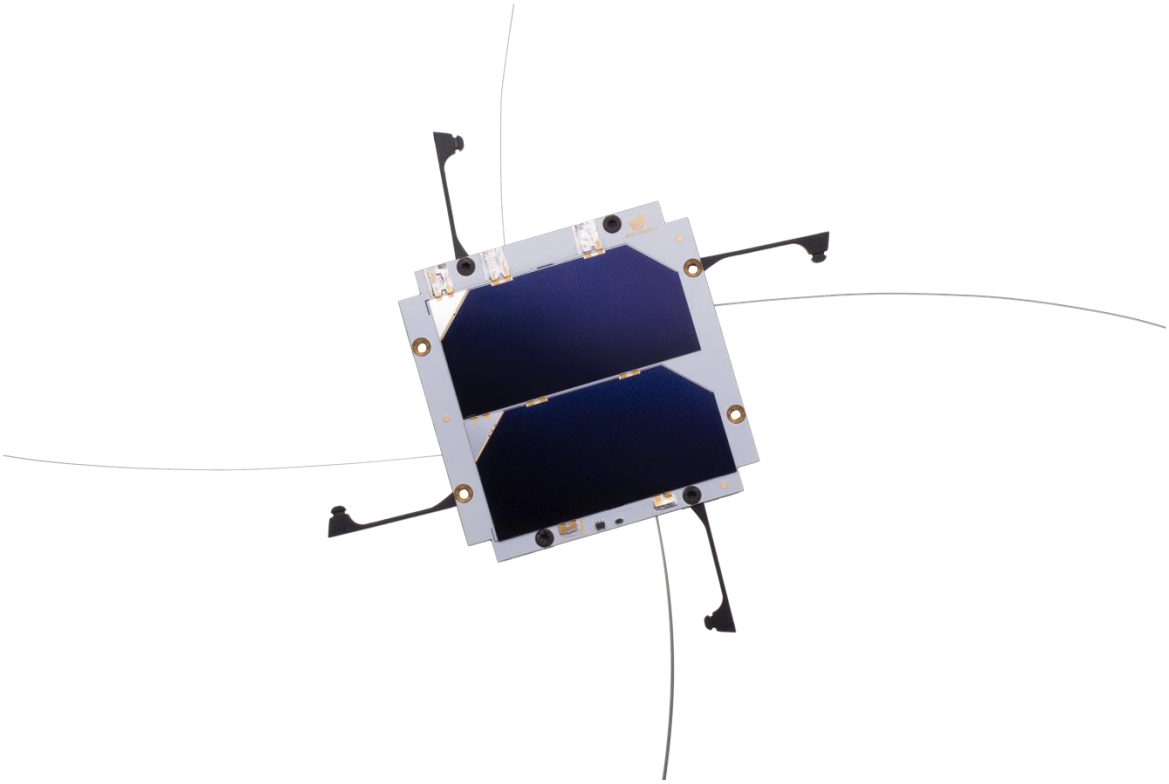


Figure 1 – EnduroSat UHF Antenna III (**Solar panel is a separate product**)

1 CHANGE LOG

Date	Version	Note
12/08/2019	Rev 1	Initial document

2 ACRONYMS LIST

LHCP	Left Hand Circular Polarization
MCX	Micro Coaxial Connector
PCB	Printed Circuit Board
RHCP	Right Hand Circuit Polarization
RF	Radio Frequency
UHF	Ultra-High Frequency
USB	Universal Serial Bus

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 double 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: 5V
- I^2C interface for monitoring and control
- Two redundant channels for direct deployment of the antenna rods with logical level
- Typical current consumption during antenna deployment: 250mA @5V
- Ultra-low current consumption in idle mode: 1mA @5V
- Rod deployment controlled sequence
- Two algorithms for antenna deployment
- Test mode jumper for I^2C verification and preventing for unwanted deployment of the antenna
- MCX Connector and secondary UFL connector inside the antenna for compatibility with different kind of satellite structures.

