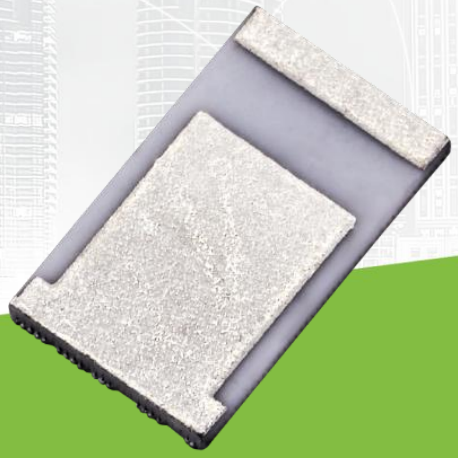
TAOGLAS®



Datasheet

Part No:
NLA.01

Description

Non-Terrestrial Networks Ceramic Substrate Loop Antenna

Covering NTN Bands 23 and n256

Features:

- Compact, Low Profile SMD Antenna
- High efficiency, omnidirectional coverage
- Covering NTN Bands 23 and n256 from 1980 - 2200MHz
- Dimensions: 5mm x 3mm x 0.5mm
- RoHS & Reach Compliant

1. Introduction

Taoglas has developed a unique ceramic miniature loop antenna series for Non-Terrestrial Networks (NTN) radio applications. At 5.0 x 3.0 x 0.5mm, the NLA.01 NTN ceramic loop antenna is a miniature edge mounted antenna designed for compact devices with minimal space availability. The radiation pattern of the loop antenna is more omni-directional than traditional patch antennas making it ideal for use where the orientation of the device is not known, of could change whilst the device is in use.

Mechanically, the NLA.01 at only 0.5mm in height has a low profile, and with a footprint of overall footprint including the keep out area of just 6.0 x 5.5mm, it requires less space on the device PCB when compared to larger patch style antennas. Based on the loop effect, this antenna works best when positioned in the center of the edge of the board, but it can still work better than traditional linear polarized chip antennas even when placed at the corner of the PCB as a substitute if restrictions apply elsewhere.

This antenna can be mounted with no performance degradation in either orientation if the antenna is soldered correctly via surface mounting. Please see the integration instructions section for further detail regarding the optimum way to integrate this antenna into your device.

Typical Applications for the NLA.01 include:

- Devices with Satellite Fallback from traditional Cellular Connectivity
- LEO/GEO IoT Terminals and Ground Stations
- Remote Asset Tracking, eg. Wildlife or Lifestock Tracking
- Rural and Remote Connectivity
- NTN Wearables or Smart Devices with SOS Capability
- Remote NTN Sensors
- Utility and Environmental Monitoring

The NLA.01 is delivered on tape and reel and now allows customers to integrate using automated pick-and-place machines during high-speed SMT production. For further optimization to customer-specific device environments and for support to integrate and test this antennas performance in your device, contact your regional Taoglas Customer Services Team.

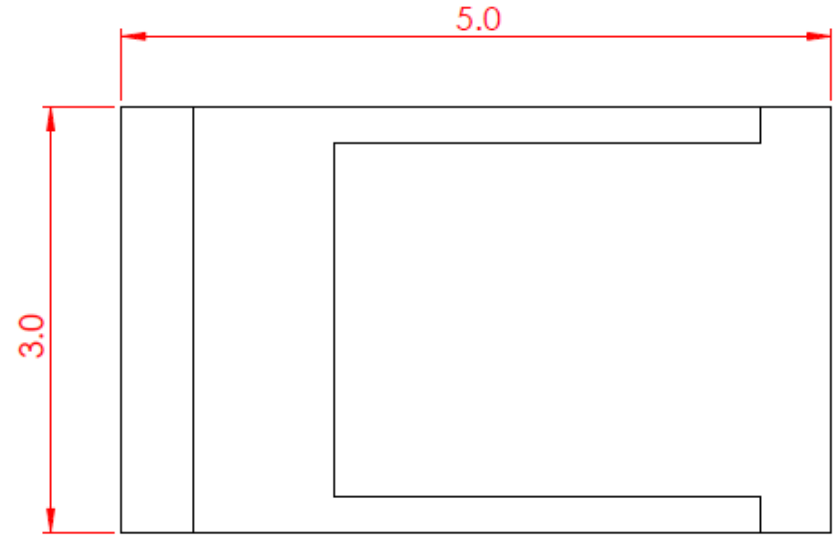
2. Specification

Electrical								
Band	Frequency (MHz)	Efficiency (%)	Average Gain (dB)	Peak Gain (dBi)	Impedance	Polarization	Radiation Pattern	Max. input power
NTN (n256)	1980-2200	45.0	-3.47	2.16	50 Ω	Linear	Omni directional	10W
Bands 23/252	2000-2200	54.1	-2.67	1.41				

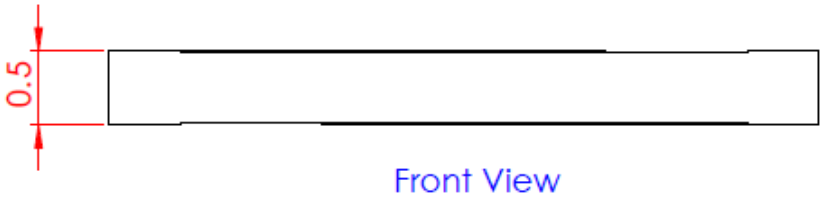
Mechanical	
Dimensions	5mm x 3mm x 0.5mm
Material	Ceramic
Mounting	SMT

Environmental	
Operation Temperature	-40°C to 85°C
Storage Temperature	-40°C to 105°C
Temperature Coefficient (τ f)	0 ± 20 ppm @-20°C to +80°C
Recommended Reel Storage Condition	5°C to 40°C Relative Humidity 20% to 70%
Moisture Sensitivity (MSL)	Level 3 (168 Hours)

