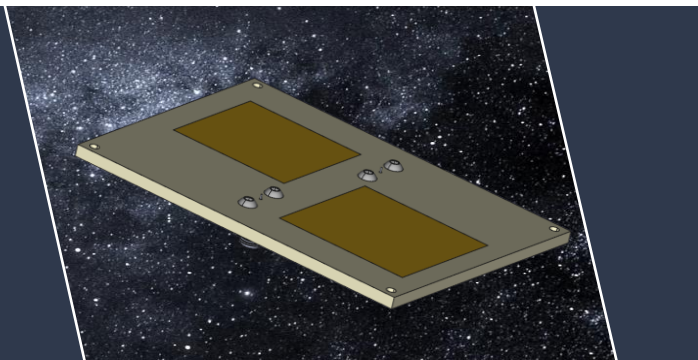


S-Band Patch Antenna with SMA Interface Control Document

- Dual Patch Antenna with SMA
- 81 x 103 mm, 1995 MHz / 2185 MHz

HIGHLIGHTS

- Circular polarization (RHCP)
- TRL 9 for basic design
- Flight Heritage since 2017
- Compatible with 1U CubeSats
- Robust design



This **COTS antenna** is designed for pico and nano satellite applications to realize simultaneous satellite-to-ground radio links.

With circular polarization, the antenna provides a robust solution regarding the steering accuracy to the ground station antenna and in case of a randomly rotation of wave polarization plane by refracts of the ionosphere.

As an RF connector, a robust SMA female connector (manufactured by RADIALL) is used. A proper mounting of the antenna can be provided by 4 screws. The antenna backside shall be grounded properly to the satellite chassis.

As dielectric, ROGERS™ laminate for space applications is used. Patches and conductors are copper with gold surface finish.

With the basic design, TRL 9 has been achieved with various successful LEO missions.

FEATURES

- Flight grade tested design
- Patch antenna design matched to customer specific frequencies
- Short delivery time

KEY SPECIFICATIONS

Tx center frequency:
2185 MHz

RF bandwidth Tx:
30 MHz

Rx center frequency:
1995 MHz

RF bandwidth Rx:
30 MHz

**Maximum gain:
(main direction)**
6 dBi

Beam width:
 $\pm 40^\circ \times \pm 40^\circ$

RF power input:
< 4W

**Temperature range:
(operationally)**
-30°C ... +60°C

VSWR:
< 1.25 center freq.
< 1.8 typical for freq. range

Impedance:
50 Ω

Type:
Dual Patch

Mass:
≈ 61 grams

**Outer dimensions
(x/y/z, w/o connector):**
81 x 103 x 3.4 mm³

Polarization:
RHCP

Connector type:
SMA (f)

Document Information

Action	Name / Signature	Company	Date
Prepared by	SPI Stefan Pirwitz	IQ	2020-02-03
Checked by	KJÄ Klaus Jäckel	IQ	2020-02-03
Product assurance	AWE Andreas Weiland	IQ	2020-02-04
Authorized by	MRE Mathias Reibe	IQ	2020-02-04

Issue	Date	Page and/or paragraph affected	Change description	Responsible
00	2020-02-03		Initial issue	Author SPI
01	2022-31-05		Adaptation RF BW and power, new IQ address	KJÄ
02	2023-09-13		Update impedance performance	SPI
03	2026-04-22		Changed Design and Name	JML

Mechanical Dimensions

Figure 1: Mechanical dimensions and positions of RF connectors. All tolerances for all mechanical dimensions are +/- 0.1mm. These are based on manufacturing tolerances by the PCB manufacturer.
(Tx port 2,185MHz; Rx port 1,995MHz)