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. There are 8 mounting holes (M3) as shown on figure 2. Four of them, shown on figure 4 are with already screwed bolts, which should not be removed. In order to mount the antenna to the structure the other four mounting holes should be used. 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.

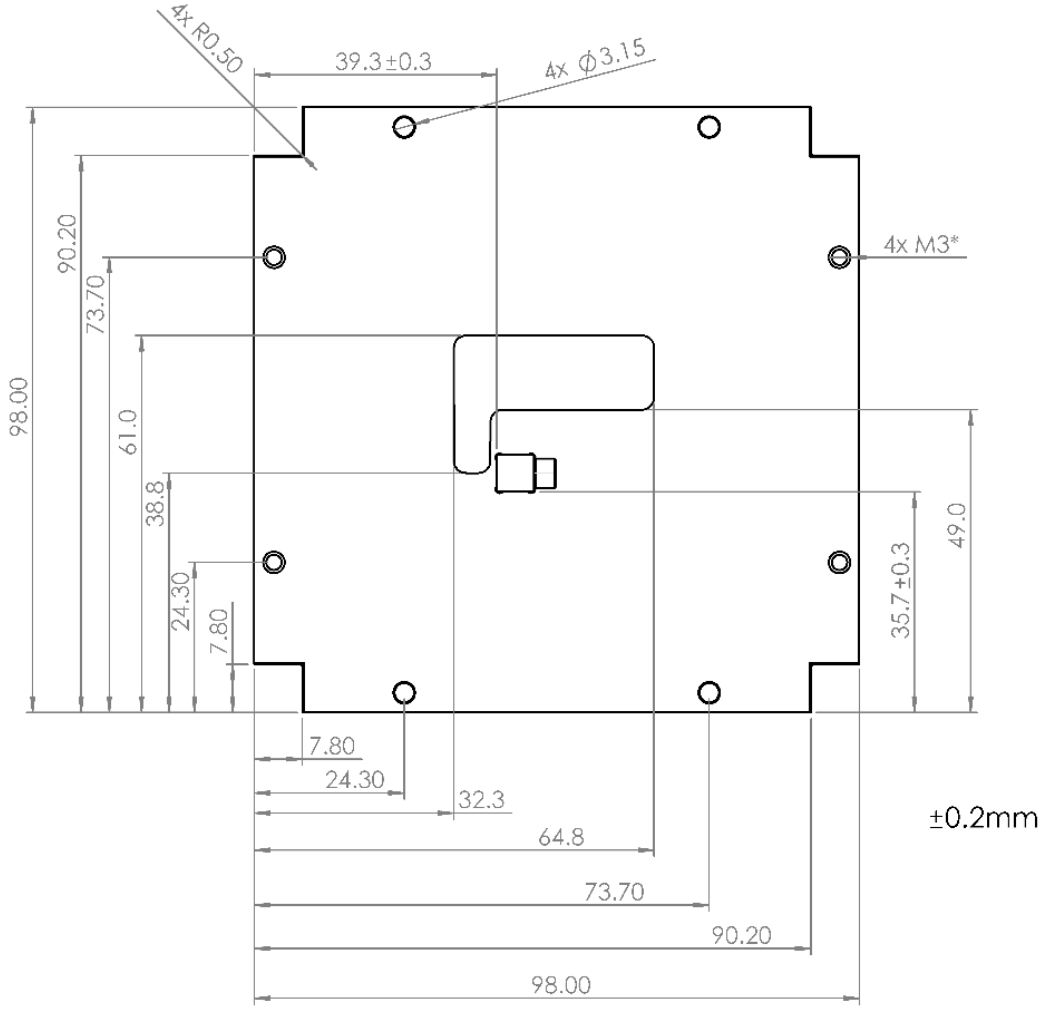


Figure 2: Physical Layout Bottom Side (dimensions in mm)