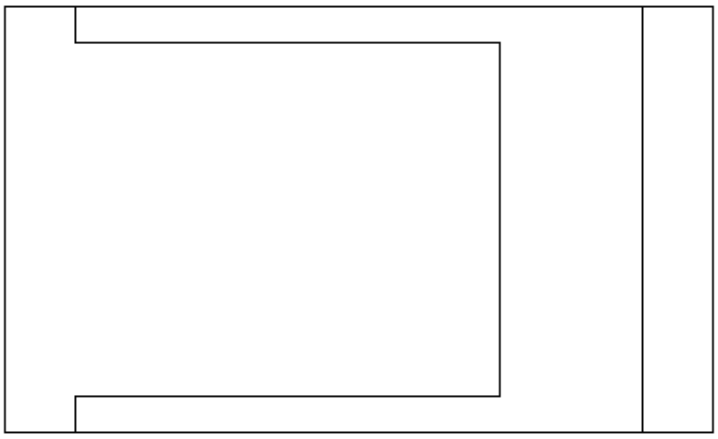
3. Mechanical Drawing



Top View



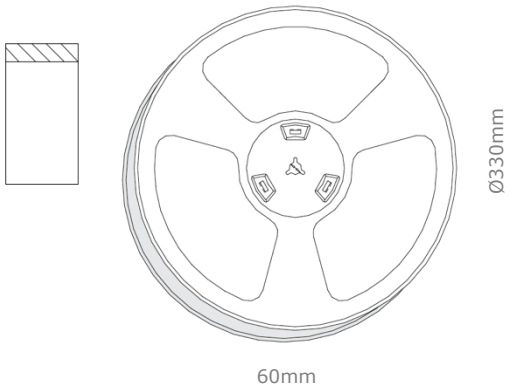
Front View



Bottom View

4. Packaging

6000pcs NLA.01 per Tape and Reel
Dimensions: Ø330 x 60mm



5. Antenna Integration Guide

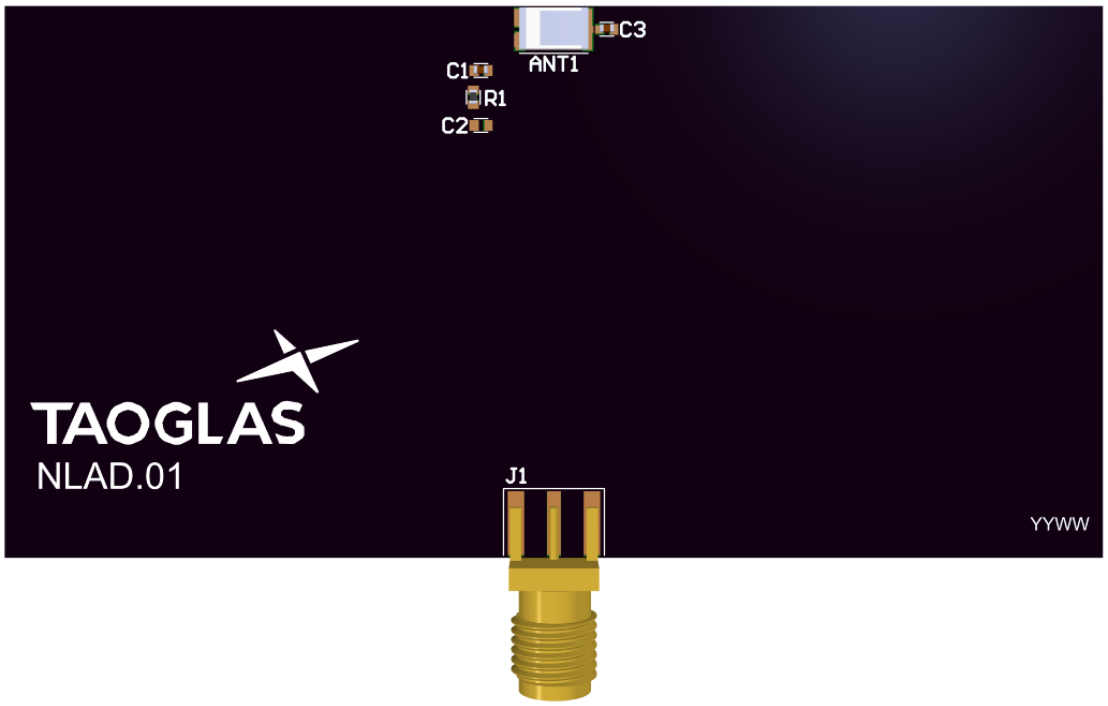
The following is an example on how to integrate the NLA.01 into a design. This antenna has 3 pins, where one pin is used for the RF Feed. Taoglas recommends using a minimum of 80x40mm ground plane (PCB) to ensure optimal performance.
The antenna should be placed mid-point on the long side of the PCB to take advantage of the ground plane on each side of the antenna.

Top view of PCB.

Detail view of antenna and components on board.

Please find the Integration files in Altium, 2D formats and the 3D model for the NLA.01 here: https://www.taoglas.com/product/ntn-ceramic-substrate-loop-antenna-covering-bands-23-and-n256/

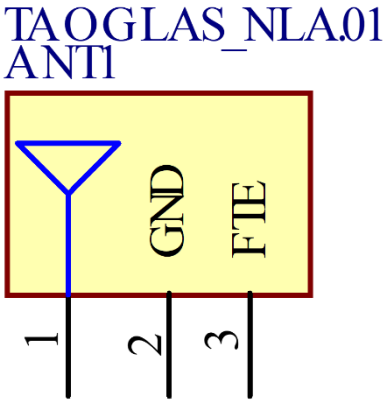
5.1 Schematic and Symbol Definition



Above is a 3D model of the NLA.01 on a PCB.

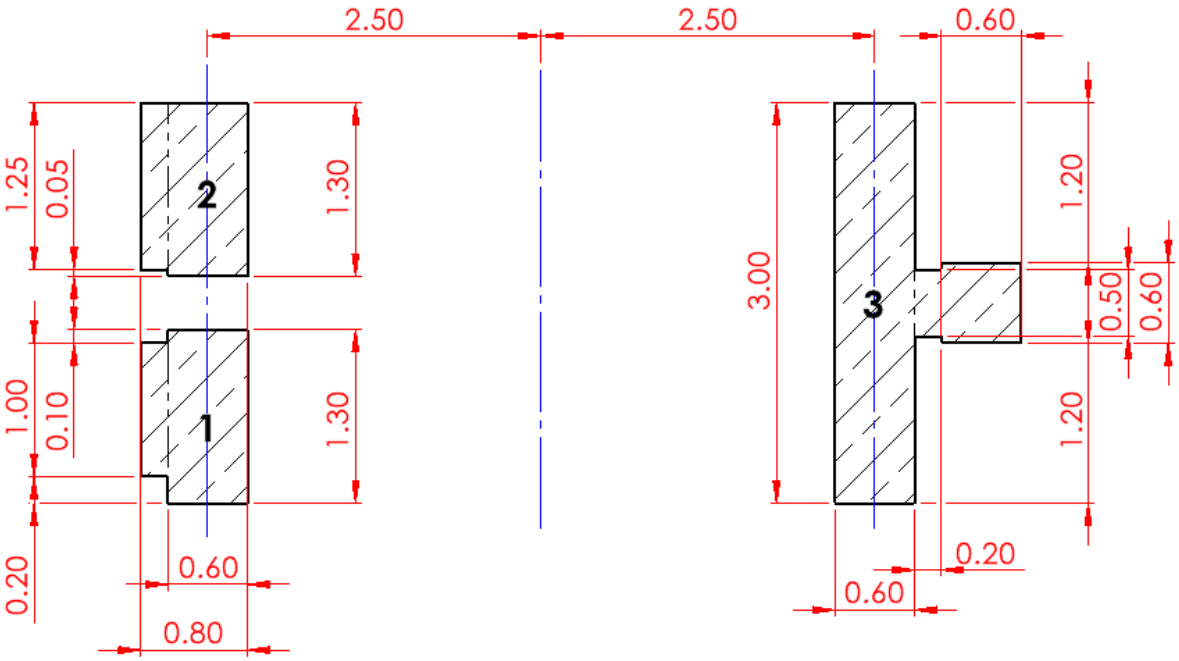
The circuit symbol for the NLA.01 is shown below. The antenna has 3 pins as indicated below.

Pin	Description
1	RF Feed
2	Ground
3	Fine Tuning Element



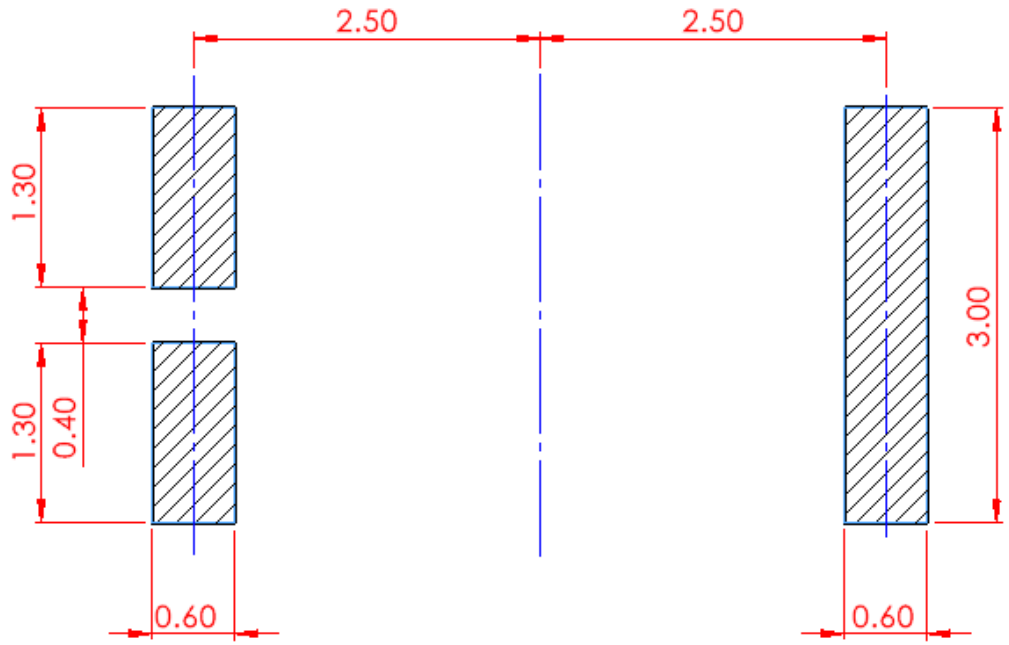
Above is a schematic symbol of NLA.01 and a table of the pin definitions.