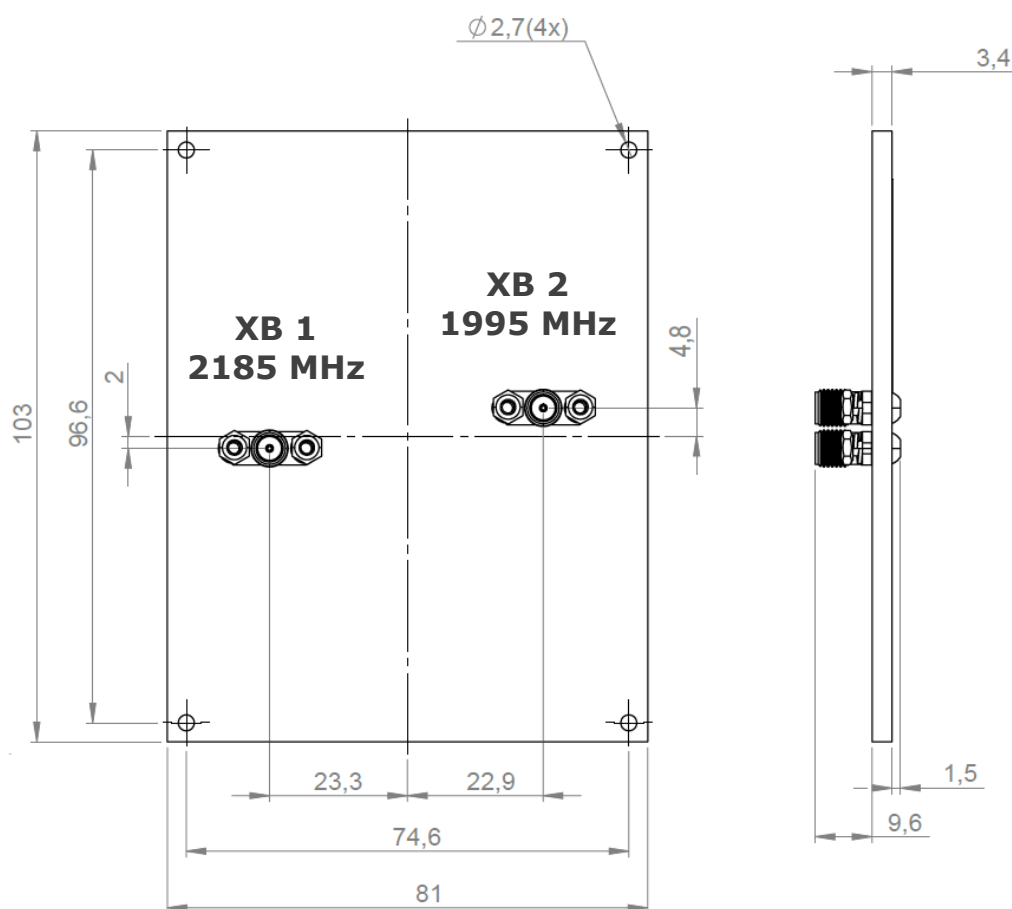


Figure 1: Mechanical dimensions and positions of RF connector SMA(f), all dimensions in mm



Figure 2: Antenna realization (similar type / patch side)