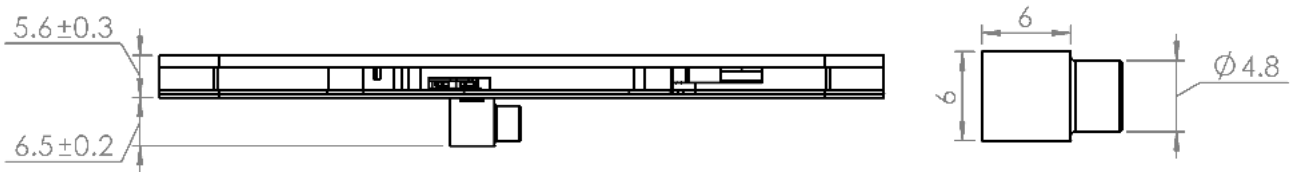


Figure 3: Side View (dimensions in mm)

** The dimensional tolerance is +/-0.2mm, unless otherwise specified.*

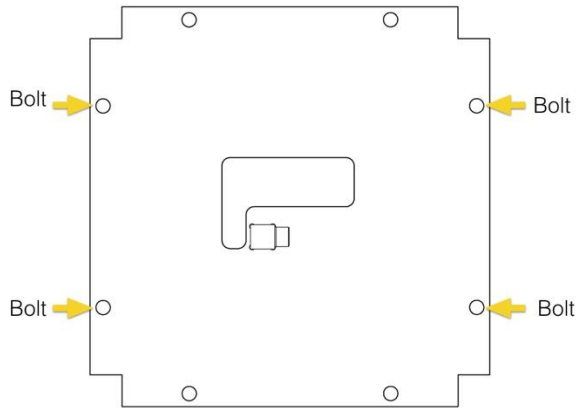


Figure 3: Proper installation of the 4 bolts configuration

The EnduroSat UHF antenna comes with four DIN965 M3x6 bolts already mounted on the positions above. The rest of the holes are used for mounting the antenna to the body. These holes are also designed for countersink screws.

7 CHARACTERISTICS

7.1 Frequency

Figure 5 shows the measured return loss of the UHF antenna.