5.2 Antenna Footprint

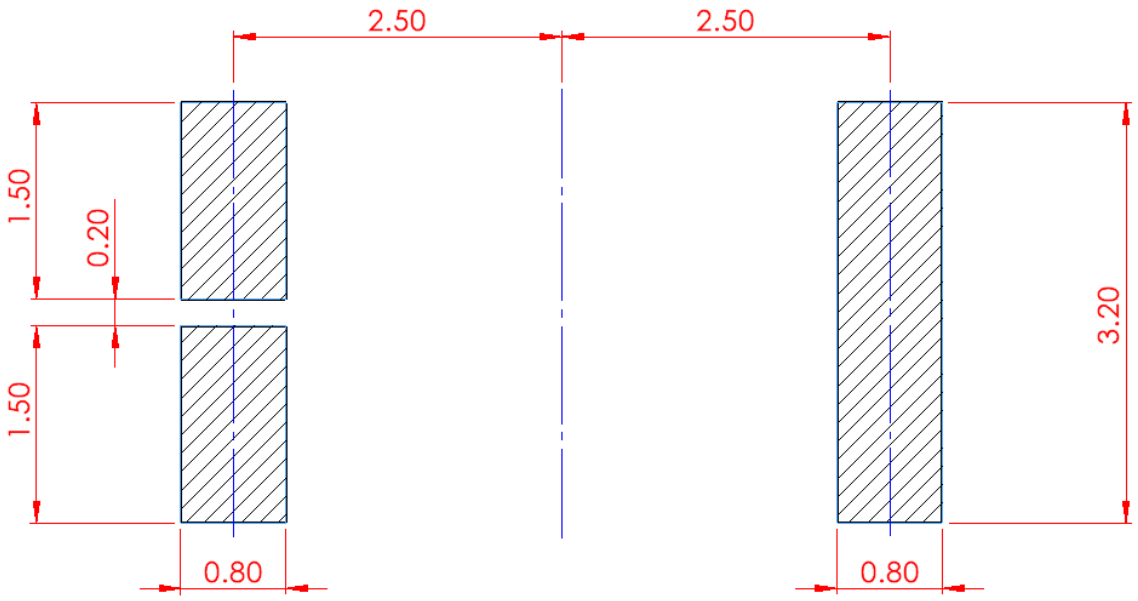


Pin	Description
1	RF Feed
2	Ground
3	Fine Tuning Element

5.3 Top Solder Paste



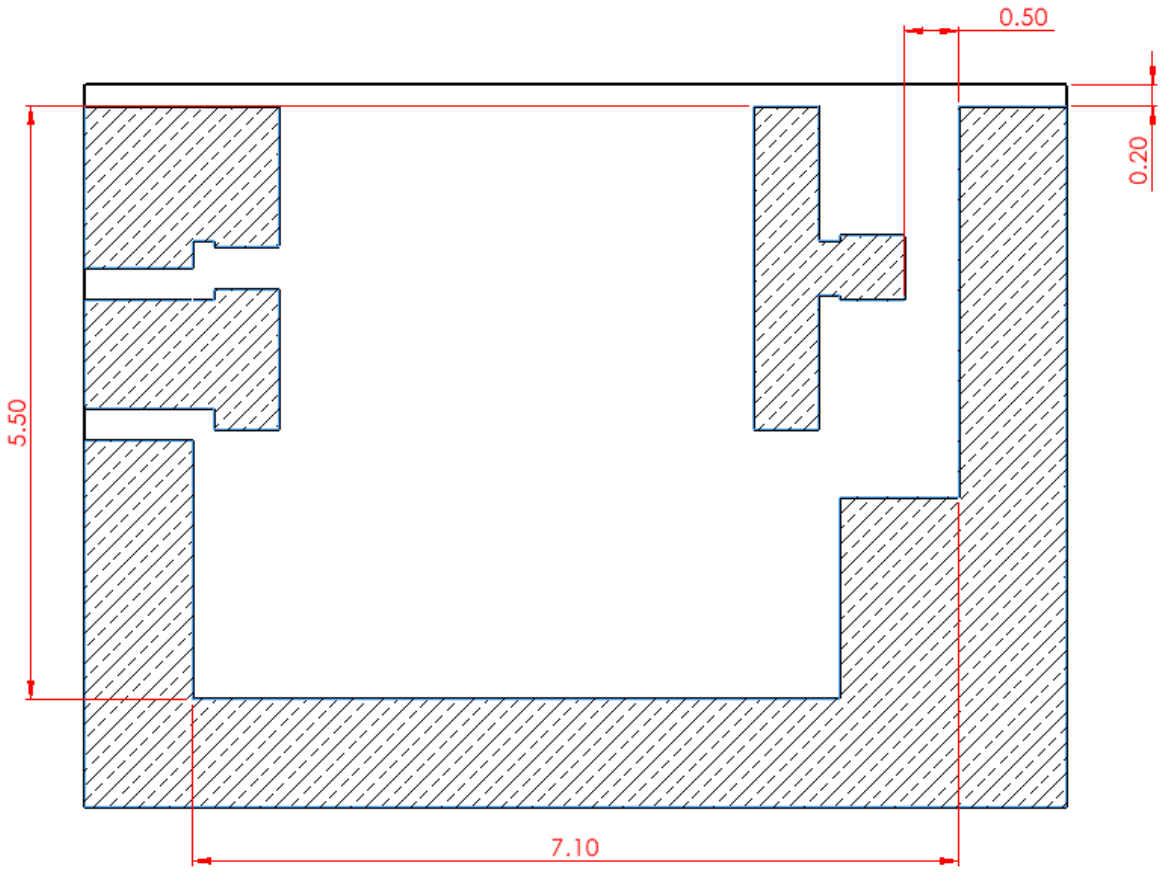
5.4 Top Solder Mask



5.5 Copper Clearance for NLA.01

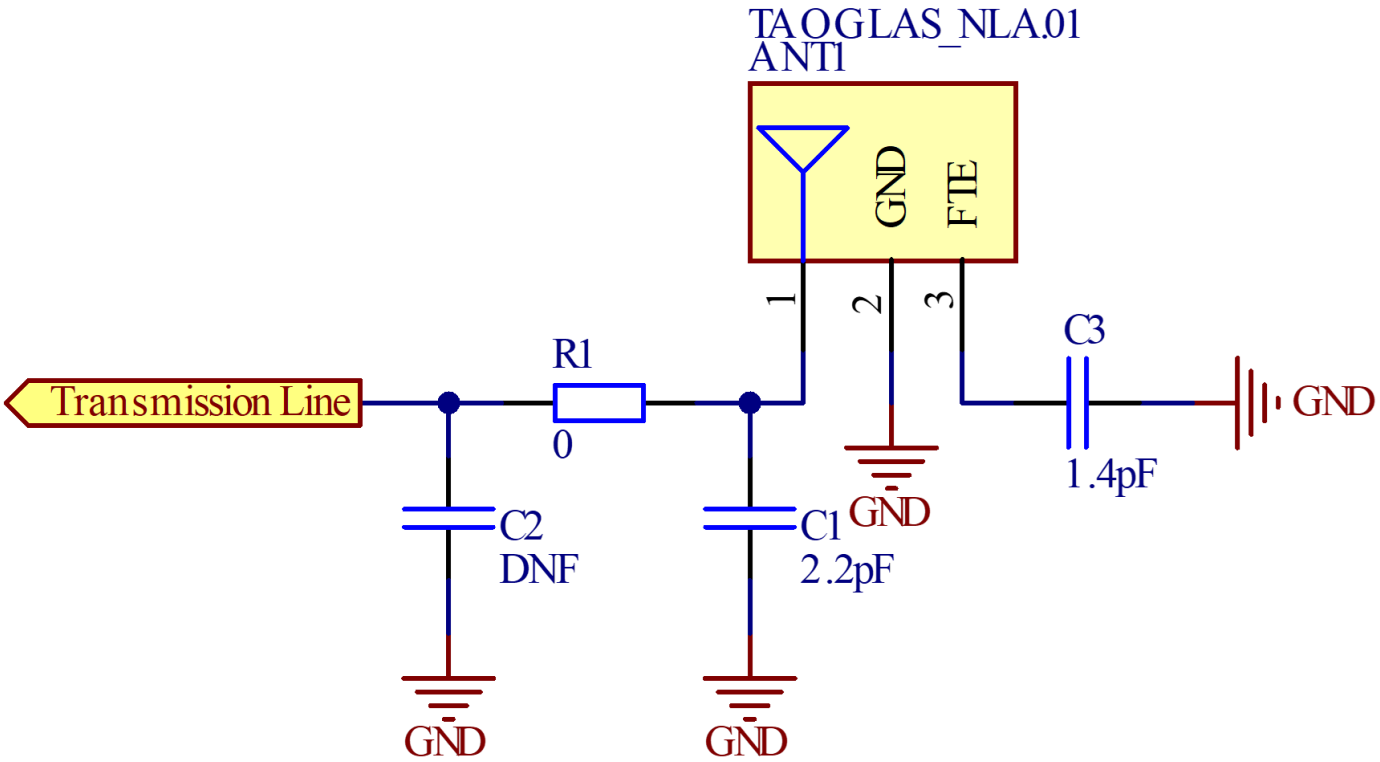
The footprint and clearance on the PCB must comply with the antenna's specification. The PCB layout shown in the diagrams below demonstrates the NLA.01 clearance area. The copper keep-out area applies to all layers on the PCB.