Simulated Data

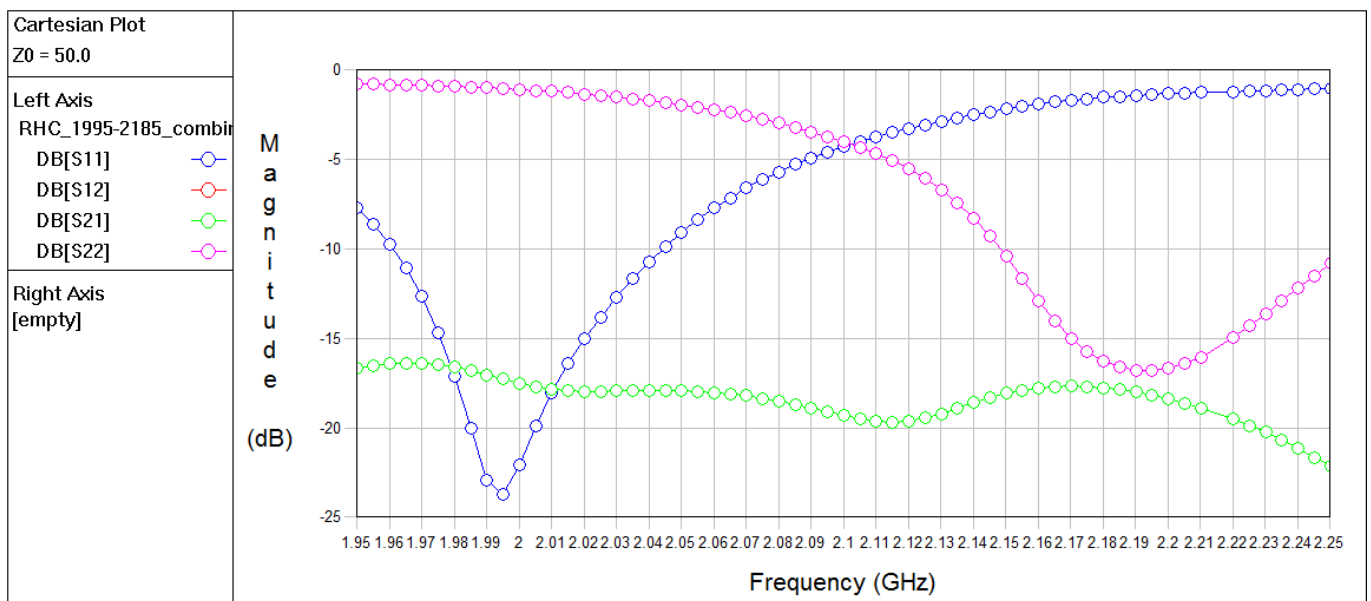


Figure 3: Simulation results of impedance matching (Tx port, S22, red and Rx port, S11, blue, S21 green)

RHC_1995-2185_
Gain (dB)

Frequency (GHz)

2.17 GHz
2.175 GHz
2.18 GHz
2.185 GHz
2.19 GHz
2.195 GHz
2.2 GHz

Phi
0.0 Degrees

E Field

E RHP

E LHP

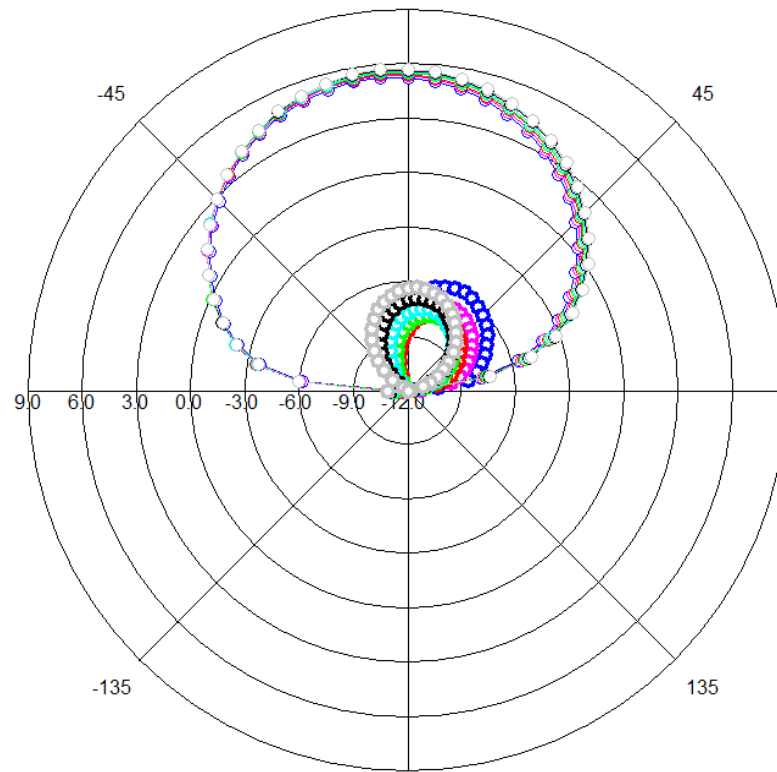


Figure 4: Simulation results of Tx antenna pattern 0°, RHC vs. LHC (bold)