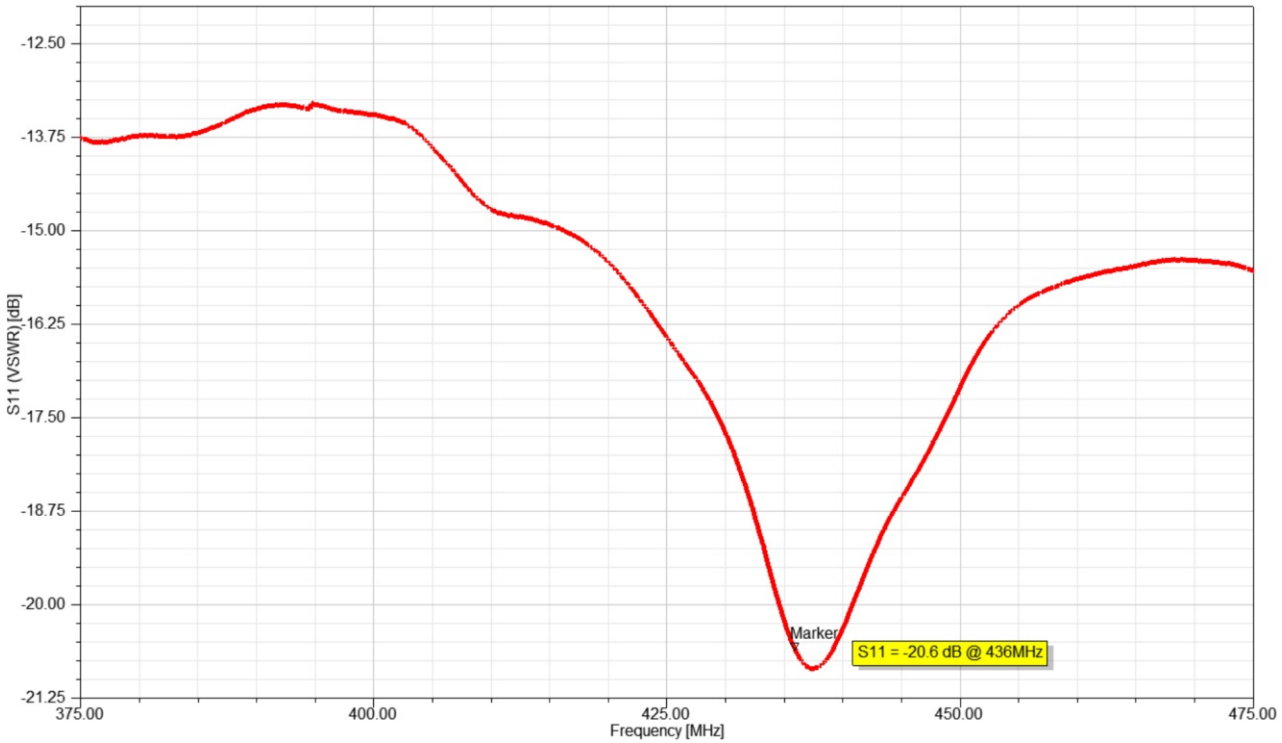


Figure 4 Measured return loss of the UHF antenna

7.2 Polarization

RHCP over the top cover of the antenna and LHCP downwards (on the side of the connectors).

7.3 Connectors

J1	MCX right angle (straight MCX or SMA upon request)
J2	Six pin Molex Pico-Lock™ 504050-0691