The copper clearance area extends to 7.1mm in length and 5.5mm in width around the antenna. The PCB edge clearance should be a minimum of 0.1mm, example below is 0.2mm.



5.6 Schematic Layout

Matching components with the NLA.01 are required for the antenna to have optimal performance in the spaces specified in the schematic below. Additional matching components may be necessary for your device, Taoglas recommends incorporating extra component footprints, forming a “pi” network, for the NLA.01.

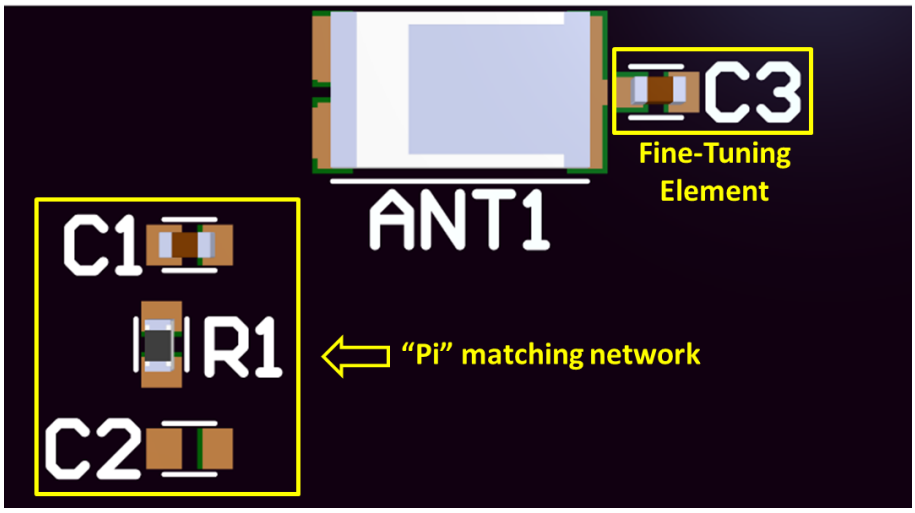


Designator	Type	Value	Manufacturer	Manufacturer Part Number
C1	Capacitor	2.2pF	Murata	GRM1555C1H2R2CA01D
C2	Not Fitted	-	-	-
C3	Capacitor	1.4pF	Murata	GJM1555C1H1R4WB01D
R1	Resistor	0 Ohm	YAGEO	RC0402JR-070RL

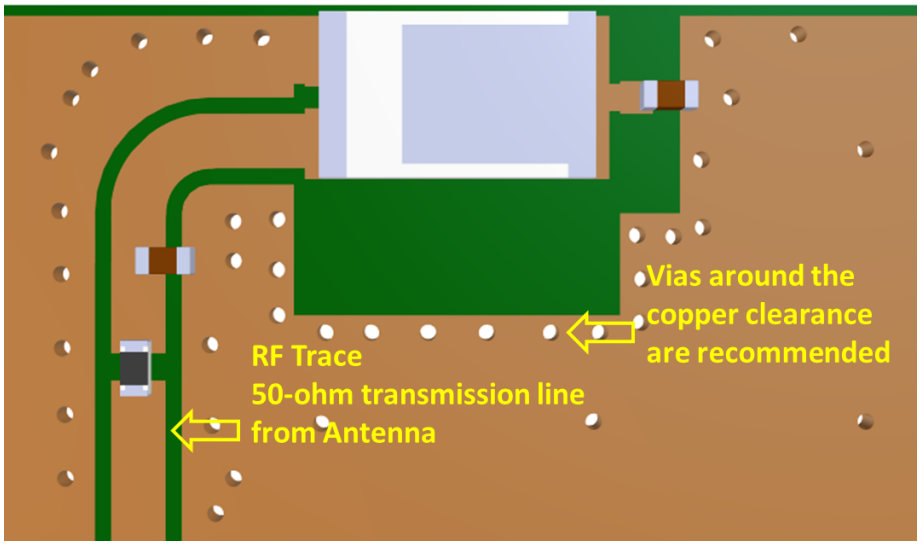
5.7 Antenna Integration

The NLA.01 should be placed mid-point on the long side of the PCB to take advantage of the ground plane extending from each side of the antenna.

The RF trace must maintain a 50 Ohm transmission line. A “Pi” Matching Network is recommended for the RF transmission line, the values and components for the matching circuit will depend on the tuning needed. Ground vias should be placed around the transmission line and the copper clearance area.



NLA.01 antenna mounted on a PCB, showing “Pi” matching network.

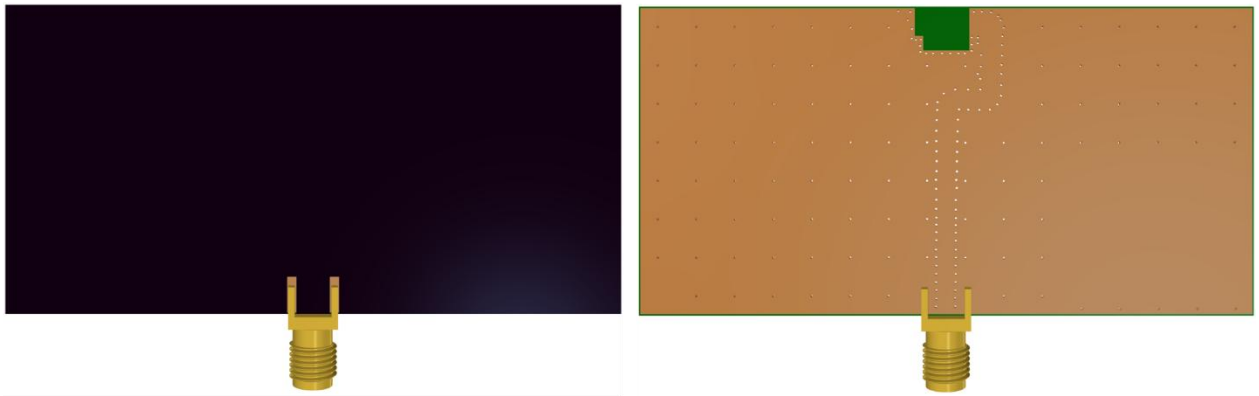


NLA.01 antenna mounted on a PCB, showing transmission line and integration notes.

5.8 Final Integration

The top side image shown below highlights the antenna transmission line. Taoglas recommends using a minimum of 80x40mm ground plane (PCB) to ensure optimal performance.