RHC_1995-2185_
Gain (dB)

Frequency (GHz)

2.17 GHz
2.175 GHz
2.18 GHz
2.185 GHz
2.19 GHz
2.195 GHz
2.2 GHz

Phi
90.0 Degrees

E Field

E RHP

E LHP

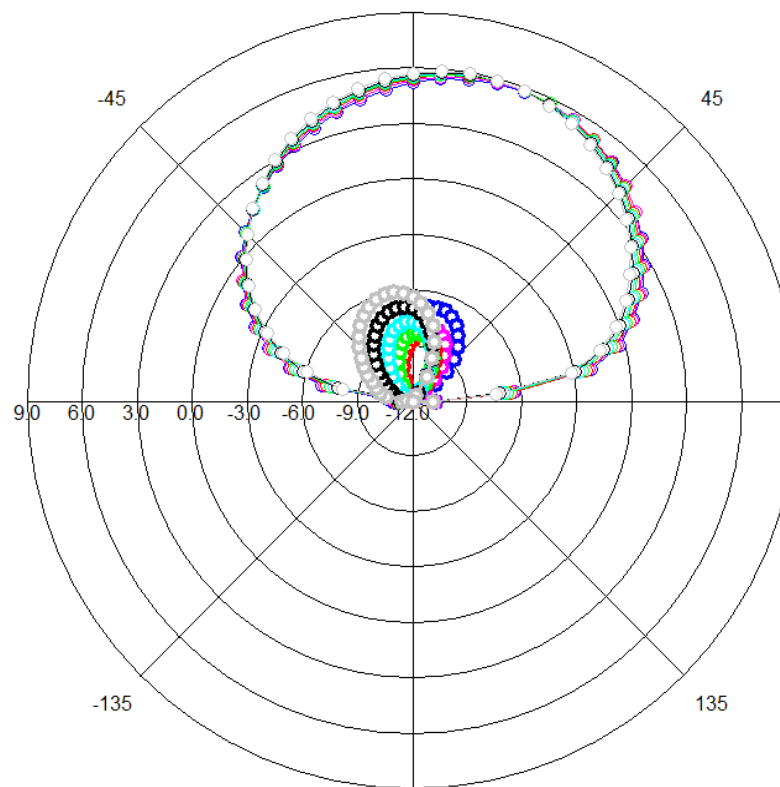


Figure 5: Simulation results of Tx antenna pattern, 90° RHC vs. LHC (bold)

RHC_1995-2185_
Gain (dB)