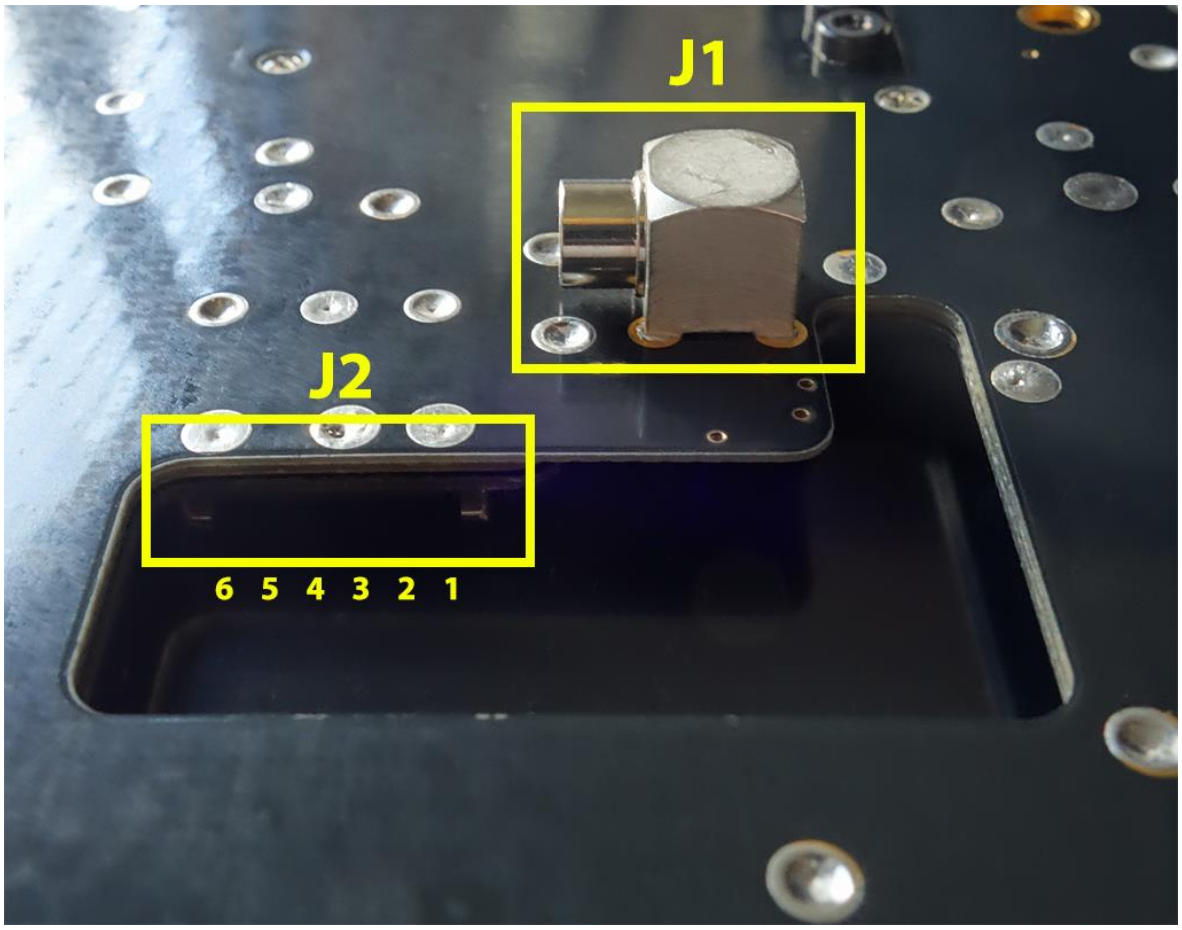


Figure 5 Bottom Side – connector location

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

J2 pinout:

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

7.4 Gain

The following figures depict the simulated radiation pattern of the antenna and when mounted on 1U, 2U, 3U.

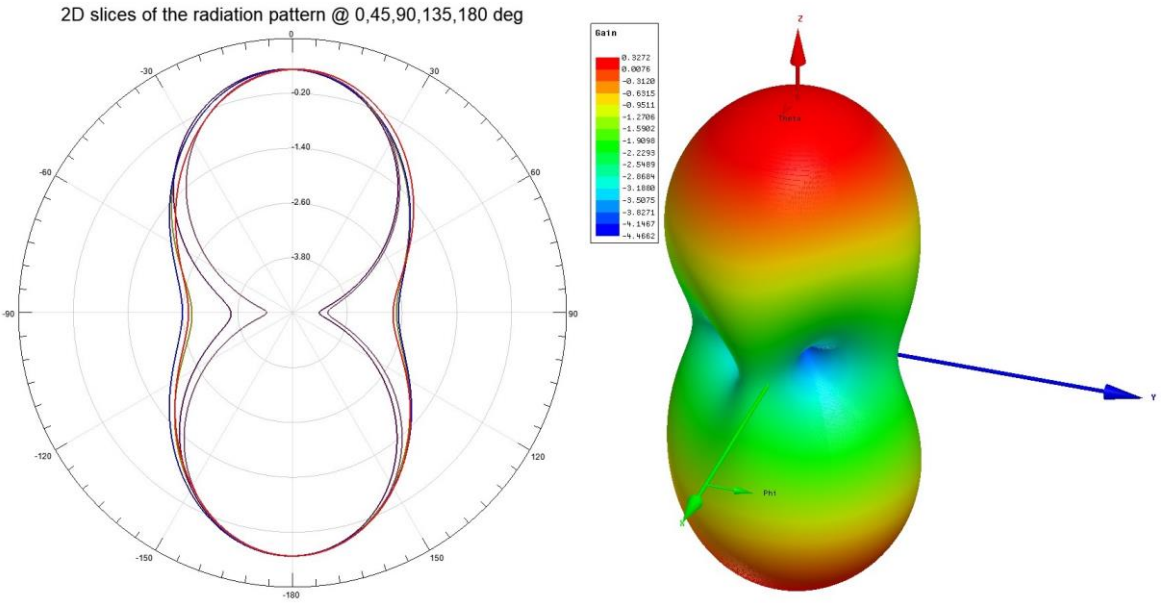


Figure 6: Radiation pattern of the antenna (free space)