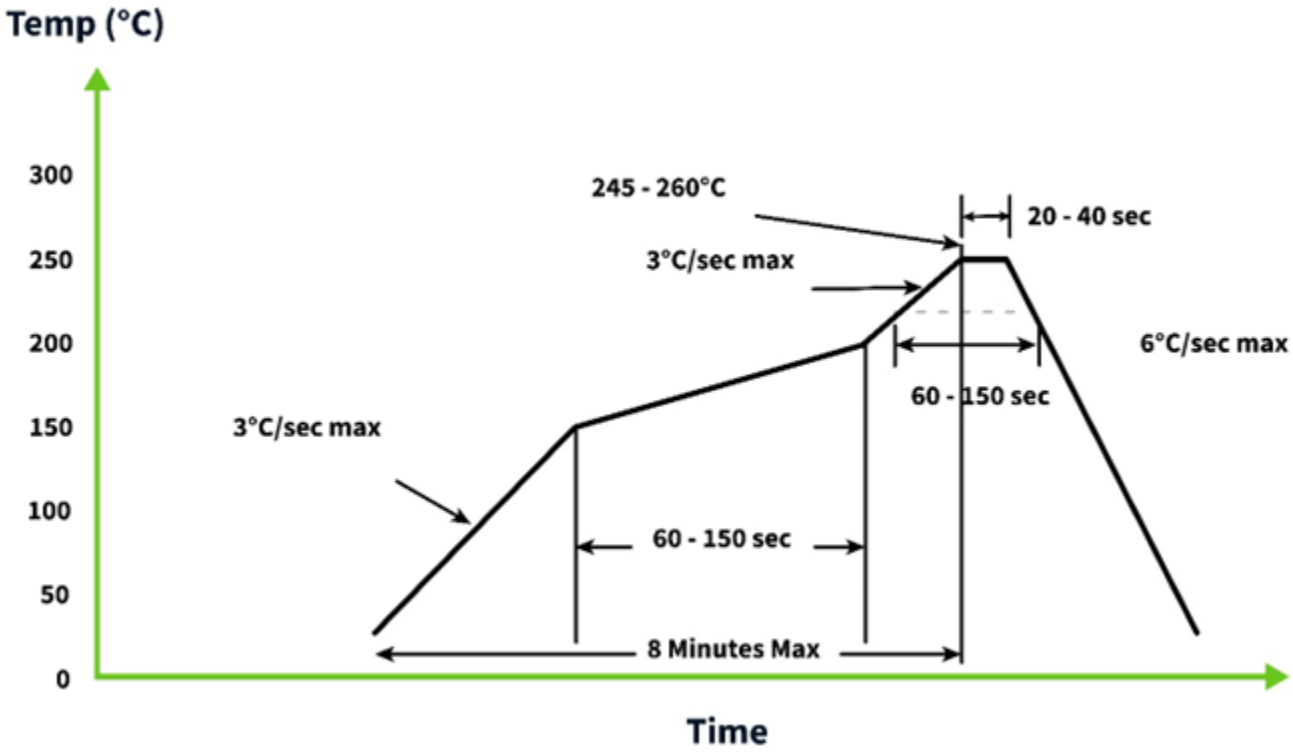
Top Side (NLA.01 placement on 80x40mm PCB)



Bottom Side (80x40mm PCB)

6. Solder Reflow Profile

The NLA.01 can be assembled by following the recommended soldering temperatures are as follows:



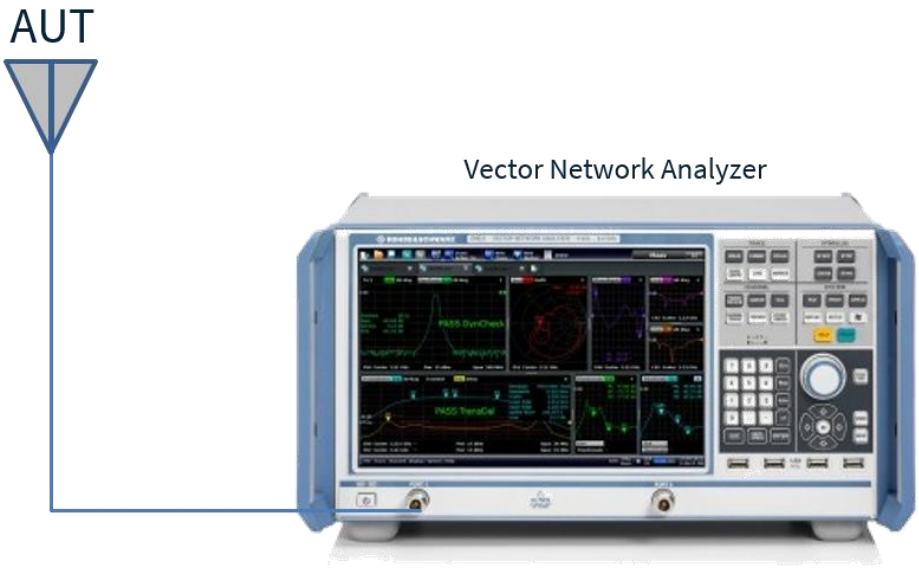
*Temperatures listed within a tolerance of +/- 10º C

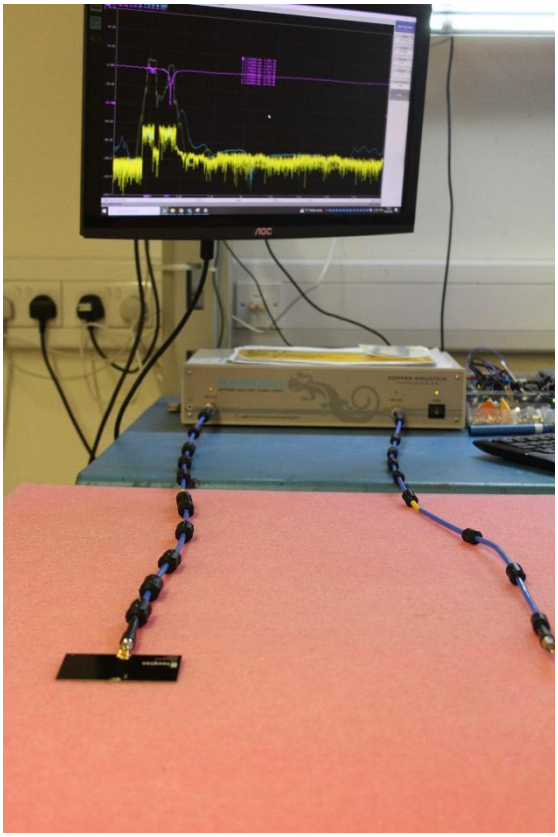
Smaller components are typically mounted on the first pass, however, we do advise mounting the NLA.01 when placing larger components on the board during subsequent reflows.

Note: Soldering flux classified ROL0 under IPC J-STD-004 is recommended.