Frequency (GHz)
1.98 GHZ
1.985 GHZ
1.99 GHZ
1.995 GHZ
2.0 GHZ

Phi
0.0 Degrees

E Field
E RHP
E LHP

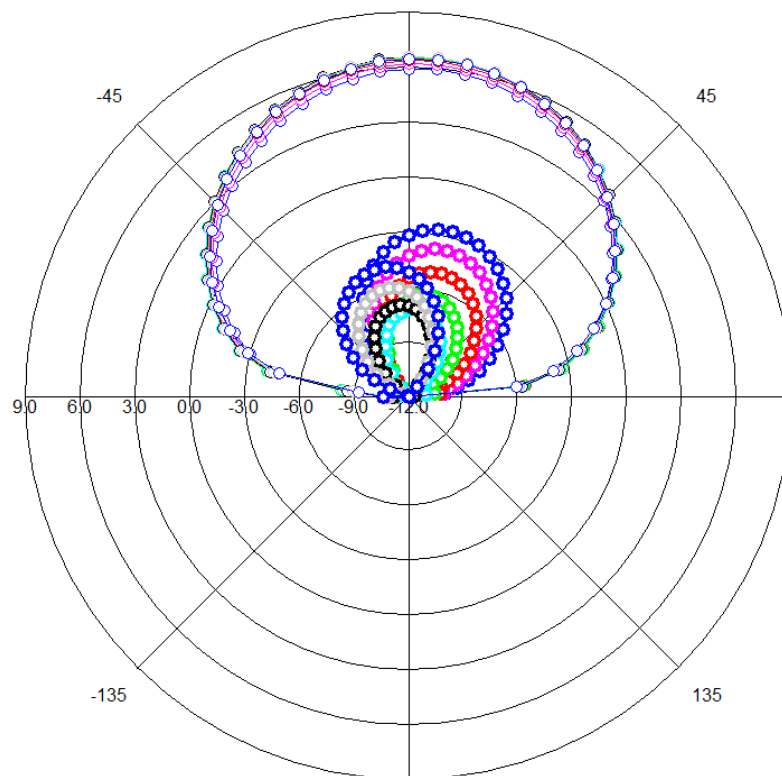


Figure 6: Simulation results of Rx antenna pattern, 0° RHC vs. LHC (bold)

RHC_1995-2185_
Gain (dB)

Frequency (GHz)
1.98 GHZ
1.985 GHZ
1.99 GHZ
1.995 GHZ
2.0 GHZ
2.005 GHZ
2.01 GHZ
2.015 GHZ

Phi
90.0 Degrees

E Field
E RHP
E LHP

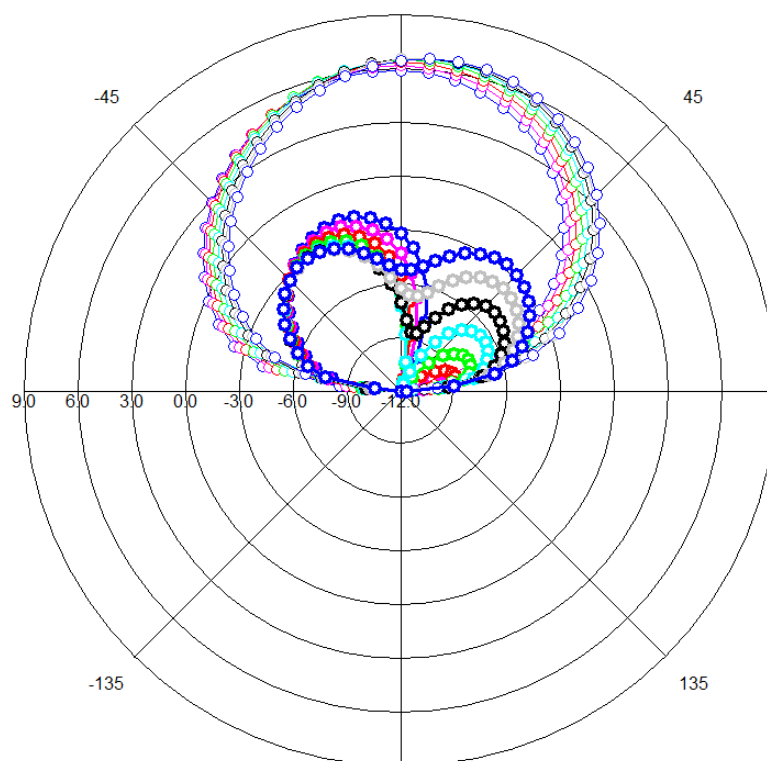


Figure 7: Simulation results of Rx antenna pattern, 90° RHC vs. LHC (bold)

Interfacing and Mounting Hints for the Antenna

Please use suitable screws and washers according to your specific requirements for mounting the antenna to the satellite chassis. Mounting of the antenna is by 6 of those screws and washers with positions as indicated in figure 1. Please ensure that the mounting area is plane.

A step file for the antenna could be provided on request.

CAUTION:



Although all external interfaces are protected against ESD, proper precautions and grounding must still be observed when handling the device. Antenna backside and outer conductors of RF connectors and feeders have electrical ground potential. They should be connected properly to satellite chassis (ground).

CAUTION:



When interfacing and operating the antennas with radio transmitters, generators or similar equipment, special care is required regarding a potential irregular radio wave radiation. Please ensure that maximum power ratings are kept. RF interfaces to be connected to the antenna ports should be free of DC.

Please make sure that no obstacles are arranged or mounted in beam direction of the antenna patches.

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