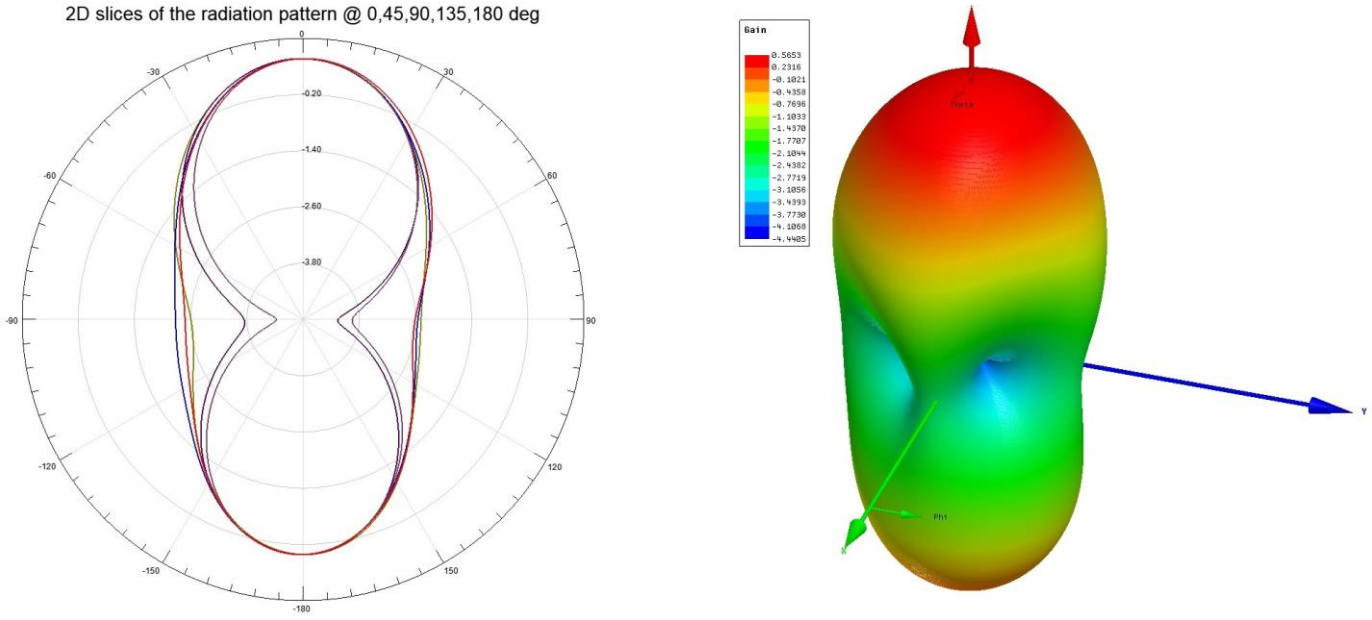


Figure 8: Radiation pattern when mounted on a 1U structure

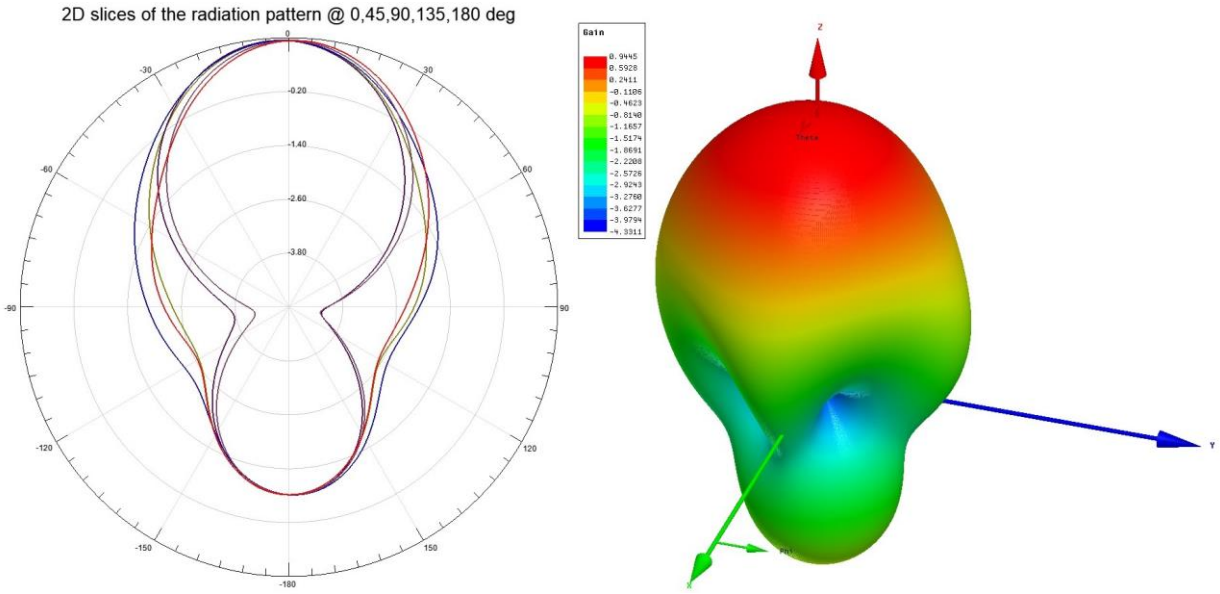


Figure 9: Radiation pattern when mounted on a 2U structure

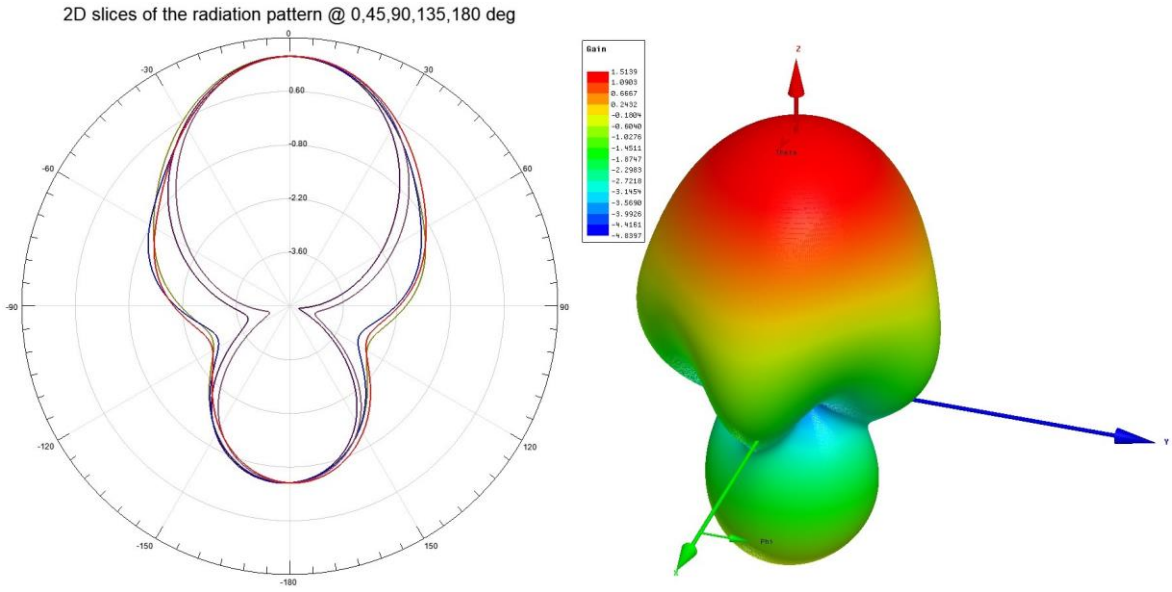


Figure 10: Radiation pattern when mounted on a 3U structure

In the above figures the antenna is positioned at the origin of the coordinate system and the satellite is along the z axis in the positive direction.

8 ELECTRICAL CHARACTERISTIC

Parameter	Condition	Min	Typ	Max
Supply Voltage [V]		4.8	5	6
Current Consumption [mA]	Idle mode		0.5	2*
	Primary burning resistor		250	280
	Primary and Back-up burning resistor		500	560
	All primary burning resistors (pin 5 activated)		1000	1120
	All back-up burning resistors (pin 6 activated)		1000	1120
Burning resistors voltage activation [V]	Logical level threshold for activation of all burning resistors (primary or back-up burning wire resistor chains – pin 1, 2)	1.5	3.3	6

*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 I^2C. 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 I^2C 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.

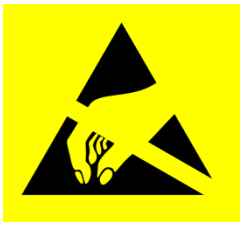
13 HANDLING AND STORAGE

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.