7. Antenna Characteristics

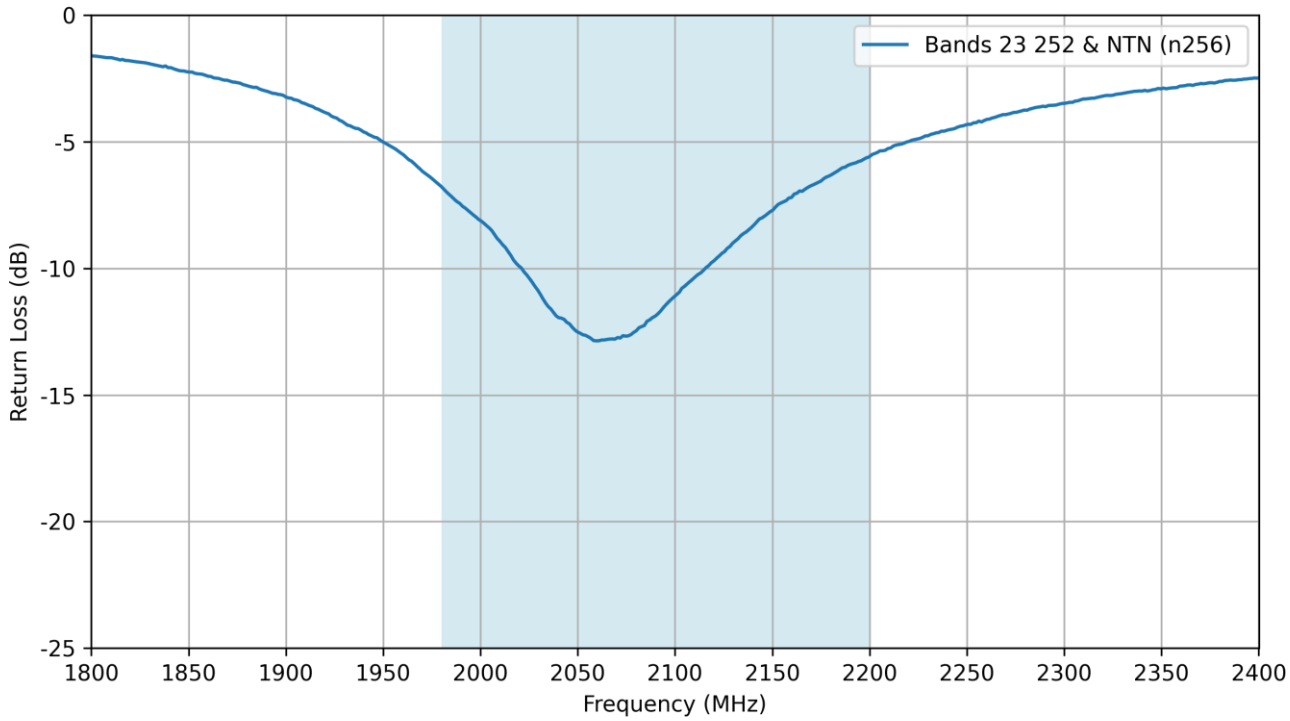
7.1 Test Setup



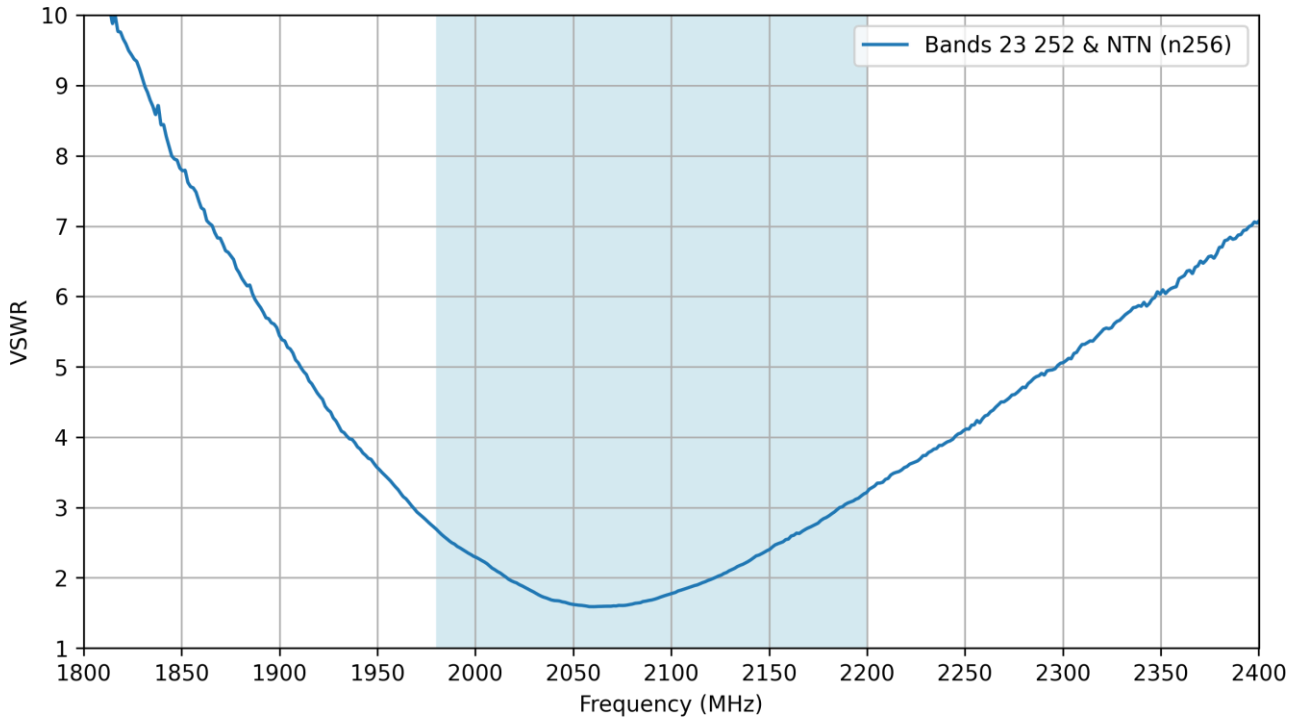


VNA Test Set-up

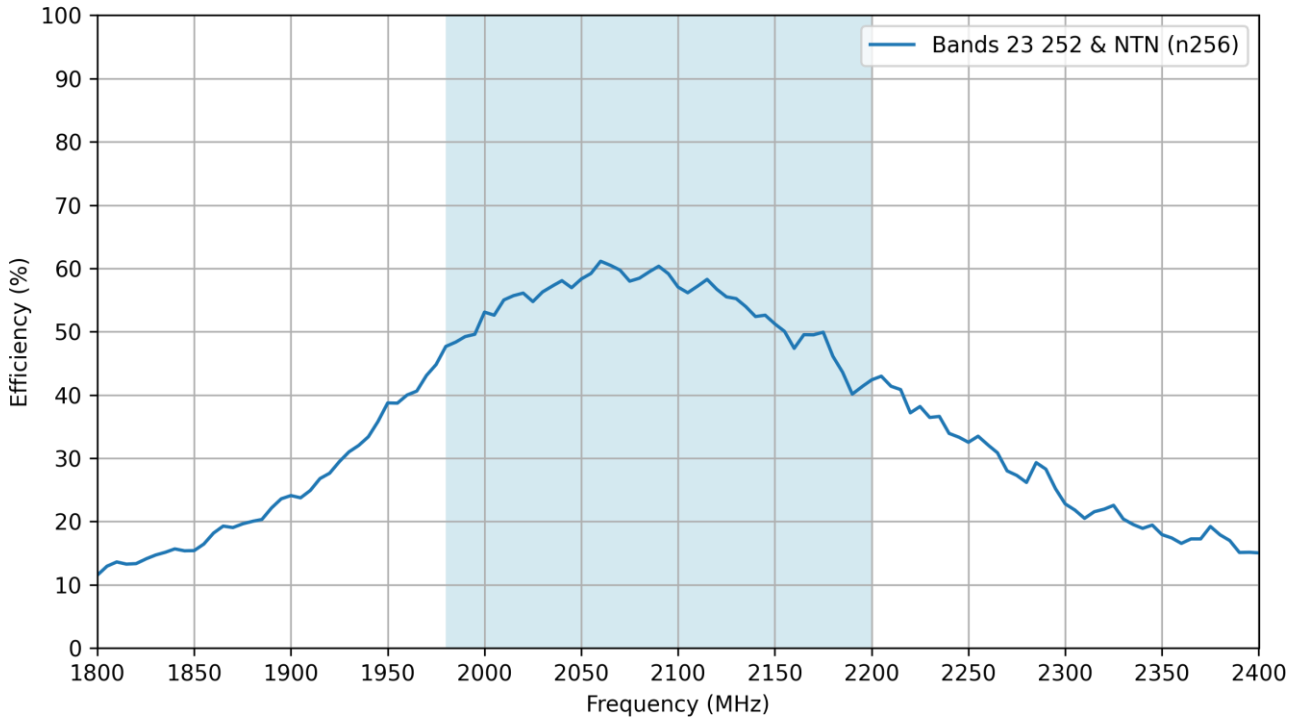
7.2 Return Loss



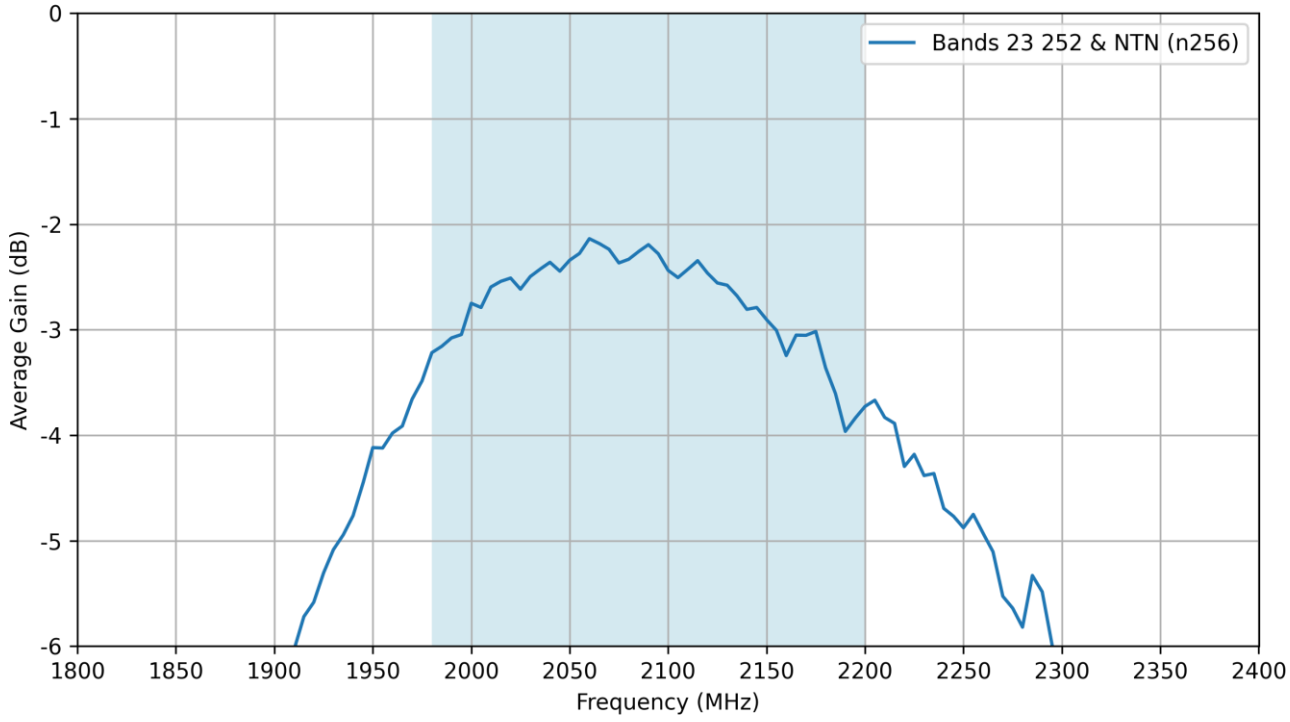
7.3 VSWR



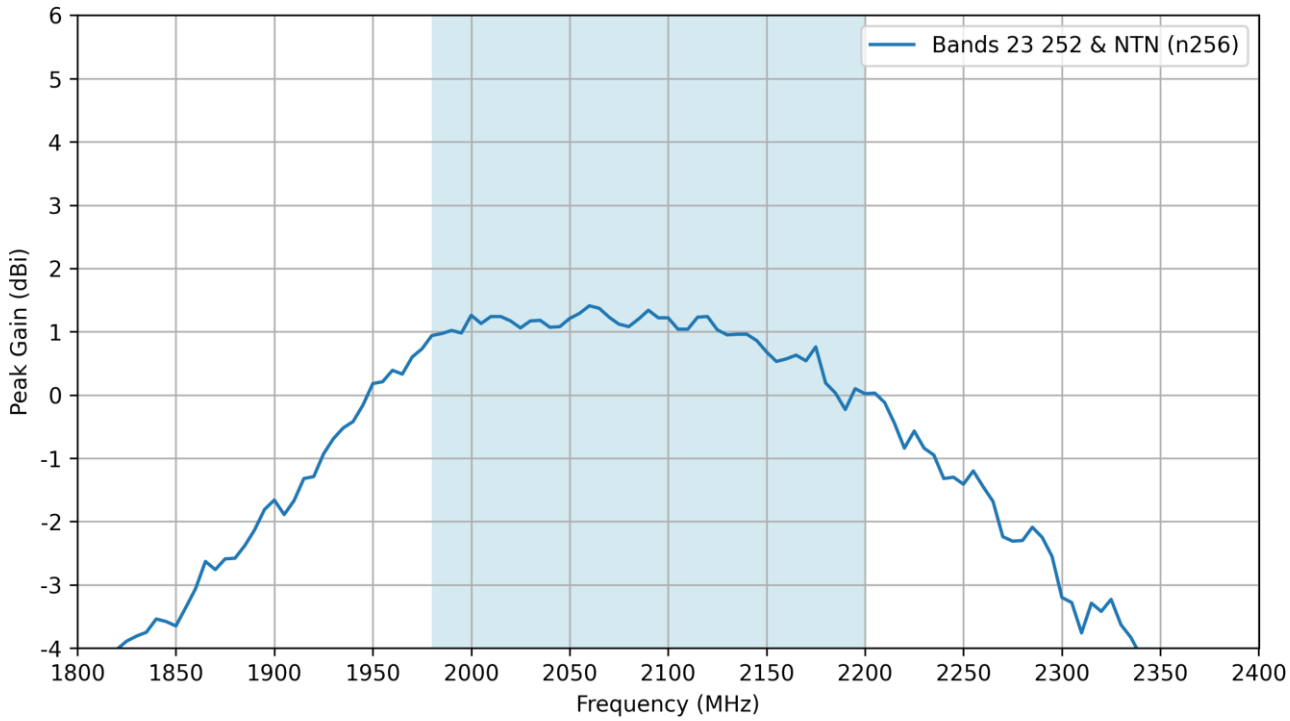
7.4 Efficiency



7.5 Average Gain

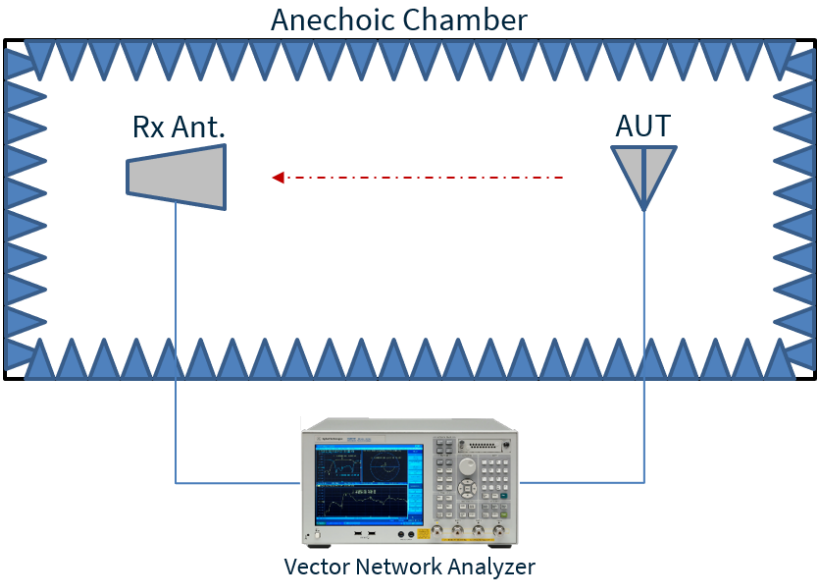


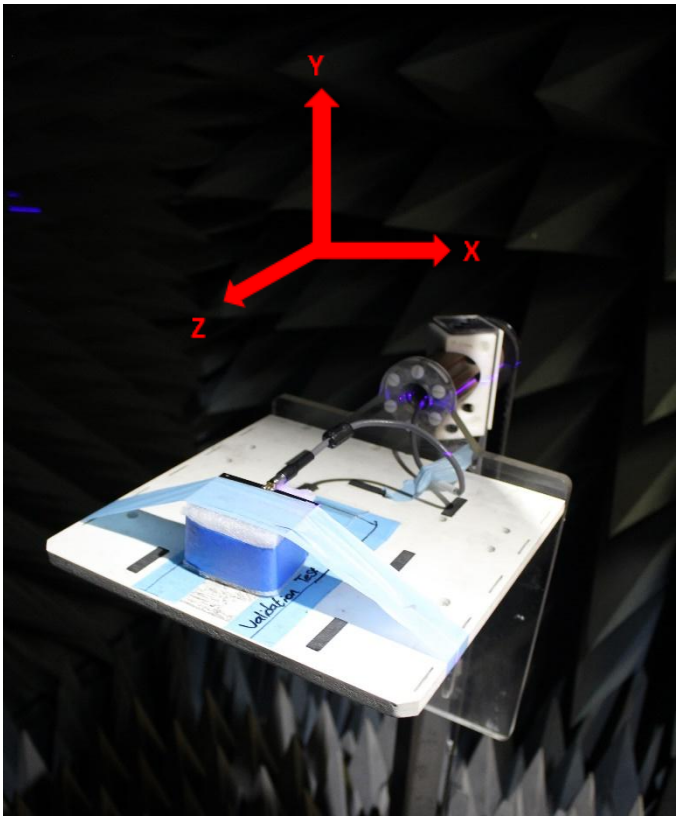
7.6 Peak Gain


Bands 23 252 & NTN (n256)
Peak Gain (dBi)
Frequency (MHz)
6
5
4
3
2
1
0
-1
-2
-3
-4
1800
1850
1900
1950
2000
2050
2100
2150
2200
2250
2300
2350
2400

8. Radiation Patterns

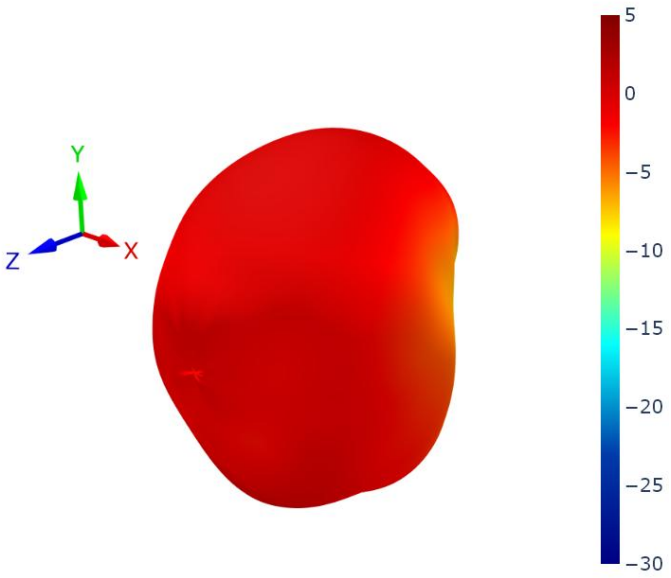
8.1 Test Setup

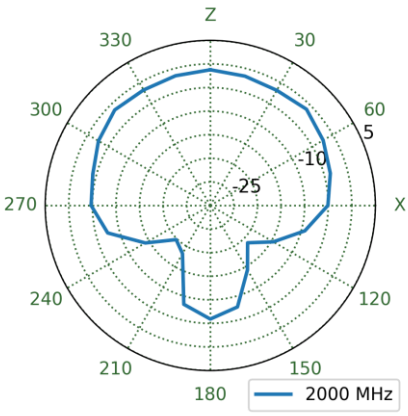
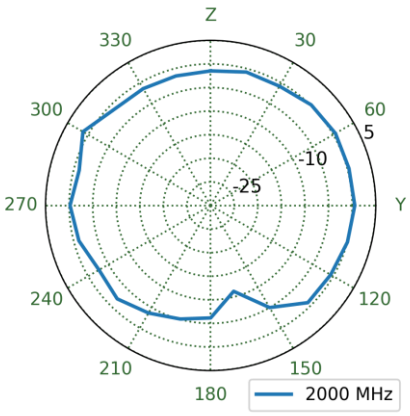
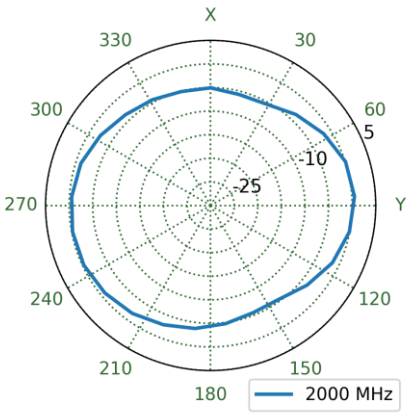




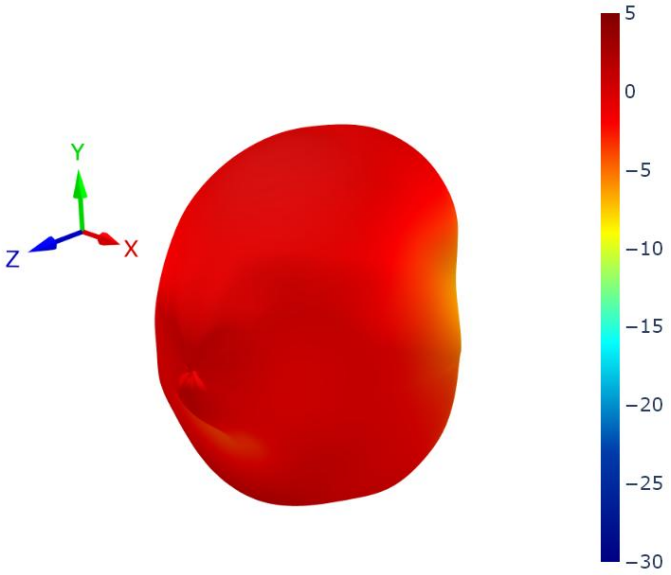
Chamber Test Set-up

8.2 Patterns at 2000 MHz

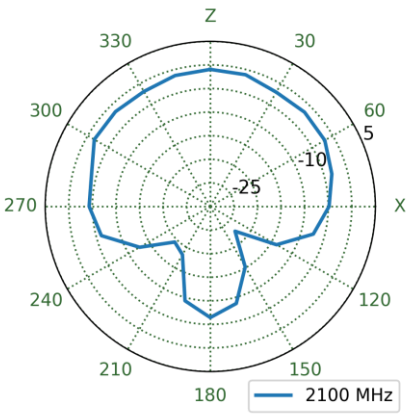


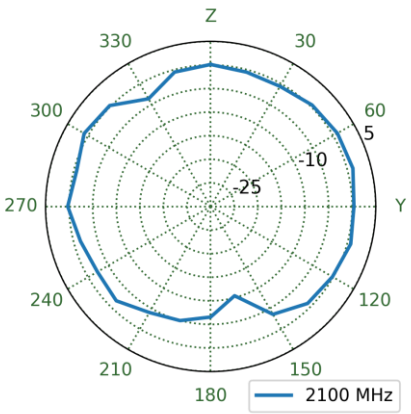
XZ Plane	YZ Plane	XY Plane
		

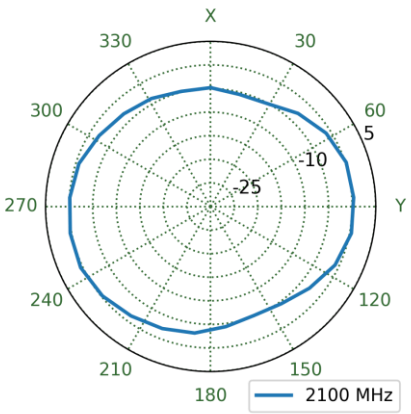
8.3 Patterns at 2100 MHz



XZ Plane	YZ Plane	XY Plane







Changelog for the datasheet

SPE-25-8-095 – NLA.01

Revision: A (Original First Release)	
Date:	2025-03-26
Notes:	Initial Release.
Author:	Gary West

Previous Revisions

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